Affinity Wind LP

Limerock Wind Farm

Environmental Assessment Registration

November 2013

Prepared by:

Rotor Mechanical Services
1383 Mount Thom Road
Salt Springs, NS B0K 1P0
Tel: (902) 925-9463
Fax: (902) 925-9464
www.rmsenergy.ca

Limerock Wind Farm

Environmental Assessment Registration

Prepared for:

Affinity Wind LP
1383 Mount Thom Road
Salt Springs, NS.

November 2013

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 Limerock COMFIT Wind Project and will consist of three 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 62N-T1. The proposed project will be located in Limerock in the municipality of Pictou. The project is referred to as the Limerock COMFIT Wind Project ("Limerock").

Limerock will provide renewable power sufficient for 2,000 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, Limerock 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.

Project Description

The Project will consist of three 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 Limerock, the Proponent will be using the 1.68 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; and
- crane pads for assembly of wind turbines.

An existing maintenance shop/control building will be home base for maintenance and operations. This is located approximately 10km from Limerock 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 Limerock have included meetings with the Municipality of Pictou, meetings with Pictou West MLA, Charlie Parker, meeting with newly elected (October 8, 2013) Pictou West MLA Karla MacFarlane, meetings with local area municipal councillor Leonard Fraser, meetings with the two bordering fire departments West River and Alma, door to

door house visits to homeowners living within 2km of the proposed site. The local community and other interested parties have had very positive feedback and support throughout the course of the development.

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; and Nova Scotia Department of Transportation and Infrastructure Renewal (TIR), Royal Canadian Mounted Police (RCMP), 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 Limerock, 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 Mountain Wind Farm since development began and has continued through the past four years of operations. Positive feedback has been received for the proposed Limerock Project.

Impact Assessment

No significant adverse residual environmental effects of the Limerock 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 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

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

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			extend no higher than 150 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 was conducted at the nearby Dalhousie site in 2008 (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.
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

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

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			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.
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.

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

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			• 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 • 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. • If required, 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	• Set turbines back far enough away from houses to meet the 40 dBA threshold used through-out Nova Scotia, Canada, and other parts of the world for wind • 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

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

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			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	• Delivery of turbines and components will use the same highway exit as Pleasant Valley's Magic Valley Fun Park and LORDA. The Proponent has been in discussions with, and will continue to update the owners about construction schedules, operational procedures and extended dialogue for any concerns or issues that may arise.
	Operation	Effect on tourism and recreation	• The Limerock Project is located near Pleasant Valley's Magic Valley Fun Park. The Proponent has been in discussions with, and will continue to update the owners of the park about any major maintenance schedules, operational procedures and extended dialogue for any concerns or issues that may arise.
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.
		Shadow flicker	• The approach angle of vehicles coming into the area with potential shadow flicker is perpendicular to the potential shadow, eliminating a 'blinking' effect. • The distance of the turbines to the highway is over 500m, meaning that if shadow flicker parameters are present, the intensity of the possible shadow effect will be extremely dull, if visible at all.
Archaeological and Cultural Resources	Construction	Disturbance	• An archaeological field survey has been conducted, no impact is predicted (Appendix H). • An MEKS (Appendix B) has been conducted, no impact is predicted • 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.

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

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			• Existing right-of-ways (RoWs) 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. • The distance of the highway from the turbines is farther than ice throw can possibly reach, therefore, no safety issue for ice throw and highway traffic is present
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 highway exit traffic for work, tourism, local travel. • No modification to existing roads expected. • A Special Move Permit and any associated approvals will be obtained through the Department of Transportation

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

Environmental Component	Project Activity	Potential Effects	Mitigation Measures
			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 locally, 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 Alma Fire Department's Executive Board. This money will go to: the local baseball fields and community halls as needed; other established charitable organizations (LORDA) 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

6.0 ENVIRONMENTAL ASSESSMENT AND RESIDUAL EFFECTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

1.0 Project Summary

Affinity Renewables 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 Incorporated (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 62N-T1. The proposed project will be located in Limerock in the Municipality of Pictou. The project is referred to as the Limerock COMFIT Wind Project ("Limerock").

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 4.99 MW of electrical power from the proposed Limerock Project.

Application was made to Nova Scotia Department of Energy (DOE) on September 19, 2011 to develop a 6.4 MW wind project to feed power to transformer 62N-T1 in Pictou County. On April 13, 2012, the Proponent was awarded a 6.0 MW COMFIT certificate, however; sub-station capacity, voltage regulations and project economics determined that 5 MW will be the maximum amount of power produced.

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 Limerock Project will be located at the existing Dalhousie Operations and Maintenance building. The primary contact for the Proponent is:

Mr. Reuben Burge
President, Affinity Wind LP
1383 Mount Thom Rd. Salt Springs, Nova Scotia, B0K 1P0
Tel: (902) 925 9463
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 Limerock COMFIT Wind Project.

1.3 PROJECT LOCATION

The Project will be located on privately owned land. The PIDs with UTM coordinates for Limerock are below.

Table 1.1 Turbine Locations

Turbine	Easting	Northing	PID	Elevation
1	513639	5043007	855163	173 meters
2	513802	5042522	855163	180 meters
3	514224	5042681	854760	190 meters

The proposed Project is located in Limerock, Pictou County, Nova Scotia. The site sits on privately owned land in Pictou County (Figure 1.1). The wind energy facility will be constructed on land that has previously been cleared for logging activities and will utilize the existing logging roads to the extent possible. A Project Study Area (Figure 1.2) was delineated around the three 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 woodland generally bounded to the north by TransCanada Highway 104, to the east, south and west by previously cleared forested land (Figure 1.2). The property required to install the Limerock Project is located on privately owned land. Private long term leases and easements are in place to permit the entire installation of this Project.

1.4 ESTIMATED CAPACITY OF FACILITY

The proposed Project will consist of three 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 1.68 MW, for a total capacity of 4.99 MW. This will generate renewable power sufficient for approximately 2,000 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 1.2 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
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

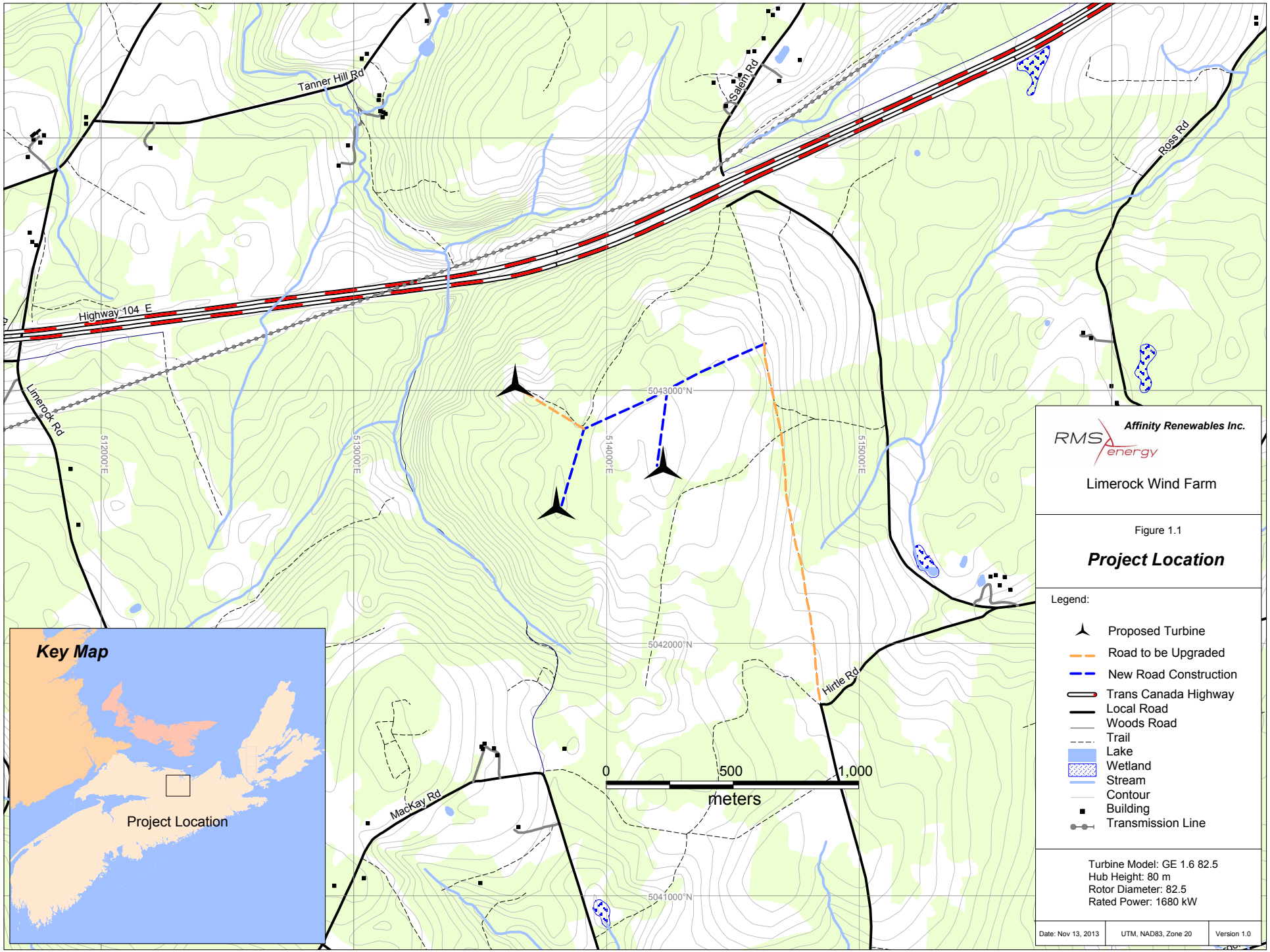
The construction schedule has been designed to account for minor delays that could result from delayed equipment arrival and adverse weather conditions.

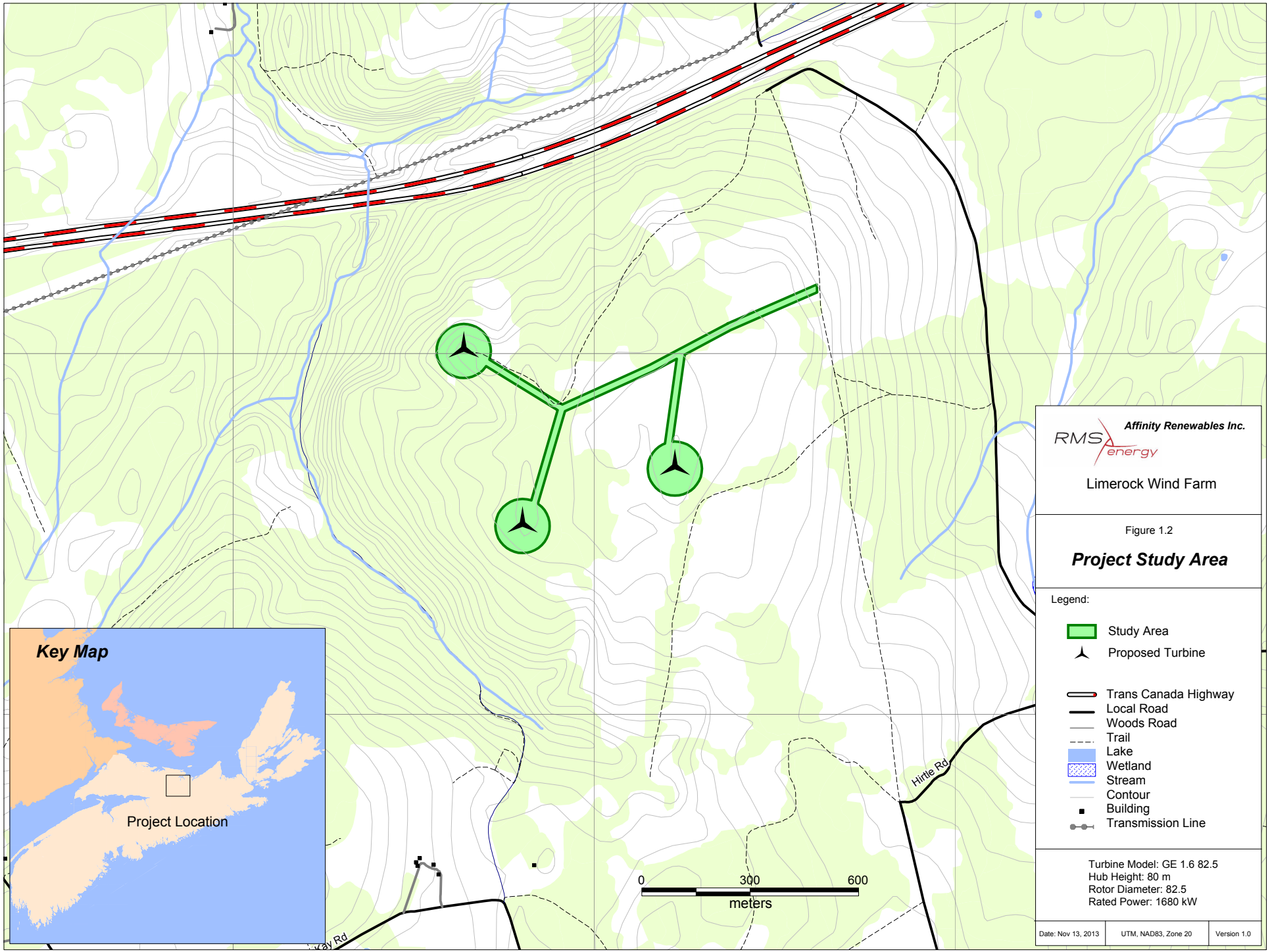
1.6 REGULATORY CONTEXT

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.

