MILLBROOK COMMUNITY WIND PROJECT

ENVIRONMENTAL ASSESSMENT REGISTRATION DOCUMENT

Proponent
Truro-Millbrook Wind Limited Partnership

Document Prepared By
Strum Consulting

May 2013

MILLBROOK COMMUNITY WIND

May 3, 2013

Mr. Steve Sanford
Nova Scotia Environment
5151 Terminal Road, 5th floor
Halifax, NS B3J 2P8

Dear Mr. Sanford,

Re: Environmental Assessment Registration
Millbrook Community Wind Project

Truro-Millbrook Wind GP, Ltd. in its Capacity as general partner for Truro-Millbrook Wind Limited Partnership is pleased to submit the Millbrook Community Wind Project Environmental Assessment Registration Document to Nova Scotia Environment.

Contact information is provided as follows:

Danny Splettstosser, Secretary
Truro-Millbrook Wind GP, Ltd.
4845 Pearl East Circle,
Suite 200, Boulder, Colorado 80301, USA
Phone: 303.953.5180
Email: splettstosser@juwi.com

Should you have any questions or concerns, please do not hesitate to contact us.

Thank you,

Danny Splettstosser
Secretary
Truro-Millbrook Wind GP, Ltd. in its Capacity as general partner for Truro-Millbrook Wind Limited Partnership

EXECUTIVE SUMMARY

Truro-Millbrook Wind Limited Partnership has proposed to develop a 6.0 megawatt three-turbine wind project in the community of Millbrook, Nova Scotia. The proponent is Truro-Millbrook Wind Limited Partnership, a partnership between the Millbrook First Nation and juwi Wind Canada Ltd. The partnership is utilizing Community Wind Farms Inc. for local development services. The proposed Project location is approximately 5.5 km southwest of Truro, Nova Scotia in the Municipality of the County of Colchester (45°19'42"N, 63° 20'43"W), and will consist of approximately 156.2 ha of privately owned land (PID 20215711). The Project will be co-located with another proposed 4.0 MW, two-turbine wind project (Truro Heights Community Wind), which will be majority owned by Eskasoni First Nation. These projects combined, result in five turbines and will have the total capacity to generate approximately 10 MW and provide power to 3,300 homes.

The Millbrook Community Wind Project has been developed in support of Nova Scotia's "Renewable Electricity Plan: A Path to Good Jobs, Stable Prices and a Cleaner Environment" , which is a strategic plan designed to decrease the province's dependence on carbon-based energy sources (fossil fuels) and move towards greener, more affordable and more reliable sources of electricity. The Project is proposed under the province of Nova Scotia's recently developed Community Feed-In-Tariff program.

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 three turbines, it is considered a small project. Based on the known existence of four bird species considered to be provincially 'At Risk' or 'Maybe At Risk' 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.

As part of the methodology of the assessment, the following environmental components were identified and evaluated based on the potential for interaction with the Project:

- Atmospheric environment;
- Geophysical environment;
- Freshwater environment (including fish and fish habitat);
- Terrestrial habitat (including wetlands);
- Terrestrial vegetation;
- Terrestrial fauna;
- Avifauna;
- Bats;
- Local demographics and industry;
- Land use and value;
- Recreation and tourism;
- Cultural and heritage resources;

- Mi'kmaq resources;
- Human health;
- Shadow flicker;
- Electromagnetic interference;
- Visual landscape; and
- Sound.

Details of this preliminary assessment are provided in Section 7.1. Based on field data, associated research and the expertise of the Project team, mitigation strategies and best management practices that were identified in Section 4.0 were applied to each component to avoid or mitigate potential effects of the Project. Where these practices and strategies were considered to be insufficient to fully mitigate potential effects, or where additional information was required, the component was identified as a valued environment component and subject to further assessment. The following valued environment components were identified:

- species of conservation interest;
- avifauna; and
- bats.

An effects assessment was then completed for each valued environment component (Section 14). The effects assessment utilized an interaction matrix to evaluate interactions between the Project phases and each valued environment component and then considered the following elements to assess potential effects:

- Description of potential negative environmental effects;
- Mitigation measures;
- Residual effects;
- Significance of residual environmental effects; and
- Monitoring or follow up programs.

Best practices and standard mitigation methods will be implemented during all phases of the Project, to ensure methods and practices are comprehensive and are adhered to. Furthermore, an environmental protection plan will be developed and communicated to all employees working on the Project.

The potential for accidents and malfunctions was also considered for each Project phase.

The effects assessment for the identified valued environment components determined that there are no significant environmental concerns or impacts (residual or cumulative) that may result from the Project that cannot be effectively mitigated or monitored.

The Project team is committed to ongoing consultation with government stakeholders, First Nations communities, and members of the local community throughout all phases of the Project.

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List of Acronyms

ACCDC	Atlantic Canada Conservation Data Centre
ARD	Acid Rock Drainage
ARIA	Archaeological Resource Impact Assessment
ATV	All-terrain Vehicle
AQHI	Air Quality Health Index
BMP	Best Management Practice
CanWEA	Canadian Wind Energy Association
CCME	Canadian Council of Ministers of the Environment
CEA	Cumulative Effects Assessment
CEAA	Canadian Environmental Assessment Act
COMFIT	Community Feed-In-Tariff
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPI	Consumer Price Index
CSA	Canadian Standards Association
CWS	Canadian Wildlife Service
CWFI	Community Wind Farms Inc.
dBA	Decibel
DEM	Digital Elevation Model
DFO	Fisheries and Oceans Canada
DND	Department of National Defense
EA	Environmental Assessment
EC	Environment Canada
EMF	Electromagnetic Field
EPP	Environmental Protection Plan
ESCP	Erosion and Sediment Control Plan
GHG	Greenhouse Gas
GIS	Geographical Information System
HC	Health Canada
IBAs	Important Bird Areas
IBoF	Inner Bay of Fundy
IPCC	Intergovernmental Panel on Climate Change
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
MBBA	Maritime Breeding Bird Atlas
MBCA	Migratory Birds Convention Act
MEKS	Mi'kmaq Ecological Knowledge Study
MORI	Market & Opinion Research International

MSDS	Material Safety Data Sheet
MTO	Ministry of Transportation of Ontario
MW	Megawatt
NOAA	National Oceanic and Atmospheric Administration
NRCan	Natural Resources Canada
NSDE	Nova Scotia Department of Energy
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Environment
NSEA	Nova Scotia Environment Act
NSESA	Nova Scotia Endangered Species Act
NSMNH	Nova Scotia Museum of Natural History
NSPI	Nova Scotia Power Inc.
NSTBD	Nova Scotia Topographic Database
NSTIR	Nova Scotia Department of Transportation and Infrastructure Renewal
NWCC	National Wind Coordinating Collaborative
OHSA	Nova Scotia Occupational Health and Safety Act
PID	Property Identification Number
RABC	Radio Advisory Board of Canada
RCMP	Royal Canadian Mounted Police
REMO	Regional Emergency Management Organization
SARA	Species at Risk Act
SOCI	Species of Conservation Interest
SWPP	Source Water Protection Plan
TAFL	Technical and Administrative Frequency Lists
TSS	Total suspended solids
UTM	Universal Transverse Mercator
VEC	Valued Ecosystem Component
WAM	Wet Areas Mapping
WHMIS	Workplace Hazardous Materials Information System
ZVI	Zone of Influence

1.0 PROJECT INFORMATION

1.1 Project Introduction

Truro-Millbrook Limited Partnership intends to construct and operate a 6 megawatt (MW) wind project (the Project) at a site in the community of Millbrook. The Project is to be "co-located" directly adjacent to the proposed Truro Heights Community Wind Project (4 MW project). The two Projects are expected to share common infrastructure (e.g. shared access from Tower Road and shared utility right of way) and will be constructed on similar timelines. Therefore, for the purposes of the environmental assessment (EA), the two Projects are largely presented together as one Project site, incorporating turbines 1 to 3 on PID 20215711 (Millbrook Community Wind), turbines 4 and 5 situated on PID 20206330 (Truro Heights Community Wind), and all associated access roads within those boundaries. The extension of Tower Road to the Project site extends across PIDs 20206595, 20206629, 20206546, and 20354015, is also evaluated as part of the EA and is referred to as the "Tower Road Extension". Further details on the spatial boundaries of the assessment can be found in Section 6.3.

The Project has been developed 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 (fossil fuels) and move the province 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 82% of the province's energy comes from non-renewable sources (NSPI 2013), mostly sourced from outside of the province. 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 2007 - Impacts, Adaptation and Vulnerability", the United Nations Intergovernmental Panel on Climate Change (IPCC) provided 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 2007).

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 MW of wind energy generated reducing greenhouse gas (GHG) emissions by as much as 2,500 tons per year, and improving air quality (NSDE 2009).

The goal of Nova Scotia's Renewable Electricity Plan is to gradually transition the province of Nova Scotia to local, renewable energy sources, including wind, tidal and solar technologies. In order to reach this objective, the province has set a commitment of 25% renewable energy by 2015, and 40% by 2020 (NSDE 2010). The plan encourages the participation of community-based organizations in this opportunity, through the incorporation of the community-based feed-in tariff (COMFIT) program. 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 Millbrook Community Wind Project, combined with the Truro Heights Community Wind Project, will contribute to meeting Nova Scotia's renewable energy goals by producing enough green energy to provide 3,300 NS homes with stable, locally-produced renewable energy.

The Project is committed to sharing economic opportunities with the local community and First Nations communities, throughout the development and life-span of the Project. Long term economic benefits will be created from the Project through job creation, tax revenue, revenue for the Millbrook First Nation, and the creation of a community sustainability fund. As the lead proponent of the Project, Millbrook First Nation will be critical to forming successful, long-term professional relationships with these communities, ensuring local job-creation and the utilization of local Mi'kmaq contractors. No public funding is required for this Project.

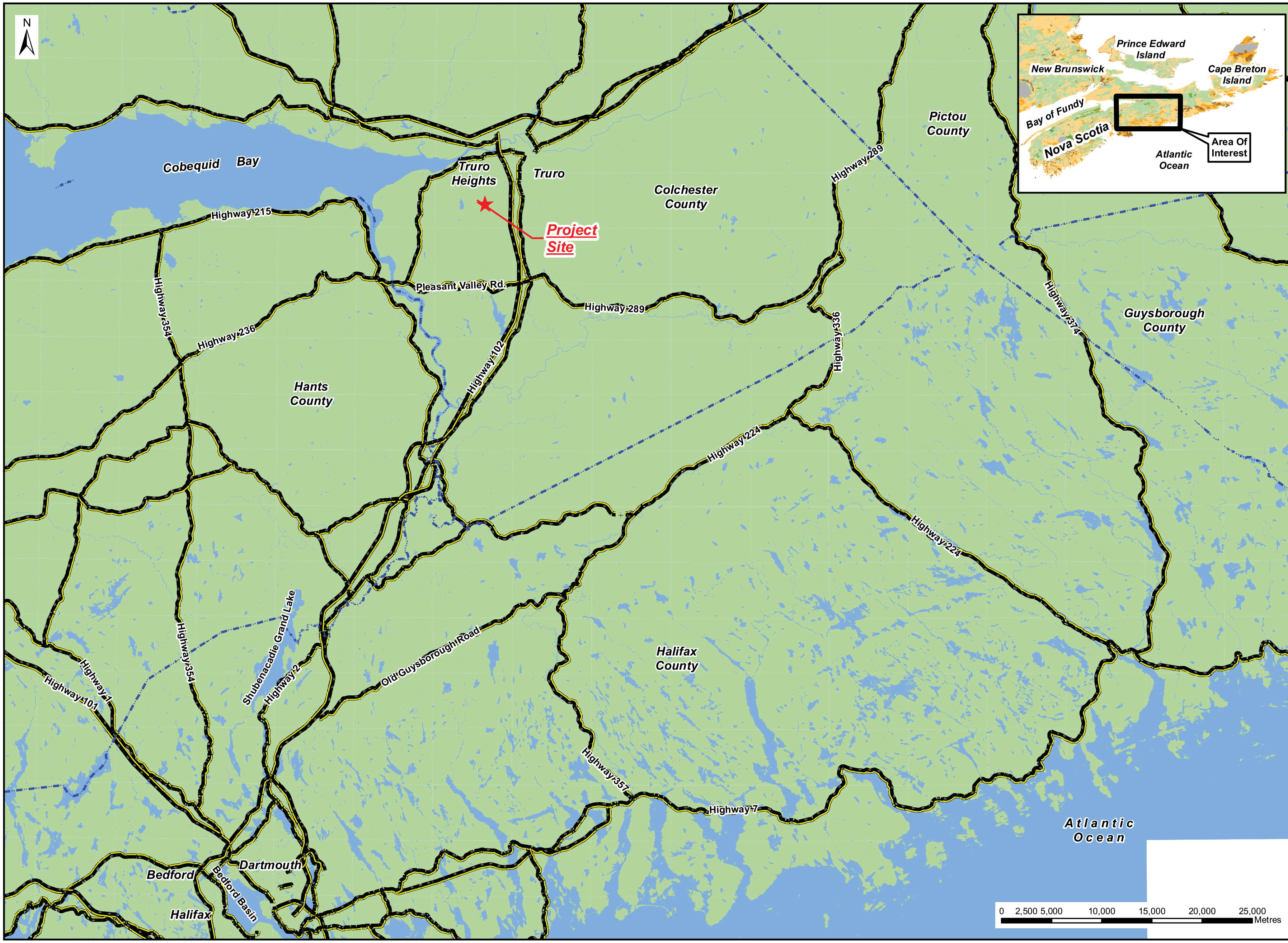
1.2 Project Summary

This section of the 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	Truro-Millbrook Wind Limited Partnership intends to construct and operate a 6 megawatt (MW) wind project at a site in the community of Millbrook, Nova Scotia. The Project would be constructed and operated conjointly with the Truro-Heights Community Wind Project, which consists of a 4 MW wind project proposed by the Truro Heights Wind Limited Partnership.
Project Name	Millbrook Community Wind Project
Proponent Name	Truro-Millbrook Wind Limited Partnership

Proponent Contact Information	Danny Splettstosser 4845 Pearl East Circle, Suite 200, Boulder, Colorado 80301 Phone: 303.953.5180 Fax: 303.953.5185 Email: splettstosser@juwi.com; please cc: j.rogers@juwi.com
Project Location	• The Project site is located near the community of Millbrook, approximately 5.5 km southwest of Truro, Nova Scotia (Drawing 1.1); • The Project site is located within Colchester County, Nova Scotia; • The approximate center of the Millbrook Project footprint is located at 45°19'30"N, 63°20'36"W; • Millbrook Project footprint lands include Property Identification Number (PID) 20215711.
Landowner(s)	Wade Dickie (Millbrook Project footprint) Joseph Wynn (Truro Heights Project footprint) 3031611 Nova Scotia Ltd. (Tower Road extension)
Closest distance from a turbine to a seasonal or permanent residence	1.1 km from Turbine 2 (Millbrook Project footprint) 719 m from Turbine 5 (Truro Heights Project footprint)
Expected rated capacity of proposed project in MW	6 MW (Millbrook Project) 4 MW (Truro Heights Project)
Project Website	www.millbrookwindfarm.ca



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

Site Location

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

juwi

Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:350,000	Drawing #: 1.1
Drawn By: H. Serhan	
Checked By: M. Smith	

1.3 Proponent Description

The proponent is Truro-Millbrook Wind Limited Partnership, a partnership that is being formed between the Millbrook First Nation (Millbrook) and juwi Wind Canada Ltd. (juwi). The partnership is utilizing Community Wind Farms Inc. (CWFI) for local development services.

Millbrook is located in Truro, Nova Scotia. The community has a stellar track record in financial management, has established profitable business relationships and has ownership and equity positions in real estate holdings and business ventures throughout Nova Scotia. The Millbrook Economic Development Corporation, a committee established by Chief and Council, is recognized within the broader business community of Colchester County as a valuable and effective business partner, collaborates with the Town of Truro and is represented on the Board of Directors of the Colchester Regional Development Agency. Millbrook continues its pursuit of economic development opportunities and regional growth opportunities that in turn meet social and economic needs of the membership. Under the COMFIT rules, Millbrook will be the majority owner of the Project. Additionally, Millbrook will be instrumental in ensuring the Project is developed in a manner that is harmonious with the local community and cultural surroundings. Millbrook will also help the team maximize local economic benefit to the community through job creation and utilization of local contractors. Additional information about Millbrook First Nation is available at: http://www.millbrookfirstnation.net/

juwi is the Canadian subsidiary of the juwi Group; an experienced renewable energy project developer with more than 2,600 MW of renewable energy projects successfully developed world wide, largely consisting of projects <20 MW each. The juwi Group has an extensive track record of community based projects with local investment opportunities, as well as turn-key projects for local municipalities, and co-operatives. The role of juwi Group will be to lead technical aspects of wind project development, fund early development activities, and act as the lead arranger in Project financing and construction. Upon completion the Project will be minority owned by juwi Wind Canada. Additional information about juwi is available at: http://www.juwinorthamerica.com/ or http://www.juwi.com/.

CWFI has been retained by the Truro-Millbrook Wind Limited Partnership and is responsible for conducting all the day to day development, community relations and permitting work associated with the Project. CWFI is a Nova Scotia based company focused on developing community based wind projects across Nova Scotia. The principals have accumulated 25 years of experience in the development of wind farms in Nova Scotia and across North America, and understand the complexity of the business as well as the benefits that can be passed directly to local communities. CWFI has extensive experience working with municipalities, First Nations, community groups and landowners across Nova Scotia to develop a portfolio of wind farms under the COMFIT program. Additional information about CWFI is available at: http://www.communitywind.ca/.

1.4 Regulatory Framework

1.4.1 Federal

A federal EA is not anticipated to be required for the Project as it is not located on federal land nor is it 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 12.2 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 2009a).

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 and are listed in this report in Section 17.0.

1.4.3 Municipal

Land use by-laws exist in the Municipality of the County of Colchester, which require approval for wind power projects. Approval is generally in the form of a development agreement. "The Municipality of Colchester Wind Turbine Development Bylaw" outlines licensing requirements, as well as several setbacks and guidelines (Appendix A). All required municipal permits (Section 17.0) and approvals will be obtained prior to construction.

1.5 Structure of Document

Table 1.2 outlines the content of each section of this 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	Mi'kmaq Ecological Knowledge Study
Section 12	Other Considerations
Section 13	Consultation and Engagement.
Section 14	Effects Assessment
Section 15	Effects of the Environment on the Project
Section 16	Cumulative Effects Assessment
Section 17	Other approvals
Section 18	Conclusions
Section 19	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 three wind turbines, each rated at 2.0 MW, for a nominal capacity of 6.0 MW in total. Under optimal conditions the turbines will be in operation, or available for operation, in excess of 93% of the time over an expected lifespan of 25 years. The turbine model will be selected following the analysis of the wind data from the Project site in summer 2013. Several models have been evaluated as part of the planning process, with some being excluded due to preliminary modeling results related to sound and shadow flicker. Of the technologies still under consideration, modeling has been completed using the turbine specifications that result in the most conservative conditions (e.g., tallest hub height, longest blade length, most power/sound output), as appropriate to the specific modeling assessment.

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 mitigation measures 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, but are not limited to:

- 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, but are not limited to:

- Access road upgrading and construction;
- Laydown area and turbine pad construction;
- Transportation of turbine components;
- Turbine assembly;
- 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 will be 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, but may not be limited to:

- Light trucks;
- Drilling rigs;
- Backhoes; and

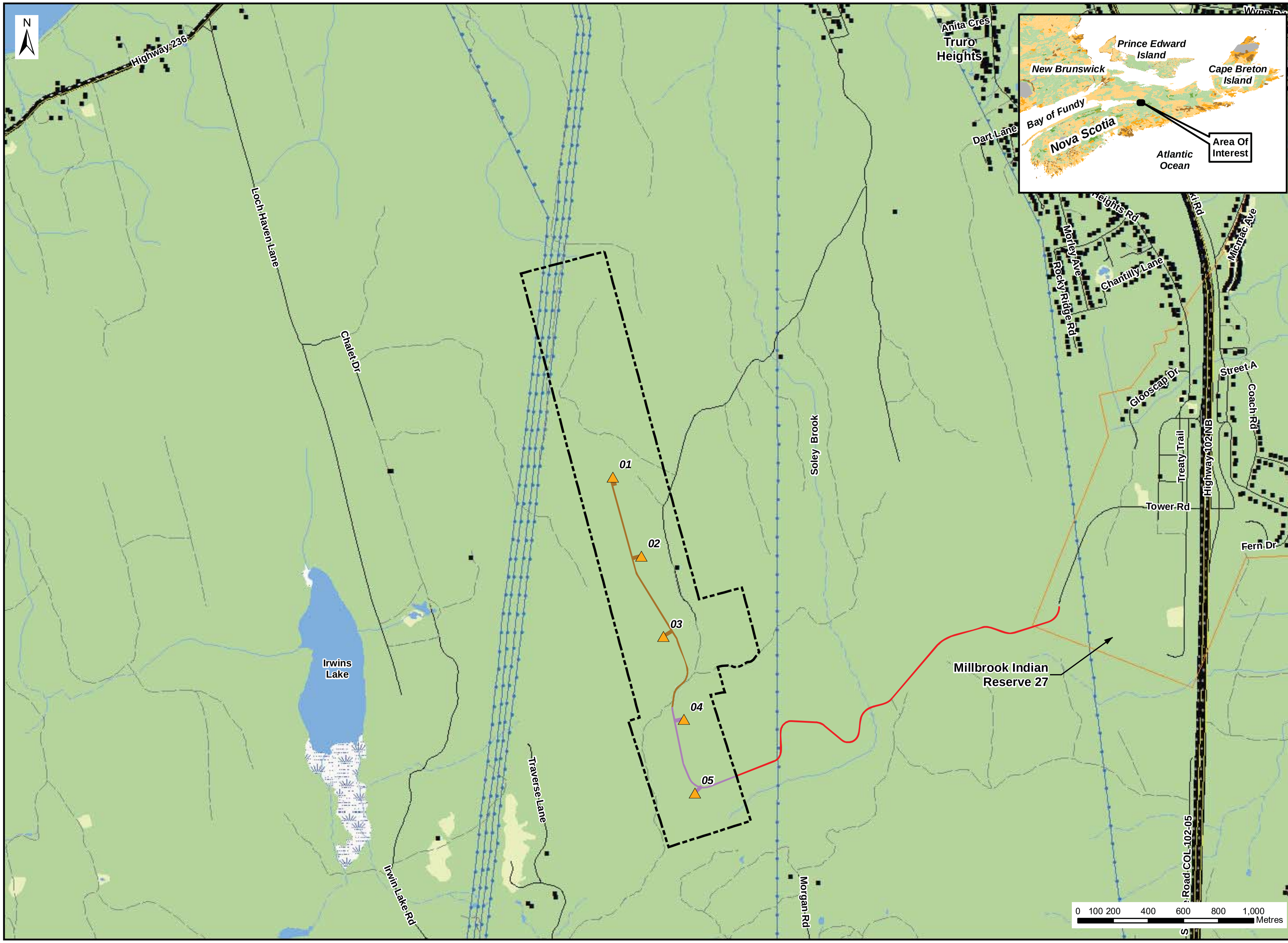
- Bunch feller (and similar harvesting equipment).

Access Road Construction
Approximately 2.4 km of new road construction off of Tower Road will be required to provide direct access to the Project site. Within the Project site boundary an additional 2.1 km of new road construction will be required to provide access to the turbines (Drawing 2.1). The access road is expected to be 10 m wide, including shoulders and ditching. In some instances, the construction right of way (ROW) width could temporarily be up to 20 m to accommodate cut and fill areas and/or wide turns. Minimal upgrades, if any, are expected to the existing Tower Road.

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 (but is not limited to) during road construction:

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



Notes:

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

Legend:

- Proposed Turbine
- Project Site Boundary

Disturbance Area (Footprint)

- Millbrook
- Truro Heights
- Tower Road Extension
- Building
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Existing Transmission Lines
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Turbine and Road Layout

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

juwi

Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:20,000	Drawing #: 2.1
Drawn By: H. Serhan	
Checked By: M. Smith	

Laydown Area and Turbine Pad Construction
General activities during the creation of the laydown and turbine pad construction areas may include, but are not limited to:

- 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; and
- Compaction of soils.

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.

During construction, the laydown area at each turbine location is expected to be approximately 1 ha in size. Following construction, much of this area will be reclaimed, such that the permanent area of disturbance at each turbine location will be approximately 0.14 ha. 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.

Equipment expected to be used for laydown area and turbine pad construction includes but is not limited to:

- 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 preliminary Transportation and Access Evaluation was completed to determine appropriate routes and means for equipment and materials to be delivered to the Project site. At this time, the exact turbine manufacturer and model have not been selected, so a typical 2.0 MW unit was assumed with all components delivered to the Port of Halifax.

A desktop review of possible routes was conducted and an appropriate route was selected and surveyed by field crews. Of the possible conflicts identified, the overpasses on the 102 Highway pose the largest potential for problems. If wind turbine components are too large to fit under an overpass, an alternate route must be chosen.

It is not anticipated that any of the potential conflicts identified will require major upgrades to existing infrastructure to transport wind turbine components assuming a typical 2.0 MW turbine is selected. While it may be necessary to provide traffic control, temporarily remove street signs and guardrails, and adjust overhead wire crossings to allow trucks to pass, no road infrastructure upgrades are anticipated.

All transportation activities will adhere to provincial timing, size and weight restrictions. Transportation of heavier equipment and materials to the site will adhere to road weight restrictions, including all Spring Weight Restrictions. Access points will be designed with proper height and width to accommodate large trucks and will adhere to commercial stopping sight distances.

The following is the proposed route from the Port of Halifax to the Project site:

1. Truck traffic carrying turbine components will leave the Port of Halifax on Marginal Road and continue to Terminal Road.
2. Traffic will turn right from Terminal Road onto Lower Water Street and continue until Lower Water merges with Barrington Street.
3. Trucks will travel on Barrington Street until the Windsor Street Exchange, where they will continue to the Bedford Highway.
4. Once on the Bedford Highway, truck traffic will continue until reaching Hammonds Plains Road where they will turn left and head west toward the 102 Highway.
5. Traffic will then turn right onto the northbound onramp.
6. Truck traffic will travel northbound on Highway 102 for approximately 80 km until reaching Exit 13A where it will exit and turn left onto Tower Road heading west.
7. Traffic will then travel west on Tower Road for approximately 1 km before entering the Project site access road.

Turbine Assembly

The wind turbine assembly includes tower sections, the nacelle, the hub, and three-blade rotors (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. Specialized equipment may be required for the safe and efficient handling of wind turbine components.

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.

Equipment expected to be used for turbine assembly includes but is not limited to:

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

Grid Connection

Electricity produced from the turbine will be stepped up to 25.0 kV via a pad mounted transformer, located adjacent to each turbine. The adjacent pad mounted transformers may or may not be required depending on the final turbine model. A power line will connect the turbines, and a line extension from the first turbine will extend the circuit to interconnect with distribution lines owned by Nova Scotia Power Inc. (NSPI) at Tower Road.

Equipment expected to be used for this process includes but is not limited to:

- 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.

Equipment expected to be used for this process includes but is not limited to:

- 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. The 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 25 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 (e.g., ice throw, high voltage). 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 25 years. Prior to year 25, 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;
- Removal of the turbine foundations to 3 feet below grade and reinstatement with top soil to ensure stabilization of the land;
- Removal, recycling (where possible), and disposal of conductor, poles and other equipment; and
- Reinstatement and stabilization of land.

3.0 PROJECT SCHEDULE

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

Table 3.1: Project Schedule

Project Activity	Timeline
Pre-EA Submission Studies	2012 to 2013
EA Approval	Summer 2013
Follow-up Environmental Studies	2013/2014
Geotechnical Assessment	Spring 2013
Engineering Design	Winter 2013-Summer 2014
Power Purchase Agreement	Early 2014
Clearing	Winter 2014
Construction	Spring-Fall 2014
Commissioning	Fall 2014
Operations	2014-2039
Decommissioning	Expected 2040

4.0 GENERAL ENVIRONMENTAL MITIGATION/BEST PRACTICES

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 14.

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.
- All clearing and grubbing activities will adhere to provincial timing requirements, as well as those required under the *Migratory Birds Convention Act* (*MBCA*) to avoid key nesting periods for migratory birds.

4.2 Blasting (if necessary)

- Blasting will be conducted in accordance with provincial legislation and subject to terms and conditions of applicable permits.
- All blasts will 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 (e.g., pre-blast survey, acid rock drainage (ARD)).
- 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
- Where blasting is planned within 500 m of residences, activities will comply with the requirements of any applicable existing by-laws.
- 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* as well as the requirement of the DFO Factsheet: "Blasting – Fish and Fish Habitat Protection" (DFO 2010a); 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 Regulation of the NS*EA*), and in consultation with relevant regulatory departments.

4.3 Transportation

- A notice will be placed in public areas along Tower Road 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 *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.
- Where feasible, vegetation management activities will take place outside of the identified bird breeding season (May-August) and will not involve herbicides.

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.
- Noise-generating construction activities will comply with the requirements of existing by-laws (where applicable).
- All reasonable efforts will be made to restrict construction-related noise and lighting to between the hours of 8am – 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.
- Construction and decommissioning will be scheduled in consultation with Community Liaison Committee (CLC) to minimize noise impacts.
- 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 as part of the EPP during the design phase of the Project, which will include a drainage plan.
- 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.
- 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 Watercourse Crossings

- All required watercourse crossings will comply with existing regulatory requirements including the "Nova Scotia Watercourse Alteration Specifications" (NSE 2010).
- Crossing of watercourses will not result in permanent diversion, restriction, or blockage of natural flow.
- Crossings will be restricted to a single location on a watercourse and occur at right angles to the watercourse or wetland.
- Crossings should be located in areas which exhibit a stable soil type and where grades approaching the crossings will not be too steep.
- The approaches to watercourse crossings will be stabilized with brush mats, where necessary. Stream banks prone to erosion may require additional stabilization. Material used to stabilize/repair stream banks will be clean, non-erodible, and will not come from the stream bank or bed.
- 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 watercourses.

4.8 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.
- 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.

4.9 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, wetlands, and private wells.
- Where possible, refueling in the field will not occur within 30 m of watercourses, water bodies and wetlands.
- Storage of all hazardous materials will comply with Workplace Hazardous Materials Information System (WHMIS) requirements. Appropriate material safety data sheets (MSDS) 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.

4.10 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 the *Transportation of Dangerous Goods Act* requirements.

4.11 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

The EPP will be submitted 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 effects. 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 2009a).

