Affinity Wind LP

Greenfield Wind Farm

Environmental Assessment Registration

November 2013

Prepared by:

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Greenfield COMFIT Wind Project: Environmental Assessment
Affinity Wind LP

Introduction

Affinity Renewables Inc. is a newly formed company created by Reuben Burge, the Director of Sustainable Funding for the Society for the Prevention and Cruelty to Animals (SPCA). Affinity Renewables Inc. (Affinity) has been created to answer the Nova Scotia Government's call for Community Feed-in-tariff projects (COMFIT). As a not-for-profit, the SPCA qualifies under COMFIT regulations as an eligible entity "community" for gaining approval to build and own renewable energy projects. This project will be known as the Greenfield COMFIT Wind Project and will consist of two GE 1.6 MW series wind turbine generators with 82.5m rotor diameter and a 25 kVA collection system connected directly into the NSPI grid at interconnection point transformer 15N-T2. The proposed project will be located in Greenfield in the municipality of Colchester. The project is referred to as the Greenfield COMFIT Wind Project ("Greenfield").

Greenfield will provide renewable power sufficient for 1,200 local homes annually and have a positive effect on the environment through displacement of burning fossil fuel. The power will be used locally as the turbines will feed directly into the distribution system. In light of both Canada's and Nova Scotia's commitment to reduce greenhouse gas emissions and invest in renewable energy, Greenfield will be an important component of Nova Scotia's energy mix.

Regulatory Approvals

The Project has a nameplate capacity exceeding 2 MW, which requires the Proponent to undergo environmental assessment as a Class I Undertaking pursuant to the Nova Scotia *Environment Act*. No federal triggers under the *Canadian Environmental Assessment Act* (*CEAA*) are anticipated at this time. This environmental assessment report (EA) is intended to meet the requirements of the provincial EA process. Additionally, this EA will provide support in seeking other environmental and planning approvals necessary for this Project.

The COMFIT program will require the Project to have EA approval in order to progress. As well, the Colchester Municipal Planning Director requires EA approval prior to issuing licences to install large scale wind turbines.

Project Description

The Project will consist of two GE1.6 MW series wind turbine generators. The generators come in varying power production capacities as well as blade lengths. The models can produce 1.62 MW, 1.68 MW and 1.85 MW. The blade lengths vary from 36.5m, 41.25m, and 50m. For Greenfield, the Proponent will be using the 1.6 MW machine with 41.25m blades. In addition, the following ancillary facilities are also considered part of the Project:

- 25 kVA collection lines to link the wind turbines to NSP's Distribution power grid;
- 690V – 25 kVA pad mounted step-up transformers located beside each turbine;

- access roads, gated as required by municipal bylaw; and
- crane pads for assembly of wind turbines.

An existing maintenance shop/control building (Rotor) will be home base for maintenance and operations. This is located approximately 25km from Greenfield and was built for Dalhousie.

Project Activities

The development of the proposed Project will include several phases, including site preparation and construction, operations and maintenance, and decommissioning. Activities within these phases will include:

- surveying;
- developing access roads;
- clearing and grubbing;
- grading;
- foundation excavation;
- pouring turbine foundations;
- equipment lay-down and turbine assembly;
- tower, generator, and rotor assembly;
- collection system and transmission line/connection to grid;
- clean-up and reclamation;
- turbine commissioning;
- access and inspection;
- operation;
- rotor, generator and tower disassembly;
- decommissioning and removal of concrete foundation; and
- decommissioning of the distribution lines.

Construction Schedule

The proposed construction schedule for the Project is presented in Table E.1. The Project is expected to be operational for at least 25 years. Decommissioning activities will last roughly the same amount of time as comparable construction activities (*i.e.*, six months).

Table E.1 Anticipated Project Activity Schedule

Project Activity	Proposed Schedule
Surveying	May 2012 to present
Clearing (primarily on existing roads requiring widening and brush clearing; includes laydown areas, collector circuits and all access roads)	February 2014
Development of access roads	February to August 2014
Excavation and installation of power poles	April to August 2014
Foundation excavation	April to September 2014
Foundation construction	April to September 2014
Delivery of equipment	September to December 2014
Wind turbine installation	October to December 2014
Stringing of wires for collector system	July to August 2014
Turbine commissioning	November 2014 to January 2015
In-service	February 2015
Site remediation, clean-up, mitigation measures and follow-up measures will be incorporated	Will start from day one construction and continue throughout operations as required

Environmental Management Strategy

The Proponent is committed to ensuring that the construction, operation, and decommissioning of the proposed Project are conducted in an environmentally responsible manner. The Proponent will successfully implement the recommended mitigation measures for the Project. To accomplish this objective, the following initiatives will be addressed: integration with the corporate environmental management framework; compliance with worker health and safety rules; emergency response planning; environmental protection planning; and environmental monitoring.

Stakeholder Consultation and Mi'kmaq Engagement

To date, the consultation activities for Greenfield have included meetings with the Municipality of Colchester, numerous meetings, site visit to Dalhousie by the Colchester Planning Advisory Committee, meetings with Colchester North MLA, Karen Casey, and Colchester-Musquodoboit

Valley MLA Gary Burrill (replaced October 8, 2013), correspondence with newly elected Colchester-Musquodoboit Valley MLA Larry Harrison, correspondence with owner of Hockeyville Arena (Salmon River), meetings with local area municipal councillors Karen MacKenzie and Lloyd Gibbs, advertised open house meetings and advertised community information meetings. The Proponent has maintained a presence in the local community since January 2013 with over 300 door-to-door visits with local residents. Email and telephone conversations have been frequent and updated whenever any concerns or questions arise. The Proponent has attended meetings put on by residents from surrounding communities, as well as held information sessions to answer questions and address concerns that have been voiced. The local community and other interested parties have had very positive feedback and support throughout the course of the development. The consultation is broken down into table format with dates and other details in Section 3.

Correspondence with regulatory agencies include: Nova Scotia Department of Energy's COMFIT Administrator, Krystal Therien and COMFIT Clerk, Sylvie Lepine; Nova Scotia Environment's Environmental Assessment Officer, Steve Sanford; Department of Natural Resources' Species at Risk Biologist, Mark Elderkin; Transport Canada; NavCanada; Nova Scotia Department of Transportation and Infrastructure; Royal Canadian Mounted Police (RCMP); the Canadian Broadcasting Company (CBC); National Forces; Canadian Coast Guard; and Environment Canada's Weather Radar Control Center. The Proponent has a commitment to all consultation parties to continue ongoing updates and progress reports. The Proponent has directly engaged the Mi'kmaq community, including the Pictou Landing First Nation, the Confederacy of Mainland Mi'kmaq (CMM), the Mi'kmaq Rights Initiative (KMK) and the Native Council of Nova Scotia/ Maritime Aboriginal Peoples' Council through information mail outs, face to face meetings and phone/email correspondence. The Proponent has commissioned AMEC Environmental to conduct a MEKS for this Project. The report can be found in Appendix B**.**

The public and Mi'kmaq communities will be invited to submit written comments on the proposed Project and information contained in the EA document during the EA review process. Additional stakeholder and community outreach initiatives include the Proponent's website (www.rmsenergy.ca), mail out of community newsletter, meetings with municipal council, open dialogue and community outreach program with neighbours of the surrounding communities near Greenfield, and an offering to the local population to have a Citizens Monitoring Group.

The public and Mi'kmaq community will continue to be engaged in future phases of development. The Proponent will develop and implement a community liaison and issues resolution program for Project operations, where the public and Mi'kmaq will be invited to participate. The public has been very receptive of the existing Dalhousie since development began and has continued through the past four years of operations. Positive feedback has been received for the proposed Greenfield Project.

Project Location

The Greenfield Project is located on privately owned land in Colchester County. The PID for the parcel of land which both turbines will be on is 20324950.

The UTM locations, with elevations for the turbines are listed below.

Turbine	PID	Easting	Northing	elevation
1	20324950	489054	5021679	192m
2	20324950	489107	5021466	191m

Impact Assessment

No significant adverse residual environmental effects of the Greenfield Project are predicted, considering the existing conditions of the Project site, the design of the Project and mitigation measures to be implemented as part of the Project. A summary of the predicted environmental effects and mitigation measures for this Project is presented in Table E.2.

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
Birds and Other Wildlife	Construction & Decommissioning	Sensory disturbance	• Visitors will remain within relevant areas, both in-vehicle and on- foot and will aim to preserve the site's natural areas. • Overall disturbance will be limited to designated workspaces and performed in compliance with the *Migratory Birds Convention Act*. • Delivery vehicles will remain on designated roads.
		Habitat loss/alteration	• Habitat loss will be mitigated by using already cleared land – this project is located almost entirely on a cattle grazing/ hay field - and by limiting the overall land disturbance to within designated workspaces. • Upon completion of construction and/or decommissioning, habitat will be restored to the extent possible. • Areas of significance (*e.g.,* wetlands) will be avoided, to the extent possible.
		Mortality	• In order to reduce the potential of bird mortality, construction activities will be performed in compliance with the *Migratory Birds Convention Act (e.g.,* clearing outside the critical time periods for breeding birds). • The Proponent has participated in training of onsite personnel regarding how to identify and properly deal with any wood turtles that may enter a work site.
	Operation	Sensory disturbance	• Although moose presence in the Project Study Area was not confirmed in the 2012 Fall PGI survey, a moose monitoring program (pellet group counts) took place in May 2013 to determine to what degree moose may use the Project Study Area. Moose presence was not

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			confirmed in the 2013 Spring PGI Survey (Appendix J) • Other forms of surveys may be requested by DNR and the Proponent is prepared to work within these recommendations. Details will be developed in consultation with NSDNR. • Proponent is committed to working with NSDNR and the landowner to protect the mainland moose population, e.g., through initiatives in the Mainland Moose Recovery Program.
		Mortality	• To reduce the potential for increased bird fatalities due to collision with wind turbines, several decisions were made in the planning of the wind farm. The turbines to be used extend no higher than 121.5 m above the ground thus avoiding the flight height of nocturnally migrating land-birds (150m). Lighting will be the minimum allowed by Transport Canada for aeronautical safety, and red lights (CL-865) may be used with the minimum intensity and flashes per minute allowable. The turbines for this Project will be built using tubular steel towers, as data indicate that lattice towers encourage perching by songbirds and by raptors during hunting and, as a result, may put these birds at risk of collisions. Post-construction monitoring will direct the need and form of further post-construction mitigation measures. • A fall migration bat study has been conducted at the site (Appendix I) to understand numbers and species of bats present/ migrating within the site. Results of that study indicate this area is not a significant bat migration route and not a significant resident bat usage area. • A bird and bat post-construction monitoring program will be developed in consultation with NSDNR and CWS. Based on the results of the program, necessary modifications to mitigation plans and/or wind farm operations will be undertaken.

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
Soils and Vegetation	Construction & Decommissioning	Soil erosion and compaction	• Access to the turbine sites will be limited to established access roads, where possible. • Size of access roads will be kept to the minimum required for the safe construction, operation and decommissioning of the equipment. • Whenever possible, construction activities will be timed to periods when the ground surface is best able to support construction equipment (winter or dry season). • Compacted soil will be reclaimed as required. • Standard erosion and sediment control measures will be implemented as required. • Topsoil and subsurface soils will be separated and stored on-site to be replaced appropriately after the pouring of the concrete foundation. When the soils are stored they will be protected from erosion and runoff.
		Loss of plant species	• Rare plant surveys were conducted on June 27 (Sean Blaney) and July 16 (Beth Cameron) 2013 to assist with micro-siting of turbines and access roads and to ensure species of particular concern to the Mi'kmaq are inventoried. • Where Plant Species of Conservation Concern are encountered, avoidance to the extent possible will be considered, especially where there maybe be a threat to the regional population. • Prior to construction, digital way-point files revealing the precise locations of all "Sensitive", "May be at Risk", "At Risk" and "Undetermined" listed species identified during field work within the area proposed for development will be provided to NSDNR (Appendix F).
Wetlands	Construction & Decommissioning	Loss of wetland area and/or function	• Wetlands will be avoided, where possible. • All activities, including equipment maintenance and refuelling, will be controlled, and/or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble, stockpiled soils, or concrete material, into a wetland. • Construction material, excess material, construction debris, and empty containers will be stored away from wetlands. • Erosion and sediment control measures will be implemented to minimize interactions with wetlands. • Functional analyses will be conducted for wetlands that cannot be avoided. • Regulatory approval will be obtained (including compensation for no net loss of function) from NSE for wetland alteration as required. Turbines will not be constructed within 30 m of a wetland unless approved by NSE.

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
Water Quality/ Aquatic Environment	Construction & Decommissioning	Surface water contamination	• Watercourses will be avoided to the extent possible. • If alteration of watercourses is required, regulatory approval from NSE of the proposed alteration will be obtained prior to construction. • All activities, including equipment maintenance and refuelling, will be controlled, and/or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble, stockpiled soils, or concrete material, into a watercourse. • Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks. • A contingency plan for accidental spills will be developed for the Project. • Turbines will not be constructed within 30 m of a watercourse unless approved by NSE.
		Sediment loading	• Watercourses will be avoided to the extent possible • General mitigation measures from the NSE Erosion and Sediment Control Handbook will be utilized to control surface water, reduce erosion and limit sedimentation. • If watercourse alterations are required, they will be done in consultation with NSE/DFO in accordance with regulatory requirements. • Land clearing and construction near watercourses (including crossing structure construction) will occur between June 1 and September 30. • Temporary erosion and sediment control measures (silt fence, straw bales etc.) will be used and maintained until all work within or near a watercourse has been completed and stabilized. • Visual assessments will be completed both quarterly and after severe storm events to ensure the effectiveness of erosion and sedimentation controls. • Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.
		Surface water flow	• Watercourses will be avoided to the extent possible. • Access roads constructed across an existing watercourse that require a culvert will follow standard industry practice, installing culverts of sufficient size to accommodate expected maximum flows within the watercourse. • A Water Approval will be obtained for all required watercourse crossings and the conditions of approvals will be followed.
		Loss of fish habitat	• In-water work will be avoided. • New and replacement culverts will be of a site appropriate design

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			• Existing stream flows will be maintained downstream of the de-watered work area during all stages of work. • All sediment and erosion control measures will be inspected weekly as well as immediately following rainfall events.
		Fish mortality	• Watercourses will be avoided to the extent possible. • Watercourse crossings, where required, will be constructed between June 1 and September 30, unless otherwise approved by NSE. • Where possible, culverts will be installed during low flow periods. If water is present, watercourses will be dammed and flow will be preserved through water pumps with a properly sized fish screen at the intake end of the hose. On-site personnel would be on hand to facilitate fish rescue within the dammed area.
Sound	Construction & Decommissioning	Increases in sound levels due to the transportation and operation of clearing equipment	• Nearby residents will be advised of significant sound generating activities and these will be scheduled to create the least disruption to receptors. • Heavy equipment will be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. • Construction equipment will have mufflers. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.
	Operation	Increase sound levels	• None required.
Tourism	Construction & Decommissioning	Effect on tourism and recreation	• None required.
	Operation	Effect on tourism and recreation	• None required.
Visual	Operation	Change to visual landscape	• Turbines will be of the same type and model, and will be painted light grey to reduce reflection. • Screening opportunities for adjacent residences through tree planting or other measures may be considered where post-construction evaluation indicates a legitimate concern.
		Lighting	• Lighting will be the minimum allowed by Transport Canada to ensure the appropriate level of aeronautical safety.

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
		Shadow flicker	• None required.
Archaeological and Cultural Resources	Construction	Disturbance	• An archaeological field survey has been conducted, no impact is predicted (Appendix H). • An MEKS has been conducted, no impact is predicted (Appendix B) • Upon discovery of an artifact, work will be stopped in the area and the appropriate authorities will be contacted.
Land Use	Construction	Reduction of forested land	• The Project will require minimal, if any, clearing of forested land. • Existing right-of-ways (RoWs) (*e.g.*, farm roads) will be used to the greatest extent possible to minimize the Project footprint. • Turbines, with their relatively small footprint on the land, have been sited with consideration for the potential impact to existing land uses. • Existing and access roads built earlier in the construction schedule will be used to install the collection system. • The Project does not require a substation.
	Operation	Disruption to undeveloped woodlands or infrastructure	• None required.
Health and Safety	Operation	Electromagnetic Fields (EMFs)	• None required.
		Infrasound energy	• None required.
		Ice throw	• During construction and operation activities, access to the wind turbine facility will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. • During site visits, vehicles will be parked up-wind of the turbines. • Warning signs will be posted at the perimeter of the Project Study Area, discouraging trespassing on private lands. • During operation, access to the wind turbine sites will be restricted to authorized personnel only (gated access) with signs posted warning of the potential for ice throw while trespassing.

Table E.2 Summary of Impact Management and Proposed Mitigation Measures

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
Local Community	Construction	Hazards and/or inconveniences to forestry operation	• Road construction schedule will consider regular traffic operation in the area to ensure required access is maintained. This includes school bus and farm equipment operations. • No modification to existing roads expected. • A Special Move Permit and any associated approvals will be obtained through the Department of Transportation and Infrastructure Renewal for heavy load transport.
	Operation	Effect on local economy	• Local residents will be employed to the extent possible during the construction, operation and decommissioning of the Project. • The lands on which the turbines will be located are owned by landowners who live in Lower Harmony, therefore, keeping the annual lease payments in the community. • Municipal taxes will be remunerated, thus increasing the local tax base, which could be used to increase funding of local municipal initiatives. • A % of the revenue created by the Project will go directly to the provincial SPCA where they will delegate funds to, as an example, the special Abuse Investigations Unit. This unit investigates abused and neglected animals province wide – local community inclusive. • A % of the revenue will go to a Community Benefits Package managed by the Salmon River Fire Department's Executive Board. This money will go to: the local baseball fields and community halls as needed; other established charitable organizations chosen by the Fire Department; and to local families/ groups as various extraordinary circumstances could occur (fire, sickness, accidents). Instances such as benefit dances will receive donations from the Project's proceeds. • Both the revenue streams, SPCA and Community, will be ongoing during the 20 year COMFIT contract Affinity has with the Department of Energy.
		Effect on property values	• None required.

Table of Contents

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

1.0 PROJECT SUMMARY

Affinity Renewables Inc. is a newly formed company created by Reuben Burge, the Director of Sustainable Funding for the Society for the Prevention and Cruelty to Animals (SPCA). Affinity Renewables Inc. (Affinity) has been created to answer the Nova Scotia Government's call for Community Feed-in-tariff projects (COMFIT). As a not-for-profit, the SPCA qualifies under COMFIT regulations as an eligible entity "community" for gaining approval to build and own renewable energy projects. This project will be known as the Greenfield COMFIT Wind Project and will consist of two GE 1.6 MW series wind turbine generators with 82.5m rotor diameter and a 25 kVA collection system connected directly into the NSPI grid at interconnection point transformer 15N-T2. The proposed project will be located in Greenfield in the municipality of Colchester. The project is referred to as the Greenfield COMFIT Wind Project ("Greenfield").

Affinity Renewables Inc. will become a limited partner in the ownership of the proposed wind project and earn annual income from shares in the facility for the 20 year term of the Power Purchase Agreement (PPA). The SPCA will share in the income benefits when the project becomes operational without sharing risk during any part of the pre-development, permitting, financing, or operational stages. Affinity Wind LP will finance the entire portion of the SPCA's ownership in order to ensure that the Not for Profit's income from donations will not be required at any stage of development or operation. Affinity will rely entirely on Rotor Mechanical Services (Rotor) to develop and operate the facility, as an Affiliate to RMSenergy Dalhousie Mountain LP (Dalhousie Mountain); Rotor has extensive experience by developing and operating Dalhousie Mountain's 34 turbine 51 megawatt (MW) facility in Mount Thom, Nova Scotia (Dalhousie).

The Proponent is responding to a provincial and federal strategy to provide approximately 25% renewable power to the provincial grid by 2015. Affinity will enter into a Power Purchase Agreement (PPA) with Nova Scotia Power Inc. (NSPI) for 3.2 MW of electrical power from the proposed Greenfield Project.

Application was made to Nova Scotia Department of Energy (DOE) on September 19, 2011 to develop a 4.8 MW wind project to feed power to transformer 15N-T2 in Colchester County. On July 31, 2012, the Proponent was awarded a 3.2 MW COMFIT certificate (Appendix L).

This proposed Project is subject to provincial environmental registration requirements as a Class I Undertaking pursuant to the Nova Scotia *Environment Act*. "The Proponent's Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document" (NSE 2007, updated 2012) was used to ensure provincial requirements for registration are met. No federal triggers under the *Canadian Environmental Assessment Act* (*CEAA*) are anticipated at this time.

This EA report includes:

- a description of the Project, including its location and details regarding its construction, operation and decommissioning;
- a summary of the existing biophysical and socioeconomic features of the area which may be subject to Project-related adverse environmental effects;
- a summary of specific environmental concerns, identified through data collection, consultation with agencies and the public, and/or based on professional judgement;
- an assessment of the positive and/or adverse effects associated with this Project;
- an assessment of cumulative environmental effects of this Project;
- an assessment of the effect of the environment on the Project;
- a summary of mitigation, impact management and monitoring measures of this Project; and
- a summary of the advantages and disadvantages of the Project taking the foregoing into account.

1.1 PROJECT PROPONENT

The Proponent is Affinity Wind LP, a partnership between Affinity Renewables Inc.; a Nova Scotia owned and operated corporation, and Firelight Infrastructure Partners Inc., a renewable energy investment firm. The head office of the proposed Greenfield Project will be located at the existing Dalhousie Operations and Maintenance building. The primary contact for the Proponent is:

President, Affinity Wind LP
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Fax: (902) 925 9464
Cell: (902) 771 0322
Email: reuben@rmsenergy.ca

1.2 TITLE OF THE PROJECT

The Project is referred to as the Greenfield COMFIT Wind Project.

1.3 PROJECT LOCATION

The proposed Project is located in Greenfield-Lower Harmony, Colchester County, Nova Scotia. The site sits on a privately owned land parcel in Colchester County (Figure 1.1). The wind energy facility will be constructed on land that has previously been cleared for farming and logging activities and will utilize the existing 1.8 km road with improvements. A Project Study Area (Figure 1.2) was delineated around the two proposed turbine locations and the upgraded roads required for access/ power collection. The Project Study Area is considered the area within which direct Project interactions with the natural environment could occur and formed the

basis for field studies. More information on site selection and design of the wind farm is provided in Section 2.4.

The wind energy facility will be constructed on previously cleared farmland generally bounded to the north by rural residential areas, to the east by previously cleared Crown land, to the south by previously cleared forested land, and west by a cattle farm and rural residential areas (Figure 1.2). The property required to install the Greenfield Project is located on privately owned land. Private long term lease and easement are in place to permit the entire installation of this Project.

1.4 ESTIMATED CAPACITY OF FACILITY

The proposed Project will consist of two wind turbine generators and ancillary facilities. The energy produced by the Project will be linked to the Nova Scotia electrical distribution system. Each turbine will have a nameplate capacity of 1.6 MW, for a total capacity of 3.2 MW. This will generate renewable power sufficient for approximately 1,200 homes annually. The electricity will be supplied directly to the NSPI electric grid under a Power Purchase Agreement (PPA).

1.5 PROJECT SCHEDULE

The proposed construction schedule and major events for the Project are presented in Tables 1.1 and 1.2. The lifespan of the proposed Project is a minimum of 25 years. Decommissioning activities will last roughly the same amount of time as comparable construction activities (*e.g.*, less than six months).

Table 1.1 Proposed Project Activity Schedule

Project Activity	Proposed Schedule
Surveying	May 2012 to present
Clearing (primarily on existing roads requiring widening and brush clearing). Includes laydown areas, collector circuits and turbine access roads.	February 2014
Development of access roads	February to August 2014
Excavation and installation of power poles	April to August 2014
Foundation excavation	April to September 2014
Foundation construction	April to September 2014
Delivery of equipment	September to December 2014
Wind turbine installation	October to December 2014
Stringing of wires for collector system	July to August 2014
Turbine commissioning	November 2014 to January 2015

Table 1.1 Proposed Project Activity Schedule

Project Activity	Proposed Schedule
In-service	February 2015
Site remediation, clean-up, mitigation measures and follow-up measures will be incorporated	Will start from day one construction and continue throughout operations as required

The construction schedule has been designed to account for minor delays that could result from delayed equipment arrival and adverse weather conditions.

1.6 REGULATORY CONTEXT

1.6.1 Environmental Assessment

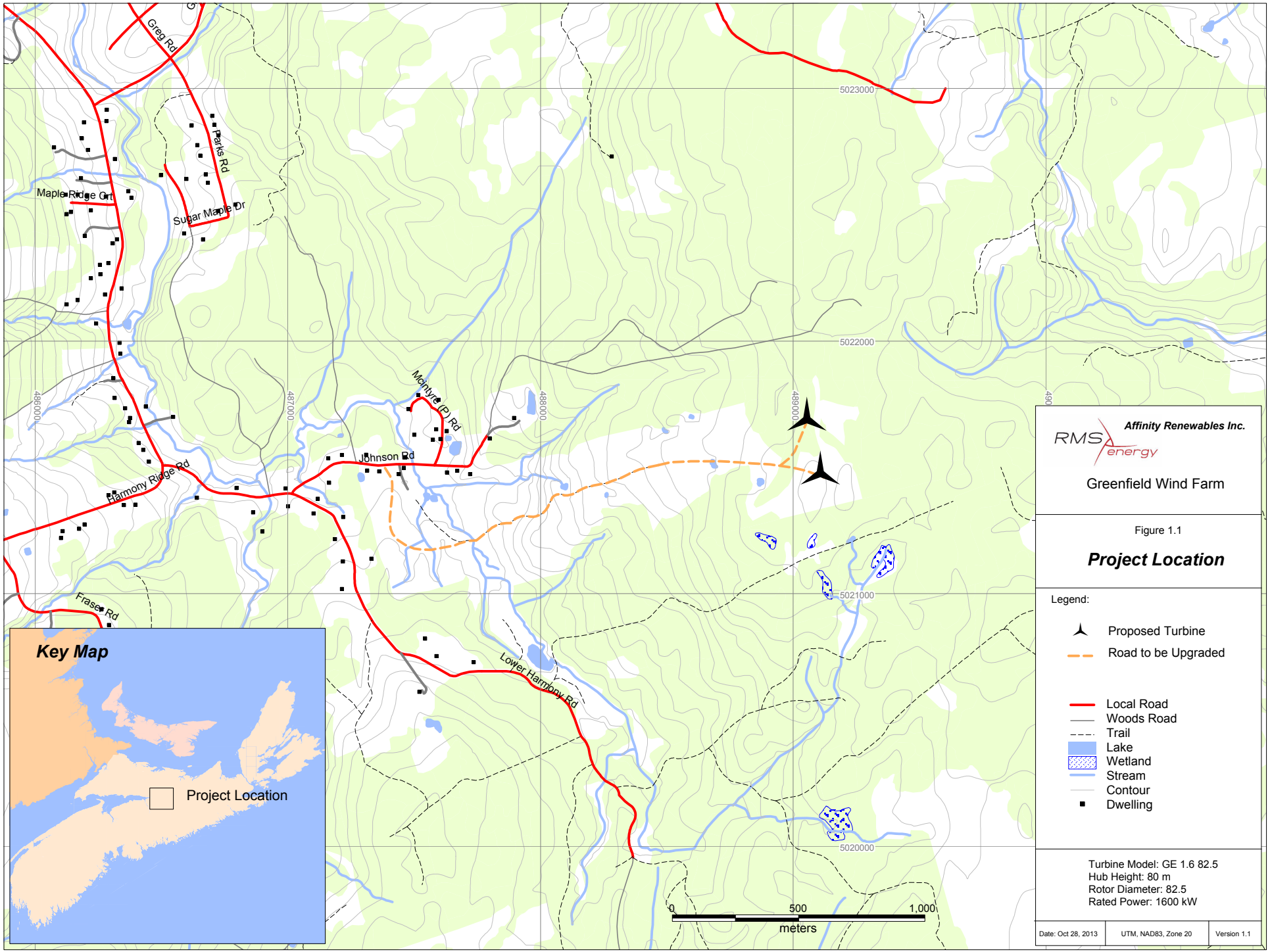
Pursuant to the Nova Scotia *Environment Act*, environmental registration with Nova Scotia Environment (NSE) is required for an electric generating facility which has a production rating of 2 MW or more derived from wind energy.

Greenfield will have a capacity exceeding 2 MW and is therefore subject to environmental registration. This EA satisfies the requirements outlined for provincial environmental registration as a Class I Undertaking and was prepared following guidance from "The Proponent's Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document" (NSE 2007, updated 2012). A Draft EA Report is not required for the project as advised by NSE.

To date, the Project has no known triggers under *CEAA*.

1.6.2 Environmental and Land Use Approvals

In addition to EA requirements, federal, provincial and municipal environmental and land use permits, licenses and approvals may be required for this Project. Table 1.2 summarizes approvals and authorizations likely to be required for the Project; this list is intended to be illustrative for EA purposes only.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Johnson Rd
Harmony Ridge Rd
Fraser Rd
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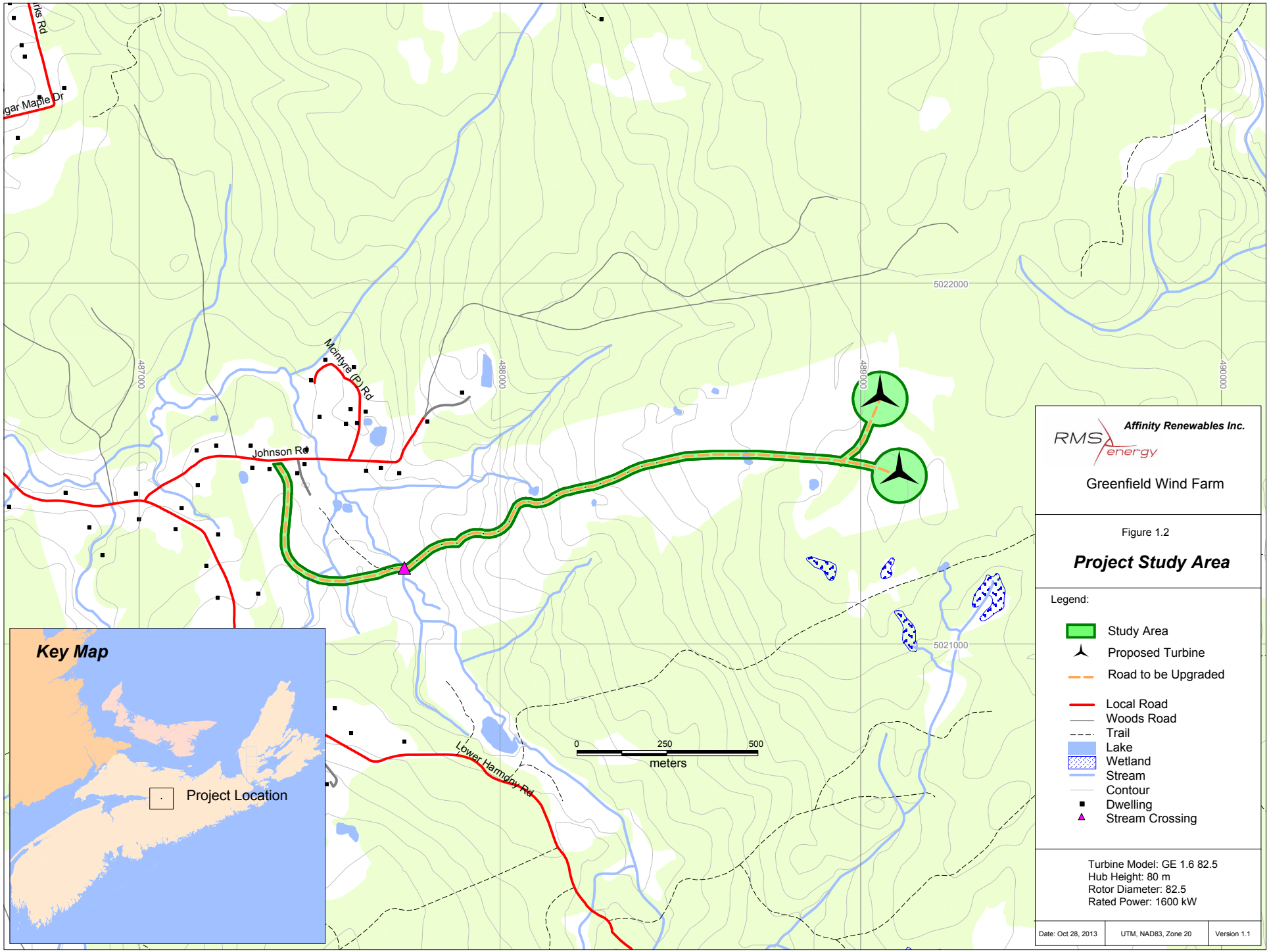
5021000
5020000
486000
487000
488000
489000
Key Map
Project Location
0
500
1,000
meters
RMS energy
Affinity Renewables Inc.
Greenfield Wind Farm
Figure 1.1
Project Location
Legend:
Proposed Turbine
Road to be Upgraded
Local Road
Woods Road
Trail
Lake
Wetland
Stream
Contour
Dwelling
Turbine Model: GE 1.6 82.5
Hub Height: 80 m
Rotor Diameter: 82.5
Rated Power: 1600 kW
Date: Oct 28, 2013
UTM, NAD83, Zone 20
Version 1.1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Johnson Rd
Lower Harmony Rd
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489000
490000
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500
meters
Key Map
Project Location
Affinity Renewables Inc.
RMS energy
Greenfield Wind Farm
Figure 1.2
Project Study Area
Legend:
Study Area
Proposed Turbine
Road to be Upgraded
Local Road
Woods Road
Trail
Lake
Wetland
Stream
Contour
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Stream Crossing
Turbine Model: GE 1.6 82.5
Hub Height: 80 m
Rotor Diameter: 82.5
Rated Power: 1600 kW
Date: Oct 28, 2013
UTM, NAD83, Zone 20
Version 1.1

Table 1.2 Required Environmental and Land Use Approvals

Approvals Required	Summary
Federal	
Canadian Aviation Regulations Standard 621.19	Section 5.9 of these regulations state that a wind turbine should have a flashing red or white beacon mounted on the highest practical point of the turbine if the structure is taller than 90 m. Lighting requirements have been determined in consultation with Transport Canada. Consultation is required with the appropriate regional Civil Aviation authority, providing information on the planned obstruction using the Aeronautical Obstruction Clearance Form. Approval (2011-543) for the Lighting Plan was received from Transport Canada on December 22, 2011. Updated approval based on layout changes was approved by Transport Canada on June 27, 2013. Land Use Submission Form was submitted to NavCanada on January 4, 2012. Approval (12-0116) was received May 22, 2012. Extended approval (13-2173) was received in July 2013 to extend the initial approval. (Appendix A)
CBC and RCMP	Nortek Resources has been contracted to complete the RABC Report on the potential effects the Project may have on CBC, RCMP and other radio/ radar frequency users. The report was completed October 2013 (Appendix A)
Provincial	
Water Approval for Watercourse Alteration (Activities Designation Regulations)	Alteration of any watercourse will require authorization from NSE under the Activities Designation Regulations. Affinity proposes to avoid watercourses to the extent practical during detailed design. Based on the current proposed road layout there is one existing watercourse crossing that will require upgrading to meet NSE standards and to safely allow cranes and heavy trucks to pass over. This work will be done under the supervision of a certified individual and will take place between June 1 and September 30, 2014.
Water Approval for Wetland Alteration (Activities Designation Regulations)	Alterations of a wetland will require authorization from NSE under the Activities Designation Regulations. Affinity proposes to avoid wetlands to the extent possible through turbine siting and road layout design. If however, it is not possible to avoid a wetland, a functional analysis will be conducted and an application will be submitted for approval of the proposed alteration.
Working within Highway Right-of-Way (*Public Highways Act*)	The proposed transmission line may disturb the surface, soil, or any structure within a highway right-of-way (including the road surface). In Nova Scotia this requires a Working within Highway Right-of-Way Permit from Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR). This approval is not anticipated to be required at this time.
Use of Right-of-Way for Pole Lines Permit (*Public Highways Act*)	Approval from NSTIR may be required for installation or upgrades of distribution line. Application will be made to Colchester County Area Manager if the electrical drawings indicate this is required.

Table 1.2 Required Environmental and Land Use Approvals

Approvals Required	Summary
Driveway Construction Permit (*Public Highways Act)*	Approval from NSTIR may be required to construct a driveway from Johnson Road onto the project lands.
Special Move Permit with Department of Transportation and Infrastructure Renewal (*Public Highways Act*)	A Special Move Permit and any associated approvals will be obtained for heavy or oversized load transport as required.
Municipal	
Municipality of the County of Colchester	The Proponent will make application to the Development Officer for Colchester County, Colin Forsyth, for a Development Licence specific to the construction of a wind turbine generator. The turbine dimensions, including foundation and manufacturer information, as well as distances to houses, property lines and roadways and public consultation fall within the regulations as required of the Municipality.

1.7 REPORT ORGANIZATION

This report is intended to meet provincial EA requirements, in accordance with the Nova Scotia *Environment Act*.

The following outlines the structure of the Report:

- Section 1 introduces the Project and summarizes the key elements of the Project and the regulatory regime.
- Section 2 provides additional Project detail on components and activities required to support this EA.
- Section 3 describes the stakeholder consultation and Mi'kmaq engagement program undertaken for this Project.
- Section 4 describes the assessment method and scope of the assessment.
- Section 5 describes the existing environment of the Project site, including both biophysical and socioeconomic elements.
- Section 6 presents the assessment of potential environmental effects for each component of the Project, including accidents and malfunctions, and discusses the potential cumulative effects of the Project in association with other existing and planned projects.
- Section 7 identifies follow-up measures that are intended to be implemented for the Project.
- The conclusion of this EA is presented in Section 8.
- Section 9 presents the signature page followed by a list of supporting documents used to prepare the report in Section 10.

- Technical reports and supporting information are presented in appendices at the end of this document.

1.8 EA AUTHORSHIP

This EA was completed in-house by staff with extensive experience in undertaking EAs specific to wind farms in Nova Scotia. All expert studies were conducted by third party professionals in their designated fields and submitted to Ms. Fulton for direct inclusion into this document. Specifically, and on behalf of Affinity, the report was prepared and reviewed by the following:

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2.0 PROJECT DESCRIPTION

The following describes the Proponent, background and location of the Project, and detailed Project activities.

2.1 PRESENTATION OF THE PROPONENT

Affinity Renewables Inc. is a newly formed company created by Reuben Burge, the Director of Sustainable Funding for the Society for the Prevention and Cruelty to Animals (SPCA). Affinity Renewables Inc. (Affinity) has been created to answer the Nova Scotia Government's call for Community Feed-in-tariff projects (COMFIT). As a not-for-profit, the SPCA qualifies under COMFIT regulations as an eligible entity "community" for gaining approval to build and own renewable energy projects. This project will be known as the Greenfield COMFIT Wind Project and will consist of two GE 1.6 MW series wind turbine generators with 82.5m rotor diameter and a 25 kVA collection system connected directly into the NSPI grid at interconnection point transformer 15N-T2. The proposed project will be located in Greenfield in the municipality of Colchester. The project is referred to as the Greenfield COMFIT Wind Project ("Greenfield").

Affinity Renewables Inc. will become a limited partner in the ownership of the proposed wind project and earn annual income from shares in the facility for the 20 year term of the Power Purchase Agreement (PPA). The SPCA, will share in the income benefits when the project becomes operational without sharing risk during any part of the pre-development, permitting, financing, or operational stages. Affinity Wind LP will finance the entire portion of the SPCA's ownership in order to ensure that the Not For Profit's income from donations will not be required at any stage of development or operation. Affinity will rely entirely on Rotor Mechanical Services (Rotor) to develop and operate the facility, as an Affiliate to RMSenergy Dalhousie Mountain LP (Dalhousie Mountain), Rotor has extensive experience by developing and operating Dalhousie Mountain's 34 turbine 51 megawatt (MW) facility in Mount Thom, Nova Scotia (Dalhousie).

A new company, Affinity Wind LP, has been created to own and operate these COMFIT projects. This Project will be known as Greenfield COMFIT Wind Project.

2.2 PROJECT BACKGROUND

Affinity is proposing to construct and operate a wind energy facility, *Greenfield*, in Greenfield, Nova Scotia. The Project will have a nameplate capacity of 3.2 MW. The Project is planned to connect into the Nova Scotia electrical distribution grid.

A met tower located in the Project Area has gathered wind data since January 14, 2013. A combination of consistent wind, previous land use, capacity on substation, distance from homes, local benefits and community desire to develop the wind potential make the site an ideal location for wind development (refer to Section 2.5 for more information on Project siting).

2.3 PURPOSE OF PROJECT

The Project has been proposed in response to the opening of application to Nova Scotia Department of Energy for the Community Feed-in-Tariff program for a total of 100 MW of distribution projects across the province. This Project will have the capacity to contribute up to 3.2 MW of clean, renewable energy to the local distribution grid, producing energy sufficient to power 1,200 homes annually. The Greenfield Project is a key part of the Nova Scotia Government's plan to integrate renewable assets into its energy mix and will assist the province to meet its 2015 renewable energy targets.

2.4 SITE SELECTION AND DESIGN

The selection of the Greenfield site was based on a number of factors including:

- Open capacity/ need for local power supply
- proximity to the Proponent's headquarters at the existing Dalhousie Mountain Wind Farm;
- preliminary wind resource assessment;
- review of terrain and topography with an altitude above sea level of around 200 m;
- access to power grid interconnection;
- site access;
- presence of existing access roads;
- existing land use;
- distance to houses, and;
- community support.

The location of each turbine is shown in Figure 1.1. This current site configuration is based on a variety of factors. The locations selected for turbines are a critical element of power generation efficiency and optimal Project economics. The selection of locations is also conditional on the absence of significant ecological or heritage features of the Project Study Area. Site selection, therefore, must consider both of these elements, as well as residential set-backs, in order to have a successful development with minimal social and environmental effects.

When siting the turbines, the applicable land use by-law setbacks (2010 - 700m from dwellings in Colchester County; see Section 3.3) were used by the Proponent as a starting point for exclusion zones. The Proponent has conducted each expert study in a manner through which the turbines may be adjusted within a 75 m radius of the mapped locations (Figure 1.2). The Proponent has been in consultation with the municipality's planning department since 2011 and is confident the Project exceeds all requirements.

The Proponent has installed a meteorological tower (Figure 2.1), leased land and completed extensive expert studies since April 2011. The planning and selection process for Greenfield turbine locations followed an iterative approach where each site was assessed both for its energy capacity and the presence of sensitive ecological or heritage resources. Sites, which

were considered at early stages in the Project, have now been scrutinized from an ecological perspective and locations adjusted to mitigate potential environmental impacts. The same level of scrutiny has been applied to the location of access roads in order to minimize adverse effects on plant communities and aquatic habitat. To the extent possible, access roads follow high ground with the route selected to minimize water crossings. The site locations, shown on Figure 1.1 with the access road layout, have been derived using this careful selection process.

Figure 2.1 Technicians check batteries for bat equipment at the bottom of Greenfield met tower

The layout focuses on the higher dry ground to avoid impinging on wetland habitat. The project covers less than 3 ha in total, leaving plenty of room around the site for wildlife to concentrate in. The area is in an existing farming area with a regenerated crown and private forest lots surrounding the property.

The Project Study Area used for bird monitoring and wildlife surveys is comprised of not only the turbine locations and access roads, but the areas surrounding and in between, as birds and wildlife are not static. However the actual footprint of the tower structures and ancillary facilities for the proposed wind farm will occupy only a small fraction of the land base within the Project

Study Area (cleared turbine area and area for the right-of-way between turbines). When considering all turbines, access roads and ancillary components, the Project is predicted to result in physical disturbance of approximately 3 ha of land, much of which has been previously disturbed (*e.g.,* farming roads and forestry activities). It is expected that the actual development will be constructed to result in a much smaller footprint with less disturbance than the study area.

As detailed design and planning progressed (including, but not limited to, community consultation, site specific geotechnical tests, archaeological and Mi'kmaq significance, Municipal by-law amendments, and biological surveys), the Proponent continued the optimization of site layout to minimize biophysical and socio-economic effects while improving Project efficiencies. A considerable amount of micro-siting has been conducted, with the proponent revising turbine sites in the field with biologists to avoid, to the extent possible, sensitive features, including wetlands and rare plants.

A description of the biophysical and socio-economic features of the Project Study Area is provided in Section 4.0.

2.5 PROJECT COMPONENTS

The Project will consist of two, GE 1.6 MW series 82.5 meter wind turbine generators. In addition, the following ancillary facilities are also considered part of the Project:

- 25 kVA collection lines (to link the wind turbines to the distribution grid);
- 690V – 25 kVA pad mounted step-up transformers located beside each turbine;
- access roads; and
- crane pads for assembly of wind turbines.

No substation is required for this project. An existing maintenance shop/control building is located approximately 25km north-east of the Project, and will be used for all Affinity Wind's projects, as well as for Dalhousie.

2.5.1 Wind Turbine Generators

The Proponent intends to use General Electric (GE) turbines (GE 1.6 MW series 82.5 meter turbines) for this Project.

Table 2.1 Summary of the technical specifications for this Project's turbine model.

Table 2.1 Technical Specifications: GE 1.6 MW Series 82.5 meter Turbine

Turbine Component	Specifications
Rated capacity	1.6 to 1.85 MW
Rated sound power level	106 dB
Cut-in wind speed	3.5 m/sec
Cut-out wind speed	25 m/sec (1 minute)
Rated wind speed	12 m/sec
Number of blades	3
Blade Diameter	82.5 m
Swept area	5345/7853 m^2
Rotor speed (variable)	20.4 rpm
Tower (hub) height	80 meter
Gearbox	Three-step planetary spur gear system
Generator	Double-fed three-phase asynchronous generator
Yaw system	Electromechanical driven with wind direction sensor and automatic cable unwind
Control system	Programmable logic controller (PLC)/ remote and monitoring system
Tower design lightning protection	Lighting receptors installed on blade tips / surge protection in electrical components

The GE 1.6 MW series 82.5 meter 60 Hz unit is a three bladed, upwind, horizontal-axis wind turbine with a blade length of 41 meters. The turbine rotor and nacelle are mounted on top of a tubular tower giving a rotor hub height of 80 meters. The components and dimensions of the turbines are illustrated in Figure 2.3 and Figure 2.4. Interior service platforms are provided. The tubular tower is tapered and manufactured in three sections from steel plates. Access to the turbine is through a lockable steel door at the base of the tower. Access to the nacelle is

provided by an interior ladder with a fall arresting safety system (Figure 2.2). Interior lights are installed at critical points from the base to the top of the tower.