Limerock will have a capacity exceeding 2 MW and is therefore subject to environmental registration. This EA satisfies the requirements outlined for provincial environmental registration


Tanner Hill Rd
Salem Rd
Ross Rd
Highway 104 E
Limerock Rd
Hirtle Rd
MacKay Rd
5043000°N
5042000°N
5041000°N
512000°E
513000°E
514000°E
515000°E
0
500
1,000
meters
Key Map
Project Location
RMS energy
Affinity Renewables Inc.
Limerock Wind Farm
Figure 1.1
Project Location
Legend:
Proposed Turbine
Road to be Upgraded
New Road Construction
Trans Canada Highway
Local Road
Woods Road
Trail
Lake
Wetland
Stream
Contour
Building
Transmission Line
Turbine Model: GE 1.6 82.5
Hub Height: 80 m
Rotor Diameter: 82.5
Rated Power: 1680 kW
Date: Nov 13, 2013
UTM, NAD83, Zone 20
Version 1.0


Affinity Renewables Inc.
RMS energy
Limerock Wind Farm
Figure 1.2
Project Study Area
Legend:
Study Area
Proposed Turbine
Trans Canada Highway
Local Road
Woods Road
Trail
Lake
Wetland
Stream
Contour
Building
Transmission Line
Turbine Model: GE 1.6 82.5
Hub Height: 80 m
Rotor Diameter: 82.5
Rated Power: 1680 kW
Date: Nov 13, 2013
UTM, NAD83, Zone 20
Version 1.0
Key Map
Project Location
0
300
600
meters
Hirtle Rd

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, licences 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.

Table 1.3 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 (2011-538) for the Lighting Plan was received from Transport Canada on December 22, 2011. Land Use Submission Form was submitted to NavCanada on January 4, 2012. Approval (12-0112) was received May 22, 2012; extended Land Use Approval (13-4048) for updated coordinates was received on November 25, 2013 **(**Appendix A)
CBC, Canadian Coast Guard, National Forces, Environment Canada's Whether Radar, Radio Canada and RCMP	Nortek Resources has been contracted to complete the 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	

Table 1.3 Required Environmental and Land Use Approvals

Approvals Required	Summary
Water Approval for Watercourse Alteration (Activities Designation Regulations)	Alteration of any watercourse will require authorization from NSE under the Activities Designation Regulations. Affinity proposed to avoid watercourses to the extent practical during detailed design. Based on the current proposed road layout there are no watercourse crossings that will be required. If unexpected changes occur and a watercourse crossing is required, 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 proposed to avoid wetlands to the extent possible through turbine siting and road layout design. If the unlikely event of having to impact 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 distribution 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).
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 Pictou County Area Manager if the electrical drawings indicate this is required. This task will be carried out by NSPI.
Driveway Construction Permit (*Public Highways Act)*	Approval from NSTIR is required to construct a driveway from the Salem Road onto the project lands. This application will be made closer to project construction.
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 Pictou	The Proponent will make application to the Development Officer for Pictou County, Van MacLeod, for a Building Permit specific to the construction of a wind turbine generator. The turbine dimensions, including foundation and manufacturer information, distances to houses, property lines and roadways and signage all 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 the author for direct inclusion into this document. Specifically, and on behalf of Affinity, the report was prepared and reviewed by the following:

Prepared by: Ms. Lisa Fulton
Environmental Lead and Project Coordinator
Rotor Mechanical Services
1383 Mt. Thom Road
Salt Springs, NS B0K 1P0
Phone: (902) 759-6626 Fax: (902) 925-9464
E-mail: lisa@rmsenergy.ca

Author/ Reviewer: Mr. Reuben Burge
President
RMSenergy Dalhousie Mountain Wind Farm/ Rotor Mechanical
1383 Mt. Thom Road
Salt Springs, NS B0K 1P0
Phone: (902) 771-0322 Fax: (902) 925-9464
E-mail: reuben@rmsenergy.ca

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 Limerock COMFIT Wind Project and will consist of three 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 62N-T1. The proposed project will be located in Limerock in the municipality of Pictou. The project is referred to as the Limerock COMFIT Wind Project ("Limerock").

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 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 Limerock Project will be located at the existing Dalhousie Operations and Maintenance building..

2.2 PROJECT BACKGROUND

Affinity is proposing to construct and operate a wind energy facility, *Limerock*, in Limerock, Pictou County, Nova Scotia. The Project will have a nameplate capacity of 4.99 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 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 4.99 MW of clean, renewable energy to the local distribution grid, producing energy sufficient to power 2,000 homes annually. The Limerock 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 Limerock 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 the turbines 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 (2007 - 600m from dwellings in Pictou County; see Section 3.3) were used by the Proponent as a starting point for exclusion zones. These setbacks have been voluntarily increased to allow 1.1 – 1.5 km between the Project and the nearest homes. 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 2007 and is confident the Project meets 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 Limerock 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 Two RMSenergy technicians erecting the met tower at Limerock.

The layout focuses on the higher dry ground to avoid impinging on wetland habitat. The project covers less than 5 ha in total, leaving plenty of room around the site for wildlife to concentrate in. The area is in an existing forested area with a regenerated crown and private forest lots surrounding the property.

The Study Area used for bird monitoring and wildlife surveys is comprised of not only the turbine locations and access roads, but also 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 5 ha of land, much of which has been previously disturbed (*e.g.,* forestry activities/roads). 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, 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 three, GE 1.6 MW series 82.5 meter wind turbine generators. The series has a range of available capacities including 1.6 MW, 1.62 MW, 1.68 MW and 1.85 MW. For the Limerock project, the 1.68 MW capacity model will be used. Throughout this EA, when the project turbine is referred to, it is titled the 1.6 MW series, however, it is a fact that the model for Limerock has 1.68 MW of capacity. There is, in actuality, no such title as a 1.68 MW GE machine, therefore, it will continue to be referred to as 1.6 MW series. 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 10km north-west of the Project, and will be used for all Affinity Wind LP's projects, as well as for the Dalhousie Mountain Wind Farm.

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 includes a 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.

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).

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

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.

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

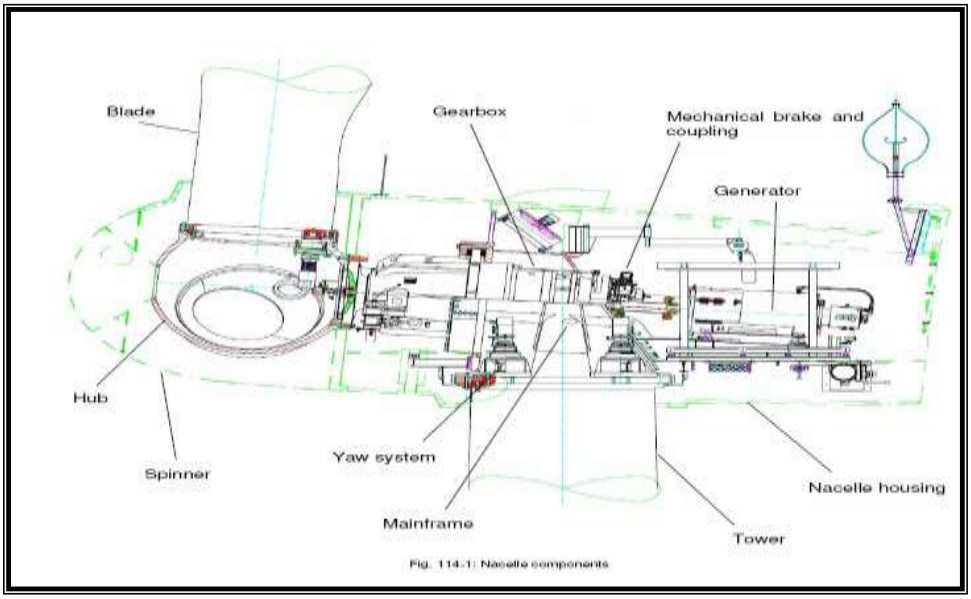
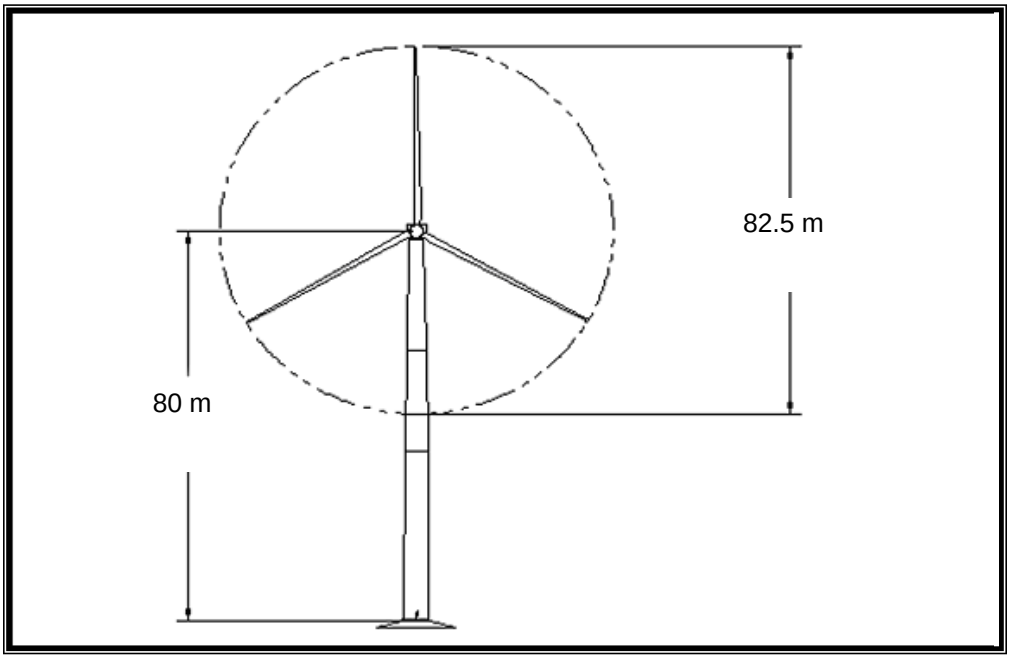


Figure 2.4 GE Energy 1.6 MW series 82.5m 60 Hz Wind Turbine Generator: External Dimensions



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.

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 62N-T1 at a point near NAD 83 UTM 20T 515043E, 5043314N.

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 landowner restrictions and load requirements for trucks transporting materials to the turbine sites. There are no stream crossings on the Limerock site. If an unknown crossing is required after further site planning, 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 if there is a need 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 1900m of new road construction will be required and approximately 1000m of existing roads previously built may be required to be upgraded. Roads on the wind farm 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 in designing access roads. Water Approvals, if required, will be sought from NSE for wetland/watercourse alterations if these features are unavoidable. Based on the current proposed road layout it is not anticipated that any watercourse crossings 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. 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.

Table 2.2 Typical Project Activities

Site Preparation and Construction	
Grading	Grading will be necessary to finish the access roads and crane-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.
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 from the site to Ross Road then onto Pleasant Valley 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 Limerock 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 Limerock 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. 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. Existing 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. 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 no watercourse crossing upgrades are required. 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 (24km from Project site) in accordance with Provincial standards.

2.6.2 Operation and Maintenance Activities

Activities associated with the operation and maintenance of Limerock 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 all three turbines lit, as advised by Transport Canada.

2.6.4 Decommissioning

Limerock 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. Ongoing consultation with the public and neighbours of the Project is an important aspect of development and operations.

Consultation activities have included meetings with stakeholders including local landowners, municipal representatives, provincial representatives and various informal meetings, phone calls and letters. The Proponent has 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.

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 Pictou (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; visits and correspondence with community members such as members of the Alma Fire Department and West River Fire Department and local charitable organizations (*i.e.,* Landsdown Outdoor Recreation Development Association (LORDA)).

Formally, the Proponent has had documented meetings with municipal representatives (area councillor, planning developer, Planning Advisory Committee (PAC)), the Executive Committee for the Alma Fire Department, as well as the (current until October 8, 2013) MLA for Pictou West, Charlie Parker and since the October 8, 2013 election, now current MLA for Pictou West, Karla MacFarlane.

Since 2011, the Proponent has gone door to door to local homeowners. All conversations including concerns and response were recorded immediately after the meetings took place. The outcome of this exercise was that homeowners within 2km of the Project do not have major concerns about the three turbines proposed in Limerock.

Neighbours to the Project will have an opportunity to peruse Project information and mapping through company website, Department of Environment website, and Public Open House sessions. Public Open House sessions will be held in early 2014.

The intent of the Public Open House sessions will be to:

- encourage dialogue between members of the Project team in attendance and the general public and stakeholders;
- enable the public and stakeholders to obtain Project information;
- view information on the proposed site and turbine locations;

- invite the public and stakeholders to join a tour of the existing Dalhousie Mountain Wind Farm (at a later date); and
- participate in the environmental and socio-economic assessment process.

Advertisements for the Open House will be circulated in the New Glasgow Daily News at least two weeks in advance of the meeting, and again one week before the meeting. Poster invitations will be placed at Gig's Convenience and Pizza and at John's Country Canteen and Agency NSLC. In addition, the Proponent will deliver flyers to mailboxes of houses surrounding the proposed Project within 2-3km.

During the Open House, representatives from Affinity will be present to answer questions and to document any issues related to the Project. All attendees will be encouraged to sign-in and take a project overview handout as well as corporate information and general information on wind energy. Attendees will be asked to complete a feedback form prior to leaving the session. These sessions are usually fairly informal and consist of a series of posters and handouts which include information on:

- maps of the proposed Project Study Area with turbine layout;
- specifications of the proposed wind turbines;
- information on the construction and installation process;
- Project schedule;
- Sound modeling study results;
- visual impact study results;
- corporate information on the Proponent; and
- information on the EA and regulatory approval process.

Few issues of concern were raised during the door to door campaign.

Additional stakeholder and community outreach initiatives include the Project website (www.rmsenergy.ca), mail-out of community newsletters, meetings with municipal council, continued door-to-door community conversation program and, as described above, public open house sessions.

Public open houses will be scheduled throughout the development process. During that time, notices will be available informing the general public that there is a 30 day public comment period for this EA.

Affinity 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 Pictou on various occasions during Project development.

The Project is located within the Municipality of the County of Pictou 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 in Municipal District 8. The councillor for this area is Leonard Fraser. Mr. Fraser was first contacted on February 17, 2012. The Proponent introduced the Project details, although in early development. Contact with Mr. Fraser has been continuous up to present and will continue as Limerock finalizes development, begins construction and becomes operational.