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:

- Canadian Wildlife Service (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 three turbines, it is considered a small project. Based on the known existence of four bird species considered to be 'At Risk' or 'Maybe At Risk' (Section 8.7) and the presence of a bat hibernacula less than 25 km from the Project site (Section 8.8), the Project is classified as having a 'Very High' potential sensitivity. As such, the Project is 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: preliminary assessment of potential interactions between selected environmental components and the Project, identification off 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

6.3.1 Spatial Boundaries

The Project is to be "co-located" directly adjacent to the proposed Truro Heights Community Wind Project (two 2 MW turbines). The Projects are expected to share common infrastructure (e.g. shared access from Tower Road and shared utility right of way) and will be constructed on similar timelines. Therefore, for the purposes of the EA, the two Projects are largely presented together as one Project site, with the footprints of each specifically identified (Drawing 2.1).

The Millbrook footprint includes turbines 1 to 3 located on PID 20215711 and the Truro Heights footprint includes turbines 4 and 5 situated on PID 20206330. All associated access roads within the footprints are considered part of the Project site. The extension of Tower Road to the Project site extends across PIDs 20206595, 20206629, 20206546, and 20354015, is also evaluated as part of the EA and is referred to as the “Tower Road Extension”.

Baseline data and predictive modeling were evaluated in consideration of the entire Project site (e.g., both Projects) and all five turbines.

For the purpose of data collection and the socio-economic environment, the Municipality of the County of Colchester was considered. In addition, residences located within a 2 km radius of the Project site were assessed as potential receptors for the purposes of evaluating potential effects from sound and shadow flicker.

6.3.2 Temporal Boundaries

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 and turbine model modifications were incorporated into the planning process in consideration of the following:

- Sighting within an optimal wind regime;
- Maintenance of a minimum 176 m 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 83 m buffer between turbine locations and field identified wetlands;
- 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 700 m setback (Colchester County setback) between turbines and occupied dwellings, 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 per year and no more than 30 minutes of flicker on the worst day for dwellings, daycares, hospitals, and schools);

- Maintenance of 1.0 times the total turbine height from property boundaries, in accordance with Colchester County by-laws ; and
- Maintenance of a 1.0 times the total turbine height from public roads in accordance with Colchester County by-laws.

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.

7.0 ENVIRONMENTAL ASSESSMENT METHODOLOGY

The methodological framework used in this EA has been developed to meet the requirements of the NS*EA*. 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, (e.g., 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 Assessment

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 14.0. 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 Identification Table

Environmental Component	Description	Identified as a VEC?	Applicable Section in the Report
Atmospheric Environment	Atmospheric environment includes consideration of air quality and climate conditions. Concerns include: - Dust generation from construction and operation activities. - Interaction with air quality due to exhaust emissions, including GHG emissions from Project equipment and vehicles during construction and operation. Only minimal amounts of dust and air emissions are expected. Mitigation for these effects is provided in Section 4. Project-related emissions are anticipated to be temporary, localized, and minor in nature. Measurable changes to the atmospheric environment are not expected.	No	Section 8.1
Geophysical Environment	Geophysical components include consideration of hydrogeology, groundwater, and bedrock and surficial geology. Concerns include: - Damage from blasting to domestic water sources. - Localized disturbances to surface soils and shallow bedrock and likelihood of ARD. - Presence of radon gas. 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. No domestic wells occur within 1 km of a proposed turbine; therefore, blasting activities (if completed) are not expected to impact private water supplies. 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*. 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. 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	Identified as a VEC?	Applicable Section in the Report
Freshwater Environment	Freshwater environments involve consideration of fish and fish habitat, which may be affected by watercourse crossings, erosion and sedimentation etc. Concerns include: - Loss or damage of fish habitat. - Decreased water quality. - Mortality of aquatic species. It is expected that three watercourse crossings will be required along the Tower Road extension (refer to Section 8.3.3). All construction activities near watercourses will comply with the applicable regulations and guidelines. Mitigation related to construction around watercourses and other watercourse related mitigation is described in Section 4. Project-related effects on the freshwater environment are anticipated to be temporary, localized, and minor in nature. Measurable changes 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: - Habitat fragmentation. - Introduction of invasive species. - Damage to wetland ecosystems. - Mortality of some smaller faunal species due to clearing activities. - Loss of vegetation and effects to fauna and flora species due to herbicide application (vegetation management). Habitat fragmentation is considered to be minimal due to the small-scale clearing required. 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. Loss of fauna is considered minimal due to the small scale clearing requirements and attention to seasonal mitigation. Effects to terrestrial flora and fauna will be mitigated through adherence to various protection legislation, as described in Section 4. Avoidance of wetland habitat has been taken into	No	Section 8.4, 8.5, and 8.6

Environmental Component	Description	Identified as a VEC?	Applicable Section in the Report
	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 and micro siting will be completed, as necessary, prior to construction and once wetland boundaries are confirmed. 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 assessed as: • "Endangered", "Threatened", or "Special Concern" r under *SARA;* and • "Endangered", "Threatened " or "Vulnerable" under the Nova Scotia *Endangered Species Act* (NS*ESA*) Consideration is also given to species: • Ranked as "Red" or "Yellow" under the NSDNR General Status Ranks of Wild Species in Nova Scotia; and • Listed "Endangered", "Threatened", or "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Based on the above criteria, one fish SOCI and three fauna SOCI have potential to occur at the Project site. No plant SOCI were identified at the Project site during field surveys. Concerns include: - Sensory disturbance. - Direct and indirect adverse environmental effects to habitat (loss or alteration). - Effects to fish passage/migration - Direct mortality of individuals. Loss of terrestrial fauna and aquatic SOCI is considered minimal due to the small scale clearing requirements, and attention to seasonal mitigation. Effects to flora and fauna will be mitigated by adherence to *SARA* and NS*ESA* as described in Section 4. However, due to special status of some species under federal and provincial federal legislation SOCI are considered further in the assessment.	Yes	Sections 8.3, 8.5, 8.6 and 14.2.1
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: - Mortality resulting from direct collision.	Yes	Sections 8.7 and 14.2.2

Environmental Component	Description	Identified as a VEC?	Applicable Section in the Report
	- Habitat alteration. - Sensory disturbance. The requirements as set out in the *MBCA* will be adhered to for clearing activities (Section 4). Due to the potential effects of wind turbines on avifauna, this component is considered for further assessment.		
Bats	The installation of wind turbines has the potential to effect bats both directly and indirectly. Concerns include: - Mortality resulting from direct collision and/or barotrauma. - Habitat alteration. - Sensory disturbance. The significance of these effects 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. 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
Socio-Economic Environment	Socio-economic aspects include economy, land use/value, and recreation and tourism may be affected by the Project; however these effects can be positive and/or negative. The Project will likely create more local jobs, increase municipal tax revenues, and provide community sustainability fund, thereby resulting in a positive change for economy. Effects to land use are not expected in the area since the Project is located on privately owned land. Research has consistently demonstrated that, in a variety of spatial settings and across a wide temporal scale, sale prices for homes surrounding wind energy facilities are not significantly different from those attained for homes sited away from wind energy facilities. The Project represents a small footprint on privately owned land. Therefore, effects to the broad recreational/tourism community are not expected. 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.	No	Section 9.1, 9.2, and 9.3

Environmental Component	Description	Identified as a VEC?	Applicable Section in the Report
Archaeological and Heritage Resources	Archaeological and heritage resources are defined as any physical remnants found on top of and/or below the surface of the ground, including on or below the sea floor, that inform us of past human use of, and interaction with, the physical environment. Archaeological and heritage resources noted for NS include areas of high archaeological potential, registered archaeological sites, and paleontological resources (e.g., fossils). Effects from the Project on this component include surface or subsurface disturbance during the construction and decommissioning activities. An effect from the operation and maintenance phase is not anticipated as those activities will take place where construction-related ground disturbance has already occurred. An Archaeological Resource Impact Assessment (ARIA) was performed for the site and indicated that no negative effects to cultural and heritage resources are expected. Effects to cultural and heritage resources are therefore considered to be non-existent. Procedures related to potential discovery of archaeological items or sites during construction/decommissioning will be described in the EPP.	No	Section 10
Mi'kmaq Resources	If present, traditional Mi'kmaq flora and fauna resources may be affected by ground disturbance during construction and decommissioning activities. A Mi'kmaq Ecological Knowledge Study (MEKS) was completed for the Project. The results of the consultation process show that Mi'kmaq ecological and traditional resources associated with the Project site are still accessible by the surrounding communities and are being utilized by a wide range of community sectors, from youth to elders. Vegetation and habitat surveys associated with the study will be completed in June 2013. The final report will provide complete analysis and presentation of field data. Based on these preliminary results, future planning and collaboration between the proponent and local Mi'kmaq communities will be maintained through the application of Mi'kmaq Ecological Knowledge.	No	Section 11
Human Health	The public is often concerned about the potential for effects to human health from wind turbines. Concerns include: - Sound. - Shadow flicker. - Infrasound. - Electromagnetic fields (EMF). - Effects to air quality from dust and air emissions.	No	Section 12, Appendix C

Environmental Component	Description	Identified as a VEC?	Applicable Section in the Report
	- Risk of ice throw. A literature review regarding the potential for effects to human health from wind turbines was completed (Appendix C). The main findings from this review are as follows: - There is no evidence that the levels of infrasound produced by the turbines present a risk to human health. - There is no discernible evidence that there are health risks associated with EMFs. - Effects to air quality are expected to be temporary, minor, and localized in nature (additional information regarding air quality is provided 'Atmospheric Environment', above). - Setbacks and safety awareness measures minimize any potential risk from ice throw (additional information regarding safety measures, including ice throw, are provided in Section 15). *(Note: Shadow flicker and sound have been considered separately).* Effects to human health are considered minimal or non-existent due to the size and location of the wind farm, mitigation, and setback distances. Measureable changes to human health are not expected.		
Shadow Flicker	Shadow flicker can occur when rotating blades cast flickering shadows during times of direct sunlight. 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. Shadow flicker, therefore, is not expected to be an issue at any existing residence/dwelling in the vicinity of the Project.	No	Section 12.1
Sound	Sound is generated during all phases of the wind farm. Concerns include: - Noise during construction and decommissioning phases. - Annoyance and unpleasantness, for local residents in close vicinity, from turbine blades during operation. 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. Construction and decommissioning will be scheduled in consultation with the CLC to minimize noise impacts. Measurable changes to sound during construction and decommissioning are not expected.	No	Section 12.4

Environmental Component	Description	Identified as a VEC?	Applicable Section in the Report
	A study was carried out of the existing ambient sound levels near the Project site. Average existing ambient sound levels at two locations near the Project site boundaries were observed to be 50.2 and 49.3 dBA during the monitoring program. Modeling results for wind farm operation indicate that all non-participating 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 during operation will be completed, as required.		
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. An EMI study completed for this Project indicated that there were no objections regarding EMI effects associated with the Project provided to date.	No	Section 12.2
Visual Landscape	Wind farms create visual effects to the local landscape. A visual assessment was completed for the Project. Predicted view planes generated by the assessment are presented in Section 12.3. Effects to the visual landscape are considered minimal to non-existent due to the size and location of the wind farm, setback distances, and the significant tree cover in the vicinity of the Project site.	No	Section 12.3

Based on the preliminary assessment of potential interactions summarized in Table 7.1, VECs identified for further assessment 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 (centered at 45°19'42"N, 63°20'43"W) lies within the Valley and Central Lowlands Ecoregion of Nova Scotia, which includes the Annapolis Valley and the watersheds of the Minas Basin and the Musquodobit Valley (Neily *et al*. 2003). This region is protected from direct coastal influences by the North Mountain and its promontory, Cape Split. Two notable uplands bordering the ecoregion, the Rawdon Hills and Wittenburg Ridge, also shelter the adjacent lowlands. As a result, the ecoregion records some of the hotter summer temperatures within the province (Neily *et al*. 2003). The typical growing season in the area of the Project site is 198 days (Webb and Marshall 1999).

Local temperature and precipitation data were obtained from the Truro meteorological station (45°22'00.00N, 63°16'00.00W) located approximately 8 km northeast of the Project site. For the period from 1971-2000, the mean annual temperature was 5.8°C, with a mean daily high of 11.1°C and a mean daily low of 0.5°C (EC 2011a). January and February were the coldest months (-6.9°C and -6.5°C, respectively), while the warmest months were July and August (18.4 °C and 17.8°C, respectively) (EC 2011a).

From 1971 to 2000, mean annual snowfall was 229.1 cm and rainfall was 991.4 mm (EC 2011a). Most snowfall is received in January and February (51.9 cm and 49.2 cm, respectively), while the rainiest months are September, October and November (101.3 mm, 104.6 mm, and 101.1 mm, respectively) (EC 2011a).

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 Truro station mentioned above. The Canadian Climate Normals (1971-2000) for this station indicate an annual maximum wind speed of 13 km/h, most commonly out of the west (EC 2011a). The maximum hourly wind speed for this station was 93 km/h, recorded on January 24th, 1963, with the highest single wind gust measuring at 134 km/h on February 2nd, 1976 (EC 2011a). According to the Nova Scotia Wind Atlas (NSDE 2007), average wind speeds at 30 m and 50 m above the ground at the Project site range from 16.2-18 km/hr., and range from 21.6-23.4 km/hr. at 80 m above the ground.

8.1.2 Air Quality

Currently in Nova Scotia, 42% of total greenhouse gas (GHG) emissions come from electricity use and 90% of electricity comes from fossil fuels (NSDE 2009). Because of this heavy 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 2010).

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 2011b). 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 Pictou, approximately 62 km northeast of the Project site. The AQHI at this site is usually low at all times of the year (EC 2011b).

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

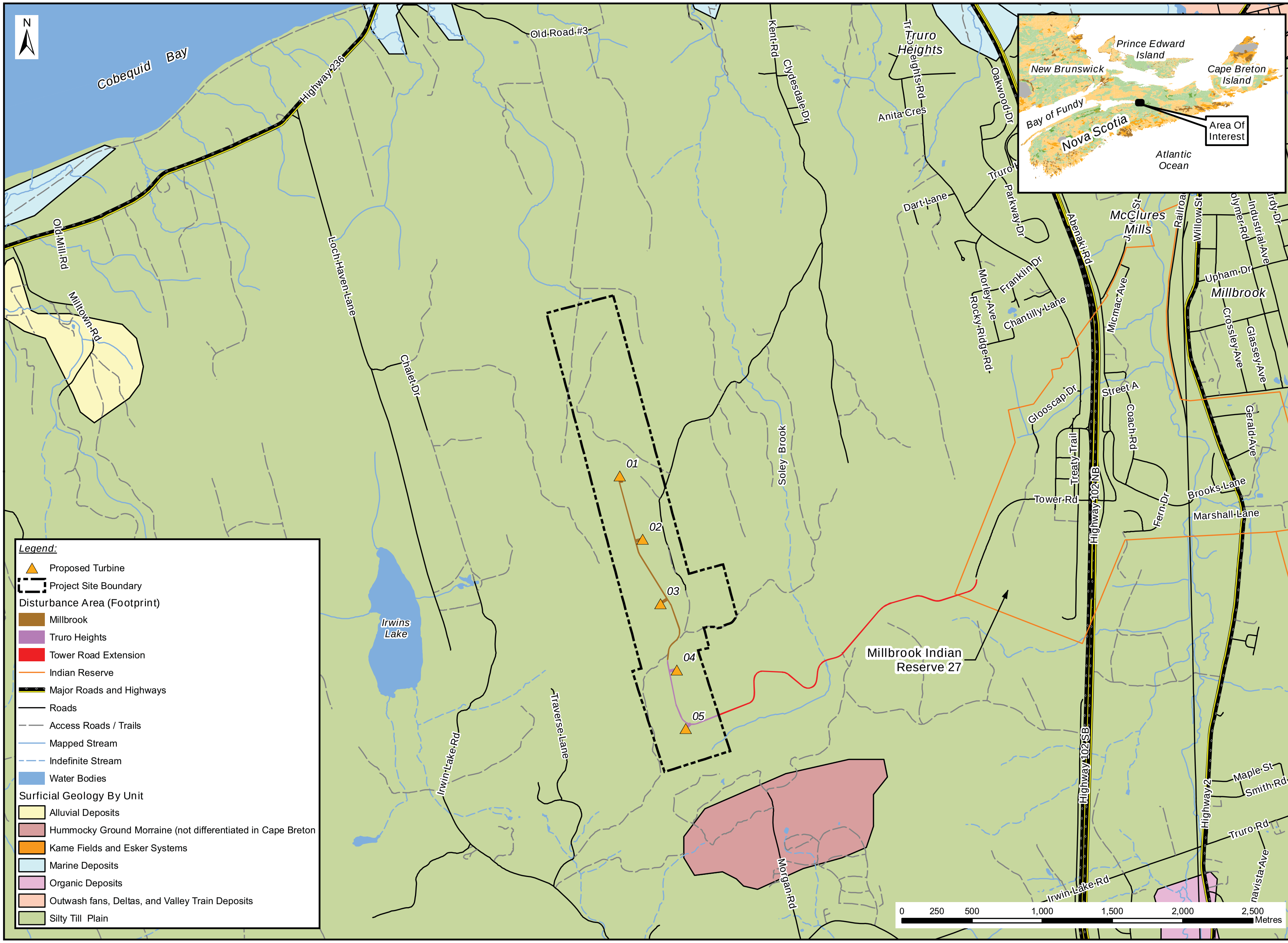
8.2 Geophysical Environment

8.2.1 Physiography and Topography

The Project site lies within the Central Lowlands Ecodistrict, located on a hummocky to undulating glacial till plain where imperfectly drained, deep, compacted, loam to clay loam till is the dominant surficial material (Neily *et al*. 2003). Topography in the area is flat to rolling with few surface boulders. Elevation on the Project site ranges from 128 m at the northern boundary to a high of 153 m near the centre of the site, then sloping to an elevation of 136 m at the southern boundary.

8.2.2 Surficial Geology

The surficial geology of the Project site is characterized as a silty till plain otherwise referred to as ground moraine (Drawing 8.1). The silty compact material is derived from both local and distant sources. Till thickness ranges from 3 – 30 m, masking bedrock undulations (Stea *et al.* 1992). The predominant soils in the area are fine textured, comprised of loams, silts and clays. Deep, reddish-brown soils are characteristic of the Ecodistrict and have been derived from the underlying Carboniferous rock. The drainage has been restricted on most of the soils due to glacial compaction of these finer textured soils (Neily *et al.* 2003).



Notes:

1. Reference: 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.

Surficial Geology

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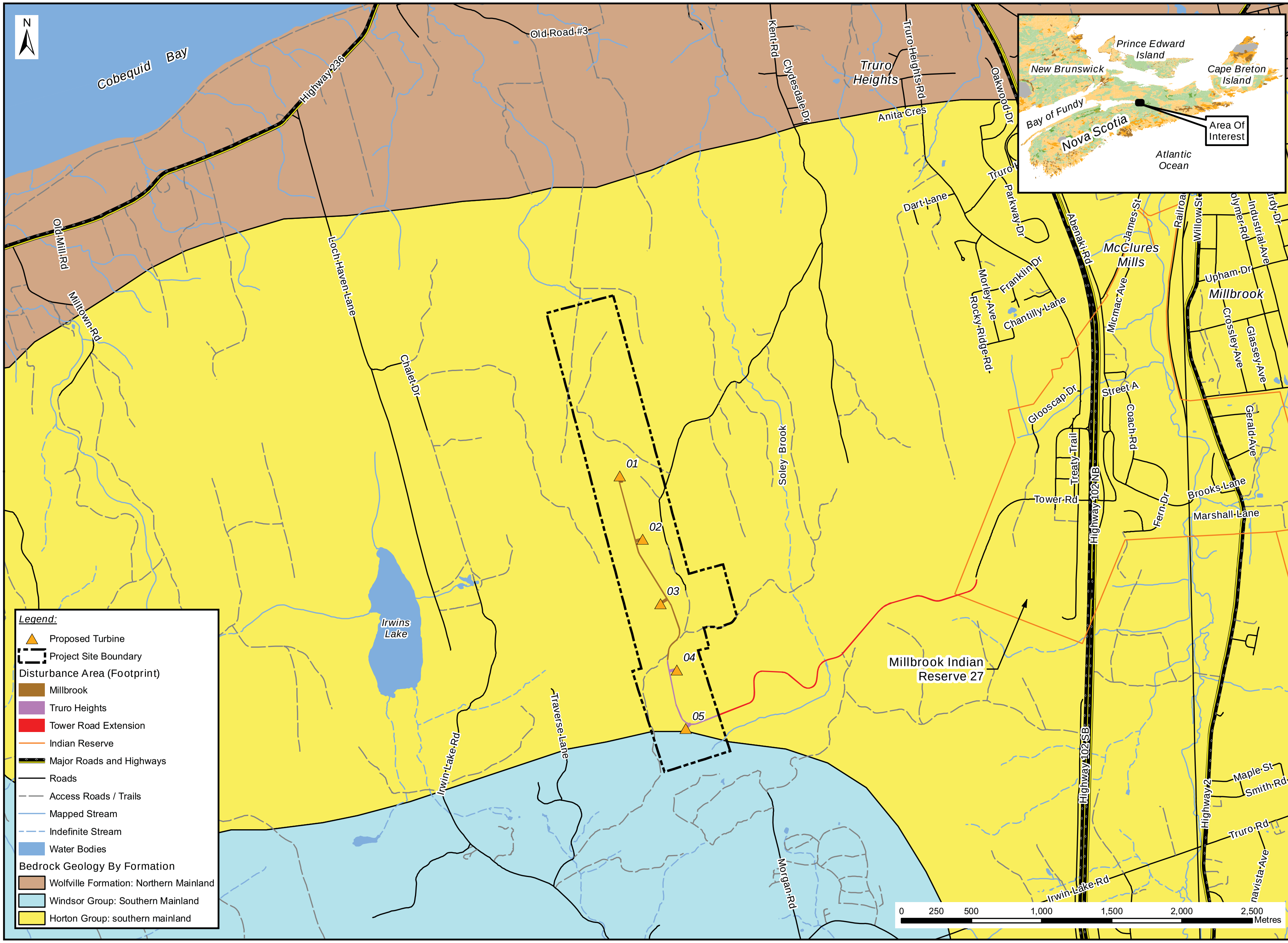
Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:25,000	Drawing #: 8.1
Drawn By: H. Serhan	
Checked By: M. Smith	

8.2.3 Bedrock Geology

Bedrock geology across the Project site consists of Late Devonian – Early Carboniferous aged sedimentary rocks of the Horton Group and Early Carboniferous aged Windsor Group (Keppie 2000) (Drawing 8.2). Bedrock within the Project footprint consists entirely of the Horton Group, composed of sandstone, coal, siltstone, shale and conglomerates. Horton rocks in the area are folded and cut by numerous faults with small stratigraphic displacement (Hennigar 1972). West and east of Truro, Triassic deposits lie unconformably against Carboniferous Horton strata (NSMNH 1996). In both areas, the Carboniferous strata are harder and form low rolling hills. The boundary with the flat red beds is generally very distinct.

According to the NSE Well Log Database, there are no drilled wells located within a 1 km m radius of the Project footprint (NSE 2011a). However a total of eight wells were identified within a 2 km radius, ranging in depths from 6.1 m to 43.5 m. All eight wells were drilled through varying surficial materials including clay, stones, boulders and gravel ranging from 1.5 m to 30.4 m in thickness, followed by shale, gypsum, quartzite, conglomerate, slate and sandstone bedrock. Within the Project footprint, only formations of the Horton Group have been mapped; however the Windsor Group underlies the southern extent of the Project site which would account for the presence of gypsum.



Notes:

1. Reference: Nova Scotia Department of Natural Resources, Minerals and Energy Branch, Map ME 2000-1, Geological Map of the Province of Nova Scotia, 1:500 000, Compiled by J. D. Keppie.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Bedrock Geology

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Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:25,000	Drawing #: 8.2
Drawn By: H. Serhan	
Checked By: M. Smith	

8.2.4 Hydrogeology and Groundwater

Groundwater Quantity

Water supplies near the Project site are generally derived from individually drilled wells. According to the NSE Well Log Database (NSE 2011a) of logs for wells constructed between 1920 and 2010, wells near the Project site have been reportedly installed through varying bedrock formations including: shale, gypsum, quartzite, conglomerate, slate and sandstone bedrock. A summary of the pertinent well properties included in these logs is presented in Table 8.1.

Table 8.1: Summary of Drilled Well Records within Approximately 2 km of the Project site

	Drilled Date (yr)	Well Depth (m)	Casing Length (m)	Estimated Yield (Lpm)	Water Level (m)	Overburden Thickness (m)	Water Bearing Fractures (m)
Minimum	1988	19.8	6.7	6.8	1.1	1.5	8.8
Maximum	2008	43.5	31.1	68.1	6.7	30.5	41.2
Average	2001	31.9	14.4	42.2	4.1	11.3	23.6
Geomean	2001	30.7	12.2	34.7	3.5	7.6	21.4
Number of well records	8	8	8	8	6	8	6

Source: NSE 2011a

Based on short term driller's estimates for the wells in Table 8.1, the average yield is approximately 42.2 liters per minute (11.1 gallons per minute) and average well depth is approximately 31.9 m (104.6 ft). These yields represent very short term yields estimated by the driller at the completion of well construction. Fracture depths ranged from 8.8 m (28.9 ft) to 41.2 m (135.1 ft). The closest drilled well to a proposed turbine is located approximately 1.25 km to the west, along Chalet Drive.

The NSDNR Pump Test Database (NSDNR 2011) provides longer term yields for select wells throughout the province. Two regional wells drilled through quartzite bedrock and located within a 10 km radius of the Project site indicate long term safe yields (Q_{20}) of 9.1 Lpm (2.4 gpm) and 272.7 Lpm (72.0 gpm), and apparent transmissivity (T) values of 1.03 and 35.9 m^2/d.

An observation well (No. 014) is located in Truro, Colchester County, approximately 5.5 km northeast of the Project site that forms part of the NSE Nova Scotia Groundwater Observation Well Network (NSE 2011b). This observation well was drilled to a depth of 91.4 m through sandstone bedrock of the Wolfville Formation. This well has been monitored since 1971. The groundwater levels appear to have decreased slightly between 1971 and 1991. There is a data gap between 1991 and 2002 when no monitoring was carried out at this well; however, sometime after 1991 the groundwater levels in this well increased and have remained relatively consistent since 2003 when monitoring began again. The increased water level at this well is believed to be a result of the decommissioning of a municipal water supply well in 1994, which was located within 1 km of the observation well.

Groundwater Quality
The Horton Group commonly contains good quality calcium bicarbonate groundwater typically low in dissolved solids and hardness, low in iron, and generally slightly basic (Hennigar 1972). Waters with relatively poor quality, due to a high concentration of sulphate are usually found where Horton rocks are located down-gradient from Windsor rocks in the groundwater flow system. Large amounts of bicarbonate hardness may be due to a close association with limestones in the Windsor Group or due to the solution of calcareous beds within the Horton Group.

The presence of uranium, radium, and radon have been documented in the Carboniferous-aged Horton Group. Mineralization is typically associated with reducing agents such as hydrocarbons, plant material and/or phosphate-rich lacustrine rocks. When released to outdoor air, radon is diluted and is not a concern; however, in enclosed spaces the gas can sometimes accumulate to high levels (Okunade *et al.* 2008). The current Canadian guideline for radon in indoor air is 200 Becquerels per m^3. Radon soil gas emissions were monitored in 2007 – 2008, at known uranium occurrences, in Millet Brook, NS. The radon gas concentrations were shown to dissipate very rapidly to negligible concentrations in ambient air at 10 cm aboveground directly over the mineralized source (Goodwin 2008). All other parameters typically meet the Guidelines for Canadian Drinking Water Quality (Health Canada 2012).

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 Central Lowlands Ecodistrict, which is part of the Valley and Central Lowlands Ecoregion (Neily *et al.* 2003). A defining feature of this Ecodistrict is the extent to which it is drained by large rivers that empty into the Bay of Fundy, including the Stewaicke and the Shubenacadie Rivers (Neily *et al.* 2003). There are few freshwater lakes within the ecodistrict (Webb and Marshall 1999), which combined with rivers and streams account for just 1.5% of the ecodistrict's area (Neily *et al.* 2003).

The Project site lies within the Salmon River Watershed (1DH). The Salmon River originates in the Cobequid Hills in the central-northeastern part of Colchester County, before turning west and flowing through the Town of Truro. The Salmon River empties into Cobequid Bay, forming an estuary at the eastern extreme of the Minas Basin. Prominent water bodies in the Salmon River Watershed include Folly Lake, MacElmon's Pond, and Farm Lake.

There are no lakes or areas of open water mapped at the Project site (Drawing 8.3). The closest water body is Irwin's Lake, a 29 ha lake situated within the Shubenacadie River Watershed located approximately 1.5 km to the west. The largest lake in the vicinity of the Project site is Shortts Lake, located approximately 8.8 km to the south.