Figure 2.2 Employee in safety harness climbing down the ladder in GE turbine.

The machine employs: active yaw control (designed to steer the machine with respect to the wind direction); active blade pitch control (designed to regulate turbine rotor speed); and generator/power electronic converter system from the speed variable drive train concept (designed to produce nominal 60 Hz, 690V electric power).

The generator is a doubly fed induction-generator with wound rotor and slip rings. Nominal speed at 1.6 MW power output series is 1550 rpm. The generator is mounted to the bedplate on elastomeric foundations to reduce vibration and associated sound.

Temperature sensors are built into the generator windings to provide a temperature reading to the wind turbine controller. In the event the generator temperature is outside of the normal operating range, an automatic shutdown of the turbine is initiated.

The electrically actuated individual blade pitch systems act as the main braking system for the wind turbine. Braking under normal operating conditions is accomplished by feathering the blades out of the wind. Any single feathered rotor blade is designed to slow the rotor, and each

rotor blade has its own back-up battery bank to provide power to the electric drive in the event of a grid line loss.

Figure 2.3 GE Energy 1.6 MW series 82.5m 60 Hz Wind Turbine Generator: Internal Components

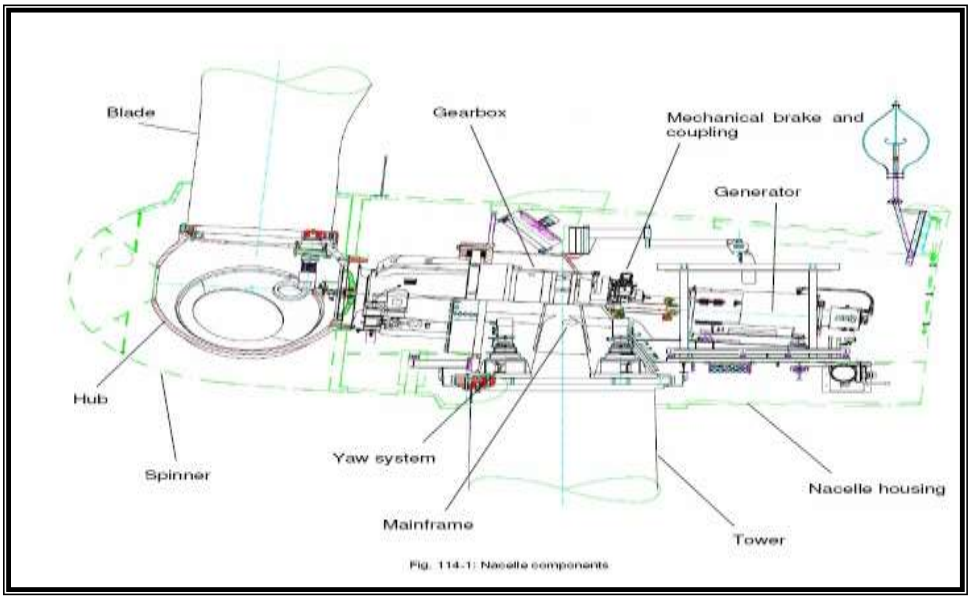
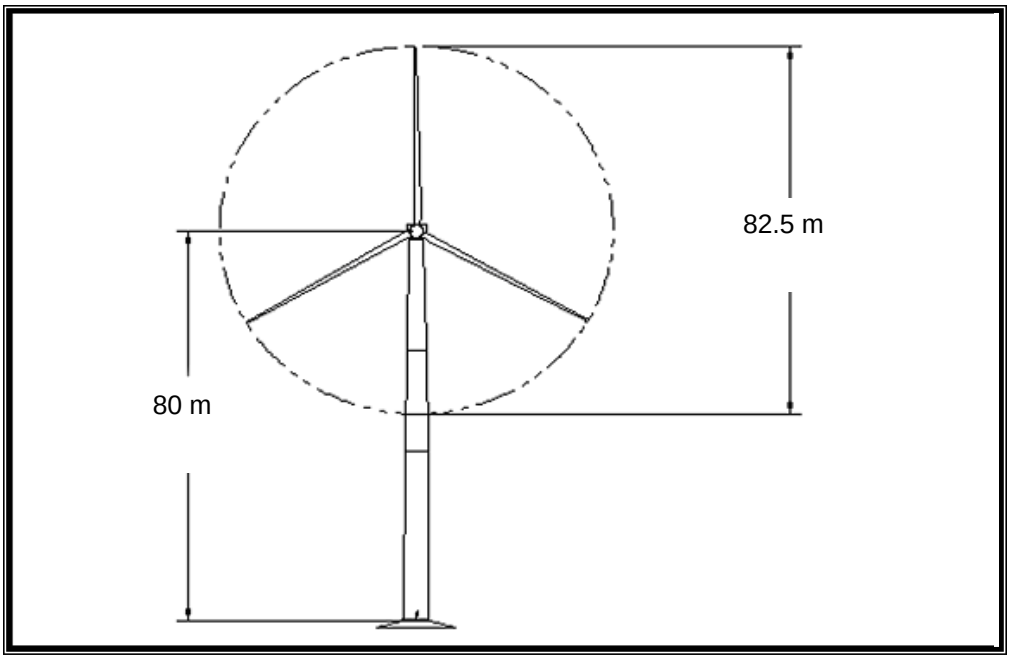


Figure 2.4 GE Energy 1.6MW series 82.5m 60 Hz Wind Turbine Generator: External Dimensions



The turbine is also equipped with a mechanical brake located at the output (high-speed) shaft of the gearbox. This brake is applied immediately only on certain emergency stops (E-stops). This brake also prevents rotation of the machinery as required by certain service activities.

The rotor blades are equipped with a strike sensor mounted in the blade tip. Additionally, a solid copper conductor from the blade tip to root provides a grounding path that leads to the grounding system at the base of the tower foundation.

Service switches at the tower top prevent service personnel at the bottom of the tower from operating certain turbine systems while service personnel are in the nacelle. To override any machine operation, E-stop buttons located in the tower base and in the nacelle can be activated to stop the turbine in the event of an emergency.

The wind turbine can be controlled automatically or manually from either the control panel located inside the nacelle or from a personal computer (PC) located in a control box at the bottom of the tower, or from a PC located offsite through internet-enabled control.

Turbine installation is completed by the mounting of the three-bladed rotor hub to the main shaft after the nacelle assembly has been mounted to the top of the tower. The nacelle of the turbine is constructed of fibreglass and lined with sound insulating foam. This sound insulating foam helps reduce acoustic emissions from the wind turbine.

2.5.2 Electrical Components

The interconnection point is located on NSPI Distribution line 15N-T2 at a point near NAD 83 UTM 20T 486750.9 E, 5022500.5 N at 102m above sea level.

A two-month construction period is anticipated to complete the main components and a two week commissioning period will be required after individual turbine commissioning is completed. The wind turbine itself produces 690V, 3 phase power and is sent via underground cables through the foundation base to a transformer pad outside the turbine. The power will be converted here by a small pad mounted step-up transformer (Figure 2.5) to convert 690V from each turbine to line voltage on the above-ground collector lines.

It will be feeding 25 kVA directly into the distribution system through a meter bank and a cut-off switch.

The overhead electrical collector lines will follow the access road system close to the ditch to provide reliable ongoing maintenance access. The poles will be placed by an excavator crew using standard methods (*e.g.*, drilling and/or jackhammer). Poles will be approximately 75m apart. The collector line circuits will be completed within a two month period. Installation of the electrical components will be conducted simultaneously and in conjunction with the turbine erection crew (Table 1.1).

Figure 2.5 Pad mounted step-up transformer to convert 690V from turbines to collector lines.

2.5.3 Additional Components

Delivery roads are currently in place from previous land uses and some new construction between turbine locations will be required. Figure 1.2 shows the turbine layout and Project access roads along with other site features. To the extent possible, existing access roads will be used, with appropriate upgrades to meet the load requirements for trucks transporting materials to the turbine sites. There is one existing stream crossing on the Greenfield site which has been upgraded as recently as spring 2013. This crossing will require upgrading. For the upgrading, the structure will be designed and supervised by a certification holder for Watercourse Alteration in Nova Scotia.

New bridges and culverts will be designed and installed in accordance with relevant NSE and DFO requirements to replace damaged and inadequate water crossings and upgrade existing roads (see Section 5.2).

2.6 PROJECT ACTIVITIES

The following section provides details on the planning, construction, operation, maintenance and decommissioning of the Project. Activities that have the potential for environmental effects in the Study Area are addressed in Section 5.0.

The development of the proposed Project will include three phases: site preparation and construction; operations and maintenance; and decommissioning (Table 2.2).

Table 2.2 Typical Project Activities

Site Preparation and Construction	
Surveying	Activities include staking the boundaries of the construction area, temporary workspace, aboveground collector lines and transmission lines, as well as marking the location of any existing underground pipelines and cables, or any biological or archaeologically significant areas.
Development of access roads	Access roads will be surveyed and staked/flagged. To access the turbines, approximately 600m of new road construction will be required and approximately 1800m of existing roads previously built to support farming activities will be upgraded. Roads on the site will be up to 10m wide. Ditches and culverts will be added where required during construction to accommodate crane movements for installation, trailers for transportation of heavy and oversized turbine equipment, maintenance vehicles and equipment for repairs/replacements. Construction roads will be designed to accommodate the crane types that will be required to erect the generators and towers. The surface soil and grubbing will be re-located in borrow areas along the road side and graded to prevent erosion and sediment runoff. Wetlands and watercourses have been avoided to the extent practical in designing access roads. Water Approvals will be sought from NSE for wetland/watercourse alterations if these features are unavoidable. Based on the current proposed road layout it is anticipated one potential watercourse crossing upgrade will be required. The ditches will be constructed along the road edge following provincial guidelines and procedures to control for surface water runoff. Culverts will be installed under the roads where necessary for cross drainage as well as installing check dams and take offs on slopes to guide run-off away from watercourses or wetlands.
Clearing and grubbing	The Project Study Area generally consists of previously cut woodlands and pasture. Approximately 1.5 ha of land is required for the construction of each turbine (including average required land for access roads per turbine), within which turbine foundations and crane pads will be located. After construction and installation, the majority of the required area will be allowed to re-vegetate; a much smaller pad for service and maintenance vehicles will remain.
Grading	Grading will be necessary to finish the access roads and pad construction to compact and level stockpiles and will follow provincial guidelines and procedures.
Soil stockpiling	All soil will be stockpiled on site during construction so that it can be used in re-vegetation and reclamation of the site once the turbines are erected. Stockpiles will be located away from watercourses and wetlands.

Table 2.2 Typical Project Activities

Site Preparation and Construction	
Foundation excavation	The turbine foundation specifications will be determined by the final geotechnical report and structural engineering at each turbine site, as is necessary to properly support the loads. The turbine foundations are designed and approved by GE and certified in Nova Scotia as required. The sand, aggregate and concrete will be prepared in a certified portable batch plant in accordance with NSE standards. Excavation for the turbine foundations will begin by removing compacted sediment/ topsoil and placing it in a dry pile, covered with plastic and will be re-placed over the area to provide a natural soil base for regeneration of indigenous plant species. The foundation requires digging to a depth where the ground has an impact measurement of 450 kpa. An engineered layer can be built if the soil bears no hard surfaces within a few meters. The diameter requiring excavation will be approximately 17m wide. Blasting is not anticipated, but if required, it would be local blasting not exceeding 2m in depth, and would not be strong enough to break up the bedrock below the foundation. Working down to this depth with a jackhammer attached to the excavator arm is the preferred method, and blasting would only occur for extremely compacted bedrock above the 2m required depth.
Pouring turbine foundations	After excavation, the bedrock surface will be levelled, compacted and covered with a 100mm thick levelling layer of concrete to allow an engineered surface to install the bolt ring section and the reinforced concrete structure. The foundation forms and rebar will be installed. Concrete will be poured into the forms continuously. When the foundation construction is complete, the topsoil and gravel mixture will be replaced and compacted in accordance with the engineering requirements for soil density.
Equipment lay-down and turbine assembly	All machinery and turbine components will use existing and/or proposed roads or crane pads for parking and lay-down areas. The sites will be complete prior to accepting delivery to allow delivery of the components directly to the individual sites, preventing unnecessary extra movement, lay-down areas, delays and cost. Each component of the turbines and generators will be trucked on a flat-deck trailer to the site and assembled.

Table 2.2 Typical Project Activities

Site Preparation and Construction	
Delivery to site	Delivery of the tower sections and main turbine components will commence as early as September 2014 as described in Table 1.1 Proposed Project Activity Schedule. This date will ensure that all road restrictions imposed by TIR are not exceeded resulting in construction delays. Typically in April and May, when the frost recedes, heavy vehicles may cause damage and erosion problems. When this occurs, the shoulders of the road become unpredictable and can lead to vehicle rollover. For safety reasons and logistics, delivery will take place only when safe road conditions are met. The benefits of a clean, gravelled road surface will reduce the environmental impact of: dust and airborne pollutants; mud on the employees work boots causing a slip or fall; truck tires transferring mud to Johnson Road then Lower Harmony Road; and cranes driving in between turbine sites and possibly sliding off the roads. The transportation of wind tower components to the site will include approximately 8 trucks per turbine. The transportation of the 300 ton erection crane and the crane components will require up to four flatbed trucks. The 75 ton and 150 ton hydraulic wheeled cranes will unload the trucks and place each turbine on the setup pad located at each individual turbine location. The first tower section may be placed during unloading for convenience and to minimize the size of the layup area. The erection crane will use a tailing crane to erect the two top tower sections, the nacelle, then the hub and blades will be placed last to complete major construction.
Tower, generator, and rotor assembly	The tower will be transported in three sections that will be assembled on site. The blade system, consisting of three blades and a hub, will also be assembled on site, attached to the generator and lifted into place at the top of the tower by a crane.
Collection system and transmission line/connection to grid	The 25 kVA electrical collection system will consist of aboveground electrical poles between turbines, distributing power from each turbine to the distribution line. Aerial cabling is installed by first drilling and placing poles, then stringing each phase of wire.
Clean-up and reclamation	Construction waste will be removed and disposed of at an approved location in accordance with local and provincial waste management requirements. A waste control operator will be hired locally to ensure proper waste management procedures are in place throughout all stages of development, construction and operations of the Greenfield Project. The temporary lay-down areas and disturbed areas around the foundation of each turbine and at the substation will be replaced with the previously excavated and stockpiled topsoil. The disturbed areas will be re-seeded. High voltage signage will be installed as necessary.
Turbine commissioning	Turbine commissioning can occur once the wind turbines have been fully installed and when NSPI is ready to accept grid interconnection. Commissioning involves testing and inspection of electrical, mechanical, and communications operability. A detailed set of operating instructions must be followed in order to connect with the electrical grid.
Operation and Maintenance	

Table 2.2 Typical Project Activities

Site Preparation and Construction	
Access and inspection	Maintenance inspections will be required for routine servicing. Light 4 x 4 trucks, vehicles, and ATVs may be used to access the towers. Larger trucks and cranes may be required periodically for larger repairs, but this is expected to occur infrequently. In addition, throughout the lifetime of the Greenfield Project, access to the turbines as part of regular non-scheduled maintenance activities will be required for resetting faults, minor component replacement and related activities. New and used lubricants, cleaning supplies and other controlled substances will be delivered, stored, handled and disposed of according to local regulations. All sediment control and watercourse alterations will be inspected while service personnel are on site.
Decommissioning and Abandonment	
Rotor, generator and tower disassembly	The rotor, generator and towers would be disassembled using a crane and removed from the site for re-use, reconditioning or disposal using a flatbed truck.
Access roads	Access roads will be removed where appropriate and in consultation with landowners.
Removal of concrete foundation	Decommissioning and reclamation will be done in accordance with landowner agreements, as approved by the County of Colchester. In some cases, foundations will be removed to a depth of approximately one meter below original ground level and filled with subsoil to rebuild the grade. The concrete foundation below one meter can remain in place. Stockpiled topsoil will be placed over the area to approximate depth of adjacent ground, depending on the land use at the time and the preference of the landowner. In some cases, depending on landowner agreements, concrete pads may stay in place.
Decommissioning of distribution lines	Above ground power-lines will be removed from the ground during decommissioning or as determined necessary by NSPI.

2.6.1 Construction Phase

Clearing activities will be scheduled outside of the breeding bird season (May to August). However, in the remote possibility that clearing activities will need to take place during the breeding bird season, an adequately trained specialist will be required to inspect the proposed work area for nesting birds prior to any site clearing. In addition, any clearing and disturbance within 50m of identified nesting or breeding areas will be avoided. Current farm roads have been considered to the extent possible as access roads to turbine locations. Compaction of soil will be minimized to the extent possible with compacted soil recovered following turbine installation. In addition, silt fencing will be erected, if required, to help prevent erosion of bare lands caused by construction activities.

Watercourses and wetlands will be avoided to the extent practical. If applicable, wetland functional analyses will be conducted for unavoidable wetlands and Water Approvals for watercourse and/or wetland alterations will be obtained from NSE. If construction is necessary

in or near watercourses or wetlands, erosion and sediment control measures will be put in place for the duration of construction in those areas. Based on the current proposed road layout, it is anticipated that one watercourse crossings may require upgrading. Additional information on watercourse crossings, including descriptions of drainage areas, and proposed mitigation measures, are provided in Section 5.2 - Aquatic Environment.

Information and warning signs will be erected adjacent to the Project site at the start of construction, to provide public information about the facility and to discourage trespassing on private lands. This signage will be maintained and updated as necessary.

Equipment on site during construction could include hydraulic fluid, brake fluid, transmission fluid, and oil from the wind turbine generator. Any refilling activities will take place either off site or in designated areas and at a minimum of 30m from wetlands or watercourses.

The turbine nacelles (which house the gearbox and the generator) and hubs will be delivered directly to the Project site. Equipment delivery is anticipated to be as early as September 2014 and therefore will avoid the spring season where weight restrictions are in place. It is anticipated that the current road network (outside of onsite turbine access roads) will not require upgrades to accommodate construction traffic. Implementing good transportation planning and safety measures during construction will minimize the potential for traffic related safety concerns. Public safety has been and will continue to be incorporated into the Project design. As stated above, land access to the construction site will be controlled through signage and restricted to authorized personnel only.

Approvals for transporting these materials will be sought from the provincial transportation departments. As the turbine components are oversized, a Special Move Permit and any associated approvals will be obtained through Nova Scotia Department of Transportation and Infrastructure Renewal (TIR) for heavy load transport. It is anticipated that the sand, aggregate and concrete will be prepared on site in the Kemptown Balefill Facility in the batch plant owned and operated by Zutphen Contractors (10km from Project site) in accordance with Provincial standards.

2.6.2 Operation and Maintenance Activities

Activities associated with the operation and maintenance of Greenfield will not be as extensive as during the construction phase. The wind turbines, once constructed, do not generate air emissions or require water usage. Maintenance inspections are required approximately once a month for routine servicing and lubricant replacement. Malfunctions and parts replacement will be assessed on an individual basis. A spares inventory will be provided by the manufacturer at the maintenance facility, and will be available for the recovery of unexpected breakdowns. Light-duty 4x4 trucks, vehicles, and ATVs may be used to access the wind turbines. For maintenance planning, access to the site will be controlled and managed through private land under the terms of the individual site land agreements and easements. Site access will be carried out on routes pre-planned to reduce excess travel and impact on existing use. Larger trucks and cranes may be required infrequently for larger repairs.

Aside from normal recovery of lubricants from the gearbox and yaw mechanism, operation activities do not generate waste. Lubricants will not contain any PCBs. New and used lubricants, cleaning supplies and other controlled substances will be delivered, stored, handled and disposed of according to local regulations. Vehicle emissions will be reduced by pre-planned maintenance activities and pre-planned access routes.

Each turbine houses a sophisticated Supervisory Control and Data Acquisition (SCADA) which continuously monitors equipment performance and instantly detects any faults to be addressed. This system will determine the frequency of regular and non-scheduled maintenance activities onsite. This system can be reached remotely, eliminating unnecessary travel to and from the site.

2.6.3 Aeronautical Obstruction Lighting

The proposed Aeronautical Obstruction lighting will be installed in compliance with Part VI of the Canadian Aviation Regulations 2007-2 Standard 6321.19 as administered by Transport Canada. This complies with CL-864 in Appendix B of the Standard. Additional information is provided in Appendix A (EMI Study Results), including the Aeronautical Llighting Plan. The Aeronautical Lighting Plan will have both turbines lit, as advised by Transport Canada.

2.6.4 Decommissioning

Greenfield is expected to be operational for at least 25 years. In the event that decommissioning and abandonment is necessary, the activities associated with the Project include:

- rotor, generator and tower disassembly;
- decommissioning of access roadways, where necessary;
- removal of concrete foundation;
- removal of distribution lines; and
- removal of pad mount transformers.

Well-designed and constructed wind energy facilities may be operated for decades. Individual wind turbines are expected to perform for up to 35 years without significant repair or replacement. Transformer facilities and underground wiring are designed for at least a 50 year life span. Individual wind turbines may be replaced or repaired as their useful life comes to an end, or if more efficient and cost-effective technology becomes available.

Upon a decision to decommission a single wind turbine or both machines at once, all equipment above ground, including towers, nacelles, transformers and controllers will be removed. Wind turbines that are operational and have market value would be carefully removed using a crane, essentially in a reverse process to assembly and installation. The resale value of such equipment would cover the cost of removal in such a case. A market for good, used wind

turbines has developed in North America, and a number of wind turbines installed in Alberta in the early 1990s originated from the U.S. used wind turbine market.

Other above-ground equipment in the wind farm, including transformers and wiring, has a ready market in either used equipment sales or in salvage. Transformers will be simply removed and sold. Wiring will be removed and sold to metal salvage companies.

As discussed above, wind energy facilities do not use or produce harmful waste products and therefore aside from normal recovery of lubricants from the gearbox and yaw mechanism, there are no requirements for harmful waste handling during decommissioning.

Wind energy facilities removed from undeveloped woodlands will require minimal remediation; native seed mixtures will be used to re-vegetate the area. Where necessary, topsoil and re-grading of access roads in the fields will occur as per the landowner's preference.

All decommissioning activities will be conducted in accordance with landowner agreements and applicable regulations and agreements at that time. It is not anticipated that watercourse crossings would be removed during decommissioning, as properly installed and maintained crossings are a benefit to the watercourse and the aquatic wildlife it contains.

As documented throughout this EA, the Project has been designed to minimize the risk of contamination during its operational lifespan. Containment and storage areas will limit contamination. Any remedial clean-up during the decommissioning or asset transfer will therefore also be limited. Provided the Project is operated and maintained in-line with industry best practices, there should be no significant environmental liabilities associated with clean-up or remediation. Regardless of the ultimate outcome, all decommissioning activities will be performed in compliance with the applicable regulations in force at that time.

2.7 FUNDING

The Project will be 100% privately funded.

3.0 STAKEHOLDER CONSULTATION AND MI'KMAQ ENGAGEMENT

Public consultation is an integral part of the environmental planning process and plays a key role in addressing potential public concerns identified in early stages of the Project. Public consultation is a requirement under NSE's "Proponent's Guide to Wind Power Projects: Guide to Preparing an Environmental Assessment Registration Document" (NSE 2007, updated 2012) and is a step in the environmental registration process. Public consultation is also required to maintain COMFIT certification. In Colchester County, public consultation for wind projects is required to be approved for a Development Licence to build. Ongoing consultation with the public and neighbours of the Project is an important aspect of development and operations.

Consultation activities have included three Open House public information sessions, meetings with stakeholders including local landowners, municipal representatives, provincial representatives and various informal meetings, phone calls and letters. The Proponent has frequently gone door to door in the vicinity of the proposed Project to engage the homeowners in conversation about any concerns or questions they may have. A summary of the homeowner consultations, including any issues, concerns and resolutions, can be found in Appendix E. The Proponent has directly engaged the Mi'kmaq community through information mail-outs, face to face meetings, scheduled phone meetings, digital file sharing, and the commissioning of a Mi'kmaq Ecological Knowledge Study (MEKS) in 2013. (Appendix B)

The following sections present further details on those opportunities given to the public and reviewing agencies for comment. Supporting documentation is provided in Appendix E**.** The Proponent will continue to communicate with the public and Mi'kmaq. During the EA review process, additional issues may be raised by the public and the Mi'kmaq who will be invited to submit written comments on the proposed Project and information contained in the EA document during the EA registration phase.

3.1 REGULATORY CONSULTATION

Various regulatory and other agencies were consulted early in the planning process to provide input into the Project and the process, and advise in terms of likely approvals and considerations for environmental assessment.

To date, the following agencies have been contacted by the Proponent:

- Environment Canada - Canadian Wildlife Service (CWS);
- Environment Canada – Meteorological Service of Canada;
- Department of National Defense (DND);
- Transport Canada;
- NAV Canada;
- Royal Canadian Mounted Police (RCMP);

- Canadian Coast Guard;
- Canadian Broadcasting Corporation (CBC);
- Radio Canada:
- Province of Nova Scotia Integrated Mobile Radio System;
- Nova Scotia Environment (NSE);
- Nova Scotia Department of Natural Resources (DNR) Species at Risk;
- Nova Scotia Transportation and Infrastructure Renewal (TIR);
- Municipality of the County of Colchester (including local representative councilors, Development Officer and Planning Advisory Committee).

Comments received during consultation were taken into consideration in preparing this EA Registration document. The Proponent will continue to work with regulatory agencies to develop appropriate follow-up measures (*e.g.*, post-construction monitoring) and submit applicable permit applications.

3.2 PUBLIC CONSULTATION

The Proponent has conducted various levels of public consultation since 2011. Informal meetings include: door to door visits and information sharing with local homeowners; attendance to community meetings; attendance to council chambers to hear any concerns raised by local citizens; visits and correspondence with community members such as members of the Salmon River Fire Department and local charitable organizations (*i.e.,* Salmon River Hockeyville).

Formally, the Proponent has had documented meetings with municipal representatives (area councillor, planning developer, Planning Advisory Committee (PAC)), the Executive Committee for the Salmon River Fire Department, as well as the MLA for Colchester North, Karen Casey and MLA for Colchester Musquodoboit Valley, Gary Burrill. On October 8, Larry Harrison was elected in place of Gary Burrill. To date, phone conversations and plans to meet in person have taken place. The Proponent held one public meeting at the Greenfield Church (March 27), as well had an Open House BBQ at the proposed site (May 29). Both meetings were advertised in newspapers and in flyers delivered door to door (Appendix E). Both meetings were very well attended (at least 75 at each meeting).

The summary in chronological order, of the public consultation process is described in detail below.

In early 2011, the Proponent began consultations with local landowners to locate the best place to propose a small wind project. After listening to concerns from the area, the Proponent moved the original location to a location that was double the distance from the nearest home, as concerned citizens had indicated. On March 4, 2013, the Proponent began the public consultation process with the local community (within 3km of project) by going door to door to

local homeowners. All conversations including concerns and response were recorded immediately after the meetings took place.

For three months, this door to door campaign took place 2-3 days per week by two individuals. There are a high percentage of supporters within 5km of the Project. This process has continued and is currently taking place on a less frequent basis now that most residents within 3km of the proposal do not have serious concerns about the Project.

On March 20, the Proponent attended an information session at the Greenfield church held by four individuals who oppose the Project. The meeting lasted from 6:30 to 10:15. The Proponent was given an opportunity to speak, as well as answer questions for the second half of the meeting.

On March 27 the Proponent hosted an information session at the Greenfield church. The meeting was advertised to 164 closest homes to the project by way of a two-page detailed project description and invitation (Appendix E). It was attended by approximately 75 local residents. There was a presentation from Reuben Burge, the main contact for the Proponent about project specific details; from Jim Roycroft, maintenance technician and CEDIF member for a separate COMFIT project; Lisa Fulton, about the environmental constraints and siting, the EA, COMFIT and municipal permitting process; from Al Steven, who has lived 350m and 750m from two large wind turbines for 8 and 6 years, respectively, as well is a Maintenance Technician at Dalhousie; and from Merci Koester who lived 450m and 850m from the same two turbines and sold her property for more than she purchased it for, and built a new home 800m from the nearest turbine.

There were 11 individuals who shared their opposition to the Project. Their questions were answered and concerns recorded. The remaining attendants shared their willingness to participate in the Project or their general support for the proposal.

Three opponents attended two separate annual general meetings of the SPCA (the Proponent's COMFIT partner) regarding the Greenfield project. The SPCA is a partner in the Project and will receive annual income from power production of the wind turbines. The Executive Director of the SPCA and the President of RMSenergy proceeded to invite these three individuals to a personal meeting to discuss project specific details and to tour the area where the project was proposed.

This meeting was scheduled for two weeks later. Upon arriving at the meeting location to take the group of three on a tour of the proposed site, the Proponent and SPCA were met with 16 protesters. The planned tour of the proposed project did not take place.

Each of the 16 individuals has been visited and heard numerous times by the Proponent and their concerns have been recorded and addressed where possible.

The Planning Advisory Committee (PAC) for Colchester County attended a site tour of the Proponent's existing Dalhousie Mountain facility. The Proponent exhibited what the turbines

look and sound like at 2000m, 1500m, 1000m and directly underneath. They visited a residence located 1.6 km from eight turbines and interviewed the homeowners. They also attended the Proponent's home in the wind farm and were invited indoors to listen to the sound level differences. This residence has 4 turbines within 700 meters, with the closest two being 175 meters and 225 meters.

On May 29 the Proponent hosted an Open House information session at the site of the met tower, in view of the proposed turbine locations. Advertisements for the Open House were circulated in the Truro Daily News on May 16 and 23, 2013. In addition, the Proponent delivered 299 detailed project descriptions and invitations door to door and to mailboxes of houses surrounding the proposed Project (Appendix E).

The Open House was held in a large tent offering tables and chairs, barbeque, food and beverages, maps and information packages (Figure 3.1). There were visual displays showing the projected sound levels, visual zone of influence, shadow flicker in maximum hours per day and shadow flicker in maximum days per year. There were comment sheets and exit surveys, as well, the Proponent populated a sign in sheet of every person who attended and their exact comments about the proposed two turbines in Greenfield. The comments from the attendees are below in Table 3.1 *Open House Attendants' Comments.* The visual images that were on display are Figures 6.10, 6.16, 6.17 and 6.18. Few issues were received about the Project (either verbally or via the written exit survey); the eight comment sheets that were filled out are found in Appendix E.

There were 77 attendants of the barbeque invited to view the visual maps on poster board 24" X 36" hanging at eye level. The engineer who performed the modelling was there to answer any technical questions relating to: how the results were calculated, parameters used for modelling, certainty of final results, etc.

Two local MLAs attended, Karen Casey (Colchester North) and Gary Burrill (Colchester Musquodoboit Valley) as well as the District Councillor for Lower Harmony (District 5), Lloyd Gibbs. All three were very supportive of the Project. The District Councillor for Greenfield (District 6), Karen MacKenzie, was invited personally via email but did not attend due to prior work obligations. Krystal Therien, COMFIT Administrator attended as an observer to the process. The Proponent, as well as eight employees who work on the 34 turbines at Dalhousie Mountain were on hand to answer any questions or engage in dialogue with those who attended the barbeque.

Figure 3.1 Greenfield Open House BBQ on location, May 29, 2013

The purpose of this Open House was to:

- encourage dialogue between members of the Project team in attendance and the general public and stakeholders;
- demonstrate the large setback distance from houses by having the attendees take the 1800m driveway into the site;
- hear and record any concerns by any attendee;
- illustrate where the turbines will physically be;
- enable the public and stakeholders to obtain Project information;
- view information on the proposed site and turbine locations;
- encourage the public and stakeholders to join a tour of the existing Dalhousie;
- participate in the environmental and socio-economic assessment process.

Table 3.1 – Greenfield Open House BBQ Attendees' Comments

Name	Address	Statement about project?
1.	Lower Harmony Road (recently purchased land at Johnson Road)	'I am not going to lose any sleep over it. I have no concerns. I am not super against it or super for it, I just have no

		concerns'
2.	Johnson Road, Lower Harmony	'totally positive'
3.	Lower Harmony Road	'100% positive'
4.	Valley View Drive, Hilden	'I support wind power in my backyard, and in Greenfield'
5.	Valley View Drive, Hilden	'I have no concerns. I am a supporter for fellow Colchester folks who support wind energy'
6.	Pictou County	'I love the windmills by my house and know that people can have an enjoyable lifestyle at the distances proposed here'
7.	Greenfield during summer months	'After reading numerous articles and speaking with a couple dozen people who live near wind turbines, I just cannot see the negative side of the argument. I fully support this project with the distances from houses set as they are'
8.	Birch Hill, Bass River, Colchester County and White Hill, Pictou County	'I would do anything to have some of these in my backyard. It sure beats Trenton (coal power plant)
9.	Johnson Road, Lower Harmony	'It's a great idea' 'I am all for them', 'those protesters down there should take a drive up here so they can see how far away you are planning to put them'
10.	Johnson Road, Lower Harmony	'It's a great idea, especially when you take that drive up you realize how far it really is up here'
11.	Thompson Road, Greenfield	'Nobody could possibly have a problem with where these are going. It's one hell of a road to get up here, a real

		good place for them'
12.	Coppergate, Greenfield	'it's not going to affect my house but I would like to run my house as a receptor for your noise modelling to see what the actual results will be there', 'I think wind power is positive in general' – Affinity followed up with results of 38 Coppergate Receptor study to homeowner on May 31, 2013 showing the predicted sound pressure levels below 35 dBA
13.	Lower Harmony Road	'I have no concerns' 'I fully support the project' 'It is better than smoke stacks in my backyard or anywhere else'
14. Karen Casey, MLA	Second Court, Valley	'I believe you have done your due diligence with setbacks, bird studies, wildlife studies. The evidence is shown here'
15.	White Tail Court	'I fully support this project and have no concerns whatsoever'
16.	White Tail Court	'It is about time. I am not worried about any effect on my property'
17.	Parks Court	'bring it on' 'I love it' 'I am excited to see this get going'
18.	College Court, Lillyvale Road	'It is fine by me' 'go for it' 'I think they are great' 'I have no concerns about my property value'
19.	Johnson Road, Lower Harmony	'I think you should get it done'
20, 21, 22.	Formally of Greenfield, now Colchester County	'I totally support it' 'property values are not an issue at all' 'noise is not an issue considering how far they are set back'
23.	Truro	'My grandma lives on Parks subdivision and I love coming to her house to get out of town. I will love coming to her

		house when the windmills are here'
24. Gary Burrill, MLA	Colchester County	'This is a good project; there is lots of evidence to show that. I think it is great for Greenfield to be connected to COMFIT'
25.	Thompson Road	'I have no concerns' 'I saw the maps, that information took away the concerns I might have had'
26.	Thompson Road	'My initial concerns were noise, birds, bats, wildlife. After discussions with Affinity and seeing maps, I have no concerns'
27.	Thompson Road	'I have no concerns at all about this project'
28.	Salmon River Rd, Murray's Siding	'The project is harmless this far away'
29.	Greenfield Road	'I am for it. It shouldn't matter to those protesters down there since it's this far away'
30.	Camden	'It does not bother me a bit, I think it is good'
31.	Camden	'I am for it'
32.	Parks Rd, Greenfield	'I think it is good. I have absolutely no concerns about property values. Clean power is positive'
33, 34.	Chagford Place, Greenfield	'I had concerns about noise at our house, I am glad to have a chance to look at the maps you have provided.'
35.	Chagford Place, Greenfield	'There are people going door to door telling us stuff that is the opposite of what your maps show. Something should be done about that, it is very scary as a homeowner to listen to them. Thank you for providing us with

		your maps and studies. I no longer have concerns'
36.	Parks Road, Greenfield	'This project is a wonderful idea. Positive, positive, positive. Support 100%'
37.	Parks Road, Greenfield	'I support this project 100%. Good idea, new and clean'
38.	Murray's Siding	'I think it is great. I have no concerns at all'
39.	Murray's Siding	'I think it is great'
40.	Greenfield	'I think this project is fine, great, no concerns. I am in the medical profession and have no health concerns'
41.	Greenfield	'I have no concerns but more information would be great – power bills, birds, construction, decommissioning.' After discussions, 'I got all the answers I asked you for, thank you. I have no concerns about this project'
42.	Curtis Drive	'I am okay with windmills'
43.	Greenfield	'I am not worried at all. I just wanted to see the information and chat with the developer because I am very interested in this. Thanks'
44.	Greenfield	'I have no concerns'
45.	Greenfield and Halifax	'I have no issues'
46.	MacGillivry Road, Dalhousie Mountain (1.7km from 4 turbines)	'I think it is a great thing. It is far enough away up here. It's farther than I live from 34 of them and I have no issues.'
47. Lloyd Gibbs,	Lower Harmony Road	'I have no concerns at all'

District 5 Councillor		
48.	MacIntyre Road	Concerns Kelvin spoke to about at the Open House: 'noise, shadows going forever, general information, where does power go, property values – are we going to purchase his house once these start spinning and making life hell, have a meeting where protesters feel like they can come, have you ever had more resistance than this, why are you working with SPCA?' Proponent discussed issues for about 20 minutes, he left with issues resolved. The Proponent met up with him down the road after the meeting and his concerns had all been addressed. Phone calls have been had between Kelvin and the Proponent since that time.
49, 50, 51.	Mount Thom (2.5km from 10 turbines)	'We love wind turbines. We can see a couple dozen from our place. We never hear them and love watching them turn. We have the Mount Thom Moto-cross track and we have never had anyone say negative things about how the turbines look. The property value issue could only be true if you lived directly underneath them. This project is far enough away from homes to not be a concern for any reason'
52.	Johnson Road, Lower Harmony	'I am one of the closest homeowners, and also have 5 rental properties within 1.7km of the machines. I totally support this project and have absolutely no concerns about property values, health or noise.'
53.	Johnson Road, Lower Harmony	'I love the turbines. I have sheep and cows and horses and grandchildren, not to mention our livelihood is here on

		this farm and surrounding properties. I have absolutely no concerns about this project.'
54.	Johnson Road, Lower Harmony	'I think this project has been studied and sited properly, the maps and modeling show that. I have no concerns whatsoever about the 2 turbines going up in Greenfield.'
55.	Dalhousie Mountain (1.6km from 8 turbines)	'I have lived 1.6km away from 8 wind turbines for almost 4 years. I have no problems with sleeping, eating, enjoyment of my property or any other health related issues because of the turbines. Since the wind farm has been built I have been happier in my home and on my property than I ever was before. I am here to let people know that when turbines are built far enough away, you can live in harmony with them.'
56.	Dalhousie Mountain (1.6km from 8 turbines)	'I love the turbines that are by my house. I wish there were more! It seems to me these maps show that there will not be any noise problems with the turbines and the houses around them. I do not believe that lower property values or health related risks can be attributable to wind turbines, especially this project with the distance between houses and the turbines.'
57.	Sutherland's River	'The facts are that this project is sited properly in terms of distance from houses (sound pressure levels and shadow flicker), avian activity, wetlands, municipal bylaw setback adherence and in a windy spot. This is what we know as facts.'

58.	Colchester County	'It seems like people have concerns but they are comforted by the mapping and having their questions answered instead of ignored, which is what the protesters at the bottom of the hill are accusing you of. This is a very positive atmosphere.'
59, 60.	Westville	'you are double the municipal distance from homes than necessary and have done all of the environmental studies, what more do people think they have a right to intrude upon.'
61.	Southern Ontario	'These turbines are 1400m from the nearest house? What are the people at the bottom of the hill so angry about and where do they live? I think this project is perfectly fine, if not over-accommodating.'
62, 63, 64.	Southern Ontario	'This looks like a great spot for a couple of turbines. The houses are far enough away and it's high and windy here.'
65.	Fitzpatrick's Mountain (350m and 700m from 2 turbines)	'There is nothing unhealthy to animals or humans about living near wind turbines. My wife and I, our 150 sheep, llamas, ponies, dogs, cats, chickens and visitors have had no issues related to wind turbines since they were installed 350m from our farm 8 years ago. This project is far enough away from houses. Homeowners won't hear anything and if they do, it will only be in their yards every now and then.'

The Proponent spoke at the Municipality of Colchester's PAC meeting on June 11, 2013. There were 16 speakers at the meeting, 11 committee members/ municipal staff and the audience overfilled the seating capacity. Six of the speakers were those in the group of 16 protesters. Eight speakers were from other jurisdictions in Colchester and other counties. Two speakers were developers of wind energy.

The Proponent has continued public consultation after June 11 by:

- sending detailed information to local residents at their request
- having individual meetings with local residents at their request
- continued door to door callings with individual homeowners near the proposed site
- setting up a website where contact information is available

Since the public consultation process began, the Proponent has kept a log of all of the concerns and comments that were received. Table 3.2 identifies every concern from every individual who consulted with the Proponent or the Proponent has heard them speak at a meeting with their concerns, as well as the resolution to the concern, wherever possible.

Table 3.2: Stakeholder concerns voiced at meetings or in direct conversation with Proponent

Person	Address	Concern	Resolution
Person 1 and Person 2	~2600 meters	1. gets migraines now, thinks they will be worse & stay for days if turbines are put in 2. clock stopped when met tower was erected 3. Wind power will cause major problems & brown outs on power grid 4. will see turbines directly from their window 5. when new turbines are replacing old ones and are much larger, old foundation will not hold the bigger machines and structural failure is eminent 6. turbines will be replaced with ones that are double the size of proposed, but remain the same distance from property lines and homes 7. price of power will rise to 38 cents per kilowatt hour	1. Setback distance from home alleviates any possible risk 2. Met towers use no frequencies, emit no frequencies or any other factor that could contribute to a clock stopping 3. Distribution level power production is exactly the answer to any worry of brown outs on power grid 4. Proponent offered to plant trees that would lessen the visual impact, individuals did not want to lose their view of the (landowner's) green cattle pasture 5. if turbines are replaced with bigger machines, engineered foundations will be constructed for these machines 6. Proponent currently adheres to all municipal bylaws regarding setback distances and will continue to do so in the future with what bylaws are in place at that time 7. contract to sell power to NSP is set rate for 20 years. That rate is lower than ratepayers currently pay to NSP. Power increases cannot be attributed to

Person	Address	Concern	Resolution
			independent power producers
Person 3	~2800 meters	1. Power rates will increase due to this project	1. contract to sell power to NSP is set rate for 20 years. That rate is lower than ratepayers currently pay to NSP. Power increases cannot be attributed to independent power producers
Person 4	~100,000 meters	1. Property values decrease by minimum of 40% 2. COMFIT process lacks clarity or transparency	1. Studies have proven that wind turbines have no effect on property values & setback distances from homes alleviate any possible risk any noise annoyance at house/ in yard 2. Opinion of government process is not responsibility of private companies
Person 5	~1500 meters	1. will support project if his power bill costs less 2. community compensation 3. landowner of turbines is spreading manure and contaminating water with improperly installed/ sized bridge	1. Proponent is not responsible for setting rates & billing 2. Project has community benefits package 3. Proponent will aid landowner in constructing new bridge to reduce risk of sedimentation of stream
Person 6	~1500 meters	1. property value compensation 2. community compensation 3. health related risks 4. cows' health related risks 5. noise annoyance	1. no risk of property value decreasing due to Project, Studies have proven that wind turbines have no effect on property values & setback distances from homes alleviate any possible risk any noise annoyance at house/ in yard 2. Proponent has community benefit package in place 3. setback distance alleviate any possible risk, for which there is no scientific evidence that it exists 4. no scientific or anecdotal evidence that this is a risk 5. setback distance ensures turbine max sound pressure will be less than 30 dBA

Person	Address	Concern	Resolution
			at this residence
Person 7	~2760 meters	1. Open House held from 3-6pm is not appropriate	1. Proponent acknowledges not everybody can attend from 3-6pm but picked this time because it overlaps the day and the night shift & continued correspondence indicates this is only concern person 7 has with Project
Person 8	~1300 meters	1. explosions from voltage in the ground on person 8's property 2. property value compensation 3. health risks specifically 'extreme depression and major anxiety' 4. believes her house is only 600 meters from the turbines, not 1400 meters 5. 'devastating wildlife and domestic animals'	1. Grounding needed for the two turbines will be limited to about 50 meters from the base of the tower, necessary for lightening protection. Explosions from this are not possible and there will not be stray voltage in the ground 2. no risk of property value decreasing due to Project, Studies have proven that wind turbines have no effect on property values & setback distances from homes alleviate any possible risk any noise annoyance at house/ in yard 3. setback distance alleviate any possible risk, for which there is no scientific evidence that it exists 4. it is a fact that the closest turbine to this residence is 1400 m 5. EA attempts to show that the impact of the Project on wildlife is minimal and sited responsibly in terms of habitat and usage of previously cleared areas. There is no scientific or anecdotal evidence to indicate risks to domestic animals
Person 9, Person 10	~2850 meters	1. health risks	1. setback distance alleviates any possible risk, for which there is no scientific evidence that it exists
Person 11	~1800 meters	1. does not like the look of wind turbines	1. Modeling for zone of visual influence shows that the two turbines will not be visible from this property (Figure 6.10).

