BARRINGTON WIND ENERGY LIMITED

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CANSO WIND FARM

ENVIRONMENTAL IMPACT STATEMENT
CANSO, NOVA SCOTIA

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GLOSSARY – ACRONYMS AND DEFINITIONS

Acronyms

ACCDC	Atlantic Canada Conservation Data Centre
ARD	Acid Rock Drainage
CEA	Cumulative Effects Assessment
CEAA	Canadian Environmental Assessment Act
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Department of Fisheries and Oceans
EA	Environmental Assessment
ECC	Environmental Component of Concern
dB(A)	Decibel (A-weighted)
L	Litre
Min	minute(s)
MBCA	Migratory Bird Convention Act
MSC	Meteorological Service of Canada
MW	Megawatts
NRCan	Natural Resources Canada
NSESA	Nova Scotia Endangered Species Act
NSDNR	Nova Scotia Department of Natural Resources
SARA	Species at Risk Act
TC	Transport Canada
VEC	Valued Ecosystem Component
VSC	Valued- Socioeconomic Component
WTG	Wind Turbine Generator

Definitions

Bog	A wetland where the accumulation of Sphagnum moss as peat determines the nature of the plant community. Floating sphagnum mats may encroach over the surface of any open water.
Cumulative Effects	A project's effects on the environment combined with the effects of projects and activities (past, existing or imminent). These may occur over a certain period of time or distance.
Environmental Assessment	The process of identifying the significant environmental impacts that a proposed project may have on the environment and the proposed mitigation efforts to minimize the impacts.
Environmental Effect	With respect to a project, any change that the project may cause in the environment, including any changes to health and socio-economic conditions, physical and cultural heritage and current land and resources used for traditional purposes by Aboriginal persons. Also included are changes to any structure or site that is of historical, archaeological, paleontological or architectural

	significance, and any change to the project that may be caused by the environment.
Estuarine Wetland	A tidal wetland that is usually semi-enclosed by land but have open, partly obstructed or sporadic access to the open ocean, and in which ocean water is at least occasionally by freshwater runoff from the land.
General Status Rank	A colour-based ranking system that provides an overall indication of species viability in Nova Scotia highlighting those species that are secure, sensitive and at risk. The general status ranking system is compiled by the Nova Scotia Department of Natural Resources.
Identified Wetlands	Those wetlands identified on the 1991 Nova Scotia Department of Natural Resources Wetlands Atlas and the 1988 Canadian Wildlife Service Nova Scotia Wetlands Atlas.
Marine Wetland	A wetland where the open ocean overlies the near-shore bottom and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and water regimes are determined primarily by the ebb and flow of oceanic tides.
Residual Effects	Effects that remain after mitigation measures have been applied
Salt Marsh	A cord grass dominated wetland. A salt marsh is characterized by the percentage of marsh that is flooded by the mean high water mark and the number of saline to brackish ponds per hectare.
Unidentified Wet Area	Those wet areas that were visible on aerial photographs and during the site visit that were not identified on the 1991 Nova Scotia Department of Natural Resources Wetlands Atlas and the 1988 Canadian Wildlife Service Nova Scotia Wetlands Atlas.
Valued Ecosystem Component (VEC)	Any part of the environment that is considered important by the proponent, members of the public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural or scientific concerns.

1.0 PROJECT SUMMARY

1.1 PROJECT PROPONENT AND OTHER CONTACTS

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1.2 PROJECT TITLE

Canso Wind Farm

1.3 PROJECT LOCATION

The proposed wind farm is located south of the Town of Canso, Guysborough County, Nova Scotia. A small part of the wind farm is located within the Town limits. Geographical Coordinates for the potential turbine locations are provided in Table 1.1. Eight of the 12 locations will be chosen.

TABLE 1.1 Geographical Coordinates

Site Name	UTM	
	Easting	Northing
1d	657835	5021500
2d	657400	5020950
3d	657070	5020640
4d	656840	5020215
5d	656420	5020250
6d	658525	5021405
7d	658950	5021190
8d	659205	5020920
9d	657720	5020750
10d	657900	5020300
11d	657480	5020520
12d	657270	5020180

Note: UTM in NAD 83 datum

1.4 ESTIMATED CAPACITY OF THE WIND FARM

There will be eight turbines with a capacity of 1.5 or 1.8 MW, and a total Capacity between 12 and 14.4 MW.

1.5 CONSTRUCTION SCHEDULE

Preliminary engineering:	Late 2003
Start of construction:	Spring 2007
Commissioning of the turbines:	Fall/Winter 2007

1.6 FEDERAL, PROVINCIAL AND MUNICIPAL INVOLVEMENT

The project requires an environmental screening under the Canadian Environmental Assessment Act (CEAA) because of federal funding, as well as an environmental assessment approval under the Nova Scotia Environmental Assessment Regulations for wind power generation with a production rating greater than 2 megawatts.

At the implementation stage, a development permit pursuant to the Municipal Government Act Part 8 Planning and Development will be required and a building permit pursuant to the Building Code Act.

1.6.1 Natural Resources Canada Involvement

Natural Resources Canada (NRCan) is expected to provide financial support to the project under the Wind Power Production Incentive (WPPI) program. The WPPI is an initiative of NRCan to provide project funding to the proponent during the construction and operation of a wind farm. The project funding provided through the WPPI, triggers a requirement under CEAA for a federal environmental assessment. To help meet the requirements of a federal environmental assessment and receive funding, BWEL has followed the guidelines stated in the document titled "*Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act*".

NRCan is requested to provide $ 5,132,013 funding over a 10-year period.

1.6.2 Other Federal Involvement

Environment Canada (EC) is expected to review the project with regards to its mandate. Also, a review by TerraChoice Environmental Marketing is expected. This environmental programme and consulting services firm is the official manager of Environment Canada's Environmental Choice^{M} Programme (ECP), an initiative of EC to promote the generation of electricity from naturally occurring energy sources such as wind power. Those energy producers that meet the requirements of the program will be issued with an EcoLogo that identifies the source as being "Green". In order to meet the criteria of the program, the proponent will need to meet the fifteen requirements listed in the Environmental Choice Program Sufficient Evidence Document, "*CD-003: Electricity – Renewable Low-impact Wind-powered Generators*".

Fisheries and Oceans Canada (DFO) is expected to review the project as part of a request for authorization to harmfully alter, disrupt, or destroy fish habitat (HADD) under Section 35(2) of the *Fisheries Act*. This authorization is required to construct one watercourse crossing using culverts over Winter Creek.

Transport Canada (TC) is expected to review the project to determine whether or not Winter Creek is a navigable waterway. If Winter Creek is a navigable waterway, an application under Section 5(1) of the *Navigable Waters Protection Act* will need to be completed and submitted to TC.

Pursuant to the Aeronautics Act and Aviation Regulations an aeronautical obstruction clearance is required from TC for approaval of the turbine heights and the turbine lighting.

1.7 AUTHOR OF THE EIS

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2.0 PROJECT DESCRIPTION

2.1 THE PROJECT PROPONENT AND ITS PARTNERS

Barrington Wind Energy Limited (BWEL or Barrington) is a privately owned Nova Scotia company based in Halifax. Barrington is dedicated to the responsible development and operation of commercial wind farms. The Canso wind farm is their first project, and will be followed by other projects, two of them in Nova Scotia. BWEL is active in climatology and wind research, as well as the design, development and design of wind farms. The founding directors Eric Twohig (President) and David Lawson are well-known wind power advocates. BWEL have an investor as a partner in this project. The Town of Canso may also have joined as a partner.

2.2 PROJECT BACKGROUND

2.2.1 Project History

In November 2003, Barrington and the Town of Canso signed an agreement to initiate the wind power project. A 50 m wind test tower was erected and equipped with multiple sensors and an electronic data logger with remote access capabilities to study the wind regime at Canso. In June 2004, the environmental field survey program was initiated. The field surveys were necessary to gather the information required to prepare the Environmental Impact Statement for the combined federal and provincial environmental assessment.

2.2.2 Political and Economic Context

The federal government encourages the development of alternative energy sources in a bid to meet its commitment to reduced emissions under the globally important Kyoto protocol. For this purpose, the federal government developed a program of financial incentives available to developers of energy sources that result in little or no emission of “green house gases”. The Canso Wind Farm is such an energy project, since it will provide energy without emission of green house gasses, by converting wind power into electricity. In addition, Nova Scotia Power Inc. is interested in buying so called “clean” energy in an effort to meet its emission targets.

The Town of Canso has been in economically hard times for several decades. As the Town relied heavily on fishery for income, the collapse of major fish stocks such as ground fish have had a devastating impact. The local fish plant now operates for only a limited number of weeks per year. The Town’s debt load has become so large (partially due to unpaid property taxes) that it is in danger of loosing its Town Status.

The wind farm will have a significant economic impact. It will provide revenue for the Town of Canso of about $100,000 per year, and there will be several million dollars of local construction cost that may stay in the local community. In addition, Canso’s electrical utility will have access to the power produced by the turbines. Since the turbine will produce power at a stable, pre-fixed price, it is expected that this will help in the industrial development of the Town, which will reduce the number of un-employed people.

2.3 PROJECT JUSTIFICATION/PURPOSE

The objective of the proposed Canso Wind Farm (Project) is to use natural wind energy to generate electricity and sell it to Nova Scotia Power Inc. (NSPI) or directly to private clients, using a renewable resource from an area south of the Town of Canso, Nova Scotia. The use of wind energy will result in electricity production with virtually no emissions of green house gasses. This will contribute to the green house gas emissions target of the federal government and to the emission reduction target of Nova Scotia Power Inc. Also, this energy is produced using a sustainable source of energy, and the price for the energy will be much more stable and predictable than the price of fossil fuels. This will help commercial users of this energy in their long-term development and competitiveness.

2.4 PROJECT SUMMARY

The project area is located near Canso, Nova Scotia, in an area of land that is currently not used commercially. There is very limited hunting or trapping activity within the project footprint. The land can be described as barren with a gently rolling topography. Surface vegetation includes small trees, tall shrubs, or wetlands.

The proposed wind farm consists of 8 wind turbines with a capacity of 1.5 or 1.8 MW each. The towers consist of tubular steel, and have a hub height of 80 m. Guy wires are not necessary. The rotor has fiberglass and epoxy wings and a diameter of 70.7 m. The blade speed is between 12 and 20 rpm. Noise levels at the base of the turbine have been calculated as 58-60 dB(A) under high wind conditions (8 m/s at a height of 10 m). Turbine lighting requirements are currently being determined by Transport Canada.

The turbines will be connected to the project substation by above ground cable. The connection from the project substation to the existing NSPI substation in Canso will be via above ground transmission cables as well. Details on the infrastructure are provided in Section 2.6.

2.5 PROJECT LOCATION

The Study Area for the proposed Canso Wind Farm lies south of the Town of Canso, Guysborough County, approximately 0.5 kilometres south of Canso Harbour (Figure 2.1). The footprint of the wind farm is spread along barren land bordering the Atlantic Ocean and measures approximately 1.5 kilometres by 4.5 kilometres (Figure 2.2). The nearest major roadway is Highway 16, which borders the Study Area to the north and west. Table 2.1 shows the geographical coordinates of the proposed turbine locations as well as of environmental and archaeological constraints.

The project area is adjacent to Chapel Gully Trail, a park used for hiking and walking. There are no First Nations Reserves or lands currently used for traditional purposes in or near the project area or the Town. Grassy Island National Historic Site is about 900 m northeast of the project area. NSDNR designated the salt marsh at the head of Chapel Gully as significant Habitat. The nearest distance between the salt marsh and a turbine is approximately 120 m.

TABLE 2.1 Geographical Coordinates

Site Name	UTM	
	Easting	Northing
1d	657835	5021500
2d	657400	5020950
3d	657070	5020640
4d	656840	5020215
5d	656420	5020250
6d	658525	5021405
7d	658950	5021190
8d	659205	5020920
9d	657720	5020750
10d	657900	5020300
11d	657480	5020520
12d	657270	5020180
Tower	657809	5020665
J. Burns Site	658654	5021335
Canso Pest House	658350	5021073
NewXng	656977	5021187
WC1/WL4	656933	5021202
WL1	657391	5021153
WL2	657775	5021134
WL3	657902	5021643

Note: UTM in NAD 83 datum; WL= Wetland; WC1 and NewXng= ATV Trail/Emergency Road crossings of Winter Creek Tributary

Figure 2.3 shows the project layout with 12 potential turbine locations (eight of which will be chosen), as well as biological and cultural environmental features of the project site and surrounding areas. An environmental constraint map was generated to help identify the best possible locations for wind turbines that would cause minimal environmental impact (Figure 2.3). The turbine and road layout has been adjusted to avoid environmental constraints identified during 2004/2005 field surveys, such as wetlands and Long-eared Owl habitat. Figure 2.3 depicts the final layout. Details on the environmental features can be found in Section 4, "Environmental Baseline Data".

2.5.1 Land Ownership

There is no known federally owned land within the footprint of the proposed wind farm. All property is either privately owned or provincial crown land, with the exception of one parcel (PID 35096700) for which the owner is unknown. Access to, and permission to use, all properties that carry project components (turbines, access road, substation), has been obtained from the respective owners.

2.6 STRUCTURAL PROJECT COMPONENTS

The Project will consist of 8 wind-turbines and associated facilities. To construct and operate these turbines, each turbine will require a cleared and levelled 20 by 100 metre square area to accommodate the lay-down area required to temporarily store, assemble and erect all components of the wind turbine. A concrete foundation pad approximately 20 metres diameter will be poured in place so that its top surface is crowned to slightly above grade. Where conditions allow, rock anchors will be used to anchor the turbines.

FIGURE 2.1 General Location

Turbine equipment will consist of an 80 m tall wind turbine tower of tubular structural steel, a top-mounted nacelle unit and three fibreglass rotor blades with a sweep diameter up to 70.5 m. The instantaneous capacity rating per turbine will be 1.5 or 1.8 MW, depending upon the selected equipment. The total wind farm production capacity will ultimately be between 12 MW and 14.4 MW. Each turbine will be accompanied by a small 2 MVA oil insulated power transformer installed on a slab-on-grade concrete base adjacent to each tower.

A roadway with a maximum roadbed width of 10 metres will be constructed and compacted to grade so as to move a heavy crane and transport truck traffic between these mini-sites. The newly constructed roadways are expected to total about 2920 m for an 8- turbine layout (turbine #1-# 8) (Figure 2.3). Access to the wind farm site will be from Wilmot Drive (off Union Street). Figure 2.3 shows a total of 12 turbines, with a total of 5050 m of roads. Some of these turbines will be used for an 8- turbine facility. The selection of turbines will depend on environmental constraints and wind power considerations.

Wooden power poles will be installed adjacent to the roadway to carry medium power lines, as well as communication lines, from the turbines to a single-story control building (7 metres by 14 metres), constructed at a central location. A utility-grade power outdoor sub-station will be built at or near the existing (NSPI) transmission grid. The preferred location is off Wilmot Drive (Fig. 2-3). The substation will be fenced in. The control building (combined control room, 25kV switchgear room, and office) will be adjacent to or attached to the fenced area. Additional fences around turbines or gates across the access roads are not planned. The turbine towers will be locked to prevent access.

The Inter-tie Substation will occupy a fenced area of approximately 420 square metres and will include a 15MVA main step-up transformer, 25kV cable bus interconnecting with the indoor switchgear, a 69kV circuit breaker and isolating switches, 69kV post type instrument transformers, 69kV metering pack, and a 69kV line steel frame dead-end structure. All outdoor substation equipment will be installed on individual concrete structures to a below-frost depth. The entire substation, including the fence system, and control building will be provided with a site-specific equipment ground electrode system installed a minimum of one metre below finished grade.

Power lines will be typical utility-grade insulated conductor wire, linking at the control house with all conventional step-up transformers, switchgear, metering, and SCADA telemetry equipment. The cables used in the communication system between the control room and the turbines will be fibreoptic cables.

The capacity of the existing infrastructure is presently being determined via a System Impact Study being performed by NSPI. The core determinant is the condition and capacity of the NSPI radial transmission line between Canso and Antigonish, Nova Scotia.

2.7 PROJECT ACTIVITIES

Project activities include construction, operation and decommissioning phases and are described below.

FIGURE 2.2 Detailed Site Plan

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FIGURE 2.3 Constraints Mapping

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Construction will begin with the construction of access roads and turbine pads, followed by the assembly if the turbines, installation of the electrical collection system and SCADA communication system, as well as the construction of the ancillary control house and substation. The transmission lines to the NSPI substation in the Town of Canso will also be upgraded at this point.

Construction was preceded by environmental and archaeological surveys of the project footprint. A pre-construction geotechnical survey of the proposed turbine locations will also be carried out. The surveys were carried out by qualified personnel (Appendix A). The geotechnical survey will be led by a geological engineer.

Construction activities will start with the clearing and grubbing of all areas needed to build the road and all turbines, followed by the construction of the roads and the erection of the turbines, as well as of the power poles and power lines connecting them to the substation. For the clearing and road building, typical construction equipment will be used (such as bulldozers and trucks). 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 via Highway 16, connecting to Trans Canada Highway 104 at Monastery. Power poles will be erected using typical equipment, including a boom truck for the installation of the power lines and communication cables. If there is soil (not rock) in the lay-down areas used for storage of turbine parts adjacent to the turbine foundations, the soil will be aerated and loosened to counteract the compaction caused by the equipment. The vegetation will be allowed to return to its natural state.

If the potential turbine locations 6d-8d are chosen, access will be along the dirt road to Glasgow Head. There is no infilling planned for this road. No beach area will be incorporated into the road. Should the road need widening of the shoulder, it will be performed on the Turf Bog Side of the road.

Operation of the wind farm will begin with the commissioning of all turbines, after all of the turbines have been erected. The lifecycle of the project is expected to be at least 25 years and may be longer. At the end of the lifecycle, further advances in technology may justify the replacement of critical components to modernize or even expand the output rating of the initial machines.

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. Re-grading 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.

De-commissioning of the wind-farm would require de-installation and removal of all steel-based components and machinery from the site. The access roads would remain, if the landowners so desired. The gathering-up lines and control building would be removed. 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 will be 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, removed off-site and deposited in a licensed facility. 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. 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.

Off-site land use would be limited to the right-of-way for a power line from the wind-farm control house to the grid interconnection.

2.7.1 Timing/Schedule

Pre-construction:	
Feb. 24, 2005	Open House in Canso
Winter 2006	Geotechnical survey
Construction:	
Spring 2007	Clearing and grubbing (Note: there won't be any clearing between May and August)
Summer/Fall 2007	Construction of the access roads and turbine pads: blasting, grading fill, etc.
	Assembly and erection of all turbines; installation of electrical collection system; installation and commissioning of the SCADA communication system.
	Construction of the substation and control building; upgrading the transmission lines to the NSPI substation in the Town of Canso.
Fall 2007	Energizing the turbines, including electrical testing (0.5-1 week per turbine; 2 weeks for the substation).
Operation:	
Fall/Winter 2007	Start of operations (24hrs/7days/week)
Once a year	Maintenance of the turbines: exchange of the transmission oils in the turbines: two weeks
Yearly	Maintenance of the access roads

2.7.2 Water Course Crossings

Winter Creek will be crossed using a culvert, since the stream is shallow (average depth 20 cm +/-10 cm) and has an average wet width of 1-1.50 m. The substrate is predominantly comprised of cobble/rubble and gravel materials with some embedded fines.

Based on the calculated drainage area, the culvert should have a 72'' or equivalent square section to accommodate a 10-year storm event. In order to achieve the effective height, it is planned to use multiple lines, i.e. two to three culverts side by side, with one section providing the complete span over the normal bank. The culvert will be re-enforced concrete in order to be able to carry the loads. The culvert will be 11 –13 m long, in order to accommodate the width of the proposed access road (10 m) and the slopes. Depending on the results of the geotechnical and topographic investigation, which still have to be carried out, and detailed design calculations, the culvert design may have to be adjusted. For example, the length may have to be increased a little if the road has to be built up over the culvert to prevent slope that are too steep for the transport vehicles. The culvert is expected to have a slope of 0.5 % or less, since the terrain is quite flat. Should the culvert slope need to exceed 0.5%, baffles will be placed into the culvert to ease fish passage.

During the construction of this crossing, the water of the stream will be diverted around the construction site by temporary culvert. Silt fences and hay bales will be utilized at the downstream location to ensure that downstream areas are not affected by the new water crossing. The sequence of construction steps will be: the temporary culvert will be installed, followed by the siltation control. The stream will then be diverted by damming the existing stream at the upstream location. The new permanent culvert will be installed and the stream will be routed back to the original location. This would take approximately three to five days. Installation will likely be in summer 2007, depending on approval of the EIS report by NSDEL and NRCAN.

Since no fish are present in the stream (Section 4.5), there is no requirement for construction of structures intended to accommodate fish, such as fish ladders. However, during construction of the road crossing and culvert, measures will be taken to prevent sand or silt from entering the stream and being carried downstream.

2.8 RESOURCE AND MATERIAL REQUIREMENTS

Each turbine is a manufactured machine, consisting of approximately 100 tons of steel and fibreglass blades. It will be assembled on site from prefabricated components and erected using a heavy lifting crane. Each turbine would have a gravity-based steel-reinforced concrete foundation poured-in-place in earth excavations roughly 2 metres deep below grade. The concrete would be mixed offsite and transported to the turbine locations. Where conditions require, rock anchors will be used for anchoring the turbines.

The power collection system consists of wooden poles, standard insulators, and wires consisting of manufactured copper with plastic insulation material. The control building and substation would be placed on a slab-on-grade concrete floor, with a four-foot frost wall as foundation, and a pre-engineered steel-frame and brick veneer exterior. The building will be heated, but is expected to have no water supply. If a water source is necessary, it will be a well. The substation will contain electrical substation equipment.

Suitable excavated material (i.e. glacial till) would be used on-site for road-building purposes. While subbase material should be at mass balance, it is expected that about 1350 tons of fill/gravel (i.e., 75 % of total) will have to be trucked in from existing quarries off-site for the topcoat. Geotextile may be used where necessary.

Since concrete and crushed rocks are trucked in, onsite rock, energy and water are not required.

2.9 WASTE DISPOSAL

General construction waste is anticipated during the construction stages of the project. The contractors onsite will be required to implement a solid/hazardous waste management plan during construction to minimize the waste generated and to re-use non-hazardous waste onsite if possible (i.e. grubbing and excavation materials). Those materials that cannot be re-used will be removed from the site and disposed of properly.

During the operational phase of the project, typical waste generated would include failed equipment, packaging materials, and other materials associated with maintenance of equipment. Those waste materials generated will be removed from the site by service technicians and disposed of properly.

2.9.1 Oil Wastes

The only known hazardous materials on-site continually during the operational phase will be transmission oil used in the transmissions of each turbine nacelle, and cooling oil in the transformers. The capacity of the oil in the nacelles is roughly 300 litres, which will be carefully replaced each summer. All waste transmission oil will be safely stored and removed off-site for safe disposal at commercially available certified facilities. This is part of the standardized operation and maintenance procedures of Good Utility Practice.

The exchange of the cooling oil in the transformers is not expected. Each turbine site will have a small 2 MVA oil insulated power transformer installed on a slab-on-grade concrete base adjacent to each tower. The oil normally is mineral oil, but "enviro-oil" can be used (which is a vegetable oil designed for electrical insulating systems). Volume of oil in each 2MVA transformer will be approximately 2000L. The main step-up transformer will also be oil-filled and will contain approximately 15,000L. Transformer oil spill containment is not normally provided except for very sensitive sites. However, the main transformer will have oil level monitoring instrumentation for protection purposes; the smaller 2MVA transformers at the tower bases will have liquid level gauges on the tank walls for monitoring status. If oil spill containment is required, it can be designed into the slabs accordingly.

Electrical insulating oil for transformers is sampled regularly and treated if regeneration is required but rarely replaced. If replacement is required, it would be carried out under strict control through a certified oil treatment contractor, who would also be required to remove the replaced oil from the site.

Maintenance of vehicles and heavy machinery during all phases of the project will be performed offsite whenever possible, thus not resulting in hazardous waste on-site. If an oil change onsite cannot be avoided, the waste oil will be carefully collected and removed from the site.

Oil spill kits will be onsite to remediate any accidental spills of oil during the operation of heavy equipment, such as hydraulic oil.

2.9.2 Other Hazardous Waste

During the operation, the tubular steel towers may occasionally need repainting or paint patching. Any remnants of paint and solvents will be removed off site and disposed of at specialized facilities. No paint will be stored on the property.

3.0 SCOPE AND METHODOLOGY OF THE ASSESSMENT

3.1 SCOPE OF THE PROJECT

The scope of the projects includes "those components of the proposed development that should be considered part of the project for the purposes of the Environmental Assessment (Natural Resources Canada, 2003, WPPI)). The scope of the project is determined by the responsible authorities.

3.2 ENVIRONMENTAL ASSESSMENT METHODOLOGY

An Environmental Assessment (EA) 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:

- Describing the project and establishing environmental baseline conditions;
- Scoping the issues and establishing the boundaries of the assessment;
- Assessing the potential environmental effects of the project, including residual and cumulative effects;
- Identifying potential mitigative measures to eliminate or minimize potential adverse effects; and
- 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 EA. 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 EA focused on the evaluation of potential interactions between project components and activities on the one side, and Valued Ecosystem Components (VECs) that were identified through an issues scoping process on the other side.

Two approaches were taken to identify the potential VECs. First, those parameters for which provincial or federal regulations are in place were identified. The second approach used for the identification of VECs involved a scoping exercise based on experience gained during other comparable environmental assessments; consultation with the public and the scientific community, supplemented by available information on the environment surrounding the proposed project; and the technical and professional expertise of AMEC. During the scoping process, "all relevant issues and concerns related to the proposed project and assessment are identified and prioritized" (Natural Resources Canada, 2003 (WPPI)).

For the purpose of this EA, 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 (Natural Resources Canada, 2003, WPPI).

The assessment of the potential effects of the environment on the Project, including extreme weather events, was conducted during the Project design phase. Any mitigative 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 involved 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 construction activities (Fall 2005 to Spring 2006) 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.

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 Town of Canso 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 ISSUES SCOPING AND VEC SELECTION (SCOPE OF THE ASSESSMENT)

This part of the environmental assessment serves to identify those environmental components that are likely to be affected by the project.

The potential interactions between project components or project activities and environmental components of concern (ECC), specifically Valued Ecosystem Components (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. During the scoping process, "all relevant issues and concerns related to the proposed project and assessment are identified and prioritized" (Natural Resources Canada, 2003 (WPPI)).

Consultations with stakeholders (e.g. regulators and the public) as well as the scientific community, are part of the issues scoping process and help in the identification of VECs. The other approach to VEC selection is based on experience gained during other comparable environmental assessments, available information on the environment surrounding the proposed project, and the technical and professional expertise of AMEC.

Protected by statute are:

- Fish and fish habitat (*Fisheries Act*)
- Migratory birds (*Migratory Birds Convention Act*)
- Species at Risk (*NS Endangered Species Act*, *NS Wildlife Act*, *Canadian Species at Risk Act*)
- Structures or historic sites of national interest (*Historic Sites and Monuments Act*)

In addition, there is the Federal Policy on Wetland Conservation, protecting wetlands.

3.5 CONSULTATION PROGRAM

BWEL (Barrington Wind Energy Limited) has conducted a program of public consultation and early public notification. This program consisted of a public open house session and contact with the landowners, representatives of relevant regulatory agencies and First Nations groups. The objectives of the program were to:

- provide an opportunity for the public to have meaningful input into key decisions with respect to project development, including the site selection process;
- provide sufficient information about the project to the public in a timely fashion to enable them to respond effectively to the development options being presented to them;
- obtain environmental and socio-economic information from those most familiar with the area to enable the identification of constraints which may affect site selection;
- identify issues and concerns of those potentially affected by the Project; and
- establish communication between BWEL and stakeholders.

The following sections outline the components of the consultation process that has been undertaken as part of the Project development.

3.5.1 Regulatory Consultation

AMEC and the Proponent have consulted with representatives from several 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 results of these consultations are noted in Table 3.1.

3.5.2 Public Consultation

The Proponent has conducted a program of public consultation and early public notification. The program consisted of contacts with landowners, constant communication with representatives of the Town of Canso, and a meeting with Town Council, followed by a public information session in the Town Hall to notify the public in early summer 2004 and get feedback from the community. The most recent program point was a Public Open House conducted as part of BWEL' s preparation of the CEAA Environmental Impact Statement document.

On February 24, 2005, Barrington conducted an open house session as part of the public notification process for the proposed Facilities. Barrington placed an advertisement in the provincial edition of the Halifax Chronicle Herald and in a local newspaper, the Guysborough Journal, on February 8, 2005, notifying the public about the upcoming open house session to discuss the proposed project. The open house was conducted at the Fire Hall in the Town of Canso, NS, from 12 am to 8 p.m.

The goal of the open house was to:

- Identify issues and concerns of those potentially effected by the project.
- Address concerns through discussions or potentially through project design adjustments.
- Obtain environmental and socioeconomic information from those most familiar with the area to enable the identification of constraints which may affect site selection (besides the information gathered from local residents during the field surveys)
- Provide sufficient information about the project in a timely manner to enable the public to respond effectively to the EIS document when it is presented during the public participation period in the EIA process.
- Inform the public about the EIA process and the opportunity for public comments.

Barrington provided the following information at the open house:

- Photos of typical turbines similar to the ones to be used at the Canso Wind Farm;
- A video presentation showing the construction of turbines;
- Numerous photos of the turbine construction;
- Information on the turbines, such as weight and size of the components;

TABLE 3.1 Regulatory Consultation Results

Contact	Means of Consultation	Issues or Concerns
Ralph Heighton, NS Dept. Agriculture and Fisheries	Email, Jan. 14, 2004	• Provided information requested by AMEC, regarding records for rare fish species distribution in NS.
Reg Sweeney, DFO, Habitat Management Division	Email, Jan. 15, 2004	• Provided information requested by AMEC, regarding fish records
Bill and Ken Ehler, Local fisheries officers	AMEC left several phone messages	• No reply
Robert Ogilvie, NS Museum	Fax on Jan. 21, 2004	• Provided information requested by AMEC, regarding Cultural and Natural Heritage • Mr. Ogilvie indicated that the site has an elevated potential for the presence of Aboriginal archaeological sites. • Potential for significant Post-Contact Period archaeological Sites cannot be determined without further analysis. • He stated that an archeological assessment is necessary prior to any surface disturbance, and provides instructions on how it should be done. • Mr. Ogilvie provided lists of known plant and bird species of concern likely to occur at the site, and pointed out that field surveys for these plants should be performed at the appropriate times for positive identification of the species. • He pointed out that bat species may be impacted by the wind generators if the generators produce sound in the ultrasonic range, specifically 20-60 KHz.
David Williams, NSDEL, Protected Areas Coordinator	Email, Jan 21, 2004	• Concerned with environmental impacts of the proposed wind farm, particularly on birds: injury/death, disturbance of migration patterns, impacts on rare species; • Also concerned about: noise, toxic substances, fire, invasive species, herbicides, vehicle watercourses and drainage patterns, wildlife-vehicle collisions, airborne pollutants and alterations to movement of organisms
Stefan Gerriets, ACCDC	January 8, 2004	• Provided information requested by AMEC on rare taxa and significant habitats in a 10 km radius around the study site.
Andrew Hicks, CWS	Email January 12, 2004	• Provided information requested by AMEC • Provided information of known birds species in the Canso area, based on waterfowl surveys carried out by CWS between 1990 and 2003
Andrew Boyne, CWS	Email January 12, 2004	• Provided information requested by AMEC • Provided information on waterfowl
Joan Reid, DFO	Meeting of proponent with Regulators, May 5, 2004 - participated by phone	• Based on the draft project description she did not expect that a HADD is necessary. Standard avoidance and mitigation should negate need for HADD, especially if instream work is done at the right time of the year. However, should the project description change to include marine construction for the shipment of turbine components, “a HADD may be required.”

TABLE 3.1 Regulatory Consultation Results

Contact	Means of Consultation	Issues or Concerns
Kevin Blair, Environment Canada	Meeting of proponent with Regulators, May 5, 2004	• Concerned about wetlands, fauna and flora species, habitats. • Suggested to provide document with the proposed methods to EC (CWS) for review. • Based on draft project description, EA is unlikely to be required; if project description is changed to include marine dredging, EA may be required for disposal at sea authorization under CEPA. • Concerned about migratory birds, wildlife at risk, bats, their habitats, including wetlands - supplied preliminary recommendations on assessment scooping
Heather Barton, Heritage Canada	Meeting of proponent with Regulators, May 5, 2004	• Interested in archaeological information, particularly because of the proximity of Grassy Island National Historic Site.
Melinda Donovan, Transport Canada	Conversation prior to the May 5, 2004 meeting	• Indicated that an EA would likely be required under the Navigable Waters protection act; need to contact TC directly to discuss application for authorization
Derek MacDonald, CEAA	Meeting of proponent with Regulators, May 5, 2004	• Suggest the “NRCan Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms” as guide to the scope of the project.
Cheryl Benjamin, CEAA	Meeting of proponent with Regulators, May 5, 2004	• Committed to drafting a Harmonization Agreement and circulate it to the parties to the EA (NRCan, TC, NSEL, possibly DFO). The agreement will be prepared and finalized concurrently with the preparation of the EA.
Helen MacPhail, NSEL	Meeting of proponent with Regulators, May 5, 2004	• Stated that the proponent must contact mandated departments (e.g. NSDNR) regarding timing and methods for the field surveys such as for rare fauna and flora
Iannick Lamirande, Natural Resources Canada	Meeting of proponent with Regulators, May 5, 2004-	• Suggested that info regarding bird survey methods etc be circulated through the FEAC to ensure it goes on registry”
Rachel Gautreau, CWS	Email, July 8, 2004	• Concerned about birds, especially migratory birds. • Provided draft document “Wind Turbines and Birds - A Guidance document for Environmental Assessment” • States that the field surveys should be carried out according to the rules for medium sized wind farms (11-50 turbines), even though the Canso project would qualify as a small wind farm (1-10), due to the importance of the area for birds
Rachel Goutreau, CWS	Email on July 8, 2004	• Concerned about migratory birds. • Provided “Baseline information requirements for Evaluation of Effects of Wind Power Facilities on Migratory Birds in Canada” • Since the Canso site contains some turbines very close to the coast, CWS also expects information on the movements of waterbirds and waterfowl in the area (i.e. whether birds currently fly over the proposed wind turbine locations) under different weather conditions and during different, in addition to the information requested in this document.
Mark Elderkin, NSDNR	Consultation by email October 11, 2004	• He states that the Arctic Fritillary butterfly, listed yellow in NS, does not occur in the Canso area, In addition, it has not been seen in Nova Scotia for over 50 years; it may be re-assessed as “undetermined” after the next review. • He noted that this species is not likely to be a conservation concern for the project.

TABLE 3.1 Regulatory Consultation Results

Contact	**Means of Consultation**	**Issues or Concerns**
Andrew Hebda, NS Museum	Email, Nov. 1, 2004	• There is no information available on the Arctic Fritillary butterfly. Mr. Hebda refers to the website: Butterflies of Nova Scotia.
Mark Elderkin, NSDNR	Email Dec. 9, 2004,	• Concerned about the assessment of rare species; • Mr. Elderkin forwarded a copy of the following document to be followed during the EA: Standards and Process Applied to Provincial Impact Assessments: Wild Species Priorities, Inventory and Mitigation Standards for Reporting
L. Benjamin, M. Pulsifer, T. Power, NSDNR	Emails on Jan. 4, 2005, March 15, 2005; April 21, 2005; April 22, 2005	• Identification on Significant Habitat WLD numbers for Guysborough County and Cape Breton.
Dan Busby, CWS	Email Feb. 3, 2005	• Outline of aspects of pre- and post- construction monitoring, referring to draft document "Wind Turbines and Birds - A Guidance document for Environmental Assessment"
Rick Fleetwood, Environment Canada	Email March 4, 2005	• Provided information on fog and ice conditions in Canso, upon request
Gerald Morin, Environment Canada	Phone call, March 4, 2005	• Provided information on fog and ice conditions in Canso, upon request
Fran E. Cesare, NSDEL	Email, March 10 and 11, 2005	• Provided Nova Scotia air quality data upon request
Transport Canada	Phone call, April 28, 2005	• TC Nova Scotia provided information on the "aeronautical obstruction clearance form" which will detail the turbine lighting requirements.
Transport Canada	Phone call, April 28, 2005	• B. Grant (TC, Ottawa) provides a summary of the current and new regulations and standards, as well as an explanation for the decision making process when deciding what lighting is required.
Andrew Hebda, NS Museum	Email, May 16-17, 2005	• Information on bat species distribution and behaviour

- Several photos of computer simulations of the turbines in the landscape, including views from the Town of Canso;
- A map indicating the proposed locations of the turbines;
- Noise modeling;
- An outline of the Environmental Assessment process;
- An outline of the public participation process and opportunities;
- A list of the archaeological and environmental field surveys which have been conducted;
- A map showing environmental constraints identified during the environmental and archaeological field surveys.