A total of ten lakes within Colchester County are included in the Nova Scotia Lake Inventory Program, which determines the baseline biophysical attributes of lakes throughout the province (NSE 2012b). With the exception of Shortts Lake, the remaining lakes are located at distances greater than 20 km from the Project site. The maximum depth of Shortts Lake, as determined from this survey, is 14 m, with mean depth of 3.6 m. Surface water temperature at the lake during the most recent survey in

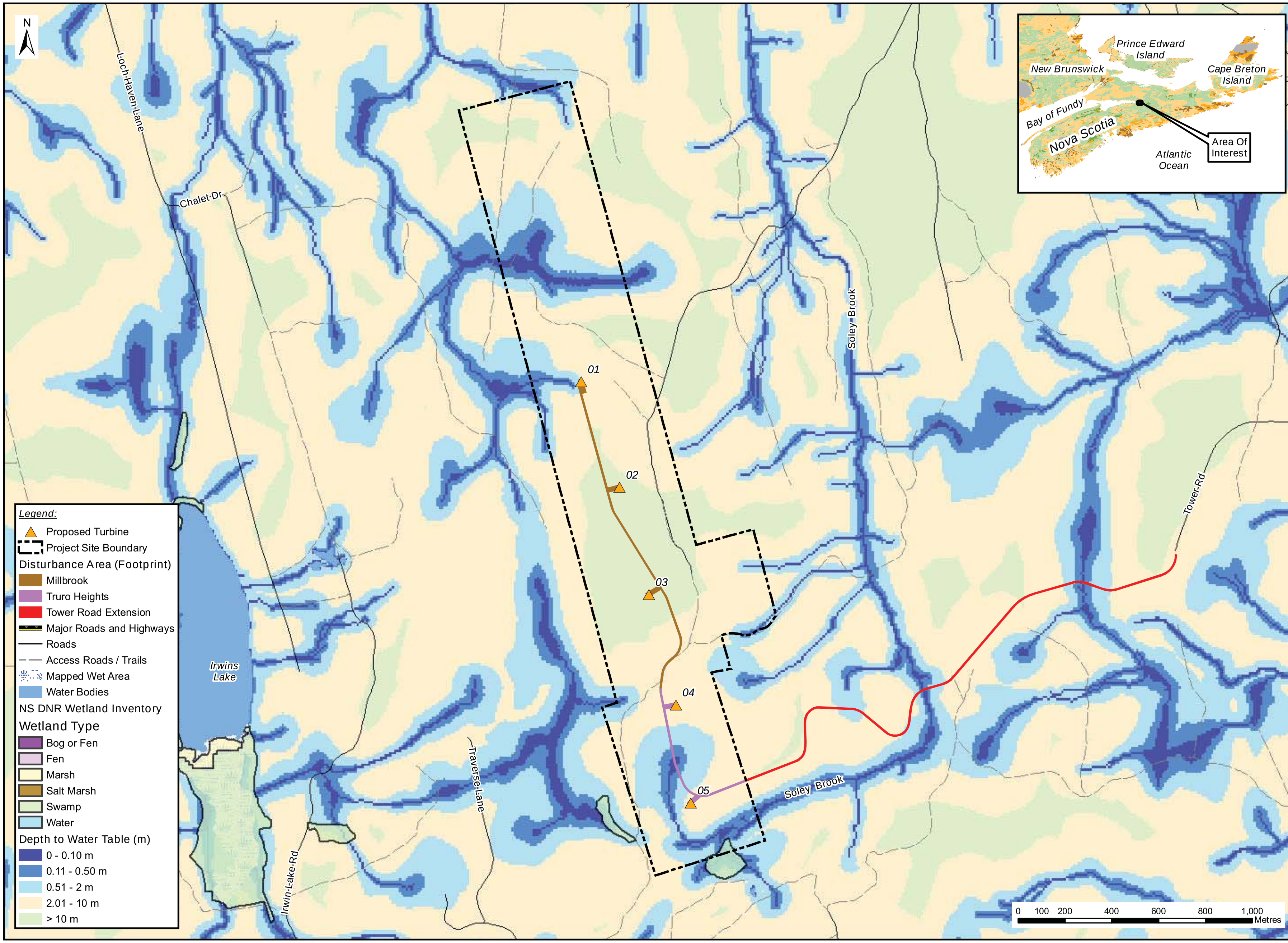
August 2005 was 22.6°C, while dissolved oxygen concentrations at the lake surface and bottom were 8.2 mg/L and 0.3 mg/L, respectively. The lake maintains a relatively neutral acidity level with pH readings ranging from 6.6 to 7.2 in August 2005 (NSE 2012b).

There are no mapped watercourses located within Project site boundaries (Drawing 8.3). Soley Brook (watercourse 5) is located approximately 0.6 km to the east of the Project site boundary and crosses the proposed access road from Tower Road to the Project site, draining water from south to north toward Cobequid Bay. A second mapped watercourse originates just outside of the northern Project site boundary (Drawing 8.3) and flows to the north into Cobequid Bay (Minas Basin).

Four additional watercourses were identified during field assessments completed in June 2012 (Drawings 8.4A-C). General characteristics for these watercourses are provided in Table 8.2.

Table 8.2: Watercourse Characteristics

Feature ID	Wetted Width (m)	Depth (cm)		Substrate	Drainage Direction
		Observed	Bankfull		
Watercourse 1	0.4	5	20	Organic fines with cobble	West to east
Watercourse 2	0.5	12	25	Organic fines with cobble and boulder	Southwest to northeast
Watercourse 3	1.2	25	10	Gravel with cobble and sand	West to east/northeast
Watercourse 4	1 to 1.5	15	20	Organic fines with cobble	South to north
Watercourse 5 (Soley brook)	1.5 to 2	25	35	Cobble with boulder and sand	South to north
Watercourse 6	1 to 1.5	10	30	Organic fines	North to south



Notes:

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

Wetland and Watercourse Desktop Review Results

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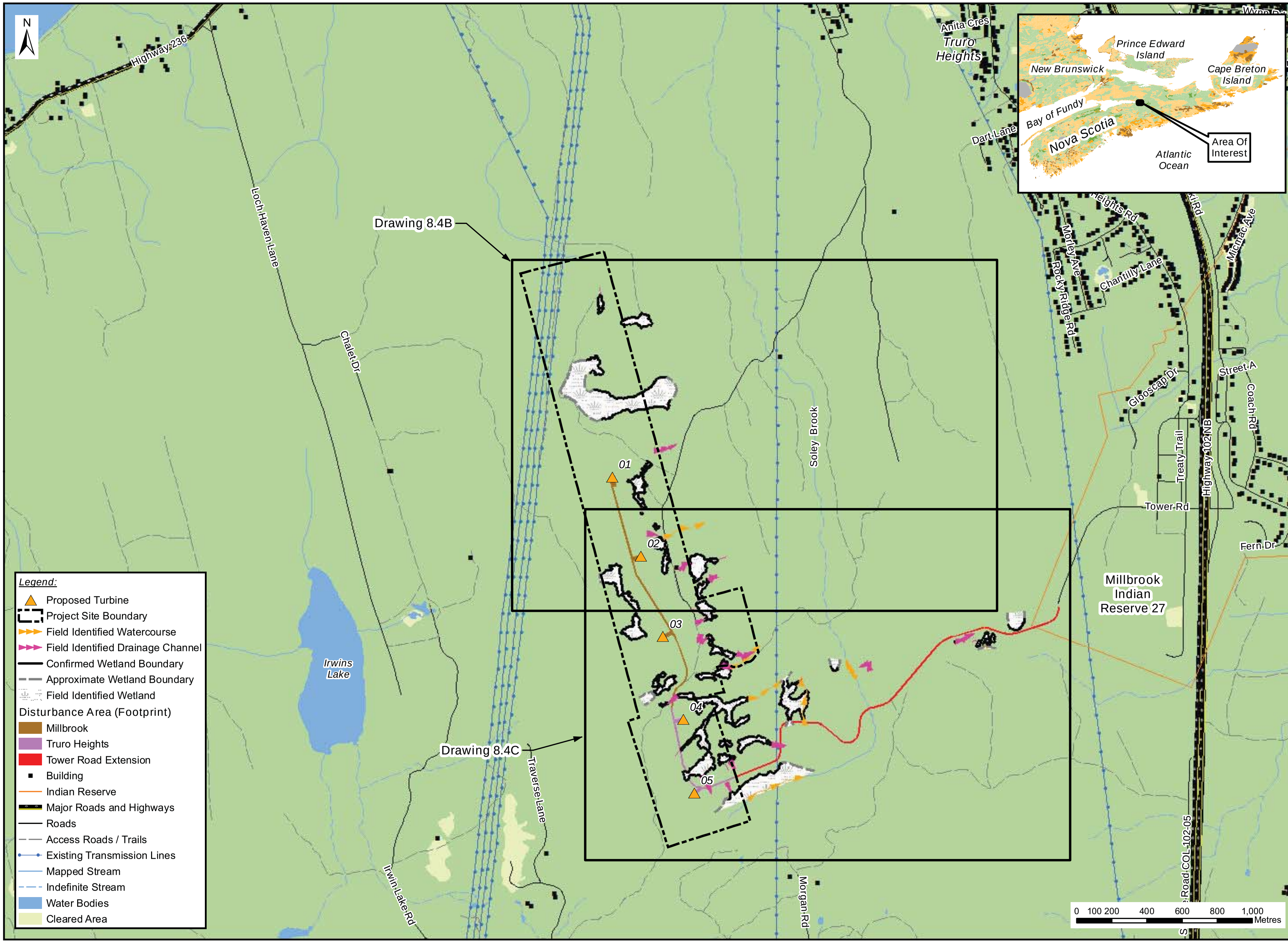
Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:15,000	Drawing #: 8.3
Drawn By: H. Serhan	
Checked By: M. Smith	



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Points And Tracks Taken Are Typically To +/-5m Accuracy.

Wetland and Watercourse Survey Results

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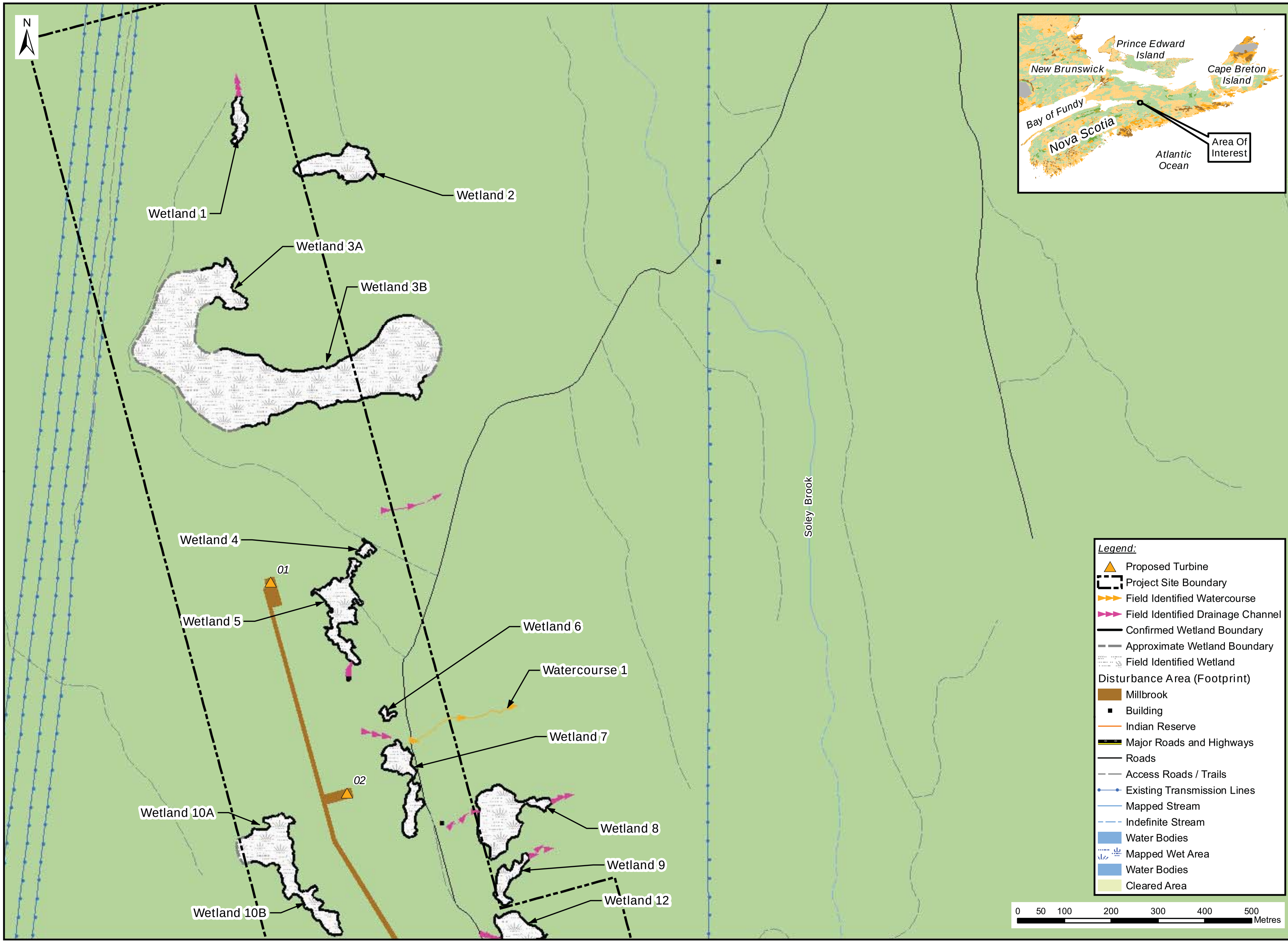
Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:20,000	Drawing #: 8.4A
Drawn By: H. Serhan	
Checked By: M. Smith	



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Point And Tracks Taken Are Typically To +/-5m Accuracy.

Wetland and Watercourse Survey Results

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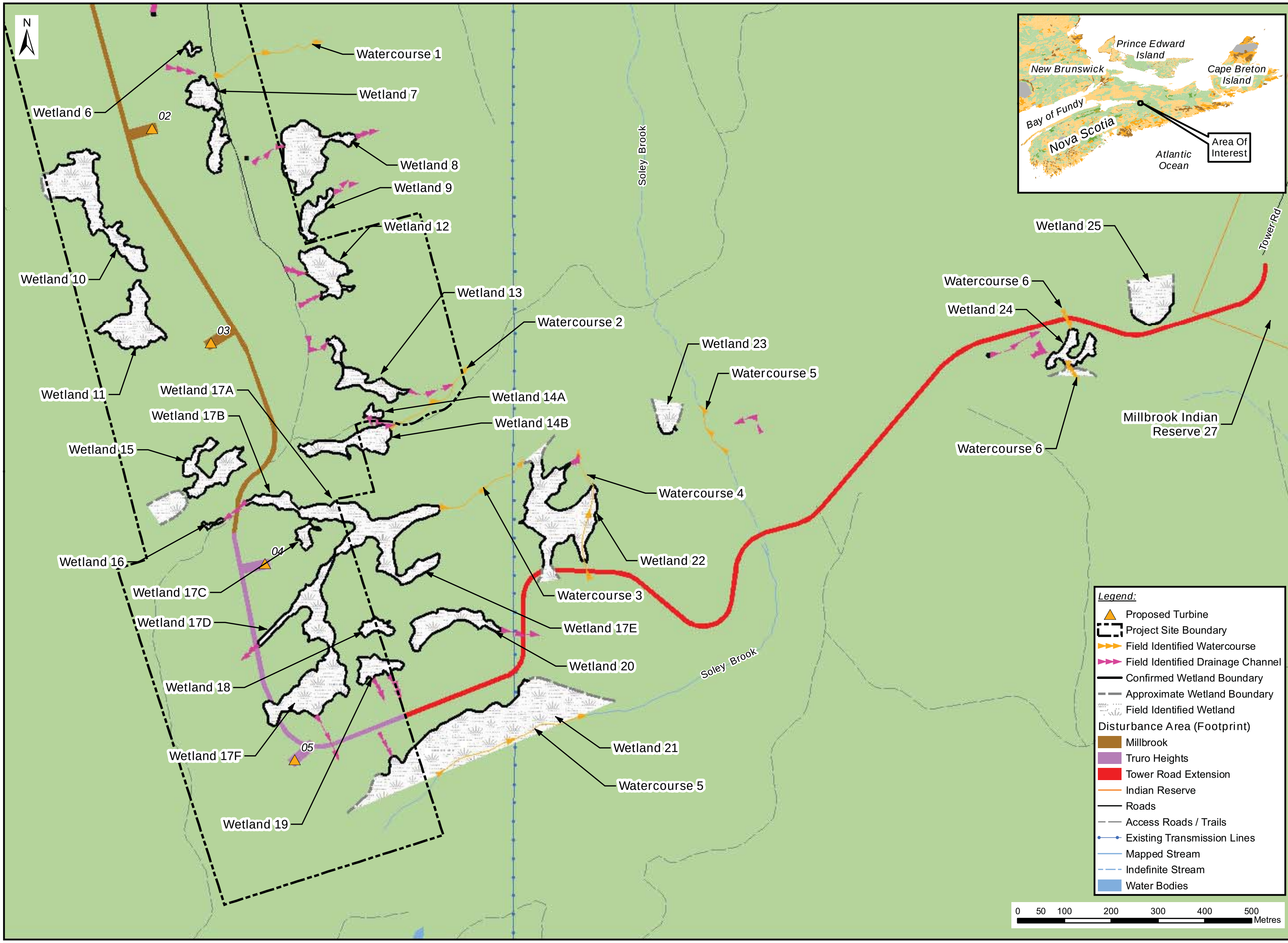
Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:7500	Drawing #: 8.4B
Drawn By: H. Serhan	
Checked By: M. Smith	



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Point And Tracks Taken Are Typically To +/-5m Accuracy.

Wetland and Watercourse Survey Results

Community Wind Farms Inc.

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:7500	Drawing #: 8.4C
Drawn By: H. Serhan	
Checked By: M. Smith	

8.3.1 Watercourse Crossings

Three watercourse crossings will be required for Watercourses 4, 5 and 6, in association with the Tower Road extension to the Project site (Drawing 8.4C). No watercourse alteration impacts are expected for turbine laydown areas or access roads.

All required watercourse crossings will comply with the "Nova Scotia Watercourse Alteration Specifications" (NSE 2010).

Additional micro siting for watercourses will be completed as necessary, once the final layout is confirmed.

8.3.2 Freshwater Fish and Fish Habitat

For the purposes of the EA, all watercourses at the Project site have been assumed to be 'fish bearing' and will be treated as such throughout site development plans.

A review of the Atlantic Canada Conservation Data Centre (ACCDC) database for fish species recorded within a 100 km radius of the Project site was completed. All species, including status rankings, are provided in Table 8.3.

Table 8.3: Fish 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]
Atlantic salmon (Gaspé-Southern Gulf of St. Lawrence, Outer Bay of Fundy, and NS Southern Uplands populations)	*Salmo salar*	No Status	Not Listed	Special Concern (Gaspé-Southern Gulf of St. Lawrence pop.); Endangered (Outer Bay of Fundy pop.); Endangered (NS Southern Uplands pop.)	Red
Atlantic salmon (Inner Bay of Fundy Population)	*Salmo salar*	Endangered	Not Listed	Endangered	Red
Atlantic sturgeon	*Acipenser oxyrinchus*	Not Listed	Not Listed	Threatened	Red
Striped bass	*Morone saxatilis*	No Status	Not Listed	Threatened	Red

Source: ACCDC 2012

[1] Government of Canada 2012; [2] NS *ESA* 2007; [3] COSEWIC 2012; [4] NSDNR 2010

Fish species recorded within a 100 km radius of the Project site were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009b) to develop a list of priority species (e.g., SOCI), which are assessed further as a VEC (Section 14.0).

In the context of this EA, SOCI include those that are:

- Assessed under the *SARA* as "Endangered", "Threatened", or "Special Concern";
- Assessed under the NS *ESA as "*Endangered*"*, "Threatened", or "Vulnerable";
- Listed by COSEWIC as "Endangered", "Threatened", or "Special Concern"; or
- Ranked by NSDNR as "Red" (at risk or may be at risk) or "Yellow" (sensitive).

Priority fish species include:

- Atlantic salmon – "Special Concern" (COSEWIC), "Red" (NSDNR);
- Atlantic salmon (Inner Bay of Fundy population) – "Endangered" (*SARA*), "Endangered" (COSEWIC) "Red" (NSDNR);
- Atlantic sturgeon – "Threatened" (COSEWIC), "Red" (NSDNR); and
- Striped bass – "Threatened" (COSEWIC), "Red" (NSDNR).

Atlantic Salmon
Atlantic salmon are an anadromous species native to the North Atlantic Ocean and coastal rivers, which undertakes long feeding migrations to the ocean as older juveniles and adults, and return to freshwater streams to reproduce. The species requires rivers that are clear, cool and well oxygenated, with pools and shallow riffles and gravel, rubble, rock or boulder bottoms for reproduction (NS Fisheries and Aquaculture 2007; COSEWIC 2010a).

Atlantic salmon identified by ACCDC within 100 km of the Project site may include those from the Gaspé-Southern Gulf of St. Lawrence, NS Southern Uplands, Outer Bay of Fundy and/or Inner Bay of Fundy populations, or designatable units (DUs). All watercourses identified at the Project site form part of the Salmon River watershed, therefore any Atlantic salmon present on site would form part of the Inner Bay of Fundy (IBoF) population.

Atlantic Salmon (Inner Bay of Fundy Population)
Inner Bay of Fundy (IBoF) salmon spawns in those rivers of Nova Scotia and New Brunswick that drain into the Minas Basin and Chignecto Bay (COSEWIC 2010a). Although iBoF Atlantic salmon have been recorded in 32 rivers in recent years, including the Salmon River, the population is estimated to have declined by 94% in the past decade (DFO 2008). Currently the Atlantic salmon is listed as extirpated from the Salmon River (Atlantic Salmon Federation 2012; COSEWIC 2010a), though this particular river has been identified to have a high potential capacity for restoring salmon populations and recovery efforts are underway (DFO 2008).

The recovery strategy for the species includes a live gene-banking program which has been developed to prevent the imminent extinction of the species (DFO 2010b), and several key populations are maintained in DFO Biodiversity Centres in NB and NS. These stocks will be used to restore self-sustaining populations in select Inner Bay of Fundy rivers. Extirpations in rivers without the support of the gene-banking program persist; however, juvenile abundance has increased in a small number of rivers receiving support from the program. Recent discussions with DFO confirm that releases of Atlantic salmon into the Salmon River are ongoing as part of the program, and that the species is now present at various locations within the watershed (C. Hominick, pers. comm.).

All on-site watercourses drain northwards into Cobequid Bay and form part of the Salmon River watershed. Though the Atlantic salmon is listed as extirpated from the Salmon River, the species can likely be encountered at various reaches of the watershed due to DFO stocking initiatives.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.1.

Atlantic Sturgeon
Little is known about the habitat requirements for Atlantic sturgeon at the northern extent of its range, but important freshwater habitats for the species appear to be rivers with access to the sea, preferably with deep channels. Research suggests that the anadromous species spawns in freshwater over hard-bottom substrates at depths of 1-3 m in areas of strong currents, under waterfalls, and in deep pools just above the marine-freshwater demarcation (COSEWIC 2011). Juveniles remain in freshwater for the first summer before migrating to estuaries in winter. Juveniles remain in the freshwater-estuary system for 3 to 5 years before migrating to the near-shore marine environment as adults (NOAA 2006).

Occurring in rivers and estuaries near North Atlantic shore environments, the Atlantic sturgeon has been reported in the Annapolis, Avon, Shubenacadie, St. Croix and LaHave River systems, as well as the Minas Basin (Colligan *et al.* 1998; COSEWIC 2011). In Canada, the species is known to spawn only in two areas, the St. John River and middle St. Lawrence. Historically, the St. Croix River was also a known spawning area, although the current status of this population is unknown.

Although the watercourses on the Project site drain into the Cobequid Bay, they are not conducive to the spawning habitat requirements of Atlantic sturgeon, therefore it is unlikely that they would be found within the Project site.

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

Striped Bass
The striped bass is an anadromous species typically associated with estuaries and coastal waters, which spawns and over-winters in fresh and occasionally brackish water.

In Nova Scotia, the Annapolis River and the Shubenacadie–Stewiacke River system in the Bay of Fundy historically supported spawning populations (Rulifson and Dadswell 1995, as cited in COSEWIC 2004). Today, the species is known to spawn only in two rivers in eastern Canada: the Miramichi and the Shubenacadie. Catches have been recorded throughout the province, including in the Annapolis River, River Phillip, Shubenacadie and Grand lakes, and the Minas Basin. The Shubenacadie River population ascends the river to overwinter in Shubenacadie and Grand lakes, then returns downstream to spawn in the Stewiacke River (a tributary of the Shubenacadie). Spawning occurs in the portion of the river affected by a tidal bore (COSEWIC 2004). Though the on-site watercourses are connected to known marine habitat in the Bay of Fundy, they do not form part of the Shubenacadie-Stewiacke system, therefore it is unlikely that striped bass would migrate through the Project site.

The Project is not expected to have any impact on striped bass and no further consideration of effects and mitigation for specific to this species has been undertaken.

General mitigation measures for aquatic fauna are provided in Section 4.0. Where required, species-specific mitigation is provided in Section 14.

8.4 Terrestrial Habitats

The Project site is situated within the Valley and Central Lowlands Ecoregion and specifically located within the Central Lowlands Ecodistrict (Neily *et al*. 2003). Impermeable clays have led to the establishment of large, peat-based wetlands and poorly-drained black spruce (*Picea mariana*) forests, with tolerant hardwood stands occurring on well-drained hills (Neily *et al*. 2003). Red spruce (*Picea rubens*) stands with hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) can be found in particularly well-drained slopes. A unique feature of the ecodistrict is the association of red pine (*Pinus resinosa*) with black spruce at poorly-drained, fire disturbed sites.

The majority of the Project site is forested, with softwood stands representing the dominant habitat feature (Table 8.4; Drawing 8.5).

Table 8.4: Habitat Types at the Project Site

Habitat Type	Area (ha)	Percent of Site
Softwood	115.83	65%
Mixed woods	45.28	26%
Powerline Corridor	8.02	5%
Clear cut	3.37	2%
Hardwood	2.91	2%
Wind Throw	1.36	1%
Treed Bog	0.319	0%
Total	**177.089**	**100%**

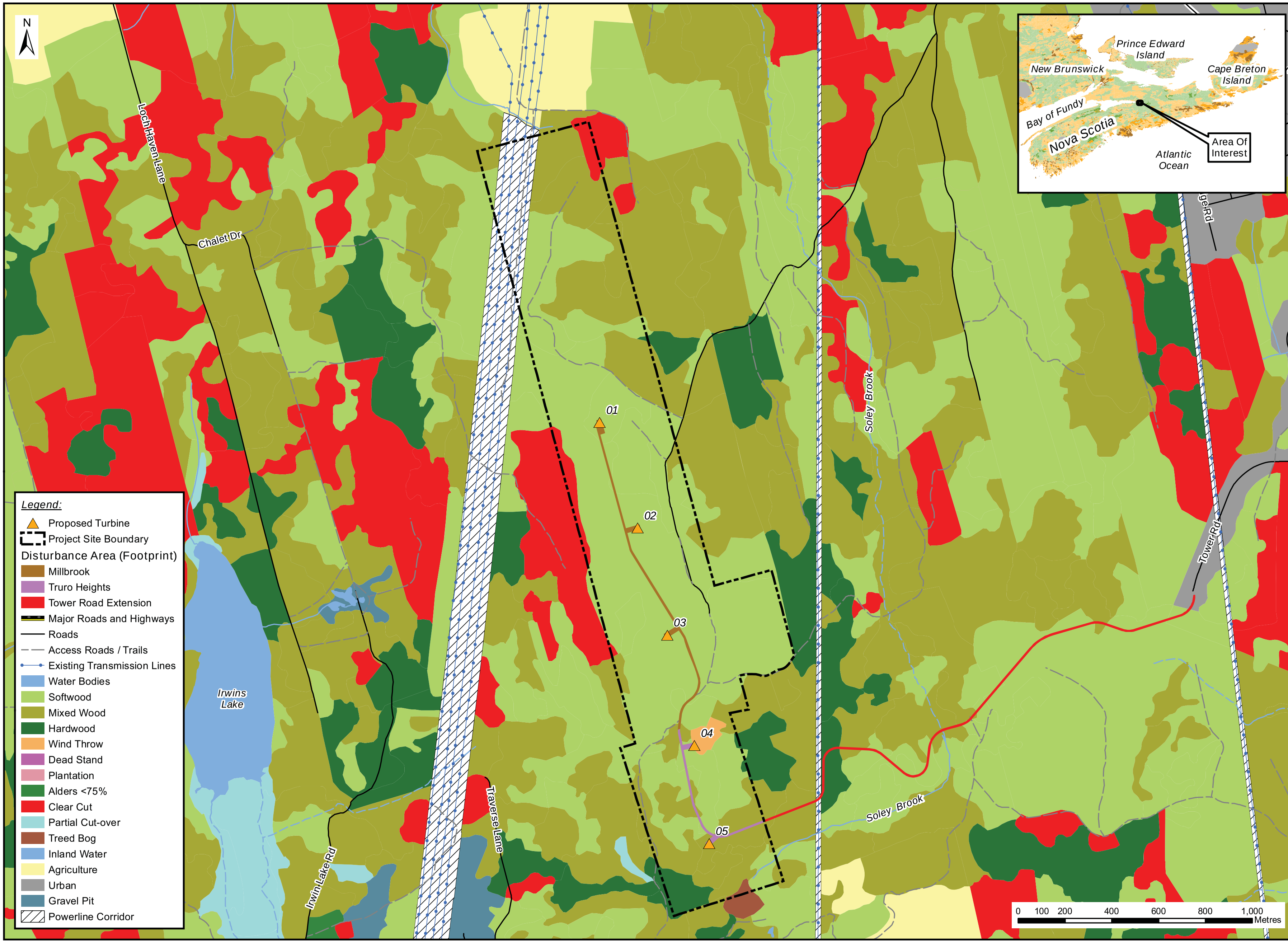
Source: NSDNR 2012a

The Project site is characterized by forest stands of mostly shade intolerant species developing on imperfectly drained soils. Young softwood dominates the central portions of the Project site, with older, balsam fir/red maple/white birch stands occurring in the northern and southern extents. Small cutover areas extend into the Project site, and a power line corridor bisects the northwestern corner of the site. These open areas increase edge habitat and add diversity to the otherwise forested landscape.

The Millbrook Project construction footprint includes a small disturbance area (e.g. access road, turbine pad, and laydown area) of approximately 4.42 ha, representing 2.49% of the total Project site area. The Truro Heights Project construction footprint includes a disturbance area of 2.72 ha, representing 1.53% of the total Project site area. Habitats within the Project site consist almost exclusively of young softwood stands, with only a small length of access road (approximately 22 m) extending through mid-aged mixed wood. An additional 2.45 ha disturbance area will result from the creation of an access road extending from Tower Road to access both Projects. Habitat along the majority of the road length consists of young softwood. A small part of the disturbed habitat (less than 0.1 ha) will also include mid-aged softwood and hardwood stands; habitat types which are relatively common in the general area.

The permanent Project footprint, meanwhile, will be significantly reduced due to the reclamation of part of the turbine laydown area used during the construction phase. The Millbrook permanent Project footprint, therefore, will include a total disturbance area of 1.84 ha, representing 1.04% of the Project site, whereas the Truro Heights permanent Project footprint will include a disturbance area of 1.01 ha, representing 0.56% of the Project site.

General mitigation measures for terrestrial habitats are provided in Section 4.0.



Notes:

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

Habitat Cover Type

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Millbrook First Nation

Community Wind Farms Inc.

juwi

Strum Consulting

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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 Habitats database (NSDNR 2012c).

Topographic mapping and the NSDNR Significant Species and Habitat database does not indicate the presence of any wetlands within the Project site (Drawing 8.3). There is however a watercourse extending from the northwestern Project boundary to the north.

The WAM for the Project site shows several streams that drain the eastern slopes of the Project site (Drawing 8.3). Additional wet areas, defined as having a depth to water table of 0.5 m or less, are identified in the north and south extents of the Project site. These wet areas may represent unmapped watercourses or areas of drainage (NSDNR 2012b).