Person	Address	Concern	Resolution
			Proponent is committed to working with individuals to plant trees that will hide the view of the turbines where legitimate issue exists.
Person 12	~1700 meters	1. 'if you build an addition on my house I'll give you all the support in the world' 2. property value compensation 3. decommissioning bond 4. solar is better than wind power 5. use crown land instead 6. blade will come off machine and could stab someone	1. the Proponent is not in the business of building houses 2. no risk of property value decreasing due to Project, Studies have proven that wind turbines have no effect on property values & setback distances from homes alleviate any possible risk any noise annoyance at house/ in yard 3. Proponent is committed to maintaining the Project for its useful life and will decommission when that time is complete. Legally contracted in land rights agreement to follow through with plan, 4. COMFIT does not include solar as a renewable energy at this time 5. crown land that is in the area is closer to homes on the other side than the Project is to any on this side, is located along the downslope of the hill and is non-accessible without destruction of wetland 6. Turbines employ Vibration Monitoring which will alert technicians to any anomalies in function of turbine; technicians inspect blades bi-annually through bolt tightening and seam inspection, as well as regular visual inspections while doing other maintenance
Person 13 and person 14		1. not comfortable with wind technology 2. health risks	1. GE is a highly innovative, technologically advanced manufacturer of wind turbines. Proponent has used this model (34 of them) for four years with above average production and

Person	Address	Concern	Resolution
		3. reduced quality of life 4. use of crown land instead	availability. Proponent has 8 full time maintenance personnel qualified and continuously trained to monitor, maintain and fix these machines 2. setback distances alleviate any possible risk, for which there is no scientific evidence that it exists 3. setback distance eliminates any noise annoyance or shadow flicker 4. crown land that is in the area is closer to homes on the other side than the Project is to any on this side, is located along the downslope of the hill and is non-accessible without destruction of wetland
Person 15 and person 16	~1800 meters	1. COMFIT is secretive and only requires 25 signatures to get a contract	1. COMFIT program is much more complicated than getting 25 signatures. Proponent has followed Department of Energy, NSE and municipal processes to ensure full disclosure of information and availability to consult, opinion of government process is not responsibility of private companies
Person 17	~4700 meters	1. health risks 2. property value compensation 3. wind industry is making billions of dollars of rural communities 4. wants 3000 meter setback from property line 5. noise travels up to 3000 meters	1. setback distances alleviate any possible risk, for which there is no scientific evidence that it exists 2. no risk of property value decreasing due to Project, Studies have proven that wind turbines have no effect on property values & setback distances from homes alleviate any possible risk any noise annoyance at house/ in yard 3. Proponent is not part of a large conglomerate. Project revenue goes to SPCA, community benefits package, landowners and Proponent. 4. Setbacks of 3000m are not possible in any place in Colchester County that

Person	Address	Concern	Resolution
			have capacity to take wind power into the distribution grid 5. Sound pressure levels that will be created by the Project have been modeled. At present layout, given all circumstances as worst case scenario, no receptor will receive sound pressure levels greater than 36 dBA, as mandated by the Municipality of Colchester.
Person 18	~1500 meters	1. health risks 2. property value compensation 3. additional turbines in future 4. loss of sound of peepers 5. swallows and bats will not return 6. vibrations from turbine going on and off will be like water torture 7. use of crown land as alternative	1. setback distances alleviate any possible risk, for which there is no scientific evidence that it exists 2. no risk of property value decreasing due to Project, Studies have proven that wind turbines have no effect on property values & setback distances from homes alleviate any possible risk any noise annoyance at house/ in yard 3. Proponent is limited in COMFIT certification as well as NSP substation capacity; both of which are not increasing in the foreseeable future 4. Project will have no effect on peepers, wetlands will be avoided and no peeper habitat will be lost. At 1500 meters the sound from the turbines will be minimal and could not overwhelm the sound of the peepers 5. Proponent has had bird study and bat study completed for Project area and minimal effect on both birds and bats is predicted, if any 6. There are no vibrations produced by the wind turbines that can be felt. At 1500 m from the turbine, there is absolutely no possibility this could occur 7. crown land that is in the area is closer

Person	Address	Concern	Resolution
			to homes on the other side than the Project is to any on this side, is located along the downslope of the hill and is non-accessible without destruction of wetland

Table 3.3 is a summary of the comments in support of the Project that have been received by the Proponent from homeowners who live within 3km of the proposed wind sites that did not attend the Open House BBQ.

Table 3.3: Comments made by homeowners living within 3km of Project (for those who did not attend the Open House BBQ)

Person	Address	Concern	Resolution
1	Johnson Road 1300 m	1. No hauling big equipment through his property	1. Project access road is not on or near property
2	Greenfield 2500 m	1. No problem with Project 2. As a community, we are supportive of the Project and don't want it to be scrapped again because of a few who oppose it	1. N/A 2. Proponent will work with opposition to mitigate concerns through proper siting processes and ongoing consultation
3	Chagford Place 2000 m	1. I'm not going to hear them here, I have no problem with them I have a problem with people coming around trying to convince me that the turbines are going to make me and my family sick	1. Proponent will work with opposition to mitigate concerns through proper siting processes and ongoing consultation
4	Coppergate 2000 m	1. No problem with project	1. N/A
5	Chagford Place	1. No problem with project 2. It's great that this	1. N/ A

Person	Address	Concern	Resolution
	2100 m	community gets to benefit from green energy	2. N/ A
6	Chagford Place 2450 m	1. My mom lives by the ones in Nuttby and has no problems 2. I can't see any problems with the project	1. N/A 2. N/A
7	Chagford Place 2250 m	1. No problem at all 2. Appreciates Proponent coming to his door, gives him comfort	1. N/ A 2. N/ A
8	MacIntyre Road 1450 m	1. My only concern is noise, otherwise I have no problem with the project	1. Run home as receptor for sound pressure modelling, bring map to homeowner, concern relieved. Worse-case scenario would have 30-35 dBA
9	Johnson Road 1700 m	1. Totally for the project 2. Got his 2 dogs from SPCA and really doesn't like driving down the road seeing signs saying the SPCA is sacrificing animals and people for money 3. people saying they represent the community but they do not represent this house 4. I couldn't go to open house BBQ because I felt threatened by the presence of opposition in my driveway chanting and stopping every car that went past	1. N/ A 2. Proponent will request SPCA signs taken down. When new signs go up, continued consultation with opposition to take SPCA related signs down 3. N/A 4. Proponent will provide homeowner with any and all information about the project
10	Lower Harmony	1. Fully support Project	1. N/A

Person	Address	Concern	Resolution
	Road 2600 m	2. Come from a place where there is smog every day and you can't drink the water, seeing 2 windmills in the distance is not going to be a problem at all	2. N/A
11	Lower Harmony Road 2450 m	1. No problem with the project at all 2. Request more information to see if some can go on their property	1. N/A 2. Proponent has committed to turbines where they are currently planned due to proximity to resident constraints, wind regime
12	Lower Harmony Road 2700 m	1. No problem with Project 2. If Larry Weatherby is part of the Project, I trust it, he's ploughed me out for 20 years	1. N/A 2. N/A
13	Tasha Drive 2500 m	1. No problems with Project	1. N/A
14	Thompson Road 1850 m	1. No problems with Project 2. love looking at windmills whenever we have a chance to see them	1. N/A 2. N/A
15	Thompson Road 1800 m	1. Not one single problem with the Project 2. Has a niece who's boyfriend works on turbines and has learned lots about them, not worried about anything at all	1. N/A 2. N/A
16	Thompson Road	1. No problems with wind turbines or this project	1. N/A

Person	Address	Concern	Resolution
	1850 m	2. Looking forward to seeing them	2. N/A
17	Thompson Road 1600 m	1. Support Project 100% 2. Only problem is original layout had two turbines on my land, now there are none, but still support the Project	1. N/A 2. Original layout had turbines 700 meters from nearest home so layout change was necessary
18	Thompson Road 1700 m	1. Supports green energy and this Project 2. Surprised closest house is 1300 meters with all the 'fuss' going door to door 3. Partnership with SPCA is wonderful – should be praised 4. Having existing wind farm gives confidence that Proponent can do this Project properly	1. N/A 2. Proponent provided maps to show Project in relation to houses, including hers 3. N/A 4. N/A
19	Thompson Road 1900 m	1. Doesn't care if Proponent put up fifty turbines, as long as there are no smoke stacks 2. Power usage from sources generated locally, without pollution can't be wrong	1. Proponent is only putting up two, and no plans to put up any more in the future 2. All power created by Project will be used before it reaches substation on Willow Avenue, Truro

Additional stakeholder and community outreach initiatives include or will include individual meetings with any concerned citizens, facilitated meetings with citizen/ council group throughout construction and operations, company/ project website (www.rmsenergy.ca), mail-out of community newsletter, meetings with municipal council, door-to-door community outreach program and additional public open house meetings.

The Proponent has developed and implemented an issues resolution program for Project construction and operation. This program includes company contacts as well as an issues

resolution procedure for community members to identify issues of concern. The procedure will document the issue and action taken to resolve and/or improve the situation.

3.3 MUNICIPAL PLANNING PROCESS

The Proponent has consulted with the Municipality of the County of Colchester on various occasions during Project planning since November 2011 (Appendix E).

The Project is located within the Municipality of the County of Colchester planning district. Aside from the Wind Energy Bylaw which applies to the entire county, there are no other land use zoning bylaws within the Project Study Area as it is located in the 'Rural General Zone'. The Project is located between District 5 (Point of Interconnection) and District 6 (turbine placement). The councillors for these areas are Lloyd Gibbs and Karen MacKenzie, respectfully.

Karen MacKenzie was first contacted by the Proponent in February 2012 and was in attendance as councillor when the Proponent presented on January 24, 2012.

Lloyd Gibbs became councillor for District 5 in late 2012. He was first contacted by the Proponent on March 6, 2013. Numerous meetings, both in person and on the phone have taken place since. Mr. Gibbs attended the Proponent's home in Dalhousie to experience the residence at 175m, 225m, and 32 other distances to turbines (very close to wind turbines).

The Project is located in designated Provincial District 10: Colchester-Musquodoboit Valley. The Member of Legislative Assembly for this area has been consulted regarding the planned Project. The MLA was Gary Burrill. The Proponent first met with Mr. Burrill in March 2012**.** This meeting was to describe the Project and the COMFIT process, the EA process, and to introduce the proposal to the MLA. Contact has been maintained since that time with email, telephone correspondence and the MLA attending two of the Proponent's Open Houses.

On October 8, 2013, a new MLA was elected: Larry Harrison.

The Municipality of Colchester developed a Wind Turbine Development Bylaw in 2009 which applied to all lands within the Municipality of the County of Colchester. Setbacks had been established for large scale (greater than 100 kW) and small scale (equal to or less than 100 kW but not less than 1 kW) wind turbines. The setback distances are listed in Table 3.4. In addition to the setback bylaws, the County of Colchester regulated the finish of the wind turbine, lettering and signage, tower accessibility and safety, lighting, test towers and outdoor storage.

Table 3.4 Municipality of the County of Colchester 2009 Bylaw Setbacks

Scale	Boundary	Distance
Large	Setback from an external property line and public roads	One times the total height of the turbine with blades in vertical position – does not apply where the adjoining property is part of the wind power project

Table 3.4 Municipality of the County of Colchester 2009 Bylaw Setbacks

Scale	Boundary	Distance
Large	Setback from an external property line and public roads	One times the total height of the turbine with blades in vertical position – does not apply where the adjoining property is part of the wind power project
Large	Setback from existing dwelling on a neighboring property	700 m*
Small	Setback from an external property line	two times the height of the turbine – does not apply where the adjoining property is part of the wind power project

*May request a reduction of the 700 m setback down to a minimum 500 m with written permission from the neighboring property owner.

Originally this Project was proposed to be between 700 and 800 meters from houses. When local residents vocalized opposition to another development in the county based on the setback distance, the Proponent decided to move the Project from the original site to where it is now proposed. When re-siting the turbines, the distance was increased to over 1km from non-adjoining property houses.

In August 2012, the Colchester Municipal Council requested that the Planning Advisory Committee re-visit the turbine bylaw and adjust for various factors. In September 2013 the PAC recommended a new version of the bylaw, which was approved by municipal council. On September 26, 2013 the bylaw passed first reading. On October 30, 2013 the bylaw passed its second reading.

On September 25, 2013, the Proponent received a hard copy of the draft bylaw from the County. The setback distance from homes was increased from 700m (with option to reduce to 500m) to 1000m (with option to reduce to 700m). A sound limit was added which limits the maximum sound output from a wind turbine at a house to 36 dBA. Public consultation with the creation of a Community Liaison Committee to be chaired by the 'local councillor' was added. Various specific topics to be addressed by the Proponent include notification, information mail-outs, and information meetings including specifications on timing, placement, and content are included in the new bylaw. Decommissioning planning and proof of acceptance by the landowner was added. Penalties for offences are laid out.

The development licences for Greenfield require approval of an environment assessment in order to have the application considered complete.

Table 3.5 Municipality of the County of Colchester 2013 Bylaw Setbacks

Scale	Boundary	Distance
Large	Setback from an external property line and public roads	One times the total height of the turbine with blades in vertical position – does not apply where the adjoining property is part of the wind power project
Large	Setback from existing dwelling on a neighboring property	1000 m*
Small	Setback from an external property line	two times the height of the turbine – does not apply where the adjoining property is part of the wind power project

*May request a reduction of the 1000 m setback down to a minimum 700 m with written permission from the neighboring property owner.

3.4 MI'KMAQ ENGAGEMENT

During 2011, 2012, and 2013 the Proponent communicated with representatives from the Mi'kmaq Rights Initiative (KMK) as well as the Confederacy of Mainland Mi'kmaq (CMM), and the Native Council of Nova Scotia (NCNS) to facilitate early, meaningful consultation with the Nova Scotia Mi'kmaq.

The Confederacy of Mainland Mi'kmaq (CMM) was commissioned to conduct a Mi'kmaq Ecological Knowledge Study (MEKS) for Dalhousie in 2008 and the Proponent has engaged AMEC Environmental to complete an MEKS for the Greenfield Project (Appendix B). The Greenfield MEKS identified land and resource use which is of particular importance to the Mi'kmaq people with respect to the Greenfield Project as well as identified and documented ecological knowledge which may be significant to the Project. As part of the EA review process, NSE will invite various Mi'kmaq organizations to review and comment on the EA document. Although the Project Study Area in the MEKS for Dalhousie includes the Greenfield Study Area in general; updated site specific studies, as well as improved knowledge gathering techniques have been applied for the new survey.

3.5 SUMMARY OF CONSULTATION AND MI'KMAQ ENGAGEMENT

Tables 3.6 and 3.7 summarize the various consultation and Mi'kmaq engagement efforts, respectively, conducted in support of the Greenfield Project.

Table 3.6 Consultation Efforts Conducted in Support of Greenfield

Association/Contact	Dates	Topic	Comments
Government Stakeholders			
Transport Canada	November – December 2011, June	Regulatory approval process	• Submitted Aeronautical Obstruction Clearance Forms and received approval of lighting plan as well as Aeronautical Obstruction Clearance (Appendix A)

Table 3.6 Consultation Efforts Conducted in Support of Greenfield

Association/Contact	Dates	Topic	Comments
	2013		• Submitted updated coordinates for review and alteration to existing approval (Appendix A)
NAV Canada	December 2011-May 2012 June 2013	Email and telephone correspondence with respect to civilian radar and air navigation equipment	• Submitted application to NAV Canada (Land Use Submission Form) and received approval on May 4, 2012 (Appendix A) • Submit request for extension of one-year approval (pre-construction approval expires after one year) (Appendix A)
DND	September - October 2013	Email correspondence with respect to existing radio-communication systems	• Project layout and coordinates sent for review and comment • DND responded in late October 2013 that they do not anticipate any interference with the Project (it is outside of the 100km consultation zone) (Appendix A)
RCMP	September - October 2013	Email correspondence with respect to existing radio-communication systems	• Project layout and coordinates sent for review and comment (Appendix A)
Environment Canada	September - October 2013	Email correspondence with respect to weather radar interference	• Project layout and coordinates sent for review and comment • Environment Canada (Meteorological Service of Canada) responded in early October 2013 that any potential interference created by the Project, based on the current plans, would not be severe and therefore they do not have any strong objections to the Project (Appendix A)
Canadian Coast Guard	September - October 2013	Email correspondence with respect to vessel traffic systems radars	• Project layout and coordinates sent for review and comment • Response received stating that the Canadian Coast Guard does not have any communications or radar sites in the vicinity of the proposed location of the Project and therefore they do not expect any interference issues (Appendix A).
Province of Nova Scotia Integrated Mobile Radio System	September - October 2013	Email correspondence with respect to existing radio-communication systems	• Project layout and coordinates sent for review and comment (Appendix A)
Nova Scotia Environment Nova Scotia Department of	February, March, April and May 2013	Telephone conversation, meeting	• Discussion to introduce/ verify the Project and seek input for scope and any potential issues. Discussion re: VEC scoping, Project siting, birds and bats, and mainland moose • Discussed moose survey results, bat

Table 3.6 Consultation Efforts Conducted in Support of Greenfield

Association/Contact	Dates	Topic	Comments
Natural Resources, Species at Risk Biologist			study necessity, bird survey results • General concerns throughout Nova Scotia regarding wildlife and preferred methods of mitigation • Wetland avoidance
Nova Scotia Transportation and Infrastructure Renewal (TIR) (*Colchester County)*	March 2013 to present	Regulatory approval process	• Application in process for access roads to Roadway within a highway right-of-way
Colchester County Municipal Development Officer and Chief Administrative Officer	November 2011 to present	Regulatory approval process	• Development permits for the turbines discussed • Scheduled presentation to Council on January 26, 2012, July 31, 2013 and September 26, 2013. • Numerous phone, in person conversations, attendance to meetings about bylaw and potential amendments
Public Consultation			
Local Landowners	August 2011 to present	Visits to homes by Proponent, phone calls and emails.	• Door to door visits, meetings, open house information sessions, PAC meetings, and site tours: results of numerous consultations found in section 3.2
Local Interest Groups	Ongoing	Local interests	• During the operations phase of the existing Dalhousie facility, numerous field trips and site visits/ tours have taken place for local public schools, TUNS engineering department, NSCC classes and other organizations. This trend will continue with the development and operations phase of Greenfield • Having the Proponent as a local homeowner, farmer, and landowner maintains the local aspect of approachability by certain groups interested in visiting the wind farm. • The Proponent has spoken at several dozen local schools, business groups, organizations and conferences about the existing and proposed wind farms and the wind energy industry and will continue to do so into the future. • The Proponent resides in a home located 175m, 225m, 500m and 700m from turbines and is asked to speak to and allow groups to visit to understand facts
Salmon River District Volunteer Fire Department	ongoing	Community benefits, safety	• One of the Proponent's roles in the community will be to provide monetary support to organizations and charities that are within the vicinity of the Project area. The fire department will be approached with helping the Proponent delegate the annual funds to better serve the members

Table 3.6 Consultation Efforts Conducted in Support of Greenfield

Association/Contact	Dates	Topic	Comments
			of the community. • The Proponent has an Emergency Response Plan that has been implemented and practiced at Dalhousie facility. The same plan will be in place for Greenfield and the fire department will be educated on the practises and contacts necessary for keeping the wind project operating safely if malfunctions or accidents occur.
Truro Daily News	May, June 2013	Community concerns	• The Proponent has been interviewed several times to provide answers to gain insight into potential risks associated with the construction and operations of windmills

Table 3.7 Mi'kmaq Engagement Efforts Conducted in Support of Greenfield

Association/Contact	Dates	Topic	Comments
Mi'kmaq Rights Initiative (KMK)	September and December 2011, May and June 2012, June, July, October 2013	Mi'kmaq interests	• In person conversation with KMK discussing COMFIT projects and up to date consultation with CMM, MAPC • Provided KMK detailed project description • Invited KMK to Open House • Provide detailed discussion regarding MEKS for Greenfield, results and timing of surveys, interviews and general information • Attendance at Knowledge Circle for MEKS
Confederacy of Mainland Mi'kmaq (CMM)	December 2011, May and November 2012, February, March 2013	MEKS	• Proponent engaged CMM in November 2012 for a proposal to conduct MEKS • Proponent will have MEKS conducted by AMEC with active participation of all Nova Scotia First Nations, including CMM
Maritime Aboriginal People's Council (MAPC)/ Native Council of Nova Scotia (NCNS)	May 2012, March 2013	Mi'kmaq interests	• Met with Roger Hunka and discussed vegetation and wildlife survey intent • Will provide Mr. Hunka and staff of construction timelines and results of studies to ensure any harvesters are aware of the Proponent's activities.
Local Band Council (Millbrook First Nation)	October 2011 to November 2012	Mi'kmaq interests	• Proponent sent detailed project description to KMK for distribution to local council (KMK requests info go to them, not directly to local council) • Local council aware of Proponent's COMFIT projects

Table 3.7 Mi'kmaq Engagement Efforts Conducted in Support of Greenfield

Association/Contact	Dates	Topic	Comments
			• Proponent offered site visit of Dalhousie to Council members

3.6 SUMMARY OF EMI STUDY

The table below summarizes the consultation timing and responses for the EMI Study for the Greenfield Project. All correspondence is available in Appendix A.

Table 3.8 Communication Summary for EMI for Greenfield

Agency	System	Notification Sent	Response Received		Issues
DND	Communication	03-Oct-13	04-Oct	Kirk	No Issues
	Radar	03-Oct-13	04-Oct	Kirk	No Issues
RCMP	Communication	03-Oct-13		Kirk	
Canadian Coast Guard	Communication	03-Oct-13	04-Oct	Kirk	No Issues
Environment Canada	Radar	03-Oct-13	08-Oct	Kirk	No Issues
NAV Canada	Radar	06-Jan-12	22-May-12	Lisa	Land Use Approval (and extension of approval June 2013)
NS Transportation	Communication	03-Oct-13	08-Oct	Kirk	No Issues
CBC	Communication	04-Oct		Kirk	
Aeronautical Lighting	Navigation	16-Nov-11	22-Dec-11	Lisa	Lighting Plan Approval (continued approval for updated locations in June 2013)

4.0 SCOPE OF THE ASSESSMENT

The following section provides the scope of the Project to be assessed as well as the factors and scope of factors to be assessed. The methods used for the EA are also described.

4.1 SCOPE

The scope of the Project to be assessed includes:

- surveying activities, such as identifying location of wind turbines;
- clearing of vegetation;
- constructing and upgrading access roads, including installation of culverts as required;
- delivery of equipment and materials including the wind turbines, foundation materials, electrical cables and ancillary equipment;
- foundation construction;
- wind turbine installation;
- electrical cabling installation (*i.e.,* installation of 25 kVA above ground collection system);
- operation and maintenance of the Project; and
- decommissioning of the turbines and the overall Project.

The potential effects of accidents and malfunctions are also considered within this EA, as are the potential cumulative effects of this Project in relation to other projects/activities in the regional area. The potential effects of the environment on the Project are also addressed.

Environmental assessments are typically organized and focused according to Valued Environmental Components (VECs) which are those biophysical and socioeconomic elements that are of particular importance to the Proponent, as well as public and regulatory stakeholders involved in the assessment process. This EA evaluates the potential environmental effects of the proposed Project elements and activities, for all Project phases, with regard to each VEC. By assessing potential impacts on VECs within the study boundaries, a meaningful evaluation of Project effects on relevant environmental aspects is achieved. VECs evaluated for this assessment include:

- soil;
- surface water quality;
- aquatic environment;
- terrestrial vegetation;
- wildlife (including birds, mammals, reptiles and amphibians);
- archaeological and heritage resources (including Aboriginal interests);

- existing and planned land use;
- local community;
- visual aesthetics;
- sound;
- permits and other approvals;
- recreation and tourism; and
- public health and safety.

4.2 METHODS

The 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 or net) effects, rather than unmitigated potential effects. The significance of residual or net effects of the Project was determined using the following criteria, based on federal and provincial EA guidance:

- value of the resource affected;
- magnitude of the effect;
- geographic extent of the effect;
- duration and frequency of the effect;
- reversibility of the effect; and
- ecological and/or social context.

A significant adverse effect is defined as a permanent change in the quality or condition of a component of the environment. It must be spatially and temporally extensive and not within acceptable limits in terms of magnitude or nature based on guidelines, standards and professional judgement. The potential level of impact (*i.e.,*adverse environmental effect) after mitigation measures (*i.e.,* net or residual effects) are identified based on NRCan's criteria and definitions provided in "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the *Canadian Environmental Assessment Act*" (NRCan 2003), presented below in Table 4.1.

Table 4.1 Definitions for the Level of Impact After Mitigation Measures

Level	Definition
High	Potential impact could threaten sustainability of the resource and should be considered a management concern. Research, monitoring and/or recovery initiatives should be considered.
Medium	Potential impact 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 impact may result in a slight decline in resource in study area during the life of the Project. Research, monitoring and/or recovery initiatives would not normally be required.
Minimal	Potential impact may result in a slight decline in resource in study area during construction phase, but the resource should return to baseline levels.
N/A	There is no interaction possible between the Project activity in question and the associated potential adverse effect.

Source: *Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act* (NRCan 2003)

Issues scoping is a critical first step in the EA process to ensure completeness and focus for the EA process. The issues scoping process included the following activities:

- review of regulatory guidelines;
- public and agency consultation;
- literature and background information review;
- field studies; and
- professional judgment of the Study Team.

The following sections discuss these activities in more detail.

4.2.1 Regulatory Guidelines

As an energy generating facility that has a production rating of at least 2 MW derived from wind, this Project is a Class I Undertaking as defined in Schedule A of the Nova Scotia Environmental Assessment Regulations and as such requires an EA registration. The Proponent's Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment Registration Document (NSE 2007, updated 2012) provides guidance on EA approach and issues scoping and was used extensively to guide the EA for this Project. Additional provincial legislation and policies that influenced this EA include the *Endangered Species Act,* Activities Designation Regulations, Nova Scotia *Wetlands Conservation Policy* (NSE 2011a), *Mi'kmaq Ecological*

Knowledge Study Protocol (November 2007), Nova Scotia Sediment and Erosion Control Handbook, and the *Operational Bulletin Respecting the Alterations of Wetlands* (NSE 2006).

Regulatory guidance for this Project was also obtained from several federal documents, including:

- *Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act* (NRCan 2003).
- *Wind Turbines and Birds – A Guidance Document for Environmental Assessment* (Environment Canada 2007a).
- *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (Environment Canada 2007b)
- *Cumulative Effects Assessment Practitioners Guide* (Canadian Environmental Assessment Agency 1999)
- *The Responsible Authority's Guide* (Canadian Environmental Assessment Agency 2003).

In addition to these regulatory guidelines, federal legislation has also been used to guide the EA in terms of issues scoping, effects assessment and mitigation requirements, including, but not limited to the *Species at Risk Act* (*SARA*) and *Migratory Birds Convention Act, 1994*.

4.2.2 Literature Review

For this EA, existing information was collected from a number of sources including, but not limited to:

- municipal documentation from the Municipality of the District of Colchester;
- 1:20,000 aerial photos;
- 1:10,000 Nova Scotia Base Mapping;
- NSDNR wetland inventory mapping;
- Atlantic Canada Conservation Data Centre (ACCDC);
- Nova Scotia Department of Tourism and Culture; Heritage Division
- reports, books and other materials on the area's natural history and geology (Section 10);
- reports, books and other materials relative to wind turbine developments and environmental effects (Section 10); and
- information available at selected websites (*e.g.*, Statistics Canada, Bird Studies Canada, Canadian Wildlife Services, Nova Scotia Government: Abandoned Mines and Shafts Inventory, *Species at Risk Act* registry).

4.2.3 Field Studies

Field studies are aimed at characterizing the natural and socio-economic environment of the Study Area. This work included:

- spring, summer, winter and fall avian monitoring (2012-2013);
- bat monitoring (August and September 2013);
- vegetation surveys (June and July 2013);
- aquatic surveys (May and June 2013); and
- site visits to support the visual impact assessment and characterization of socio-economic environment (July, September and October 2012, April, May - ongoing 2013).
- rare plant surveys within planned turbine footprints during detailed planning and design (including Aboriginal traditional plant survey) (June and July 2013);
- Moose PGI surveys (Fall 2012 and Spring 2013);
- Mi'kmaq Ecological Knowledge Study; and,
- archaeological survey (including Aboriginal significance).

4.2.4 Professional Judgment

Project personnel involved in the completion of this EA are trained, professional biologists, scientists, planners, wind generation developers and operators, and/or EA practitioners. Professional judgment was exercised through the selection of environmental components and in the evaluation of environmental effects in this report. The use of professional judgment in EA practice is widely accepted and complements the aforementioned scoping techniques.

4.3 SPATIAL AND TEMPORAL BOUNDARIES OF THE ASSESSMENT

For this Project, the assessment of effects was undertaken for the area identified as the Project Study Area (see Figures 1.1 and 1.2), unless otherwise identified. Use of the term "Project Study Area" is meant to signify site development areas for the wind farm that will be physically impacted/ altered for the construction and/or operation of the wind farm (roads and turbine layout areas). For the purpose of data collection of the socio-economic environment, the Municipality of the District of Colchester was also considered. The temporal scope of this assessment covers the construction, operation and decommissioning phases of the Project, which is expected to extend over the next 25 years.

5.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

5.1 GEOPHYSICAL ENVIRONMENT

The following sections outline the geophysical environment of the Study Area including the physiography and topography, surficial geology, bedrock geology, and hydrogeology of the area. These observations are based on a review of publically-available regional resource mapping as well as multiple site reconnaissance required to identify specific issues at the individual turbine sites. Detailed geotechnical investigations will be conducted at each turbine site prior to construction.

5.1.1 Physiography and Topography

The Project is located west of the Colchester County line, in District 6 (see Figure 1.2 and 5.1). The turbines will be located at the highest points on the surrounding hilly area. To the north and east of the Project are parcels of Crown land. To the west is a cattle farm and sparsely populated rural areas. To the south of the Project are previously cleared forested areas. The proposed turbines take up approximately 1-1.5 ha each (including access roads) and with the Project containing just two machines, the footprint of disturbed area including upgraded roads and previously cleared areas is roughly 3 hectares.

This area is characterized by hills and valleys, with many farms and residential settlements taking over the previously forested areas.. Elevations range from 70m in the low valley to in excess of 200 m in the uplands. Drainage at Greenfield is primarily to the west and southwest towards tributaries to the Salmon River watershed. The one water course required to be crossed for Greenfield is a tributary west of the Project to Christie Brook.

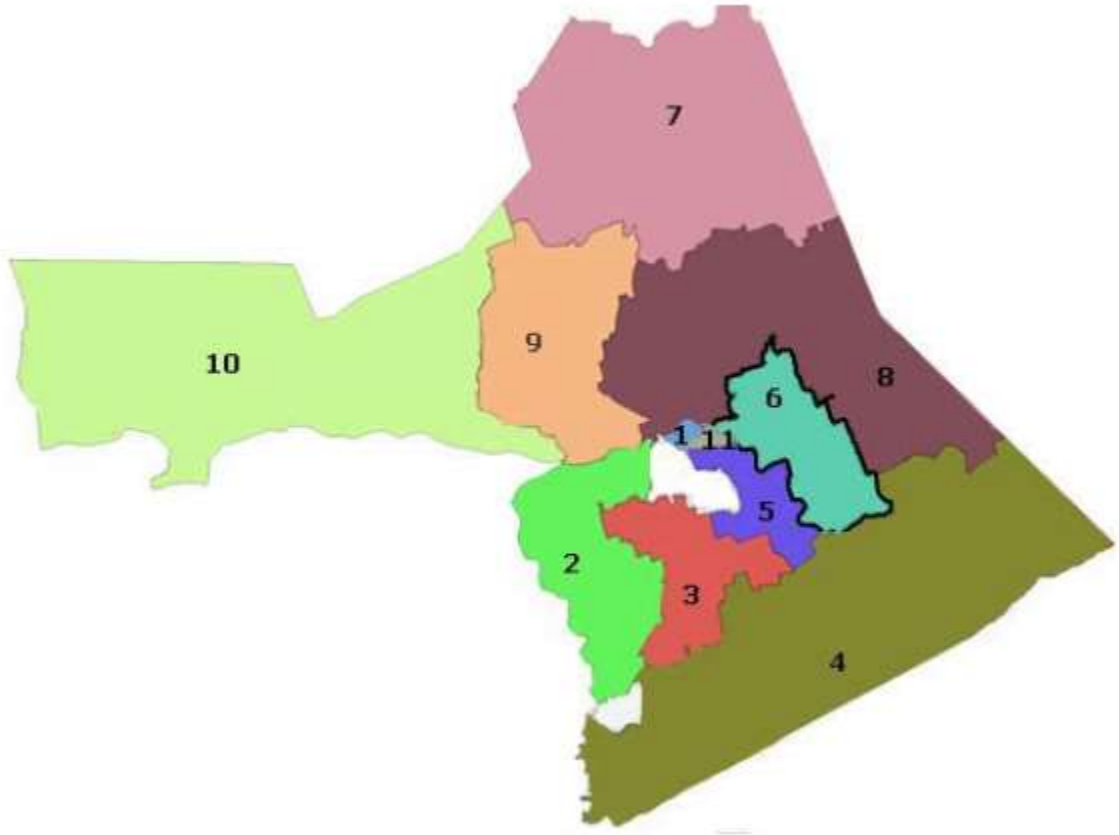
5.1.2 Surficial Geology

The Project Study Area is directly on the Greenfield Anticline. The turbines will be constructed in the *Graham Hill Formation* which is made up of red and maroon weathering, finer grained litharenite to feldspathic litharenite and siltstone with thick intervals of grey weathering, interstratified, coarser conglomerate. Clasts include quartz, mica, intra-formational siltstone (0.5 – 1 cm), and flow-banded rhyolite (Neily *et al.* 2003).

5.1.3 Bedrock Geology

The specific bedrock geology of the individual turbine sites and access roads will be determined upon excavation and/or drilling for foundation design. Due to the very small impact area of the Project, assessing the bedrock geology based on available literature can only be estimated and is not useful in the Project Study Area description.

Figure 5.1 Colchester Municipal District Map with District 6 Outlined



5.1.4 Hydrogeology/Groundwater

The project is located over 1300m from the nearest residential water well. The foundations for the turbines will be no deeper than 2.4 meters from ground elevation. The hydrogeology/ groundwater for this area do not have the potential to be adversely affected.

5.2 AQUATIC ENVIRONMENT

The project study area contains one water crossing that will most likely need to be replaced. It is located along the farm road and was in bad repair in 2011 when the initial site walk-through took place (Figure 1.2). Currently the water crossing is sized appropriately for the delineated drainage area; however, it may prove to require upgrading to carry the oversized loads delivering turbines and ancillary components. During construction, should the crossing be determined to be insufficient for project activities, the watercourse alteration will follow best practices outlined in the Nova Scotia Environment Watercourse Alteration Certification Training Manual will be applied and will fall under the certificate holder's blanket approval for 2014.

Best practises include but are not limited to the following: pump around of water to transfer from up to down-stream; a properly sized fish screen attached to the intake end of the water hose; any fish located pooling in the upstream temporary pooling area will be transferred to the

downstream without being out of water and overseen by a biologist; proper sedimentation and erosion control measures shall be implemented to limit oxygen deprivation of water on the outtake end; all work will be done in the dry; no deleterious materials will be released into the watercourse (*i.e.,* fueling/ maintenance will not take place within 30m of a watercourse).

The Aquatic Environment section summarizes the results of research and aquatic field surveys conducted by Ross Hall from April to August 2013, as well as Sean Blaney during the June 2013 botany survey along the proposed Project access road corridors. This work was undertaken, in part, to identify potential triggers under *CEAA* associated with the proposed wind farm development as well as to provide baseline information for the fish and fish habitat existing conditions. In particular, the surveys were carried out to identify fish habitat within the Project Study Area at the one watercourse with the potential to interact with the Project through an existing access road crossing location and in particular, identify potential access road crossings that may require Authorization under the federal *Fisheries Act* associated with Harmful Alteration, Disruption or Destruction (HADD) of fish habitat. Field investigations also evaluated the potential for any water crossings to require Authorization under the *Navigable Waters Protection Act (NWPA).* The aquatic habitat assessment information was used to support future evaluation of design options or crossing structures and to develop mitigation measures to avoid *HADD*.

Watercourses with the potential to interact with the Project were identified through a review of 1:10,000 maps in relation to the proposed Project at the time of the survey.

One potential watercourse crossing was identified from the existing mapping and known turbine layout. No additional potential watercourse crossings were identified in-field. It is estimated that the Project will require constructing or upgrading no other water crossing locations.

This crossing is a tributary (Figures 5.2 and 5.3) to Christie Brook. Christie Brook flows to join the Salmon River. The tributary by the farm is shallow and becomes almost dry in periods of low rainfall as through August 2013. However there is high flow after significant rainfall events as occurred in early September 2013. Substrate is cobble and gravel. Electric and conventional fencing keeps cattle from the stream. The proposed wind turbine locations are easterly and 1.3 km to 1.8 km distant from this brook. Access to the turbine site is past the farm buildings and over this brook.

Figure 5.2: Tributary to Christie Brook with existing road culverts for potential upgrades for delivery of equipment.

Figure 5.3: Tributary with existing water-crossing after heavy rains in September 2013

5.2.1 Species of Conservation Concern

There are two freshwater fish species and one mussel species in Nova Scotia with special conservation status as designated by *SARA*:

- Atlantic whitefish (*Coregonus huntsmani*) – Endangered;
- Atlantic salmon (inner Bay of Fundy (iBoF) population) (*Salmo salar*) – Endangered; and
- Yellow lampmussel (*Lampsilis cariosa*) – Special Concern.

The Atlantic Whitefish and the Yellow Lamp Mussel do not occur in watercourses in Central Nova Scotia and are not a concern at Greenfield.

The Salmon River, into which the tributary of Christie Brook flows, once supported a large population of the genetic distinct inner Bay of Fundy (iBoF) Atlantic Salmon. Fry or parr stages of Atlantic Salmon perhaps did or could occur within the small tributary where a stream crossing needs improvement. In most likelihood, and unfortunately, the iBoF salmon population is gone from the Salmon River watershed. A COSEWIC 2010 evaluation and a Department of Fisheries report (DOF, 2008) states the iBoF Salmon population once bred in 32 rivers tributary to the inner Bay of Fundy, from just east of the Saint John River, to the Gaspereau River in Nova Scotia; however, spawning no longer occurs in most rivers. The population, which is thought to have consisted of about 40,000 individuals earlier in the 20th century, is believed to have been fewer than 200 individuals for the total 32 watersheds tributary to the Bay of Fundy in 2008. Survival through the marine phase of the species' life history is currently extremely poor, and the continued existence of this population depends on a captive rearing program.

No electro-seining or other sampling was done at the study area since (1) it would be inappropriate and (2) illegal for a potentially occurring SARA species.

A possible improvement to a stream crossing by the proponent makes the recognition that the tributary is Salmonid habitat (Brook Trout and potentially Atlantic Salmon) and best management practices are undertaken to protect the fish resource.

Significant Wildlife and Habitats

For the purpose of this EA, Wildlife is defined as all wild mammals, birds, reptiles, amphibians, fish, invertebrates, plants, fungi, algae, bacteria, and other wild organisms.

Potential effects of industrial undertakings on wildlife species and habitats need to be identified and addressed in environmental assessments.

Any industrial development, including an undertaking for a wind turbine, has a potential in some way to affect flora and fauna, yet it is essential to keep any impact as very minimal and that no impact occur for species that are considered endangered, threatened, or of special concern. The document Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (Nova Scotia Environment November 2005, Revised September 2009) provides guidance for safe guarding sensitive wildlife and habitat.

A key message contained within this guide is that the focus for EA documents is to be on priority species and habitats.

Priority Species

Priority species to consider are (1) Species considered Endangered, Threatened, or of Special Concern by the Committee on the endangered Wildlife of Canada (COSEWIC) and the Federal Species-at Risk Act (SARA 2003); (2) Species listed as Endangered, Threatened, or Vulnerable by the Nova Scotia Endangered Species Act (NSESA 1999); Species of Conservation Concern identified in Nova Scotia General Status of Wildlife Species (NSGSWS). (Note: Mark Elderkin, DNR Species at Risk Biologist provides a link to a more up-to-date NSGSWS. This is *Wild Species - General Status of Species in Canada.* The Wild Species report provides an overview of the status of Canada's species. It brings the results of provincial, territorial, and federal monitoring efforts onto a single platform for the first time. http://www.wildspecies.ca/. Appendix 1 explains these status rankings).

Significant Habitats

Wildlife species are dependent on habitat. Each wildlife species has behavioral and physical adaptations that are a reflection of the habitat that it exploits. Some species live within specialized habitats and, especially for these, loss of habitat is a major reason why some species have become Species at Risk or Species of Conservation Concern. During an undertaking it is essential to identify and protect significant habitats.

Significant Habitats include:

1. Sites where species of risk or other species of conservation concern can be found and/or;,
2. Sites where unusually large concentrations of wildlife occur and/or;
3. Habitats that are rare in the province.

Managed Areas:

Managed areas include such areas as Provincial Parks or Wildlife Management Areas and usually have a legal designation.

Aquatic Habitats

Many Aquatic Habitats are Significant Habitats for the reasons described above; and additionally all aquatic habitats are sensitive habitats. Lakes, watercourses and wetlands provide habitat for many water adapted and water dependent species. Aquatic habitats are easily degraded and require special attention during an Environmental Assessment. The wildlife that lives and is constrained within aquatic environments is vulnerable. Additionally, there is wildlife that has both a terrestrial and an aquatic life history. Hence wildlife richness is

proportionally greater on the borders of aquatic habitats. Besides their value to wildlife, wetlands provide a diversity of other ecosystem services.

COSEWIC Fish Species of Conservation Concern

American eel (*Anguilla rostrata*) was assessed in 2012 as Threatened by COSEWIC. While this species is not currently afforded the additional protection of a *SARA* designation, there is potential in the future for the species to be listed by the Act. Adult American eel normally inhabit mud bottomed lakes and rivers. The occurrence of this species in the small tributary to Christie Brook is unlikely.

Provincial Fish Species of Conservation Concern

Based on habitat evaluation and observation of a landowner Brook Trout (*Salvelinus fontinalis*) does occur in the Christie Brook Tributary. The NSDNR lists this species as sensitive. A possible improvement to a stream crossing by the proponent makes the recognition that the tributary is Salmonid habitat (Brook Trout and potentially Atlantic Salmon) and best management practices are undertaken to protect the fish resource.

Table 5.1 Priority Fish Species Listed within 100 km. NS status (2010) as determined from Wild Species - General Status of Species in Canada. Also listed NSESA, COSEWIC, SARA status.

Common Name	Scientific Name	NSGSWS 2010	Habitat	Occurrence
Atlantic Salmon (Inner Bay of Fundy)	*Salmo salar*	May Be At Risk COSEWIC: Endangered (2010) NSESA: SARA: Endangered (2010)	Has a complex life cycle requiring shallow, rapidly-flowing water of streams with gravel substrates for spawning and for growth of parr. Parr can move into smaller stream tributaries during their 2-3 years in fresh water.	Unlikely
Brook Stickleback	*Culaea inconstans*	Sensitive	Lives in the weedy or grassy portions of steams or small bog lakes. Only one NS record in Cumb. Co. (Gilhen, 1974).	Unlikely
Pearl Dace	*Marganiscus margarita*	Sensitive	Inhabits boggy lakes and streams. Known only Cumb., Pictou, and Lake Ainslie, CB (Gilhen, 1974).	Unlikely
Brook Trout	*Salvelinus fontinalis*	Sensitive	Occurs in well-oxygenated waters of lakes, and streams. Often seeks pools during season of warm and low water.	Possible
Gaspereau	*Alosa pseudoharengus*	Sensitive	Enter freshwater in lakes and quiet stretches of streams to spawn in June. Adults move back to sea. Young move into brackish water during August and September.	Unlikely
American Eel	*Anguilla rostrata*	Secure(2005) COSEWIC: Special Concern(2006) Threatened (2012)	This catadromous fish spawns at sea. Larval stage or elvers migrate into freshwater streams, transform to adult shape, and grow up to a lengths of 1 metre. Mature eels return to the sea to spawn. In freshwater inhabit mud-bottomed lakes and rivers.	Unlikely

The elevated locations for planned wind turbines on a hill top and are not near any fish habitat. Fish habitat does occur in a tributary of Christie brook. In building an access road to the turbines, a stream crossing improvement is perhaps necessary over this brook. The tributary behind the farm is shallow, becoming almost dry in times of little rainfall. Stream bottom behind

the farm is cobble. Livestock is fenced from entering the stream. The landowner, a farmer and long-time resident along this tributary, states that Brook trout do occur in this tributary. Any improvement to the existing stream crossing will be done with the recognition that the tributary is Salmonid habitat and the work done in the manner necessary for the protection of fish species.

5.2.1.1 Freshwater Mussels

Seven species of Freshwater Mussels are considered for possible impact by the proposed wind turbines. The biologist making this determination has experience in freshwater mussel fieldwork and has contributed data to ACCDC (Hall, 2003).

There are no lakes or streams close to the actual positions of the proposed wind turbines at the Greenfield site and no freshwater mussel habitat or population is here affected. The shallow tributary of Christie Brook which is prone to becoming dry in seasons of no rainfall is unlikely to have freshwater mussel. Nedeau et al. (2000) states that river-living mussels prefer stream depths ranging from one to 30 feet. In smaller streams freshwater mussels will not survive if streams periodically become dry or if in winter shallow stream bottom is exposed to ice scouring.

That said, any improvement work on a stream crossing is a short term disruption. The construction would incorporate means to prevent short and long-term siltation of the tributary necessary for protection of both fin fish and shell fish.

Table 5.2 Freshwater Mussels. Priority Species within 100 Km. NS status (2010) as determined from Wild Species - General Status of Species in Canada. Also listed NSESA, COSEWIC, SARA status.

Common Name	Scientific Name	NSGSWS 2010	Habitat	Occurrence
Squawfoot (Creeper)	*Strophitus undulatus*	May Be At Risk (2010)	Found only in streams and rivers in Maine but reported in lakes elsewhere. Only present known location in Nova Scotia is in a lake near Oxford. Sand and fine gravel substrates.	Unlikely
Delicate Lamp Mussel (Tidewater Mucket)	*Lampsilis (Leptodea) orhracea*	Sensitive (2010)	Coastal lakes, ponds, and slow-moving portions of rivers, including artificial impoundments. Substrates variable and includes silt, sand, gravel, cobble, and occasionally clay. Nova Scotia occurrences in lakes near NS-NB border.	Unlikely
Yellow Lamp Mussel	*Lampsilis cariosa*	May Be At Risk COSEWIC: Special Concern (2004) NSESA: Threatened (2006)	Seems to prefer medium to large rivers. Found in lakes and impounded sections of rivers. Substrates include silt, sand, gravel, and cobble. Only known	Unlikely

			occurrences in Nova Scotia on Cape Breton Island.	
Brook Floater (Swollen Wedge Mussel)	*Alasmidonta variosa*	Sensitive (2010) COSEWIC: Special Concern (2009) NSESA: Threatened (2013)	Flowing habitats from small streams to large rivers. Not in high-gradient, fast water flow, nor usually in slow water. Generally thought to prefer coarse sand and gravel substrate.	Unlikely
Triangle Floater	*Alismidonta undulata*	Secure (2010)	Most frequently in streams and rivers, although sometimes lakes and streams. Most frequently on sand and gravel substrate.	Unlikely
Eastern Lampmussel	*Lampsilis radiata*	Sensitive (2010)	Small streams, large rivers, ponds, and lakes. Prefers sand or gravel substrate. Best known in lakes of north eastern Nova Scotia where it can occur in large numbers.	Unlikely
Eastern Pearlshell	*Margaritifera margaritifera*	Sensitive (2010)	Streams and small rivers that support salmonids. Prefers sand, gravel, or cobble substrates.	Unlikely

5.2.2 Surface Water

The Project is situated on the ridge line that divides water-flow. The elevation of the water crossing at Greenfield is about 117m asl while the turbines sit at about 200m asl. The water crossing is over 1400m from the turbines. The current conditions do not guide water-flow in any specific direction through or around the cattle grazing field. At the bottom of the field is the stream. The Project is unlikely to result in an interaction with surface water levels except for improvement to the ditching and collection systems so as to limit the amount of waste the water travels to on route to the stream. Nor is the Project likely to result in an alteration of surface water regimes within the Project Study Area or watershed, therefore, existing water withdrawal permits in the watershed were not addressed.