Thirty four (34) members of the public attended the public Open House session. Names and contact information are available on request. The attendees had the opportunity to ask questions of Barrington representatives, EastPoint Engineering Ltd. staff, a representative of the construction company, as well as the Environmental Consultants from AMEC Earth & Environmental, who were in attendance at the session.

The majority of participants came to gain information on the project and on the progress of the project development. Few participants had particular concerns about the project. The issues raised and the responses of the proponent are noted in Table 3.2. In addition, one participant commented positively on the innovativeness of the energy production, and the fact that Canso was chosen as location. Most participants openly expressed support for the project, including the people concerned with noise or visual impacts. The participants of the Open House did not voice opposition to the project. Several people were interested in the employment opportunities provided by the project. Several people hoped that this project would be the start of Canso's economic recovery.

TABLE 3.2 Comments Received and Addressed Through the Open House Session

Question/Concerns/Comments	**Response**
Noise from the Turbines (several enquiries)	Explanation of the noise modeling graphs, with examples of noise levels people have experienced in everyday life.
Visibility of the turbines and look of the landscape (several enquiries)	The computer simulations were pointed out and explained.
Employment opportunities (several enquiries)	Referral to the representative of the construction company
Amount of energy produced per turbine (1 enquiry)	Comparison of the amount of energy produced by one turbine with the energy needs of the Town of Canso.
Start of the project implementation (1 enquiry)	Fall 2005

3.5.3 Consultation with First Nations

Consultations with First Nations representatives were carried out as part of the Heritage Resource investigation. The First Nations Bands at Chapel Island and Escasoni did not voice any direct concerns for First Nations sites in the Study area (see Section 4.6).

3.6 SELECTING VALUED ECOSYSTEM COMPONENTS (VEC)

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.

Based on this information, a preliminary list of environmental and socio-economic components of concern (ECCs and ESCs) was developed, and the Project VECs were selected (Table 3.3).

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 analysis.

ECCs with existing federal or provincial environmental regulations, such as endangered species and migratory species, are all of concern and were selected as VECs. Other potential VECs were identified during the scoping exercise. Issues that regulators were concerned about were also selected as VECs, e.g. most birds were of concern for CWS due to the coastal location of the project. In addition, any issues raised by the public, as well as most ECC with an existing pathway, have been selected as VEC. If not, the exclusion is explained.

The 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 and VSCs (valued socio-economic components):

- Bedrock geology (Acid Rock Drainage)
- Air quality
- Birds
  - Breeding birds, migratory birds, shore birds, etc
- Species at Risk
- Wetland (habitat and function), including:
  - Loss of wetland function
  - Loss of habitat for flora and fauna
- Aesthetics: quiet enjoyment of the area (Noise impacts)
- Aesthetics: visual impacts
- Health and Safety/Accident prevention
- Economy, including:
  - Local job creation, tax income

In addition to these VECs, the ECCs 'fish and fish habitat', as well as 'archeological resources' (protected by statute), were considered VECs until field surveys revealed that:

- there are no fish in WinterCreek, and
- archeological resources are located outside the turbine and access road sites.

The field surveys were carried out as part of the environmental baseline description. Therefore, these ECCs are included in the baseline description (Section 4), but excluded from the Impact Assessment (Section 5).

TABLE 3.3 Issues Scoping: Summary of VEC/VSC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site/Route Selection		VEC/VSC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC/VSC)
		Yes	No	Yes	No	Yes	No		
Environmental Setting:									
Geophysical Environment	Bedrock Geology - acid rock drainage	X			X	X		Construction: clearing and grubbing, excavation and blasting	Included as a VEC - potential effects on Winter Creek and salt marsh
Atmospheric Environment	Air quality standards: • Ambient air (Human Health and Safety)	X			X	X		Construction and transport equipment, construction, turbines, transformers: air emissions (exhaust fumes, leaks, vapour), dust	Included as a VEC - protected by statute/regulation (SO_2, NOx, PM; CO, (HC). Though minor quantities will be produced for short time during construction of project, the project implementation may have positive impact.
	• Ozone layer (Ozone Depleting Substances)		X				X	Air emissions (leaks, vapour) not likely,	Excluded as a VEC – no pathway. No ozone depleting substances generated during Project activities.
	• Greenhouse gases/global climate change	X					X	Construction and transport equipment: emissions	Excluded as VEC - included with air quality
Terrestrial, Wetland, Aquatic Environment a) Species and Habitat	• Plants	X			X		X	<u>Construction/decom:</u> clearing and grubbing, excavation, blasting, equipment: Noise, air emissions (exhaust), introduction of non-native and invasive species, habitat destruction and fragmentation <u>Operations</u>: wires, turbines, buildings, transformer, power/cable poles: Collisions, lights, noise, ice throw, toxic leaks (fuel spills, transmission oil, transformer oil, poles, road maintenances, Habitat	Excluded as a VEC – Populations of these species are protected/included with other VECs (wetland habitat, critical habitat features, species of special status).
	• Wildlife (mammals, reptiles and amphibians, invertebrates)	X			X		X		Excluded as a VEC – Populations of these species are protected/included with other VECs (wetland habitat, critical habitat features, species of special status).

TABLE 3.3 Issues Scoping: Summary of VEC/VSC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site/Route Selection		VEC/VSC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC/VSC)
		Yes	No	Yes	No	Yes	No		
	• Wildlife: birds	X			X	X		destruction and fragmentation	Birds: included as VEC - all birds breeding in or migrating through the project area are considered to be a VEC, due to the potentially long-term impact by the infrastructure, and concerns expressed by CWS
	• Habitat (except wetland)	X			X		X	Construction of road and turbine pads: clearing, grubbing, excavation: habitat destruction and fragmentation, introduction of invasive species. Operations: poles, turbines, transformer: toxic leaks	Excluded as a VEC - Included with other VECs (birds, Species of Special Status)
	• Species of Special Status (flora & fauna)	X		X		X		Construction/decom: clearing, grubbing, excavation, blasting, equipment: noise, air emissions; introduction of non-native and invasive species; habitat destruction and fragmentation Operations: turbines, wires, poles, transformer: collisions, noise, lights, ice throw, toxic leaks	Included as a VEC – Protected by statute/regulation. If a species is endangered, effects on individuals may be considered significant.
	• Nesting and Breeding Sites	X		X			X	Construction: clearing, grubbing, excavation, blasting. Operations wires, turbines, buildings, transformer, power/cable poles: collisions, lights, noise, toxic leaks (fuel, transmission oil, transformer oil, poles, road maintenance	Excluded as a VEC – included with other VEC (birds), avoided during site selection
	• Significant Habitat	X			X		X	All	Excluded as a VEC – included with other Species of Special Statues, wetlands). Represents potentially limiting habitat to populations of wildlife.

TABLE 3.3 Issues Scoping: Summary of VEC/VSC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site/Route Selection		VEC/VSC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC/VSC)
		Yes	No	Yes	No	Yes	No		
	• Ongoing Management Initiatives (e.g. permanent forest sample plots)		X				X	--	Excluded as a VEC – no such areas in the project area
b) Terrestrial Environment	• Soil Quality (physical, chemical, biological)		X		X		X	<u>Construction/decom</u>: clearing, grubbing, excavation, equipment: toxic leaks, spills; soil compaction, soil erosion. <u>Operations</u>: turbines, poles, transformers, equipment: toxic leaks and spills	Excluded as a VEC – included with other VECs (wetlands, accidents and malfunctions, etc.
c) Wetland Environment	• Wetland	X		w.p.		X		<u>Construction/decom</u> : clearing and grubbing, excavation, equipment: silt run-off, infilling; fuel spills. <u>Operations:</u> turbines, poles, transformers, equipment: toxic leaks and spills; habitat destruction and fragmentation	Included as a VEC – Protected by regulatory authorities (Federal no net loss in wetland function policy)
d) Aquatic Environment	• Fish Species*	X				X		Construction/decom.: water course crossing;	Included as a VEC – but no fish present in Winter Creek
	• Fish Habitat*	X		X		X		Construction/decom: water course crossing: sedimentation, habitat destruction	Included as VEC – but no fish in Winter Creek, method of constructing stream crossing will avoid sediment transport into Chapel Gully
	• Sediment quality	X		X			X	Construction/decom: water course crossing	Excluded as VEC - avoided through mitigation measures listed in wetlands
e) Surface and Ground water	• Ground Water Quality and Quantity	X			X		X	<u>Construction/decom</u> :clearing and grubbing, excavation, blasting, equipment: leaks and spills (fuel, transmission oil, transformer oil) <u>Operations:</u> turbines, poles, transformers, equipment: toxic leaks and spills	Excluded as VEC - no receptors; limited potential of interaction (accidents, leaks); spill kits for emergencies
	• Hydrogeology	X			X		X	<u>Construction</u>: excavation, blasting, equipment	Excluded as a VEC – included with VEC wetlands, bedrock geology

TABLE 3.3 Issues Scoping: Summary of VEC/VSC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site/Route Selection		VEC/VSC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC/VSC)
		Yes	No	Yes	No	Yes	No		
	• Surface Water Quality and Quantity	X			X		X	Construction/decom: clearing and grubbing, excavation, blasting, equipment: water course obstruction, siltation/run-off Operations: turbines, poles, transformers, equipment : toxic leaks and spills (fuel, oils)	Excluded as a VEC – Protected/included with other VECs (wetland habitat, fish habitat, species of special status, and groundwater resources).
	• Hydrology	X			X		X	Construction/decom: clearing and grubbing, blasting, equipment: watercourse obstruction	Excluded as a VEC – Protected/included with other VECs (fish habitat, wetlands).
	• Interaction with surface drainage	X		X			X	Construction: excavation, roads, pads, stream crossing; Operations: roads, pads	Excluded as a VEC - included in other VECs (wetlands)
	• Watercourse alteration	X		w.p.			X	Construction of access road	Excluded as VEC - no fish; disruption is very short term due to culvert construction
Socio-Economic Setting:									
Economy	• Local Economy (expenditures, local business and employment)	X			X	X		Construction/decom.; Operations & Maintenance	Included as a VSC – No adverse effect - Potential to increase beneficial effects of local construction, operational expenditures and employment; public concern.
	• Access to Property	X					X	--	Excluded as a VSC – access to property will not be lost
Land Use	• Industry/Commercial								
	- local business		X				X	--	Excluded as a VSC - no such land use in project area
	• Institutional facilities (proximity)								
	- hospitals/nursing homes	X					X	Construction/decom. clearing and grubbing, excavation, blasting, equipment: noise, air emissions, dust Operations: turbines, wires: noise, shadow flicker	Excluded as a VSC – included with other VECs (Health and Safety, Quiet Enjoyment of the area (Noise).

TABLE 3.3 Issues Scoping: Summary of VEC/VSC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site/Route Selection		VEC/VSC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC/VSC)
		Yes	No	Yes	No	Yes	No		
	- churches	X			X		X	Construction/decom. clearing and grubbing, excavation, blasting, equipment: noise, air emissions Operations: turbines, wires: noise	Excluded as a VSC – Access and safety identified elsewhere.
	- schools	X			X		X	Construction/deco.: vehicle traffic: exhaust, noise, dust, safety	Excluded as a VSC – Access & safety identified elsewhere.
	- cemeteries		X				X	--	Excluded as a VSC – not in project area.
	• Residential	X		w.p.			X	Construction/decom: clearing and grubbing, excavation, blasting, equipment: noise, air emissions, dust Operations: turbines, wires: noise, toxic leaks/spills; shadow flicker,, ice, breakage	Excluded as a VSC – Included with other VSCs (health and safety; quiet enjoyment of the area)
	• Recreational								
	- parks		X				X	--	Excluded as a VSC – No pathway of concern.
	- trails	X		X			X	Construction/decom: clearing and grubbing, excavation, blasting, equipment: noise, air emissions, dust, access Operations: turbines, road, wires, poles: noise, ice, toxic leaks/spills, access to/displacement of trail, view, ice, breakage,	Excluded as a VSC – Included with other VSCs (health and safety, quiet enjoyment of the area)
	- cottages	X			X		X	Construction clearing and grubbing, excavation, blasting, equipment: noise, air emissions, dust, access Operations: turbines, wires: noise, ice, breakage, access, toxic leaks/spills	Excluded as a VSC - cottage not used any more (owner information)
	- tourism infrastructure (trail)	X					X	Construction/decom and operations: access to trail, noise, view	Excluded as a VSC - included with other VSC (quiet enjoyment of the area)
	- hunting and fishing	X			X		X	Construction/decom: noise, operations: access	Excluded as VSC - minor interaction and few receptors; no fishing in project area

TABLE 3.3 Issues Scoping: Summary of VEC/VSC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site/Route Selection		VEC/VSC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC/VSC)
		Yes	No	Yes	No	Yes	No		
	• Aesthetics: Visual Resources	X		w.p.		X		<u>Operations</u>: Turbines, transformer building: visually displeasing, noise, lights	Included as a VSC - public concern
	• Aesthetics: Quiet Enjoyment of the area	X		w.p.		X		<u>Construction/decom.</u>: Noise <u>Operation</u>: Noise	Included as a VSC - Public concern
Infra-structure	• Public/Private Utility		X				X	--	Excluded as a VSC – no pathway identified
	• Municipal Water/Sewer/Sewage Treatment Plant/Storm Sewer		X				X	--	Excluded as a VSC – no pathway
	• Traffic	X			X		X	<u>Construction/decom.</u>: fill and turbine transport	Excluded as a VSC – included with other VSC (Health and safety)
	• Municipal Infrastructure/Roads	X			X		X	<u>Construction/decom</u>: fill and turbine transport, heavy lifting equipment: weight damage	Excluded as a VSC – no pathway of concern
	• Water Supply Areas (and aquifer recharge)		X	X			X	<u>Construction/decom and operations</u>: equipment, turbines, transformers, poles: toxic leaks/spills (fuel, oils)	Excluded as a VSC – no receptors (no wells, no water flowing towards the water supply lake)
	• Landfill Sites		X	X			X	Non-toxic construction waste	Excluded as a VSC – No pathway of concern; excluded through waste management practices;
Natural Resources (Renewable and Non-Renewable)	• Agriculture, forestry		X				X	--	Excluded as a VSC – No such land use in project area
	• Fisheries (commercial, recreational, and Aboriginal)		X				X	--	Excluded as VSC – though protected by statute/regulation, there are no fisheries in the project area.
	• Mines, Quarries, Pits, Peat Bogs & Claims,		X				X	--	Excluded as VEC - No such land use in project area
Archaeological and Heritage Resources, Culture	• Archaeological/Heritage Resources*		X	X		X		<u>Construction/decom.</u> clearing and grubbing, excavation, blasting: surface disruption	Included as a VSC – but field surveys showed no such resources in the project foot print
Aboriginal Interests	• Burial sites, religious sites • Fishing and hunting		X				X	--	Excluded as VSC - No such aboriginal interests

TABLE 3.3 Issues Scoping: Summary of VEC/VSC Selection and Pathway Analysis

Environment/ Resources	Environmental/Socio-Economic Components of Concern (ECC)	Pathway		ECC Avoided During Site/Route Selection		VEC/VSC		Interactions with Project Activities/Components and Possible Pathways	Rationale for Inclusion/Exclusion as Valued Environmental/Socio-Economic Component (VEC/VSC)
		Yes	No	Yes	No	Yes	No		
Community and Emergency Services	• Emergency Services	X					X	Construction/decom.; Operation: Accidental Events	Excluded as a VSC – Accidental Events - Included wit h other VSCs (Heath and Safety; Accident and Malfunctions)
	• Safety/Accident Prevention	X				X		<u>Construction/decom, operation</u>: traffic, turbines: collisions, ice, breakage	Included as a VSC – Safety concern.
	• Hazardous waste	X					X	<u>Construction/decom., operation</u>: toxic waste and leaks: fuel and oils (transformer, transmission)	Excluded as VSC - included with other VSC (Health and Safety); best management practices

Notes: w.p. = where possible

3.7 PREDICTING ENVIRONMENTAL EFFECTS

In the Canadian Environmental Assessment Act (CEAA, 1994 (2005)), "Environmental Effect" means

- any (direct) change that the project may cause in the environment
- any effect of this change to the environment on:
  - health and socio-economic conditions,
  - physical and cultural heritage,
  - current use of lands and resources for traditional purposes by aboriginal persons,
  - any structure, site or thing that is of historical, archaeological, paleontological or architectural significance;
- any change to the project caused by the environment.

Only environmental changes as defined above (CEAA) will be considered when determining the significance of the effects.

Methodologies used in the identification and assessment of impacts may be specific to each discipline. They can be grouped in the following categories:

- Review of published literature;
- Interviews with resource persons and knowledgeable individuals;
- Stakeholder consultations; and
- Formulation of impact hypotheses and linkages for each VEC deemed to be vulnerable to impact from project activities.

Predictions are based on a combination of objective (measurable) and subjective (deduced) experience based on professional judgment and evaluation. Impacts are assessed using a defined impact rating as discussed in Section 3.8.

Reference to environmental assessments undertaken for similar projects is a useful method of checking the spectrum and intensity of anticipated impacts. Comparative analysis can be used to prepare checklists and to draw analogies.

The assumptions made when determining the significance of effects, and the uncertainty that surrounds the prediction will be outlined during the assessment (Section 5).

3.8 RATING IMPACT SIGNIFICANCE

The Reference Guide "Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects" (CEAA, 1994) provides the framework for responsible authorities to decide whether a project is likely to cause significant adverse environmental effects under CEAA. Only environmental changes as defined above (CEAA) will be considered when determining the significance the effects (CEAA, 1994). As stated in the Reference Guide, the concept of significance is extremely important in the Act "to ensure that projects that are to be carried out in Canada or on federal lands do not cause significant adverse environmental effects outside the jurisdiction in which the projects are carried out."

A common scale of reference for rating an impact is needed to compare the relative importance of various environmental effects. An impact is defined as "the change effected on one or more of the VECs as a result of project activities". It affects specific groups, populations or species, and results in the state of the VEC being modified in terms of an increase or decrease in its nature (characteristics), abundance, or distribution. Impacts are categorized as negative (adverse) or positive.

The scoping exercise used to describe the VECs (including definition of spatial and temporal bounds) included an element of likelihood of interaction between the VEC and project activities. The focus of the environmental assessment is, therefore, on these interactions. The following considerations have been applied when evaluating the significance of potential impacts on the VECs:

- The geographic extent - the area affected;
- Duration - the length of time that the impact will be experienced;
- The magnitude - the fraction of the population or the resource base that will be affected; and
- The sensitivity and the ability of the VEC to recover.

The framework for determining whether environmental effects are adverse, significant, and likely, consists of the following steps (CEAA, 1994/2005):

- Determine whether the environmental effect is adverse;
- Determine whether the adverse environmental effect is significant or, in other words, determine the impact rating; and
- Determine whether the significant environmental effect is likely (i.e. the probability of occurrence of significant adverse environmental effects).

The key words in this section are "adverse," "significant," and "likely." Although these terms are not directly defined, the Reference Guide provides criteria to facilitate their interpretation as shown in Table 3.4. Each step listed above is connected with a set of criteria.

Based on these criteria, where significant adverse effects are likely, mitigation or intervention on the part of the Proponent is required. Effects that are not considered adverse likely require no mitigative response. If residual impacts remain after the application of mitigation, these impacts need to be assessed for significance.

Determination of "significance" should also consider scientific determinations, social values, public concerns, and economic judgments. Significance is assessed in two ways:

- Where available/applicable environmental standards, guidelines, and objectives are used to assess significance; and

- Where environmental standards, guidelines and objectives are not applicable, experience and professional judgment are used to assess significance in the context of population level effects and VEC function.

TABLE 3.4 Criteria to Facilitate Assessment of Impacts

Key Terms	Criteria
Adverse	• Threat to, or loss of rare or endangered species; • Reductions in species diversity; • Loss of critical/productive habitat; • Transformation of natural landscapes; • Negative effects on human health 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; • Foreclosure of future resource use or production • Etc.
Significant	• Magnitude; • Geographic extent; • Duration and frequency; • Irreversibility; and • Ecological context.
Likely	• Probability of occurrence; and • Scientific uncertainty.

Source: CEAA (1994)

The assumptions made when determining the significance, and the uncertainty surrounding the predictions will be outlined during the assessment (Section 5).

3.9 MITIGATION

When significant adverse effects are likely, mitigation measures are required.

Mitigation is defined as the “elimination, reduction or control of adverse environmental effects, including restitution through replacement, restoration, compensation, or any other means for any damage to the environment caused by such effects” (Natural Resources Canada, 2003 WPPI guideline).

Mitigation will be consistent with the requirements of all relevant legislation, regulations, guidelines and policies, as well as management plans, specifications, and best management practices, where practical. Mitigation will be considered in a hierarchical manner with impact avoidance measures identified first, reduction measures second and compensation last.

Mitigation measures will be outlines for all VECs within the bio-physical and socio-economic environment. All proposed mitigation measures will be described in detail, including methods, timing and duration.

3.10 RESIDUAL EFFECTS

Residual effects are defined as effects that remain after mitigation measures have been applied (Natural Resources Canada, 2003: WPPI). Mitigation measures include emergency response and contingency plans.

The significance of the residual effects will be evaluated in terms of:

- magnitude;
- geographical extend;
- timing, duration and frequency;
- degree to which effects a reversible or can be mitigated;
- probability of occurrence;
- standards, guidelines or other objectives;
- ecological and social/cultural context; and
- the capacity of renewable and non-renewable resources (including but not limited to recreational areas) to meet the needs of the present and the future.

The impact assessment will include clear statements of whether residual environmental effects are significant, not significant or uncertain.

It may be important to mitigate the residual effects. The importance of such measures is determined by using the definitions provided by Natural Resources Canada (2003 WPPI guideline) (Table 3. 5).

TABLE 3.5 Level of Impact After Mitigation Measures

Level	Definition
High	Potential impact could threaten sustainability of the resource and should be considered a management concern. Research, monitoring and/or recovery initiatives should be considered.
Medium	Potential impact could result in a decline in resource to lower-than-baseline but stable levels in the study area, after project closure and into the foreseeable future. Regional management actions such as research monitoring and/or recovery initiatives may be required.
Low	Potential impact may result in a slight decline in the resource in the study area during the life of the project. Research, monitoring and/or recovery initiatives would not normally be required.
Minimal	Potential impact may result in a slight decline in the resource in the study area during the construction phase, but the resource should return to baseline levels.

Source: Natural Resources Canada, 2003 (WPPI guideline)

4.0 ENVIRONMENTAL CHARACTERISTICS: BASELINE DATA

4.1 GEOPHYSICAL ENVIRONMENT

4.1.1 Physiography

The Study Area occupies an exposed headland just south of the Town. In the majority of the study area, the terrain is gently rolling, but it becomes more steeply undulating in the northern portion around sites 6, 7, and 8. In this area, there also appears to be severe shoreline erosion, reflected by the steep cliffs of the drumlins along the road to Glasgow Head and Betsy's Point, as well as the damage to the road to Betsy's point during winter storms.

4.1.2 Geology and Topography

The topography in the Canso Area is generally flat, but there are some gently rolling hills (drumlins) in the north and south of the study area.

The bedrock geology of the Study Area is divided with the contact running west (WNW) to east (ESE). The Meguma Group, Goldenville Formation, occupies the north portion of the Study Area. It generally consists of greywacke, quartzite, slate, schist (formed by metamorphosis of Meguma greywacke and slates) and gneiss rock types. The Goldenville formation rock occupies a relatively narrow strip of land coming from the west and passing south of the Town, roughly following the ridge that is outlined by Highway 16. The band crosses through the coastal ridge opposite of George Island (Geological Map of Nova Scotia, 1979). The rock is classified as GO_{Gg} (metamorphosed Goldenville Formation schist). George Island bedrock is made up of the similar material (GO_{Gg} Goldenville pervasively injected with granite. The south portion of the study area is generally made up of intrusive rocks such as granite and granodiorite (Nova Scotia Geology Map, 1994) (DC_g = devono-carboniferous granite (Geological Map of Nova Scotia, 1979). The granite often appears as knolls in the landscape, rising up to 200 m above sea level, though much lower in the study area (Nova Scotia Museum, 2003).

Acid generating rocks are a group of mineralized geologic materials that contain various sulfides. When these minerals are disturbed and come into contact with water, oxygen, and iron reducing bacteria, the sulfide minerals become oxidized and acid is generated in the process. The presence of iron reducing bacteria serves as a catalyst that accelerates acid production, and the potential for generation of acid rock drainage (ARD). Carbonate minerals, where present, serve to buffer acid generation.

Surficial geology of the Study Area can be categorized into three different units (Surface Geology Map of Nova Scotia, 1992). The majority of the Study Area is classified as bedrock with outcrops at the surface. The various knolls in the area are classified as drumlins, which range from 4 to 30 metres in depth and generally consist of glacial silty till and a high percentage of distant source material including red clay. The large bog adjacent to Hazel Lake is classified as an organic deposit, which can range in depth from 1 metre at the edge to 5 metres in the center. These organic deposits generally consist of sphagnum moss, peat and clay.

4.1.3 Soil Quality

Soils are often very thin or absent throughout the study area, with large bedrock outcrops. However, soils can reach up to 25-30 m depth in the glacial till drumlins. Where soil cover has developed over granite, it is mostly Gibraltar soil (well-drained sandy loam). Danesville gleyed podzol (imperfectly drained sandy loam) and Bridgewater soils (well-drained, shaley silt loams) can also be found on the Canso peninsula (NS Museum, 2003). No significant deposits of sand or gravel are known (CBCL, 2003).

Drainage varies but is generally poor due to nearness of bedrock and localized wet areas are common in the study area. Soils are acidic and generally low in nutrients.

4.1.4 Hydrogeology

A recent study on the ground water supply potential commissioned by the Town of Canso and carried out by CBCL Ltd (2003) summarizes the available information on groundwater quality and quantity.

4.1.4.1 Groundwater Quality

Information on ground water chemistry for water wells in the vicinity of the Town of Canso is very limited. However, ground water chemistry is influenced by the location of the well site, i.e. the geologic formation (CBCL, 2003).

Ground water from wells in the Goldenville formation can be expected to be moderately hard, calcium-bicarbonate water of good chemical quality and a neutral pH. All parameters can be expected to be within Canadian Drinking Water Guidelines, except for occasional exceedances of iron, manganese and rarely, arsenic. Elevated iron and manganese values are often the result of interactions with nearby wetlands. Arsenic in excess of the drinking water guideline can occur “along the crests of bedrock anticline structures”, which is common in gold mining areas throughout southern Nova Scotia (CBCL, 2003).

Ground water in granite will generally have a similar water quality, and most parameters will be within the Canadian Drinking Water Guidelines (CBCL, 2003). However, elevated concentrations of arsenic, iron and manganese can occur in mineralized zones near the contacts of Meguma Group bedrock and granite. Radionuclides such as Lead –210 and radium have been found in granite elsewhere in Nova Scotia, and Uranium in excess of the Canadian guideline (0.02 mg/L) can occur, particularly in areas with thick clay and glacial till drumlins.

However, ground water from dug wells in the glacial till overburden can range from “dilute, naturally corrosive sodium-water type in permeable sand aquifers”, to “very hard calcium-bicarbonate water type in dense glacial tills” (CBCL, 2003). Also, water from dug wells is often contaminated with elevated concentrations of iron, manganese and coliform bacteria, and also is more easily impacted by road salt, lawn pesticides etc. (CBCL, 2003). Ground water extracted with high capacity wells near the coast may lead to influx of seawater into the well.

4.1.4.2 Groundwater Quantity

Domestic wells in the Canso area have a low well yield between 0.8 and 113 L/min (geometric mean 7.7 L/min or 1.7 igpm) (CBCL, 2003). The 43 wells in the Canso area are between 7.6 and 93.0 m deep and 152 cm in diameter. The mean yields (geometric and median) are similar for both the granite and Goldenville formation (9 L/min) (NSDEL Well Drillers Records (1965-2000), in CBCL, 2003). The water table is between 1.1 to 7.6 m below ground (data from 9 pumping tests of drilled wells throughout Guysborough County). Also, these pumping tests across Guysborough County resulted in a higher geometric mean yield of 17.3 l (CBCL, 2003).

The well yield in the Canso area is lower than yields of wells in the same rock formations elsewhere in NS (CBCL, 2003). For all of Nova Scotia, wells in granite appear to yield more water than wells in Goldenville quarzite (geometric mean 25.9 L/min vs. 21.4 L/min (though the minimum yield in Goldenville formation can be half of the minimum yield in granite) (CBCL, 2003).

4.2 ATMOSPHERIC ENVIRONMENT

4.2.1 Climate in Nova Scotia

Nova Scotia' s climate is influenced by the sea. A maritime climate has a reduced temperature range, in part because the ocean provides cooling in the spring and summer, but supplies heat in winter and fall. The latter moderates winter temperatures and prolongs the fall season. However, the warming effect during the winter does not exist when sea ice covers the ocean, such as the Northumberland Strait. Cool seawater in the summer also suppresses the local formation of storms by influencing the air masses, however the meeting of warm Gulf Stream water with the cold water of the Labrador stream also leads to many days of thick sea fog, which can move inlands. Storms are more frequent and intense during the late fall and early winter, leading to a slight increase in precipitation. Generally, the climate is moist, but droughts do occur. About 15 % of precipitation is in the form of snow (except 30 % in Cape Breton). Snowfall at the warm Atlantic coast and the mouth of Bay of Fundy with about 150 cm per year is only 2/3 of the amount that falls inland, and is replaced by rain and freezing rain. Also, snowcover usually comes and goes in coastal areas, and the number of days with snowcover is reduced in coastal areas near open water (Atlantic Climate Centre, Environment Canada, 2005).

Atlantic Canada experiences more storms than any other part of Canada. These storms can be any combination of very high winds, heavy precipitation, high waves, storm surges of more than one meter, freezing spray, reduced visibility and wind chill. Blizzards and ice storms occur every year. However, thunderstorms with lightning occur less often than elsewhere: about 10 days per year in Nova Scotia, compared to northern and central New Brunswick where they receive twice that. In the coldest months, the wind predominantly blows from the west and northwest with an average speed of 22 km/h. In the summer, the wind comes mostly from the south or southwest with an average 10-15 km/h. However, wind conditions vary greatly even within short distances due to natural and anthropogenic characteristics of the area. In coastal areas, onshore sea breeze circulation often develops in the warmer seasons (Atlantic Climate Centre, Environment Canada, 2005).

4.2.2 Climate Normals for Canso

The climate is cool and maritime. The weather station in Canso (45° 19' N / Long 60° 58' W, elevation 25.90 m) does not exist any more. However, climate data are available for the years 1964-1971. Also, there are several weather stations within 60-70 km radius around Canso (MSC (Meteorological Service of Canada), 2004 a). The weather station in Canso was run manually, i.e. a person would make the observations, usually hourly, which may provide more accurate information on certain parameters such as fog and ice than from automatic stations. (G.Morin, Environment Canada, personal communication, 2005).

Canadian Climate Normals or Averages are available for Deming (Latitude 45° 13' N and Longitude 61° 11'W, elevation 15.8 m, for 1956-1990), Dickie Brook (45°21' N / 61°30' W, elevation 3 m, for 1950-1990 only) and Port Hastings (45°38' N / 61°.24'W, elevation 23 m) (Table 4.2.1). However, Port Hastings is located about 55 km from Canso, on the southwestern coast of Cape Breton Island, which is likely to result in different weather and climatic conditions. Deming is located about 24 km southwest of Canso, on Deming Point close to Lower Whitehead and Port Felix. Dickie Brook is located about 64 km southwest of Canso, close to New Harbour (near Tor Bay) and about 6 km inlands (MSC, 2004a).

Based on its proximity to Canso and its location at the coast, Deming is most likely to have very similar climate conditions to Canso. This is reflected in the similarity of the average data for Canso and Deming (1956-1990). In addition, data are available for 1956 to 1990 and for 1971-2000. Data for Port Hastings, which are also available for long timeframes, are included for comparison. The data in Table 4.2.1 show the average temperatures and average precipitation for the time periods indicated, as well as extreme temperature events. Data were obtained from the Environment Canada weather office web page (EC, 2004 b) and the Meteorological Service of Canada (Environment Canada) web page (MSC, 2004 b).

The climate data for Canso appear to be most similar to the data for Deming, which therefore can be used to get an estimate for the climate situation in Canso today. The average annual precipitation (rain plus snow) in Canso for the years 1964-1970 was 1397 mm, the mean daily temperature was 5.7ºC. Average daily maximum and minimum temperatures were 9.2 and 2.1ºC, respectively. Extreme temperatures over this time period ranged from –25ºC in February to 27.8ºC in July.

For Deming, the average daily mean temperature is similar to Canso's with 5.6 and 5.8ºC, but the temperature range between mean daily maximum and mean daily minimum was more restricted. Also, the mean annual precipitation is higher than in Canso. The data for Deming appear to show a trend for increasing rainfall and total precipitation, and very vaguely for daily average temperatures, but decreasing snow fall for the two time periods 1956-1990 and the more recent 1971-2000. (In Port Hastings, all categories of precipitation increase).

Data on wind speed and direction were not available from these sources. Generally, winds are strongest in the winter months and weakest in the summer months.

TABLE 4.2.1 Canadian Climate Normals and Averages up to the Year 2000

	Canso 1964-1970	**Deming 1956-1990***	**Deming 1971-2000 Code A****	**Dickie Brook 1950-1990***	**Port Hastings 1874-1989***	**Port Hastings 1971-2000 Code D****
Daily max T [ºC]	9.2	8.6	8.8	--.	10.4	10.5
Daily min T [ºC]	2.1	2.4	2.7	--	2.2	2.2
Daily mean T [ºC]	5.7	5.6	5.8 +/-0.7	--	6.3	6.4 +/-0.6
Extreme max [ºC]	27.8 (July 1970	31.1 (1976/06/22)	Same	--	37.2 (1892/07/29)	Same
Extreme min. [ºC]	-25 (Feb. 1967)	-25 (1967/02/13)	Same, and (1993/01/31)	--	-26.7 (1897/01/21 and 1897/03/02)	Same
Rainfall [mm]	1182.7	1277.4	1318.8	1455.9	1269.8	1357.0
Snow [cm]	214.3	118	109.0	217.2	176.8	182.1
Precipitation [mm]	1397.04	1395.5	1427.8	1676.7	1448.7	1538.5
Extreme daily rainfall [mm]	--	115.6 (1976/11/18)	Same	113 (1969/11/09)	127.8 (1968/08/30)[+]	Same
Extreme daily snow [cm]	--	28.2 (1977/12/28	Same	35.6 (1956/02/07 and 1983/12/24)	63.5 (1890/12/30)	Same
Extreme snow depth [cm]	--	--	86.6 (1962/03/01)	--	--	157.0 (1987/03/17)
Days with						
Max. Temp. above 0 ºC	--	311	312.6	--	307	--
Max. Temp under 0 ºC	--	--	52.7	--	51.5	--
Min. T. under –20 ºC	--	--	1.3	--	--	1.9 D
Measurable precipitation	--	143	154.3	142	159	173.6
Measurable Rain	--	126	137.2	117	140	153.4
Measurable Snow	--	23	24.5	33	25	27.0

Source: *MSC (Meteorological Service of Canada), 2004 b
**Environment Canada 2004 b: Canadian Climate Normals 1971-2000

Notes: [+] Extreme daily precipitation: 132.1 mm on 1888/Feb/11 (127 mm rain+ 48.3 mm snow)
Measurable= later as "greater than 0.2 mm"
Code A= at least 30 years of data; C= at least 20 years of data ; D= at least a15 years of data

4.2.2.1 Fog

Fog is formed predominantly from mid-spring to early summer, when warm, moist air over Gulf Stream water meets with cold air over the Labrador stream. Dense bands of fog are formed off the coast, but may move inlands with the wind. Sea fog often affects headlands by day and moves inland by night. Canso has on average 115 days with fog, while Sydney has 80, Halifax airport 122, and Yarmouth 118 days. Nova Scotia can have extended spells of fog. The record stands at 85 days with at least 1 hour of fog per day during 92 days of summer in 1967. In other seasons, fog is not much less persistent and more local (Atlantic Climate Centre, Environment Canada, 2005).

