ENVIRONMENTAL IMPACT STATEMENT
HERMANVILLE/CLEARSPRING
30 MEGAWATT WIND FARM
HERMANVILLE, PE

FINAL REPORT

Submitted to:

Prince Edward Island Energy Corporation
Charlottetown, PE

Submitted by:

AMEC Environment & Infrastructure,

A Division of AMEC Americas Limited
Fredericton, NB

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TE121023

EXECUTIVE SUMMARY

Prince Edward Island Energy Corporation ("PEIEC") proposes to develop and operate a 30 megawatt (MW) wind farm. The Hermanville/Clearspring 30 MW Wind Farm, hereafter referred to as the "Project", would be located between Clearspring and Hermanville, near the northeastern tip of the province of Prince Edward Island (PEI). The Study Area consists of approximately 4.5 kilometres (km) along Northside Road (Route 16) between New Zealand Road and Souris Line Road; 3 km along New Zealand Road from Northside Road, 2 km along Souris Line Road from Northside Road and 4.4 km along the southern boundary. The Study Area has been used in the past and currently for forestry purposes. The main stem of the proposed transmission line will be located along the eastern boundary of Souris Line Road between Northside Road and Grant Road.

The Study Area has minimal residential development around its perimeter and can meet the Provincial requirements of a setback four (4) times the height of the turbine from any residential development. Along Souris Line Road, the proposed transmission line will run adjacent to six (6) residential properties. Approximately 20 km east of the Project is the East Point Wind Farm which currently operates ten (10) wind turbines and was also developed by PEIEC.

The proposed Project implementation will begin Spring 2013, with operations to begin in late fall 2013. The Project will consist of erecting ten (10) wind turbines, each capable of producing 3 MW for a total nameplate production of 30 MW; a meteorological mast; a buried and/or overhead electrical collector system; single phase power line for the substation, substation; service building, 138 kilovolt (kV) transmission line between the substation and existing T-12 transmission line; as well as access roads to each turbine, substation and service building. Key environmental features identified within the Study Area are watercourses, wetlands, avian fauna (birds and bats) as well as identified floral Species-at-Risk. The operational life of this Project's assets is expected to be twenty-five (25) years, at which time the assets will have to be replaced or decommissioned.

The goal of the Project is to allow PEIEC to fulfil its directive to develop another 30 MW of wind power for domestic consumption by 2013 as stated in the PEI Energy Accord. Direct, measurable benefits of the Project to the Province and Canada will include:

- reduced emissions, thereby contributing to Canada's objective of reducing national total greenhouse gas (GHG) emissions by 17% from 2005 levels by the year 2020;
- enabling the Province to generate approximately 30% of its electricity from renewable power;
- lowered dependence on imports of electricity to the Province;
- more stabilized electricity costs within the Province; and
- economic development benefits to the local area.

This report addresses the environmental effects of the construction, operation and decommissioning project phases. The information reviewed and field studies have shown that no significant adverse residual impacts on the valued environmental components (VECs) are likely.

The generation of electricity from renewable resources such as wind is in accordance with federal and provincial strategies, since it contributes to the reduction of GHG emissions and air pollutants. The Hermanville/Clearspring 30 MW Wind Farm, once approved, would contribute to the reduction of GHG emissions required to meet Canada's and the Province of PEI's targets.

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ACCDC	Atlantic Canada Conservation Data Centre
ACSR	Aluminium conductor steel reinforced
AM	amplitude modulated
ARD	Acid Rock Drainage
ATC	Air Traffic Control
ASU	Archaeological Services Unit, New Brunswick
ATV	All-terrain vehicle
AWEA	American Wind Energy Association
BLM	Bureau of Land Management
CanWEA	Canadian Wind Energy Association
CCME	Canadian Council of Ministers of the Environment
CEAA	*Canadian Environmental Assessment Act*
CLI	Canadian Land Inventory
cm	Centimetres
CO	carbon monoxide
CO_2	Carbon dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRTC	Canadian Radio-television and Telecommunications Commission
CSA	Canadian Standards Association
CSD	Census Subdivisions
CWS	Canadian Wildlife Service
dB	decibels
DBS	Depth Below Surface
DFO	Fisheries and Oceans Canada
DND	Department of National Defence
DUC	Ducks Unlimited Canada
EC	Environment Canada
ECC	Environmental Components of Concern
EEM	environmental effects monitoring
EHJV	Eastern Habitat Joint Venture
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMF	Electric and Magnetic Field
EMP	Environmental Management Plan
EMR	Electromagnetic Radiation
EPA	Elevated Potential Area for Archaeological/Heritage Resources
EPP	Environmental Protection Plan
FM	frequency modulated
GHG	green house gas
GPS	Global Positioning System
GWh/year	Gigawatt hours per year

ha	hectare
HADD	Harmful Alteration, Disruption and Destruction
HRIA	Heritage Resource Impact Assessment
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram
kHz	kilohertz
km	kilometres
km^2	square kilometres
km/h	kilometres per hour
kV	kilovolt
kV/m	kilovolt per metre
kW	kilowatt
kWh	kilowatt-hour
m	metres
m^2	square metres
m^3	cubic metres
m/s	metres per second
MASL	metres above sea level
MBBA	Maritime Breeding Bird Atlas
MBCA	Migratory Birds Convention Act
MCM	thousand circular mils
MCPEI	Mi’kmaq Confederacy of Prince Edward Island
MECL	Maritime Electric Company Limited
mG	milligauss
mg/L	milligrams per litre
mg/m^3	milligrams per cubic metre
mm	millimetres
m/s	metres per second
MSDS	Material Safety Data Sheet
MW	Megawatt
na	Not Applicable
NAAQOs	National Ambient Air Quality Objectives
NAWCC	North American Wetlands Conservation Council
NB	New Brunswick
NBDELG	New Brunswick Department of Environment and Local Government
NGO	Non-Governmental Organizations
NO_x	oxides of nitrogen
NRCan	Natural Resources Canada
NS	Nova Scotia
OMNR	Ontario Ministry of Natural Resources
PEI	Prince Edward Island
PEIAAS	Prince Edward Island Aboriginal Affairs Secretariat

PEICSS	Prince Edward Island Department of Community Services and Seniors
PEIDAF	Prince Edward Island Department of Agriculture and Forestry
PEIDEEF	Prince Edward Island Department of Environment, Energy and Forestry
PEIDELJ	Prince Edward Island Department of Environment, Labour and Justice
PEIDFARD	Prince Edward Island Department of Fisheries, Aquaculture and Rural Development
PEIDFEMA	Prince Edward Island Department of Finance, Energy and Municipal Affairs
PEIDHW	Prince Edward Island Department of Health and Wellness
PEIDTC	Prince Edward Island Department of Tourism and Culture
PEIDTIR	Prince Edward Island Department of Transportation and Infrastructure Renewal
PEIEC	Prince Edward Island Energy Corporation
PID	Property Identification Number
PM	Particulate Mater
POL	Petroleum, Oil, and Lubricants
ppb	parts per billion
RABC	Radio Advisory Board of Canada
RCMP	Royal Canadian Mounted Police
RCS	radar cross section
RF	radio frequency
SARA	Species at Risk Act
SARPR	Species at Risk Public Registry
SO_2	sulphur dioxide
SSEPP	Site-specific Environmental Protection Plan
StatsCan	Statistics Canada
TC	Transport Canada
The Agency	Canadian Environmental Assessment Agency
TSP	Total Suspended Particulates
TV	Television
US	United States
UTM	Universal Transverse Mercator
VEC	Valued Environmental Components
VOCs	Volatile organic compounds
WGA	Washburn, Gillis & Associates
WHMIS	Workplace Hazardous Material Information System
WNS	White Nose Syndrome
WTG	Wind Turbine Generator
WWBZAP	Watercourse, Wetland and Buffer Zone Alteration Permit
YBP	Years Before Present
ug/L	micrograms per litre
$\mu g/m^3$	micrograms per cubic metre
µm	micrometres
µS/cm	micro-siemens per centimetre
°C	degrees Celsius

1.0 PROJECT SUMMARY

1.1 STRUCTURE OF THE DOCUMENT

This report documents the assessment of the environmental effects of the proposed construction, operation and decommissioning of the Hermanville/Clearspring - 30 Megawatt (MW) Wind Farm (the Project). This assessment was conducted in accordance with the requirements of the Prince Edward Island (PEI) *Environmental Protection Act*. To date, the Project has no known triggers under the federal *Canadian Environmental Assessment Act* (CEAA). The report utilizes the PEI Environmental Impact Assessment (EIA) Guidelines.

The report is divided into the following sections:

- Section 1.0 Provides basic information on the Project's proponent, location, schedule and regulatory environment.
- Section 2.0 Provides the need and justification for the Project as well as a description of the Project activities.
- Section 3.0 Describes the scope of the EIA, consultations undertaken as well as the temporal and spatial boundaries.
- Section 4.0 Describes the existing environmental and socio-economic setting of the study area.
- Section 5.0 Describes the impact assessment of all the environmental and socio-economic issues identified as relevant for the proposed Project.
- Section 6.0 Presents a summary of potential environmental impacts and mitigation.
- Section 7.0 Describes the effects of the environment on the project.
- Section 8.0 Presents the assessment of cumulative effects.
- Section 9.0 Conclusion
- Section 10.0 List of Supporting Documents.

1.2 PROJECT PROPONENT AND PREVIOUS DEVELOPMENTS

PEI Energy Corporation (PEIEC) is a Provincial Crown corporation, established in 1978. It is responsible for pursuing and promoting the development of energy systems and the generation, production, transmission of energy, in all its forms, on an economic and efficient basis.

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The first commercial wind farm in Atlantic Canada was commissioned in November, 2001 by PEIEC in North Cape, PEI. The wind farm was a 5.28 MW facility that was doubled in capacity in 2003 due to the huge success of the initial phase of the development. Since that time other wind farms in the province have been commissioned and include projects by private companies, a turbine supplier, a not-for-profit research and development company as well as a municipal electrical utility. More recently, PEIEC developed the East Point Wind Farm. The East Point Wind Farm is a 30 MW wind farm built in Elmira, Kings County and commissioned in 2007 that currently produces approximately 90 million kilowatt-hours (kWh) of emission-free electricity.

1.3 TITLE OF PROJECT

Hermanville/Clearspring – 30 Megawatt Wind Farm.

1.4 PROJECT LOCATION

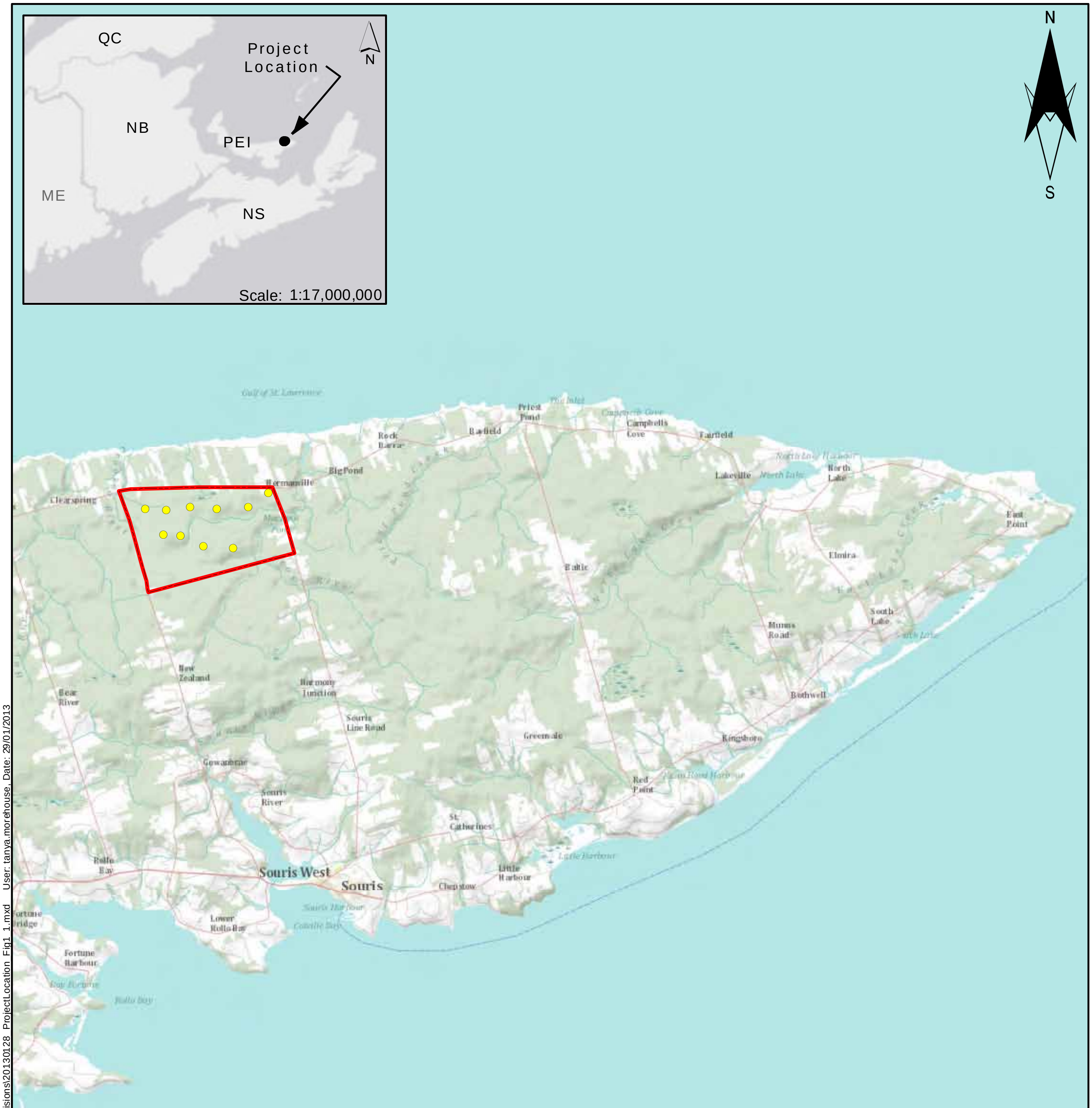
The Project is located on the northeastern tip of the Province of PEI (46.46°N x 62.32°W) between Hermanville and Clearspring, Kings County (Figure 1.1). The location is noted for excellent wind regimes with direct and continuous exposure to the prevailing southwest winds during the summer months and northwest winds in the winter.

Universal Transverse Mercator (UTM) geographical coordinates for the ten turbine locations (T1 – T10) are provided in Table 1.1.

Table 1.1 UTM Geographical Coordinates

Turbine Name	UTM	
	Easting	Northing
T1	551822	5144883
T2	552428	5144850
T3	553133	5144945
T4	553902	5144900
T5	554837	5144944
T6	555417	5145353
T7	552347	5144141
T8	552848	5144106
T9	553510	5143806
T10	554389	5143748

Note: UTM Zone 20, in NAD 83 datum



The map shown here has been created with all due and reasonable care and is strictly for use with AMEC Project Number: TE121023.
This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind.
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CLIENT: PEI ENERGY CORPORATION

PROJECT: HERMANVILLE / CLEARSPRING 30MW WIND FARM

TITLE: PROJECT LOCATION
FIGURE 1.1

AMEC Environment & Infrastructure
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amec

DWN BY: TM	DATUM: NAD 83 CSRS	DATE: January 28, 2013
CHK BY: CL	PROJECTION: UTM ZONE 20	PROJECT No: TE121023
REV NO: N/A	SCALE: 1 : 165,000	FIGURE: 1.1

Legend

SOURCE: ESRI Map Service (World Topo Map)

- Proposed Turbine Locations
- Project Footprint

3,000 1,500 0 3,000
Metres

Path: G:\GIS\PROJECTS\TE121023_PEI_EnergyCorp_EastPtWind\MXD\20130128_Revisions\20130128_ProjectLocation_Fig1_1.mxd User: tanya.morehouse, Date: 29/01/2013

The entire Project footprint represents approximately 20.0 hectares (ha) on the twenty-four (24) properties within the Study Area and forty (40) properties along Souris Line Road for the proposed transmission line. The Study Area is composed of forested land that is predominantly mixed and the general land use is forestry.

1.5 ESTIMATED CAPACITY OF WIND FARM

1.5.1 Nominal Capacity

The Project will be implemented in one stage. This stage will consist of the installation of ten (10) wind turbines (T1, T2, T3, T4, T5, T6, T7, T8, T9, and T10) with a capacity of 3 MW each, generating a total of 30 MW of electrical wind power.

1.5.2 Expected Annual Energy Production

The expected annual energy production of this Project is 114 gigawatt hours per year (GWh/year).

1.6 CONSTRUCTION SCHEDULE

The estimated construction schedule is depicted in Table 1.2.

Table 1.2 Proposed Construction Schedule

30 MW of Wind Power	Date
EIA Completed	January 2013
Geotechnical Engineering Information for Wind Turbine Site	December 2012
Site surveying, Clearing and Grubbing of Project Area	Spring 2013
Access Road Construction	Spring 2013
Wind Turbine Site Earthworks Construction	Spring/Summer 2013
Wind Turbine Erection	Fall 2013
Substation/Service Building Site Earthworks Construction	Summer 2013
Single Phase Power Line/Collector System	Summer/Fall 2013
Transmission System	Summer/Fall 2013
Commissioning of Wind Turbines and Substation	Late Fall 2013

1.7 AGENCIES INVOLVED IN ENVIRONMENTAL ASSESSMENT

The Project will be carried out on several parcels of land between Clearspring and Hermanville of Kings County, PEI. Seventeen (17) parcels are Provincially-owned Crown land and the remainder are under private ownership. There are no federal lands being used for the Project.

1.7.1 Municipal Agency Involvement in the Project

There are no municipal permits required for the Project as the location is not within any municipal boundaries.

1.7.2 Provincial Agency Involvement in the Project

An approval under the PEI EIA Regulations for wind power generation is required for the Project as stipulated under Section 9 of the PEI *Environmental Protection Act*. The PEI Department of Environment, Labour and Justice (PEIDELJ) has the mandate to oversee the Provincial EIA Approval process. In addition, the Project may require Watercourse, Wetland and Buffer Zone Activity Permits (WWBZAP) during the construction phase.

The Project must also comply with requirements under the Subdivision and Development Regulations of the *Planning Act* for setbacks from habitable buildings and other structures.

1.7.3 Federal Agency Involvement in the Project

The Project does not have a known designated physical activity under the federal *Canadian Environmental Assessment Act,* 2012.

1.8 REGULATORY FRAMEWORK

The construction, operation, and maintenance of the Project will be undertaken in accordance with all applicable legislation, regulatory approvals, and relevant guidelines.

1.8.1 Regulations and Statutes Involved in Assessing the Project

Table 1.3 provides a list of environmental legislation, approvals, and guidelines that may be applicable to the proposed Project.

1.9 AUTHOR OF ENVIRONMENTAL IMPACT STATEMENT

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Table 1.3 Environmental Legislation and Guidelines which may be Applicable to the Proposed Project

Acts/Regulations/Guidelines	Section/Regulations	Requirement	Department or Agency
1. Provincial Acts and Regulations			
Archaeology Act	S. 7(1)	Permit required to conduct an archaeological investigation.	PEI Department of Health and Wellness (PEIDHW)
	Archaeology Regulations	Designation of archaeological site. Application for work permit.	
Electrical Inspection Act	S. 2	Canadian Electrical Code standards	PEIDELJ
	General Regulations	Licensing of installations Permit to Supply Energy	
	Canadian Electrical Code Regulations	Compliance with Regulations	
Energy Corporation Act	General	Objectives and powers	PEI Department of Finance, Energy and Municipal Affairs (PEIDFEMA)
Environmental Protection Act	S. 9-11	Approval of EIA Watercourses, Buffer Zones, Forested Buffer Zones	PEIDELJ
	Air Quality Regulations	Schedule A: Ambient Air Contaminant Ground Level Concentration Standards	
	Environmental Impact Assessment Fees Regulations	Requirement for EIA and fees	
	Excavation Pits Regulations	Permit required for excavation	
	Sewage Disposal Systems Regulations	Permit required for construction	
	Watercourse and Wetland Buffer Zone Activity Regulations	Required permits	
Fire Prevention Act	S.31	Control of fires during forest clearing	PEIDELJ
Highway Traffic Act		Special permit required if vehicle configuration not authorized	PEI Department of Transportation and Infrastructure Renewal (PEIDTIR)
Occupational Health and Safety Act	General Regulations	General	PEI Public Service Commission
	Fall Protection Regulations	Fall Arrest System	
	Scaffolding Regulations	If utilized	
	Workplace Hazardous Materials Information System Regulations	General	

Table 1.3 Environmental Legislation and Guidelines which may be Applicable to the Proposed Project

Acts/Regulations/Guidelines	Section/Regulations	Requirement	Department or Agency
Planning Act	Provincial Planning	Permit required for construction	PEIDFEMA
	S. 54.1	Minimum setback distance of at least four times the height of the turbine from the nearest habitable residence	
Roads Act	S. 4.1 Section 46	Granting of Easements along Public Roads Overweight Vehicle Permit	PEIDTIR
	Highway Access Regulations	Entrance way Permit	
	Public Utility Easement (Fees) Regulations	Easement Fees	
Wildlife Conservation Act	S. 7	Endangered, Threatened, and Species of Special Concern	PEI Department of Agriculture and Forestry (PEIDAF)
2. Provincial Policies and Guidelines			
PEI Wetland Conservation Policy	General	Compliance to "No Net Loss" of wetlands or wetland function through avoidance, minimization or compensation	PEIDAF
PEI Watercourse and Wetland Alteration Guidelines	General	Permit required for all alterations made within 10 metres (m) of any watercourse or wetland boundary	PEIDELJ
PEI Environmental Impact Assessment Guidelines		To adhere to the PEI EIA review process	PEIDELJ
3. Federal Statutes			
Canadian Environmental Assessment Act, 2012	4.1(b)	Ensure that designated projects are considered in a careful and precautionary manner to avoid significant adverse environmental effects.	Canadian Environmental Assessment Agency (the Agency)
	5.1(a)	Applies to any change that may be caused to fish, aquatic species as defined in the *Species at Risk Act* and migratory birds.	the Agency
Federal Policy on Wetlands Conservation		No net loss of wetland function.	Environment Canada (EC)
Canadian Environmental Protection Act	56.1	Requirement for pollution prevention plans.	EC and Health Canada
	95.1	Requirement for the reporting and implementation of remedial measures associated with the release of toxic substances.	EC and Health Canada

Table 1.3 Environmental Legislation and Guidelines which may be Applicable to the Proposed Project

Acts/Regulations/Guidelines	Section/Regulations	Requirement	Department or Agency
	185.1	Controls the movement of hazardous waste or hazardous recyclable material, or prescribed non-hazardous waste for final disposal.	EC and Health Canada
	186.1	Requirement that wastes are not to be abandoned during transit.	EC and Health Canada
	199.1	Requirement for an environmental emergency plan with respect to controlled substances.	EC and Health Canada
Fisheries Act	S.32	Prohibition of destruction of commercial fish except as authorized.	Fisheries and Oceans Canada (DFO)
	S.35	Prohibition of work or undertaking that causes Harmful Alteration, Disruption or Destruction (HADD) of fisheries habitat unless authorized.	DFO
	S. 36	Prohibition of deposit of a deleterious substance into waters frequented by fish.	EC (on behalf of DFO)
	S.37(1)	Requires submission of Plans to DFO.	DFO
Migratory Birds Convention Act (MBCA)	S. 6	Prohibits activities that will result in negative effects on migratory birds (listed under the MBCA) or their eggs, nests and young.	EC
	S 5.1	Prohibition of deposit of a deleterious substance into migratory bird habitat.	EC
Species-At-Risk Act (SARA)		Prohibits activities that will result in negative effects on Species-at-Risk (listed in Schedule 1 of SARA) or their Critical Habitat (as identified in a species Recovery Plan).	EC
Navigable Waters Protection Act	S.5(2)	Minister determination that work does not interfere with navigation (exemption).	Minister of Transport/Coast Guard
	S.5(1)	Approval required for construction of work in Navigable Water if work will interfere with navigation.	Minister of Transport/Coast Guard
Minor Works and Waters Order under the *Navigable Waters Protection Act* (Section 13)	S.5 S.10 S.11	In the context of this Project, a Navigable Waters Permit is not necessary for works classified as Aerial Cables – Power and Communication (S.5); Temporary Works (S.10) or in Minor Navigable Waters (S.11).	Minister of Transport/Coast Guard
Aeronautics Act	Aviation Regulations	Approval by Transport Canada (TC) for aeronautical obstruction clearance.	TC

Table 1.3 Environmental Legislation and Guidelines which may be Applicable to the Proposed Project

Acts/Regulations/Guidelines	Section/Regulations	Requirement	Department or Agency
4. Federal Guidelines and Standards			
Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms under the Canadian Environmental Assessment Act			EC
Wind Turbines and Birds – A Guidance Document for Environmental Assessment	General		Canadian Wildlife Service (CWS) - EC
Technical Information and Guidelines on the Assessment of the Potential Impact of Wind Turbines on Radiocommunication, Radar and Seismoacoustic Systems			Radio Advisory Board of Canada (RABC) and the Canadian Wind Energy Association (CanWEA)
Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds	General		CWS – EC
Minor Waters User Guide 2010		Details under what conditions a watercourse can be deemed a Minor Navigable Water and be exempt from the *Navigable Waters Protection Act* application process.	Minister of Transport/Coast Guard
Responsible Authority's Guide		Ensure environmental consideration incorporated into planning process (federal, money, lands, or jurisdiction).	The Agency
Canadian Environmental Protection Act	Canada-Wide Standards	Canada – Wide Standards for Particulate Matter (PM) and Ozone, Canadian Council of Ministers of the Environment (CCME), June 2000;	Health Canada
	National Ambient Air Quality Objectives (NAAQOs)		National Advisory Committee Working Group on Air Quality Objectives and Guidelines

2.0 PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

2.1.1 National and Regional Political Considerations

Due to continued and increased reliance on fossil fuels in Canada and around the world there is growing economic and environmental concern with regard to a continued and increasing reliance on fossil fuels. Economically, in the last 10 years, the price of a barrel of oil has risen from under $25 to over $140 at its peak in 2008. Environmentally, Canada is one of the highest producers, contributing about 2% per capita of the global total of greenhouse gas (GHG) emissions of which approximately 80% are predominantly associated with the production or consumption of fossil fuels for energy purposes (EC, 2012a). Combustion of fossil fuels generates harmful pollutants such as sulphur dioxide (SO_2), oxides of nitrogen (NO_x), mercury, volatile organic compounds (VOCs) as well as GHG emissions. These contribute to climate change and directly impact human and environmental health.

To address these concerns, the Canadian Government is committed to reducing Canada's total GHG emissions by 17% from 2005 levels by 2020, and that 90% of Canada's electricity be provided by non-emitting sources. In order to achieve this target, the Canadian Government has, and continues to, implement measures to increase the share of renewable energy in the overall energy mix and to promote, as well as accelerate, technology development and deployment. Since 2008, Canada has spent and committed, at both federal and provincial levels, approximately $11 billion to support clean energy and technology investments. At the Copenhagen Conference on Climate Change, Canada worked with other Parties towards the development of the Copenhagen Accord - an agreement that marked a significant breakthrough in the global effort to address climate change. Canada plans to implement the strategies of the Copenhagen Accord and to complete the negotiations with the United Nations Framework Convention on Climate Change for a comprehensive, legally binding post-2012 agreement (Government of Canada, 2010a).

Coinciding with the National abatement efforts, the Province of PEI has taken and continues to take steps to reduce emissions through the development of large and small-scale renewable energy programs, energy efficiency strategies and partnerships, as well as improvements to agricultural, forestry and waste management practices. As of 2008, PEI's GHG emissions were 1% below 1990 levels (PEI Department of Environment, Energy and Forestry (PEIDEEF), 2011). This is in part a result of investments in wind energy. In the fall of 2004, the Province of PEI legislated the *Renewable Energy Act*. This Act requires all electric utilities to have at least 15% of their electrical energy requirements be supplied from renewable energy sources by 2010. As a follow-up to this Act, in November, 2010, the Provincial Government released the PEI Energy Accord which came into effect on March 1st, 2011. One of the major components of the Accord was to enable the Province to generate 30% of its electrical power from renewable energy by 2013. The overall goals of the Energy Accord are to lower electricity rates; stabilize electricity rates and increase PEI's reliance on locally-owned wind power.

2.2 PURPOSE OF PROJECT

2.2.1 Justification for the Project

PEI is a world leader in producing renewable electricity from wind power, with the PEIEC at the forefront of this development. As part of the Energy Accord, the PEIEC was given the directive to develop another 30 MW of wind power to enable the Province to generate 30% of its electrical power from renewable energy by 2013.

The purpose of the Project is to allow the PEIEC to achieve its mandate as part of the Energy Accord.

2.2.2 Project Objectives

Direct, measurable benefits of the Project to Canada, the Province and region will include:

- reduced emissions, thereby contributing to Canada's objective of reducing national total GHG emissions by 17% from 2005 levels by the year 2020;
- compliance with PEI's *Renewable Energy Act*;
- enabling the Province to reach its goal of generating 30% of its electrical power from renewable energy by 2013 as per the PEI Energy Accord;
- lowered dependence on imports of electricity to the Province;
- more stabilized electricity costs within the Province; and
- economic development benefits to the local area.

2.3 ALTERNATIVES TO THE PROJECT

Two alternatives to the Project have been considered. The alternatives are:

- no action; and
- expansion of the East Point Wind Farm facility.

The "no action" option is not acceptable to PEIEC. As a Provincial entity PEIEC is mandated as part the PEI Energy Accord to develop another 30 MW of wind power for domestic consumption to enable the Province to generate 30% of its electrical power from renewable energy by 2013.

The expansion of the East Point Wind Farm facility was initially the preferred option of PEIEC. PEIEC has collected wind data from various sites across the Province and the results indicated that the most attractive site was the expansion of this existing facility located in Elmira, PEI. However, the proposed expansion of the existing facility was rejected by the Eastern Kings Community Council in April 2012 (The Guardian, 2012). Consequently, the present location at Hermanville/Clearspring, PEI, which is located approximately 20 kilometres (km) to the west of the East Point Wind Farm, has been proposed.

2.4 SUMMARY OF PROJECT

The Project will consist of erecting ten (10) wind turbines, each capable of producing 3 MW for a total nameplate production of 30 MW; a meteorological mast; a buried and/or overhead electrical collector system; substation; service building, 138 kilovolt (kV) transmission line between the substation and existing transmission line; as well as access roads to each turbine and substation.

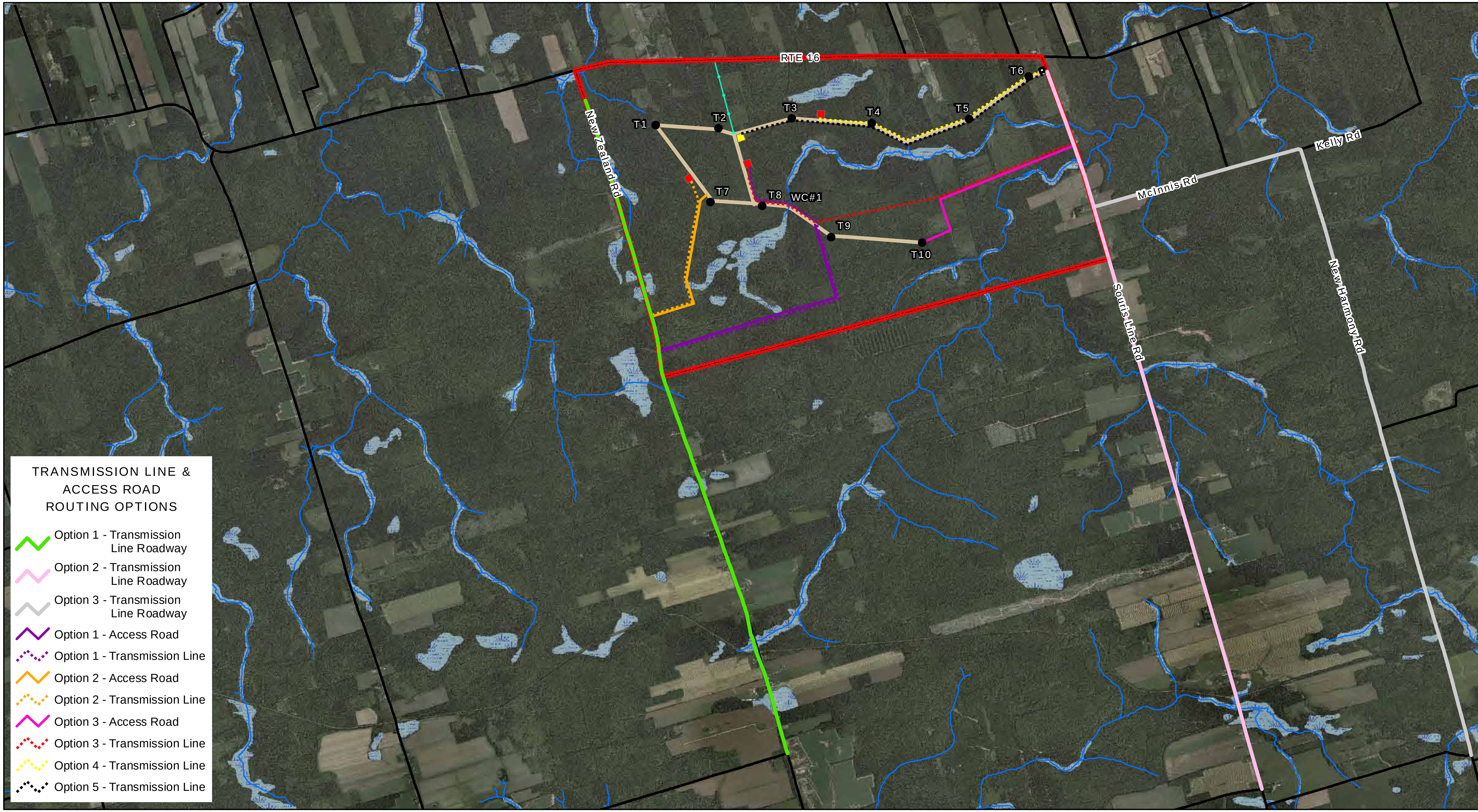
Initially three options for the location of the substation and access road to the turbine maintenance road as well as five options for the location of transmission line within the Study Area were under consideration. In addition, there were three options for the location of the transmission line leading from the Study Area to the existing T-12 transmission line, which is designed and constructed to 138 kV standards, stemming from the East Point Wind Farm (Figure 2.1). It should be noted that early in the routing selection of the transmission line, a route along New Harmony/Kelly Road was looked into (Option 3) but due to environmental and economical constraints due to the amount of tree trimming that would be required, this option was rejected. Based on the results of the environmental field surveys, in addition to social and economic considerations, Option 3 for the location of the substation and Option 5 for the location of the transmission line within the Study Area were selected as well as Option 2 along the Souris Line Road for the main stem of the transmission line.

Underground collector cables with three conductors and/or overhead 15 kV collector cables will connect each turbine to the on-site substation. At the wind farm's substation, power will be stepped up to 138 kV and then transported via a 10.0 km 138 kV transmission line to a connection point on the existing T-12 transmission line (which will now be designated as Y-104), the connection point being approximately 6.0 km to the south of the Study Area. T-12 is currently operated at 69 kV but will be converted to 138 kV operation in mid-2013. The line used to connect the substation to the existing power line will be 477 Hawk aluminum conductor steel reinforced cables (ACSR) overhead; the same as the existing power line T-12.

In order to provide back-up power to the substation, a 12.5kV single phase power line will also be constructed and operated as part of the Project. This power line will connect the substation to an existing three phase 12.5kV distribution power line located along Northside Road (Route 16). The single phase 12.5kV power line will be constructed adjacent to an existing woods road and will measure approximately 700 m in length. It is expected to require the installation of 10 to 12 wooden electrical poles that are approximately 12 m high.

Approximately 7.0 km of new, private access roads will be constructed in order to gain access to turbine locations T1 to T10 as well as the substation and service building. The Project will be accessed via two improved/constructed roads stemming from the Souris Line Road.

The scope of the Project includes the construction, operation, and decommissioning of the proposed wind farm, including associated components and activities such as: access roads, turbine transportation and assembly, collector system installation, substation and service building construction, as well as transmission line installation.



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Turbine
Optional Substation Location
Substation
Service Building
Substation Power Line
Roads
Watercourse
Turbine Maintenance Road
Provincial Wetland
Project Footprint

N
S
500 250 0 500
Metres

CLIENT: PEI ENERGY CORPORATION	AMEC Environment & Infrastructure A Division of AMEC Americas Ltd. 495 Prospect St, Suite 1 Fredericton, N.B., E3B 9M4 (P) 506-458-1000		
PROJECT: HERMANVILLE / CLEARSPRING 30MW WIND FARM	DWN BY: TM	DATUM: UTM Zone 20	DATE: January, 2013
	CHK BY: CL	PROJECTION: NAD83	PROJECT No: TE121023
TITLE: PROJECT ROUTING OPTIONS	REV NO: N/A	SCALE: 1 : 35,000	FIGURE: 2.1

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2.5 LOCATION OF PROJECT

The site selected for the Project is located between Clearspring and Hermanville, on the northeastern tip of the Province of PEI, in Kings county (46.46°N x 62.32°W) (Figure 1.1). The site is located near the shore of the Atlantic Ocean and is noted for excellent wind regimes with direct and continuous exposure to the prevailing southwest winds during the summer months and northwest winds in the winter.

The Study Area consists of approximately 4.5 km along Northside Road (Route 16) between New Zealand Road and Souris Line Road; 3 km along New Zealand Road from Northside Road; 2 km along Souris Line Road from Northside Road and 4.4 km along the southern boundary.

The main portion of the proposed transmission line will be located along the eastern boundary of Souris Line Road between Northside Road and Grant Road. The Project located within the Study Area and adjacent to Souris Line Road will occupy a total footprint of approximately 14.0 ha spread across several properties, seventeen (17) of which are provincially owned.

The Project is located approximately 2.0 km inland with an elevation varying from 24 to 51 m. Within the Study Area, the habitat is predominantly forested with a few wetland areas and one main watercourse crossing from west to east. Along Souris Line Road, the proposed transmission line would cross five (5) watercourses and two (2) wetlands. The Project located within the Study Area has minimal residential development around its perimeter and can meet the provincial requirements of a setback four times the height of the turbine from any habitable buildings and other structures. Along Souris Line Road the transmission line could be located within 30 m from residential buildings. There are six (6) residential properties on the Souris Line Road along the proposed route.

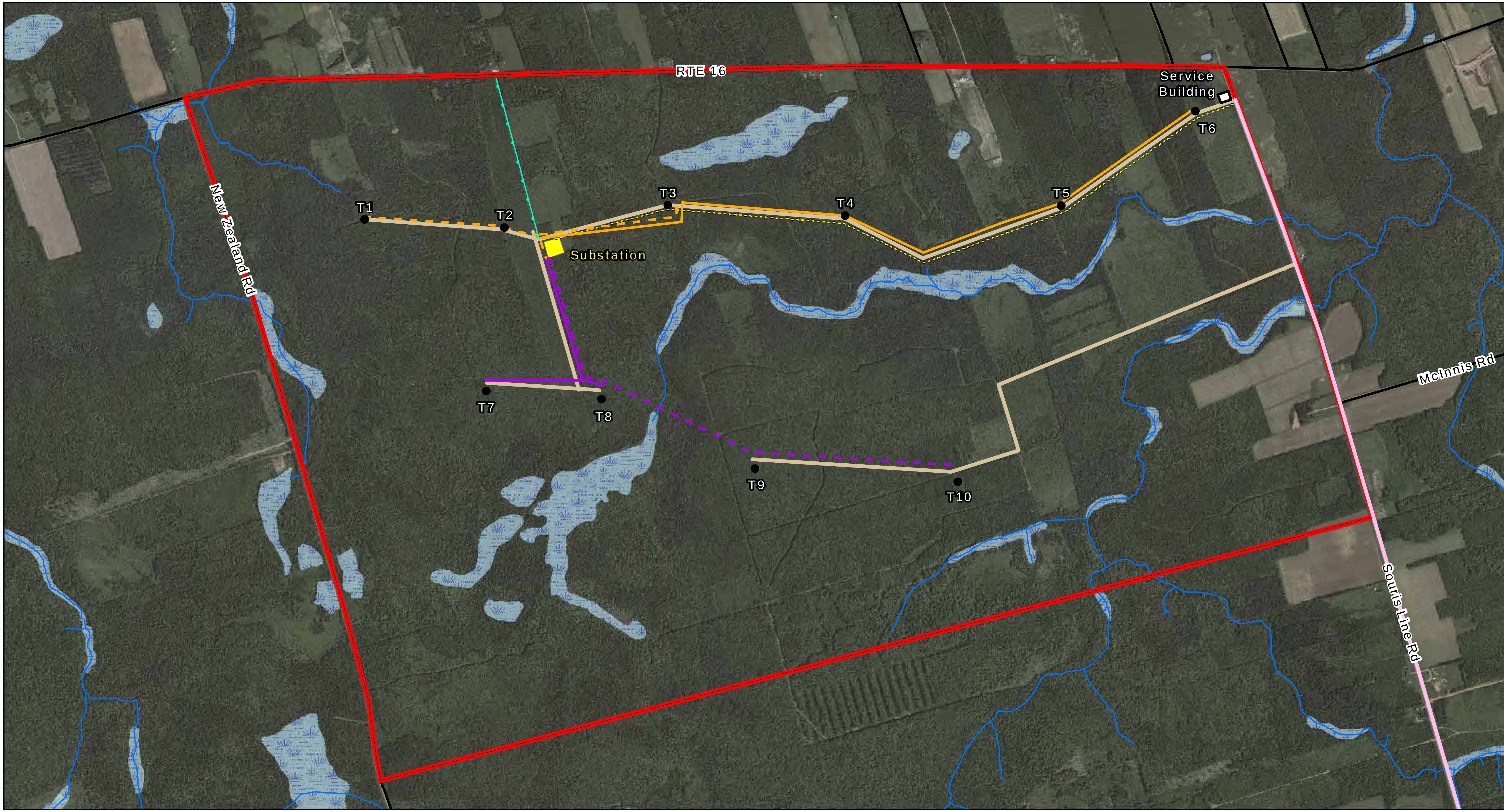
2.5.1 Site Layout

Figure 2.2 presents an overhead aerial photo showing the detailed location of all Project components and activities. These include turbine locations, connection cables, access roads, substation, service building, transmission lines and property delineations.

2.5.2 Land Ownership

The Project will be implemented on several parcels of land between Clearspring and Hermanville, Kings County, PEI. Seventeen (17) parcels are provincially owned Crown land with the remainder of the parcels of land under private ownership. Table 2.1 identifies the properties by Property Identification Number (PID) and tenure category.

Access to, and permission to use, all properties that carry Project components (turbines, access road, substation, service building, power lines, etc.) will be obtained from the respective owners prior to commencement of Project activities.



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PROJECT: HERMANVILLE / CLEARSPRING 30MW WIND FARM	DWN BY: TM	DATUM: UTM Zone 20	DATE: January, 2013		
TITLE: FINAL PROPOSED PROJECT FOOTPRINT	CHK BY: CL	PROJECTION: NAD83	PROJECT No: TE121023		
	REV NO: N/A	SCALE: 1 : 16,000	FIGURE: 2.2		

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- Turbine
- Substation
- Service Building
- Project Footprint
- Substation Power Line
- Transmission Line
- Turbine Maintenance Road
- Option 2 - Transmission Line Roadway
- Roads
- Watercourse
- Provincial Wetland

Collector Lines

- NE
- NW
- SE
- SW

N S

500 250 0 500 Metres

Table 2.1 Property Identification Numbers and Tenure within Project Footprint

PID	Tenure
114058	Private
113845	PEI
727313	Private
707117	Private
682781	Private
113696	Private
551044	PEI
114041	PEI
583377	PEI
114330	Private
148791	PEI
450593	PEI
114389	PEI
463406	Private
114421	Private
114439	PEI
114488	PEI
114470	PEI
525584	Private
114504	PEI
114454	PEI
114520	PEI
114447	Private
114496	PEI
114082	Private
1018241	Private
823708	Private
106005	Private
106013	Private
106021	Private
106047	Private
105882	Private
105874	Private
105809	Private
105825	Private
105866	PEI
105858	Private
432062	Private
106088	Private
105833	Private
711291	Private
718825	Private
105676	Private
105627	Private
105635	Private
105593	Private
552117	Private
105585	Private
105569	Private
803296	Private
105304	Private
105312	Private

PID	Tenure
1042951	Private
541557	PEI
105239	PEI
105247	Private
417469	Private
540039	Private
105288	Private
823666	Private
799767	Private
799742	Private
638676	Private
541813	Private

2.5.3 Key Environmental and Cultural Features

There are a few environmental and cultural features in the general area of the Project that could potentially be affected by the Project. These are presented in Figure 2.3 showing the geographical context of the site.

These include:

- Environmental Features
  - Avian fauna (birds and bats)
  - Watercourse
  - Wetland
  - Species-at-Risk Habitat
- Land Use Features
  - Forestry
  - Residential properties
  - Heritage Sites

2.6 DETAILED PROJECT ACTIVITIES

Figure 2.2 depicts the infrastructure locations within the Project Area upon completion of the Project.

2.6.1 Planning Phase

2.6.1.1 Surveying Activities

In order to optimize Project layout several surveys need to be conducted. These include a meteorological survey, environmental surveys, geotechnical surveys and land surveys.

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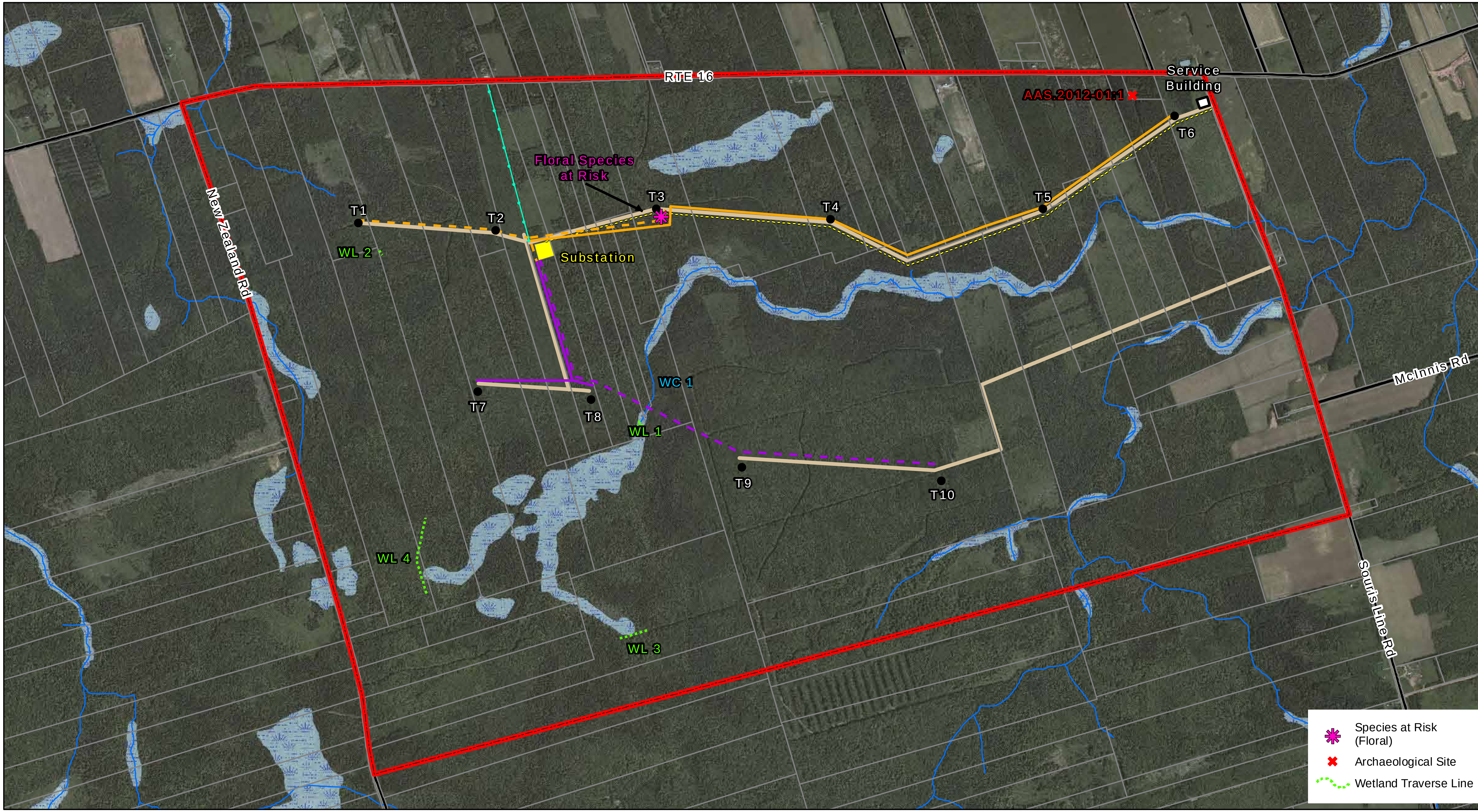

CLIENT: PEI ENERGY CORPORATION	AMEC Environment & Infrastructure A Division of AMEC Americas Ltd. 495 Prospect St, Suite 1 Fredericton, N.B., E3B 9M4 (P) 506-458-1000 amec	
PROJECT: HERMANVILLE / CLEARSPRING 30MW WIND FARM	DWN BY: TM	DATUM: UTM Zone 20	DATE: January, 2013
	CHK BY: CL	PROJECTION: NAD83	PROJECT No: TE121023
TITLE: KEY ENVIRONMENTAL & CULTURAL FEATURES	REV NO: N/A	SCALE: 1 : 16,000	FIGURE: 2.3

Turbine
Substation
Service Building
Project Footprint
Roads
Transmission Line
Substation Power Line
Turbine Maintenance Road
Watercourse
Provincial Wetland
Property Boundaries

Collector Lines
NE
NW
SE
SW

N

200 100 0 200 Metres

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Meteorological Survey

The purpose of a meteorological survey is to determine exact wind conditions. Prior to the construction of a wind farm, measurement towers (met towers or met masts) are erected. These masts are typically mounted with anemometers at a range of heights up to the hub height of the proposed wind turbines which log the wind speed data at frequent intervals (e.g. every ten minutes) for at least one year; preferably two or more. The data collected then allows the developer to determine if the site is economically viable for a wind farm, and to choose wind turbines optimized for the local wind speed distribution.