Water quality within the Project Study Area can be described as temperate and slightly acidic with low conductivity, based on conditions observed during the field assessments. These conditions are typical to Nova Scotia. Since the Project Study Area is underlain by the Graham Hill Formation bedrock and not Halifax formation slates, acid generating rock is not anticipated to be a risk during the construction activities.

5.2.3 Watercourse Crossings Summary

The physical habitat, water quality and fish population assessments confirmed that the watercourses/ drainage channel crossed by the proposed access road in the Project Study Area is a stream that supports species of salmoniod fish.

The single water crossing identified through the desktop review and field assessments is anticipated to require a crossing structure that facilitates fish passage, reduces habitat loss, and improves existing water quality. Best practices in culvert installation will be implemented with proper sizing, material and sedimentation and erosion control methods used.

5.2.4 Navigable Waters

The Navigable Waters Protection Program (NWPP) ensures the public's right to navigate Canada's waters without obstruction. This is accomplished through the administration of the *Navigable Waters Protection Act (NWPA)*. The *NWPA* is a federal law designed to protect the public right of navigation. In order to minimize the impact to navigation, the NWPP ensures that works constructed in navigable waterways are reviewed and regulated. There is not any navigable watercourse identified in the Project Study Area. Therefore, no authorization is required under *NWPA* for any of the watercourses in the Project Study Area.

5.3 TERRESTRIAL ENVIRONMENT

The terrestrial environment section details the flora and fauna, including any species of special conservation concern, which may be present within the Project Study Area. A desktop review is done to identify priority species within a 100km radius of the proposed development area. Information sources for this are the NS Department of Natural Resources Significant Habitat (SigHab) database, contact with the Nova Scotia Museum of Natural History, the Atlantic Canada Conservation Data Center (ACCDC), and other possible sources such as universities or local naturalists. The ACCDC incorporates the NS SigHab into their database. The ACCDC has provided a Data Report of Rare and Endangered Taxa and Special Areas at a 100 km radius from the proposed development area (Appendix C). The NS Museum of Natural History (NS Communities, Culture and Heritage) has provided a list of plant and animal species-at-risk (Appendix C).

5.3.1 Vegetation Types

The Project Study Area is located within the Central Uplands Eco-district of Nova Scotia, as identified by NSDNR's Ecological Land Classification (Neily *et al.* 2003). This eco-district occupies the gently rolling uplands of central Nova Scotia with elevations up to 300m. Red spruce is the dominant forest species in the eco-district. Pure stands of tolerant hardwoods are present on the crests and upper slopes of hills and steeper hummocks. Hemlock prefers the sheltered moist sites of lower slopes along streams and rivers and white pint is scattered on the better drained, coarse textured soils. The Project is located in Eco-section WMKK which is characterized by well drained, medium texture soil on hilly terrain.

The Project Study Area is on land that has previously been harvested without allowing regeneration of trees to grow back. Instead, the area has been mowed and shaped into fields for pasture. The tree removal was necessary as the majority of the land within the Project Study Area is either existing pasture or planned for pasture. Turbine locations were in fact harvested for "hog fuel". The area is presently regenerating back but eventually will be converted to farm fields.

Two wind turbines are planned for the Greenfield site and the pad or foot print of each turbine will displace 0.5 hectare of forest area. An existing farm road (Figure 5.4), which travels uphill 1.4km in an easterly direction and through beef cattle pasture, provides access close to the turbines. This road will require upgrading. An additional approximate 0.6km of poor road will require rebuilding to connect to the turbine sites. The habitat where these two turbines are planned is recently harvested forest (Figure 5.5). The intended land-use by the farmer is conversion to farmland pasture. An optional third turbine location was proposed on a neighbouring property and this property is a managed woodlot with young growth softwood. If access to the optional third location is required, an approximate further 0.2 km of new road and 0.3 rebuilding of a small woodlot road would have been necessary. This optional location is referred to in Sean Blaney's rare plants and breeding bird survey as well.

Figure 5.4: Road through farm fields to turbine locations

Figure 5.5: Proposed turbine site and regenerating forest.

Desktop Review

A first step is to identify what priority species have the potential to occur near the development site. A desktop review is done to identify priority species within a 100 km radius of the proposed development area. Information sources for this are the NS Dept. of Natural Resources Significant Habitat (SigHab) database, contact with the Nova Scotia Museum of Natural History, the Atlantic Canada Conservation Data Center (ACCDC), and other possible sources such as universities or local naturalists. The ACCDC incorporates the NS SigHab into their database. The ACCDC has provided a Data Report of Rare and Endangered Taxa and Special Areas at a 100 km radius from the proposed development area. The NS Museum of Natural History (NS Communities, Culture and Heritage) has provided a list of plant and animal species-at-risk. (Appendix C)

By examination and comparison of the habitat requirements of each of these proximity species to the habitats occurring within the development area, a shortlist of priority species for different wildlife taxa is developed. The short-list prioritizes species that may require further population study and avoidance measures.

The result of the ACCDC 100km buffer around the Greenfield study area summary contains 1593 records of 295 vascular, 60 records of 15 nonvascular flora. The buffer also contains 1233 records of 71 vertebrate, 408 records of 80 invertebrate fauna (Appendix C).

Priority plants make up the larger portion of the rare and endangered wildlife as identified by ACCDC within the 100km radius buffer. Sean Blaney, a respected botanist, was entrusted to examine the study area for rare and endangered flora.

5.3.2 Rare Plants and Species Richness

Rare plants and floral species richness in the Project Area was described using a combination of desktop and field surveys.

The botanist documented full lists of vascular plant and bird species observed while on site with locations documented for the first observation of each species. For provincially rare species (those ranked S3S4 or lower by AC CDC, see Appendix 1 in Blaney's report), he recorded location by GPS and noted abundance, extent of occurrence and habitat (Appendix F).

Vascular Plant Species

Sean Blaney recorded 137 vascular plant taxa (111 native, 26 exotic; Table 5.3), only one of which was of conservation significance: Meadow Willow (*Salix petiolaris*, S3 – Secure; see Appendix 1 of Blaney's report for definitions) was present (a single shrub) in a seepy forest opening along a small streambed (details in Table 5.4).

Meadow Willow is a marginally rare species in Nova Scotia, which was overlooked by early botanists but is now known from Queens County to southern Cape Breton Island. It is likely increasing in abundance and possibly distribution in response to forestry because it tends to do well in disturbed roadside ditches. The species is not considered rare in New Brunswick.

Further visits to the site would yield additional species to those recorded, but the list developed is likely fairly complete. Based on the nature and condition of the plant communities present, it is not likely that many additional provincially rare plant species would be found in the project footprint (Blaney, 2013).

Table 5.3 Vascular plants recorded in the Greenfield COMFIT project footprint with Nova Scotia S-ranks and General Status (GS) ranks. Taxonomy follows Kartesz (1999) – *Synthesis of the North American Flora*, CD-ROM.

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Equisetaceae	**Horsetail Family**			
Equisetum arvense	Field Horsetail	S5	Secure	
Osmundaceae	**Flowering Fern Family**			
Osmunda cinnamomea	Cinnamon Fern	S5	Secure	
Osmunda claytoniana	Interrupted Fern	S5	Secure	
Dennstaedtiaceae	**Bracken Fern Family**			
Dennstaedtia punctilobula	Eastern Hay-Scented Fern	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Thelypteridaceae	**Marsh-Fern Family**			
Thelypteris noveboracensis	New York Fern	S5	Secure	
Dryopteridaceae	**Wood-Fern Family**			
Athyrium filix-femina ssp. angustum	Common Lady Fern	S5	Secure	
Dryopteris campyloptera	Mountain Wood Fern	S5	Secure	
Dryopteris carthusiana	Spinulose Wood Fern	S5	Secure	
Dryopteris intermedia	Evergreen Wood Fern	S5	Secure	
Pinaceae	**Pine Family**			
Abies balsamea	Balsam Fir	S5	Secure	
Picea mariana	Black Spruce	S5	Secure	
Ranunculaceae	**Buttercup Family**			
Coptis trifolia	Goldthread	S5	Secure	
Ranunculus acris	Common Buttercup	SNA	Exotic	
Ranunculus repens	Creeping Buttercup	SNA	Exotic	
Betulaceae	**Birch Family**			
Alnus incana ssp. rugosa	Speckled Alder	S5	Secure	
Betula alleghaniensis	Yellow Birch	S5	Secure	
Betula papyrifera var. papyrifera	Heart-leaved Birch	S5	Secure	
Betula populifolia	Gray Birch	S5	Secure	
Caryophyllaceae	**Pink Family**			
Cerastium fontanum ssp. vulgare	Common Chickweed	SNA	Exotic	
Polygonaceae	**Smartweed Family**			
Polygonum cilinode	Fringed Black Bindweed	S5	Secure	
Polygonum hydropiper	Marshpepper Smartweed	SNA	Exotic	
Polygonum sagittatum	Arrow-leaved Smartweed	S5	Secure	
Rumex acetosella	Sheep Sorrel	SNA	Exotic	
Clusiaceae	**St. John's-wort Family**			
Hypericum canadense	Canada St John's-wort	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Violaceae	**Violet Family**			
Viola macloskeyi ssp. pallens	Small White Violet	S5	Secure	
Salicaceae	**Willow Family**			
Populus grandidentata	Large-toothed Aspen	S5	Secure	
Populus tremuloides	Trembling Aspen	S5	Secure	
Salix bebbiana	Bebb's Willow	S5	Secure	
Salix humilis	Upland Willow	S5	Secure	
Salix lucida	Shining Willow	S5	Secure	
Salix petiolaris	Meadow Willow	S3	Secure	
Salix pyrifolia	Balsam Willow	S5	Secure	
Ericaceae	**Heath Family**			
Gaultheria hispidula	Creeping Snowberry	S5	Secure	
Kalmia angustifolia	Sheep Laurel	S5	Secure	
Vaccinium angustifolium	Late Lowbush Blueberry	S5	Secure	
Primulaceae	**Primrose Family**			
Trientalis borealis	Northern Starflower	S5	Secure	
Grossulariaceae	**Currant Family**			
Ribes glandulosum	Skunk Currant	S5	Secure	
Saxifragaceae	**Saxifrage Family**			
Chrysosplenium americanum	American Golden Saxifrage	S5	Secure	
Rosaceae	**Rose Family**			
Fragaria virginiana	Wild Strawberry	S5	Secure	
Geum macrophyllum	Large-Leaved Avens	S5	Secure	
Geum rivale	Water Avens	S5	Secure	
Potentilla simplex	Old Field Cinquefoil	S5	Secure	
Prunus pensylvanica	Pin Cherry	S5	Secure	
Rubus allegheniensis	Alleghany Blackberry	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Rubus canadensis	Smooth Blackberry	S5	Secure	ID refers to sp. in the broad sense
Rubus idaeus ssp. strigosus	Red Raspberry	S5	Secure	
Rubus pubescens	Dwarf Red Raspberry	S5	Secure	
Spiraea tomentosa	Steeplebush	S5	Secure	
Fabaceae	**Bean Family**			
Trifolium pratense	Red Clover	SNA	Exotic	
Trifolium repens	White Clover	SNA	Exotic	
Vicia cracca	Tufted Vetch	SNA	Exotic	
Onagraceae	**Evening-Primrose Family**			
Chamerion angustifolium	Fireweed	S5	Secure	
Cornaceae	**Dogwood Family**			
Cornus canadensis	Bunchberry	S5	Secure	
Aquifoliaceae	**Holly Family**			
Nemopanthus mucronatus	Mountain Holly	S5	Secure	
Rhamnaceae	**Buckthorn Family**			
Frangula alnus	Glossy Buckthorn	SNA	Exotic	
Aceraceae	**Maple Family**			
Acer pensylvanicum	Striped Maple	S5	Secure	
Acer rubrum	Red Maple	S5	Secure	
Acer saccharum	Sugar Maple	S5	Secure	
Oxalidaceae	**Wood-Sorrel Family**			
Oxalis montana	Common Wood Sorrel	S5	Secure	
Balsaminaceae	**Touch-me-not Family**			
Impatiens capensis	Spotted Jewelweed	S5	Secure	
Araliaceae	**Sarsaparilla Family**			
Aralia hispida	Bristly Sarsaparilla	S5	Secure	
Aralia nudicaulis	Wild Sarsaparilla	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Lamiaceae	**Mint Family**			
Lycopus uniflorus	Northern Water Horehound	S5	Secure	
Prunella vulgaris	Common Self-heal	S5	Secure	
Scutellaria lateriflora	Mad-dog Skullcap	S5	Secure	
Plantaginaceae	**Plantain Family**			
Plantago major	Common Plantain	SNA	Exotic	
Oleaceae	**Olive Family**			
Fraxinus americana	White Ash	S5	Secure	
Scrophulariaceae	**Snapdragon Family**			
Veronica officinalis	Common Speedwell	S5	Exotic	
Rubiaceae	**Bedstraw Family**			
Galium palustre	Common Marsh Bedstraw	S5	Secure	
Mitchella repens	Partridgeberry	S5	Secure	
Caprifoliaceae	**Honeysuckle Family**			
Linnaea borealis ssp. americana	Twinflower	S5	Secure	
Lonicera canadensis	Canada Fly Honeysuckle	S5	Secure	
Sambucus racemosa	Red Elderberry	S5	Secure	
Asteraceae	**Aster Family**			
Anaphalis margaritacea	Pearly Everlasting	S5	Secure	
Doellingeria umbellata	Hairy Flat-top White Aster	S5	Secure	
Eupatorium perfoliatum	Common Boneset	S5	Secure	
Eurybia macrophylla	Large-leaved Aster	S5	Secure	
Euthamia graminifolia	Grass-leaved Goldenrod	S5	Secure	
Hieracium piloselloides	Tall Hawkweed	SNA	Exotic	ID to sp. probable, not confirmed
Hieracium aurantiacum	Orange Hawkweed	SNA	Exotic	
Hieracium caespitosum	Field Hawkweed	SNA	Exotic	
Hieracium scabrum	Rough Hawkweed	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Hieracium x flagellare	Whiplash Hawkweed	SNA	Exotic	ID to sp. probable, not confirmed
Matricaria discoidea	Pineapple Weed	SNA	Exotic	
Oclemena acuminata	Whorled Wood Aster	S5	Secure	
Prenanthes altissima	Tall Rattlesnakeroot	S5	Secure	
Prenanthes trifoliolata	Three-leaved Rattlesnakeroot	S5	Secure	
Senecio jacobaea	Tansy Ragwort	SNA	Exotic	
Solidago puberula	Downy Goldenrod	S5	Secure	
Solidago rugosa	Rough-stemmed Goldenrod	S5	Secure	
Solidago uliginosa	Northern Bog Goldenrod	S5	Secure	
Symphyotrichum lateriflorum	Calico Aster	S5	Secure	
Symphyotrichum puniceum	Purple-stemmed Aster	S5	Secure	
Juncaceae	**Rush Family**			
Juncus effusus	Soft Rush	S5	Secure	
Juncus tenuis	Path Rush	S5	Secure	
Luzula multiflora	Common Woodrush	S5	Secure	
Cyperaceae	**Sedge Family**			
Carex arctata	Drooping Woodland Sedge	S5	Secure	
Carex brunnescens ssp. sphaerostachya	Brownish Sedge	S5	Secure	
Carex communis	Fibrous-Root Sedge	S5	Secure	
Carex crawfordii	Crawford's Sedge	S5	Secure	
Carex debilis var. rudgei	White-edged Sedge	S5	Secure	
Carex deflexa	Northern Sedge	S4	Secure	
Carex echinata	Star Sedge	S5	Secure	
Carex gynandra	Nodding Sedge	S5	Secure	
Carex intumescens	Bladder Sedge	S5	Secure	
Carex leptalea	Bristly-stalked Sedge	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Carex leptonervia	Finely-Nerved Sedge	S5	Secure	
Carex novae-angliae	New England Sedge	S5	Secure	
Carex scoparia	Broom Sedge	S5	Secure	
Carex stipata	Awl-fruited Sedge	S5	Secure	
Carex trisperma var. trisperma	Three-seeded Sedge	S5	Secure	
Eriophorum virginicum	Tawny Cottongrass	S5	Secure	
Scirpus atrocinctus	Black-girdled Bulrush	S5	Secure	
Scirpus cyperinus	Common Woolly Bulrush	S5	Secure	
Scirpus hattorianus	Mosquito Bulrush	S5	Secure	
Poaceae	**Grass Family**			
Agrostis capillaris	Colonial Bent Grass	SNA	Exotic	
Agrostis gigantea	Redtop	SNA	Exotic	
Agrostis scabra	Rough Bent Grass	S5	Secure	
Anthoxanthum odoratum	Large Sweet Vernal Grass	SNA	Exotic	
Calamagrostis canadensis	Bluejoint Reed Grass	S5	Secure	
Cinna latifolia	Drooping Wood Reed Grass	S5	Secure	
Dactylis glomerata	Orchard Grass	SNA	Exotic	
Danthonia compressa	Flattened Oat Grass	S5	Secure	
Danthonia spicata	Poverty Oat Grass	S5	Secure	
Dichanthelium acuminatum	Woolly Panic Grass	S5	Secure	
Festuca filiformis	Hair Fescue	SNA	Exotic	
Glyceria grandis	Common Tall Manna Grass	S4S5	Secure	
Glyceria melicaria	Slender Manna Grass	S4	Secure	
Glyceria striata	Fowl Manna Grass	S5	Secure	
Lolium arundinaceum	Tall Fescue	SNA	Exotic	
Lolium pratense	Meadow Fescue	SNA	Exotic	
Phleum pratense	Common Timothy	SNA	Exotic	
Poa alsodes	Grove Blue Grass	S4	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Poa pratensis	Kentucky Blue Grass	S5	Secure	
Poa trivialis	Rough Blue Grass	SNA	Exotic	
Liliaceae	**Lily Family**			
Maianthemum canadense	Wild Lily-of-The-Valley	S5	Secure	
Orchidaceae	**Orchid Family**			
Platanthera psycodes	Small Purple Fringed Orchid	S4	Secure	ID to sp. probable, not confirmed (non-flowering)

Table 5.4 Vegetation Type Overview Locations, site community descriptions and dominant understory flora of proposed turbine locations at the Greenfield COMFIT site. (Blaney, 2013)

Turbine #	Latitude	Longitude	Site Description	Dominant Understorey Species
G01	45.347481	-63.138644	~ 5 year old regenerating clearcut; pin cherry 35% cover	*Aralia hispida; Carex brunnescens ssp. sphaerostachya; Rubus idaeus ssp. strigosus; Rubus canadensis; Danthonia spicata; Carex novae-angliae; Dennstaedtia punctilobula*
G02	45.346056	-63.139818	Potential turbine footprint includes: ***a)*** 5 to 10 year old regenerating clearcut dominated by pin cherry and red maple and in the process of conversion from forest to cattle pasture, and ***b)*** ~25 year old red maple - balsam fir - yellow birch - white birch regenerating forest	***Regenerating clearcut:*** *Rubus idaeus ssp. strigosus; Carex brunnescens ssp. sphaerostachya; Carex novae-angliae; Aralia hispida; Dennstaedtia punctilobula; Carex debilis var. rudgei; Betula papyrifera var. papyrifera; Carex intumescens; Scirpus cyperinus; Betula populifolia; Euthamia graminifolia; Agrostis scabra; Doellingeria umbellata; Rumex acetosella;* ***Young forest:*** *Some of above + Maianthemum canadense; Aralia nudicaulis; Oxalis montana; Dryopteris intermedia; Dryopteris campyloptera; Thelypteris noveboracensis; Osmunda cinnamomea*
G03	45.345139	-63.134417	Dry, gravelly log landing site and road at edge of 20-25 year old black spruce plantation with balsam fir - yellow birch - red maple; precommercial	***Spruce plantation (most of potential turbine footprint):*** very sparse understory of *Dryopteris campyloptera; Dryopteris intermedia; Maianthemum canadense*

			thinning ~10 years ago	

5.3.3 Wetlands

The distribution and abundance of wetlands in the Project Area was determined by a combination of aerial photo review and field surveys. Subsequent access road and layout adjustments placed all disturbances for the Project outside of any wetlands. Follow up field identification was conducted concurrently with vegetation surveys, which occurred in June 2013. During field surveys, 3 proposed turbine sites were visited, which were represented by a circular plot with a 75 m diameter representing the footprint of the turbine. Field surveyors searched for wetlands within each proposed turbine site as they existed at the time of survey. Wetlands were not encountered along the road and turbine sites, however there were small wet areas noted within the Study Area. When encountered, wetlands were noted and typically delineated to their edges.

5.3.3.1 Results

The Nova Scotia Wetland Inventory identifies two wetlands near the proposed turbine sites. One is a 1.48 ha Treed (Black Spruce) Swamp close to turbine two (Figure 5.6). It straddles the easterly property line between private land and a Crown land property. This tree cover is Black Spruce. The forest floor is largely sphagnum. Mountain Holly (*Nemopanthus mucronatus*) is a common shrub within the stand. Tawny Cotton Grass (*Eriophorum virginicum*), a plant of bogs and swamps, occurs in scattered clumps. There is no open water or untreed bog within the wetland.

Figure 5.6 Black Spruce Swamp. Mountain Holly is in foreground

Another wetland is a 1.25 ha Tall Shrub (Alder) Swamp to the south which is over 400 metres from the closest turbine. At this distance it is unaffected by the undertaking.

In addition there is a wetland (Figure 5.7) not identified in the provincial inventory. A Black Spruce forest stand was harvested previous to the landowner purchasing the land for the process of clearing for farm land. The harvested area was in a hollow with poor drainage. A wetland with meadow characteristics has now developed. This wetland size is about 1.75 ha. Dominate wetland plant is *Scirpus cyperinus*, a plant of wet meadows and swamps. Cattail (*Typha latifolia*) is also present in lesser amounts. There are a few small open water habitats that occur in old ruts caused by logging vehicles.

Figure 5.7 *Scirpus cyperinus* growing in wet meadow

5.3.3.2 Wetland Functions

Wetlands are important environmental features that provide a number of beneficial functions, including: surface water detention and water flow moderation; water flow maintenance; groundwater recharge; shoreline erosion protection; water quality treatment; carbon sequestration and storage; and biological productivity and habitat for Species of Conservation Interest. .

5.4 Birds and Other Wildlife

5.4.1 Birds

The Project Study Area contains few land features that may concentrate birds. Information on the distribution and abundance of birds in the Project Study Area was derived from field surveys, publicly available data and documents. The methodologies and results of desktop and field studies conducted in support of the Project are described in the following sections.

5.4.1.1 Desktop Studies

An important source of bird information is the Maritimes Breeding Bird Atlas (MBBA) database (Nature Counts 2011), which contains a summary of bird distribution and abundance across the Maritime Provinces of Canada. The MBBA data was used to provide a general inventory of breeding birds in the vicinity of the Project Study Area. The MBBA also provides a list of bird Species of Conservation Concern which may be present in the Project Study Area, and also the locations of recent (2006-2010) records of species.

The MBBA web site for the square applicable to the study area is http://www.mba-aom.ca/jsp/datasummaries.jsp?lang=en&extent=Sq&summtype=SpList&square=20MR82#results.

Species observed or heard singing in suitable nesting habitat are classified as possible breeders. Species exhibiting the following behaviours are classed as probable breeders:

- courtship behaviour between a male and female;
- birds visiting a probable nest site;
- birds displaying agitated behaviour; and
- male and female observed together in suitable nesting habitat.

Species are confirmed as breeding if any of the following items or activities were observed:

- nest building or adults carrying nesting material;
- distraction display or injury feigning;
- recently fledged young;
- occupied nest located; and
- adult observed carrying food or fecal sac for young.

The desktop review considers 50 priority bird species (Table 5.5). Bird species with only a coastal occurrence (example Roseate Tern and Red Knot) are not considered. Certain species with habitat dependence on open water bodies such as Common Loon and Duck species are thought unlikely to occur since their habitat is lacking here. However 30 of the considered 50 priority species are a possible occurrence at the study area.

Table 5.5 Priority Avian Species Listed within 100km. NS status (2010) as determined from Wild Species - General Status of Species in Canada. Also listed NSESA, COSEWIC, SARA status. Bird species with only coastal occurrence are not listed.

Common Name	Scientific Name	NSGSWS 2010	COSEWIC Status	NSESA Status	SARA	Occurrence
Olive-sided Flycatcher	*Contopus cooperi*	At Risk	Threatened (2007)	Threatened (2013)	Threatened	Possible
Common Nighthawk	*Chordeiles minor*	At Risk	Threatened (2007)	Threatened (2007)	Threatened	Possible
Bobolink	*Dolichonyx oryzivorus*	Sensitive	Threatened (2010)	Vulnerable (2013)		Possible

Killdeer	*Charadrius vociferus*	Sensitive				Possible
Blue-winged Teal	*Anas dicors*	May Be At Risk				Unlikely
Peregrine Falcon	*Falco peregrinus*	Sensitive	Special Concern (2007	Vulnerable (2007)	Special Concern	Unlikely
Rusty Blackbird	*Euphagus carolinus*	May Be At Risk	Special Concern (2006)	Endangered (2013)	Special Concern	Possible
Short-eared owl	*Asio flammeus*	May Be At Risk	Special Concern (2008)		Special Concern	Unlikely
Barn Swallow	*Hirundo rustica*	Sensitive	Threatened (2011)	Threatened (2013)		Possible
Bay-breasted Warbler	*Dendroica castanea*	Sensitive				Possible
Black-backed Woodpecker	*Picoides arcticus*	Sensitive				Possible
Spotted Sandpiper	*Actitis macularius*	Sensitive				Unlikely
Wilson's Snipe	*Gallinago delicata*	Sensitive				Possible
Tennessee Warbler	*Vermivora peregrina*	Sensitive				Possible
Bank Swallow	*Riparia riparia*	May Be At Risk				Unlikely
Pine Grosbeak	*Pinicola enucleator*	May Be At Risk				Possible
Northern Pintail	*Anas acuta*	May Be At Risk				Unlikely
Common Loon	*Gavia immer*	May Be At Risk				Unlikely
Northern Shoveller	*Anas clypeata*	May Be At Risk				Unlikely
American Bittern	*Botaurus lentiginosus*	Sensitive				Unlikely
Cape May warbler	*Dendroica tigrina*	Sensitive				Possible
Gray Jay	*Perisoreus canadensis*	Sensitive				Possible
Blackpoll Warbler	*Dendroica striata*	Sensitive				Possible
Wilson's Warbler	*Wilsonia pusilla*	Sensitive				Possible
Pine Siskin	*Spinus pinus*	Sensitive				Possible
Tree Swallow	*Tachycineta bicolor*	Sensitive				Possible
Ruby-crowned Kinglet	*Regulus calendula*	Sensitive				Possible
Golden-crowned Kinglet	*Regulus satrapa*	Sensitive				Possible
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Sensitive				Possible
Boreal Chickadee	*Poecile hudsonicus*	Sensitive				Possible
Canada Warbler	*Wilsonia canadensis*	At Risk	Threatened (2008)	Endangered (2013)	Threatened	Possible
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Sensitive				Possible
Gadwall	*Anas strepera*	May Be At Risk				Unlikely
Gray Catbird	*Dumetella carolinensis*	May Be At Risk				Possible

Pied-billed Grebe	*Podilymbus podiceps*	Sensitive				Unlikely
Vesper Sparrow	*Pooecetes gramineus*	May Be At Risk				Unlikely
Cliff Swallow	*Petrochelidon pyrrhonota*	May Be At Risk				Possible
Baltimore Oriole	*Icterus galbula*	May Be At Risk				Unlikely
Long-eared Owl	*Asio otus*	May Be At Risk				Possible
Black-billed Cuckoo	*Coccyzus erythropthalmus*	May Be At Risk				Possible
Eastern Wood-pewee	*Contopus virens*	Sensitive	Special Concern (2013)	Vulnerable (2013)		Possible
Great-crested Flycatcher	*Myiarchus crinitus*	May Be At Risk				Possible
Chimney Swift	*Chaetura pelagica*	At Risk	Threatened (2007)	Endangered (2013)	Threatened	Possible
Purple Martin	*Progne subis*	At Risk				Unlikely
Eastern Meadowlark	*Sturnella magna*	Sensitive	Threatened (2011)			Unlikely
Eastern Phoebe	*Sayornis phoebe*	Sensitive				Possible
Eastern Bluebird	*Sialia sialis*	Sensitive	NAR (1996)			Unlikely
Whip-poor-will	*Caprimulgus vociferus*	At Risk	Threatened (2009)	Endangered (2013)	Threatened	Unlikely
Bicknell's Thrush	*Catharus bicknelli*	At Risk	Threatened (2009)	Endangered (2013)	Threatened	Unlikely
Willow flycatcher	*Empidonax traillii*	Sensitive				Unlikely

5.4.1.2 Field Surveys

A pre-construction (baseline) bird monitoring program was conducted between April 2012 and July 2013 by a two qualified biological technicians. The scope of the monitoring program and the survey protocol used was based on Environment Canada's Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (Environment Canada 2007). Bird surveys conducted included fall and spring migration surveys, raptor watches, overwintering surveys, and breeding bird surveys.

During all field surveys, technicians and biologists, as well as the Proponent are always on the watch for any Species of Concern. On June 27, 2013, during the botany survey, three young Killdeer were spotted running along the driveway with the mother distracting the intruders. The photo below shows one of the fledglings spotted. Killdeer is ranked as sensitive by NSDNR. Sensitive means the species is on an enhanced watch list to detect any population decline.

Throughout the study of the Greenfield survey location, a total of 38 different bird species were recorded. Within these 38 species, three were listed as below S4 (Table 5.6) the Eastern Wood Pewee, Boreal Chickadee and the Yellow-bellied Flycatcher, all other species are listed by the ACCDC (Atlantic Canada Conservation Data Centre), as S5 or S4. For a complete list of species, total counts and their Sub-national ranks (S-Ranks) found through the duration of the study. (Table 5.7) (*Black Bird, 2013)*

Figure 5.8 A young killdeer located on June 27, 2013.

Table 5.6 Uncommon Avian Species Recorded sub-national and global ranks as defined by the Atlantic Canada Conservation Data Centre found throughout the Greenfield wind project location, Colchester County, Nova Scotia, data collected by Black Bird Environmental Consulting, April - March, 2012-13.

UNCOMMON SPECIES			
Common Name	**Scientific Name**	**Global Rank**	**Sub-National Ranks**
Boreal Chickadee	*Poecile hudsonica*	G5	S3
Eastern Wood Pewee	*Contopus virens*	G5	S3S4B
Yellow Bellied Flycatcher	*Empidonax flaviventris*	G5	S3S4B

*** S3B** - Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences)

*** S4B** - Usually widespread, fairly common, and apparently secure with many occurrences, but of longer-term concern (100+ occurrences), Breeding (Migratory species).

*** G5** - Very common, secure under present conditions.

Table 5.7 Complete List of Bird Species Observed During the 52 Week Study at Greenfield, Colchester County, Nova Scotia, data collected by Black Bird Environmental Consulting, April - May 2012-2013.

COMPLETE SPECIES LIST			
Common Name	**Scientific Name**	**Global Ranks**	**Sub-National Ranks**
American Robin	*Turdus migratorius*	G5	S5B*
Blue Jay	*Cyanocitta cristata*	G5	S5
Red-winged Blackbird	*Agelaius phoeniceus*	G5	S4S5B*
Mourning Dove	*Zenaida macroura*	G5	S5
Common Raven	*Corvus corax*	G5	S5
American crow	*Corvus brachyrhynchos*	G5	S5
European Starling	*Sturnus vulgaris*	G5	SNA*
white-throated Sparrow	*Zonotrichia albicollis*	G5	S5B
Song Sparrow	*Melospiza melodia*	G5	S5B
Pileated Woodpecker	*Dryocopus pileatus*	G5	S5
Hairy Woodpecker	*Picoides villosus*	G5	S5
Northern Flicker	*Colaptes auratus*	G5	S5B
Yellow-bellied Sapsucker	*phyrapicus varius*	G5	S4S5B
Red-breasted Nuthatch	*Sitta canadensis*	G5	S4S5
Golden Crowned Kinglet	*Regulus satrapa*	G5	S4
American Goldfinch	*Carduelis tristis*	G5	S5
Swainson's Thrush	*Catharus ustulatus*	G5	S4S5
Yellow-rumped Warbler	*Dendroica coronata*	G5	S5
Black-throated Blue Warbler	*Dendroica caerulescens*	G5	S5B
Black-throated Green Warbler	*Dendroica virens*	G5	S4S5B
Black-and-White Warbler	*Mniotilta varia*	G5	S4S5B
Magnolia Warbler	*Dendroica magnolia*	G5	S5B
Eastern Wood Pewee	*Contopus virens*	G5	S3S4B
Ovenbird	*Seiurus aurocapillus*	G5	S5B
Winter Wren	*Troglodytes troglodytes*	G5	S5B
Black-capped Chickadee	*Poecile atricapilla*	G5	S5B
Boreal Chickadee	*Poecile hudsonica*	G5	S3
Yellow Bellied Flycatcher	*Empidonax flaviventris*	G5	S3S4B
Alder Flycatcher	*Empidonax alnorum*	G5	S5B
Dark-eyed Junco	*Junco hyemalis*	G5	S4S5
Red-eyed Vireo	*Vireo olivaceus*	G5	S5B
Common Yellowthroat	*Geothlypis trichas*	G5	S5B
American Redstart	*Setophaga ruticilla*	G5	S5B
Northern Parula	*Parula americana*	G5	S5B

Ruby-throated Hummingbird	*Archilochus colubris*	G5	S5B
Ruffed Grouse	*Bonasa umbellus*	G5	S4S5B
Ring-necked Pheasant	*Phasianus colchicus*	G5	SNA
Red-tailed Hawk	*Buteo jamaicensis*	G5	S5

*** S3B** - Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences), Breeding (Migratory species).

*** S4B** - Usually widespread, fairly common, and apparently secure with many occurrences, but of longer-term concern (100+ occurrences), Breeding (Migratory species).

*** S5B** - Widespread, abundant, and secure, under present conditions, Breeding (Migratory species).
*** G5** - Very common, secure under present conditions.

*** NA** - Not Applicable: A conservation status is not applicable because the species is either: a) exotic, b) not definitively known to occur in the province or c) a hybrid not considered to be conservation significance.

On June 27, 2013, the Proponents, Ross Hall, biologist and Sean Blaney, botanist, took a site walk to record plant species in the areas. Mr. Blaney, trained in bird studies and well-practiced, observed several bird species in different habitats and recorded his accounts in his Rare Plant Survey (Appendix F).

Table 5.8 List of Birds Recorded Incidentally by Sean Blaney on June 27, 2013 at Greenfield, with provincial status ranks and breeding evidence recorded following the methods of the Maritimes Breeding Bird Atlas. Breeding evidence with codes are: Poss = Possible breeding, H = adult in suitable nesting habitat, S = singing male in suitable nesting habitat; Prob = Probable breeding, P = pair in suitable nesting habitat; Conf = Confirmed breeding, FY = flightless or dependent young, NE = nest with eggs. Shaded species are of conservation concern with details of their occurrences given in Table 5.9 and locations mapped in Appendix F. (Blaney, 2013)

Species	Common Name	Breeding Evidence	NS End. Sp. Act	S-rank	GS Rank
Charadrius vociferus	Killdeer	Conf-FY		S3S4B	Sensitive
Zenaida macroura	Mourning Dove	Poss-S		S5	Secure
Contopus virens	Eastern Wood-Pewee	Poss-S	Vulnerable	S3S4B	Sensitive
Empidonax alnorum	Alder Flycatcher	Poss-S		S5B	Secure
Regulus calendula	Ruby-crowned Kinglet	Poss-S		S4B	Sensitive
Catharus ustulatus	Swainson's Thrush	Poss-H		S4S5B	Secure
Catharus guttatus	Hermit Thrush	Poss-S		S5B	Secure
Turdus migratorius	American Robin	Poss-S		S5B	Secure

Vireo olivaceus	Red-eyed Vireo	Conf-NE		S5B	Secure
Dendroica magnolia	Magnolia Warbler	Poss-S		S5B	Secure
Dendroica virens	Black-throated Green Warbler	Poss-S		S4S5B	Secure
Seiurus aurocapilla	Ovenbird	Poss-S		S5B	Secure
Geothlypis trichas	Common Yellowthroat	Poss-S		S5B	Secure
Wilsonia canadensis	Canada Warbler	Poss-S	Endangered	S3B	At Risk
Melospiza melodia	Song Sparrow	Poss-S		S5B	Secure
Melospiza lincolnii	Lincoln's Sparrow	Poss-S		S4B	Secure
Junco hyemalis	Dark-eyed Junco	Poss-S		S4S5	Secure
Dolichonyx oryzivorus	Bobolink	Prob-P	Vulnerable	S3S4B	Sensitive
Agelaius phoeniceus	Red-winged Blackbird	Poss-H		S4S5B	Secure
Carpodacus purpureus	Purple Finch	Poss-S		S4S5	Secure
Carduelis pinus	Pine Siskin	Poss-H		S3S4B,S5N	Sensitive
Carduelis tristis	American Goldfinch	Poss-S		S5	Secure

Table 5.9 Species of Conservation Concern Recorded at Greenfield, June 27, 2013 with provincial status, location of observation and description the occurrence and potential construction impacts. A specimen of Meadow Willow was collected and will be deposited at the E.C. Smith Herbarium at Acadia University. (Blaney, 2013)

Common Name	**Species**	**S-rank**	**GS Rank**	**Latitude**	**Longitude**	**Location Uncertainty (m)**	**Description**
Meadow Willow	*Salix petiolaris*	S3	Secure	45.344655	-63.136842	10	1 large shrub in seepy forest opening in streambed within regenerating clearcut
Bobolink	*Dolichonyx oryzivorus*	S3S4B	Sensitive	45.346763	-63.148609	50	4+ adults in suitable nesting habitat (open pasture & hayfield). Habitat potentially affected

							by increasing width of access road through pasture.
Killdeer	*Charadrius vociferus*	S3S4B	Sensitive	45.346957	-63.145627	25	Agitated female with 4 flightless young in open pasture along gravelly track. Habitat potentially affected by increasing width of access road through pasture.
Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive	45.345043	-63.137432	65	Singing male in suitable nesting habitat (15-20 year old balsam fir - black spruce forest / plantation). Habitat potentially affected by construction of access road.
Canada Warbler	*Wilsonia canadensis*	S3B	At Risk	45.345138	-63.135009	10	Singing male in suitable nesting habitat (shrubby wet peatland depression in 15-20 year old balsam fir - black spruce forest / plantation). Habitat within or very near to construction footprint of Turbine G03.
Pine Siskin	*Carduelis pinus*	S3S4B,S5N	Sensitive	45.345138	-63.135009	10	Adult in suitable nesting habitat (overhead from shrubby wet peatland depression in 15-20 year old balsam fir - black spruce forest / plantation). Not clearly nesting within project area, but potential habitat affected by construction of Turbine G03 & associated access road.
Eastern Wood-Pewee	*Contopus virens*	S3S4B	Sensitive	45.346372	-63.143183	25	singing male in suitable nesting habitat (sugar maple forest). Habitat potentially affected by construction of access road.

Table 5.10 Incidental Avian Observations by Biologist Ross Hall

Species	Date	Location
Common Snipe	May 9, 2013	Study Area
American Robin	"	Study Area
Song Sparrow	"	Study Area
Killdeer	"	Study Area
Red-winged Blackbird	"	Study Area
American Crow	"	Near cattle farm
Canada Geese	"	Near cattle farm
Mallard	"	Near cattle farm
European Starling	"	Near cattle farm
American Kestrel	September 6, 2013	Study Area
Bald Eagle	"	Study Area
European Starling	"	Near cattle farm
Dark-eyed Junco	"	Study Area
White-throated Sparrow	"	Study Area
Savannah Sparrow	"	Study Area
Song Sparrow	"	Study Area
Rock Dove	"	Near cattle farm
Northern Flicker (with young)	"	Study Area
Mourning Dove	"	Study Area

5.4.1.3 Survey Summary

There was a dramatic increase in population during the months of May and June, which are the core migration periods, as well as the breeding season of the majority of species found within Nova Scotia. This tells us that there is a breeding population of various species within the Greenfield study area. There was also a slow drop in population each month as the temperature dropped, and the winter weather moved in. This is typical behavior for birds at this time of year, as the colder weather moves in; the migratory species finish breeding and start migrating south for the winter months.

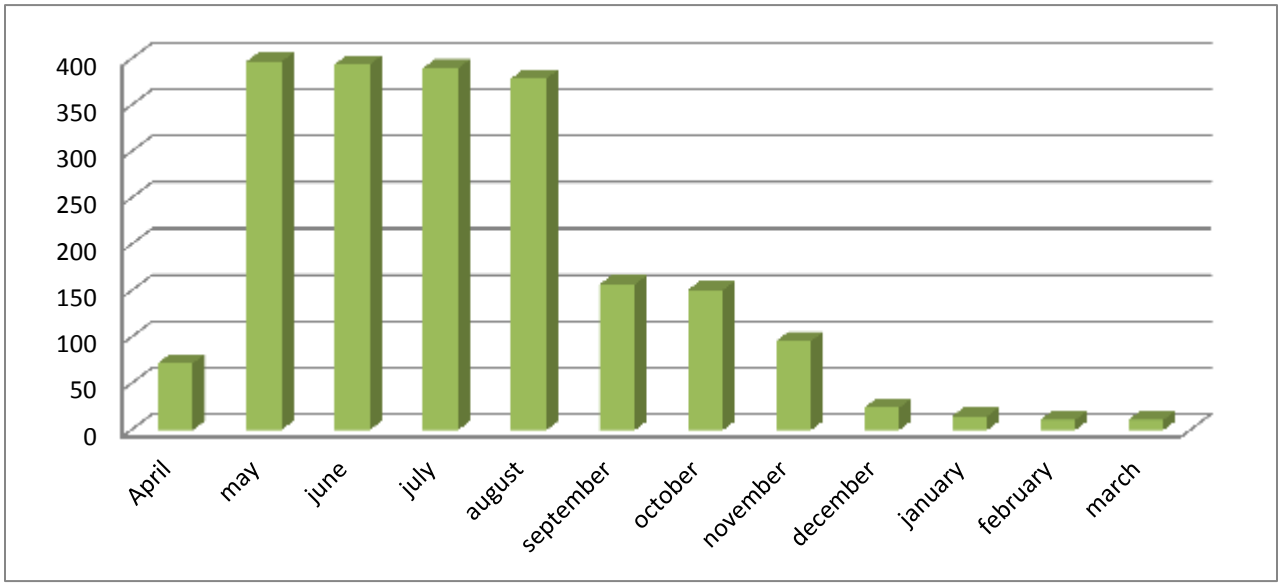
Figure 5.9 shows the population trends throughout the duration of the study. The highest population count was found during the month of May with approximately 400 birds recorded. The population then drops slightly each month, with the largest drop in population from August

at approximately 380 birds, to September at approximately 160 birds. The lowest population count was found during the months of February and March with approximately 10 birds recorded.

During the study at the Greenfield location, 38 avian species were observed. Within this 38, three species were listed below the S-rank of S5. The Eastern Wood Pewee (*Contopus virens*) as well as the Yellow- Bellied Flycatcher (*Empidonax flaviventris*) both shared an S-Rank of S3S4B. The ACCDC defines S4 as: usually widespread**,** fairly common, and apparently secure with many occurrences, but of longer-term concern (100+ occurrences). S3 as: uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences).

The Eastern Wood Pewee breeds in about every type of wooded habitat, and will use both deciduous and coniferous forest. It is often associated with forest clearings and edges all of which are present throughout this study area. The Yellow-Bellied Flycatcher breeds in boreal coniferous forests and nests in cool, moist forests, bogs and swamps. They winter in a variety of habitats from forests to semi-open habitats. The Boreal Chickadee (*Poecile hudsonica*) had an S-rank of S3. This species will use both young and mature forests, as long as they are nominated with evergreens. Their ability to use both mature and younger forests helps the Boreal Chickadees withstand the effects of logging and other effects within their range. Although these species are not at a critical level of risk, pressure on these species may push their ranks down and result in further diminishing their populations.

Figure 5.9 Avian Population Trends found during the study of the 52 week Greenfield survey, Colchester County, Nova Scotia, data collected by Black Bird Environmental Consulting, April – March 2012-2013.



5.4.2 Mammals

5.4.2.2 Overview

Information regarding the presence of mammals, including rare species, and sensitive mammal habitat within the Project Study Area was derived using a review of data for the area obtained from ACCDC and an environmental screening report generated from records at the NS Department of Tourism and Culture: Heritage Division (Appendix C). In addition to this, the biologist was a regional biologist for Department of Natural Resources in Nova Scotia with extensive knowledge of habitat types and expected/ potential species found within.

5.4.2.3 Mammal Species of Conservation Concern

Table 5.11 lists nine mammals reported in the 100 km search results that should be analysed in order to determine whether or not each may make use of habitats in the Project Area. Most of these species are relatively common in the province; however, three species - little brown myotis (*Myotis lucifugus*), northern long-eared myotis (*Myotis septentrionalis*) and tri-colored bat (*Perimyotis subflavus)* are Yellow listed by NSDNR indicating that they are sensitive to human activities and natural events. This general status designation is attributable to the fact that these bats gather in large numbers in a limited number of caves and abandoned mines to hibernate. This concentration of their populations places them at higher risk. These species are discussed in more detail in the following text.

Table 5.11 Priority Mammal Species Listed within 100km. NS status (2010) as determined from Wild Species - General Status of Species in Canada. Also listed NSESA, COSEWIC, SARA status.