For Canso, the highest occurrence of fog is from April through July, when fog occurs on approximately 45-50 % of days. Fog is generally formed in the morning, and dissipates during the day. Onshore breezes, which help to move the fog, generally occur in the afternoon (Environment Canada Climate Data).

In addition to these extensive periods of fog, periods of mist, low clouds and smog can reduce visibility and sunshine. On average, the sunshine in Nova Scotia is only about half of what it could be, with 1700-1969 hours a year. August is the sunniest month along the coast. 75-90 days per year are sunless days (i.e. days with less than 5 minutes of sun) and peak from November to February. Sunny days peak from July to October for a total of 130-160 days per year (Atlantic Climate Centre, Environment Canada, 2005).

4.2.2.2 Ice

Ice can be formed on structures and soil as a result of freezing precipitation (rain, drizzle, snow, etc), but also by melting and re-freezing of snow, or freezing sea spray. Few data are available for ice formation in Canso or nearby towns. Ice data are available for Canso for a period of 8 years from 1964 to 1970. During that time, Canso had on average about 7 days (6.8 days) with ice formation during the winter and spring months, covering December to May. Most days with ice occurred in March, followed by February (Table 4.2.2). These data are based on “manual” observation (i.e. an actual person making the observations, and hourly observation intervals). These data are more reliable than data derived from automatic devices. The average number of ice days for Canso is higher than for Port Hastings, NS, where the average is about 3 or 4 days with freezing precipitation per year (G. Morin, Environment Canada, Personal Communication, March 4, 2005).

TABLE 4.2.2 Average Number of Days With Ice Formation in Canso Over an Eight Year Observation Period

Month	Average Number of Days with Ice
December	0.4
January	1.0
February	2.3
March	2.6
April	0.5
May	0.1

Source: Environment Canada, 2004

4.2.2.3 Lightning

According to a flash density map, Nova Scotia experienced on average 0.2-0.7 lightning flashes per square kilometer per year in the period from 1998 to 2002, cloud-to-cloud and cloud-to-ground counts combined (MSC, 2005 a). In the Canso area, there are about 5-10 days per year with lightning flashes (MSC, 2005 b).

4.2.3 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 are eventually deposited on vegetation, soil, water surfaces, and other objects, when they are washed out of the atmosphere by precipitation. In some cases, the contaminants return to the atmosphere by the action of wind.

The air quality within the general area is currently monitored continuously by provincial and federal governments. There is no air quality monitoring station in Canso. The information in this section is based on results from monitoring stations closest to Canso, operated by the National Air Pollution Surveillance Network (NAPS) of the Environment Protection Service of Environment Canada and the Air Quality Branch of the Nova Scotia Department of the Environment and Lands (NSDEL). The nearest NAPS station is in Sydney (144 km NE of Canso). Halifax is 244 km SW and Charlottetown, PEI, 240 km west. However, a NSDEL sampling station in Pictou (168 km W) is also participating in the NAPS Network (NAPS website). NSDEL also has a sampling station in Port Hawkesbury (NSDEL, 2005, personal communication).

The parameters continuously monitored at these stations vary: sulphur dioxide (SO_2) is monitored in Port Hawkesbury and Sydney, ozone (O_3) in Pictou and Sydney, and particulate matter smaller than 2.5. micron ($PM_{2.5}$) is measured in Sydney. Nitrogen dioxide (NO_2), carbon monoxide (CO) and Volatile Organic Compounds (VOCs) are not monitored at these stations. Data were obtained from NSDEL by request, since the webpage is currently unavailable.

Data was obtained by request from NSDEL (2005) and shows the annual averages for these three stations up to and including 2003.

4.2.3.1 Particulate Matter (PM)

The term Total Suspended Particulates (TSP) refers to those particulates in the air such as smoke, soot and dust that remain suspended in the air and do not readily settle out. TSPs are a broad class of chemically and physically diverse substances that can either be in a solid or liquid state or in combination. TSPs greater than 10 µm in size create problems such as visibility reduction, soiling, material damage, and vegetation damage. The TSPs become a potential hazard to human health when the particle size is less than 10 µm in diameter. Sources include fuel combustion for heating and transport, forest fires, building materials, etc.

The Air Quality Regulations under the Nova Scotia Environment Act set maximum permissible ground level concentrations at 70 $\mu g/m^3$ (geometric mean) for an annual averaging period and 120 $\mu g/m^3$ for a 24-hour averaging period (NSDEL, 2005 b). National (Ambient) Air Quality objectives (N(A)AQS) set the same values for the Maximum Acceptable Levels, and set the Maximum Desirable Level at 60 $\mu g/m^3$ (annual geometric mean) (NAPS, 2003; 2004). The Canada wide standard set by the CCME for the 24-h average is 30 $\mu g/m^3$, to be achieved in 2010 (CCME, 2005).

$PM_{2.5}$ has been monitored in Sydney since 1998, but annual average values are not available due to lack of continuous data (NSDEL, 2005). In 2002, there were no exceedances of the 24-hour Acceptable Limits of the NAQ limits (NAPS, 2003).

4.2.3.2 Sulphur Dioxide

Sulphur dioxide is emitted as a byproduct from the burning of fossil fuels for heating or transportation, which all contain sulphur as impurities at various levels. Other sources include oil refineries, and pulp and paper mills. SO_2 levels detected in the air in Nova Scotia reflect the locally produced SO_2 as well as the SO_2 that arrives here by long distance transport.

The NSDEL Air Quality Regulations set a maximum permissible ground level concentration for SO_2 of 900 µg/m^3 (or 34 pphm, 344 ppb) for a 1-hour period, 300 µg/m^3 (or 11pphm, 115 ppb) for a 24-hour period, and 60 µg/m^3 (or 2 pphm, 23 ppb) for an annual average (NSDEL, 2005 b). National (Ambient) Air Quality Objectives set the same values for the Maximum Acceptable Levels, but set the Maximum Desirable Level at 30 µg/m^3 (11 ppb; 0.01ppm) (annual geometric mean), 150 µg/m^3 (57 ppb, 0.06 ppm) for the 24-hour average and 450 µg/m^3 (172 ppb; 0.17 ppm) for the 1-hour average (NAPS, 2003; 2004).

At the Sydney station, the values for SO_2 exceed the current permissible ground level for Nova Scotia (2 pphm) in most years from 1977-1989 and in 2002, with a range from 3 – 7 pphm and a maximum value of 11 pphm in 1984. They stay on the limit in 1999, 2000 and 2001, with 2 pphm. In 2002, the value was 6 pphm, i.e. triple the limit (NSDEL, 2005). However, the readings in 2002 never exceeded the National Air Quality Objectives (NAQ) for the 1-h and 24h means (NAPS, 2003). For Port Hawkesbury, annual averages are only available from 1996 on. The values vary between –1.1 and 0.9 pphm, thus never exceeding the NS guideline (NSDEL, 2005).

4.2.3.3 Ground Level Ozone

Nova Scotia emission sources do not contribute significantly to the creation of ground-level ozone. Nova Scotia is, however, a receptor of ground-level ozone, since it lies in the path of emissions from major urban and industrialized centres in the eastern United States and central Canada. Ground-level ozone is formed as a result of a photochemical reaction between nitrogen oxides and hydrocarbons. It is mostly generated during daylight hours, with levels highest between late spring and early fall.

The NSDEL Air Quality Regulations set a Maximum Permissible Limit for ground-level ozone of 160 µg/m^3 (8.2 pphm; 82 ppb, 0.08 ppm) for a 1-hour period (NSDEL, 2005 b). This is also the Maximum Acceptable level for the NAAQs, while the Maximum Desirable Level is set at 100 µg/m^3 (51 ppb, 0.05 ppm) (NAPS, 2003; 2004). The Canada Wide Standard is set at 65 ppb for the 8-h average, to be achieved in 2010 (CCME, 2005).

The annual average ground level ozone concentration in Pictou was 28 ppb in 2003. Data are also available for Sydney: 26 ppb in 2002 and 25 ppb in 2003. All three values are below the NS guideline (82 ppb) (NSDEL, 2005). However, the readings in Pictou for 2002 exceeded the NAQ Objectives 76 times for the 1-hour Desirable Limits (i.e. roughly 1.5 % of times) and once for the 1-hour Acceptable Limits. The station in Sydney exceeded the Desirable 1-hour Limit five times (i.e. less than 0.5 % of time), but not the 1-hour Acceptable Limits (NAPS, 2003).

4.2.3.4 Carbon Monoxide (CO)

Carbon monoxide (CO) is formed from the incomplete combustion of carbon compounds.

CO is not currently monitored at any of the three stations.

4.2.3.5 Nitrogen Dioxide (NO_2)

Nitric oxide is released from the exhaust of combustion engines and furnaces. Nitric oxide is an unstable compound and is readily converted to nitrogen dioxide (NO_2). Nitrogen dioxide contributes to the formation of acid rain and is a primary precursor pollutant in the formation of smog.

Nitrogen Dioxide is not currently monitored at any of the three stations.

4.2.3.6 Carbon Dioxide (CO_2)

CO_2 is estimated to account for approximately half of the anticipated world temperature increase. Major contributors of CO_2 are combustion sources (about 80 %). Forest fires and decomposing vegetation are the major natural contributors.

Ambient CO_2 is not currently monitored at any of the three stations.

4.2.3.7 Volatile Organic Compounds

VOCs all contain the element carbon and readily produce vapours at room temperature and at normal atmospheric pressure. VOCs are emitted from fuels, solvents, paints, glues, etc.

VOCs are not currently monitored at any of the three stations.

4.2.4 Noise

Ambient baseline noise levels within the study area (project foot print) and close to the nearest possible receptors (residents, significant wildlife habitats, etc.) have been obtained on April 5-7, 2005, i.e. prior to construction. A follow up study is planned during the vegetation period.

Noise measurements were conducted at four locations near the margins of the proposed wind farm:

- near the Hospital/Senior's Residence on the crescent shaped Wilmot drive closest to the proposed turbines (Station 1),
- at the southern most area of the Stan Rogers Festival grounds/Ball field (Station 2),
- across the road of the last residence on the road to Glasgow Head near turbine 6 (Station 3), and
- at the western rim of the cleared area at the children's camp on Glasgow Head (Station 4).

Noise measurements were performed for 2-hour periods within each of the three time slots from 7am to 7 pm, 7pm to 11 pm and 11pm to 7 am. These time slots are based on the NSDEL Noise Guidelines:

- A Leq of 65 dBA between 0700 and 1900 hours
- A Leq of 60 dBA between 1900 and 2300 hours
- A Leq of 55 dBA between 2300 and 0700 hours.

During the monitoring periods, traffic was generally light to non-existing. At location 3, only two cars or trucks drove by during the afternoon measurements. Traffic at location 1 (near the Hospital) was higher, with 11 vehicles passing during the afternoon measurements and five vehicles in the early evening. At location 2, there was one three-wheeler passing by the ball field twice during the afternoon measurements.

On April 5, both the afternoon and the evening were very windy. During the evening, the wind diminished and fog started to form. In the night, it was foggy, and the wind was less than during the day. A fog horn was audible in the distance on both days. On April 6th, 2005, the weather was clear during the day and the night. The afternoon was windy (light wind at location 1), with the wind picking up during afternoon at location 2. In the evening and in the night, it was less windy than during the day at both location 2 and 4.

The noise monitoring data show that the ambient noise is below the NSDEL Guidelines at any time of the day (Table 4.2.3.).

TABLE 4.2.3 Ambient Pre-construction Noise Levels (Leq) in [dBA] Close to the Proposed Wind Farm in Canso, NS

Location	7 am – 7 pm	7 pm to 11 pm	11 pm to 7 am	Date
Site 1 (Hospital)	50.3 (3.30-5.30 pm)	41.7 (8 – 10 pm)	38.7 (11 pm-1 am)	April 6-7, 2005
Site 2 (Ball Field)	35.8 (3.15-5.15 pm)	39.75* (8.10-10.10 pm)	35.7 (11 pm-1 am)	April 6-7, 2005
Site 3 (Last house)	44.6 (5 -7 pm)	41.4 (9-11 pm)	41.3 (11.30 pm-1.30 am)	April 5-6, 2005
Site 4 (Camp)	47.35** (4.40-6.40 pm)	46.7 (9.15-11.15 pm)	44.32*** (11.30 pm-1.30 am)	April 5-6, 2005

* = average of 39.8 and 39.7
** = average of 49.5 and 45.2 dB(A)
*** = average of 46.2/ 43.5/ 46.1/ 43.4/ 42.4 dB(A)
Averages had to be formed due to battery shutdown, which interrupted the measurements and resulted in the delivery of several Leqs for each period.

4.3 TERRESTRIAL ENVIRONMENT

The description of the terrestrial environment includes information on habitat, plants and animals found in the project area. The description is based on a survey of available existing information, including species at risk databases. Environmental constraints discovered during surveys resulted in an adjustment of the proposed turbine locations. Subsequent surveys focused on the new locations. All turbines are within 60 m of their original location, except for turbine 1s and 5 (Table 4.3.2). Turbines 11 and 12 were added in spring 2005 and were not covered in the 2004 surveys, but were included in the spring 2005 bird surveys. Plant, habitat and breeding bird surveys for these new locations as well as 1d and 5 d will be carried out in spring and summer of 2005, prior to construction. Details on the field surveys conducted to-date are provided in the following sections.

4.3.1 Flora and Habitat Assessment

The specific scope of work for the habitat assessment involved the following:

- Reviewing the habitat and flora baseline data gathered in previous studies (i.e. Canso Wind Farm Feasibility Study, Flora of Nova Scotia, the Nova Scotia Department of Natural Resources (NSDNR) Phenology Database);
- Consulting with knowledgeable individuals regarding potential biological resources throughout the Study Area;
- Locating all proposed turbine sites and roadways;
- Conducting a biological inventory including plants, and habitat for each of the proposed sites and roadways, with particular attention to plant and wildlife species at risk which have the potential to occur in the Study Area;
- Recording GPS coordinates of all significant species/areas found within the property;
- Identifying any wetlands within the Study Area that were not previously noted on the Canadian Wildlife Service (CWS) or NSDNR Wetlands Atlas; and
- Include results of the field investigations in a constraints map.

4.3.1.1 Flora and Habitat Assessment Field Assessment Methodology

Habitat assessments were carried out for each turbine including a 50 m radius footprint at each site and the proposed roadways linking the sites. Each site was located in the field using a handheld Garmin Global Positioning System (GPS) unit. An Environmental Technologist, G. Bell, and a Botanist, Dr. M. Sensen, carried out the surveys by documenting the habitat characteristics and producing a botanical inventory for each site, with special emphasis on species of special status. Alternative sites were located and surveyed for those initial sites that were located near environmental or construction related constraints (Turbines 9a, 7a). Wetlands that were not previously noted on the Canadian Wildlife Service (CWS) or NSDNR Wetlands Atlas, were characterized using wetland data sheets, which were developed by AMEC personnel based on Dickinson (1994). Wetland data sheets are provided in Appendix B.

Field surveys were conducted at the proposed sites on June 23rd and 24th, 2004for the purpose of characterizing the habitat at each site and to identify the presence of, or the high potential to support, plant species of special status. Sites 1-6, 7a, 8, 9a and 10 were surveyed. Additional field surveys were conducted September 8 to 10th, 2004, in order to investigate relocated sites (turbine locations 1a and 4a) and to cover plant species in bloom around this later time of the year, with particular attention to species of special status (see section 4.3.4). In September, sites 1-3, 4a, 5, 6, 7a, 8, 9a and 10 were surveyed. The plant species observed at each site are listed in Table 4.3.1. In addition, the proposed roadways linking the sites were surveyed for rare species during both June and September.

TABLE 4.3.1 Plant Species Observed At Each Site

Scientific Name	Common Name	1	1a	2	3*	4	4a	5*	6	7a	8	9	9a*	10*
Abies balsamea	Balsam Fir		X	X	X	X	X	X	X	X	X	X	X	X
Myrica gale	Sweet Gale		X											
Acer spicatum	Mountain Maple		X				X							
Acer rubrum	Red Maple		X	X	X	X		X	X	X	X	X	X	X
Alnus incana	Speckled Alder	X							X	X	X			
Alnus viridis	Downy Alder		X	X	X	X		X	X	X	X	X	X	X
Amelanchier canadensis	Shadbush	X		X	X	X		X	X	X	X	X	X	X
Aralia nudicaulis	Wild Sarsaparilla		X	X	X	X	X	X	X	X	X	X	X	X
Aronia arbutifolia	Red Chokeberry	X		X	X	X								
Aster sp.	Aster								X	X	X			
Aster acuminatus	Wood Aster		X				X							
Aster umbellatus	Tall White Aster						X							
Athyrium filix-femina	Lady-Fern				X									
Betula papyrifera	Paper Birch		X	X	X	X	X	X				X	X	X
Betula cordifolia	Heart-leaf Birch		X				X							
Calamagrostis canadensis	Blue-Joint Reedgrass	X												
Chamaedaphne calyculata	Leatherleaf	X												
Clintonia borealis	Clinton Lily	X	X	X	X	X	X	X	X	X	X	X	X	X
Coptis trifolia	Goldthread				X		X							
Corema conradii	Broom-Crowberry											X	X	
Cornus canadensis	Bunchberry		X	X	X	X	X	X	X	X	X	X	X	X
Cypripedium acaule	Pink Lady's-slipper								X	X	X			
Dennstaedtia punctilobula	Hay-scented Fern						X							
Diphasiastrum sitchense	Savin-leaved Clubmoss												X	
Drosera rotundifolia	Roundleaf Sundew												X	
Dryopteris campyloptera	Eastern Spreading Wood Fern		X											
Dryopteris intermedia	Evergreen Wood Fern						X							
Gaultheria hispidula	Creeping Snowberry								X	X	X			
Gaultheria procumbens	Teaberry	X	X	X		X		X	X	X	X	X	X	X
Gaylussacia baccata	Black Huckleberry	X						X				X	X	X
Hamamelis virginiana	Witch hazel			X	X	X								
Iris versicolor	Blueflag	X												
Kalmia angustifolia	Sheep-Laurel		X	X	X	X		X	X	X	X	X	X	X
Kalmia polifolia	Pale Laurel												X	
Lactuca biennis	Tall Blue Lettuce								X	X	X			
Larix laricina	American Larch, Tamarack	X	X										X	
Ledum groenlandicum	Labrador Tea		X					X			X		X	X
Linnaea borealis	Twinflower		X	X	X	X	X		X	X	X	X	X	X
Lonicera villosa	Mountain Fly-Honeysuckle	X												
Maianthemum canadense	Wild Lily-of-The-Valley			X	X	X	X	X	X	X	X	X	X	X
Mitchella repens	Partridge Berry		X											
Monotropa uniflora	Indian-Pipe		X								X			
Nemopanthus mucronatus	False Holly	X	X	X	X	X		X				X	X	X
Osmunda cinnamomea	Cinnamon Fern	X		X			X							
Osmunda claytoniana	Interrupted Fern								X	X	X			
Oxalis Montana	White Wood-Sorrel								X	X	X			

TABLE 4.3.1 Plant Species Observed At Each Site

Scientific Name	**Common Name**	**1**	**1a**	**2**	**3***	**4**	**4a**	**5***	**6**	**7a**	**8**	**9**	**9a***	**10***
Picea mariana	Black Spruce	X	X	X	X	X		X				X	X	X
Picea rubens	Red Spruce		X						X	X	X			
Pinus banksiana	Jack Pine		X	X				X				X	X	X
Prunis pennsylvanica	Pin Cherry			X	X	X								
Pteridium aquilinum	Bracken Fern		X	X	X	X	X	X	X	X	X	X	X	X
Rhododendron canadense	Rhodora	X	X	X	X	X	X	X				X	X	X
Rosa nitida	Swamp Rose	X												
Rubus idaeus	Red Raspberry	X												
Solidago rugosa	Rough-stem Goldenrod	X	X											
Sorbus Americana	American Mountain-Ash		X	X	X	X	X	X	X	X	X	X	X	X
Sparganium emersum	Green-Fruited Burreed													
Sphagnum sp.	Sphagnum moss	X	X	X	X	X	X	X	X				X	X
Spiraea alba	Narrow-Leaved Meadow-Sweet	X		X	X	X		X				X	X	X
Streptopus roseus	Rose Twisted Stalk				X				X	X	X			
Trientalis borealis	Northern Starflower		X	X	X	X	X	X	X	X	X	X	X	X
Vaccinium angustifolium	Lowbush Blueberry		X	X				X	X	X	X	X	X	
Vaccinium vitis-idaea	Mountain Cranberry		X	X	X	X		X	X	X	X	X	X	X
Viburnum nudum	Wild Raisin	X	X	X			X	X				X	X	X

*Note: Locations are identical for 3= 3d, 5= 4d, 9a= 9d, 10= 10d.

TABLE 4.3.2 Site Coordinates

Site Name	**Location**		**UTM**	
	Latitude	**Longitude**	**Easting**	**Northing**
1	45° 19’ 40.94”	60° 59’ 28.77”	657408	5021355
1a	45° 19’ 39.5 ‘’	60° 59’ 48.1 ‘’	656989	5021299
1b/1d			*657835*	*5021500*
2	45° 19’ 26.15”	60° 59’ 31.99”	657349	5020896
2a2			**657347**	**5020851**
2b			*657398*	*5021089*
2d			*657400*	*5020950*
3	45° 19’ 18.02”	60° 59’ 45.20”	657068	5020638
3b			*657051*	*5020653*
3d= 3			*657070*	*5020640*
4	45° 19’ 07.88”	60° 59’ 30.72”	657391	5020333
4a	45° 19’ 39.5 ’’	60° 59’48.1 ’’	657195	5020469
4a2			**657250**	**5020346**
4b			*657115*	*5020144*
4d= 5			*656840*	*5020215*
5	45° 19’ 04.52”	60° 59’ 56.93”	656823	5020215
5b			*656377*	*5020215*
5d			*656420*	*5020250*
6	45° 19’ 42.47”	60° 58’ 36.30”	658549	5021430
6b/6d			*658508*	*5021405*
6d			*658525*	*5021405*
7	45° 19’ 35.90”	60° 58’ 18.67”	658938	5021237
7a	45° 19’ 33.45”	60° 58’ 16.33”	658991(659072)	5021163(5021120)
7 a2			**658948**	**5021188**
7b			*658882*	*5021173*
7d			*658950*	*5021190*
8	45° 19’ 27.31”	60° 58’ 07.45”	659189	5020978
8b=8d			*659205*	*5020920*

TABLE 4.3.2 Site Coordinates

Site Name	Location		UTM	
	Latitude	Longitude	Easting	Northing
9	45° 19' 21.88"	60° 59' 10.38"	657823	5020776
9a	45° 19' 21.05"	60° 59' 14.19"	657741	5020749
9b			*657750*	*5020819*
9d(=ca.9a)			*657720*	*5020750*
10	45° 19' 06.80"	60° 59' 07.24"	657903	5020312
10b			*657927*	*5020400*
10 d=10			*657900*	*5020300*
11d			*657480*	*5020520*
12d			*657270*	*5020180*
Tower	45° 19' 18.31"	60° 59' 11.14"	657809	5020665
J. Burns Site	45° 19' 39.42"	60° 58' 31.99"	658654	5021335
Canso Pest House	45° 19' 31.00''	60° 58' 45.8 ''	658350	5021073
NewXng	45° 19' 33.6 ''	60° 57' 40.5 ''	656977	5021187
WC1/ WL4	45° 19' 36.4 ''	60° 59' 50.8 ''	656933	5021202
WL1	45° 19' 34.4 "	60° 59' 29.8 ''	657391	5021153
WL2	45° 19' 33.5 ''	60° 59' 12.2 ''	657775	5021134
WL3	45° 19' 49.9 ''	60° 59' 05.8 ''	657902	5021643
Tree Cut	45° 19' 32.12"	60° 58' 12.91"	659066	5021124
Bog	45° 19' 33.55"	60° 58' 22.07"	658866	5021163
Boggy	45° 19' 43.07"	60° 58' 36.98"	658534	5021449
Boggy 1	45° 19' 41.58"	60° 58' 36.59"	658543	5021403
Boggy 2	45° 19' 40.52"	60° 58' 35.82"	658561	5021371

Note: UTM in NAD 83 datum
WL= Wetland; WC= Winter Creek Tributary Crossing
Bold: locations after the Geotechnical Survey Nov. 18/19, 2004 - not used in any of the baseline surveys
Italics: - Changes November 26, 2004 - all locations named "#b"-
- Changes April 2005 - all locations named " #d"

4.3.1.2 Flora and Habitat Assessment Results

Bedrock is mainly meta-sedimentary and granitic with high quartz content. Soils are very thin or absent throughout the study area with large bedrock outcrops. The terrain in the majority of the study area is gently rolling but becomes more steeply undulating in the northern portion around sites 6, 7, and 8. Drainage varies, but is generally poor due to nearness of bedrock. Extremely localized wet areas are common. Soils are acid and generally low in nutrients. There is a cool maritime climate and the Study Area occupies an exposed headland where shoreline erosion appears severe in some areas (e.g. the road to Betsy's Point).

The cool, wet climate and shallow acid soils has promoted the growth of boreal vegetation with generally low species diversity throughout all the sites. The species abundance at each site varies widely and appears to be most sensitive to micro-topography, and soil depth. The generally poor nature of the soil and extremely variable moisture has caused most vegetation to appear stressed or stunted in the south and central portions of the Study Area which may be referred to as "barrens". Within this region, trees (mainly Jack Pine) are typically shorter than 3.5 metres, despite being at least 30 years old (estimate based on disturbance), and the forest structure is open and patchy. There is a continuous carpet of sphagnum moss and caribou moss throughout, and a dense low shrub layer (mainly rhodora and sheep laurel).

The coordinates for the originally proposed site 9 were located within the Chapel Gully Trail Area, therefore an adjacent substitute Site 9a (located outside the trail area) was chosen and both sites were surveyed. Sites 2, 5, 9, 9a, and 10 exhibit the strongest characteristics of barrens with the most open forest structure (30 – 50% cover). This is also true for sites 2d, 4d (= 5), 9d and 10d, because these sites are located within the buffer radius surveyed around each of the original sites. Site 2 d is within 50 m of Site 2, and site 4d, 9d and 10d are within 20 m of Site 5 (=4d), 9a and 10, respectively.

Sites 3/3d, 4, and 4a have a more closed forest structure (70-80% cover) and have a higher proportion of broadleaved trees (mountain ash, white birch) and tall shrubs (alder, pin cherry). The alternative Site 4a was chosen in September 2004 in order to avoid high value bird habitat identified within Site 4 (see Section 5.6). The coordinates for Site 3d are identical to site 3.

Sites 6, 7, and 8 are located near the coast on much deeper soils in a steeper, well drained terrain. Due to intense coastal erosion, there was not enough space between the road and the coast to locate the original site 7. Therefore, an adjacent alternate site 7a on the west side of the Union Street gravel road extension was chosen and surveyed in both spring and fall habitat surveys. These sites are typical boreal coniferous forest of spruce-fir with nearly complete crown closure (90-100%) and a relatively sparse ground cover of shade tolerant herbs such as bunchberry, starflower, and sarsaparilla. The forest floor is frequently bare except for terrestrial mosses. There has been some recent forest clearing activity in the immediate vicinity of Site 7a, which will reduce the amount of clearing necessary for project activities at this site.

Site 1, now abandoned, is located near Winter Creek on a very wet site with deep organic soil. There appears to be a hydrologic connection with the creek, via a small stream and it was identified as wetland habitat (Wetland 1 – shrub swamp subclass). Site 1vegetation is similar to sites 3 and 4 but includes wetland plants such as blue-flag iris and swamp rose, while jack pine was completely absent. An alternative Site 1a was identified in September several hundred metres west in order to avoid this complex drainage system. Site 1a is composed partly of regenerating field with an even aged cover of young mountain ash and mountain maple trees with a remnant mix of mature birch, spruce, and pine. The ground cover is composed of shade tolerant boreal forest herbs like bunch berry, starflower, and sarsaparilla. The other half of the site is open sub-barren boreal forest composed of mature (slightly stunted) spruce, tamarack, and jack pine with scattered birch, maple, and tall shrubs. The ground cover consists mainly of a dense low shrub layer with rhodora, sheep laurel, Labrador tea, and scattered tall shrubs (mainly wild raisin). Thick mosses cover the ground beneath other vegetation.

The location of potential access road crossings at Winter Creek and a tributary of Winter Creek were surveyed for plant species of special status. This potential access road overlaps with an existing firefighting road, now heavily used by ATVs. Also, the land along Winter Creek was surveyed. Only one plant species of concern, bog or Massachusetts fern (*Thelypteris simulata*), was found near Winter Creek in a northeasterly direction of turbine 3b/d. This fern is ranked S3 in Nova Scotia by the ACCDC, indicating fewer than 100 reported occurrences in the Province. However, the NS Department of Natural Resources has ranked this plant in NS as “green”. Therefore, this plant is not believed to be sensitive or at risk.

4.3.1.3 Flora and Habitat at the Current Turbine Locations

The turbine locations were adjusted several times since spring 2004. During those adjustments, turbines have been moved from the locations covered by earlier (2004) field surveys. Also, more potential locations were added since November 2005: Sites 5b/d, 11d, and 12d. However, most turbines are still close to the originally proposed, thus surveyed, locations (Table 4.3. 2). Any turbines located within about 15 m of the original coordinates were considered to be at an identical location, since the EPE (Estimated Positional Error, i.e. the inaccuracy), of the GPS usually ranges between 5 and 15 m. Therefore, the current turbines 3d, 4d (=5), 9d and 10 d are identical to original location (3, 5, 9a and 10). Site 9 d may carry more stunted hardwood trees than location 9a, as the soil cover is slightly higher than at 9a (barrens).

Locations 2d, 6d and 8d are within 50 m from the original sites (2, 6, and 8). This is within the buffer area surveyed around the turbines, and the plant composition and habitat have therefore been described. They have the characteristics of barrens (2d) and boreal forest (6d, 8d), respectively.

During the field surveys in 2004, a large area of ground was covered, consisting of the turbine locations and the proposed access roads. Based on the observations during those surveys, it is likely that turbine locations 11d and 12 d have similar habitat as the original Turbines 3 and 4 (i.e. a more closed forest structure, and a higher proportion of broadleaved trees and tall shrubs).

Locations 7d is close (within 40-70 m) to the original location 7a. However, it is now located at the bottom of the coastal drumlin near Turf Bog. While this area is covered with trees like location 7a (except for the clear cut), it is also wetter. It can be expected that the ground cover is dominated by mosses, including Sphagnum moss. However, all three coastal locations are now further west and at a lower elevation as the originally proposed locations, thus following the recommendations of the bird expert, decreasing the potential for collisions with migrating passerines.

Location 1d is about 200 m east of the originally proposed location. It now is closer to the Chapel Gully Trail, in an area of tall shrubs. There does not appear to be a potential for rare species in this type of vegetation, which was observed at other locations (e.g. 1a).

The vegetation at location 5d is likely similar to that at location 2, 5 (now 4d) or 3, based on ecological land classification data (NSDNR) and the fairly uniform vegetation observed during the field surveys, though the bird specialist reports forest with standing snags, similar to what was found at the original location 4.

<u>*Supplementary Survey*</u>

Additional surveys for habitats and rare plants were carried out June 28th to 30th, 2005, and August 10th to 12th, 2005. During these surveys, all turbine sites added since September 2004 (1d, 5d, 11d, 12d), and the foot print of the road after the layout changes from February 2005 were surveyed, including the new watercourse crossing on Winter Creek. Site 7d and 9d were surveyed, because the minor adjustments to the turbine locations since September 2004 have placed the new locations partially or totally in a different habitat than before. Turbine 7d is now located at the bottom of the forested slope and in the margin of Turf Bog. Turbine 9d now is located mostly in forested area rather than shrub barrens. In addition, in August 2005 surveys were repeated for all sites that have not changed location since September 2004 (2d, 3d, 4d, 6d, 8d, 10d) in order to supplement previous plant observations with any plants only identifiable in mid-summer, since previous surveys were conducted in the Spring or the Fall seasons. Site 2d, 3d and 4d were also surveyed in June 2005. The results of the additional survey are discussed below. For results related to flora refer to Section 4.3.4.1.5.

Site 1d is composed of regenerating field covered by even aged young tamarack and red maple trees with a large component of tall shrubs such as wild raisin, round-leaved dogwood, Bartrams serviceberry, and speckled alder. The ground cover is composed of shade tolerant boreal forest herbs like bunch berry, starflower, and sarsaparilla, and interrupted fern. Small patches of sphagnum moss are scattered over the ground.

Sites 2d, 3d, 9d and 12d have a relatively closed forest structure (70-90% cover) and have a majority of broadleaved trees (mountain ash, red maple, birch) and tall shrubs (alder, pin cherry). These sites also have ground cover composed of shade tolerant boreal forest herbs as described above. Forest age ranges from young (20 to 25 years) at site 3d, through immature (25-35) at site 2d, to mature (60 to 80 years) at site 12d. There is a variable under-story of spruce/fir saplings at each site.

Sites 5d, 6d, 8d and part of 7d are located on relatively deep soils in a steep, well drained site. These sites are typical boreal coniferous forest of spruce-fir with nearly complete crown closure (90-100%) and a relatively sparse ground cover of shade tolerant herbs such as bunchberry, starflower, sarsaparilla, and occasional Indian pipe. The forest floor is frequently bare except for terrestrial mosses. The balsam fir population at Site 5d has suffered a massive insect or disease impact and more than 50% of the trees are standing dead.

Site 7d is located west of the Union Street gravel road extension on the lower slope at the margin of Turf Bog. Plant species observed within the forest portion of Site 7d included many introduced species that would not ordinarily occur in coniferous forest habitat such as red top and wild oats. These are probably present due to the close proximity to the road and adjacent disturbed areas. Plant species within the Turf Bog margin are dominated by tall shrubs (mainly alder), whereas, the majority of the bog is composed of low shrubs such as rhodora, pale laurel, and sweetgale. Grasses and sedges in the Turf Bog are relatively spars due to the dense shrub layer, but include cotton-grass, soft rush, and wool grass.

Sites 4d, 10d, 11d and the eastern portion of Site 9d exhibit the strongest characteristics of barrens with the most open forest structure (30 – 70% cover). The tree species are characterized by the presence of jack pine with varying amounts of spruce, balsam fir, tamarack, and a few maple (red- or mountain-). The soils are generally thin with exposed bedrock humps occurring regularly. Drainage is poor, resulting in areas of extreme but short term wetness. Plant species observed indicates a low pH, poor nutrition soil. The under-story is dominated by low shrubs such as rhodora, sheep laurel, Labrador tea, and huckleberry. These are so dense that other ground vegetation is both sparse and of very low diversity.

A number of grasses and sedges were observed in an old fire-fighting access road along the edge of Site 9d that would not ordinarily occur in this habitat such as common wool-grass, white-beak rush, and brown-fruited rush.

The location of the proposed watercourse crossing at Winter Creek was only surveyed for plant species of special status. No species of special status was identified.

Winter Creek is one metre wide at the crossing and, at the time of the survey, was 0.4 to 0.5 metres deep. The substrate was composed of coarse gravel and large rock fragments. Aquatic vegetation in the stream includes small patches of water-celery. The water colour is very dark brown and a faint stagnant odour was present during the survey. The flow velocity was very low. The surrounding forest is mature mixed hardwood and softwood.