Seventeen areas of wetland habitat were delineated during field surveys completed in summer 2012 (Drawings 8.4A-C). Wetland habitat characterizations are provided in Table D1, Appendix D. Wetlands identified at the Project site and along the Tower Road extension are all treed swamps or shrub swamps. The treed swamps are located throughout the central and southern portions of the Project site, with a large shrub swamp occupying approximately 6 ha of the northern Project site area. In northern portions of the Project site, the general movement of water is to the northwest toward off-site watercourses that drain into the Cobequid Bay. The wetlands located near the eastern Project site boundary drain down slope to the east appearing to join a watercourse (Watercourse 5) off-site that flows north into the Cobequid Bay (Drawing 8.4C). The wetlands located near the western Project site boundary appear to be isolated at the top of a plateau, and do not have an obvious drainage direction. The treed/shrub swamp habitats on the Project site are for the most part tolerant hardwood or mixed wood dominated habitats that appear to have been disturbed by silviculture activities. The herbaceous under stories of these wetlands are dominated by sedges (*Carex spp.*), bulrushes (*Scirpus spp.*) or ferns. Typical hydrological indicators of wetland habitat include saturated soils, standing surface water, and shallow (<30 cm) water table depths. The soils in these wetlands are for the most part comprised of a thin organic horizon over depleted mineral soils or sandy soils with redoximorphic (soil mottling) features.

Based on the current Project site layout, no wetland alterations are expected within the Millbrook footprint. One wetland (Wetland 22) along the Tower Road extension will require a small alteration of 254.9 m^2. Once the detail design for the Tower Road extension is complete, additional micro siting for wetlands will be completed, as necessary.

One wetland (Wetland 17f) will be directly impacted by new road construction on the Truro Heights footprint. It is estimated that 405.2 m^2 of wetland will be impacted by the construction of the road (based on a permanent total road width of 10 m).

Wetland alterations represent a small area of disturbance. Overall, it is expected that the Project will have a minimal effect on wetland habitat and hydrological functions. A provincial wetland alteration permit will be sought for alteration locations as required by the Nova Scotia Wetland Alteration Application process during the permitting stage of the Project. This will include completing a characterization of the functions of the wetlands 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. Any compensation required for direct impacts to wetland habitat will be provided in accordance with NSE requirements.

8.5 Terrestrial Vegetation

ACCDC records indicate that 279 vascular and 13 nonvascular plant species have been identified within 100 km of the Project site (ACCDC 2012). Of the 292 species identified by ACCDC, 177 vascular and one nonvascular plant 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 Appendix E.

A plant survey was completed in October 2012 within the Project site boundaries. A complete list of plant species identified during the survey is provided in Appendix E.

No vascular plant SOCI were observed during this survey.

General mitigation measures for Project-related effects to terrestrial vegetation are provided in Section 4.0.

8.6 Terrestrial Fauna

A review of the NS Significant Species and Habitat Database (NSDNR 2012c) and ACCDC data (ACCDC 2012) for species recorded within a 100 km radius of the Project site was completed. A comparison of habitat mapping data (Section 8.5) to known habitat requirements for species expected to occur within the area, and for all SOCI, was also completed.

Species identified during field surveys or that have been recorded within a 100 km radius of the Project site were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009b) to develop a list of priority species, as presented in the sections that follow.

8.6.1 Mammals

The Nova Scotia Significant Species and Habitats Database (NSDNR 2012c) contains 47 unique species and/or habitat records pertaining to mammals within a 100 km radius of the Project site. These records include:

- Forty-four records that are classified as "Deer Wintering", which relate to known over-wintering habitat for White-tailed deer (*Odocoileus virginianus).* The closest identified deer wintering ground is located approximately 7.7 km to the southeast, in the area of Little River and Brandy Brook;

- One record is classified as "Species of Concern" which relates to Long-tailed shrew (*Sorex dispar*);
- One record is classified as "Species at Risk", which relates to Southern flying squirrel (*Glaucomys volans*); and
- One record is classified as "Other Habitat", which corresponds to American black bear (*Ursus americanus*).

The ACCDC database (2012) indicates that three species of terrestrial mammals (excluding bats) have been recorded within a 100 km radius of the Project site (Table 8.5).

Table 8.5: 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]
Long-tailed shrew	*Sorex dispar*	Not Listed	Not Listed	Not Listed	Yellow
Mainland moose	*Alces alces*	Not Listed	Endangered	Not Listed	Red
Southern flying squirrel	*Glaucomys volans*	Not Listed	Not Listed	Not at Risk	Yellow

Source: ACCDC 2012

[1]Government of Canada 2012; [2]NS ESA 2007; [3]COSEWIC 2012; [4]NSDNR 2010

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 any area.

Field surveys (between February 2012 and March 2013) 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).

Snow-tracking surveys, targeting Mainland moose, but encompassing all other wildlife species, were conducted in February and March 2013. A detailed methodology for snow-tracking surveys is provided in Appendix F.

Table 8.6 lists the mammal species observed/identified at or near the Project site during all field surveys.

Table 8.6: Mammal Species Observed/Identified during Field Surveys

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
American porcupine	*Erethizon dorsatum*	Not Listed	Not Listed	Not Listed	Green
Bobcat	*Lynx rufus*	Not Listed	Not Listed	Not Listed	Green
Coyote	*Canis latrans*	Not Listed	Not Listed	Not Listed	Green
Red fox	*Vulpes vulpes*	Not Listed	Not Listed	Not Listed	Green
Red squirrel	*Tamiasciurus hudsonicus*	Not Listed	Not Listed	Not Listed	Green
Short-tailed shrew	*Blarina brevicauda*	Not Listed	Not Listed	Not Listed	Green

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Short-tailed Weasel	*Mustela erminea*	Not Listed	Not Listed	Not Listed	Green
Snowshoe hare	*Lepus americanus*	Not Listed	Not Listed	Not Listed	Green
Southern red-backed vole	*Myodes gapperi*	Not Listed	Not Listed	Not Listed	Green
White-footed deer mouse	*Peromyscus leucopus*	Not Listed	Not Listed	Not Listed	Green
White-tailed deer	*Odocoileus virginianus*	Not Listed	Not Listed	Not Listed	Green

[1]Government of Canada 2012; [2]NS *ESA* 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Priority mammal species include:

- Long-tailed shrew – “Yellow” (NSDNR);
- Mainland moose – “Endangered” (NS *ESA*), “Red” (NSDNR); and
- Southern flying squirrel – “Yellow” (NSDNR).

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).

Long-tailed shrew in Nova Scotia was thought to be found only in the Cobequid Mountains (Scott 1987; Woolaver *et al*. 1998), but more recent research has identified an additional population 60 km to the southwest, near Wolfville (Shafer and Stewart 2006). ACCDC data indicate that the closest observation of Long-tailed shrew to the Project site was 33 ± 10 km away.

No indication of Long-tailed shrew was observed during field studies, although small mammals can be difficult to observe in the absence of targeted surveys (e.g., live-trapping). Furthermore, no talus slope habitat is present at the Project site. Considering that the range of this species in Nova Scotia does not coincide with the Project location and that suitable habitat is absent, it is highly unlikely that Long-tailed shrew occur at the Project site.

The Project is therefore not expected to have any impact on Long-tailed shrew 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 recent cutovers, offers quality foraging habitat for moose, and interspersed wetlands provide suitable summer habitat for cows and calves (Parker 2003; Snaith & 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 2012d), and the Project site is located within 2.5 km of the southeastern extent of the Cobequid Concentration area. ACCDC records, meanwhile, indicate that the closest observation of this species to the Project site was 49 ± 10 km away.

No evidence of Mainland moose was observed at the Project site, including during targeted snow-tracking surveys conducted in January and March 2013. While the Project site lacks key habitat features to support the year-round needs of Mainland moose, namely aquatic sites and extensive foraging habitat, the Project site forms part of a diversified landscape which may support this species. It is possible that Mainland moose occur at the Project site, particularly during the winter months when softwood habitat is more heavily exploited.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

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). ACCDC data indicate that the closest observation of this species to the Project site was 82 ± 10 km away.

No indication of Southern flying squirrel was observed during field studies. Furthermore, red oak was not identified at the Project site during intensive botany surveys, a finding which is supported by local habitat mapping. Given that this key habitat feature is absent and that the known geographic range of the species in Nova Scotia does not coincide with the Project location, it is highly 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 NS Significant Species and Habitats Database (NSDNR 2012c) contains 32 unique records corresponding to reptile habitat within a 100 km radius of the Project site, with no such records in relation to amphibians. These records include:

- Thirty-one records that are classified as “Species at Risk”, of which 30 pertain to Wood turtle (*Clemmys insculpta*) and 1 relates to Common snapping turtle (*Chelydra serpentina*).
- Two records for Wood turtle that are located within 10 km of the Project site; one along the Chiganois River 6.8 km to the northwest, and one along the Little River 9.4 km to the south.
- One record is classified as “Species of Concern” which corresponds to Painted turtle (*Chrysemys picta*).

The ACCDC database identifies two terrestrial herpetofauna taxa within a 100 km radius of the Project site (Table 8.7).

Table 8.7: Reptile and Amphibian 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]
Four-toed salamander	*Hemidactylium scutatum*	Not Listed	Not Listed	Not at Risk	Green
Wood turtle	*Clemmys insculpta*	Threatened	Vulnerable	Threatened	Yellow

Source: ACCDC 2012

[1]Government of Canada 2012; [2]NS ESA 2007; [3]COSEWIC 2012; [4]NSDNR 2010

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 February 2012 and March 2013. Species were either identified directly through visual observation, or indirectly using other evidence (e.g., calls, egg masses, tadpoles, etc.). Table 8.8 lists the amphibian and reptile species identified at or near the Project site during field studies.

Table 8.8: Herpetofauna Species Recorded During Field Surveys

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
American toad	*Anaxyrus americanus*	Not Listed	Not Listed	Not Listed	Green
Green frog	*Lithobates clamitans*	Not Listed	Not Listed	Not Listed	Green
Eastern red-backed salamander	*Plethodon cinereus*	Not Listed	Not Listed	Not Listed	Green
Spotted salamander	*Ambystoma maculatum*	Not Listed	Not Listed	Not Listed	Green

[1]Government of Canada 2012; [2]NS *ESA* 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Priority herpetofauna species include:

- Common snapping turtle – "Special Concern" (*SARA*), "Special Concern" (COSEWIC); and
- Wood turtle – "Threatened" (*SARA*), "Vulnerable" (NS *ESA*), "Threatened" (COSEWIC), "Yellow" (NSDNR).

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

Common snapping turtle
Common 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 mainland Nova Scotia, including Colchester County (COSEWIC 2008), although ACCDC records do not include Common snapping turtle records within 100 km of the Project site.

No indication of Common snapping turtle was observed during field studies. Furthermore, watercourses at the Project site are relatively small and of shallow depth, and open water features are absent. Given the apparent lack of suitable habitat, it is unlikely that Common snapping turtle occurs at the Project site.

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

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).

The species is found throughout the province but seems to be most abundant in central Nova Scotia, including the Salmon River and Shubenacadie River watersheds (MacGregor and Elderkin 2003). ACCDC data indicate that the closest observation of this species to the Project site was 10 ± 10 km away.

No indication of Wood turtle was observed during field studies. However, suitable watercourse and associated riparian habitat is present at the Project site to support Wood turtles throughout the annual cycle (Drawing 8.5). Given that the species is concentrated in central Nova Scotia, and that suitable habitat is present, it is very likely that the individual Wood turtle home ranges include part of the Project site.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

8.6.3 Butterflies and *Odonates*
The NS Significant Species and Habitats database (NSDNR 2012c) contains five unique records corresponding to butterflies and *Odonates* within a 100 km radius of the Project site. These habitat features include:

- Three records classified as “Species of Concern”, which pertain to Jutta arctic (*Oeneis jutta*) and Little bluet (*Enallagma minusculum*).
- One record classified as “Species at Risk”, which relates to the Ebony boghaunter (*Williamsonia fletcheri*).
- One record classified as “Other Habitat”, which corresponds to the Hoary elfin (*Incisalia polia*).

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

The ACCDC database contains records of 69 unique taxa of butterfly and *Odonates* within a 100 km radius of the Project site (Table 8.9).

Table 8.9: 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]
Acadian hairstreak	*Satyrium acadica*	Not Listed	Not Listed	Not Listed	Undetermined
Amber-winged spreadwing	*Lestes eurinus*	Not Listed	Not Listed	Not Listed	Green
Aphrodite fritillary	*Speyeria aphrodite*	Not Listed	Not Listed	Not Listed	Green
Arctic fritillary	*Boloria chariclea*	Not Listed	Not Listed	Not Listed	Yellow
Aurora damsel	*Chromagrion conditum*	Not Listed	Not Listed	Not Listed	Green
Azure bluet	*Houstonia caerulea*	Not Listed	Not Listed	Not Listed	Green
Baltimore checkerspot	*Euphydryas phaeton*	Not Listed	Not Listed	Not Listed	Green
Banded hairstreak	*Satyrium calanus*	Not Listed	Not Listed	Not Listed	Undetermined
Band-winged meadowhawk	*Sympetrum semicinctum*	Not Listed	Not Listed	Not Listed	Green
Bog elfin	*Callophrys lanoraieensis*	Not Listed	Not Listed	Not Listed	Red
Bronze copper	*Lycaena hyllus*	Not Listed	Not Listed	Not Listed	Green
Brook snaketail	*Ophiogomphus aspersus*	Not Listed	Not Listed	Not Listed	Red
Brush-tipped emerald	*Somatochlora walshii*	Not Listed	Not Listed	Not Listed	Green
Clamp-tipped emerald	*Somatochlora tenebrosa*	Not Listed	Not Listed	Not Listed	Green
Common branded skipper	*Hesperia comma*	Not Listed	Not Listed	Not Listed	Green
Common roadside-skipper	*Amblyscirtes vialis*	Not Listed	Not Listed	Not Listed	Green
Compton tortoiseshell	*Nymphalis l-album*	Not Listed	Not Listed	Not Listed	Green
Crimson-ringed whiteface	*Leucorrhinia glacialis*	Not Listed	Not Listed	Not Listed	Green
Delicate emerald	*Somatochlora franklini*	Not Listed	Not Listed	Not Listed	Yellow
Early hairstreak	*Erora laeta*	Not Listed	Not Listed	Not Listed	Red
Eastern comma	*Polygonia comma*	Not Listed	Not Listed	Not Listed	Not Listed
Eastern pine elfin	*Callophrys niphon*	Not Listed	Not Listed	Not Listed	Green
Eastern red damsel	*Amphiagrion saucium*	Not Listed	Not Listed	Not Listed	Green
Ebony boghaunter	*Williamsonia fletcheri*	Not Listed	Not Listed	Not Listed	Red
Elfin skimmer	*Nannothemis bella*	Not Listed	Not Listed	Not Listed	Green

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Forcipate emerald	*Somatochlora forcipata*	Not Listed	Not Listed	Not Listed	Red
Gray comma	*Polygonia progne*	Not Listed	Not Listed	Not Listed	Green
Green comma	*Polygonia faunus*	Not Listed	Not Listed	Not Listed	Green
Greenish blue	*Plebejus saepiolus*	Not Listed	Not Listed	Not Listed	Not Listed
Harlequin darner	*Gomphaeschna furcillata*	Not Listed	Not Listed	Not Listed	Yellow
Harpoon clubtail	*Gomphus descriptus*	Not Listed	Not Listed	Not Listed	Yellow
Harvester	*Feniseca tarquinius*	Not Listed	Not Listed	Not Listed	Green
Henry's elfin	*Callophrys henrici*	Not Listed	Not Listed	Not Listed	Green
Hoary comma	*Polygonia gracilis*	Not Listed	Not Listed	Not Listed	Yellow
Hoary elfin	*Callophrys polios*	Not Listed	Not Listed	Not Listed	Green
Jutta arctic	*Oeneis jutta*	Not Listed	Not Listed	Not Listed	Red
Juvenal's duskywing	*Erynnis juvenalis*	Not Listed	Not Listed	Not Listed	Green
Kennedy's emerald	*Somatochlora kennedyi*	Not Listed	Not Listed	Not Listed	Red
Lake darner	*Aeshna eremita*	Not Listed	Not Listed	Not Listed	Green
Lance-tipped darner	*Aeshna constricta*	Not Listed	Not Listed	Not Listed	Green
Laurentian skipper	*Hesperia comma*	Not Listed	Not Listed	Not Listed	Green
Maine snaketail	*Ophiogomphus mainensis*	Not Listed	Not Listed	Not Listed	Red
Milbert's tortoiseshell	*Aglais milberti*	Not Listed	Not Listed	Not Listed	Green
Monarch	*Danaus plexippus*	Special Concern	Not Listed	Special Concern	Yellow
Mottled darner	*Aeshna clepsydra*	Not Listed	Not Listed	Not Listed	Green
Mustard white	*Pieris oleracea*	Not Listed	Not Listed	Not Listed	Yellow
Northern cloudywing	*Thorybes pylades*	Not Listed	Not Listed	Not Listed	Yellow
Northern pearly-eye	*Lethe anthedon*	Not Listed	Not Listed	Not Listed	Green
Northern pygmy clubtail	*Lanthus parvulus*	Not Listed	Not Listed	Not Listed	Green
Ocellated darner	*Boyeria grafiana*	Not Listed	Not Listed	Not Listed	Yellow
Orange bluet	*Enallagma signatum*	Not Listed	Not Listed	Not Listed	Red
Petite emerald	*Dorocordulia lepida*	Not Listed	Not Listed	Not Listed	Green
Prince baskettail	*Epitheca princeps*	Not Listed	Not Listed	Not Listed	Yellow

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Quebec emerald	*Somatochlora brevicincta*	Not Listed	Not Listed	Not Listed	Red
Question mark	*Polygonia interrogationis*	Not Listed	Not Listed	Not Listed	Green
Racket-tailed emerald	*Dorocordulia libera*	Not Listed	Not Listed	Not Listed	Green
Riffle snaketail	*Ophiogomphus carolus*	Not Listed	Not Listed	Not Listed	Green
Rusty snaketail	*Ophiogomphus rupinsulensis*	Not Listed	Not Listed	Not Listed	Red
Salt and pepper skipper	*Amblyscirtes hegon*	Not Listed	Not Listed	Not Listed	Green
Salt marsh copper	*Lycaena dospassosi*	Not Listed	Not Listed	Not Listed	Not Listed
Satyr comma	*Polygonia satyrus*	Not Listed	Not Listed	Not Listed	Yellow
Skillet clubtail	*Gomphus ventricosus*	Not Listed	Not Listed	Not Listed	Red
Ski-tailed emerald	*Somatochlora elongata*	Not Listed	Not Listed	Not Listed	Green
Sphagnum sprite	*Nehalennia gracilis*	Not Listed	Not Listed	Not Listed	Green
Striped hairstreak	*Satyrium liparops*	Not Listed	Not Listed	Not Listed	Undetermined
Subarctic darner	*Aeshna subarctica*	Not Listed	Not Listed	Not Listed	Green
Taiga bluet	*Coenagrion resolutum*	Not Listed	Not Listed	Not Listed	Red
Twin-spotted spiketail	*Cordulegaster maculata*	Not Listed	Not Listed	Not Listed	Green
Zebra clubtail	*Stylurus scudderi*	Not Listed	Not Listed	Not Listed	Red

Source: ACCDC 2012

[1]Government of Canada 2012; [2]NS ESA 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Field studies of butterfly and *Odonate* species were conducted in conjunction with other surveys in summer 2012. Species were identified by direct observation of individuals. Table 8.10 lists the butterfly species found at or near the Project site during field surveys.

Table 8.10: Butterfly and Odonate Species Observed During Field Surveys

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Cabbage white	*Pieris rapae*	Not Listed	Not Listed	Not Listed	Exotic
Canadian tiger swallowtail	*Papilio canadensis*	Not Listed	Not Listed	Not Listed	Green
Mourning cloak	*Nymphalis antiopa*	Not Listed	Not Listed	Not Listed	Green
White admiral	*Limenitis arthemis*	Not Listed	Not Listed	Not Listed	Green

[1]Government of Canada 2012; [2]NS ESA 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Priority butterfly and *Odonate* species include:

- Arctic fritillary – “Yellow” (NSDNR);
- Bog elfin – “Red” (NSDNR);
- Brook snaketail – “Red” (NSDNR);
- Delicate emerald – “Yellow” (NSDNR);
- Early hairstreak – “Red” (NSDNR);
- Ebony boghaunter – “Red” (NSDNR);
- Forcipate emerald – “Red” (NSDNR);
- Harlequin darner – “Yellow” (NSDNR);
- Harpoon clubtail – “Yellow” (NSDNR);
- Hoary comma – “Yellow” (NSDNR);
- Jutta arctic – “Red” (NSDNR);
- Kennedy's Emerald – “Red” (NSDNR);
- Maine Snaketail – “Red” (NSDNR);
- Monarch – “Special Concern” (*SARA*), “Special Concern” (COSEWIC), “Yellow” (NSDNR);
- Mustard White – “Yellow” (NSDNR);
- Northern cloudywing – “Yellow” (NSDNR);
- Ocellated darner – “Yellow” (NSDNR);
- Orange bluet – “Red” (NSDNR);
- Prince baskettail – “Yellow” (NSDNR);
- Quebec emerald – “Red” (NSDNR);
- Rusty snaketail – “Red” (NSDNR);
- Satyr comma – “Yellow” (NSDNR);
- Skillet clubtail – “Red” (NSDNR);
- Taiga bluet – “Red” (NSDNR); and
- Zebra clubtail – “Red” (NSDNR).

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 (Mersey Tobeatic Institute 2008).

Nova Scotia falls within the breeding range of this migratory species (COSEWIC 2010b), 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. Furthermore, open habitat is limited at the Project site. However, 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 species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

The requirements as set out in *SARA* and *NSESA* 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 14.

8.7 Avifauna

The Project site is dominated by forest stands of varying composition and successional stage. In addition, field studies have identified several areas of wetland habitat throughout the Project site. This diversity of habitat types provides foraging, breeding, and roosting habitat for a variety of resident and migratory bird species. Baseline information was utilized to gain insight into protected avifauna habitats, species utilization of the area, and to identify SOCI potentially occurring at or near the Project site.

The closest Important Bird Area (IBA) (IBA Canada 2012) is the Cobequid Bay IBA located 1.56 km north of the Project site. Part of a network of IBAs at the head of the Bay of Fundy, the Cobequid Bay IBA provides key staging habitat for thousands of migratory shorebirds each autumn. Up to 40,000 Semipalmated Sandpipers, representing approximately 1.2% of the global population, have been recorded in Cobequid Bay during late July and early August, when they gather to feed on the millions of amphipods present in the mudflats that become exposed during the Bay of Fundy's low tide. Other shorebird species that congregate in Cobequid Bay include Semipalmated Plover (*Charadrius semipalmatus*), Black-bellied Plover (*Pluvialis squatarola*), Red Knot (*Calidris canutus*), Sanderling (*Calidris alba*), Least Sandpiper (*Calidris minutilla*), Dunlin (*Calidris alpine*), and White-rumped Sandpiper (*Calidris fuscicollis*). In addition, up to 3,000 Canada Geese (*Branta canadensis*) have been recorded at this IBA during the spring migration (IBA Canada 2012).

The Project site is contained within two map squares of the Maritime Breeding Bird Atlas (MBBA); the southern half of the Project site falls within map square 20MR71, while the northern half of the Project site falls within map square 20MR72 (MBBA 2012). In the most recent edition of the MBBA (covering the years 2006-2010), 101 species were identified as being possible, probable, or confirmed breeders within this area. The following SOCI are considered possible, probable, or confirmed breeder in the two survey areas:

- American Bittern (*Botaurus lentiginosus*) – "Yellow" (NSDNR);
- Barn Swallow (*Hirundo rustica*) – "Threatened" (COSEWIC), "Yellow" (NSDNR);
- Black-billed Cuckoo (*Coccyzus erythropthalmus*) – "Red" (NSDNR);
- Blue-winged Teal (*Anas discors*) – "Red" (NSDNR);
- Bobolink (*Dolichonyx oryzivorus*) – "Threatened" (COSEWIC), "Yellow" (NSDNR);
- Chimney Swift (*Chaetura pelagica*) – "Threatened" (*SARA*), "Endangered" (NS *ESA)*, "Threatened" (COSEWIC), "Red" (NSDNR);
- Common Loon – "Red" (NSDNR);
- Common Nighthawk (*Chordeiles minor*) – "Threatened" (*SARA*), "Threatened" (COSEWIC), "Red" (NSDNR);
- Eastern Kingbird (*Tyrannus tyrannus*) – "Yellow" (NSDNR);

- Eastern Phoebe (*Sayornis phoebe*) – “Yellow” (NSDNR);
- Eastern Wood-Pewee (*Contopus virens*) – “Yellow” (NSDNR), “Special Concern” (COSEWIC);
- Gadwall (*Anas strepera*) – “Red” (NSDNR);
- Golden-crowned Kinglet (*Regulus satrapa*) – “Yellow” (NSDNR 2010);
- Gray Catbird (*Dumetella carolinensis*) – “Red” (NSDNR);
- Gray Jay (*Perisoreus canadensis*) – “Yellow” (NSDNR);
- Killdeer (*Charadrius vociferous*) – “Yellow” (NSDNR 2010);
- Pine Siskin (*Spinus pinus*) – “Yellow” (NSDNR 2010);
- Rose-breasted Grosbeak (*Pheucticus ludovicianus*) – “Yellow” (NSDNR);
- Ruby-crowned Kinglet (*Regulus calendula*) – “Yellow” (NSDNR);
- Spotted Sandpiper (*Actitis macularius*) – “Yellow” (NSDNR);
- Tree Swallow (*Tachycineta bicolor*) – “Yellow” (NSDNR);
- Wilson's Snipe (*Gallinago delicate*) – “Yellow” (NSDNR); and
- Wilson's Warbler (*Wilsonia pusilla*) – “Yellow” (NSDNR).

The NS Significant Species and Habitats database contains 493 unique records pertaining to birds and/or bird habitat within a 100 km radius of the Project site. These records include:

- 204 classified in the database as “Other Habitat”, of which the majority relate to Bald Eagle (*Haliaeetus leucocephalus*) (151), but also include records of Osprey (*Pandion haliaetus*) (6), Gray Partridge (*Perdix perdix*) (2), and Common Eider (*Somateria mollissima*) (2), among others;
- 108 records classified as “Species of Concern”, of which the majority relate to Common Loon (*Gavia immer*) (36), but also include records of unclassified Tern species (12), Common Tern (*Sterna hirundo*) (12), and Northern Goshawk (*Accipiter gentilis*) (6), among others;
- 104 records classified as “Species at Risk”, primarily relating to Piping Plover (32), Peregrine Falcon (*Falco peregrinus*) (7), and Harlequin Duck (*Histrionicus histrionicus*) (7), but also include records of Common Tern (5) and Roseate Tern (*Sterna dougallii*) (3), among others; and
- 77 records classified as “Migratory Bird”, including Great Blue unclassified shorebirds (23), Double-crested Cormorant (*Phalacrocorax auritus*) (16), Common Eider (12), Great Blue Heron (*Ardea herodias*) (10), and American Black Duck (*Anas rubripes*) (7), among others.

Table 8.11. Significant Habitat Features Related to Birds within a 25 km Radius of the Project Site

Species	Location	Distance from Project Site (km)	Direction
Bald Eagle	Chiganois River	8.07	N
Canada Goose	MacElmon's Pond	8.10	NW
Bald Eagle	Debert Wildlife Management Area	8.23	NW
Bald Eagle	Princeport	9.10	W
Bald Eagle	Masstown	9.65	NW
Bald Eagle	Green Creek	9.74	SW
Bald Eagle	Green Creek	9.76	SW

Source: NSDNR 2012c

The ACCDC database contains records of 60 bird species within a 100 km radius of the Project site. Table 8.12 lists these species as well as their respective provincial and national conservation status ranks.