The Project is located in designated Provincial District 41: Pictou West. The Member of Legislative Assembly for this area has been consulted regarding the planned Project. The MLA was Charlie Parker; however, he was replaced by Karla MacFarlane on October 8.

The Proponent first met with Mr. Parker in October 2011 for this particular Project (however Mr. Parker is familiar with the Proponent as the Dalhousie project is also in his district). 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 various meetings at local events.

Karla MacFarlane met with the Proponent on October 28, 2013 to introduce her to Limerock Project details and allow her the opportunity to ask questions. She is scheduled to tour the Dalhousie site in the near future. Topics such as sound modeling, distance from homes, shadow flicker, visual assessment, SPCA and fire hall donations were all discussed. Information sharing will continue throughout development and operations.

The Alma Volunteer Fire Department oversees the area where Limerock will be constructed. The line shared with the West River Fire Department is within a few hundred meters of the Project. Both departments have been consulted; however, the Executive Board of the Alma Brigade will carry on the responsibilities of the Proponent's Community Benefits Program. The department has signed letters of support for the Project (Appendix E).

The Proponent and the Alma Fire Department have been in contact regarding the Limerock Project since January 31, 2012.

LORDA (the Landsdowne Outdoor Recreational Development Association) is a not-for-profit located close to the Project. They have been identified by the Proponent as an organization locally who could be part of the Community Benefits Program. The Proponent met with the Board of Directors on March 5, 2012 where they signed letters of support for the Project (Appendix E).

The Municipality of Pictou developed the Wind Turbine Development Bylaw in September 2007 which applied to all lands within the Municipality of the County of Pictou. Setbacks have 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 Pictou regulates the finish of the wind turbine, lettering and signage and lighting.

Table 3.1 Municipality of the County of Pictou 2007 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	600 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

When siting the turbines, the by-law distances above have been increased to a minimum of double the requirements from non-adjoining property houses 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 75m radius of the mapped locations.

3.4 MI'KMAQ ENGAGEMENT

During 2011, 2012, and 2013 the Proponent communicated with representatives from the local First Nation, Pictou Landing, 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 the Dalhousie Mountain Wind Farm in 2008 and the Proponent has engaged AMEC Environmental to complete an MEKS for the Limerock Project (Appendix B). The Limerock MEKS identified land and resource use which is of particular importance to the Mi'kmaq people with respect to the Limerock 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 Limerock 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 3.2 and 3.3 summarize the various consultation and Mi'kmaq engagement efforts, respectively, conducted in support of the Limerock Project.

Table 3.2 Consultation Efforts Conducted in Support of Limerock

Association/Contact	Dates	Topic	Comments
Government Stakeholders			
Transport Canada	November – December 2011, June 2013	Regulatory approval process	• Submitted Aeronautical Obstruction Clearance Forms and received approval of lighting plan as well as Aeronautical Obstruction Clearance (Appendix A) • 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) • extension of one-year approval (pre-construction approval expires after one year) received Nov 25, 2013 (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 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 that any potential interference created by the Project, based on the current plans, would be manageable and therefore they do not have any strong objections to the Project (Appendix A)
Canadian Coast Guard	September 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	September 2013	Email correspondence with respect to	• Project layout and coordinates sent for review and comment (Appendix A)

Table 3.2 Consultation Efforts Conducted in Support of Limerock

Association/Contact	Dates	Topic	Comments
System		existing radio-communication systems	
Nova Scotia Environment Nova Scotia Department of Natural Resources, Species at Risk Biologist	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 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) (*Pictou County)*	March 2013 to present	Regulatory approval process	• Application in process for access roads to Roadway within a highway right-of-way • Application in process for pole installation and driveway installation within a highway right-of-way
Pictou 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 in February, 2012 • Previous meetings regarding the wind turbine bylaw requirements in Pictou County since 2007
Public Consultation			
Local Landowners	Early 2011 to present	Visits to homes by Proponent, phone calls	• Door to door visits, meetings, information sharing
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 Limerock • 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

Table 3.2 Consultation Efforts Conducted in Support of Limerock

Association/Contact	Dates	Topic	Comments
			located 175m, 225m, 500m and 700m from turbines and is asked to speak to and allow groups to visit to understand facts
Local Organizations	2007 – ongoing	Community benefits	• The Proponent has donated money to numerous local charitable funds including: the Pictou Skate Park; the Mount Thom MX track and a couple of young racers; the Pictou County Lite Horse Club; the Truro Exhibition Rodeo; and recently $20,000 to the Hector Arena Capital Fund (Figure 6.6)
Alma District Volunteer Fire Department	January 2012 – 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 has been tasked with helping the Proponent delegate the annual funds to better serve the members of the community. • The Proponent has an Emergency Response Plan that has been implemented and practiced at the Dalhousie facility. The same plan will be in place for Limerock 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.
West River District Volunteer Fire Department	2007 – ongoing	Community benefits, safety	• Limerock is located along the border of the two fire districts. Therefore, both departments have been engaged in this process. • In early 2013, this department took place in a mock emergency drill at Dalhousie Mountain which simulated real life safety issues associated with an emergency on the wind farm. • 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 has been tasked with helping the Proponent delegate the annual funds to better serve the members of the community. • The Proponent has an Emergency Response Plan that has been implemented and practiced at the Dalhousie facility. The same plan will be in place for Limerock 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.

Table 3.3 Mi'kmaq Engagement Efforts Conducted for the Limerock Project

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 • Project detailed discussion regarding MEKS for Limerock, 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 (Pictou Landing First Nation)	October 2011 to present	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) • The Proponent entered into negotiations with the local council to work on a wind site on their land in Pictou County. This engagement saw several presentations to the council and band staff, site tours of potential wind development sites in Pictou Landing, and an open offer to visit Dalhousie Mountain. The Proponent will continue to engage the band through the MEKS process, and further down the road with educational presentations and workshops.

3.6 SUMMARY OF EMI STUDY

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

Agency	System	Notification Sent	Response Received	BY	Issues
DND	Communication	04-Oct-13	04-Oct	Kirk	No Issues
	Radar	04-Oct-13	04-Oct	Kirk	No Issues
RCMP	Communication	04-Oct-13		Kirk	
Canadian Coast Guard	Communication	04-Oct-13	04-Oct	Kirk	No Issues
Environment Canada	Radar	04-Oct-13	08-Oct	Kirk	No issues
NAV Canada	Radar	06-Jan-12	20-Jul-12	Lisa	No issues-updated file #13-1401 Land Use Approval renewed Nov 25, 2013
NS Transporation	Communication	04-Oct-13	08-Oct	Kirk	No Issues
CBC	Communication	04-Oct		Kirk	
Aeronautical Lighting	Navigation	16-Nov-11	22-Dec-11	Lisa	No issues – 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 Pictou;
- 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 (see Section 10);
- reports, books and other materials relative to wind turbine developments and environmental effects (see 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);

- 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, 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 County of Pictou 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 in Pictou County, in District 8 (Figure 1.2 and Figure 5.1). The turbines will be located at the highest points on the surrounding hilly area. To the north of the Project is Trans-Canada Highway 104, to the east of the Project are parcels of Crown and privately owned land. To the west is forestry land. To the south of the Project are previously cleared forested areas and sparsely populated rural lands. The proposed turbines take up approximately 1-1.5 ha each (including access roads) and with the Project containing just three machines, the footprint of disturbed area is roughly 4 – 5 hectares.

This area is characterized by hills and valleys, with a few farms and residential settlements taking over the previously forested areas. The area used to have more farming families in the past. Elevations range from 90m in the valleys to in excess of 200m in the uplands. Drainage at Limerock is primarily towards tributaries to the Middle River watershed.

5.1.2 Surficial Geology

Broadly described, Limerock is located on the very eastern edge of the Cobequid Hills Eco-district of Nova Scotia (Neily et al, 2003). The Cobequid Hills Ecodistrict extends from Cape Chignecto in Cumberland County into Pictou County. The highest points on the mainland are found on the Cobequids at Nuttby Mountain and Dalhousie Mountain which rise to 335 m above sea level. The geological history of the Cobequids is complex. Most of the strata are pre-carboniferous and are resistant to erosion. The Cobequids provide a watershed for streams running north or south which leave the mountains in deep, steep-walled gorges as a series of falls or cascades. The soils of the Cobequids are dominated by coarse gravelly to stony sandy loams derived from igneous and metamorphic rocks. In many areas, the soils are shallow to bedrock, especially on the well-drained, coarse textured soils found on hilly topography.

Figure 5.1 Municipal District Map Showing District 8 and Project Location

The Cobequids support pure stands of tolerant hardwoods extending from the crests to lower slopes of hills and large hummocks. In between these hills, extensive flats of imperfectly drained coarse textured soils on the level to hummocky terrain are found where forests of red spruce and black spruce dominate. Another characteristic of the eco-district are the steep-sided ravines with well drained coarse to medium textured soils where forests of shade tolerant species including hemlock, white pine, white ash and ironwood can be found. Many stands of white spruce can be found in the eco-district, again on the abandoned farmland of the early settlers.

Options for four wind turbine locations have been studied at the Limerock location. Only three of the four locations will have a turbine. Each of the three will have a foot print or pad that displaces 0.5 hectare of forest area. The locations for all turbines have a clear-cut forest harvest history (Figure 5.2). Turbine locations are on an elevated prominent hill at 200m elevation. Highway 104 is 400 to 700m to the north of the turbine locations. To the west the land slopes off steeply through mature forest for 400m to Sweet Brook and there are mature stands of White Spruce and Eastern Hemlock. The White Spruce indicates a once farming

history on this hillside. To the east the slope is more gradual towards the Salem Road and has a forest recovering from past harvests. To the south are mature hardwood stands.

Approximately 1900m of new access road are necessary, including the upgrading of existing right-of-ways. Accompanying the road right-of -way are power poles and a collector power line. From the Salem Road, the access road will route further west 1000m upslope to the turbine positions.

Figure 5.2 Regenerating forest representative of forest type displaced by turbines

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.

5.1.4 Hydrogeology/Groundwater

The project is located over 1100m from the nearest residential water well. The foundations for the turbines will be no deeper than 2.4 meters from ground elevation. The closest turbine will be located at a ground elevation of 182m. The land drops quickly to 85m toward the well and the well is located on the other side of the valley at 156m. The hydrogeology/ groundwater for this area do not have the potential to be adversely affected.

5.2 AQUATIC ENVIRONMENT

The project study area does not contain any water crossings that may potentially need to be constructed or replaced. During construction, should any unknown crossing be determined to be required 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 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 with the potential to interact with the Project through any 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 Study Area at the time of the survey (Figure 1.2).

No potential watercourse crossings were identified in-field. It is estimated that the Project will require constructing or upgrading no water crossing locations.

5.2.1 Species of Conservation Concern

There are two freshwater fish species and one mussel species in Nova Scotia with special federal 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 Yellow Lamp Mussel do not occur in watercourses in central Nova Scotia and are not a concern at Limerock. There is no watercourse affected for the construction and operation of Limerock, therefore, there is no concern for potential Atlantic salmon to be threatened by the Project.

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 inhabit mud bottomed lakes and rivers. This habitat is not present within the Project Study Area.

Provincial Fish Species of Conservation Concern

There is one species of freshwater fish listed under the Nova Scotia *Endangered Species Act*. That species is the Atlantic whitefish, which is also listed under *SARA*. Given that Atlantic whitefish are not known to inhabit the watershed associated with this Project, their listing under the *Endangered Species Act* did not affect the assessment.

No fish species has potential to be found within the Study Area as there are no watercourses located within the Project roads or turbine layout areas.

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 (Gulf of St. Lawrence)	*Salmo salar*	May Be At Risk COSEWIC: Special Concern (2010) NSESA:	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.	Possible
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

Three turbines are planned for the Limerock area. The footprint locations of these turbines are not near any fish habitat. However the construction of a collector transmission line is planned to for the forestry road that currently connects the Ross Road and the Salem Road. This road crosses Brown Brook, which has good Salmonid characteristics with clear water, moderate flow, in-stream woody debris, and gravel and some cobble substrate. Brown Brook flows easterly to join the Middle River of Pictou at Alma. The stream is shallow with a depth of only a few centimetres and has a high possibility of becoming dry in summers of extreme drought. The stream bed is 3 metres wide and on the July 5, 2013 day of a visit had a 1.5 metre water surface width. Several small Salmonid species were seen, presumably Brook Trout but no collections were made.

5.2.2.1 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 Limerock site and no freshwater mussel habitat or population is here affected. There will be no impact on freshwater mussels

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 occurrences in Nova Scotia on Cape Breton Island.	Unlikely
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

Sweet Brook, which is westerly of the turbine site, will be unaffected by the development.

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 streams collecting into tributaries surrounding the Project. 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.

5.2.3 Watercourse Crossings Summary

The physical habitat, water quality and fish population assessments confirmed that no watercourse crossings are necessary for construction of the Limerock project.

5.2.5 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 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 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 allowing regeneration.

Three wind turbines are planned for the Limerock site and the pad or foot print of each turbine will displace 0.5 hectare of forest area. A 1000m long access road will be required to be upgraded to get close to the turbines. An additional approximate 1800m of new road construction will be required to connect to the other two turbine sites. The habitat where these turbines are planned is recently harvested 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 100km 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 100km 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.

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 Limerock study area summary contains 1392 records of 263 vascular, 70 records of 10 nonvascular flora. The buffer also contains 1146 records of 64 vertebrate, 407 records of 85 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.

5.3.2

5.3.2

5.3.2

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 201 vascular plant taxa (157 native, 44 exotic; Table 5.3), none of which are of conservation significance. Further visits to the site would yield additional species, but 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.