The lack of fallen or dead trees and the presence of cut stumps near the banks suggest that this area was cleared in the past. Tree species include very mature red- and mountain-maple, with immature to mature red spruce and balsam fir beginning to overtake the broadleaf over-story. The herbaceous ground cover is slightly more diverse than other Project sites, as would be expected in a riparian zone, but is still dominated by typical boreal forest vegetation that occurs throughout the project area.

4.3.1.4 Wetlands and Significant Habitats

The Federal Government is committed to wetland conservation by adopting the "Federal Policy on Wetland Conservation". The objective is to "promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions". According to the "Federal Policy on Wetland Conservation - Implementation Guide for Federal Land Managers", in some areas (where wetland loss has been severe), the further loss of wetlands will be avoided wherever possible. In the current project, wetlands within the project foot print or in adjacent areas that may potentially be impacted by project activities, were identified and described, in order to avoid these areas wherever possible, both in view of the federal policy and the value for rare species.

In September 2004, a field survey of the project area was conducted to identify and describe any wetlands in close proximity to the project footprint. Four wetlands were originally identified in the field, which were either crossed, or very close to the originally proposed wind turbine sites or access road. In addition, a fifth wetland exists, called "Turf Bog". Turf Bog is a previously known wetland (Topographic Map sheet 11F/07). The location of these wetlands are shown on the environmental constraint mapping (Figure 2.3). The wetlands were described using the standardized wetland data sheets provided in Appendix B. GPS coordinates for the above wetlands and all other environmental and construction constraints were obtained in the field and are provided in Table 4.3.2. There have been subsequent changes to the project design in order to avoid all wetland areas. Following is a description of these wetlands.

Wetland 1 is a shrubby bog complex within low-lying terrain, which stretches from Winter Creek to the base of the Festival staging area. There is some open water, and the overall vegetation cover is greater than 95 % (Appendix B). This location was the preliminary site for the proposed access road crossing on Winter Creek and also contained the initially proposed Turbine Site 1. The width of the wetland at this crossing is approximately 100 m. However, since this wetland is quite large and there are other suitable locations, this site was abandoned in order to avoid wetland habitat.

Wetland 2 was near the preliminary (originally) proposed access road. This wetland is typical of the numerous isolated bogs in the general project area and was found to support Grass pink, a common bog orchid (*Calopogon tuberosis*), bake-apple (*Rubus chamaemorus*, indicative of coastal bogs), and a wide variety of other acid bog herbs. Vegetation cover is greater than 95 %. This site has now been avoided during the project design phase in order to protect wetland habitat and no interaction with the project is expected.

Wetland 3 is a small shallow marsh that lies in a narrow valley leading down into Chapel Gully. The preliminary proposed access road crossed this wetland at an existing crossing point used regularly by ATVs. This crossing location has been abandoned.

Wetland 4 is a very large bog (21 ha). Vegetation cover is greater than 95 % (Appendix C). Winter Creek and it's tributary originate in this bog. An existing wide ATV-trail (former fire fighting road) passes through an extremity of this large wetland. It is proposed to use this trail as an access road for the Project, however, the final road design will be diverted at Winter Creek to a location downstream from the existing trail (in roughly eastern direction), approximately 50 m outside the wetland limits. At the point nearest to the Project, the wetland is composed of shallow marsh and shrub swamp habitat that occupies a narrow gully through which the greater bog drains. The proposed access road is downgradient from the wetland, therefore no potential effects are anticipated.

Turf Bog is a large shrubby bog with some shallow marsh, located at the coast east and south east of Chapel Gully. To the east, this bog is bordered by coastal drumlins and the road to Glasgow Head and Betsy's Point. Vegetation cover is greater than 95 % and consists of many of the low shrub species common in the barrens, with some fresh water herbs (swamp candles, blue flag iris, and with bluejoint reedgrass at the wetland margins), and a few sea-side narrow leaved emergents and herbs, such as scotch lovage, *Schoenoplectus* sp. and *Juncus gerardii*.

There are numerous other wetlands (mostly small isolated bogs) in the general area of the project, which are not close to the project footprint and no interaction with the project is anticipated. The final locations for the wind turbine sites and access road will be at least 50 m from the nearest wetland habitat in all cases.

4.3.2 Significant Habitats in and Around Canso

A review of the NSDNR Significant Habitat (SigHab) database resulted in a large number of significant habitats within a 100 km radius (new NSDNR guideline) around the project site (NSDNR, 2005). Only one area is located in Canso: the salt marsh at the head of Chapel Gully, which is crossed by the trail. It is dealt with in Section 4.5, Aquatic Environment.

Within a radius of 50 km around Canso, there are 523 WLD number listings: 56 counts for deer wintering areas, 16 for freshwater areas, 34 for migratory bird areas, 168 counts for species of concern; 2 for rare plant, 103 for species at risk, 8 for old forest, 5 for salt marsh, 53 for wetland and 78 for "other habitat" growth forest (NSDNR, 2005) (Appendix C). However, several WLD numbers are listed multiple times, therefore the total number of significant habitat areas within 50 km from Canso is 244 (244 WLD numbers). The significant habitats nearest to the project site are shown in Table 4.3.3 and Fig. 4.1. The listing of all significant habitats within 50 km, as extracted from the SigHab Data base, can be found in Appendix C.

Besides the saltmarsh mentioned above, the closest significant habitats include several migratory bird areas, a small area of old forest, and one "other habitat" on an island east of Durells Island. In addition, there are several locations marked for species of conservation concern. At a greater distance from the project location, there are large migratory bird areas, three species at risk and several species of conservation concern locations (Table 4.3. 3).

The remaining 222 significant habitats identified from the NSDNR database area greater than 30 km from the proposed project site. These other areas include old forest, deer wintering areas, rare plant locations, and several “other habitats”, in addition to further locations for migratory birds, species at risk and species of conservation concern (Appendix C).

TABLE 4.3.3 Significant Habitats Within 30 km of Canso, Nova Scotia

WLD #	Location in relation to Canso	Type
GU 859	In Canso: Chapel Gully	Salt Marsh
GU 858	Island, 3.4 km northeast	Other habitat
GU 915	7.2 km south	Migratory birds
GU 266	Close to Fox Island Main, 7 km west	Old forest, small area
RI 375	Near Little Anse; 16 km north, Isle Madame	Migratory birds (Whimbrel)
RI 367	Cape Auquet , 17 km north, near Arichat	Migratory birds (Whimbrel)
RI 430	Island, about 18 km north, near Little Anse	Species of conservation concern (Tern)
GU 877	Island, about 18 SW	Other habitat
RI 324	Island, about 20 km north	Species of conservation concern (Common Tern; Arctic Tern; Common Eider)
RI 541	About 21 km north, in the Arichat area	Species of conservation concern (Spurred Gentian; Slender Cotton-grass)
RI 323	Island, near Arichat	Migratory birds (Great Blue Heron, Double-crested Cormorant)
GU 940	Island near Port Felix/ Whithead, about 22 km SW	Species at risk (Roseate Tern)
GU 875	Island near Whithead, about 22 km SW	Other habitat
GU 874	Island, near Whithead, about 23 km SW	Species of conservation concern (Common Eider; Limestone Scurvey- grass)
GU 873	Island, near Whithead, about 23 km SW	Species of conservation concern (see above)
GU 872	Island, near Whithead, about 23 km SW	Species of conservation concern (see above)
RI 680	Isle Madame, about 23 km north	Species of conservation concern (Eastern Elliptio; Eastern Floater; Triangle Floater)
GU 871	Cole Harbour to Tor Bay, about 25-33 km SW	Migratory birds, large area
GU 938	Island, about 25-30 km SW	Species at risk (Roseate Tern)
RI 326	Isle Madame, ca.29 km north	Species of conservation concern (Common Loon)
RI 322	Isle Madame, ca. 30 km north	Species of conservation concern (Common Loon)

Source: NSDNR, 2005:SigHab database

4.3.2.1 Indication of Earlier Disturbance in the Project Area

There were no indications of earlier anthropogenic disturbances in the area. However, the occurrence of Jack Pine on the barrens (e.g. location 9) indicated that forest fires have previously occurred. This conclusion was confirmed by local informants, who reported that the ATV trail/emergency road was put in to fight forest fires. Also, it is known that the forested area has been previously logged (local informant). Most of the earlier uses of the land will be described in Section 4.6.5 Land use.

4.3.3 Fauna

During the habitat and plant surveys, the area was also surveyed for fauna other than birds and fishes, with particular attention to species at risk. These surveys were carried out by G. Bell, Environmental Technologist, S. Cox, Biologist, and M. Sensen, Botanist. Birds and fishes were investigated in separate, specialized surveys and are described in Sections 4.4 and 4.5.

4.3.3.1 Terrestrial Fauna (Other Than Birds) Observed in the Project Area

Few animals (other than birds) were observed in the project area. Tracks and droppings of deer were found throughout the area. The skull of a female deer was found in forested area along Winter Creek. Other sightings were a young rabbit at Site 7a on September 10th, 2004, a frog in Winter Creek, an American Toad (red phase) near Winter Creek and a garter snake along the ATV trail. Coyotes are present in the area (personal communication from local informants).

4.3.4 Species of Special Status

The following section focuses on species of special status that are of concern as a result of the potential project disturbances at Canso.

Plant and animal species of special status in Nova Scotia include:

- species listed by COSEWIC as endangered, threatened or of special concern;
- species protected under the Nova Scotia Endangered Species Act;
- wildlife protected under the Nova Scotia Wildlife Act;
- species listed in the NSDNR General Status Ranks of Wild Species in Nova Scotia as "Red" or "Yellow"; and
- species designated as rare by species/resource experts such as the ACCDC (as S1, S2 and S3) and the NS Museum.

Descriptions of the ranking systems used by COSEWIC, the NSDNR General Status Ranks of Wild Species in Nova Scotia, the NS Museum, and the ACCDC databases are provided in Appendix D. Wild species which are listed as species of concern by COSEWIC or NSESA or in the NSDNR General Status Report, are summarized by taxonomic group in the "Priority Species List" supplied in Appendix E. New instructions from NSDNR (Dec. 9, 2004, M. Elderkin) require the next two evaluation steps to be summarized in separate tables.

COSEWIC, NSDNR, NSMNH and ACCDC databases were reviewed for information on previously recorded sightings, in order to compile a short list of endangered species that occur in the general geographical area of the project, i.e. Eastern Nova Scotia. Sources included previously completed reports that summarized published and unpublished listings of occurrences of rare species. In addition, distribution maps from a variety of literary sources such as the Nova Scotia Breeding Bird Survey, and Roland's Flora of Nova Scotia (see below) were reviewed to determine potential occurrences of priority species in the Study area. The results of this review are summarized in "Short lists of Priority Species" (see below).

The species in the short list were reviewed regarding their habitat requirements. Those species, which exist in, or frequent habitats that also have been found within the study area or immediate surrounding areas, are listed in the tables "Species with elevated potential to occur at the project sites". These species are likely to occur at the wind farm site and received special attention during targeted or comprehensive (flora) field surveys in order to confirm their presence or absence at the project sites. However, it is possible that other species of special status exist within the area without previously recorded sightings. Therefore, the potential presence of other priority species with habitat requirements (see Appendix E) met by habitat

FIGURE 4.1 Significant Habitats Within 50 km Radius Around The Proposed Canso Wind Farm

available at the project site were considered during the field surveys. Suitable habitat was scanned for indications of these species.

4.3.4.1 Flora

4.3.4.1.1 Plant Species of Special Status with Elevated Potential to Occur at the Site

Based on information available from the Department of Natural Resources databases (rare plants in NS and the phenology database), 70 plant species of special status occur in Eastern Nova Scotia. The "Short List of Priority Plant Species in Eastern Nova Scotia" is provided in Appendix F, along with information on habitat and flowering times. After comparing habitat requirements of the short listed priority species with available habitat at the wind farm site, the following check list of plant species at risk was assembled (Table 4.3.4). Information on the phenology is included, since the timing of the field surveys is based on the flowering times.

TABLE 4.3.4 Plant Species at Risk with Elevated Potential to Occur in the Project Area

Common Name	NSDNR Name	Status Rank	NS S-Rank	Seasonality*
Early Anemone	*Anemone multifida var.h*	Red	S1	late May – ea
Mountain Sandwort	*Arenaria (Minuartia) groenlandica*	Yellow	S2	May – June
Swamp Birch	*Betula glandulosa (B. nana)*	Yellow	S2	June – Sept
Purple-Stem Swamp Beggar's Tick	*Bidens connata*	Yellow	S3?	August – Sept
Lance-Leaf Grape-Fern	*Botrychium lanceolatum*	Yellow	S2	Aug
Marsh Bellflower	*Campanula aparinoides*	Yellow	S3?	late May – ea
Small-Flower Bitter-Cress	*Cardamine parviflora va*	Yellow	S2	April – Aug
Large Toothwort	*Cardamine X maxima*	Red	S1	late July – Aug
Chestnut-Colored Sedge	*Carex castanea*	Red	S2	June – Aug
Northern Bog Sedge	*Carex dioica*	Red	S1	July – Sept
A Sedge	*Carex lepidocarpa (C. viridula var.elat)*	Red	S1	July – Sept
Little Green Sedge	*Carex viridula ssp. bra*	Red	S1	June – Sept
Hemlock Parsley	*Conioselinum chinense*	Yellow	S2S3	May – June
Rose Coreopsis	*Coreopsis rosea*	Red	S1	August – Octo
A Hawthorn	*Crataegus flabellata*	Yellow	S?	June – Aug
Hairy Swamp Loosestrif	*Decodon verticillatus v*	Yellow	S2S3	late May – June
Showy Tick-Trefoil	*Desmodium canadense*	Red	S1	June – Aug
Wiegand's Wild Rye	*Elymus wiegandii var. w*	Red	S1	July – Nov
Purple Crowberry	*Empetrum rubrum var. ea*	Yellow	S2S3	July – Oct
Hornemann Willow-Herb	*Epilobium hornemannii*	Yellow	S2S3	July – Sept
Meadow Horsetail	*Equisetum pratense*	Yellow	S2	July – Aug
Joe-Pye Thoroughwort	*Eupatorium dubium*	Red	S2	August – Sept
Black Ash	*Fraxinus nigra*	Yellow	S3	all year
Northern Comandra	*Geocaulon lividum*	Yellow	S2S3	late May-ea
Downy Rattlesnake-Plan	*Goodyera pubescens*	Red	S1	July – Aug
Purple False Oats	*Graphephorum melicoides*	Yellow	S1	June – July
Water-Pennywort	*Hydrocotyle umbellata*	Red	S1	May to July
Bottlebrush Grass	*Hystrix patula*	Red	S1	July – Aug
Slender Blue Flag	*Iris prismatica*	Red	S1	June – Aug
Bulbous Rush	*Juncus bulbosus*	Yellow	S1	Unknown
Yellow Canada Lily	*Lilium canadense ssp. ca.*	Yellow	S2S3	July – Sept
Farwell's Water-Milfoil	*Myriophyllum farwellii*	Yellow	S2	June – Sept
St. John's Oxytrope	*Oxytropis campestris*	Red	S1	July – Sept
Common Butterwort	*Pinguicula vulgaris*	Red	S1	July
Southern Rein Orchid	*Platanthera flava var.*	Yellow	S2	July – Oct
Threadfoot	*Podostemum ceratophyllum*	Red	S1	late July – Aug

TABLE 4.3.4 Plant Species at Risk with Elevated Potential to Occur in the Project Area

Alderleaf Buckthorn	*Rhamnus alnifolia*	Yellow	S3	July – Sept
Willow Dock	*Rumex salicifolius ssp.*	Yellow	S2	June
Plymouth Gentian	*Sabatia kennedyana*	Red	S1	Aug
Silky Willow	*Salix sericea*	Yellow	S2	May – Sept
Long's Bulrush	*Scirpus longii*	Red	S2	July – Sep
Northern Bur-Reed	*Sparganium hyperboreum*	Yellow	S1S2	late July – A
Yellow Nodding Ladies'	*Spiranthes ochroleuca*	Yellow	S2	late July – A
Heart-Leaved Foam Flow	*Tiarella cordifolia*	Yellow	S2	year-round
Northern Blueberry	*Vaccinium boreale*	Red	S2	June – Sept
Alpine Blueberry	*Vaccinium uliginosum va*	Yellow	S2	June – Sept
Common Alexanders	*Zizia aurea*	Yellow	S1S2	May – June

Note: 1. Season in which the plant is most easily identifiable. Taken from NSDNR Phenology Database. Several seasonality periods have been adopted from regions outside "Eastern NS" (where the Project is located), mainly from "Cape Breton".

4.3.4.1.2 Plant Species of Special Status Known to Occur in the Canso Area

In a letter dated January 21, 2004, the NS Museum indicated that two plant species of concern are confirmed in nearby habitats (Table 4.3.5). In an email dated January 8, 2004, the ACCDC indicated that six plant species are recorded within a 5 km buffer around the Study Area (Table 4.3-5A). Five of these species (i.e. all except *V. ovalifolium*) are not listed in the NSDNR rare plant phenology database or the NSDNR rare plant database. The flowering times for those plants in Table 4.3-5A were derived from Roland's Flora of Nova Scotia (1998). The ACCDC also indicated that it is reasonable to assume that many of the species identified within the buffer, could occur within the Study Area. However, based on available habitat at the project site, the presence of Richardson rush appears to be unlikely, since it usually occurs on calcareous substrate (Roland's Flora of Nova Scotia, 1998).

TABLE 4.3.5 Plant Species of Special Status Known to Occur Near the Study Area (NS Museum, 2004)

Species	Scientific Name	General Status Rank in Nova Scotia
Acadian Quillwort	*Isoetes acadiensis*	Yellow
Oval-Leaf Huckleberry	*Vaccinium ovalifolium*	Red

Notes: 1 – Listed in 2001.

TABLE 4.3.5A Plant Species of Special Status Known to Occur Within 5 km of Canso (ACCDC, 2004)

Common Name	Scientific Name	ACCDC Rank	Phenology*
Rich's Sea Blite	*Suaeda maritima ssp. Richii*	S1	May flower later than Aug.-Sept.
Oval-leaf Huckleberry	*Vaccinium ovalifolium*	S1	Late July to early September
Northern Dewberry	*Rubus flagellaris*	S1	May-early June
Slender Sedge	*Carex tenera*	S1/S2	Late May to August
A Rush/Richardson Rush	*Juncus alpinoarticulatus*	S1/S2	July-August
Hooded Ladies'-Tresses	*Spiranthes romanzoffiana*	S3/S4	Late July to early August

Notes: S1/S2 - Considered extremely rare or rare throughout its range in Nova Scotia
S3/S4 – May be uncommon or widespread through its range in Nova Scotia, depending on its location.
- from: Roland's Flora Of Nova Scotia, 1998.

4.3.4.1.3 Flora Species at Risk Field Survey Methodology

Comprehensive plant field surveys were carried out June 23rd and 24th, 2004, and September 8th to 10th, 2004, emphasizing plant species of special status. The survey dates were chosen to cover the different seasonalities of the species in Table 4.3.4 to 4.3.6, in order to confirm the presence/absence of all plant species of special status within the Study Area.

4.3.4.1.4 Flora Species at Risk Field Survey Results

No vascular plant species of special status were observed within any of the proposed wind generator sites that were surveyed or the access road. However, after the changes to the project layout after September 2004, the locations 1d, 5d, 7d, 11d and 12d need to be re-evaluated, as well as the adjusted access road. Given the relatively low diversity within and uniform nature of the available habitat, the potential for vascular plant species at risk to occur is considered low. In addition, due to the fact that wetlands/bogs were avoided by adjusting the project layout, the potential for rare species is decreased.

<u>Lichens</u>

In addition, the area was surveyed for the presence of the boreal felt lichen, *Erioderma pedicellatum*, which is listed as endangered under the Nova Scotia Endangered Species Act and COSEWIC since 2003. None were found.

4.3.4.1.5 Flora Species, Supplementary Survey

Additional surveys for habitats and rare plants were carried out June 28th to 30th, 2005, and August 10th to 12th, 2005. During these surveys, all turbine sites added since September 2004 (1d, 5d, 11d, 12d), and the foot print of the road after the layout changes from February 2005 were surveyed, including the new watercourse crossing on Winter Creek.

Site 7d and 9d were surveyed, because the minor adjustments to the turbine locations since September 2004 have placed the new locations partially or totally in a different habitat than before. Turbine 7d is now located at the bottom of the forested slope and in the margin of Turf Bog. Turbine 9d now is located mostly in forested area rather than shrub barrens. In addition, in August 2005 surveys were repeated for all sites that have not changed location since September 2004 (2d, 3d, 4d, 6d, 8d, 10d) in order to supplement previous plant observations with any plants only identifiable in mid-summer, since previous surveys were conducted in the Spring or the Fall seasons. Site 2d, 3d and 4d were also surveyed in June 2005. The results of the additional survey are discussed below.

Plant inventories were collected at each turbine location, with special focus on plant species of Conservation Concern (NSDNR General Status of Wild Life Report, NS Endangered Species Act, COSEWIC, and the species provided by ACCDC and NSMUSEUM listed in Table 4.3.5 and 4.3.5A.). All plant species of conservation concern were considered when surveying roadways and turbine locations, including lichens, grasses, sedges and rushes. Turbine locations 4d and 10d did not support any grasses, sedges and rushes, and locations 5d, 8d, 11d and 12d only carried one species of theses monocots. At some locations, this may have been caused by the presence of an extremely dense low shrub layer. The plant inventory table serves as a feature of the habitat description. The survey of the road foot print focussed only on species of Conservation Concern. The proposed access road passes though mixed forest upland terrain and no wetlands are crossed.

Since wetlands were avoided in the project layout, the number of sedges and rushes observed during the field surveys was very low. Also, several turbine locations were covered with a very dense layer of shrubs, which very much reduced the available space for a herb layer. Those locations did not carry any monocots. Many grasses identified were observed in road/trail habitats and included several species that do not commonly occur in forest habitat.

No plant species of special status was identified at any of the surveyed sites.

TABLE 4.3.6: Plant Species Recorded During 2005 Survey

Scientific Name	Common Name	1d	2d	3d	4d	5d	6d	7d	8d	9d	10d	11d	12d	W/C
Abies balsamea	Balsam Fir		X	X	X	X	X	X	X	X	X	X	X	X
Acer rubrum	Red Maple	X	X	X	X	X	X	X	X	X	X	X		X
Acer spicatum	Mountain Maple			X		X							X	X
Agrostis alba	Red-top Grass	X						X						
Agrostis stolonifera	Creeping Bent-grass			X		X								
Alnus incana	Speckled Alder	X			X		X	X	X					
Alnus viridis	Downy Alder		X	X	X		X	X	X	X	X	X		X
Amelanchier bartramiana	Bartrams Serviceberry	X												
Amelanchier canadensis	Shadbush		X		X		X		X	X	X	X	X	
Anthoxanthum oderatum	Sweet Vernal Grass	X												
Aralia nudicaulis	Wild Sarsaparilla	X	X	X	X	X	X	X	X	X	X	X	X	X
Aster acuminatus	Wood Aster	X	X	X	X	X		X					X	X
Aster cordifolius	Heart leaved Aster						X	X	X					
Aster umbellatus	Tall White Aster		X											X
Athyrium filix-femina	Lady-Fern			X										
Avena fatua	Wild Oats							X						
Betula allegeniensis	Yellow Birch			X										
Betula cordifolia	Heart-leaf Birch		X	X		X							X	
Betula papyrifera	Paper Birch		X	X	X			X		X	X	X	X	
Calamagrostis canadensis	Blue-Joint Reedgrass							X						X
Carex communis	Fibrous-root Sedge	X		X									X	X
Carex debilis	Weak Sedge	X												
Carex disperma	Two-seeded Sedge		X			X	X		X					
Carex echinata	Star Sedge						X			X				X
Carex foliculata	Northern Long Sedge													X
Chamaedaphne calyculata	Leather-leaf							X						
Clintonia borealis	Clinton Lily	X	X	X	X	X	X	X	X	X	X	X	X	
Coptis trifolia	Goldthread		X	X		X		X		X			X	X
Corema conradii	Broom-Crowberry									X		X		
Cornus canadensis	Bunchberry	X	X	X	X	X	X	X	X	X	X	X	X	X
Cornus rugosa	Round-leaved Dogwood	X												X
Cypripedium acaule	Pink Lady's-slipper						X		X	X				
Deschampsia flexuosa	Common Hair-grass						X	X						
Diphasiastrum sitchense	Savin-leaved Clubmoss			X		X				X				
Drosera rotundifolia	Roundleaf Sundew									X				
Epigaea repens	Trailing Arbutus												X	
Eriophorum tenellum	Cotton-grass									X		X		

Scientific Name	Common Name	1d	2d	3d	4d	5d	6d	7d	8d	9d	10d	11d	12d	W/C
Fragaria virginiana	Wild Strawberry							X						X
Gaultheria hispidula	Creeping Snowberry						X		X					
Gaultheria procumbens	Teaberry			X	X	X	X	X	X	X	X	X	X	
Gaylussacia baccata	Black Huckleberry				X					X	X	X		
Glyceria striata	Fowl Manna Grass													X
Hamamelis virginiana	Witch hazel			X										
Hieracium pilosella	Mouse-ear Hawkweed							X						
Ilex verticillata	Canada Holly							X						X
Iris versicolor	Blueflag							X						X
Juncus effusus	Soft Rush							X						
Juncus pelocarpus	Brown-fruited Sedge									X				
Kalmia angustifolia	Sheep-Laurel	X	X	X	X	X	X	X	X	X	X	X	X	
Kalmia polifolia	Pale Laurel							X		X				
Lactuca biennis	Tall Blue Lettuce						X		X					
Larix laricina	American Larch, Tamarack	X	X					X		X		X		
Ledum groenlandicum	Labrador Tea		X		X	X		X	X	X	X	X	X	X
Linnaea borealis	Twinflower		X	X		X	X	X	X	X	X		X	
Lonicera villosa	Mountain Fly-Honeysuckle							X						
Luzula acuminata	Pointed Wood-rush		X					X						
Lycopus americanus	Bugle-weed							X						
Lysimachia terestris	Swamp Candles							X						
Maianthemum canadense	Wild Lily-of-The-Valley	X	X	X	X	X	X	X	X	X	X	X	X	X
Mitchella repens	Partridge Berry	X	X	X										
Monotropa uniflora	Indian-Pipe								X				X	X
Myrica gale	Sweet Gale							X						X
Nemopanthus mucronatus	False Holly	X	X	X	X	X		X		X	X	X	X	
Osmunda cinnamomea	Cinnamon Fern	X					X	X		X				X
Osmunda claytoniana	Interrupted Fern			X		X	X		X				X	
Oxalis montana	White Wood-Sorrel			X		X	X	X	X				X	
Phegopteris connectilis	Northern Beech Fern					X								X
Picea mariana	Black Spruce	X			X			X		X	X	X		
Picea rubens	Red Spruce	X	X	X		X	X	X	X				X	X
Pinus banksiana	Jack Pine				X					X	X	X		
Prenanthes trifoliata	Lions Paw													X
Prunus pennsylvanica	Pin Cherry			X										
Prunus virginiana	Chokecherry							X						
Pteridium aquilinum	Bracken Fern	X	X	X	X	X	X	X	X	X	X	X	X	
Rhododendron canadense	Rhodora		X	X	X	X		X	X	X	X	X	X	X
Rhyncospora alba	White-beak Rush									X				
Rubus hispidus	Dewberry													X
Salix eriocephala	Red-tipped Willow							X						
Sarracenia purpurea	Pitcher Plant							X						
Scirpus cyperinus	Common Wool-grass							X		X				
Solidago rugosa	Rough-stem Goldenrod							X						
Sorbus americana	American Mountain-Ash		X	X	X	X	X		X	X	X	X	X	X
Sphagnum sp.	Sphagnum moss	X		X	X	X	X			X	X	X		X
Spiraea alba	Meadow-Sweet	X			X	X				X	X	X		
Streptopus roseus	Rose Twisted Stalk			X		X	X		X				X	
Thelypteris noveboracensis	New York Fern	X					X							X

Scientific Name	Common Name	1d	2d	3d	4d	5d	6d	7d	8d	9d	10d	11d	12d	W/C
Trientalis borealis	Northern Starflower	X	X	X	X	X	X	X	X	X	X	X	X	X
Vaccinium angustifolium	Lowbush Blueberry				X		X		X	X		X		
Vaccinium myrtilloides	Velvet-leaved Blueberry	X	X	X		X		X	X				X	X
Vaccinium vitis-idaea	Mountain Cranberry		X	X	X		X	X	X	X	X	X	X	
Vallisneria americana	Water Celery													X
Veronica officinalis	Common Speedwell							X						
Viburnum nudum	Wild Raisin	X		X	X	X		X		X	X	X		X
Viola cucullata	Marsh Blue Violet							X						

*Note: W/C = Watercourse crossing location.
Some locations are identical to those surveyed earlier: 3d = 3, 4d = 5, 9d = 9a, 10d =10.

4.3.4.2 Terrestrial Fauna

4.3.4.2.1 Terrestrial Fauna Species at Risk Other Than Birds Which Potentially Occur at the Project Site

Before the field surveys, a database search was conducted in order to assemble a list of fauna species of concern in Nova Scotia. In 2004, a number of mammals, herpetiles, molluscs, lepidoptera and odonates are listed under COSEWIC, NSDNR, NSESA (listed in 2000 to 2003) are listed with the ACCDC. These species are assembled in the Priority List (Appendix E). Priority species that are known to occur in Eastern Nova Scotia are listed in (Table 4.3.7 to 4.3.12). Where available, distribution maps were also consulted for this evaluation.

The species in the short lists were then evaluated for their potential to occur in Canso, based on habitat requirements, and assembled into a list of species with elevated potential to occur at the study site (Table 4.3.12). Those species received particular attention during the field surveys. Information on known occurrences of species of special status in the Canso area was acquired from the NSMNH and ACCDC. However, since data on many species (e.g. butterflies and odonata) are obviously still scarce, particularly in remote areas such as Canso, Priority Species not listed in the short lists were considered during the field survey, when suitable habitat was discovered.

<u>Mammals</u>

There are 13 species of mammals listed as “at risk” in Nova Scotia (Appendix E). Based on distribution maps and known sightings, a Short list of Priority Species Mammals occurring in eastern Nova Scotia (”Regional Species”) was assembled (Table 4.3-7). Of the thirteen mammals on the priority list, none have been officially recorded in the Canso area, or Eastern Mainland Nova Scotia. The closest confirmed location for a priority species is in Pictou County, where Fishers have been observed (Appendix E).

However, local informants report that there are bats in Canso. Little brown bats were identified by a local naturalist, though this identification was not confirmed (Table 4.3.7). Bats can be seen flying around street lights during the summer. The Children’s Camp on Glasgow Head and Turf Bog (along the coastal road to Glasgow Head and west of the coastal drumlins) are other places where foraging bats are seen at dusk or have been seen in the past. Also, there used to be (and still may be) roosting bats at the local high school, taking advantage of an overhang at the building. These are the bats that were caught and identified by the local naturalist as “little brown bats". In addition, almost every summer a Canso resident finds bats roosting in the attic of a house, which usually results in the "extermination" of the bats. The most recent case was in the summer of 2004 or 2003, when a small group of 4-5 bats was discovered in a house in the center of the Town near the RCMP station. These bats were killed. There are no reports of hibernating bats, suggesting that all bats leave the area in the fall.

TABLE 4.3.7 Short List of Mammal Species at Risk in Eastern Nova Scotia

Scientific Name	Common Name	COSEWIC*	NS General Status	NS Endangered Species Act*
Martes pennanti	Fisher	--	Yellow	--
Myotis lucifugus	Little brown bat**	--	Yellow	--

* as of September 2004
** species identification not confirmed

Based on information available from NatureServe and the behaviour of the bats in Canso (foraging around lights, use of buildings and roosting individually or in groups), any or all of the other species may be present (Erickson et al., 2002; NatureServe, 2005). Also, the Museum of Natural History (2004) pointed out that the lack of confirmed sightings of bats in Eastern Nova Scotia could be due to lack of records rather than lack of species presence.

However, silver-haired bat, red bat and hoary bat are at or beyond their northern range limits in Nova Scotia (Borders et al., 2003). While there has been no research on bat presence in the Canso area, it is assumed that there may be the odd hoary bat, but very few or no individuals of the other two species. Also, Eastern pipistrelle are not likely to occur in Canso, but this still needs confirmation through field surveys (Hugh Broders, personal communication). Eastern pipistrelle may also be at its northern limits in Nova Scotia, though records are comparatively more frequent than for tree bats (Broders et al., 2003). The most northerly record of Eastern pipistrelle is from a hibernation site in Halifax County. They may exist further north, but current summertime records are restricted to southwestern Nova Scotia (A. Hebda, personal communication). Little brown bat and Northern long-eared bat are likely to occur in Canso (H. Broders, personal communication).

Therefore, three priority bat species were included in the habitat evaluation: little brown bat, Northern long-eared bat and Eastern pipistrelle.

Habitat Requirements

Fishers will inhabit primarily dense coniferous or mixed forests, including early successional forest with dense overhead cover (Nature Serve 2004). Hardwood stands may be preferred during the summer months; however, they should have a dense understorey of young conifers, shrubs, and herbaceous cover. There are no proposed turbine sites with such habitat. The forested sites typically have a sparse understorey, and the remaining sites are dominated by small shrubs.

The little brown bat forages in forested areas (hardwood and mixed) near watercourses, but also in orchards, old fields and grasslands/herbaceous lands. It may be found over bogs/fens, and in forested wetlands (Dilworth, 1984; Nature Serve, 2004). It was found foraging at ground level over forest trails, rivers and stillwaters (Broders et al., 2003). Eastern pipistrelles can be found along open hardwood woodland areas with some large trees, but also orchards, old fields and grasslands/herbaceous lands. It forages at tree top level and often over water (Nature serve, 2004). It was found foraging high over water, mostly rivers, and sometimes lakes (Broders et al., 2003). Both species hibernate in caves or mines with high humidity (Nature Serve, 2004). Little brown bats may also use hollow trees, buildings or caves for roosting, while Eastern pipistrelle roosts among foliage, and sometimes in buildings, but rarely in caves (only at night). Some Eastern pipistrelle migrate south in the autumn, but some hibernate in the north (ibid.). There is no habitat for hibernacula within the proposed sites. However, these species may be found foraging in the area during the summer months.

Northern long-eared bats can be found in woodland and forests of any composition. They forage above and among the canopy, but also along clearings and occasionally over water (NatureServe, 2004). They were found foraging at ground level over forest trails. This species is a forest interior species (Broders at al., 2003). It uses caves, mines and quarries for hibernation and summer nighttime roosts, while crevices, hollows, under bark, and diverse small spaces on buildings, are used for summer daytime roosting. These bats do not migrate south (NatureServe, 2005). While there may be potential daytime roosting areas for this species, the night time roosting or hibernation habitat is not present at the proposed sites.

All species live in habitat that has standing snag/hollow trees as a special feature (NatureServe 2005). Since the forest in the project area has been logged, and/or destroyed by forest fire, trees are generally small and the potential for dead or hollow trees is reduced, except at the southern boundary of the project area, thus reducing the quality of the habitat and potential number of bats in the area. However, there are cavities between large boulders and small hollows in rocks in the area (local informant), which may potentially be used by bat species other than hoary bats and red bats for summertime roosting. Therefore, there appears to be potential summertime and foraging habitat for at least some of the bat priority species, though habitat quality is likely poor.

Thus, bats may occur in the study area and are included in a list of species with elevated potential to occur in the project area (Table 4.3.12). However, as pointed out earlier, there are no confirmed sightings of bats in Eastern NS (NS Museum of Natural History, ACCDC, 2004; H. Broders, personal communication, 2005).

While moose and lynx no longer occur in Eastern mainland Nova Scotia, there appears to be suitable habitat for them (Nature Serve, 2004; Appendix E). Lynx tend to inhabit wooded and swampy areas where snowshoe hare are abundant, and moose inhabit second-growth forest, openings, swamps, lakes and wetlands. Therefore, these two species are considered to have a small potential for presence (Table 4.3. 12), and field surveys included looking for signs of the presence of these two species. However, most of these habitats are not in turbine locations, since wetlands were avoided. No indications of moose or lynx were observed during the field studies.