Common Name	Scientific Name	NSGSWS 2010	Habitat	100Km Radius
Mainland Moose	*Alces alces*	At Risk NSESA: Endangered (2003)	Forest, especially those with intermediate stages of forest succession interspersed with lakes and streams. Thrives best in absence of white-tailed Deer.	Possible
Fisher	*Martes pennanti*	Sensitive	Seems to prefer heavy mixed forests and rarely ventures far into large open areas.	Possible
Long-tailed Shrew	*Sorex dispar*	Sensitive COSEWIC: Not At Risk(2006)	Prefers moist conditions in coniferous forests especially talus slopes overgrown with moss.	Unlikely
Eastern Pipistrelle	*Pipistrellus subflatus*	Sensitive(2010) NSESA: Endangered(2013) COSEWIC: Endangered(2012)	Congregatory hibernation in caves. (Likely at risk from White-nose-Syndrome.)	Possible

Northern Long-eared Bat	*Myotis septentrionalis*	Sensitive NSESA: Endangered(2013) COSEWIC: Endangered(2012)	Congregatory hibernation in caves. (Population decline due to White-nose-Syndrome.)	Possible
Little Brown Bat	*Myotis lucifugus*	Sensitive NSESA: Endangered(2013) COSEWIC: Endangered(2012)	Congregatory hibernation in caves. (90% population decline in 3 years due to White-nose-Syndrome.)	Possible
Hoary Bat	*Lasiurus cinereus*	Undetermined	Migratory. A tree bat.	Possible
Red Bat	*Lasiurus borealis*	Undetermined	Migratory. A tree bat.	Possible
Silver-haired Bat	*Lasionycteris noctivagans*	Undetermined	Migratory. A tree bat.	Possible

5.4.2.2.1 Mainland Moose

The area surrounding the study area of the proposed wind turbine development is fragmented by many roadways, and has many forms of human disturbances. It has a high deer population and deer transmit a deadly disease (P. tenuis) to moose. It is outside the core area of moose distribution, mapped by the Nova Scotia of Natural Resources (2007). Further evidence of the absence of moose is that since 1978, NSDNR has surveyed moose and deer populations with a method of counting fecal pellet groups in the spring of a year along 1000 x 2 metre plots (Basquill et al., 2011). It is referred to as a Pellet Group Inventory (PGI). Across the province there are 689 plot locations. Basquill et al. (2011) has mapped these plot locations and has indicated at each plot whether moose fecal pellet groups were found in multiple years, only once, or never found. This map illustrates no moose pellet groups found over several years near the proposed turbine site.

A further determination for the presence or absence of moose population is the location and completion of five (5) new PGI plots near the turbine area (Figure 5.10). Methodology follows the protocol used by NSDNR for completion of their plots. Plots locations were mapped by a Wildlife Biologist, Ross Hall, who chose more favourable potential moose habitats near the turbine site to better test the absence or presence of moose during the past winter. From the end of leaf fall in November to the time of PGI implementation in spring, moose have an approximate 200 day deposition period for fecal pellet groups that are visible on leaf litter. Over this time one moose has the potential to deposit 2600 pellet groups and the PGI survey technique has a good likelihood of finding moose evidence if any is present (Appendix J).

Greenfield PGI plots were completed on 27 April, 2013 after snow melt. A Forest Technician, Jody Hamper, completed the lots. A Black Bear was seen while completing these plots. No moose pellet groups were found. It is concluded from this survey and other map evidence that

there is no resident moose population at the study area. This does not preclude the possibility of an occasional moose passing through the area.

5.4.2.2.2 Fisher

Fisher is likely to occur near the proposed wind turbine site. Central Nova Scotia has a relatively stable fisher population. A cause for downfall in fisher population and a principal reason for their sensitive status is their vulnerability to trapping. In Nova Scotia fur harvesters are permitted to retain one (1) accidentally caught fisher. Fisher trapping is discouraged yet several are taken. The total Nova Scotia harvest of "mistake" fisher in 2011-2012 was 192 animals. Colchester and Pictou Counties accounted for 25 and 36 of these animals, respectively. The construction of each wind turbine will displace about 0.5 hectare of forestland per turbine yet the effect of the placement of wind turbines to fisher population is minimal.

5.4.2.2.3 Short-tailed Shrews

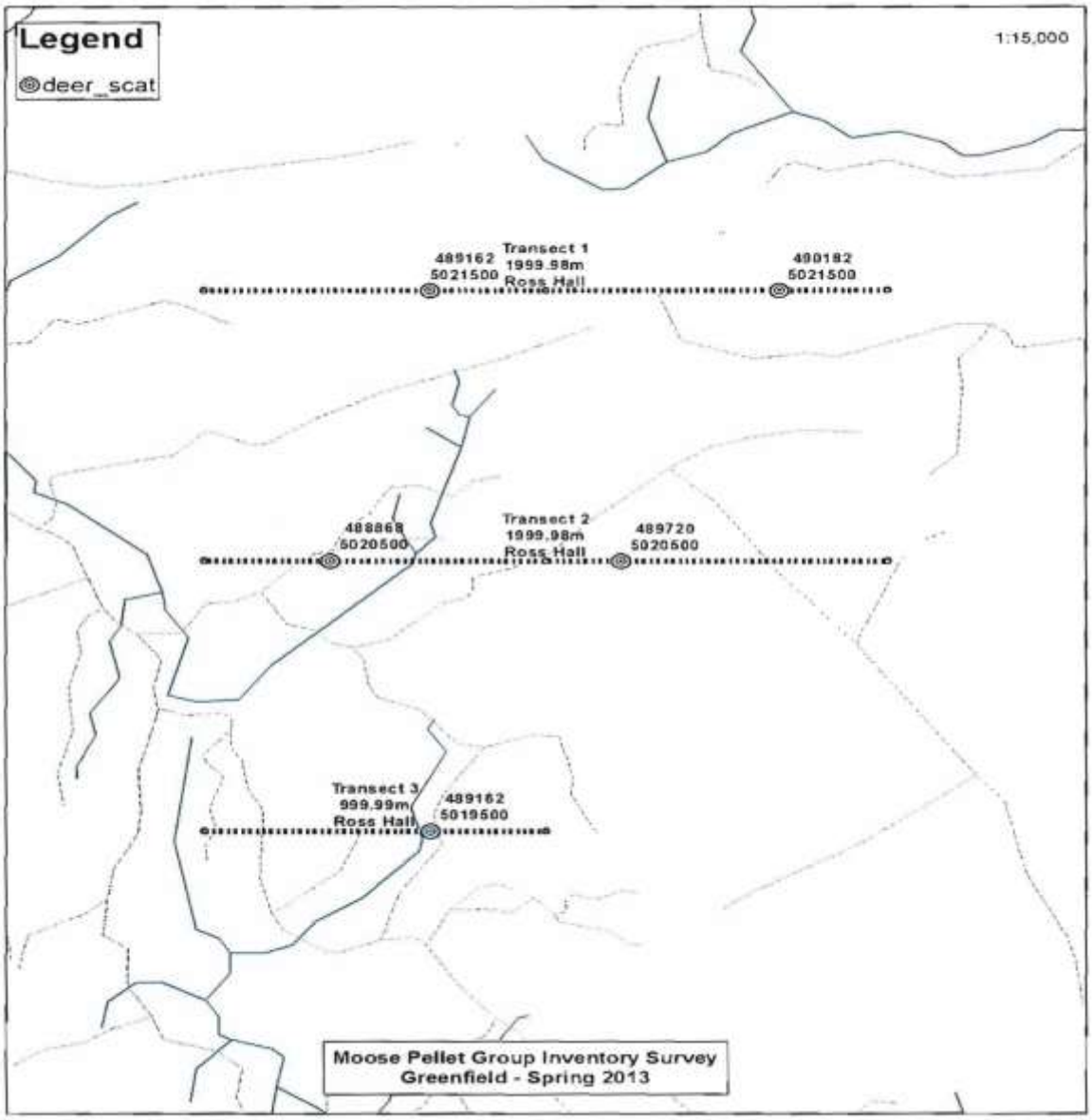
COSEWIC now lists Short-tailed Shrew as Not at Risk (2006). Since an early discovery of Short-tailed Shrew in the Wentworth Valley, Cumberland County, Nova Scotia, subsequent studies by Woolaver et al. (1998) and Shafer and Stewart (2006) have shown a wider distribution of this animal. Also the talus habitat in which this shrew lives is not present near the proposed wind turbine sites. The proposed wind turbine undertaking will not affect Short-tailed shrew.

5.4.2.2.4 Bats

Pre-construction bat surveys were undertaken at Greenfield during August and September 2013 by Hugh Broders and his team of researchers. Three ana-bat detectors were deployed at the site on July 30. The first was put at the forest/ non-forest boundary where Greenfield 2 is proposed. The microphone was installed at three meters. The second detector was put at 40m on the met tower. This was done by attaching the microphone apparatus to the second set of guy wires and using a pulley system along the second guy wire 90 degrees from the microphone. The third detector was placed at the base of the met tower at approximately 3 meters. The results of the bat study can be found in Appendix I.

The Proponent reviewed the Summary for Abandoned Mine Opening database provided on the Nova Scotia provincial website including all known abandoned and existing mines or shafts within 5km of the site. Consultation with Department of Natural Resources and Nova Scotia Environment resulted in the Proponent undertaking the 2013 bat study for Greenfield. The nearest known hibernaculum is over 25km from the Project site.

Figure 5.10 5km of Transects used in Greenfield 2013 Moose PGI Survey



All bat species native to Nova Scotia are considered to be sensitive to anthropogenic disturbance. However, the risk of bat collision with wind turbines is generally greater for migrating bats than for resident breeding, commuting or foraging bats, which generally forage between 1-10 m above ground level and seldom above 25 m, thus avoiding turbine blades (Erickson *et al.* 2002). Migratory bat species such as the hoary bat (*Lasiurus cinereus*), the red bat (*Lasiurus borealis*), and silver haired bat (*Lasionycteris noctivagans*) may be present in low

numbers in the Project Study Area. These migratory bats are found across North America, but there have been few accounts of these species in the province.

Bats are cryptic, nocturnal animals that are difficult to study, and the technology that allows researchers to effectively study bats is relatively new. In the Maritimes, intensive research into bats and bat populations has only begun within the last 15 years. In that time, studies employing a broad range of techniques and tools including acoustic monitoring, netting, radio-tracking, DNA analysis, stable isotopes, and transponder (PIT) tags, have been undertaken. Seven species are known to occur in Nova Scotia including hoary bats, silver-haired bats, eastern red bats, big brown bats (*Eptesicus fuscus*), tricolored bat (*Perimyotis subflavus*), northern long-eared (*Myotis septentrionalis*) and little brown myotis (*Myotis lucifugus*) (Broders *et al.* 2003; Van Zyll de Jong 1985), although only the latter three species have confirmed populations within Nova Scotia (Broders *et al* 2003; Burns and Broders 2010; Randall 2011). None of these three are considered migratory species or are typically at high risk of interaction with wind farms, with the possible exception of the tri-colored bat, which comprised 24% of bat mortality at a small wind development at Buffalo Mountain in eastern Tennessee where tri-colored bats are the most common local species. However, the distribution of tri-colored bats in Nova Scotia appears to be limited to the southwestern portion of the province (Farrow and Broders 2010).

To date, there have been few records of migratory bat species in Nova Scotia. The Nova Scotia Natural History Collections contain eight records of hoary bats and two records of silver-haired bats, although there are multiple records from ships and Cape Cod that suggest these species do migrate north across the Gulf of Maine (Brown 1953; Miller 1897; Norton 1930; Peterson 1970). However, more recent systematic surveys of bats in Nova Scotia suggest that these species rarely occur (Farrow 2007; Rockwell 2005). In 2001, Broders *et al.* (2003) recorded more than 30,000 echolocation sequences during migration periods in Kejimkujik National Park and Brier Island, of which less than 0.001% were attributable to migratory species. During the course of this study the first breeding record for red bat was incidentally recorded in Yarmouth, NS.

Likewise, there are very few records of big brown bats in Nova Scotia. They are known to occur in low numbers in New Brunswick, likely associated with human occupied buildings (McAlpine *et al.* 2002). In Nova Scotia, Taylor (1997) found three hibernating big brown bats, suggesting that there may be year round residents in the Province, although subsequent work at Nova Scotia hibernacula has provided no additional evidence of their overwintering presence (Randall 2011).

Landscape and site level features identified as indicators for increased likelihood of presence of bats, have been assessed for the proposed Project Study Area. These features, as outlined by NBDNR (2009) include:

- Known hibernacula or potential caves or mines within 5 km of the site;
- Coastline, or major water bodies within 500 m; or

- Forested ridge habitat on or near the site.

Known or Potential Winter Hibernacula

The rapid spread of White-nose syndrome throughout the Maritimes and the resulting catastrophic consequences on local bat populations have increased attention and concern focused on the winter hibernacula where the associated fungus *Geomyces destructans*, is thought to spread and propagate (Blehert *et al.* 2009). Hibernacula can house large concentrations of bats and may be the sites of swarming activity where large numbers of bats congregate near cave or mine openings in late summer or fall where they engage in social behaviours that include courtship and copulation (Rivers *et al.* 2005). In Nova Scotia, researchers at Dalhousie and Saint Mary's Universities have recently undertaken studies of bat movements among hibernacula in Nova Scotia and New Brunswick in an attempt to better understand the structure and movement of bat populations in the Region.

NSDNR has documented more than 600 mining areas, containing approximately 7,000 mining features which are or were at one time, open to the surface (NSDNR 1995). Some of these abandoned shafts are known to be used by hibernating bats. There may be additional mines that are not included within this database. Many of the mines that are recorded are of unknown status (in terms of depth, condition opening etc.) but most that are known are flooded, in-filled, or too shallow for the thermal conditions required by hibernating bats. Where known, the database records information on the abandoned mine opening that includes: depth, flooding, condition of opening, physical form (shaft/slope/adit), etc. One recent study by Randall (2011) considered known caves and abandoned mines in mainland Nova Scotia, and identified 30 of these as having potential importance to bats, 21 of which were previously unstudied. In the course of these surveys, no abandoned mines around the wind development area were identified as having high potential for swarming bats. There were four mine openings identified as having potential approximately 50 km to the southeast of the site near New Lairg and McLellan's Brook, but none of these openings were found to have swarming activity. The predictive model developed in this study suggested that caves must have a depth of at least 50 m to have greater than 10% chance to be used as a swarming site for bats. Suitable bat hibernacula must also be humid with consistent, cool temperatures (Brack 2007; Ingersoll *et al.* 2010).

There are six known abandoned mine shafts within 5km of the Project. All are located in Smithfield and were constructed to prospect for lead. The bat study for Greenfield has encompassed these shafts. One location was set up with bat monitoring equipment during the same study period as the Greenfield bat study.

Species Status of Local Bats and White-Nose Syndrome

White- nose Syndrome is currently understood to be the primary threat to little brown myotis, northern long-eared myotis and the tri-colored bat. These three species are currently listed as Endangered by COSEWIC following an emergency assessment on February 3, 2012. In 2013, all three were listed as *Endangered* under NSESA. These assessments and subsequent status

changes are largely the result of the threat from the rapidly spreading white-nose fungus, and the decimating effects it has on the populations of little brown myotis, northern long-eared myotis, and the tri-colored bats. The two *Myotis* species have historically been the most common species of bat in the Maritimes, but populations at affected hibernacula in the region have been decimated. No other bats species occurring in the Province have special status.

In 2006, the first case of white-nose syndrome was recorded in North America, in Albany, New York. This syndrome is caused by a fungus (*Geomyces destructans*) which grows in cold, humid environments, the same environments where cave-dwelling bats are known to hibernate. White-nose syndrome affects bats while they are hibernating, causing hibernating bats to become dehydrated and malnourished, which in turn causes bats to become active at a time when they are unable to survive winter conditions and food resources are non-existent (Forbes 2012a,b,c). White-nose syndrome has spread at an average rate of approximately 200-400 km each year, and has now been recorded in Canada, in Ontario, New Brunswick, and Nova Scotia. In these three provinces, many sites are averaging mortality rates above 90% (Forbes 2012a). The fungus responsible for white-nose syndrome is believed to have originated in Europe, and is spread both by bats that have been infected, and people visiting caves (Forbes 2012a).

The fungus has been recorded in Nova Scotia, as of fall 2011, and it is anticipated that the effects throughout the Maritimes will be similar to that recently seen in northeastern United States and adjacent New Brunswick, where mortality rates in a single cave were over 94% over two years (Forbes 2012a, b). In February 2013, the fungus was recorded in PEI. In order to reduce the risk of spreading the White-nose Syndrome, permission to enter caves and conduct surveys has been restricted throughout Nova Scotia (Forbes 2012a).

While direct interactions between these three species are anticipated to be minimal as discussed in Section 6.2.1, consideration must be given to the siting of turbines and associated infrastructure to avoid hibernacula and maternity colonies.

In communications with Nova Scotia Department of Natural Resources Species at Risk Biologist, the Proponent has been made aware that the population is being severely affected by the presence of White-nosed Syndrome in Nova Scotia. There have been cases of bats emerging from their wintering hibernacula in February and being found in areas that were not before thought to have such habitats. Furthermore, due to the lack of food, cold weather and sluggish effect of sickness, the bats that are found are highly likely to only have travelled 1-2 km from their emergence point.

To date, no winter mortality has been reported within 5 km of the Project Study Area.

Major Water Bodies

There are no major water bodies within 5 km of the Project Study Area. The nearest major feature is the inland end of the Salmon River which is within 5 km of the Project. The nearest

coastline is the Northumberland Strait to the North which is more than 34 km away and the Bay of Fundy tidal inlet is approximately 25km west of the site.

Forested Ridge Habitat

Most wind developments on eastern North America are located along forested ridgelines due to the geography of the region, and the wind speeds that can be found along these features. Wind developments along these features may experience elevated mortality levels when migrating bats exploit favorable air currents associated with the features, or use them as navigational markers. *Myotis* species mortality has been found at forested ridge wind development areas in eastern North America to a lesser extent than migratory bats, probably due to their tendency to fly close to the ground (Broders 2003). The nature and cause of mortality of non-migratory bats at wind developments is poorly understood, but research is currently underway in Nova Scotia to better understand the movements of bats to/from and between hibernacula in the fall and spring which may help to better predict the risk factors associated with placement of wind developments.

Roosting and Foraging Habitat

Assuming that little brown and northern long-eared myotis are present, it is possible that maternity colonies may occur near the site which may be sensitive to construction activities, operational disturbance, or direct mortality from collisions with turbines. While male northern long eared and little brown myotis have less specific or limiting roosting requirements, maternity colonies of the local *Myotis* species are typically found in hollow, tolerant hardwood trees, or in the case of reproductive little brown myotis, in man-made structure where available (Broders and Forbes 2004). There are no buildings located within the Project Area. Roughly 90% of the area is non-forested and immature forested land. This compares to the greater landscape, of which a much higher percentage falls within mature hardwood or mixed-wood. While these figures do not indicate the actual presence of maternity colonies on the site, they suggest that relative to the surrounding landscape, the siting of the three turbines has less potential for interaction with reproductive bats than other locations in the landscape might.

While the potential for direct interaction with breeding Myotis species is anticipated to be low, their recently updated COSEWIC status warrants precautions to avoid direct interaction with breeding Myotis bats. Clearing and other construction activities that produce high noise levels such as jack-hammering will be conducted outside the active season for bats.

The information below is taken directly from Dr. Hugh Broders' bat survey report (Appendix I). Referred sources for the section below are listed at the end of the bat report, Appendix I.

The objectives of this bat survey were to:

(1) Provide information on the occurrence and relative magnitude of bat activity in the proposed development area, based on analysis of acoustic survey results;

(2) Provide relevant information on the resource requirements of local bat species that may be useful for the decision-making process on the proposed development; and

(3) Make relevant recommendations based on the results of this project and recent developments in the field of bats and wind energy.

Review of Key Issues

Background

Currently in Nova Scotia there are >150 wind turbines in operation (CanWEA 2013) and, as of yet, we are not aware of any incidents of major mortality, though bats have been killed. For context and qualification, most of these turbines have been in operation for only a short period of time (months to 7 years or less) and it is not known how thoroughly all existing operational turbines have been surveyed for bat fatalities or how well documented and reported the findings are. In the following sections we discuss the various means by which bats may be impacted by wind energy developments, including direct mortality, changes to habitat availability, and disruption of movement patterns (e.g., foraging, mating, migrations, or abandonment of sites).

Direct Mortality

Proximate causes of bat fatalities at wind energy developments may be due to direct strike by rotating turbine blades, collision with turbine towers, barotrauma or any combination of the three. Barotrauma involves tissue damage to the lungs due to rapid or excessive air-pressure reduction near moving turbines blades (Baerwald et al. 2008, Cryan and Barclay 2009) and the discussion of the relative role of barotrauma in the death of bats at wind energy developments remains on-going (Grodsky et al. 2011, Capparella et al. 2012, Rollins et al. 2012). In North America, significant bat fatality events at wind energy developments occur primarily in the late summer and early fall, peaking during the period that coincides with fall migration (Johnson 2005b, Cryan and Brown 2007, Arnett et al. 2008a). These trends have led researchers to believe that migration plays a key role in the susceptibility of certain bat species to wind turbine fatalities (Cryan and Barclay 2009). Although some fatality has also been documented during the spring (Brown and Hamilton 2006, Arnett et al. 2008a), numbers are much lower, thought to be a result of more scattered migratory behaviour, or possibly the use of different routes compared to fall migration.

The species that have the largest number of kills at wind farms are the long-distance migratory bats, including the hoary bat (*Lasiurus cinereus*), the eastern red bat (*L. borealis*), and the silver-haired bat (*Lasionycteris noctivagans*). In North America, these species make up about 75-80% of the documented fatalities at wind energy developments, with the hoary bat alone comprising almost half (Kunz et al. 2007, Arnett et al. 2008a). The cumulative impacts of current mortality rates as a result of wind turbines on these affected species could have long-term population effects (Kunz et al. 2007). Bat fatalities have also been reported for resident hibernating bat species, including the big brown bat (*Eptesicus fuscus*), the little brown bat (*Myotis lucifugus*), the northern long-eared bat (*M. septentrionalis*), and the tri-colored bat (*Perimyotis subflavus*) (Nicholson 2003, Johnson 2005b, Jain et al. 2007, Arnett et al. 2008a). At some sites in the eastern United States high numbers of fatalities of these resident, hibernating

species have been reported (Kunz et al. 2007).

Various explanations for the high incidence of bat fatalities at wind energy developments have been proposed (Johnson 2005b, Kunz et al. 2007, Arnett et al. 2008a, Cryan and Barclay 2009). Estimates of the number of bat fatalities vary widely from less than 3 bats/turbine/year (Johnson et al. 2003, Johnson et al. 2004) to upwards of 50 bats/turbine/year (Nicholson 2003, Kerns et al. 2005, Jain et al. 2007). Given the considerable variability in species composition and rates of bat fatalities among wind energy facilities, it is likely that location-specific qualities of individual facilities are important (e.g., located along migration routes or other flight corridors). It has also been proposed that the use of turbines with increasing height has extended developments further into the flight space used by migrating bats (Barclay et al. 2007). However, behavioural observations of bats displaying flight patterns typical of foraging activity prior to collisions with turbines (Horn et al. 2008) may suggest that bats are actively foraging which may mean that foraging while migrating may take place for some individuals. Others have hypothesized that collisions may result from bats being attracted to turbines out of curiosity, misperception (failure to avoid a detected obstacle or interference with perception of an obstacle), or as potential feeding, roosting, and mating opportunities (reviewed in Cryan and Barclay 2009). To date, the cause(s) of bat fatalities at turbines remains unclear and is an active area of research.

As mortalities may be the result of site-specific and design-specific characteristics and conditions, it is important to conduct site-specific monitoring studies to make reliable inferences on the potential impacts of a wind energy development on local bat populations (American Society of Mammalogists 2008).

Habitat Availability

In forested landscapes, habitat availability for bats may be impacted by the alteration or removal of vegetation to accommodate roads and wind turbine installations. This may include the direct loss of resources (e.g., roost trees), fragmentation of habitat components (e.g., foraging and roosting areas), or other disturbance that may cause bats to vacate certain areas, likely acting to degrade the local environment for bat colonies/populations that reside in the area during the summer. This negative impact of new wind energy developments is likely to occur, and will contribute to the cumulative effect of habitat loss that is occurring throughout the range of most bat species.

At the site level, small-scale clearings in forested landscapes have been shown to attract certain bat species, which use these areas for foraging (Grindal and Brigham 1998, Hayes and Loeb 2007). Removal of vegetation can create edges and small clearings which can act to concentrate prey for bats. The extent to which this loss of vegetation can be perceived to be beneficial to bats is not known and will vary from site to site, as there must be a balance between the availability of suitable roosting resources with the availability of suitable foraging areas within commuting distance to provide conditions that favour the occupancy of resident bat species (Henderson and Broders 2008).

Movement Patterns

From the perspective of bat movement, resident bats may be affected by wind energy developments through alterations to foraging areas and possible disruption of commuting movements between roosting and foraging areas. There is some genetic evidence to suggest that bat movements can be

impeded by fragmentation of habitat, which can scale up to population or distributional level effects (Kerth and Petit 2005, Meyer et al. 2009). However, this is not well understood for most species. Little is known about the dynamics of movement (e.g., altitude, travel routes, frequency of visitation) of resident, hibernating bats to and from hibernation sites. Anecdotal evidence suggests that bats likely use ridges and other linear landscape elements (e.g., riparian corridors) as travel routes, depending on the landscape (Arnett 2005, Lausen 2007, Furmankiewicz and Kucharska 2009). In the late summer and early autumn large numbers of bats congregate at the entrances to underground hibernacula in an activity referred to as 'swarming' (Davis and Hitchcock 1965, Fenton 1969, Thomas and Fenton 1979, Glover and Altringham 2008). During the swarming period bats do not roost in hibernacula; research being conducted in Nova Scotia indicates that resident bats are 'on the move', roosting transiently on the landscape (Lowe 2012), though we do not have a full understanding of the dynamics of these behaviours. Swarming may serve several functions, including courtship, copulation, and orienting young-of-the-year to over-wintering sites (Fenton 1969, Thomas and Fenton 1979).

Movement data from Ontario and Manitoba suggests that resident bats may move up to at least 120 km between hibernacula within a year, and up to at least 500 km between years (Fenton 1969, Norquay et al. 2013). In New England, there are records of bats moving 214 km between hibernacula within one year, with one female moving 128 km in only three nights during spring emergence from hibernation (Davis and Hitchcock 1965). Obviously these resident hibernating species are at least capable of large scale migratory movements on the order of hundreds of kilometers. It is not known whether flight behaviour (e.g., height, routes, etc.) during this time differs from when resident species are in their summering area; the paucity of information on this aspect of their biology would appear to be one of the largest impediments in accurately predicting the impact of wind energy developments on local bat populations (Weller et al. 2009).

Bats in Nova Scotia

Nova Scotia Bat species

In Nova Scotia there are occurrence records for seven species of bats (Table 1; van Zyll de Jong 1985, Broders et al. 2003, Segers et al. 2013), and each have been documented to have experienced fatalities at wind turbine sites (Arnett et al. 2008a). There are three species of long-distance migratory bats recorded in the province, the hoary bat, the eastern red bat, and the silver-haired bat. These three species have extensive distributional ranges throughout North America, with Nova Scotia at or near their northern range limit (van Zyll de Jong 1985). Low numbers of echolocation recordings of the long-distance migratory species in Nova Scotia by Broders (2003) and other unpublished work suggests that there are no significant populations or large scale migratory movements of these species in the province, but they do occur regularly and are often associated with coastal or off-shore occurrences (Cryan and Brown 2007, Czenze et al. 2011, Segers et al. 2013). Two species of bats in the genus Myotis, the little brown bat and the northern long-eared bat, are the only abundant and widely distributed bats in Nova Scotia (Broders et al. 2003, Henderson et al. 2009). These 5–8g insectivorous bats are sympatric over much of their range (Fenton and Barclay 1980, van Zyll de Jong 1985, Caceres and Barclay 2000). A third species, the tri-coloured bat, has a significant population in the province, however they are likely restricted to southwest Nova Scotia (Broders et al. 2003, Rockwell 2005, Farrow and Broders 2011). These three species are gregarious species that over-winter in caves and abandoned mines in the region (Moseley 2007, Randall 2011). There is only one unconfirmed observation of the big brown bat, also a

gregarious species, hibernating at a cave in central mainland Nova Scotia (Taylor 1997).

Ecology of Resident Species

Northern long-eared and little brown bats are expected to be the most likely species to occupy the proposed development area. The life history of both of these species is typical for temperate, insectivorous bats. Their annual cycle consists of a period of activity (reproduction) in the summer, and a hibernation period in the winter. Females of the two species bear the full cost of reproduction in the summer, from pregnancy to providing sole parental care to juveniles (Barclay 1991, Hamilton and Barclay 1994, Broders 2003).

The northern long-eared bat is a forest interior species that primarily roosts and forages in the interior of forests (Broders 2003, Jung et al. 2004, Henderson and Broders 2008). Females form maternity colonies, roosting in coniferous or deciduous trees, depending on availability (Foster and Kurta 1999, Broders et al. 2006, Garroway and Broders 2008). Males typically roost solitarily in either deciduous or coniferous trees (Lacki and Schwierjohann 2001, Jung et al. 2004, Ford et al. 2006). The little brown bat is a generalist species that is associated with forests, as well as human-dominated environments (Barclay 1982, Jung et al. 1999). This species has been found to forage over water and in forests (Anthony and Kunz 1977, Fenton and Barclay 1980), and both males and females (i.e., maternity colonies) have been documented roosting in both buildings and trees (Crampton and Barclay 1998, Broders and Forbes 2004). During the summer, it appears that most of the commuting and foraging activity of northern long-eared and little brown bats occurs close to the ground (Broders 2003). Nonetheless, our ability to survey bat activity at high altitudes is extremely limited, and therefore our ability to make inference on the vertical distribution of bats is also limited.

A third species that occurs in significant numbers in Nova Scotia, the tri-colored bat, is not likely to occur in the proposed development area (Farrow and Broders 2011). In Nova Scotia, work that we have done in Kejimkujik National Park suggests that this species roost in Usnea lichen species and forages over waterways (Poissant et al. 2010).

White Nose Syndrome

In 2012, three species of bats found in Nova Scotia were listed by COSEWIC as Endangered, and in 2013 were listed as Endangered by the Province of Nova Scotia. This is primarily due to the spread of an emerging infectious disease known as White Nose Syndrome (WNS) that is responsible for unprecedented mortality in hibernating bats through much of eastern North America (Blehert et al. 2009, United States Fish & Wildlife Service 2012). The condition is caused by *Pseudogymnoascus destructans* (formerly *Geomyces destructans)*, a cold-loving fungus that thrives in cave conditions and as such, impacts bat population directly during the winter hibernation period (Lorch et al. 2011, Blehert 2012, Minnis and Lindner 2013). It is thought to disrupt patterns of torpor which results in death by starvation or dehydration (Cryan et al. 2010, Reeder et al. 2012, Warnecke et al. 2013). First documented in New York State in 2006 (Blehert et al. 2009), WNS spread rapidly to 19 states and four Canadian provinces by 2011 and is thought to be responsible for the death of more than 5.5 million bats (United States Fish & Wildlife Service 2012). White Nose Syndrome has been confirmed among populations of seven species of bats; the little brown bat, the most abundant species in the region currently affected by WNS, has experienced the most dramatic population declines (Frick et al. 2010).

Some hibernacula have seen mortality rates of 90 to 100 percent of resident hibernating bats as a result of infection with WNS (United States Fish & Wildlife Service 2012), leading researchers to believe that WNS could lead to local extinctions of the little brown bat, as well as other species (Frick et al. 2010). White Nose Syndrome was first documented in Nova Scotia in April 2011 and declines of 80% to 99.9% have since been recorded in winter populations (Broders and Burns, unpublished data). Therefore it would be prudent to protect any surviving animals that may be genetically predisposed to surviving the infection. Even prior to WNS, bats were increasingly recognized as a conservation priority in North America. Now, in consideration of the sharp declines and rapid spread of WNS, serious concerns have been raised about the impact of WNS on the population viability of affected bat species, consequently impacting the conservation status of bat species at the local, national and global level (Table 1). Given that hibernacula represent one of the more critical resources for bats, as they allow successful over-wintering, they are important to protect.

Potential for Hibernacula

The Nova Scotia Proponent's Guide to Wind Power Projects (Nova Scotia Environment 2012) states that wind farm sites within 25 km of a known bat hibernacula have a 'very high' site sensitivity. There are no known hibernacula within 25 km of the Greenfield Wind Energy Project area (Moseley 2007, Randall 2011). The nearest known major bat hibernaculum is Hayes Cave, the largest hibernaculum in NS, which is located in Maple Grove approximately 32 km from the proposed development area. At approximately 43 km away is Lear Shaft, located in Londonderry in an area with extensive underground mine workings and a number of mine openings. There are no underground records of hibernating bats from this site (owing to the structure of the site, a now-gated vertical shaft). In sampling on 7 nights in the autumns of 2009 and 2010, bat captures using harp traps resulted in an average of 8 bats captured per sampling hour indicating this is a fall swarming site (Burns unpublished data). Overwinter surveys for white-nose syndrome monitoring in 2012 yielded the collection of bat carcasses around the mine opening in winter demonstrating this site is a hibernaculum.

According to the Nova Scotia Abandoned Mine Openings Database (Fisher and Hennick 2009), there are 26 underground abandoned mine opening records in the vicinity of the Greenfield project (within 25 km) . Of these, the records suggest that 21 of the records have original depths of 21m or less and/or filled in suggesting they would be unsuitable as hibernacula. Of the remaining 5 sites, 2 have been filled in (KPT-1-025 and EMM-1-001) leaving three openings to be potentially explored for bat activity (BRF-1-002, SPB-1-003 and KPT-1-007). In 2010, Randall (2011) conducted ultrasonic monitoring at five sites in the vicinity of the proposed development area; at three closely situated adits at New Lairg, Pictou County, McLellan's Brook Cave, Pictou County and at Natural Bridge Cave, Colchester County. She concluded that none of these exhibited strong evidence of fall swarming activity by bats although there were captures of bats at Natural Bridge Cave on one sampling night.

Results

Bat detectors within the proposed wind energy development were deployed from July 30 through to October 11, 2013 and recorded continuously throughout this period. Detectors at the abandoned mine openings were deployed and recorded continuously from July 30 to the September 21, 2013.

Within the proposed wind energy development area there were 521 acoustic files recorded on the 3 microphones (2 detectors) with 19 classified as bat-generated ultrasound files and the remaining classified as extraneous noise (Table 4). Of these, 14 were recorded at the forest edge site (site 1), 5 recorded at the base of the meterological tower (site 2) and no bat call sequence files were recorded on the high microphone on the meteorological tower. The majority of call sequences (18/19; 94.7 %) were classified as Myotis species (i.e., includes northern long-eared and little brown bats); as stated above no attempt was made to identify these call sequences to the species level given the difficulty in achieving such identifications. There was one call sequence attributed to a hoary bat that was recorded on the night of 23 August 2013.

The bat detector at the Brookfield AMO recorded 46 acoustic files with 21 classified as bat-generated ultrasound files (Table 5). Sixty-six percent (n= 14) of the bat call sequences were classified as Myotis species, 28.6 % (n=6) were classified as hoary bat and there was one call sequence that was classified as unknown (4.7%). The hoary bat sequences were recorded on three nights with one sequence on the evening of Aug 21, two sequences on Sept 1st within 18 minutes of each other and three sequences on Sept 2nd within 28 minutes of each other. This suggests an individual bat on each night made the calls. The unknown sequence recorded was short in duration (5.14 milliseconds) consisting of 8 calls which lacked the distinctive frequency modulated sweep typical of bat calls and thus encompassed a maximum and minimum frequency of 39.54 kHz and 38.54 kHz, respectively. These characteristics fall within known parameters for Myotis species or potentially a red bat however the missing shape parameters precluded a positive identification to a particular species group although do represent discrete bat call pulses. The bat detector at the Smithfield AMO recorded 210 acoustic files with 87 classified as bat-generated ultrasound files (Table 5). Myotis species again dominated the call sequences at 97.7% followed by 2.3% attributable to hoary bat call sequences. The hoary bat sequences at Smithfield were recorded on 2 separate nights with a single recorded on each of August 27 and September 8th. At the Kemptown AMO there was 1204 acoustic files recorded with10 classified as bat-generated ultrasound files. Myotis species comprised 60% of the call sequences and the remaining 40% were attributable to hoary bat call sequences. The hoary bat sequences were recorded on three nights with one sequence on the evening of Aug 28, two sequences on September 2 and one sequence on September 3rd. This is suggestive of an individual bat on each night.

The average number of recorded bat call sequences per night in the proposed development area (average for the two sites) was 0.26 (SD =0.61) during the sampling period. To place the relative magnitude of activity recorded in the study area into context, in 129 nights of monitoring along five forested edges in the Greater Fundy National Park Ecosystem from June to August 1999, the average number of sequences per night was 27 (SD = 44; Broders unpublished data). In 650 nights of monitoring at river sites in forested landscapes in southwest Nova Scotia from June to August of 2005-2006, the average number of sequences per night was 128 (SD = 232; Farrow unpublished data), though note that rivers act to concentrate bat activity, as they are used as foraging and commuting corridors (Laval et al. 1977, Fenton and Barclay 1980, Fujita and Kunz 1984, Krusic et al. 1996, Zimmerman and Glanz 2000, Lacki et al. 2007). Both of these previous comparisons were conducted prior to the emergence of white nose syndrome and therefore may not be directly comparable. In a forested landscape in Colchester County, Nova Scotia, we detected an approximate 99% decrease in bat echolocation activity from 2012 to 2013 at forested and riparian sites that were monitored for bat activity following the confirmation of mortality from white nose syndrome in Nova Scotia (Segers and Broders, unpublished data).

The average number of recorded bat call sequences per night for the Brookfield, Smithfield and Kemptown abandoned mine openings were 0.40 (SD = 0.91), 1.64 (SD = 2.72), 0.14 (SD = 0.42), respectively. The Smithfield AMO had the highest level of bat activity of the four study areas and although bat activity was low, there was a trend of bat activity increasing towards the end of August and early September (Figure 1, Appendix I) as predicted for swarming sites.

5.4.3 Reptiles and Amphibians

5.4.3.1 Overview

All amphibian species in Nova Scotia are considered secure. The Nova Scotia Museum of Natural History (Nova Scotia Community, Culture & Heritage) does list popyploid populations of Blue-spotted Salmamader (Ambystoma laterale) and *erethrystic forma* of Eastern Red-backed Salamander (*Plethodon cinereus*) as species of significance. Gilhen (1984) writes that the erythristic phase of the Eastern-red Backed Salamander might be 15 percent or less of the population in localities where it does occur. In Blue-spotted Salamander some females have three sets of chromosomes rather than pairs and are referred to as triploid. Neither of these rarer forms of salamander, while of biological interest, is known to have an elevated level of conservation concern.

5.4.3.2 Herpetile Species of Conservation Concern

Two reptile species, the Wood Turtle and the Snapping turtle, are considered as priority species.

Table 5.12 Priority Reptiles and Amphibians Species Listed within 100 km. NS status (2010) as determined from Wild Species - General Status of Species in Canada. Also listed NSESA, COSEWIC, SARA status.

Common Name	Scientific Name	NSGSWS 2010	Habitat	Occurrence
Wood Turtle	*Clemmys insculpta*	Sensitive COSEWIC: Threatened (2007) NSESA: Threatened (2013) SARA: Threatened (2010)	Wood turtles are generally found in riparian areas or flood plains. Wood turtles need three habitat components: a stream or river, a sandy nesting substrate and a forested area.	Low possibility
Snapping Turtle	*Chelydra serpentina*	Secure (2010) COSEWIC: Special Concern (2008) NSESA: Vulnerable (2013) SARA: Special Concern	Vegetated shallows of lakes and streams. Mature females leave the water for a brief period to lay eggs. Underwater hibernation.	Unlikely

WOOD TURTLE

Wood Turtle Habitat Requirements (MacGreggor and Elderkin, 2003)

Wood turtles are generally found in riparian areas or flood plains. Wood turtles need three key habitat components: a stream or river, a sandy nesting substrate, and a forested area.

- A Stream or River

Wood turtles need access to water for thermoregulation, movement, hibernation, and mating. In spring when temperatures are cool, the turtles are often found associated with clear, moderately flowing streams, creeks or rivers. At this time, they usually overnight in the water, but spend much time during the day on land basking on along the shore. Wood turtles prefer hard-bottomed streams and rivers composed of sand or gravel, and avoid clay or muck-bottomed drainage. Clear medium sized (7 to 100 feet wide) rivers and streams are ideal.

- Sandy Nesting Substrate

Wood turtles nest in sand or sand-gravel areas like sand bars, sand points, and cut banks along or in the river. They will also use artificial nesting sites (e.g. gravel pits, logging roads, road shoulders, bridge crossings, residential settlements) when they are available.

- Forest

The wood turtle is the most terrestrial of the freshwater turtles in the family Emydidae. In summer when temperatures are warmer, wood turtles spend more time on land. Wood turtles make their home in shaded, wet-mesic forested (coniferous or deciduous) flood plains or riparian areas. The turtles use dense mixtures of low-growing vegetation for foraging, and bask in sunlit openings.

Wood Turtle Natural History (Gilhen, 1984)

In late April and early May Wood turtles surface from hibernation sites to bask on the river bank. In late June-early July females move to sand or gravel banks to lay eggs. Hatchlings emerge in the autumn. During the summer Wood Turtles will travel up stream tributaries. They feed on horsetails, berries, earthworms and other invertebrates. In October they return to the main stream to hibernate, laying on stream bottoms away from the main current.

The Wood Turtle in year 2000 was listed Vulnerable and protected under the NSESA. In year 2013 the NSESA status for Wood turtle was upgraded to Threatened and this indicates a concern for a continued declining Wood Turtle population in Nova Scotia. Wood Turtle in year 2010 received threatened status and protection under SARA.

Locations for wind turbines are chosen at the tops of hill and no watercourse is near the area of the proposed wind turbines. Further away, a stream crossing improvement is perhaps necessary for an access road over a tributary of Christie Brook (Refer photos 6 and 7). The North and Salmon River watershed that enters Cobequid Bay has records of 1-2 Wood Turtles by ACDCC and NSDNR (MacGregor and Elderkin, 2003). There is some potential of Wood Turtle within the Christie Brook watershed. The tributary behind the farm is shallow, becoming

almost dry in times of little rainfall. Stream bottom behind the farm is cobble. Livestock is fenced from entering the stream. There is feeding opportunity for Wood Turtle but no hibernation or egg laying opportunity. The landowner (farmer and long-time resident) along this tributary has not seen turtles here. The possibility of Wood Turtle at this location is very low but cannot be completely ruled out. In the event a stream crossing for the access road requires improvement, this work will be only a short term disturbance event and cause no degradation of turtle habitat.

In 2012, the Proponent commissioned a highly qualified biologist to brief the Environmental and construction managers for the Proponent on the wood turtles in a two-day interactive workshop. The turtle workshop, held in May 2012, demonstrated actual species (found well outside of the Project Study Area - >100 km away at East River Saint Mary's). The workshop consisted of a power-point presentation and general Q & A session followed by field visit to the turtle study area. It is unlikely the Wood Turtle will be encountered at the Greenfield project area yet this previous interactive training ensures that should the wood turtle be recorded or encountered within work activities (construction, operations, decommissioning) that proper precautions will take place on behalf of on-site staff.

SNAPPING TURTLE

Habitat

Snapping Turtles spend most of their lives in water. They prefer shallow waters so they can hide under the soft mud and leaf litter, with only their noses exposed to the surface to breathe. During the nesting season, from early to mid-summer, females travel overland in search of a suitable nesting site, usually gravel y or sandy areas along streams. Snapping Turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits.

Threats

It takes 15 to 20 years for a Snapping Turtle to reach maturity. As a result, adult mortality greatly affects the species' survival. During the summer, many turtles cross roads in search of mates, food and nest sites. This is risky for turtles as they are to slow to get out of the way of moving vehicles. Snapping Turtles are also sometimes intentionally persecuted. Eggs in nests around urban and agricultural areas are subject to predators such as raccoons and striped skunks.

In 2013, Snapping Turtle was given Vulnerable status through the NSESA. On a national level SARA lists it as a species of Special Concern.

No suitable deep pond or stream occurs close to the proposed turbine sites. The shallow tributary of Christie Brook is believed too shallow for Snapping Turtle habitat. The same as for Wood Turtle, in the event a stream crossing for the access road requires improvement, this work will be only a short term disturbance event and cause no degradation of Snapping Turtle habitat.

5.4.4 Dragonflies and Damselflies (Odonta)

One hundred and sixteen dragonflies and damselflies occur in Nova Scotia. Dragonflies are dependent on a variety of streams and wetlands for completion of their life cycle. Thirty species are listed (Table 5.13) for comparison of their habitat requirements and the habitats occurring at the development site. The biologist making this determination has done workshop training with Paul-Michael Brunelle and contributed over 200 voucher specimens to the Atlantic Dragonfly Inventory Program (ADIP).

Because of the presence of a shallow marsh at Greenfield, up to 13 priority species are at first considered to have a potential to occur at the Greenfield site. The Greenfield area was examined for Odonta on June 27 and September 6, 2013. The September 6 visit revealed a better understanding of the ephemeral character of the shallow marsh. Dominate wetland plant is *Scirpus cyperinus*, a plant of wet meadows and swamps. The wetland becomes water charged after snow melt and after significant rainfall but becomes near dry at other times. From this observation the wetland is considered unsuitable habitat for many pond breeding Odonta that require a more permanent water body. Of note at this wetland was the lack of Bluet (*Enallagma*) species that often occur in profusion near ponds.

On June 27 Four-spotted Skimmer (*Libellula quadrimaculata*) and Common Whitetail (*Libellula lydia*) were recorded. Both these species will breed in small water filled borrow pits. On September 6 there was large numbers of White-faced Meadowhawk (*Sympetrum obtrusum*), a species that includes temporary ponds amongst sites for breeding. One Eastern Forktail (*Ischnura verticalis*) was seen at a small, water filled, vehicle rutted area. A few *Aeshna* (possibly Canada Darner) were also visiting this small open water area and flying widely over the area.

Figures 5.11 and 5.12 Four-spotted Skimmer and White-faced Meadowhawk, both secure species

Table 5.13 Priority Odonta Listed within 100 km of Project. NS status (2010) as determined from Wild Species - General Status of Species in Canada. Also listed NSESA, COSEWIC, SARA status.