Table 5.3 Vascular plants recorded in the Limerock 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. (Blaney, 2013)

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Lycopodiaceae	**Clubmoss Family**			
Lycopodium annotinum	Stiff Clubmoss	S5	Secure	
Lycopodium clavatum	Running Clubmoss	S5	Secure	ID refers to sp. in the broad sense
Lycopodium dendroideum	Round-branched Tree-clubmoss	S5	Secure	
Lycopodium digitatum	Southern Clubmoss	S5	Secure	
Equisetaceae	**Horsetail Family**			
Equisetum sylvaticum	Woodland 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	
Pteridium aquilinum var. latiusculum	Bracken Fern	S5	Secure	
Thelypteridaceae	**Marsh-Fern Family**			
Phegopteris connectilis	Northern Beech Fern	S5	Secure	
Thelypteris noveboracensis	New York Fern	S5	Secure	
Dryopteridaceae	**Wood-Fern Family**			

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Athyrium filix-femina ssp. angustum	Common Lady Fern	S5	Secure	
Dryopteris carthusiana	Spinulose Wood Fern	S5	Secure	
Dryopteris cristata	Crested Wood Fern	S5	Secure	
Dryopteris intermedia	Evergreen Wood Fern	S5	Secure	
Dryopteris x uliginosa	a Hybrid Wood-fern	SNA	Not Assessed	ID to sp. probable, not confirmed
Gymnocarpium dryopteris	Common Oak Fern	S5	Secure	
Onoclea sensibilis	Sensitive Fern	S5	Secure	
Polystichum acrostichoides	Christmas Fern	S5	Secure	
Pinaceae	**Pine Family**			
Abies balsamea	Balsam Fir	S5	Secure	
Picea mariana	Black Spruce	S5	Secure	
Picea rubens	Red Spruce	S5	Secure	
Pinus strobus	Eastern White Pine	S5	Secure	
Tsuga canadensis	Eastern Hemlock	S4S5	Secure	
Ranunculaceae	**Buttercup Family**			
Ranunculus abortivus	Kidney-Leaved Buttercup	S4S5	Secure	
Ranunculus acris	Common Buttercup	SNA	Exotic	
Ranunculus repens	Creeping Buttercup	SNA	Exotic	
Myricaceae	**Bayberry Family**			
Morella pensylvanica	Northern Bayberry	S5	Secure	
Fagaceae	**Beech Family**			
Fagus grandifolia	American Beech	S5	Secure	
Quercus rubra	Northern Red Oak	S5	Secure	
Betulaceae	**Birch Family**			
Alnus incana ssp. rugosa	Speckled Alder	S5	Secure	
Alnus viridis ssp. crispa	Green Alder	S5	Secure	
Betula alleghaniensis	Yellow Birch	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Betula papyrifera var. papyrifera	Heart-leaved Birch	S5	Secure	
Betula populifolia	Gray Birch	S5	Secure	
Betula x caerulea	a hybrid Birch [papyrifera X populifolia]	SNA	Not Assessed	
Corylus cornuta	Beaked Hazel	S5	Secure	
Ostrya virginiana	Ironwood	S5	Secure	
Caryophyllaceae	**Pink Family**			
Moehringia lateriflora	Blunt-leaved Sandwort	S5	Secure	
Stellaria graminea	Little Starwort	SNA	Exotic	
Polygonaceae	**Smartweed Family**			
Polygonum sagittatum	Arrow-leaved Smartweed	S5	Secure	
Rumex acetosella	Sheep Sorrel	SNA	Exotic	
Rumex crispus	Curled Dock	SNA	Exotic	
Rumex orbiculatus	Greater Water Dock	S5	Secure	
Clusiaceae	**St. John's-wort Family**			
Hypericum perforatum	Common St. John's-wort	SNA	Exotic	
Violaceae	**Violet Family**			
Viola blanda var. palustriformis	Sweet White Violet	S5	Secure	
Viola cucullata	Marsh Blue Violet	S5	Secure	
Viola sororia	Woolly Blue 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 discolor	Pussy Willow	S5	Secure	
Salix eriocephala	Cottony Willow	S5	Secure	
Salix humilis	Upland Willow	S5	Secure	
Salix pyrifolia	Balsam Willow	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Ericaceae	**Heath Family**			
Gaultheria procumbens	Eastern Teaberry	S5	Secure	
Kalmia angustifolia	Sheep Laurel	S5	Secure	
Monotropaceae	**Indian Pipe Family**			
Monotropa uniflora	Indian Pipe	S5	Secure	
Primulaceae	**Primrose Family**			
Trientalis borealis	Northern Starflower	S5	Secure	
Grossulariaceae	**Currant Family**			
Ribes glandulosum	Skunk Currant	S5	Secure	
Ribes hirtellum	Smooth Gooseberry	S5	Secure	
Rosaceae	**Rose Family**			
Amelanchier laevis	Smooth Serviceberry	S5	Secure	ID to sp. probable, not confirmed
Fragaria virginiana	Wild Strawberry	S5	Secure	
Geum sp.	#N/A			
Potentilla simplex	Old Field Cinquefoil	S5	Secure	
Prunus pensylvanica	Pin Cherry	S5	Secure	
Prunus virginiana	Chokecherry	S5	Secure	
Rosa carolina	Carolina Rose	S4S5	Secure	
Rosa multiflora	Multiflora Rose	SNA	Exotic	
Rosa virginiana	Virginia Rose	S5	Secure	
Rubus allegheniensis	Alleghaney Blackberry	S5	Secure	
Rubus canadensis	Smooth Blackberry	S5	Secure	
Rubus idaeus ssp. strigosus	Red Raspberry	S5	Secure	
Rubus pubescens	Dwarf Red Raspberry	S5	Secure	
Sorbus americana	American Mountain Ash	S5	Secure	
Fabaceae	**Bean Family**			
Lotus corniculatus	Garden Bird's-foot Trefoil	SNA	Exotic	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Medicago lupulina	Black Medick	SNA	Exotic	
Melilotus officinalis	Yellow Sweet-clover	SNA	Exotic	
Trifolium aureum	Yellow Clover	SNA	Exotic	
Trifolium hybridum	Alsike Clover	SNA	Exotic	
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	
Epilobium ciliatum	Northern Willowherb	S5	Secure	
Epilobium leptophyllum	Bog Willowherb	S5	Secure	
Oenothera perennis	Perennial Evening Primrose	S5	Secure	
Cornaceae	**Dogwood Family**			
Cornus alternifolia	Alternate-leaved Dogwood	S5	Secure	
Cornus canadensis	Bunchberry	S5	Secure	
Cornus sericea	Red Osier Dogwood	S5	Secure	
Rhamnaceae	**Buckthorn Family**			
Frangula alnus	Glossy Buckthorn	SNA	Exotic	
Aceraceae	**Maple Family**			
Acer pensylvanicum	Striped Maple	S5	Secure	
Acer saccharum	Sugar Maple	S5	Secure	
Oxalidaceae	**Wood-Sorrel Family**			
Oxalis montana	Common Wood Sorrel	S5	Secure	
Geraniaceae	**Geranium Family**			
Geranium robertianum	Herb Robert	S4	Secure	
Araliaceae	**Sarsaparilla Family**			
Aralia nudicaulis	Wild Sarsaparilla	S5	Secure	
Apiaceae	**Carrot Family**			

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Daucus carota	Queen Anne's Lace	SNA	Exotic	
Lamiaceae	**Mint Family**			
Galeopsis tetrahit	Common Hemp-nettle	SNA	Exotic	ID refers to sp. in the broad sense
Lycopus uniflorus	Northern Water Horehound	S5	Secure	
Mentha arvensis	Wild Mint	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**			
Euphrasia sp.	Eyebright sp.			
Rhinanthus minor	Little Yellow Rattle	S5	Secure	
Veronica officinalis	Common Speedwell	S5	Exotic	
Veronica serpyllifolia ssp. serpyllifolia	Thyme-Leaved Speedwell	SNA	Exotic	
Rubiaceae	**Bedstraw Family**			
Galium mollugo	Smooth Bedstraw	SNA	Exotic	
Galium palustre	Common Marsh Bedstraw	S5	Secure	
Galium trifidum	Three-petaled Bedstraw	S5	Secure	ID to sp. probable, not confirmed
Galium triflorum	Three-flowered Bedstraw	S5	Secure	
Mitchella repens	Partridgeberry	S5	Secure	
Caprifoliaceae	**Honeysuckle Family**			
Diervilla lonicera	Northern Bush Honeysuckle	S5	Secure	
Linnaea borealis ssp. americana	Twinflower	S5	Secure	
Lonicera canadensis	Canada Fly Honeysuckle	S5	Secure	
Sambucus racemosa	Red Elderberry	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Viburnum nudum var. cassinoides	Northern Wild Raisin	S5	Secure	
Asteraceae	**Aster Family**			
Achillea millefolium	Common Yarrow	S5	Secure	
Anaphalis margaritacea	Pearly Everlasting	S5	Secure	
Bidens frondosa	Devil's Beggarticks	S5	Secure	
Bidens sp.	Beggarticks sp.			
Cirsium arvense	Canada Thistle	SNA	Exotic	
Doellingeria umbellata	Hairy Flat-top White Aster	S5	Secure	
Erigeron annuus	Annual Fleabane	S4S5	Secure	
Erigeron strigosus	Rough Fleabane	S5	Secure	
Eupatorium perfoliatum	Common Boneset	S5	Secure	
Euthamia graminifolia	Grass-leaved Goldenrod	S5	Secure	
Hieracium piloselloides	Tall Hawkweed	SNA	Exotic	
Hieracium aurantiacum	Orange Hawkweed	SNA	Exotic	
Hieracium caespitosum	Field Hawkweed	SNA	Exotic	
Hieracium lachenalii	Common Hawkweed	SNA	Exotic	
Lactuca canadensis	Canada Lettuce	S5	Secure	
Leontodon autumnalis	Fall Dandelion	SNA	Exotic	
Leucanthemum vulgare	Oxeye Daisy	SNA	Exotic	
Matricaria discoidea	Pineapple Weed	SNA	Exotic	
Oclemena acuminata	Whorled Wood Aster	S5	Secure	
Packera schweinitziana	Schweinitz's Groundsel	S4	Secure	
Prenanthes trifoliolata	Three-leaved Rattlesnakeroot	S5	Secure	
Senecio jacobaea	Tansy Ragwort	SNA	Exotic	
Solidago bicolor	White Goldenrod	S5	Secure	
Solidago canadensis	Canada Goldenrod	S5	Secure	
Solidago gigantea	Giant Goldenrod	S5	Secure	
Solidago juncea	Early Goldenrod	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
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	
Taraxacum officinale	Common Dandelion	SNA	Exotic	
Tragopogon pratensis	Meadow Goatsbeard	SNA	Exotic	
Tussilago farfara	Coltsfoot	SNA	Exotic	
Alismataceae	**Water Plantain Family**			
Alisma triviale	Northern Water Plantain	S5	Secure	
Juncaceae	**Rush Family**			
Juncus articulatus	Jointed Rush	S5	Secure	
Juncus effusus	Soft Rush	S5	Secure	
Juncus filiformis	Thread Rush	S5	Secure	
Juncus tenuis	Path Rush	S5	Secure	
Luzula acuminata	Hairy Woodrush	S5	Secure	
Luzula multiflora	Common Woodrush	S5	Secure	
Cyperaceae	**Sedge Family**			
Carex arctata	Drooping Woodland Sedge	S5	Secure	
Carex canescens	Silvery Sedge	S5	Secure	
Carex debilis var. rudgei	White-edged Sedge	S5	Secure	
Carex disperma	Two-seeded Sedge	S5	Secure	
Carex gynandra	Nodding Sedge	S5	Secure	
Carex intumescens	Bladder Sedge	S5	Secure	
Carex lurida	Sallow Sedge	S5	Secure	
Carex novae-angliae	New England Sedge	S5	Secure	
Carex pallescens	Pale Sedge	S5	Secure	
Carex scoparia	Broom Sedge	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Carex stipata	Awl-fruited Sedge	S5	Secure	
Carex trisperma var. trisperma	Three-seeded Sedge	S5	Secure	
Eleocharis obtusa	Blunt Spikerush	S5	Secure	
Eleocharis tenuis	Slender Spikerush	S5	Secure	
Scirpus cyperinus	Common Woolly Bulrush	S5	Secure	ID refers to sp. in the broad sense
Scirpus hattorianus	Mosquito Bulrush	S5	Secure	
Scirpus microcarpus	Small-fruited Bulrush	S5	Secure	
Poaceae	**Grass Family**			
Agrostis stolonifera	Creeping Bent Grass	S5	Secure	
Alopecurus pratensis	Meadow Foxtail	SNA	Exotic	
Anthoxanthum odoratum	Large Sweet Vernal Grass	SNA	Exotic	
Calamagrostis canadensis	Bluejoint Reed Grass	S5	Secure	
Danthonia compressa	Flattened Oat Grass	S5	Secure	
Danthonia spicata	Poverty Oat Grass	S5	Secure	
Dichanthelium boreale	Northern Panic Grass	S5	Secure	
Festuca filiformis	Hair Fescue	SNA	Exotic	
Festuca heteromalla	Spreading Fescue	SNA	Exotic	ID to sp. probable, not confirmed
Glyceria striata	Fowl Manna Grass	S5	Secure	
Leersia oryzoides	Rice Cut Grass	S5	Secure	
Lolium arundinaceum	Tall Fescue	SNA	Exotic	
Muhlenbergia uniflora	Bog Muhly	S5	Secure	ID to sp. probable, not confirmed
Phalaris arundinacea	Reed Canary Grass	S5	Secure	
Phleum pratense	Common Timothy	SNA	Exotic	
Poa annua	Annual Blue Grass	SNA	Exotic	
Poa compressa	Canada Blue Grass	SNA	Exotic	
Poa palustris	Fowl Blue Grass	S5	Secure	

Species / Family	Common Name	S-rank	GS Rank	ID Notes
Poa pratensis	Kentucky Blue Grass	S5	Secure	
Poa saltuensis	Weak Blue Grass	S4S5	Secure	
Typhaceae	**Cat-tail Family**			
Typha latifolia	Broad-leaved Cattail	S5	Secure	
Liliaceae	**Lily Family**			
Maianthemum canadense	Wild Lily-of-The-Valley	S5	Secure	
Medeola virginiana	Indian Cucumber Root	S5	Secure	
Iridaceae	**Iris Family**			
Sisyrinchium montanum	Mountain Blue-eyed-grass	S5	Secure	
Orchidaceae	**Orchid Family**			
Platanthera lacera	Ragged Fringed Orchid	S4S5	Secure	ID to sp. probable, not confirmed

The areas surrounding each potential turbine site was surveyed and the descriptions are found below in Table 5.4.