The number of measurement towers implemented depends on the size of the project. In this situation, only one mast was erected. The location of the tower was placed adjacent to an existing woods road. An area of approximately 100 square metres (m^2) was cleared to allow erection of the tower and placement of guy wires.

The meteorological mast was installed and commissioned on July 18, 2012. It measures 82.7 m in height and is constructed of an open, triangular, steel lattice tower which is guyed. Instrumentation was mounted at heights of 2, 40, 60, 80 and 82.7 m. Directional vanes were mounted at the 40 and 80 m heights and temperature sensors were mounted at 2 and 82 m levels with a barometric pressure sensor also mounted at the 2 m level. All instrument mounting follows recommended best practices set forth by the International Electrotechnical Commission (IEC) 61400-12 standard. A data logger was mounted near ground level and is equipped with a cellular data transmission device which transmits recorded data to an email account on a daily basis. The tower is strategically located between proposed turbines T2 and T3 to assist with survey activities (Figure 2.2). The tower is considered to be a mobile unit and will be decommissioned after two years of service.

Environmental Surveys

In order to fully understand the environmental constraints of a Project, several environmental surveys are conducted. These include:

- Walkthrough
- Bird surveys
- Bat surveys
- Vegetation survey
- Wetland survey
- Fish habitat survey
- Fish survey
- Archaeological survey

Please note that flora and fauna species at risk surveys were integrated in the vegetation, bird, bat, and fish surveys. These surveys were carried out by the following personnel over the periods indicated in Table 2.2.

For more information regarding the methodology as well as results of these surveys please refer to Section 4.0 Existing Environment.

The results of these surveys allow optimization of the layout of the Project by minimizing impacts to Valued Environmental Components (VECs) through avoidance where possible. In addition, they provide the Proponent with information regarding the necessary mitigation measures.

Table 2.2 Surveys Conducted, Personnel Qualifications and Survey Periods

Survey	Personnel and Qualifications	Survey Period
Wetlands	Christina LaFlamme, M.Sc. Garrett Bell, CET	August 27th and 30th, 2012 September 13th and 14th, 2012
Vegetation	Christina LaFlamme, M.Sc. Garrett Bell, CET	August 27th and 30th, 2012 September 13th and 14th, 2012
Fish and Fish Habitat Survey	Garrett Bell, CET Morley Pinsent, M.Sc.	October 5th, 2012
Avian Species Inventory and Behaviour Assessment	Cathleen MacCormack, Env. Tech.	Spring: April, May and June Breeding: June, July Fall: July, August, September, October and November Winter: November through March
Bat Species Inventory	Morley Pinsent, M.Sc. Cathleen MacCormack, Env. Tech.	August to October 2012
Heritage & Archaeological Resources	Darcy Dignam, B.A., M.A., RPA	September 10th to 13th, 2012 October 15th to 20th, 2012

Geotechnical Survey

During the planning phase, a geotechnical survey is conducted to assess the general subsurface conditions by looking at the physical characteristics of soil and bedrock. The purpose of geotechnical investigations is to determine engineering recommendations for designing the earthworks and foundations for structures in order to prevent human and material damage due to earthquakes, foundation cracks and other catastrophes.

The survey generally consists of standard field tests and laboratory analysis. Standard field tests include drilling, coring and test pits as well as electrical resistivity testing. Test locations are typically accessed using track-mounted drill rigs and boreholes, drilled to varying depths using a combination of auger drilling and rock coring. Test pits are small excavated areas, dug until bedrock is hit. The track mounted-rigs typically require a cleared 6 m wide swath to allow for access and require an additional 6.5 m^2 of cleared land for the temporary work area. All drilled boreholes and excavated test pits are backfilled with soil cuttings and sealed at the ground surface. Standpipe piezometers are typically installed afterwards to allow subsequent measurement of groundwater levels at the site.

The electrical resistivity test requires four probes to be placed into the soil and then measured using a soil resistance meter. Several tests are conducted with different spacings between the probes to determine soil electrical resistance, which is a critical factor when designing the electrical grounding system.

Core samples taken during field test are sent to the laboratory for analysis. Laboratory analysis consists of determining the physical characteristics (density, plasticity, grain size distribution, and natural water content) of soil and bedrock as well as test soil corrosivity and sulphate content.

A pre-construction geotechnical survey led by a geological engineer will also be carried out prior to construction and final turbine tower foundation design.

Land Survey

During the planning phase, land surveys are conducted to identify the exact location of the Project footprint as well as boundaries of properties located within the Study Area. This is necessary to ensure that the Project footprint is where it needs to be and that no element of the Project footprint impacts properties that have not signed an agreement with the Proponent. Land surveys consist of placing markers at the corners or along the lines of parcels and the Project footprint. These markers are often in the form of iron rods in the ground. Cleared site lines in wooded areas are generally 1.5 m wide.

2.6.2 Construction Phase

The construction component of the Project will begin in the spring of 2013. Work through the spring will primarily involve final site surveying, clearing and grubbing as possible subject to weather conditions. Final engineering and design will take place during the winter of 2012/2013. Major construction will begin in late spring 2013 and carry on to completion in late fall 2013.

The construction process will be:

- Road and access construction and upgrades (existing woods road, widening, reinforcement and strengthening as required).
- Turbine site (10) development. Establishment of crane pad, lay-down areas and turbine foundations.
- Substation and service building construction to take place concurrently with the above two steps.
- Placement of single phase line for substation, collector lines from turbines to substation, and transmission line from substation to existing T-12 transmission line.
- Erection of towers and placement of turbines.
- Installation of new transmission line connection.

- Testing, connection and integration with grid.
- Removal of all temporary works and restoration of site.

All electrical installations and materials will be in compliance with the Province of PEI's *Electrical Inspection Act* and the Canadian Electrical Code.

All construction activities outlined below will be addressed in the Project Environmental Protection Plan (EPP), a draft of which is provided in Appendix A. Site-specific EPPs (SSEPPs) will be developed for each turbine construction site.

2.6.2.1 Site Preparation

The first physical construction activities to be undertaken will involve clearing; grubbing and compacting access roads, power cable alignments, the substation, service building, turbine foundation sites and any temporary work areas.

2.6.2.2 New and Existing Access Roads

All access roads and underground/overhead cables will be located so as to minimize their impact on the environment. All-season, unpaved access roads will be required to access each turbine location and the substation from existing public roads during the construction, operation and decommissioning phases of the Project. The Souris Line Road will be the main road utilized to access the Project. Access roads will be approximately 6 m wide with a 1 m shoulder on each side, with a right-of-way width of 20 to 30 m depending on the utility requirements (Figure 2.4).

The single phase line for substation and the collector lines from the turbines to the substation will either be buried and/or overhead. The transmission line will be overhead. Within the Study Area there is one watercourse to be crossed with a collector line. Along Souris Line Road there are five (5) watercourses and two (2) wetlands that may be spanned, depending on the final line design. If pole placements are required in wetlands, untreated poles (wood, fibreglass or steel) will be used. In addition, ditching and cross drainage will likely be required.

The following steps are involved in the construction of access roads:

- Tree clearing will be conducted by qualified contractors. Merchantable timber will be salvaged. All non-merchantable fiber will be mulched and spread on-site.
- Land will be grubbed by a qualified contractor using typical construction equipment such as excavators, bulldozers and trucks.
- Borrow material will be used to build the roads to grade.
- The road surface will be compacted to provide a smooth, erosion-resistant, safe surface.
- Leftover grubbed material will be used to restore borrow pits.

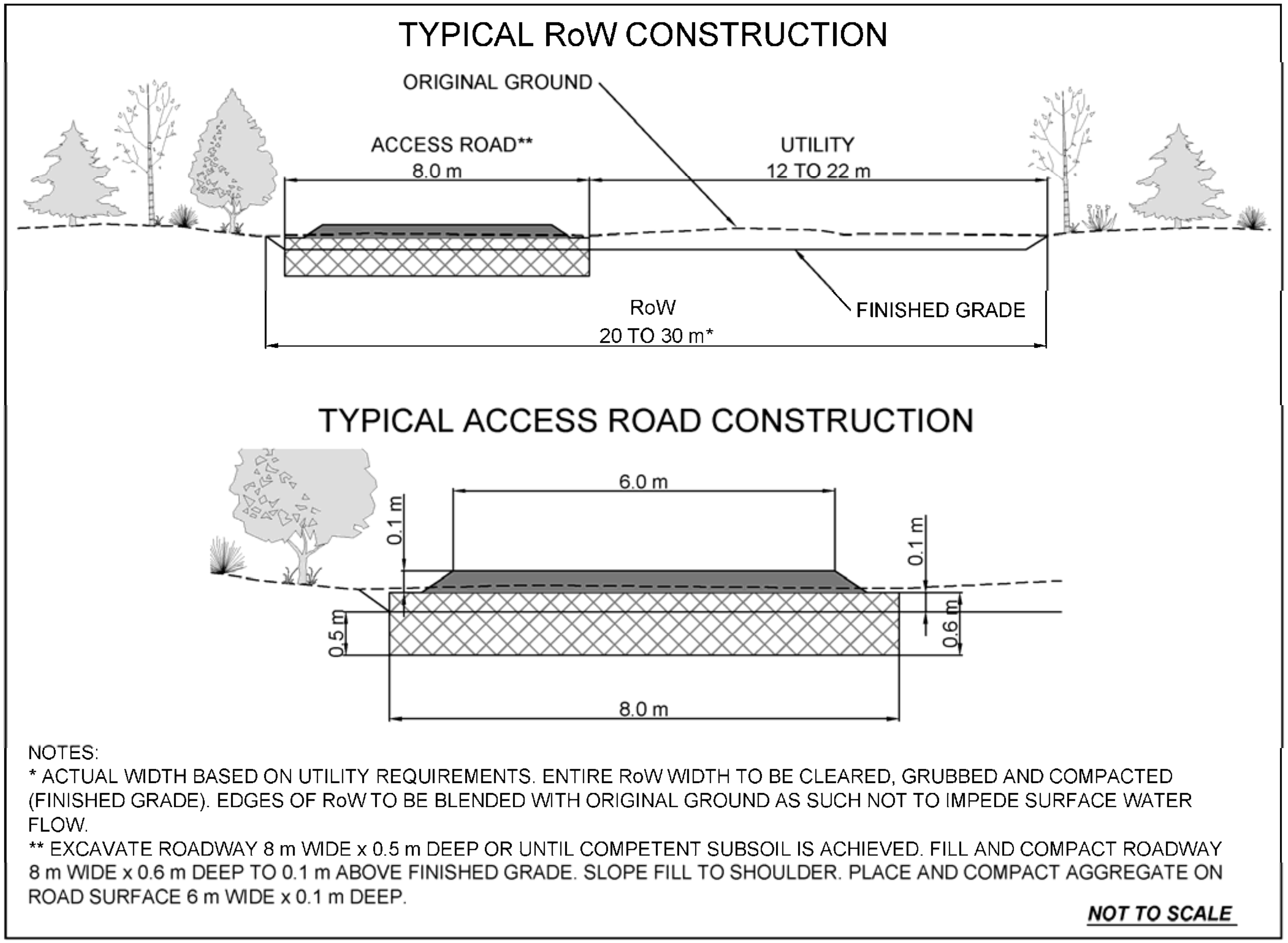

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Figure 2.4 Typical Access Right-of-Way and Road Construction

In order to service the turbine locations shown in Figure 2.2, approximately 6.0 km of new roads will need to be constructed and 1.4 km of existing roads and trails upgraded to accommodate heavy equipment to be used during turbine installation and operations.

All road surfaces will be approximately 6 m wide in order to enable equipment and support vehicles to access the sites. These roads will require approximately 20 to 30 m to be cleared, grubbed and compacted depending on the utility requirements. Where necessary, prior to any site work within 10 m of a watercourse and/or wetland, a Watercourse, Wetland and Buffer Zone Alteration Permit (WWBZAP) will be obtained.

It is estimated that road requirements will result in a removal of approximately 13.5 ha of forest production.

2.6.2.3 Delivery of Equipment

Turbine parts will be delivered by specialized, heavy transport trailer trucks, and a heavy lifting crane will be brought in to erect the turbines. All turbine parts and the machinery will be delivered using public roadways from either the Port of Georgetown or the Port of Souris. As a result of previous wind turbine development in eastern PEI, systems and processes have been developed to accommodate movement of these components.

It will be the responsibility of the turbine supplier to schedule, deliver and obtain appropriate transportation and safety permits as per the Province's *Highway Traffic Act*.

2.6.2.4 Wind Turbine Assembly

At each turbine location a lay-down area for blades will be constructed in addition to an assembly location for tower components. A reinforced crane pad will also be built adjacent to each turbine site. Figure 2.5 shows a typical site clearing and lay-down area configuration for the installation of the 3 MW turbines. Figure 2.6 illustrates typical reinforced crane pad designs.

Based on the proposed locations of the turbines, it is recognized by the Proponent that this typical installation may require site-specific modifications to accommodate possible environmental constraints.

Crane Pads, Unloading and Lay-down Areas
The total area of temporary work space required for each turbine is 70 m x 80 m (0.56 ha) thereby ultimately requiring a total of 5.6 ha for ten (10) turbines. All lay down areas will be rehabilitated. Construction equipment for the Project will consist primarily of standard heavy construction machines (tracked and/or tired excavators, bulldozers, graders, double and single axle dump trucks, etc.). Tower and turbine erection will require a specialized heavy lift crane. All turbine locations will have a hub height of 92 m with rotor diameters of 116 m. Blades will be constructed of fibre reinforced plastic, coated with a special surface protection.

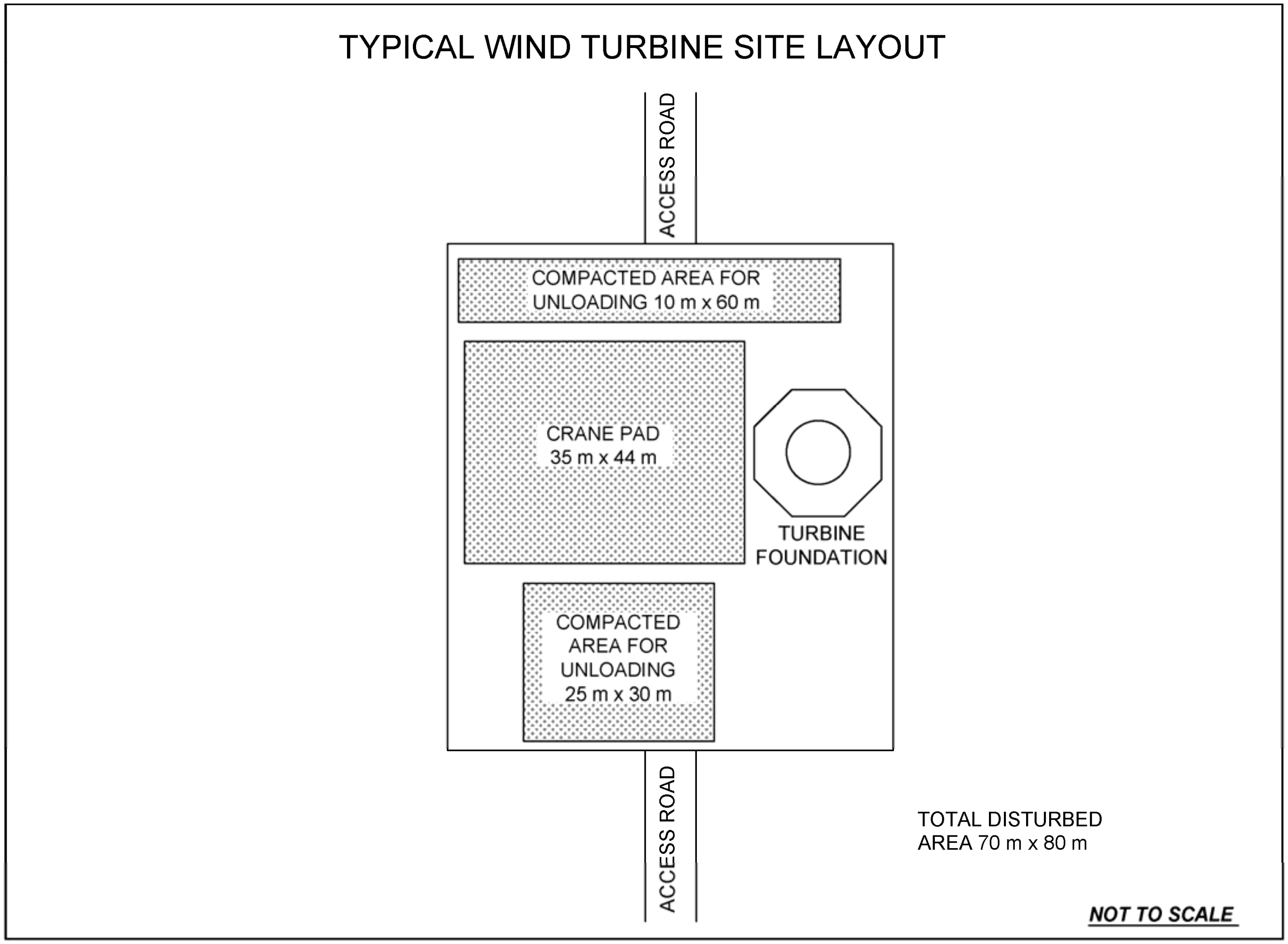

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Figure 2.5 Typical Wind Turbine Site Layout

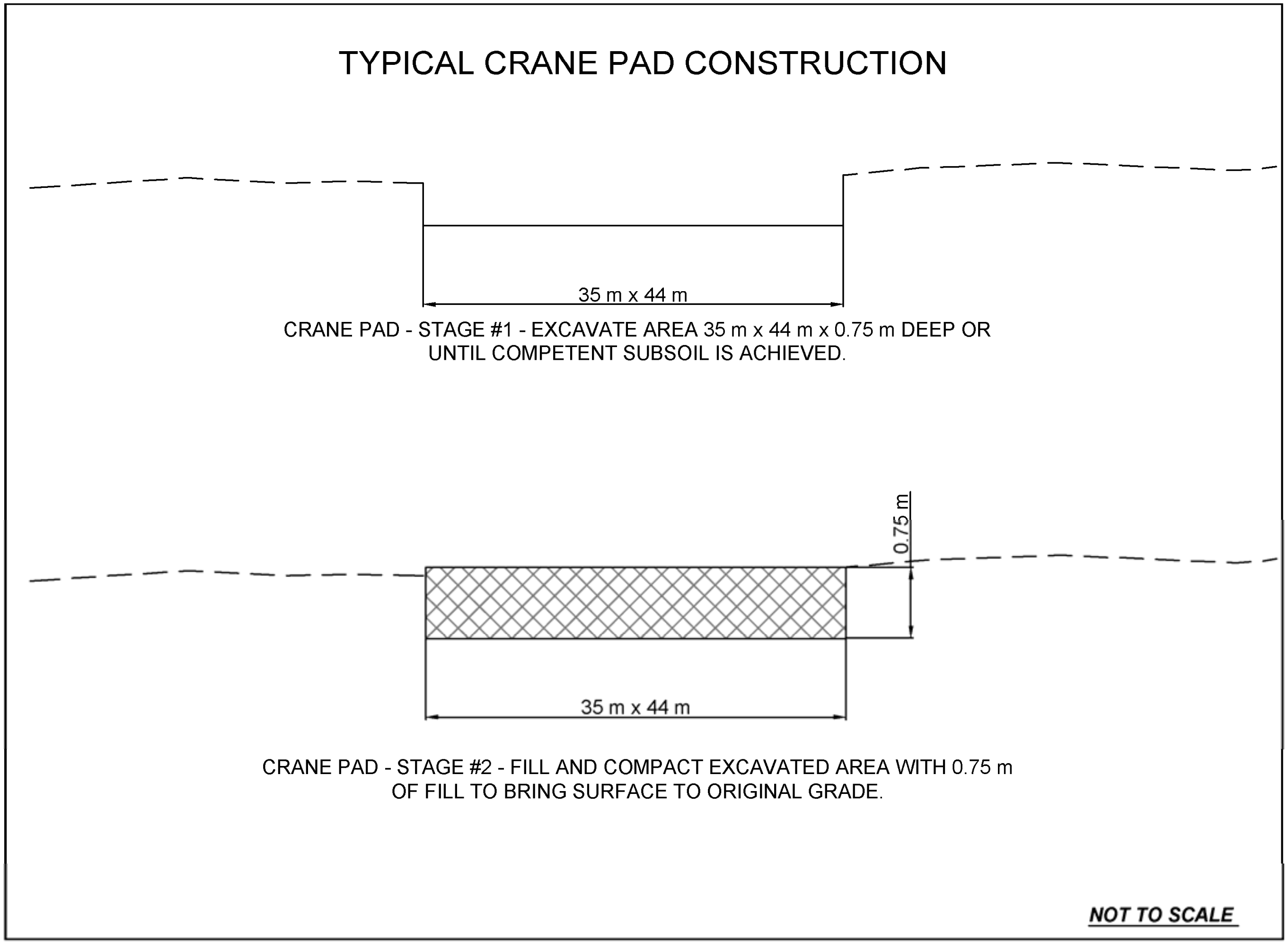

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Figure 2.6 Typical Reinforced Crane Pad Design

An area adjacent to each wind turbine (approximately 35 m X 44 m) will be prepared to support the heavy lift crane. The crane pads and unloading areas have the same construction requirements as the access roads. There will be two additional areas adjacent to the foundation measuring approximately 25 m X 30 m and 10 m X 60 m each, required for the tower, turbine and blade components to be unloaded and stored prior to installation. The turbine and blade lay-down areas require specific grades to allow the components to be unloaded and stored. Once the turbine has been installed, the lay-down area land will be returned to its original use.

Turbine T3 is located in a mature deciduous forest area and a floral species listed by the General Status for PEI as "May Be At Risk" was observed (refer to Section 4.3.3.2 for more details). None of the floral species identified during the survey are legislatively protected and the populations observed were found to be scattered throughout the Study Area in their respective habitat. Consequently, the area at the turbine site to be cleared, grubbed, graded and compacted will only need to be slightly modified to avoid the identified species.

Foundations

The excavated hole for each turbine base will be approximately 20 m by 20 m. They will be excavated to a depth of 3 m. Each turbine base will require an estimated 350 cubic metre (m^3) of concrete. The actual base will be approximately 16 m in diameter.

Foundations for the turbine towers will be fabricated using steel-reinforced concrete. The following steps are involved in construction of turbine foundations:

- Excavation of area (approximately 400 to 900 m^2).
- Compacting perimeter of the excavation.
- Installation of form work, rebar, backfilling and placement of concrete for tower base.
- Disposal of excess material.

An excavator will be used to excavate the foundation. Subsoil will be moved and used to in-fill any hollows on-site and or will be removed from the site.

The foundation itself will then be backfilled and compacted with selected fill and subsoil. The foundations will be left for a minimum period of one month to set before tower erection.

Following the erection of the towers, any disturbed areas adjacent to the work area will be re-seeded with existing native crops as appropriate.

The final foundation design will be subject to the results of the pre-construction geotechnical survey; generally, however, the depth of a foundation is typically approximately 3 m. No blasting will be required as the underlying bedrock is friable.

2.6.2.5 Substation Power Line

A 12.5kV single phase power line stemming from the Northside road will be constructed to serve as a back-up utility connection. This power line will connect the substation to an existing three phase 12.5kV distribution power line located along Northside Road (Route 16). The single phase 12.5kV power line will be constructed adjacent to an existing woods road and will measure approximately 700 m in length. It is expected to require the installation of 10 to 12 wooden electrical poles that are approximately 12 m high. Construction activities will be similar to those described in Section 2.6.2.7 Transmission Line.

2.6.2.6 Interconnection Cabling

Each turbine will be connected to the future on-site substation by either underground (500 to 100 MCM) or overhead (15 kV) cables, or a combination thereof.

If underground, the cable will be installed, along with fibre-optic communication cable in a trench. A self-propelled trencher or backhoe will dig a trench measuring approximately 1.0 m wide and 1.5 m deep (below the frost line). The bottom of the trench will then be covered with a layer of sand before laying the cable. The cable is protected by covering it with planks prior to backfilling and applying magnetic warning tape. Metal signage will be used to mark the location of the buried cables.

2.6.2.7 Transmission Line

An approximately 10.0 km transmission line connecting the Project substation to the existing T-12 transmission line will be erected. The entire transmission line will follow the newly constructed access road from the substation to Souris Line Road, then along the east side of the Souris Line Road to the existing transmission line T-12.

The construction activities associated with this Project component are:

- surveying of the line;
- identifying placement of poles, and guy wires (if necessary);
- the selective mechanical removal of vegetation, primarily trees, interfering with the operation of the transmission line;
- preparation of temporary access area at proposed pole locations;
- setting of the dress poles (i.e. insulators and other hardware will be attached to the pole before their erection);
- placement of guy wires (if necessary);
- stringing and installation of conductors; and
- restoration of disturbed land areas.

A specially equipped utility truck will be used to auger the holes and set the poles while parked on the side of the road. Poles will be placed approximately 50 to 70 m apart. Poles will generally be standard Class 2 wood single or double pole structures with a height of approximately 18 m above grade. Non-wood poles would only be considered for use in wetland areas if conditions warrant their use. Pole height will vary depending on terrain and may need to be higher when traversing sloped areas. Figure 2.7 shows a photo of the typical 138kV transmission line armless construction.

Figure 2.7 Typical Transmission Line Construction

2.6.2.8 On-site Substation

In order to connect the collector cables to the existing power line, a substation is necessary to step up the 15 kV power coming from the wind farm's collector system to 138 kV. The construction activities associated with this Project component are:

- clearing of land and sub-grade preparation, requiring a footprint of approximately 100 m^2;
- installation of grounding network;
- installation of surface fill and fencing;

- construction of concrete bases for substation components;
- delivery and installation of the substation unit;
- use of cranes to receive the transformer and large equipment; and
- connection of the substation to transmission line.

2.6.2.9 On-site Service Building

A service building is required for the operation/maintenance of the wind farm. The service building will consist of offices, lunchroom/meeting room, warehouse/workshop, as well as shower and washroom facilities. A potable well will be drilled and a septic system will be installed following provincial requirements. The building will be heated using a heat pump. A driveway/parking area will be constructed along the side of the building.

The construction activities associated with this Project component are:

- clearing of land and sub-grade preparation, requiring a footprint of approximately 300 to 350 m^2;
- installation of surface fill;
- construction of concrete base for service building;
- construction of service building; and
- installation of potable well and septic system.

2.6.2.10 Gates and Fencing

Chain-link security fencing will enclose the substation with one locked access gate for maintenance purposes. Fencing will be a minimum of 2 m tall with access-restricting wire at the top. A motion activated alarm and lighting system will be installed to detect unauthorized entrance. A monitoring company will alert the Royal Canadian Mounted Police (RCMP) and the fire department depending on the alarm type. In addition, PEIEC staff will be alerted.

2.6.2.11 Turbine Commissioning

The final activity of the Construction Phase consists of testing prior to start-up and physical adjustments to the turbines.

2.6.3 Operation Phase

The operational life span of the turbines is rated as 25 years. Approaching that time, decisions will be made with regard to continuing operations of the wind park with new or refurbished turbines and/or other equipment, or dismantling the operation and returning the site to its original condition using modern technologies to accomplish this objective.

2.6.3.1 Road Maintenance

During the operation of the wind farm, the access roadways will be maintained at a level suitable to boom truck-sized vehicles, but on a level below that required for heavy cranes. Regrading and rolling of the access road may periodically be required to maintain it for heavy lifting equipment (in case of major repairs). Ditches along the road will have to be regularly maintained as well.

2.6.3.2 Turbine Operations

Operation of the wind farm will commence when the required approvals and authorizations are in place to supply energy into the grid.

The wind turbines selected for this Project operate within a range of wind speeds from 3 metres per second (m/s) to 25 m/s. During periods when wind conditions are below the minimum or exceed the maximum (25 m/s for an average of 10 minutes), the turbines cut-out and do not produce energy until speeds have been reduced to 20 m/s for an average of 10 minutes.

Wind turbines will not operate in cases of mechanical breakdown, extreme weather, grid outages or during periods of regular maintenance.

2.6.3.3 Transmission Line Operations

MECL will be in charge of the operation of the transmission line and has established protocols for the inspection and maintenance of operating transmission lines. A visual inspection of the transmission line will be conducted on a standard that meets good utility practice. Inspections will be done by driving the route adjacent to the transmission lines. For maintenance, MECL will endeavour to use equipment that can access the line from the roadway when possible.

2.6.4 Decommissioning Phase

Nearing the end of the 25 year operational life span of the turbines, decisions will be made with regard to continuing operations of the wind park with new or refurbished turbines and/or other equipment, or dismantling the operation and returning the site to its original condition using modern technologies to accomplish this objective.

Decommissioning of the wind farm would require de-installation and removal of all physical components and machinery from the site. The access roads would remain, if the landowners so desired. The collector lines, single phase power line and substation would be removed. The transmission line will also be removed if it was no longer required for other purposes. Concrete turbine pads and building foundations will be removed to a reasonable depth and re-claimed, unless the landowner wishes to use them as they are. The equipment used for the de-construction would be essentially the same as for the construction (e.g. heavy lifting and transport equipment, earth moving equipment and trucks to transport waste materials).

If the turbines are refurbished to increase the Project lifetime, heavy transport vehicles and a heavy lifting crane would also be necessary to transport turbine parts and to de-construct and re-construct the turbines. All transformer and turbine liquids will be carefully collected, moved off-site and disposed of at a licensed facility. Any areas disturbed by Project activities will be re-vegetated to prevent erosion. This includes the access roads, unless the landowner wants to retain them.

3.0 SCOPE OF THE ASSESSMENT

3.1 SCOPE OF THE PROJECT AND ITS ASSESSMENT

As the Project is not a known designated physical activity under the CEAA, the scope of the Environmental Impact Statement (EIS) is to be carried out in accordance with the requirements of the Province's EIA Guidelines (revised January 2010) under the Province's *Environmental Protection Act*. Revisions to these Guidelines include Appendix B: Special Note for Wind Turbine Projects, which stipulates that all proposals must include an associated power corridor proposal.

3.2 METHODOLOGY OF ENVIRONMENTAL ASSESSMENT

To facilitate the review of identified issues, an understanding and description of the environment within which the activities will occur, or potentially have an influence on, was developed from a review of existing information. Potential positive and negative interactions between Project activities and the environment were identified. Where negative interactions were anticipated and potential effects were a concern, methods for mitigating the effects were proposed.

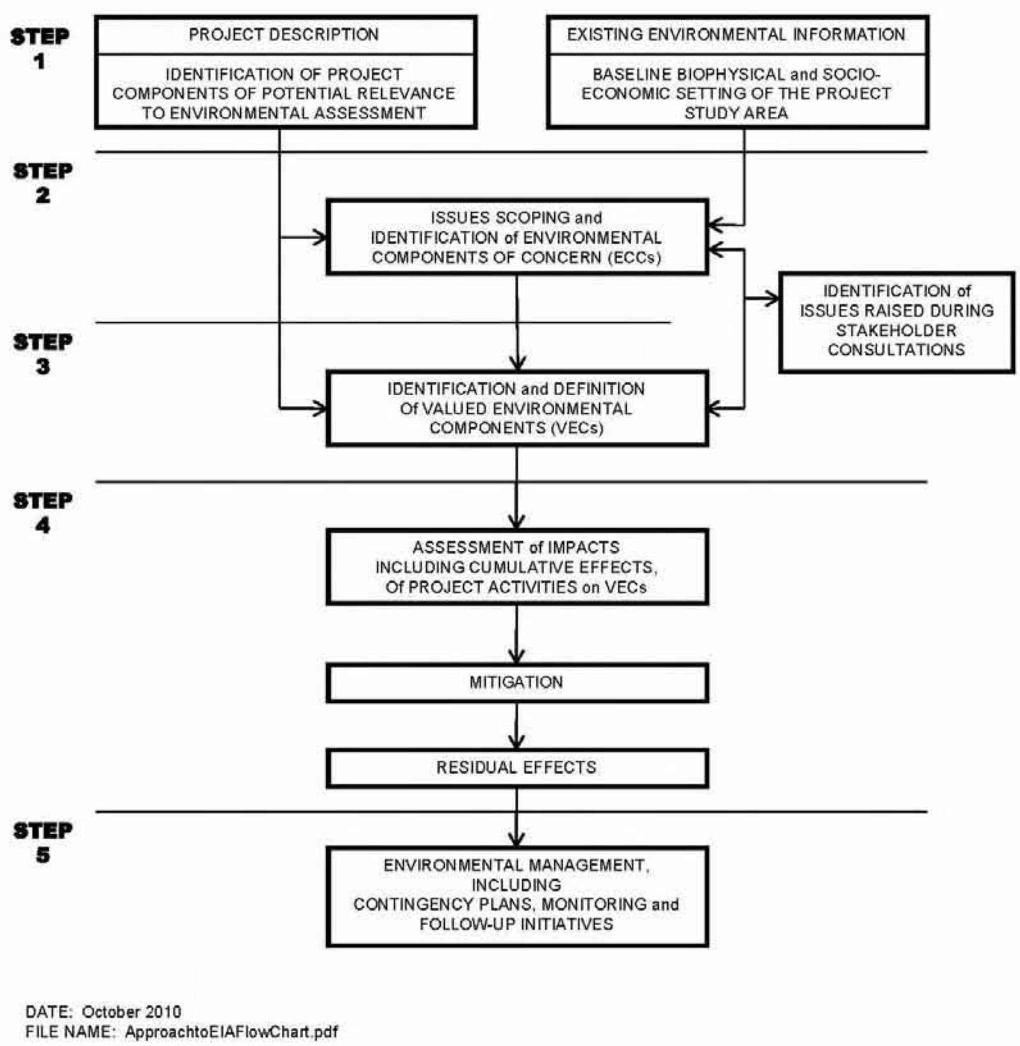
An environmental assessment is a complete process, which should begin at the earliest stages of planning and remain in force throughout the life of a project, moving through a series of stages listed below and as shown in Figure 3.1.

- Step 1: Describing the project and establishing environmental baseline conditions.
- Step 2: Scoping the issues and establishing the boundaries of the assessment.
- Step 3: Assessing the potential environmental effects of the project, including residual and cumulative effects.
- Step 4: Identifying potential mitigation measures to eliminate or minimize potential adverse effects.
- Step 5: Environmental effects monitoring and follow-up programs.

The technique of Beanlands and Duinker (1983) and the guidance provided by various federal and provincial documents were employed to assist in the design and conduct of the environmental assessment. This approach emphasizes the use of VECs as the focal points for impact assessment. Generally, VECs are defined as those aspects of the ecosystem or associated socio-economic systems that are important to humans.

The environmental assessment focuses on the evaluation of potential interactions between project components and activities on the one side, and VECs that were identified through an issues scoping process on the other side.

Figure 3.1 Approach to Environmental Impact (Effects) Assessment



Two approaches were taken for identifying VECs, upon which the assessment focuses. First, those parameters for which Provincial and Federal Regulations are in place were identified. Second, a scoping exercise was conducted, based upon previous EIA experience with similar Project components, consultation, and available information related to the environment near the Project site. As suggested by Beanlands and Duinker (1983), VECs were determined on the basis of perceived public concerns related to social, cultural, economic, or aesthetic values. The VECs were also chosen to reflect the scientific concerns of the professional community.

For the purpose of this EIA, the interactions (effects) between Project activities and Environmental Components of Concern (ECCs) are examined to select a defined set of VECs that will be assessed. The significance of potential interactions and the likelihood of the interactions are also considered. Possible measures to mitigate impacts are identified and, where residual impacts are identified, measures to compensate have been considered. Impact of malfunctions and accidents, as well as cumulative effects, are to be included in the evaluation of the environmental effects.

The assessment of the potential effects of the environment on the Project, including extreme weather events, was conducted during the Project design phase. Extreme events that apply include storms and icing. Storms and icing are referenced with regard to the ability to shut down the turbines, if required, and also the design of the turbines to accommodate high winds. Any mitigation project design modifications that may have been required were incorporated in the final project design that is described in this document.

3.3 TEMPORAL AND SPATIAL BOUNDARIES OF THE PROJECT

The traditional approach to project bounding involves assessing changes to the environment within the physical boundaries of development. Beanlands and Duinker (1983) determined that in order to properly evaluate impacts, physical and biological properties must be determined temporally and spatially. This approach has been taken for the determination of bounds for the assessment of the proposed Project. The effects of a specific project activity on a VEC may differ in both space and time from the effect of any other activity. Some project activities may have long-term consequences, while others will be of short duration.

Temporal project bounding for the proposed Project includes the short-term clearing and construction activities (Spring 2013 to Fall 2013) as well as the long-term operation of the wind energy facility (turbine lifetime 25 years) and its decommissioning, including site remediation. There is some temporal variability, since a refurbishment of the turbines at the end of their regular lifetime is likely. This refurbishment will likely double the lifetime of the wind generator facility. Also, the duration of the effects is likely to vary with the VEC and the project activity.

Therefore, different temporal boundaries may be used to reflect:

- the nature and duration of the effect;
- the characteristics of the indicator; and
- the types of actions and projects that will need to be considered within the cumulative effects assessment.

For the purposes of this Study, the temporal bounds for each Stage of the Project have been categorized into three phases:

- Phase 1: Construction Period.
- Phase 2: Operations and Maintenance.
- Phase 3. Decommissioning/Refurbishment.

The spatial boundaries for assessing potential effects will typically be established by determining the spatial extent of an effect of a project component or a project activity. The physical boundaries of the site are as shown on Figure 2.2.

The physical (spatial) boundaries of the project may vary depending on the individual VEC. For example, for endangered plant species, the project boundaries will be restricted to the lay-down areas, access roads and ancillary structures. However, for socio-economic impacts, the boundary extends the Project Footprint to include the East Parish area (Lots 43 to 47) in Kings County at a minimum.

Scientific and technical knowledge, input from the public, professional experience and traditional knowledge will be used to develop the temporal and spatial boundaries.

3.4 CONSULTATION PROGRAM

Consultation with Provincial agencies such as the PEIDELJ and PEIDTIR has been regular since the inception of the Project and is ongoing as it evolves. The Provincial EIA process also requires consultation with any and all interested stakeholders. PEIEC will be an integral part of that process.

3.4.1 Public Consultation

The Provincial EIA process requires consultation with the public in an open house format which is well advertised. For this scale of Project, a Level II Notification will be required. This will involve a public information session and a newspaper advertisement that will run for 6 consecutive days in the Guardian as well as in one edition of the Eastern Graphic. The Eastern Graphic is a weekly paper. Currently, the Project has received significant media coverage and PEIEC staff has been in communication with many community members in the area for the past year or so. A formal public meeting, as required by the EIA process, will be conducted in the latter portion of February, 2013. Residents and landowners from the Hermanville/Clearspring area of the Province will be invited to attend through a public notification process.

3.4.2 Consultations with Stakeholders and Interest Groups

A few environmental Non-Governmental Organizations (NGOs) and local resource people with local historical knowledge were consulted during the preparation of the EIA. In certain circumstances, these NGOs and persons provided baseline environmental and social information. In other circumstances, their professional opinions and perspectives were obtained. Table 3.1 provides a list of persons contacted, their affiliation and information discussed.

Table 3.1 Non-Governmental Organizations and Local Resource Representatives Contacted, their Affiliation and Topics Discussed

Contact	Affiliation	Topics Discussed
Morley Pinsent	AMEC E&I contact	Local Environmental and Social Setting
Ron Estabrook	PEIEC	Hermanville/Clearspring 30 MW Wind Farm, Energy Corp. properties, and previous Wind Farm studies
John Cunniffe	MECL	Hermanville/Clearspring 30 MW Wind Farm 138kV Transmission Line and T-12 Transmission Line.
Chief Darlene Bernard	Lennox Island	Traditional First Nations activities in area
Chief Brian Francis	Abegweit Band	Traditional First Nations activities in area
Don MacKenzie	Mi'Kmaq Confederacy	Traditional First Nations activities in area
Jamie Thomas	Native Council of PEI	Traditional First Nations activities in area
Fred Cheverie	Souris and Area Watershed Association Souris and Area Branch of the PEI Wildlife Federation	Fishery and wildlife resources in area

3.5 REGULATORY CONSULTATION

AMEC and the Proponent have consulted with representatives from several federal and provincial regulatory agencies, local government representatives, and resource managers in order to identify any issues specific to the proposed project and identify appropriate mitigation strategies. The agencies/individuals consulted, and the topics of these consultations are noted in Table 3.2.

Table 3.2 Regulatory Representatives from Federal, Provincial and Municipal Organizations Contacted, their Affiliation and Topics Discussed

Contact	Affiliation	Topics Discussed
Dr. Helen E. Kristmanson	PEI Aboriginal Affairs Secretariat (PEIAAS) Director	• Heritage Resource Impact Assessment
P. Jon Hutchinson	PEIDAF, Manager of Public Lands	• Access to Public Lands
Greg Wilson	PEIDEEF, Manager, Environmental Permitting and Legislation	• Project Description • Environmental Impact Statement Process • Early stage planning process
Jay Carr	PEIDEEF, Environmental Impact Assessment Officer	• Project Description • Environmental Impact Statement Process

3.6 ISSUES SCOPING AND VEC SELECTION (SCOPE OF THE ASSESSMENT)

Issues scoping is an important part in the VEC identification process. The issues scoping process for this assessment included: review of past, relevant environmental and scientific reports; review of public concerns; regulatory agency consultation; and the study team's professional judgment.

3.6.1 Issues Scoping

The first step in the selection of VECs involved issues scoping to identify ECCs, and was based on:

- Concerns expressed by various stakeholders, including the scientific community, as well as comments from the public, government departments and agencies.
- Review of applicable statutes and regulations.
- Review of similar projects such as Summerside Wind Farm, East Point Wind Farm, Suez Farms, and WEICan Wind Energy Research and Development Park and Storage System.
- Consideration of available literature and reference materials.

Perceived public concerns related to social, cultural, economic, or aesthetic values, as suggested by Beanlands and Duinker (1983).

The approach to the selection of VECs involves an initial evaluation to determine the likelihood of an interaction or linkage (pathway) between ECCs and project activities, including all the components of the Project. Where linkages between ECCs and project activities exist and potential effects are of concern, these components are selected as VECs and subject to further analyses.

ECCs with existing federal or provincial environmental regulations, such as endangered species and migratory species, are all of concern and were selected as VECs. Issues that regulators were concerned about were also selected as VECs, e.g. bat populations were of concern for PEIDELJ due to the presence of white-nose-syndrome (WNS) in bats residing in New Brunswick (NB) and Nova Scotia (NS). In addition, any issues raised by the public, as well as most ECCs with an existing pathway, have been selected as VEC. If not, the exclusion is explained.

The potential interactions between project components or project activities and ECCs, specifically VECs, are identified during an issues scoping process. Environmental components include the biological, physical and socio-economic environment. As a result of this process, the actual assessment will focus (only) on issues/components of concern.

Environmental and social components protected by federal statute are:

- Fish and Fish Habitat (*Fisheries Act*).
- Migratory Birds (MBCA).
- Species at Risk (SARA).
- Structures or historic sites of national interest (*Historic Sites and Monuments Act*).
- Air Traffic Safety (*Aeronautics Act*).

In addition, there are both the Federal and Provincial Policies on Wetland Conservation, protecting wetlands.

3.6.2 VEC Selection

Based on this information, a preliminary list of ECCs was developed, and the Project VECs were selected (Table 3.3). This part of the EIA serves to identify those environmental components that are likely to be affected by the Project.

The existing environment baseline description and the impact assessment focus on the selected VECs. Where a linkage between proposed project activities and the ECCs is absent, or is deemed unlikely to result in an effect, no further analysis is required. The evaluation of the ECCs resulted in the following Project VECs:

- Air Quality
- Archaeology and Heritage
- Avian Species (birds and bats)
- Fauna (non-avian species)
- Fish and Fish Habitat
- Floral Species at Risk

Table 3.3 Issues Scoping: Summary of VEC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site Selection		VEC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC)
		Yes	No	Yes	No	Yes	No		
Geophysical Environment	Soil and Soil Quality	X			X		X	Construction: clearing and grubbing, excavation, spills, compaction, erosion Operations: spills, land removed from production for duration of the project	Excluded: soil and soil quality issues included with Land Use as well as Accidents and Malfunctions VECs
	Geology (Acid Rock Drainage)	X		X			X		Excluded: Bedrock is composed of conglomerate and sandstone, not considered to possess acid generating materials.
	Seismicity	X			X		X	Operations: Seismic activity could affect structural integrity of turbine towers	Excluded: PEI not an active seismic region
	Hydrogeology/Groundwater	X		X			X	Construction: excavation of foundations and spills	Excluded: no blasting is required, nearest well is over 600 m from site. Encompassed with other VEC – Surface Water Quality
	Sub-surface Resources		X		X		X		Excluded: Project will not interact with subsurface resources nor restrict potential development.
Aquatic Environment	Fish Habitat	X			X	X		Construction: clearing and installation of aerial cables	Included: One watercourse identified with brook trout (*Salvelinus fontinalis*) observed. Watercourse will require clearing within 10 m buffer zone.
	Fish	X			X	X		Construction: clearing and installation of aerial cables	Included: One watercourse identified with brook trout (*Salvelinus fontinalis*) observed. Watercourse will require clearing within 10 m buffer zone.
	Surface Hydrology		X	X			X		Excluded: Access road will not cross any watercourses. No in-stream activity.
	Surface Water Quality	X			X	X		Construction: clearing and installation of aerial cables	Included: Several watercourses to be spanned by power lines. One watercourse will require clearing within 10 m buffer zone.
Terrestrial Environment	Habitat • Forest	X			X		X	Construction: clearing and grubbing, excavation,	Excluded: Habitat issues are encompassed within Fauna as well as Floral Species-at-Risk VECs

Table 3.3 Issues Scoping: Summary of VEC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site Selection		VEC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC)
		Yes	No	Yes	No	Yes	No		
	Fauna							Construction/decom: noise, visual impacts and the presence of humans (workers in the area), habitat loss by clearing and grubbing, excavation, equipment: silt run-off, infilling; fuel spills. Operations: collisions with turbines, lights, barrier effect, toxic leaks and spills, habitat destruction	Included: Protected by regulation. Bats also considered. Some minor project interaction with terrestrial mammals.
	• Mammals		X		X		X		
	• Local and Migratory Birds	X			X	X			
	• Bats	X			X	X			
	Species-at-Risk							Construction/decom: noise, visual impacts and the presence of humans (workers in the area), habitat loss by clearing and grubbing, excavation, equipment: silt run-off, infilling; fuel spills. Operations: collisions with turbines, lights, barrier effect, toxic leaks and spills, habitat destruction	Included: Protected by statute/regulation. If a species is endangered, effects on individuals may be considered significant.
	• Flora Species-at-Risk	X			X	X			
	• Fauna Species-at-Risk	X			X	X			

Table 3.3 Issues Scoping: Summary of VEC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site Selection		VEC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC)
		Yes	No	Yes	No	Yes	No		
	Designated Areas and Other Critical Habitat Areas							Construction/decom: noise, visual impacts and the presence of humans (workers in the area), habitat loss by clearing and grubbing, excavation, equipment: silt run-off, infilling; fuel spills. Operations: collisions with turbines, lights, barrier effect, toxic leaks and spills, habitat destruction	Excluded: Avoided during site selection.
	• Demonstration Woodlots,		X	X			X		
	• Wildlife Management/Protection Areas		X	X			X		
	• National Wildlife Areas/Migratory Bird Sanctuaries		X	X			X X		
	• Designated Wetlands/Eastern Habitat Joint Venture Areas (EHJVs)		X	X			X		
	• Critical Natural Areas		X				X		
	• Nature Reserves		X				X		
	• National and Provincial Parks		X				X		
	Wetland Environment	X			X	X		Construction/decom: direct destruction, fragmentation and erosion during clearing and grubbing, excavation, fuel spills. Operations: transformer and equipment toxic leaks and spills	Included: Could not be avoided for 138 kV transmission line routing. Impacts expected to be minimal as wetlands will be spanned and poles will be placed adjacent to existing Souris Line Rd. right-of-way.