Table 8.12: Bird 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]
American Coot	*Fulica americana*	Not Listed	Not Listed	Not at Risk	Undetermined
American Golden-Plover	*Pluvialis dominica*	Not Listed	Not Listed	Not Listed	Yellow
Arctic Tern	*Sterna paradisaea*	Not Listed	Not Listed	Not Listed	Red
Atlantic Brant	*Branta bernicla*	Not Listed	Not Listed	Not Listed	Yellow
Baltimore Oriole	*Icterus galbula*	Not Listed	Not Listed	Not Listed	Red
Barrow's Goldeneye	*Bucephala islandica*	Special Concern	Not Listed	Special Concern	Red
Bicknell's Thrush	*Catharus bicknelli*	Special Concern	Vulnerable	Threatened	Red
Black Guillemot	*Cepphus grylle*	Not Listed	Not Listed	Not Listed	Green
Black Tern	*Chlidonias niger*	Not Listed	Not Listed	Not at Risk	Red
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Not Listed	Not Listed	Not Listed	Red
Black-headed Gull	*Chroicocephalus ridibundus*	Not Listed	Not Listed	Not Listed	Green
Bobolink	*Dolichonyx oryzivorus*	No Status	Not Listed	Threatened	Yellow
Boreal Owl	*Aegolius funereus*	Not Listed	Not Listed	Not at Risk	Undetermined
Brown Thrasher	*Toxostoma rufum*	Not Listed	Not Listed	Not Listed	Undetermined
Common Goldeneye	*Bucephala clangula*	Not Listed	Not Listed	Not Listed	Green
Common Moorhen	*Gallinula chloropus*	Not Listed	Not Listed	Not Listed	Undetermined
Common Tern	*Sterna hirundo*	Not Listed	Not Listed	Not at Risk	Yellow
Eastern Bluebird	*Sialia sialis*	Not Listed	Not Listed	Not at Risk	Yellow
Eastern Meadowlark	*Sturnella magna*	No Status	Not Listed	Threatened	Yellow
Eastern Phoebe	*Sayornis phoebe*	Not Listed	Not Listed	Not Listed	Yellow
Eskimo Curlew	*Numenius borealis*	Endangered	Not Listed	Endangered	Undetermined
Gadwall	*Anas strepera*	Not Listed	Not Listed	Not Listed	Red
Great Crested Flycatcher	*Myiarchus crinitus*	Not Listed	Not Listed	Not Listed	Red
Greater Scaup	*Aythya marila*	Not Listed	Not Listed	Not Listed	Green
Greater Yellowlegs	*Tringa melanoleuca*	Not Listed	Not Listed	Not Listed	Yellow
Harlequin Duck	*Histrionicus histrionicus*	Special Concern	Endangered	Special Concern	Red
Horned Lark	*Eremophila alpestris*	Not Listed	Not Listed	Not Listed	Green
Hudsonian Godwit	*Limosa haemastica*	Not Listed	Not Listed	Not Listed	Yellow
Indigo Bunting	*Passerina cyanea*	Not Listed	Not Listed	Not Listed	Undetermined
Least Sandpiper	*Calidris minutilla*	Not Listed	Not Listed	Not Listed	Green
Long-eared Owl	*Asio otus*	Not Listed	Not Listed	Not Listed	Red
Marsh Wren	*Cistothorus palustris*	Not Listed	Not Listed	Not Listed	Undetermined
Northern Cardinal	*Cardinalis cardinalis*	Not Listed	Not Listed	Not Listed	Green
Northern Goshawk	*Accipiter gentilis*	Not Listed	Not Listed	Not at Risk	Green
Northern Mockingbird	*Mimus polyglottos*	Not Listed	Not Listed	Not Listed	Green
Northern Pintail	*Anas acuta*	Not Listed	Not Listed	Not Listed	Red

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Northern Shoveler	*Anas clypeata*	Not Listed	Not Listed	Not Listed	Red
Peregrine Falcon	*Falco peregrinus*	Threatened	Vulnerable	Special Concern	Yellow
Philadelphia Vireo	*Vireo philadelphicus*	Not Listed	Not Listed	Not Listed	Undetermined
Purple Martin	*Progne subis*	Not Listed	Not Listed	Not Listed	Red
Purple Sandpiper	*Calidris maritima*	Not Listed	Not Listed	Not Listed	Yellow
Red Crossbill	*Loxia curvirostra*	Not Listed	Not Listed	Not Listed	Green
Red Knot rufa ssp	*Calidris canutus*	No Status	Endangered	Endangered	Red
Red Phalarope	*Phalaropus fulicarius*	Not Listed	Not Listed	Not Listed	Yellow
Red-breasted Merganser	*Mergus serrator*	Not Listed	Not Listed	Not Listed	Green
Red-necked Phalarope	*Phalaropus lobatus*	Not Listed	Not Listed	Not Listed	Yellow
Roseate Tern	*Sterna dougallii*	Endangered	Endangered	Endangered	Red
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Not Listed	Special Concern	Red
Savannah Sparrow princeps ssp	*Passerculus sandwichensis*	Special Concern	Not Listed	Special Concern	Green
Scarlet Tanager	*Piranga olivacea*	Not Listed	Not Listed	Not Listed	Undetermined
Semipalmated Plover	*Charadrius semipalmatus*	Not Listed	Not Listed	Not Listed	Green
Short-eared Owl	*Asio flammeus*	Special Concern	Not Listed	Special Concern	Red
Solitary Sandpiper	*Tringa solitaria*	Not Listed	Not Listed	Not Listed	Green
Vesper Sparrow	*Pooecetes gramineus*	Not Listed	Not Listed	Not Listed	Red
Virginia Rail	*Rallus limicola*	Not Listed	Not Listed	Not Listed	Undetermined
Warbling Vireo	*Vireo gilvus*	Not Listed	Not Listed	Not Listed	Undetermined
Whimbrel	*Numenius phaeopus*	Not Listed	Not Listed	Not Listed	Yellow
Whip-Poor-Will	*Caprimulgus vociferus*	Threatened	Not Listed	Threatened	Red
Willow Flycatcher	*Empidonax traillii*	Not Listed	Not Listed	Not Listed	Yellow
Wood Thrush	*Hylocichla mustelina*	Not Listed	Not Listed	Not Listed	Undetermined

Source: ACCDC 2012

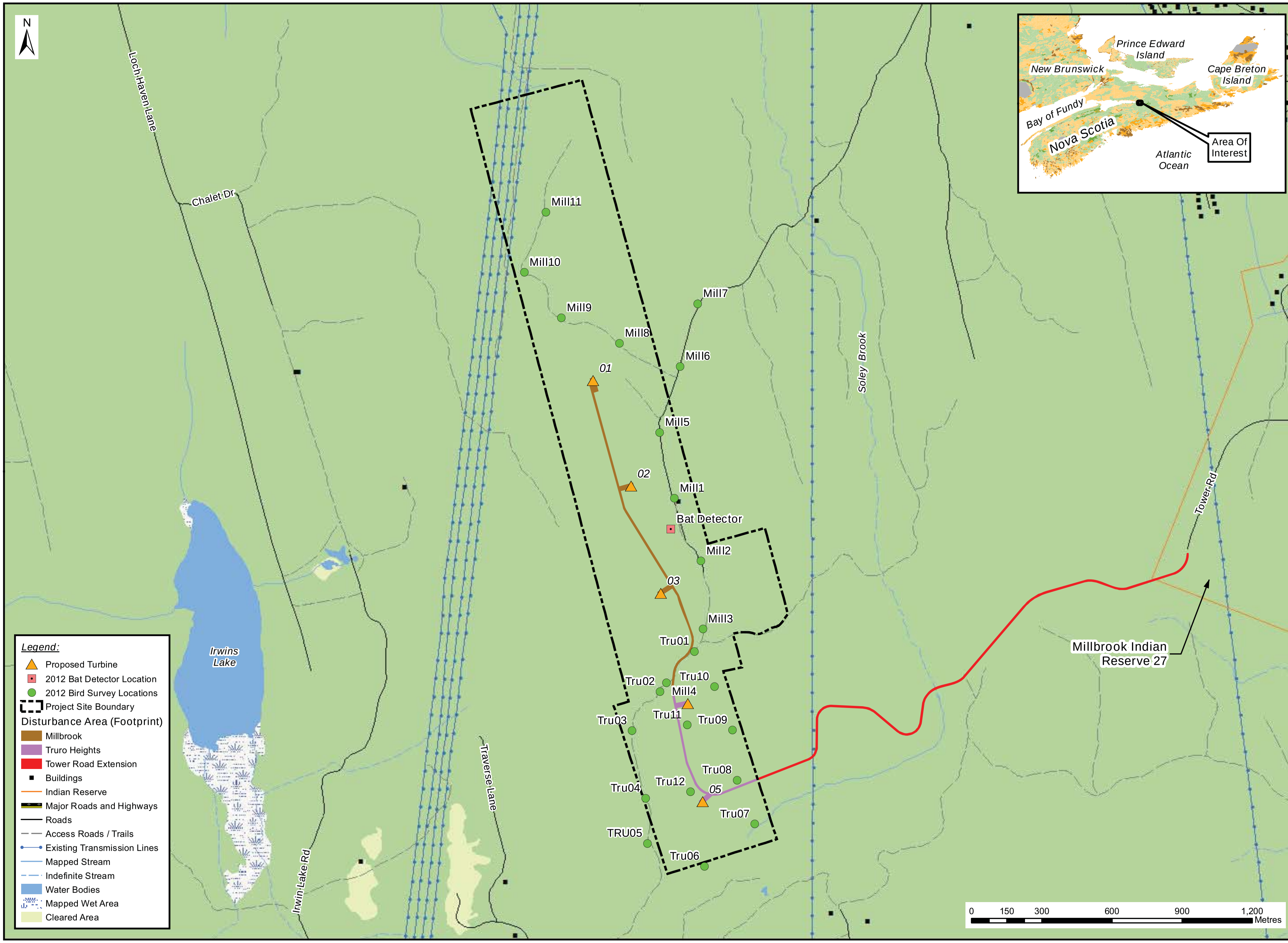
[1]Government of Canada 2012; [2]NS ESA 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Field surveys were completed to gather data to characterize the year round, pre-construction (baseline) bird community at the Project site and were designed to capture changes in the diversity and abundance of bird species at the Project site coinciding with such important events as breeding and migration. All field surveys were designed in consultation with officials from NSDNR and CWS, and conformed to protocols outlined in the document "Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds" (CWS 2007).

For the purposes of this assessment, data obtained through avifauna surveys has been considered in conjunction with that collected for the adjacent Truro Heights Community Wind Project. This approach was taken to ensure that data analysis and interpretation was representative of the bird community in the general Project area.

A summary of each bird survey is provided in the following sections. Detailed methodology and results for bird surveys are provided in Appendix G.

Winter Bird Survey
Twenty-four area searches were conducted at or near the respective Project sites on February 21, 2012 and February 11, 2013 (Drawing 8.6). A total of 24 species were identified, including 324 individual birds (Tables G1/2, Appendix G). Black-capped Chickadee (*Parus atricapillus*), American Crow (*Corvus brachyrhynchos*), and American Goldfinch (*Carduelis tristis*) were the most abundant species, while Common Raven (*Corvus corax*) was also commonly observed. A flock of 27 European Starlings (*Sturnus vulgaris*) constituted the largest single congregation of winter birds.



Notes:

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

Bird Survey and Bat Detector Locations

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

juwi

Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:15,000	Drawing #: 8.6
Drawn By: H. Serhan	
Checked By: M. Smith	

Spring Migration Surveys
Spring migration surveys were conducted at or near the Project sites on April 28, May 7, and May 21, 2012, during which a total of 32 stopover count surveys were conducted at 11 locations (Drawing 8.6).

A total of 49 species, comprising 972 individual birds, were observed during the spring migration surveys (Tables G 3/4, Appendix G). American Robin (*Turdus migratorius*) was the most frequently observed and most abundant species, while White-throated Sparrow (*Zonotrichia albicollis*) was the second most frequently observed and abundant species. Black-throated Green Warbler (*Dendroica virens*), Hermit Thrush (*Catharus guttatus*), Magnolia Warbler (*Dendroica magnolia*) and Yellow-rumped Warbler (*Dendroica coronate*) were also commonly observed during these surveys.

Breeding Bird Surveys
Nine point count locations were surveyed on June 8 and again on June 20, 2012; an additional location was surveyed on June 8 (Drawing 8.6). A total of 877 individual birds, representing 52 species, were observed during these point counts (Table G5/6, Appendix G). Twenty-one of these species are considered probable breeders based upon the observation of breeding pairs and/or the establishment of permanent territories, and four species are confirmed breeders based upon the observation of nests, adults carrying food, or recently fledged young (MBBA 2006). The most frequently observed and abundant species were American Robin, Red-eyed Vireo (*Vireo olivaceus*), and Black-throated Green Warbler, respectively.

The vast majority of the species identified during the breeding bird surveys were passerines. However, a variety of non-passerine birds were also observed during these surveys, including Common Loon (*Gavia immer*) (waterfowl); Hairy Woodpecker (*Picoides villosus*), Northern Flicker (*Colaptes auratus*), and Pileated Woodpecker (*Dryocopus pileatus*) (woodpeckers); Osprey (*Pandion haliaetus*), Red-tailed Hawk (*Buteo jamaicensis*), and Sharp-shinned Hawk (*Accipiter striatus*) (birds of prey); and Ring-necked Pheasant (*Phasianus colchicus*) and Ruffed Grouse (*Bonasa umbellus*) (upland game birds).

Fall Migration Surveys
A total of 58 stopover count surveys were conducted at 25 locations at or near the Project site boundaries on September 18, October 5, October 24, November 5, and November 15, 2012 (Drawing 8.6). Forty-nine species, consisting of 1,167 individual birds, were recorded during the fall migration surveys (Table G7/8, Appendix G). Blue Jay (*Cyanocitta cristata*), American Crow, and Golden-crowned Kinglet (*Regulus satrapa*) were the most frequently observed species. The most abundant species were Common Grackle (*Quiscalus quiscula*) and Red-winged Blackbird (*Agelaius phoeniceus*), both of which were observed in flocks in excess of 60 individuals. Passerines dominated the fall bird community at the Project site, although non-passerines species including Downy Woodpecker (*Picoides pubescens*), Hairy Woodpecker, Pileated Woodpecker, Northern Flicker (woodpeckers), Common Loon (waterfowl), Herring Gull (*Larus argentatus*) (waterbird), and Ruffed Grouse (upland gamebird) were also observed. No birds of prey were observed during the fall surveys.

Summary of Bird Surveys

The Project site is situated in a landscape interspersed with agricultural areas, urban development, and forest stands. Habitat at the Project site consists primarily of young softwood and mixed forest stands, with mature forest present at the southern and northern extents. The landscape position and habitat character of the Project site influence the bird community during all seasons.

Small numbers of migrants begin to arrive at the Project site in late April, but a significant influx does not occur until early May. At this time, significant numbers of American Robin, Hermit Thrush, and White-throated Sparrow descend on the site; a second migrant wave occurs in late May, when wood-warblers such as Magnolia Warbler, Black-throated Green Warbler, and Black-and-white Warbler (*Mniotilta varia*) appear in relative abundance. Abundance and diversity were relatively consistent throughout the Project site, particularly in May.

Seventy-nine percent (79%) of the species observed during spring surveys were also recorded during the breeding season. Furthermore, there was no significant difference in the number of birds observed per survey location in May (spring surveys) and June (breeding season surveys) ($F = 2.45$, $p = 0.125$). These results suggest that most birds arriving at the Project site during spring migration remain to establish breeding territories. Forest dwelling birds breed at the Project site at reasonable densities, and are abundant throughout the Project site during the breeding season. Dominant species, particularly thrushes and warblers, are a reflection of the fir/spruce forest type that is prevalent in the interior of the Project site. High breeding densities throughout the Project site are likely due to habitat heterogeneity typical of mixed-age, mixed wood stands and the presence of edge habitat associated with cutovers. Key indicator species, including Pileated Woodpecker, are indicative of relatively large patches of mature forest habitat in the southern and northern extents of the Project site (e.g. outside of the Millbrook Project footprint). Pileated Woodpecker and Northern Flicker, both primary cavity nesters, were confirmed breeders at the Project site. The presence of these species can create nesting habitat for a variety of secondary cavity nesters, including birds of prey such as American Kestrel (*Falco sparverius*) Northern Saw-Whet Owl (*Aegolius acadicus*), as well as a variety of passerines including Winter Wren (*Troglodytes troglodytes*) and Eastern Bluebird (*Sialia sialis).* Indeed, the mature forest at the Project site appears to feature snags in numbers high enough to support a diverse, yet not particularly abundant, cavity nesting community.

The fall bird community at the Project site was dominated by resident species, including Black-capped Chickadee, American Crow, Blue Jay, and Golden-crowned Kinglet. Overall, resident species accounted for 43.6% of the birds observed during the fall months. In some cases, it can be difficult to separate migrants from resident birds. Yellow-rumped Warbler and Dark-eyed Junco (*Junco hyemalis*), for example, are typically considered migrants, but some individuals over-winter in Nova Scotia when food resources are available. It is likely that the individuals observed in September and October at the Project site were migrants, however, since both species were present in low numbers or absent in November. Although species diversity was relatively high, migrant warblers, sparrows, and thrushes were generally observed in low numbers throughout the migration period. Exceptions included reasonable numbers of American Robin and White-throated Sparrow. The only observations of diurnal migrant flocks consisted of a single flock of 135 Common Grackles and two, smaller flocks of Red-winged Blackbirds moving through the Project site in October. Migrants were largely absent from the Project site in November, at which time small flocks of nomadic Pine Grosbeak (*Pinicola enucleator*) and White-winged Crossbill (*Loxia leucoptera*) occurred, presumably to access seed-resources in intact conifer stands.

Winter data were collected at the Project sites in two consecutive years; conclusions should therefore be interpreted with caution as between-year variation may introduce a bias. Overall abundance and diversity, for example, were significantly higher in 2012 than in 2013 ($F= 6.02$, $p= 0.02$ and $F= 8.67$, $p= <0.01$, respectively). The results in both years, however, demonstrate that the Project site supports a limited winter bird community consisting of both resident and nomadic species, with only a minor winter visitor component, as is typical of most of Nova Scotia during the winter months (Davis and Browne 1996). In some cases, species were less abundant than habitat/observations during other times of year might suggest. This is particularly true of Golden-crowned Kinglet, which were largely absent during winter surveys in both years despite the presence of apparently suitable softwood habitat. Low numbers of Golden-crowned Kinglets have been reported throughout Nova Scotia this winter, which may reflect a die-off resulting from severe winter conditions (Swanson *et al*. 2012). Barred Owl (*Strix varia*), and to a lesser extent Hairy Woodpecker, are indicative of mature forest habitat.

Overall, there were 77 different species identified at or near the Project site during surveys conducted throughout the year, including 14 SOCI (Table 8.13, Drawing 8.7).

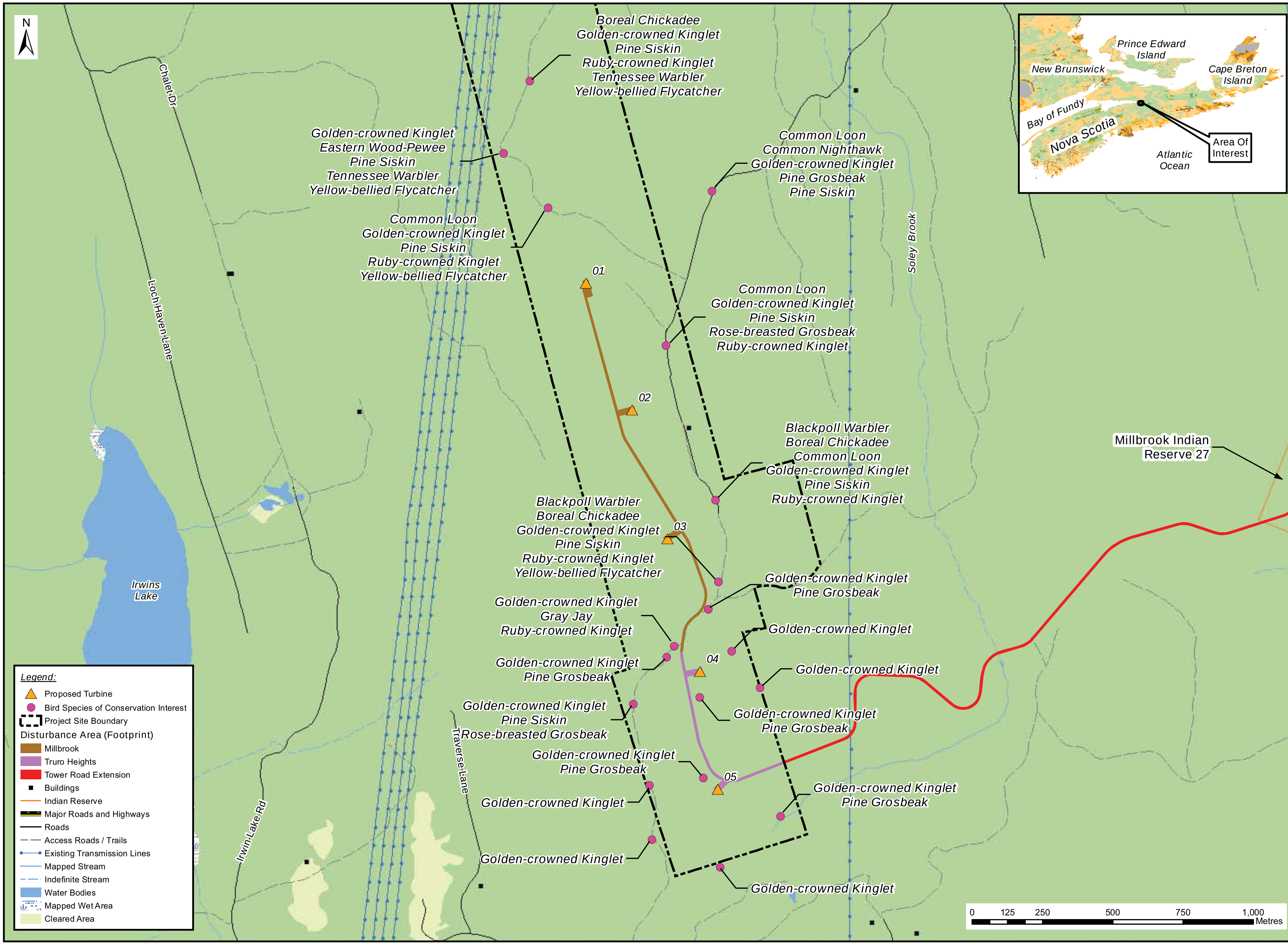
Table 8.13: Bird SOCI identified at the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status [2]	COSEWIC Status[3]	NSDNR Status[4]	Survey(s) Observed (Individuals Observed)
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Not listed	Not listed	Not listed	Red	Spring (1), Fall (1)
Blackpoll Warbler	*Dendroica striata*	Not listed	Not listed	Not listed	Yellow	Fall (7)
Boreal Chickadee	*Poecile hudsonicus*	Not listed	Not listed	Not listed	Yellow	Fall (3), Winter (4)
Common Loon	*Gavia immer*	Not listed	Not listed	Not at Risk	Red	Breeding (4), Fall (1)
Common Nighthawk	*Chordeiles minor*	Threatened	Threatened	Threatened	Red	Breeding (1)
Eastern Wood-pewee	*Contopus virens*	Not listed	Not listed	Special Concern	Yellow	Spring (2), Breeding (2)
Golden-crowned Kinglet	*Regulus satrapa*	Not listed	Not listed	Not listed	Yellow	Winter (4), Spring (2), Breeding (1), Fall (84)
Gray Jay	*Perisoreus canadensis*	Not listed	Not listed	Not listed	Yellow	Fall (2), Winter (3)
Pine Grosbeak	*Pinicola enucleator*	Not listed	Not listed	Not listed	Red	Fall (21)

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status [2]	COSEWIC Status[3]	NSDNR Status[4]	Survey(s) Observed (Individuals Observed)
Pine Siskin	*Spinus pinus*	Not listed	Not listed	Not listed	Yellow	Winter (15), Spring (14), Fall (3)
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Not listed	Not listed	Not listed	Yellow	Breeding (4), Fall (3)
Ruby-crowned Kinglet	*Regulus calendula*	Not listed	Not listed	Not listed	Yellow	Spring (12), Breeding (1), Fall
Tennessee Warbler	*Oreothlypis peregrina*	Not listed	Not listed	Not listed	Yellow	Breeding (2)
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Not listed	Not listed	Not listed	Yellow	Spring (2), Breeding (8)

[1]Government of Canada 2012; [2]NS ESA 2007; [3]COSEWIC 2012; [4]NSDNR 2010

The requirements as set out in the *MBCA* will be adhered to for Project activities. Additional mitigation measures for avifauna are provided in Section 4 and 14.



Notes:

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

Bird Species of Conservation Interest Locations

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

juwi

Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:12,500	Drawing #: 8.7
Drawn By: G. Gregory	
Checked By: M. Smith	

8.8 Bats

The NS Significant Species and Habitats database (NSDNR 2012c) indicates 20 features related to bats and/or bat habitats within a 100 km radius of the Project site. Most of which pertain to observations of Little brown myotis. Other bat species observed within this radius include Tri-colored bat and Northern long-eared bat.

Moseley (2007) provided an overview of the known bat hibernacula in the caves and mines of Nova Scotia. This research indicates 16 known hibernacula within a 100 km radius of the Project site (Table 8.14).

Table 8.14: Known Bat Hibernacula within 100 km of the Project Site

Hibernacula	Distance from Project Site (km)	Direction
Hayes Cave	18.84	SW
Lear Shaft	25.38	NW
Black Brook	29.45	S
Gayes River Gold Mine	34.02	S
Minasville Ice Cave	36.78	W
Cave of the Bats	39.02	SSW
Centre Rawdon Gold Mine	42.63	SW
Peddlar's Tunnel	43.86	W
New Laing Adit	45.92	ENE
Walton Barite Mine	51.67	WSW
Woodville Ice Cave	56.28	SW
McLellan's Brook Cave	63.95	ENE
Lake Charlotte Gold Mine	66.14	SSE
Miller's Creek Cave	67.3	SW
Cheverie Cave	67.94	WSW
Frenchman's Cave	69.6	SW

Source: Moseley 2007

Hayes Cave, the largest known bat hibernaculum in Nova Scotia, is located approximately 18.8 km to the southwest of the Project site (Moseley 2007). The Little brown myotis is the most common species at this gypsum cave (Poissant and Broders 2008; Randall 2011), although the Northern-long eared myotis, and the Tri-colored bat also occur between September and June (Davis and Browne 1996; Moseley 2007). Up to 6,000 bats have been recorded at Hayes Cave during winter hibernation (Davis and Browne 1996), although preliminary data from 2012 suggest that White-nose syndrome has reduced this hibernating population to approximately 250 (M. Elderkin, personal communication).

Table 8.15 presents bat species recorded within a 100 km radius of the Project site, according to ACCDC.

Table 8.15: Bat 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]
Hoary bat	*Lasiurus cinereus*	Not Listed	Not Listed	Not Listed	Undetermined
Northern long-eared myotis	*Myotis septentrionalis*	Not Listed	Not Listed	Endangered	Yellow
Tri-colored bat	*Perimyotis subflavus*	Not Listed	Not Listed	Endangered	Yellow

Source: ACCDC 2012
[1]Government of Canada 2012; [2]NS ESA 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Field surveys of bat migration/habitat use were carried out from September 8th to September 25th, 2012 using an AnaBat SD2 Detector (Titley Electronics, Columbia, Missouri) deployed at the Project site. Field survey methodology and timing was designed in consultation with NSDNR (M. Elderkin, pers. comm.).

Bats are known to engage in feeding activities in close proximity to bodies of water where insects are prevalent (Furlonger *et al*. 1987). As such the detector was deployed in a clearing associated with a meteorological tower installed to collect site-specific weather data. The detector was located 718 m south-southeast of Turbine 1, 251 m southeast of Turbine 2, 276 m north/northeast of Turbine 3 (Drawing 8.6).

Due to their similarity, calls of Nova Scotia's two resident *Myotis* species (Little brown myotis and Northern long-eared myotis) can be difficult to reliably distinguish from one another (O'Farrell *et al.* 1999, Broders 2011), so these calls were not identified to species.

In total, 500 files were recorded, of which only 168 files were determined to be bat generated ultrasound. Most echolocation calls were recorded between September 10th and 14th, and were associated with *Myotis* species bats (e.g., Little brown myotis and Northern long-eared myotis) (Table 8.16). Thirteen of the 168 calls identified were categorized as unknown species. These calls were clearly bat generated ultrasound; however, the quality of the files was not sufficient to render a positive identification. However, most of the unknown calls were likely *Myotis* spp. due to the frequency and slope of the calls.

One Silver-haired bat (*Lasionycteris noctivagans*) call was detected on the night of September 9th (Table 8.16). This seems to be an isolated occurrence as no other calls were detected over the course of the survey. Because Silver-haired bats are migratory, this bat could have been passing through the area, as early to mid-September coincides with the peak migration period. One of the unknown calls detected on the night of September 12th had characteristics consistent with Tri-colored bat (*Perimyotis subflavus*); however, some segments of the call were clearly *Myotis* spp. This was an isolated occurrence and all prior and subsequent calls were identified as *Myotis* spp.

Table 8.16: Number of Echolocation Calls Recorded at Project Site (Sept 8th – 25th)

Date	Echolocation Calls			
	Myotis	*Lasionycteris noctivagans*	Unknown spp.	Total
9/8/2012	0	0	0	0
9/9/2012	2	1	0	3
9/10/2012	12	0	0	12
9/11/2012	0	0	0	0
9/12/2012	78	0	5	83
9/13/2012	36	0	7	43
9/14/2012	10	0	1	11
9/15/2012	1	0	0	1
9/16/2012	5	0	0	5
9/17/2012	9	0	0	9
9/18/2012	0	0	0	0
9/19/2012	0	0	1	1
9/20/2012	0	0	0	0
9/21/2012	0	0	0	0
9/22/2012	0	0	0	0
Total	**153**	**1**	**13**	**168**

An average of 12 echolocation calls per night were detected during the monitoring period. The highest recorded activity occurred on the night of September 12th during which 83 of 168 (49.4%) of echolocation calls were detected. Increased activity on this night may have been due to the presence of just one or a few bats, likely *Myotis* spp., continuously foraging in close proximity to the detector over the course of the evening. It is not necessarily an indication of bat abundance but may indicate that there was an abundance of insects in the area surrounding the detector on that particular night.

As expected, average nightly bat activity peaked between 20:00 and 23:00 coinciding with sunset and resultant bat emergence due to insect availability.

Bat species that were identified during field surveys or that have been recorded within a 100 km radius of the Project site were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009b) to develop a list of priority species. These priority bat species include:

- Little brown myotis – "Endangered" (COSEWIC), "Yellow" (NSDNR);
- Northern long-eared myotis– "Endangered" (COSEWIC), "Yellow" (NSDNR); and
- Tri-colored bat – "Endangered" (COSEWIC), "Yellow" (NSDNR).

Little brown myotis
During the spring and summer, Little brown myotis can be found feeding on small aerial insects over water bodies and at the edges of forest clearings during the evening and night (Barclay 1991). During the day, the Little brown myotis will roost in buildings, trees, under rocks, in wood piles, and in caves, congregating in tight spaces to roost at night (Fenton and Barclay 1980). As a non-migratory species, Little brown myotis are known to congregate in large hibernation groups, known as hibernacula, from September to early or mid-May in abandoned mines or caves (Fenton and Barclay 1980; Moseley 2007).

Little brown myotis is the most common species in Nova Scotia, and is probably ubiquitous in the province (Broders *et al*. 2003). According to the ACCDC database, no observations of Little brown myotis were recorded within 100km of the Project site. Until recently however, no bat species were considered to be of conservation concern in Nova Scotia, so these observations of Little brown myotos may have gone un-reported to the ACCDC. Multiple known hibernacula are known to occur within a 100 km radius of the Project site, including Hayes Caves, the largest known hibernacula in the province.

A number of echolocation calls emitted by *Myotis sp.* were detected at the Project site, most of which were likely generated by Little brown myotis. In addition, suitable habitat is present at the Project site, including forest stands of varying age composition (Drawing 8.5). It is therefore highly likely that this species occurs at the Project site, either during the early summer breeding season or during late-summer movements to hibernacula.

Potential effects of the Project on bat species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.3.

Northern-long eared myotis
The Northern-long eared myotis often feeds shortly after sunset near water bodies and open areas near forest edges (Gill 2006). During the day, Northern long-eared myotis show a preference for roosting in trees, the characteristics of which have been shown to vary according to the reproductive status of bred females (Garroway and Broders 2008). Females appear to prefer shade tolerant deciduous trees over coniferous trees, whereas males roost solitarily in coniferous or mixed-stands in mid-decay stages (Broders and Forbes 2004). Northern long-eared myotis are also non-migratory and are typically associated with the Little brown myotis during hibernation, in caves or abandoned mines (Moseley 2007). Hibernation in this species is thought to begin as early as September and can last until May (as cited in Caceres and Barclay 2000).This species is widely distributed in the eastern United States and Canada, and is commonly encountered during swarming and hibernation (Caceres and Barclay 2000).

Although once considered uncommon throughout Nova Scotia (Moseley 2007), Northern long-eared myotis is likely ubiquitous in the forested regions of the province (Broders *et al*. 2003). ACCDC data indicates that the closest Northern long-eared myotis sighting to the Project site was 23±10 km away; in addition, this species has been identified at several known hibernacula within a 100 km radius of the Project site.

A number of echolocation calls emitted by *Myotis sp.* were detected at the Project site, of which a proportion was likely from Northern long-eared myotis. In addition, suitable forest habitat is present throughout the Project site (Drawing 8.5). It is therefore highly likely that this species occurs at the Project site, either during the breeding season/summer or during late-summer movements to hibernacula.

Potential effects of the Project on bat species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.3.