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

Turbine #	Latitude	Longitude	Site Description	Dominant Understory Species
L01	45.542383	-62.817470	Upper rim of old gravel pit at margin of 25 year old black spruce plantation with balsam fir - red maple - gray birch mixed in.	***Open habitat:*** *Festuca filiformis; Potentilla simplex; Solidago juncea; Doellingeria umbellata; Anthoxanthum odoratum; Fragaria virginiana.* ***Shrubby forest:*** *Oclemena acuminata; Doellingeria umbellata; Maianthemum canadense; Solidago rugosa*
L02	45.540341	-62.824273	Half is dense 15-20 deciduous forest regeneration (yellow birch - white birch - pin cherry - red maple - white pine - trembling aspen); half is more mature forest of sugar maple5 - yellow birch2 - red maple1 - hemlock1 - (balsam fir - white ash - red spruce)1 reaching up to 100+ years old toward the back of the	***Younger forest:*** *Dennstaedtia punctilobula; Maianthemum canadense; Oclemena acuminata; Aralia nudicaulis.* ***Older forest:*** *saplings - Acer pensylvanicum; Abies balsamea; Picea rubens; Pinus strobus. Herbs - Dryopteris intermedia;*

			potential turbine footprint	*Maianthemum canadense; Coptis trifolia; Trientalis borealis; Thelypteris noveboracensis*
L03	45.536793	-62.819818	**E half (Wagner):** ~20 year old white birch - gray birch - red maple - yellow birch - white ash with canopy closure fairly open to fairly dense; **W half (private):** ~60 year old sugar maple - yellow birch - balsam fir - red maple	***Younger E forest:*** *Doellingeria umbellata; Solidago rugosa; Rubus idaeus ssp. strigosus.* ***Older W forest:*** *Saplings - Abies balsamea; Acer pensylvanicum. Herbs: Dryopteris intermedia; Coptis trifolia; Cornus canadensis; Maianthemum canadense; Mitchella repens; Medeola virginiana; Lycopodium annotinum*
L03 (alt. site)	45.539900	-62.815635	~15-20 year old open balsam fir - white birch - white spruce regeneration from clearcut	*Rubus idaeus ssp. strigosus; Rubus canadensis; Doellingeria umbellata; Solidago rugosa; Fragaria virgininiana; Danthonia spicata; Solidago juncea; Potentilla simplex; Maianthemum canadense; Hieracium lachenalii.* ***Wetter parts:*** *Carex gynandra; Scirpus cyperinus; Calamagrostis canadensis; Polygonum sagittatum*

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, 4 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.

5.4 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.

Species observed or heard singing in suitable nesting habitat are classified as possible breeders.

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	Vulnerable (2013)		Possible

			(2013)			
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 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.

Throughout the study of the Limerock Wind Project location, a total of 39 different bird species were recorded. Within these 39 species, four were listed as below S5 (Table 5.6). The Killdeer, the Eastern Wood Pewee, the boreal chickadee and the Wilsons snipe are listed sub-nationally as S3S4B, all other recorded species are listed by the ACCDC as S5. A complete list of species and their Sub-national ranks (S-Ranks) found through the duration of the study is found in Table 5.7. (Atlantic Canadian Conservation Data Centre, 2010).

Table 5.6 Uncommon Avian Species Recorded sub-national and global ranks as defined by the Atlantic Canada Conservation Data Centre found throughout the Limerock wind project location, Pictou 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**
Killdeer	*Charadrius vociferus*	G5	S3S4B
Eastern Wood Pewee	*Contopus virens*	G5	S3S4B
Wilson's Snipe	*Gallinago delicata*	G5	S3S4B

*** 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).

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

Table 5.7 Complete List of Bird Species Observed During the 52 Week Study at Limerock, Pictou County, Nova Scotia, data collected by Black Bird Environmental Consulting, April - March 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
Common Grackle	*Quiscalus quiscula*	G5	S5B
Mourning Dove	*Zenaida macroura*	G5	S5
Herring Gull	*Larus argentatus*	G5	S4S5
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
Belted Kingfisher	*Megaceryle alcyon*	G5	S5B
Killdeer	*Charadrius vociferus*	G5	S3S4B
Pileated Woodpecker	*Dryocopus pileatus*	G5	S5
Downy Woodpecker	*Picoides pubescens*	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
Black-throated Green Warbler	*Dendroica virens*	G5	S4S5B
Black-and-White Warbler	*Mniotilta varia*	G5	S4S5B
Eastern Wood Pewee	*Contopus virens*	G5	S3S4B
Ovenbird	*Seiurus aurocapillus*	G5	S5B
Winter Wren	*Troglodytes troglodytes*	G5	S5B
Black-capped Chickadee	*Poecile atricapilla*	G5	S5
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
Ruffed Grouse	*Bonasa umbellus*	G5	S4S5B
Ring-necked Pheasant	*Phasianus colchicus*	G5	SNA
Wilson's Snipe	*Gallinago delicata*	G5	S3S4B
Bald eagle	*Haliaeetus leucocephalus*	G5	S4
American Goldfinch	*Carduelis tristis*	G5	S5
Purple Finch	*Carpodacus purpureus*	G5	S4S5
Swainson's Thrush	*Catharus ustulatus*	G5	S4S5
Yellow-rumped Warbler	*Dendroica coronata*	G5	S5
White-breasted Nuthatch	*Sitta carolinensis*	G5	S4

*** 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).

*** 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 28, 2013, the Proponent, 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 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 28, 2013 at Limerock with breeding evidence recorded following the methods of the Maritimes Breeding Bird Atlas. Breeding evidence with codes are: Possible breeding (Poss) - H = adult in suitable nesting habitat; S = singing male in suitable nesting habitat; Probable breeding (Prob) – A = adult exhibiting agitated behaviour. Shaded species are of conservation concern with details of occurrence given in Table 5.8 and locations mapped in Appendix F. (Blaney, 2013)

Species	Common Name	NS End. Sp. Act	S-rank	GS Rank	Breeding Evidence
Charadrius vociferus	Killdeer		S3S4B	Sensitive	Prob-A
Zenaida macroura	Mourning Dove		S5	Secure	Poss-S
Colaptes auratus	Northern Flicker		S5B	Secure	Poss-S
Contopus cooperi	Olive-sided Flycatcher	Vulnerable	S3B	At Risk	Poss-S
Contopus virens	Eastern Wood-Pewee	Vulnerable	S3S4B	Sensitive	Poss-S
Empidonax minimus	Least Flycatcher		S4B	Secure	Poss-S

Certhia americana	Brown Creeper		S5	Secure	Poss-H
Catharus ustulatus	Swainson's Thrush		S4S5B	Secure	Poss-H
Catharus guttatus	Hermit Thrush		S5B	Secure	Poss-S
Turdus migratorius	American Robin		S5B	Secure	Poss-H
Bombycilla cedrorum	Cedar Waxwing		S5B	Secure	Poss-H
Vireo solitarius	Blue-headed Vireo		S5B	Secure	Poss-S
Vireo olivaceus	Red-eyed Vireo		S5B	Secure	Poss-S
Vermivora ruficapilla	Nashville Warbler		S5B	Secure	Poss-S
Parula americana	Northern Parula		S5B	Secure	Poss-S
Dendroica virens	Black-throated Green Warbler		S4S5B	Secure	Poss-S
Seiurus aurocapilla	Ovenbird		S5B	Secure	Poss-S
Wilsonia canadensis	Canada Warbler	Endangered	S3B	At Risk	Poss-S
Spizella passerina	Chipping Sparrow		S4S5B	Secure	Poss-S
Zonotrichia albicollis	White-throated Sparrow		S5B	Secure	Poss-S
Carpodacus purpureus	Purple Finch		S4S5	Secure	Poss-S
Carduelis tristis	American Goldfinch		S5	Secure	Poss-H

Table 5.9 Species of Conservation Concern Recorded at Limerock, June 28, 2013 with provincial status, location of observation and description of the occurrence and potential construction impacts.

Common Name	Species	S-rank	GS Rank	Latitude	Longitude	Location Uncertainty (m)	Description
white ash swamp				45.536456	-62.820515	10	~80 years old suggesting fai
Killdeer	*Charadrius vociferus*	S3S4B	Sensitive	45.543207	-62.818535	25	agitated pair i habitat (old gr
Olive-sided Flycatcher	*Contopus cooperi*	S3B	At Risk	45.540410	-62.815160	75	singing male i habitat (regen
Eastern Wood-Pewee	*Contopus virens*	S3S4B	Sensitive	45.538980	-62.821370	50	singing male i habitat (hardw
Eastern Wood-Pewee	*Contopus virens*	S3S4B	Sensitive	45.540341	-62.824273	50	singing male i habitat (mixed stand with nu pines)

Canada Warbler	*Wilsonia canadensis*	S3B	At Risk	45.539050	-62.822310	10	singing male i habitat (young white birch - b forest)

Table 5.10 Incidental Avian Observations by Biologist Ross Hall

Species	Date	Notes
Yellow-rumped Warbler	May 8, 2013	-
Ruby-crowned Kinglet	"	-
American Robin	"	Lots
Northern Flicker	"	-
Purple Finch	"	-
Pileated Woodpecker	"	-
Ruffed Grouse	"	-
American Woodcock	"	-
Mourning Dove	"	-
Blue Jay	"	-
Blue-headed Vireo	"	-
Ovenbird	"	-
White-throated Sparrow	"	-
Killdeer	"	Near gravel pit
Ring-necked Duck	"	Distant pond on Salem Road
Black Duck	"	Distant pond on Salem Road

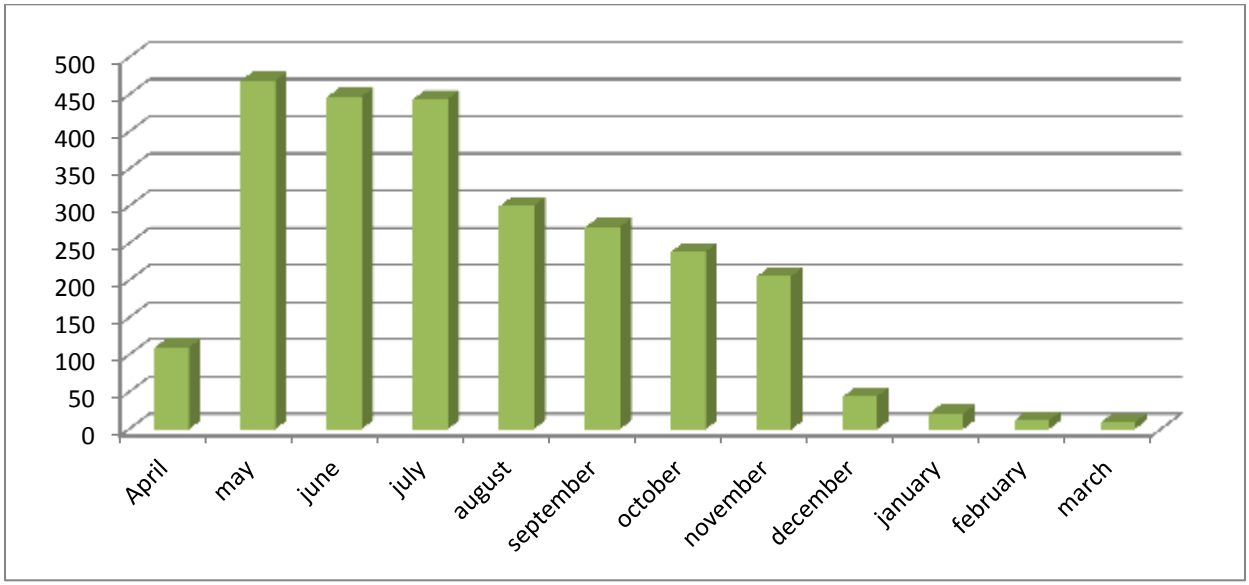
5.4.1.3 Survey Summary

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

Limerock 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 5.3 shows the population trends throughout the duration of the study. The highest population count was found during the month of May with approximately 470 birds recorded. The population then drops slightly each month, with the largest drop in population from November at approximately 200 birds, to December at approximately 45 birds. The lowest population count was found during the month of March with approximately 10 birds recorded.

Figure 5.3 Avian Population Trends found during the study of the 52 week for Limerock, Pictou County, Nova Scotia, data collected by Black Bird Environmental Consulting, April – March 2012-2013.



During the Limerock survey, 39 avian species were observed. With the exception of four species, all species had an S-Rank of S5 which is defined by the ACCDC as: Widespread, abundant, and secure, under present conditions. This is the highest S-Rank and therefore these species have a very low potential to be threatened by the construction of wind turbines on this site. The Eastern Wood Pewee (*Contopus virens*), the Killdeer (*Charadrius vociferous*), Boreal Chickadee (*Poecile hudsonicus*) and the Wilson's Snipe (*Gallinago delicate*) share 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, which

are present throughout this study area. The Killdeer can be found in open grasslands, wetlands, fields, croplands and pastures. The Killdeer recorded in this study area was found near a grassy meadow which bordered on a large rock quarry. This area will not be disturbed for the construction/ upgrading of the access roads, however, vehicular traffic will be passing through the area. The Boreal Chickadee is usually found deep in spruce/fir forests away from human disturbance. These birds live off the insects and larva typically found in softwood trees. They are able to live in the spruce/fir forests year-round in Nova Scotia as they are the type of bird that stores food away in the fall so it has food for the winter. It is not uncommon to see them at a bird feeder in the winter if food does become scares throughout the long winter months. The Boreal Chickadees were recorded in the immature and mature softwood habitat types. The Wilson's Snipe is typically found in wet marshy areas; they will forage in wet meadows, fields, and marshy areas. Although there were not an abundance of wet areas throughout this study area, this bird may have just been passing through. This species was only recorded once throughout the entire study. Although these species are not at a critical level of risk, pressure on this species may push these ranks down and result in further diminishing these populations.