<u>Reptiles and Amphibians</u>

Of the four herpetile priority species in Nova Scotia (Appendix E), only wood turtle and four-toed salamander have the potential to occur in the Canso area (Table 4.3.8). Blanding's turtle and Northern ribbon snake are restricted to southwestern Nova Scotia, in the general area of Kejimkujik National Park (Queens and Lunenburg Counties) (Gilhen 1984). In addition, Blanding's turtle, like wood turtles, needs sandy or gravelly shores for breeding, which does not occur in or near the project area.

While wood turtles occur in central and northern NS, the sightings nearest to the project area are in the St Mary's River watershed, Guysborough County (about 100 km SW of Canso), and in southern Cape Breton (ca. 80 km NW of Canso). The four-toed salamander occurs all over Nova Scotia, with most observations made in southwestern NS. The locations closest to Canso area are near Liscombe Mills and in southern Cape Breton (120 km and 50 km distance from the project area, respectively).

TABLE 4.3.8 Short List of Herpetile Species at Risk in Eastern Nova Scotia

Scientific Name	Common Name	COSEWIC*	NS General Status	NS Endangered Species Act*
Clemmys insculpta (Glyptemis insculpta)	Wood Turtle	Special Concern	Yellow	Vulnerable (2000)
Hemidactylium scutatum	Four-toed Salamander	--	Yellow	--

* as of September 2004

Habitat Requirements

The wood turtle requires deep, slow moving water with open, sandy or gravely shores for basking and nesting. There is no such habitat at any of the 10 proposed sites, or the access road. Therefore, wood turtles are unlikely to occur within the project area.

The four-toed salamander is mainly found in, or around, sphagnum bogs, but can also be found in the peaty margins of watercourses and lakes (Clayden et al., 1984). While there may be such habitat along the lower part of Winter Creek (WL1), this bog has been avoided in the project design. However, after the latest changes in Project design (Nov. 2004 and April 2005), the Turbine location 7d is now located near Turf Bog.

Molluscs

There are six species of Molluscs in the Priority List (Appendix E). Distribution maps show that only the delicate lamp mussel, eastern lamp mussel and eastern river pearl mussel have occurrences including the Canso Area, while the other species do not occur here (Clarke, 1981). Yellow Lamp Mussel was found in Cape Breton (Sydney River) and southern NB, though Clarke's description could be interpreted to imply that the distribution is continuous. Therefore, only four species could potentially occur in Canso (Table 4.3.9)

TABLE 4.3.9 Short list of Mollusc Species at Risk in Eastern Nova Scotia

Scientific Name	Common Name	COSEWIC*	NS General Status	NS Endangered Species Act*
Lampsilis cariosa	Yellow Lamp Mussel	Special Concern	Red	--
Lampsilis ochraceae	Delicate Lamp Mussel (Tidewater Mucket)	--	Yellow	--
Lampsilis radiata	Eastern Lamp Mussel	--	Yellow	--
Margaritifera margaritifera	Eastern River Pearl Mussel (E. Pearl Sh.	--	Yellow	--

* as of September 2004

Habitat Requirements

Based on the habitat requirements, there could be potential habitat for these species in Winter Creek, except for the Delicate Lamp Mussel, though the amount of sand is very low (Clark, 1981, see Appendix E). However, the major obstacle for the presence of these species is their larval development. Freshwater mussels generally parasitize on fish during certain stages on their development, except for Squawfoot (Clarke, 1981). No fish were found in Winter Creek (section 4. 5.4). Therefore, there appears to be no habitat for these mussels in the whole project area.

However, though Squawfoot is not listed as occurring in the Canso area, Winter Creek could provide suitable habitat for this species (Table 4.3.12).

Lepidoptera

Nine species of butterflies are listed as “at risk” in the General Status of Wildlife in Nova Scotia Report. These species are listed in the Priority List (Appendix E). These species are also listed as “sensitive” of “at risk” in Nova Scotia in “Wild Species 2000 - the general status of Species in Canada”.

All nine butterfly species included in the Priority list have not previously been reported in Canso or surrounding areas. For three species, there is no information on the distribution available (“Butterflies of Nova Scotia”, 2005): hoary comma, sartyr anglewing (comma) and Arctic fritillary (Appendix E). Since there were no food plants for larvae of hoary comma and satyr comma (see below), enquiries regarding distribution were only made regarding the Arctic fritillary. NSDNR (Mark Elderkin, 2004) and a butterfly specialist for Nova Scotia recommended by the NSMNH (P. Payzant) were contacted.

The Arctic Fritillary (*Boloria chariclea*) adult is typically found in June and July. This species occurs in boreal woodlands and black spruce sphagnum bogs (Pyle, 1994). A cotton grass (*Eriophorum spissum*) may be the food plant of the Arctic fritillary larvae as well as violets (*Viola* sp.), scrub willows (*Salix* sp.) and possibly blueberries (*Vaccinium* sp.) (Opler, 1995). Another source lists the food plants as mountain avens (G*eum peckii*) and possibly violets, and the flying time as August (The Butterflies of Nova Scotia, 2004). However, one potential food plant is blueberry, though it is not listed as food plant for Nova Scotia. Blueberries were found at several locations (Table 4.3.1). Inquiries with P. Payzant (personal communication) showed that the species has been collected in Nova Scotia in 1943 and 1949, both in Colchester County in the Parrsboro area. There have been no known sightings since. The range map in Layberry et al. (1998) shows sightings near Parrsboro and at the extreme northern tip of Cape Breton. Information obtained from NSDNR (M. Elderkin, Species at Risk Biologist, personal communication), showed that very little information and no recent sightings are available. The previous sightings were ephemeral (i.e. the butterflies only stayed for very few years). This suggest that their presence was “accidental”, which will likely result in downgrading of this species from “Yellow” when the listings are revised in the future (M. Elderkin, personal communication). This species therefore is not likely to occur at the project site, and may not be of conservation concern much longer.

As a result of the distribution map review, there are no butterfly species of concern that should be short listed as occurring in Eastern Nova Scotia. However, most of the butterflies have been seen only at one or two locations in Nova Scotia. Data are generally so scarce, that there appears to be little reliability of the distribution map data. Under-reporting of locations is quite possible, since there are few interested, knowledgeable people out looking for butterflies. Therefore, the eight remaining butterfly species of concern were subjected to the evaluation of habitat requirements, in particular, the larval food plants, to get a more reliable picture of which species are not likely to occur.

Butterflies depend on plants as the food source for their juvenile stage, the caterpillar. Many species are very specialized on one or a few plant species. Since adults are mobile and can be expected to be able to search for nectar producing plants in a larger, though somewhat limited area, thus avoiding areas devoid of vegetation due to project activities, the butterfly species could be impacted by project activities that would destroy food plants for the caterpillars. Plant inventories assembled during the field visits allow to assess the presence of habitat for these butterflies.

The Early Hairstreak (*Erora iaeta*) occurs in hardwood forests (mature beech-maple woods), as well as northern mixed forests (Nature Serve, 2004; Pyle, 1994). The young larvae feed on the developing beechnuts, and hazelnut is suspected to be a food resource where beech does not occur (Nature Serve, 2004). Food plants do not occur at any of the turbine locations (Table 4.3.1), nor the surrounding area.

The Northern Cloudywing (*Thorybes pylades*) occurs in open woods, shrubland and various types of woodland habitat. Typically, the adults fly from May through July (Pyle, 1994). The host plants for this species include those in the legume family (*Fabaceae*), where the larvae also construct protective nests using leaves of the food plant and silk (Pyle, 1994). There were no food plants on any of the turbine sites (Table 4.3.1).

Monarch butterflies utilize habitats such as meadows, weedy fields and watercourses where milkweed is present, during the breeding season. Monarchs can occur almost anywhere in NS during spring migration, and in the breeding season near the food plants. Monarchs are common to abundant during the fall migration. At certain locations, the monarchs are then very abundant, notably along the Atlantic coast. These fall migrants are thought to originate from outside the province. Small numbers are resident. There is no milkweed present within any of the proposed sites (Table 4.3.1).

The Hoary Comma (*Polygonia gracilis*) occurs in boreal forests, woodland habitats, clearings and rivers (Nature Serve, 2004; Pyle, 1994). The adults fly from July into September. The larval stage feeds on currants and gooseberries (*Ribes* sp.), western azalea (*Rhododendron occidentale*), and mock azalea (*Menziesia glabella*) (Opler, 1995). These food plants were not observed at any of the proposed sites during field surveys (Table 4.3.1).

The Satyr Comma (*Polygonia satyrus*) larval stage feeds on stinging nettle (*Urtica* sp.) and forms a protective shelter by curling leaves around itself (Pyle, 1994). The adults fly from early spring to late autumn and occupy habitats such as streamsides, boreal forest edges, and wooded City Parks (Nature Serve, 2004; Pyle, 1994). There were no stinging nettle plants identified at any of the proposed sites during the field visit (Table 4.3.1).

The Jutta Arctic (*Oeneis jutta*) typically flies in June and July. The habitat for this species is described as black spruce and tamarack sphagnum bog areas or moist tundra areas (Nature

Serve, 2004; Pyle, 1994). The food plants for this species include *Eriophorum spissum*; *Carex geyeri*, *C. concinna* and other sedges and grasses. While there were patches of black spruce bog habitat in the Study Area, none of the proposed sites were located within habitat of this type. In addition, wetlands, i.e., the habitat for the food plants, have been avoided in the project design.

The Bog elfin (*Incisalia lanoraieensis*) is known to occur in areas of forested wetland and acid bogs with patches of black spruce or tamarack and conifer forests. The larvae feed on the new spruce shoots. This species is very closely associated with black spruce (Nature Serve, 2004). The adults can be found from May through June (Pyle, 1994). While there were patches of black spruce bog habitat in the Study Area, none of the proposed sites were located within habitat of this type. Based on field survey experience in the project area, this includes location 1d, 2d, 3d, 4d, 5d, 6d, 8d, 10d, 11d and 12d, and very likely 7 d. These food plants grow in wetland areas, which were avoided during the project design.

The short tailed swallowtail (*Papilio brevicauda*) typically flies in June and July. The larval stage feeds on various plant species of the carrot family, including cow parsnip (*Heracleum sp.*), angelica (*Angelica sp.*) and scotch lovage (*Ligusticum scothicum*) (Pyle, 1994). The typical habitat for this species includes evergreen forest edge, inland meadows, grassed sea cliffs, rocky beaches and village gardens (Nature Serve, 2004; Pyle, 1994). Short-tailed swallow tails are very rare, and may not be present in Nova Scotia in most years. It is not known whether stable populations exist in NS. When it is found, it is in coastal areas, where food plants are present (e.g. Scotch lovage) (Butterflies of Nova Scotia, 2004). There were no food plants at any of the proposed sites surveyed. However, Turbine 7a has since been moved and is now located on or near the edge of Turf bog. Scotch lovage had been noticed in Turf Bog during the habitat surveys. However, based on previous site visits, it is known that this turbine location is wooded with mostly coniferous trees. Therefore, food plants are not expected at this turbine location or its access road.

In summary, there are no food plants for early hairstreak, northern cloudywing, monarch, hoary comma and sartyr comma at any of the turbine sites or the access road (Table 4.3.1).

Therefore, the only endangered butterfly species that could potentially occur at the project site are Jutta Arctic, Bog-Elfin and Short-tailed Swallowtail (Table 4.3.12). However, no turbine locations or access road pathways that were surveyed are located in suitable habitat. Location 1d, 5d, 7d, 11d and 12d, which were chosen after the field surveys, are also not likely located in suitable habitat for these butterflies, based on the knowledge of the project area from previous field surveys. In addition, there are no confirmed sightings for any of these species in Eastern Nova Scotia

<u>Odonata</u>

There are 13 species of dragonflies and damselflies listed as Red or Yellow in the General Status of Wildlife in Nova Scotia Report. None are listed under COSEWIC or the Nova Scotia Endangered Species Act (Appendix E).

Very little information on the distribution of odonates is available for Nova Scotia. Guysborough County is the least studied county in Nova Scotia (P. Brunelle, personal communication). Based on available information on confirmed sightings, only one of the Priority Species has been recorded in Guysborough County (Table 4.3.10; P. Brunelle, personal communication).

TABLE 4.3.10 Short-List of Odonate Species at Risk in Guysborough County++

Scientific Name	Common Name	COSEWIC*	NS General Status	NS Endangered Species Act
Sympetrum danae	Black Meadowfly	--	Yellow	--

* as of September 2004
++Source: Paul Brunelle, personal communication.

Since the scarcity of records certainly is partly due to under-reporting, the distribution map data seem to be less reliable. Therefore, all 13 species were subjected to the evaluation of habitat requirements.

Due to their life cycle, the biggest impact on these insects would be from destruction or alteration of their breeding and juvenile living habitat, which is aquatic. As adults, they roam over larger areas. Most are agile fliers and can be expected to be able to avoid the turbines. Information on breeding habitat requirements in Nova Scotia was obtained from P. Brunelle, (personal communication, 2005).

Based on habitat requirements (Appendix E), there is no potential breeding habitat for most species, except Zorro Clubtail (Northern Pygmy Clubtail). This species prefers clear streams and brooks with strong currents over clean gravel, cobbles and bedrock, over fairly unproductive soils (NatureServe, 2004). It is only found in primary and secondary brooks and streams running through fairly undisturbed forest, heavily shaded. (P. Brunelle, personal communication, 2005). It is unlikely that Brook Snaketail and Zebra Clubtail would use Winter Creek for breeding, as the flow is minimal. The amount of sand bottom is very low and cobbles and rocks are frequent (Appendix B). Black Meadowfly inhabits marshes with slow moving streams and ponds, with soft substratum. It often, but not always, is associated with peatlands. In Cape Breton, it was found in salt marsh ponds (P. Brunelle, personal communication). Therefore, there may be habitat for this species in Wetland 1 (Table 4.3.12). However, none of these habitats is located on any of the turbine sites or the access road.

4.3.4.2.2 Terrestrial Fauna Species at Risk (Other Than Birds) Known to Occur in the Project Area

Both the Nova Scotia Museum of Natural History and ACCDC do not have any records any fauna species at risk other than birds in the Canso area, including a 5 km radius around the project site. However, in a letter dated January 21, 2004, the NS Museum indicated that, though bat species are not listed by the NS Museum, all bat species in Nova Scotia are ranked yellow.

4.3.4.2.3 Terrestrial Fauna Species at Risk with Elevated Potential to Occur in the Project Area

Based on habitat requirements that align with habitat available in the project area/turbine sites and access roads, the following Priority Species with previous sightings require special attention during field surveys (Table 4.3.11). The presence/absence of these species was confirmed through directed field surveys.

TABLE 4.3.11 Terrestrial Fauna Species at Risk with Elevated Potential to Occur in the Project Area

Scientific Name	Common Name	COSEWIC*	NS General Status	NS Endangered Species Act
Mammals				
Myotis lucifugus	Little Brown Bat	--	Yellow	--
Amphibians				
Hemidactylium scutatum	Four-toed Salamander	--	Yellow	--
Odonata				
Sympetrum danae	Black Meadowfly	--	Yellow	--

*as of September 2004

In addition, the following Priority species animals require habitat that may be available at the project site, even though there are no recent confirmed sightings of the species in the project area, i.e., they are not short-listed above. The potential presence of these species was considered during the field surveys (Table 4.3.12).

TABLE 4.3.12 Priority Species Without Confirmed Sightings in Canso, but Whose Habitat Requirements are met by Available Habitat

Scientific Name	Common Name	COSEWIC*	NS General Status	NS Endangered Species Act
Mammals				
Alces alces	Moose	--	Red	Endangered (2003): NS Mainland Population
Lynx lynx/L. canadense	(Canada) Lynx	--	Red	Endangered (2002)
Myotis septentrionalis	Northern Long-eared Bat	--	Yellow	--
Pipistrellus subflavus	Eastern Pipistrelle	--	Yellow	--
Molluscs				
Strophitus undulates	Squawfoot	--	Red	--
Lepidoptera+				
Oeneis jutta	Jutta Arctic	--	Red	--
Incisalia lanoraieensis	Bog Elfin	--	Red	--
Papilio brevicauda	Short-tailed Swallowtail	--	Yellow	--
Odonata+				
Lanthus parvulus	Zorro (Northern Pygmy) Clubtail	--	Yellow	--

+ Wetlands have been avoided in the project design. Therefore, food plants or breeding habitat for these species are not impacted

4.3.4.2.4 Terrestrial Fauna Species at Risk (other than Birds) Field Surveys Methodology

The field surveys for the animal species listed in Table 4.3.11 were conducted as directed surveys, focusing on fauna species at risk. This is unlike the bird surveys (section 4.4), which were carried out by assembling comprehensive bird inventories.

All proposed wind turbine sites (1a, 2, 3, 4a, 5, 6-8, 9a, 10) were surveyed during a habitat survey conducted from September 8 to 10th, 2004, The survey focused on locating the species at risk listed above. For dragon flies and damselflies, the presence of nymphs is required as proof the presence of the species in the habitat (P. Brunelle, personal communication, 2005). Bird and fish species at risk were surveyed separately and are dealt with in the respective separate sections. In addition, any animal species encountered during earlier field surveys focusing on other topics (plants and birds) where registered.

Since the distribution data for many taxonomic groups are scarce, at least partly due to under reporting, lack of research and knowledgeable interested people, any animal species observed was scrutinized, and any habitat encountered which appeared suitable for species at risk was investigated.

4.3.4.2.5 Terrestrial Fauna Species at Risk (other than Birds) Field Survey results

Based on observations of the habitat at each of the proposed sites, there is no critical habitat (including food plants) for most species at risk. No species at risk were noted during the field survey.

Location 1d, 5d, 7d, 11d and 12d, which were chosen after September 2004, are also not located in suitable habitat for these animals, based on the knowledge of the project area from previous field surveys and the general avoidance of wetlands. Plant and habitat surveys of these locations and their proposed access roads in the summer of 2005 will reveal if this assumption is true. As a consequence, the potential for the presence of animal species at risk on the project sites is considered to be small.

Mammals

While habitat is available for Moose and potentially Lynx (no information on sufficient numbers of prey), no signs of moose (i.e., shed antlers, feces, tracks) or lynx inhabitation (i.e., tracks) were noted during the survey. Also, bats were not noticed during the field surveys, even though potential habitat, at least for foraging, is available.

Molluscs

During the habitat surveys, no molluscs were encountered in Winter Creek.

Herpetiles

No four toed salamanders were seen.

Lepidoptera

None of the three species (Table 4.3.12) was encountered during the field surveys.

Odonata

During the summer and fall field surveys, no dragonflies or damselflies were noticed or caught. Also, no nymphs were seen in Winter Creek during the electro fishing surveys of fish habitat.

4.4 AVIAN SURVEYS

Based on background data search and observations during site visits, it is known that birds breed in and migrate close to, or through the project area. The area can be expected to be close to migratory bird routes, as there are several significant habitats for migratory birds located north and south of Canso, though these areas are at least 16 km away from the project area (see Section 4.1). Migrating birds are protected under the federal “Migratory Birds Act”.

Since both breeding and migrating birds are likely to be impacted by the wind turbines, a comprehensive field inventory of breeding and migrating birds was developed.

The field program for the bird surveys was developed in communication with CWS, NSDNR and Environment Canada. Data was collected according to the parameters set out in the guidance document, "*Baseline Information Requirements for Evaluation of Effects of Wind Power Facilities on Migratory Birds in Atlantic Canada*". It also follows the rules set out in the in the CWS draft guidance document, "*Wind Turbines and Birds – A Guidance Document for Environmental Assessment*". The baseline information requirements for onshore and off-shore wind farms of different size are summarized in table 2 of the draft guidance document (Appendix G). As requested by CWS, the field program was developed based on the parameters for medium size onshore wind farms (11-50 turbines), even though the Canso wind farm, with 8 turbines, is actually in the "small wind farm" category. CWS based this request on the geographical location (coastal) of the proposed project, and the known importance of the area for birds.

Multiple individual surveys were carried out during 2004 and 2005, focusing on different bird target groups. All surveys were carried out by an experienced Birder (C. Stevens) with over 25 years of birding knowledge and trained in the methods of scientific bird observation and data collection (Appendix A). An overview of the surveys, including the schedule, is given in Table 4.4.1. The schedule was developed by the bird specialist, who also carried out the surveys. The migration survey schedule was adjusted on short notice based on current reports of the migration activity, in order to survey during peak migration activities whenever possible.

TABLE 4.4.1 Bird Survey Schedule

Type of Survey	Date	Notes
Breeding Birds	First week of July 2004	Includes morning chorus
Fall Shorebird Migration	Mid August	
Fall Passerine Migration I – insect eaters	First week of September 2004	
Fall Passerine Migration – seed eaters	mid to late October 2004	
Fall Passerine Migration - various other passerines	November 2004	Historical data from local birders birders
Fall Hawk Migration	Not necessary (after consultation with NSDNR, CWS)	Movements of hawks other raptors were recorded during surveys for other birds
Winter Birds	First week of January, plus Christmas Bird Counts	
Owls II	Mid April	
Waterfowl Spring Migration	Mid April 2005 (week of April 15th, 2005)	
Spring Passerine Migration	Mid April	Early migrants
Spring Passerine Migration	May 2005, main survey	Migration peak; migration ranges from March to June
Breeding Birds	June 2005	Supplementary breeding bird survey for Sites 1d, 5d, 11d, 12 d

The following sections summarize the survey result with the exception of the results from the main spring migration survey (May 2005) and the supplementary breeding bird survey (June 2005). These two surveys represent a supplementary field survey program which was conducted after the report on the initial surveys had been completed. The results of these surveys therefore have been presented separately in Sections 4.4.3.4 and 4.4.6

4.4.1 Bird Species at Risk Which Potentially Occur in the Project Area

There are 29 species of birds that are of conservation concern in Nova Scotia. These species are provided in the Priority Species List in Appendix E. (Table 4.4.2). In addition, all raptors are protected under the Nova Scotia Wildlife Act. While a number of the priority species have not been recorded in Eastern Nova Scotia, there is a high potential that most of the Priority species can be found in the project area either as breeding birds or during migration.

TABLE 4.4.2 Bird Species at Risk with Potential to Occur at the Wind Farm Site

Scientific Name	Common Name	COSEWIC**	NS General Status	NS Endangered Species Act
*Accipiter gentiles**	Northern Goshawk	--	Yellow	--
Alca torda	Razorbill	--	Yellow	--
*Ammodramus caudacutus**	Sharp-tailed Sparrow	--	Yellow	--
Asio flammeus	Short-Eared Owl	Special concern	Yellow	--
Asio otus	Long-eared Owl	--	Yellow	--
Branta bernicla	Brant	--	Yellow	--
Bucephala islandica (eastern population)	Barrow's Goldeneye	Special Concern	Yellow	--
Calidris pusilla	Semipalmated Sandpiper	--	Yellow	--
Catharus minimus (C. bicknellii)	Bicknell's Thrush	Special Concern	Yellow	Special Concern[2]
*Charadrius melodus ssp.melodus**	Piping Plover	Endangered	Red	Endangered[1]
*Dolichonyx oryzivorus**	Bobolink	--	Yellow	--
Egretta thula	Snowy Egret	--	Yellow	--
Falco peregrinus ssp.anatum	Peregrine Falcon	Threatened	Red	Threatened[1]
Fratercula arctica	Atlantic Puffin	--	Yellow	--
*Gavia immer**	Common Loon	--	Yellow	--
Histrionicus histrionicus (eastern population)	Harlequin Duck	Special Concern	Red	Endangered[1]
Egretta thula	Snowy Egret	--	Yellow	--
Numenius borealis	Eskimo Curlew	Endangered	--	--
Nycticorax nycticorax	Black-crowned Night Heron	--	Yellow	--
Passerculus sandwichensis ssp. Princeps*	Ipswich Sparrow (Savannah Sparrow*)	Special Concern	Yellow	--
Phalaropus fulicaria	Red Phalarope	--	Yellow	--
Phalaropus lobatus	Red-necked Phalarope	--	Yellow	--
Pooectes gramineus	Vesper Sparrow	--	Yellow	--
Progne subis	Purple Martin	--	Yellow	--
Sialia sialis	Eastern Bluebird	--	Yellow	--
*Sterna dougalli**	Roseate Tern	Endangered	Red	Endangered[1]
Sterna hirundo	Common Tern	--	Yellow	--
*Sterna paradisea**	Arctic Tern	--	Yellow	--
Sturnella magna	Eastern Meadowlark	--	Yellow	--

Notes: 1= listed in 2000
2= listed in 2002
* = confirmed breeding (Erskine, 1992) see Table 4.4.-5
** Committee on the Status of Endangered Wildlife in Canada

Therefore, a short list of priority species in Eastern Nova Scotia and a selection of species with high potential to occur in the study area based on habitat requirements were not assembled.

For example, Eastern Meadowlark would have been eliminated in the short list, since distribution maps did not show it in Eastern Nova Scotia, but it was found during the late fall passerine migration. Table 4.4.2 is identical to the list of birds in the Priority Species list (Appendix E).

Based on the available habitat in the project area, most of these species have a potential to occur in the Canso area. Three of the species of concern have a very low likelihood to occur in the project footprint, due to lack of breeding habitat: Atlantic Puffins, Eastern meadowlark and purple martin. Habitat for Bobolinks is very limited. However, they may occur in adjacent areas. Also, peregrine falcons, Barrow's goldeneye, common loon and Eskimo curlew are unlikely to breed in the Canso area, but are likely to migrate or winter here. Therefore, a short list of species with elevated potential to occur the Canso area, either in the project foot print or in the buffer zones to be surveyed, would be identical to the above list.

4.4.2 Bird Species at Risk Known From the Canso Area

Two sources provided information on records of bird species at risk in the Canso area.
In a letter dated January 21, 2004, the NS Museum indicated that six bird species of concern are confirmed in nearby habitats (Table 4.4.3). In an email dated January 8, 2004, the ACCDC indicated that six bird species of special status are recorded within a 5 km buffer around the Study Area (Table 4.4.4). The ACCDC also indicated that it is reasonable to assume that many of the species identified within the buffer, could occur within the Study Area.

TABLE 4.4.3 Bird Species of Special Status Known to Occur Near the Study Area (NS Museum, 2004)

Common Name	Scientific Name	NS General Status
Bobolink	*Dolichonyx oryzivorus*	Yellow
Arctic Tern	*Sterna paradisaea*	Yellow
Common Loon	*Gavia immer*	Yellow
Northern Mockingbird	*Mimus polyglottos*	Green
Merlin	*Falco columbarius*	Green
Osprey	*Pandion haliaetus*	Green

1 – Listed in 2001.

While Northern mockingbird, Merlin and Osprey are listed green (i.e. no concern) in the Nova Scotia General Status of Wildlife Report, Merlin and Osprey are included here because raptors are protected under the NS *Wildlife Act*; Northern mocking birds are considered to be of concern by the ACCDC (see Table 4.4-4).

TABLE 4.4.4 Bird Species of Special Status Known to Occur Within 5 km of Canso (ACCDC, 2004)

Common Name	Scientific Name	ACCDC Rank
Mmerlin	*Falco columbarius*	S3/S4B
Parasitic Jaeger	*Stercorarius parasiticus*	S3M
Arctic Tern	*Sterna paradisaea*	S3B
Boreal Chickadee	*Poecile hudsonica*	S3/S4
Northern Mockingbird	*Mimus polyglottos*	S3B
Bobolink	*Dolichonyx oryzivorus*	S3B

Notes: B= Breeding Population
M= Migratory population
S3/S4= May be uncommon or widespread through its range in Nova Scotia, depending on its location.
S3= Uncommon through its range in Nova Scotia or found only in restricted range, even if abundant in some locations.

The presence/absence of all potential and known species identified in the above tables was confirmed through comprehensive field surveys/investigations.

4.4.3 Breeding Bird Surveys

The specific scope of work for the breeding bird survey involved the following:

- Identify the breeding species within the Study Area, the Immediate Buffer Zone (5 kilometre radius), and the Greater Buffer Zone (20 kilometre radius);
- Identify if any of the bird species are a species of special status (species listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), species listed as S1, S2, and S3 by the Atlantic Canada Conservation Data Centre (ACCDC), and species listed by NSDNR;
- Identify whether nests or critical habitat of Species at Risk listed by COSEWIC, ACCDC, and NSDNR occur within the Study Area; and
- Identify whether any bird colonies occur in the Study Area.

4.4.3.1 Breeding Birds Known to Occur in the Project Area

A review of the available information showed that there are approximately 116 species of breeding birds possible within a 20-kilometer radius of the proposed study area (Table 4.4.5). This count is based on ideal habitat as well as confirmed sightings in the area (Erskine, 1992). Previous surveys completed by the CWS as far back as 1996 have recorded several wintering waterfowl such as black duck, common goldeneye, long tailed duck, common eider, bufflehead, black scoter, surf scoter, white winged scoter, and Canadian geese to be common along the coast near Canso. Several gull, cormorant, and tern colonies have also been recorded in and around the several islands near Canso (CWS, 2003).

TABLE 4.4.5 Breeding Bird Species Near Canso (Erskine, 1992)

Scientific Name	Common Name	Scientific Name	Common Name
Gavia immer	Common Loon	*Oceanodroma leucorhoa*	Leach's Storm Petrel
Phalacrocorax auritus	Double-crested Cormorant	*Ardea herodias*	Great Blue Heron
Branta canadensis	Canada Goose	*Anas crecca*	Green-winged Teal
Anas rubripes	American Black Duck	*Anas platyrhynchos*	Mallard
Anas discors	Blue-winged Teal	*Aythya collaris*	Ring-necked Duck
Somateria mollissima	Common Eider	*Mergus merganser*	Common Merganser
Pandion haliaetus	Osprey	*Circus cyaneus*	Northern Harrier
Falco sparverius	American Kestrel	*Falco columbarius*	Merlin
Dendragapus canadensis	Spruce Grouse	*Bonasa umbrellas*	Ruffed Grouse
Catoptrophorus semipalmatus	Willet	*Actitis macularia*	Spotted Sandpiper
Gallinago gallinago	Common Snipe	*Scolapax minor*	American Woodcock
Larus argentatus	Herring Gull	*Larus marinus*	Great Black-backed Gull
Sterna paradisea	ArcticTern	*Cepphus grille*	Black Guillemot
Columba livia	Rock Dove	*Zenaida macroura*	Mourning Dove
Bubo virginianus	Great Horned Owl	*Archilochus colubris*	Ruby-throated Hummingbird
Ceryle alcyon	Belted Kingfisher	*Picoides pubescens*	Downy Woodpecker
Picoides villosus	Hairy Woodpecker	*Picoides arcticus*	Black-backed Woodpecker
Colaptes auratus	Northern Flicker	*Dryocopus pileatus*	Pileated Woodpecker
Contopus borealis	Olive-sided Flycatcher	*Contopus virens*	Eastern Wood-Pewee
Empidonax flaviventris	Yellow-bellied Flycatcher	*Empidonax alnorum*	Alder Flycatcher

TABLE 4.4.5 Breeding Bird Species Near Canso (Erskine, 1992)

Scientific Name	Common Name	Scientific Name	Common Name
Empidonax minimus	Least Flycatcher	*Tyrannus tyrannus*	Eastern Kingbird
Tachycineta bicolor	Tree Swallow	*Riparia riparia*	Bank Swallow
Hirundo rustica	Barn Swallow	*Perisoreus canadensis*	Gray Jay
Cyanocitta cristata	Blue Jay	*Corvus brachyrhynchos*	American Crow
Corvus corax	Common Raven	*Parus atricapillus*	Black-capped Chickadee
Parus hudsonicus	Boreal Chickadee	*Sitta canadensis*	Red-breasted Nuthatch
Certhia Americana	Brown Creeper	*Troglodytes troglodytes*	Winter Wren
Regulus satrapa	Golden-crowned Kinglet	*Regulus calendula*	Ruby-crowned Kinglet
Sialia sialis	Eastern Bluebird	*Catharus ustulatus*	Swainson's Thrush
Catharus guttatus	Hermit Thrush	*Turdus migratorius*	American Robin
Dumetella carolinensis	Gray Catbird	*Mimus polyglottos*	Northern Mockingbird
Bombycilla cedrorum	Cedar Waxwing	*Sturnus vulgaris*	European Starling
Vireo solitarius	Solitary Vireo	*Vireo olivaceus*	Red-eyed Vireo
Vermivora peregrina	Tennesee Warbler	*Vermivora ruficapilla*	Nashville Warbler
Parula Americana	Northern Parula Warbler	*Dendroica petechia*	Yellow Warbler
Dendroica pensylvanica	Chestnut-sided Warbler	*Dendroica magnolia*	Magnolia Warbler
Dendroica tigrina	Cape May Warbler	*Dendroica coronata*	Yellow-rumped Warbler
Dendroica virens	Black-throated Green Warbler	*Dendroica fusca*	Blackburnian Warbler
Dendroica palmarum	Palm Warbler	*Dendroica castanea*	Bay-breasted Warbler
Dendroica striata	Blackpoll Warbler	*Mniotilta varia*	Black-and-white Warbler
Setophaga ruticilla	American Redstart	*Seiurus noveboracensis*	Northern Waterthrush
Oporornis philadelphia	Mounring Warbler	*Geothlypis trichas*	Common Yellowthroat
Wisonia pusilla	Wilson's Warbler	*Wilsonia canadensis*	Canada Warbler
Pheucticus ludovicianus	Rose-breasted Grosbeak	*Spizella passerina*	Chipping Sparrow
Passerculus sandwichensis	Savannah Sparrow	*Passerella iliaca*	Fox Sparrow
Melospiza melodia	Song Sparrow	*Melospiza lincolnii*	Lincoln's Sparrow
Melospiza georgiana	Swamp Sparrow	*Zonotrichia albicollis*	White-throated Sparrow
Junco hyemalis	Dark-eyed Junco	*Dolichonyx oryzivorus*	Bobolink
Agelaius phoeniceus	Red-winged Blackbird	*Euphagus carolinus*	Rusty Blackbird
Quiscalus quiscula	Common Grackle	*Molothrus ater*	Brown-headed Cowbird
Pinicola enucleator	Pine Grosbeak	*Carpodacus purpureus*	Purple Finch
Loxia Leucoptera	White-winged Crossbill	*Carduelis pinus*	Pine Siskin
Carduelis tristis	American Goldfinch	*Coccothraustes vespertinus*	Evening Grosbeak
Passer domesticus	House Sparrow	*Botaurus lentiginous*	American Bittern
Haliaeetus leucocephalus	Bald Eagle	*Accipiter gentilis*	Northern Goshawk
Charadrius melodus	Piping Plover	*Sterna dougallii*	Roseate Tern
Chaetura pelagica	Chimney Swift	*Sitta carolinensis*	White-breasted Nuthatch
Ammodramus caudacutus	Sharp-tailed Sparrow	*Cathartes aura*	Turkey Vulture

4.4.3.2 Breeding Bird Field Survey Methodology

The breeding bird data was collected according to the parameters set out in the guidance document, "*Baseline Information Requirements for Evaluation of Effects of Wind Power Facilities on Migratory Birds in Atlantic Canada*" (CWS 2003; CWS no date). In addition, CWS requested that data be collected as per the parameters set out for a medium sized project, due to the coastal setting. These parameters are set out in Table 2 of the draft guidance document, "*Wind Turbines and Birds – A Guidance Document for Environmental Assessment*" (Appendix G).

All surveys were carried out by an experienced Birder with over 25 years of birding knowledge and trained in the methods of scientific bird observation and data collection. Data was recorded as to which species were present during the breeding season, as well as information on their breeding status and relative abundance. This data was recorded for the 10 proposed turbine sites, an Immediate Buffer Zone of 5 kilometres, and a Greater Buffer Zone of 5 to 20 kilometres.

Special emphasis was placed on gathering information on the movements of water birds and waterfowl during the breeding season. The movement of breeding birds was surveyed to determine if they move through the proposed sites or the Immediate Buffer Zone to reach important feeding areas, etc. Special efforts were made to determine which birds of prey were breeding on the proposed sites and in the Immediate Buffer Zone and to determine where their nests might be located. Also the presence of any species within the proposed sites or the Immediate Buffer Zone that used aerial courtship displays as part of their courtship practices were noted.