Common Name	Scientific Name	NS DNR Status 2010	Habitat	Occurrence Greenfield
Ebony Boghunter	*Williamsonia fletcheri*	May Be At Risk	Bogs and Fens. Larvae develop within saturated sphagnum.	Possible
Brook Snaketail	*Ophiogomphus aspersus*	May Be At Risk	Clear streams where shallow current ripples over sand.	Unlikely
Twinhorned Snaketail (Maine Snaketail)	*Ophiogomphus mainensis*	May Be At Risk	Overall habitat is clear rivers and streams with strong current over coarse cobbles and with periodic rapids sections.	Unlikely
Rusty Snaketail	*Ophiogomphus rupinsulensis*	May Be At Risk	Medium to large swift-flowing rivers and streams.	Unlikely
Skillet Clubtail	*Gomphus ventricosus*	May Be At Risk	In the Northeast, the larvae inhabit large rivers where they burrow in the soft mud of deep pools.	Unlikely
Williamson's Emerald	*Somatochlora williansoni*	May Be At Risk	Pond breeding.	Unlikely*
Taiga Bluet	*Coenagrion resolutum*	May Be At Risk	Marshes, pools, sloughs, and small well-vegetated ponds.	Unlikely
Harpoon Clubtail	*Gomphus descriptus*	Sensitive	River breeding.	Unlikely
Zorro Clubtail (Northern Pygmy Clubtail)	*Lanthus parvulus*	Sensitive	Springs and small woodland streams.	Unlikely
Prince Baskettail	*Epitheca princeps*	Sensitive	Large, often poorly vegetated, ponds and lakes, as well as sluggish streams and rivers with mucky bottoms.	Unlikely
Clamptipped Emerald	*Somatochlora tenebrosa*	Secure	Very small, often partially dry, shaded streams and brooks.	Unlikely
Little Bluet	*Enallagma minusculum*	Secure	The microhabitat is stands of floating-leaved vegetation (*Brasenia*, Water Shield, *Nymphaea*, Waterlily, Nymphoides, Floating Heart, *Potamogeton*, Pondweed) or emergent plants (Equisetum, Horsetail, *Juncus*, Rush) in shallows along the shore of lakes and ponds.	Unlikely
Harlequin Darner	*Gomphaeschna furcllata*	Sensitive	Pond breeding.	Unlikely*
Kennedy's Emerald	*Somatochlora kennedyi*	May Be At Risk	Pond breeding.	Unlikely*
Orange Bluet	*Enallagma*	May Be	Slow-moving streams and	Unlikely

	signatum	At Risk	ponds.	
Quebec Emerald	*Somatochlora brevicincta*	May Be At Risk	Pond breeding. This species has broad habitat tolerance requiring intermediate to high floating plant richness, a narrow to intermediate emergent zone width, intermediate to high tolerance to disturbance, and intermediate to coarse substrates.	Unlikely
Delicate Emerald	*Somatochlora franklini*	Sensitive	Pond breeding.	Unlikely*
Zebra Clubtail	*Stylurus scudderi*	May Be At Risk	Overall habitat appears to be streams and rivers with slight to moderate current and gravel or sandy benthos. Possibly inhabits forest streams with a slight to moderate current. Collection in Nova Scotia has been at slow, mesotrophic to eutrophic waters with clay, sand and mud bottoms (Cornwallis River at Highway 101, Annapolis River at Middleton, P.M. Brunelle). Both sites show some signs of eutrophication due to agriculture, and this suggests that the species may be tolerant of lowered water quality.	Unlikely
Amberwinged Spreadwing	*Lestes eurinus*	Secure	Pond breeding.	Unlikely*
Forcipate Emerald	*Somatochlora forcipata*	May Be At Risk	River breeding.	Unlikely
Black Meadowhawk	*Sympetrum danae*	Sensitive	A variety of habitats, but most common at bogs, marshes, and fens.	Possible
Subarctic Bluet	*Coenagrion interrogatum*	May Be At Risk	Pond breeding.	Unlikely*
Ringed Emerald	*Somatochlora albicincta*	May Be At Risk	Pond breeding.	Unlikely*
Muskeg Emerald	*Somatochlora septentrionalis*	Sensitive	Pond breeding.	Unlikely*
Ocellated Darner	*Boyeria grafiana*	Sensitive	Shaded streams, rivers, and poorly vegetated windswept lakes.	Unlikely
Canada Whiteface	*Leucorrhinia patrica*	May Be At Risk	Pond breeding.	Unlikely*
Black Saddlebags	*Tramea lacerata*	May Be At Risk	Breeds at ponds, lakes, and freshwater marshes. Often seen in upland areas well away	Unlikely*

			from water.	
Spot-winged Glider	*Pantala hymenaea*	Sensitive	Temporary pools and puddles, rarely brackish. Often seen well away from water.	Possible
Vesper Bluet	*Enallagma vesperum*	Sensitive	Ponds, lakes, and slow vegetated streams.	Unlikely
Seaside Dragonlet	*Erythrodiplex berenice*	Sensitive	Salt marshes.	Unlikely

**Occurrence revised from possible to unlikely after wetland examination.*

5.4.5 Butterflies

There is some discrepancy between S-ranks for species identified by ACCDC within a 100 km radius and the rankings given by NSGSWS. The rankings, indicated by http://www.wildspecies.ca/ are chosen as predominate.

The analysis of priority butterfly species borrows heavily from the work of the presently ongoing Maritime Butterfly Atlas http://www.accdc.com/butterflyatlas/home_e.html and the work of Peter and Linda Payzant http://novascotiabutterflies.ca/ack.cgi. The MBA began in 2010 and will continue at least to 2014. Like the Maritime Breeding Bird Atlas it is a citizen based survey by volunteer naturalists.

Twenty seven priority (27) butterfly species are considered (Table 5.14) for analysis. Some (5) are listed as secure or are listed as not occurring (4) in Nova Scotia by NSGSWS, but are noted in the ACCDC 100km radius search as having a higher level of conservation concern.

Of the 27 priority species, seven (7) species are thought as unlikely to be present through habitat comparisons or because of only having old historic records (Greenish Blue only has one 1908 record). Only three (3) species are in a Maybe at Risk category. One (Early Hairstreak) of these Maybe at Risk species is unlikely to occur since its larvae require Beech trees (*Fagus grandifolia*) that produce nuts. Two other Maybe at Risk species (Bog Elfin and Jutta Arctic) require bog habitats and the wind turbine undertaking will not impact such wetland habitats. There are 6 species in a Sensitive category. One sensitive species, the Monarch, would not find Common Milkweed (*Asclepias syriaca*) for larval food plant at the study area and in fall migration is more commonly near the coast. Five (5) Sensitive butterfly species (Northern Cloudywing, Mustard White, Arctic Fritillary , Satyr Comma and Hoary Comma)are possible. However these species are described by Payzant with descriptors as scarce, rare and extremely rare. The current Maritime Butterfly Atlas, a survey based on citizen naturalists, has recorded very few records to date for these species in the Province of Nova Scotia.

During field surveys of the study site(s) any butterflies observed were photographed. Certain common and secure species were seen but no observations for the species listed in Table 5.14.

The placement of all turbines will occur within recent harvested and plantation type forest. This is a common habitat type in the area and the turbine pads only displace a small portion of this

type of forest cover. It is believed that the wind turbine development will have a minimum effect on butterfly habitat or population.

Table 5.14 Priority Butterfly Species Listed within 100 Km. NS status (2010) as determined from Wild Species - General Status of Species in Canada. Also listed NSESA, COSEWIC, SARA status.

Common Name	Scientific Name	NS DNR Status (2010)	Habitat	Larval Foodplant	Occurrence
Northern Cloudywing	*Thorybes pylades*	Sensitive	Unknown. Possibly partial wooded places.	Herbaceous Fabaceae. (Pea or Bean Family)	Possible
Pepper and Salt Skipper	*Amblyscirtes hegon*	Secure	Glades, woods edges, roadsides or along streams often in rather heavily forested settings.	Kentucky bluegrass (Poa pratensis), striped oats (Agrostis), and Bermuda grass (Cynodon dactylon).	Possible
Common Roadside Skipper	*Amblyscirtes vialis*	Secure	Very hard to predict in many areas. Usually deciduous woodlands or clearings, streamsides, roads, edges of deciduous forest. Also dry mixed oak-pine forest, rocky barrens, glades, or right of ways through forests.	A variety of grasses. Kentucky Bluegrass (*Poa pratensis*) and bent grasses (*Agrostis* ssp.).	Possible
Mustard White	*Pieris oleracea*	Sensitive	Deciduous woods and bogs.	Various mustard family plants	Possible
Bronze Copper	*Lycaena hyllus*	Secure	A variety of open, wet habitats.	Curled Dock (*Rumex crispus*) and Water Dock *(Rumex orbiculatus*) and Knotweeds (Polygonium ssp.).	Unlikely
Maritime (Salt Marsh) Copper	*Lycaena dospassosi*	Not Listed	Salt marshes with the larval foodplant and plenty of sea lavendar.	Larval foodplant is *Potentilla egedii*. Adult nectar plant is sea lavendar (*Limonium nashii.).*	Unlikely
Henry's Elfin	*Callophrys henrici*	Secure	Variety of woodland and bog habitats.	Mountain Holly (*Nemophanthus mucronata*).	Possible
Eastern Pine Elfin	*Callophrys niphon*	Secure	In and around dry pine woods.	White Pine (*Pinus strobus*) and Jack Pine (*Pinus banksiana*).	Unlikely
Bog Elfin	*Callophrys (Incisalia) lanoraieensis*	May Be At Risk	Black Spruce-Tamarack bogs.	Black Spruce (*Picea mariana*).	Possible
Acadian Hairstreak	*Satyrium acadica*	Undetermined	Streams, marshes, wet meadows	Willows (*Salix* spp.).	Possible

Banded Hairstreak	*Satyrium calanus*	Undetermined	Deciduous forest edges, city gardens, roadsides.	Flowering shrubs that are in bloom in late Spring and Summer, such as Dogwoods (*Cornus* spp.), ? Meadowsweet (*Spiraea* spp.), and late-blooming viburnums (*Viburnum* spp.).	Possible
Striped Hairstreak	*Satyrium liparops*	Undetermined	Deciduous forest edges, city gardens, roadsides.	*Rosaceae* family including Plum and Cherry (*Prunus* spp.) and Hawthorns (*Crataegus* spp.). Also recorded on oak, willow and blueberry.	Possible
Early Hairstreak	*Erora laeta*	May Be At Risk	Deciduous woods where Beech is present.	American Beech (*Fagus grandifolia*), possibly also Beaked Hazelnut (*Corylus cornuta*).	Possible
Greenish Blue	*Plebejus saepiolus*	Not Listed	Moderately disturbed areas where clover grows.	Clovers.	Only one old record for NS. Unlikely.
Monarch	*Danaus plexippus*	Sensitive COSEWIC: Special Concern	Almost anywhere during the spring (northward) migration; near the larval foodplants during the breeding season; in the fall commonly near the coast, often in large numbers, all heading south.	Common Milkweed *(Asclepias syriaca)* and Swamp Milkweed *(A. incarnata)*. Neither plant grows in great abundance in Nova Scotia.	Unlikely
Arctic Frittary	*Boloria chariclea*	Sensitive	Boreal forest and bogs.	Willows and possibly violets.	Possible
Eastern Comma	*Polygonia comma*	Not Listed	Parks, suburbs, a variety of habitats.	Stinging Nettle (*Utrica diocia*), Wood Nettle (*Laportea canadensis*), elm (Ulmus ssp.) and Hops (*Humulus lupulus*).	Possible. Not listed as species in NS DNR General Status list.
Satyr Comma	*Polygonia satyrus*	Sensitive	Boreal forest.	Nettles, *Urtica* sp.	Possible
Hoary Comma	*Polygonia gracilis*	Sensitive	Boreal forest.	Currants.	Possible

Compton Tortoiseshell	*Roddia vaualbum*	Not Listed	Boreal and coastal forest habitats. Adults overwinter.	Various willows (*Salix* ssp.), alders (*Alnus* ssp.), amd poplars (*Populus* ssp.).	Possible. Not listed as species in NS DNR General Status list.
Milbert's Tortoiseshell	*Aglais milberti*	Secure	A forest species, typically seen at woodlot edges and along forestry roads. Adults overwinter.	Stinging nettle (*Utrica diocia*).	Possible
Jutta Arctic	*Oeneis jutta*	May Be At Risk	Bogs and fens.	Sedge Family (*Cyperaceae*), Tussock Cotton Grass (*Eriophorum vaginatum*), *Carex* Species	Possible

Figure 5.13 Mourning Cloak photographed on site

Significant Habitats include:

1. Sites where species of risk or other species of conservation concern can be found and/or;
2. Sites where unusually large concentrations of wildlife occur and/or;
3. Habitats that are rare in the province.

Managed areas include such areas as Provincial Parks or wildlife Management Areas and usually have a legal designation.

The ACCDC GIS scan identifies no Managed Areas or Significant Areas within 5 km of the study area. However the Dept. of Natural Resources SigHab Database does map a polygon near Clifford Brook on the Salmon River. This polygon identifies rare plants and Bald Eagle nesting. At nearly 5 km distance, the SigHab area is not affected by the proposed wind turbine development. NSDNR maps no deer wintering areas at the study area.

5.5 ATMOSPHERIC ENVIRONMENT

The following section describes the climate and air quality of the site.

5.5.1 Climate

Weather data was acquired from the Truro meteorological station, which is located approximately 12 km west of the Project site. Based on Environment Canada climate normals or averages for the period of 1971-2000, the average annual temperature in the region is 5.8ºC, with the average daily maximum and minimum being 11.1ºC and 0.5ºC, respectively (Environment Canada 2011). The warmest period during the year is typically from June to August (daily mean of 17.0ºC), while the coldest period is between December and February (daily mean of -5.6ºC) (Environment Canada 2011). Historical high wind speeds recorded were maximum hourly wind speed at 93 km/h on January 24, 1963 and maximum gust speed at 134 km/h on February 2, 1976 (Environment Canada 2011).

According to 1971-2000 precipitation data at the Truro station, precipitation occurs approximately 174.7 days per year and averages approximately 1,202 mm of precipitation throughout the year, where 83% is rain and the remainder is snow (Environment Canada 2008).

Average wind direction for the year in Truro from the 1971-2000 census shows a predominantly S-SE in winter and SW-W in the summer (Environment Canada 2013).

5.5.2 Air Quality

A network of ambient air monitoring stations is set up throughout the province to measure ambient concentrations of various air contaminants. The closest air quality monitoring station to the Project Area is located in Pictou. However, only ozone and PM is monitored at this location. The next closest ambient air quality monitoring stations to the Project are the Halifax and Port Hawkesbury monitoring stations. A list of the contaminants monitored at both of these locations, their distance to the Project Study Area, and annual averages is presented in Table 5.15.

Table 5.15 Various Ambient Air Monitoring Stations Located Near the Study Area

Monitoring Station	Contaminant	Approximate Distance from Project (km)	Annual Averages	
			2005	2006
Pictou	O_3 (ppb)	25	22.6*(7 months)	27.7*(10 months)
	PM_{25} ($\mu g/m^3$) (BAM)		7	7.7*(9 months)
Halifax	SO_2 (ppb)	100	6	6
	CO (ppm)		0.5*(10 months)	0
	NO_2 (ppb)		16*(7 months)	16
	O_3 (ppb)		13	21
	$PM_{2.5}$ ($\mu g/m^3$)(TEOM)		5*(9 months)	4*(9 months)
	$PM_{2.5}$ ($\mu g/m^3$) (BAM)		NA	7*(6 months)
	$PM_{2.5}$ ($\mu g/m^3$)(Dichot)		NA	8*(9 months)
	PM_{10} ($\mu g/m^3$)(Dichot)		NA	14*(9 months)
Port Hawkesbury	SO_2 (ppb)	125	2.8*(10 months)	2

* - Annual mean calculated over the number of months indicated.

NA - Data Not Available (Reference: Environment Canada, 2008)

Based on monitoring results from the most recently published National Air Pollution Surveillance (NAPS) Network ambient air quality monitoring reports for 2005 and 2006 (Environment Canada 2008), the following general conclusions can be made:

- The monitored concentrations of particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) at the Halifax monitoring station have generally been low;
- None of the monitored concentrations of carbon monoxide exceeded the 1-hour or 8-hour objectives (35,000 $\mu g/m^3$ and 15,000 $\mu g/m^3$, respectively);
- None of the monitored concentrations of nitrogen dioxide exceeded the 1-hour or Annual objectives (400 $\mu g/m^3$ and 100 $\mu g/m^3$, respectively);
- None of the monitored concentrations of sulphur dioxide exceeded the 1-hour or 24-hour objectives (900 $\mu g/m^3$ and 300 $\mu g/m^3$, respectively);
- In 2005 and 2006 the ambient air quality 1-hour objective for ozone of 82 ppb was not exceeded at any of the monitoring stations.

Given the fact that there is no ambient air monitoring station located on or in the immediate vicinity of Greenfield, that there is limited data available from the ambient air monitoring station in Pictou, and that the Halifax ambient air monitoring stations include emissions from industrial activities (which is not characteristic of the Project Study Area), it can be reasonably estimated that the Project Area is representative of a rural environment where all contaminant concentrations would meet the Ambient Air Quality Objectives.

5.6 SOCIO-ECONOMIC CONDITIONS

5.6.1 Population

The Project is located in Greenfield in Colchester County, Nova Scotia. Nearby communities include Lower Harmony, Murray's Siding, Salmon River and Valley. Population statistics for Colchester County from the 2006 census are summarized in Table 5.16 below.

Table 5.16 Population Statistics for Colchester County from 2006 Census

Population and Dwelling Counts	County of Colchester
Population in 2006	50,023
Population in 2001	49,307
2001 to 2006 population change (%)	1.5
Total private dwellings	22,951
Population density per square kilometer	13.8
Land area (square km)	3,627.69

Source: Statistics Canada 2006 Census

Colchester County experienced an increase in population from 2006 to 2011 of 1.9%. The age groups with the age ranges 40-44 and 45-49 years had population increases higher than the other age ranges with the median age of the population being 44.5. Approximately 16.7% of the population was over the age of 65, higher than the province's statistic. Approximately 4.3% of the population identified as Aboriginal, while 3.9% identified as foreign-born (Statistics Canada 2011).

5.6.2 Health, Industry, and Employment

In 2005 27,370 residents of Colchester County, 15 years of age or more, earned an income (from either full time or part time jobs). The median income for all persons working in Colchester County was $21,018 , which is below the provincial median of $22,608. For those in

Colchester who had full-time work all year-round, median earnings were $33,030, which is below the provincial average of $36,917 (Statistics Canada 2011).

Table 5.17 lists the participation in local industry for Colchester County. Tourism likely falls into the category of "Other Services", as it is not specifically listed by StatsCan. The largest industry is the business services and manufacturing industries.

Table 5.17 Employment by Industry in Colchester County

Industry	Colchester County		
	Total Employed	Total Males Employed	Total Females Employed
Total – Experienced Labour Force 15 Years and Over	25,160	13,245	11,915
Agriculture and Other Resource-Based Industries	1,460	1,135	325
Construction	1,685	1,510	165
Manufacturing	3,575	2,310	1,270
Wholesale Trade	1,470	1,120	345
Retail Trade	3,285	1,455	1,825
Finance and Real Estate	740	340	400
Health Care and Social Services	2,365	340	2,025
Educational Services	1,875	670	1,205
Business Services	3,905	2,265	1,645
Other Services	4,790	2,085	2,705

Source: Statistics Canada 2011

Based on the 2011 census, the unemployment rate in Colchester County was reported to be 8.2% which is lower than the provincial unemployment rate of 8.8%.

5.6.3 Recreation and Tourism

Colchester County is bounded on the west by the Fundy Shore and on the northeast by the Northumberland Shore providing scenic views, warm waters and the world's highest tides from the Bay of Fundy. Colchester offers a variety of accommodations, parks, dining, museums, exhibits and over 25 registered heritage sites. Some notable heritage sites located within 50km of the Project include: the Dominion Chair Company General Store, Bass River; Isgonish Marsh

Burying Grounds, Belmont; Yuill Barn, Old Barns; numerous sites in both Tatamagouche and Great Village; the Molsem Cemetary – the first Islamic cemetery in North America, built in 1944; and the Greenfield United Church.

A number of outdoor recreation and activities include hiking/walking on trails such as the Cobequid Trail, Victoria Park, Five Island Provincial Park, Shubenacadie Wildlife park, Gully Lake Wilderness Area, Economy Trail and many other picturesque locations. There are challenging golf courses, corn-mazes, markets, eco-tours, lake, river and ocean swimming, hiking trails, numerous camping sites, river rafting and skiing, both cross-country and down-hill in Colchester County.

The county consists of many small communities and villages. The largest town in the county is Truro, known as the 'Hub of Nova Scotia'.

The Cobequid Eco-trails Society is a non-profit organization that maintains the trail system in the Gully Lake Wilderness Area, as well as the Economy Trail and others in the county. The Proponent has a working relationship with the Society and will continue to provide donations and services where needed as outlined in the Community Benefits program.

Dalhousie University's Agricultural College is located in Bible Hill, not far from the Greenfield Project area, as well; the Nova Scotia Community College is located in Truro.

5.6.4 Land Use

The land uses in the Project Area over the last one hundred years have been forestry, farming and hunting, and still are today The Canada Land Inventory, Soil Classification for Agriculture shows the area as being "Class 7" which does not support arable culture or permanent pasture. On the lands in which Greenfield is proposed, the landowners have brought soil from the valley to the uplands to create suitable pasture and grazing habitat for their beef cattle.

5.6.5 Property Values

In 2006 in Colchester there were 20,855 dwellings of which 15,270 were owned and 5,445 were rented. Approximately 71% of the dwellings in Colchester were constructed before 1986. The average value of a home in 2006 was $129,116, approximately $28,884 less than the provincial average (Statistics Canada 2011).

In a study titled *Wind Energy Study – Effect on Real Estate Values in the Municipality of Chatham-Kent, Ontario,* the authors analyzed the effect on real estate values arising from the installation and operation of wind turbines. The study was prepared in accordance with the *Canadian Uniform Standards of Professional Appraisal Practice* for the APPRAISAL INSTITUTE OF CANADA (Canning and Simmons, 2010).

The report demonstrates what dozens of other studies indicate: that 'in the study area, where wind farms were clearly visible, there was no empirical evidence to indicate that rural residential

properties realized lower sale prices than similar residential properties within the same area that were outside of the viewshed of a wind turbine' (Canning and Simmons, 2010).

At the Proponent's existing Dalhousie Mountain project, property values have not been negatively affected from the construction and operation of the wind farm. If a property has a turbine on it, the value greatly increased as there is an added guaranteed income associated with the property. Since the Dalhousie project is 1500m from the nearest house, and all of the local homeowners are happy with the project, there has been no negative effect on the community's opinion of the area and therefore, not affected property values. During the writing of this assessment, a family of four was in the process of building their new home less than 1500m from this 34 turbine wind farm. In addition, the increased exposure of the Dalhousie Mountain area through media and wind farm events have made this beautiful, quiet area of Nova Scotia more widely known and used recreationally and therefore, potentially has increased the value of the properties.

Tax rates in Colchester County in 2013-2014 are $0.84 per $100 for residential property taxation. Within ten kilometers of where the Project is proposed, there are no sidewalks, recreation areas, public parks, commercial development, public transit, convenience stores, artisan shops, bike routes, schools, libraries or seniors complexes. There are numerous cattle farms, horse ranches, trucking facilities, excavation and other earth moving companies, as well as the largest wood mill in Colchester County.

Many local residents that are employed work in the town of Truro or other areas such as New Glasgow, while others work from home in farming.

5.6.6 Acoustic Environment

Background sound measurements were not taken as a component of this study. The location is situated in a typical rural residential setting with background noises generated from farm machinery, dump trucks, excavators, regular traffic. The nearest house is approximately 1350 m from the turbines.

A sound modelling study was conducted based on actual turbine sound pressure levels provided by GE for the 1.6 MW series machines. This sound assessment relied on the approach that recognizes that rural areas, with low housing density and local transportation noise can be characterized sufficiently by assuming nighttime background L_{eq} of 35 dBA, and daytime L_{eq} of 45 dBA.Based on forest vegetation, commercial and residential usage as well as roadways, ambient sound levels within and surrounding the Project Area are assumed to be 45 dB_A during the day (0700 to 2200 hrs) and 35 dB_A during the night (2200 to 0700 hrs).

Ontario guidelines for sound assessment consider only the incremental change associated with the operation of the wind turbines. It is considered appropriate here, and in similar situations, to consider the cumulative impact of all wind turbines at the receptors that are influenced by the proposed Greenfield Project. The Greenfield sound model has considered both turbines in its projections.

Furthermore, as stated in Section 3.3 Municipal Planning Process, the County of Colchester, where Greenfield is located, has implemented a bylaw which restricts the placement of any turbines within a residential area where sound level exceeds 36 dBA at a residence. The modelling for sound for this project has been performed and demonstrates that the two turbines in Greenfield will not emit sound levels that reach the municipal threshold at any nearby dwelling (Appendix D).

5.6.7 Heritage Sites, Archaeological Sites and Other Cultural Resources

The assessment of archaeological potential for the site considered both prehistoric and historic period resources. Archaeological potential modeling for prehistoric era sites is based largely on the identification of landscape features which are either known to have attracted past habitation or land use, or which appear to have potential for attracting human use. These features include the availability of potable water, suitability for habitation (*e.g.,* ground conditions), proximity to desirable resources (such as workable stone), and proximity to water transportation routes, coastal areas, portage routes and food supplies.

5.6.7.1 Archaeology

In November 2011, the Proponent received a desktop screening review of the Project area from Nova Scotia Department of Tourism, Culture and Heritage (Appendix C). The result of the desktop review states 'Staff notes that there are no recorded archaeological sites on file for the project area. There is one recorded archaeological site to the north west of the study area. The potential for First Nation archaeological resources within the project area can be considered low. The potential for historic archaeological resources within the project area can be considered moderate to high. Historic maps indicate settlement. Staff recommends that an assessment for archaeological resources takes place.' (Bennett, 2011).

During the several field surveys the Proponent has taken throughout the development of the Greenfield project there have not been any foundations or other indicators of previous settlements located on or near the Greenfield Project. The land is owned by a farmer has used the land for farming and forestry.

A desktop archaeological study was performed for the turbine locations and road entrance followed by a field reconnaissance exercise in the fall of 2013 (Permit # A2013NS086). The results of the study (Appendix H) determined that there are no archaeologically significant areas that will be affected by the development and operation of the Greenfield Project.

5.6.7.2 Archaeological Potential

5.6.7.2.1 First Nations

While there are no First Nations sites recorded within or immediately surrounding the Project Area, it is well known, and has been noted since the earliest written accounts of the area, that the Mi'kmaq were present in the river valleys throughout Colchester County. These areas would have been important to First Nations groups as both transportation routes and food sources are available in these areas.

The Greenfield study area is within approximately 20 kilometers of the Debert and Belmont Palaeo-Indian archaeology sites. The potential for historic archaeological resources for the study area can be considered moderate to high as historic maps indicate settlement (Nova Scotia Heritage, 2011).

An MEKS was conducted by AMEC Environmental for Greenfield. Findings from this report can be found in Appendix B.

5.6.7.2.2 Historic

There is one recorded historic archaeological site within the Project Study Area; the saw mill. However, the Maritime Archaeological Resource inventory does list other archaeological sites recorded as being in the area surrounding the Project Area (Appendix H).

Davis MacIntyre & Associates Limited conducted an archaeological resource impact assessment of the proposed Greenfield Wind Project in Colchester County. The purpose of the assessment was to determine the potential for archaeological resources within the study area and to provide recommendations for mitigation, if necessary. The assessment included a historic background study and reconnaissance (Glen & de Boer, 2013).

The study concluded that only one potential archaeological resource is located near the development. This resource, a saw mill, appears to be located to the north of the access road along the watercourse crossing. Provided the access road layout does not change, impact to the saw mill site should be avoidable (Glen & de Boer, 2013).

5.6.7.3 Summary

Both the historical documentation and the archaeological work done in this area to date demonstrate the potential for further archaeological resources within the study area. The ARIA conducted by Davis MacIntyre & Associates suggests there will be no impact to historically significant findings in the area.

The MEKS conducted by AMEC Environmental suggests that no known sites of pre-contact significance are located within the study area. The results of this study will be submitted upon receipt.

With the above being said, it is noted that if any archaeologically significant artifacts are discovered during construction, or at any time, to contact NS Department of Culture and Heritage.

5.6.8 Land and Resources Used for Traditional Purposes by Mi'kmaq Persons

The Proponent has commissioned AMEC Environmental to conduct an MEKS for the Greenfield site to determine historical and current use of lands for traditional purposes for the proposed Project (Appendix B). This study takes into account all available records from Mi'kmaq and government/ cultural records, field studies and extensive interviews with knowledge holders

from the Mi'kmaq communities. The study also contains a field work portion using existing surveys as well as new site specific studies such as botany and bird studies.

5.6.9 Transportation Infrastructure

The Project Area receives strictly farm traffic including all-terrain vehicles, horses, cattle, four-wheel drive vehicles and various farm tractors. The site is accessed through the landowner's farm driveway with a series of cattle gates along the 1800m driveway leading to the met tower. The surrounding roadways along the primary component transportation route consist of high volume traffic secondary highways and rural paved roads. It is anticipated that the current road network (outside of onsite turbine access road) will not require upgrades to accommodate construction traffic. Roads that will be used will have the capacity to take the oversized and overweight loads as a very high volume of large log and chip trucks, many being V-trains use the road network daily.

5.6.10 Safety Issues

Lands within the Project Area do not generally present safety issues apart from tripping or slipping on slick wet surfaces. Construction and decommissioning activities associated with the wind farm may present some safety challenges with respect to these hazards and routine hazards associated with construction activities. In the operational phase, safety issues such as potential for ice throw must be considered in the context of local populace and public access issues. All safety issues have been addressed with the appropriate design and mitigation measures (*e.g.,* setbacks, restricted access, public notification).

The Proponent will communicate any ice throw risks to the landowner, recreational clubs in the area and the Salmon River Fire Department to promote safe use of the lands for winter purposes such as cross-country skiing and snow-shoeing. The landowner and other site workers also patrol the site on snowmobile during the winter to promote safe distance parking by any potential snowmobile/ trail users. Signs will be posted at a point around the turbine advising persons to keep a distance of 150m from the turbine as a precaution.

5.6.11 Visual Landscape

The Project Area is located on a forested hill top which has entirely been cleared for pasture. It does somewhat support other vegetation types including wetlands. Wind turbines are visible throughout the Province of Nova Scotia, and have become an important visual landmark in many areas.

A visual landscape assessment was conducted for the Project. This assessment was completed with the use of a computerized simulation that superimposed wind turbine images, which are located and scaled to size, onto photographs of existing views in the area for the purpose of creating a realistic representation of the proposed wind farm from a specific view.

Further information and view-shed photographs on the area's visual landscape are presented in Section 6.2.1.5.

6.0 ENVIRONMENTAL ASSESSMENT AND RESIDUAL EFFECTS

The following section assesses the potential interactions between the Project and the biophysical and socio-economic environment, and includes: an assessment of potential cumulative environmental effects; an assessment of the effects of the environment on the Project; and the potential effects of accidents and malfunctions.

The potential effects are described for the construction, operation and decommissioning phases of the Project and suggested mitigation is presented to reduce or eliminate these potential effects. The potential interactions between the Project and the environment are summarized, as are the proposed mitigation measures to reduce or eliminate residual (or net) effects.

Table 6.1 summarizes the potential interactions between the Project and VECs.

Table 6.1 Potential Interactions Between the Project and Valued Environmental Components

Project Activities	Valued Environmental Components												Section
	Surface Water Quality	Aquatic Environment	Soils andl Vegetation	Wetlands	Birds & Other Wildlife	Archaeological/	Land Use	Local Community	Visual Aesthetics	Noise	Recreation and Tourism	Public Health and Safety	
Construction													
Surveying and Siting	X		X		X								6.1.1
Land Clearing	X	X	X	X	X	X	X			X			6.1.2
Road Construction/Modification		X	X	X	X	X	X	X		X			6.1.3
Delivery of Equipment			X		X			X		X		X	6.1.4
Temporary Storage Facilities			X		X	X						X	6.1.5
Foundation Construction			X		X	X	X			X		X	6.1.6
Tower and Turbine Assembly			X		X				X	X		X	6.1.7
Electrical Cabling Installation (Interconnection from Turbines to Point of Interconnection (POI))			X		X		X		X	X			6.1.8
Fencing/Gates							X					X	6.1.9

Table 6.1 Potential Interactions Between the Project and Valued Environmental Components

Project Activities	Valued Environmental Components												Section
	Surface Water Quality	Aquatic Environment	Soils andl Vegetation	Wetlands	Birds & Other Wildlife	Archaeological/	Land Use	Local Community	Visual Aesthetics	Noise	Recreation and Tourism	Public Health and Safety	
Operation													
Operation & Maintenance					X		X	X	X	X	X	X	6.2
Decommissioning													
Turbine and Ancillary Equipment Removal	X	X			X		X	X	X	X	X		6.3.1
Removal of Power Line			X		X		X	X	X	X	X		6.3.2
Site Remediation/ Reclamation			X		X		X	X	X	X	X		6.3.3
Accidents and Malfunctions													
Accidents and Malfunctions	X	X	X		X		X	X	X	X		X	6.4

6.1 PROJECT CONSTRUCTION ACTIVITIES – ENVIRONMENTAL EFFECTS

The following sections describe the main construction activities and the potential effects associated with each activity. All activities associated with Project construction, including equipment maintenance and refueling, will be controlled through standard mitigation to ensure that there is a low impact associated with construction of the Project. The construction zone of impact will be localized within the Project Area.

Overall, potential environmental impacts will be mitigated using the following standard practices:

- limit access to the turbine site via one established access road which enters through the driveway of the landowner's farm, making use of previously gravelled areas for which zero clearing is required;
- keep the size and grade of access roads to the minimum required for the safe transportation of construction equipment;
- construct proper drainage along roadways to limit washouts, maintain even road surfaces and avoid sediment runoff;
- flag/fence areas with valued environmental features (*e.g.,* wetlands), and exclude construction activities from within these identified areas to the extent practical;
- ensure no deleterious material can come in contact with wet areas by fueling and doing any vehicular fluids changing in designated areas;

- whenever practical, time clearing activities to periods when the ground surface is best able to support construction equipment (winter or dry season) to prevent rutting and to avoid clearing during sensitive ecological periods events, such as breeding seasons for resident birds (*i.e.,* May to August); and
- upon clean-up, replace topsoil stored on-site and re-vegetate areas that were temporarily cleared, where possible, with native seed mixtures or with a mix of species similar to those on adjacent lands to restore affected lands to their previous condition.

The remainder of this section focuses on the individual phases of construction and operation, and details the potential environmental effects associated with each activity.

6.1.1 Surveying and Siting Operations

The siting of the wind turbines was initially carried out through field surveys by the Proponent with a GPS, then vetted against data using computer software analyzing meteorological data. This software, however, does not account for municipal setback distances or areas that are environmentally sensitive, so site visits by biologists and archaeologists were conducted and combined with existing mapping data to identify environmental constraints. Prior to construction, land surveyors will conduct a site visit to identify the exact location of each turbine on foot. Survey stakes will be used to mark each turbine site, temporary workspace and access road construction. These areas have been surveyed, as appropriate, by a qualified biologists, botanists and archaeologists for rare and sensitive environmental features *(i.e.,* rare plants, wetlands) and recommendations made to avoid these constraints to the extent possible. Table 6.2 summarizes the potential environmental effects of surveying and siting activities.

Geotechnical testing will be undertaken at the turbine sites. This will require access by testing equipment and may require limited, localized brush removal to permit equipment operation. Geotechnical testing will be undertaken by qualified operators and supervised by an attending engineer. Existing right-of-ways (RoWs) will be used where possible and the equipment will not traverse watercourses or wetlands. This activity is expected to have minimal environmental effects.

Table 6.2 Potential Effects of Surveying and Siting Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	• Visitors will remain within relevant areas, both in-vehicle and on-foot and will aim to	2	1	1/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to the Project

Table 6.2 Potential Effects of Surveying and Siting Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		preserve the site's natural areas.						footprint. The area to be subject to this disturbance has been previously disturbed by human presence (*e.g.,* clearing for pasture) and Project disturbance will be reversible.
Terrestrial Vegetation	Limited vegetation removal	• Minimize vegetation removal • Avoid wetlands and watercourses • Best environmental practices for geotechnical testing	1	1	1/1	R	2	Highly localized vegetation removal for equipment access will avoid sensitive ecological features and sites will be restored as part of post construction site restoration

1 Note	Geographic Extent	1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
	Magnitude	1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g,* affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

The net effects of siting and surveying activities will be spatially limited to certain areas within the Project footprint, as well as temporally limited to within the siting and surveying visits. Overall the level of impact will be **minimal** and **not significant**, especially considering that in the area, birds and wildlife already experience a certain level of sensory disturbance due to ongoing farming and nearby forestry activities and associated human presence. Vegetation removal will be minimal and sensitive ecological features will be avoided. It should be noted that this phase is very important in ensuring that the overall Project is carried out with the least possible disturbance to birds and wildlife by precisely identifying sensitive habitats within or near areas proposed for disturbance. Micro-siting of infrastructure has also taken into consideration connectivity of landscape to maintain potential corridors for wildlife migration as well as wetland functionality through the area. Appropriate construction work zones will be chosen, to the extent practical, in order to limit the degree of disturbance.

6.1.2 Land Clearing

The lands within the Project Area are cleared and in the process of becoming pasture with evidence of recent and non-recent clearing operations. The examination of NSDNR mapping and the completion of 5 new PGI plots have indicated that there is no occurrence of resident Mainland Moose near the development site (Appendix J). Two priority mammal species (the Fisher and the Short-tailed Shrew) are unaffected by the turbine development. Land clearing and vegetation removal in terms of forest habitat or wetlands will not be required for the construction of access roads, or installation of poles for collection cables. However, turbine foundations as well as crane pads and lay-up areas may require minimal vegetation alteration. Table 6.3 summarizes the potential environmental effects of land clearing activities.

For the construction of the Project, the Proponent anticipates that they will require minimal removal of trees but no alteration of wetlands.

Table 6.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	• Ensure that overall disturbance is limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act* (MBCA). • Conduct clearing outside the breeding period of most migratory birds.	2	1	1/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to within a few hundred metres of the Project footprint. The area to be subject to this disturbance is not forested land and effects associated with sensory disturbance will be reversible.
	Habitat alteration and loss	• Clear only the land necessary for construction activities and limit the overall land disturbance to within designated workspaces. • Existing access roads will be used and this	1	1	1/1	I	2	Although some habitat loss will be considered irreversible (*i.e.*, 20 years), this "irreversible" habitat loss will be limited in geographic extent and magnitude and will be on land that will ultimately be cleared for pasture/fields regardless of whether

Table 6.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		will minimize habitat loss. • Upon completion of construction and/or decommissioning, habitat will be restored to the extent possible. • Areas of significance (*e.g.,* nesting sites) will be avoided, to the extent possible.						the Project goes ahead or not. The area of habitat that will be altered due to land clearing activities for access roads and turbines will be a very small proportion of what is available due to the size of the Project as well as the fact that the majority of the Project has been sited to use existing access roads and previously cleared areas, and therefore the impact will be minimal.
	Mortality	• In order to reduce the potential of bird mortality, land clearing and construction activities will be performed in compliance with the *Migratory Birds Convention Act*. • Train onsite personnel regarding how to identify and properly deal with any wood turtles that may enter a work site.	1	1	1/1	I	2	Land clearing activities mirror current farming operations in the Project Area. Due to timing of land clearing activities outside the breeding period for most migratory birds, it is predicted that there will be no residual effect on bird mortality. Onsite staff have been trained to identify wood turtles and what to do if one is encountered during any construction/ development activity.
Soils and Terrestrial Vegetation	Soil erosion and compaction	• Limit access to the turbine sites via established access roads. • Size and grade of access roads will be kept to the minimum required for the safe construction, operation and decommissioning of the equipment.	1	1	1/1	R	2	Implementation of mitigation measures will ensure that soil quality within the Project Area will be preserved, and no residual effects will exist.

Table 6.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		• Whenever practical, clearing activities will be conducted during periods when the ground surface is best able to support construction equipment (winter or dry season). • Replace/re-introduce topsoil stored on-site to enable the reclamation of land to its original condition.						
	Loss of plant species of conservation concern	• Prior to construction, digital way-point files revealing the precise locations of all "Sensitive", "May be at Risk", "At Risk" and "Undetermined" listed species identified during field work within the area proposed for development will be provided to NSDNR. • Where Plant Species of Conservation Concern are encountered, avoidance to the extent possible will be considered, especially where there may be a threat to the regional population. Where avoidance is not possible, additional mitigative measures will be developed in consultation with NSE and NSDNR.	1	1	1/1	R	2	Vegetation surveys have been conducted to assist with micro-siting of turbines and access road layout. Mitigation for species of conservation concern encountered within the Project footprint will ensure there is no significant residual environmental effect on Plant Species of Conservation Concern. In the botany survey in the appendices, it is noted that the locations of the two turbines and the access roads do not interfere or threaten to interfere with plant species of conservation concern.
Wetlands	Loss of wetland area and/or function	• Avoid all wetlands, where practical. • If wetland impact is unavoidable, a functional analysis of	1	1	2/1	R	2	Site surveys indicate that no wetlands will be impacted for the construction of this Project. If inadvertent

Table 6.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		the wetland will be conducted and regulatory approval of the proposed alteration will be obtained prior to construction. • Erosion and sediment control measures will be implemented to protect wetlands during construction.						impacts on wetlands were to occur, any loss of wetland habitat will be compensated to ensure no net loss of wetland function.
Surface Water Quality/ Aquatic Environment	Surface water contamination	• Site access roads so as not to require any new water crossings • General mitigation measures from the NSE Erosion and Sediment Control Handbook will be utilized Including: • Avoidance of watercourses to the extent possible. If alteration of watercourses is required, regulatory approval of the proposed alteration will be obtained prior to construction. • All activities, including equipment maintenance and refuelling, will be controlled or done off-site to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse. • Construction material, excess material, construction debris,	1	1	1/1	R	2	By following mitigation measures, adverse interactions with surface water quality and fish habitat will be minimized and no significant residual effects will result. The water-crossings required for Greenfield is existing and in bad repair. Upgrades made to the structure or full replacement will improve surface water quality as well as aquatic environment. All upgrades will be done in accordance with NSE's Watercourse Alteration Regulations.

Table 6.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		and empty containers will be stored away from watercourses and watercourse banks. • A contingency plan for accidental spills will be developed for the Project.						
	Sediment loading	• Site access roads so as not to have any new water crossings • General mitigation measures from the NSE Erosion and Sediment Control Handbook will be utilized including avoidance of interaction with watercourses to the extent possible. • Land clearing and construction near watercourses (including crossing structure construction) will occur between June 1 and September 30. • Temporary erosion and sediment control measures, silt fence, straw bales (etc.) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. • Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required,	1	1	1/1	R	2	By following mitigation measures, negative interactions with surface water quality and fish habitat in the Project Area will be minimized and no significant residual effects are predicted. Upgrades required for Greenfield access roads where water already crosses will be upgraded with the result of stopping the current sediment loading which is currently taking place periodically at the crossing.

Table 6.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		have been established.						
Sound	Increases to sound levels due to the transportation and operation of clearing equipment	• Nearby residents will be advised of significant sound generating activities and these will be scheduled to create the least disruption to receptors. • Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. • Construction equipment will have mufflers. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	1	1	2/1	R	2	Increased sound levels caused by land clearing will be temporary in nature and will be caused by activities conducted during working, daylight hours. Due to the distance to the nearest residence, existing farming and trucking activity that takes place in the area, the short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect is considered not significant.
Archaeological and Cultural Resources	Disturbance	• Areas of significance will be avoided. • If ground disturbance is necessary in areas of medium or high archaeological potential, these activities will be monitored by a licensed archaeologist. • In the event that an archeological heritage resource is discovered, work in the immediate area will stop and the	1	1	2/1	R	2	Local areas of archaeological potential identified near the Study Area are not anticipated to be impacted by the Project. An archaeological field survey has been conducted and a contingency plan will be implemented. No significant residual effects to archaeological and cultural resources are anticipated.

Table 6.3 Potential Effects of Land Clearing Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		appropriate authorities will be contacted.						

1 Note

Geographic Extent	1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
Magnitude	1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g,* affecting a whole stock, population or habitat outside the range of natural variation.
Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
Reversibility	R = reversible, I = irreversible.
Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

The amount of clearing for the Project is limited by using existing access roads to the extent possible and preferential placement of the two turbines in existing cleared areas. Considering the footprint of the turbine locations, along with access roads, it is estimated that the Project Footprint will be less than 3 ha. Vegetation types most affected by clearing include immature softwood, mature hardwood, hay field and pasture areas (access roads will be built mainly on farm access road right-of-ways).

The effective mapping and avoidance of natural habitat hosting vascular plant species of conservation concern during facility layout design, including site-specific vegetation and wetland surveys (where required), micro-siting of turbines and ancillary structures and infrastructure, use of existing access roads and cleared areas to a large extent, and successful restoration measures during the Project's construction, operation and decommissioning stages, will not likely result in significant environmental effects to native habitat from the Project. If wetland or watercourse alterations cannot be avoided, all necessary regulatory approvals will be obtained prior to the disturbance.

The preliminary background research indicates that the Study Area may have potential for containing First Nations archaeological resources. An MEKS has been conducted and has found no areas that need to be avoided. If an archaeological resource of any kind is discovered during land clearing activities, work in the area will cease and the Proponent will contact the proper authorities.

The net effects of clearing activities will be spatially limited to the two turbine areas and approximately 500m of new road construction within the Project footprint. Overall the level of impact will be **minimal** and **not significant**, especially considering that the area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing farming and clearing activities, and associated human activities. Standard mitigation measures to protect terrestrial resources, aquatic resources, archaeological resources and humans from construction disturbance will be adequate to effectively reduce or eliminate residual effects.

6.1.3 Road Construction/Modification

To the extent possible, existing access roads will be used, and upgraded where required. The site is currently accessible right up to the met tower. Access roads will be surveyed and staked/flagged from that point onto each turbine location, with a 20 x 40m crane pad and an area for the assembled blades and hub to sit prior to lifting onto the nacelle. Roads on the wind farm site will be up to 10m wide to accommodate maintenance vehicles and equipment for repairs/replacements. Construction roads will be designed to accommodate the crane types that will be required to erect the wind turbine generators and towers. Roads will be constructed by placing a layer of geo-grid on the native soil, followed by layers of compacted shale or sandstone with a screened stone topping. Since the landowner currently uses this road for access to his back property, the upgraded road will continue to be used but will be in better repair and withstand precipitation without sediment loading through the now non-existent ditches.

Watercourses and wetlands will be avoided to the extent possible. The layout has been designed so that no new water-crossings need to be created. There is one existing water crossing at the bottom of the hill that will need to be replaced and sized properly for both load capacity as well as major weather events. For the upgrade, the culvert will be designed and installed in consultation with NSE and DFO and in accordance with applicable regulations, specifications (*i.e*. Erosion and Sedimentation Control Handbook for Construction Sites (NSE 1988) and Watercourse Alteration Specifications (latest edition)) and conditions of approval. Wetland alteration, if required although extremely unlikely, will be in accordance with applicable regulations and conditions of approval including compensation planning.

The potential environmental effects associated with road construction (including culvert installation) include impacts to birds and other wildlife, water quality/aquatic environment, noise levels, archaeological/cultural resources, land use and traffic. Table 6.4 summarizes the potential environmental effects of road construction/modification activities.