5.4.2 Mammals

5.4.2.1 Overview

Nova Scotia is home to 57 species of terrestrial mammal (Davis and Browne 1996). The mammal fauna of Nova Scotia has been altered dramatically since the arrival of Europeans. A number of species have been extirpated, such as the caribou (*Rangifer tarandus*) and the wolf (*Canis lupus*), due to habitat destruction, human encroachment and hunting (Davis and Browne 1996; Banfield 1974). Others species, such as the white-tailed deer *(Odocoileus virginianus)* and eastern coyote *(Canis latrans)*, appear to have benefited from human disturbance, and are relatively recent arrivals to the province (Davis and Browne 1996). The abundant mammal species are generally mobile and widespread in Nova Scotia, and the mammal fauna of the province has not been delineated into distinct communities (Davis and Browne 1996). However, a number of mammal species native to Nova Scotia currently have restricted ranges and exist in distinct populations.

Information regarding the presence of mammals, including rare species, and sensitive mammal habitat within the Limerock 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 for this EA is a regional biologist for Department of Natural Resources in Nova Scotia with extensive knowledge of habitat types and expected/ potential species found within.

5.4.2.2 Mammal Species of Conservation Concern

Habitat types in the Project Study Area are described in Section 5.3.1. Given the limited types of habitat present in the Project Study Area, it can be expected to support some typical mammal species characteristic of forested and open habitats. The Project Study Area has been heavily

modified by various anthropogenic activities including farming, forestry and road construction. Evidence of the presence of mammals was collected during the field surveys. This included visual sightings, distinctive calls, tracks, scat, dens, lodges and other distinctive spoor that could be used to identify mammals.

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 (besides Mainland Moose); 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 of Project. NS status (2010) as determined from Wild Species - General Status of Species in Canada. Also listed NSESA, COSEWIC, SARA status**.**

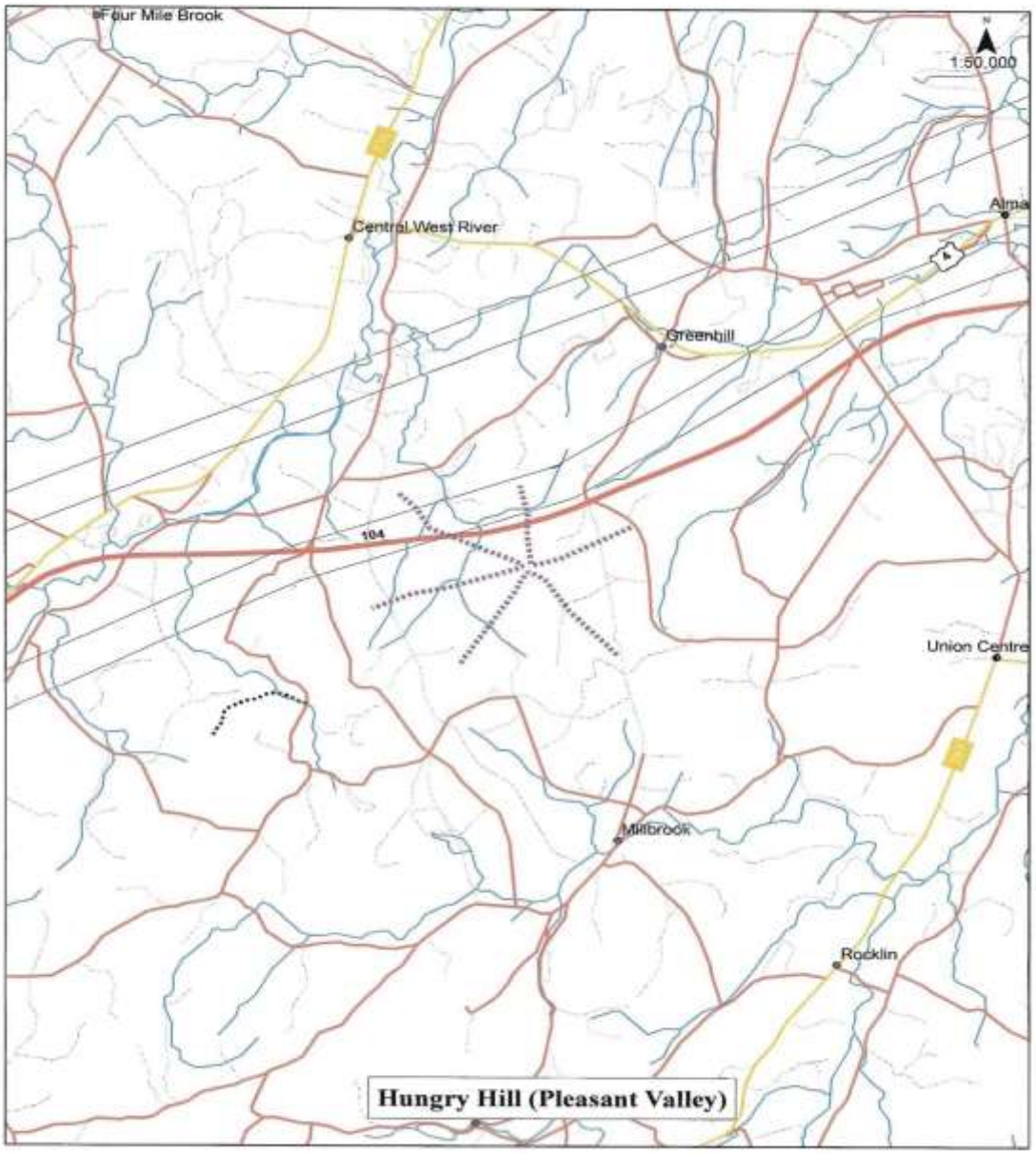
Common Name	Scientific Name	NSGSWS 2010	Habitat	100Km Radius
Mainland Moose	*Alces alces*	At Risk NSESA: Endangered (2003)	Forest, especially those with intermediate stages of forest succession interspersed with lakes and streams. Thrives best in absence of white-tailed Deer.	Possible
Fisher	*Martes 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 development is fragmented by many roadways, including 100 series highways, and has many forms of human disturbances. It has a high deer population and deer transmit a deadly disease, *Parelaphostrongylus tenuis* (brain-worm or meningeal worm), 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 1000m x 2m 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 (1) multiple years, (2) found only once, or (3) 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 5.4). 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).

Figure 5.4 Transects used in Limerock 2013 Moose PGI Survey



Limerock 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 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. The construction of each wind turbine will displace about 0.5 hectare of forest land per turbine yet the effect of the placement of wind turbines to fisher population is minimal.

5.4.2.2.3 Long-tailed Shrew

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 has a very low potential to affect Short-tailed shrew.

5.4.2.2.4 Bats

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).

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 not undertaking a bat study for Limerock. Results of the 2008 Dalhousie Mountain Bat Study, as well as the extremely low population left from the devastation from White-nosed Syndrome, indicate a very low potential for the three turbines at Limerock to negatively affect bat populations. The results of the Dalhousie Mountain 2008 bat study as well as the Kemptown 2013 Bat Survey are available in Appendix I (both less than 25km from Limerock).

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).

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).

Results of summer and fall monitoring throughout Nova Scotia show that, in some places, 95% to 100% of the resident population has been wiped out completely (Broders and Bates, 2013). While not all areas are affected as dramatically as this, all areas have been affected.

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 (pers. Conv.).

Major Water Bodies

There are no major water bodies within 5 km of the Project Study Area. The nearest major feature is the beginning of the Middle River, which is over 8km away. The nearest coastline is the Northumberland Strait to the North-east which is more than 25 km away.

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.

The proposed Project is not located along a predominantly forested ridge rather located largely in non-forested farmland or immature stage of forest development. Bats migrating towards the US would typically migrate along ridgelines in southwest – northeast direction.

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.

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

Amphibians and reptiles are normally treated together as herpetiles. There are 22 terrestrial and freshwater herpetile species recorded from Nova Scotia. The herpetile fauna of Nova Scotia is relatively sparse when compared to adjacent mainland areas of the continent, mostly because of the difficulty of post-glacial colonization of this peninsula and a relatively harsh climate.

Information regarding the herpetile fauna in the Project Study Area was obtained from existing information sources (*e.g.,* ACCDC 2011 and records from the study biologist) and field surveys.

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 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	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 (MacGreggor and Elderkin, 2003).

- 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.

No watercourses occur in the immediate area of the Project. Therefore, it is highly unlikely that Wood Turtle would be found in the area and even less likely that this Project would have a negative impact on Wood Turtles or their habitat.

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. This 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 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).

The Limerock study area lacks habitat for pond breeding Odonta but Brown Brook (approximately 1.9km away) offers possible habitat for river breeding species associated with small brooks. Vernal pools discovered beneath a mixed forest stand with White Ash perhaps provides habitat for Spot-winged Glider. No Odonta were observed on June 28 and July 5 visits to the study area and includes the area of Brown Brook.

Table 5.13 Priority Odonta and Dragonfly Species Listed within 100km 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 Limerock
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.	Possible
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.	Possible
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.	Possible
Zorro Clubtail (Northern Pygmy Clubtail)	*Lanthus parvulus*	Sensitive	Springs and small woodland streams.	Possible
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.	Possible
Little Bluet	*Enallagma minusculum*	Secure	The microhabitat is stands of floating-leaved vegetation (*Brasenia*, Water Shield, *Nymphaea*, Waterlily, Nymphoides, Floating Heart, *Potamogeton*, Pondweed) or	Unlikely

			emergent plants (Equisetum, Horsetail, *Juncus*, Rush) in shallows along the shore of lakes and ponds.	
Harlequin Darner	*Gomphaeschna furcllata*	Sensitive	Pond breeding.	Unlikely
Kennedy's Emerald	*Somatochlora kennedyi*	May Be At Risk	Pond breeding.	Unlikely
Orange Bluet	*Enallagma signatum*	May Be At Risk	Slow-moving streams and ponds.	Possible
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.	Possible
Amberwinged Spreadwing	*Lestes eurinus*	Secure	Pond breeding.	Unlikely
Forcipate Emerald	*Somatochlora forcipata*	May Be At Risk	River breeding.	Possible
Black Meadowhawk	*Sympetrum danae*	Sensitive	A variety of habitats, but most common at bogs, marshes, and fens.	Unlikely
Subarctic Bluet	*Coenagrion interrogatum*	May Be At Risk	Pond breeding.	Unlikely
Ringed Emerald	*Somatochlora albicincta*	May Be At Risk	Pond breeding.	Unlikely
Muskeg	*Somatochlora*	Sensitive	Pond breeding.	Unlikely

Emerald	*septentrionalis*			
Ocellated Darner	*Boyeria grafiana*	Sensitive	Shaded streams, rivers, and poorly vegetated windswept lakes.	Possible
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 from water.	Unlikely
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

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*	Sensitive	Boreal forest.	Nettles, *Urtica* sp.	Possible

	satyrus				
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

5.4.6 Significant Habitats and Managed Areas

No significant habitats as previously identified and mapped by NSDNR occur near the study site. The ACCDA GIS scan identifies two provincial parks (Greenhill and Salt Springs) within 5 km of the study area. At 4 and 5 km distances, neither park is affected by the proposed wind turbine development.

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 2013).

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).

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 µg/m^3 and 15,000 µg/m^3, respectively);
- None of the monitored concentrations of nitrogen dioxide exceeded the 1-hour or Annual objectives (400 µg/m^3 and 100 µg/m^3, respectively);
- None of the monitored concentrations of sulphur dioxide exceeded the 1-hour or 24-hour objectives (900 µg/m^3 and 300 µg/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 Limerock, 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 Limerock in Pictou County, Nova Scotia. Nearby communities include Salt Springs, Pleasant Valley, Millbrook, Alma, Greenhill, Salem and Durham. Population statistics for Pictou County from the 2006 census are summarized in Table 5.16 below.

Table 5.16 Population Statistics for Pictou County from 2006 Census

Population and Dwelling Counts	County of Pictou
Population in 2006	46,513
Population in 2001	46,965
2001 to 2006 population change (%)	-1.0
Total private dwellings	21,768
Population density per square kilometer	16.3

Land area (square km)	2,845.26

Source: Statistics Canada 2006 Census

Pictou County has experienced population decline from 2001 to 2006 of -1.0%. The 2006 population of Pictou County was distributed fairly evenly across various age groups with the age ranges 40-44, 45-49, 50-54 and 55-59 being higher than other age ranges. The median age of the population was 43.6, which is slightly older than the provincial median of 41.8. Approximately 16.7% of the population was over the age of 65, which is somewhat higher than the province's statistic of 15.1%. Approximately 1.7% of the population identified as Aboriginal, while 2.8% identified as foreign-born (Statistics Canada 2011).

5.6.2 Health, Industry, and Employment

In Pictou County, the Pictou County Health Authority (PCHA) is responsible for delivering health care services to the county and regional programs to the larger population of northeastern Nova Scotia through the Aberdeen Hospital in New Glasgow, Sutherland Harris Memorial Hospital in Pictou, Addiction Services, Mental Health Services and Public Health Services.

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

Table 5.17 Employment by Industry in Pictou County

Industry	Pictou County		
	Total Employed	Total Males Employed	Total Females Employed
Total – Experienced Labour Force 15 Years and Over	22,905	12,220	10,685
Agriculture and Other Resource-Based Industries	1,320	1,085	235
Construction	1,335	1,165	170
Manufacturing	3,805	3,190	615
Wholesale Trade	555	415	145
Retail Trade	3,430	1,410	2,020
Finance and Real Estate	650	320	325

Table 5.17 Employment by Industry in Pictou County

Industry	Pictou County		
	Total Employed	Total Males Employed	Total Females Employed
Health Care and Social Services	2,675	295	2,380
Educational Services	1,350	475	875
Business Services	4,220	2,355	1,865
Other Services	3,555	1,500	2,055

Source: Statistics Canada 2011

As listed in Table 5.18, Michelin Tire is the top employer in Pictou County with 1,400 local employees (Pictou Regional Development Agency). Empire Company and Chignecto Regional School Board employ 942 and 923 employees, respectively (Pictou Regional Development Agency).