Bird species were detected and easily identified by sight, songs and call notes. Dawn chorus observations were made at each site and point counts carried out. Each of the proposed sites, as well as a good portion of the 5-kilometre buffer was covered by foot. Attempts were made to identify locally known breeding colonies within 20 km of the proposed sites. All data collected on colonial species was based upon estimates from long distance observation during surveys and data gathered from local naturalists. Colonies and islands suspected to support colonies were not visited or disturbed during the breeding bird surveys.

Owl surveys were not carried out, as this was not the correct time of year for such surveys. However, data was collected on two species of owls, which were heard during separate dawn chorus observations.

Data was collected on how habitats were used by the various species present and which habitats received the greatest amount of use, both at the proposed sites and in the Immediate Buffer Zone. At all times, species of special status were alertly watched and listened for and surveys were carried out in a manner that would provide as little disturbance as possible to any breeding species.

Since the turbine layout was changed after the breeding bird surveys were concluded, these new locations (1d, 5d, 11d, 12d) were surveyed for breeding birds in June 2005 (i.e. pre-construction). The remaining turbine locations are within 50 m of the locations surveyed in 2004, and therefore are within the buffer covered around each turbine location. The breeding bird surveys of the 5 km and 25 km buffer zones, as well as all other bird surveys, covered the project area and were not be repeated. Results of the supplemental breeding bird surveys can be found in Section 4.4.3.4.

4.4.3.3 Breeding Bird Field Survey Results (2004)

A total of 138 species of birds were found to be present during the breeding season within 20 kilometers (Greater Buffer Zone) of the proposed wind farm. Of those, 76 species were present within 5 kilometres (Immediate Buffer Zone) of the proposed turbine sites. Of those, 47 species were found within the proposed sites, of which 29 species were confirmed as breeding.

4.4.3.3.1 Breeding Birds Within the Proposed Turbine Locations

During the surveys a total of 10 sites were visited. Seven sites were within approximately 500 m to a kilometer of the coast and had been previously classified as inland sites (# 1, 2, 3, 4, 5, 9a, 10) (also, 11d, 12d, and 5d), while the remaining three (# 6, 7a, 8) had been classified as coastal sites. From a birding point of view however, all 10 sites would be considered coastal sites as each site was close enough to the coast to have it influence the species of avian life present. However, none of the sites were located near enough to the coastline to contain any shoreline, thus, there are no shoreline related birds recorded on the proposed sites.

In addition, there were no bodies of water (salt or fresh) on any of the proposed sites large enough to support waterfowl, which resulted in no waterfowl being recorded on the sites. However, due to their proximity to the coast, two species of water related birds (Common Loon and Belted Kingfisher) were recorded as flying over the proposed sites. Their heights, direction and assumed purpose of flights are noted below.

Data was collected on a total of 47 species, which were observed during the breeding bird surveys on or over the proposed sites. Of those 47 species, 29 were confirmed as breeding and another 15 were classified as likely to be breeding based upon behavior and appropriate habitat. The location of each species, its relative abundance, and its breeding status can be found recorded in Table 4.4.6. With the exception of Site 4, no species were found on the proposed sites that were not found in the Immediate Buffer surrounding the sites.

TABLE 4.4.6 Breeding Species Within the Proposed Turbine Sites

Species	Status
Waterfowl	
Common Loon	One bird on two occasions observed flying over proposed sites at altitudes of more than 400 meters in a north-south direction, traveling between the coast and most likely the larger lakes located in the Greater Buffer or perhaps as a shortcut to reach another section of coast.
Birds of Prey	
Long-eared Owl	Heard calling at Site 4 in appropriate breeding habitat.
Non Aligned Species	
Belted Kingfisher	One bird on three occasions observed flying over proposed sites at altitudes of less than 200 meters in a north-south and west-east directions. Traveling between the coast and Chapel Gully for purposes of feeding in the Chapel Gully.
Mourning Dove	Only observed at Site 2 but fairy common in the general area.
Black Backed Woodpecker	A family of Black Backed Woodpeckers was found feeding very close to Site 8.
Hairy Woodpecker	Attending young on Site 4, breeding at this site due to more mature trees, but also present in other areas inside the immediate buffer.
Northern Flicker	At Site 8 due to more mature trees nearby.
Red Breasted Nuthatch	Present at Sites 2 & 4, most likely breeding due to appropriate habitat & behavior.
Passerines	
American Crow	Family groups encountered at Sites 2, 1, 6 & 7a.
Common Raven	Family group feeding at Site 7a.
Gray Jay	Family group feeding at Site 7a.
Black-capped Chickadee	Found breeding at Sites 1 & 4.
Boreal Chickadee	Present at Site 3 most likely breeding due to appropriate habitat & behavior.
Golden-crowned Kinglet	Present at Site 4 most likely breeding due to appropriate habitat & behavior.
Ruby-crowned Kinglet	Present at Site 5 most likely breeding due to appropriate habitat & behavior.
Winter Wren	Present at Sites 5 & 8, most likely breeding due to appropriate habitat & behavior.
Alder Flycatcher	Confirmed as breeding at Sites 1, 10 & 6.
Yellow-bellied Flycatcher	Present at Site 4 most likely breeding due to appropriate habitat & behavior.

TABLE 4.4.6 Breeding Species Within the Proposed Turbine Sites

Species	Status
Cedar Waxwing	Present at Site 1 gathering nesting material.
American Robin	Confirmed as breeding at Sites 2, 3, 9a, 10 & 4.
Hermit Thrush	Present at Sites 10, 6, 7, 8, 2, 3, 1, 9a & 4, most likely breeding due to appropriate & behavior. Confirmed as breeding at Sites 4, 6, 9a & 10.
Swainson's Thrush	Present at Sites 10, 6, 7, 8, 9a & 4, most likely breeding due to appropriate habitat.
Blue Headed Vireo	Present at Sites 2, 3, 1, 10, 4 & 5, most likely breeding due to appropriate habitat & behavior.
Red-eyed Vireo	Confirmed as breeding at Site 4.
Philadelphia Vireo	Present at Site 9a in appropriate habitat but not exhibiting any compelling breeding behavior.
Nashville Warbler	Present at Sites 3, 9a & 10, most likely breeding due to appropriate habitat & behavior. Confirmed as breeding at Site 3.
Yellow Warbler	Confirmed as breeding at Site 10.
Magnolia Warbler	Present at Sites 3, 1, 4, 7a & 8, most likely breeding due to appropriate & behavior. Confirmed as breeding at Site 3.
Yellow-rumped Warbler	Confirmed as breeding at Sites 3, 10, 4, 7a & 8.
Black-and-white Warbler	Present at Sites 2, 3, 10 & 4, most likely breeding due to appropriate habitat & behavior. Confirmed as breeding at Site 3.
Common Yellowthroat	Present at all Sites. Confirmed breeding at sites 1, 5, 6, 8 & 10.
Chestnut-sided Warbler	Confirmed as breeding at Site 3.
Black-throated Green Warbler	Uncommon, three pairs most likely breeding on or adjacent to Site 4 due to behavior and presence of appropriate habitat.
Palm Warbler	Confirmed as breeding at Sites 3, 1, 9a, 5 & 6, present at 7a.
Blackpoll Warbler	Present at Site 3, most likely breeding due to appropriate habitat & behavior. Confirmed as breeding at Sites 1 & 5.
American Redstart	Present at Sites 4, 6, & 7a, most likely breeding due to appropriate habitat & behavior. Confirmed as breeding at Sites 2 & 10.
Wilson's Warbler	Confirmed as breeding at Site 1.
Song Sparrow	Confirmed as breeding at Sites 10, 7a, 8 & 6.
Fox Sparrow	Confirmed as breeding at Sites 10, 6 & 8. Present at Sites 5 & 7a most likely breeding due to appropriate habitat & behavior.
Lincoln's Sparrow	Confirmed as breeding at Site 5. Present and may be breeding at Site 8.
White-throated Sparrow	Confirmed as breeding at Sites 7a, 2, 3, 1, 9a, 10, 4, 5 & 6.
Dark-eyed Junco	Confirmed as breeding at Sites 6, 8, 4, 5, 6, & 7a. Present and may be breeding at Sites 2, 3 & 1 due to appropriate habitat & behavior.
Purple Finch	Present at Sites 3, 5 & 7a, most likely breeding due to appropriate habitat & behavior.
Pine Siskin	Confirmed as breeding at Sites 2 & 1. Present at 9a, 4 & 6 and may be breeding due to appropriate habitat & behavior.
Evening Grosbeak	Confirmed as breeding at Site 4.
White-winged Crossbill	Confirmed as breeding at Sites 2, 3, 1, 4 & 5.
American Goldfinch	Mated pairs at Sites 6, 2, 1 & 5.

Source: Stevens, C., 2004

The following sections provide a summary for each of the sites surveyed.

Site 1

Site 1 is very typical of the prominent local habitat of evergreen dominated forest with increased amounts of deciduous shrub nearby, which accounted for the slight increase of warbler species. Data gathered indicated that Site 1 was the only site to have nesting Cedar Waxwings and breeding Wilson's Warblers but both species were also found elsewhere in the Immediate Buffer Zone.

Site 2

At Site 2 both birds and vegetation were very typical of the prominent local habitat of evergreen dominated forest with some smaller deciduous trees mixed in. Data gathered indicated that Site 2 was the only site to have Mourning Doves, but this species is a common breeder in the Greater Buffer Zone.

Site 3

This site, like Site 2, was very typical of the prominent local habitat of evergreen dominated forest with smaller deciduous mixed in. The bird species at this site, when combined with the species recorded at Site 2, give a good picture of the range of dominant species in the typical habitat found in the study area. During the survey, Site 3 produced an unusual number of breeding confirmations due to fact the surveyors were at the right spot at the right time. However, all the species confirmed as breeding at this site were also found to be breeding in the Immediate Buffer Zone.

Site 4

The white spruce, balsam fir and white birch trees were all taller on and in the immediate vicinity of Site 4. This leads to a richer diversity of bird species including the only Long-eared Owl found, as well as Hairy Woodpecker, Yellow Bellied Flycatcher, Evening Grosbeaks, Red Eyed Vireo, Golden Crowned Kinglets and BlackThroated Green Warblers.

Site 5

At Site 5, the vegetation is dominated by Jack Pine. A healthy population of Lincoln Sparrows, along with good numbers of Common Yellowthroats, Palm Warblers and White Throated Sparrows exist. Almost identical habitat to Site 5 can be found adjacent to Site 9 inside the Chapel Gully Park boundary where the observation tower is situated. A small wet area bordering Site 5 dominated by deciduous shrubs created a richer edge where the two habitats met and accounted for the presence of Winter Wren and the only Ruby Crowned Kinglet detected during the site surveys.

Site 6

Site 6 is one of three proposed sites located close enough to the coast to be considered a coastal site, but is not close enough to take in or directly affect actual shoreline. This site exhibits a denser combination of spruce and fir than the more inland sites. This, along with a stronger coastal influence, leads to a drop in breeding bird diversity and a slight increase in Hermit Thrushes and an even greater increase in Swainson Thrushes and Song Sparrows.

Site 7a

The habitat immediately surrounding Site 7a was the same as that found on Sites 6 and 8, which results in Site 7a having species similar to the other two coastal sites. However, Site 7a itself was mostly cut over, leading to less breeding opportunity but greater foraging opportunity. This resulted in a drop in the quantity of birds present and a slight shift in species. This was most noticeable by the presence of a feeding family of Northern Ravens and a feeding family of

Gray Jays. Common Yellowthroat was the dominant breeding warbler species on all three coastal sites.

Site 8

Site 8 is very similar to Site 6 and likewise exhibits a denser combination of spruce and fir. This along with a stronger coastal influence lead to a drop in breeding bird diversity and a slight increase in Hermit Thrushes and an even greater increase in Swainson Thrushes and Song Sparrows. In addition, because Site 8 is closer to Glasgow Head with noticeably larger evergreens, it had two species of woodpeckers not found on Site 6.

Site 9a

Site 9a had habitat and birds similar to most of the local area and can be characterized by slighter larger numbers of breeding Hermit Thrushes, White Throated Sparrows and American Robins. One apparent anomaly was the presence of a male Philadelphia Vireo. Philadelphia Vireos breed in our neighboring province of New Brunswick. A pair or two have also been recorded as breeding in the Amherst area in the past few years, indicating that Nova Scotia is most likely at the edge of a range expansion. This particular Philadelphia Vireo was singing on habitat that could be classified as "marginal" at best, for its breeding needs. His behavior of constantly moving about and being easily intimidated by other birds present indicated that the bird was mate-less and had been unable to establish a defined territory of its own. This bird will likely either continue to wander or perhaps spend the summer in the Canso area, leaving with the fall migration and not returning in the spring. Canso is well known as a catch pit for wandering strays.

Site 10

This site consisted of the prominent local habitat of evergreen dominated forest with a slight increase in the numbers of woodland bird species, due to the presence of taller deciduous trees of white birch, red maple and mountain ash. This is the only site where Yellow Warbler was recorded as present and breeding, but this species is in fact a common breeder both in the Immediate Buffer and the Greater Buffer Zones.

4.4.3.3.2 Species of Special Status Found Close to the Project Locations

All breeding bird species found within the proposed sites were compared with the COSEWIC, NSDNR, and the ACCDC databases for species of special status. There are five bird species of special status that exist within the proposed sites, and are listed below:

- Common Loon (NSDNR Yellow Rank);
- Long-eared Owl (NSDNR Yellow Rank; ACCDC S1S2 Rank);
- Black Backed Woodpecker (ACCDC S3S4 Rank);
- Boreal Chickadee (ACCDC S3S4 Rank); and
- Philadelphia Vireo (ACCDC S2B Rank).

The Long-eared Owl was found only within site 4, where suitable breeding habitat exists. Therefore, an alternate site (site 4a) was chosen by adjusting the project layout and was surveyed in later field surveys.

The Common Loon was spotted flying over the proposed turbine sites at an approximate elevation of 400 metres.

The Black Backed Woodpecker was found feeding near site 8, but not breeding. Approximately 3-4 breeding pairs of this woodpecker are known throughout the Greater Buffer Zone, with the closest ones located at the Union Cemetery in the Town of Canso.

The Boreal Chickadee is noted to be a common breeder in spruce woodlands surrounding the Canso area.

The Philadelphia Vireo is a non-breeding summer stray that usually breeds in New Brunswick.

4.4.3.3.3 Breeding Birds in the Immediate Buffer Zone

The Immediate Buffer Zone was defined as all of the area found within approximately 5 kilometres of the proposed turbine sites. The woodland portion of the buffer was very similar to the habitat found at the proposed sites. It was noted that breeding density was intensified wherever alder swamps were present, or where the percentage of hardwood shrubs or deciduous trees increased.

Much of the Immediate Buffer Zone lies within Chapel Gully Park. In addition to the woodlands, there were a range of habitats, which included small freshwater ponds, brackish inlets, a salt marsh, a field, urban settings, rocky shoreline and coastal waters. These additional habitats contributed to a greater diversity in avian species than the number of birds, which were found on the proposed sites.

In all, information was gathered on a total of 76 species of birds discovered within the Immediate Buffer Zone. These species are listed in Table 4.4.7 along with their breeding status and relative abundance.

For the purpose of this study, birds present were classified as common and uncommon. Common species are those that can be easily observed on a regular basis inside the Immediate Buffer Zone. Uncommon species are those that are not easily encountered on a regular basis due to low breeding numbers in the Immediate Buffer Zone.

It should also be noted that some species found in the Greater Buffer Zone, even those classified as widespread common breeders, were not detected in the Immediate Buffer Zone during the breeding bird surveys. In some cases, this was due to lack of preferred habitat. In other cases, appropriate habitat did exist and it is likely that those species do breed inside the Immediate Buffer Zone from time to time. These possible breeders are made up of the 8 species, which are listed in Table 4.4.8 along with their Greater Buffer Zone status.

TABLE 4.4.7 Breeding Birds in the Immediate Buffer Zone

Species	Status
Waterfowl	
Common Loon	Common, coastal areas used for feeding, observed flying over buffer zone at altitudes of more than 400 meters, see onsite data for additional details.
Double-crested Cormorant	Common, coastal areas used for feeding as well as fresher water section of Chapel Gully near the mouth of Winter Creek.
Great Cormorant	Common, coastal areas used for feeding.
Canada Goose	Uncommon, fresher water section of Chapel Gully used for feeding near the mouth of Winter Creek.
Common Eider	Common, coastal areas used for feeding.
Aerialists & Seabirds	
Great Black-backed Gull	Common, coastal areas used for feeding.
Herring Gull	Common, coastal areas used for feeding as well as fresher water section of Chapel Gully.
Arctic Tern	Common, coastal areas used for feeding.
Common Tern	Common, coastal areas used for feeding.
Roseate Tern	Uncommon, one pair observed, coastal areas used for feeding.
Shorebirds & Waders	
Great Blue Heron	Common, coastal areas used for feeding.
Whimbrel	Uncommon during surveys, common later in summer, coastal areas used for southward migration, no suitable feeding sites noted for this species within the immediate buffer.
Spotted Sandpiper	Common, confirmed as breeding along coastal areas.
Willet	Common, confirmed as breeding along coastal areas and in Chapel Gully near the mouth of Winter Creek.
Birds of Prey	
Northern Harrier	Common, confirmed as breeding.
Sharp-shinned Hawk	Common, confirmed as breeding.
Great Horned Owl	Probably uncommon, one bird heard near Site 1 during Dawn Chorus.
Long-eared Owl	Common, present in summer, breeding status unknown.
Game Birds	
Ruffed Grouse	Common, most likely breeding due to behavior and presence of appropriate habitat.
Spruce Grouse	Common, confirmed as breeding.
Non Aligned Species	
Belted Kingfisher	Common, confirmed as breeding in coastal bank between Sites 7 & 8, and feeding in Chapel Gully near the mouth of Winter Creek, observed flying over proposed sites at altitudes of less than 200 meters, see onsite data for additional details.
Mourning Dove	Common, most likely breeding due to behavior and presence of appropriate habitat.
Tree Swallow	Common, most likely breeding due to behavior and presence of appropriate habitat.
Hairy Woodpecker	Common, confirmed as breeding.
Black Backed Woodpecker	Uncommon, confirmed as breeding in low numbers.
Northern Flicker	Uncommon, most likely breeding due to behavior and presence of appropriate habitat.
Red Breasted Nuthatch	Common, most likely breeding due to behavior and presence of appropriate habitat.
Passerines	
American Crow	Common, confirmed as breeding.
Common Raven	Common, most likely breeding due to behavior and presence of appropriate habitat.
Blue Jay	Common, breeder.
Gray Jay	Uncommon, confirmed as breeding.
Black-capped Chickadee	Common, confirmed as breeding.
Boreal Chickadee	Uncommon, confirmed as breeding.
Golden-crowned Kinglet	Common, confirmed as breeding.
Ruby-crowned Kinglet	Uncommon, most likely breeding due to behavior and presence of appropriate habitat.
Winter Wren	Uncommon, most likely breeding due to behavior and presence of appropriate habitat.

TABLE 4.4.7 Breeding Birds in the Immediate Buffer Zone

Species	**Status**
Alder Flycatcher	Common, confirmed as breeding.
Yellow Bellied Flycatcher	Uncommon, most likely breeding due to behavior and presence of appropriate habitat.
European Starling	Common, confirmed as breeding.
Cedar Waxwing	Common, confirmed as breeding.
Red-winged Blackbird	Common, confirmed as breeding.
Common Grackle	Common, confirmed as breeding.
Brown-headed Cowbird	Common, most likely breeding due to behavior and presence of appropriate host species
American Robin	Common, confirmed as breeding.
Hermit Thrush	Common, confirmed as breeding.
Swainson's Thrush	Common, confirmed as breeding.
Veery	Uncommon, most likely breeding due to behavior and presence of appropriate habitat.
Blue Headed Vireo	Uncommon, most likely breeding due to behavior and presence of appropriate habitat.
Red-eyed Vireo	Uncommon, most likely breeding due to behavior and presence of appropriate habitat.
Philadelphia Vireo	Uncommon, non-breeding summer stray.
Nashville Warbler	Uncommon, confirmed as breeding.
Yellow Warbler	Common, confirmed as breeding.
Magnolia Warbler	Common, confirmed as breeding.
Yellow-rumped Warbler	Common, confirmed as breeding.
Black-and-white Warbler	Common, confirmed as breeding.
Common Yellowthroat	Common, confirmed as breeding.
Chestnut-sided Warbler	Uncommon, confirmed as breeding.
Black-throated Green Warbler	Uncommon, most likely breeding due to behavior and presence of appropriate habitat, found only at and immediately adjacent to Site 4.
Palm Warbler	Common, confirmed as breeding.
Blackpoll Warbler	Common, confirmed as breeding.
American Redstart	Common, confirmed as breeding.
Wilson's Warbler	Uncommon, confirmed as breeding.
Savannah Sparrow	Common, confirmed as breeding.
Song Sparrow	Common, confirmed as breeding.
Swamp Sparrow	Uncommon, most likely breeding due to behavior and presence of appropriate habitat
Fox Sparrow	Uncommon, confirmed as breeding.
Lincoln's Sparrow	Uncommon, confirmed as breeding.
White-throated Sparrow	Common, confirmed as breeding.
Nelsons Sharp Tailed Sparrow	Uncommon, most likely breeding due to behavior and presence of appropriate habitat.
Dark-eyed Junco	Common, confirmed as breeding.
Purple Finch	Common, confirmed as breeding.
Pine Siskin	Common, confirmed as breeding.
Evening Grosbeak	Common, confirmed as breeding.
Pine Grosbeak	Uncommon, most likely breeding due to behavior and presence of appropriate habitat.
White-winged Crossbill	Common, confirmed as breeding.
American Goldfinch	Common, most likely breeding due to behavior and presence of appropriate habitat.

Source: Stevens, C., 2004

TABLE 4.4.8 Additional Species Which may Breed in the Immediate Buffer Zone

Species	**Status Within Greater Buffer Zone**
American Black Duck	Widespread common breeder.
Mallard	Breed in small numbers but the population is on the increase.
American Woodcock	Widespread common breeder.
Common Snipe	Widespread common breeder.
Merlin	Widespread common breeder.
Tree Swallow	Widespread common breeder.
Downy Woodpecker	Widespread common breeder, most common species of woodpecker to breed in the local area.
Chipping Sparrow	Widespread common breeder.

Source: Stevens, C., 2004

4.4.3.3.4 Species of Special Status in the Immediate Buffer Zone

All breeding bird species found within the Immediate Buffer Zone were compared with the COSEWIC, NSDNR, and the ACCDC databases for species of special status. Of these, nine bird species of special status were found to exist within the Immediate Buffer Zone. Only five of these species have been observed within the area of the proposed sites (see Section 4.4.3.3.2). The 9 species of special status and their current ranking are listed below:

- Common Loon (NSDNR Yellow; ACCDC: S4B,S4N);
- Arctic Tern (NSDNR Yellow; ACCDC S3B);
- Common Tern (NSDNR Yellow; ACCDC S3B);
- Roseate Tern (COSEWIC Endangered; NSDNR Red; ACCDC S1B);
- Long-eared Owl (NSDNR Yellow; ACCDC S1S2);
- Black Backed Woodpecker (ACCDC S3S4);
- Boreal Chickadee (ACCDC S3S4);
- Philadelphia Vireo (ACCDC S2B);
- Nelson's Sharp Tailed Sparrow (ACCDC S2S3B)

4.4.3.3.5 Breeding Birds in Greater Buffer Zone

The Greater Buffer Zone was classified as all of the area within a 20-kilometre radius of the proposed wind farm. However, due to the vastness and ruggedness of this area, field surveys were limited to a 5-kilometre radius. Data on the additional area was gained through consultation with local naturalists on their past and present personal observations. This list does not include previously published historical data such as that which is found in the Maritime Breeding Bird Atlas. This list does include all species known to be present in the breeding season during the months of June, July and August, excluding obvious August migrants such as flocks of migrating shorebirds.

In total, data was collected on 138 species of birds. These species can be found listed in Table 4.4.9 along with their breeding status and relative abundance.

The Greater Buffer Zone is an area that has numerous barrier islands littered with colonial nesters. Much of the surrounding coastal evergreen barrens are low in woodland breeding bird diversity, however, breeding variety jumps significantly as one moves inland away from the stunting affects of a harsher coastal climate. All data on colonial species are based upon estimates from long distance observation during surveys and data gathered from local naturalists. Colonies were not visited or disturbed during the breeding bird surveys.

TABLE 4.4.9 Breeding Bird Species Within 20-Kilometre Radius

Species	Status
Waterfowl	
Common Loon	Considered common but only three nesting lakes were reported to be in the immediate area. These are Wilkinson Lake, Whistlehouse Lake, and Hazel Lake in Hazel Hill. Other lakes in the area large enough to potentially attract loons included Three Mile Lake and Snyders Lake.
Double-crested Cormorant	Abundant, colony establish on nearby Crow Island.
Great Cormorant	Common, colony establish on nearby Crow Island.
Red Breasted Merganser	Uncommon breeder, a pair successfully raised a family on Grassy Island in Canso in 2002.
Canada Goose	Common breeder for the past 4 -5 years especially in the Little Dover area.
Wood Duck	Uncommon breeder, 1-2 pairs breed each year at the dam in Canso.
Northern Shoveler	One summer record at the Tickle.
American Black Duck	Widespread common breeder.
Common Eider	Common breeder on several of the local barrier islands including Crow, Hog, Darbie, & Fox. In the immediate vicinity the largest colony is on Crow Island where an estimated 200-300 pairs breed each year.
Mallard	Breed in small numbers but the population is on the increase.
Ring-necked Duck	Widespread common breeder.
American Wigeon	4 or 5 pairs present each summer.
Blue Winged Teal	Three lakes in the area are known to support one to two pairs each.
Green Winged Teal	Widespread common breeder.
Aerialists & Seabirds	
Great Black-backed Gull	Abundant breeder with over a thousand individuals present in Canso Harbour most summer days, they are believed to make up just over fifty percent of the breeding gull population.
Lesser Black Back Gull	One record, June 2004 in Canso Harbour.
Herring Gull	Abundant breeder with over a thousand individuals present in Canso harbour most summer days.
Ring Billed Gull	Occasional bird present in summer, unknown if they breed.
Laughing Gull	An average of one Laughing Gull is reported in Canso Harbour each year in the spring or summer, often lingering in the area for most of the breeding season.
Franklins Gull	One record, July 2004 in Canso Harbour.
Iceland Gull	Occasional non-breeding individual present in summer.
Black legged Kittiwake	Occasional, assumed to be, non-breeding individuals present in summer.
Arctic Tern	Common breeder on a number of the local barrier islands including Tickle Island
Common Tern	Common breeder on a number of the local barrier islands including Tickle Island.
Roseate Tern	Each year one to pairs breed of the local barrier islands.
Leach's Storm Petrel	Commonly seen all summer, just outside the chain of barrier islands surrounding Canso, several are also found dead each year on main road in Canso, suspected victims of power line strikes, closest locally known breeding colony is about 30 nautical miles away on Country Island.
Atlantic Puffin	Commonly seen feeding in open ocean areas far outside the chain of barrier islands surrounding Canso during the summer months.
Black Guillemot	Two pairs each at White Head and Cole Harbour.
Northern Gannet	Common year round in open ocean areas outside the chain of barrier islands surrounding Canso.
Pomarine Jaeger	One or two were seen feeding each summer in open ocean areas outside the chain of

TABLE 4.4.9 Breeding Bird Species Within 20-Kilometre Radius

Species	Status
	barrier islands surrounding Canso.
Parasitic Jaeger	One or two were seen feeding each summer in open ocean areas outside the chain of barrier islands surrounding Canso.
South Polar Skua	One or two seen feeding each summer in open ocean areas about one nautical mile outside the chain of barrier islands surrounding Canso.
Shorebirds & Waders	
Great Blue Heron	Common, breeding rookery location is unknown but is suspected as present, long tern observations by locals indicate that it is likely located more than five to ten kilometers from Canso.
American Bittern	Uncommon to common on back edges of larger lakes in the area.
Glossy Ibis	One record, summer 2004 a single bird spent a good portion of the summer in Chapel Gully.
Whimbrel	Present in summer starting in July as south bound migrant.
Piping Plover	Last known breeding attempt was five years ago at Salmon River beach.
Spotted Sandpiper	Widespread common breeder.
Willet	Widespread common breeder.
American Woodcock	Widespread uncommon breeder.
Common Snipe	Widespread uncommon breeder.
Semipalmated Plover	Uncommon breeder, have nested in the Guysborough (Town not county) area.
Birds of Prey	
Bald Eagle	Present in summer, breeds, most years there is an active nest on Georges Island.
Osprey	Common breeder, 6 known nests in 20km radius, two closest breeding pairs to Canso are on Georges Island and Chapel Hill.
Turkey Vulture	Non-breeding summer visitor.
Northern Harrier	Widespread, common breeder.
Sharp-shinned Hawk	Confirmed breeder, commonly seen in summer but before July 2004 breeding was unconfirmed.
Red Tailed Hawk	Present in summer, breeding status unknown, 1 or 2 are seen each summer riding the thermals.
Merlin	Widespread common breeder.
American Kestrel	Uncommon breeder, a few are seen each summer near old farmland in the Hazel Hill area.
Great Horned Owl	Common breeder, most common local owl species, known to breed near proposed turbine sites.
Long-eared Owl	Unknown as present until July 2004 breeding bird surveys.
Barred Owl	Uncommon breeder, known to breed near larger local lakes.
Saw Whet Owl	Uncommon breeder, no known breeding location near proposed turbine sites.
Game Birds	
Ruffed Grouse	Common breeder in shrubby woodlands such as those found at Chapel Gully.
Spruce Grouse	Common breeder especially in the Chapel Gully and Mathews Hill areas.
Non Aligned Species	
Belted Kingfisher	Common breeder, in the local area, annual nester at Camp Glasgow, at the Tickle and on Grassy Island.
Ruby-throated Hummingbird	Common breeder in the Town of Canso.
Rock Pigeon	Common breeder in Canso.
Mourning Dove	Widespread common breeder.
Cliff Swallow	Uncommon breeder, average of 1 pair per summer often seen feeding near government wharf in Canso, breeding site unknown.
Tree Swallow	Widespread common breeder.
Barn Swallow	Uncommon breeder with maybe a dozen pairs breeding over a wide area.
Bank Swallow	Declining breeder, now down to an average of 1 pair per summer, breeding site unknown.
Chimney Swift	Occasionally seen in summer but not in recent years, last known colony was located five years ago in an old farm house about 30 km from study area in Tor Bay.
Downy Woodpecker	Widespread common breeder, most common species of woodpecker to breed in the

TABLE 4.4.9 Breeding Bird Species Within 20-Kilometre Radius

Species	Status
	local area.
Black-backed Woodpecker	Uncommon breeder, 3 to 4 breeding pairs locally with the best-known breeding site near the Union Cemetery in Canso.
Pileated Woodpecker	Uncommon breeder, 2-3 breeding pairs recorded each year in the Fox Harbour area, occasionally seen in summer at Chapel Gully.
Hairy Woodpecker	Widespread common breeder.
Northern Flicker	Uncommon breeder, breeds locally at Glasgow Head.
Red Breasted Nuthatch	Widespread common breeder.
White Breasted Nuthatch	Confirmed as breeding in Fox Harbour in summer of 2004.
Three Toed Woodpecker	Uncommon breeder, 1 or two pairs present each summer in the Cooeycoff Lake area.
Passerines	
American Crow	Widespread common breeder.
Common Raven	Widespread common breeder.
Blue Jay	Widespread common breeder.
Gray Jay	Uncommon breeder, occasionally found breeding on Fox Island, discovered breeding during July breeding bird surveys near Glasgow Head.
Black-capped Chickadee	Widespread common breeder.
Boreal Chickadee	Widespread common breeder in spruce woodlands.
Golden-crowned Kinglet	Present in summer, breeding status unknown until confirmed as breeding by July Surveys, uncommon breeder.
Ruby-crowned Kinglet	Uncommon in summer, breeding status unknown.
Winter Wren	A few present each summer, breeding status unknown.
Scissor Tailed Flycatcher	Three records of summer strays, one in 1976, one in 1989, one in 2000.
Alder Flycatcher	Widespread common breeder.
Eastern Kingbird	Often present in early summer, but not normally seen later in the season, breeding status unknown.
Olive-sided Flycatcher	Three summer records, breeding status unknown.
Yellow-bellied Flycatcher	Uncommon in summer, breeding status unknown until confirmed as breeding by July Surveys, uncommon breeder.
Least Flycatcher	Uncommon in summer, breeding status unknown.
European Starling	Widespread common breeder.
Cedar Waxwing	Widespread common breeder.
Red-winged Blackbird	Widespread common breeder.
Common Grackle	Widespread common breeder.
Bobolink	Seen mostly in spring breeding status unknown but potential habitat does exist in Hazel Hill.
Shiny Cowbird	One record June 2004.
Brown-headed Cowbird	Widespread common breeder.
American Robin	Widespread common breeder.
Hermit Thrush	Widespread common breeder.
Swainson's Thrush	Widespread common breeder.
Veery	Uncommon in summer, breeding status unknown.
Eastern Bluebird	Uncommon breeder, successful breeding pair in Canso, summer 2002.
Northern Mockingbird	Uncommon breeder, common breeder in the Town of Canso with a few pairs present each summer.
Gray Catbird	Fairly common in summer, breeding status unknown.
Blue Headed Vireo	Uncommon in summer, breeding status unknown.
Red-eyed Vireo	Uncommon in summer, breeding status unknown until confirmed as breeding during July 2004 breeding bird surveys.
Philadelphia Vireo	Summer stray.
Nashville Warbler	Breeding status unknown until confirmed as breeding during July 2004 breeding bird surveys, uncommon breeder.
Yellow Warbler	Widespread common breeder.
Magnolia Warbler	Widespread common breeder.
Yellow-rumped Warbler	Widespread common breeder.
Black-and-white Warbler	Breeding status unknown until confirmed as breeding during July 2004 breeding bird

TABLE 4.4.9 Breeding Bird Species Within 20-Kilometre Radius

Species	Status
	surveys, uncommon breeder.
Common Yellowthroat	Widespread common breeder.
Chestnut-sided Warbler	Widespread common breeder.
Black-throated Green Warbler	Breeding status unknown until confirmed as breeding during July 2004 breeding bird surveys, uncommon breeder.
Bay Breasted Warbler	Common breeder mainly in the Fox Harbour area.
Canada Warbler	Occasionally seen in summer, breeding status unknown.
Cape May Warbler	Confirmed breeder, 3-4 pairs present each summer.
Blackburnian Warbler	Confirmed breeder, 4-5 pairs present each summer mainly in the Cole Harbour & Queensport areas.
Palm Warbler	Widespread common breeder.
Blackpoll Warbler	Widespread common breeder.
American Redstart	Breeding status unknown until confirmed as breeding during July 2004 breeding bird surveys, common breeder.
Wilson's Warbler	Breeding status unknown until confirmed as breeding during July 2004 breeding bird surveys, uncommon breeder.
Savannah Sparrow	Widespread common breeder.
Song Sparrow	Widespread common breeder.
Chipping Sparrow	Widespread common breeder.
Swamp Sparrow	Widespread common breeder.
Fox Sparrow	Common breeder in and near Canso.
Lincoln's Sparrow	Thought of as uncommon in summer, breeding status unknown until confirmed as breeding during July 2004 breeding bird surveys, common breeder in Chapel Gully at two locations.
White-throated Sparrow	Widespread common breeder.
Nelsons Sharp Tailed Sparrow	Uncommon breeder in the salt marshes of Chapel Gully.
Dark-eyed Junco	Widespread common breeder.
Purple Finch	Widespread common breeder.
Pine Siskin	Widespread common breeder.
Rose Breasted Grosbeak	Widespread common breeder.
Evening Grosbeak	Widespread common breeder.
Pine Grosbeak	A few occasionally seen in summer, breeding status unknown.
White-winged Crossbill	Widespread common breeder.
American Goldfinch	Widespread common breeder.
House Sparrow	Widespread common breeder near human habitation.