Tri-colored bat (Eastern pipistrelle)
Tri-colored bats, formerly known as the Eastern pipistrelle, forage over water bodies, tree canopies and in open areas (Quinn and Broders 2007; Poissant and Broders 2008). This species requires clumps of *Usnea* lichen for roosting; a habitat feature typically associated with mature spruce and balsam fir trees (Farrow 2007), which are present at the Project site. This species is non-migratory, and generally hibernates alone, or in small numbers, in caves or abandoned mines where it appears to show a preference for small side passages, rather than main passages (Fujita and Kunz 1984; Moseley 2007). Individuals show strong fidelity to specific hibernacula, although in Nova Scotia only 10 hibernating individuals have ever been recorded (Quinn and Broders 2007).

The species occurs throughout most of eastern North America, with Nova Scotia representing the northeastern extent of its range (Fujita and Kunz 1984). Within Nova Scotia the species has a restricted breeding distribution focused in the interior of the southwest region of the province (Farrow and Broders 2011). Research conducted at Kejimkujik National Park found the Tri-colored bat to be locally abundant, and results indicate that this population may represent the only breeding population of the species in Canada (Broders *et al*. 2003). In the summer months, the Tri-colored bat is concentrated in a geographic area bounded by Wolfville to the west, Halifax to the northeast, and Shelburne to the southeast (Quinn and Broders 2007). ACCDC data indicates that the closest observation of this species to the Project site was 16±5 km away, and Tri-colored bat has been recorded in Hayes Cave less than 20 km away.

One echolocation signal recorded during field studies had characteristics of Tri-colored bat, although a conclusive species determination was not possible in this instance. Nonetheless, suitable softwood dominated roosting habitat is present at the Project site, and in consideration of the site's proximity to Hayes Cave, it is highly likely that Tri-colored bat occurs at the Project site, probably during late summer movements to hibernacula.

Potential effects of the Project on bat species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.3.

Mitigation measures for bats are provided in Section 4 and 14.

9.0 SOCIO-ECONOMIC ENVIRONMENT

9.1 Local Demographics and Industry

The Project site is located on land within the Municipality of the County of Colchester. The Municipality is home to many long established communities including Bible Hill, Old Barns, Brookfield, Upper Stewiacke, Salmon River, Tatamagouche, North River, Debert, Great Village, and the Millbrook First Nation community. The population centres in Colchester County are Truro (population 23,261) and Stewiacke (population 1,438) (Statistics Canada 2011). The nearest communities to the Project site are Truro Heights (3.1 km), Lower Truro (3.8 km), Millbrook (4.2 km), and Hilden (4.5 km).

9.1.1 Demography

Population statistics for Colchester County and the Town of Truro from the 2011 census are summarized in Table 9.1.

Table 9.1: Population in Colchester County and the Town of Truro

Population Statistics	Colchester County	Truro
Population in 2011	50,968	23,261
Population in 2006	50,023	22,376
Population change from 2006-2011 (%)	1.9	4.0
Total private dwellings in 2011	24,478	11,046
Land area (km^2)	3,627.94	44.72
Population density per km^2	14.0	520.1

Source: Statistics Canada 2011

The age distribution in Colchester County and the Town of Truro reveals slightly older populations with a median age of 42.5 years and 44.7 years, respectively compared to the median age of the province (41.8), and HRM (39.0) (Statistics Canada 2006). A breakdown of age distribution in Colchester County and the Town of Truro is outlined in Table 9.2 below.

Table 9.2: Age in Colchester County and the Town of Truro

Age Statistics	Colchester County	Truro
0 - 14 years	8,375 (16.7%)	1,565 (13.3 %)
15 - 64 years	33,505 (67.0%)	7,575 (64.4 %)
65+ years	8,145 (16.3%)	2,630 (22.3 %)
Total Population	**50,025 (100%)**	**11,770 (100%)**

Source: Statistics Canada 2006

Colchester County's average housing cost is $129,116, slightly less than Truro at $132,142; however, both are lower than the provincial average of $158,000 (Statistics Canada 2006). As for median earnings for full-time, full year earners, Colchester County and Truro fall below the provincial median earnings of $36,917 for full-time, full year earners (Statistics Canada 2006) (Table 9.3).

Table 9.3: Household Costs and Median Earnings for Full-Time, Full Year Earners

Jurisdictions	Average Housing Cost	Median Earnings
Colchester County	$129,116	$33,030
Town of Truro	$132,142	$30,898
Province of Nova Scotia	**$158,000**	**$36,917**

Source: Statistics Canada 2006

9.1.2 Health Care and Emergency Services

The Town of Truro has a fire department consisting of highly dedicated career and volunteer fire personnel. Recently, the County of Colchester, the Town of Stewiacke and the Town of Truro have signed an agreement to develop one Emergency Plan for the region. This plan will be developed by the Regional Emergency Management Organization (REMO). The REMO is made up of the Regional Emergency Management Advisory Committee, the Regional Protective Services Coordinator and the Regional Emergency Planning Committee. The Advisory Committee is comprised of the mayor of each municipality and one other elected official. The Planning Committee is comprised of representatives from community services, law enforcement, fire, health services, engineering, transportation and communications (REMO 2011).

Health services in the region include Colchester Regional Hospital located in the Town of Truro.

9.1.3 Industry and Employment

Employment and unemployment rates for January 2013 in the North Shore Economic Region (includes Colchester County) indicates that the unemployment rate was 12.2%, which is higher than the provincial average of 9.4% (Statistics Canada 2013). The North Shore employment rate of 53.1% is lower than the provincial rate of 57.1% (Statistics Canada 2013).

A breakdown of the labour force within Colchester County and Truro is provided in Table 9.4. The highest proportion of workers in both Colchester County and Truro fall into the “other services” category (19.0% and 18.8%, respectively). While Statistics Canada does not specifically list tourism as an industry, it likely falls under the “other services” heading. The high proportion of workers listed as working within “other services” and “retail trade” is reflective of the tourism industry. Other significant industries include business services, manufacturing, and health care (Statistics Canada 2006).

Table 9.4: Labour Force by Industry in Colchester County and the Town of Truro

Industry	Total Colchester County	Industry	Total Truro
Total experienced labour force 15 years +	25,150	**Total experienced labour force 15 years +**	5,695
Other services	4,790	**Other services**	1,070
Business services	3,905	**Business services**	1,055
Manufacturing	3,575	**Retail trade**	750

Industry	Total Colchester County	Industry	Total Truro
Retail trade	3,285	**Health care and social services**	725
Health care and social services	2,365	**Manufacturing**	720
Educational services	1,875	**Educational services**	505
Construction	1,685	**Wholesale trade**	340
Wholesale trade	1,470	**Construction**	245
Agriculture and other resource-based industries	1,460	**Finance and real estate**	170
Finance and real estate	740	**Agriculture and other resource-based industries**	115

Source: Statistics Canada 2006

A review of businesses located within 5 km of the Project site is outlined in Table 9.5.

Table 9.5: Local Businesses and Proximity to Project Site

Business	Proximity to Project Site*
Irwin Lake Chalets	1.5 km west of the Project site, on Loch Haven Lane
Super 8 Truro	3.1 km east of the Project site, on Treaty Trail
Truro Visitor Information Center	3.2 km east of the Project site, on Treaty Trail
Empire Theatres Studio 7 Truro	3.1 km east of the Project site, on Treaty Trail
Subway	3.1 km east of the Project site, on Treaty Trail
Leon’s Furniture	3.1 km east of the Project site, on Treaty Trail
Saltscapes Restaurant and General Store	3.2 km east of the Project site, on Treaty Trail
Leisure Days RV Center	3.2 km east of the Project site, on Treaty Trail
Tim Horton’s and Stone Cold Creamery	3.2 km east of the Project site, on Treaty Trail
A&W Restaurant and Ultramar	3.2 km east of the Project site, on Treaty Trail
Treaty Entertainment	3.2 km east of the Project site, on Treaty Trail

*All distances measured from center of the Project Site, using the most direct route.

Economic effects as a result of the Project will include job creation, increased revenue for the Millbrook First Nation, tax revenue for the Municipality of the District of Colchester, and investment in the local community through the Community Sustainability Fund.

It is estimated that the Project will result in approximately $15-$17 million in investments into the province of Nova Scotia. It is estimated that the Project will result in millions of dollars in contracts with Nova Scotian companies for the delivery of equipment and construction materials, as well as professional development, construction and operational services. A significant portion of the total investment will come from sources outside Nova Scotia, resulting in a significant capital investment into the Nova Scotia economy.

Job Creation
Elements of job creation throughout the lifespan of the Project include:

- Project Development- During the development phase of the Project, Nova Scotian professionals will deliver a variety of services, including: civil and electrical engineering services, legal services, financial services, environmental & biological survey services, archaeological services, land and community relations services, website development, and many others. As this project is one of many COMFIT projects being developed in the Province it is difficult to precisely estimate the number of full-time-equivalent jobs that are created through the development of this Project alone, however it is known that dozens of professionals within Nova Scotia will render their services as part of the development of the Project.
- Construction - Though the construction phase of the Project is relatively short, it will require significant manpower for realization. Much of the construction employment will come through contracting and subcontracting of Nova Scotian construction firms. This will likely include significant elements of civil and electrical construction. During the construction phase, it is estimated that 50 people will be temporarily employed by the Project. Many of these people will be employed through Nova Scotia construction firms which are part of the project.
- Operations and Maintenance - Operational wind projects require long-term operations and maintenance professionals to be located either on-site or within short driving distance of the Project. Technical maintenance of the turbines requires three technicians at all times for Safety purposes. In addition to the three technicians, there will be a team of two individuals representing the owner as site managers and facilitating the maintenance of all balance of plant equipment. It is generally anticipated that a team of two operations and maintenance technicians can maintain regular operations and maintenance service on approximately a dozen turbines. Once constructed, it is anticipated that the Project will be one of several projects which share long-term operations and maintenance teams to ensure project performance. The jobs associated with operations and maintenance are long-term, steady, stable, and high-paying jobs.

The involvement of Millbrook First Nation as a Project partner will maximize the local economic benefit to the community through job creation and utilization of local contractors. As Millbrook First Nation is to be a majority owner of the Project, significant efforts have been made and will continue to be made to involve Mi'kmaq owned and affiliated businesses and laborers in the development, construction and operation of the Project. In addition, the proponents are working to develop an Industrial Benefit Agreement for the Project, which aims to create opportunities for Mi'kmaq contractors and labor to participate in the Project.

In addition to the direct investments that the Project would bring to Nova Scotia's economy, a suit of auxiliary economic benefits can also be expected. It has previously been demonstrated that investments in wind power developments can result in significant indirect ancillary benefits to local communities. Workers that are directly involved with the development would contribute to local economies by redistributing wealth to a variety of goods and services such as hotels, restaurants, and grocery stores (USDE 2008).

Tax Revenue

As outlined in the *Wind Turbine Facilities Municipal Taxation Act (2006),* the Municipality of the District of Colchester will receive tax revenues per MW on an annual basis and as such, the royalty will annually increase as the Consumer Price Index (CPI) rises. Property taxes to be paid to the municipality over the lifespan of the Project are estimated at $1.2 million.

Investment in the Local Community

Through investments into a Community Sustainability Fund, the proponent is committed to sharing the economic benefits of the Project with the surrounding community. The fund will contribute 1% of the annual revenues to the local community development association to be used for the betterment of the community. It is estimated that over the lifetime of the Project the Community Sustainability Fund will invest more than $600,000 in the local community.

9.2 Land Use and Value

Presently, the area surrounding the Project site property is primarily zoned as "Resource Forest". The property on which the wind farm is proposed to be built is privately owned, and small scale forestry is the only current economic activity occurring on the Project site.

Potential effects on property values is often a primary concern of neighboring residents due largely to anecdotal reports from appraisers of drastic declines in property values following the nearby installation of a wind energy facility (as reviewed in Gulden 2011). Despite these concerns, a number of rigorous and statistically defensible studies have concluded that wind energy developments have had no significant effect on surrounding property values.

The most comprehensive study to date on the impact of wind farms on property values was completed by Hoen *et al.* (2009). This research analyzed data on nearly 7,500 sales of single family homes situated within 10 miles of 24 existing wind farms in the United States. Eight different hedonic pricing models failed to generate statistically significant evidence that property values for houses located within 10 miles of wind farms are influenced by the developments. Subsequent research by the same laboratory but employing further analyses confirmed these results (Hoen *et al*. 2010).

Carter (2011) analyzed home transactions in a rural landscape surrounding small (1-4 turbines) wind energy developments, while employing a hedonic model to statistically control for variables affecting all real estate transactions such as square footage, age of home, and school zone. This study concluded that proximity to the wind farms did not impact average selling price of homes; in fact, in one case, homes closer to a wind farm sold for significantly higher than those elsewhere.

A study by Hinman (2010) tracked property transactions in communities located close to a 240-turbine wind farm for an eight year period that spanned pre-development and operation stages. Hinman (2010) found that before project approval, property values in the area decreased. This was attributed to a fear of the unknown effects that the development would have; an effect known as anticipation stigma. However, once the development became operational, property values recovered. This recovery was attributed to a greater understanding of the operational effects of the development. Anticipation stigma, however, was not detected in a similar study in Colorado (Laposa and Mueller 2010), in which it was concluded that the announcement of a large wind energy development did not significantly reduce the selling prices of homes surrounding the proposed development.

Although there is some evidence of a “valley” in property values in the interim between wind farm announcement and operation (Hoen 2011), research has consistently demonstrated that, in a variety of spatial settings and across a wide temporal scale, sale prices for homes surrounding wind energy facilities are not significantly different from those attained for homes sited away from wind energy facilities.

9.3 Recreation and Tourism

Existing outdoor recreation in the area includes hunting, fishing, ATVing, and hiking. There are wildlife associations serving the area, notably the Cobequid Wildlife Rehabilitation Centre in Brookfield, the Cobequid Salmon Association in Truro, the Vahalla Gun Club in Truro, and the Nova Scotia Wildlife Carvers and Artists Association in Truro. For hiking, the Cobequid Trail Network lies north of the Project site in Old Barns, extending 11 km east towards the Town of Truro. The area is also home to the South Colchester ATV Club in Brookfield and the North Shore ATV Club in Truro (ATV Association of NS 2012).

The 2011 Nova Scotia Visitor Exit Survey Community Report outlines the total trips (stopped or stayed) to communities in Nova Scotia, to particular tourist regions, as well as capture rates of communities within tourist regions (Nova Scotia Department of Economic and Rural Development and Tourism 2011). The communities of Truro, Brookfield and Stewiacke in the Fundy Shore Annapolis Valley Region were examined. Table 9.6 shows the total trips (people who stopped for at least 30 minutes or stayed overnight) that were made to these communities, as well as their capture rate (the percentage of parties that stopped in a specific community compared to other communities within the region) out of the total number of parties who visited the tourism region.

Table 9.6: Communities Visited in Nova Scotia

Region/Community	Total Trips (% who stopped or stayed)	Capture Rate (%)
Fundy Shore and Annapolis Valley	**37%**	
Truro	21%	56%
Brookfield	2%	4%
Stewiacke	3%	8%

Source: Nova Scotia Department of Economic and Rural Development and Tourism 2011

The data shows tourism in Brookfield and Stewiacke is not a major economic driver. Comparatively, Truro is a more popular destination solidifying the town's reputation as a transportation hub for the Maritimes with all major highways intersecting through the town. Being located at the tip of the Bay of Fundy, Truro offers the tidal bore experience in additional to an array of activities including golf courses, multiple museums, Victoria Park and several accommodations and dining options for tourists.

The Project site is privately owned, though evidence of various forms of recreational activity have been observed on the site, including hunting and ATV/snowmobile use.

It is difficult to determine with certainty how tourists will react to a wind development. Wind farms are objects of fascination for many and thus can generate tourism for the local community. Some wind farms get upwards of 60,000 visits a year and the benefits of even drawing a fraction of that amount of visitors to a community can be felt by many businesses including shops, restaurants and hotels (CanWEA 2006). Pincher Creek, Alberta developed a 19 MW wind farm in 1993, since that time tourism revenue from visitors from as far away as Russia has generated $5,000 in annual sales of clothing and souvenirs branded with the “Naturally Powerful Pincher Creek” logo (CanWEA 2006).

A 2002 study from Market & Opinion Research International (MORI) interviewed tourists visiting Argyll and Bute, Scotland and asked them about their attitudes towards the presence of wind farms in the area. Of those who knew about the surrounding wind farms (40% of those interviewed), 43% felt that wind farms had a positive effect on the area, 43% felt it made no difference, and 8% felt it had a negative effect (MORI 2002).

No negative effects from the Project are expected to the broader recreational community, as access to the turbines will be limited due to the fact that they will be located on private lands and generally removed from public areas and provincial roads.

10.0 CULTURAL AND HERITAGE RESOURCES

10.1 Archeological Resource Impact Assessment

Davis MacIntyre & Associates Limited conducted an ARIA for the Project. The purpose of the assessment was to determine the potential for historic and pre-contact period archeological resources within the Project site through background research and site reconnaissance. The study area included the Millbrook Community Wind Project site and the Truro Heights Community Wind Project site. Background research indicated that Mi'kmaq settled along Salmon River and the banks of Cobequid Bay; however, historic maps indicate that there were no roads into the study area until after 1902 suggesting that people were not likely settled here in historic times (Davis MacIntyre & Associates Ltd. 2012). The only cultural activity near the study area in the early 20th century was located to the north along Soley and McNutt's Brooks where saw mills and related camps were established and to the south where a single building, possibly a camp related to gypsum extraction, were located (Davis MacIntyre & Associates Ltd. 2012).

A field survey completed in (October and December) 2012 concluded that there is a low potential for both Mi'kmaq and Euro-Canadian resources. The field assessment revealed that much of the study area was logged throughout the latter quarter of the 20th century at which point the road may have been pushed through beyond Kent Road (Davis MacIntyre & Associates Ltd. 2012). The ARIA was forwarded to the NS Department of Communities, Culture and Heritage. The response letter is provided in Appendix H, confirming that no significant archaeological material will be disturbed by the Project.

Procedures related to potential discovery of archaeological items or sites during construction/decommissioning will be described in the EPP.

11.0 MI'KMAQ RESOURCES

A MEKS is being completed by NEXUS Coastal Resource Management and is currently in progress. The purpose of the study is to document the collective ecological knowledge held by the Mi'kmaq and identify any concerns regarding the Project's impact on the Mi'kmaq's use of land, resources and special places within the study area defined for the MEKS (i.e., the Project site and the immediate surrounding area). Although the Millbrook and Truro Heights Community Wind Projects are being developed collaboratively, the MEKS report provided in Appendix I is related specifically to the Millbrook Project.

The methodology for the MEKS was developed in accordance with the protocol adopted by the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO). A desktop review was conducted to gather all relevant information pertaining to the Project study area, historical Mi'kmaq knowledge and Mi'kmaq resource use. Workshops with local Mi'kmaq knowledge holders enabled the collection of local site-specific knowledge of historical and current Mi'kmaq use of natural resources. A field survey will be conducted in June 2013 to identify and locate general habitats, plant species and other related resources that may be of importance to the Mi'kmaq community. The final report will provide complete analysis and presentation of field data from the June field surveys.

The results of the consultation process show that there has been a long-standing relationship and interest with the regions in and around the Project site. The meeting held with Mi'kmaq participants from the Millbrook First Nation highlights the vested interest the Mi'kmaq have with their traditional territory. Mi'kmaq ecological and traditional resources associated with the area are still accessible by the surrounding communities and are being utilized by a wide range of community sectors, from youth to elders. While some activities and areas are more commonly cited than others, the level of community interest in the lands and resources remains active and relevant. It should be noted that the Millbrook First Nations is a partner in the development of this Project. This Project is widely known within the community and has substantial community support. There is also large support within the Mi'kmaq community for similar renewable energy developments.

Based on the preliminary results, future planning and collaboration between the proponent and local Mi'kmaq communities will be maintained throughout the development of the Project through the application of Mi'kmaq Ecological Knowledge, in keeping with the principles and statements of the United Nations Declaration of the Rights of Indigenous Peoples.

The MEKS is provided in Appendix I.

12.0 OTHER CONSIDERATIONS

12.1 Shadow Flicker

Shadow flicker can occur when rotating blades cast flickering shadows during times of direct sunlight. The magnitude of shadow flicker is determined by the position and height of the sun, wind speed and direction, geographical location, time of year, cloud cover, turbine hub height and rotor diameter, and proximity to the turbine (CanWEA 2011).

For shadow flicker to occur, the following criteria must be met:

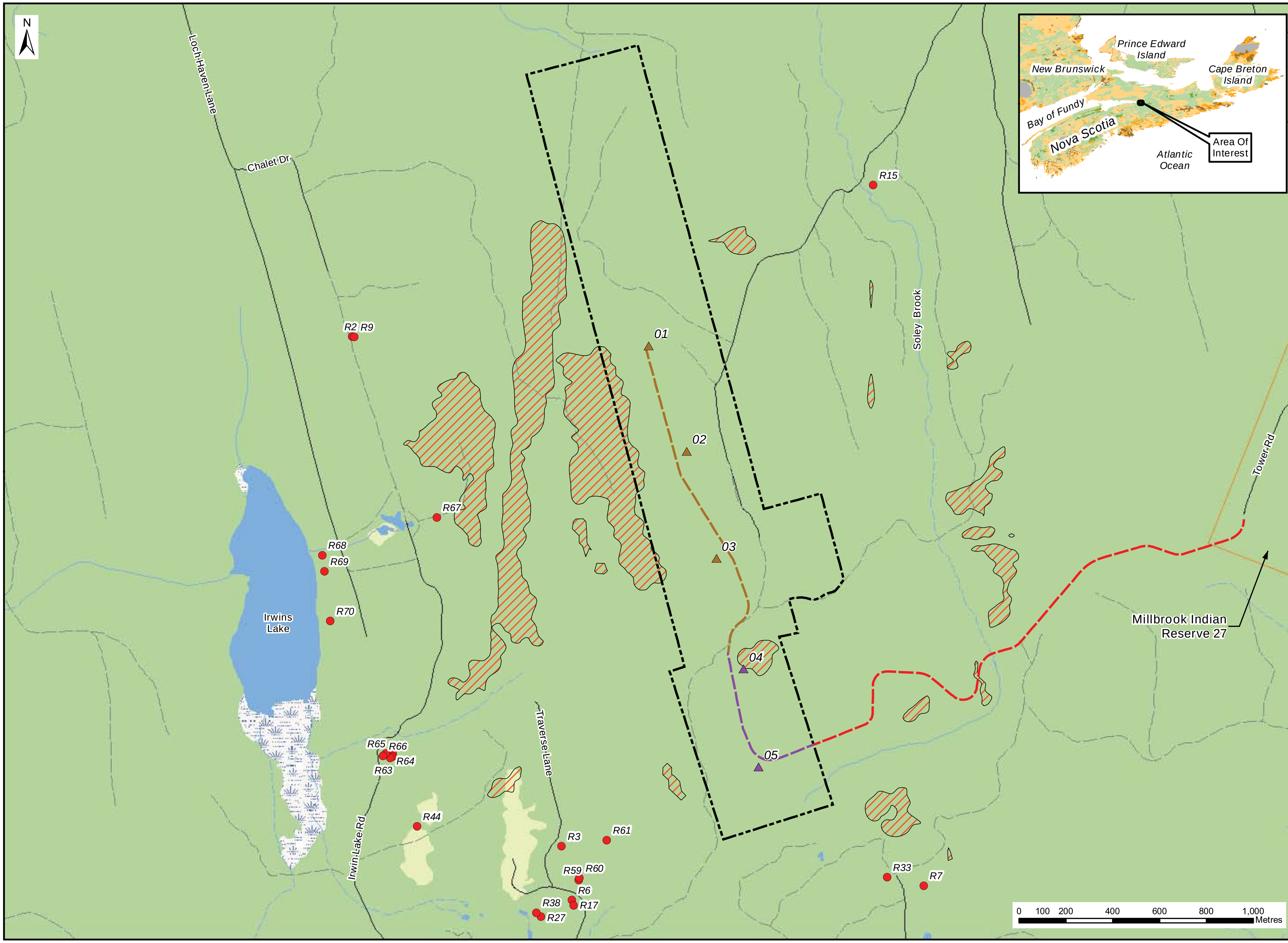
1. The sun must be shining and not be obscured by clouds/fog.
2. The source turbine must be operating.
3. The wind turbine must be situated between the sun and the shadow receptor.
4. The wind turbine must be facing directly towards, or away from, the sun such that the rotational plane of the blades (rotor plane) is perpendicular to the azimuth of incident sun rays. For this to occur, the wind direction would have to be parallel to the azimuth of the incident sun rays throughout the day.
5. The line of sight between the turbine and the shadow receptor must be clear. Light-impermeable obstacles, such as vegetation, tall structures, etc., will prevent shadow flicker from occurring at the receptor.
6. The shadow receptor has to be close enough to the turbine to be in the shadow.

A shadow flicker assessment was completed for the proposed Project to assess the potential effect on surrounding shadow receptors. The assessment included consideration of the Truro Heights Community Wind Project. The analysis was conducted using the WindPRO version 2.8 software package using worst case scenario conditions, including constant sunshine and receptor windows oriented perpendicular to the rotational axis of the turbines. There are no municipal, provincial, or federal guidelines related to shadow flicker, but many jurisdictions have adopted the industry standard of no more than 30 hours of shadow flicker per year, or no more than 30 minutes of shadow flicker on the worst day of the year. These guidelines were used in the shadow flicker assessment for the Project.

As a final agreement has not been reached with a turbine supplier, all turbine models under consideration were modeled separately. This conservative measure was taken to ensure that all potential shadow-related issues are addressed, regardless of the turbine model ultimately used for the Project.

A list of 70 non-participating structures (i.e. those not located within the Project site) within a 2 km radius of the proposed turbine locations was developed using GIS data from the Nova Scotia Geomatics Centre and aerial imagery. For modeling purposes, the receptor list is considered to be conservative as no distinction has been made between habitable dwellings and barns, sheds, or outbuildings. In cases where topographic mapping indicated a structure that was not visible on aerial imagery, field truthing was carried out to verify that no structure was present; if verified, the receptor was removed from the model. Vegetation effects were incorporated into the model using data from the Nova Scotia Forest Inventory (NSDNR 2012a). Specifically, forest stand height was included to determine if any part of the turbine will be visible from the receptor location. If vegetation obscures the visibility of turbines from a receptor, shadow flicker will not occur at that location.

Modeling results (Appendix J) indicated that all receptors are predicted comply with the 30 hours of shadow flicker per year/30 minutes of shadow flicker per day guideline (Drawing 12.1).



Notes:

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

Legend:

- Project Site Boundary
- Millbrook Proposed Road
- Truro Heights Proposed Road
- Tower Road Extension
- Truro Heights Turbine
- Millbrook Turbine
- Existing Receptors
- 30+ Shadow Flicker Hours Per Year
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Shadow Flicker Modeling Results

ESKASONI Corporate Division

MILLBROOK FIRST NATION

Community Wind Farms Inc.

juwi

Strum CONSULTING

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:15,000	Drawing #: 12.1
Drawn By: G. Gregory	
Checked By: M. Smith	

12.2 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 (RABC and CanWEA 2012). In response to this phenomenon, the Radio Advisory Board of Canada (RABC) and CanWEA developed guidelines for assessing the EMI potential from a wind turbine development. These guidelines outline a consultation based assessment protocol that establishes areas, called "consultation zones", around transmission systems, based on the system's type and function.

The EMI study for this Project was completed in accordance with the RABC/CanWEA published guidelines. Location information and frequency details were obtained from the Technical and Administrative Frequency Lists (TAFL) database, which is administered by Industry Canada, and from email communications with the Royal Canadian Mounted Police (RCMP), Department of National Defense (DND), Canadian Coast Guard, Environment Canada, NAV CANADA, Natural Resources Canada, and Industry Canada. Results are provided in Table 12.1.

Table 12.1: Radar Transmission Array Interference Consultation Results

	Operator	Required/ Suggested Consultation Zone Radius	Consultation Results
Television - Broadcast and Reception			
Analog Television Broadcast (Private)	n/a	2 km	Three analog transmitters within the consultation zone. The closest is located 0.7 km away.
Analog TV Broadcast (Public)	CBC	89 km	One television transmitter within the consultation zone, located 79 km away.
Analog Television Receivers	n/a	6.96 km	Consultation may be required to evaluate the effects of the Project on analog TV reception within 14 km radius. However, analog signal transmission has been predominantly replaced. The majority of TV broadcast operators have converted their analog NTSC TV stations to the ATSC North American digital standard, as required by a decision of the CRTC (Public Notice CRTC 2007-53).
Radio – Broadcast and Reception			
AM Radio (Private)	n/a	5 km (omnidirectional antenna) 15 km (directional antenna)	One AM tower within consultation zone. 2 km from proposed wind farm. Call Sign 540Halifax @ 0.76 MHz
AM Radio (Public)	CBC	5 km	None required – interference unlikely.
FM Radio (Private)	n/a	2 km	None required – interference unlikely.
FM Radio (CBC)	CBC	5 km	No receivers located within consultation n zone.

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	Operator	Required/ Suggested Consultation Zone Radius	Consultation Results
Regulatory Agencies			
Air defense and air control radar systems	DND	100 km	No objections or concerns.
DND Radio Communications	DND	n/a	No objections or concerns.
Maritime vessel traffic system radars	Canadian Coast Guard	60 km	No objections or concerns.
Radar communication systems	RCMP	N/A	No response received.
VHF omnidirectional range	Nav Canada	15 km	No objections or concerns.
Primary air traffic control surveillance radar		80 km (primary surveillance) 10 km (secondary surveillance)	
Weather radar	Environment Canada	50 km	No objections or concerns.
Seismic monitoring stations	Natural Resources Canada (NRCan)	N/A	No response received.

Relevant correspondence from operators and reporting is provided in Appendix K. Once the finalized layout is confirmed, the above agencies will be provided with the updated information, as appropriate.

Point to Point Systems
The CanWEA/RABC Guidelines recommend a consultation zone within a 1 km radius around the transmit and receive sites for point to point type radio systems, and a cylinder around the transmission path, with a diameter determined as a function of the Fresnel zone.