Table 5.18 Top Employers in Pictou County

Employer	Business	Number of Employees Locally
Michelin Tire	Tire Manufacturing	1,400
Empire Company	Sobeys (Grocery Retail) Crombie REIT (Real Estate) Empire Theatres	942
Chignecto Regional School Board	School Board	923
Convergys Inc	In-Bound Call Centre	500
Pictou County Health Authority	Hospital/Health Services	800
Northern Pulp	Pulp Manufacturing	340
ICT Group	Contact Centre	240

Employer	Business	Number of Employees Locally
Advocate Printing & Publishing	Print & Marketing Communications	182
Maritime Steel & Foundries	Iron Steel Production	148
Nova Scotia Power Corp	Electric Utility	128
Scotsburn Dairy Group	Dairy Production	105
Wear Well Garments	Garment Manufacturing	100

In 2005, 24,860 residents of Pictou 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 Pictou County was $20,762, which is below the provincial median of $22,608. For those in Pictou who had full-time work all year-round, median earnings were $35,300, which is still well below the provincial average of $36,917 (Statistics Canada 2011).

Based on the 2006 census, the unemployment rate for Pictou County is 9.5% which is slightly higher than the provincial unemployment rate of 9.1%.

5.6.3 Recreation and Tourism

Pictou County is bordered by the Northumberland Shores, Colchester, Antigonish and Guysborough Counties. The County of Pictou offers a wide variety of accommodations, dining, theatre venues, museums, parks, wilderness areas, beaches, festivals, exhibits and heritage sites. A number of outdoor recreation and activities include hiking/walking on trails such as the Jitney Walking Trail, Short Line Trail and Fitzpatrick Trail, Kayaking, golfing, bird watching and visiting nearby beaches such as the Caribou Provincial Park, Munroe's Island Nature Reserve, Melberby Beach and Waterside Beach Provincial Park.

The County has a large shopping center, the Highland Square Mall, as well as hundreds of shops and services. Restaurants are located throughout the county to serve both the town and rural patrons.

There is a Nova Scotia Community College located in Stellarton, as well as various boutique academies offering training in services such as fisheries training, massage therapy, cosmetics, and accounting.

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 Limerock is proposed, the landowners are private, with Crown owned land to the east. All lands in and around the Project area have been subjected to logging in the last one hundred years.

The existing access road is gated at the north-east entrance. This gate will remain in place as it is owned by the landowner and limits access to a small quarry. Snowmobile and ATV traffic (fairly limited amount of usage) will continue to be permitted to travel through the area with safety signage present to make users aware of potential ice throw danger.

5.6.5 Property Values

In 2006, there were 19,290 dwellings in Pictou County, of which 14,820 were owned and 4,365 were rented. Approximately 79% of the dwellings in Pictou County were constructed before 1986. The average value of a home in 2006 was $114,744, approximately $43,256 less than the provincial average (Statistics Canada 2011). 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 Wind Farm, 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.

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 highway traffic and usual ambient sound emitters such as trees and other wind obstructions. The nearest house is approximately 1100m from the turbines.

A sound modelling study was conducted based on actual sound pressure levels from GE about the 1.6 MW series machines. This 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 Limerock Project. The Limerock sound study has considered all three turbines in its projections.

Furthermore, the province of Nova Scotia, through the Environmental Assessment regulations, limits the placement of any turbines within a sound level higher than 40 dBA. The modelling for sound for this project has been done and the three machines in Limerock will not create sound higher than 40 dBA 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 a recorded site immediately to the south west of the study area; two other sites recorded further south west, one north, one northwest and one east of the study area. The potential for pre-contact archaeological resources within the study area can be considered low.

The potential for historic archaeological resources within the project area can be considered moderate to high as 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 Limerock project there was one foundation located by the Proponent. Although outside of the turbine lay-out and road access corridors, the Proponent alerted archaeologists to the site for investigation and inclusion in reporting/ historical records searchable in the future. The site was searched by April MacIntyre and Steven Davis in October (Appendix H).

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 # A2013NS087). 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 Limerock Project.

5.6.7.2 Archaeological Potential

5.6.7.2.1 First Nations

While there are no First Nations sites recorded within or 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 potential for pre-contact archaeological resources for the study area can be considered low (Nova Scotia Heritage, 2011).

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

5.6.7.2.2 Historic

There are no recorded historic archaeological sites within the Project Study Area. However the Maritime Archaeological Resource inventory lists archaeological sites recorded as being in the area surrounding the Project Area. All of the identified archaeological sites date to the historic period and are of a residential/settlement and agricultural nature. None of these sites are directly inside the footprint of the Project.

Below is the Executive Summary from Davis MacIntyre ARIA. The entire assessment is in Appendix H.

Davis MacIntyre & Associates Limited conducted an archaeological resource impact assessment of the proposed Limerock Wind Project in Pictou County. The purpose of the assessment was to determine the potential for archaeological resourced within the study area

and to provide recommendations for mitigation, if necessary. The assessment incuded an historic background study and reconnaissance. The study concluded that, while the property had been granted as early as the late 18th century, there was likely no settlement in this area until the early 19th century when Scottish immigrants took up the lands. Crown land grant records indicate that these lands were escheated from the original grantees and turned over to Scottish immigrants in 1813 and 1815. Historic maps from the third and fourth quarters of the 19th century show that there were settlers in the area at the time and that many of them had erected houses on their lands. The reconnaissance revealed that there was, indeed, historical agricultural activity in the area, particularly along Salem Road and an old unnamed road to the west which is now used for ATV traffic. However, the only remnants of that activity that were encountered were field clearing stone piles which are not considered to be archaeologically significant. It is possible that the associated buildings lay outside the study area or were impacted by 20th century clear cutting in this area. Other stone piles were located along the access road between turbines #1 and #2 but these appear to be related to more recent endeavors, possibly 20th century silviculture and are not considered archaeologically significant. Likewise, recent activity was encountered near turbine #3 which is considered insignificant. Finally, archaeologists were alerted to the presence of historic foundation outside the study area near the far northwestern end of the access road. It is believed that this may relate to early pioneer settlement and is, therefore, archaeologically significant. However it is not expected to be impacted by the construction.

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.

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 Limerock 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 logging traffic including all-terrain vehicles, four-wheel drive vehicles and various logging specific equipment. The area is used for limited ATV and snowmobile travel. The site is accessed from two directions through trails and existing roads. The surrounding roadways along the primary component transportation route consist of TransCanada Highway 104, ending at Exit 20. Entering the Ross Road which extends to the Salem Road, where the privately owned access road is located; the route follows this road passes less than ten houses. It is anticipated that the current road network (outside of onsite turbine access road) will not require upgrades to accommodate construction traffic. The possibility of the Proponent having to widen some turns between the highway exit and end of Ross Road does exist. 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 will be 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 both the Alma and West River Fire Departments 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.

5.6.11 Visual Landscape

The Project Area is located on a forested hill top which has been cleared for logging at different times over the last 100 years. It does somewhat support other vegetation types including wetlands. The Project Area will be visible from TransCanada Highway 104 from both directions. This is the case throughout Nova Scotia's mainland landscape, with turbines visible in Barney's River, Maryvale, Antigonish, New Glasgow, Scotsburn, Mt Thom, Brookfield, Amherst and River John.

A visual landscape assessment was conducted for the Project (Figures 6.10 – 6.14). 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								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
Operation													
Operation & Maintenance					X		X	X	X	X	X	X	6.2

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	
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;
- keep the size and grade of access roads to the minimum required for the safe transportation of construction equipment;
- keep transportation vehicles at a low speed and maintain watering down of roadways if dust becomes an issue;
- 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 biologist 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 preserve the site's natural areas.	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 footprint. The area to be subject to this disturbance has been previously disturbed by human presence (*e.g.,* forestry activity) 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 forestry activities and four-lane TransCanada Highway, 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 have been cleared and are in the different stages of regrowth. The examination of NSDNR mapping and the completion of 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 (other than the existing highway located approximately 500m away) 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	1	1	1/1	I	2	Although some habitat loss will be considered irreversible (*i.e.*, 20 years), this “irreversible”

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 limit the overall land disturbance to within designated workspaces. • Existing access roads will be used and this 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.						habitat loss will be limited in geographic extent and magnitude and will be on land that will ultimately be cleared for forestry regardless of whether 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 forestry 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	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	
		kept to the minimum required for the safe construction, operation and decommissioning of the equipment. • 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 (Appendix F) it is noted that the locations of the turbines and access roads do not interfere or threaten to interfere with plant species of conservation concern.

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	
Wetlands	Loss of wetland area and/or function	• Avoid all wetlands, where practical. • If wetland impact is unavoidable, a functional analysis of 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.	1	1	2/1	R	2	Site surveys indicate that no wetlands will be impacted for the construction of this Project. If inadvertent 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	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. No water-crossings are required for Limerock. Upgrades to existing structures along the Ross Road may be required, however, are not expected. 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	
		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.						
	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	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. No water crossing structures are required to be constructed for the Limerock Project.

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	
		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 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 highway traffic noise created 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	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	
		resource is discovered, activity will cease and the Coordinator of Special Places 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 5 ha. Vegetation types most affected by clearing include immature softwood and immature and mature hardwood.

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 three turbine areas and approximately 1800m 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 the location of the four-lane highway, 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 enters the property through an existing road, 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. Should an upgrade be required during construction, 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 from construction of access roads.
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 the results of the flora survey, no species of conservation concern are expected to be 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	No newly constructed or upgraded water crossings are anticipated for the Limerock Project. No residual effects are expected.
	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	No newly constructed or upgraded water crossings are anticipated for the Limerock Project. No residual effects are expected.

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.						
	Surface water	• General mitigation measures from the NSE	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	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 will be preserved through	1	1	2/1	I	2	No newly constructed or upgraded water crossings are anticipated for the Limerock Project. No residual effects are expected.

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 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 used on all heavy	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	
		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 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 has historically been cleared generationally for forestry operations. Land lost for forestry operations due to access road construction will be a very small proportion of what is available and therefore the impact should be 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 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. Although very unlikely, if watercourse or wetland alteration is necessary, it 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 to maintain access to the lands. 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 and typical regular rural traffic such as tractors and ATVs. The project area is subject to forestry activity, which is what the main activity on the land parcels has been historically up until now. With the exception of this outside traffic, the actual Project footprint receives no other traffic (road is private after the Ross Road).

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 (per turbine). In addition, a flatbed truck will be used for the nacelle for each machine, and one flatbed truck can transport two rotor blades at once. 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.

The effect on land use will primarily be increased usage of Exit 20 and Ross Road in Limerock to the access road entrance of the Project area and possible disruption 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 (four homes along the route) so disruptions to existing traffic will be minimal.

Figure 6.1 shows a typical blade transportation truck.

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 and only for a short duration of time. 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 the TransCanada Highway. 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 limited to one road after the highway exit until the entrance to the wind facility. 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 close proximity to the highway 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 three 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 ½ 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	• 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

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	
								be situated to minimize disturbance to existing 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	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	
		the appropriate 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,	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	
		delivery 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.						
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	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	
		place in overly windy 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 forestry, the highway 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 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 Terrestrial Vegetation	Compaction and contamination – via heavy equipment	• Topsoil will be stored on-site for future use in restoring the land to its original condition. • Standard erosion and sediment control measures will be	1	1	1/1	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	
		implemented as required.						
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 control measures will be removed at the completion of the work but not until permanent erosion control measures, if	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	
		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 where the lines currently stop on Ross Road.	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 forestry 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.
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	1	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	
		have already vetted against resource discovery so installation of the lines will not require new impact areas.						

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 potential loss of material from a small private quarry visible from the highway; 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, which are 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 Limerock 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 the Dalhousie Mountain Wind Farm, 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

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. These will always be pointed downwards toward the workers. • Project does not require a substation (which have bright lights usually on during nighttime hours for safety)						will be 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 6.8 and 6.9) Results of the

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	
								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 and bird 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 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. 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.
Land Use	Disruption to	• The Project has been	1	2	5/1	R	2	The Project is built on

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	
	undeveloped woodlands or infrastructure	designed to minimize impacts to the local land use. No mitigation, therefore, is required as no significant impacts are predicted.						forested land. 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 in a wide range of community uses	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 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). This will continue and expand with the operations of this new Project (Figure 6.6)

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	
	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 off road vehicular 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 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 three turbines.	4	2	5/6	R	2	Given the viewing distances and sparse population, the visual impact will not be significant. Some 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	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

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	
		safety.						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 • Locate machines far enough from highway that shadow flicker will not be an issue	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 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 Limerock site. Potential flicker at the

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	
								highway can only occur for a few hundred meters, and will always be perpendicular to the driver. The distance of the highway from the source of shadow (over 500m) reduces the intensity of the shadow to a dull, non-noticeable effect.
Sound	Increases to sound levels	• Noise created from the operation of the wind turbines will not exceed the provincial threshold of 40 dBA.	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 three 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 Limerock is over 1000 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 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 the private property	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 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	

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).

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.

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

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 F and Appendix G
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 F and Appendix G
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
What habitat types occur on the site and in the surrounding area?	See Section 5.4.1, Appendices B, F and 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 project 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

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

Question	Answer
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 logged areas. 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 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 15km South-west from the outlet of Middle River, and about 30km South of the Northumberland Straight outside of Pictou Harbour.
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 logging, recreational riding/ ATV trails, hunting, and the TransCanada Highway.
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.
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 activity such as forestry/ clearing.

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

Question	Answer
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, the traffic on the TransCanada Highway 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 three turbines constructed for the Limerock 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 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 40m 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). 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 the Dalhousie Mountain Wind Farm 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 the Dalhousie Mountain Wind Farm 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 the 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 all three 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 three 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 Limerock 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 Limerock 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.

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.**

Figure 6.7 A family of Canadian Geese Hatched and Raised in the Dalhousie Mountain Wind Farm in Fourth Year of Operations

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 the Dalhousie Mountain Wind Farm and drives 11km 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, three at Limerock) 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.* forestry and recreational usage, TransCanada Highway) 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 noise 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.

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.

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.

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

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

Reptiles and Amphibians

The possibility of Wood Turtle in the Project area is very low. In the event there is a stream crossing for the access road, this work is a short term disturbance event and will cause minimum degradation of turtle habitat. Nevertheless awareness will be heightened during the construction and operation of wind turbines to watch and report any turtle occurrence along the access road.