Source: Stevens, C., 2004

4.4.3.3.6 Species of Special Status in the Greater Buffer Zone

All breeding bird species found within the Greater Buffer Zone were compared with the COSEWIC, NSDNR, and the ACCDC databases for species of special status. There are 24 known bird species of special status that were found to exist within the Greater Buffer Zone. Only five of these species have been observed within the area of the proposed sites (see Section 4.4.3.3.2). The 24 species of special status and their current ranking are listed below:

- Common Loon (NSDNR Yellow);
- Red Breasted Merganser (ACCDC S2S3B);
- Northern Shoveler (ACCDC S2B);
- Laughing Gull (NSDNR Blue; ACCDC S2N);
- Black Legged Kittiwake (ACCDC S2B);

- Arctic Tern (NSDNR Yellow; ACCDC S3B);
- Common Tern (NSDNR Yellow; ACCDC S3B);
- Roseate Tern (COSEWIC Endangered; NSDNR Red; ACCDC S1B);
- Atlantic Puffin (NSDNR Yellow; ACCDC S1B);
- Black Guillemot (ACCDC S3);
- Parasitic Jaeger (ACCDC S3M);
- Piping Plover (COSEWIC Endangered; NSDNR Red; ACCDC S1B);
- Semipalmated Plover (ACCDC S2B);
- Bald Eagle (ACCDC S3N);
- Merlin (ACCDC S3S4B);
- Long-eared Owl (NSDNR Yellow; ACCDC S1S2);
- Black Backed Woodpecker (ACCDC S3S4);
- Three Toed Woodpecker (ACCDC S2);
- Boreal Chickadee (ACCDC S3S4);
- Bobolink (NSDNR Yellow; ACCDC S3B);
- Eastern Bluebird (NSDNR Yellow; ACCDC S2S3B);
- Northern Mockingbird (ACCDC S3B);
- Philadelphia Vireo (ACCDC S2B);
- Nelson's Sharp Tailed Sparrow (ACCDC S2S3B).

4.4.3.4 Breeding Bird Survey (June 2005)

Following the completion of the surveys discussed in the previous sections, and in an effort to further reduce the potential for adverse environmental effects, BWEL identified two additional turbine candidate sites (11 and 12, referred to as 11d and 12d). In addition, the turbine sites that were added in the Fall of 2004 (i.e., after the completion of the 2004 breeding bird survey) were surveyed. This are sites 1d and 5d. Further, sites 3d, 4d, 9d and 10 d were surveyed as these were "on the way" between surveys for the other sites.

The survey methodologies used during the supplemental breeding bird survey of June of 2005 closely match those employed during the 2004 breeding bird surveys with the focus being placed on gathering data on the new sites (11d, 12d, 1d and 5d).

One of the main differences between the methodologies employed in the June 2005 survey compared to those used in the July 2004 surveys is that no offsite data was gathered including incidental observations. One other major difference between the two surveys was the type of data gathered. During the July 2004 surveys, a more complete picture was obtained of the breeding bird population in the general Canso area. However, during the June 2005 surveys much more detailed information was obtained for the species using the exact areas potentially effected by the proposed turbines. Observers were also able to gather additional data on the breeding status on the species observed.

All surveys were carried out by the same bird expert who conducted all of the previous bird surveys for the Project. The expert brings with him over 25 years of birding knowledge and is trained in the methods of scientific bird observation and data collection and with extensive experience in carrying out breeding bird surveys.

Detection and identification of bird species were carried out using both sight based skills and auditory knowledge of songs and call notes. Timing of the breeding bird surveys was chosen to coincide with the time of year that the breeding bird activity would be at its peak in the Canso Area. In addition all sites were carefully surveyed during the early morning hours when both bird song and feeding of young are at a daily high.

At all times, special emphasis was placed on gathering information on the movements of species at risk or species of special status. In addition surveys were conducted in a manner that would provide as little disturbance as possible to these and other species.

4.4.3.4.1 Breeding Bird Survey Results (2005)

A total of 56 species of birds were recorded on or within 200 meters of selected turbine sites during the June 2005 breeding bird surveys.

Detailed on-site numerical data on the presence of these species can be found in Appendix M, Table M-1. The information in Table M-1 includes all numerical data gathered on numbers and species of birds present on sites including incidental data collected as surveyors passed through a proposed turbine site en route to sites selected for field study during the June 2005 breeding bird surveys. For additional details see the “Site Analysis” (below) for sites and species mentioned in Table M-1.

Table M-2 contains information on the general breeding status and abundance of the species observed during the June 2005 surveys. In this case the general breeding status is the breeding status of the species in the area surrounding the Town of Canso. This table also contains detailed breeding status information gathered on each site and organized by species.

Findings for individual site locations (Figure 2.3) are briefly discussed below

<u>Site 1d</u>

Site 1d was an active breeding location where 26 species of birds were recorded, including six species not found on any of the other proposed turbine sites and one species found on just one other site. When this data is combined with the more extensive breeding data gathered in 2004 the apparent significance of Site 1d is greatly diminished. In all cases but one, the species found on Site 1d are common breeders that are breeding at several nearby locations. The one exception is Wilson’s Warbler, an uncommon breeder, however this species was discovered at a couple of other nearby locations during the 2004 breeding bird surveys.

Site 2d

No unusual breeding bird species were observed on Site 2d, nor was there any unique breeding bird habitat found at this location.

Site 3d

No unusual breeding bird species were observed on Site 3d, nor was there any unique breeding bird habitat found on this location.

Site 4d

On Site 4 breeding bird presence was relatively low with only 10d breeding bird species observed during the surveys. One uncommon breeding species present was the Ovenbird which was also confirmed as breeding on Site 5d.

Site 5d

Of the sites surveyed this site contained by far the greatest variety of breeding species, including nine species not found on other sites. A number of the species present were birds that are not common breeders in the Canso area. Surveyors considered this site as an significant breeding bird location that is not duplicated in the immediate vicinity of the project.

Site 9d

Site 9d was an active breeding site with several unusual breeding species of birds. It is of note, that Site 9d is located close to the boundaries of Chapel Gully Park where virtually identical breeding bird habitat containing the same mix of species is protected.

Site 10d

Site 10d was an active site for breeding species including a few unusual breeders such as Long-eared Owl and Mourning Warbler. Like Site 9d the breeding habitat found on Site 10d is similar enough to habitat found in the adjacent Chapel Gully Park that the same species can be found breeding inside the park boundaries.

Site 11d

For the most part this site was composed of common breeders with the exception of the Olive-sided Flycatcher. Although this flycatcher is an uncommon breeder in the Canso area, habitat that is normally used by this species can be found at a few locations close to Site 11d providing possible uprooted individuals with nearby alternate breeding sites.

Site 12d

As far as breeding birds are concerned, Site 12d does not stand out from the other proposed sites. However, it does attract a couple of species not found on the other sites. The less common species present however can be found at other locations in the vicinity that have not been chosen as proposed turbine sites.

4.4.3.5 Species of Special Status Observed during Breeding Birds Survey (June 2005)

All breeding bird species found within the proposed sites during the July 2005 survey were compared with COSEWIC, NSDNR, and ACCDC databases for species of special status. Species of special concern that breed within the proposed sites are listed below:

- Long-eared Owl (NSDNR Yellow Rank; ACCDC S1S2 Rank); and
- Boreal Chickadee (ACCDC S3S4 Rank).

The Long-eared Owl was heard calling near Site 10d, where suitable breeding habitat exists. The Boreal Chickadee is noted to be a common breeder in spruce woodlands surrounding the Canso area.

The Common Loon, Black Backed Woodpecker, and Philadelphia Vireo, which had been observed in the previous breeding bird survey (see Section 4.4.3.3.2), were not recorded on any of the site during the July 2005 survey.

4.4.4 2004 Fall Bird Migration

The avian surveys were continued in summer and fall 2004 with surveys of migratory birds moving south (see Table 4.4.1). Migratory birds, including their nests, eggs and young, are protected under the Migratory Bird Convention Act (MBCA). This group of birds includes the species listed in the Canadian Wildlife Service Occasional Papers No.1, “Birds Protected in Canada Under the Migratory Birds Convention Act” (EC, 2004). As part of the surveys, the species/species composition and approximate numbers of migrants are required parameters (Appendix G).

The surveys of migratory birds carried out for the proposed project consisted of surveys of:

- Fall shorebirds;
- Fall passerines: insect eaters, seed eaters and various other passerines;
- Non-aligned species (e.g. non-passerine birds such as swallows and hummingbirds);
- Waders;
- Seabird and Aerialists;
- Waterfowl; and
- Raptors.

The migration of shore birds and passerines was of primary interest for various reasons, including location of the bird movements and numbers of birds. Fall passerine surveys were expected to have the largest impact on the proposed project (C. Stevens, personal comm., 2004). Ideally, the passerine surveys should consist of three separate surveys: one each for the peak of the insect eaters migration, one for the seed eaters and one for the peak of various other passerines. The three peaks occur in three different months: September, October and November, respectively. The data for the various other passerines (November migration) were obtained from historical records and current records of local birders.

4.4.4.1 Fall Migration Survey Methodology

Fall Migration Surveys were carried out intermittently from July to October, 2004, for the purpose of gathering data on a wide range of migrating bird species that pass through or near the proposed wind farm in the community of Canso, Nova Scotia during their southward migration.
As requested by the Canadian Wildlife Service, the fall migration data was collected according to the parameters laid out for "medium sized projects" in "Wind Turbines and Birds – A Guidance Document for Environmental Assessment". In order to ascertain the composition of the birds that migrate through the Canso area, a number of migration surveys were carried out based upon CWS requirements, initial data gathered, and the likelihood of which species would be encountered migrating in or near the project area.

All avian surveys were carried out by an experienced observer with over 25 years of birding knowledge and trained in the methods of scientific bird observation and data collection. Since most migrants do not engage in song, bird species were primarily detected and identified by sight, flight patterns and flight notes and contact calls. At all times, special emphasis was placed on gathering information on the movements of species at risk or species of special status. In addition, surveys were conducted in a manner that would provide as little disturbance as possible to these and other species.

4.4.4.1.1 Shore Bird Migration, Waders and Seabirds

The documentation of the shorebird migration was one of the primary goals of the fall migration surveys. Shorebird Surveys were conducted according to tidal conditions. During high tides, potential stop over sites and possible roosting sites were searched. During low tide, feeding sites were the primary target. At all times directional movements of shorebirds were noted as well as their use of particular locations as migration corridors.

During surveys of areas, any signs of use by shorebirds were looked for, including all potential roosting sites, all potential feeding sites, staging areas, and migration corridors. Surveys were conducted both on and near the project site as well as sites further a field where data was gathered as an off site comparison. All available shoreline was surveyed by foot within a two kilometre radius of the proposed project. This equaled approximately fourteen kilometres of shoreline and included the outer coast from the breakwater in Canso Harbour to Betsy's Point and the inner coast of Turf Bog, Chapel Gully, Spinney Gully and all areas in between.

In addition, more distant coastal areas accessible by car were also surveyed which included Canso Harbour, The Tittle, Durrel Island, a seven kilometre stretch of the Dover Road, and a forty two kilometre stretch of the Atlantic Coastal Highway 316 and a twenty five kilometer stretch of Highway 16 along Chedabucto Bay. Data was also gathered on shorebird activity on Grassy Island.

Due to the location of the turbines, no boats trips were scheduled to observe seabirds. However, observers were prepared to collect data as to the proximity of seabirds to the proposed sites and their movements should weather conditions have carried seabirds into the study area during the scheduled survey times. Observations of any aerialist migration was included as part of the regular fall surveys.

All signs of migrating waders were searched for, using the methodologies laid out in this document.

4.4.4.1.2 Waterfowl

Most of the fall migration surveys were scheduled to take place before the main waterfowl migration due in part to the low number of waterfowl expected to be encountered inside the area that could be impacted by the wind turbines. Within two kilometres of the proposed farm little exists in the way of appealing habitat for migrating dabblers such as cattail marshes, freshwater ponds or grain fields.

In addition, in conversation with local naturalists two important pieces of data were revealed in regards to waterfowl movements in the area. Firstly, during the entire fall migration, waterfowl are under intensive hunting pressure both inside and outside of the regular hunting season. Secondly the vast majority of waterfowl species seen migrating in the area are observed along the outside edge of the ring of islands that encircle the Canso Headland from Canso Harbour to Dover Bay and are highly unlikely to be impacted by any land based wind farms. However, migrating waterfowl encountered closer to the project site during the scheduled fall surveys were recorded as well as their positions in relation to the proposed project.

It should also be noted that waterfowl migrations surveys are planned for the spring, a time for which local data suggests a greater number of waterfowl might be present.

4.4.4.1.3 Hawk Migration and Owls

As a result of consultations with both the Canadian Wildlife Services and the Department of Natural Resources (M. Elderkin), it was ascertained that separate Hawk Migration Surveys were not required at this time. Thus hawk surveys were not carried out. However, all observations of birds of prey made during the songbird and shorebird migration surveys were noted.

Nocturnal Surveys for migrating owl species such as Long-eared Owl and the Northern Saw-whet Owls were not carried out at this time, but in spring 2005.

4.4.4.1.4 Gamebirds

In Nova Scotia there is no gamebird migration. Therefore, surveys specifically for these species were not undertaken.

4.4.4.1.5 Passerines

The detection and documentation of passerine movements was another primary goal of the fall migration surveys. For the passerine migration, surveys were conducted both on and near the project site as well as further a field where data was gathered as an off site comparison. All ten proposed turbines sites were surveyed as well as their alternates. Surveys were also carried out in all woodlands and green spaces that occurred within two kilometres of the turbine sites. This area included the Chapel Gully Park, Glasgow Head, Glasgow camp and Betsy’s Point. In addition, the entire Town of Canso was surveyed as well as Highway 16 as far as Yellow Marsh and the first seven kilometers of the Dover Road.

Passerine surveys were conducted during peak morning and late afternoon feeding periods and late in the day to search for staging areas. Passerine surveys were also carried out at first light to record migration corridors, landfall sites, possible fallouts, directional movements and estimated heights. Since most migrants do not engage in song, bird species were primarily detected and identified by sight, flight patterns and flight notes and contact calls.

The first round of passerine surveys were timed to coincide with the peak of the insect eating migrants such as the warblers, vireos, wrens, and flycatchers, since this group along with the shorebirds represents many of the species that pass through Nova Scotia during the early fall migration (including September).

The second round of passerine surveys was target to late fall migrants and was carried out in October 2004. It was scheduled to enable the observation of the main movement of many of the berry eating and seed eating passerines such as the finches, thrushes, mimic thrushes, tanagers, larks, grosbeaks, buntings and sparrow families.

4.4.4.1.6 Non-Aligned Species

Surveys were also carried out to detect and record the southward movements of ”non-aligned species”, a group of birds composed of miscellaneous non-passerine land birds such as swallows and hummingbirds. Since the majority of the species in this category are daytime migrants, midday surveys were included in addition to the regular early morning and late in the day surveys.

4.4.4.2 Fall Migration Results

A variety of fall migration surveys were conducted in order to gather data on eight distinct groupings of birds. Each of these groups is described below, along with details on the species that were found. In total, these eight groups of migrants provided 65 species and more than 5,000 southward bound individuals during the fall surveys (in August and September).

4.4.4.2.1 Shorebird Migration

During the Shorebird surveys data was gathered at all sites that could be potentially used by shorebirds within a two kilometre radius of the proposed turbine sites. These sites included approximately fourteen kilometers of shoreline. Much of this shoreline was composed of fairly exposed coastline protected in part by a ring of barrier islands. For the purpose of this study this area of shoreline was termed the “Outer Coast”. Detailed data on the shorebirds observed in these areas can be found in Table 4.4.10.

The other portion of the coastline was made up of a more sheltered shoreline associated with the Turf Bog, Spinney Gully, and Chapel Gully. For the purpose of this study this area of shoreline was termed as “Inner Coast”. Detailed data on the shorebirds observed in these areas can be found in Table 4.4.11.

These tables contain the distance in meters of each shorebird species from the closest proposed turbine sites as well as their abundance levels and what sort of activities they were engaged in. If in flight, their approximated height and direction of their flight paths were also noted.

TABLE 4.4.10 Shorebirds at the Outer Coastline From the Canso Breakwater to Betsy's Point Beach, Canso, NS, Fall 2004

Location	Species and Activity
100 meters North of Site 1	8 Whimbrels roosting in a field
220 meters north of Site 6	6 Spotted Sandpipers feeding
300 meters from Sites 6, 7 and 8	100 + Whimbrels low over the water flying in a southerly direction
400 meters from Sites 7 and 8	5 Semipalmated Sandpipers E and SE flights of 200+ meters 2 Semipalmated Plovers SE flights of 200+ meters
110 meters north of Site 8	1 Least Sandpiper feeding
330 meters east of Site 8	6 Spotted Sandpiper feeding
730 meters South East of Site 8	5 Spotted Sandpipers feeding
860 meters South of Site 8	4 Spotted Sandpipers feeding
490 meters SE of Site 8	4 Semipalmated Sandpipers - feeding on a small sandy beach 7 Semipalmated Plovers - feeding on a small sandy beach
450 meters SE of Site 8	1 Semipalmated Sandpiper - Easterly flight of 100+ meters 12 Semipalmated Plovers -S, SE & NW flights of 300+ meters 1 Least Sandpiper –SW flight of 200 + meters
Betsy's Point Beach 960 meters SSE of Site 8 960 meters ENE of Site 10	8 Semipalmated Sandpipers -feeding and roosting individuals 78 Semipalmated Plovers -feeding and roosting individuals 1 Greater Yellowlegs -feeding 18 Least Sandpipers -feeding and roosting individuals

TABLE 4.4.11 Shorebirds at the Inner Coastline of Turf Bog, Chapel Gully and Spinney Gully at Canso, NS, Fall 2004

Location	Species and Activity
300 meters south east of Site 8	1 Whimbrel flying over the Turf Bog coming from the direction of Spinney Gully at a height of 500+ meters
250 meters South East of Site 10	1 Black bellied Plover flies over in a easterly direction at a height greater than 400 meters
Mouth of Winter Creek in Chapel Gully	1 Wilson's Snipe feeding, may have been a local breeder

Table 4.4.12 lists all of the shorebird species discovered during the fall surveys. Species are divided up into the key locations or places where the greatest numbers of shorebirds were observed during the fall surveys. Table 4.4.12 also shows the relative abundance of the birds present and indicates how each location was being used. A tabulation of the total number of species at each site and the total number of individuals is also provided for an easier comparison between sites. The species found in Tables 4.4.10 and 4.4.11 are also provided in Table 4.4.12 for a quick comparison of near-turbine sites to key shorebird locations found further from the proposed project site.

In addition to the shorebird species reported above and below, habitats indicated that Ruddy Turnstones should be present. Although none were observed during the shorebird surveys, consultation with local naturalists revealed that they are indeed common migrants during the fall migration.

TABLE 4.4.12 Species Recorded During Shorebird Migration Surveys at Key Locations at Canso, NS

Species	Key Locations and Abundance					
	Canso and Outer Coast	Inner Coast	Grassy Island	Black Duck Cove Park	Tor Bay Provincial Park	New Harbour
Black Bellied Plover	...	1	10	...	12	164
Semipalmated Plover	99	..	50	37	50	377
Killdeer	...	...	...	...	...	1
Common Snipe	...	1	...	...	...	...
Short Billed Dowitcher	...	...	...	...	...	124
Hudsonian Godwit	...	...	...	...	...	2
Whimbrel	100+	1	100+	...	9	1
Long Billed Curlew	...	...	1	...	...	...
Spotted Sandpiper	15	...	...	...	...	1
Willet	...	...	...	...	...	12
Greater Yellowlegs	1	...	10	...	1	88
Lesser Yellowlegs	...	...	2	...	...	19
Sanderling	...	...	...	...	6	20
Pectoral Sandpiper	...	...	...	...	...	1
Least Sandpiper	20	...	...	16	...	26
Semipalmated Sandpiper	18	...	...	8	2	257
Bairds Sandpiper	...	...	...	...	...	2
White Rumped Sandpiper	...	...	....	...	1	32
Total Species	6 Species	3 Species	6 Species	3 Species	7 Species	16 Species
Total Individuals	253+	3	173+	61	81	1127

4.4.4.2.2 Shorebird Migration Corridors

One of the purposes of the migration surveys was to discover if any migration corridors were evident in the area and to record where these corridors existed.

The section of the Canso Peninsula, which passes by Turbine Sites 6, 7 & 8, receives little use by migrating shorebirds, with the exception of the spotted sandpiper. Most shorebirds instead skip this area by “hopscotching” from island to island. Low lying areas along the peninsula are used as shortcuts to reach Betsy’s Point and other islands. Betsy’s Beach is the most important mainland site on the peninsula, attracting small numbers of both roosting and feeding birds. A few individuals were also found to be using the more marginal habitat of the rocky Betsy’s Beach in the same way.

Further out from this shoreline, over the open water, more than a hundred whimbrels were recorded this fall, migrating along the peninsula from July to September. This however, most likely represents only a portion of the whimbrels that pass through this area, since during just one day of observations more than one hundred whimbrels were noted as present on and around Grassy Island. This would indicate that Grassy Island lies in a major flyway for whimbrel.

4.4.4.2.3 Seabird & Aerialist Migration

No seabird migration was observed during surveys but this is not unusual as most seabird migration is noted from off shore locations such as islands and boats, and at exposed coastal locations before, during or after stormy weather.

The Aerialists group is primarily composed of gull and tern species. As expected, there were no noticeable differences in gull numbers from what was found during the breeding bird surveys. This is not surprising as most gull species will not arrive in Nova Scotia until just before and during the winter season. Such birds arriving in the Canso area will be recorded during the winter surveys. During the fall surveys, terns were present only in low numbers, representing a portion of the breeding birds that had been present during the summer. No terns were observed passing through the region from other areas. No other aerialists were detected in the general area during the fall surveys.

4.4.4.2.4 Migration of Waders

Surveys revealed that little habitat is present in the immediate area of Canso that would be appealing to large numbers of waders. For this reason, the only wading species observed during the surveys was the versatile great blue heron, which appeared in small numbers at scattered locations all along the coast. Less than thirty individuals were observed and most sightings were of single birds. At no location were there more than two birds present at any one time.

Many of the waders that have been sighted in the Canso area in the recent past have been rare strays that latch onto whatever small piece of habitat they can find. The brackish pond in Chapel Gully Creek has been used both in the fall and spring as such a location.

One notable exception is the cattle egret. One or two of these birds are reported from the Canso Area each fall often in the fields one hundred meters to the north of Site 1.

4.4.4.2.5 Waterfowl Migration

Waterfowl species observed during the surveys included flocks of double crested cormorants passing overhead at a height greater than a thousand meters. In the small brackish pond found in Chapel Gully Creek small numbers of green winged teal and American black ducks had moved in from nearby breeding areas for the purpose of feeding. Surveyors recorded a couple family groups numbering less than 15 individuals and suggest this spot could be used as a small staging area by local waterfowl.

No waterfowl movement was observed during coastline surveys, but it should be noted that the vast majority of the area that lies outside the ring of islands is unobservable from shoreline locations.

4.4.4.2.6 Raptor Migration

Migrating hawks included individuals and pairs of sharp shinned hawks, American kestrels, merlins, Northern harriers, and red tailed hawks. It should be noted that these small numbers are not necessarily representative of the actual hawk migrants present, since surveys were not carried out during hawk migration peaks or in the locations or during the time of day that hawks would be most active. Only one bird of prey was noted in close proximity to a proposed turbine site, a merlin that was observed sixty meters north of Site 6.

4.4.4.2.7 Migration of Non-Aligned Species

Four non-aligned species were observed migrating through the Canso area. These included very small numbers of belted kingfishers, barn swallows, tree swallows, downy woodpeckers and ruby throated hummingbirds. In all cases, none of these species were observed on the proposed turbine sites or appeared close enough to the sites to come in contact with turbines should they be erected there.

4.4.4.2.8 Passerine Migration: Insect Eaters

The passerine migrations were the largest migrations recorded in the Canso area during the fall 2004 surveys, with well over 3,000 individual birds being documented by September.

Nearly all migrant flocks had the same composition of species. A list of all species encountered during the surveys can be found in Table 4.4.13, as well as their estimated numbers. Numbers are best presented as estimates, since in most cases surveyors were counting medium to large size flocks of rapidly moving small birds. However, since these flocks are usually composed of many individuals of the same species, a count of the number of species present is quite accurate.

Inside each flock of common species, a less common species or two is often present. In some cases, this species might be missed, but their presence is often detected by their contact notes, which stand out, as they naturally sounds quite different from the contact notes of the common species.

4.4.4.2.9 Passerine Migrant Activity

During these surveys, all ten proposed turbine sites were visited repeatedly. A description of migrant activity at each site follows.

<u>Site 1</u>

One hundred meters north of Site 1 is the beginning of a low-lying area that is used extensively by migrating passerines. This area is approximately three hundred to four hundred meters long and runs to just past the water tower hilltop in Canso. Nearly a hundred migrating birds were recorded traveling along this valley corridor at vegetation level during our surveys. Another couple hundred migrants were recorded traveling at heights of greater than two to three hundred meters.

Four hundred to six hundred meters east of Site 1, a location that encompasses the hill top area at the entrance of Chapel Gully Park, as well as the entire length of the Wilmot Subdivision Road from its end to its beginning at the hospital, was a hot spot of passerine migrant activity. From this site, flocks of migrants were tracked traveling north towards the Town, and south, southeast and southwest towards the coast.

TABLE 4.4.13 Insect Eating Passerine Migrants Discovered During Fall 2004 Surveys, Canso, NS

Species	Number of Individuals Recorded
Black-capped Chickadee	300+
Ruby-crowned Kinglet	40+
Alder Flycatcher	10
Eastern Kingbird	1
Red-winged Blackbird	12
Common Grackle	1,000+
Brown-headed Cowbird	6
Blue Headed Vireo	30+
Red-eyed Vireo	40+
Nashville Warbler	40+
Yellow Warbler	80+
Magnolia Warbler	150+
Yellow-rumped Warbler	500+
Black-and-white Warbler	70+
Common Yellowthroat	300+
Chestnut-sided Warbler	30+
Black-throated Green Warbler	50+
Bay Breasted Warbler	35+
Canada Warbler	10+
Cape May Warbler	5
Blackburnian Warbler	3
Palm Warbler	50+
Ovenbird	10
Tennessee Warbler	10+
Northern Water Thrush	10+
Blackpoll Warbler	80+
American Redstart	40+
Wilson's Warbler	20+
Pine Warbler	1
Lark Sparrow	1
Dark-eyed Junco	150+
Baltimore Oriole	2

Site 2

No migrating passerines were observed on or near Site 2.

Site 3

No migrating passerines were observed on or near Site 3.

Site 4

Approximately two hundred meters south of Site 4, a mixed flock of migrating passerines was encountered consisting of an estimated fifty individuals.

Site 5

This site and the surrounding area were devoid of migrant activity.

Sites 6, 7a & 8

All three of these sites are located along the coastal side of a strip of land used by migrating passerines as a landfall site. During the fall surveys, about three hundred passerines were observed coming in from over the ocean and landing at the high points along this peninsula. Most of the birds would drop in vertically, but some entered the vegetation at about a 45 degree angle. From the high points the birds dispersed into the surrounding vegetation to rest and feed. It was also noted that the flat areas along the peninsula were used by the passerine migrants as shortcuts in the same way as the migrating shorebirds had used them.

The areas closest to the proposed turbine sites of particular heavy use by arriving migrants are indicated in Table 4.4.14. Flock sizes in the table are identified as small, medium or large. For the purpose of this study, a small size flock would consist of ten to twenty individuals. A medium sized flock would consist of twenty five to ninety five individuals. A large flock would be made up of anywhere from a hundred to several hundred birds.

TABLE 4.4.14 Areas of Heaviest Use by Passerines Near the Proposed Turbine Sites 6, 7a, and 8 at Canso, NS

Location	Flock Size and Vegetation
71 Meters North West From Site 7	a forested site with a large flock of newly arrived mixed warbler species
200 South East Meters From Site 7	a forested site with a small mixed flock of migrating passerines
400 Meters South East From Site 7	a flat heath area with a flock of 200 migrating Yellow Rumped Warblers
100 Meters North East From Site 8	a forested site with a small flock of mixed migrants
140 Meters South East From Site 8	a forested landfall site dominated by angled drop ins.
200 Meters South East From Site 8	a forested landfall site with numerous steep drop ins by passerines
290 Meters South From Site 8	a forested landfall site with numerous steep drop ins by passerines
450 Meters South East From Site 8	a flat heath area being used for travel by passerines; a forested area on the south east edge of this gap was a landfall site for large numbers of passerines.

Site 9

No migrants were recorded at or near Site 9 during the fall surveys.

Site 10

During the fall surveys Site 10 and the habitats in the immediate vicinity gave no indication of being of importance to migrating passerines.

Other Passerine Migration Sites

Two other important sites discovered being used by migrating passerines in the Canso area are the large drumlin at Glasgow Camp at the end of the Canso Peninsula and the green areas lining the first two kilometers of the Dover Road.

The Glasgow Camp site was the second most active site in the Canso area, with new migrants arriving there during every day of the surveys. The Dover Road site appeared to be a very busy feeding area and demonstrated the ability to attract rare species from great distances.

4.4.4.2.10 Passerine Migration: Berry and Seed-eating Species

This section deals with the late fall surveys carried out in October 2004. The surveys were timed to coincide with the peak of many of the berry eating and seed eating passerines such as the finches, thrushes, mimic thrushes, tanagers, larks, grosbeaks, buntings and sparrow families. At all times, special emphasis was placed on gathering information on the movements of species at risk or species of special status. In addition surveys were conducted in a manner that would provide as little disturbance as possible to these and other species.

A total of seventy five species of birds were recorded in the Canso area during the October surveys, thirty nine of which were late fall migrants. Those thirty nine species along with their relative abundance can be found listed in Table 4.4.15. This table also shows the key locations for each species. Further details on each location can be found below the table.

Chapel Gully Park, the Dover Road and the unnamed dirt road that travels along the coast past proposed sites 6, 7a and 8 contained key feeding and resting locations for some of the migrants but most of the best sites were located within Town of Canso.

During the early (main) fall surveys the first two kilometers of the Dover Road contained the most active areas for migrating passerines. However during the October surveys nearly all the migrant activity was observed near the end of the Dover Road, in and around Black Duck Cove Park.

Chapel Gully Park provides protected feeding locations for woodland migrants and contains a rich supply of berry producing bushes, and cone bearing trees. One of the most productive areas in the park was a protected hillside near the park entrance located 126 meters from Site 1a. A small pocket of migrants was also detected in the park about 600 meters from Site 6.

The proposed turbine sites represented the least active areas for migrants with the majority of the proposed sites being without any bird species.

On the dirt road running past sites 6, 7a and 8, the closest migrant activity was 550 meters from Site 8 near the beginning of the road. Most of the migrants along this road were concentrated between the end of the road at Glasgow Camp and the piece of land stretching towards Betsy's Point. Some migrants were also recorded on nearby Glasgow Head.

In the Town of Canso the majority of birds were discovered in four locations: Irving Hill, Carleton Street, the RV Park and the valley that runs through the back of the Town behind the water tower.

The RV Park is a mixed wet grassland area that has been mostly filled in to build parking/camping spaces. Historically this site attracted a good variety of species that use wet meadows. Some of those species such as the Cattle Egret can still find a bit of the old habitat present. The grasses present continue to make this location an excellent site for migrating seed eaters.

TABLE 4.4.15 Species and Number of Individuals Recorded During Late Fall Migration Surveys at Key Locations

	Proposed Turbine Sites	Town of Canso	Chapel Gully Park	Dover Road	Road to Glasgow Head and Glasgow Camp
Cattle Egret		1			
Yellow Billed Cuckoo		4			
Yellow Shafted Flicker		1			
Water Pipit		1			
Carolina Wren		1			
Winter Wren		1			
Black Capped Chickadee	5	30	40	20	20
Ruby Crowned Kinglet			1		
Blue Gray Gnatcatcher		3			
American Robin	100	12	100	20	12
Northern Mockingbird		1			
Eastern Bluebird		1			
White Eyed Vireo		1			
Yellow Throated Vireo			1		
Yellow Rumped Warbler		4	20		
Orange Crowned Warbler		4			
Pine Warbler		1			
Common Yellowthroat			1		
Red winged Blackbird		2			
Common Grackle		17			
Bobolink		8			
Eastern Meadowlark		2			
Baltimore Oriole			2		
Dickcissel		8			
Snow Bunting					1
Dark Eyed Junco		8	12	20	25
Purple Finch	10	30	40	12	20
Pine Siskin	1000	15000	10000	1000	5000
American Goldfinch	4	70	40	10	12
Blue Grosbeak		1			
Indigo Bunting		11	1	1	1
Rose Breasted Grosbeak		3		1	
Eastern Towhee			1		1
White Throated Sparrow		5		4	6
White Crowned Sparrow	1				
Chipping Sparrow	1				1
Swamp Sparrow	1	1		1	
Song Sparrow		15		8	6
Savannah Sparrow		3			1
Number of late Fall Migrant species (Total=39 Species)	8 Species	31 Species	13 Species	11 Species	13 Species

Irving Hill is heavily used by birds, both as a landfall site and protected feeding area.

The main attraction of Carleton Street is active bird feeders and the fact that it is built along a high ridge that runs from Irving Hill to the valley behind the water tower.

The valley is a hotbed of migrant activity. It runs the entire length of Canso and contains a mixture of woodland and grassland habitat. During both the September and October surveys this valley produced new migrants several times a day.

4.4.4.2.11 Species of Special Status detected during the Fall Migrating Bird Surveys

Among the large number of migrating birds recorded in the August to October bird surveys, there were four species of conservation concern Listed by NSDNR. Four more species are considered a conservation concern by ACCDC.

During the shore bird migration, 18 semipalmated sandpipers were recorded in the Canso area, all of them between 400 and 500 m from the nearest turbines, # 7 and 8, or 960 m from # 8 and 10 (Table 4.4-10). Semipalmated sandpipers are listed “Yellow” in Nova Scotia.

During the late fall surveys for seed and berry eating passerines, eight bobolinks, one eastern bluebird, two eastern meadowlarks, one northern mockingbird were discovered in the Town of Canso, i.e. not at the Project Site (Table 4.4.14).

- Semipalmated sandpiper (NSDNR yellow)
- Bobolink (NSDNR yellow)
- Eastern bluebirds (NSDNR yellow)
- Eastern meadowlark (NSDNR yellow)
- Northern mockingbird (NSDNR Green, but ACCDC S3B)
- Indigo bunting (ACCDC S2 S3B)
- White crowned sparrow (ACCDC S3M)
- Baltimore oriole (ACCDC S3B)

In addition to these species of conservation concern, there were several species of raptors, which are all protected under the NS *Wildlife Act*. Individuals and pairs of sharp shinned hawks, American kestrels, merlins, Northern harriers, and red tailed hawks were recorded during the August shorebird migration. As pointed out earlier, these small numbers are not necessarily representative of the actual hawk migrants present, since surveys were not carried out during hawk migration peaks or in the locations or during the time of day that hawks would be most active (in consultation with CWS and NSDNR). Only one bird of prey was noted in close proximity to a proposed turbine site, a merlin, which was observed 60 m north of Site 6.

However, all migratory birds including their nests, eggs and young, are protected under the Migratory Bird Convention Act (1916/1994), which includes migratory non-game birds such as loons and gulls, migratory game birds such as waterfowl, and most insectiferous songbirds (except blackbirds), (Department of Justice Canada, 2005).

4.4.5 Winter Bird Surveys

This section contains the information gathered on avian species known to spend the winter season in the greater Canso area. It includes a complete summary of the data gathered during the 2005 winter bird surveys, and the 2005 Canso Audubon Christmas Bird Count.

4.4.5.1 Winter Bird Survey Methodology

Field surveys were carried out in first week of January of 2005 for the purpose of gathering data on which species of birds were present, their relative abundance, and how the area is used by both visiting winter species, and members of non-migratory avian population that are present during the winter months.