Table 6.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	• Ensure that overall disturbance is limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act*.	1	1	2/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to within several hundred metres of the Project footprint.
	Habitat loss/alteration	• Habitat loss may be mitigated by only clearing the land necessary for construction activities and by limiting the overall land disturbance to within designated workspaces. • Upon completion of construction and/or decommissioning, habitat will be restored to the extent possible.	1	1	1/1	I	2	Habitat loss will be considered to be irreversible (*i.e.*, 20 years) but the area of habitat that will be altered due to access road construction will be a very small proportion of what is available, and therefore the impact will be minimal.
	Mortality	• In order to reduce the potential of bird mortality, land clearing and construction activities will be performed in compliance with the *Migratory Birds Convention Act* (e.g., outside of critical time periods for breeding birds). • Onsite personnel have been trained regarding how to identify and properly deal with any wood turtles that may enter a work site.	2	1	1/1	I	2	It is predicted that there will be no residual effect on bird mortality.
Soils and	Soil erosion and	• Access to the turbine	1	1	1/1	R	2	Implementation of mitigation measures will

Table 6.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Terrestrial Vegetation	compaction	sites will be limited to established access roads. • The size and grade of access roads will be kept to the minimum required for the safe construction, operation and decommissioning of the equipment. • Whenever possible, clearing activities will be timed for periods when the ground surface is best able to support construction equipment (winter or dry season). • Compacted soil will be reclaimed as required.						preserve soil quality within the Project Area; no residual effects are predicted.
	Loss of plant species of conservation concern	• Use of existing roads greatly reduces amount of land to be cleared. • Prior to construction, digital way-point files revealing the precise locations of all "Sensitive", "May be at Risk", "At Risk" and "Undetermined" listed species identified during field work within the area proposed for development will be provided to NSDNR (listed in Appendix F). Where Plant Species of Conservation Concern are encountered, avoidance to the extent	1	1	1/1	R	2	Based on implementation of mitigation for species of conservation concern encountered within the Project footprint a significant residual environmental effect on Plant Species of Conservation Concern is not predicted.

Table 6.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		possible will be considered, especially where there may be a threat to the regional population. Where this is not possible, additional mitigation will be developed in consultation with NSE and NSDNR.						
Wetlands	Loss of wetland area and/or function	• Avoid all wetlands, where possible. • All activities, including equipment maintenance and refuelling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a wetland. • Construction material, excess material, construction debris, stockpiled soils, and empty containers will be stored away from wetlands • If alteration of wetlands is required, functional analyses of the potentially affected wetlands will be conducted and regulatory approval of the proposed alteration will be obtained prior to construction.	1	1	2/1	R	2	Follow-up wetlands surveys will be conducted if necessary to confirm the absence of wetland within the Project footprint. Any loss of wetland habitat will be compensated to achieve no net loss of wetland function.

Table 6.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Water Quality/ Aquatic Environment	Surface water contamination	• Watercourses will be avoided to the extent possible. • All activities, including equipment maintenance and refuelling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble, stockpiled soils, or concrete material, into a watercourse. • Construction material, excess material, construction debris, and empty containers will be stored away from watercourses and watercourse banks. • A contingency plan for accidental spills will be developed for the Project.	1	1	2/1	R	2	There is one water crossing that exists and will most likely be replaced with a properly sized open-bottom culvert in accordance with NSE. Currently this crossing does not provide adequate load capacity for the delivery of the machinery nor is there any ditching to divert contamination from running directly into the stream. No other water crossings are anticipated for the Greenfield Project. No residual effects are expected other than an increase in water quality.
	Sediment loading	• Design access route so as not to require any water crossings • General mitigation measures from the NSE Erosion and Sediment Control Handbook will be utilized including avoidance of interaction with watercourses to the	1	1	2/1	R	2	There is one water crossing that exists and will be replaced with a properly sized open-bottom culvert in accordance with NSE. Currently this crossing does not provide adequate sediment control nor is there any

Table 6.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		extent possible. If watercourse alterations are required, they will be done in consultation with NSE/DFO and in accordance with regulatory requirements. • If required, in-stream work will occur between June 1 and September 30 where possible, unless otherwise approved by NSE. • Temporary erosion and sediment control measures, silt fence, straw bales (etc.) will be used and maintained until 100% of all work within or near a watercourse has been completed and stabilized. • Temporary sediment control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established. • Visual assessments will be completed from time to time and after severe storm events to ensure effectiveness of erosion and sedimentation control.						ditching to divert contamination from running directly into the stream. No other water crossings are anticipated for the Greenfield Project. No residual effects are expected other than an increase in water quality.
	Surface water	• General mitigation	2	1	2/1	R	2	No residual effects are

Table 6.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
	flow	measures from the NSE Erosion and Sediment Control Handbook will be utilized including avoidance of interactions with watercourses to the extent possible. • Should access roads have to be constructed across existing watercourse that requires a culvert; the Proponent will follow standard industry practice, installing culverts of sufficient size to accommodate expected maximum flows within the watercourse. • A Watercourse Alteration Approval will be obtained for all required watercourse crossings and the conditions of approvals will be followed.						expected.
	Fish mortality	• Watercourses will be avoided to the extent possible. • Watercourse crossings, where required, will be constructed between the period of June 1 to September 30 unless otherwise approved by NSE • Where possible, culverts will be installed during low flow periods. If water is present, watercourses will be dammed and flow	1	1	2/1	I	2	No residual effects are expected given these mitigation measures. The current culvert is not properly sized and therefore sediment and runoff as well as flooding are risks. With the replacement of a properly sized culvert at this location, fish mortality potential is reduced drastically.

Table 6.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		will be preserved through water pumps with an adequately sized fish screen on the intake line. Personnel will be onsite to facilitate fish rescue within the dammed area. • Where fish bearing streams must be crossed (*e.g.,* culvert installation) DFO will be consulted regarding possible requirements for authorization under the *Fisheries Act.*						
	Loss of fish habitat	• In-water work will be avoided. • New and replacement culverts will be of an open-bottom design. • Existing stream flows will be maintained downstream of the de-watered work area during all stages of work. • All sediment and erosion control measures will be inspected bi-weekly as well as immediately following rainfall events.	1	1	2/1	R	2	By following mitigation measures, adverse interactions with fish habitat will be minimized and no significant residual effects will result
Sound	Increases to sound levels due to the transportation and operation of clearing equipment	• Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. • Construction equipment will have mufflers. • Noise abatement equipment, in good working order, will be	2	1	2/1	R	2	Residual effects are expected to be minimal, as discussed in Table 6.2.

Table 6.4 Potential Effects of Road Construction/Modification

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		used on all heavy machinery used on the Project.						
Archaeological and Cultural Resources	Disturbance	• Areas of significance will be avoided to the extent possible.	1	1	2/1	R	2	No residual effects are expected.
Land Use	Reduction of forested and farmed land	• Existing roads will be used as access roads to the extent possible to eliminate forest clearing. • Foundations and layout areas will be constructed in such a manner to minimize the Project footprint.	1	1	1/1	R	2	The area is continually being cleared of forested areas to make way for farm land. The area of forested land that will be lost due to access road construction will be a very small proportion of what is available and therefore the impact should be minimal. The area of farm land that will be lost is minimal and no residual effect is expected.

1 Note	Geographic Extent	1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
	Magnitude	1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

The construction of access roads on individual landowner's private property will comprise a relatively small portion of the Study Area, and thereby should not jeopardize species habitat. The Proponent will take advantage of existing access roads and upgrade those as necessary. Sensory disturbance for birds and other wildlife will be temporary in nature and low in magnitude. Where required, one culvert will be installed according to regulatory requirements and, although very unlikely, if wetland alteration is necessary, this will require regulatory

approvals. Mitigation to control surface water and thereby erosion will follow the methods outlined in the NSE Erosion and Sediment Control Handbook and further outlined in the EPP. Should it be deemed necessary, compensation to ensure DFO's policy of no net loss of function will be undertaken post-construction. Access roads will be used where existing and will be upgraded. The agreement with the landowner is to allow these roads to stay after decommissioning because the road is the farmer's access to the back property. Using existing access roads will thereby limit any additional long-term impacts due to the wind project. Overall it is anticipated that with implementation of the above-stated mitigation measures, the environmental impact associated with access road construction and modification activities will be **minimal** and **not significant**.

6.1.4 Delivery of Equipment

Currently, traffic patterns around (outside of) the Project Area, are varied and consist of residential, heavy truck and typical regular rural traffic such as tractors, hobby vehicles and ATVs. The project area is subject to farming activity, which is what the main activity on the land parcel has been historically up until now. With the exception of this outside traffic, the actual Project footprint receives no other traffic (road is private passed the Johnson Road (into the driveway of the farm)).

The trucks used for the heavy loads of turbine and crane components have multiple axles, with the potential to add more, and have steering capability at the back end, allowing them to turn corners much tighter than trucks without such rear steering capability. A large mobile crane will also be required, approximately the size of a standard semi-trailer.

It is anticipated that the current road network (outside of onsite turbine access roads) will not require upgrades to accommodate construction traffic and therefore a transport study is not proposed.

Approvals for transporting these materials will be sought from the provincial transportation departments. As the turbine components are oversized, a Special Move Permit and any associated approvals will be obtained through NSTIR for heavy load transport.

The tower sections, nacelles, and rotor parts will be moved to each turbine site by flatbed truck and placed into an exact position for picking up using cranes. One flatbed truck will be used for each of the three tower sections. In addition, a flatbed truck will be used for the nacelle for each machine, and one flatbed truck will be required to transport two rotor blades. By stacking the blades side by side on the flatbed, the transportation cost and fuel consumption is reduced by 33% for the blade transportation. Parts shipped loose will require just one truckload in total for all turbines for COMFIT projects proposed by the Proponent (5 in total). Each crane requires multiple trucks to bring in the components for erection and ballast. As well, padmount transformers will be delivered three per truck (one truck for Project). This site preparation will require approximately ten people for five days for each turbine. All the equipment at the site will be cleaned using a pressure washer and biodegradable truck wash.

Figure 6.1 shows a typical blade transportation truck.

The effect on land use will primarily be increased usage of secondary roads from the wood mill in Greenfield to the access road entrance on Johnson Road. Mild disruption is possible to regular commuting traffic during overlapping timeframes during the delivery of all project components. These deliveries may slow or interrupt traffic along the delivery route before turning onto the project access road. Traffic is not typically heavy in this area, as well, there are only two turbines and ancillary equipment being delivered so disruptions to existing traffic will be minimal.

There is a small possibility for impacts to local sound levels and traffic due to the transportation of materials. Only slight increases in the typical sound levels from delivery are expected. In addition, the potential increase in sound levels may cause sensory disturbance to birds and other wildlife, although neighbouring properties have various noise creation of their own, such as farming, wood chipping, welding shop, heavy equipment business and a mechanic shop. Therefore the sound levels associated with large trucks are not outside of the typical sound levels experienced in the area. Table 6.5 summarizes the potential environmental effects of activities associated with the delivery of equipment to the site.

Table 6.5 Potential Effects of Delivery of Equipment

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	• Delivery vehicles will remain on designated roads.	2	1	1/1	R	2	Sensory disturbance may cause habitat avoidance but it likely will be temporary in nature, small in magnitude and restricted to within several hundred metres of the Project footprint. The area to be subject to this disturbance is rural residential and farm land, however disturbance will be reversible.
Sound	Increase in sound levels	• Equipment will be delivered between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary.	2	1	1/1	R	2	No significant impact on increase in sound levels from delivery is expected.
Local Community	Hazards and/or inconveniences to traffic	• No modifications to existing roads are expected at this time. • A Special Move Permit and any associated approvals will be obtained through the Department of Transportation and Infrastructure Renewal for heavy load transport.	1	1	1/1	R	2	No significant impact on road use is expected.

Table 6.5 Potential Effects of Delivery of Equipment

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	

Note 1 Geographic Extent: 1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2

Magnitude: 1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.

Duration: 1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.

Frequency: 1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.

Reversibility: R = reversible, I = irreversible.

Ecological Context: 1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

It is anticipated that with implementation of the above-mentioned mitigation measures, the residual effects of the delivery of equipment will be **minimal** and **not significant**. Delivery traffic flows for a short period of time and is less than annual summer maintenance interruptions. Therefore it is unlikely that there will be a significant inconvenience to local motorists or emergency services.

6.1.5 Temporary Storage Facilities

Temporary storage facilities/equipment lay-down will comprise a small portion of the Project Study Area, and should not jeopardize species habitat. These areas have been included in the site specific studies for plants and wildlife, and archaeological resources. Sensory disturbance and habitat loss/alteration for birds and other wildlife will be temporary in nature and not significant. The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing farming activities and associated human activities. Upon completion of construction, the temporary storage facilities will be removed and the ground will be remediated to its previous use. The environmental effects of temporary storage facilities are principally due to land clearing and delivery of equipment, and are discussed in Sections 6.1.2 and 6.1.4. Overall it is anticipated that with the implementation of the above-stated mitigation measures, the environmental impact associated with the temporary storage facilities will be **minimal** and **not significant**.

6.1.6 Foundation Construction

Foundations of the two turbines and padmount transformers will leave a small footprint on the landscape that will last the extent of the Project's life. Excavation of soils and installation of the engineered foundations have the potential to interact with several environmental components. Environmental components that potentially could be impacted as a result of foundation construction include birds and other wildlife, soils and terrestrial vegetation, land use, noise and

archaeological/cultural resources. Table 6.6 summarizes the potential environmental effects of activities associated with foundation construction.

Table 6.6 Potential Effects of Foundation Construction

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	• Overall disturbance will be limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act.* • Onsite personnel have been trained regarding how to identify and properly deal with any wood turtles that may enter a work site.	1	1	1/2	R	2	Sensory disturbance may cause habitat avoidance but it is likely to be temporary in nature, small in magnitude and restricted to within several hundred metres of the turbine locations. The area to be disturbed by foundations totals less than ¼ ha for both foundations..
	Mortality	• Construction activities will be performed in compliance with the *Migratory Birds Convention Act*.	1	1	1/2	I	2	It is predicted that there will be no residual effect on bird mortality.
Soils	Soil disturbance and erosion	• Topsoil and subsurface soils will be separated and stored on-site to be replaced appropriately after the pouring of the concrete foundation. When the soils are stored they will be protected from erosion and runoff.	1	1	1/2	R	2	By implementing these standard mitigation measures, the residual effect on soils will not be significant and will have a minimal level of impact.
Land Use	Reduction of land available for forestry or farming	• Turbines, with their relatively small footprint on the land, have been sited with consideration for the potential impact to existing land uses.	1	2	1/2	R	2	The area of forested land that will be lost due to foundation construction will be a very small proportion of what is available and will be situated to minimize disturbance to existing

Table 6.6 Potential Effects of Foundation Construction

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								forestry operations. Due to the limited footprint, its reversibility after decommissioning and small proportion of land to be directly impacted by foundation construction, the residual effect is expected to be minimal.
Sound	Increases to sound levels due to operation of equipment	• All internal combustion engines will be fitted with appropriate muffler systems. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	1	1	1/2	R	2	Increased sound levels caused by foundation construction will be temporary in nature and will be conducted during working, daylight hours. Due to the distance of construction activities to homes, short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect is considered not significant.
Archaeological and Cultural Resources	Disturbance	• Areas of significance will be avoided to the extent possible. • Any possible archaeological or cultural resources encountered will see the work in that area stopped immediately and the Proponent will contact the appropriate	1	1	1/2	R	2	No residual effects are predicted.

Table 6.6 Potential Effects of Foundation Construction

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		authorities.						

1 Note

Geographic Extent	1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
Magnitude	1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.
Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
Reversibility	R = reversible, I = irreversible.
Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Figure 6.2 Foundation Partially Complete with Frames and Rebar in View

The foundations will comprise a relatively small portion of the Project Area land*, i.e.,* less than ½ hectares in total. Sensory disturbance for birds and other wildlife during foundation construction will be temporary in nature. Upon completion of construction, the ground surrounding the

foundations will be restored. Overall, it is anticipated that with the implementation of the above-stated mitigation measures, the residual effects associated with foundation construction will be **minimal** and **not significant**.

6.1.7 Tower and Turbine Assembly and Installation

The tower comes in three sections that will be assembled on site. The rotor blade system, consisting of three blades and a hub, will also be assembled on site, attached to the generator and lifted into place at the top of the tower by a large hydraulic crane. This will require approximately ten people for three days per turbine. An additional 1-2 days will be required to install the remainder of the turbine assembly. Control and switching equipment will be placed on each turbine pad by a crane. A large crawler crane with a hydraulic crane will be used to install each tower section. Each tower section will be lifted and secured with bolts to the section below, followed by the nacelle being secured to the top tower section. Finally, the assembled rotor will be lifted and attached to the nacelle.

This phase of construction could potentially have impacts on birds and other wildlife, soils and vegetation, safety, and sound levels. Table 6.7 summarizes the potential environmental effects of activities associated with tower and turbine assembly and installation.

Table 6.7 Potential Effects of Tower and Turbine Assembly and Installation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	• Overall disturbance will be limited to designated workspaces, and performed in compliance with the *Migratory Birds Convention Act*. • Onsite personnel have been trained regarding how to identify and properly deal with any wood turtles that may enter a work site.	1	1	2/1	R	2	Sensory disturbance likely will be temporary in nature, small in magnitude and restricted to within several hundred metres of the turbine locations. The residual effect is considered minimal.
Soils	Soil compaction and contamination	• Trucks and equipment will remain in designated workspaces. • Whenever possible, delivery will be timed for periods when the ground	1	1	2/1	R	2	No residual effects are expected.

Table 6.7 Potential Effects of Tower and Turbine Assembly and Installation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		surface is best able to support construction equipment (winter or dry season). • Compacted soil will be reclaimed as required.						
Sound	Increases to sound levels due to the transportation and operation of equipment	• Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. • All internal combustion engines will be fitted with appropriate mufflers systems. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project.	1	2	2/1	R	2	Increased sound levels caused by equipment assembly and installation will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect is considered not significant.
Safety	Increase in potential for accidents	• All machinery and equipment will be maintained in good working order and inspected for wear prior to each shift. • All employees and contractors will adhere to the Safety Policies in place. • Access to the site will be limited to employees and contractors only. • Crane lifts will not take place in overly windy	1	1	1/1	R	2	Personnel and/ or contractors will be trained to use any equipment or machinery that they are working on/ with. No persons will be permitted to visit the site during construction without proper safety training. The effect is considered not significant.

Table 6.7 Potential Effects of Tower and Turbine Assembly and Installation

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		conditions. • Emergency Response Plan is implemented and local First Responders have been trained for turbine specific accidents.						

1 Note

Geographic Extent	1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
Magnitude	1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.
Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
Reversibility	R = reversible, I = irreversible.
Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Figures 6.3 and 6.4 below show the hub and blade assembly positioned on the ground ready for hoisting and attaching to the nacelle.

Sensory disturbance for birds and other wildlife will be temporary in nature, limited in extent, and low in magnitude. The area's birds and wildlife already experience a certain level of sensory disturbance due to ongoing farming and associated human activities, and therefore are expected to be able to tolerate the similar disturbance associated with construction activities, or use available habitat outside the range of disturbance. There is not any sensitive habitat such as interior forest within the vicinity of the Project activities. Compacted soil will be remediated and reclaimed as appropriate, and measures will be in place to decrease the likelihood of contamination occurring. Safety policies and Emergency Response Plans have been implemented by the Proponent and all onsite personnel will strictly adhere to these policies. Overall it is anticipated that with the implementation of the above-stated mitigation measures, the residual effects associated with the tower and turbine assembly and installation will be **minimal** and **not significant**.

Figure 6.5 Turbine Tower Erected with Crane Ready to Hoist the Blade Assembly

6.1.8 Turbine to Distribution Interconnection

Above-ground 25 kVA electrical cables will be installed and run from each turbine to the distribution interconnection following existing linear disturbances (*i.e.,* access road system).

Potentially affected environmental components include birds and other wildlife, soils and terrestrial vegetation, water quality/aquatic environment, noise, land use and archaeological/cultural resources. Table 6.8 summarizes the potential environmental effects of activities associated with interconnection of the turbines' collector system.

Table 6.8 Potential Effects of Turbine to Distribution Interconnection

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds and Other Wildlife	Sensory disturbance	• Overall disturbance will be limited to designated workspaces. • All internal combustion engines will be fitted with appropriate muffler systems. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project. • Train onsite personnel regarding how to identify and properly deal with any wood turtles that may enter a work site. • Mitigation recommended by the Avian Power Line Interaction Committee (1994, 1996 and updates) will be considered to minimize effects of overhead distribution lines.	2	1	2/1	R	2	Sensory disturbance likely will be temporary in nature, small in magnitude and restricted to the Project Area. The residual effect is considered minimal.
Soils and	Compaction	• Topsoil will be stored	1	1	1/1	R	2	No residual effects are

Table 6.8 Potential Effects of Turbine to Distribution Interconnection

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Terrestrial Vegetation	and contamination – via heavy equipment	on-site for future use in restoring the land to its original condition. • Standard erosion and sediment control measures will be implemented as required.						expected.
Water Quality/ Aquatic Environment	Surface water contamination	• Watercourses will be avoided to the extent possible. • All activities, including equipment maintenance and refuelling, will be controlled, or will be done off-site, to prevent entry of petroleum products or other deleterious substances, including any debris, waste, rubble or concrete material, into a watercourse or wetland.	1	1	2/1	R	2	No residual effects are expected.
	Sediment loading	• General mitigation measures from the NSE Erosion and Sediment Control Handbook will be utilized to control water, reduce erosion and limit sedimentation. • Watercourses will be avoided to the extent possible. • Temporary erosion and sediment control measures, silt fence, straw bales (*etc.*) will be used and maintained until all work within or near a watercourse has been completed and stabilized. • Temporary sediment	2	1	2/1	R	2	No residual effects are expected.

Table 6.8 Potential Effects of Turbine to Distribution Interconnection

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		control measures will be removed at the completion of the work but not until permanent erosion control measures, if required, have been established.						
Sound	Increases to sound levels due to the transportation and operation of equipment	• Heavy equipment will only be operated between 7:00 a.m. and 10:00 p.m., avoiding Sundays and holidays unless absolutely necessary. • All internal combustion engines will be fitted with appropriate muffler systems. • Noise abatement equipment, in good working order, will be used on all heavy machinery used on the Project. • Powerline installation will be limited to the one property and will not be necessary outside of that private land.	2	1	2/1	R	2	Increased sound levels will be temporary in nature and will be conducted during working, daylight hours. Due to the short nature of this disturbance and its limited geographic range, the level of impact will be minimal and residual effect is considered not significant.
Land Use	Reduction of farm land	• Existing access roads built or upgraded earlier in the construction schedule will be used to install the collection system. • The Project will not require a substation	1	1	2/1	R	2	Provided these mitigation measures, and considering the temporary and reversible nature of this effect over a small spatial scale, no residual effects are expected.

Table 6.8 Potential Effects of Turbine to Distribution Interconnection

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Archaeological and Cultural Resources	Disturbance	• Areas of significance will be avoided to the extent possible. • Work will take place along ditched areas beside the access road. Earlier construction will have already vetted against resource discovery so installation of the lines will not require new impact areas.	1	1	2/1	R	2	No residual effects are expected.

1 Note	Geographic Extent	1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
	Magnitude	1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects.

Overall it is anticipated that, with the implementation of the above-mentioned mitigation measures, the residual effects of the collection system installation will be **minimal** and **not significant**.

6.1.9 Fencing/Gates

The access road for the Project is already gated to limit the movement of cattle from one area to another; therefore environmental effects and mitigation are not discussed.

6.1.10 Parking Lots

The need for a parking lot is not anticipated for the Project. Temporary storage areas, addressed in Section 6.1.5, will be the location of any necessary parking of vehicles or equipment; therefore environmental effects and mitigation are not discussed.

6.2 OPERATIONAL ACTIVITIES – ENVIRONMENTAL EFFECTS

The environmental components that may be adversely affected by the operation of the Greenfield Project include land use, recreation, visual aesthetics, ambient sound levels, birds and other wildlife and health and safety. Table 6.9 provides a general overview of these components and associated impacts. The remainder of Section 6.2 describes these interactions and potential effects in greater detail.

Table 6.9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
Birds	Sensory disturbance	• Site turbines in areas that are not in or near Important Bird Areas • Use modern equipment which is proven to have lower sound levels	2	2	5/6	R	2	It is anticipated that sensory disturbance during Project operations may cause birds to change their flight patterns in order to avoid the towers and rotating blades. This will serve to reduce the number of bird collisions. There is potential for avoidance of habitat within the vicinity of the turbines; this will be evaluated during post-construction monitoring.
	Mortality	• Lighting will be the minimum allowed by Transport Canada for aeronautical safety, and red flashing or continuous lights (CL-865) may be used with the minimum intensity and flashes per minute allowable. The turbines for this Project will be built using tubular steel towers, as some data indicate that lattice towers encourage	2	2	5/6	I	2	Given existing information from operating wind energy facilities elsewhere in North America, and the four years of operation of Dalhousie, it is anticipated that fatalities due to avian collision with wind turbines will not cause significant bird fatalities, either of sensitive species or large numbers of birds. Post-construction monitoring will be

Table 6.9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		perching by raptors during hunting and, as a result, may put these birds at risk of collisions. Lights on the entrance of the machines will be kept off unless maintenance occurs after daylight hours. • Project does not require a substation (which have bright lights usually on during nighttime hours for safety)						implemented to confirm that the effect of the Project on bird populations is not significant. (Figure 6.7) The Proponent will hire a qualified technician to create and conduct an avian (and bat) post-construction monitoring program which will be overseen by a qualified biologist. This will be created in discussion with DNR and CWS.
Other Wildlife	Sensory disturbance	• A moose monitoring program (pellet group inventory counts) has been implemented to determine the degree to which moose use the Project Area. • This will continue into post-construction to determine if the turbines and associated infrastructure are an impediment to free movement of mammals.	2	2	5/1	R	2	Studies of game animals in western North America (*e.g.,* Anderson *et al.* 1999) have shown that species are either unaffected by wind energy facilities, given their small footprint and the preservation of existing land use, or that they can readily adapt to the presence of wind turbines. At this site, habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when on-site human activities are less frequent and would occur on a short-term basis. (Figure

Table 6.9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								6.8 and 6.9) Results of the 2012 and 2013 PGI surveys have not indicated any moose presence in and around the three proposed locations and ancillary equipment.
	Mortality	• Post-construction monitoring (*e.g.,* bat monitoring) will direct the need and form of further post-construction mitigation measures. • A bird and bat monitoring program will be developed in consultation with NSDNR and CWS. Based on the results of the program, necessary modifications to mitigation plans and/or wind farm operations will be undertaken.	2	2	5/1	I	2	Based on existing information from monitoring programs elsewhere in North America, the results of the Greenfield Bat Survey, and the location of the Project relative to the existing facility at Dalhousie and its post construction monitoring results, it is anticipated that the impact of wind farm operations on bat mortality will not be significant. However, post-construction monitoring will be implemented to confirm this expectation. The risk of bat collisions is greater for migrating bats than for resident breeding, commuting or foraging bats. Pre-construction monitoring was conducted in August and September 2013 and post-construction monitoring will occur once operations begin in order to correspond to migration activities by migratory species and the movement of resident species to hibernacula.

Table 6.9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								The Proponent will hire a qualified technician to create and conduct an avian (and bat) post-construction monitoring program which will be overseen by a qualified biologist.
Land Use	Disruption to undeveloped woodlands or infrastructure	• The Project has been designed to minimize impacts to the local land use. No mitigation, therefore, is required as no significant impacts are predicted.	1	2	5/1	R	2	The Project is built on farmland which has, for the most part, already eliminated the area for undeveloped woodlands. The effect of wind turbines on undeveloped woodlands is negligible with only a small portion of the available land required for wind turbines, ancillary equipment and access roads.
Local Community	Effect on local economy	• Local residents will be employed to the extent possible during the construction, operation and decommissioning of the Project. • Annual payments in the form of lease payments, as well as community donation and assistance donations from the Project will occur every year for the lifetime of the Project • Active Community Benefits Package will aid	4	1	5/6	R	2	A positive residual effect would be realized by the operation of the Project, through increases in employment opportunities, direct landowner payments, annual hiring of snow-removal services, increases in private spending due to an influx of Project personnel, and an increase in the municipal tax base. Donations to the local community by the Proponent in the last two

Table 6.9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		in a wide range of community uses						years include Hector Arena Capitol Fund, Pictou Skate Park, Truro Exhibition and Rodeo, Dalhousie Mountain Snowmobile Club, Pictou County Lite Horse Club, Individual Moto-cross racers (youth and intermediate) and Boy Scouts Canada. This will continue and expand with the operations of this new Project in Colchester County. (Figure 6.6)
	Effect on property values	• None required	4	1	5/6	R	2	Existing information indicates that property values are not adversely affected by the construction and operation of wind farms. With the positive effect on local economy directly from the Project, some properties may be updated and better maintained, which can increase a property's value
Recreation and Tourism	Effect to tourism and recreation	• None required.	4	2	5/6	R	2	The Project Area is not subject to recreation other than private landowner usage, which will remain unchanged.
Visual	Change to visual landscape	• Turbines will be all of the same type and model, and will be painted light grey to reduce reflection • Screening opportunities	4	2	5/6	R	2	Given the viewing distances and sparse population, the visual impact will not be significant. Some

Table 6.9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		for adjacent residences through tree planting or other measures may be considered where post-construction evaluation indicates a legitimate concern. • The Project is limited to two turbines.						landowners within the Study Area will have views of the wind turbines from the residences, but many views will be obstructed by terrain, existing vegetation and distance.
	Lighting	• Lighting will be the minimum allowed by Transport Canada to ensure the appropriate level of aeronautical safety.	4	2	5/6	R	2	Given the viewing distance of lights on turbines combined with soft light (not brightness), the presence of these lights will not place excessive nighttime visual pollution within several kilometers of the Study Area.
	Shadow flicker	• Locate machines far enough away from homes that shadow flicker will not be possible. • Shadow flicker will not exceed allowable limits	2	2	5/1	R	2	Modeling of shadow flicker indicates there are no potential visual impacts at the residences outside of the Project caused by shadow flicker. This is due mainly to setback distances used in planning locations as well as the limited duration and distance of visibility under "ideal" viewing conditions as well as the presence of existing vegetation which would effectively mitigate potential adverse effects. A registry will be created to document complaints of shadow flicker. Complaints of shadow flicker received from a receptor will be monitored

Table 6.9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								from that receptor. Information collected from the shadow flicker monitoring will be used will be used to develop further mitigation, if warranted. However, no dwellings or businesses are within the range of shadow flicker at the Greenfield site.
Sound	Increases to sound levels	• Noise created from the operation of the wind turbines will not exceed the provincial threshold of 40 dBa at any time. • Colchester County limits the sound levels even further than the province, at 36 dBA maximum output.	2	2	5/6	R	2	Modelling of predicted sound levels caused by the operation of wind turbines indicated that all the receptors outside of the Project Area are not expected to receive sound exposures from the proposed two turbines that are not within acceptable sound limits. As a result, an increase in sound levels due to the operation of the Project is not anticipated.
Health & Safety	Electromagnetic fields (EMFs)	• Construct turbines far enough away from houses so as not to be exposed to EMF (this distance is about 350 m and the closest house to a turbine for Greenfield is over 1300 m)	1	2	5/1	R	2	The strength of the EMF from equipment decreases rapidly with increasing distance. EMF produced by this equipment is typically indistinguishable from background levels. The EMF produced by the equipment within the turbines will be very weak, reduced not just by distance, but also by

Table 6.9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
								objects such as trees and other objects that conduct electricity. Overall the EMF is not anticipated to have any negative results on human health and safety.
	Infrasound energy	• None required.	1	1	5/1	R	2	There is no evidence that the wind turbine technology proposed for this Project presents any potential problems related to the generation of infrasound energy.
	Ice throw	• During construction and operation activities, access to the wind turbine facility will be restricted to authorized personnel wearing proper personal protective equipment and who have had appropriate safety training. • During site visits, vehicles will be parked up-wind of the turbines. • During operation, access to the wind turbine sites will be restricted to authorized personnel only. • Signage warning of the dangers of ice throw will be placed upon entrance of the facility for anyone who enters onto the	1	1	5/1	R	2	Due to the setback distances to the nearest receptors, it is not possible that ice throw would present a risk to neighbouring landowners. For maintenance personnel, the potential of ice throw presents a greater risk to health and safety. With the implementation of the mitigation measures proposed herein, the risk of injury and property damage will be reduced.

Table 6.9 Summary of Potential Effects of Operational Activities

Potential Interaction	Potential Effect	Mitigation	Significance Criteria for Adverse Effect[1]					Residual Effect
			Geographic Extent	Magnitude	Duration/ Frequency	Reversibility	Ecological Context	
		private property						

1 Note	Geographic Extent	1 = <500 m^2, 2 = 500 m^2 – 1 km^2, 3 = 1 –10 km^2, 4 = 11 – 100 km^2, 5 = 101 – 1000 km^2, 6 = >1000 km^2
	Magnitude	1 = Low: *e.g.,* specific group or habitat, localized one generation or less, within natural variation, 2 = Medium: *e.g.,* portion of a population or habitat, one or two generations, rapid and unpredictable change, temporarily outside range of natural variability, 3 = High: *e.g.,* affecting a whole stock, population or habitat outside the range of natural variation.
	Duration	1 = <1 month, 2 = 1-12 months, 3 = 13-36 months, 4 = 37-72 months, 5 = >72 months.
	Frequency	1 = <11 events/year, 2 = 11-50 events/year, 3 = 51-100 events/year, 4 = 101-200 events/year, 5 = >200 events/year, 6 = continuous.
	Reversibility	R = reversible, I = irreversible.
	Ecological Context	1 = Pristine area or area not adversely affected by human activity, 2 = evidence of adverse effects

6.2.1 Wind Turbine Operation

The following sections discuss the potential effects of the operation of the Project on the biophysical and socio-economic environment.

The Project is owned by the Nova Scotia SPCA. A significant portion of the revenue created by the power production at Limerock will go directly to the SPCA. A portion of the revenue created will also go to the Community Benefits Fund, as described earlier, for the Alma Fire Department to distribute annually. In addition to this, the Proponent actively donates to various organizations/ individuals in need throughout the existing community surrounding Dalhousie. In September 2013, the Proponent made a significant donation to the Hector Arena Capitol Fund. This is for a small rink in the town of Pictou to complete upgrades necessary to continue operating (Figure 6.6).

Figure 6.6 Proponent and Staff with Donation Check to Hector Arena Fund Representatives

6.2.1.1 Effects on Birds

Environment Canada's "Wind Turbines and Birds – A Guidance Document for Environmental Assessment" and "Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds" (Environment Canada 2007a and 2007b) were considered during the pre-construction surveys and EA of Project impacts on birds.

In particular, Tables 1 to 3 of Environment Canada (2007a) were consulted to identify the sensitivity, facility size, and level of concern. According to the criteria identified in the aforementioned tables, the facility would be considered small due to the number of turbines at the proposed Project, and is considered to have an overall low sensitivity due to the general lack of landform structures in the Project Area and the results of the pre-construction survey. As a result, the Project would be considered a Category 1. Table 6.10 identifies the information that Environment Canada would expect to be considered for projects with a Category 3 or 4 level of concern.

Projects in Category 1 represent the lowest level of potential risk to birds. Usually, such projects would require some basic surveys before construction to assess bird populations within the proposed area for the turbines, and to confirm that there are not any sensitive factors that were previously overlooked. However, it is important to recognize that even basic surveys must

usually be conducted over a one year period, to ensure they are done at the appropriate time of year for each species. Depending on the numbers of birds detected, some follow-up surveys may be required to assess impacts, but these would likely be minimal. Most likely, these would involve some surveys for short periods in each of 1 or 2 years post-construction, possibly starting one year after construction. In cases where little or no habitat would be impacted (e.g., wind turbines within an industrial park), few if any bird surveys may be required. Some carcass searching will be required to rule out unexpected mass mortality events (Environment Canada, 2007a).

Table 6.10 Questions for Consideration as per Environment Canada (2007a)

Question	Answer
Identify the species that breed and winter at the site and in the surrounding area, and indicate their relative abundance.	See Section 5.4.1, Appendix G and Appendix F
Identify any species at risk, including species listed under the *Species at Risk Act (SARA),* provincially or territorially designated species, species designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or species designated as priority species by the ACCDC, Partners in Flight (PIF) or the CWS.	See Section 5.4.1, Appendix G and Appendix F
Identify bird colonies (note species, size, location).	No bird colonies have been identified during pre-construction surveys, and none have been identified during other surveys in the region, including the MBBA (2006-2010).
Identify raptors, shorebird concentrations.	See Section 5.4.1 and Appendix G
Identify species that give aerial flight displays.	Few species that typically give aerial flight displays during the breeding season have been identified. See Appendix G.
Identify the species that congregate at significant migration staging areas at or near the site.	The Project Study Area does not appear to be a major staging or stopover site for migration (see Section 5.4.1 and Appendix G).
Identify the species that frequently migrate through or near the area.	See Section 5.4.1.
Identify the species that commute (*i.e.,* between breeding and foraging habitats) through or near the area, as compared to other locations within the region.	There were no commuting species noted by the surveyor during the pre-construction survey. See Section 5.4.1 and Appendix G

Table 6.10 Questions for Consideration as per Environment Canada (2007a)

Question	Answer
What habitat types occur on the site and in the surrounding area?	See Section 5.4.1, Appendix B, Appendix F and Appendix G
Do these habitats typically support habitat-sensitive or habitat specialist species, *e.g.,* forest-interior species, grassland species, or shrub-land species?	The Project Area does not provide valuable habitat for bird species compared to other areas in the region. Due to the fragmentation that has already occurred in the Project Area, all forested habitat is considered edge habitat, no interior forest will be lost. The use of existing access for the majority of the layout and the size of the proposal will limit the fragmentation caused by the Project.
What is the relative density of breeding birds in these habitats?	See Section 5.4.1, Appendix F and Appendix G
What breeding or migrating birds do these habitats typically support?	See Section 5.4.1 and Appendix G
How much of each habitat type or function will be lost or altered as a result of this development?	The Project footprint will be primarily on an existing road and pasture/ farm fields. Some forest in regeneration may require clearing for foundation and/ or layup areas. Project infrastructure locations (including access roads) will maximize use of existing roads and cleared lands. Table 5.4 presents a detailed breakdown of habitat types and areas to be affected (Blaney, 2013). Most affected (according to NSDNR forestry data) include farm fields, immature softwood, clear-cut, and other non-forested areas. This generally reflects the relative abundance of these habitats on the local landscape.
What topographical features, such as islands, peninsulas, and ridges, are located on or near the site that may influence bird activity and movement?	Project site is situated in hilly terrain common to the Cobequid Hills Ecodistrict, however the project contains no locations that would be classified as a ridge likely to concentrate migrating birds. The Project Area is at least 45 km from the coast, Tatamagouche Bay (to the north), and over 20 km from the Bay of Fundy (to the west)
What is the expected amount and type of human presence (vehicles, pedestrians, tourism, etc.) at the site at different times of the year, during and following construction?	See Section 2 for information on Project traffic. The area is already subjected to human disturbance as a result of farming and recreational horseback riding/ ATV trails and hunting.
What are the relevant meteorological data, such as wind speed, wind direction and visibility (*e.g.,* number of days during migration period with visibility <200 m or cloud bases <200 m) for the site?	Typical climatological data for the region is provided in Section 5.5.1. Information on the frequency of low visibility conditions is unavailable for this area.
If a bird colony is located within 5 km of the Project area, or if a nationally recognized site occurs within 1 km, do individual birds pass through the proposed turbine locations as part of their daily movements? What proportion of the colony does this represent?	No bird colonies are known to occur within 5 km of the Project, nor is there a nationally recognized site within 1 km. Given the distance to the coast, there is low risk to seabird colonies. No seabirds have been recorded near the Project Area.

Table 6.10 Questions for Consideration as per Environment Canada (2007a)

Question	Answer
Do raptors breed at the site or within 1 km of the site? If so, what species are present and how close do they nest to the proposed facility?	No raptors were confirmed breeding at the site.
If the site is recognized by local experts as having bird habitat that is locally important, how much of this habitat would be lost or altered by the proposed Project?	The Project Area is not considered to have bird habitat that is locally important. The majority of Project lands have already been impacted by farming and other human activity such as forestry/ clearing.
If the site contains land features (islands, ridges, shorelines, peninsulas, areas of open water in winter, etc) that may concentrate birds on migration, while staging, or in winter: do birds concentrate at this site during any of the seasons mentioned above?	As indicated in Section 5.4.1, the survey data generally shows no evidence of large concentrations of birds in the Project Area.
If the site is recognized by CWS or local experts as regionally or locally important to birds, how does the number and diversity of birds that use the site in the season of interest compare to other locations in the region or province? How much habitat would be lost or altered by the proposed Project?	The site is not recognized by CWS or local experts as regionally or locally important to birds. The habitat included in the Project Area is not regionally or locally important to birds. The Project Area is characterized primarily by fragmented forest habitat of little value compared to other locations in the region or province.
If large numbers of birds may commute through or near the area during the day, what is the height and direction of this movement, and how does this relate to the proposed Project design and turbine locations?	Refer to Section 5.4.1. No large numbers of birds were observed commuting through or near the area during the day.

The potential environmental effects resulting from Project-related activities on birds include sensory disturbance and mortality. Section 5.4.1 provides detailed information on the breeding, wintering and migrating birds of the Project Study Area and the broader regional area.

Sensory Disturbance

Sensory disturbance of birds may occur during all phases of the Project as a result of on-site human activities such as surveying, clearing, trenching, turbine assembly, equipment operation, site inspections and site decommissioning. A certain level of sensory disturbance to birds in the area has already resulted from clearing of trees for hay fields and associated human presence. The operation of the wind turbines may also result in visual and auditory disturbance of wildlife, including birds. Breeding birds may avoid habitat within a zone surrounding the immediate Project footprint, although sensitivity is species-specific (Kingsley and Whittam 2005). Many species will not avoid habitat near rotating wind turbines, as has been noted by James (2003) and James and Coady (2003), but other species show a reduction in breeding densities near turbines (Johnson *et al.* 2000). There will be only two turbines constructed for the Greenfield

Project. Habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when human presence on-site is less frequent and typically of short duration. Given the use of the existing 1.8km road and previously disturbed areas for the majority of the proposed wind farm infrastructure, only a small fraction of the project will add to habitat fragmentation, with no loss of interior forest habitat.

The flight behaviour of birds may be influenced by project development. Operation of the turbines may affect bird movements through the partial obstruction of regular flight paths. Certain species (*e.g.,* waterfowl) appear to exhibit avoidance behaviour when flying close to an operating wind farm, while others do not appear to be influenced by the presence of a wind farm (James 2003; Kingsley and Whittam 2005). (Figure 6.7) Breeding birds at Pickering, Ontario, do not appear to be disrupted by the 1.8 MW operating turbine, and birds continue to nest and move within the area as before (James 2003). Most diurnal migrants fly at low altitude, within 40 m of the ground, and are unlikely to be significantly disturbed by the wind turbines or associated facilities. At night, migrants fly well above the height of the wind turbines, typically greater than 150 m above the ground, and are thus also unlikely to be disturbed by the Project. However, visual or auditory features that cause bird avoidance may have a constructive effect in that birds will be less likely to accidentally collide with turbines. Migration surveys conducted for the proposal would suggest the site is of relatively low risk, given the low numbers of migrating birds and typically small flock sizes. The Project Area does not appear to be in a major migration pathway.

Mortality

A possible effect of this Project on birds is mortality due to collisions with the operating wind turbines. There is a perception that wind turbines cause many bird deaths, and it has been highlighted by regulatory agencies and non-governmental agencies as an issue that needs to be addressed. General information about bird-turbine collisions is presented below.

'We estimated impacts on birds from the development and operation of wind turbines in Canada considering both mortality due to collisions and loss of nesting habitat. We estimated collision mortality using data from carcass searches for 43 wind farms, incorporating correction factors for scavenger removal, searcher efficiency, and carcasses that fell beyond the area searched. On average, 8.2 ± 1.4 birds (95% C.I.) were killed per turbine per year at these sites, although the numbers at individual wind farms varied from 0 - 26.9 birds per turbine per year. Based on 2955 installed turbines (the number installed in Canada by December 2011), an estimated 23,300 birds (95% C.I. 20,000 - 28,300) would be killed from collisions with turbines each year. We estimated direct habitat loss based on data from 32 wind farms in Canada. On average, total habitat loss per turbine was 1.23 ha, which corresponds to an estimated total habitat loss due to wind farms nationwide of 3635 ha. Despite concerns about the impacts of biased correction factors on the accuracy of mortality estimates, these values are likely much lower than those from collisions with some other anthropogenic sources such as windows, vehicles, or towers, or habitat loss due to many other forms of development. Species composition data suggest that < 0.2% of the population of any species is currently affected by mortality or displacement from wind turbine development. Therefore, population level impacts are unlikely,

provided that highly sensitive or rare habitats, as well as concentration areas for species at risk, are avoided'. (*Zimmerling et. al, 2013)*

Kingsley and Whittam (2005) provide a detailed review of available information regarding turbine-related bird fatalities in North America and elsewhere. Numerous studies during the last 20+ years have been conducted to estimate bird mortality at wind farms, from a single turbine or small wind farms such as the present proposal (2), to larger wind farms with thousands of wind turbines (Gill *et al.* 1996; Erickson *et al.* 2001; Percival 2001). This level of study effort is principally due to the circumstances at one large site in California, Altamont Pass, which alerted industry, government and the public to potential bird mortality at wind-farms. Thousands of wind turbines installed in the early 1980s at Altamont Pass were shown to cause high raptor (hawks, eagles and falcons) mortality. Collisions with the turbine structures were the primary cause of death, although electrocution and wire collisions also played a part (Orloff and Flannery 1992). These raptor fatalities triggered an increase in scrutiny of potential wind farm developments, which has led to the development of monitoring protocols and a substantial amount of data on bird use and mortality at proposed and existing wind farms.

Despite these early studies in California, very few raptors have been found killed at other North American wind farms (Erickson and West 2002; Kingsley and Whittam 2005). Songbirds are the most frequent casualties of wind farms in North America, and tend to collide with wind turbines more frequently during migration. Breeding birds appear to adapt to the presence of wind turbines near their nesting and/or foraging areas and avoid collision (Erickson *et al.* 2002; James 2003; James and Coady 2003; Kingsley and Whittam 2005). Songbirds can make up anywhere from 10% to 90% of the overall bird fatalities, depending on the location of the wind turbine site (Erickson *et al.* 2001). Excluding California, 78% of bird casualties at wind farms in the United States tend to be of migratory species (Kingsley and Whittam 2005). Many of these collisions occur at night, when individuals may be attracted to lit structures and collide with transmission wires, turbine towers or other structures in a wind farm. Findings at a West Virginia wind farm, where 27 birds were killed by colliding with a substation and the three wind turbines closest to the substation on a foggy night during May 2003, are probably attributable to the sodium vapour lights of the substation, which, combined with the very low visibility and the presence of the wind farm on a rise in elevation, may have caused this rare mortality event (Kerlinger 2003). No fatalities were found at any of the other 41 wind turbines of the wind farm, located further away from the substation and its sodium vapour lights (Kerlinger 2003). In spring 2011, a similar event occurred in Nova Scotia during a persistent fog event. Bird mortality was observed at two wind farms (Glen Dhu and Nuttby Mountain) in the region. In both cases, these wind farms have lighted substations located within their wind farm facilities. No such mortalities were observed at Dalhousie Mountain during this fog event, which lies between the Nuttby Mountain and Glen Dhu wind farms, and it has been surmised that this may be due to the separation of the substation from the wind farm facility (5km from substation to nearest turbine).