Snapping Turtle are unlikely to occur here. Closer to the elevated locations for placement of the wind turbines, no turtle or habitat occurs.

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 white-nose syndrome, predation 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 Limerock site were not undertaken in consultation with Nova Scotia Department of Natural Resources and Nova Scotia Environment. However, the survey results for the 2008 Dalhousie study, as well as the 2013 Kemptown study (both less than 25km from Limerock) are available in Appendix I.

Future monitoring from the towers may occur when more is known about the migration and its significance to the overall population of the three species of bats in Nova Scotia which are currently under special status as endangered. Dr. Hugh Broders undertook pre-construction studies at the Proponent's Kemptown, Greenfield and Dalhousie sites. These projects are located 25km, 31km and 10km, respectively, from the Limerock project. The results of these studies may also play a role in the bigger picture. As indicated in Section 5.4.2.2.1, no knownbat hibernaculum is located within 5 km of the Study Area. This assessment of risk based on landscape level and site specific features attributed to elevated risk levels for bat mortality found that there are no important risk factors evident within the proposed Project Study Area. Features considered to have potential for elevated risk to bats such as known hibernacula or potential caves or mines; coastline, major water bodies, and wetlands; or forested ridge habitat are absent. The Project Study Area is at, or beyond the northern range limits for migratory species and while it cannot be ruled out, high rates of mortality of the locally common *Myotis* species is not anticipated.

Post-construction fatality monitoring will be conducted at the site for at least one season, including the fall migration period from mid-August to late September. The duration of the monitoring could depend on levels of mortality found in the first season. In the event that mortality is high at the site, operational mitigation can be employed to reduce mortality which may include changes to cut-in wind speeds, feathering of blade under certain wind speeds, or shut-downs during high activity periods. The Ontario Ministry of Natural Resources (OMNR) (2010) recommends a threshold of 10 bat deaths/turbine/year (quantified as noted above, not average of wind project) after-which mitigation should be implemented to reduce mortality through operational mitigation. There are currently no guidelines in Nova Scotia for monitoring bat populations, in part due to the lack of good baseline data. In the absence of these guidelines, post-construction monitoring protocols and mitigation measures, should monitoring in the first year of operations deem them necessary, will be developed in consultation with NSDNR. Monitoring will include fall bat mortality surveys to be conducted at a frequency to be determined though consultation with regulators.

As discussed above, the Proponent is committed to monitoring the Project for bat mortality as a minimum during its first year of operation to identify if bats are affected, 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 on privately owned, 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 (8 km) 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 house distance to turbines at 200m, 300m, 400m, 500m, 550m, and so on. Since operations began, three houses within 800m have been sold at or above values the houses were originally purchased for. Four new homes have been built in the last several years within 1300m of the turbines. The setting is much closer to residents than the setting for the Limerock Project. The Fitzpatrick turbines are located at the height of land with rural communities and mixed land usage surrounding the area and 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 Dalhousie Project has been operational, numerous homes have been purchased and built within 3km of the turbines.

Located 10km east of the Dalhousie Mountain Wind Farm, the proposed Limerock 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 6.12-6.14 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.

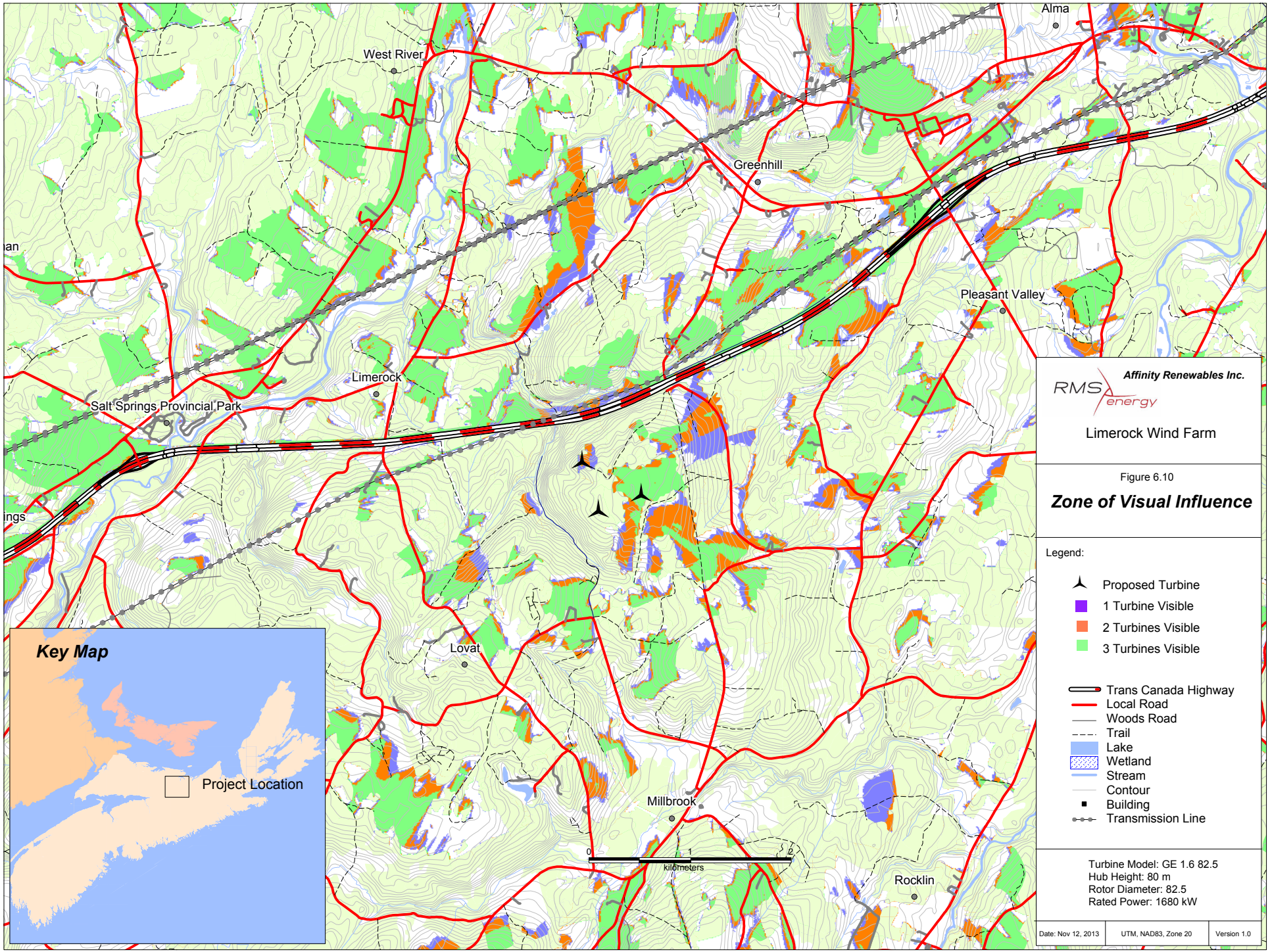
The viewing distances from the locations analyzed in this report indicate that all of the residences within the Project Study Area will be greater than 1000m from the nearest wind turbine. Given the viewing distance of greater than 1000m combined with vegetation and terrain, the presence of these lit towers will not place excessive nighttime visual pollution in the Study Area.

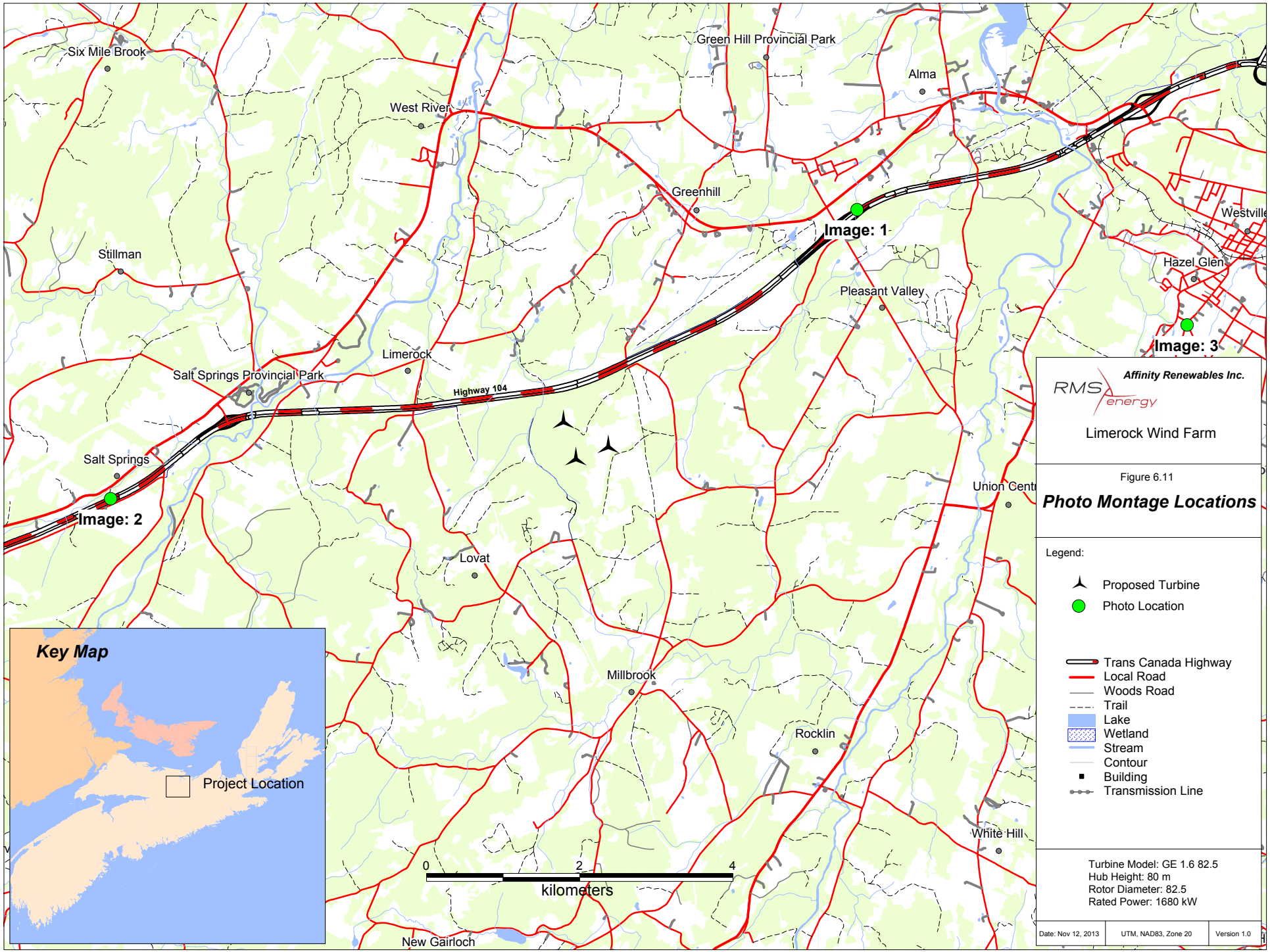
6.2.1.6 Shadow Flicker

Shadow flicker caused by wind turbines is defined as alternating changes in light intensity due to the moving blade shadows cast on the ground and objects (including through windows of residences). It has the potential to cause health concerns resulting from repeated exposures.

The effects of shadow flicker are more prevalent when the sun is low in the sky at either sunrise or sunset. Therefore it is also more likely to occur during the summer and winter solstices (June 21 and December 21) than during the spring and fall equinoxes (March 21 and Sept 21) when the sun is higher in the sky.

The shadow flicker frequency is related to both the rotor speed and the number of blades on the rotor. In this report shadow flicker was modeled based on the GE 1.6 MW 3 blade wind turbine that has a rotor diameter of 82.5 m and a hub height of 80 m.


Alma
West River
Greenhill
Pleasant Valley
Limerock
Salt Springs Provincial Park
Lovat
Millbrook
Rocklin
0
1
2
kilometers
Key Map
Project Location
Affinity Renewables Inc.
RMS energy
Limerock Wind Farm
Figure 6.10
Zone of Visual Influence
Legend:
Proposed Turbine
1 Turbine Visible
2 Turbines Visible
3 Turbines Visible
Trans Canada Highway
Local Road
Woods Road
Trail
Lake
Wetland
Stream
Contour
Building
Transmission Line
Turbine Model: GE 1.6 82.5
Hub Height: 80 m
Rotor Diameter: 82.5
Rated Power: 1680 kW
Date: Nov 12, 2013
UTM, NAD83, Zone 20
Version 1.0


Six Mile Brook
West River
Green Hill Provincial Park
Alma
Greenhill
Image: 1
Stillman
Hazel Glen
Pleasant Valley
Image: 3
Limerock
Salt Springs Provincial Park
Highway 104
Salt Springs
Image: 2
Lovat
Millbrook
Rocklin
White Hill
New Gairloch
Key Map
Project Location
0
2
4
kilometers
Affinity Renewables Inc.
RMS energy
Limerock Wind Farm
Figure 6.11
Photo Montage Locations
Legend:
Proposed Turbine
Photo Location
Trans Canada Highway
Local Road
Woods Road
Trail
Lake
Wetland
Stream
Contour
Building
Transmission Line
Turbine Model: GE 1.6 82.5
Hub Height: 80 m
Rotor Diameter: 82.5
Rated Power: 1680 kW
Date: Nov 12, 2013
UTM, NAD83, Zone 20
Version 1.0

Affinity Renewables Inc.

RMS Energy

Figure 6.12

Limerock Wind Farm

Visual Simulation 1

As viewed from Highway 104

Image

Easting: 517,477
Northing: 5,045,804
Photograph Date: October 28, 2013
View Angle: 230 Degrees

Turbine

Manufacturer: General Electric
Model: GE 1.6 82.5
Hub Height: 80 m
Rotor Diameter: 82 m
Rated Power: 1680 kW

Coordinate System	UTM, NAD83, Zone 20	November 13, 2013
Analysis By: AL-PRO Wind Energy Consulting Canada Inc.		AL-PRO