Table 3.3 Issues Scoping: Summary of VEC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site Selection		VEC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC)
		Yes	**No**	**Yes**	**No**	**Yes**	**No**		
Atmospheric Environment	Air Quality • Ambient air (Human Health and Safety)	X			X	X		Construction/decom: Dust from construction and transport equipment, construction of turbines, transformers: air emissions (exhaust fumes, leaks, vapour), dust.	Included: Protected by statute/regulation (SO2, NOx, PM etc). Minor quantities will be produced for short time during construction of project.
	• Climatology	X			X		X	Construction/decom: Emissions (exhaust fumes, leaks, vapour) from construction and transport equipment	Excluded: Will be addressed as part of Air Quality
Socio-Economic Environment									
Local Economy and Community	• Population Demographics • Local Economy (expenditures, local business and employment) • Industry and Commerce	X X X			X X X	X X X		Construction/decom.: Employment opportunities for local population, operational expenditures, heavy lift crane could interfere with airport operations Operations & Maintenance: new permanent employment opportunities.	Included: Potential to increase beneficial effects of local construction, operational expenditures and employment
	• Recreation and Tourism	X			X		X	Construction: delivery of turbine components, Operations: Visual appearance	Excluded: Addressed in Visual Landscape and Local Economy
Land Use	• Industry/Commercial		X		X		X	Construction: large construction equipment (tall cranes) Operations: new permanent employment opportunities.	Excluded: Potential to increase beneficial effects of local construction, operational expenditures and employment addressed as Local Economy
	• Planned Development		X	X			X		Excluded: No new land use developments planned in Study Area
	• Residential	X			X		X	Construction/decom: clearing and grubbing, excavation, equipment: noise, air emissions, dust Operations: turbines, rotor noise, toxic leaks/spills; shadow flicker	Excluded: Included with other VECs (Air Quality, Human Health and Safety; Accidents and Malfunctions, Visual Landscape)

Table 3.3 Issues Scoping: Summary of VEC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site Selection		VEC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC)
		Yes	No	Yes	No	Yes	No		
	• Cultural/Institutional		X	X			X		Excluded: Project activities will not interact with cultural or institutional resources.
	• Communications and Radar Systems	X			X		X		Excluded as VEC – Project activities will not interact with communications and radar systems
	• Fisheries		X	X			X		Excluded: Project activities will not interact with recreational or commercial fisheries.
	• Agricultural		X	X			X		Excluded: Project activities will not interact with agriculture operations
	• Forestry		X		X	X			Included: Potential interruption to forestry operations, areas removed from production
	• Transportation Infrastructure	X			X	X		Construction: transportation of turbine components to Project Site.	Included: Construction requires large cranes and the delivery of turbines by highway during tourist season, this could cause traffic delays, aggravation and damage to roads.
Community Emergency Services	• Medical Services • Fire Protection Services • Police Protection Services	X X X			X X X		X X X	Construction: potential for accidents and malfunctions during all construction activities. Operations: potential for accidents and malfunctions during all maintenance activities.	Excluded: Addressed within Accident and Malfunctions
Heritage and Archaeological Resources	• Native Resources • Historic Resources	X X			X X	X X		Construction/decom. clearing and grubbing, excavation, surface disruption.	Included: Potential for undocumented resources to be exposed during construction activities.
First Nation/Aboriginal Communities	• Aboriginal Fisheries • Traditional Land uses		X X		X X		X X		Excluded: No project interaction with Aboriginal fisheries. No traditional land use has been identified to the proponent.
Human Health and Safety	• Noise	X			X	X		Construction: clearing, grubbing and installation of towers Operations: noise from rotors	Included: Noise from construction activities is temporary and not expected to disturb residents, noise from rotors has been modeled and turbines located to mitigate potential effects.

Table 3.3 Issues Scoping: Summary of VEC Selection and Pathway Analysis

Environment/ Resources	**Environmental/Socio-Economic Components of Concern (ECC)**	**Pathway**		**ECC Avoided During Site Selection**		**VEC**		**Interactions with Project Activities/Components and Possible Pathways**	**Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC)**
		Yes	**No**	**Yes**	**No**	**Yes**	**No**		
	• Shadow Flicker	X		X		X		Operations: sunlight shining at certain low angles through the rotating rotors can cause a periodic flickering of light.	Included: shadow flicker may affect 14 receptors to varying degrees. Most if not all are expected to observe only minimal levels.
	• Occupation Heath and Safety	X			X	X		Construction: during all construction activities there is the potential for workplace injuries, whether by accidents or equipment malfunctions. Operation: during maintenance of wind turbines and on-going operation of substation and storage facility there is the potential for workplace injuries, whether by accidents or equipment malfunctions.	Included: potential workplace accidents and mechanical failures
Aesthetics and Visual Landscape	• ViewScape	X			X	X		Operation: presence of tall structures.	Included: no wind turbines currently present in Hermanville/Clearspring
Accidents and Malfunctions	• Soils and Soil Quality	X			X	X		Construction: Spills, accidental release of hazardous substances, traffic accidents Operations: spills and accidental release of hazardous substances, traffic accidents, icing and breakage	All potential effects due to accidents and malfunctions
	• Wetlands		X	X			X		
	• Hydrogeology/ Groundwater	X			X	X			
	• Water resources	X			X	X			
	• Air Quality	X			X	X			
	• Human and Occupational Health and Safety	X			X	X			

- Land Use
- Local Economy
- Local Traffic
- Public Health and Safety (including noise)
- Surface Water Hydrology and Quality
- Visual Landscape
- Wetland

3.7 APPROACH TO DETERMINATION OF SIGNIFICANCE

The assessment or determination of the significance of potential effects will be based on the Responsible Authority's Guide developed by the Agency, with consideration of other relevant Federal and Provincial regulatory requirements.

The Responsible Authority's Guide has been successfully applied to similar projects in the past, and has been widely accepted by government and regulatory agencies within Canada, as the standard for the completion of EIAs.

The Reference Guide entitled "Determining Whether A Project Is Likely To Cause Significant Adverse Environmental Effects" included in the Responsible Authority's Guide (The Agency, 1994) will be used as the basis for determining the significance of identified potential effects. This determination consists of the following steps:

- determine whether the environmental effect is adverse;
- determine whether the adverse environmental effect is significant; and
- determine whether the significant environmental effect is likely.

Although the terms "adverse," "significant" and "likely" are not directly defined, The Agency (1994) provides criteria to facilitate interpretation (Table 3.4). Significance of adverse effects will be directly related to regulatory guidelines and statute requirements where applicable. The assessment will determine whether the residual environmental effects of the Project are significant or non-significant after application of mitigation measures.

For the purposes of the EIA, an effect will be defined as the change effected on a VEC(s) as a result of Project activities. A Project induced change may affect specific groups, populations, or species, resulting in modification of the VEC(s) in terms of an increase or decrease in its nature (characteristics), abundance, or distribution. Effects will be categorized as either negative (adverse) or positive. Any adverse effects will be determined to be significant or non-significant in consideration of assessment criteria discussed above. The Assessment will focus on those interactions between the VECs and Project activities, which are likely.

Table 3.4 presents the criteria to be considered in the assessment of potential environmental effects – According to the *Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects*, (The Agency, 1994).

Table 3.4 Criteria to be Considered in the Assessment of Potential Environmental Effects

Key Terms	Criteria
Adverse	• loss of species of special status (*i.e.,* Species at Risk); • reductions in species diversity; • loss of critical/productive habitat; • transformation of natural landscapes; • negative effects on human health, well-being, or quality of life; • reductions in the capacity of renewable resources to meet the needs of present and future generations; • loss of current use of lands and resources for traditional purposes by Aboriginal persons; and • foreclosure of future resource use or production.
Significant	• magnitude; • geographic extent; • duration and frequency; • reversibility; and • ecological context.
Likely	• probability of occurrence; and • scientific uncertainty.

Source: The Responsible Authority's Guide (The Agency, 1994).

4.0 ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

This section provides a description of the environmental and the socio-economic setting for the Study Area (Figure 2.2), and includes those components of the environment potentially affected by the proposed Project, or those which may influence or place constraints on the execution of Project-related activities.

The environmental setting is presented to allow assessment of the impact of the proposed Project. Description of the setting includes an overview of regional and local geological, aquatic, wetland, terrestrial and atmospheric characteristics in addition to designated areas and other critical habitat features of the proposed Project.

4.1 GEOPHYSICAL ENVIRONMENT

PEI is located in the Gulf of St. Lawrence, off the Atlantic coast of the Canadian mainland. It is separated from NB, NS and Cape Breton Island by the Northumberland Strait. PEI is approximately 250 km long and varying widths of 6.5 to 50 km with a maximum surface elevation of 127 m above sea level (van de Poll, 1983). The topography within the Study Area is classified as undulating with a slope of 2 to 4% (Agriculture Canada, 1988). The elevation ranges from 30 and 45 m above sea level.

4.1.1 Soil and Soil Quality

The soil in the Study Area is composed mainly of Alberry (80%) / Culloden (10%) mixed type. Both Alberry and Culloden soils are orthic humo-ferric podzol, however Alberry soil characteristics are classified as coarse-loamy, deep, acidic, cool humid, and well-drained whereas Culloden soil characteristics are classified as a sandy, deep, acidic, cool humid, and rapidly draining. The prevalence for soil erosion is the main limiting factor for this type of soil.

In terms of agricultural productivity, based on the Canadian Land Inventory (CLI), the soils are rated predominantly Class 5 with pockets of 2 and 7 in the eastern portion of the Study Area. Class 5 soil is described as having very severe limitations that restrict their capability to produce perennial forage crops, but improvement practices are feasible. Class 2 soils have moderate limitations that restrict the range of crops or require special conservation practices whereas Class 7 soils have no capability for arable culture or permanent pasture. For commercial forest production, the CLI rates the soil as Class 5_F, which are soils having low fertility and severe limitations for the growth of commercial forests.

A preliminary geotechnical investigation has been completed.

4.1.2 Geology (Acid Rock Drainage)

PEI bedrock is primarily composed of PEI “redbeds” broken into five formal formations. The bedrock underlying the Study Area is the Orby Head formation (van de Poll, 1988) and is composed of conglomerate and sandstone. The Northeastern part of the Province is generally low-lying with an extensive cover of glacial material usually 1 to 3 m thick with thicknesses exceeding 14 m locally (van de Poll, 1983). Surficial deposits consist generally of ground moraine sand phase till (Agriculture Canada, 1988).

The primary issue pertaining to the geological substrate is potential exposure of sulphide-containing rocks to oxygen (atmospheric conditions); for example, through construction activities. This exposure can lead to acid rock drainage (ARD) (Howells and Fox, 1998). ARD is characterized by low pH (pH 2-4) and high content of dissolved metals (Howells and Fox, 1998), in particular aluminium, manganese and iron, as well as trace elements such as copper, nickel and cobalt, from the rock (Zentilli and Fox, 1997). Often, bacteria are involved in the oxidation, but the reaction also occurs abiotically. The rate of acid formation is dependent on the type of sulphide mineral and environmental conditions such as ambient temperature, the amount of rainfall, the presence or absence of bacteria, and the availability of oxidants (Fox et al., 1997).

The sulphide concentrations in the redbeds of PEI are low and there is no potential for ARD in the Study Area (George Somers, pers. comm., PEIDEEF 2007).

4.1.3 Seismicity

PEI is not in an earthquake zone (InfoPEI, 2010). The potential for an earthquake of sufficient magnitude to disrupt the operation of the wind park is remote and not likely to occur within the Project's temporal boundaries (25 years).

4.1.4 Hydrogeology/Groundwater

Groundwater provides 100% of PEI's drinking water. There are currently 16 groundwater level observation wells located across PEI. The groundwater monitoring wells nearest the Project are located on New Zealand Road and Souris Line Road. These wells provide groundwater level data, but not groundwater quality data. There is no known existing ground or groundwater contamination in the Project area.

Based on the anticipated evacuation depth of approximately 3 m and the friable nature of red sandstone, blasting will not be required.

4.1.5 Sub-surface Resources

PEI has no current commercially developed mineral resources; however interest exists in oil and gas exploration. According to PEIDFEMA (2011), "PEI's hydrocarbon potential has yet to be fully assessed as, to date only twenty exploratory wells and one re-entry well have been drilled on and around the province".

Much of PEI is underlain by seams of coal of various thicknesses. Located too deep for economic extraction, these coal formations may provide the Province with energy in the form of coalbed methane.

The presence of the Project will not interfere with any future exploration or ultimate development of mining activities.

4.2 AQUATIC ENVIRONMENT

4.2.1 Surface Hydrology and Water Quality

The Study Area falls within the hydrometric subdivision 1CD as defined by EC (EC, 1986) and is located within the Cross River watershed. This watershed is composed of 4429 ha of land and approximately 48 km of stream (Souris and Area Branch of PEI Wildlife Federation, 2012). All surface runoff from this portion of the watershed drains into Big Pond, which drains into the Gulf of Saint Lawrence. A tributary of Cross River will be spanned by aerial cables within the Study Area.

Near the Study Area, surface water quality is monitored at Bear River (Station Number MSC 33). Table 4.1 lists the values of several parameters analysed in the surface water collected from 2007 to 2012 at Station Number MSC 33.

Table 4.1 Surface Water Data taken at Bear River (Station Number MSC 33)

Parameter	Average Value	Unit of Measure
pH	7.6	pH units
Total Alkalinity	65.1	milligrams per litre (mg/L)
Conductivity	0.243	mS/cm
Total Suspended Solids	4.2	mg/L
Total Nitrates	0.50	mg/L
Dissolved Oxygen	10.5	mg/L
Faecal Coliform	49	MPN/100mL
Total Phosphorus	28.3	µg/L
Total Nitrogen	0.7	mg/L
Ammonia	< 0.1	mg/L
Cadmium	< 0.005	mg/L
Calcium	16.9	mg/L
Chloride	14.7	mg/L
Chromium	< 0.05	mg/L
Iron	0.11	mg/L
Magnesium	9.13	mg/L
Manganese	0.02	mg/L
Nickel	< 0.05	mg/L
Potassium	1.2	mg/L
Sodium	8.01	mg/L

Typical problems detected in PEI surface water are a result of bank erosion and runoff from farming operations. Erosion is prevalent in PEI, due to the silty nature of its soil. Siltation can be detected as changes in embankments and soil cover in watercourses. It can be detected in surface water quality as Total Suspended Solids. Runoff from nearby land use also affects surface water quality. Fertilizer use for crops can contribute to increased levels of nitrates and/or phosphorus, followed by a decrease in dissolved oxygen levels, while farm animal waste causes faecal coliform contamination. The surface water quality results for Bear River (Table 4.1) are below CCME Guidelines for the Protection of Aquatic Life, with the exception of faecal coliform presence (CCME, 1999).

4.2.2 Aquatic Habitat and Fauna

Project activity within the proposed wind farm area will interact with one watercourse. The watercourse (WC1) is a 1st order tributary of Cross River with a bank full width of 1.85 m. It flows west to east, with its headwaters stemming from a large wetland with a beaver impoundment. This watercourse subsequently joins the western branch of Cross River just east of Souris Line Road. The Project design indicates the tributary of Cross River will be spanned by aerial cables. There will be no instream work conducted.

A fish and fish habitat survey was conducted October 5th, 2012. The fish habitat survey was conducted 165 m downstream of the aerial cable span location to 155 m upstream. The landscape on either side of the watercourse consists mostly of mature mixed forest. The surveyed section of the watercourse consists mostly of riffles and runs with an average wet width and depth of approximately 1.8 m and 23 centimetres (cm), respectively.

Substrate in the surveyed section of this watercourse consists of 19% rubble, 35% gravel, 41% sand, and 1% fines. It should be noted that there is a greater amount of fines upstream in comparison to downstream sections of the watercourse. The level of embeddedness of the substrate is generally high. Undercut banks and overhanging vegetation, which provide good cover for species such as brook trout, were plentiful in the surveyed area.

Vegetation consisted of 31% shrubs and 69% trees, with an overall shade coverage for the watercourse of approximately 75%. The slope of the valley of this watercourse was moderate with no erosion occurring on the banks.

At the time of the survey, the watercourse had a dissolved oxygen level of 10.4 mg/L, conductivity of 115.8 micro-siemens per centimetre (µS/cm), and water temperature of 12.9 degrees Celsius (°C). The pH was measured at 9.4. A fish survey was also conducted and confirmed the presence of resident brook trout (*Salvelinus fontinalis*).

The proposed 138 kV transmission line will traverse five (5) watercourses before joining the T-12 transmission line. Poles will be placed no closer than 10 m from any watercourse and wetlands will be avoided where possible.

4.3 WETLAND ENVIRONMENT

4.3.1 Wetland Resources

Both collectively and as individual units, wetland resources serve a variety of important ecological and socio-economic functions. Wetlands function in the maintenance of surface and groundwater resources and quality, as well as providing wildlife habitat. The value of wetlands to society and their ecological value are derived from their biological productivity and biodiversity.

Wetlands are generally characterized by hydrophytic vegetation, and can vary from a closed peat bog to an open water body dominated by submergent vegetation. By providing natural flood control, points of recharge and discharge of groundwater, acting as filters, and by trapping silt, wetlands play an important role in the hydrological cycle and generally enhance the water regime. As they provide habitat for a wide variety of plants and animals, they may be highly productive and often exceed adjacent uplands in their standing crops, productivity, and biodiversity. In the past, wetlands have been viewed mainly in terms of development, such as agricultural land or peat resources. However, their ecological value is now more clearly understood. Ecological wetland values may include sustenance for waterfowl, sources of fish production, storage and slow release of water, erosion protection, and areas of aesthetic or recreational enjoyment.

With increasing competition for land, particularly in urban areas, wetlands have continued to be impacted through dyking, filling, drainage, flooding, and other forms of conversion. Such use has caused the number and extent of wetlands to decrease substantially (Bond, *et al.*, 1992). This is particularly true of coastal wetlands where historical losses in the Maritimes may be as high as 80% (Hanson & Calkins, 1996). PEI contains only 4% of the vegetated wetland area in the Maritimes, but a disproportionately high amount (19%) of salt marsh habitat.

4.3.2 Wetland Regulation

Wetland alterations in PEI are controlled by Section 10 of the *PEI Environmental Protection Act*. Wetlands are defined as “lands commonly referred to as marshes, salt marshes, swamps, bogs, flats and shallow water areas that are saturated with water long enough to promote wetland or aquatic biological processes which are indicated by poorly drained soil, water-tolerant vegetation, and biological activities adapted to a wet environment.” Before commencing a project that involves work within 10 m of or within a wetland, a WWBZAP is required.

The Federal government established a “no net loss of wetland function” policy in co-operation with the Provinces (EC, 1991). In addition to the provincial *Watercourse/Wetland Alteration Guidelines*, in 2003 the Province also created a Wetland Conservation Policy with commitments to the “no net loss of wetland function” objective and identifying specific wetlands and wetland types as Provincially Significant. Activities proposed within Provincially Significant Wetlands are usually subject to severe restrictions. Under the *Watercourse and Wetlands Alteration Guidelines* any disturbance of the ground within 10 m of a watercourse or wetland boundary needs a permit.

The focal purpose of the Federal Policy on Wetland Conservation policy is the sustainable management of wetland resources (both for wildlife and humans) and is underpinned by a commitment to “no net loss of wetland function”. This policy has been strongly applied and several specific guidance documents are available to federal employees including:

- The Federal Policy on Wetland Conservation (EC, 1991);
- Implementing “No Net Loss” Goals To Conserve Wetlands In Canada (North American Wetlands Conservation Council (NAWCC), 1992);
- Wetland Evaluation Guide (Bond *et al*., 1992);

- The Federal Policy on Wetland Conservation; Implementation Guide for Federal Land Managers (EC, 1996);
- Wetlands Environmental Assessment Guideline (Milko, 1998);
- Wetlands And Government (NAWCC, 1999); and
- Wetland Mitigation in Canada (NAWCC, 2000).

Two main concepts in federal guidance include the wetland “mitigation sequence” and the principal of “no net loss of wetland function”. These are briefly described below.

Mitigation Sequence
When developing mitigation for potential effects on wetlands, a hierarchical sequence of “mitigation” alternatives must be applied, which includes:

- avoidance of impacts;
- minimization of unavoidable impacts; and
- compensation for residual impacts that cannot be minimized (i.e., net loss).

No Net Loss
The “no net loss” principle requires any such loss to be compensated, ideally through provision of similar wetland function at the same location. This may be accomplished by restoration or enhancement of degraded or low function wetland or outright creation of wetland habitat. There are also other compensatory options that may be acceptable (as a last resort) including support of wetland research activities or securing wetland areas that are currently under stress from private land use.

The assessment of potential impacts on wetland resources at a site must be conducted through several sequential steps including:

- identification of potential wetland area;
- field verification of actual wetlands;
- delineation of wetland boundaries;
- assessment of wetland functionality; and
- assessment of potential impacts from Project activities.

4.3.3 Wetland Identification

Wetlands were located within the Study Area based on a field reconnaissance and assessment conducted by Christina LaFlamme, M.Sc. between August 27th and 30th, 2012 and by Garrett Bell, CET between September 13th and 14th, 2012 within the Study Area. A total of four (4) wetlands were observed within the proposed wind farm area, none of which will be impacted (Figure 2.3). Two (2) additional wetlands were noted within the proposed routing of the 138 kV transmission line along Souris Line Rd. It is anticipated that these wetlands will be spanned. If a wetland cannot be spanned, appropriate poles (wood, fibreglass or steel) will be used. It is not anticipated that this placement will incur a net loss of wetland habitat or function. Mitigation measures as described in Section 5.2.3 and in Table 6.1 will be applied.

4.4 TERRESTRIAL ENVIRONMENT

PEI is located in the Atlantic Maritime Ecozone. This area extends from the Gaspé Peninsula at the mouth of the St. Lawrence River southwest through Quebec to the United States (US) border south of Sherbrooke and includes the provinces of NS and NB. This ecozone consists of unique ecosystems such as mixed-wood Acadian forests, sand dunes along seaboards and coastal islands. This ecozone has been heavily influenced by human settlement, which is especially notable in PEI. The majority of Acadian forests in the Province were transformed into farmland, especially on the more fertile lands of central PEI.

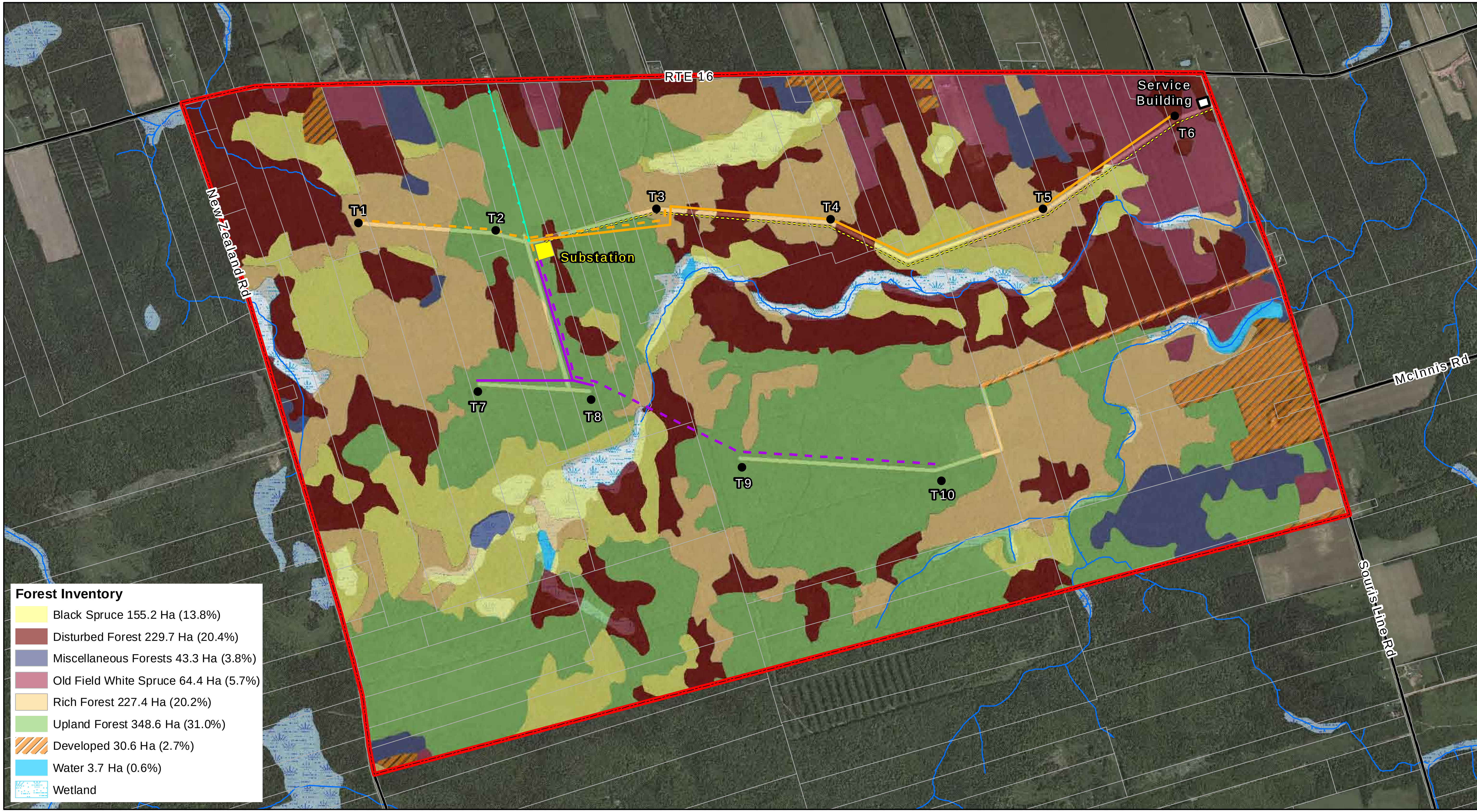
4.4.1 Flora

According to Rowe (1972), on the somewhat higher land of the eastern parts of the Province, the dominant forest communities are tolerant hardwoods with conifers generally confined to narrow belts along streams. In this particular area, according to the forest inventory data (2000), the Study Area (Figure 4.1) encompasses 1125 ha of which 31.0% is rich forest, 20.4% disturbed forest, 20.2% upland hardwood, 13.8% black spruce, 5.7% old field white spruce, 3.8% miscellaneous forest, 2.7% developed, 1.9% wetland and 0.6% water. Upland forest is defined by the presence of sugar maple, American beech, yellow birch and Eastern hemlock. Rich forest is defined to include red maple, American elm, white ash and Eastern white cedar. Black spruce forest includes this tree on both wet and dry sites. Old field white spruce is former agricultural land that is regenerating in white spruce. Miscellaneous forests include clear cuts, plantations, alders, burned areas and windfalls. Disturbed forests are those that do not fall into any other category (PEIDEEF, 2011).

From August 27th to 30th, 2012 and again from September 13th to 14th, a vegetation survey was conducted at the Study Area to provide a more detailed description and accounting for vegetative conditions.

At that time, most flowering plants including asters and goldenrods were in bloom. Early spring ephemerals that typically bloom between May and early July could not be identified to species, particularly early blooming orchids. During the survey, several Atlantic Canada Conservation Data Centre (ACCDC) listed floral Species-at-Risk were observed (see Section 4.3.3). Of those identified, none of the floral species are legislatively protected and the populations observed were found well established and scattered throughout the Study Area in their respective habitat.

Consequently, with appropriate mitigation measures described in Section 5.2 it is anticipated that the Project's ecological impact will be relatively small for an undertaking of its size.



Path: G:\GIS\PROJECTS\TE121023_PEI_EnergyCorp_EastPtWind\MXD\20130128_Revisions\20130128_ForestHabitat_Fig4_1.mxd User: tanya.morehouse, Date: 29/01/2013 SOURCE: http://www.gov.pe.ca/gis/(2000 Data Base)

CLIENT:	PEI ENERGY CORPORATION	AMEC Environment & Infrastructure A Division of AMEC Americas Ltd. 495 Prospect St, Suite 1 Fredericton, N.B., E3B 9M4 (P) 506-458-1000				
PROJECT:	HERMANVILLE / CLEARSPRING 30MW WIND FARM	DWN BY: TM	DATUM: UTM Zone 20	DATE: January, 2013		
		CHK BY: CL	PROJECTION: NAD83	PROJECT No: TE121023		
TITLE:	FOREST HABITAT IN PROJECT FOOTPRINT	REV NO: N/A	SCALE: 1 : 16,000	FIGURE: 4.1		

Turbine
Substation
Service Building
Project Footprint
Transmission Line
Roads
Turbine Maintenance Road
Substation Power Line
Watercourse
Provincial Wetland
Property Boundaries

Collector Lines
NE
NW
SE
SW

N
S
200 100 0 200 Metres

Based on the field survey, the Study Area was divided into seven (7) terrestrial vegetative habitats as follows:

- Mature Mixed Forest
- Mature Deciduous Forest
- Mature Coniferous Forest
- Coniferous Plantation
- Regenerating Forest
- Vegetated Woods Road
- Wetland

Table 4.2 describes the vegetative habitats of the proposed wind turbine and substation facility sites as described in provincial forest inventory mapping and listed above.

Table 4.2 Habitat at / Adjacent to each Site

Site Name	**Habitat Type**	
	Mapped	**Field Identified**
T1	Rich Forest	Mature Mixed Forest
T2	Upland Forest	Mature Mixed Forest
T3	Rich Forest	Mature Deciduous Forest
T4	Rich Forest	Mature Mixed Forest
T5	Rich Forest	Mature Mixed Forest
T6	Disturbed Forest	Regenerating Forest
T7	Upland Forest	Mature Mixed Forest
T8	Upland Forest	Mature Mixed Forest
T9	Upland Forest	Mature Mixed Forest
T10	Upland Forest	Mature Mixed Forest
Substation	Disturbed and Upland Forest	Mature Mixed Forest
Service Building	Disturbed Forest	Regenerating Forest

Mature mixed forest is comprised of red maple (*Acer rubrum*), white birch (*Betula papyrifera*) and balsam fir (*Abies balsamea*) in the overstorey. When not bare the understorey is predominantly bracken ferns (*Pteridium aquilinum*), sarsaparilla (*Aralia nudicaulis*), bunchberry (*Cornus canadensis*) and wild lily-of-the-valley (*Maianthemum canadense*). Other common species observed included ground hemlock (*Taxus canadensis*), witherrod (*Viburnum nudum*), wood ferns (*Dryopteris* sp.), whorled wood aster (*Oclemena acuminate*), blue-bead lily (*Clintonia borealis*), wintergreen (*Gaultheria procumbens*), starflower (*Trientalis borealis*), twinflower (*Linnaea borealis*), mayflower (*Epigaea repens*) and Indian pipe (*Monotropa uniflora*).

The overstorey forest composition in the mature deciduous forest is similar to that of the mature mixed forest with the exception that the balsam fir trees are saplings. Within the mature coniferous forest the understorey is generally bare or comprised of feather moss with an overstorey predominantly of balsam fir and/or white spruce (*Picea glauca*) and/or black spruce (*Picea mariana*). Notably, pinesap (*Monotropa hypopithys*) has been observed in several of the predominately coniferous habitats.

The vegetation situated in the coniferous plantation habitat type is typically comprised of young white pine (*Pinus strobus*) and white spruce intermingled with red maple sucker shoots, witherrod, blueberry (*Vaccinium angustifolium*), bracken ferns, sarsaparilla, bunchberry, and twinflower. The regenerating forest shrub layer and understory habitat is similar but with more floral species typical of disturbed areas such as pin cherry (*Prunus pensylvanica*), fireweed (*Chamerion angustifolium*), goldenrods (*Solidago* sp.) and asters. This vegetation assemblage can also be observed along the woods roads with the exception of a lack of a shrub layer. It should be noted that several of the woods roads had *Spiranthes ochroleuca* growing in great numbers.

The presence of mature mixed forest habitat is the dominant forest type observed within the Study Area. This habitat type was observed in all the wind turbine locations with the exception of T3 which is considered to be predominately a mature deciduous forest, and T6 which is in a regenerating forest. It should be noted that near T3, *Polypodium appalachianum* was observed. The second dominant forest habitat is mature deciduous woods. This forest type is found mainly intermingled with mixed forests along the proposed access road between wind turbine locations; especially between T10 and T9 as well as around T8 and T7. Regenerating forests and coniferous plantations are easily observed in the eastern portion of the Study Area as well as along the access road between T5 and Souris Line Road and between T10 and Souris Line Road.

A total of four wetland areas were observed during the surveys, three of which were delineated (Figure 2.1). The first wetland (WL1) is located along an existing watercourse. The wetland is a mapped wetland and was classified as an aquatic bed due to the large beaver dam at one end. Biodiversity is high compared to the rest of the Study Area with the presence of *Ranunculus gmelinii* and *Agrostis perennans* most notably observed. It is not anticipated that the proposed access road will impact this wetland as it is located greater than 30 m downstream of its edge. Wetland 2 (WL2) is located just south of T1. This is an unmapped forested wetland dominated by red maple and balsam fir in the overstorey, alders and witherrod in the understory, and various mosses and herbs in the understory. Most notably observed were several *Platanthera lacera* orchids as well as *Agrostis perennans*. The third wetland (WL3) delineated is located in the centre of Option 1. It is a shrub swamp that, although dominated by mountain maple in the overstorey, is noted to have several wetland species in the understory such as cinnamon fern, interrupted fern, sensitive fern, jewel-weed and joe-pye-weed.

Based on the observations in the field, the locations of the wind turbine and access roads are well placed. It should be noted that the vegetation survey was conducted in late August and consequently spring ephemerals such as coralroot (*Corallorhiza trifida*) could not be confirmed. Nonetheless, due to the generally disturbed nature of the sites surveyed, a spring survey is not recommended.

4.4.2 Fauna

The terrestrial fauna of interest in context of the Project are avian and bat populations. These faunal species have the potential to interact with the towers, rotors and guylines. PEI does have resident populations of other terrestrial fauna such as furbearers (fox, coyotes, rabbits etc.) that are of public interest but are not likely to have adverse interactions with the Project.

4.4.2.1 Local and Migratory Birds

There are approximately 333 species of birds which can be found in PEI (Government of PEI, 2012). Most migratory birds are protected under the federal MBCA. Under this Act, no person shall deposit, or permit to be deposited oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds, and no person shall possess, buy, sell, exchange or give a migratory bird or nest or make it the subject of a commercial transaction, without lawful excuse, and no person shall disturb, destroy or take a nest, egg, nest shelter, eider duck shelter, or duck box of a migratory bird without a permit. Birds that are not protected under the MBCA include grouse, quail, pheasants, ptarmigan, hawks, owls, eagles, falcons, cormorants, pelicans, crows, jays and kingfishers. In PEI, migratory birds typically nest during the “sensitive nesting window” of May 1 to August 31, and begin migration in late September. Migratory routes are dependent on several factors including origin, species and time of day that migration occurs.

The following literature and information sources were reviewed and/or contacted:

- Maritime Breeding Bird Atlas (MBBA) (2nd Atlas, 2012);
- ACCDC;
- PEIDAF, Fish and Wildlife Division (Government of PEI, 2012);
- Christmas Bird Count (CBC) Database (CBC 2012); and
- MBCA, 1991.

Once the above sources were consulted, all of the bird species that could potentially occur in the Study Area were compiled in a species list. Within the MBBA 2nd Atlas (MBBA, 2012), which was compiled over the period of 2006 – 2010, Region #27 is comprised entirely of PEI and is broken into 101 area “squares” where 139 bird species have been identified. The Study Area lies within Square #20NS54 (Hermanville), where 95 bird species have been identified as possible, probable or confirmed breeders. Most of these species nest within the sensitive nesting window (May 1 to August 31).

Fourteen (14) of these species have been known to breed outside the sensitive breeding window and are protected under the MBCA, as shown in Table 4.3.

Table 4.3 Migratory Bird Species Potentially Breeding in the Study Area Outside the Sensitive Nesting Window

Species	*Habitat	[1]Breeding Dates
American black duck	Wide variety of wetlands surrounding freshwater or marine water	Apr 1 – Aug 31
Ring-necked duck	Wooded areas around freshwater	Mid-May – Early Sept
Common merganser	Wooded areas around freshwater	Early Apr – Aug 31
Mourning dove	Open woodland and forest edge; nests on ground or low branches	Mid-May – Sept 30
Pileated woodpecker	Dense coniferous or mixed forests with tall closed canopy	Late Apr – Early July
Eastern wood-pewee	Wide variety of forest types, usually disturbed or open	Early June – Early Sept
Red-eyed vireo	Hardwood groves; nests on deciduous trees	Early June – Mid-Sept
Barn swallow	Nests inside barns or beneath overhanging structures	Mid-May – Early Sept
American robin	Varied interior habitat; nests in tree forks, branches or building ledges	May 1 – Late Sept
Cedar waxwing	Open woodland and forest edge; nests in shrubs or trees	Early June – Mid-Sept
Dark-eyed junco	Open woodland and forest edge; concealed nest on ground	May 1 – Early Sept
White-winged crossbill	Coniferous or mixed forest edge	Feb 1 – Aug 31
Pine siskin	Varied interior habitat; nests in trees	Late Apr – Early Aug
American goldfinch	Varied interior habitat, nests low in trees or shrubs	Late June – Sept 30

(*NatureServe, 2012)
[1] MBBA, 2012

Other rare birds that appeared in the 2nd MBBA atlas for this square, but are not protected by the MBCA and/or nest within the sensitive nesting window, include the sharp-tailed grouse, boreal owl and the Canada warbler.

Information on winter resident species in eastern PEI was obtained by consulting the CBC database. The Project Area lies approximately 5 km from the westernmost edge of the CBC circle for East Point. The East Point CBC was held on six years, from 2001-2005 and again in 2011. Over the six CBCs, a total of 103 species were observed wintering at East Point including two federally listed species at risk, the Harlequin Duck and Barrow's Goldeneye (SARA: Special Concern). It is noted that both of these species are coastal waterfowl, and are therefore very unlikely to occur in the habitat of the Project Area.

The ACCDC database was consulted to obtain records of rare avian species occurrences within a 5 km radius of the Project Area. Three species of migratory birds that breed outside the sensitive nesting area were listed by the ACCDC: the barn swallow, pileated woodpecker and pine siskin. Rare birds are discussed further in Section 4.4.3.2 below within Faunal Species-at-Risk.

Most migrating bird species are protected under the federal MBCA. Since both breeding and migrating birds have the potential to be impacted by the wind turbines, a comprehensive field inventory of breeding and migrating birds was developed.

Baseline bird surveys of the Project Area were conducted by Cathleen McCormack (Appendix B). The methodology of these surveys was based on previous survey work completed in the area, which had been developed in consultation with CWS (Dalzell, 2010). Surveys were initiated in April 2012 and consisted of four seasonal components: spring migration (April to early June), peak breeding season (June to early July), autumn migration (August to November), and winter residency (currently in progress; December to March). For spring and fall migration and winter residents, surveys were conducted along a roadside transect with 19 stops spaced approximately 325 m apart. During the breeding season, ten-minute point counts were conducted at the turbine locations to survey breeding birds, and observed breeding evidence (according to Bird Studies Canada and MBBA criteria) was recorded.

The objectives of the study were to determine: 1) what species make use of the habitat at the proposed wind farm site at different times of year; 2) of the species present at the site, which may be most susceptible to collision with turbines based on flight height and behaviour; 3) the peak spring and fall migration periods at the site, based on bird abundance and species diversity; and 4) whether any species at risk or species of conservation concern make use of the proposed site during migration or for breeding.

During the 2012 spring migration period, a total of 12 transect surveys were conducted between April 18th and June 3rd. Over 1000 individual birds of 54 different species were observed, with the highest abundance and diversity noted in mid-May to early June. During the fall migration period, 23 surveys were conducted between July 30th and November 15th; a total of 2133 individual birds and 60 species were detected, with the greatest abundance and species diversity occurring early in the migration season from July 30th to September 1st. Almost all of the species observed during the migration counts are known to breed in the region, with few northern or southern migrant species seen; therefore, it is not believed that the area serves as a significant migration stopover.

Over the course of three breeding bird surveys conducted between June 12th and July 2nd, a total of 353 individual birds were observed and breeding evidence for 35 species was recorded (29 probable breeders and a further six possible breeders). The winter resident surveys are still in progress; however, only 14 birds of seven species were observed during the December transect survey.

No federally or provincially listed species at risk were observed during the surveys. The report concludes that there is relatively little risk of bird mortality by collisions with the wind turbines at the Project Area, as the site does not appear to be part of a major migration corridor, and species that engage in aerial displays which would put them at greater risk of collision (e.g. Wilson's Snipe and Bobolink) were not observed at the site. Disturbance/displacement and habitat loss present moderate concerns; however, the habitat types found in the Project Area are not unique to the region, and the size of the proposed wind farm is fairly small (10 turbines).

4.4.2.2 Bats

Little is known of bat populations in Prince Edward Island. Four species of bats have been reported to occur within the Province, including the little brown bat (*Myotis lucifugus,* formerly *M. keeni*), the northern long-eared bat (*Myotis septentrionalis*), the hoary bat (*Lasiurus cinereus*), and red bat (*Lasiurus borealis*). The distribution, abundance, and status of bats in PEI are poorly known, though a recent study indicated that little brown bats and northern long-eared bats were the most abundant and widespread species in PEI, while hoary bats are likely rare migrants to the Province (Henderson *et al.* 2009). The ACCDC has ranked the little brown bat as S5, and the northern long eared bat as S1S2. The two other species are indicated as being present but transient therefore are not ranked.

Bats hibernating in Eastern North America are currently being threatened by a newly emerging disease known as "white-nose syndrome" (WNS), which is caused by a fungus thriving in the cold damp environment provided by typical bat caves. As of autumn 2012, 90% of the previously common little brown bat species has been decimated in NB and NS. There are also indications that the northern long-eared bat and tri-coloured bat populations may have been even worse affected. The disease has been confirmed in Quebec and Ontario, and the syndrome is spreading at a rate of 200-400km/yr to date. At this rate, the entire Canadian population will be impacted in 11 to 22 years.

As a result, an emergency assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has listed these three bat species as "Endangered" in February of 2012, which may lead to a protective designation under the SARA (COSEWIC, 2012). Lack of hibernation habitat (hibernacula) on PEI indicates that summer bat populations probably migrate to the nearby provinces of NB and NS in the winter, leading to speculation that PEI populations have already been impacted as well (Henderson, 2009; CBC, 2012). However, to date no bats with WNS have been observed in PEI (pers. comm., McBurney, Scott, December 2012).

A single sight report of a suspected red bat in PEI exists (Cameron, 1958, cited in Sobey 2007). The ACCDC lists the red bat as SNA in PEI, and is classified as transient. This species is not discussed in depth in this document.

Brief overviews of the behaviour and life histories of the little brown bat, northern long-eared bat, and hoary bat are provided in the following subsections

Little brown bat

The little brown bat was probably the most common bat species in North America, ranging from Alaska to California (Barbour and Davis, 1969). In PEI, the ACCDC listed them as S5, meaning their status in the Province is secure with many occurrences. It is one of two bat species considered to have significant populations in PEI (Henderson, Farrow and Broders (2009).

This small non-migratory species is abundant in forested areas, and is often associated with human settlement. In summer, reproductive females may form nursery colonies containing hundreds, sometimes thousands of individuals in buildings, attics, and other man-made structures. Females generally give birth to single young. Males and non-reproductive females roost alone or in smaller groups and may be found in buildings, caves, trees, under rocks, behind shutters, in crevices, and under tree bark (Barbour and Davis, 1969, Fenton and Barclay 1980). Broders and Forbes (2004) noted that little brown bat roost selection appears highly dependent on the number of snags (dead trees) in the area.

Little brown bats often forage over water (Fenton and Bell, 1981), but have also been seen foraging in woodlands and developed areas (van Zyll de Jong, 1985). They eat a wide variety of insects, including flies, beetles, butterflies, moths, caddis flies, cicadas, leafhoppers, aphids, scales, ants, bees, and wasps (Whitaker 1972, Anthony and Kunz 1977, Whitaker 2004). A single little brown bat can catch up to 1,200 insects in just one hour during peak feeding activity (BatCon, 2006).

While many bat species mainly hunt flying insects (a behaviour known as "hawking"), little brown bats and northern long-eared bats can also take prey off foliage, other surfaces or the ground; a behaviour known as "gleaning" (Ratcliffe and Dawson 2003). Their large ears, characteristically short, high frequency, soft echolocation call (Faure *et al*. 1993), and ability to hover in flight make this gleaning behaviour possible (Ratcliffe and Dawson 2003).

In late summer, little brown bats may travel hundreds of kilometres to swarm around caves and abandoned mines (Fenton and Barclay 1980). Their hibernation sites tend to be extremely humid (>90%) and to maintain temperatures above-freezing (i.e., 1-5°C) (Fenton *et al*., 1983; Fenton and Barclay 1980). Brown *et al.* (2007) reported over 600 little brown bats overwintering in a basement in Queens County in PEI, however this was atypical behaviour for this species and the unnatural hibernaculum no longer exists.

Northern long-eared bat

The northern long-eared bat was also widely distributed across North America, with a range from Newfoundland and the eastern US to coastal British Columbia (Barbour and Davis, 1969). The ACCDC lists them as an S1S2 species in PEI, meaning they are considered rare in the province. It is considered uncommon in PEI, but is still one of the two bat species considered to have significant populations in the province (Henderson, Farrow and Broders 2009).

This small non-migratory species is considered a forest-interior species (Broders *et al*. 2006; Caceres and Barclay, 2000) and occurs in both hardwood and softwood forests (Foster and Kurta, 1999). Maternity colonies appear to occur most often in mature, shade tolerant deciduous tree stands (Broders and Forbes, 2004) where females generally give birth to single young. Males and non-reproductive females typically roost in tree cavities and beneath peeling bark. Such individuals may switch roosts every two days and have roosts up to 2 km apart (Foster and Kurta, 1999; Jung *et al*. 2004). This species is generally more solitary than the little brown bat and is most often found singly or in very small groups.

Northern long-eared bats have been observed foraging along forest edges, over forest clearings, at tree-top level, and occasionally over ponds (BatCon, 2006). Similar to little brown bats, northern long-eared bats eat a variety of insects, including Coleoptera (beetles), Diptera (true flies), Lepidoptera (butterflies and moths) and Trichoptera (caddisflies) (Brack and Whitaker 2001, Carter *et al*. 2003, Whitaker 2004). Also like little brown bats, northern long-eared bats exhibit hawking behaviour in addition to gleaning (Ratcliffe and Dawson 2003).

Little is known about the population dynamics and reproductive biology of this species. They swarm in mines and caves in the fall, and hibernate in many of these same spaces, although not in large numbers. Northern long-eared bats are said to prefer cooler hibernation temperatures than Little Brown Bats (van Zyll de Jong 1985). Brown *et al*. (2007) published the first report of this species' occurrence and evidence of over wintering in PEI. This report was based on the capture of two specimens by a domestic cat and on the presence of 136 specimens found in an atypical hibernaculum in Queens County, which also supported hibernating little brown bats (see previous subsection on little brown bats).

Hoary bat

The hoary bat is a widespread species, ranging throughout North America from Alaska south into Brazil and Guatemala. They are also found in Hawaii and in the Galapagos (Barbour and Davis 1969). PEI appears to be on the far eastern edge of their range, as they are considered rare migrants to the Province (Henderson *et al.* 2009). This species was first observed in PEI in 1999 (McAlpine *et al*. 2002). The ACCDC does not rank the hoary bat in PEI, considering it transient.

These large migratory bats are high and fast fliers, averaging 7.7 m/s while foraging (Salcedo *et al.* 1995). Adult females roost alone or with their dependent young, usually 3-12 m above the ground (van Zyll de Jong 1985). During the summer, there is often some segregation based on sex, with females concentrated in eastern North America and males concentrated in the western North America (Findley and Jones 1964; Cryan 2003). Females give birth in spring (i.e., mid-May to late June); usually litters of two, but may have up to four pups (Bogan 1972, Koehler and Barclay 2000).

Hoary bats often forage in open spaces over glades or lakes in forested areas (Banfield 1974, van Zyll de Jong 1985). Menzel *et al*. (2005) reported significantly greater activity levels above the forest canopy than within or below it. Hoary bats primarily feed on Lepidoptera (butterflies and moths) (Black 1974, Whitaker 1972, Carter *et al*. 2003), though they may consume a wide variety of insects.

Most hoary bats migrate south for the winter, which has so far limited the impact of the WNS outbreak to their populations - though individuals have been found in Michigan, New York and Ontario during the winter (Shump and Shump 1982, Bouchard *et al*. 2001). Hoary bats may travel as far as Mexico (Barbour and Davis 1969, Cryan 2003). Migrants often travel in groups while moving south in the fall (Shump and Shump 1982). In the spring, a northern migration occurs and Findley and Jones (1964) reported females preceding males during this migration.