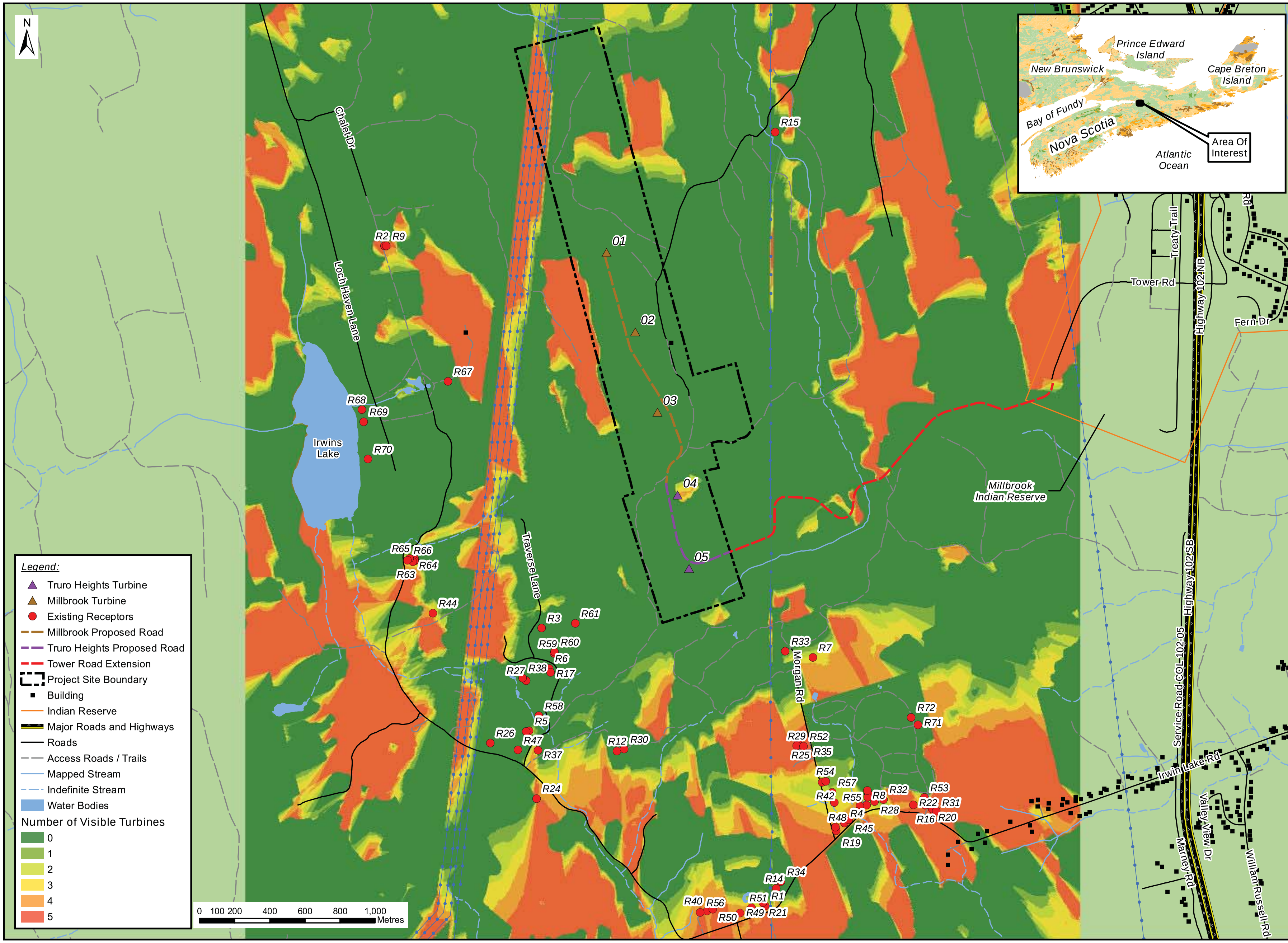
A total of 348 search results were identified as point to point radio systems. These results were paired using the call sign field, where call signs were not available pairing was completed based on Owner and TX/RX frequency pairing. One tower was identified to be within the 1 km consultation zone. This tower has a call sign of VFW529 and is owned by the local Fire Department.

12.3 Visual Landscape

Zone of Visual Influence (ZVI)
The visibility of wind turbines from a given location is influenced by local topography as well as obstacles which could obscure sightlines. Turbine visibility was modeled using the WindPRO version 2.8 software package. Model inputs included proposed turbine locations for the Millbrook and Truro Heights Community Wind Projects, local elevation data, as well as forest stand height from the Nova Scotia Forest Inventory (NSDNR 2012a). Turbine visibility was calculated based upon a 5 m grid resolution to achieve the highest precision possible. For the purposes of the model, a turbine was deemed visible if any part could be seen from given location, including any part of the rotating blade above the tower and hub assembly. An assessment area of 2,848 hectares was defined to encompass a 2 km buffer around the proposed turbine locations.

As a final agreement has not been reached with a turbine supplier, modeling was conducted using the tallest (hub height + ½ rotor diameter) turbine model under consideration, as this model extends farthest into the air and is therefore more likely to be visible.

Model results indicate that no turbines will be visible from 68.2% (1,942 ha) of the assessment area, while five turbines will be visible from 17% (484 ha) of the area (Drawing 12.2).



Notes:

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

ZVI Analysis Results

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

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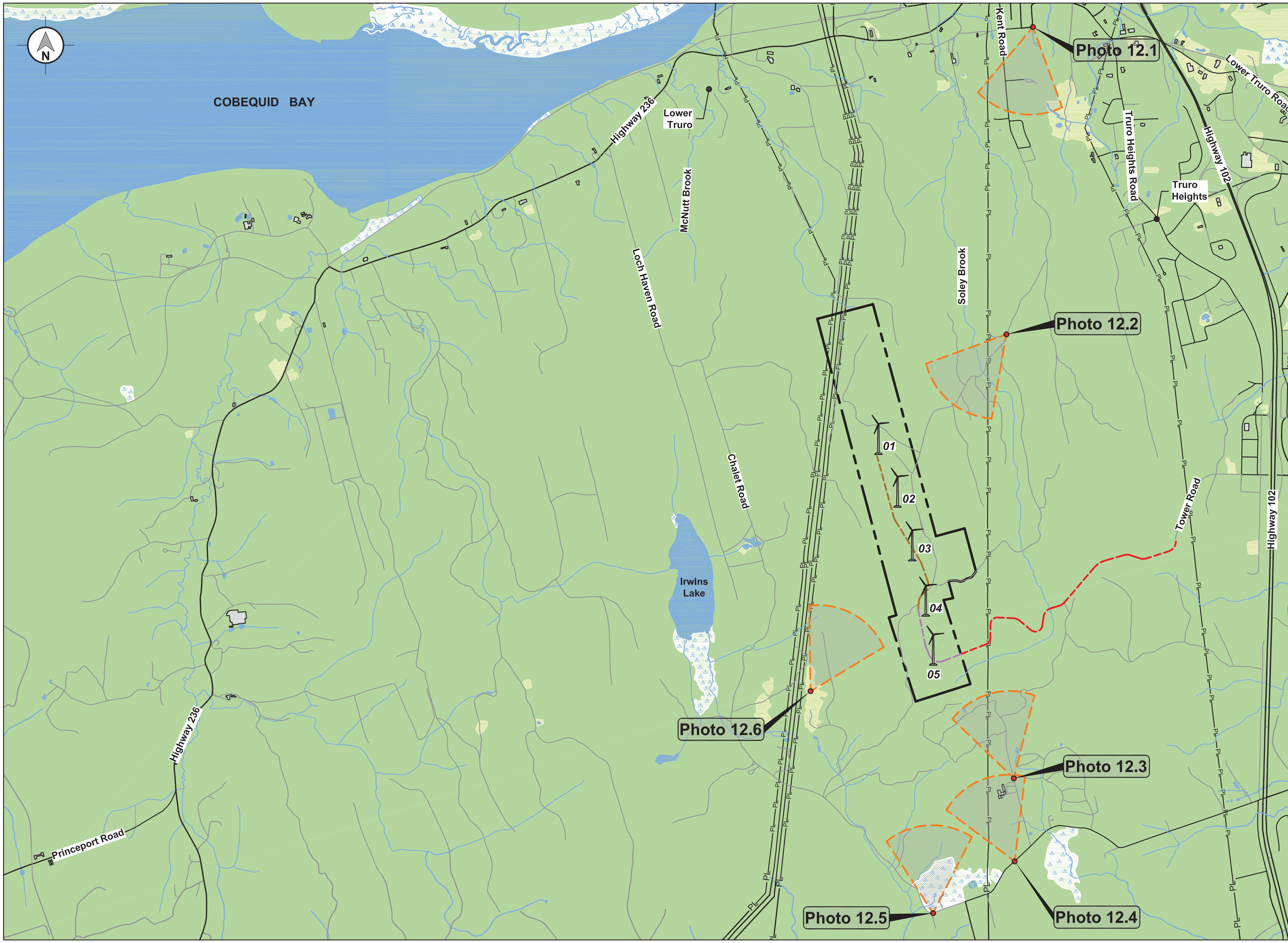
Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:20,000	Drawing #: 12.2
Drawn By: G. Gregory	
Checked By: M. Smith	

Predicted View Plane
Representative photos were taken from vantage points within the community to represent the existing and future visual landscape.

Photographs were collected with magnetic bearings and a GPS waypoint recorded at each photo location. Geographical Information System (GIS) software was used to plot the photo locations and construct bearing lines to assist in the construction of a 3D view, generated using the GIS. A 3D surface was then constructed using the provincial Digital Elevation Model (DEM) points from the Nova Scotia Topographic Database, which supports 5 m contour intervals. The proposed turbine location and specifics regarding the height of the turbine were used to develop the view plane. Each selected viewing site was created using the viewer location (photo GPS point, elevation, and bearing line) resulting in an accurate 3D view. The resulting computer generated view was then merged with the digital photographs using a scaled image of the proposed turbine.

Photos were taken from six locations as shown in Drawing 12.3. Simulated results, including turbines from both the Millbrook and Truro Heights Projects, are provided in Figures 12.1-12.6.



Notes:

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

Legend:

- Proposed Turbine Location
- Viewpoint Location
- Direction of View
- Project Site Boundary
- Millbrook Proposed Road
- Truro Heights Proposed Road
- Tower Road Extension
- Existing Paved Road
- Existing Trail / Access Road
- Mapped Stream
- Indefinite Stream
- Mapped Water Bodies
- Mapped Wet Area
- Cleared Area

Visual Assessment Locations

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

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Strum Consulting

DATE: April 2013	PROJECT #: 12-4328/12-4544
SCALE: 1:25,000	DRAWING #: 12.3
DRAWN BY: H. Serhan	
CHECKED BY: M. Smith	

Predicted View:

Actual View:

Figure 12.1. Tideview Drive: View to the southwest, towards the Project site.

Predicted View:

Actual View:

Figure 12.2. Kent Road: View to the southwest, towards the Project site.

Predicted View:

Actual View:

Figure 12.3. Morgan Road: View to the northwest, towards the Project site.

Predicted View:

Actual View:

Figure 12.4. Irwin Lake Road: View to the northwest, towards the Project site.

Predicted View:

Actual View:

Figure 12.5. Irwin Lake Road: View to the north, towards the Project site.

Predicted View:

Actual View:

Figure 12.6. Little Brook Road: View to the northeast, towards the Project site.

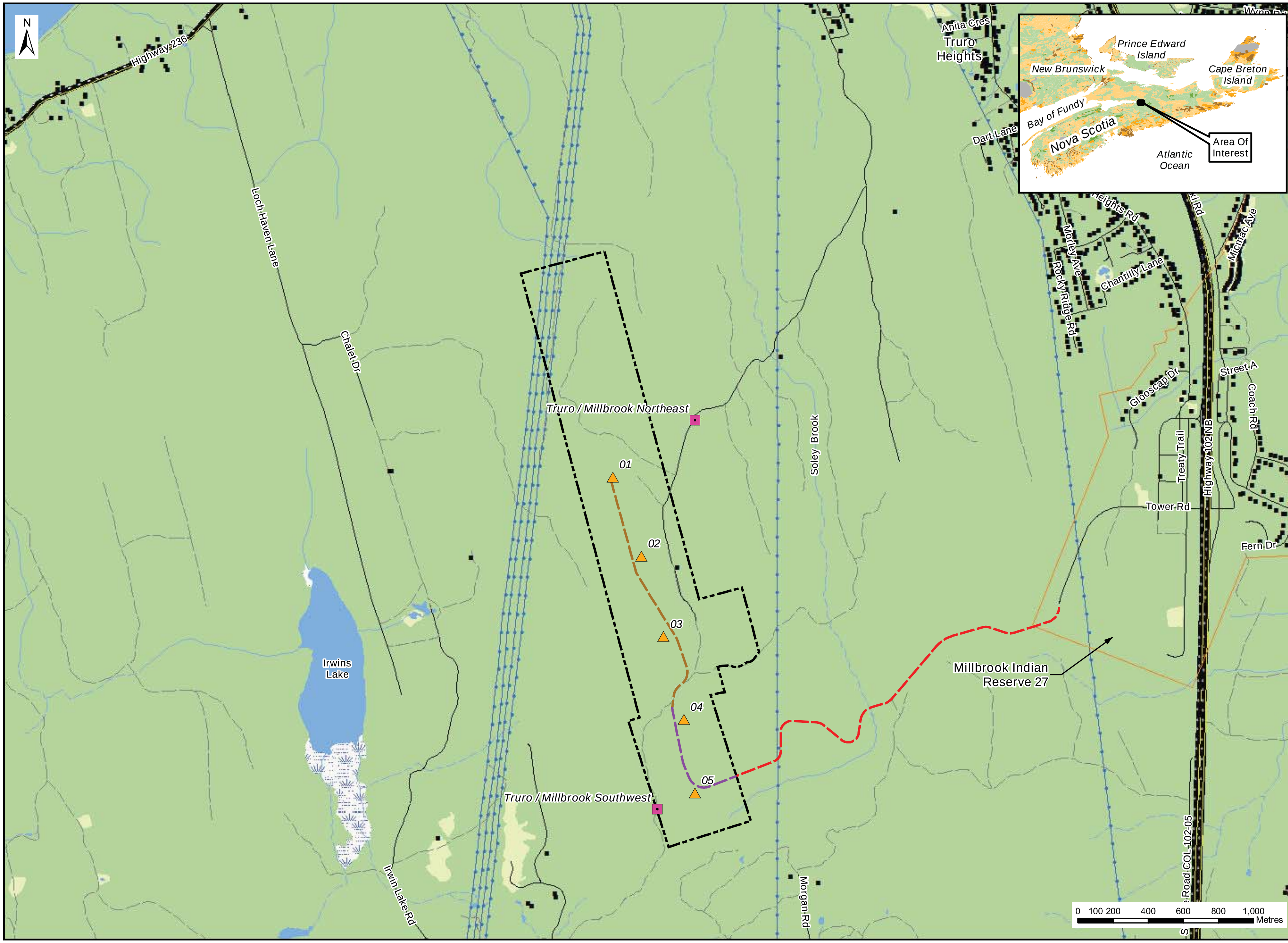
12.4 Sound

Sound from wind turbines comes from two general sources: the mechanical equipment, and the interaction of the air with the turbine parts, primarily the blades (NSDE 2008). In modern turbine designs, much of the mechanical noise is mitigated through the use of noise insulating materials. Aerodynamic noise, however, is a product of the turning of turbine blades and is thus an unavoidable aspect of wind power operations. Turbines can emit noises of different frequencies, and an individual's perception of the noise can depend on hearing acuity and tolerance for particular noise types (NRC 2007). Furthermore, the propagation of sound from the turbine source to a receptor, such as a residential dwelling, is influenced not only by the sound power level emitted from the turbine, but also by local factors such as distance to the receptor, topography, and weather conditions (Hau 2006). For example, increases in wind speed result in increases in ambient, natural noise (from vegetation movement) that can mask the sounds emitted from the turbine(s) (NRC 2007).

Ambient Sound Assessment

Ambient sound monitoring was completed to establish pre-construction sound levels at a two locations at the Project site. Locations were selected to be in close proximity to potential receptors (Drawing 12.4). Average sound levels over the duration of the sampling period were measured to be 49.3 and 50.2 dBA. Sound levels are likely influenced by existing sound generated by traffic on the nearby 102 highway.

Details of the assessment including methodology, full results and discussion are provided in Appendix L.



Notes:

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

Legend:

- Proposed Turbine
- Sound Monitor
- Millbrook Proposed Road
- Truro Heights Proposed Road
- Tower Road Extension
- Project Site Boundary
- Building
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Existing Transmission Lines
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Sound Monitoring Locations

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

juwi

Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:20,000	Drawing #: 12.4
Drawn By: H. Serhan	
Checked By: M. Smith	

Acoustic Assessment

An acoustic assessment was conducted for the Project to predict sound pressure levels at identified receptors within a 2 km radius of the proposed turbine locations. The assessment was completed using the WindPro v. 2.8 software package. For the purposes of this model, receptors included all structures identified in the provincial topographic mapping, as well as any additional identifiable structures based on aerial imagery. In cases where topographic mapping indicated a structure that was not visible on aerial imagery, field truthing was carried out to verify that the no structure was present; if verified, the receptor was removed from the model. The assessment also included consideration of the Truro Heights Community Wind Project. The model followed ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method and calculations, and was based on the following input information:

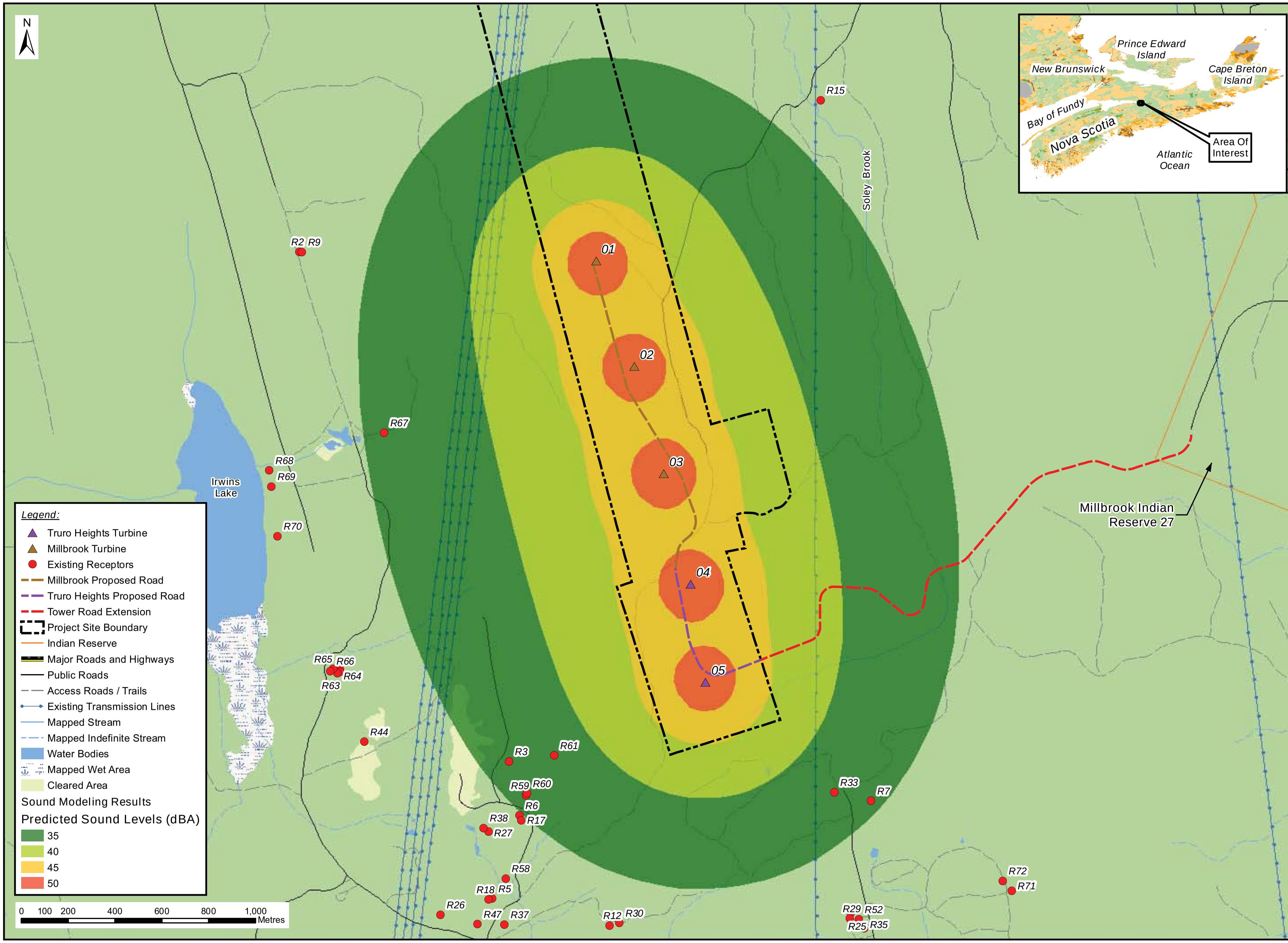
- UTM coordinates for the wind turbines;
- Generic 1/1 Octave band sound power level data for the wind turbines, as calculated by WindPro;
- UTM coordinates for receptors;
- A wind speed of 8 m/s, the speed at which the highest sound power level output is achieved (based on test data from the manufacturer); and
- Topographic data for the surrounding area.

As a final agreement has not been reached with a turbine supplier, all turbine models under consideration were modeled separately. This conservative measure was taken to ensure that all potential noise-related issues are addressed, regardless of the turbine model ultimately used for the Project. The most conservative results (e.g. the turbine model producing the loudest overall sound pressure level at receptors) are presented.

Nova Scotia has no specific sound guidelines for wind farms; however, through the EA process, NSE requires that predicted noise levels at identified residential receptors (as well as daycares, hospitals and schools) not exceed 40 dBA. As this guideline is intended to be protective of human sleep disturbance, 40 dBA does not apply to commercial receptors. Mapping illustrating the predicted sound levels relative to receptors is provided in Drawing 12.5

A total of 70 existing non-participating structures (i.e. those not located on Project lands) were identified within a 2 km radius of the proposed turbine locations. Modeling results indicated that all receptors are predicted to comply with the NSE standard of 40 dBA. Excessive noise resulting from turbine operation is therefore not expected to be an issue at any existing dwellings/residences. Detailed results are provided in Appendix L.

A literature review related to infrasound is provided in Appendix C.



Notes:

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

Sound Modeling Results

Eskasoni Corporate Division

Millbrook First Nation

Community Wind Farms Inc.

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Strum Consulting

Date: April 2013	Project #: 12-4328/12-4544
Scale: 1:15,000	Drawing #: 12.5
Drawn By: G. Gregory	
Checked By: M. Smith	

13.0 CONSULTATION AND ENGAGEMENT

13.1 Public Consultation

As Communications Coordinator, Mr. Keith Towse (CWFI) coordinates meetings, addresses community concerns, and acts as a liaison between the community and the Project team.

The Project team has met several times with Municipality of Colchester staff and local residents, as well as provincial and federal government staff. A summary of the consultation for this Project is provided in Table 13.1. Specific concerns identified by the public are provided in Appendix M. Detailed information on community events and the website is provided below.

Table 13.1: Consultation Meetings and Events

Date	Stakeholder	Activity Summary
September 15, 2011	NSE EA Branch	Early environmental discussions to better understand critical issues and permitting regime.
September 2011	Community	Distributed information leaflet to residential properties within 1 km with a link to an online survey.
November 10, 2011	Municipality	Meeting with Municipality of Colchester staff (Colin Forsyth) to provide Project information.
January 16, 2012	NSE EA Branch	Meeting with NSE staff to introduce the Project.
March 12, 2012	CWS and NSDNR	Bird monitoring protocol provided to CWS and NSDNR.
April 24, 2012	CWS	Received written feedback from CWS regarding the bird monitoring program.
May 30, 2012	Community Municipality	First Open House event held at Glooscap Heritage Centre – attended by approximately 30 members of the public, Millbrook First Nation Chief Gloade and members of Band Council.
June 13, 2012	NSDNR	Phone conversation with DNR staff to discuss bat monitoring and timing.
June 27, 2012	NSE EA Branch	Meeting with NSE Staff and Eric Christmas to discuss issues relating to noise and shadow flicker.
September 23, 2012	Province	Meeting with Gary Burill (MLA) to provide Project update.
September 28, 2012	NSDE	Meeting with Barry Francis to discuss development of Mi'kmaq Supply Chain.
September 28, 2012	NSDE	Meeting with Krystal Therien to discuss general update of Project and partnership developments.
October 15, 2012	NSDNR	Email update to NSDNR regarding bird and bat monitoring.
November 12, 2012	Municipality	Meeting with Colchester Mayor Bob Taylor and Chief Gloade to provide Project update.
November 15, 2012	NSDNR	Email regarding species status.
November 2012 – January 2013	Municipality	Telephone meetings with Geoff Stewart (Colchester Councillor) – provided information to be passed to Hilden Community Association.
October 2012- February 2013	Community	Individual meetings with all residents within 2 km of Project site to deliver Project update.
December 5-7, 2012	NSDNR	Provided moose monitoring protocol to NSDNR staff and incorporated feedback into protocol.

Date	Stakeholder	Activity Summary
February 2013	Municipality	Meeting with Municipality of Colchester staff (Colin Forsyth) to provide Project update.
February 14, 2013	NSE EA Branch	Met with NSE staff to discuss the Project.
February 18, 2013	NSDNR	Received feedback on moose protocol update.
April 4, 2013	NSE EA Branch and NSDNR	Met with NSE and NSDNR staff to discuss the Project.
May 2, 2013	Community	Wind 101 information session (see below).
May 1 – 2, 2013	Community	Distributed summary of EA report to all residences within 2 km of Project site.
March 4, 2013	Hilden Community Association	Met with members of Hilden Community Association, members of the Municipality of Colchester Council and staff to provide Project update.
May 11, 2013	Community	Wind farm tour (see below).
May 13, 2013	Community	Second Open house planned for May 2013.

Community Events

One community open house event was held in Millbrook on May 30, 2012 from 7-9 pm to inform the public about the Project and to hear local comments and concerns. The open house featured posters that provided information about the Project and associated studies that were underway. Copies of the posters and newsletter from the open house are provided in Appendix M. Attendees had the opportunity to speak one-on-one with Project team members and submit written comments and/or questions.

The proponent hosted a Wind 101 information session that was presented by Dr. Lukas Swan (Dalhousie University) on May 2, 2013 at the Glooscap Heritage Centre. The purpose of the session was to provide the community with general information about local energy/electricity use and production, wind energy, and wind project development. A sign-up sheet was available at the presentation for those wishing to take a wind farm tour on May 11, 2013.

The Project Team will continue to help address any concerns raised by local citizens over the duration of the Project's development and has planned another open house event for May 13th at 6:00-9:00 pm, located at the Glooscap Heritage Centre.

Website

A website for the Project was developed in August 2012 and can be accessed at: at: www.millbrookwindfarm.ca. The website provides an overview of the Project, provides access to the featured posters presented at the first community open house, shares information on upcoming meetings, and Project news, as well as allows interested public to pose questions to the Project team. The website also contains a Mi'kmaq language page.

Aboriginal Engagement
Preliminary Project details have been submitted to the KMKNO, the Confederacy of Mainland Mi'kmaq, the Native Council of Nova Scotia, the Union of Nova Scotia Indians, and the Unama'ki Institute of Natural Resources.

Millbrook First Nation is the COMFIT eligible community partner for the Project, and therefore has been highly involved in Project activities to date. As such, Millbrook First Nation has been invaluable in ensuring the project is developed in a manner that is harmonious with the surrounding community and culture. The involvement of Millbrook First Nation will also maximize the local economic benefit to the community through job creation and utilization of local contractors. In addition, the proponents are working to develop an Industrial Benefit Agreement for the Project, which aims to create opportunities for Mi'kmaq contractors and labor to participate in the Project.

14.0 EFFECTS ASSESSMENT

Based on the discussion in Section 7, the following VECs have been identified for additional assessment:

- SOCI;
- Avifauna; and
- Bats.

To ensure all relevant issues and concerns related to the proposed Project are identified, an interaction matrix was used to evaluate the interactions between the Project phases and the VECs (Table 14.1). The potential for accidents and malfunctions is also considered for each Project phase.

Table 14.1: Interaction Matrix

Project Phases/Activities	SOCI	Avifauna	Bats
Site Preparation and Construction			
Land Surveys for Placement of Roads, Turbines and Associated Works			
Geotechnical Investigations	X	X	
Placement of Sedimentation and Erosion Control Measures			
Clearing of Trees and Grubbing Areas for Construction	X	X	X
Access Road Upgrading and Construction	X	X	X
Laydown Area and Turbine Pad Construction	X	X	X
Transportation of Turbine Components			
Turbine Assembly	X	X	X
Grid Connection			
Removal of Temporary Works and Site Restoration	X		
Commissioning			

Project Phases/Activities	SOCI	Avifauna	Bats
Operation & Maintenance			
General Operation and Maintenance	X	X	X
Vegetation Management		X	
Decommissioning			
Dismantling and Removal of Turbines from Project Site	X	X	X
Removal of Turbine Foundations to Below Grade and Reinstatement of Topsoil	X	X	X
Removal of On-site Roads and Reinstatement of Lands	X	X	X
Removal and Disposal of Collection System, Conductor and Poles	X	X	X
Removal of All Other Equipment and Stabilization of Lands	X	X	X

14.1 Environmental Effects Analysis Methodology

The completion of the environmental effects analysis involves consideration of the following elements:

- Description of potential negative environmental effects;
- Mitigation measures;
- Residual effects;
- Significance of residual environmental effects; and
- Monitoring or follow up programs.

This EA is structured to include proposed mitigation to reduce or eliminate potential adverse environmental effects. The determination of significance of adverse environmental effects is based on post-mitigation (residual) effects, rather than unmitigated potential effects. The significance of residual effects of the Project will be determined using the criteria, based on federal and provincial EA guidance (Table 14.2).

The expectation for, and significance of, residual effects determines the need for a monitoring and/or follow-up program.

Table 14.2: Criteria for Identification and Definition of Environmental Impacts

Attribute	Options	Definition
Scope (Geographic Extent)	Local	Effect restricted to area within 1 km of the Project site
	Regional	Effect extends up to several km from the Project site
	Provincial	Effect extends throughout Nova Scotia
Duration	Short-term	Effects last for less than 1 year
	Medium-term	Effects last for 1 to 10 years
	Long-term	Effects last for greater than 10 years
Frequency	Once	Occurs only once
	Intermittent	Occurs occasionally at irregular intervals
	Continuous	Occurs on a regular basis and regular intervals

Attribute	Options	Definition
Magnitude	Negligible	No measurable change from background in the population or resource; or in the case of air, soil, or water quality, if the parameter remains less than the standard, guideline, or objective
	Low	Effect causes <1% change in the population or resource (where possible the population or resource base is defined in quantitative terms)
	Moderate	Effect causes 1 to 10% change in the population or resource
	High	Effect causes >10% change in population in resource

The potential level of impact after mitigation measures are applied (e.g. residual effects) was identified based on the criteria and definitions provided in the NRCan document, "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act" (NRCan 2003), as shown in Table 14.3.