In October 2013, an Environment Canada study was released that shows that more than 276 million birds are killed in Canada every year from human-related activity, which includes deaths caused by cats owned, or not controlled well, by humans. The study also says that over 2

million nests are destroyed each year in Canada. The estimated figure of 276 million is out of a total of 10 billion birds. This study did not take into account chickens, turkeys or other poultry killed for food consumption. The methods of the avian mortality were released with deaths caused by wind turbines not making the top ten list. The total for Canada was 16,700 birds caused by wind turbines.

Although fatalities occur at wind energy facilities, the number of fatalities is generally small. This is especially noticeable when compared to bird fatalities caused by other sources, such as communication towers, roads, cats and buildings. Erickson *et al.* (2001) compared estimates of bird mortality caused by different human sources in the United States, and estimated that an average of 2.19 birds per turbine, or between 10,000 and 40,000 birds, are killed each year. Compared to other sources, such as feral and domestic cats (hundreds of millions), power lines (130 – 174 million), windows both residential and commercial (100 million – 1 billion), pesticides (70 - 80 million), automobiles (60 – 80 million) and lighted communications towers (40 – 50 million), the mortality caused by wind turbines is significantly less (AWEA, 2013). Each house in North America kills on average between 1 and 10 birds each year, and tall buildings kill many more (Dunn 1993, Kingsley and Whittam 2005). Additionally, Kingsley and Whittam (2005) indicate that the effects are small compared to the millions of birds that travel through existing wind power developments in the U.S. each year. This has been noted for two sites in Washington and one site in Minnesota, where conservative estimates of mortality, using surveillance radar and carcass surveys to determine passage rates and fatality rates, respectively, are less than 0.01% of birds passing through each wind farm (Erickson 2003). In Canada, existing wind farms in Alberta were included in a research study examining the movement of nocturnal migrant birds (and bats) using radar and sound recording technology. This research, conducted during the fall of 2004, compared the behaviour and abundance of birds and bats between operating wind farms and comparable sites without wind turbines. Millikin (2005) estimated that approximately 0.02% of the individuals (birds and bats combined) observed on radar may have resulted in a collision with a turbine. Furthermore, this research identified that these nocturnally migrating birds exhibited avoidance behaviour, with individuals reducing their speed and increasing their flight height to avoid the turbines (Millikin 2005). Nocturnal bird studies were not conducted as a part of this Project.

The National Wind Coordinating Collaborative (Strickland *et al*. 2011) summarized the bird mortality rates from 63 studies of wind power facilities across North America and Canada. The NWCC reports that bird mortality rates range from 0-14.0 birds per MW per year, with two-thirds reporting less than or equal to three fatalities per MW per year. Data collected during the casualty monitoring program at Dalhousie in 2010 and 2011 suggest mortality rates are at the very low end of the ranges reported by NWCC. Overall, the findings of the studies discussed above indicate that bird fatalities caused by wind turbines are very low in the majority of cases (Erickson *et al.* 2001; Percival 2001; Erickson and West2002; Kingsley and Whittam 2005). Locally, two years of post-construction monitoring of Dalhousie facility, in operation since December 2009, has resulted in very low recorded mortalities, 3 birds in 2 years, with adjusted correction factors for worst case scenario, the mortality rate is less than 0.25 birds/ turbine/ year. However, it is important to reduce or eliminate fatalities to the extent possible, and it is

important to understand what factors may increase the collision risk of birds at a wind farm. A number of factors may influence the potential for bird-turbine interactions that lead to bird kills, including weather and lighting, landscape features, turbine design, facility design and bird abundance and behaviour. These are described further in the following discussion.

Weather and Lighting

When conditions are clear, there is low likelihood that birds will collide with wind turbines (Crockford 1992; Kingsley and Whittam 2005). However, low visibility (<200 m) may cause nocturnal migrants to fly at lower altitudes, and lights may attract individuals (Jones and Francis 2003; Kingsley and Whittam 2005).

Birds may be attracted to red visibility beacons or other lighting associated with turbine structures. Lighting that attracts birds can increase the probability of bird-turbine collisions and result in kills. CWS recommends that the minimum amount of pilot warning and obstruction avoidance lighting should be used on tall structures. Only strobe lights will be used at night, at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada. The use of solid-burning or slow pulsing warning lights at night will be avoided. Transport Canada typically specifies red flashing lights for wind farms in Canada (Canadian Aviation Regulations Standard 621.19); CL-864 medium intensity red flashing lights were installed on selected turbines at Dalhousie site. Spotlights or other exterior or decorative lights will not be used to illuminate turbines. Lighting elsewhere within the Project will be the minimum necessary for safety. Lighting for the safety of the employees will be shielded to shine down and only to where it is needed, without compromising safety, and turned off when not in use. Final lighting selection determined in consultation with Transport Canada has the two turbines lit. A recent study of communications towers found that fewer avian fatalities are recorded at flashing versus steady-burning lights, regardless of the colour (Gehring *et al.* 2009).

Turbine Design

Turbine height is believed to be a strong influence on the likelihood of collision with taller structures having an increased risk of collision, while structures below 150 m cause minimal mortality (Kerlinger 2000; Crawford and Engstrom 2001; Kingsley and Whittam 2005). Migratory birds typically fly at altitudes greater than 150 m such that structures lower than 150 m in height do not usually obstruct migratory bird movements or result in bird mortality (Kingsley and Whittam 2005). The turbines for the Project will be 80 m hub height with a rotor diameter of 82.5 m. As a result, the greatest height of the turbines will be 121.25 m above the foundation, or well below 150 m. At this height, the turbines are not predicted to obstruct the movements of most migratory birds that frequent the region or to increase risk of material collision. Furthermore, results from a research project in Alberta indicate that migrating birds will modify their flight paths to increase in flight height when approaching an operating wind farm (Millikin 2005).

Facility Design

The scale of the wind farm has a direct influence on the potential for bird-turbine collisions. Facilities of 100 turbines or more are thought to more likely have a greater effect in terms of bird mortality due to the increased number of vertical obstacles (potential collision hazards) in the landscape (Environment Canada 2007a). The Project will consist of two turbines and will therefore be considered to be a small-sized facility. With the site sensitivity considered low and the small size of the Project makes the facility a Category 1 level of concern (Environment Canada 2007a).

Bird Abundance and Behaviour

The avian study results (Appendix G) showed that the Greenfield survey location is an adequate representation of previously cleared Acadian forests found throughout Nova Scotia. There are no habitat types or bird species of a unique nature found throughout this study area. There are no threatened or endangered species found throughout the area. Although there are breeding populations of birds found within the Greenfield area, the habitat types are not unique in nature and there are there are suitable habitat types for alternate nesting grounds in close proximity. (*Black Bird, 2013)*

Potential Impact and Mitigation

Evidence from wind farms in North America and elsewhere, as noted above, suggests that bird collisions are likely to occur but are in very low numbers, and the potential for significant bird kills is low. The results of the pre-construction bird survey program and collection of existing data indicate that the bird use of the Project Area does not cause concern with regards to increasing risk of collision, disturbance or habitat alteration. However, there are further monitoring measures that will help verify these potential effects to bird populations.

Bird surveys will continue in the same transect and area search locations once operations begin in 2015 and further add to the knowledge of bird use in the region. Construction on-site will occur outside of the breeding season to the extent possible to avoid contravention of the *Migratory Birds Convention Act*. If clearing activities cannot be scheduled to avoid the breeding season for most birds (May to August), then a birder on-site will use non-intrusive searching methods to identify the potential for nests within or immediately adjacent to work areas, and flag them for avoidance during construction. In cases when nests are known to be easy to locate, active nest searches may be performed.

Figure 6.7 Family of Canadian Geese Hatched and Raised in the Dalhousie Mountain Wind Farm, Fourth Year of Operations (2013)

To determine the accuracy of the predicted environmental effects and ensure all mitigation measures are successful, post-construction monitoring will be conducted. This study will include breeding bird, migration, mortality, scavenger efficiency, and searcher efficiency surveys. The length of the post-construction bird monitoring program will be determined in consultation with CWS and NSDNR although it is expected that two years of monitoring may be required (see Section 7.2). The results of the post-construction monitoring will be used to assess the success of the mitigation measures.

Taking into account the mitigation measures, there likely will be residual effects of the Project on local bird populations. In general, sensory disturbance will be infrequent, temporary in nature, reversible, small in magnitude and restricted to the Project Area given the mitigation measures proposed. Residual effects of sensory disturbance are not predicted to be significant. Fatalities as a result of colliding with structures within the Project will be irreversible, but they are expected to be infrequent and minor in magnitude and in geographic extent. It is unlikely that mortality will affect birds at a population level. As a result, the residual effect of this mortality is considered to be **low** and **not significant.**

6.2.1.2 Other Wildlife

Other wildlife species of importance include mammals, reptiles and amphibians. Most species are year-round residents of the Project Area and adjacent lands, although certain local or long-distance migrations of some species occur. Potential environmental effects of the Project on wildlife include habitat alteration, mortality and sensory disturbance.

Sensory Disturbance

Wildlife sensory disturbance may occur as a result of on-going human activity on-site as well as visual and auditory disturbance related to the operation of the turbines. Sensitivity of wildlife to disturbance varies by species and life-stage.

Human presence (noise, sight and smell) and vehicles may disturb wildlife. During operation of the wind-farm, Project-related vehicles and personnel will be in the vicinity of wind turbines on a regular basis for ongoing maintenance. It is likely that some disturbance of diurnal wildlife will occur during operation and maintenance of the Project. The Proponent lives in Dalhousie and drives the 11km commute to work at the bottom of the mountain at least twice daily. The sighting of animals including black bear (Figure 6.8), deer, bobcat (Figure 6.9), rabbits, beavers, and a multitude of avian species are a frequent event. This suggests that if the turbines (34 at Dalhousie, two at Greenfield) have a limited effect on diurnal species when operations begin that will lessen over time as the species and individuals become accustomed to the addition of wind mills in the area. Bats are unlikely to be affected by human presence as they are nocturnal and the majority of human presence will occur in the Project Area during the day. Although there is the potential for limited human presence induced disturbance to wildlife, significant adverse effects are not predicted for several reasons. First, the Project Area has a high degree of existing human disturbance (*i.e.* farming and recreational usage) and thus wildlife species have either become acclimatized to some degree of human disturbance or have already left the area. Second, disturbance will be intermittent and generated sound will be of low levels (*i.e.,* human speech and vehicle noise). Third, no rare or at-risk wildlife species were reported as breeding in the Project Area. In order to further reduce the severity of the effects of human disturbance on wildlife, worker presence on-site will be minimized and limited to designated work areas. In addition, all Project-related vehicles will be maintained to minimize noise and no idling will be permitted. In consideration of existing conditions and suggested mitigation, no significant adverse effects are predicted on wildlife due to human presence during operation and maintenance.

Figure 6.8 Power Pole at Dalhousie with Black Bear Markings, Spring 2013.

The operation of the wind turbines may also result in visual and auditory disturbance of wildlife. However, studies in the western United States have shown that there has been no significant effect of the construction and operation of wind farms on big game (Strickland and Erickson 2003), indicating that species are either unaffected by these developments, given their small footprint and the preservation of existing land use, or that they can readily adapt to the presence of wind turbines. At this site, habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when human presence on-site is less frequent and would occur on a short-term basis.

Figure 6.9 Bobcat Photographed by Proponent at Dalhousie, Summer 2013 found in landowner's woodlot.

Mainland Moose

The examination of NSDNR mapping and the completion of 5 new PGI plots have indicated that there is no occurrence of resident Mainland Moose near the development site (Appendix J). Two priority mammal species (the Fisher and the Short-tailed Shrew) will not be affected by the turbine development.

In order to determine if potential moose presence in the Project Area is increasing, the pellet group survey transects that were conducted for the project will continue to be repeated post-construction. The results of these surveys will be submitted directly to NSDNR. These surveys are discussed further in Section 7.1.

Mortality

Mortality of wildlife has the potential to occur during all phases of Project development. During construction and decommissioning, there is a small chance that small mammals may be harmed as a result of limited site clearing and through the use of heavy equipment for moving materials on and off the Project site. However, additional potential for mortality relates to interactions between operating wind turbines and bats. Bats have been identified as animals with the potential to be affected by wind energy facilities, as measured by numbers of carcasses found during surveys at wind farms in the United States and Canada. The remainder of this section describes the issue of

bat mortality at wind farms in more detail, places the issue in the Nova Scotia context and provides background to the assessment.

Bat Turbine Collisions

Despite having the ability to navigate cluttered environments in the darkness, bats are known to collide with large man-made structures, occasionally with fatal consequences. Bat collision mortality has been identified to occur with various kinds of tall structures including lighthouses, buildings, power lines, communication towers and wind turbines. Bat collision with human structures appears to be an infrequent occurrence, but it has the potential to be of concern. A recent study by Long *et al*. (2010) found that echoes returned from moving turbine blades that could render them attractive or difficult for approaching bats to detect and locate in time for avoidance, which might explain the sometimes inordinate rates of mortality at some wind farms.

The first report of bat fatalities at a wind farm was by Hall and Richards (1972). Over four years, 22 White-striped Mastiff-Bats (*Tadarida australis*) were found at the base of turbines at an Australian wind farm. Since then, bat fatalities have been reported at several wind farms in North America (Arnett *et al*. 2006). A report by Arnett *et al*. (2006) synthesized available information from 21 post-construction fatality studies across the United States and Alberta . This summary shows a consistent trend in fatalities occurring in late summer and fall among primarily lasiurine migratory species. Hoary bats, red bats, and silver-haired bats had constituted most of the mortality at wind farms. At one wind development where the tri-colored bat is the most common resident bat, tri-colored bat mortality approached 25%. However, fatalities among resident bat species such as *Myotis* spp. and big brown bats were low with the exception of two sites located in Alberta and Iowa where little brown myotis comprised 25% of mortality. There were no reports of fatalities of threatened or endangered species. Overall estimated mean fatality rates per MW varied between 0.2 and 53.3 (0.1 and 69.6 deaths/turbine/year) with the highest rates occurring in the eastern US. The average rate across all sites was 11.6 fatalities/MW/year. The study also found that fatalities were not generally concentrated around particular turbines and strobe lights recommended by the FAA did not influence rates of fatality.

Based on the timing of spring migration (Koehler and Barclay 2000), spring migrations of Hoary, Eastern Red and Silver-haired bats are most likely to occur in May. Despite these movements, Arnett *et al*. (2008) found that far fewer collision fatalities occurred in the spring at wind farms in the United States and Alberta. Erickson *et al.* (2002) found that of 536 recorded bat collision fatalities at wind farms across the United States, only two were killed in May (Erickson *et al.* 2002). Collision data collected from other types of structures also support these findings. For example, of 50 dead Eastern Red Bats collected at a building in Chicago, 48 were found in the fall and two in the spring (Timm 1989). It is not clear why spring migrants collide with wind turbines far less frequently than fall migrants. Behavioral differences between migrating hoary bats in the spring and fall may influence collision risk, as suggested by Johnson *et al.* (2002). These differences have been reported in Florida, where autumn migration occurred in waves, whereas the spatial distribution of bats during spring migration appears to be far more scattered (Zinn and Baker 1979).

The principal factors adversely affecting bat populations are predation, white-nose syndrome and habitat alteration/destruction, not collision with wind turbines or any other human structure (Bat Conservation International 2001). Despite this, bats are being killed at wind farms, or at least some wind farms, though the factors putting them at risk of colliding with wind turbines are still poorly understood. Without a clear understanding of what would place bats at risk of collision, it is difficult to predict the frequency of bat-turbine collisions. For example, Erickson *et al.* (2002) reports on several instances where bats were observed foraging very close to turbines without being struck by the turbine blades. This is further complicated by a lack of understanding of bat ecology, especially on migration, and the paucity of data on abundance and movement of bats at multiple spatial scales (continent-wide, provincial, regional) that could provide context for pre-construction surveys.

Barotrauma

It is understood that barotrauma could be the cause of death of some bats found at wind energy facilities (Baerwald *et al.* 2008). Barotrauma involves tissue damage to air containing structures (*i.e.,* lungs) caused by rapid or excessive air pressure change. In this case, it is believed that air pressure change at the trailing edge of turbine blades (in movement) causes expansion of air in the lungs not accommodated by exhalation, therefore resulting in lung damage and internal hemorrhaging. However, a more recent study by Grodsky *et al.* (2011) used radiology to investigate causes of mortality and found that a majority of the bats (74%; 29 of 39) examined had bone fractures that are likely to have occurred during direct collision with turbines. Approximately one-half (52%; 12 of 23) of bats whose ears were examined had mild to severe hemorrhaging in the middle or inner ears (or both). The true nature of mortality resulting from turbine collision remains poorly understood.

Fatalities in the Northeast

While pre-construction bat surveys have demonstrated little correlation with actual fatalities post-construction, operating wind farms in the area have demonstrated that bat fatalities are low. The operational Kent Hills Wind Farm located near Prosser Brook, New Brunswick along the Bay of Fundy could be considered a high potential site for bat interaction based on its location near a known hibernaculum, and proximity to the Bay of Fundy Coast. Despite these factors, mortality at this site has been low over the last two years of carcass monitoring (32 turbines) with only one bat carcass found in 2009 and four in 2010. The estimated casualties corrected for searcher efficiency over the entire period is 0.10 casualties per turbine (Stantec 2010, 2011a).

Likewise, a post construction monitoring study at the Mars Hill Wind Development along the New Brunswick/Maine border found no unreasonable adverse impact to these species, recording only 0.17 fatalities per turbine per year in 2008, and 0.43 in 2007 (Stantec 2009). These numbers represent only a fraction of the mortality experienced at many other wind developments in the eastern US. These low numbers could be considered noteworthy given that the Mars Hill project follows a highly pronounced north-south running ridge, surrounded by

agricultural plateau that could present an obvious migratory marker for any bats that might be moving through the area.

The scientific community is moving away from quantifying mortality at wind farms as individuals per MW or turbine based on averages. This arises from the fact that during post construction studies at wind farms there have been cases where one turbine has been recorded as having a large number of bat kills but when averaged out over the number of machines at the project, the numbers look smaller (and less of an impact) than they actually. An example would be a wind farm with 25 turbines: 17 deaths recorded at one site and a total of 19 for the whole project. The average would be stated to be 0.76 bats per turbine which wouldn't sound that alarming. However, when reported as actual numbers, 17 bats for one turbine, the magnitude of the negative impact is better understood.

While nearby wind developments have demonstrated low rates of mortality, migration pathways can be localized and our ability to predict the locations of migration corridors is limited. There are also other post-construction monitoring programs underway in the Maritimes that may help to shed additional light on the general hazard of fatalities to bats in the region.

Pre-construction bat surveys at the proposed Greenfield site were undertaken in August/September 2013 (Appendix I). On July 30, eco-location emitters and recorders were deployed at three areas. One was hoisted to 40m and attached to the met tower while one was deployed at 2m at the same location (located very close to proposed location of Turbine 1). The third detection device was deployed at about 2m at the proposed location of Turbine 2 along the edge line of cleared area/ regenerated forest. The nighttime activity was recorded from July 30 until September 30 2013. Batteries were changed and recordings uploaded on August 23 and September 13.

Results from the bat survey report are quoted below; the entire report is contained in Appendix I.

Discussion

Interpretation of these data are problematic for assessing relative risk to bats at the proposed development given our knowledge of the devastating impacts that white nose syndrome has had, and is having, on local bat populations. Elsewhere, white nose syndrome reduced the summer bat activity by >75% (Dzal et al. 2011). This past winter (2012-2013), there were hundreds of fatalities recorded at several known hibernacula in the province and annual monitoring counts of bats at such hibernacula down, on average, by 94% (Broders and Burns, unpublished data). The disease is now confirmed in seven counties in central Nova Scotia, including the proposed development area. These observations are suggestive of a major mortality event in the area, potentially decreasing the magnitude of bat activity in the area in the summer of 2013. This is supported by other work we are conducting in the region suggesting a >99% reduction in the magnitude of echolocation activity in 2013, relative to 2012 (Segers and Broders, unpublished), and decimation of a number of maternity colonies in the region. For these reasons this dataset must be interpreted with caution.

Despite the above, there was no acoustic evidence of a significant movement or concentration of bats through the area investigated during this pre-construction survey of bat activity. The magnitude of activity was low compared to baseline levels (collected prior to 2007) expected in a forested ecosystem in the region. Although we cannot rule out the possibility that mortality events associated with this development will occur, we have found no evidence to suggest that the proposed project will cause large numbers of direct mortality of bats. That being said, in light of white nose syndrome and the recent listing of the species as endangered, the significance of any mortality is greater than just a couple of years ago.

The majority of the identified echolocation sequences recorded for this project was attributable to the two species of Myotis bats known to occur in Nova Scotia, the little brown bat and the northern long-eared bat. This was expected as they are the only abundant and widely-distributed species in the province, and are two of only three species with significant populations in the province (Broders et al. 2003). Although we did not distinguish the calls of Myotis species, the majority of the recorded sequences likely represent the little brown bat, as this species is known to forage in open areas and over water. The northern long-eared bat is a recognized forest interior species (Jung et al. 1999, Henderson and Broders 2008), and is less likely to use open areas for foraging and commuting (Henderson and Broders 2008). Additionally, the northern long-eared bat has lower intensity echolocation calls and is thus not recorded as well as the little brown bat (Miller and Treat 1993, Broders et al. 2004). There were no echolocation sequences that were attributable to the tri-colored bat, which was expected as this species is only locally abundant in southwest Nova Scotia and the proposed development is outside of the known provincial distribution for this species (Farrow and Broders 2011).

Myotis bats are relatively new to the list of species among fatalities at wind turbines sites. This may be due to the fact that the first large scale wind developments were located primarily in western North America, typically in agricultural and open prairie landscapes (reviewed in Johnson 2005b). Fatalities of these resident, non-migratory species were largely absent from these sites, likely due to the association of these species with forested landscapes. More recently, evidence of Myotis fatalities resulting from collisions with wind turbines have been noted at sites in eastern North America (reviewed in Johnson 2005b, Jain et al. 2007, Arnett et al. 2008a). Although there are fewer documented fatalities of Myotis bats compared to long-distance migratory species, there is still a risk of direct mortality.

Other than direct bat mortality as a result of collisions with turbines, there is also the potential that disruption of the forest structure (e.g., removal of trees and fragmentation of forest stands for roads and clearings) will degrade the local environment for colonies/populations of Myotis bats that reside in the area during the summer. This can occur by the elimination of existing roost trees, the isolation of trees left standing, as well as the elimination or degradation of foraging areas for bats. These negative impacts will almost certainly occur and will add to the cumulative impact of habitat loss that is occurring throughout the ranges of these species. Additionally, these resident bat species make what are generally considered to be short distance migrations, in comparison to long-distance migratory behaviour by other bats species, from their summering areas to underground sites where they hibernate. Little is known about the flight behaviour and dynamics of these movements (i.e., height of travel, and routes); therefore, it is difficult to predict the specific effects that wind developments will have on the movements of local populations of bats.

The low number of call sequences attributed to the hoary bat, a long-distance migratory bat species, suggests that there are no large populations or migratory movements of these species at the study area. This fits with our current knowledge of their status in the province, but they do occur regularly but in low frequency although are especially vulnerable to wind facilities. This species is a solitary, tree-roosting species with an extensive distributional range throughout North American (van Zyll de Jong 1985). This species, in addition to red and silver-haired bats, have received the greatest attention with regards to wind energy developments because they make up the large majority of documented fatalities at existing developments in North America. Any mortality of this species would be significant to Nova Scotia given there low numbers in the region. Significant bat fatality events at wind energy developments occur primarily in the late summer and early fall, peaking during the period that coincides with the long-distance fall migration of these species (Johnson 2005b, Cryan and Brown 2007, Arnett et al. 2008a), leading researchers to believe that migration plays a key role in the susceptibility of certain bat species to wind turbine fatalities (Cryan and Barclay 2009). It has been proposed that this may be because these species travel at a height that puts them at increased risk of collisions with rotating turbine blades (Barclay et al. 2007, Arnett et al. 2008a).

The low number of bat call sequences recorded at the abandoned mine openings suggest they are not major hibernacula. However, given the impacts of WNS such low levels of activity are not unsurprising, even if the sites were important hibernacula. Although this activity is generally low and would not qualify for the criteria set out by Randall (2011) for designating swarming sites, this current work was carried out post-white nose syndrome which almost certainly reduced the overall magnitude of bat activity recorded. Further, Randall's work was carried out directly at the entrances of underground sites where activity is highest as the animals interact, whereas the detector at Smithfield was placed on a forest edge near presumed entrances and therefore activity may be lower since it is not directly at the swarming site entrance. Despite this, the activity at the Brookfield and Kemptown AMO's suggest that they are not currently major autumn swarming sites for bats. The Smithfield AMO had the highest level of bat activity recorded of all three study areas sampled in this study and the seasonal trend of increasing activity fits the pattern of increased activity at swarming sites in the period of the end of August and early September that begins to decrease around the middle of September (Burns unpublished data; Tutty 2006). These data are more suggestive of the site being a swarming site and may also potentially be a hibernaculum. Alternatively, this site may not represent a swarming site but may be situated along a migration corridor for bats to other travel among swarming sites which may explain the trend in bat activity following the patterns known for the autumn swarming season. Further work would be required to assess the importance of this site as an autumn swarming site, migration corridor or over-wintering site (hibernaculum).

The Proponent is committed to post construction monitoring as recommended by the survey report from Broders and Burns as outlined below.

1. *Post-construction monitoring* – A rigorous post-construction monitoring program, appropriately designed to account for searcher efficiency and scavenger rates, needs to be established to quantify bat fatality rates. These surveys should be conducted over an entire season (April to October), but especially during the fall migration period (mid-August to late-September) for at least two years. Should fatalities occur, they should be investigated with respect to their spatial distribution relative to wind turbines,

turbine lighting, weather conditions, and other site specific factors, and should trends be identified, operations should be adjusted in an adaptive management framework. In this manner, mitigation can be focused on any identified high risk areas/infrastructure to minimize future fatalities. These data are essential for assessing potential risks at future developments in the region; therefore it is critical that the results of these surveys be appropriately reported.

2. *Retain key bat habitat* – Key bat habitat should be identified and retained in the project area to continue to support existing summer colonies/populations of bats. Retention of these bat habitat resources should be in a spatial manner that provides connectivity in the project area and with the larger landscape to ensure foraging and roosting areas remain well connected. Consideration of the potential for fragmentation of bat habitat resources should also be taken with regards to the development of road networks and transmission lines in the project area.

3. *Minimize project footprint* – To the extent possible, minimize the direct loss of bat habitat resources (e.g., wetlands, riparian areas, mature deciduous-dominated forest stands), and minimize the extent of bat habitat impacted by the development.

4. *Return to pre-project state upon decommissioning* – The project area should be returned to the state that existed prior to the development of the site once the project is decommissioned. This should include planning to ensure the continuity of forest stand succession to provide and maintain appropriate roosting areas well into the future as existing roost trees die off. Retention of forest stands of a range of ages will provide mature trees for bat roosting resources in the future.

5. *Develop an operations fatality mitigation plan* – Recent experimental case studies in Alberta and the United States have demonstrated dramatic reductions in bat fatalities at operational wind energy facilities can be made by changing operational parameters during the peak fatality period (Baerwald et al. 2009, Arnett et al. 2010). These include changes to when turbine rotors begin turning in low winds via alterations to wind-speed triggers and blade angles to lower rotor speed. These studies have found decreases in bat mortalities ranging from 44% to as high as 93% reductions on a nightly basis at relatively low cost to annual power production loss, at approximately ≤ 1%. This plan should be adaptive as operations continue through time and be in place prior to operations commencing such that if any bat mortalities be observed at the site once operational, the plan can be implemented immediately.

6. *Remain up to date with current research* –There is presently an abundance of on-going research aimed at determining the impacts of wind energy developments on populations of bats. Other studies are focusing on investigating the efficacy of potential mitigation measures, including the effects of weather on bat activity patterns and collisions with wind turbines, and possible bat deterrents (including acoustic and radar emissions). As these are active areas of research, it is essential that the most current studies and guidelines are used to guide management decisions and development plans for wind energy projects.

As discussed above, the Proponent is committed to monitoring the Project during operations to identify if a bat population is using the area, if any mortality is occurring, and will be prepared to adopt post-construction mitigation measures should there be a need. At this stage, the level of

impact is considered **low** and **not significant**. These surveys are discussed further in Section 7.0.

6.2.1.3 Land Use

As indicated in Section 5.3 of this report, the land required for Project development is one 100 acre plot of predominantly cleared land which has historically been subjected to farming and forestry activities. The Project Study Area does support other vegetation types including wetlands and disturbed areas such as roads. The effect of wind turbines on undeveloped lands within the Project Study Area is negligible with only a minor portion of land use required to house turbines and their ancillary equipment. Land use impacts associated with construction and operation of the Project will be negligible since it will not impair or impact current land uses, change land use patterns, or be incompatible with existing uses. The residual impact to existing land use is considered to be **minimal** and **not significant**.

6.2.1.4 Property Values

Prior to 2003, there was a general lack of empirical data assessing the impact of wind energy facilities on the economic value of properties whether within a wind farm or within sight of a wind farm. However, Sterzinger *et al.* (2003) undertook such a study, statistically testing whether the perception that property values are negatively affected by wind farms is true or false. For their study, Sterzinger *et al.* (2003) compiled data on every U.S. wind energy development commissioned between 1998 and 2001 that was of a capacity of 10 MW or greater. Property sales records for the area within 5 miles (8km) of the wind farm were collected for the three years prior to commissioning and the three years following commissioning, to determine if there was a difference between pre-construction and post-construction property sales. For comparison, sales records were also collected for the same time period from communities comparable to that included for each wind farm. A total of 10 wind power projects were analysed, including two projects from New York, two projects in Pennsylvania and one project in Vermont (Sterzinger *et al.* 2003).

Overall, property values increased with the same rate in wind farm communities within 8 km of a wind farm compared to similar communities without wind farms (Sterzinger *et al.* 2003). Nine of the ten projects showed a greater increase in property values after commissioning compared to the period prior to commissioning, and when looking at the rate of increase in property values after commissioning of the wind farm, communities near a wind farm actually had greater increases to property values than those without a nearby wind farm (Sterzinger *et al.* 2003). These findings indicate that there is no support for the notion that the development of wind farms decreases property values.

In 2010, a study was undertaken for the Municipality of Chatham-Kent, Ontario. The purpose was to execute a market-based empirical study into the effects of wind turbines on local residential real estate values (Canning and Simmons, 2010). They selected a study are with the following attributes: there had been a sufficient volume of sales of similar properties in the same general area but not in proximity to a wind farm following its completion; there had been sufficient volume of sales of similar properties in the same general area but not in proximity to a

wind farm (beyond the viewshed); and, there was sufficient access to registry office sales records, and local area real estate board listing information (Canning and Simmons, 2010). Data was analyzed to determine the effect on real estate values as a result of proximity to wind turbines. Specifically they compared properties within the viewshed and those not within the viewshed of wind turbines. Concerns expressed by those near proposed or existing wind farms were aesthetics, shadow flicker and sound (audible and low frequency) (Canning and Simmons).

In Chatham-Kent, there are over 700 wind turbines (Municipal Website).

The conclusion of the study was there was no statistical inference to demonstrate that wind farms negatively affect rural residential market values in Chatham-Kent. Furthermore, this study did not find any consistent evidence from the analyzed data that such a negative correlation exists in the Municipality of Chatham-Kent. During the course of gathering data, there were no unusual quantities of rural residential properties listed for sale in the study area. Four unrelated data processes were used in studying the property sales information for Chatham-Kent. The only consistency was that each evaluation methodology found that it was highly unlikely that any type of a causal relationship exists between wind farms and the market values of rural residential real estate (Canning and Simmons).

It also summarizes that where wind farms were clearly visible, there was no empirical data to indicate that rural residential properties realized lower sale prices than similar residential properties within the same area that were outside of the viewshed of a wind turbine (Canning and Simmons).

The U.S. Department of Energy, Washington, D.C. investigated the possible relationship between proximity to wind facilities and property values in 2009. Research was collected on almost 7,500 sales of single family homes situated within 10 miles of 24 existing wind facilities in nine different U.S. states. The conclusions of the study are drawn from eight different hedonic pricing models, as well as both repeat sales and sales volume models. The various analyses are strongly consistent in that none of the models uncovers conclusive evidence of the existence of any widespread property value impacts that might be present in communities surrounding wind energy facilities. Specifically, neither the view of the wind facilities nor the distance of the home to those facilities is found to have any consistent, measurable, and statistically significant effect on home sales prices. Although the analysis cannot dismiss the possibility that individual homes or small numbers of homes have been or could be negatively impacted, it finds that if these impacts do exist, they are either too small and/or too infrequent to result in any widespread, statistically observable impact (Hoen, *et. al.* 2009)

Further assessment of the potential impact of wind farms on property values was conducted by ECONorthwest (2002). For this assessment, interviews were conducted with tax assessors from 13 counties in the United States for which wind farms had been developed during the previous 10 years. Based on these interviews with unbiased and trained assessors of property values, ECONorthwest (2002) concluded that there is no loss of value for those residential

properties with views of wind turbines (*i.e.,* views of wind turbines do not negatively impact property values).

A report conducted by the Renewable Energy Policy Project (REPP 2003) concluded that, based on a study of nine different communities from across the United States, property values of homes within a wind farm's viewshed were not harmed by the construction and operation of the wind energy facility. To the contrary, for the majority of the projects analyzed, property values actually rose more quickly in the viewsheds than in comparable communities outside of the viewsheds (REPP 2003). Furthermore, statistical evidence does not support the idea that property values within the viewshed of wind farms suffer or perform poorer than in comparable regions (REPP 2003). This statistical analysis is supported by a literature review conducted as part of the REPP (2003) study.

The Environmental Review Report for the Wolfe Island Wind Project near Kingston, Ontario (CREC 2007) also includes a comprehensive review of literature on property value studies conducted in Australia, Denmark, United Kingdom, the United States, and Canada. These studies consistently reported a neutral or positive effect on property values (CREC 2007).

At Fitzpatrick's Mountain in Pictou County, there are two 800 kW Enercon wind turbines operating. They were constructed prior to municipal bylaws being implemented which resulted in houses being 200m, 300m, 400m, 500m, 550m, etc. Since operations began, three houses within 800m have been sold at or above values the house were originally purchased for. Four new homes have been built in the last several years within 1300m of the turbines. The setting is much like the setting for the Greenfield Project where the turbines are located at the height of land with rural communities and mixed land usage around the area. The turbines have been operational since 2005 and 2006.

As discussed in Section 5.6.5, at the existing Dalhousie facility, property values have not been affected. If property has turbine on it, the value is greatly increased as there is an added guaranteed income associated with the property. Dalhousie is over 1500m from the nearest house, and all of the local homeowners are happy with the project, therefore, there has been no negative effect on the property values.

Since the Proponent's Dalhousie Mountain Project has become operational, numerous homes purchased or built within 3km of the turbines.

Located 24km south-west of Dalhousie, the proposed Greenfield Project is also in a rural setting, and is surrounded by a mix of forested and agricultural lands and residential properties. The Project has the potential to represent a long-term land use, which may have the effect of promoting some stability in land values. It is predicted that residual impacts on property values as a result of the wind farm are likely to be **minimal** and **not significant**.

6.2.1.5 Visual Impacts

Due to the importance of assessing the potential impact to the area's visual aesthetics, a visual impact assessment was completed. The following section summarizes the visual assessment with respect to the photo montage analysis and shadow flicker analysis that were conducted.

Viewsheds

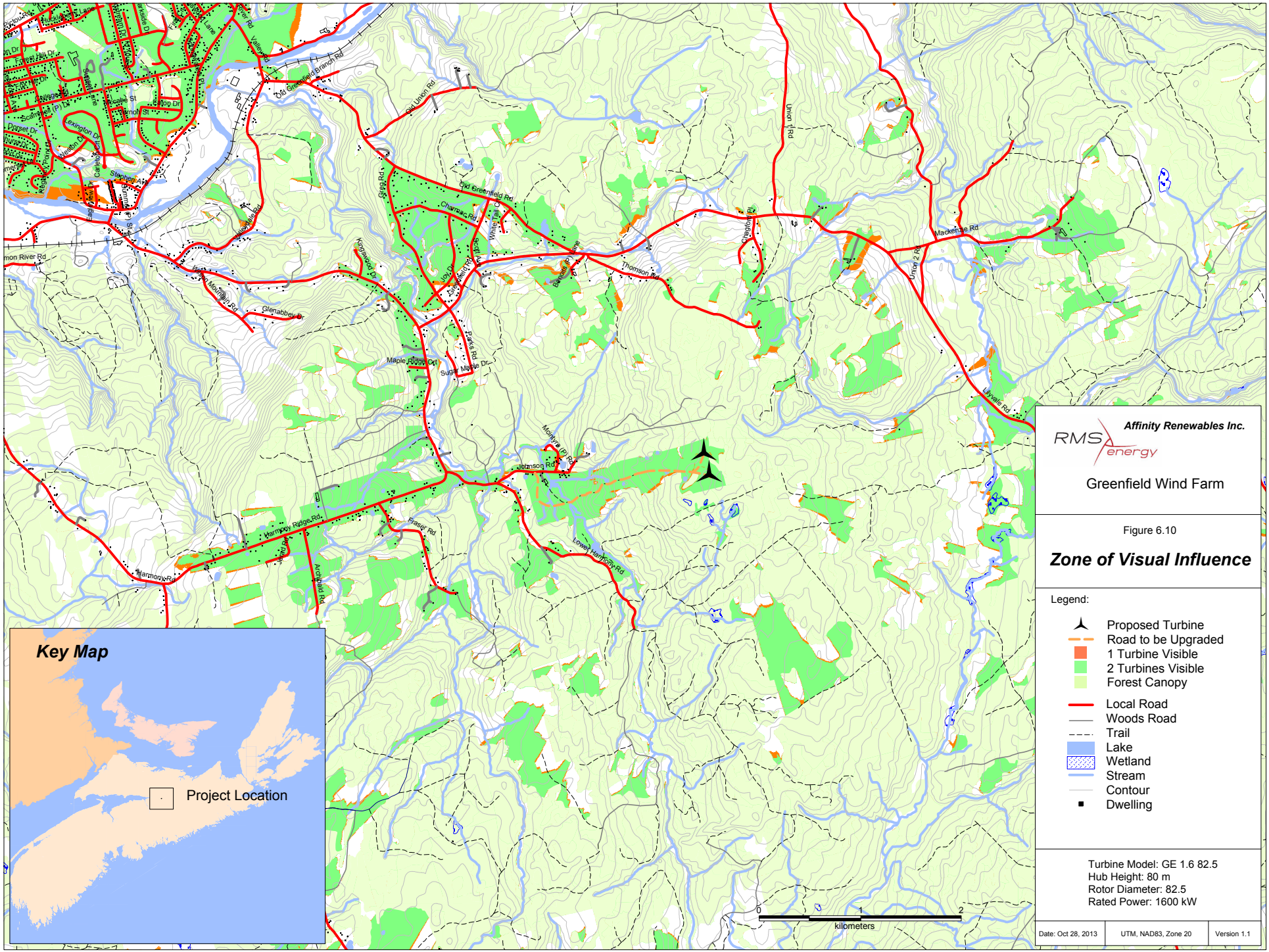
The modeling software used by Nortek Resources to render photo montages for the assessment is produced by EMD, Denmark and is part of the WindPro 2.4 suite of modeling software. A photo montage is a photograph taken in the field from a specific location with the proposed wind farm turbines superimposed to scale. It is a graphical representation of what the constructed turbines could potentially look like upon completion from a particular vantage point. Figure 6.10 provides a viewshed overview and Figure 6.11 shows the viewing locations selected for the assessment (*i.e.,* location from which photographs were taken) Figures 6.12, 6.13, 6.14 and 6.15 show the simulated results.

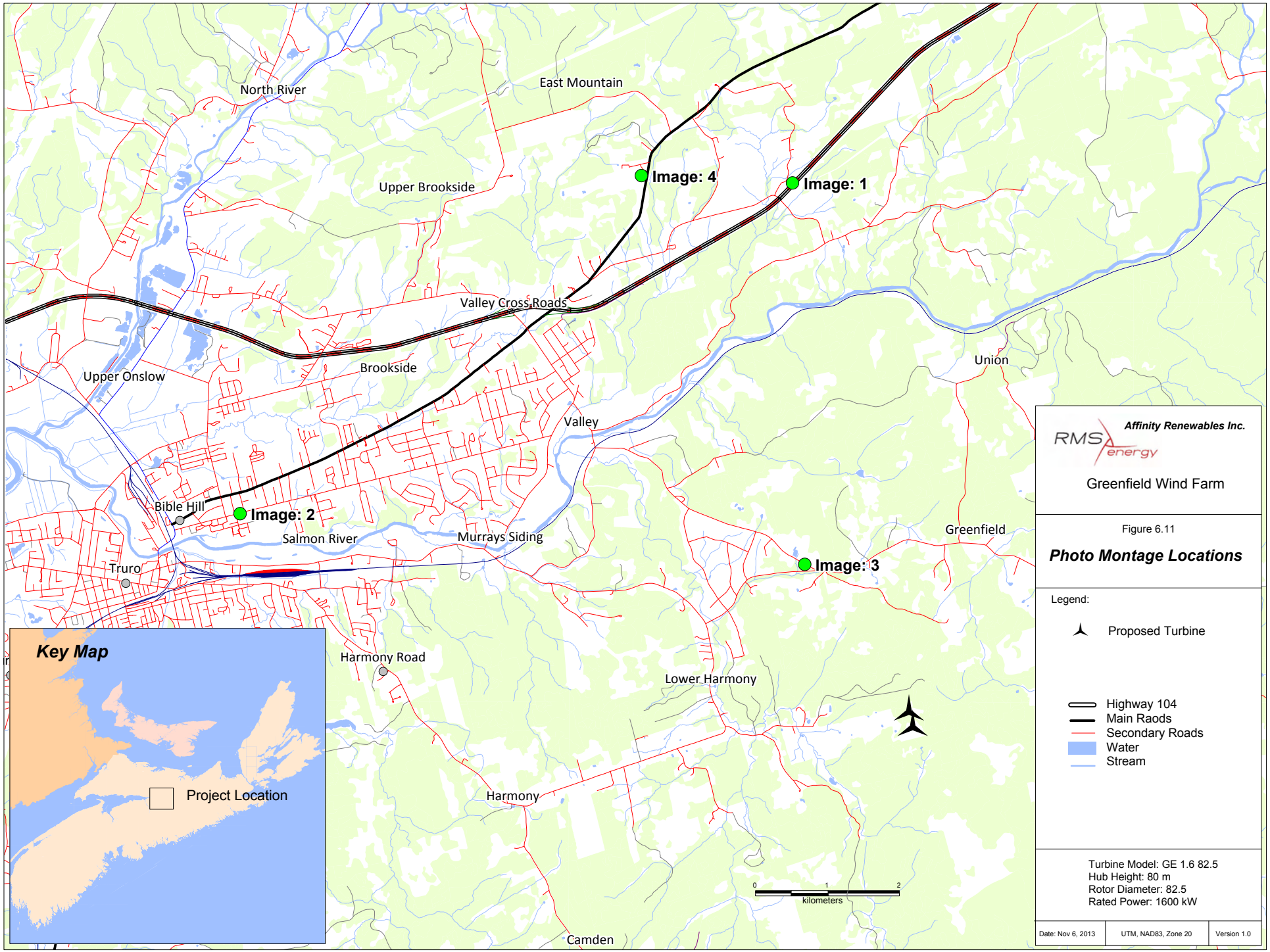
The turbines are designed to rotate and be oriented facing the prevailing wind direction at any given time. The towers themselves will be light grey and constructed of rolled steel. The nacelle at the top of the tower, which contains the generator, is fiberglass and will also be light grey. The base of the tower is approximately 4.6 m across, while the height of the turbine towers will be approximately 80 m, with rotor blades that are approximately 41.25 m long.

Lighting

The wind turbine generators will be lit to meet the requirements of Transport Canada's Canadian Aviation Regulations (CAR) 621.19. Lighting will be the minimum required to ensure the appropriate level of aeronautic safety and red lights (CL-865) may be used with the minimum intensity and flashes per minute allowable.

The viewing distances from the locations analyzed in this report indicate that all of the residences within the Project Study Area will be greater than 1300 m from the nearest wind turbine. Given the viewing distance of greater than 1300m combined with vegetation and terrain, the presence of these lit towers will not place excessive nighttime visual pollution in the Study Area.


Key Map
Project Location
Affinity Renewables Inc.
RMS Energy
Greenfield Wind Farm
Figure 6.10
Zone of Visual Influence
Legend:
Proposed Turbine
Road to be Upgraded
1 Turbine Visible
2 Turbines Visible
Forest Canopy
Local Road
Woods Road
Trail
Lake
Wetland
Stream
Contour
Dwelling
Turbine Model: GE 1.6 82.5
Hub Height: 80 m
Rotor Diameter: 82.5
Rated Power: 1600 kW
0
1
2
kilometers
Date: Oct 28, 2013
UTM, NAD83, Zone 20
Version 1.1


North River
East Mountain
Upper Brookside
Image: 4
Image: 1
Valley Cross Roads
Upper Onslow
Brookside
Union
Valley
Bible Hill
Image: 2
Salmon River
Murrays Siding
Greenfield
Truro
Image: 3
Harmony Road
Lower Harmony
Harmony
Camden
Key Map
Project Location
0
1
2
kilometers
Affinity Renewables Inc.
RMS energy
Greenfield Wind Farm
Figure 6.11
Photo Montage Locations
Legend:
Proposed Turbine
Highway 104
Main Raods
Secondary Roads
Water
Stream
Turbine Model: GE 1.6 82.5
Hub Height: 80 m
Rotor Diameter: 82.5
Rated Power: 1600 kW
Date: Nov 6, 2013
UTM, NAD83, Zone 20
Version 1.0