Bat Surveys on the Hermanville/Clearspring Project Site

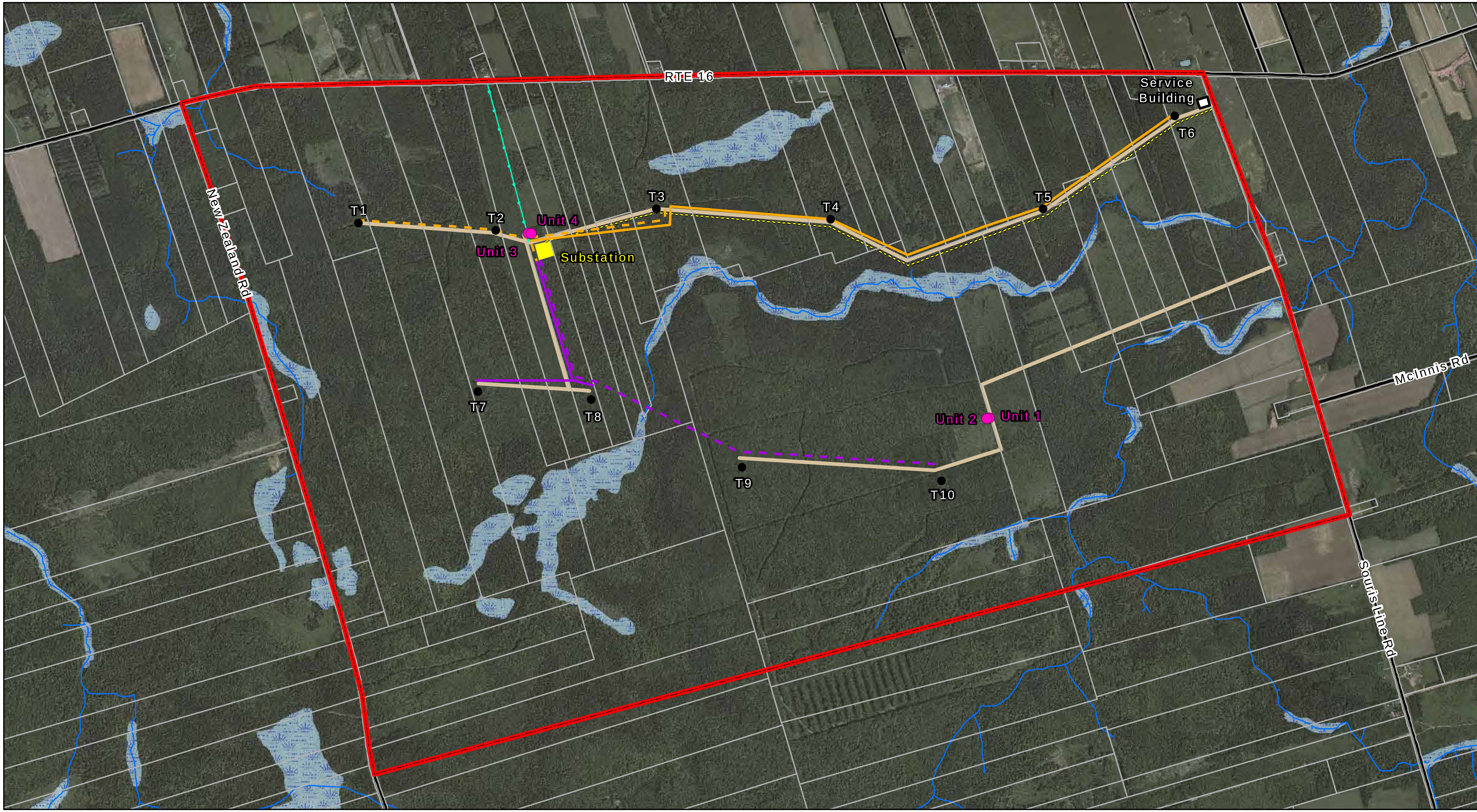
Passive acoustic survey methods were used to record bat calls to determine the occurrence of bats on the Project site. Anabat II and SD2 compact flash bat detectors (Titley Electronics Pty. Ltd, Ballina, New South Wales, Australia) were deployed in areas likely to support bats and set to record all ultrasonic sounds between 7 pm and 7 am.

The Unit #1 Anabat II detector (Figure 4.2) was deployed on the Project site from August 12th to October 13th, 2012. The detector along with its power supply was set up on the ground in a waterproof housing fitted with a microphone tube, which allowed sampling of a section of the sky approximately 45 degrees from horizontal. The setup was placed within 5 m of the tree line on the site, with the microphone tube pointing parallel to the tree line (northeast) to allow sampling of the forest edge.

In addition, three (3) aerial bat monitoring systems where installed and operated at the Hermanville/Clearspring site. For Unit #2, AMEC, with the support of Frontier Power Systems personnel, erected a 10 m portable mast. This tower was situated at the edge of the cleared site adjacent to the treeline (Figure 4.2) approximately 10 m to the east of the ground system unit (Unit #1). Both were aimed in the same westerly direction along the treeline. The microphone was mounted facing downwards, and a 45 degree Lexan plate reflected incoming sounds into the waterproof housing. This allowed sampling of a horizontal section of the sky at treetop height. The unit operated from August 24th to October 13th, 2012.

For Units #3 and #4 (Figure 4.2), the Anabat II detectors were mounted to the meteorological mast erected by Frontier Power Systems. The microphone from Unit #3 was situated 20 m above grade and the microphone from Unit #4 was located at 40 m above grade. Unit #3 was pointed to pick up sounds from a westerly direction whereas Unit #4 was aimed in an easterly direction. Both units were operated from August 28th to October 13th, 2012.

The rationale for locating microphone units at these elevations was to determine levels of bat activity at heights within or near the operating radius of wind turbine blades.



Path: G:\GIS\PROJECTS\TE121023_PEI_EnergyCorp_EastPEIWind\MXD\20130128_Revisions\20130128_BatSurveyLocation_Fig4_2.mxd User: tanya.morehouse, Date: 29/01/2013 SOURCE: http://www.gov.pe.ca/gis/(2000 Data Base)

CLIENT: PEI ENERGY CORPORATION

AMEC Environment & Infrastructure
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amec

PROJECT: HERMANVILLE / CLEARSPRING 30MW WIND FARM

TITLE: ANABAT UNIT LOCATIONS

DWN BY: TM	DATUM: UTM Zone 20	DATE: January, 2013
CHK BY: CL	PROJECTION: NAD83	PROJECT No: TE121023
REV NO: N/A	SCALE: 1 : 16,000	FIGURE: 4.2

Bat Monitoring Unit
Turbine
Substation
Service Building
Transmission Line
Roads
Turbine Maintenance Road
Substation Power Line
Watercourse
Provincial Wetland
Project Footprint
Property Boundaries

Collector Lines
NE
NW
SE
SW

N S
200 100 0 200 Metres

The map shown here has been created with all due and reasonable care and is strictly for use with AMEC Project Number: TE121023. This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind. AMEC assumes no liability, direct or indirect, whatsoever for any such third party or unintended use.

Overall, recording units were on site for a total of 208 unit days and were actively collecting data for a total of 171 unit days (82% of time on site). All the units experienced some minor technical difficulties (batteries exhausted, card corruption, etc.) and were down for some period of time. Of the 171 unit days recorded, a total of 70 unit days observed bat activity (41% of the time on site). Bat activity was most pronounced in August with 28 of the 36 unit days (78%) having at least one bat occurrence. This decreased substantially in September, with only 26 of 85 unit days (31%) showing evidence of bat presence and in October, with only 16 of 48 unit days (33%) having evidence of bat presence. Intensity of bat activity (total number of bat occurrences) showed a similar trend.

The majority (99.6%) of bat observations were determined to likely be *Myotis* spp. (either little brown or northern long eared bats). In addition, two (2) records were identified as likely to be hoary bats (*Lasiurus cinereus)* and three (3) records were determined to possibly be red bats (*Lasiurus borealis)*. The five non-*Myotis* records were recorded by Unit #1 on the 18th, 19th, 21st, & 22nd of August, 2012. For more detail on the pre-construction bat monitoring program and results please refer to Appendix C.

4.4.3 Species at Risk

The following section focuses on Species at Risk (i.e., endangered, threatened, of special concern, and rare species), which are of concern due to potential disturbance as a result of Project development. Available information on the known occurrence of floral and faunal Species at Risk in the Study Area was compiled and reviewed to determine their presence relative to the proposed infrastructure. Sources included published and unpublished listings of occurrences of such species and these are described below.

The federal SARA came into force in June 2003, as part of a three-part national strategy for the protection of wildlife Species at Risk, which also includes commitments under the Accord for the Protection of Species at Risk and activities under the Habitat Stewardship Program for Species at Risk. The listing process begins with a species assessment that is conducted by COSEWIC. Based on a status report, species specialist subcommittees assess and assign the status of a wildlife species believed to be at some degree of risk. SARA uses the COSEWIC scientific assessment when making the listing decision. Once a species is added to Schedule 1 it benefits from all the legal protection afforded, and the mandatory recovery planning required under SARA. The Act provides federal legislation to prevent wildlife species from becoming extinct and to provide for their recovery. Under the Act, an ongoing process of monitoring, assessment, response, recovery, and evaluation will be undertaken to improve the species status and ecosystem. The prohibitions and offences portions of the Act came into effect in June 2004. The status of species protected under SARA can be found at the Species at Risk Public Registry (SARPR) online at http://www.registrelep-sararegistry.gc.ca.

The Forests, Fish and Wildlife Division of the PEIDAF provides additional species protection through its *Wildlife Conservation Act*. The Act includes provisions for the protection of species at risk and their habitats. A Provincial Species at Risk Advisory Committee is in place to assess the Province's wildlife resources and advise the Minister of PEIDELJ of those species that should be listed by SARA for the Province.

COSEWIC and SARA categorize rare species into three main groups according to their status within the Province:

- Endangered: A wildlife species facing imminent extirpation or extinction.
- Threatened: A wildlife species likely to become endangered if limiting factors are not reversed.
- Special Concern: A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

The ACCDC is part of the NatureServe network, a non-government agency which maintains conservation data for the Atlantic Provinces. An information response was received from the ACCDC July 11, 2012 for a list of occurrences of rare and endangered flora and fauna within and near the proposed Study Area. The paragraphs below detail species of conservation concern that could potentially occur in the vicinity of the proposed Project. S1, S2, and S3 ranked species are considered to be extremely rare to uncommon within its range in the Province and are discussed in the following sections. S4 and S5 ranked species are not discussed, as these species are widespread and their occurrences are fairly common to abundant.

The 5 km buffer around the Study Area contains 208 records of 54 vascular plants as well as 56 records of nonvascular plants. In regards to fauna, 50 records of 22 vertebrate fauna were reported.

4.4.3.1 Flora Species-at-Risk

The following plant species of concern are identified in Table 4.4 as known to occur within 5 km of the Project Site and therefore potentially occurring within the Project Area (ACCDC, 2012).

In addition, there are two (2) SARA plant species found in PEI and listed as Schedule 1 which appeared on the ACCDC Range Maps as rank 1 or "possible occurrence" within the 5 km buffer of the Study Area. Those species are:

- Beach pinweed (*Lechea maritima var. subcylindrica*); and
- Gulf of St. Lawrence aster (*Symphyotrichum laurentianum*).

Table 4.4 Plant Species of Concern Potentially in the Study Area

Scientific Name	Common Name	S-Rank	Habitat*
Atrichum crispum	Moss	S2?	Unknown
Aulacomnium androgynum	Little groove moss	S1S2	Wooded ravine, sandstone boulders along creek; humus woods.
Botrychium lanceolatum	Triangle moonwort	S1S2	Rich hardwoods and clearings
Botrychium lanceolatum var. angustisegmentum	Triangle moonwort	S1S2	Various woodland and floodplain scenarios
Botrychium multifidum	Leathery moonwort	S2	Stabilized dunes, rich hardwoods and clearings
Botrychium virginianum	Rattlesnake fern	S3	Rich hardwoods
Campylostelium saxicola	Moss	S1S2	Wooded ravine, sandstone boulders along creek; side of somewhat shaded boulder wooded slope
Carex deflexa	Northern sedge	S2	Lichen mats of open forest or sandy/gravelly areas
Carex pallescens	Pale sedge	S3S4	Moist meadows, clearings and edge habitat
Cirsium muticum	Swamp thistle	S2S3	Swamps and wet meadows
Corallorhiza maculata	Spotted coralroot	S2	Mature, dry woods
Corallorhiza trifida	Early coralroot	S2	Seepage areas and close to streams in rich woods
Cypripedium parviflorum var. pubescens	Yellow lady's slipper	S2	Damp woods or boggy areas
Deparia acrostichoides	Silvery glade fern	S3	Rich, moist hardwoods
Dichodontium pellucidum	Transparent fork moss	S2S3	Wooded ravine on sandstone boulders along creek.
Dicranum leioneuron	Moss	S1?	Sphagnum hummocks or raised bog
Dicranum ontariense	Ontario broom moss	S2S4	Wooded ravine on sandstone boulders along creek; on humus in wooded ravine.
Dryopteris filix-mas	Male fern	S1	Dense woods on limestone
Eriophorum viridicarinatum	Green-keeled cottongrass	S2	Sphagnum bogs.
Fissidens bryoides	Lesser pocket moss	S2S3	Wooded ravine, sandstone boulders along creek; soil over somewhat shaded rock beside creek.
Fraxinus nigra	Black ash	S2	Swamps and river bottomlands
Geranium robertianum	Herb Robert	S3S4	Rocky woods and wet ledges
Geum macrophyllum	Large-leaved avens	S2?	Rich woods and thickets
Goodyera oblongifolia	Menzies' rattlesnake-plantain	S1	Damp old growth or coniferous/mixed woods
Goodyera repens	Lesser rattlesnake-plantain	S2	Moist old growth coniferous woods or wetlands

Table 4.4 Plant Species of Concern Potentially in the Study Area

Scientific Name	Common Name	S-Rank	Habitat*
Goodyera tesselata	Checkered rattlesnake-plantain	S2	Dry coniferous woods and evergreen bogs
Gymnostomum aeruginosum	Tufted rock beardless moss	S1	Wooded ravine on sandstone boulders along creek; on somewhat shaded rock.
Heterocladium dimorphum	Dimorphous tangle moss	S2S3	Wooded ravine on sandstone boulders along creek; on humus in wooded ravine.
Hydrocotyle americana	American marsh pennywort	S3	Moist woods, meadows and thickets
Hygroamblystegium tenax	Fountain feather moss	S2S3	Unknown
Hypericum mutilum	Dwarf St. John's-wort	S1	Damp open areas
Hypnum cupressiforme	Cypress-leaved plait moss	S1S3	Wooded ravine, sandstone boulders along creek; side of somewhat shaded rock beside creek.
Juncus canadensis	Canada rush	S2?	Ditches and other wet areas
Juncus filiformis	Thread rush	S2S3	Shores, marsh edges and ditches
Juniperus communis var. depressa	Common juniper	S3?	Dry, exposed ledges and old pastures
Lactuca canadensis	Canada Lettuce	S3?	Moist clearings and thickets.
Leptobryum pyriforme	Golden thread moss	S3S4	Wooded ravine on sandstone boulders along creek; on sandy soil over boulder beside creek.
Listera convallarioides	Broad-leaved twayblade	S2	Moist areas along streams and lake shores
Listera cordata	Heart-leaved twayblade	S2	Moist banks and coniferous swamps and bogs
Lycopodiella inundata	Northern bog clubmoss	S2S3	Standing water of peatlands
Lycopodium obscurum	Flat-branched tree-clubmoss	S1S2	Damp, open woods and clearings
Mnium spinulosum	Moss	S2S4	Wooded ravine on sandstone boulders along creek; on humus over somewhat shaded boulder on wooded slope
Moneses uniflora	One-flowered wintergreen	S3	Mossy coniferous woods
Monotropa hypopithys	Pinesap	S3	Parasitic on roots of pines in dry sandy soil
Muhlenbergia mexicana	Mexican muhly	S2	Shores and rocky banks
Onchophorus wahlenbergii	Wahlenberg's spur moss	S2S4	Wooded ravine on sandstone boulders along creek; on somewhat shaded boulder in woods
Osmorhiza claytonii	Hairy sweet cicely	S2	Moist woods and clearings

Table 4.4 Plant Species of Concern Potentially in the Study Area

Scientific Name	Common Name	S-Rank	Habitat*
Panax trifolius	Dwarf ginseng	S2	Rich deciduous woods
Paraleucobryum longifolium	Long-leaved notchleaf moss	S2?	Wooded ravine on sandstone boulders along creek; on somewhat shaded rock in wooded ravine.
Plagiomnium medium	Common leafy moss	S2S4	Wooded ravine on sandstone boulders along creek; on boulder beside creek.
Platanthera aquilonis	Leafy Northern Green Orchid	S2	Various sedge meadows, bogs, ditches and wooded areas
Platanthera clavellata	Club spur orchid	S3	Swamp woods, sunlit stream banks and disturbed sites
Platanthera dilatata	White bog orchid	S3	Springy areas, evergreen bogs and sedge meadows
Platanthera orbiculata	Small round-leaved orchid	S2	Variety of dry or swampy wooded areas
Polystichum acrostichoides	Christmas fern	S3	Rich woods and rocky slopes
Pseudotaxiphyllum elegans	Elegant silk moss	S1S2	Wooded ravine on sandstone boulders along creek; on soil under overhanging rock.
Pyrola asarifolia	Pink pyrola	S2	Mostly coniferous woods.
Pyrola chlorantha	Green-flowered pyrola	S1S2	Mostly coniferous woods
Ranunculus gmelinii	Gmelin's water buttercup	S2	Lime-rich wet meadows, ponds, and streams.
Ranunculus recurvatus	Hooked buttercup	S1?	Rich wooded areas
Rhamnus alnifolia	Alder-leaved buckthorn	S3S4	Swamps and bog margins especially in calcareous areas.
Rhizomnium appalachianum	Appalachian leafy moss	S2S4	Wooded ravine on sandstone boulders along creek; on sandy soil beside creek.
Rhizomnium punctatum	Dotted leafy moss	S2S4	Wooded ravine on sandstone boulders along creek; on soil over boulder beside creek.
Ribes triste	Swamp red currant	S3S4	Rocky, moist woods and thickets
Sanicula marilandica	Maryland sanicle	S3	Woods, thickets and meadows
Schistidium rivulare	River bloom moss	S1S2	Wooded ravine on sandstone boulders along creek; on somewhat shaded boulder in woods
Sphagnum flavicomans	Northeastern peat moss	S1?	Bog
Sphagnum tenellum	Soft peat moss	S1?	Bog
Spiranthes ochroleuca	Yellow Ladies'-tresses	S1	Disturbed areas such as open gravel pits, roadsides and lawns

Table 4.4 Plant Species of Concern Potentially in the Study Area

Scientific Name	Common Name	S-Rank	Habitat*
Stellaria alsine	Trailing stitchwort	S2S3	Wet banks and springy areas
Stellaria borealis	Boreal stitchwort	S2S3	Seepy area in red spruce-dominated, mature, mixed forest.
Veronica scutellata	Marsh speedwell	S3S4	Shores and similar wet areas
Viola labradorica	Labrador violet	S3	Cool moist rocky shores or ledge crevices
Viola renifolia	Kidney-leaved white violet	S3	Moist, cool woods and rocky slopes

Note: * Habitat as described in NatureServe, 2012; ACCDC, 2012; Hinds, 2000.

None of the SARA protected species, or the majority of the above noted at-risk species, are anticipated to be found within the Study Area. During a vegetation survey conducted in mid-August and early September, however, some of the species were observed (see Table 4.5). Recommendations have been made in Section 5.0 to ensure that essential habitat and the species themselves are not harmed.

Table 4.5 Floral Species-at-Risk Observed During the August and September 2012 Vegetation Survey

Scientific Name	Common Name	ACCDC Rank	General Status of Species in PEI	Location*
Agrostis perennans	Perennial Bentgrass	S3?	Sensitive	WL1 and WL2
Botrychium virginianum	Rattlesnake Fern	S3	Secure	Option 2
Corallorhiza sp.	Coralroot	S2	May be at risk or Sensitive	Option 1
Cypripedium parviflorum	Small Yellow Lady's-Slipper	S2	Sensitive	Option 2
Fraxinus nigra	Black Ash	S2	May be at risk	Option 2
Hydrocotyle americana	American Water-Pennywort	S3	Sensitive	WL1
Juncus filiformis	Thread Rush	S2S3	Sensitive	WL1
Monotropa hypopithys	American Pinesap	S3	Secure	Scattered
Platanthera clavellata	Small Green Woodland Orchid	S3	Sensitive	Option 2
Platanthera dilatata	Leafy White Orchid	S3	Sensitive	Option 2
Polypodium appalachianum	Appalachian Polypody	S1	May Be At Risk	TB3
Polystichum acrostichoides	Christmas Fern	S3	Secure	Option 2
Ranunculus gmelinii	Small Yellow Water-Crowfoot	S2	Sensitive	WL1
Rosa carolina	Carolina Rose	S2S3	Sensitive	Option 2
Solidago flexicaulis	Broad-Leaved	S3S4	Sensitive	Option 2

Scientific Name	Common Name	ACCDC Rank	General Status of Species in PEI	Location*
	Goldenrod			
Sparganium americanum	American Bur-Reed	S2?	Undetermined	WC1 and WL1
Spiranthes ochroleuca	Ladies'-Tresses	S1	May Be At Risk	Woods Roads
Vaccinium vitis-idaea	Mountain Cranberry	S3	Secure	Option 3 and Woods Roads

Note: See Figure 2.1 and 2.3 for location of Options, Wetlands and Watercourses.

Please note, as stated in Section 2.6 and depicted in Figure 2.1, the proposed access road between T1 and T7, T8 and T9, as well as access road and substation options 1, 2 and 3 will not be pursued. Consequently only turbine location T3's temporary footprint will be modified to accommodate the presence of *Polypodium appalachianum,* which is currently located just along the southern edge of the proposed temporary workspace footprint.

4.4.3.2 Fauna Species-at-Risk

For the Province of PEI SARA lists three bird species as Endangered under Schedule 1: the piping plover (*Charadrius melodus melodus*), eskimo curlew (*Numenius borealis*) and the red knot (rufa subspecies, *Calidris canutus rufa*). SARA further lists the Canada warbler, common nighthawk (*Chordeiles minor*), and olive-sided flycatcher (*Contopus cooperi*) as Threatened and the rusty blackbird (*Euphagus carolinus*), barrow's goldeneye (*Bucephala islandica*), the short-eared owl (*Asio flammeus*) as Species of Special Concern under Schedule 1. The monarch butterfly (*Danaus plexippus*) is an arthropod listed as a Species of Special Concern under Schedule 1 which occurs in PEI.

The following faunal species of concern are identified in Table 4.6 as occurring within 5 km of the Project Area (ACCDC, 2012):

Table 4.6 Faunal Species of Concern in the Study Area (ACCDC)

Scientific Name	Common Name	S-Rank	Habitat*
Actitis macularius	Spotted sandpiper	S3S4B	Near freshwater in open or wooded areas, seacoasts or sometimes marshes
Anas acuta	Northern pintail	S3B	Lakes, rivers, marshes and ponds in fields or open boreal forests.
Anas discors	Blue-winged teal	S3S4B	Grassland surrounding freshwater marshes, ponds, lakes and sluggish streams.
Buteo jamaicensis	Red-tailed hawk	S3B	Tall trees in edge or open country
Carduelis pinus	Pine siskin	S2S3B, S4N	Coniferous or mixed woods, shrub thickets and suburban yards.
Charadrius melodus melodus	Piping plover melodus ssp	S1B	Sandy beaches and lakeshores.
Coccothraustes vespertinus	Evening grosbeak	S2B, S4N	Coniferous and mixed woods

Table 4.6 Faunal Species of Concern in the Study Area (ACCDC)

Scientific Name	Common Name	S-Rank	Habitat*
Dolichonyx oryzivorus	Bobolink	S3B	Frequents open habitats & grasslands
Dryocopus pileatus	Pileated woodpecker	S1	Coniferous or mixed wood areas near residential areas of towns or parks.
Gallinago gallinago	Common snipe	S3S4B	Wet meadows and bushy swamps
Gavia immer	Common loon	S1B, S4N	Small islands, quiet backwaters, or mainland shores near lakes
Hirundo rustica	Barn Swallow	S3B	Nests communally in mud nests under bridges, in barns & caves
Mergus serrator	Red-breasted Merganser	S2B,S5N	Saltwater habitats
Perisoreus canadensis	Gray jay	S3	Coniferous and mixed wood in open or edge areas or bogs
Pheucticus ludovicianus	Rose-breasted grosbeak	S3B	Edge areas or dense growths of small trees in parks.
Picoides arcticus	Black-backed woodpecker	S2	Coniferous forests, especially recently burned forests
Seiurus noveboracensis	Northern waterthrush	S3B	Cool, wooded swamps, bog thickets and rivers bordered with willow or alders
Sitta carolinensis	White-breasted nuthatch	S1	Open woods or edge areas
Tyrannus tyrannus	Eastern kingbird	S3B	Edge or open areas
Vermivora peregrine	Tennessee warbler	S3B	Edges of dense spruce, cleared balsam/tamarack bogs, alder thickets and open deciduous growth
Wilsonia canadensis	Canada Warbler	S3B	Dense understory of mature deciduous or mixed woodlands, shrubby areas near streams and swamps.

Note: * Habitat as described in NatureServe, 2012; Tufts, 1998.

The two SARA listed Species-at-Risk observed within the Study Area according to the ACCDC are the:

- Canada warbler, which is listed as “Threatened”; and
- Piping plover (*melodus* sub-species), which is listed as “Endangered”.

The Canada warbler prefers dense marshes around freshwater lakes and rivers. It’s listed as S3B under the ACCDC, indicating that it’s an “uncommon breeder” throughout its range in the Province. The Canada warbler inhabits areas of dense understorey of mature deciduous or mixed woodlands, shrubby areas near streams and swamps (Stokes and Stokes, 1996). The cause of its decline is attributed to significant loss of wintering habitat in South America.

The piping plover is a small, thrush-sized shorebird that breeds along the Atlantic coast from Newfoundland to South Carolina. They nest above the normal high-water mark on exposed sandy or gravelly beaches. On the Atlantic coast, they often nest in association with small cobble and other small beach debris on ocean beaches, sand spits, or barrier beaches, where they also forage for food (SARPR, 2012).

The Study Area does not provide suitable habitat to the piping plover but may provide habitat to the Canada warbler.

One of the species listed in Table 4.6, the common snipe, is considered an “upland game” bird in PEI (PEIDAF, 2012a).

No SARA or provincially listed species at risk were found during the 2012 surveys of the Project Area. Seven species of conservation concern according to the ACCDC were found: White-breasted Nuthatch (S1), Wilson’s Warbler (S2B), Pine Siskin (S2S3B,S4N), Gray Jay (S3), Bay-breasted Warbler (S3B), Rose-breasted Grosbeak (S3B) and Herring Gull (S3B,S5N). It should be noted that three species that are considered to be of conservation concern in the province only during breeding, the Pine Siskin, Rose-breasted Grosbeak and Herring Gull, were not detected during the breeding season surveys.

Two other SARA species, both listed as “Special Concern” are noted to “perhaps be present” according to the ACCDC predictive range maps:

- Monarch butterfly (*Danaus plexippus*); and
- Barrow’s goldeneye (*Bucephala islandica*)

The habitat present in the Study Area is unlikely for either the monarch butterfly or Barrow’s goldeneye. There is some potential along Souris Line Road for the presence of milkweed, the monarch butterflies preferred food. However, it is unlikely the installation of the transmission line will impact the monarch butterfly.

4.4.4 Designated Areas and Other Critical Habitat Features

Available information on designated areas and other habitat features identified as sensitive or critical was compiled and reviewed to determine their location in relation to the Study Area (ACCDC, 2012).

A number of natural areas within the Province of PEI have been either formally protected or inventoried as sites of potential significance and are recommended for protection as Conservation Areas or Significant Natural Areas. According to the *Natural Areas Protection Act* (2004), a natural area:

- contains natural ecosystems or constitutes the habitat of rare, endangered or uncommon plant or animal species;
- contains unusual botanical, zoological, geological, morphological or palaeontological features;
- exhibits exceptional and diversified scenery;
- provides haven for seasonal concentrations of birds and animals; or
- provides opportunities for scientific and educational programs in aspects of the natural environment.

The areas identified below are referred to as Designated Areas in this report.

Conservation Areas are federally or provincially managed areas and are identified by Environment Canada (Protecting Our Natural Heritage: Conservation Areas in Atlantic Canada, Environment Canada, Undated). Categories under the heading of Conservation Areas include:

- protected natural areas;
- wildlife management/protection areas;
- national wildlife areas/migratory bird sanctuaries; and
- designated wetlands/Eastern Habitat Joint Venture (EHJVs) areas.

Categories under the heading Significant Natural Areas include:

- environmentally significant areas;
- critical natural areas;
- nature reserves; and
- national and provincial parks.

All of the Conservation Areas and Significant Natural Areas listed above have been identified by Federal and/or Provincial regulatory authorities as areas for consideration and protection.

There are seventeen (17) Wildlife Management Areas protected by the Provincial *Wildlife Protection Act* totalling 5,431 ha on PEI – some of which are also designated as Natural Areas under the Provincial *Natural Areas Protection Act* (InfoPEI, 2011a). One such area, the Townshend Woodlot Natural Area, is located approximately 3.5 km from the centre of the Study Area. This is an old-growth forest which includes sugar maple, beech, yellow birch and red maple and is classified by the International Biological Program as “the best remnant of the original deciduous forest cover of Prince Edward Island” (Majka, 2010). Prior to its protection under the *Natural Areas Protection Act* in 1972, disturbances to the woodlot included the creation of woods roads and the removal of deadwood. The area is also host to a variety of invasive exotic species.

Ducks Unlimited Canada (DUC) works with government, industry and landowners to conserve wetlands that are critical to waterfowl, wildlife and the environment (DUC, 2012). There are no DUC areas within the Project Footprint, but there are three (3) located within 5km of the Study Area: Clearspring DUC, Harmony Junction DUC, and Borrow Pit 1 DUC.

There are six (6) forest management properties on PEI, one of which is located in New Harmony, which is just outside the 5 km search area buffer of the Study Area (approximately 6 km away). This is a demonstration woodlot established by the PEIDAF which covers 107 ha.

There are eleven (11) Provincial camping parks and fifteen (15) Provincial day-use Parks on PEI. There is no Federal or Provincial Parks located within 5 km of the Study Area. The closest Parks to the Study Area is the Souris Beach Provincial Park which is located on Route 2 approximately 13 km away and the Greenwich National Park, which is 30 km from the Project.

4.5 ATMOSPHERIC ENVIRONMENT

4.5.1 Climatology

The climate of the Study Area is described below. The information is based upon Climate Normals available from the EC weather station which is closest to the Study Area, which is 10 km away in East Baltic.

The climate of PEI is strongly influenced by the ocean which is within 20 km of any Island community. Consequently, delays in the onset of the seasons are caused by the ocean's retention of heat. Generally the winters are milder than the rest of the provinces in Canada, spring is late and cool, summers are modest and breezy and autumn is mild. From January to early April, when the Gulf and straits become ice covered, the Island becomes as continental as the interior of NB (The Weather Network, 2012). PEI ranks #1 in Canada for having the most freezing rain days and being the most humid summer location and #2 in the country for having the windiest summer and winter (EC, 2012b).

The Canadian Climate Normals (1971 - 2000) recorded from the climate station in East Baltic indicate the mean annual temperature is 5.4ºC with a mean annual maximum of 9.1ºC and a mean annual minimum of 1.8 ºC. The extreme maximum and minimum temperatures recorded are 33.5^{o}C and -31.0^{o}C, respectively (EC, 2012c).

Of the total of 1226.3 millimetres (mm) annual precipitation (total water equivalent of snowfall plus rainfall), 960.9 mm (approximately 78%) falls as rain. With regards to lightning, according to a flash density map, Charlottetown, PEI, experiences on average 0.39 lightning flashes per square kilometre per year (as averaged in the period from 1999 to 2008, cloud-to-cloud and cloud-to-ground counts combined (EC, 2011a).

4.5.2 Ambient Air Quality

Air quality is influenced by the concentrations of air contaminants in the atmosphere. Air contaminants are emitted by both natural and anthropogenic sources and are transported, dispersed, or concentrated by meteorological and topographical conditions. Air contaminants eventually settle or are washed out of the atmosphere by rain and are deposited on vegetation, livestock, soil, water surfaces, and other objects. In some cases, contaminants may be redistributed into the atmosphere by wind.

In 2000, the CCME developed the Canada-Wide Standards for PM and Ozone in response to the agreement signed by both the Canadian and PEI governments in an effort to significantly reduce these pollutants by 2010. The Province's air quality is considered to be good and consistently better than those values set by the Canada-Wide Standards, though impacts are detected from long-range transport of pollutants from northeastern US and eastern Canada as well as local emission sources (PEIDEEF, 2011). PEI has also established air quality standards as part of the Air Quality Regulations under the Provincial *Environmental Protection Act* (Table 4.7).

As part of the National Air Pollution Surveillance Network, PEI maintains three monitoring stations (one per county) which record ozone levels, fine particulate matter, sulphur dioxide, nitrogen oxides, mercury and acid precipitation. The data is used to produce an Air Quality Health Index, which allows Canadians to protect themselves from the negative effects of air pollution (PEIDHW, 2012).

Table 4.7 Air Quality Guidelines in PEI

Pollutant	Averaging Period			
	1 Hour	8 Hour	24 Hour	1 Year
Carbon monoxide	35 mg/m^3	15 mg/m^3		
Hydrogen sulphide	15 µg/m^3		5 µg/m^3	
Nitrogen dioxide	400 µg/m^3			100 µg/m^3
Sulphur dioxide*	900 µg/m^3		300 µg/m^3	60 µg/m^3
Total Suspended Particulate			120 µg/m^3	70 µg/m^3

Particulate Matter (PM)

The term PM refers to those particulates in the air, such as smoke, soot, and dust that remain suspended in the air and do not settle out readily. PM is a broad class of chemically and physically diverse substances that can either be in a solid or liquid state, or in a combination of these two states.

PM is further characterized according to size, becoming a potential human health hazard when the particle size is equal to or less than 10 micrometres (µm) in diameter (PM_{10}) (NB Department of Environment and Local Government (NBDELG), Undated). These particles are typical of dust granules that are invisible to the naked eye as individual specks. Such particles are commonly generated from building materials, combustion, human activities, and outdoor sources, including atmospheric dust and combustion emissions from mobile and stationary sources (Washburn & Gillis and Associates (WGA), 1996). Total suspended particulate (TSP) is a total measurement of all PM present, regardless of size, for which there are Guidelines under the PEI Air Quality Regulations.

PM_{10} data is not currently monitored in Southampton, and Charlottetown monitoring was discontinued in 2006. Historical levels in Charlottetown indicate a range of 9 to 13 micrograms per cubic metre ($\mu g/m^3$) between the years of 1997 to 2005. The TSP level at the Charlottetown station decreased to 12 $\mu g/m^3$ in 2002 from 18 $\mu g/m^3$ recorded in 1994 - which is all well below the Guideline value of 120 $\mu g/m^3$.

Particles of 2.5 µm or less ($PM_{2.5}$) are small enough to inhale into the lungs and are believed to cause respiratory and cardiovascular problems. These particles are visible as clouds of smoke and are typically high in sulphates, nitrates, carbon and heavy metals, being produced by fossil fuel combustion, vehicle exhaust and industrial emissions (NBDELG, Undated).

The CCME Canada-Wide Standards $PM_{2.5}$ target value is 30 $\mu g/m^3$ over a 24-hour averaging period, based on the 98^{th} percentile annual ambient measurements averaged over three consecutive years (CCME, 2000). In 2009, the average fine particulate level ($PM_{2.5}$) at the Southampton monitoring station was only 4 $\mu g/m^3$ (PEIDEEF, 2011).

Ground Level Ozone

Ground-level ozone is formed as a result of a photochemical reaction between NO_x and VOCs. It is mostly generated during daylight hours, with levels highest between late spring and early fall under intense sunlight. Unlike the ozone in our stratosphere that the earth depends on to filter ultraviolet (UV) rays, ground-level ozone is harmful to the lungs, and negatively affects some crops and other vegetation (NBDELG, Undated).

PEI sources do not contribute significant emissions which result in the creation of ground-level ozone. However, PEI experiences elevated concentrations of ground-level ozone, since it lies downwind of major urban and industrialized centres in the US and central Canada. For data collected up to 2010, the Canadian NAAQOs (Health Canada, 1999) provide a guideline for ground level ozone of 82 parts per billion (ppb) over a 1-hour averaging period. The Canada-Wide Standard developed in 2000 by the CCME for ozone was set at a target value of 65 ppb over an 8 hour averaging period, which is based on 4th highest annual ambient measurement, averaged over three consecutive years.

Ground level ozone has been monitored at Southampton since 2004. The number of hours recording exceedances of the 65 ppb Guideline has dropped from 5 hours in 2005 to 0 hours in both 2008 and 2009. Maximum values for 2008 and 2009 were 56 ppb and 64 ppb, respectively. The annual average has risen from 24 ppb in 2004 to 30 ppb in 2005 – all of which is below the 2010 target of 65 ppb (PEIDEEF, 2011).

4.5.3 Wind Resources

PEI is ranked #2 of all the provinces in Canada for having both the windiest summers and the windiest winters (EC, 2012b). Winds are strongest during the winter when storms typically occur, usually from the west or northwest. Summer breezes tend to be south or southwest (The Weather Network, 2012). According to the Canadian Wind Energy Atlas, the mean windspeed at the site of the Study Area, located in Quadrangle 21, is 9.26 m/s at 80 m above ground and 7.63 m/s at 50 m above ground. The highest wind speeds of 11.00 m/s and 9.41 m/s at 80 m and 50m, respectively, are recorded in the winter (EC, 2003). The height of the turbines at Hermanville/Clearspring will be 92 m with a cut-in speed of 3 m/s and a maximum speed of 25 m/s.

4.5.4 Existing Noise Level

The predominant source of noise in the area is generated by wind. Other existing sources of noise in the surrounding area would be associated with tourist traffic and related establishments, agricultural activity, fishing activities, forestry activities and recreational activities (hunting, ATV usage, etc.).

An ambient sound study is being conducted by Frontier Power Systems to quantify ambient sound levels prior to the construction of the wind farm, at locations typical of the nearest noise receptors. This study is in progress, but data collection has been disrupted by ongoing utility work in the vicinity of the monitoring sites, and low temperature limitations of the sound monitoring equipment. The ambient sound study will be completed when conditions permit. The results of this study are expected to reveal typical ambient sound levels for a rural setting, and establish the relationship between ambient sound levels and wind speed. It is important to quantify ambient sound levels as a function of wind speed. The critical wind speed range for wind turbine noise is generally considered to be approximately 5 m/s to 10 m/s at 10m above ground level. In this wind speed range the turbines are producing power, but background noise levels are usually not high enough to completely mask or drown out the turbine noise. At higher wind speeds, wind induced background noise levels continue to increase, while wind turbine noise levels have reached their maximum.

The ambient sound study will also provide baseline data if post construction noise measurements are completed.

A noise impact assessment was also conducted by Frontier Power Systems, to determine if noise from the wind turbines could negatively impact nearby residences (Appendix D).

4.6 SOCIO-ECONOMIC SETTING

The proposed wind farm is located in Kings County near the eastern tip of PEI, bordered to the north by Route 16, to the east by Souris Line Road and to the west by the New Zealand Road. The following sections describe the socio-economic setting of the area.

4.6.1 Population Demographics

Statistics Canada (StatsCan) considers each county of PEI a “census division” and further subdivides each division into census subdivisions (CSDs), which correspond to communities, townships and royalties. The Study Area is located within census division 01 (Kings County), more specifically CSD Lot 44 (township and royalty). The total land area of Lot 44 is 1,685.8 square kilometres (km^2). The nearest town is Souris, whose CSD is located directly southeast on the opposite shore. The most recent census was conducted in 2011, though data regarding education and labour has not yet been released since the 2006 census (StatsCan, 2011).

Between 2006 and 2011, the population of Lot 44 experienced a decline of 7.1% while the overall population of PEI increased by 3.2% during the same time period (Table 4.8).

Table 4.8 Population Profile

Location	2006	2011	% Change
Lot 44 Township and Royalty	868	806	-7.1
Kings County	18,608	17,990	-3.3
PEI	135,851	140,204	+3.2

Population density for the Lot 44 area is 10.4 people per square kilometre (km^2), which is similar to that of Kings County as a whole (10.7 per km^2), but less than half the provincial average of 24.7 people per km^2. Most of the population is English-speaking (95%) (StatsCan, 2011).

The total number of occupied dwellings in the area is 305, with a median age of 43.8 years. Most homes are single-detached houses (275) with an average number of persons per household of 2.6, which is similar to the Provincial average of 2.4 (StatsCan, 2011).

In 2005, the Lot 44 area had a working age population (those 15 years and over) of 55. The participation rate was 75.7% with an employment rate of 68.2%, both of which were higher than the rates of 68.2% and 60.7%, respectively, for the Province. The median earnings for full time employees in the Lot 44 area in 2005 was $39,026, 14% higher than the Provincial average. Most people (77%) worked within Kings County, but outside Lot 44 (StatsCan, 2006).

Based on the 2006 Census, 71% of the population aged 15 and up have at least a high school education (compared to 73% provincially). College diplomas were held by 15%, and university degrees were held by another 15% percent of the working age population (StatsCan, 2006).

4.6.2 Local Economy

The Study Area is located between the small communities of Clearspring and Hermanville, which are connected by Northside Road (Route 16), approximately 2.5 km from the Gulf of St. Lawrence shoreline.

A review of the 2005 Lot 44 labour force by occupation reveals that 24% are employed by primary industry. Another 18% had occupations related to trades, transport and equipment operators. Most of the area's population (77%), however, commute outside Lot 44 for work. There are only two businesses listed in Hermanville under the Government of PEI Business Guide: the Prince Edward Distillery and the Johnson Shore Inn, which are under shared ownership (Government of PEI Business Guide, 2012).

The closest town is Souris, located approximately 12 km southeast with a population of 1,173 residents. There are over a hundred businesses listed in the Business Guide for Souris, providing a wide range of community and medical services for Eastern Kings residents as well as accommodations, restaurants and cafes to support tourism. There are also four potato farming operations and three aquaculture facilities based in Souris. One of PEI's five "Rural Action Centres" is located in Souris, providing access to government-funded entrepreneurial programs to aid in business and community development. Souris is the departure port for the Magdalen Islands (Îles-de-Madeleine) Ferry. The CTMA – Traversiers provides daily year-round ferry service to Quebec's archipelago of islands.

4.6.3 Land Use

4.6.3.1 Industrial

East Point Wind Farm

Located approximately 24 km to the east of the proposed project footprint is an existing wind farm in Elmira. This wind farm was also developed by the PEIEC and commissioned in 2007 and currently consists of 10 Vestas V-90 wind turbines, each rated at 3 MW, for a total capacity of 30 MW. During the 2011/2012 fiscal year, PEIEC reported 97.2% turbine availability and 98,402 MW hours in electricity production at this site. All electricity generated from the turbines is sold to Maritime Electric Company Limited (MECL) (PEIEC, 2010) for on island consumption.

4.6.3.2 Tourism

The Study Area is bordered on the north by Northside Road (Route 16) which comprises the 54 km "North Shore Discovery Drive" described by the East Tourist Group. The scenic drive from Greenwich National Park to St. Peters includes five beaches, historic displays at St. Peter's Landing, Naufrage Harbour, Campbells Cove Campground, as well as the Prince Edward Distillery and Johnson Shore Inn. The Prince Edward Distillery, which produces Canada's first and only potato vodka, is located in Hermanville. The Distillery offers tours of their facility and oceanfront accommodations are available at the affiliated Johnson Shore Inn.

The Confederation Trail runs lengthwise across the centre of Eastern Kings, approximately 4 km south of the Project. The Trail, which enables hiking or biking of the Province from tip to tip, was completed in 2000 by refurbishing abandoned railway lines. The section of Trail south of the Project Area is surrounded by softwood with hardwood stands in upland sections. Local wildlife sightings of foxes, ruffed grouse, owls and gray jays are common. At Harmony Junction, the trail forks, providing routes to either Souris or Elmira (Tourism PEI, 2012).

4.6.3.3 Commercial

The nearest commercial centre is the town of Souris, which contains several retail and service businesses.

4.6.3.4 Residential

The Project Area is located in an almost completely forested area of Kings County, PEI. The immediate environs of the Study Area are sparsely populated with the nearest residential homes, many of which are seasonal. The nearest residence to the Project Footprint is approximately 600 m away.

4.6.3.5 Fisheries

Recreational Fisheries

There is one watercourse in the Study Area, which is a 1st order tributary of Cross River flowing west to east. Brook trout were identified during a survey conducted on October 5, 2012.

Commercial Fisheries and Aquaculture

According to DFO Traditional Fishing Knowledge mapping distributions of commercially fished species occur inshore in the Gulf of St. Lawrence. The charted area 4023E illustrates the “inshore distribution” of species found off the marine shoreline located 2.5 km from the Project Area. Species such as lobster, rock crab, toad crab, bluefin tuna, Atlantic herring, Atlantic mackerel, shark, winter flounder, hake, and Atlantic cod as well as Irish moss are available for harvest along the north eastern coast (DFO, 2004). The nearest DFO Small Craft Harbour is Naufrage Harbour, which is approximately 12 km from the Project Footprint. PEI Aquaculture of blue mussels, eastern oysters, rainbow trout and arctic char is concentrated in twenty bays and estuaries, predominantly on the northshore in the Gulf of St. Lawrence – though none off Lot 44 where the Project is located (DFO, 2011).

4.6.3.6 Forestry

Though there is no active forestry occurring in the Project Area currently, the entire area has been managed historically, some cleared within the past decade. The Crown land portion has been accumulated through the purchase of land from harvesters since the 1960’s. The Crown forests of the Study Area are managed by the Eastern Forest District which accepts tenders from the public for harvest of timber and non-timber forest products as well as silvicultural work (PEIDAF, 2012b). Though cleared areas and plantations are most evident near the Souris Line Road, wood roads exist throughout the area.

4.6.4 Local Governance, Community Services and Infrastructure

4.6.4.1 Transportation Infrastructure

Roads

Route 16, the Northside Road, provides access around the entire Eastern Kings peninsula and represents the northern border of the Project Footprint. The adjoining routes 305 (Souris Line Road) and 306 (New Zealand Road) both provide access from the north shore to the south shore of the peninsula, where Souris is located. The Project access road will be located off the northern end of Souris Line Road, near Turbine T6.

Rail

The railway transportation system ceased service on PEI on December 31, 1989 after 114 years of service. The railway beds have been converted into a multi-use trail system known as the Confederation Trail (Tourism PEI, 2012).

Air

The nearest full-service airport to the Project Area is the Charlottetown Airport, located approximately 80 km away. It is a public airport featuring two runways (7000 ft and 5000 ft in length), an airline terminal and an adjacent business park with 43 serviced lots. Airlines offering service include Air Canada and WestJet as well as seasonal service by Sunwing and Delta Airlines (Charlottetown Airport Authority, 2012). A registered aerodrome, Cablehead Airpark, is located in St. Peter's Bay, approximately 25 km from the Project.

4.6.4.2 Electricity

Eighty-six percent (86%) of PEI's energy usage is in the form of electricity distributed by MECL. Eighteen percent (18%) of that electricity is produced by wind farms in the Province, and the balance is purchased from NB, which provides electricity through two submarine cables (PEIDEEF, 2008a). MECL also operates two fossil fuel-fired generating plants in PEI, one in Charlottetown and one in Borden to supplement the supply during peak loading and for backup purposes and during supply interruptions from the mainland (MECL, 2012).

An approximately 10.0 km transmission line connecting the Project substation to the existing T-12 transmission line will be erected. The entire transmission line will follow the newly constructed access road to Souris Line Road, then along Souris Line Road to the transmission line.

4.6.4.3 Cultural/Institutional

The main communities in close proximity to the proposed project site are Hermanville and Clearspring; the nearest town being Souris. Churches of various denominations are located in St. Peter's Bay and Souris, notably the historic St. Mary's Roman Catholic Church in Souris. Education is administered by the Eastern School District. The nearest schools are located in Souris: the Souris Consolidated School, providing grades K-8, followed by the Souris Regional High School (grades 9-12) (InfoPEI, 2012). Souris also provides a Community School, offering adult recreational courses ranging from guitar lessons to interior decorating (PEI Community Schools Association, 2012). In addition, Souris has a Holland College campus. The University of PEI, the Atlantic Veterinary College, the Maritime Christian College and other Holland College specialized campuses are located in Charlottetown (InfoPEI, 2012).

4.6.4.4 Communication and Radar Systems

RABC recommends that wind turbines be at least 50 km from EC Weather Radars (RABC, 2007). The nearest of these are located in Chipman, NB, Marion Bridge, NS and Halifax, NS, which are both well outside this radius (EC, 2008).

The RABC also recommends that consultation with the Department of National Defence (DND) and NAV Canada take place early in the development of a wind farm. Wind farms which lie within the direct “line of site” to radar systems can create various forms of interference. Though all tall structures can interfere with radar, wind turbines are of unique concern as their rotating blades can mimic that of an aircraft, creating radar clutter. These effects are difficult to predict as DND radar and Air Traffic Control (ATC) radar have various coverage footprints and sensitivities. In addition, wind turbines can rotate 360° in order to accommodate wind direction, changing the radar cross section (RCS) accordingly (RABC, 2007). The International Energy Agency (IEA), however, concluded in their 2003 Wind Energy Annual Report that past concerns about radar interferences have been “overestimated” (IEA, 2004). The Project is located far enough from any private or public airport and therefore should not potentially affect air traffic systems as a 10 km consultation radius is recommended (RABC, 2007). The nearest private airport is located approximately 25 km away in St. Peter’s Bay and the nearest commercial airport is 80 km away in Charlottetown. Bell Aliant is the principal communications provider in PEI.

Frontier Power Systems has completed an assessment of potential impact on radio communication and radar systems (Appendix E). This assessment has been conducted using the guidelines prepared by the Radio Advisory Board of Canada (RABC) and the Wind Energy Association of Canada, in the document: *Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems* (RABC 2007).