Table 14.3: Definition of Significant Residual Environmental Impact

Significance Level	Definition
High	Potential effect could threaten sustainability of the resource and should be considered a management concern. Research, monitoring, and/or recovery initiatives should be considered.
Medium	Potential effect could result in a decline in resource to lower-than-baseline but stable levels in the study area after project closure and into the foreseeable future. Regional management actions such as research, monitoring, and/or recovery initiatives may be required.
Low	Potential effect may result in slight decline in resource in study area during life of the project. Research, monitoring, and/or recovery initiatives would not normally be required.
Minimal/None	Potential effect may result in slight decline in resource in study area during construction phase, but should return to baseline levels.

14.2 Effects Assessment

Effects and mitigation measures related to each VEC are described below. Potential effects of the Project on the identified VECs are further analyzed in Tables 14.4 to 14.6 to identify and evaluate the significance of residual effects, based on the criteria listed above. Mitigation measures are also summarized.

14.2.1 Species of Conservation Interest

It is widely acknowledged that wind energy development can have a suite of potential direct and indirect effects on terrestrial fauna (Arnett *et al.* 2007; Kuvlesky, Jr. *et al.* 2007). General construction activities within and adjacent to watercourses and water bodies, can affect aquatic fauna and habitat. The extent and magnitude of these effects can vary with the stage of the Project but are present for all phases.

During the site preparation and construction phases of wind energy projects, potential effects to SOCI will be related to:

- sensory disturbance;
- habitat loss/alteration and/or fragmentation;
- effects to fish passage/migration and
- collision mortality.

Sensory Disturbance
Sensory disturbance to terrestrial fauna SOCI may occur from a variety of anthropogenic sources. For wind energy projects, disturbance effects are typically most significant during the construction phase, which involves increased presence of on-site personnel, vehicles, and heavy equipment (Helldin *et al.* 2012). Avoidance effects related to the construction phase have been reported for large mammals in two cases [e.g., Rocky Mountain Elk (*Cervus elaphus*) (Walter *et al.* 2006) and wolves (Álvares *et al.* 2011)], but in both cases the effects were temporary and subsided once construction was completed. It is expected that avoidance or displacement effects related to the site preparation and construction phases of the Project will not persist in the long-term.

It is also important to distinguish wind energy facility roads from high-use motorways in regards to sensory disturbance. Many of the documented effects of roads are related to avoidance due to traffic noise (Forman and Alexander 1998). The magnitude of such effects will be greatly reduced in the context of this wind energy development, as road traffic will be minimal (maintenance vehicles during operations) and limited.

Sensory disturbance during the operations and maintenance phase of the Project will be limited to the presence of on-site personnel conducting maintenance on Project infrastructure. Although literature on the topic is sparse, most evidence suggests that in general, terrestrial fauna are not adversely affected by operating wind turbines. It was determined that a population of elk in Oklahoma, for example, did not change their home range or experience reduced dietary quality within an operating wind power development (Walter *et al.* 2006). It is therefore unlikely that ungulates in the Project site, including White-tailed deer and potentially Mainland moose, will be affected. Likewise, small mammal communities at wind energy developments do not appear to be affected by turbine operations (de Lucas *et al.* 2005).

Effects to terrestrial fauna SOCI during the decommissioning phase of the Project will be similar to those experienced during the site preparation/construction phase (Helldin *et al.* 2012). Namely, sensory disturbance due to the increased presence of on-site personnel and the operation of heavy equipment may elicit temporary displacement/avoidance behaviours in mobile wildlife species.

Sensory disturbance impacts related to aquatic SOCI are not expected.

Habitat Loss/Alteration
Although the permanent footprint of a wind energy facility is generally estimated to be just 5 to 10% of the Project site (Arnett *et al.* 2007), there is the potential that significant habitat elements for certain terrestrial fauna SOCI may altered/removed during site preparation activities, such as

clearing, for turbine pads and access roads. The effects may be negligible if the habitat is in adequate supply in the general area surrounding the Project site (Arnett *et al.* 2007). Since the permanent disturbance area of both the Truro Heights and Millbrook Project footprints represent 1.6% of the total Project site, and forest stands of similar age and composition are prominent in nearby areas, the effects of habitat loss/alteration on terrestrial fauna SOCI will be minimized.

The construction of roads has a variety of well-documented, adverse effects including fragmentation of otherwise continuous segments of suitable habitat and restriction of movement of individuals between habitat patches (Trombulak and Frissell 2000, Eigenbrod *et al.* 2008), avoidance of adjacent habitat, increased access for hunters/poachers (Brody and Pelton 1989; Helldin *et al.* 2012), which can potentially result in increased mortality of certain wildlife species while also facilitating the expansion of interspecific competitors (Beazley *et al.* 2004) and exotic species (Trombulak and Frissell 2000). The road network for this Project will have a small footprint due to the overall size of the Project, which will significantly reduce the magnitude of any potential effects.

Effects to Atlantic salmon and its habitat during the site preparation and construction phases the Project are primarily related to the construction and upgrading of access roads and the installation of crossing structures where roads intercept watercourses. Vegetation clearing along banks and land adjacent to watercourses could result in significant habitat degradation for fish and other aquatic biota if appropriate mitigation techniques are not employed. The alteration or removal of riparian vegetation may result in bank instability and erosion, leading to sedimentation of the water body and degradation of water quality.

Removal of overhanging vegetation from stream banks decreases shade/cover for fish resulting in increased vulnerability to predators and potentially in increased localized water temperatures. Likewise, the removal of instream cover, such as coarse woody material or edge habitat (e.g. undercut banks) may have a similar effect on fish habitat. Coarse woody material also provides habitat for aquatic invertebrates. Alterations to channel morphology and interference with sediment transport may also lead to Atlantic salmon habitat modification/degradation (MTO 2009). Many effects to Atlantic salmon habitat can be mitigated through thoughtful planning and the incorporation of standard mitigation and BMPs (refer to Section 4).
The potential effects of the Project on fauna SOCI habitat during the operational phase are likely to be minimal. Aside from surface disturbance and the possible removal of regenerated vegetation, decommissioning will not include additional habitat loss/alteration. Therefore, the effects to fauna SOCI during this phase of the Project are not expected to be significant in magnitude nor long-term in duration.

Effects to Passage/Migration
Lack of consideration for fish migration/passage during the design of crossing structures and/or appropriate installation techniques may also lead to a number of effects on Atlantic salmon. These effects typically manifest as modifications or barriers to fish movement through the affected watercourse. Barriers to fish passage include velocity barriers, alteration of the stream gradient and insufficient flow/depth (MTO 2009).

Many effects to Atlantic salmon passage can be mitigated through thoughtful planning and the incorporation of standard mitigation and BMPs (refer to Section 4.0).

Mortality
Increased vehicle and heavy equipment traffic during all phases of the Project may result in collisions with terrestrial wildlife. It is expected that these collision events will be minimized by the implementation of safe work practices (e.g., strict adherence to speed limits, obeying all warning signs). Collisions, should they occur, will be infrequent and will not have a significant effect on population levels.

General Mitigation Measures
The following specific mitigative measures will be implemented to avoid and mitigate any potential effects on fauna and aquatic SOCI:

- Minimization of the footprint of physical disturbance by:
    - Designing and constructing access roads to avoid environmentally sensitive habitats, where possible, and ensuring the most efficient means to access turbines is achieved.
    - Maintenance of a buffer around sensitive habitats such as watercourses and wetlands, where possible.
    - Minimizing routine vegetation clearing:
        - clearing of land only if required for construction area footprint;
        - restoration of areas of disturbance where possible, post construction; and
        - siting construction compounds in/on non-sensitive areas.
    - Completion of a comprehensive schedule and determination of timelines to efficiently complete Project activities within the shortest time frames possible.

Species-Specific Mitigation
Desktop and field analyses for terrestrial and aquatic fauna SOCI revealed several species that have the potential to occur at the Project site. Addressing the potential effects from the Project on these species will require species-specific mitigation techniques, as described below:

Mainland moose:
- Pre-construction snow-tracking surveys revealed no evidence of Mainland moose at the Project site. The EPP for the Project will require Project personnel to report any Mainland moose sightings to NSDNR.

Monarch:
- Should large congregations of Monarchs be found at the Project site, Project activities in the area should cease until the migrating group has left the Project site. This is most likely to occur in late summer, prior to the fall migration.

Wood turtle:

- Based on recommendations outlined in the document 'Protecting and Conserving Wood Turtles: A Stewardship Plan for Nova Scotia' (MacGregor and Elderkin 2003), and the NS Transportation and Public Works Generic Environmental Protection Plan for the Construction of 100 Series Highways (2007), the following general procedures will be implemented to ensure the protection of Wood turtles:
    - Any turtles found (identification booklet to be provided to site personnel) will be relocated outside of the construction zone, along the same habitat corridor in the direction of travel the turtle was originally oriented and preferably upstream within the same riparian habitat corridor (< 400 m).
    - Any sightings of wood turtle will be reported to the NS Wood Turtle Recovery Team at 1-866-727-3447
    - Adequate, permanent buffers of vegetation will be left around important Wood turtle habitat. If necessary (e.g., in the event that Wood turtles are confirmed at the site), an appropriate mixture of shrubs and trees shall be planted to create a buffer.

Atlantic salmon:

- The siting, design, installation and decommissioning of all crossing structures will incorporate ongoing consultation with DFO, and NSE, and will avoid areas of sensitive habitat and ensure that fish passage is maintained.
- Additional mitigation for the protection of fish habitat will be ensured through the NS watercourse alteration permitting process.

14.2.2 Avifauna

The effects of a wind farm on birds 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 (Drewitt and Langston 2006). Although some effects are related to construction (e.g. habitat alteration), most potential effects on avifauna are mainly related to operation and may include:

- habitat loss/alteration;
- mortality resulting from direct collision; and
- sensory disturbance.

Habitat Loss/Alteration

Habitat alterations resulting from the site preparation and construction phases of wind energy developments have the potential to affect bird populations either directly or indirectly (Arnett *et al.* 2007). However, effects are considered less severe than those from other energy extraction developments such as oil and gas exploration because the disturbance is limited to the construction footprint (turbine pads, roads, associated buildings, etc.) (Kuvlesky *et al.* 2007). The magnitude of these effects, however, may be increased if the disturbed area contains sensitive plant communities that provide important habitat to local bird populations (Kuvlesky *et al.* 2007). Altered landscapes can potentially lead to displacement of species with sensitive habitat requirements (Arnett *et al.* 2007). Site clearing and preparation may involve the removal of key habitat features, such as standing deadwood, mature trees, or shrub cover required as foraging and/or breeding habitat for certain bird species.

Mature forest, for example, is present in the southern and northern extents of the Project site; however, Project infrastructure does not coincide with this habitat type. Surface disturbance is greater in the construction phase than in the operational phase because large right of ways need to be created to accommodate large construction equipment and transport vehicles (Arnett *et al.* 2007). It can therefore be assumed that impacts associated from direct habitat alteration are greatest in the short-term, except when key habitat features are permanently removed. Depending on the availability of nearby alternative habitat, habitat alterations associated with wind energy infrastructure may have detrimental effects on local bird populations. The landscape of the Project site and immediately surrounding area features forest stands that would appear to provide suitable alternative habitat to bird species displaced due to habitat alteration at the Project site.

Collision Mortality
The most overt potential effect of the Project on birds is direct mortality resulting from collision with Project infrastructure, namely turbine blades, during the operational phase. Most evidence suggests that mortality levels resulting from turbine collisions are low (EC *et al.* 2012) although many studies do not adequately incorporate carcass removal by scavengers into mortality estimates. In a review of night migrant fatalities at wind farm sites in North America, Kerlinger *et al.* (2010) found fatality rates of less than one bird/turbine/year to approximately seven birds/turbine/year, even with corrections made for scavenger removal and searcher efficiency. Furthermore, multi-bird fatality events, in which more than three birds were killed at a turbine site in a single night, were found to be rare and may have been related to lighting and/or inclement weather (Kerlinger *et al.* 2010).

Collision risk is greater on or near areas used by large numbers of foraging or roosting birds or in important migratory flyways (Drewitt and Langston 2006). In Canada, passerines account for 70% of all fatalities, with most occurring during the fall migration season (EC *et al.* 2012). The probability of raptor collision with wind turbines depends on the species, turbine height, and local topography (de Lucas *et al.* 2008). Collision risk can therefore be greatly reduced by incorporating knowledge of the avifauna into the design and placement of wind power infrastructure.

Evidence cited by Erickson *et al.* (2001), NAS (2007) and Manville (2009) in NWCC (2010), demonstrates that although only general estimates are available, the number of birds killed at wind energy developments is substantially lower than then estimated annual bird casualty rates from a variety of other anthropogenic factors including vehicles, buildings, and windows, power transmission lines, communication towers, toxic chemicals (including pesticides), and feral and domestic cats (NWCC 2010). In summary, available research suggests that the probability of large-scale fatality events occurring at wind farms is extremely low (Kerlinger *et al.* 2010).

Sensory Disturbance
Sensory disturbance to birds can occur during the construction, operational, and decommissioning phases of wind power projects, and can be caused by the increased presence of personnel, vehicle movement, operation of heavy equipment, and the operation of the turbines themselves (Drewitt and Langston 2006). It is thought that disturbance to birds may have a greater population impact than collisions, although research is lacking in this area (Kingsley and Whittam 2005). Primary concerns with regards to sensory disturbance are related to displacement and potential effects on key physiological processes such as breeding.

Some studies have shown that birds will exhibit avoidance behaviours post-construction, leading to a variable degree of displacement from previously used habitat (reviewed in Drewitt and Langston 2006) which essentially amounts to habitat loss. In most cases, such displacement is on the scale of tens to hundreds of metres, which can lead to localized changes in bird densities (Leddy *et al.*1999; Pearce-Higgins *et al.* 2009). However, while birds may avoid specific sites, the evidence does not suggest that birds abandon the general area as a whole. Other research indicates that the presence of wind turbines has no effect on the distribution of the bird community (Devereux *et al.* 2008) and birds may habituate to the presence of operating wind turbines (Madsen and Boertmann 2008). The tolerance to Project related disturbance may be species specific but may also be related to the availability of alternative habitat (Kingsley and Whittam 2005). Thus, careful site selection of turbines to avoid any unique habitat types will alleviate some disturbance and/or displacement effects, especially during the operational phase of the Project.

General Mitigation Measures
The following mitigative measures will be implemented to avoid and mitigate any potential effects on avifauna:

- Where possible, clearing of site vegetation will be conducted outside of the breeding and nesting season for birds (April 1 to August 31). If this is not possible, a mitigation plan will be developed in consultation with NSDNR and CWS prior to clearing activities.
- Use of lighting during construction will be limited to minimum levels.
- Use of lighting on turbine hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada.
- There will be no general lighting at the Project site. Lighting will only be used when technicians are working on-site.
- Where possible, placement of Project infrastructure in habitats significant to bird species (as identified during avian surveys) will be avoided. These include wetlands, mature forests, and areas with large, hollow trees.
- Post-construction monitoring will be implemented under direction from NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.

14.2.3 Bats
The installation of wind turbines has the potential to affect bats both directly and indirectly (Arnett *et al.* 2007). Although some effects are related to construction (e.g. habitat alteration), most potential effects on bats are mainly related to operation and may include:

- habitat loss/alteration;
- mortality resulting from direct collision and/or barotrauma; and
- sensory disturbance.

The significance of these effects 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.

Habitat Loss/Alteration
Habitat alterations, including vegetation clearing and soil disruption (NRC 2007) resulting from the site preparation and construction phases, may affect bats (Arnett *et al.* 2007). The removal of trees during the site clearing and preparation phases can be especially detrimental, particularly to those bat species which use trees as roosting habitat (Arnett *et al.* 2007).

Some studies, however, suggest that habitat changes related to wind power developments may in fact create benefits to bats by increasing cleared areas and creating access roads, both of which can be used by bats as foraging habitat (as cited in Arnett *et al.* 2007; Kunz *et al.* 2007a). In relation to this, small-scale disturbances, including creating small cutblocks or small scale access roads through forested habitat, have been shown to stimulate an increase in bat activity relative to previous years (Grindal and Brigham 1998). It is important to note, however, that increased edge habitat due to forest clearing may subsequently increase the risk of mortality by virtue of attracting bats to the area of the operating turbine (Kunz *et al.* 2007b).

Mortality
Mortality of bats is a potential effect during the operational phase of wind energy projects, Necropsy of recovered carcasses found that the cause of death for baths killed at wind-energy facilities is an indiscernible combination of direct collision with the turbine blades and barotrauma (Grodsky *et al.* 2011), although more recent pathological research has found that traumatic injury is the major cause of bat mortality at wind farms and that post-mortem artifacts may manifest themselves as pulmonary barotrauma lesions (Rollins *et al.* 2012). Barotrauma is characterized by a drop in atmospheric pressure along the top of a rotating turbine blade, which causes thoracic, abdominal, and pulmonary injury to bats when passing through the low pressure area (Baerwald *et al.* 2008).

Much of the established literature has not attempted to elucidate the causes of bat mortality but has instead reported on the magnitude of mortalities. In Canada, EC reports that bat fatalities outnumber bird fatalities (EC *et al.* 2012). This causes concern as bats are long-lived and have low reproductive rates (Arnett *et al.* 2007).

Research suggests that migratory tree-roosting species suffer the highest fatalities at wind farms (Kunz *et al.* 2007a; Kuvlesky *et al.* 2007; Cryan and Barclay 2009), although deaths of Tri-colored bats constituted 25.4% of total bat fatalities at wind facilities in the eastern United States (as cited in Arnett *et al.* 2007). Migratory species, including Hoary bat, Eastern red bat, and Silver-haired bat, accounted for 71% of 2,270 bat fatalities recorded at wind energy facilities across Canada between 2006 and 2010 (EC *et al.* 2012). Although an individual Silver-haired bat was identified at the Project site during field studies, results of pre-construction bat monitoring do not suggest that the species occurs at high densities in the area. Most bat fatalities are reported in the late summer months (Johnson 2005) coinciding with the start of swarming and autumn migration (Arnett *et al.* 2007: EC *et al.* 2012). Periods of high mortality may therefore be linked with the timing of large-scale insect migrations when bats feed at altitudes consistent with wind turbine heights (Rydell *et al.* 2010). It has been found that bat fatalities increase exponentially with wind tower height, with turbine towers 65 m or taller having the highest fatality rates (Barclay *et al.* 2007). This hypothesis is also supported by the findings of Horn *et al.* (2008), who reported that bats were not being struck by turbine blades when flying in a straight line en route to another destination, but were struck while foraging in and around the rotor-swept zone of the turbine.

Temporal variation in bat activity and subsequent fatality rates can be influenced by weather variables, as well as the characteristics of the facility (Baerwald and Barclay 2011). Although bats exhibit species-specific responses to environmental variables (Baerwald and Barclay 2011), in general they appear to be more active when wind speeds are low, which increases the risk of collisions with rotating turbine blades (Arnett *et al.* 2007) and mortality resulting from barotrauma.

Sensory Disturbance
Increased human presence may also disturb roosting bats (Arnett *et al.* 2007), but it is unknown if this disturbance is sufficient to disrupt normal behaviour or physiology. Sensory disturbance to bats is most likely during the site preparation/construction and decommissioning phase of the Project, during which the presence of on-site personnel and equipment will be the highest. During hibernation, bats are sensitive to human presence, and human intrusion into hibernacula can lead to increased arousals leading to a premature depletion of fat reserves (Thomas 1995). Siting wind-energy facilities away from hibernacula is therefore recommended in the design phases of these projects.

It is unknown if noise associated with the operational phase of wind energy projects has any measureable effect on bats, although it is thought that bats may become acoustically disoriented by the low-frequency noise emitted from rotating turbines (Kunz *et al.* 2007a). Bats have been shown, experimentally, to avoid foraging in areas with intense, broadband noise (Schaub *et al.* 2008), however this research was not conducted in the context of wind-energy development and other studies indicate that bats have been shown to forage in close proximity to operational turbines (Horn *et al.* 2008).

General Mitigation Measures
The following specific mitigative measures will be implemented to avoid and mitigate any potential effects on bats:

- Use of lighting during construction and on turbine hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada.
- Where possible, placement of Project infrastructure in or directly adjacent to habitats significant to bat species will be avoided. These include hibernacula, wetlands, and lands directly adjacent to open bodies of water.
- Post-construction monitoring will be implemented under direction from NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.

14.3 Environmental Effects Analysis
The following tables (Tables 14.4 to 14.6) identify and evaluate the significance of residual effects for each phase of the Project on each VEC. Accidents and malfunctions are also analyzed. As most of the mitigation is the same for avifauna and bats, these VECs are considered together in order to decrease repetition.

Table 14.4: Environmental Effects Analysis – Construction Phase

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory disturbance • Habitat loss/alteration and/or fragmentation. • Effects to fish passage/migration. • Mortality.	*General Mitigation Measures* • Implementation of the EPP. • Minimize of the footprint of physical disturbance • Avoid sensitive habitats during Project siting. • Implementation of Safe Work Practices and strict adherence to speed limits and warning signs to avoid traffic collisions. • Maintain of a buffer around sensitive habitats such as watercourses and wetlands, wherever possible. • Minimize vegetation clearing, wherever possible. • Prompt restoration of cleared areas post-construction. • Maintain efficient timelines to complete Project activities within the shortest amount of time possible. • Herbicides will not be utilized in the removal of vegetation during construction activities. *Species-specific Mitigation* • The EPP for the Project will require Project personnel to report any Mainland moose sightings to NSDNR.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		• Should large congregations of Monarchs be found at the Project site, Project activities in the area should cease until the migrating group has left the Project site. • Leave adequate, permanent buffers of vegetation around important Wood turtle habitat. • Report any Wood turtle sightings to the Wood Turtle Recovery Team. • In the event that Wood turtles are confirmed at the site, an appropriate mixture of shrubs and trees will be planted to create a buffer. • Relocate any wood turtles outside of the construction zone (as per guidelines outlined in MacGregor and Elderkin 2003, and NSTPW 2007). • All watercourses on the Project site will be treated as salmonid bearing during all phases of the Project. • All in-stream work will be conducted "in-the-dry" and adhere to timing windows (Atlantic salmon). • Crossing structures will be designed and installed in consultation with DFO and NSE to ensure fish passage is facilitated (Atlantic salmon).			

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
Avifauna and Bats	• Habitat loss/Alteration • Mortality • Sensory disturbance.	• Implementation of the EPP. • Conduct vegetation clearing outside of the breeding and nesting season for birds (April to August). • If this is not possible, a mitigation plan will be developed in consultation with NSDNR and CWS prior to clearing activities. • Limit the use of lighting during construction to minimum acceptable levels. • Avoid placement of Project infrastructure in habitats significant to bird and bat species. These include wetlands, hibernacula, mature forests, land directly adjacent to open water and areas with large, hollow trees.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No residual effect anticipated	Not applicable
Accidents and Malfunctions	• Accidental spill/release. • Failure of erosion and sediment /control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Table 14.5: Environmental Effects Analysis – Operation/Maintenance Phase

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory Disturbance • Collision Mortality	• Implementation of the EPP. • Implementation of Safe Work Practices and strict adherence to speed limits and warning signs to avoid traffic collisions. • Minimize road traffic to the extent possible. • Implement efficient timelines to complete Project activities within the shortest possible time frame. • To the extent possible, plan operation and maintenance activities to avoid sensitive habitats and minimize time on-site. • Herbicides will not be utilized in the removal of vegetation during maintenance activities. *Species-specific Mitigation* • In-stream maintenance activities will be conducted “in-the-dry”, and adhere to timing windows (Atlantic salmon).	Scope: Local Duration: Long-term Frequency: Intermittent Magnitude: Negligible	No residual effect anticipated	Not applicable
Avifauna and Bats	• Mortality from collision (avifauna and bats) or barotrauma (bats).	• Implementation of the EPP. • To the extent possible, plan operation and maintenance activities to minimize time on-site. • Avoid routine vegetation clearing during breeding and nesting season.	Scope: Local Duration: Long-term Frequency: Continuous Magnitude: Low	It is expected that birds and bats will avoid the immediate area of the turbines (but not the Project site and surrounding area), which	Low-Medium

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
	• Sensory disturbance.	• Avoid all unnecessary lighting at the Project site. Lighting will only be used when technicians are working on-site. • Limit lighting on turbine hubs and blades to minimum levels while still meeting requirements of Transport Canada. • Implement post-construction monitoring under direction of NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.		will reduce the number of bird collisions. Bird and bat fatalities due to turbine collisions are not expected to be significant.	
Accidents and Malfunctions	• Accidental release. • Failure of erosion and sediment control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Table 14.6: Environmental Effects Analysis – Decommissioning Phase

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory Disturbance. • Habitat alteration and/or degradation. • Mortality.	• Implementation of the EPP. • Minimize of the footprint of physical disturbance to the extent possible. • Avoid disturbing sensitive during decommissioning. • Prompt restoration of cleared areas post-construction. • Maintain efficient timelines to complete Project activities within the shortest amount of time possible. • Limit access to existing roads only. • Avoidance of known significant habitat, where possible. • Herbicides will not be utilized in the removal of vegetation during decommissioning activities. *Species-specific Mitigation* • In-stream decommissioning work will be conducted “in-the-dry” and adhere to timing windows (Atlantic salmon). • Stream banks will be promptly re-stabilized and re-vegetated post-decommissioning (Atlantic salmon).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible	No residual effect anticipated	Not applicable
Avifauna and Bats	• Sensory disturbance.	• Implementation of the EPP • Limit access to existing roads only. • Limit time on site.	Scope: Local Duration: Short-term Frequency: Once	No residual effect anticipated	Not applicable

Environmental Component (VEC)	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		• Avoid decommissioning activities during breeding/nesting season, to the extent possible. • Restore vegetation promptly following decommissioning. • Limit the use of lighting during decommissioning to minimum acceptable levels	Magnitude: Negligible		
Accidents and Malfunctions	• Accidental release. • Failure of erosion and sediment control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

14.4 Follow-up Measures

A potential residual effect for avifauna and bats was noted in Table 14.5. The potential effect of collisions and/or fatalities to avifauna and bats will be addressed in post-construction monitoring programs that will be implemented to assess the effects of the operation of the proposed wind farm.

Monitoring programs are scheduled to begin in 2015.

15.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Environmental factors that have the potential to have damaging effects on wind turbines include:

- Extreme wind (typically associated with hurricanes);
- Hail;
- Ice storms/ ice formation;
- Heavy snow;
- Lightning; and
- Fire.

The primary mitigative measure employed during the construction and operation of the Project will be to educate and train site personnel. Environmental and safety orientations will be conducted prior to the start of construction and all staff will be informed of the potential effects of the environment on the Project. Staff responsible for the operation and maintenance of the Project will be trained on the design and operation of the turbine, including applicable operating procedures, safety protocols and evacuation plans.

Modern wind turbines are equipped with a number of mechanisms to reduce damage caused by extreme weather and are designed to shut down when certain thresholds are detected (CanWEA 2011). Further, best practices and industry standards will be applied to the operation of the Project to manage risks of damage from extreme events. Table 15.1 demonstrates potential effects resulting from environmental events and the mitigation associated with each.

Table 15.1 Effects of Environmental Events and Associated Mitigation

Environmental Event	Effect	Mitigation
Hurricane/ Extreme winds	Damage to blades.	• Turbine design equipped to shut down.
Hail	Damage to blades.	• Turbine maintenance according to best practices and industry standards.
Ice storms	Ice formation. Potential ice throw.	• Turbine design equipped to shut down • Appropriate safety protocol • Restrict use of Project site signage to indicate potential falling ice
Heavy snow	Damage to turbines.	• Turbine design equipped to shut down
Lightning strike	Potential fire during operation. Damage to electrical systems.	• Turbine design equipped with built-in grounding system • Appropriate safety protocol.

Environmental Event	Effect	Mitigation
Fire	Fire during construction due to materials and machinery	• Appropriate safety protocol • Fire prevention plan • Evacuation plan • Local training of first responders

16.0 CUMULATIVE EFFECTS ASSESSMENT

Concerns are often raised about the long-term changes that may occur not only as a result of a single action but of the combined effects of each successive action on the environment (Hegmann *et al.*1999).

The cumulative effects assessment focuses only on adverse effects of the Project remaining after the application of mitigation measures (e.g., only residual effects). For this Project, the only VECs identified to have a potential residual effect are avifauna and bats (i.e., collision mortality). Therefore, known or anticipated activities within a 20 km radius of the Project site were reviewed to identify the potential for cumulative effects on collision mortality for avifauna and bats.

A search for existing or proposed wind farm developments was completed within the 20 km radius of the Project site. No future expansion is planned for the Millbrook or Truro Heights Community Wind Projects. One 4.8 MW wind farm project was identified in the Truro area (within 10 km of the Project site), which has the potential to act cumulatively with this Project. Both Projects are of relatively small size, and consist of eight turbines in total; therefore the potential for cumulative effects related to avifauna and bat mortality as a result of both Projects is considered not significant.

17.0 OTHER APPROVALS

In addition to the EA Approval, several other permits and/or approvals may be required prior to the start of construction (Table 17.1).

Table 17.1: Future Approvals

Approval/Notification/Permit Required	Government Agency
Municipal	
Wind Energy Facility Development Permit	Municipality of Colchester
Building Permit	Municipality of Colchester
Provincial	
EPP/Sediment and Erosion Control Plan	NSE
Watercourse Alteration Approval	NSE
Wetland Alteration Approval	NSE
Notification of Blasting (if required)	NSE
Work within Highway Right-of-Way (if required)	NSTIR
Access Permit	NSTIR
Use of Right-of-Way for Pole Lines	NSTIR
Electricity Standard Approval	NSDE
Elevator/Lift License	Nova Scotia Department of Labour and Advanced Education
Overweight/ Special Move Permit	Service Nova Scotia

Approval/Notification/Permit Required	Government Agency
Federal	
Blasting Near Watercourses Approval (if required)	DFO
Notification of Project (awaiting response)	RCMP
Final design, location and height of turbines	NRCan
Lighting design for navigational purposes	Nav Canada
Aeronautical Obstruction Clearance	Transport Canada

18.0 CONCLUSIONS

In accordance with "A Proponent's Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment" (NSE 2012a), the studies, regulatory assessments, and VEC evaluations described within this document have been considered both singularly and cumulatively.

The results indicate that there are no significant environmental concerns or effects that may result from the Project that cannot be effectively mitigated or monitored.

Best practices and standard mitigation methods will be implemented during all phases of the Project, to ensure methods and practices are comprehensive and are adhered to. Furthermore, an EPP will be developed and communicated to all employees working on the Project.

Combined with the Truro Heights Community Wind Project, the proposed capacity of the five turbines (10 MW) will produce enough energy to power 3,300 households with local, clean renewable energy and will contribute to reaching Nova Scotia's renewable energy commitments.

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M. Elderkin, personnel communications. June 13, 2012. Bat Monitoring.

C. Hominick, personal communications. April 10, 2013. Atlantic salmon in the Salmon River watershed, Colchester County.