The RABC/CanWEA Guidelines are used to determine a consultation zone around various types of radio communication and radar systems that may be affected by the proposed wind turbines. If a consultation zone overlaps with the proposed turbine layout, a consultation process is initiated with the system operator. Additionally, these guidelines provide a mandatory contact list for coordination with agencies responsible for weather radar, navigational radar, national defense, and public safety radio systems.

No consultation zones were found to overlap with the proposed turbine layout, and all mandatory contacts have been initiated.

Clearance has been received by all respective parties with the exception of NAV Canada who have indicated that they will provide a response by early February.

4.6.4.5 Emergency Services

The Study area is covered by a province-wide 911 service.

<u>Medical Services</u>

Medical services in the area are provided by the Souris Hospital. Providing service to all of Eastern Kings, it is a 17 bed acute and ambulatory care facility which also houses physicians’ offices, clinics and addiction services. In addition there is the Eastern Kings Health Centre in Souris and the Montague Health Centre in Montague. These health centres offer the primary health care to their communities (InfoPEI, 2011b).

Fire Protection Services

There are volunteer fire departments serving the area which are located in Souris and St. Peters Bay (InfoPEI, 2007).

Police Protection Services

The area is patrolled by the RCMP detachment based on Main Street in Souris (RCMP, 2012).

4.6.5 Heritage and Archaeological Resources

The objectives of a Heritage Resource Impact Assessment (HRIA) are to identify, inventory, and evaluate all sites of archaeological, historical, and architectural significance within the Project impact area and to assess the potential impact on these heritage resources. The Project study area will include the turbine footprints, potential access routes, connecting line routes, and construction lay-down areas, and the transmission line routing. The objectives of an HRIA are accomplished via a four-phase process:

- Phase 1: Background desktop review (documentary research, Regulator consultation).
- Phase 2: Field examination (visual surface survey, informational interviews).
- Phase 3: Field evaluation (archaeological field survey).
- Phase 4: Significance determination, impact assessment, mitigation, and contingency plan.

This four-phase process is approached sequentially and involves decision points along the way. While these steps are initially addressed in a linear fashion, they are actually iterative as circumstances commonly arise during the course of investigations that require previous phases to be revisited. The methodology used for each phase is determined based upon the results obtained in the preceding phase.

4.6.5.1 Phase 1 Background Desktop Review

Phase 1 background research was undertaken for the proposed Project area in order to assess the potential for heritage resources. The documentary research will include the following:

- reviewing present day and historic aerial photographs and topographic maps;
- reviewing previous archaeological surveys conducted in the area;
- identifying any private artifact collections from the area;
- reviewing documentation on existing identified heritage sites in the vicinity;
- conducting a literature review of archaeological literature sources;
- consulting with the provincial archaeology regulator (Dr. Helen E. Kristmanson, Director of Aboriginal Affairs and Archaeology, Aboriginal Affairs Secretariat, Executive Council Office, Government of Prince Edward Island) (PEIDAAS);

- consulting with provincial heritage representative (Charlotte Stewart, Heritage Officer, Culture, Heritage and Libraries, Department of Tourism and Culture);
- identifying any National or Provincial historic sites or designations in the area;
- conducting a literature review of historical literature sources; and
- contacting representatives of local First Nations groups (Abegweit First Nation and Mi'kmaq Confederacy of Prince Edward Island (MCPEI)).

Past and present transportation routes and habitation areas are considered to be high potential areas for heritage resources. Watercourses and water bodies were the primary transportation routes of the past, while roads are the primary transportation routes of the more recent past and present. Prehistoric peoples (Native) and European settlers utilized the river systems of PEI as transportation routes and the shorelines as settlement areas. Therefore, shorelines of the province's rivers, lakes, and coast have high potential for heritage resources from both the prehistoric and historic time periods. In addition, since watercourses change over time, early Holocene Period shorelines, that would hold potential for Palaeoindian archaeological resources (9,000 to 12,000 years before present (YBP)), may also exist. Gravel deposits located near present day or prehistoric watercourse channels could be part of prehistoric shorelines once inhabited by Palaeoindians. In addition to watercourse and water body shorelines, trails and roads are potentially historical transportation routes and are indicators of prehistoric portage routes and historic habitation locations. Elevated terraces, strategic vistas, and plateaus also hold potential for Native archaeological sites as they may have been used during prehistoric times as look-out sites for travel, hunting, and monitoring animal migrations.

<u>Potential Native Archaeological Resources</u>

The Natives of PEI have referred to PEI as *Abegweit*, often translated as "Cradled on the Waves" or *Minegoo* meaning "The Island" (Acadian-Cajun Genealogy & History 2012, Campbell No date). There is evidence in the archaeological record that between 9,000 and 12,000 YBP there were people occupying areas of the present-day Maritime Provinces of Canada. This Palaeoindian culture manufactured "lithic" (stone) tools of a typology called "fluted points". These lithic points ("arrowheads") have long narrow grooves on each side, which extend from the base of the point for some distance. This technology is used to thin an area in order to haft the point to a wooden shaft. Lithic artifacts with some of these characteristics have been identified west of the Project area in Tryon (Keenlyside 2011)[1] and at Greenwich on St. Peters Bay (Ibid.), as well as southeast of the Project area in the Souris and Basin Head areas (Keenlyside 1982:69-70, Maloney 1973:2). All of these possible Palaeoindian artifact finds were recovered from within four kilometres (km) of the coastal shoreline.[2] Therefore, we may

[1] This isolated find was recovered by the late Aage Sorensen in the 1930s and was recently donated to the PEI Museum and Heritage Foundation by his son Jack Sorensen.
[2] While the Tryon artifact was recovered from "approximately 4 km inland" (Bonnichsen et al. 1991), the other artifacts with Palaeoindian attributes appear to have been recovered from locations within two km of the shoreline.

conclude that there was a Palaeoindian presence on PEI, which could potentially include the Project area.

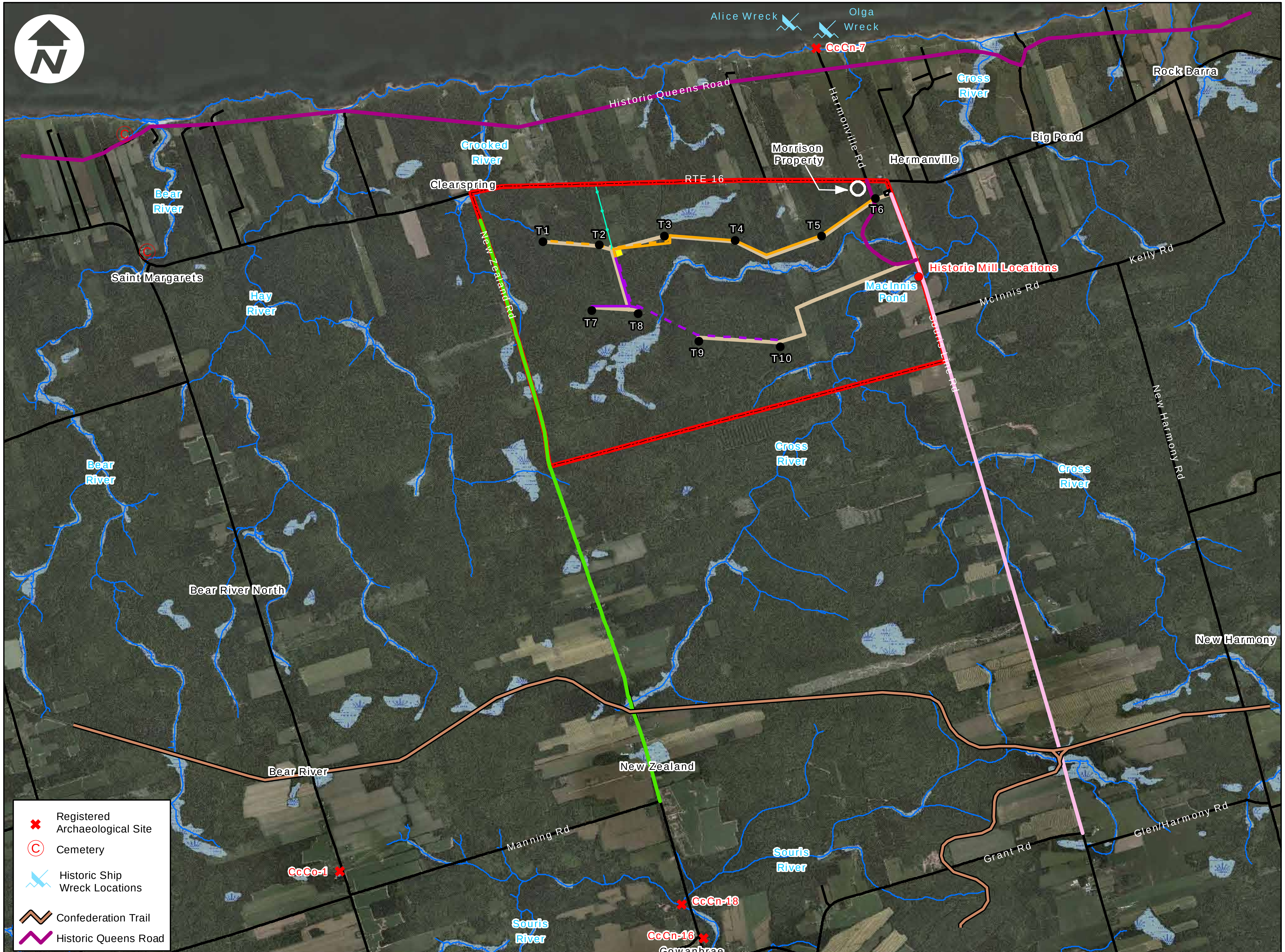
Similar to the Passamaquoddy region in Charlotte County of New Brunswick (see Blair 1999, Bishop 1994, Black 1984, Davis 1982), there have been reported finds of “shell middens” along the coast of PEI (Maloney, 1973:3). Shell middens are mounds of discarded shellfish remains that are characteristic pre-contact (prehistoric) campsites. Davis and Christianson’s coastal survey of Murray Harbour, on the east shore of PEI, identified three pre-contact oyster shell middens eroding from the shoreline (Davis and Christianson 1981). The interpreted ages of these sites identified in the Passamaquoddy region of New Brunswick range from 4000 to 1500 YBP. Since the Project area is located over one kilometre from the northern shoreline of PEI, there is little possibility of this type of cultural feature (prehistoric shell middens) to be located within the Project area. However, inland watercourses and lakes have potential for Pre-contact archaeological resources as they may have been used in prehistoric times for transportation, habitation, and/or resource procurement purposes. While numerous post-Palaeoindian pre-contact Native sites have been identified across PEI, there has only been one registered in the vicinity of the Project area (Site CcCo-1). Site CcCo-1 is located southwest of the Project area (Figure 4.3) and has been interpreted as a possible Late Archaic site (6000 and 4000 YBP).

While no other precontact Native sites have been identified in the immediate vicinity of the Project area, this does not preclude the possibility that they exist. This area of the province has yet to be thoroughly surveyed for archaeological resources.

<u>Potential Historic Heritage/Archaeological Resources</u>

The first documented account of PEI was by Jacques Cartier in 1534 and was first mentioned as “Île Saint-Jean” by Samuel de Champlain in 1604 (de Jong 1973:11, Info PEI Web-site 2006). In the 16th and 17th centuries the island was reportedly only visited irregularly by fishermen and traders (de Jong 1973:11-12). Under the authority of The French Crown, Île Saint-Jean was initially granted and re-granted numerous times in the late 1600s to early 1700s in attempts to establish settlements there. The island was initially granted to Nicolas Denys, La Grande Barbe, in the mid-1600s (Acadian-Cajun Genealogy` & History 2012, Harvey 1926). In 1663 Île Saint-Jean was re-granted to Sieur Doublet, a captain in the French navy (Campbell 1875, Harvey 1926). In 1710, the east coast of Isle St. Jean was granted to Sieur de Louvigny, Major of Quebec, who revoked the concession in 1716 (Harvey 1926). No permanent settlement had been established prior to 1719, when Île Saint-Jean was granted to Comte de Saint Pierre, the First Equerry to the Duchess of Orleans (Ibid.).[3]

[3] This grant was then revoked in 1730 (Harvey 1926).



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TITLE:
FIGURE 4.3 PHASE 1 IDENTIFIED ARCHAEOLOGICAL & HERITAGE FEATURES

PROJECT:
HERMANVILLE / CLEARSPRING 30 MW WIND FARM

CLIENT:
PEI ENERGY CORPORATION

LOCATION:
HERMANVILLE / CLEARSPRING, PRINCE EDWARD ISLAND

DATE: **JANUARY, 2013**

DATUM: **NAD 1983**

PROJECTION: **UTM ZONE 20**

SOURCE: **HTTP://WWW.GOVPE.CA/GIS/ (2010 DATA BASE)**

AMEC PROJECT NO: **TE121023**

LEGEND:
- Turbine
- Substation
- Service Building
- Project Footprint
- Substation Power Line
- Roads
- Watercourse
- Turbine Maintenance Road
- Provincial Wetland
- Option 1 - Transmission Line Roadway
- Option 2 - Transmission Line Roadway

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- SW

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In the 1720s there was permanent French settlement located at present-day Charlottetown (*Port la Joye*) and at Point Saint Pierre (de Jong 1973:18, Info PEI Web-site 2006, The Island Register 2012, Harvey 1926). While historic mapping indicates that locations east of present-day Charlottetown were inhabited by the Acadians, it appears as though they were primarily south (Souris and Fortune) and west (Saint Pierre) of the Project area (The Island Register 2012). The 1728 census reports 105 individuals residing in Port la Joie, 116 in Port Saint Pierre, and 12 at Point de l'Est.

Pre-1758 mapping of Île Saint-Jean does not indicate settlement in the present-day Hermanville area (Ibid.). Historical mapping of this period only give names for two locations in the general area that were not inhabited at the time: "Franche River" (likely North Lake Creek) to the east (Island Imagined 2012) and "Havre à Naufrage" (Shipwreck Point and Naufrage) to the west of the Project area (The Island Register 2012). There is no specific historical reference to Acadian habitation or land use in the present-day Hermanville area during the 1700s.

Île Saint-Jean changed hands from the French to the British, back to the French, and ultimately back to the British following the Treaty of Paris in 1763 (Info PEI Web-site 2006). As a result of the Expulsion of 1758, most of the Acadian inhabitants of Île Saint-Jean left the island. In 1767, with only an estimated 207 remaining (Harvey 1926),[4] the British Captain Samuel Holland (Surveyor General of British North America) surveyed and divided the island into 67 numbered lots (Boylan 1973:35, The Island Register 2012). These lots were then granted by the British Crown to "influential British" (Acadian-Cajun Genealogy & History 2012). The present Project area is located on the east side of PEI on Lots 44 and 45.

The initial proprietors of Lots 44 and 45 from 1767-1800 were reportedly William Fitzherbert, Esq. and Robert Campbell (Lot 44) and William Matthew Burt and John Calender (Lot 45) (The Island Register 2012).

Little progress was made with the resettlement of PEI from the granting year of 1767 to 1779, as no steps were taken to introduce settlers to all the lots (Campbell 1875). In 1780 it was proposed that the anglicized name of Saint John Island be changed to New Ireland, to further encourage Irish immigrants (Ibid.). While this name change was not adopted at that time, in 1799 the island was renamed Prince Edward Island in honour of the fourth son of King George III. By the turn of the century, no attempt at settlement had been made in 48 of the lots (Ibid.). Settlement from the British Isles (Britain, Scotland, and Ireland) occurred primarily in the early 1800s (Campbell No date). The British settlers emigrated primarily between 1815 and 1854, the Scottish between 1770 and the mid-1800s, and the Irish between 1763 and 1880 (Ibid.).

Present-day Hermanville was settled predominantly by the Scottish. While the first wave of Scottish immigrants settled further to the west, they eventually made their way to settle the Hermanville area. Originally, the Hermanville area was named Black Bush (MacCormack pers.

[4] In a letter addressed to the Earl of Hillsborough, Captain Holland reported that there were about 30 families on the island who were regarded as prisoners (Campbell 1875).

com. 2012). However, this area was ultimately named “Hermanville” after its first settler (circa 1850) and postmaster Herman McDonald (Douglas 1925, Rayburn 1973). McDonald owned the property north of the Souris Line Road and Route 16 intersection and east of Hermanville Road. As indicated in Figure 4.4, a reproduction of the 1880 Meacham map of this area (Island Imagined 2012), Herman McDonald’s shoreline property had the “Hermanville Hotel” on it, which was on the “Queens Road”. Neither the hotel nor the road is still present today. However, evidence of this past road is still apparent in the historical aerial photograph record through observable surficial features.

Other features of interest depicted on the 1880 historic mapping of this area (Figure 4.4) include a previous alignment of the north end of Souris Line Road and the identification of grist and saw mills at the east side of McInnis Pond. The 1880 Meacham mapping (Ibid.) also indicates that there was only one building structure at that time in the vicinity of the Project impact area, on the south side of Rte 16 on the Neil Morrison property. The locations of these features have been indicated on a present-day aerial photograph (Figure 4.3). The 1935 aerial photographs of the Project area identify numerous structures along both New Zealand Road and Souris Line Road, but only one on the south side of Route 16 within the Project area (historically the Morrison property). None of these structures are evident on present-day aerial photographs. While this portion of the historic Morrison property is slightly outside of the presently proposed Project area, due to its proximity and potential for associated peripheral heritage resources, it was included in the field visual survey.

There are presently no registered archaeological sites identified within the Project impact area. However, there is one historic site immediately north of the Project area by the coast (CcCn-7) and two immediately to the south by the Souris River (CcCn-16 and CcCn-18). As indicated on Figure 4.3 site CcCn-7 is located at the north end of Hermanville road.

This site, which is comprised of two deep stone cellar features, is reportedly the remnants of the Hermanville Hotel and possibly the post office from the late 19th century. The two registered archaeological sites depicted immediately south of the Project area (Figure 4.3) are also remnants of historical occupation going back to the 19th century.

Approximately four (4) km northwest of the Project area there is the Saint Margaret of Scotland Pioneer Cemetery. As indicated on Figure 4.3, this pioneer cemetery (est. 1805) is located near the shoreline alongside the previous routing of Queens Road. Also indicated on Figure 4.3 is the location of the present-day St. Margarets cemetery, which is located by Route 16 next to the present location of St. Margarets Roman Catholic Church. These are the only cemeteries in the immediate vicinity of the Project area, but are both well outside of the Project impact area.

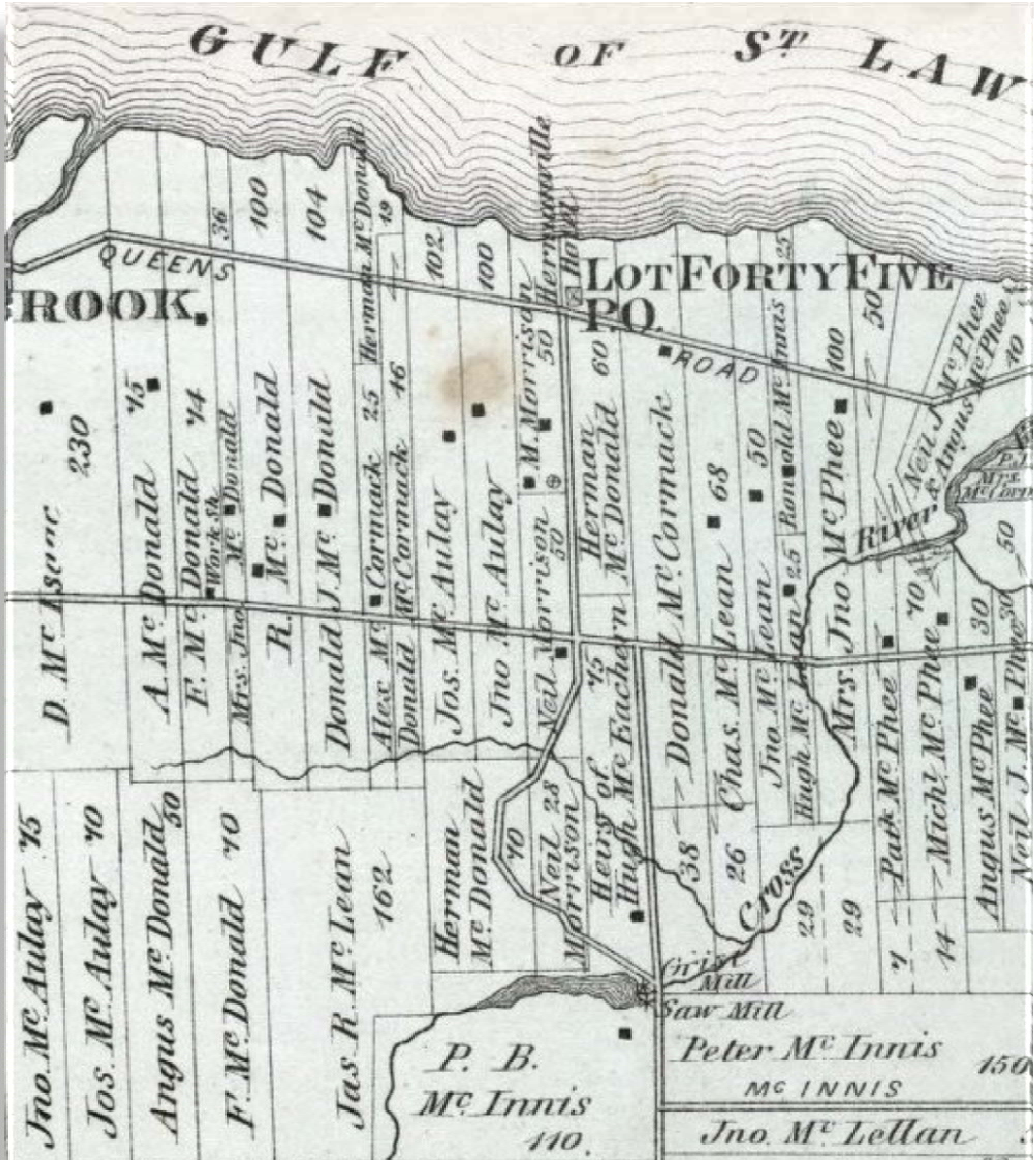


Figure 4.4 1880 Meacham Map of Hermanville Area

South of the Project turbine placements, but within potential transmission line routes, are crossings of and historic railway line (circa 1872) that is now part of the Confederation Trail.[5] Also, Route 16, Souris Line Road, and the New Zealand Road all appear to be historic travel routes. A review of the 1935 aerial photographs of the potential transmission line routes identified numerous building sites along both the Souris Line Road and the southern portion of New Zealand Road. The locations of these early 20th century structures were transposed onto a present day aerial photograph to identify potential existing heritage structures and/or locations where structures that existed in 1935 were no longer present. Nineteen structure locations were evident in the 1935 aerial photographs within 50 m of the New Zealand Road along that potential transmission line routing, while nine were evident along the Souris Line Road routing. These locations, as well as watercourse crossings (and the railway line crossings), have potential for heritage resources. Therefore, these locations were documented and considered during the visual survey of the proposed transmission line routing options.

While historical documentation indicates that the general area in the vicinity of Hermanville has been historically utilised or inhabited for over 300 years, there are no registered or designated heritage places located within the Project area (Stewart pers. com. 2012, Historic Places Prince Edward Island 2012, Canadian Register of Historic Places 2012). There are, however, seven locations identified as being of historic interest in the vicinity of the Project area. In Souris, south of the Project area, there are five buildings (McLean House Inn, Matthew House, Matthew and McLean Heritage Building, Souris Town Hall, and St. Mary's Roman Catholic Church) and a lighthouse (the Souris Historic Lighthouse) that have been registered provincially or federally (Historic Places Prince Edward Island 2012, Canadian Register of Historic Places 2012).

Since the Project is located relatively close to the northern coast of PEI, a brief search was conducted for documentation on shipwrecks in the area immediately north of Hermanville. There was an 1897 report of the hull of a small fishing Schooner from the Magdalen Islands, the *Alice*, coming ashore at Black Bush (Hermanville); her crew of four were all lost (Canadian Heritage Information Network (CHIN) 2012). There are also accounts of two "barques" (sailing ships with three or more masts) being wrecked near Hermanville during the 1906 storm called the "Yankee Gale" (Island Narratives Program 2012). The *Olga* sank directly off the coast at Hermanville, where remnants are reported still located on the seabed (Figure 4.3). Salvage from the *Olga* was said to have been used to build and furnish homes in the area (Ibid.). The "Yankee Gale" of 1906 also sunk the *Sovinto*, killing 12 of the crew of 22. Remnants of this wreck can reportedly still be found on the rocks of Priest Pond (Carew's Reef), which is approximately 8 km east of Hermanville (Ibid.). While these events would have historically impacted the community of Hermanville, they do not appear to have any bearing on the present Project.

[5] The PEI railway was abandoned in 1989.

4.6.5.2 Phase 2 Field Examination

The second phase of the HRIA included a surface examination of the Project impact area and vicinity. In addition, Phase 2 activities included informational interviews with local informants and representatives of the local First Nations communities. Prior to conducting any field activity permission was sought from impacted landowner(s) to visually survey their land.

Visual Field Survey

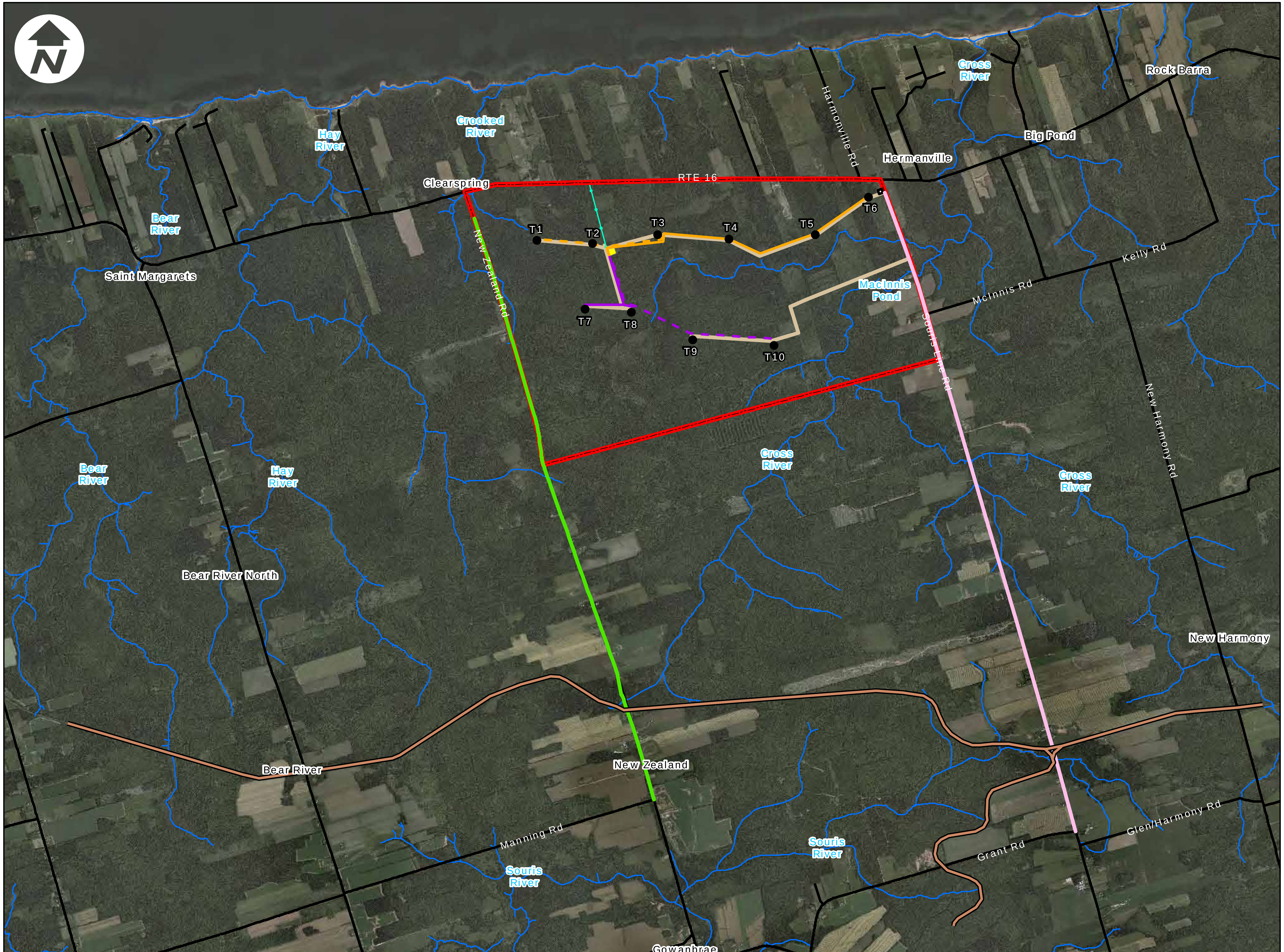
The objective of the field examination (visual surface survey) is to obtain first-hand exposure to the Project area geography and topography to aid in the early identification of potential heritage resource locations. The archaeological visual survey involves a close examination of the surface of the impact area and vicinity, with particular attention to subsurface exposures, watercourse erosional faces, forest clearings, and other areas indicated as having elevated potential from Phase 1 investigations and archaeological modelling. For this Project, areas of particular interest included watercourse shorelines, historical roads, forest clearings, and the historical railway line in the Project area.

All proposed Project impact areas, as well as potential transmission line routing, were visually surveyed between September 10th and 14th, 2012 by permitted AMEC archaeologist Darcy Dignam and Cathleen McCormack of Frontier Power Systems. The visual survey included the following elements depicted on Figure 4.5:

- Locations of turbines 1 through 10;
- Access roads connecting these 10 turbines;
- The substation location;
- Option 1 roadway transmission line route (on New Zealand Road south to Manning Road); and
- Option 2 roadway transmission line route (on Souris Line Road south to Grant Road).

A pedestrian survey was conducted for all of the turbine locations, access roads, and substation location in the northern Project impact area. Two Global Positioning System (GPS) devices (Trimble GHX and Garmin GPSmap76) were used in the field to identify the proposed locations for all of the Project elements. While satellite reception was poor for sections of the Project area, using a combination of the two units provided both accurate and consistent readings for purposes of a visual survey.

The survey for the roadway transmission line options was conducted from the roadside from a slow-moving vehicle. When a location of interest was observed or indicated on the GPS or Project mapping, the vehicle was stopped and the area of interest was more closely observed on foot.



TITLE:

FIGURE 4.5
VISUAL SURVEY AREA

PROJECT:

HERMANVILLE / CLEARSPRING
30 MW WIND FARM

CLIENT:

PEI ENERGY CORPORATION

LOCATION:

HERMANVILLE / CLEARSPRING,
PRINCE EDWARD ISLAND

DATE: **JANUARY, 2013**

DATUM: **NAD 1983**

PROJECTION: **UTM ZONE 20**

SOURCE: **HTTP:/WWW.GOVPE.CA/GIS/ (2010 DATA BASE)**

AMEC PROJECT NO: **TE121023**

LEGEND:

- Turbine
- Substation
- Service Building
- Project Footprint
- Option 1 - Transmission Line Roadway
- Option 2 - Transmission Line Roadway
- Substation Power Line
- Roads
- Confederation Trail
- Turbine Maintenance Road
- Watercourse

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- SW

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Observations were made from the roadside since access to these properties along the New Zealand and Souris Line Roads was not procured prior to conducting the survey.

As a result of conducting the visual survey of the Project area and vicinity (including the two options for the roadway transmission line), one unregistered archaeological site and eight areas where there is elevated potential for archaeological or heritage resources were identified.

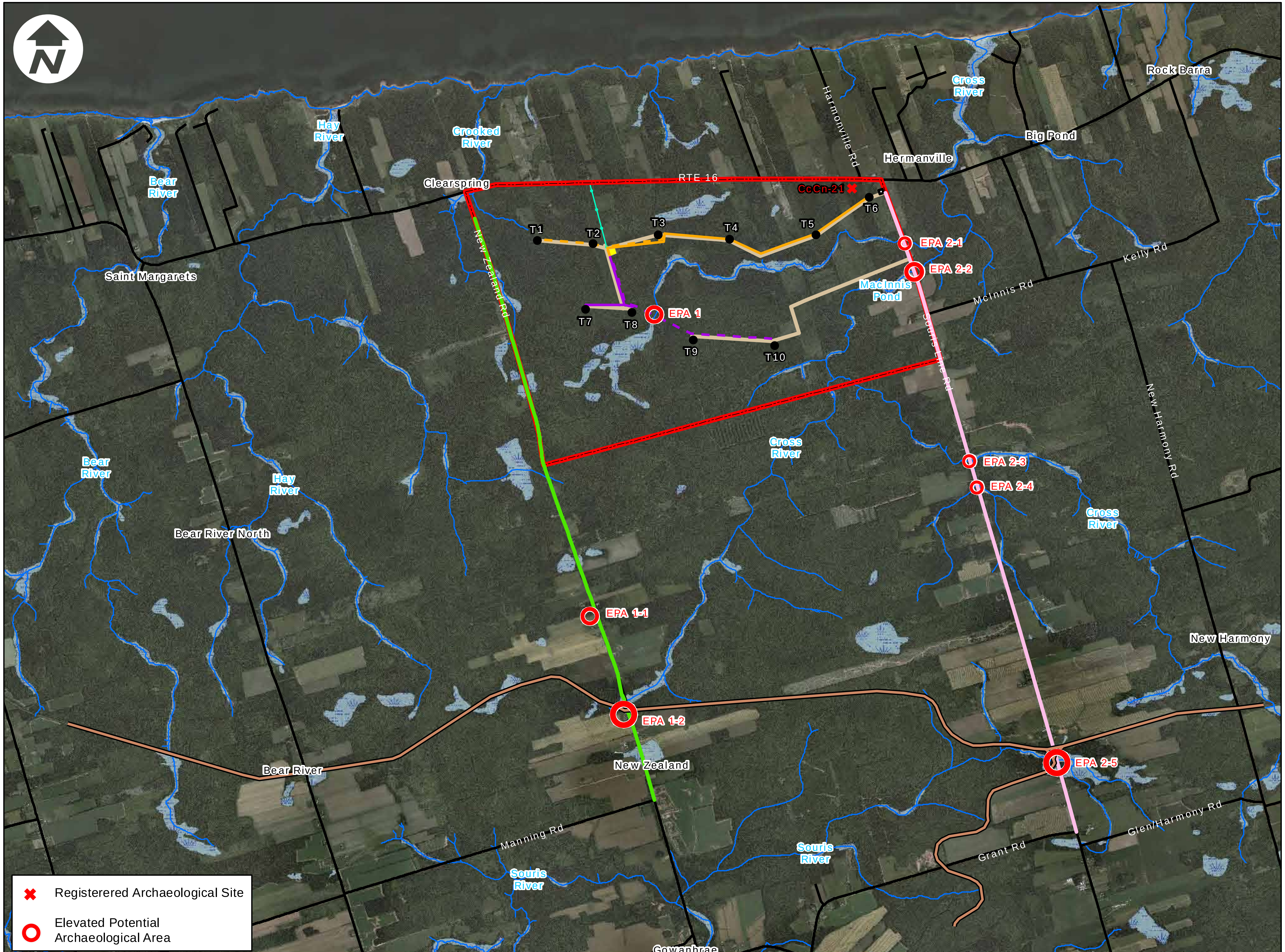
As indicated in Figure 4.6, an historic archaeological site was identified approximately 225 m northwest of Turbine 6, near the intersection of Route 16 and Souris Line Road (Site CcCn-21). This site is comprised of a dirt road running south from Route 16 towards ground depression with the remnants of a red sandstone foundation, a discarded 250 gallon oil tank, and a few shards of 20th century flat glass. In the immediate vicinity of the depression feature are cleared areas with raspberry bushes and apple trees, which are indicators of historic occupation. The site is located on the historic Neil Morrison property, on which the 1880 Meacham map (Figure 4.4) depicts a structure. A comparison of the historical aerial photographs of this location indicates the presence of historical building structures from 1935 until 1974 (Figure 4.7). The 1990 to 2010 aerial photographs show only limited clearing in this area and no remaining structures. While this archaeological resource has been registered with the province as a site, it is located far enough from the Project impact area to have no effect on the proposed Project.

The eight Elevated Potential Areas (EPAs) identified from the visual survey are comprised primarily of watercourse crossings. As indicated on Figure 4.6, only one EPA (EPA 1) is located within the northern turbine/access road impact area. The remaining EPAs are located on the roadway transmission line route options. Table 4.9 lists the eight identified EPAs, their locations, and what cultural or natural feature contributes to their designation.

Informational Interviews

The primary objective of informational interviews is to access local knowledge on both identified and unreported heritage resources from people who have firsthand experience with the Project area. These discussions can elicit a more local community-based knowledge and history of an area. A secondary objective of these interviews is to inform the local community of the nature and the date(s) of the field activity.

As indicated in Table 4.10 Heritage and Archaeology Contacts, the local informants who were interviewed did not have any knowledge of heritage or archaeological resources within the Project area. Cathleen MacCormack provided the historical fact that “Black Bush” was the previous name of the Hermanville area (pers. com. 2012). To date there has been no response from Chief Brian Francis of the Abegweit First Nation. While a representative of MCPEI responded to our Project query/announcement, to date they have not provided any additional data with regards to First Nations past and present land use in the Hermanville area.



TITLE:

FIGURE 4.6
PHASE 2
IDENTIFIED ARCHAEOLOGICAL SITE
&
ELEVATED POTENTIAL AREAS

PROJECT:

HERMANVILLE / CLEARSPRING
30 MW WIND FARM

CLIENT:

PEI ENERGY CORPORATION

LOCATION:

HERMANVILLE / CLEARSPRING,
PRINCE EDWARD ISLAND

DATE: **JANUARY, 2013**

DATUM: **NAD 1983**

PROJECTION: **UTM ZONE 20**

SOURCE: **HTTP://WWW.GOVPE.CA/GIS/ (2010 DATA BASE)**

AMEC PROJECT NO: **TE121023**

LEGEND:

- Turbine
- Substation
- Service Building
- Project Footprint
- Substation Power Line
- Roads
- Confederation Trail
- Turbine Maintenance Road
- Watercourse
- Provincial Wetland
- Option 1 - Transmission Line Roadway
- Option 2 - Transmission Line Roadway

Collector Lines

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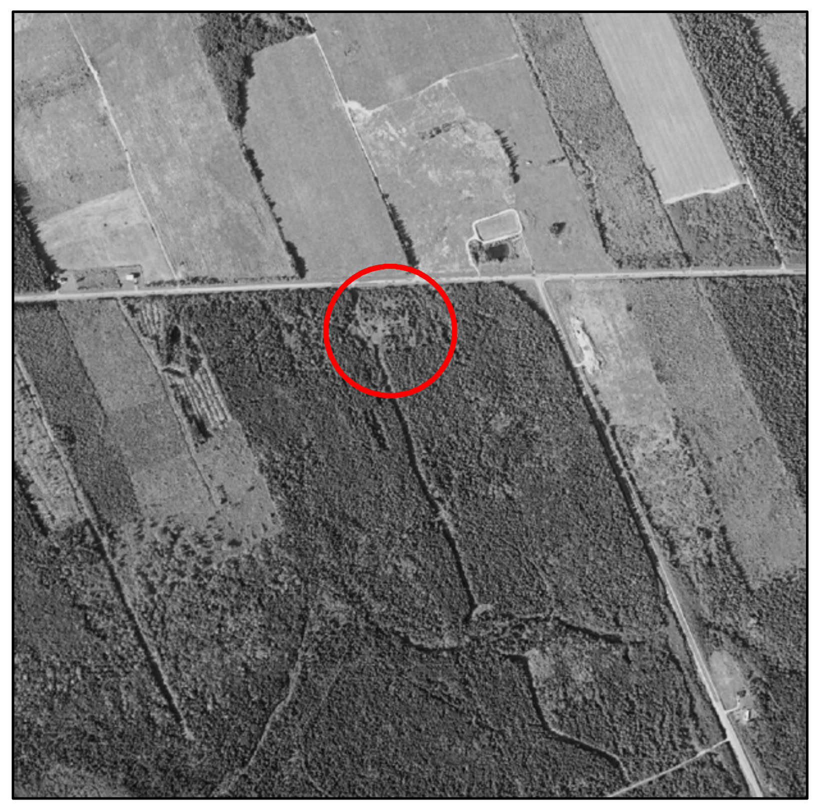
1935

1958

1974

1990



2000

2010

The map shown here has been created with all due and reasonable care and is strictly for use with AMEC Project Number: TE121023.
This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind.
AMEC assumes no liability, direct or indirect, whatsoever for any such third party or unintended use.

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TITLE:

FIGURE 4.7
Site Ccn-21 Historical Aerial Photograph Comparison (1935 to 2010)

PROJECT:

HERMANVILLE / CLEARSPRING 30 MW WIND FARM

CLIENT:

PEI ENERGY CORPORATION

LOCATION:

HERMANVILLE / CLEARSPRING, PRINCE EDWARD ISLAND

DATE: **JANUARY, 2013**

DATUM: **NAD 1983**

PROJECTION: **UTM ZONE 20**

SOURCE: **HTTP:/WWW.GOVPE.CA/GIS/ (2010 DATA BASE)**

AMEC PROJECT NO: **TE121023**

LEGEND:

Site Area

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Table 4.9 Elevated Potential Areas for Archaeological and Heritage Resources

EPA Label	EPA Description	Impact Area Location	Location*	
			Latitude	Longitude
EPA 1	Crossing of a watercourse (Cross River tributary) that has potential for Native archaeological resources.	Northern turbine and access road area	46.44827°	62.30881°
EPA 1-1	On the west side of New Zealand Road there was an historic dwelling close to the roadside in 1935, which no longer exists. Therefore, there is potential for historic archaeological resources.	Transmission line Option 1 (New Zealand Road)	46.41907°	62.31737°
EPA 1-2	Crossing of a watercourse (intersection of Cross River tributary and Souris River tributary at a perched wetland) that has potential for Native archaeological resources. It is also the centre of the historic settlement of New Zealand and the crossing of the historic railway line.	Transmission line Option 1 (New Zealand Road)	46.40913°	62.31271°
EPA 2-1	Crossing of a watercourse (Cross River tributary) that has potential for Native archaeological resources	Transmission line Option 2 (Souris Line Road)	46.45523°	62.27368°
EPA 2-2	Crossing of a watercourse (Cross River tributary) that has potential for Native archaeological resources. It is also the location (MacInnis Pond) where historic Grist and Saw Mills were located.	Transmission line Option 2 (Souris Line Road)	46.45132°	62.27168°
EPA 2-3	Crossing of a watercourse (Cross River) that has potential for Native archaeological resources.	Transmission line Option 2 (Souris Line Road)	46.43368°	62.26460°
EPA 2-4	Crossing of a watercourse (Cross River tributary) that has potential for Native archaeological resources.	Transmission line Option 2 (Souris Line Road)	46.43107°	62.26347°
EPA 2-5	Crossing of a watercourse (Souris River) that has potential for Native archaeological resources. It is also in the vicinity of the historic railway line and station (Harmony Station).	Transmission line Option 2 (Souris Line Road)	46.40469°	62.25326°

* Decimal Degrees, NAD 83

Table 4.10 Heritage and Archaeology Contacts

Contact	Affiliation	Mode of Contact	Results of Contact
Helen E. Kristmanson	Director, PEIAAS	Consult In person & Email	• Consultation regarding area background information sources • Consultation on Phase 3 recommendations and methodology • Consultation regarding mitigation recommendations
Andrew Ramsay	Policy Analyst, PEIAAS	Consult In person & Email	• Provided specific archaeological site information for general Project area and vicinity • Consultation regarding area background information sources • Provided general "Tradition Mi'kmaq Land Use" information for the Project area • Registration of Site CcCn-21
Cathleen MacCormack	Local resident	In person	• No knowledge of Native artifact finds in the area • Stated Hermanville formerly called "Black Bush"
Charlotte Stewart	Heritage Officer, Department of Tourism and Culture	Email	• Confirmed that there are no registered or designated heritage places within the Project area • Recommended sources for historic records for the area
Ryan Keenan	Rollo Bay Holdings Ltd. (Resident of New Zealand)	In person	• Did not think there were any structures in the New Zealand area that were 100 years old or older • No knowledge of Native artifact finds in the area
Alvin Keenan	Rollo Bay Holdings Ltd. (Resident of New Zealand)	In person	• Did not think there were any structures in the New Zealand area that were 100 years old or older • No knowledge of native artifact finds in the area
Tammy MacDonald	Consultation/Negotiation Coordinator, Historical Researcher Mi'kmaq Confederacy of PEI	Email	• Responded to request, but no information shared to date
Brian Francis	Chief, Abegweit First Nation, PEI	Email	• No response to date

4.6.5.3 Phase 3 Field Evaluation

A field evaluation involves subsurface testing. The Phase 3 testing strategy is project specific and is developed in consultation with the provincial regulator. The extent of the subsurface field testing (if recommended) is determined once initial Phase 1 and 2 investigations have been conducted. For this Project, the field testing strategy was developed based on the New Brunswick Guidelines (ASU 2009) and through consultation with the PEI provincial regulator.

Field evaluation testing was conducted at only one location within the Project footprint, watercourse crossing (WC) 1 in the event that this watercourse should be crossed for the project. At this location, systematic subsurface testing was conducted within the Project right-of-way (RoW) extending 80 m back from each shoreline of the watercourse. The width of the RoW will be 25 metres (m) wide within 20 m of the watercourse shoreline and 20 m wide further out.

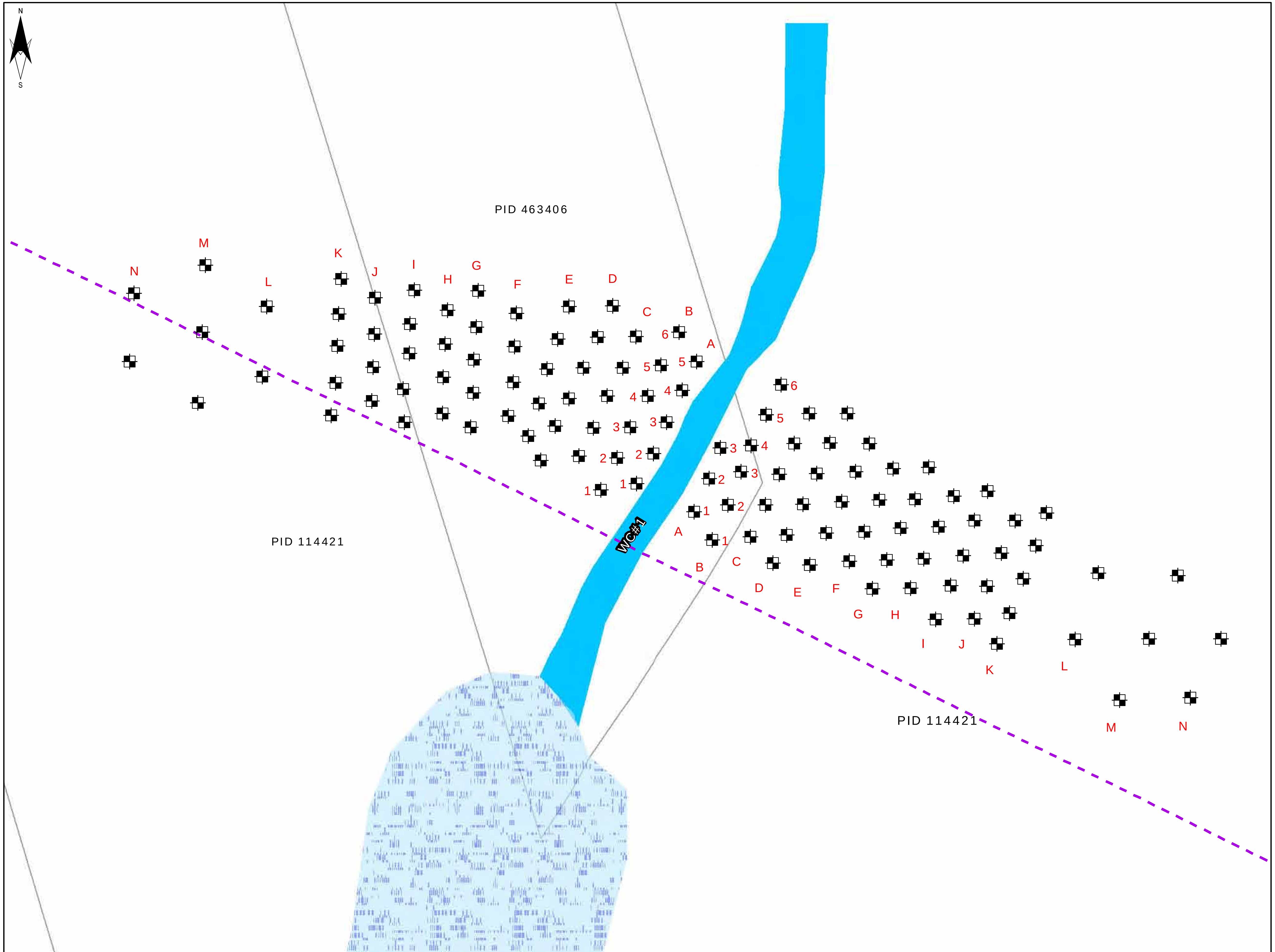
The testing unit used was a hand-shovelled 50x50 cm test-pit, with the extracted materials being screened through ¼ inch screen mesh to extract possible cultural materials. These test-pits were placed in a staggered testing pattern within the RoW, beginning at the shoreline and extending 80 m on each side. In accordance with the New Brunswick Guidelines (ASU 2009), the testing interval used was 5 m within 50 m of the watercourse and 10 m for the final 30 m of the testing areas on each side of the watercourse within the Project RoW. As indicated in Figure 4.8, this resulted in the excavation of a total of 120 test-pits.

GPS units were used to determine the centreline of the Project RoW within the testing area. Unfortunately, satellite reception at WC 1 was poor and intermittent for all of the days in the field. Therefore, it was difficult to acquire accurate readings with both the Trimble GHX GPS unit (sub-metre accuracy) and the Garmin GPSmap76 unit (5-10 metre accuracy). A combination of GPS readings and field mapping was used to identify the RoW centreline at WC 1. As indicated on Figure 4.8, the RoW bends south shortly after it crosses the watercourse. These bend points, on either side of WC 1, were particularly difficult to identify in the field. Thus, while the RoW bend point on the northwest side of WC 1 was incorporated in the testing grid, the bend on the southeast side of the watercourse was not.

The field evaluation program was conducted between October 15 and 20, 2012 by an archaeological crew that included D.J. Dignam, L. Atkinson, J. Webb, K. Thorburn, and C. MacCormack.

In accordance with the New Brunswick Guidelines (ASU 2009) and following consultation with a representative of the PEI regulator (PEIAAS), it was determined that no Phase 3 preconstruction subsurface testing was required for the seven EPAs identified along the potential roadway transmission line routes. However, pre-construction field investigations were required where the proposed access road between Turbines 8 and 9 crosses a tributary of Cross River (EA 1). As indicated in the methodology, this effort involved the archaeological excavation of 120 shovel test-pits.

Testing was initiated in EA 1 on the southeast side of WC 1 and finished on the northwest side. While there were differences in soil stratigraphy within and between areas, Table 4.11 presents a very typical test-pit soil stratigraphy.



TITLE:

FIGURE 4.8
PHASE 3
ARCHAEOLOGICAL
FIELD EVALUATION TESTING
AT
WATERCOURSE CROSSING 1

PROJECT:

HERMANVILLE / CLEARSPRING
30 MW WIND FARM

CLIENT:

PEI ENERGY CORPORATION

LOCATION:

HERMANVILLE / CLEARSPRING,
PRINCE EDWARD ISLAND

DATE: **JANUARY, 2013**

DATUM: **NAD 1983**

PROJECTION: **UTM ZONE 20**

SOURCE: **HTTP://WWW.GOVPE.CA/GIS/ (2010 DATA BASE)**

AMEC PROJECT NO: **TE121023**

LEGEND:

- 50x50 Test Pit
- Collector Line SE
- Watercourse
- Provincal Wetland
- Property Boundary

10 5 0 10
Meters

1:550

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Path: G:\GIS\PROJECTS\TE121023_PEI_EnergyCorp_EastPIWind\MXD\20130128_Revisions\20130128_Phase3_FieldEvalTesting_WC1_Fig4_8.mxd User: tanya.morehouse, Date: 29/01/2013

Table 4.11 Typical Test-Pit Soil Stratigraphy (Test-pit B5 on Southeast Side)

Layer #	Soil Description	DBS (cm)
1	Moss/sod – dark brown sandy/silty loam & organics (humus)	0-14
2	Light orange and grey mottled fine silty sand	14-27
3	Orangey brown fine-coarse silty sand w/ red sandstone pebbles/cobbles	27-41
4	Consolidated red-orange medium-coarse silty sand (till)	41-46
Finishing Depth		46

* DBS = Depth Below Surface.

The depth of each natural soil layer and the depth at which the water table was reached (if it was reached) varied from test-pit to test-pit. The number of transition sandy layers between the top humus layer and the bottom till layer also often varied from the most common four layers identified in Table 4.10. In a few localized spots in the testing area on the southeast side of WC 1, water was reached prior to reaching archaeological bottom (till).

No archaeological resources were identified as a result of this Phase 3 testing exercise at WC1. In fact, no artifacts (Native or historic) or cultural features were identified in any test-pit. Therefore, there is no subsurface physical evidence of any pre-historic or historic activity within the area tested.

4.6.5.4 Summary

One historic site was identified and registered with the provincial government during the course of the archaeological investigations conducted to date. This site, CcCn-21, appears to likely be the remnants of a late 19th century residential structure, which was occupied, or at least still standing, into the mid 1970s. However, this site is located outside of the proposed Project area. Therefore, there is no perceived negative impact on archaeological site CcCn-21 resulting from the presently proposed Project.

The Project design and impact of the construction of the transmission line along the side of the roadway (running south to connect with an existing transmission line) is not presently known. No pre-construction mitigation measures were recommended or conducted to identify potential archaeological resources within the assessed EPAs along these routes. However, depending on the proposed construction methodology (ground impact) in these areas[6], some level of limited construction mitigation will be required to prepare for the possible discovery of archaeological resources during construction.

[6] It is presently assumed that the transmission lines will be constructed overhead, within 10 metres of the side of the roadway, and with ground impact being limited to augering holes for the line poles.

4.6.6 Palaeontological Resources

As previously stated in section 4.1.2 Geology, the bedrock of PEI is comprised of formations of "red beds". Red beds are sedimentary layers composed primarily of sandstone, siltstone and shale. The red beds of PEI are called "New Red Sandstone" and are associated with rocks laid down during the geological Permian period (299-252 million years ago), the last period of the Paleozoic Era (The Paleontology Portal 2012).

The fossils of PEI are little known and overshadowed by those identified in other neighbouring provinces (Brink et al. 2012). Fossils of terrestrial vertebrates from the Early Permian Period have been identified on the island, but these finds have been few and incomplete (Ibid.). A diversity of trace fossils, both animal and plant, have been found in Permian-age red beds on PEI (The Paleontology Portal 2012). These have included traces of invertebrate and footprints of early reptiles, such as cotylosaurs and pelycosaurs. A piece of a pelycosaur skull was recovered from PEI in the mid-1800s, the first ever discovered in Canada (Ibid.). Recently, in Eldon (southwest of the Project area) preserved trackways (footprints) were discovered, which have been interpreted as Ichniotherium (a large-bodied Permian herbivore) (Brink et al. 2012). This specimen is the largest of its type ever found. In Kings County, Permian plant fossils have been recovered from Murray Harbour and Governors Island (US and Canada Fossil Sites 2012). While there are reports of palaeontological resources identified on PEI, as illustrated above, there are none recorded from the Project area. No palaeontological resources were identified during the surficial visual survey of the Project area.

4.6.7 First Nations/ Aboriginal Communities

The Project is not proposed to overlap a present day First Nations community. Geographically, the closest First Nation community is Morell of the Abegweit Mi'kmaq First Nation. While the Abegweit Mi'kmaq First Nation is comprised of three communities (Scotchfort, Rocky Point, and Morell), Morell is physically the closest to the proposed Project impact area. For this Study, AMEC is committed to informational exchange relationships with a representative of the Abegweit First Nation, as well as the provincial aboriginal organization of MCPEI.

While the Mi'kmaq traditional use of the general Project area has not yet been reported by a representative of the Native community, information housed with PEIAAS indicates that this area of the north coast has likely been used by the Native community as a travel route, possibly as an overnight campsite, and to trap and procure muskrat, ducks, geese, crab and lobster (PEIAAS 2012).

To date, there have been no indications to the proponent that the proposed wind park would have an adverse effect on traditional land use by Aboriginal people.

4.6.7.1 Aboriginal Fisheries

The lobster fishery, both as a commercial enterprise and a traditional food fishery, is a staple for the Aboriginal people. The wind farm project will not interact with these fisheries.

4.6.8 Safety Issues

There are several potential safety issues for both the public and on-site workers. The potential hazards from the construction and decommissioning phases are limited to the workers, as the public will be prevented from accessing the site. The exception to this would be the transportation of materials to and from the site which extends the spatial boundaries to include public roads. Any special permits required for the delivery of turbine components using over weight or non-compliant trucking configurations will be obtained.

The potential hazards from the operation phase include maintenance activities, the potential formation of ice on the turbine blades (ice-throw), and the potential for breakage of turbines or turbine blades. Maintenance hazards are limited to workers but the other scenarios pose a risk to anyone that may be near the site. Structural failure of the turbines and rotors is a rare event but can be caused by material fatigue, rotor over-speed, poor maintenance or lightning strikes. There are also safety issues regarding human health, such as shadow flicker and excessive noise levels.

The Project Area is set away from any residential subdivision area and the potential for interaction with the public is minimal.

4.6.9 Visual Landscape

The terrain of PEI is a predominantly flat to moderately undulating plain, best described as gently rolling (Agriculture Canada, 2006). Approximately 75% of the land surface is less than 45 metres above sea level (MASL) (PEIDAF), 2003). The Project is located on upland forest which slopes down towards Northside Road, and continues to drop in elevation to the shore. Northside Road is a coastal drive featuring beaches and the red cliffs of PEI. It also leads to the existing East Point Wind Farm and historic lighthouses located approximately 20 km east.

A representation of the potential impacts to the visual landscape for this Project was prepared by Frontier Power Systems (Appendix F).

5.0 IMPACT ASSESSMENT, MITIGATION AND RESIDUAL EFFECTS ASSESSMENT

The planning, construction, operation, maintenance and decommissioning phases of the proposed wind farm will have the potential to affect the biological, bio-physical and socio-economic environments. This section will describe potential interactions between the Project and the environmental components. The assessment conducted follows the six-step process outlined below:

- describing the Project activities;
- identifying and describing the environmental component(s) that will be affected*;
- describing the impact of any interaction between the environment and the Project;
- describing the mitigation measures;
- identifying any residual environmental effects after mitigation measures are applied; and
- determining the importance of effects after mitigation measures have been applied.

* Detailed project activities, for all Phases are provided in Section 2.

This process was followed in order to ensure that interactions between the Project components and the environment were adequately described, that the likely environmental effects are identified and properly assessed, and that the importance of any residual effect is determined.

The importance of effects after mitigation measures (residual effects) are determined using the definitions of level of impact established in the Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms under the Canadian Environmental Assessment Act Guidelines (NRCan, 2003) (Table 5.1).

Table 5.1 Definitions of 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 slight decline in resource in Study Area during life of the project. Regional management actions such as research, monitoring and/or recovery initiatives would not normally be required.
Minimal	Potential impact may result in slight decline in resource in Study Area during construction phase, but should return to baseline levels.

As described in Section 3.6 the following VECs have been identified as having the most potential for impact due to the Project:

- Air Quality
- Archaeology and Heritage
- Avian Species (birds) and bats
- Fauna (terrestrial)
- Fish and Fish Habitat
- Floral Species at Risk
- Land Use
- Local Economy
- Local Traffic
- Public Health and Safety (includes Noise)
- Surface Water Hydrology and Quality
- Visual Landscape
- Wetland

5.1 PLANNING PHASE

5.1.1 Public Consultation

During the planning phase, PEIEC collected wind data from various sites across the Province to determine the best location for the development of a 30 MW project. Please refer to Section 2.3 for details regarding initial public discussions with respect to the development of the 30 MW project. For more information regarding the formal public consultation process and methodology please refer to Section 9.0.

5.1.2 Surveys

In order to optimize Project layout several surveys will need to be conducted. These include a meteorological survey, environmental surveys, a geotechnical survey and land surveys. For more information regarding these surveys refer to Section 2.6 and Section 4.0 for methodology and results.

The following is a list of VECs identified as potentially being impacted by survey activities:

- Avian Species (birds) and bats
- Fauna (terrestrial)
- Fish and Fish Habitat

- Land Use
- Public Health and Safety (includes Noise)
- Surface Water Quality

5.1.2.1 Impact Assessment

Environmental concerns are generally related to the removal of minor amounts of vegetation during geotechnical and land surveys. Any removal of vegetation can alter or destroy existing or potential wildlife habitat, as well as impact watercourses. In addition, noise disturbance to wildlife as a result of activity in the area may occur. The presence of surveyors in the area may also limit the land use opportunities during survey operations. These survey activities are temporary and are anticipated to have a minimal impact on all environmental features.

5.1.2.2 Recommended Mitigation

The following recommended mitigation measures will minimize the potential environmental effects of vegetation clearing and disposal during geotechnical and land survey work:

- The Proponent will ensure all required permits and approvals from federal, provincial and municipal agencies are acquired for the area of work prior to surveys.

Avian Species / Fauna (birds and bats)

- The cutting of survey lines will be kept to a minimum. Where possible, alternate areas not requiring cut lines will be used.
- Whenever possible, cutting lines to the boundary between treed and open areas will be avoided.
- Survey lines will be limited in width to that which is absolutely necessary for line of sight and not more than 1.5 m.
- As required, trees and shrubs will be cut no more than 300 mm above the ground.
- All trees not exactly located on survey lines will be left standing and trees partly on lines will be notched (notch not to exceed 1/3 tree diameter) instead of removed, to allow sighting.
- Vehicles will yield the right-of-way to wildlife and no attempt to harass or disturb wildlife will be made by any person.
- Work area will be kept clean of food scraps and garbage.
- Waste will be transported to an approved landfill on a regular basis.

Fish and Fish Habitat/ Surface Water Quality

- Work conducted in the vicinity of wetlands/watercourses will be conducted in a manner which ensures that erosion and sedimentation of wetlands/watercourses is minimized.
- Trees will be felled in a way that damage to standing trees adjacent to the survey line is minimized. Trees will be felled away from and not into or over a wetland/watercourse. Slash will not be placed or left in wetlands/watercourses. Any debris material removed from a wetland/watercourse and adjacent areas will be disposed of, or placed in a manner such that it cannot enter a wetland/watercourse.
- Felled trees having a top diameter of 8 cm or more will be cut in lengths and piled for reuse as merchantable timber. Non-merchantable timber will be chipped and spread outside the buffer zone of a wetland or watercourse (i.e., greater than 10 m from a wetland or watercourse). In circumstances where landowners will not permit the use of alternate locations the buffer zone will be reduced to a minimum of 10 m.
- When surveying construction layouts, areas that will be cleared do not require strict adherence to the above; except trees, shrubs and areas to be saved or left natural as noted on the plans or marked in the field.
- There will be no cutting, and no heavy equipment or motorized vehicles will enter the areas designated as environmentally sensitive by the Project Manager.
- The extent of activities in environmentally sensitive areas will be minimized, including the restriction of walking to established walking paths if available.
- Petroleum products will be handled, stored, and disposed of in a manner that will minimize the potential for spills.
- Fuelling of equipment will not occur within the buffer zone of a watercourse/wetland or other environmentally sensitive areas.
- There will be no discharges into any watercourse, wetland or ditch.

Land Use/ Noise/ Public health and Safety

- Vehicle traffic and heavy equipment operation on-site will be limited to hours of 07h00 to 21h00, Monday to Saturday, except in extraordinary circumstances.
- All-terrain vehicles (ATVs) will remain within the right-of-way except as approved by the Project Manager.
- All flammable waste will be disposed of on a regular basis.
- There will be no smoking within 50 m of flammable product storage or usage. Areas for disposal of smoking material will be clearly posted.
- Fire-fighting equipment, sufficient to suit on-site fire hazards, will be maintained in proper condition and to the manufacturer's standards.
- On-site personnel will take immediate steps to extinguish the fire using appropriate equipment. Notify nearby personnel, the Project Manager and Construction Manager.

- If the fire cannot be contained, contact the Souris Fire Department at 9-1-1.
- In case of related medical emergencies, emergency medical assistance will be requested from 9-1-1.

This information can be found in the following sections of the EPP (Appendix A):

- Section 3.1 – General Measures
- Section 3.11 – Surveying
- Section 7.4 – Wildlife Encounters
- Section 7.5 – Fires

5.1.2.3 Residual Effects

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures described above are implemented.

5.2 CONSTRUCTION PHASE

As described in Section 2.6.2, the construction phase will consist of:

- Road and access construction and upgrades (existing woods road, widening, reinforcement and strengthening as required).
- Turbine site (10) development. Establishment of crane pads, lay down areas and turbine foundations.
- Substation construction to take place concurrently with the above two steps.
- Placement of a single phase line to the substation, collector lines from turbines to substation and transmission line from substation to existing T-12 transmission line.
- Erection of towers and placement of turbines.
- Testing, connection and integration with grid.
- Removal of all temporary works and restoration of site.

Therefore the main impacts to the environment will occur during land preparation (clearing, grubbing and excavation) for access routes and temporary work spaces as well as during building construction, interconnection to distribution system and turbine assembly.

The entire construction of the Hermanville/Clearspring 30 MW Wind Farm will follow an activity schedule similar to that defined in Table 1.2.

5.2.1 Site Access, Delivery of Equipment and Vehicle Movement

The following is a list of VECs identified as potentially being impacted by site access, delivery of equipment and vehicle movement:

- Air Quality
- Fauna
- Land Use
- Local Economy
- Local Traffic
- Public Health and Safety (includes Noise)

5.2.1.1 Impact Assessment

Air Quality
Vehicles and equipment produce gaseous emissions (CO, CO_2, and unburned hydrocarbons) from the combustion of fuels, gas, or diesel. In addition, dust and other airborne particulate matter (PM) may be generated by vehicle movement on unpaved surfaces. Generally, emissions may cause occasional nuisance problems on construction sites; however, they typically do not present problems outside the immediate construction area.

Fauna (including Avian Species)
The presence and movement of vehicles in the Project area can create a temporary disturbance to fauna due to noise, visual impacts and the presence of humans (workers in the area). This can relate into direct injury or mortality with vehicle collisions as well as disturbance of normal behaviour during foraging and breeding. Generally, effects are limited to the duration of activity and typically do not present problems outside the immediate construction area.

Land Use
The potential area available for forestry land use would be reduced as activity increases in the area through delivery of equipment and temporary equipment lay-down.

Local Economy
There is potentially a net benefit to the local economy as a result of Project activities since workers, equipment and materials will be needed. There will be numerous tasks that fall into the category “general construction”, which does not require training specific for wind turbines. In addition, a large number of specialists that assemble wind turbines come from within the Province. Therefore, it can be expected that at least some workers will be hired locally and regionally. The non-resident work force will consist of specialists in engineering design and turbine commissioning, crane operators and/or specialized transport vehicle drivers. Local businesses will have the opportunity to provide materials, such as crushed rock for the construction of roads, as well as construction equipment. Also, the presence of the non-

resident workforce will provide opportunities for businesses that provide food and accommodation, or food implements for the workers who choose to cook for themselves.

Local Traffic

During the construction, there will be an increase in traffic in and on the roads around the rural areas of Hermanville/Clearspring, PEI. Traffic related to the Project will consist of automobiles carrying workers, trucks to transport soil, rock and waste, heavy lifting equipment, and flatbed trailer trucks transporting construction equipment and turbine parts. During this period, transport vehicles may intermittently inconvenience the flow of traffic along Souris Line Road. Traffic management may be required when the wind turbines are being delivered to the site. This would consist of temporarily stopping traffic when any long vehicle carrying wind turbine components enters the site.

Public Health and Safety (includes Noise)

The increase in vehicle movement on local roads would have the potential to affect public health and safety. The impact on transportation routes and the public include possible damage to road infrastructure and interference with traffic flows.

Increased traffic could conceivably lead to a higher risk of traffic related accidents for the public. Therefore, adverse effects are likely. These accidents may cause injury to the persons involved, or even death. At the minimum, there would be damage to property, i.e., the cars involved. Since many of these additional traffic participants are large, heavy vehicles, the outcome of traffic accidents can be expected to be more severe than if it were a collision with a regular car.

Considering the short and intermittent nature of the construction activities, the daily schedule, the season of the year chosen for construction, and the distance of the Project Site from the closest receptors, the impact on the people living close to the construction site and along the transport route is considered to be not significant, although intermittent truck traffic will be audible for most of the construction period. While there may be short-term annoyance, adverse effects on the health of individuals are not expected.

Construction activities such as excavating and trucking will produce varying levels of noise. These noise levels will be dependent upon many factors, including weather conditions, topography, vegetation, and construction practices. Table 5.2 lists typical noise levels for various construction equipment and activities. Due to the nature of the proposed Project, noise effects are anticipated to be localized and will be in short duration in the context of the Project life cycle.

Table 5.2 Noise Levels at Various Distances from Typical Construction Equipment

Equipment	dB at 15/30 m+	dB at 76 m*	dB at 152 m*	dB at 305 m*	dB at 762 m*	dB at 1524 m*
Bulldozer	85 / 80.2	71	65	59	51	45
Crane, mobile	83 / 81.3	69	63	57	49	43
(Dump) Truck	88 / 67.1	74	68	62	54	48
Front-end loader	85 / 80.2	71	65	59	51	45
Concrete mixer truck	85 / 85.2	71	65	59	51	45
Generator	81 / --	67	61	55	47	41
Grader	85 / --	71	65	59	51	45
Backhoe	-- / 81.3	-	-	-	-	-
Roller	74 / --	-	-	-	-	-

Notes: * The estimated sound levels at various distances are based on the assumption that sound pressure diminishes by 6 A-weighted decibel (db(A)) with each doubling of distance.

Source: * HMMNH (1995) in BLM,2004
+ CBCL , 2003

5.2.1.2 Recommended Mitigation

The following recommended mitigation measures will minimize the potential environmental effects of site access, delivery of equipment and vehicle movement:

Air Quality

- All heavy construction equipment will be maintained in accordance with the manufacturer's specifications and equipped with appropriate equipment so as to reduce the potential for air emissions.
- Water will be applied as a dust suppressant as needed to prevent fugitive emissions.
- The exits of the construction sites will be equipped with effective dirt traps.

Fauna (including Avian Species)

- Imported equipment will be thoroughly cleaned before it arrives on PEI in order to prevent the introduction of exotic species.
- Contract Manager will ensure equipment being introduced from outside the Project area is inspected and thoroughly cleaned (if necessary) prior to mobilization to ensure no vegetative matter or seeds are attached to the equipment to prevent the spread of invasive species. A high pressure water wash prior to transport may facilitate this process.

- If there is soil (not rock) in the lay-down areas used for assembly of turbine parts adjacent to the turbine foundations, the soil will be aerated and loosened after use to counteract the compaction caused by the equipment. The vegetation will be allowed to return to a natural state.
- All personnel will report the presence of wildlife on construction site to the Construction Manager.

Land Use/ Local Traffic/ Public Health and Safety (includes Noise)

- The Proponent will ensure landowners and the public are notified of the schedule of construction activities taking place.
- Vehicle traffic, construction activities, and heavy equipment operation on-site will be limited to hours of 07h00 to 21h00, Monday to Saturday, except in extraordinary circumstances.
- To the extent practical, access to and from the Project should follow predefined travel routes.
- The routing of truck traffic through residential areas will be controlled during the maximum period of activity.
- Equipment and vehicles will only operate on cleared right-of-ways or areas designated for construction activities in the Plans/Drawings.
- If complaints arise due to truck traffic, acceptable alternate routing may be evaluated by the Contractor and PEIEC and implemented accordingly.
- During construction and operation, a telephone contact number for the Project Manager will be provided to area residents for the purpose of reporting noise complaints. When a complaint is received, the Project Manager will make every reasonable attempt to address the complaint. A record of all complaints and resolutions will be kept and reported to Regulatory Authorities on an annual basis.
- All heavy construction equipment will be maintained in accordance with the manufacturer's specifications and equipped with appropriate mufflers and other noise control equipment to minimize noise where appropriate.
- Routine maintenance of machinery will be performed off-site as much as possible. Some heavy equipment, such as the cranes, will be maintained on-site due to the challenges involved in moving the equipment.
- A professional service provider will be used for snow and ice removal on roads. PEIEC will stipulate that the contractor follow the Best Management Practices as described in Environment Canada's "Best Management Practices for Salt Use on Private Roads, Parking Lots and Sidewalks".

This information can be found in the following sections of the EPP (Appendix A):

- Section 3.1 – General Measures
- Section 3.12 – Equipment Movement
- Section 4.3 – Snow Removal
- Section 5.2 – Air Quality and Dust Control
- Section 5.3 – Noise Control
- Section 7.2 – Fuel and Hazardous Materials Spills
- Section 7.4 – Wildlife Encounters

In addition, with respect to public health and safety, since the traffic related to the construction activities cannot be avoided, the mitigation has to focus on other methods, such as increasing the safety for the public and the transportation workers. Safety can be increased by making sure that transportation workers have been trained to adhere to safe driving rules, such as no alcohol and no cell phone use when driving, and by ensuring that they are alerted to the fact that there may be children crossing the roads at any time and any location.

The people along the route should be made aware of the times when the traffic will be increased, for example, by posting notices in public places or messages in newspaper and/or radio. Notes should be sent to the schools, to alert the children to the additional traffic, and to encourage the schools to practice traffic safety with the children.

Also, refer to Section 5.2.4 for information regarding accidents and malfunctions.

5.2.1.3 Residual Effects

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures listed above and in the EPP (Appendix A), are implemented.

5.2.2 Clearing, Grubbing and Excavation

The following VECs have been identified as having the most potential for impact as a result of clearing, grubbing and excavation activities. This includes construction of new access roads, upgrading existing access roads as well as establishment of crane pads, laydown areas, substation footprint and temporary work spaces.

- Air Quality
- Archaeology and Heritage
- Avian Species (birds) and bats
- Fauna (terrestrial species)
- Fish and Fish Habitat
- Floral Species at Risk

- Land Use
- Local Economy
- Local Traffic
- Public Health and Safety (includes Noise)
- Surface Water Quality
- Wetland

5.2.2.1 Impact Assessment

Air Quality

As described in Section 5.2.1 vehicle and equipment emissions as well as dust and other airborne PM generated by the Project may impact air quality. The primary air quality concern is the effect of PM, mainly fugitive dust, on the surrounding environment.

The potential effect of particulates is influenced by site and weather conditions (rain and wind direction) and by preventative measures implemented during Project activities to minimize emissions. Emissions of particulates that exceed air quality guidelines may result in problems on the construction site and under special circumstances (such as strong winds), off-site. The level of particulates at construction sites depends on the silt content of the soils being disturbed, the proportion of dry days, operator habits, construction vehicle type and speeds, vehicle weights, and the number of vehicles.

Studies indicate that dust from similar construction activities (including excavation and grading) settles out very quickly, and a level of 150 $\mu g/m^3$ will be exceeded at a distance of 50 m only 2% to 3% of the time (National Cooperative Highway Research Program, 1999). The Province of PEI has an acceptable level of 70 $\mu g/m^3$ for an annual averaging period.

During the construction phase, dust is likely to be produced due to the movement of soil and gravel. Dust is a known trigger of health problems in susceptible people, e.g. asthmatic people. The effects of such attacks can be serious, even fatal. The residential area near the Project Site is small and the number of people with breathing related health problems can be expected to be small. The nearest dwelling to a turbine location is over 600 m north of the Project area, therefore, adverse effects from dust are not likely. Furthermore, agricultural practises in the area typically involve exposing significantly greater amounts of soils, for longer periods of time than the Project.

Archaeology and Heritage

As a result of the HRIA investigations for two proposed routings for an overhead transmission line (New Zealand Road and Souris Line Road), seven locations were assessed as being EPAs. Until a final route construction methodology is chosen (thus determining specific impact), construction mitigation for the ground disturbing activities within the impacted EPAs cannot be definitively established. The extent of this activity will be determined by the provincial regulator once these variables are known.

Archaeological investigations and potential determination are based on modeling. There remains limited potential throughout any Project area to encounter buried heritage features that do not fit the present model. The geographical extent of any adverse effects will be the entire resource and adjacent areas associated with heritage resources that occur within the Project footprint. The magnitude of construction effects on unknown heritage resources will be high, as clearing and excavation activities will expose the resource. This effect will be immediate and irreversible. If unknown resources are encountered during either the construction or operation phase, they will be affected, and effects will be site-specific. However, the potential for significant loss of knowledge would be minimized through the initiation of a contingency plan for affected resources.

Avian Species (Birds)

The main impacts to bird species during clearing, grubbing and excavation activities includes: direct injury or death of adult birds, nestlings or eggs through collisions or the destruction of nests; temporary disturbance of birds due to noise, visual impacts and the presence of humans (workers in the area); and intermittent or permanent loss, fragmentation, alteration or degradation of breeding, feeding and resting habitat. Habitat degradation can result from fugitive dust for the construction and movement of construction equipment, negative changes to water quality due to erosion and run-off, and introduction and spread of invasive vegetation.

The sight and sound of humans and vehicles and other engines are known to disturb birds. The disturbance can result in interruption of the regular behaviour, such as feeding, migrating and breeding. Birds tend to avoid areas where they are disturbed. If birds are displaced to avoid disturbance, this effectively means a loss in suitable habitat. Disturbance effects are species, season, and site-specific (Langston and Pullan, 2003). There are few studies on disturbance effects, and often there are no conclusive results (Langston and Pullan, 2003). Some species may habituate to these new conditions, but others do not appear to be able to do this (Langston and Pullan, 2003).

The greatest impact to birds during the construction of the wind farm will be lost, altered, and fragmented habitat (BLM, 2004). Land that will be lost include: new permanent access roads, location of wind turbines and substation. This impact is considered to be moderate, however the total amount of habitat that will be displaced is small compared to the total available in the Study Area.

The altered areas should return to the original vegetation immediately after the end of construction. This impact will consist of a short-term loss of habitat for one or a limited number of years, until the vegetation has recovered. Bird use of this land for feeding and resting will only be impacted for the duration of construction work itself, i.e. a few weeks at each location. However, since the habitat will be altered until it has recovered, the composition of the bird species using a particular area will be changed to reflect their different feeding habits.

Avian Species (Bats)
Impacts on bats could result from direct effects such as death of individuals during the land clearing activity, or indirect impacts due to loss and/or alteration of habitat as well as disturbance and noise. Many of the impacts to birds can be extrapolated to bats. Whether an impact is significant depends on the number of bats impacted and the vulnerability of the species.

Worldwide, habitat loss has been identified as the main cause of declines in bat populations (Mickleburgh *et al*. 2002). Bats need several types of habitat to survive. These are 1) foraging areas, 2) summer roosting areas, and 3) hibernation areas. Loss or alteration of any of these habitats types can have impacts on bats. Wind power developments can potentially impact these crucial habitats in a variety of ways.

Tree clearing activities remove or alter foraging and roosting sites, and are detrimental to local bat populations (Waldien *et al*. 2000*a*, 2000*b*; Hayes 2003, Humphrey 1982). This can also affect bat species which hibernate in hollow trees or on the ground. In particular, removal of large diameter snags and/ or hollow trees can be detrimental to maternity colonies and local populations (Bringham *et al.* 1997; Waldien *et al*. 2000*a*, 2000*b*). Alteration or degradation of riparian areas could also affect foraging habitats. Replacement of mature forest areas with younger regenerating forest can also affect bats. Broders and Forbes (2004) noted that in NB, roost selection by male little brown bats appeared highly dependent on the number of snags (dead trees) in the area.

Fauna (Non-Avian Species)
As described in Section 5.2.1, impacts to fauna (excluding avian species) include temporary disturbance of normal behaviour during foraging and breeding due to noise, visual impacts and the presence of humans (workers in the area) as well as injury or mortality with vehicle collisions. Generally, effects are limited to the duration of activity and typically do not present problems outside the immediate construction area.

Fish and Fish Habitat/ Surface Water Quality
As described in Section 4.2, there is one watercourse confirmed to be a salmonid fish bearing stream that will be spanned by an aerial cable. Potential impacts to surface water relate to structural habitat effects and disturbance of erodible material in or adjacent to the watercourse resulting from Project activities in or near the watercourse.

Riparian vegetation stabilizes banks, moderates water temperature by shading, and provides cover for fish. Failure to encourage re-growth of vegetation along watercourse banks following a disturbance may lead to elevated or diminished water temperatures, increased sediment, and loss of refuge for many fish species.

Surface runoff from disturbed areas can transport eroded soils into a watercourse. The soil may then deposit, and thereby affect aquatic resources. The erosion of soil from the site footprint and unstabilized areas can potentially harm fish inhabiting adjacent watercourses. Suspended solids are carried in the water column and can adversely affect fish and benthic invertebrate populations. Potential effects on fish include the elimination of spawning habitat by sediment infilling; clogging of gills; reduction of light and changes in predator-prey interactions by increased turbidity.

Sublethal effects have been reported for a variety of fish species in waters with suspended sediment concentrations of approximately 650 mg/L or greater, when fish are continually exposed for a period of several days (Appleby and Scarratt, 1989). Physiological effects are related to the concentrations and durations of exposure (Anderson *et al.*, 1996). Fish mortality can result from exposure to high concentrations of suspended sediment for a short duration, or a long exposure to suspended solids of low concentration. There are also differences in sensitivity between species. While levels of 100 mg/L are frequently cited as harmful, lethal levels (LC_{10}) of suspended sediment for a number of fish species are above 580 mg/L in static bioassays (Sherk *et al.*, 1974). Mortality of fish eggs or alevins within the stream substrate may also be caused by the deposition of previously suspended fine material. The size and shape of the suspended particles also has a bearing on the suspended sediment concentration that causes fish mortality (Anderson *et al.*, 1996).

Fish habitat also includes fish food organisms. Benthic macroinvertebrates make up the majority of fish food organisms in north temperate streams. These organisms are adversely affected by increased levels of suspended sediment, either through direct mortality, displacement to another area, or loss of habitat. Sedimentation events have been shown to result in decreases in invertebrate density, biomass, and species diversity (Gammon, 1970). Benthic invertebrates may become buried under high sediment loads and suffer other ill-effects such as clogged gills, decreased food supply as well as habitat loss. While behavioural effects such as predator-prey interactions are easily reversed (Newcombe, 1994), the physiological damage caused by sediment on aquatic organisms can be fatal.

The proposed wind farm is situated inland. Clearing will be required within 10 m of the tributary to Cross River located within the Study Area. Clearing measures employed to protect the wetland and watercourse will address potential surface water issues.

Floral Species at Risk

As discussed in Section 4.4.3.1 there are several flora species listed by ACCDC observed in the Study Area. In addition, vegetation surveys as described in Section 4.4.1 confirmed the presence of some of these species. There is a potential for physical disturbance of flora during land preparation activities. It should be noted that none of the species identified are listed by SARA or COSEWIC. Care will be taken to avoid the *Polypodium appalachianum* observed near T3.

Wetland

As described in Section 4.3.3 there were four (4) wetlands identified within the Study Area and two (2) along Souris Line Road. The wetlands identified within the Study Area will not be impacted by Project activities; however the wetlands identified along Souris Line Road are located within 30 m of the proposed transmission line. Potential impacts to these wetlands include settling of PM on wetland vegetation, erosion/sedimentation issues, and introduction of invasive species.

Settling of PM on wetland vegetation and erosion/sedimentation issues, could result in the suppression of vegetation growth or exceedance of local water quality guidelines for an extended period. With respect to invasive species, some species such as the alien race of common reed (*Phragmites australis*), are known to severely degrade wetland diversity by producing dense monocultures; which displace the range of naturally occurring vegetation species. These species may be introduced through seeds, roots or “rootable” fragments stuck to construction/maintenance equipment and shoes of workers.

Land Use

The potential area available for forestry land use would be reduced by approximately 1% through the creation and/or modification of existing/new access roads, wind turbines and the substation.

Local Economy

Benefits to local economy described in Section 5.2.1 are applicable to clearing, grubbing and excavation activities as well.

Local Traffic/ Public Health and Safety (including Noise)

Impacts to local traffic as well as public health and safety described in Section 5.2.1 are applicable to clearing, grubbing and excavation activities as well. During the construction phase, accidents connected to the construction activities may pose a physical hazard to the workers on-site (i.e. they are occupational hazards). The public will be prevented from accessing the Project Area during that time and therefore are not at risk.

5.2.2.2 Recommended Mitigation

The following recommended mitigations will minimize the potential environmental effects of clearing, grubbing and excavation:

- The Proponent will ensure all required permits and approvals from federal, provincial and municipal agencies are acquired for the area of work prior to construction.
- The Project Manager and Contract Manager will ensure construction activities are undertaken in accordance with all applicable conditions, permits and approvals received from federal, provincial and municipal authorities.

Land Use / Public Health and Safety

- Property boundaries will be identified, where possible, prior to commencing work activities. This may include staking out private property prior to work operations.
- The Proponent will ensure landowners and the public are notified of the schedule of construction activities taking place.

- All site activities will be carefully planned and performed in such a manner that noise is minimized.
- The frequency and/or duration of noise producing activities will be minimized wherever possible.
- All heavy construction equipment will be maintained in accordance with the manufacturer’s specifications and equipped with appropriate mufflers and other noise control equipment to minimize noise where appropriate.
- Vehicle traffic, construction activities, and heavy equipment operation on-site will be limited to hours of 07h00 to 21h00, Monday to Saturday, except in extraordinary circumstances.
- The Contractor will ensure idling of construction vehicles is limited.
- The routing of truck traffic through residential areas will be controlled during the maximum period of activity.
- The working limits of the Project footprint will be clearly defined to prevent trespassing. The Contract Manager will ensure all of its activities are contained with the defined Project footprint.
- Equipment and vehicles will only operate on cleared right-of-ways or areas designated for construction activities in the Plans/Drawings.
- The area of disturbance will be limited to that which is absolutely necessary to conduct the work.
- Clearing will be minimized to that necessary to construct and operate ten turbines and the electrical substation, install single phase line, collector lines and transmission lines and implement access roads 6 m wide with a 1 m shoulder on each side, plus clearing for electrical infrastructure.
- Soil compaction will be avoided by limiting the traffic flow on access roads.
- Because soil admixing can also result from excessive rutting of access roads, travel on the access roads will be limited following periods of heavy rain.
- The potential for soil admixing to occur will be mitigated through the stripping of topsoil from any area which requires grading and the storage of the topsoil separately from the subsoil for reuse during rehabilitation of the site.
- Stripping of topsoil will consist of removing the top 10-15 cm of soil and placing it separately to minimize admixing.
- Stoniness will be avoided by removing any noticeable stone concentration to an approved location.
- During the excavation for the foundation, any shallow soft rock that may be encountered will not be mixed with the topsoil. Topsoil and excavated overburden and bedrock will be stored in separate stockpiles for later use during rehabilitation.
- Excavated materials will largely be used on original clearing sites, where appropriate.

- All sand, aggregate, soil, or other materials in place or in stockpiles must be contained to prevent materials from producing dusty conditions and from cross contamination, as determined necessary by the Site Supervisor or Construction Manager.
- Sand and soil stockpiles will be bermed and sloped (and seeded with non-invasive, herbaceous, native species, if abandoned) to minimize runoff. If stockpiles are not needed immediately, temporary erosion and sediment control devices will be installed and regularly maintained.
- Only material approved by the Project Manager and the Site Supervisor will be disposed of or reused onsite (e.g., clean fill materials).
- Mobile fuelling trucks will be used to minimize the requirements for on-site storage of petroleum, oils or lubricants (POLs).
- The transport of fuel will be conducted in compliance with the *Transportation of Dangerous Goods Act*.
- Diesel fuel and gasoline may be stored on site in limited quantities. Drums as required for one day's use will be on site, and drums will be delivered on a daily basis. Fuel drums will be stored upright on a deck with drip trays for the collection of spilled substances.
- Where possible, vehicle maintenance will be performed off site, at a nearby commercial fuelling station, in order to minimize the amount of lubricants and oils stored on site. Some heavy equipment, such as the cranes, will be maintained on-site due to the challenges involved in moving the equipment.
- The Contractor will make daily inspections of hydraulic and fuel systems on machinery and leaks will be repaired immediately. All leaks will be reported to the Canadian Coast Guard at 1-800-565-1633. Regarding transmission line, leaks will be reported in compliance with MECL Spill Agreement for Line Construction.
- On-site POL storage will be in a ventilated, lockable steel container. The container will be equipped with galvanized steel drip trays for the collection of spilled substances.
- Spill decks will be used for transferring products to smaller containers.
- Fire extinguishers and spill kits will be located near POL storage areas.
- POL storage areas will be identified by signs, and "No Smoking" signs will be displayed at all POL storage sites and refuelling areas.
- Smoking will not be permitted within 50 m of any POL storage area. On-site signage will indicate the location of smoking areas.
- When refueling equipment, operators will:
  - use designated fuelling locations;
  - use drips trays;
  - use leak free containers and reinforced rip and puncture proof hoses and nozzles;
  - be in attendance for the duration of the procedure; and
  - seal all storage container outlets except the outlet currently in use.

- Fuelling attendants will be trained in the requirements under the Fuel and Hazardous Material Spills Contingency Plan in Section 7.2 of the EPP (Appendix A).
- Waste POLs will be stored in a ventilated, lockable steel container. The container will be equipped with galvanized steel drip trays for the collection of spilled substances.
- Waste solvents and oils will be stored separately.
- All used oil and petroleum products will be removed from the site and disposed of in an acceptable manner in accordance with government regulations, and requirements. Waste oil will be collected separately and offered for recycling or stored for collection by an appropriate special waste collection and disposal company.
- Greasy or oily rags or materials subject to spontaneous combustion will be deposited, and kept, in an appropriate receptacle. This material will be removed from the work site on a regular basis and will be disposed of in an approved existing waste disposal facility.
- POL waste disposal will be the responsibility of the Contractor.
- Waste produced during the Project construction will be sorted as per the requirements of the PEI Waste Watch Program.
- During the initial stages of site development and where it is not feasible to install sewage treatment facilities, portable and/or temporary toilets and washcars will be developed with holding tanks.
- The holding tanks will be pumped and emptied at as required and disposed of by the sanitation contractor at an approved facility.
- Domestic waste from temporary office quarters will be gathered on a regular basis and stored in closed containers until recycled or disposed of as per the requirements of the PEI Waste Watch Program.
- All surplus materials, rubbish, waste materials, and construction debris will be removed from the site upon completion of construction of the Project.
- All waste will be handled in accordance with relevant provincial and federal requirements.
- Waste material will not be dumped on-site. In such case as waste materials are inadvertently dumped, the Construction Manager (or designate) will immediately act to have the dumped material cleaned up and removed.
- Firefighting equipment, sufficient to suit on-site fire hazards, will be maintained in proper condition and to the manufacturer's standards.
- On-site personnel will take immediate steps to extinguish the fire using appropriate equipment.
- If the fire cannot be contained, contact the Souris Fire Department at 9-1-1. Notify nearby personnel, the Project Manager and Construction Manager
- In case of related medical emergencies, emergency medical assistance will be requested from 9-1-1.

Fish and Fish Habitat/ Surface Water Quality/ Wetland

- Environmentally sensitive areas (i.e. wetlands and watercourse) will be staked out prior to work operations so that these areas are protected.
- A 10 m buffer zone will be maintained on each side of a wetland/watercourse.
- The Construction Manager will limit activity within watercourse and wetland buffer zones, as well as within areas where rare species are noted to occur.
- Work conducted in the vicinity of wetlands/watercourses will be conducted in a manner which ensures that erosion and sedimentation of wetlands/watercourses is minimized.
- Appropriate erosion control measures will be installed prior to conducting the work. Work will be completed as soon as possible, and will be suspended during and immediately after intense rainstorms and during periods of high runoff.
- Equipment travel will be limited to roads during rainfall events.
- In areas where extensive erosion occurs (e.g., along steep slopes) or in environmentally sensitive areas, an active re-vegetation program will be implemented as soon as possible following disturbance to ensure rapid re-vegetation.
- Materials cleared from the sites (brush, logs, soil, etc.) should not be dumped into otherwise unaffected land and are not permitted within any watercourse/wetland buffer zone.
- Slash will be piled outside the buffer zone of a wetland or watercourse (i.e., greater than 10 m from a wetland or watercourse) for subsequent chipping and disposal in an approved facility.
- Construction equipment will not enter buffer zones of wetlands/watercourses or environmentally sensitive areas, except within the Project footprint and under direct supervision of the Site Supervisor or Environmental Inspector.
- Erosion control measures will be monitored during construction activities within the right-of-way and any areas associated with Project construction activities. Where damage to these erosion control measures is observed, they will be promptly repaired to prevent siltation of wetlands/watercourses or other environmentally sensitive areas.
- Where a vegetation buffer between erodible slopes and water bodies is less than 10 m, or where construction areas are immediately upgradient of adjacent properties, an engineered silt fence will be constructed to control silt runoff and placed along the down gradient perimeter of the construction area.
- Sediment-laden water resulting from dust control measures will be collected by erosion control measures in place on-site such as sediment control fences and check dams.
- Silt or sediment control fences will consist of woven synthetic fibre fabric attached to wooden posts.
- In extremely erodible areas, hay or straw mulch will be used as required for protection.
- Silt fences will not be used to control sedimentation within a ditch or watercourse.

- Where erosion control within a drainage ditch is required, geotextile wrapped straw bales will be installed to provide a check dam and prevent downstream sedimentation. Some rockfill or rip rap may be installed on the downstream side of the check dam to secure the structure during heavy rainfall events.
- The Contractor will maintain the erosion control structures in a functional condition as long as necessary to contain sediment from run-off, from time of installation until a sufficient vegetative cover growth (>90% cover) has been established.
- All erosion control structures and sediment control fences will be inspected before, during and following each rainfall event and at least daily during periods of prolonged rainfall. Any damage arising from major storm events will be repaired as soon as possible to the satisfaction of the Site Supervisor.
- Retained sediment will be removed when it has accumulated to a level of half the height of the fence/barrier and disposed at least 10 m away from any wetland or watercourse in a manner that prevents it from entering a wetland or watercourse.
- If siltation of the nearby watercourses is observed, notify the Construction Manager and identify the source of the siltation. Siltation indicates preventative measures have been ineffective.
- Suspend any construction operations contributing to the problem.
- Isolate, contain, and control the source using measures such as straw bales or brush mats. Erosion control structures will be fixed immediately.
- If the release has affected, or has the potential to affect, a sensitive area (i.e., a wetland or watercourse), the Site Supervisor will contact and consult with the appropriate regulatory authorities (e.g., PEIDELJ, DFO) as required for notification and planning.
- To ensure that erosion and sediment control measures are in effective working order, their condition will be monitored periodically and prior to, during, and following storm events.
- Accumulated sediment will be removed once it reaches a depth of one-half the effective height of the control measure or a depth of 300 mm immediately upstream of the control measure.
- For all erosion control measures, accumulated sediment will be removed as necessary to perform maintenance repairs.
- Accumulated sediment will be removed immediately prior to the removal of control measures.
- The sediment removed will be deposited in an area that is approved by the Construction Manager and will not result in erosion and runoff into a watercourse.
- No waste or debris will be permitted to enter any watercourse.
- Run-off from a disposal/storage area will not be allowed to enter a watercourse.
- The on-site POL storage container shall be located on level terrain, at least 100 m from any water body or wetland.

- No POL storage will occur in sensitive areas (e.g., near wetlands, watercourses or wells) or associated buffer zone.
- Fuelling must be done at least 30 m from a wetland or waterbody.
- Servicing of equipment will not be allowed within 100 m of a wetland, watercourse or drainage ditch.
- The Contractor will, with the prior approval of the Site Supervisor, designate and use areas for the transfer and limited temporary storage of hazardous materials and special wastes. These sites will be properly labeled and appropriately controlled, and will be located a minimum of 10 m from a wetland or watercourse.
- On-site temporary disposal areas for surplus material will be designated and will be located a minimum of 10 m from a wetland or watercourse.

Fauna (including avian species)

- All clearing, grubbing and trimming activities will be scheduled to avoid sensitive breeding, nesting and brooding periods (typically May 1st to August 31st) of avian species (birds and bats) as much as possible. All other construction activities will be scheduled between May 1 and the end of the construction period for that calendar year.
- Limit removal of tall trees and snags to areas absolutely necessary for construction, including trees of 15 cm diameter or greater.
- For clearing activities the following measures will be implemented:
    - Clearing activities will be scheduled in consideration of critical habitat features (e.g., wetland areas) identified during the pre-construction field survey.
    - The proponent will instruct the management team and contractors on the MBCA, the importance of habitat, the significance of the nesting period, and measures to be implemented to minimize any disturbance to birds/nests.
    - A bird nest survey of the area will be conducted by a professional biologist/ornithologist/birder prior to clearing activities. The bird species recorded during the survey will be used as an indicator regarding the potential nesting habitat in the area.
    - The typical nesting habitat for these species would be investigated for potential nests.
    - Nest trees will be felled prior to or after the nesting season.
    - The occurrence of all identified nests will be documented.

- If there is soil (not rock) in the lay-down areas used for assembly of turbine parts adjacent to the turbine foundations, the soil will be aerated and loosened after use to counteract the compaction caused by the equipment. The vegetation will be allowed to return to a natural state.
- When grassed areas are encountered during grading, every effort will be made to leave such grassed areas intact.

- Native plant regeneration will be promoted in any areas that are cleared but not built upon (i.e. roadside ditches, temporary laydown areas, etc.).
- Use native plants or no vegetation at all around turbines, avoid Mountain ash trees.
- Avoid mowed lawn.
- Imported equipment will be thoroughly cleaned before it arrives on PEI in order to prevent the introduction of exotic species.
- Food waste will be stored in a manner that ensures wildlife will not be attracted and will be removed from the site on a daily basis.
- All personnel will report the presence of wildlife to the Construction Manager.
- When wildlife sightings are reported to the Construction Manager, the Construction Manager will initiate any reasonable action to reduce the chance of disruption or injury. Should disruption or injury to the wildlife occur, the Construction Manager will contact the on-call Conservation Officer.
- In the case of wildlife encounters in sensitive areas, and for consultation on appropriate action to be taken for any encounter, the Construction Manager will contact the on-call Conservation Officer. However, in general:
  - No attempt to harass wildlife will be made by any person at the work site; and
  - Equipment and vehicles will yield the right-of-way to wildlife.

- If dead animals are encountered (including birds or bats), they will be removed and disposed of, as soon as possible, in consultation with the local Provincial Wildlife Officer (or, in the case of a pet, the PEI Humane Society). All handling of bird carcasses will be in accordance with the MBCA salvage permit. If SARA species carcasses are found they will be sent to the Sackville CWS office with suitable permitting as advised by the CWS.
- In the case of encounters with injured or diseased wildlife at the work site (including birds or bats), the Construction Manager will contact the on-call Conservation Officer. No attempt will be made to harass the animal, and no person at the work site will come into direct contact with the animal. Injured birds will be transported to the Atlantic Veterinary College in Charlottetown, PEI where they will be received by a certified wildlife rehabilitator.
- If an injured or dead bird or bat is encountered, the following information will be recorded: date and time it was found, injury sustained (if identifiable), cause of injury (if known), and species. This information will be kept on file for incorporation into the post-construction bird and bat monitoring program.

Air Quality

- All site activities will be carefully planned and performed in such a manner that air emissions are minimized.
- The frequency and/or duration of air emissions producing activities will be minimized wherever possible.

- All heavy construction equipment will be maintained in accordance with the manufacturer's specifications and equipped with appropriate equipment so as to reduce the potential for air emissions.
- Water will be applied as a dust suppressant as needed to prevent fugitive emissions.
- Infrequently used storage areas for stockpiled materials will be shielded from wind exposure by covering with mats, tarpaulins, re-vegetating or similar methods and/or devices.
- The speed limit will be reduced on construction-site pathways to minimize dust formation.
- The Contractor will ensure idling of construction vehicles is limited.
- The routing of truck traffic through residential areas will be controlled during the maximum period of activity.
- Do not load trucks with soil above the freeboard.
- Minimize drop heights when loading trucks.
- Moisten land before clearing.
- Slash will not be burned.
- The time between topsoil storage and reclamation will be minimized, thus reducing exposure of the topsoil to the wind.

Archaeology and Heritage

As a result of the HRIA investigations for two proposed routings for an overhead transmission line (New Zealand Road and Souris Line Road), seven locations were assessed as being EPAs. Until a final route construction methodology is chosen (thus determining specific impact), construction mitigation for the ground disturbing activities within the impacted EPAs cannot be definitively established. The extent of this activity will be determined by the provincial regulator once these variables are known.

One of the following three mitigations options will be required by the provincial regulator (PEIAAS) when construction is conducted within the EPAs on the selected transmission line route:

- Having a permitted archaeologist monitor (on site) all ground disturbing activities within the EPAs, **or**
- Having a permitted archaeologist be on call during construction should possible archaeological resources be identified during these activities, **or**
- Having construction crews self-monitor and report any identified cultural materials to the provincial regulator directly.

Archaeological investigations and potential determination are based on modeling. There remains limited potential throughout any Project area to encounter buried heritage features that do not fit the present model. Therefore, in addition to one of the preceding construction mitigation measures, during construction excavations for this Project it is recommended that:

- Construction crews should be made aware of the potential for heritage resources within their construction area.
- A heritage resources protocol should be in place and adhered to during construction, in the event that additional heritage resources or human remains are discovered.
- In part, the content of the protocol addresses an incident where potential heritage resources or human remains are found during construction, operation, or maintenance of the proposed Project. Work in the area must cease and the provincial regulator (PEIAAS) must be contacted. If such a find should occur when a permitted archaeologist is either on-site or on-call, the permitted archaeologist will make the determination and report the find to PEIAAS.

This recommended mitigation measures listed above can be found in the following sections of the EPP (Appendix A):

- Section 3.1 – General Measures
- Section 3.2 – Vegetation Clearing and Disposal
- Section 3.3 – Ditching
- Section 3.4 – Grubbing, Stripping, and Excavation
- Section 3.5 – Disposal of Excavated Waste Materials
- Section 3.6 – Infilling and Grading
- Section 3.7 – Culvert Installation and Stabilization
- Section 3.9 – Handling, Storage and Use of Aggregate Materials
- Section 3.12 – Equipment Movement
- Section 4.3 – Snow Removal
- Section 5.1 – Erosion Control
- Section 5.2 – Air Quality and Dust Control
- Section 5.3 – Noise Control
- Section 6.1 – Petroleum, Oils, Lubricants, and Other Hazardous Materials
- Section 6.2 – Solid Waste Disposal
- Section 6.3 – Sewage Disposal
- Section 7.1 – Erosion Control Failure
- Section 7.2 – Fuel and Hazardous Materials Spills
- Section 7.3 – Archaeological Heritage Resources

- Section 7.4 – Wildlife Encounters
- Section 7.5 – Fires

In addition, refer to Section 5.2.4 for information regarding accidents and malfunctions.

5.2.2.3 Residual Effects

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures in the sections listed in the EPP (Appendix A), are implemented.

5.2.3 Building Construction and Turbine Assembly

The following VECs have been identified as having the most potential for impact as a result of building construction and turbine assembly activities. This includes construction of turbine foundations, wind turbine assembly, substation construction, placement of transmission lines from turbines to substation and from substation to existing transmission line as well as removal of all temporary works and restoration of site for operation.

- Air Quality
- Archaeology and Heritage
- Avian Species (birds) and bats
- Fauna (terrestrial species)
- Fish and Fish Habitat
- Land Use
- Local Economy
- Local Traffic
- Public Health and Safety (including noise)
- Surface Water
- Wetland

5.2.3.1 Impact Assessment

VEC impact assessments detailed in Section 5.2.2 are similar to those VECs listed above.

5.2.3.2 Recommended Mitigation

The mitigation measures recommended in Section 5.2.2 are also applicable and will minimize the potential environmental effects of building construction and turbine assembly. In addition the following mitigation measures are recommended:

- Any excavation or grading during the construction of the site will be conducted in a manner that ensures the minimum amount of disturbance necessary.

- Access roads will be used, where possible, for all equipment, including cable reels, line trucks, and tensioning equipment.
- Erosion and sedimentation control measures will be in place prior to any grubbing activity.
- In extremely erodible areas, hay or straw mulch will be used as required for protection.
- Silt or sediment control fences will consist of woven synthetic fibre fabric attached to wooden posts. Silt fences will not be used in watercourses.
- Where a vegetation buffer between erodible slopes and water bodies is less than 10 m, an engineered silt fence will be constructed to control silt runoff and the silt fence will be placed along the down gradient perimeter of the construction area.
- Replanting will occur upon completion of cable-laying operations.
- Form oil may be used sparingly to allow forms to separate from concrete following curing.
- Only the chutes of concrete trucks will require on-site cleaning of wet concrete to permit their storage for transport. The volume of water used and extent of washing will be kept to a minimum.
- Washing of chutes on-site will occur at a designated location, outside of the wetland boundary, that will permit containment of the wash water in a settling pond away from any subsurface drains, streams or storm drains. If such a system cannot be located on-site, then the wash area should permit containment of the wash water so that it can be disposed of off-site at the ready mix plant.
- Washing of the drum at the end of a day's delivery will occur at the ready-mix concrete plant.
- No chemicals will be used in the washing of concrete trucks or forms on-site.
- Aggregate used in the production of concrete will not be stored on-site and concrete will not be produced on-site.
- In the event that water from the wash water containment area requires release to the environment, the effluent will be tested prior to release for parameters related to any concrete additives used in the production of the ready mix concrete (e.g., total hydrocarbons, sodium hydroxide), pH, and TSS will meet the limits specified by the PEIELJ. Suspended solids concentrations within effluent released will not exceed 25 mg/L (monthly average) or 50 mg/L (grab sample) above background.
- If concrete is mixed on site, drainage from the concrete production area and aggregate storage area, and washwater from the cleaning of batch plant mixers, mixer trucks, conveyors, and pipe delivery systems will be directed to a settling pond for control and treatment, as appropriate. Effluent will be treated as appropriate before release to receiving waters, or alternatively, effluent will be recycled for reuse after treatment. Solids which accumulate in a settling pond will be removed on a regular basis to ensure the settling pond remains effective.

- In areas where the ground is wet, transmission line poles will be dug using a 750 mm auger; while holding the pole in place, aggregate is poured around the pole and tamped, and the hole is filled with additional aggregate, or by other acceptable construction practices.
- Poles will be placed no closer than 10 m from any watercourse, and wetlands will be avoided where possible. If a watercourse or wetland cannot be spanned, untreated poles (wood, fibreglass or steel) will be used.

Recommended mitigation measures can be found in the following sections of the EPP (Appendix A):

- Section 3.1 – General Measures
- Section 3.6 – Infilling and Grading
- Section 3.8 – Installation of Underground Cables
- Section 3.9 – Handling, Storage and Use of Aggregate Materials
- Section 3.10 – Concrete Pouring Operations
- Section 3.12 – Equipment Movement
- Section 4.3 – Snow Removal
- Section 5.1 – Erosion Control
- Section 5.2 – Air Quality and Dust Control
- Section 5.3 – Noise Control
- Section 6.1 – Petroleum, Oils, Lubricants, and Other Hazardous Materials
- Section 6.2 – Solid Waste Disposal
- Section 6.3 – Sewage Disposal
- Section 7.1 – Erosion Control Failure
- Section 7.2 – Fuel and Hazardous Materials Spills
- Section 7.3 – Archaeological Heritage Resources
- Section 7.4 – Wildlife Encounters
- Section 7.5 – Fires

In addition, refer to Section 5.2.4 for information regarding accidents and malfunctions.

5.2.3.3 Residual Effects

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures in the sections listed above of the EPP (Appendix A), are implemented.

5.2.4 Accidents and Malfunctions

The following VECs have been identified as having the most potential for impact as a result of accidents and malfunctions:

- Air Quality
- Avian Species (birds) and bats
- Fauna (non-avian species)
- Fish and Fish Habitat
- Local Traffic
- Public Health and Safety
- Surface Water
- Wetland

5.2.4.1 Impact Assessment

Hazardous construction activities include clearing and grubbing of the land, excavation, construction of roads, excavation and construction of foundations and buildings (control building and electrical substation), delivery of equipment, assembly and erection of turbines, erection of power poles and power lines. During the construction phase, accidents connected to the construction activities may pose a physical hazard to the workers on-site (i.e. they are occupational hazards). In addition, there is potential for exposure to hazardous substances. Risks to occupational health and safety can be minimized, if workers follow safety standards and use appropriate protective equipment. Still, accidents may occur. These accidents may be significant to the individual based on the severity and the potential irreversibility of the consequences.

The public will be prevented from accessing the Project Area during that time.

The potential release of hazardous materials and construction debris to the surrounding environment during Project activities may increase background contaminant levels. In addition, the accidental release of petroleum products from construction equipment and wind turbines could have adverse effects.

Spills or exposure to toxic substances, either directly or indirectly via contaminated soil or water, has the potential to lead to negative impacts on flora and fauna, including Species-at-Risk. If several individuals of a species are affected, it would have an impact on population level and therefore the effects would be considered significant. Adverse effects can also occur if wetlands or watercourses in and around the Project Area are exposed to contaminants. Spills have the potential to cause long-term significant adverse effects to both soil and water quality.

5.2.4.2 Recommended Mitigation

The fundamental approach to accidents is one of prevention through training and being prepared to respond to any emergency. The preventative measures and contingency planning identified below will be developed with reference to the Canadian Standards Association (CSA) publication "Emergency Planning for Industry" (CAN/CSA-Z731-99). Best management practices prescribe the presence of spill kits on location and on the vehicles. Spill management procedures as outlined in the contingency plan will be followed when a spill occurs. Spill kits are mandatory on-site. Any discharge will be cleaned immediately and authorities notified (e.g. PEIDELJ, DFO).

The following measures will be implemented to minimize the potential environmental effects in the event of a fuel or hazardous material spill:

- Hazardous materials will be handled only by personnel who are trained and qualified in the handling of these materials, and only in accordance with manufacturer's instructions and government regulations. The WHMIS program will be implemented in accordance with the PEI *Occupational Health and Safety Act* and Regulations. All Employees involved with hazardous materials will be trained in the use of safety equipment, spill prevention equipment and emergency response procedures.
- Hazardous materials will be stored and handled in accordance with applicable provincial and federal regulations, codes and guidelines.
- Storage of hazardous materials will not occur in environmentally sensitive areas, such as wetlands or watercourses (see Section 6.1).
- Hazardous material containers will be properly labeled in compliance with the requirements of WHMIS.
- Material Safety Data Sheets (MSDS) will be available for all hazardous materials in use or stored on-site.
- A Fuel and Hazardous Material Spill Contingency Plan has been developed below. Designated personnel will be trained in the procedures and responsibilities outlined in the Contingency Plan.
- All hazardous materials will be removed and disposed of in an acceptable manner in accordance with government regulations and requirements. Hazardous materials may be removed from the site by an appropriate special waste collection and disposal company.
- Contaminated materials will be separated from uncontaminated materials and disposed of at approved waste disposal facilities.
- Reduce the need for hazardous substances by substituting for less harmful ones.
- Incorporate appropriate preventative and response measures and construction practices.
- Providing environmental awareness training to contractors and workers involved in the Project. Training will include the handling, clean-up, reporting and disposal of contaminated material.
- Maintaining appropriate spill response equipment in a readily accessible location.

- Reporting all spills to applicable authorities (e.g., 24-hour emergency reporting system 1-800-565-1633).
- The inspection of equipment (e.g., construction vehicles, exhaust systems) by the site personnel to ensure that vehicles with obvious fuel or oil leaks do not enter the project area.

In the event of a spill, the contingency plan includes the following:

- If it is safe to do so, the individual who discovers the leak or spill will immediately attempt to stop and contain the leak or spill.
- Any spill or leak must be reported immediately to the Construction Manager.
- The Construction Manager will immediately report the spill to the Canadian Coast Guard, Environmental Emergencies 24-hour Report Line (see Section 9.0 for telephone numbers). A Spill Report Form (provided in Section 11.0) will be filled out and will include:
    - a description of the source, including the name of the owner or operator;
    - the nature, extent, duration and environmental impact of the release;
    - the cause or suspected cause of the release; and
    - any remedial action taken or to be taken to prevent a recurrence of the leak or spill.

- Regarding transmission line, leaks will be reported in compliance with MECL Spill Agreement for Line Construction.
- The Contractor will have the full authority to take appropriate action without unnecessary delay. The Spill Report Form in Section 11.0 (Appendix A) will be filled out immediately following the discovery of the spill or leak, by the Contractor, and forwarded to the Project Manager. Spill Reports will be made available to the PEIELJ upon request.
- The Contractor will assume the overall responsibility for coordinating the clean-up and maintaining the contingency plan (Appendix A) current and up-to-date. The Contractor will, in consultation with the regulatory authorities (if warranted):
    - deploy on-site personnel to contain the spilled material using a dyke, pit, or absorbent material;
    - assess site conditions and environmental impact of various cleanup procedures;
    - choose and implement an appropriate cleanup procedure;
    - deploy on-site personnel to mobilize pumps and empty drums (or other appropriate storage) to the spill site;
    - dispose of all contaminated debris, cleaning materials, and absorbents by placing in an approved disposal site; and
    - take all necessary precautions to ensure that the incident does not recur.

- The Contractor, with approval by the Project Manager, will send a completed Spill Report Form to the PEIELJ, as soon as possible, and no later than 30 days after the spill.

During construction, the following resources will be available at an appropriate location in readiness to respond to accidental releases of fuels and/or hazardous materials:

- Absorbent materials (i.e., sorbent pads, Sorb-All, peat moss).
- Small equipment such as shovels, rakes, tool kit, sledgehammer, buckets, stakes, tarpaulins, one empty drum, and protective equipment.
- Section 9.0 of the EPP (Appendix A) contains the contact list for spill response.

In addition, the following mitigation measures can be applied:

- Workers and operators of heavy equipment will be properly trained in order to avoid hazardous situations occurring related to the use of the heavy equipment. Also, anyone involved with excavation, road and foundation excavation, power line installation, etc., must be appropriately trained to perform the task.
- A Health and Safety Policy and Procedures Manual should be developed specific to this Project to ensure that all staff adheres to the proper health and safety procedures. This program should be based on all federal and provincial legal standards, and industry codes of practice. The manual should document training and reporting of accidents.
- It has to be ensured that staff adheres to health and safety standards and procedures (as outlined in the federal and provincial *Occupational Health and Safety Act*), safe work practices, etc.
- In addition, emergency response procedures will be put in place to ensure that an injured individual will receive competent help as quickly as possible.

While the effects of an accident may be severe for the individual, accidents are expected to be rare occurrences, particularly after the implementation of mitigation measures. Based on the relatively small number of injuries and fatalities reported in connection with wind farms, the likelihood for accidents can be considered minimal. Therefore, with the implementation of the above noted mitigation measures, significant residual effects are considered to be minimal.

Recommended mitigation measures are provided in the following sections of the EPP (Appendix A):

- Section 3.1 – General Measures
- Section 6.1 – Petroleum, Oils, Lubricants, and Other Hazardous Materials
- Section 6.2 – Solid Waste Disposal
- Section 6.3 – Sewage Disposal
- Section 7.2 – Fuel and Hazardous Materials Spills

5.2.4.3 Residual Effects

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures in the sections listed above are implemented.

5.3 OPERATIONAL PHASE

As described in Section 2.6.3, the operation phase will consist of:

- Operation and maintenance of wind turbines;
- Operation and maintenance of power lines and substation; and
- Maintenance of access roads.

The main impacts to the environment are related to the operation and maintenance of the wind turbines. The operational life span of the turbines is rated as 25 years.

5.3.1 Wind Turbine Operation and Maintenance

The following VECs have been identified as having the most potential for impact as a result of wind turbine operation and maintenance.

- Avian Species (birds and bats)
- Fauna (non-avian species)
- Land Use
- Local Economy
- Public Health and Safety (including noise)
- Visual Landscape

5.3.1.1 Impact Assessment

Avian Species (Birds)
Birds have long been a concern for wind turbine generators, particularly due to the potential for collisions with the turbines. The impact best known to the public is the potential for direct bird mortality due to collisions with turbines, but other potential impacts are mortality from collisions with guy wires, power lines, loss or degradation of habitat, disturbance, barrier effect, interference with normal behaviour (such as feeding, breeding), etc. These effects can be caused by activities associated with construction, operation and decommissioning of the wind farm. A detailed literature review of the interactions between birds and wind farms is provided in the bird survey report in Appendix G. This review documents the different potential impacts and their significance on breeding/resident birds, migrating birds and by bird species and/or species groups.

Any bird using the wind farm area may be impacted by the wind farm related structures and activities. Field surveys were conducted throughout 2012 to determine if there are breeding birds, resident non-breeding birds, migratory birds or wintering birds which use the Project Area at different times of the year.

The sensitivity to disturbance varies from species to species, and may also vary with the type of behaviour that is influenced. Studies in the Netherlands demonstrated that breeding bird density near roads was less than the density away from roads (BLM, 2004). Monitoring studies of wind farms showed that, in a given species, breeding birds were much less sensitive to turbine presences than migrating, resting birds (German Wind Energy Association, 2005). Sounds produced by the turbine may also disturb birds, but many birds adapt to the presence over time and progressively move closer to the turbines – a behaviour known as "habituation". Since disturbance and avoidance vary from species to species, and may also vary depending on the status of the bird (breeding, floating, migrating), the impact assessment will be carried out for separate species groups, where necessary and where literature data are available. Impacts will be more important for species-at-risk, or protected species such as migrating birds. Impacts would also be larger for previously undisturbed areas.

Effects of wind turbine developments on birds fall mainly into two categories: indirect effects due to habitat loss and disturbance, among others, as well as the direct effect of injury or mortality through collisions.

The following table (Table 5.3) identifies the potential impact to birds based operation and maintenance activities or structure.

Table 5.3 Potential Impacts to Birds Due to Wind Farm Operations and Maintenance

Potential Impact	Project Activity or Structure	Pathway	Duration and Physical Boundaries
Habitat loss, alteration and degradation (resulting in loss of birds)	Maintenance visits and public access to the area; existence of access roads	Introduction of invasive plant species.	Short-term and long-term; in the project footprint (tower pads, roads, ancillary structures).
Direct injury or mortality	Presence and operation of turbines, turbine lights; and guy wires on meteorological mast	Collisions with the Structures, increased predation if project structures can be used for perching by raptors	Long-term, but restricted to Project Area and low magnitude, project footprint
Direct injury or mortality to nest and young	Maintenance of access roads, turbine site and substation and service building site maintenance	Mowing or cutting of vegetation	Short-term, but repeatedly; restricted to Project Area

Potential Impact	Project Activity or Structure	Pathway	Duration and Physical Boundaries
Disturbance of migration and daily movements (barrier effect)	Presence and arrangement of turbines	Turbine size, arrangement, and blade movement may form a visual barrier to bird movement, potentially exacerbated by noise	Long-term, restricted to Project Area
Disturbance of normal behaviour: foraging and breeding; habitat avoidance, displacement/ exclusion of birds	Turbine operations, maintenance using motor vehicles, vegetation management	Noise from turbine operation and maintenance activities, as well as the presence of turbines and blade movement may result in avoidance of Project Area	Short-term and long-term; greatest effect in areas with the highest noise; particularly along access roads and at turbine locations.
Disturbance of normal behaviour: foraging and breeding; habitat avoidance, displacement/exclusion of birds	Daily presence of humans and vehicles (maintenance and visitors)	Disturbance of normal behaviour such as feeding, breeding	Short-term and long term, mostly restricted to the area around access roads and turbine pads
Mortality or health impacts from exposure to toxic contaminants	Accidental spills or releases of transmission oils and/or vehicle fuel	Exposure to toxic chemicals	Short-term or long-term; restricted to the location where the spill occurred
Drinking water supply	Roads and turbine pads	Erosion and run-off	Short-term, but may extend beyond Project Area.
Fire	Fires caused by construction activities (land clearing), Access to the area by visors, including visitor vehicles	Fire may result in mortality, and reduction of habitat quality due to loss of vegetation or establishment of invasive species.	Short-term; Project Area and potentially beyond

Notes: 1 Table is based on Bureau of Land Management (BLM), 2004

Avian Species (Bats)

During the operational phase, bats could be affected by collisions with turbines or infrastructure such as buildings, power lines, etc, or by noise from the turbines if it interferes with foraging. They could also be attracted to, or repelled by, the turbine noise. Turbines may also affect the distribution of insect prey.

Bat collisions

During the operational phase, there is a potential risk to bats from collisions with turbines or ancillary structures. Bats have been shown to be killed by the collision with the turning rotor blades of turbines (Horn *et al*., 2004). The mechanism is unclear as bats are thought to detect moving objects better than stationary ones (Jen and McCarty, 1978). While bats have been shown to fly and feed in close proximity to the wind turbines (Ahlen 2003, Horn *et al.* 2008) via radar, echolocation is relatively ineffective at distances greater than 10m for most bats species, so bats foraging around turbines may fail to predict rotor velocity or to detect the large rapidly moving turbine blades (Ahlen 2003). There is nothing in a bat's natural habitat which is comparable to a turbine, so they may not recognize it as a threat.

It has been suggested that turbines may attract bats in some way, leading to increased risk of collision. It has been postulated that land clearing for construction of access roads, turbine foundations, and power transmission lines might attract bats by mimicking natural linear landscape features, such as natural forest edges, along which foraging and commuting bats may regularly travel (Kunz *et al*. 2007b; Verboom and Huitema 1997). Several authors have suggested that tree-roosting bats may mistake the turbine monopoles for roost trees and fly into the rotor blades (Ahlen 2003, von Hensen 2004, cited in Baerwald *et al.* 2008). Cryan (2008) suggested that tree bats collide with turbines while engaging in mating behaviours that centre on the tallest' trees' in the landscape (in this case, the turbines).

Many other hypotheses involve the attraction of insects. Turbines are often situated at the highest points in the landscape, where some flying insects tend to gather (''hilltopping'', see Thornhill and Alcock 1983), potentially attracting foraging bats. Published studies in North America reveal a surprising lack of correlation between local landscape features and fatalities at wind energy sites (Arnett *et al*. 2008). An example is the relatively high fatality rates of bats reported from sites in open, treeless, relatively unmodified landscapes (e.g., Alberta, Canada—Baerwald 2008). Other authors have suggested that insects may be attracted to aviation lights or the warmth (Ahlen 2003, von Hensen 2004 cited in Baerwald *et al.* 2008) or colour of turbines, in turn drawing in hungry bats (Kunz *et al*. 2007b). It has also been suggested that the clearing of treed areas around turbine sites creates habitat conducive to the aerial insects which most bats feed upon (Grindal and Brigham 1998, von Hensen 2004 cited in Baerwald *et al.* 2008), thereby indirectly attracting foraging bats (Limpens and Kaptyen 1991, Verboom and Spoelstra 1999, Menzel *et al.* 2005).

The risk for resident bats (little brown bat and northern long-eared bats) is different from the risk to migrating bats (eg. hoary bat). Though there is a risk of fatal collisions with turbines when bats are present, most published reports show that mortality of resident bats is generally low; numbers may vary, however, with the location of the wind farm. Erickson et al. (2002) states that the collision risk for resident breeding bats is virtually nil, resulting in no apparent impact on resident breeding bats. In addition, the risk to bats is somewhat correlated with the number of passes a bat makes across wind turbines (one mortality for every 70 passes) (Johnson et al., 2002, in Erickson et al., 2002). Collision risk is low because bats generally forage below 25 m height (Erickson et al., 2002). The lowest blade height for the turbine model chosen for the Project is approximately 34 m. Bats will only infrequently fly within the blade height, particularly since the trees in the area are short. Broders *et al*., (2003) have found that little brown bats and Northern long-eared bats are typically caught near ground level. In Hermanville, the number of bats living and foraging in the area is moderate and composed mainly of little brown bats and northern long-eared bats. However due to the species of the bats found present and the height of the lowest blade, the risk from turbine strikes to the resident bats at the Project Site is considered low. Data accumulated at 20m and 40m above ground level during monitoring at the Hermanville Site recorded seven (7) and two (2) bat calls respectively during a total of 85 monitoring nights. While data from ground level and 10 m above ground level recorded 795 and 363 bat calls respectively during a total of 84 recording nights.

Migrating bats are known to be at a higher risk from collisions with turbines than resident bats (Keeley et al., 2001; Erickson et al., 2002) - possibly because they may rely on sight more than echolocation while migrating (Curry and Kerlinger 2005; Van Gelder, 1956 in Keeley et al., 2001). Also, long distance migrants such as hoary or red bats (*Lasiurus* spp) may be more likely to fly through open areas, and to fly at heights that would bring them into contact with turbine blades or cables used for anchoring turbines or communication towers than short distance migrants such as *Myotis* sp. (Keeley et al., 2001). Again, the risk is positively correlated with the number of bats passing through the turbine area. Recent surveys indicate the Project area is not an important migratory route for bats. Consequently, Project impacts on migratory bats are considered to be minimal to nonexistent.

There will be negligible impacts from collisions with guy wires, since these will not be used for the attachment of turbines. Only the meteorological tower on site will be supported by guy wires. Guy wires are also not anticipated to be necessary for the power line poles. There is some risk from collisions with power lines since portions of the collector system on-site may be overhead and the transmission line will be completely overhead. However, this impact is considered low as a review of available literature by the Ontario Ministry of Natural Resources (OMNR, 2006) stated that general observations to date indicate that bats do not typically collide with transmission structures, guy wires, or meteorological towers (i.e., stationary structures).

Barotrauma (Changes in Pressure)

The vortices created at the turbine blade tips may also injure bats, causing rapid decompression due to changes in atmospheric pressure as the rotor blades rotate downward. Recent evidence has come to light which indicates an additional threat which is unique to bats. It has long been recognized that spinning turbine blades create vortices at the turbine blade tips, causing rapid changes in atmospheric pressure as the rotor blades rotate downward. The decompression hypothesis suggests that bats are killed by lung injuries (barotrauma) due to the rapid reductions in air pressure near the moving turbine blades (Kunz *et al.* 2007a; Dürr and Bach 2004 and von Hensen (2004), both cited in Baerwald *et al.* 2008). This rapid change in air pressure causes damage to bat lungs, resulting in death. Evidence for this effect comes from the fact that some bats killed at wind turbines show no sign of external injury, but necropsies have shown signs of internal organ damage consistent with decompression (Baerwald *et al*. 2008, Durr and Bach 2004, von Hensen 2004 cited in Baerwald *et al.* 2008). Baerwald *et al.* (2009) provided the first evidence that barotrauma is the cause of death in a high proportion of bat deaths around a wind turbine. Their study found that 90% of all bat fatalities (nearly half of which showed no external injury) at a wind turbine in Alberta involved internal hemorrhaging consistent with barotrauma, and that direct collision with turbine blades accounted for 50% of fatalities. The faster a turbine blade is spinning, the greater the pressure drop in the vortex. Modern turbines blades reach speeds of 55-80 m/s, resulting in pressure drops of 5-10 KPa, sufficient to cause serious damage in small mammals (Dreyfuss *et al*.1985). It appears that birds, with their unique respiratory systems of compact, rigid lungs, are less susceptible to barotrauma than mammals, which have larger, more pliant lungs (Baerwald *et al.* 2009).

Noise Impacts
During the operational phase, bats could also be impacted by noises emitted by the turbines. As bats use ultrasound (20 kilohertz (kHz) and up) for echolocation of prey, there could potentially be interference with foraging activities, if the sounds from the turbine cover the frequencies that bats use for echolocation. The frequencies and volume of sound in the 20 – 60 kHz range are of particular interest. Sounds emanating from wind farms could potentially result in bats avoiding the area or, conversely, may attract bats to the turbines (Keeley et al., 2001, Schmidt and Joermann 1986), potentially increasing the risk of collisions. However, since bats were found to forage at distances as close as 1 m from a moving turbine blade (Bach et al., 1999, in Keeley et al., 2001), it appears unlikely that bats would avoid a wind farm because of noise. They have been shown via thermal imaging to fly and feed in close proximity to the wind turbines (Ahlen 2003, Horn et al. 2007). Erickson et al. (2002) stated there is no impact of turbine noise on echolocation, as bats are generally able to avoid moving turbine blades, because only few resident bats collide with the turbines, even if there is a high level of bat activity around turbines. Therefore, sound emissions from turbines are not expected to adversely affect foraging activities or lead to displacement of bats.

Other Impacts
Since some bats are known to be sensitive to magnetic fields, (Buchler and Wasilewski 1985; Holland *et al*. 2006), it is possible that the complex electromagnetic fields produced by turbines around nacelles may interfere with perception in these species. Further research is required to determine the extent of this effect, if any, though such research is beyond the scope of this Project.

Fauna (non-invasive species)
The VEC impact assessment detailed in Section 5.2.2 for Fauna is similar to impacts to Fauna during wind turbine operation and maintenance.

Land Use
A small portion of land will be permanently removed for forestry. However, the presence of new/upgraded permanent access roads may facilitate forestry activity in the area.

Local Economy
During the operational phase, there is likely opportunity for local residents to gain long-term employment for the maintenance of the wind park. Site and turbine maintenance, such as turbine and ground cleaning as well as vegetation control, will be carried out. Workforce, equipment and materials will be needed and training will be made available.

In addition, wind farms are known to attract tourists. The East Point Wind Farm is located approximately 20 km east of the proposed project. Consequently, this area is known to have a higher number of tourists that are attracted to visiting wind farms due to the presence of an existing wind farm in the area.

Property prices are not likely to drop after the installation of the wind farm. Recently, several studies have been conducted in the US as well as in Canada to address this issue. A study conducted in the US (Ernest Orlando Lawrence Berkeley National Laboratory, 2009), concluded that, "... 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." It further went on to say that any possible negative impacts that may exist were concluded to be either too small and/or too infrequent to result in any statistically observable impact.

This conclusion was also observed in a report conducted in Ontario (Canning G. and J. Simmons, 2010) as well as in Illinois (Hinman, J.L., 2010). It should be stated that the study conducted in Illinois did notice property value decreases prior to construction, but that these values rebounded during operation of the wind park.

Public Health and Safety

During the operational phase of the wind park, potential hazards arise from activities due to routine maintenance of turbines and ancillary facilities and raise both occupational and public safety concerns. Occupational concerns are addressed in Sections 5.2.4 and 5.3.4 Accidents and Malfunctions.

Noise

Noise produced by the wind turbines is a frequent concern with people living close to wind farms. Health Canada is currently developing a study to explore the relationship between wind turbine noise and the extent of health effects reported by, and objectively measured in, those living near wind power developments. Results of this study are anticipated to be released in 2014. Massachusetts (Massachusetts Department of Environmental Protection, 2012) has recently completed a study which reviewed the potential effects of noise generated from wind farms. The report concluded that there is no evidence to suggest an association between the noise generated from wind turbines and mental and/or physical health.

Noise results from the conversion of wind energy into sound when interacting with the rotors. Other project activities could also result in noise. Sound is measured in decibels (dB). Audible sound range is from 0 dB (the threshold of hearing) to 140 dB (the pain threshold) (BLM, 2004). Human hearing normally detects frequencies between 20 Hz and 30 kHz but the ear does not respond equally to all frequencies and we are much more sensitive to sounds in the frequency range about 1 kHz to 4 kHz (1000 to 4000 vibrations per second) than to very low or high frequency sounds. For this reason, sound meters are usually fitted with a filter whose response to frequency is a bit like that of the human ear. The "A weighting filter" is commonly used for environmental noise and is expressed as dB(A). This scale is thought to be more reflective of human hearing, as it filters out lower frequencies, which are less damaging.

The Project Area is in a rural setting with low anthropogenic noise levels. The Government of PEI has regulations for siting wind turbines at least four times their height from any residential area (*Planning Act*, Section 54.1 of the Subdivision and Development Regulations). At this setback distance, ambient noise levels are expected to significantly reduce the amount of audible noise from the turbines. Ambient noise includes everyday sounds such as passing cars, birds singing, rustling leaves, and wind blowing through trees and vegetation.

The impact of the noise created by Project activities depends on several factors, most of which influence sound propagation: distance from the source, height of the source, atmospheric conditions (especially humidity), intervening topography or structures, vegetation cover, wind speed, wind direction, turbulence (Beranek and Ver 1992 in BLM, 2004), as well as background noise levels. Any sound level created by a point source such as a wind turbine generator (WTG) will drop by 6 dB with each doubling of the distance, while noise from a line source, such as highways or powerlines, decreases by about 3 dB per doubling of distance (BLM, 2004). These decreases can be enhanced by the presence of vegetation, such as shrubs, topography, etc. As sound is carried on the wind, sound impacts will not only be larger downwind of the source than upwind, but they will be carried further. To what degree the sounds originating from Project activities are actually noticed by the receptors (people) also depends on the amount of background noise at the receptor's location, as well as on the amount of sound produced by the wind itself. Wind alone, due to the interaction with vegetation or structures, can actually be quite noisy, for example, 32-45 dB during moderately high winds of 10 m/s (Sea Breeze, 2004).

Noise impacts on people fall into three categories: 1) annoyance or nuisance - a subjective effect; 2) interference with speech, sleep, learning, etc.; and 3) physical effects such as hearing loss or anxiety. Generally, sound levels associated with environmental effects are low, therefore resulting in effects in category 1 and 2, but not category 3 (BLM, 2004).

Whether noise is considered annoying depends largely on the sensitivity of the listener. However, the type of noise (constant, impulsive, low frequency, tonal, etc), circumstances and the difference from previously existing noise, all influence the perception. Tonal noise (containing discrete tones) stands out much more against background noise. While changes in noise levels of 3 dB are less noticeable, a 5 dB change is likely to result in comments, and a 10 dB change (perceived as a doubling in sound level) is highly likely to result in adverse reactions from the people impacted (BLM, 2004).

Noise levels associated with the regular maintenance activities, such as visits to the turbines and power lines, are expected to result in a low level of noise, since light vehicles are used and they will be driven slowly. There is potential for short periods of increased noise levels, when repairs to the roads are necessary, or when there are major repairs to the turbines, including exchange of nacelles or rotors. In both cases, heavy equipment would be brought in, resulting in increased noise.

Based on the distance between the Project Area and residential areas, impacts on residents are not expected from the use of regular sized vehicles. Also, heavy equipment use will be very infrequent and at considerable distance from the receptors, resulting in non-significant and short-term impacts. Mitigation measures are not necessary.

During the operational phase, noise can originate from the substation (transformer and switchgear noise), vehicle traffic between the WTGs, maintenance activities and deliveries, and noise from the wind turbines themselves. The noise may have effects on humans and wildlife. The nearest residence is located over 600 m north from the nearest turbine.

Noise produced by the wind turbines is a frequent concern with people living close to wind farms. Wind turbines produce both mechanical and aerodynamic noise (BLM, 2004). While modern wind turbines are designed and built to produce much less sound "side-effects" than earlier models, there still is a gentle "swishing" sound associated with the rotor movement, which becomes louder as the wind speed increases. This aerodynamic noise has broad-band character (BLM, 2004). It can be reduced through blade design, but cannot be avoided. As sound is carried with the wind, locations downwind from the turbines will experience a higher noise level than those upwind, and locations further downwind will detect more noise than those at similar distances upwind.

A noise analysis was conducted by Frontier Power Systems to determine if noise produced by the wind turbines would negatively impact nearby residences. A total of 18 noise receptors were observed none of which are anticipated to be impacted by noise generated during normal operation of the wind farm (Appendix D).

During the operation phase, noise may be associated with the presence and rotation of the turbine blades, the substation and the vehicles used for the regular visits to turbines and power lines for monitoring and maintenance activities. According to the specifications of the Acciona Windpower brochure, the turbines produce a maximum power level sound of 107.4 dB(A).

The fact that the turbines are set back at least 600 m from the nearest residences will significantly reduce the amount of noise audible in those areas. Nearby residents should be informed in advance when particularly noisy construction activities such as blasting (not anticipated on this project) will be performed. Using engine brakes should be discouraged.

As avoidance is the best mitigation, the wind farm layout was designed with a setback distance of at least four times the height of the turbine between the turbine and the nearest residences. It is also recommended that the wind farm operator establish a noise complaint mitigation protocol to receive, assess, and respond to potential noise complaints. An adaptive management approach may also be appropriate. This could include upgrades to houses for improved noise impedance or installation of noise screens to provide additional noise attenuation. This could also include noise reduced operation (reduced power output) of certain turbines under certain conditions if they are identified as problematic.

Shadow flicker

Shadow flicker is the term used to describe the moving shadow cast by the moving rotors, which causes a flickering effect. The rotating blades cause an abrupt change between light and dark, which can occur at different frequencies, depending on the speed of the rotation. Rotation speed is a function of the wind speed and the size and type of the rotors. If this shadow is cast on occupied buildings, the people inside can be disturbed (Gipe, 1995; in BLM, 2004). The occurrence depends both on the location of the observer relative to the turbine and on the time of day or of the year. Shadow flicker is only present at distances of less than 1400 m from the turbine (Massachusetts Department of Environmental Protection, 2012).

While most people are unaffected by shadow flicker, there have been reports of people being negatively affected by it, including the development of psychological problems. These reports are mainly from Europe, where people live close to wind farms, and wind turbines have been in operation for a long time. In addition a more recent report (Massachusetts Department of Environmental Protection, 2012) states that there is limited scientific evidence to suggest an association between annoyance from prolonged shadow flicker and potential mental and physical health effects. Early wind turbines were generally smaller, and some models had only two blades. Both features can result in very rapid shadow flicker. Modern wind turbines generally use three wing rotors, and the rotors also turn slower, due to the increased size of the turbines.

Shadow flicker is considered an important issue in Europe, but not the US. One reason for this is the geographical location (latitude). The American Wind Energy Association (AWEA, 2010) states, that shadow flicker is not a problem for the US for the majority of the year, with the exception of Alaska, where the sun is low in the sky for most of the year.

The location of this Project is 46.46°N x 62.32°W, which is further south than northern US at 49 degrees latitude. There is, however, a small likelihood for adverse effects from shadow flicker. While the flicker is annoying to most people affected by it, there are concerns that it may trigger epileptic seizures in the susceptible population if the frequency of the flicker is high enough (Bossanyi, et al., 2001). The threshold frequency which may trigger seizures is about 2.5 Hz - a frequency that is not reached with modern, three-blade turbine rotors. The modern turbine rotors generally have blade-passing frequencies of less than 1.75 Hz (Bossanyi et al., 2001).

While there are no legal limits to the exposure to shadow flicker, a judge in Germany responded to a complaint about the “nuisance” with setting 30 hours of exposure to shadow flicker per year as an acceptable limit. Considering that shadow flicker only occurs when there is both bright sunlight and wind, the probability for shadow flicker is much reduced. In addition, any one location is only exposed to flicker for a relatively small number of minutes under these conditions, since the shadow moves. Residents in houses shaded by trees are not likely to notice any turbine shadow.

An assessment of the potential for shadow flicker impacts for this Project was conducted by Frontier Power Systems (Appendix H). A total of 18 receptors were identified of which 14 have a theoretical maximum flicker level above 30 hours per year, or may experience more than 30 minutes of flicker per day. The more representative, worst-case values do not exceed 30 hours per year for any of the receptors. Several receptors were considered on an individual basis to determine if site specific conditions may mitigate potential shadow flicker issues. Most are expected to observe only minimal levels of shadow flicker (or none at all) due to distance to the turbines and the presence of trees in the line of sight to the turbines.

In the event that shadow flicker is a nuisance for nearby receptors there are various mitigation measures that may be employed. Mitigation measures could include planting vegetation or tree lines, which will block the line of sight to the turbines causing flicker, or installation of window blinds or awnings. A more extreme mitigation measure would be to shut down the turbines which are known to cause problematic flicker, during the times when it is known to occur.

Electric and Magnetic Fields

There has been public concern expressed in the past over potential health implications from electromagnetic fields (EMFs) from electrical power transmission and distribution lines. Health Canada has issued an opinion on the subject (Health Canada 2008). It is the opinion of Health Canada that health risks to the public from exposures to power-frequency EMFs have not been established, and a warning to the public to avoid living near or spending time in proximity to power lines is not required (Health Canada 2008).

Visual Landscape

Wind turbines are highly visible in any landscape, due to their size and colour. Therefore, they can produce adverse visual impacts. Adverse visual impacts can be defined as an “unwelcome visual intrusion, or the creation of visual contrasts, that affect the quality of the landscape” (BLM, 2004). The concept of adverse visual impacts implies that steps should be taken to protect the scenic resources from unnecessary adverse effects (BLM, 2004).

Though visual impacts are widely recognized as one of the most important impacts of wind farms, it is often difficult to determine the significance of the impact. The impact can be described in specific terms, but the human response is highly subjective and therefore cannot be quantified (BLM, 2004). Adverse visual impacts can be grouped into three major types: unnatural intrusion of man-made appearance or disfigurement; partial degradation, reduction or impairment of the existing level of visual quality, and complete loss of the visual resources.

The US Bureau of Land Management (BLM) defines visual impacts as the contrast perceived by observers between existing landscapes and proposed projects and activities (BLM, 2004). Therefore, the amount of visual contrast produced will influence the degree to which a structure or “activity intrudes on, degrades or reduces the visual quality of a landscape” (BLM, 2004).

The wind turbines in the Project Area will be highly visible in the landscape however will be situated inland which will help mitigate impacts that would occur were these turbines located along the shore. Because of their size, colour and exposed location, wind turbines cannot be reduced or concealed; consequently visual impacts are therefore likely. Factors that contribute to negative impressions are: lattice towers, shiny surfaces, colour contrast to the surroundings, artificial, industrial appearance contrasting the natural environment, presence of logos or advertising signs, location of turbines at prominent landscape features, arrangement of turbines, etc. Glare from shiny surfaces and shadow flicker contribute to the visual impacts, as may lighting requirements. Strong, steady lighting may cause “skyglow” (BLM, 2004). Also, “untidy” arrangement of turbines may increase the negative impression. Garbage, traces of leaks from the nacelles, and otherwise dirty turbines will also result in a more negative impression on the viewer, as do “idle” turbines or turbines with parts missing (BLM, 2004).

5.3.1.2 Recommended Mitigation

The following recommended mitigations will minimize the potential environmental effects of wind turbine operation and maintenance:

- Sensitive features (i.e. rare plants, watercourses, environmentally sensitive habitats) identified during construction will be protected during maintenance activities.
- Install bird deterrents on guy wires attached to the meteorological mast.
- Do not create areas of high prey density during habitat restoration and maintenance.
- Use native plants or no vegetation at all around turbines; avoid Mountain ash (*Sorbus* sp.) trees.
- Avoid mowed lawn and avoid use of herbicides and pesticides.
- All waste generated in the removal of damaged and deteriorated components will be collected for proper disposal.
- All materials, where possible, will be reused. Non-salvageable materials will be disposed of at a provincially approved location.
- All necessary precautions will be taken to prevent discharge or loss of any harmful material or substance into a watercourse.
- All empty containers of paint, solvents, and cleaners will be disposed of in an appropriate manner (see Section 6.1) at a provincially approved location.
- To the extent possible, sandblasting will be done in an off-site maintenance shop.
- If on-site sandblasting is necessary, screens or tarps will enclose the area to be sandblasted. Sandblasting will be performed over a surface which allows the sand or residue to be collected upon completion of sandblasting (i.e. plastic or plywood). Sandblasting will not be performed in high wind conditions.
- Minimum amount of aviation lighting required by TC should be used, and TC should be consulted to see if white strobe lights with a minimum number of flashes per minute can be used.
- Strong lights, such as sodium vapour lights which are often used for security at substation buildings, should be avoided or shielded.
- Lights will be positioned such that the direction of light is opposite to that of any residential areas.

- Where nuisance to local residents is an issue, scheduling of specific activities may be directed by the Project Manager.
- Area lighting will be positioned and directed so as not to cause glare to approaching traffic.
- Lighting will be directed toward the ground wherever possible.

In addition, while visual impacts of turbines cannot be avoided without abandoning the Project, there are a number of mitigation measures that will reduce the potential for negative impacts (BLM, 2004). A number of these mitigation measures have been considered by the turbine manufacturer and during the planning of the wind farm layout. These include:

- tubular towers;
- aesthetic balance in the design;
- light grey colour, non reflective, non-shiny steel;
- turbine model identical for all turbines;
- turbines arranged in clusters where possible (no disorder);
- no long lines of turbines;
- turbines are not located on elevated land points; and
- information for the public using computer simulations of the landscape with the turbines.

Other mitigation measures to be considered are:

- Minimizing the lighting on the turbines to what is required for air safety, choosing flashing lights over steady lights.
- Minimizing the Project footprint and implement erosion control and dust abatement.
- Repair turbines immediately and remove obsolete turbines instead of just switching them off, in order to prevent the impression of idle turbines.
- Clean the turbines, particularly traces of spills from the nacelle.
- Remove excess materials and any ‘fugitive’ litter from the Project Area.
- Avoid posting commercial signs.

Also, refer to Section 5.3.4 for information regarding accidents and malfunctions.

An EEM program is recommended as part of the operations of the Project. EEM studies are normally undertaken to fulfil the following objectives:

- to verify environmental impact statement predictions and evaluate the effectiveness of mitigation measures;

- to detect undesirable changes in the environment; and/or
- to improve the understanding of environmental cause and effect relationships.

The EEM will be site-specific and include documentation of the following:

- All turbine locations will be monitored for mortalities of bird and bat species due to collision with the turbines blades, or other project interactions. PEIDELJ will be consulted in developing the monitoring details and data will be provided to interested regulating agencies. The monitoring program for birds will be developed following the CWS' "Guidance Document for Environmental Assessment; Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds", (CWS, 2006). This monitoring program will be subject to approval by the Provincial government.
- Surveys for bat strikes should occur throughout the migration period in spring and late summer, early fall (i.e., April/May and August/September). Surveys should be conducted by a person with knowledge of bat identification, early in the morning around the bases of the turbines, extending outward from the base to a 50 m radius. If dead bats are found, they should be identified to species, photographed, collected and given an identification number. Information on the location, condition of the bat and of weather conditions the previous night should also be recorded. This data should be reported to the PEIELJ. If mortalities occur in numbers that may cause concern, discussions with the PEIELJ should be conducted to identify additional potential mitigation measures.

A copy of the proposed bird and bat mortality monitoring plan is located in Appendix G.

Recommended mitigation measures are provided in the following sections of the EPP (Appendix A):

- Section 4.1 – Structure Maintenance and Clearing
- Section 5.4 – Lighting Control
- Section 7.2 – Fuel and Hazardous Materials Spills
- Section 7.4 – Wildlife Encounters
- Section 7.5 – Fires
- Section 8.1 – Environmental Effects Monitoring Program

5.3.1.3 Residual Effects

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures in the sections listed above of the EPP (Appendix A), are implemented.

5.3.2 Power Lines Operation and Maintenance

The following VECs have been identified as having the most potential for impact as a result of wind turbine operation and maintenance.

- Avian Species (birds) and bats;
- Fauna (non-avian species);
- Land Use; and
- Public Health and Safety.

5.3.2.1 Impact Assessment

Portions of the VEC impact assessments detailed in Section 5.3.1 are similar to those VECs listed above.

5.3.2.2 Recommended Mitigation

The mitigation measures recommended in Section 5.3.1 are also applicable and will minimize the potential environmental effects of wind turbine operation and maintenance:

Recommended mitigation measures are provided in the following sections of the EPP (Appendix A):

- Section 7.2 – Fuel and Hazardous Materials Spills
- Section 7.4 – Wildlife Encounters
- Section 7.5 – Fires
- Section 8.1 – Environmental Effects Monitoring Program

In addition, refer to Section 5.3.4 for information regarding accidents and malfunctions.

5.3.2.3 Residual Effects

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures in the sections listed above of the EPP (Appendix A), are implemented.

5.3.3 Road Maintenance

The following VECs have been identified as having the most potential for impact as a result of wind turbine operation and maintenance.

- Air Quality
- Avian Species (birds) and bats
- Fauna (non-avian species)

- Fish and Fish Habitat
- Land Use
- Local Economy
- Public Health and Safety
- Surface Water

5.3.3.1 Impact Assessment

Portions of the Air Quality VEC impact assessment detailed in Section 5.2.2 is similar to impacts that would be experienced for this activity.

Portions of the other VEC impact assessments listed above are similar to those detailed in Section 5.3.1.

5.3.3.2 Recommended Mitigation

The mitigation measures recommended in Section 5.2.2 for Air Quality as well as those detailed in Section 5.3.1 are also applicable and will minimize the potential environmental effects of wind turbine operation and maintenance:

Recommended mitigation measures are provided in the following sections of the EPP (Appendix A):

- Section 4.2 – Road Maintenance
- Section 4.3 – Snow Removal
- Section 7.2 – Fuel and Hazardous Materials Spills
- Section 7.4 – Wildlife Encounters
- Section 7.5 – Fires
- Section 8.1 – Environmental Effects Monitoring Program

In addition, refer to Section 5.3.4 for information regarding accidents and malfunctions.

5.3.3.3 Residual Effects

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures in the sections listed above of the EPP (Appendix A), are implemented.

5.3.4 Accidents and Malfunctions

The following VECs have been identified as having the most potential for impact as a result of accidents and malfunctions:

- Air Quality
- Avian Species (birds) and bats
- Fauna (non-avian species)
- Local Traffic
- Public Health and Safety
- Surface Water

5.3.4.1 Impact Assessment

The VEC impact assessments detailed in Section 5.2.4 are similar to those VECs listed above.

In addition, there are safety concerns unique to operating wind farms which include occupational safety, icing, and breakage.

Occupational Safety
Unique occupational hazards include rotating/spinning equipment, high winds, energizing system, heights (BLM, 2004), as well as the installation and maintenance of the turbines. The latter results in hazards similar to those associated with building high buildings or bridges. There have been studies tracking the number of injuries and fatalities associated with wind power projects, both worldwide and in the US (Gipe 1995 in BLM, 2004). While Gipe reports 14 fatalities and several serious injuries from the 1970s to the 1990s, Sorensen reports 20 fatalities and hundreds of injuries. Gipe points out that several of the fatalities occurred in the early years of wind power development. Therefore, some fatalities may have been based on inexperience with the specific types of hazards, and are less likely to occur again. Most accidents were related to construction, but some occurred during maintenance (e.g. 5 of the 14 fatalities). Falls, neglecting to wear safety belts, electrical burns, etc., all resulted in serious effects.

Breakage
While icing is a normal process (and therefore will occur regularly) during the operation of wind turbines under the climatic conditions at the Project Site, breakage of the turbine or turbine blades is qualified as an accident or malfunction.

In the past, a major safety hazard of wind turbine operations has been the breakage of a turbine blade, which results in the parts being thrown off. Blade breakage can be the result of several occurrences, though each is a rare event.

Blades may break apart as a result of rotor overspeed, though this happens mostly with older and smaller turbines, and happens extremely rarely. Material fatigue can also lead to blade breakage (Hau, 2000 in BLM, 2004). It is difficult to predict the trajectory of the broken rotor blade pieces, however, it is known that a blade or turbine part has rarely travelled further than 500 m from the tower; generally, most pieces land within 100 and 200 m (Manwell et al., 2002 in BLM, 2004). Today, proper engineering design and quality control are expected to make blade breaks rare. There have been no reports of fatalities due to blade throws to date. Nonetheless, it should be noted that according to the Caithness Windfarm Information Forum (2012) there have been approximately 249 separate incidents related to blade failure. Also, lightning strikes have been known to cause breakage. In addition to breaks in rotor blades, the turbine tower could potentially collapse.

During both construction and decommissioning phases, the rotors will be shut off, resulting in low risk of rotor blade parts being thrown off. However, there is an extremely low potential risk from collapses of the turbine towers, or, even more rarely, the rotors can drop off during construction. This hazard is posed to workers on-site and is covered under occupational safety (see above). The public will have no access to the turbine sites during the construction and de-commissioning phases. Therefore, adverse effects from breakage are not likely during these project phases.

Like icing, breakage of blades poses mainly a public health and safety concern, though operations personnel may be impacted as well. Broken pieces can be thrown like projectiles, and may cause injury and even death, as well as damage to property if residences or vehicles are hit. However, no fatalities have been reported yet (see above).

Since the turbines are new and will be inspected yearly, breaks from material fatigue are not expected. The biggest concern for a cause of breakage therefore is lightning strike. PEI, according to a flash density map, experiences an average of 42 lightning flashes per one hundred square kilometres per year in the period from 1998 to 2002, cloud-to-cloud and cloud-to-ground counts combined (EC, 2011a).

Though breakage is considered a very rare event, the impact is considered significant, warranting mitigation measures.

Fire

According to a recent report (Caithness Windfarm Information Forum, 2012), fire is the second most common accident cause with respect to wind farms. Fire can arise from a number of sources with some turbine types more prone to ignition than others. Fire damage can be caused by lightning strike, machinery breakdown, failure in electrical installations and by resonant circuits. These risks are increased in the more modern turbines as there is more equipment and combustible material in the nacelle which can cause the fire to spread more rapidly (CFPA Europe, 2010). In addition, due to the generally isolated nature of wind farms and height of the turbine, it is often difficult for fire-fighters to put fires out quickly. Consequently forest fires may erupt and can spread rapidly and cause damages to nearby residences.

5.3.4.2 Recommended Mitigation

The fundamental approach to accidents is one of prevention through training and being prepared to respond to any emergency. The preventative measures and contingency planning identified below will be developed with reference to the Canadian Standards Association (CSA) publication "Emergency Planning for Industry" (CAN/CSA-Z731-99). Best management practices prescribe the presence of spill kits on location and on the vehicles. Spill management procedures as outlined in the contingency plan (Appendix A) will be followed when a spill occurs. Spill kits are mandatory on-site. Any discharge will be cleaned immediately and authorities notified (e.g. PEIELJ, DFO).

The mitigation measures recommended in Section 5.2.4 are applicable and will minimize the potential environmental effects of accidents and malfunctions:

Recommended mitigation measures are provided in the following sections of the EPP (Appendix A):

- Section 6.1 – Petroleum, Oils, Lubricants, and Other Hazardous Materials
- Section 7.2 – Fuel and Hazardous Materials Spills
- Section 7.5 – Fires

In addition, the following measures should be implemented.

Occupational Safety
The International Electrotechnical Commission (IEC) has published minimum safety requirements for WTG systems (IEC, 2002). The IEC requires that the WTG Systems manufacturer provide the operator of the wind farm with an operator's instruction manual, which should also include additional information geared to the local conditions. The operator's manual "should include information on system safe operating limits and descriptions, start-up and shut-down procedures, alarm response actions, and an emergency procedures plan" (IEC, 1992 in BLM, 2004). The emergency procedures plan should cover a range of emergencies that can arise from the operation of wind generators, including: "overspeeding, icing, lightning storms, earthquakes, broken or loose guy wires, brake failure, rotor imbalance, loose fasteners, sand storms, fires, floods, and other component failures". Information provided in this owner's manual should be used to minimize the hazards.

During all phases of the Project there is potential for accidents to occur. Some accidents may have significant consequences. Such events may include fires and uncontrolled releases of materials such as POLs, solvents and epoxy resins. Uncontrolled release of such materials may affect the health and safety of individuals, air quality, water quality, including surface or ground water and terrestrial or aquatic habitat, wetlands and wildlife, in particular, species-at-risk. Accidents specific to wind farms include ice-throw and blade breakage, which could impact individuals and property.

Petroleum product spills can occur during site clearing and construction due to equipment malfunctions and refueling activities. Also, there may be spills of transmission oil or transformer liquids during maintenance of the turbines and transformers, spills of fuel or oil from the vehicles used for turbine and road maintenance, and leaks of transformer and transmission liquids from turbines and transformers during normal operation. Spills of paint or solvents used for turbine paint touch-ups are possible. Herbicides are not anticipated to be used so they have not been considered in the impact analysis.

Breakage

The best mitigation is avoidance. Therefore, safety zones should be included in the Project design. A safety set back of 290 m reduced the likelihood of blade fragment impacts greatly. A set-back of at least 500 m from residences and roads would eliminate any possibility of impacts. The nearest residence is over 500m away.

Signs at the start of wind farm area will warn visitors to safety hazards connected to wind turbines, particularly the danger of lightning strikes, and advise the public to leave area during a thunder storm. A public education session should be considered for the local residents to alert them to the safety hazards and how to avoid them.

If flags are installed at the start of the road system as a mitigation procedure for ice throw concerns, the flags should also be used during thunderstorms, and warning signs or flags should be set up while the storm lasts.

Operations staff will have to wear protective equipment such as hard hats whenever they approach the turbines. Also, they will be trained to be aware of the potential dangers from blade breakage. The Health and Safety Procedure Manual should include safety protocols to be followed, particularly during annual maintenance activities.

Tower failure, resulting in the collapse of a turbine, is highly unlikely.

Fire

The wind turbines will be equipped with comprehensive lightning and surge protection. In addition protection systems will be put in place to ensure immediate, controlled shutdown of the wind turbine with disconnection from the power system. The use of combustible materials will be minimized or avoided where possible. Regular maintenance and inspections as per the maintenance manual will minimize fires caused by technical defects in the electrical and mechanical systems.

5.3.4.3 Residual Effects

It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures in the sections listed above of the EPP (Appendix A), are implemented.

5.4 DECOMMISSIONING PHASE

As described in Section 2.6.4, should after 25 years the wind farm be decommissioned, the decommissioning phase would require de-installation and removal of all physical components and machinery from the site. The access roads would remain, if the landowners so desired. The single phase line, collector lines and substation would be removed. Concrete turbine pads and building foundations will be removed to a reasonable depth and re-claimed, unless the landowner wishes to use them as they are. The transmission line would be maintained and used for other purposes (transmission or distribution) if there is an immediate or future need identified. If not, it would be dismantled. The equipment used for the de-construction would be essentially the same as for the construction (e.g. heavy lifting and transport equipment, earth moving equipment and trucks to transport waste materials).

5.4.1 Removal of Infrastructure

The following VECs have been identified as having the most potential for impact as a result of decommissioning activities. This includes removal of the single phase line, collector lines and substation as well as the removal of wind turbines and foundations.

- Air Quality
- Avian Species (birds and bats)
- Fauna (non-avian species)
- Land Use
- Local Economy
- Local Traffic
- Noise
- Public Health and Safety

The VEC impact assessments detailed in Sections 5.2.1 and 5.2.3 are similar to those VECs listed above. It is anticipated that the residual adverse effects of the Project on the environment will be minimal after the mitigation measures in the sections listed in Sections 5.2.1 and 5.2.3 are implemented.

In addition, the following measures should be implemented for excess materials and waste management.

- All excess materials and waste will be transported off-site by flatbed trailer or dump truck.
- Any hazardous wastes that are used and/or stored such as POLs will be removed in accordance to provincial regulations and disposed of at an approved facility.
- All waste to be transported by a registered hauler.

5.4.2 Site Remediation

The Project is situated in a predominantly forested setting. After infrastructure has been removed, the area will be allowed to return naturally to its previous setting. To address any unexpected spills in the area, the PEIEC will complete a Phase I and II Environmental Assessment of the wind turbine and substation lease areas when remediating the lands. This assessment would review all past records of spills recorded during the life of the Project. Should any spill be identified, testing would be conducted to ensure there are no negative effects to surface soils or ground water. If any contamination is noted, they will be remediated immediately by PEIEC.

6.0 SUMMARY OF POTENTIAL IMPACTS OF THE PROJECT AND MITIGATION

In this section, the impact assessments carried out in Section 5.1 to 5.4 are summarized in Table 6.1.

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
Planning Phase : Geotechnical and Land Surveys: • Vegetation Removal	Avian Species (birds and bats) Fauna	• Removal of existing or potential habitat • Avoidance and changes to movement caused by noise, visual impacts, and human presence •	• Minimize cut lines. • Avoid cutting lines between treed and open areas. • Survey lines will not be wider than 1.5 m. • Cut trees and shrubs at least 300 mm above ground. • All trees not on survey lines will be left standing and trees partly on line will be notched (notch not to exceed 1/3 tree diameter) • Vehicles will yield the right-of-way to wildlife • Do not harass or disturb wildlife. • Keep work area clean of food scraps and garbage and transport waste to an approved landfill on a regular basis.	No residual effects expected	Minimal
	Fish and Fish Habitat Surface Water Quality	• Degradation of fish habitat and water quality	• Implement erosion/sedimentation mitigation measures of wetlands/watercourses when necessary. • Do not place debris or felled trees into wetlands/watercourses. • No heavy equipment or motorized vehicles will enter wetlands/watercourses.	No residual effects expected	Minimal
	Land Use Public Health and Safety (includes Noise	• Noise disturbance • Limits to land use	• Limit traffic to regular working hours. • ATVs will remain within the designated areas. • Use proper fire hazard procedures. • In case of emergency call 911.	No significant effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
<u>Construction, Operation and Decommissioning Phases:</u> Site Access, Delivery of Equipment and Vehicle Movement • Traffic • Operation of vehicles.	Air Quality	• Formation of dust and exhaust fumes • Dust created from soil depleted of vegetation and from gravel access roads	• Equipment should be kept in good running order • Use dust abatement techniques • Use water as dust suppressant. • The exits of the construction sites will be equipped with effective dirt traps. • Impose and enforce speed limits on access roads. • Do not load trucks with soil above the freeboard. • Minimize drop heights when loading trucks. • During operation allow vegetation cut in the lay down areas to grow back.	No residual effects expected	Minimal
	Avian Species (birds and bats) Fauna	• Avoidance and changes to movement caused by noise, visual impacts, and human presence • Disturbance of normal behaviour during foraging and breeding • Mortality due to vehicle collisions • Respiratory health effects from dust	• Inspect and clean imported equipment for invasive species. • Aerate exposed soil to allow natural revegetation. • Report all wildlife sitings. • Vehicles will yield the right-of-way to wildlife • Do not harass or disturb wildlife.	No residual effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
	Land Use Local Economy Local Traffic Public Health and Safety (including Noise)	• Limits to land use • Positive impact: work, income • Increased traffic including possible damage to roads and interference with traffic flows. • Damage or injury as a result of traffic accidents\\ • Noise disturbance	• Notify landowners and the public of construction activities schedule. • Complaint registry to be developed for traffic, noise and other Project concerns. • Limit traffic to regular working hours. • Traffic in and out of site to follow travel routes and only operate on cleared right-of-ways or areas. • The routing of truck traffic through residential areas will be controlled during the maximum period of activity. • Deliveries scheduled during periods of low local traffic and when weight restrictions are not in practise. • Repairs to public roads to implemented should the need arise. • All Project vehicles will be properly maintained and muffled to reduce noise emissions. • Routine maintenance of machinery will be off-site as much as possible. Some heavy equipment, such as the cranes, will be maintained on-site due to the challenges involved in moving the equipment. • The Contractor will make daily inspections of hydraulic and fuel systems on machinery, and leaks will be repaired immediately. All leaks will be reported to the Canadian Coast Guard at 1-800-565-1633.	No residual effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
			• Regarding transmission line, leaks will be reported in compliance with MECL Spill Agreement for Line Construction. • Construction equipment will not enter buffer zones of wetlands/watercourses • Erosion control measures are to be implemented and maintained • All staging areas will be located 100 m outside any wetland/watercourse. • Professional service provider to be used for snow and ice removal. To follow BMPs.		

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
<u>Construction Phase:</u> Clearing, Grubbing and Excavation	Air Quality	• Formation of dust and exhaust fumes	• Minimize air emissions through proper planning. • All heavy construction equipment will be maintained equipped with appropriate equipment to reduce air emissions. • Water will be applied as a dust suppressant as needed to prevent fugitive emissions. • The speed limit will be reduced. • Idling of vehicles will be limited. • The routing of truck traffic through residential areas will be controlled during the maximum period of activity. • Do not load trucks with soil above the freeboard. • Minimize drop heights when loading trucks. • Moisten land before clearing. • Exposed project areas to be covered. • The time between topsoil storage and reclamation will be minimized, thus reducing exposure of the topsoil to the wind. • Slash will not be burned.	No significant effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
	Archaeology and Heritage	• Potential for significant loss of knowledge or unrecorded physical resource	• Construction crews should be made aware of the potential for heritage resources within their construction area. • A heritage resources protocol should be in place and adhered to during construction, in the event that additional heritage resources or human remains are discovered. One of the following three mitigations options will be required by the provincial regulator (PEIAAS) when construction is conducted within the EPAs on the selected transmission line route: • Having a permitted archaeologist monitor (on site) all ground disturbing activities within the EPAs, **or** • Having a permitted archaeologist be on call during construction should possible archaeological resources be identified during these activities, **or** • Having construction crews self-monitor and report any identified cultural materials to the provincial regulator directly.	No significant effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
	Avian Species (Birds and Bats) Fauna	• Potential mortality of adults, young and eggs from collisions, or nest destruction • Killing of individuals during land clearing activity • Avoidance and changes to migratory movement caused by noise, visual impacts, and human presence • Reduction of quality and quantity of habitat • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Respiratory health effects from dust • Changes to the water regime by erosion and runoff • Habitat degradation by invasive species • Exposure to toxic chemicals	• All construction activities will be scheduled between May 1st to August 31st, except clearing and grubbing which should be completed prior to May 1st. • Limit removal of tall trees and snags. • Minimize cutting large patches of forest. • Aerate compacted soil to allow natural revegetation. • When grassed areas are encountered during grading, every effort will be made to leave such grassed areas intact. • Native plant regeneration will be promoted in any areas that are cleared but not built upon (i.e. roadside ditches, temporary laydown areas, etc.). • Use native plants or no vegetation at all around turbines, avoid Mountain ash trees. • Avoid mowed lawn. • The area cleared will not exceed the absolute minimum amount necessary. • Materials cleared from the sites (brush, logs, soil, etc.) should not be dumped into otherwise unaffected land • Inspect and clean imported equipment for invasive species. • Keep work area clean of food scraps and garbage and transport waste to an approved landfill on a regular basis. • Do not harass or disturb wildlife.	No significant effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact

			• Report notable wildlife sitings (dangerous, injured or dead).
			• Alterations to existing natural drainage patterns will be minimized
			• For construction activities <u>required</u> during the sensitive nesting season the following measures will be implemented:
			  ◦ Clearing activities will be scheduled in consideration of critical habitat features (e.g., wetland areas) identified during the pre-construction field survey.
			  ◦ The proponent will instruct the management team and contractors on the MBCA, the importance of habitat, the significance of the nesting period, and measures to be implemented to minimize any disturbance to birds/nests.
			  ◦ A bird nest survey of the area will be conducted by a professional biologist/ornithologist/birder prior to clearing activities. The bird species recorded during the survey will be used as an indicator regarding the potential nesting habitat in the area.
			  ◦ The typical nesting habitat for these species would be investigated for potential nests.
			  ◦ Nest trees will be felled prior to or after the nesting season.
			  ◦ The occurrence of all identified nests will be documented.		

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
	Fish and Fish Habitat Surface Water Quality Wetland	• Impacts to water flow and drainage • Loss of fish habitat • Reduced species diversity • Toxic effects from chemicals substances	• Environmentally sensitive areas (i.e. wetlands and watercourse) will be staked out prior to work operations so that these areas are protected. • A 10 m buffer zone will be maintained on each side of a wetland/watercourse. • Activity to be limited within watercourse and wetland buffer zones. • Implement erosion/sedimentation mitigation measures of wetlands/watercourses when necessary. • No waste, debris or felled trees into wetlands/watercourses or buffer zone. • No heavy equipment or motorized vehicles will enter wetlands/watercourses. • Work to be completed as soon as possible. • The on-site POL storage container shall be located on level terrain, at least 100 m from any water body or wetland. • No POL storage will occur in sensitive areas (e.g., near wetlands, watercourses or wells) or associated buffer zone. • Fuelling must be done at least 30 m from a wetland or waterbody. • Servicing of equipment will not be allowed within 100 m of a wetland, watercourse or drainage ditch.	No significant effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
	Land Use Local Economy Public Health and Safety	• Limited use of land • Positive impact: work, income, taxes • Noise disturbance • Accidents (workers and public)	• Landowners and the public to be notified of Project schedule. • Schedule activities to minimize noise impacts. • All Project vehicles will be properly maintained and muffled to reduce noise emissions. • The Contractor will ensure idling of construction vehicles is limited. • Property boundaries to be identified. • Equipment and vehicles will only operate on cleared right-of-ways or areas designated for construction activities in the Plans/Drawings. • The area of disturbance will be limited to that which is absolutely necessary to conduct the work. • Equipment travel will be limited to roads during period of rain	No significant effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
			• Topsoil stripping will be kept to a minimum • Top soils will be kept separate from all sub-soils • Shallow soft rock will be kept separate from topsoil • The time between top soil stripping and rehabilitation will be minimized • A follow-up survey will be conducted to identify areas requiring further rehabilitation • Proper drainage will be incorporated into both road and foundation designs • Landowner will be compensated for land removed from production • Properly train workers involved with heavy equipment and excavation • Develop a health and safety program • Put in place emergency response procedures • Timing of work • Limit construction to daytime hours and weekdays • Carry out construction in winter and early spring • Inform residents when activities will be particularly noisy • Keep the public off-site during construction.		

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
Construction Phase: Building Construction and Turbine Assembly	Air Quality Archaeology and Heritage Avian Species Fauna Fish and Fish Habitat Surface Water Wetland Land Use Local Economy	• Formation of dust and exhaust fumes • Respiratory health effects from dust • Potential for significant loss of knowledge or physical resources • Avoidance and changes to migratory movement caused by noise, visual impacts, and human presence. • Reduction of quality and quantity of habitat • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat. • Changes to the water regime by erosion and runoff • Habitat degradation by invasive species • Exposure to toxic chemicals Impacts to water flow and drainage • Reduced species diversity • Toxic effects from chemicals substances • Limited use of land • Positive impact: work, income, taxes	• See mitigation measures for clearing, grubbing and excavation. • Minimize area disturbed. • Use access roads for equipment movement. • Place and maintain proper erosion/sedimentation measures. • Replanting will occur upon completion of cable-laying operations. • Form oil may be used sparingly to allow forms to separate from concrete following curing. • Only the chutes of concrete trucks will require on-site cleaning of wet concrete to permit their storage for transport. The volume of water used and extent of washing will be kept to a minimum. • Washing of chutes on-site will occur at a designated location. • Washing of the drum at the end of a day's delivery will occur at the ready-mix concrete plant. • No chemicals will be used in the washing of concrete trucks or forms on-site. • Drainage from washwater will be directed to a settling pond for control and treatment. Effluent will be treated or recycled for reuse. Solids will be removed on a regular basis.	No significant effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
	Local Traffic Public Health and Safety (including noise)	• Noise disturbance • Accidents (workers and public)	• Prior to release of washwater, concrete additives (e.g. total hydrocarbons, sodium hydroxide), pH, and TSS will meet the limits specified by the PEIELJ. Suspended solids concentrations within effluent released will not exceed 25 mg/L (monthly average) or 50 mg/L (grab sample) above background. • Aggregate used in the production of concrete will not be stored on-site and concrete will not be produced on-site. • In areas where the ground is wet, transmission line poles will be dug using a 750 mm auger; while holding the pole in place, aggregate is poured around the pole and tamped, and the hole is filled with additional aggregate, or by other acceptable construction practices. • Poles will be placed no closer than 10 m from any watercourse, and wetlands will be avoided where possible. If a watercourse or wetland cannot be spanned, untreated poles (wood, fibreglass or steel) will be used.	No significant effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
Construction and Decommissioning Phases: Accidents and Malfunctions	Air Quality Avian Species Fauna Fish and Fish Habitat Surface Water Local Traffic Public Health and Safety (including noise)	• Potential hydrocarbon contamination of soil and water. • Potential adverse effects to flora and fauna as a result of exposure to toxic substances. • Damage or injury as a result of traffic accidents	• Replace hazardous materials with less harmful ones when possible • Incorporate preventative and response measures into construction practices • Provide environmental awareness training • Maintain appropriate spill response equipment • Report all spills to applicable authorities (e.g. 24 hour emergency reporting system 1-800-565-1633) • Inspect equipment to ensure equipment and vehicles have no obvious leaks • Do not refuel vehicles on-site • Store all hazardous materials outside of a 30 m buffer around wetlands and watercourses • Maintain and update and inventory of hazardous materials on-site. • Train workers to adhere to safe driving rules in order to prevent traffic accidents • Public notification of an increase in construction traffic.	No significant effects expected	Minimal

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
<u>Operation Phase:</u> Wind Turbine Operation and Maintenance	Avian Species (Birds)	• Direct mortality or injury from collisions with turbines • Disturbance and avoidance of potential breeding habitat due to human presence • Noise may interfere with feeding, migration, and breeding • Interference with movement due to barrier effect (avoidance of turbines) • Increased predator pressure (exposed prey) • Fire	• Control visits to the area by both workers and public • Keep workers from entering areas where no work is done and vegetation is unchanged • Encourage public to refrain from visiting access roads during breeding season (May – end of July) • Avoid migrating bird landfall sites • Prevent perching and nesting on turbines • No guywires on wind turbine structures • Do not create areas of high prey density during habitat restoration and maintenance • Use native plants or no vegetation at all around turbines, avoid Mountain ash trees • Avoid mowed lawn • Use minimum amount of and white colour aviation lighting in accordance with Transport Canada Guidelines • Avoid or shield strong lights such as sodium vapour lights • Implement monitoring program	Reduction in population density for birds disturbed by turbines; Limited mortality of birds (birds can return to preconstruction levels when wind farm is decommissioned) None expected for: barrier and fire	Low

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
	Avian Species (Bats)	• Collisions with turbines • Attraction/deterrence by turbines • Interference with foraging by noise from turbines • Presence of people on a regular basis, toxic chemical spills, and use of herbicides or pesticides may affect bats and should not be used	• Carry out monitoring for bat strikes • Turn off turbines during few nights of fall migration (if deemed necessary) • Avoid pesticide use • Implement monitoring program	Potential for mortalities (*Myotis* spp.) every year for the lifetime of the wind farm	Low: (*Myotis* sp.)
	Land Use	• Small portion of land permanently displaced.	• Minimize area displaced. • Allow temporary laydown areas to revegetate. • Compensate land owner.	Small area permanently displaced.	Low
	Local Economy	• Positive impact: employment opportunities, income, taxes, contribution to power supply	N/A	Positive No residual effects expected	Positive

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
	Public Health and Safety (including noise)	• Accidents (physical harm) • Shadow flicker • Noise	• Properly train workers involved with equipment, handling, turbines, power lines, etc. • Develop a health and safety program • Make available an emergency procedures plan covering possible component failures • Installation of shutters or curtains to block incoming flicker • Establishment of vegetation shielding • Construction/installation of a physical barrier • Ensure a setback distance of at least 290 m • Turbines automatically shut down at very high wind speeds	Impacts are expected to be low for all factors	Low
	Visual Landscape	• Turbines in the natural landscape • Strong steady lighting may cause "skyglow" • Glare • Negative impressions caused by "untidy" turbine arrangement, garbage, leaks from nacelles, idle turbines or turbines with parts missing	• Use tubular towers • Create aesthetic balance in the design • Use light grey colour, non reflective, not shiny steel • Arrange turbines in clusters • Do not arrange turbines in long lines • Minimize lighting on the turbines • Minimize project footprint, implement erosion control and dust abatement • Repair turbines immediately	Residual effects are likely despite mitigation measures	Low

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
			• Clean turbines • Remove excess materials and litter • Avoid posting commercial signs		
Operational Phase: Road and Power Lines Operation and Maintenance	Avian Species (Birds and Bats) Fauna	• Direct mortality or injury from collisions with overhead power lines. • Electrocution from powerlines • Disturbance and avoidance of potential breeding habitat due to human presence • Noise may interfere with feeding, migration, and breeding • Guywires to be used on single meteorological mast	• See mitigation measures for wind turbine operation. • Place high-visibility flight diverters on guy wires. • Install bird deterrents on guywires attached to meteorological mast.	Small number of mortality potentially every year for the lifetime of the wind farm	Low
	Fish and Fish Habitat Surface Water Quality	• Impacts to water flow and drainage • Loss of fish habitat • Toxic effects from chemicals substances	• See mitigation measures for clearing, grubbing and excavation in Construction Phase.	Impacts are expected to be low for all factors	Low
	Land Use Local Economy Public Health and Safety (including Noise)	• Limited use of land • Positive impact: work, income, taxes • Noise disturbance • Accidents (workers and public)	• See mitigation measures for clearing, grubbing and excavation in Construction Phase	Impacts are expected to be low for all factors	Low

Table 6.1 Summary of Environmental Impacts

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact
Operational Phase: Accidental and Malfunctions	Air Quality Avian Species Fauna Fish and Fish Habitat Surface Water Local Traffic Public Health and Safety (including noise)	• Potential hydrocarbon contamination of soil and water. • Potential adverse effects to flora and fauna as a result of exposure to toxic substances. • Icing and breakage • Fire • Damage or injury as a result of traffic accidents	• The mitigation for spills and traffic accidents for the construction phase is sufficient for the operation phase. • Workers will be trained on the hazards of ice build up on tall structures • Warning signals or flags should be set up to warn of potential ice issues • If those measures are not heeded other options must be investigated • A safety set-back of at least 290 m will mitigate most effects of breakage. • Staff should wear protective equipment when on-site	No significant effects expected	Minimal

7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Several environmental factors could have adverse effects on the Project: extreme weather events, fire, and global climate change. These effects have been considered during the Project design phase.

7.1 EXTREME WEATHER

Severe weather events could potentially damage wind turbines due to conditions exceeding the operational design of the wind turbines. High winds, extreme temperatures, and icing on blades all have the potential to shut down wind turbines, thus not producing energy and revenue.

Violent local storms in the form of tornadoes, severe thunderstorms, and hailstorms are atypical for the Province. Nonetheless, the Island is susceptible to the destructive forces of much more powerful Atlantic storms. Such storms can generate strong winds, heavy rains and storm surges. During the Atlantic hurricane period (summer through late fall), dissipating hurricanes tracking along the Atlantic coast expend their energy and remaining rainfalls over the Island (EC, 2000). One of the most drenching and damaging storms of this kind occurred on September 7th, 1999. Charlottetown recorded 200 mm of rain, the greatest daily total ever recorded for any PEI station. The highest sustained wind experienced in Charlottetown was 166km/hr which occurred during Hurricane Ginny on October 30, 1963 (Atlantic Climate Adaptation Solutions Association, 2011).

In the winter, storms can produce a variety of weather conditions. These can consist of hurricane force winds exceeding 100 km/h with heavy precipitation composed of rain, snow or a mix thereof. When such events occur during high tide, storm surges become a problem (EC, 2000). On February 19th, 2004, “White Juan” had winds up to 104 km/hr and dumped 74 cm of snow in Charlottetown (Atlantic Climate Adaptation Solutions Association, 2011).

These winter storms can pass rapidly through the region or stall and batter the Province for days. When the centres of the storms remain to the south of the Island, precipitation reaches the Gulf and the Island in the form of snow. If the low centre passes to the north of the Island, the snow changes to freezing rain and then rain. Freezing rain is rare, and generally occurs for approximately 40 hours per year (EC, 2000).

Under certain weather conditions, ice can build up on the wind turbine blades, even if they are moving. This ice can be thrown off the blades, which poses a hazard to workers on-site, as well as the public in the vicinity of the turbines.

Ice can build up due to melting snow or when the air temperature is below 0ºC, while there is humidity in the air (including rain, fog or drizzle). These conditions are relatively frequent along PEI’s Atlantic coast, even though the winter weather conditions are comparatively mild. The amount and the consistency of ice depend on the weather conditions and the operational status of the turbines (i.e. moving or stationary). Morgan et al. 1998 (in Sea Breeze 2004) mention that ice build-up is greater on moving turbines than on stationary ones.

Most ice shedding occurs as temperatures rise and the ice thaws from the rotor (Morgan et al., 1998 in Sea Breeze 2004). Typically, icing on the rotors and nacelle leads to automatic rotor shutdown. Restart happens only when the ice has melted, and the operators re-start the turbine. However, the authors state that it is common practice for operators to speed up this process by thawing the sensors, and re-starting the still ice-covered rotors. This leads to heavy ice shedding. Few data are available on the mass of the ice pieces and the distance they travel (Morgan et al., 1998 in Sea Breeze 2004). Observations put the mass of pieces found on the ground between 0.1 and 1 kilogram (kg), and the distance to 15-100 m (rotor diameter up to 60 m), but it is not known how well the area was searched. Large pieces tend to disintegrate in flight. Ice tends to fall predominantly downwind from the turbine. Also, it appears that most ice drops off rather than being thrown off (Morgan et al., 1998 in Sea Breeze 2004).

To date, no fatalities have been reported as a result of icing and only 34 known incidents of ice throw injury observed (Caithness Windfarm Information Forum, 2012). Ice throw can be of little danger to the public since the setbacks required to minimize noise are usually sufficient to protect the public from any danger from thrown ice. In addition, ice build up on the rotors slows down the rotation. This is sensed in the turbines control system, and causes the turbine to shut down. Morgan et al. (1998 in Sea Breeze 2004) state that the risk of being struck by ice thrown from a turbine is "diminishingly small" at distances over 250 m from a turbine with moderate icing. The same report points out that there were no earlier studies on this concern, and that this is probably due to the fact that there had been no reported injuries from thrown ice, despite the 6000 MW of turbine power installed world-wide. However, the authors also state that there had been several "significant incidents" in Germany in 1997-1998. The Canadian Wind Energy Association (CanWEA, 2007) recommends a distance of blade length plus 10 metres from public roads, non-participating property lines and other developments.

Ice being thrown off the blades in theory poses a health and safety concern for any person on the site or near the turbines, since it may result in injuries. The ice may be thrown up to 100 m (Morgan et al., 1998 in Sea Breeze, 2004). However, ice is mainly a public safety issue, since operations personnel are trained and are more likely to avoid the hazard. On the other hand, operations staff is at greater risk from ice since they work more regularly and at shorter distances from the turbines. In addition to personal injuries, ice impacts may cause damage to residences and vehicles.

Adverse effects from ice build up and ice-throw are likely. While the frequency is relatively low, the effects are potentially severe. Therefore, ice is considered to potentially cause significant impacts, and mitigation measures should be applied.

Recommended Mitigations

Based on the climate data available some extreme weather events are likely. Extreme weather events which could occur within PEI are listed in Table 7.1. In addition, the possible effect and mitigation associated with these events are presented.

Table 7.1 Extreme Events, Associated Effects, and Mitigation

Weather Event	Effect	Mitigation
Extreme Wind	Damage to blades	Automated control system would initiate shut down.
Hail	Damage to blades	Appropriate turbine maintenance.
Heavy rain and flooding	None anticipated	None.
Heavy snow	Damage to turbine components	Automated control system would initiate shut down.
Ice Storms	Icing on blades resulting in potential ice throw.	Automated control system would initiate shut down.
Lightning	Potential for fires within nacelle of turbine.	Lightning protection system would conduct surge away from nacelle.

The effects on the turbines have been considered during the Project designs, and losses to productivity are not a concern. The turbine towers will be equipped with lightning protection and electronic wind speed monitoring. In the case of extreme weather conditions with wind speeds exceeding 25 m/s, the rotors cut-out.

All workers will be trained on the hazards due to ice build up on tall structures. The wind turbines should be set back a sufficient distance from the nearest residences, roads and public access areas for an appropriate distance to prevent ice impacts. This set back distance (safety zone) should be slightly larger than the 100 m the ice is expected to fly. Experience gained with wind farms in Ontario indicates that a minimum distance of 150-200 m should be maintained to residences.

The turbines proposed for the Project will be set back by at least 600 m from residences.

With the application of the aforementioned mitigation measures, significant adverse effects of extreme weather events on the Project are not likely.

7.2 WILDFIRE

Uncontrolled wild fires can be very destructive and may arise as a result of natural occurrences such as lightning strikes, negligence such as from people using fire to burn off old grasses, or by accident such as from equipment sparks. In PEI, fire season typically runs from March 15 to November 30th. Between 2007 and 2010 there were between four and eight forest fires fought by the PEI Forest Service per year with an average of approximately 6 ha of land burned. In years previous to that there were anywhere from 12 to 80 fires per year with over 200 ha burned during the worst year (PEIDAF, 2012c).

To assist in preventing damage to the wind turbines, service building and substation should a wild fire occur in the Project area, it should be ensured that an area of 25 m around the structure is free from all scrub and low brush. Safety mechanisms are to be in place to shut down facilities in case of fire. Please refer to Section 5.3.4 for more detail.

7.3 GLOBAL CLIMATE CHANGE

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which can be attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (Government of Canada, 2010b). Emissions of GHGs (including CO_2, methane (CH_4), nitrous oxide (N_2O), ozone (O_3), sulphur hexafluoride (SF_6), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and chlorofluorocarbons (CFCs)) released into the atmosphere primarily through anthropogenic activities such as the burning of fossil fuels are contributing to global climate change (Government of Canada, 2010b).

The Intergovernmental Panel on Climate Change (IPCC) is an international organization of the world's leading climate scientists, and is affiliated with the United Nations. According to the IPCC, the average global temperature is expected to rise by 1.1 – 6.4 ºC over the next century (IPCC, 2007). In Canada, a warming trend of +1.4 ^{o}C was identified over the period of 1948 to 2007 (Government of Canada, 2010b). The increases are predicted to differ depending on the region, with the highest increases expected in the northern regions and south-central Prairies (Lemmen *et. al.*, 2008).

The increase in average temperatures is projected to be accompanied by an increase in severe weather events, and a rise in sea levels. Severe weather events include flood, drought and storms, and the rise in sea levels will increase the number and severity (height) of storm surges, the wave energy and erosion (Lemmen *et. al.*, 2008).

Although PEI produces only 0.3% of Canada's GHG emissions and is considered a "low emitter", this Province has been identified as an area most vulnerable to sea level rise because of its characteristic highly erodible sandstone bedrock, indented sandy shoreline with many estuaries and marshes, and ongoing submergence of coastline (PEIDEEF, 2008b).

A study conducted on sea-level rise on PEI adopted the IPCC's central value of about 0.5 m for sea-level rise and 0.2 m for crustal subsidence in the Charlottetown area by 2100 (McCulloch, 2002). Predictions for sea-levels show that the rise will vary from location to location, with parts of the North Shore of PEI being rated as highly sensitive due to exposure of the coast to the open Gulf of St. Lawrence, with potential wave-generating fetches of several hundred kilometres (McCulloch, 2002).

Based on this information and location of the wind farm, it is very unlikely the wind farm project in Hermanville will be impacted by flooding due to storm surges and sea-level rise, flooding from increased precipitation, an increase in the number of days with ice-formation, and an increased number of severe weather occurrences.

8.0 CUMULATIVE EFFECTS ASSESSMENT

The PEIELJ requires consideration of cumulative effects that are likely to occur in respect to the Project. While the CEAA, which forms a basis for the consideration of cumulative effects does not define cumulative environmental effects specifically, it does provide a number of points that indicate what should be considered. First, all environmental effects as described in the Act can be considered cumulatively. Second, the Act states that EAs must consider the cumulative environmental effects "that are likely to result from the project in combination with other projects or activities that have or will be carried out" (Drouin and LeBlanc, 1994). Future projects that are reasonably foreseeable should be considered (The Agency, 1999).

The term "Cumulative Effect" has been defined as:

- the summation of effects over time which can be attributed to the operation of the Project itself; and
- the overall effects on the ecosystem of the Project Area that can be attributed to the Project and other existing and planned future projects.

The Agency (1999) provides a reference guide entitled 'Cumulative Effects Assessment Practitioners Guide'.

8.1 BOUNDARIES

For the purpose of identifying and assessing cumulative effects, the spatial dimensions can be variable, depending on the VEC that is being assessed. For example, the cumulative effects on air quality can cover an area well beyond the footprint of the Study Area. The temporal boundaries are extended to include past, current, and known planned or reasonably foreseeable projects.

8.2 OTHER PROJECTS IN THE AREA

8.2.1 Existing

A search of the CEAA Registry and the PEI EIA Registry identified no projects within 1 km of the site, 7 additional projects within 5 km and 3 additional projects within 10 km of the Project Site that have been initiated or approved. The projects are all related to harbour and/or small craft harbour maintenance and improvement, as well as three municipal infrastructure improvement projects.

In general, development activity in the area is focused on the near shore and inshore fishery, agriculture, tourism and forestry. The land/water interface of the fishery in the area is concentrated at small craft harbours in North Lake and Naufrage. A larger harbour is located in the Town of Souris. Agriculture in the area is primarily associated with potato production involving a three year crop rotation program of row crop, grain and forage crops successively. There is significant blueberry production also in the area. A vodka distillery is located adjacent to the proposed Wind Farm location, and is associated with an Inn on the shoreline in excess of

1 km from the project site. Forestry harvesting activities occur intermittently on small woodlots throughout the area.

The major development activity in the general area (approximately 20 km eastward) is the development of wind energy. The East Point Wind farm project was developed in 2006 and a transmission line to move energy from the project into the provincial distribution. The transmission line is presently undergoing extensive upgrades. The Hermanville/Clearspring 30 MW Wind Farm project area lies within an area of excellent to outstanding wind energy potential. It is quite possible that future wind farm development may take place within the general area.

8.2.2 Future

As part of the Energy Accord, the PEIEC was given the directive to develop another 30 MW of wind power to enable the Province to generate 30% of its electrical power from renewable energy by 2013. The Hermanville/Clearspring 30 MW Wind Farm is part of that development plan for additional wind power in the province.

8.3 IMPACT ASSESSMENT

Following the definitions of the term, the “residual effects on the environment”, i.e. effects after mitigation measures have been put in place, combined with the environmental effects of past, present and future projects and activities will be considered in this assessment. Also, a “combination of different individual environmental effects of the project acting on the same environmental component” can result in cumulative effects.

8.3.1 Potential Cumulative Effects

The VECs presented in Section 5 have been examined alongside other past, present and future projects for potential adverse cumulative effects. A summary of the cumulative effects discussed are summarized in Table 8.1.

There have been 13 specific VECs identified with reference to the Wind Park project (Table 3.3). Of those VECs identified, three can be considered to be components of cumulative effects analysis. Table 8.1 indicates the potential cumulative effects VECs and the rationale for inclusion/exclusion.

The potential for cumulative effects exists for: birds, bats, and floral Species-at-Risk. These will be discussed below. There are no major developments such as a power plant or oil refinery underway in the Province that will have far reaching effects on the VECs discussed in this document. The examination of cumulative effects will focus on projects within an approximate 10 km radius of the Study Area as well as present and future wind farm developments.

Table 8.1 Potential Cumulative Effects for VECs and Rationale for Inclusion

VEC	Potential for Cumulative Effect	Rationale for Inclusion/Exclusion	Level of Cumulative Effect
Air Quality	No	Effect localized and limited to construction phase	not applicable (na)
Archeology and Heritage	No	Effect localized and limited to construction phase	na
Avian Species (birds and bats)	Yes	Increased possibility of interaction with turbines. Removal of Habitat	Low
Fauna (non-avian species)	No	Effect minimal and limited to short-term in immediate construction area	na
Fish and Fish Habitat	No	Minimal effect associated with aerial cable span across fish bearing watercourse. No ongoing or cumulative effect	na
Floral Species at Risk	Yes	Rare species in surrounding areas	Minimal
Land Use	No	No other significant development activities in the surrounding area	na
Local Economy	No	Localized	na
Local Traffic	No	Will be limited to construction phase. Not ongoing/cumulative	na
Public Health and Safety (including noise)	No	Specific to project only	na
Surface Water Hydrology and Quality	No	Minimal effect associated with aerial cable span across watercourses. No ongoing or cumulative effect	na
Visual Landscape	No	Specific to project only	na
Wetland	No	Minimal effect associated with aerial cable span across wetlands. All poles will be located within existing Souris Line Road right-of-way. No ongoing or cumulative effect.	na

8.3.2 Birds

Birds can be affected by wind generation developments during construction and operation phases. During construction, particularly during sensitive breeding and nesting periods, disruption of breeding, nesting and rearing can occur due to noise, removal of habitat, and destruction of nests as well as suitable habitat. Mitigation for these situations is dealt with in the project specific VEC sections. There are no other wind projects, nor are there any other significant construction activities planned in the general area for the proposed construction period. Thus, cumulative effects with regard to this component will be negligible.

During operation and maintenance, displacement can occur and can lead to habitat loss for birds (Drewitt and Langston, 2006) Birds can be displaced by the presence of the turbines themselves through visual, noise and vibration impacts, and also by repeated vehicle movements related to maintenance. While the other wind farms in the region are in operational mode, regular maintenance does not result in excessive intrusion. However, there will be some cumulative effect as a result of this project. Mitigative measures (minimizing footprint, making maximum use of existing access routes, and remote monitoring) will aid in limiting the cumulative impact.

Habitat loss can have a long term cumulative effect on bird populations. However, the total footprint for this project will be approximately 20.0 ha. It is located entirely in wooded areas comprised of a variety of forest types and various stages of harvest and/or regrowth. It is unlikely that habitat loss due to construction of roads, turbines and other associated structures will have an appreciable negative impact on species diversity or numbers.

Previous studies have indicated that birds may exhibit avoidance behavior when encountering a series of turbines. They may either fly around or over the turbines without stopping (Dalzell, 2010). The area is not in a significant migration flyway.

While risk of collision has been thought of as a major cause of bird mortality in relation to wind turbines, studies have shown this to be a relatively low level of mortality in birds (Drewitt and Langston, 2006). In addition, very few bird deaths due to wind turbine collision have been recorded at wind turbines already in existence in the area (the East Point Wind Farm project).

Post construction avian and bat mortality surveys carried out at the East Point Wind Plant during the spring, summer and fall of 2007 and 2008 found that “there are very few occurrences of avian and bat mortalities at the East Point Wind Plant” (Bird Studies Canada, 2009).

In summary, cumulative effects to avian species are expected to be insignificant if proposed mitigation conditions are implemented (Table 8.2).

8.3.3 Bats

As has been pointed out in Section 4.4.2.2, bats can be subject to disruption by wind turbines through construction activities, human activities during operations, and mortality as a result of passing close to rotating turbine blades.

No pre-construction bat studies have been undertaken with regard to any of the other wind turbine locations in the region. The post-construction mortality surveys carried out at the East Point Wind Plant in 2007 and 2008 reported two little brown bat carcasses were found in 2007 and two found in 2008 (Bird Studies Canada, 2008; Bird Studies Canada, 2009). This EIS includes a survey of bat presence and abundance. Based on the data, there appears to be significant levels of bat activity in the project area. Essentially all of this activity was recorded at or near ground level (i.e. 0 m to 10 m). Monitoring bat activity at 20m and 40m above ground level revealed little or no bat activity. There will likely be minimal cumulative effect on bat populations as a result of operational activities associated with this project. It is unknown what effect changes in habitat may cause as a result of the clearing and timber removal associated with this project. It could be positive, negative or benign. An ongoing monitoring program and follow-up to gain some insight into this is proposed as a mitigation measure.

In summary, cumulative effects to bat species are expected to be insignificant if proposed mitigation conditions are implemented (Table 8.2).

8.3.4 Floral Species at Risk

While some rare species are known to exist in the general area of the project, particularly site T3, they are mostly limited to the small bog areas. A rare plants survey at the footprint locations of the turbines did not reveal any species listed by SARA or COSEWIC. Mitigation measures have been implemented to take into account protective measures for some of the unique flora that exists in areas adjacent to project footprint locations.

It is likely that cumulative effects with regard to flora at risk will be minimal with regard to this project (Table 8.2).

Table 8.2 Summary of Cumulative Effects

Valued Ecosystem Components (VECs)	Description of Project Activities	Other Activities	Assessment of Cumulative Effects	Level of Cumulative Effect
All	All	Past tree cutting, agriculture	Unknown	Unknown
Bird population	Turbines, power lines, access construction. (Collisions)	Visitors/Public access	• Disturbance from public access may add to losses from collisions • Removal/destruction of habitat • Birds may move in from adjacent areas	Low
Bat population	Construction of turbines & infrastructure	na	• Restriction of access • Pressure change impacts	Low
Flora at Risk	Construction of turbines & infrastructure	Existing access maintenance and improvement.	• Possible losses & habitat limitation.	Minimal

9.0 CONCLUSION

This report addresses the environmental effects of the construction, operation and decommissioning project phases. The information to date has shown that no significant adverse residual impacts on the VECs are likely.

The generation of electricity from renewable resources such as wind is in accordance with federal and provincial strategies, since it contributes to the reduction of GHG emissions and air pollutants. The Hermanville/Clearspring 30 MW Wind Farm, if approved, would contribute to the reduction of GHG emissions required to meet Canada's and the Province of PEI's targets.

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