The timing of the winter surveys was chosen to:

- allow enough of the season to pass in order to provide winter visitors from the far north enough time to reach the Canso area,
- carry out the surveys before serious winter kill-off could occur due to the harshness of weather or lack of local food supply, and
- ensure that the survey period would include the date of the annual Audubon Christmas Bird Count for the Canso area.

As requested by the Canadian Wildlife Service, the winter field data was collected according to the parameters laid out for “medium sized projects” in “Wind Turbines and Birds – A Guidance Document for Environmental Assessment”.

Historical data on winter bird species was gathered by consultation with long term residents with knowledge of past bird observations. Data on winter bird species was also gleaned from Canso Christmas Bird Counts carried out for the past five years , and as a follow up to those surveys, minor amounts of data was also gathered on species wintering in the greater Canso area in 2005 through regular contact with local bird enthusiasts. The data are included in Table 4.4.16.

Due to adjustments in the turbine layout, the locations surveyed were #1b to 10b. Most of these locations are only a small distance away from the location surveyed in earlier surveys, except 1b (ca. 150 –200 m) and 5b (ca. 400 m). The coordinates for these locations can be found in Table 4.3.2.

All the proposed turbine sites were surveyed by foot during the winter surveys as well as all accessible areas within a two kilometer radius of the proposed sites. Additional surveys were carried out primarily by automobile on all land and water areas viewable or accessible by vehicle within a 25 kilometer radius of the proposed turbine project. These surveys encompassed the areas along Highway 16 from Half Island Cove to and including the Town of Canso, along Highway 316 from Port Felix and Lower Whitehead to Half Island Cove, and the entire seven kilometer stretch of the Little Dover Road.

All surveys were carried out by experienced birders, who each have more than 25 years of birding knowledge. Both are trained in the methods of scientific bird observation and data collection. Since most winter bird species do not engage in song, bird species were primarily detected and identified by sight, flight patterns, flight notes and winter call notes.

Winter surveys were conducted during peak morning and late afternoon feeding periods of regional winter species. Additional surveys were carried out in the middle of the day to search for southern strays, species that are most active during the warmest part of the day due to their sensitivity to cold. Tidal conditions were also taken into consideration. A brief nocturnal survey was carried out in order to ascertain the possibilities of overwintering owls.

At all times, special emphasis was placed on gathering information on the movements of species at risk or species of special status. In addition, surveys were conducted in a manner that would provide as little disturbance as possible to these and other overwintering species.

4.4.5.2 Winter Bird Field Survey Results

In winter, Canso Harbour plays host to rich variety of waterfowl that are present in moderately high numbers. Feeders in the town itself support an unusual number of stray species.

During the field surveys carried out in January 2005, one hundred and eight species of birds were recorded as wintering in the Canso area. Fifteen of those species were found using habitats on or near the proposed turbine sites during the 2005 winter bird surveys. The low number of species found during the winter surveys at the sites chosen for the proposed turbines was likely due to the fact that most of the proposed turbines will be situated on relatively exposed woodlands that in the winter of 2005 contained only a small variety of winter food items and no open water. A complete list of all winter species found in the greater Canso area along with their relative abundance are documented in Table 4.4.16.

Of the 108 species seen during the winter surveys in January 2005, only 15 were found on or near the proposed turbine sites (Table 4.4.17). During the winter surveys, very little variation was noted between any of the sites for the proposed turbines. Those sites and the surrounding woodlands supported only a small variety of winter bird life. One notable exception was the large numbers of American Robins that gather there annually to feed on the abundant winter berry supply in most years (not in 2005). In some winters the swaths of jack pines may also draw a large number of cone feeding species such as Pine Siskins, Pine Grosbeaks, Red Crossbills, etc. During the 2005 winter survey, large numbers of Pine Siskins were present at feeders in Town, but only small numbers were observed on or near the proposed sites, most likely due to a low cone crop. Small bands of both Black Capped Chickadees and Boreal Chickadees were the most commonly encountered species. These flocks often contained one or two individuals of another species. The occasional Red Breasted Nuthatch, Brown Creeper, or Golden Crowned Kinglet were discovered traveling with the chickadee flocks. It should be noted that the lack of any open water on or near the turbines contributed to the lack of water related species.

TABLE 4.4.16 Relative Abundance of Winter Bird Species

Species	Status
Waterfowl	
Red-throated Loon	Annual winter visitor.
Common Loon*	Widespread common winter visitor.
Pied-billed Grebe	Occasional winter visitor.
Horned Grebe	Arrives annually in December. 10 -15 individuals sighted daily throughout winter.
Red-necked Grebe	Present in small numbers each winter.
Great Cormorant	Common in winter.
Double-crested Cormorant	A few stragglers seen each winter.
Snow Goose	Rare winter visitor. Recorded at least twice in the area.
Canada Goose	Uncommon winter visitor.
Green Winged Teal	Occasional winter straggler reported.
American Black Duck	Present in small numbers year-round.

TABLE 4.4.16 Relative Abundance of Winter Bird Species

Species	Status
Mallard	Small but increasing numbers seen in winter.
Northern Pintail	Occasional winter straggler reported.
Gadwall	Occasional winter straggler reported.
American Wigeon	Occasional winter straggler reported.
Greater Scaup	Common winter species. 30-50 individuals seen daily in area.
Lesser Scaup	Uncommon winter species. 1-2 birds sighted each winter.
Common Eider	Widespread common winter and year-round resident.
Harlequin Duck*	Occasionally seen in winter.
Old Squaw	Widespread common winter visitor with more than 100 birds seen on a daily basis.
Black Scoter	Widespread common winter visitor.
White-winged Scoter	Widespread common winter visitor with 100+ individuals seen daily.
Surf Scoter	Widespread common winter visitor.
Common Goldeneye	Common winter visitor.
Barrow's Goldeneye*	Uncommon winter species. 1-6 birds present each winter.
Bufflehead	Common winter visitor. Increasing in numbers. Typically 10-15 birds seen in area daily.
Tufted Duck	Rare Winter Stray
Hooded Merganser	Uncommon Winter Visitor
Common Merganser	Common winter visitor.
Red Breasted Merganser	Widespread common winter visitor. 100+ individuals seen daily in area.
Birds of Prey	
Bald Eagle	Widespread common winter and year-round resident.
Northern Harrier	Uncommon Winter Visitor
Sharp-shinned Hawk	Widespread common winter and year-round resident.
Red Tailed Hawk	Uncommon Winter Visitor
Rough-legged Hawk	Common winter visitor.
Merlin	Uncommon winter and year-round resident.
Saw-whet Owl	Occasionally present in winter.
Great Horned Owl	Unrecorded in winter but likely present. Status will be confirmed in surveys to be carried out in March/April of 2005.
Snowy Owl	Recorded in the area sporadically, usually during winters when Snowy Owls have erupted southward from their normal wintering territory in the far north.
Game Birds	
Ruffed Grouse	Common and year-round resident.
Spruce Grouse	Locally common winter and year-round resident.
Shorebirds & Waders	**Shorebirds & Waders**
Greater Yellowlegs	Occasional winter straggler reported.
Purple Sandpiper	Common winter visitor, present in small numbers.
Wilson's Snipe	Occasional winter straggler reported.
American Woodcock	Occasional winter straggler reported.
Aerialists & Seabirds	
Northern Gannet	Common year-round resident. Seen most frequently in winter after stormy weather.
Great Black-backed Gull	Widespread common winter and year-round residents.
Black-legged Kittiwake	Few individuals seen occasionally after winter storms.
Common Black-headed Gull	Uncommon winter visitors.
Herring Gull	Widespread common winter and year-round residents.
Ring Billed Gull	Few present each winter. Increasing in numbers.
Bonaparte's Gull	Uncommon winter visitors.
Glaucous Gull	Common winter visitor.
Iceland Gull	Widespread common winter visitor. 100-200 individuals are seen daily throughout winter season.
Ivory Gull	Rare winter stray, 2 records.
Ross' Gull	One individual recorded in the early 80's.
Northern Fulmar	Individuals sighted occasionally in area after winter storms.
Dovekie	Widespread common winter visitor.

TABLE 4.4.16 Relative Abundance of Winter Bird Species

Species	Status
Thick-billed Murre	Common winter visitor.
Razorbill*	Uncommon winter visitor.
Black Guillemot	Widespread common winter visitor.
Non Aligned Species	
Belted Kingfisher	Occasional individual seen in winter.
Rock Pigeon	Small but increasing year-round population.
Mourning Dove	Common winter and year-round resident.
Red-headed Woodpecker	Rare winter stray, only two records both for winter of 2005.
Downy Woodpecker	Widespread common winter and year-round residents.
Hairy Woodpecker	Widespread common winter and year-round residents.
Northern Flicker	Uncommon winter visitor.
Black-backed Woodpecker	Uncommon winter and year-round resident.
Horned Lark	Occasionally seen in winter.
Red Breasted Nuthatch	Widespread common winter and year-round resident.
White Breasted Nuthatch	Uncommon winter visitor. A few seen each winter.
Brown Creeper	Uncommon winter visitor.
Winter Wren	Uncommon winter visitor.
Passerines	
American Crow	Widespread common winter and year-round resident.
Common Raven	Widespread common winter and year-round resident.
Blue Jay	Widespread common winter and year-round resident.
Gray Jay	Uncommon winter and year-round resident.
Black-capped Chickadee	Widespread common winter and year-round resident.
Boreal Chickadee	Widespread common winter and year-round resident.
Golden-crowned Kinglet	Uncommon winter visitor. Small flocks recorded most winters.
Ruby-crowned Kinglet	Winter stray. Occasional individual seen in winter.
American Robin	Widespread common winter visitors with thousands recorded as gathering each winter to feed on local food sources.
Northern Mockingbird	Uncommon winter visitor. 1-2 birds present each winter.
Bohemian Waxwing	Variable during eruptive years. Seen in large numbers but in other winters not recorded at all.
Cedar Waxwing	Uncommon winter visitor. Small flocks encountered occasionally in winter.
Northern Shrike	Uncommon winter visitor. 1-3 recorded each winter.
European Starling	Widespread common year-round and winter resident.
Palm Warbler	Uncommon rare winter stray.
Yellow-breasted Chat	Uncommon winter stray. Usually 1 individual sighted each winter.
Dickcissel	Rare but regular winter stray.
American Tree Sparrow	Common in small numbers most winters, occasionally erupting into large numbers
Savannah Sparrow	Uncommon winter straggler
White-throated Sparrow	Common winter visitor.
Lincoln=s Sparrow	Rare winter stray.
Swamp Sparrow	Uncommon winter straggler.
Dark-eyed Junco	Widespread common winter visitor.
Lapland Longspur	Uncommon winter visitor.
Snow Bunting	Uncommon winter visitor.
Pine Grosbeak	Uncommon most winters, occasionally erupting into large numbers.
Purple Finch	Widespread common winter visitor.
White-winged Crossbill	Widespread common winter visitor.
Common Redpoll	Uncommon most winters, occasionally erupting into large numbers.
Pine Siskin	Widespread common winter visitor.
American Goldfinch	Widespread common winter visitor.
Evening Grosbeak	Widespread common winter visitor.
House Sparrow	Widespread common year-round and winter resident.

Note: * Species listed as Red or Yellow in NS General Status of Wild Species Report, as Endangered under Nova Scotia Endangered Species Act, or as Special Concern by COSEWIC.

TABLE 4.4.17 Species Recorded on or Near Proposed Turbine Sites

Species	Observation
Ruffed Grouse	One set of tracks was found in snow near Site 9b.
Red Breasted Nuthatch	A total of eight were found within 500 meters of proposed turbine sites.
Brown Creeper	Two were discovered feeding near Site 6b
American Crow	Eighty three individuals were found at various locations within 500 meters of proposed turbine sites.
Black-capped Chickadee	Thirty eight individuals were recorded on or very near several of the proposed turbine sites.
Boreal Chickadee	Eleven individuals were found within 500 meters of proposed turbine sites.
Golden-crowned Kinglet	Three individuals were found within 500 meters of Site 8b traveling in the company of chickadees.
American Robin	Only about two hundred individuals were recorded during the surveys but in most winters over a thousand birds are reported to be present.
Song Sparrow	One to four individuals were found on each of the following sites :Sites 6b, 7b and 8b.
Dark-eyed Junco	Dark Eyed Juncos were present in small numbers on or near most sites.
Purple Finch	Purple Finches were present in small numbers on or near most sites.
Common Redpoll	One Common Redpoll was recorded near Site 9b.
Pine Siskin	Pine Siskins were present in small numbers on or near most sites.
American Goldfinch	American Goldfinches were present in small numbers on or near most sites.
Evening Grosbeak	Two Evening Grosbeaks were recorded near Site 9b

Table 4.4.18 contains all the data gathered during the January 2005 Canso Christmas Bird Count. This data was gathered by three teams of birders. Each team was in the field for approximately eight hours. As part of the Christmas Bird Count a brief nocturnal survey was carried out in order to locate overwintering owls. Only one Northern saw-whet owl was detected, but it is likely that other owl species overwinter in the area.

TABLE 4.4.18 Data Collected During the Canso 2005 Audubon Christmas Bird Count

Species Recorded	Number of Individuals Recorded
Waterfowl	
Red-throated Loon	1
Common Loon*	24
Horned Grebe	2
Red-necked Grebe	7
Double-crested Cormorant	1
Canada Goose	6
American Black Duck	23
Mallard	1
Greater Scaup	25
Common Eider	160
Long-tailed Duck	71
Black Scoter	3
White-winged Scoter	20
Surf Scoter	7
Common Goldeneye	21
Barrow's Goldeneye*	2
Bufflehead	2
Red Breasted Merganser	156
Birds of Prey	
Bald Eagle	2
Northern Harrier	1
Sharp-shinned Hawk	1
Merlin	1
Shorebirds & Waders	

TABLE 4.4.18 Data Collected During the Canso 2005 Audubon Christmas Bird Count

Species Recorded	Number of Individuals Recorded
Purple Sandpiper	40
American Woodcock	1
Aerialists & Seabirds	
Northern Gannet	1
Great Black-backed Gull	42
Herring Gull	162
Bonaparte's Gull	1
Glaucous Gull	2
Iceland Gull	52
Dovekie	45
Razorbill*	1
Black Guillemot	66
Non Aligned Species	
Rock Pigeon	52
Mourning Dove	34
Red-headed Woodpecker	2
Downy Woodpecker	1
Hairy Woodpecker	2
Red Breasted Nuthatch	4
Brown Creeper	2
Passerines	
American Crow	230
Common Raven	22
Blue Jay	23
Gray Jay	2
Black-capped Chickadee	115
Boreal Chickadee	44
Golden-crowned Kinglet	55
Ruby-crowned Kinglet	1
American Robin	497
Northern Mockingbird	2
Cedar Waxwing	203
European Starling	743
Palm Warbler	1
Dickcissel	4
American Tree Sparrow	9
Song Sparrow	21
Lincoln's Sparrow	1
Swamp Sparrow	1
White-throated Sparrow	21
Dark-eyed Junco	72
Snow Bunting	1
Pine Grosbeak	7
Purple Finch	16
White-winged Crossbill	2
Common Redpoll	1
Pine Siskin	1
American Goldfinch	164
Evening Grosbeak	8
House Sparrow	35
Total Species = 69	**Total Individuals = 3500**

Note: * Species listed as Red or Yellow in NS General Status of Wild Species Report, as Endangered under Nova Scotia Endangered Species Act, or as Special Concern by COSEWIC.

4.4.5.2.1 Species of Special Status detected during the Winter Bird Surveys

During the winter bird surveys in January 2005, four species of concern were found in the greater Canso area, but none on a turbine location or within 500 m of a proposed turbine.

These four species of concern found in the Canso area were:

- Common Loon (Yellow; ACCDC: S4B, S4N)
- Harlequin Duck (Red, Endangered, Special Concern, S2N)
- Barrow's Goldeneye (Yellow, Special Concern; S1N), and
- Razorbill (Yellow; S1B, SZN)

They are associated with water and were seen on saltwater.

Also, all raptors are protected under the Nova Scotia Wildlife Act. While nine species of birds of prey were found in the Canso area (Table 4.4.16), none used the turbine sites or were within about 500 m of a turbine (Table 4.4.17).

In addition to the species of concern listed by NSDNR, NSESA and COSEWIC, there are several species that are considered "uncommon throughout or with restricted range but abundant locally (S3)" in Nova Scotia by ACCDC (2005). Note that the ACCDC evaluates breeding (B), migrating (M) and non-breeding (N) population segments separately. These species are:

Red-necked Grebe (S3S4M), Snow Goose (S3M), Northern Pintail (S2B), Gadwall (S2B), Greater Scaup (S3N), Lesser Scaup (S2N), Common Goldeneye (S2B), Red Breasted Merganser (S2S3B), Greater Yellowlegs (S2B, S5M), Purple Sandpiper (S3N), Black-legged Kittiwake (S2B, S3N), Ivory Gull (SAN - Accidental and infrequent), Common Black-backed Gull (S3N), Glaucous Gull (S3N), Black Guillemot (S3), Black-backed Woodpecker (S3S4), Horned Lark (S2B), Boreal Chickadee (S3S4), Northern Mockingbird (S3B) and Northern Shrike (S3N) (Table 4.4.16). Of these species, only the Boreal Chickadee (S3S4) was found on or near proposed turbines (Table 4.4.17).

4.4.6 Spring Owl Surveys

4.4.6.1 Owls Survey Methodology

Nocturnal spring surveys were carried out in mid April 2005 in order to determine the presence and status of breeding owl species. Owl Surveys were conducted early enough to detect the breeding activities of the larger species of owls and late enough to allow the smaller and migrating species of owls enough time to return to their breeding territories.

To supplement these surveys data was gathered though consultation with local bird enthusiasts who have knowledge of current observations as well as some experience with past early spring migrations.

As requested by the Canadian Wildlife Service, all early spring field data was collected according to the parameters laid out for "medium sized projects" as explained in the guidance document for environmental assessment for "Wind Turbines and Birds".

Nocturnal surveys were conducted only on nights of no precipitation and less than 10 kilometre per hour winds. Owls were detected using a combination of listening, tape playing, and verbal calling. Care was taken not to overexcite any owls encountered or to dwell within their established territory. Owl surveys were led by field observers with extensive experience with owl surveys and owl survey methodologies. Eleven of the 12 proposed sites were surveyed for owls. Only Site 5 was not surveyed due to the fact that no safe way could be discovered to reach this location in the darkness. During the surveys, efforts were made to detect any species of owls which may of been present with efforts centering on Northern saw-whet owl, boreal owl, barred owl, long-eared owl, and great horned owl.

During the early land migrants portion of the survey all 12 proposed sites were surveyed. In addition surveys were carried out in all woodlands and green spaces that occurred within two kilometers of the turbine sites. This area included the Chapel Gully Park, Glasgow Head, Glasgow Camp, Betsy's Point and the Towns of Canso and Hazel Hill.

At all times, special emphasis was placed on gathering information on species at risk or species of special status. In addition, surveys were conducted in a manner that would provide as little disturbance as possible to these and other species present.

4.4.6.2 Spring Owl Survey Results: Nocturnal Surveys - Owl Activity Overview

During the nocturnal surveys five species of owls were detected and a total of 29 individual owls were observed. Twenty of these individuals were found to be using habitat on or near the proposed turbine sites. This number includes a dense breeding population of seventeen Northern saw-whet Owls, a pair of long-eared owls and a male great horned owl. It is also likely that the female Great Horned was nearby brooding young as the breeding bird surveys carried out in July of 2005 and the historical data indicates that at least one pair of Great Horned Owls breed near the proposed turbine sites, feeding both in woodland areas and preying on gull chicks from nearby islands.

Outside the immediate vicinity of the proposed turbine project a pair of barred owls were discovered about 10 kilometers away and the first ever confirmed breeding pair of boreal owls on mainland Nova Scotia were detected about 40 kilometers from the project site.

Near the proposed project, owl activity was most prominent in the vicinity of Sites 1d, 2d, 6d, 9d and 10d. Below is an estimate of site-by-site use based upon personal experiences, observations of the behavior of the owls encountered and habitat. Exact locations of each owl in relation to the closest possible turbine site can be found in Table 4.4.19.

<u>Site 1d</u>

In all likelihood Northern saw-whet owls breed close to proposed Site 1d and probably use the location as a place to gather food.

Site 2d

Site 2d is likely used both as a breeding area and a feeding area for a pair of Northern saw-whet owls.

Site 2d is part of a very large feeding area regularly used by a pair of breeding great horned owls. A very vocal great horned owl could be heard traveling through areas to the northwest, west, and north of Site 2d. This is the same general area where great horned owls are encountered each summer. Due to the large hunting range of this owl we were unable to pinpoint the location of the nesting area that could easily be on one of the near shore islands.

Site 3d

No owls were found at Site 3d but based upon habitat this site may be used as feeding area for Northern saw-whet owls.

Site 4d

Long-eared owls were detected at or near four of the proposed turbine sites. It is believed that the observations were of one mated pair that appear to be nesting east of Site 4d between Sites 10d, 11d & 12d.

Site 5d

During the nocturnal surveys extra preparations and precautions were taken in order to better ensure the safety of the survey team, as should an injury occur late at night, deep in the woods it would be difficult to obtain assistance. For this reason it was decided that any site that could not be reached via a fairly safe approach would not be visited during the nocturnal surveys. Fortunately Site 5d was the only site where a safe route could not be found. Surveys of that site during the daytime however revealed excellent breeding habitat for owls with plenty of large trees for species such as great horned and long-eared and an abundance of cavities for owl species such as barred, Northern saw-whet and boreal owl.

This habitat was judged to be better than the habitat around the original site 4, now abandoned (Long-eared owls) (C. Stevens, personal communication). There is an osprey nest near this site. Whether it is still used has to be identified during the breeding bird surveys (C. Stevens, personal communication).

Site 6d

Three Northern saw-whet owls were detected near Site 6d but it is doubtful that any of the three are breeding on Site 6d. The closest individual appears to be breeding in the larger tress found in the campground near Site 6d. This individual most likely includes Site 6d in its hunting territory. The other two owls, although close to Site 6d, in a straight line distance are actually breeding in the woods on the far side of Chapel Gully. Since the hunting habitat is of better quality and of larger proportions on that side of the gully it is unlikely that these individuals would use Site 6d as a breeding area. Site 6d does lie in a straight line distance between the breeding territory of the great horned owl and near shore islands where great horned owls travel to later in the season to capture gull chicks.

TABLE 4.4.19 Owl Species Detected on or Near Proposed Turbine Sites

Site	Species Information
Proposed Site # 1d	• One Northern Saw-whet Owl was seen and heard calling in appropriate breeding habitat 300 meters east of Site 1d. • One Northern Saw-whet Owl was seen and heard calling in appropriate breeding habitat 200 meters west of Site 1d.
Proposed Site # 2d	• A pair of Northern Saw-whet Owls seen and heard calling in appropriate breeding habitat 400 meters north east of Site 2d. • A Great Horned Owl was heard calling on Site 2d and to the north west, west, and north of Site 2
Proposed Site # 3d	• No owls were detected at this location
Proposed Site # 4d	• One Long-eared Owl heard calling in appropriate breeding habitat 350 meters east of Site 4d
Proposed Site # 5d	• Unable to reach during Owl Surveys
Proposed Site # 6d	• One Northern Saw-whet Owl seen and heard calling in appropriate breeding habitat 400 meters west of Site 6d • One Northern Saw-whet Owl seen and heard calling in appropriate breeding habitat 460 meters south west of Site 6d • One Northern Saw-whet Owl seen and heard calling in appropriate breeding habitat 140 meters east of Site 6d.
Proposed Site # 7d	• One pair of Northern Saw-whet Owls were seen and heard calling in appropriate breeding habitat 650 meters west of Site 7d.
Proposed Site # 8	• No owls were detected at this location
Proposed Site # 9	• A pair of Northern Saw-whet Owls were seen and heard calling in appropriate breeding habitat 400 meters north east of Site 9d. • A pair of Northern Saw-whet Owls were seen and heard calling in appropriate breeding habitat on Site 9d. • Two Northern Saw-whet Owls were seen and heard calling in appropriate breeding habitat 300 meters south of Site 9d, one dominant individual and one passive.
Proposed Site # 10d	• One Northern Saw-whet Owl seen and heard calling in appropriate breeding habitat 550 meters east of Site 10d. • One Long-eared Owl seen in appropriate breeding habitat 350 meters east of Site 10d. • One Long-eared Owl heard calling in appropriate breeding habitat 500 meters west of Site 10d
Proposed Site # 11d	• One Northern Saw-whet Owl seen and heard calling in appropriate breeding habitat 300 meters east of Site 11d.
Proposed Site # 12d	• One Long-eared Owl was heard in appropriate breeding habitat 350 meters north of Site 12d.

Note: * Species of special status: Species listed as Red or Yellow in NS General Status of Wild Species Report, as Endangered under Nova Scotia Endangered Species Act, or as Special Concern by COSEWIC.

Site 7d

A pair of Northern saw-whets are definitely breeding in the vicinity of Site 7d. However as in Site 6d this pair is spending the majority of their time in the woodlands on the other side of the gully and have little reason to cross over the gully to reach an area of habitat that is both smaller in size and composed of less desirable habitat.

As with Site 6d, Site 7d may be traveled through by great horned owls to reach the near shore islands.

Site 8d

No owls were detected at this site but it is likely that it is used from time to time as a feeding area by Northern saw-whet owls.

Site 9d

Site 9d appears to lie near the center of the local Northern saw-whet owl breeding area. Two pairs of saw-whets were found breeding near Site 9d and two individual saw-whets were also present. The last two birds did not behave as a pair so they may have been an unmated pair or more likely a mated male and a submissive young unmated male that may or may not be driven from the area.

Site 10d

Site 10d may be used as a feeding area for Northern saw-whets owls but perhaps sparingly so as one of their natural predators, the long-eared owl is nesting somewhere close to Site 10d. It is suspected (based upon behavior) that the two long-eared owls discovered at separate locations near Site 10d are indeed a mated pair that appear to be breeding in the area between Sites 10d, 11 and 12d. However the hunting range of this pair encompasses an even greater area as indicated by the presence of the female 350 meters east of Site 10d.

Site 11d

Northern saw-whet owls most likely use Site 11d as a feeding area but appear to be breeding either east or north of Site 11d.

Site 11d is most likely also used as a feeding area by long-eared owls suspected to be breeding in the large trees south of Site 11d.

Site 12d

The male long-eared owl heard near this site is believed to be a part of the pair nesting in the roughly triangular area between Sites 10d, 11d and 12d.

4.4.6.2.1 Species of Special Status Detected During the Spring Owl Survey:

During the spring owl surveys, one owl species of special status was discovered:

- Long-eared owl (NSDNR Yellow)

4.4.7 Spring Migration

Surveys for waterfowl and other birds migrating in early spring were carried out in mid April 2005. The peak of the spring migration of passerines is in May. The data for the passerine spring migration peak are not available yet and will be submitted as an addendum to the EIS.

A total of 103 species were documented as occurring in the Canso area during the time of the early spring migration, including breeding owls. Twenty nine of those species were observed on or near the proposed turbine sites.

4.4.7.1 Early Spring Migration Methodologies

Early Migration Surveys were carried out in mid April 2005 for the purpose of gathering data on early migrating bird species that pass through or near the proposed wind farm project in the community of Canso, Nova Scotia during their northward migration. Surveys were designed specifically to gathering data on both saltwater and freshwater members of the waterfowl family as well as other species of water related birds. Additional surveys were carried out to gain data on a wide range of early land migrants. The locations surveyed were: 1d, 2d, 3d, 4d, 5d, 6d, 7d, 8d, 9d, 10d, 11d and 12d.

The timing of the spring surveys was chosen to take place during the peak of the spring waterfowl migration of saltwater species along the coast of Nova Scotia. Surveys for freshwater species were carried out after the majority of ice had disappeared from the local lakes and ponds. Surveys for early land migrants were timed to catch the greatest period of activity for the widest range of species.

To supplement these surveys data was gathered though consultation with local bird enthusiasts who have knowledge of current observations as well as some experience with past early spring migrations.

As requested by the Canadian Wildlife Service, all early spring field data was collected according to the parameters laid out for “medium sized projects” as explained in the guidance document for environmental assessment for “Wind Turbines and Birds”.

During the early land migrants portion of the survey all 12 proposed sites were surveyed. In addition, surveys were carried out in all woodlands and green spaces that occurred within two kilometers of the turbine sites. This area included the Chapel Gully Park, Glasgow Head, Glasgow Camp, Betsy’s Point and the Towns of Canso and Hazel Hill.

Land migrant surveys were conducted in the early morning hours to capture the arrival of night migrants and document their activity during their peak feeding period. Surveys were also conducted in the middle of the day when heat created a peak of insect activity and an opportunity for new migrants to feed. Additional late afternoon surveys were productive at detecting the arrival of strictly diurnal migrants.

Waterfowl surveys were carried out during varying tidal conditions, to take advantage of the situations created by high, low and between tides. Since all proposed turbine sites are located close to the coast during the waterfowl surveys directional movements of species and heights of flights, were noted as well as how each area was used by the birds present.

Waterfowl early spring surveys were conducted both on and near the project site as well as sites further afield where data was gathered as an offsite comparison.

For the waterfowl portion of the early spring surveys all available shoreline was surveyed within a two kilometer radius of the proposed project. This equaled approximately 14 kilometers of shoreline and included the outer coast from the breakwater in Canso Harbour to Betsy's Point and the inner coast of Turf Bog, Chapel Gully, Spinney Gully and all areas in between.

Additional coastal areas surveyed by car included all of Canso Harbour, The Tittle, and Durrel Island. These surveys also included all saltwater areas and the various freshwater pools, ponds, and marshes found along the seven kilometer stretch of the Dover Road, a 42 kilometer stretch of the Atlantic Coastal Highway 316 and a 25 kilometer stretch of Highway 16 along Chedabucto Bay. Major freshwater areas closest to the proposed project were also checked for waterfowl species. These water bodies included Hazel Lake, Ice Lake, Wilkins Lake, Basin Lake, Three Mile Lake, and Little Kavanaugh Lake.

All surveys were carried out by experienced birders who each have more than 25 years of birding knowledge and are trained in the methods of scientific bird observation and data collection. Bird species were primarily detected and identified by song, call notes, sight, and flight patterns.

At all times, special emphasis was placed on gathering information on species at risk or species of special status. In addition surveys were conducted in a manner that would provide as little disturbance as possible to these and other species present.

4.4.7.2 Early Spring Migration Results

4.4.7.2.1 Avian Species Recorded in the Canso Area in Early Spring

A total of 103 species were documented as occurring in the Canso area during the time of the early spring migration, including breeding owls. Table 4.4.20 contains a complete list of all the species known to use the Canso area during the early spring season (including historical data). This table includes data on their general status and relative abundance. Boreal Owls were found at a distance of 40 km from the project site (Section4.4.6.2).

Twenty-six diurnal species were observed on or near the proposed turbine sites. Details on those 26 species can be found in Table 4.4.21.

It should be noted that the early spring migration of land based species is typically rather diffuse, so it is not surprising that no migration corridors were detected during the surveys.

TABLE 4.4.20 Status and Relative Abundance of Species Present in Early Spring

Species	Status
Waterfowl	
Red-throated Loon	Migrates though the Canso area each early spring in moderate numbers.
Common Loon*	Widespread common early spring migrant.
Pied-billed Grebe	Uncommon early spring migrant with an average of one individual reported in most early springs
Horned Grebe	Widespread common early spring migrant.
Red-necked Grebe	Widespread common early spring migrant.
Great Cormorant	Widespread common early spring migrant.
Double-crested Cormorant	Widespread common early spring migrant.
Canada Goose	Widespread common early spring migrant.
Green Winged Teal	Widespread common early spring migrant.
Blue Winged Teal	Uncommon early spring migrant.
American Black Duck	Uncommon early spring migrant.

TABLE 4.4.20 Status and Relative Abundance of Species Present in Early Spring

Species	Status
Mallard	A regular early spring migrant present in small numbers but increasing in frequency each early spring.
Northern Pintail	Uncommon early spring migrant.
American Wigeon	Uncommon early spring migrant.
Ring-necked Duck	Widespread common early spring migrant.
Greater Scaup	Small numbers migrate through the Canso area each early spring
Lesser Scaup	Uncommon early spring migrant.
Common Eider	Widespread common early spring migrant.
Harlequin Duck*	Common early spring migrant.
Long Tailed Duck	Widespread common early spring migrant.
Black Scoter	Widespread common early spring migrant.
White-winged Scoter	Widespread common early spring migrant.
Surf Scoter	Widespread common early spring migrant.
Common Goldeneye	Common early spring migrant.
Barrows Goldeneye*	Uncommon early spring migrant.
Bufflehead	Uncommon to common early spring migrant.
Hooded Merganser	Uncommon early spring migrant.
Common Merganser	Widespread common early spring migrant.
Red Breasted Merganser	Widespread common early spring migrant.
Birds of Prey	
Bald Eagle	Widespread common early spring migrant and year-round resident.
Northern Harrier	Widespread common early spring migrant.
Sharp-shinned Hawk	Widespread common early spring migrant and year-round resident.
Red Tailed Hawk	Common early spring migrant.
Rough-legged Hawk	Common early spring migrant.
American Kestrel	Common early spring migrant.
Merlin	Common early spring migrant.
Northern Goshawk *	Uncommon early spring migrant.
Northern Saw-whet Owl	Common early spring migrant.
Great Horned Owl	Uncommon year-round resident.
Long-eared Owl*	Uncommon early spring migrant and year –round resident.
Barred Owl	Uncommon year-round resident.
Boreal Owl	Rare, first confirmed nesting pair on mainland Nova Scotia ; 40 km from the project site.
Game Birds	
Ruffed Grouse	Common year round resident.
Spruce Grouse	Common year round resident.
Shorebirds & Waders	**Shorebirds & Waders**
American Woodcock	Common early spring migrant.
Great Blue Heron	Widespread common early spring migrant.
Great Egret	Rare but regular early spring migrant.
Snowy Egret*	Rare but regular early spring migrant.
Cattle Egret	Rare but regular early spring migrant.
Glossy Ibis	Rare early spring migrant.
Aerialists & Seabirds	
Northern Gannet	Widespread common early spring migrant.
Great Black-backed Gull	Common year-round resident.
Lesser Black-backed Gull	Rare early spring migrant.
Herring Gull	Common year-round resident.
Ring Billed Gull	Common early spring migrant.
Iceland Gull	Common early spring migrant.
Glaucous Gull	Common early spring migrant.
Common Gull	Rare early spring migrant.
Black Guillemot	Common early spring migrant.
Non Aligned Species	

TABLE 4.4.20 Status and Relative Abundance of Species Present in Early Spring

Species	Status
Belted Kingfisher	Uncommon early spring migrant.
Rock Pigeon	Small but increasing year-round population.
Mourning Dove	Common early spring migrant.
Red-headed Woodpecker	One record - rare early spring resident, arrived previous fall and survived the winter.
Downy Woodpecker	Common year-round resident.
Hairy Woodpecker	Common year-round resident.
Northern Flicker	Common early spring migrant.
Black-backed Woodpecker	Uncommon year-round resident.
Pileated woodpecker	Uncommon year-round resident.
Eastern Phoebe	Uncommon early spring migrant.
Red Breasted Nuthatch	Common year-round resident.
Brown Creeper	Uncommon year-round resident.
Passerines	
American Crow	Common year-round resident.
Common Raven	Common year-round resident.
Blue Jay	Common year-round resident.
Gray Jay	Uncommon year-round resident.
Black-capped Chickadee	Common year-round resident.
Boreal Chickadee	Common year-round resident.
Golden-crowned Kinglet	Uncommon year-round resident.
Ruby-crowned Kinglet	Uncommon early spring migrant.
American Robin	Widespread common early spring migrant.
European Starling	Widespread common year-round resident.
Yellow Rumped Warbler	Common early spring migrant.
Dickcissel	For the past three years rare but regular fall strays that survive in small numbers (1-3 individuals) into spring.
Savannah Sparrow	Uncommon early spring migrant.
Song Sparrow	Widespread common early spring migrant.
White-throated Sparrow	Uncommon to common early spring migrant.
Swamp Sparrow	Uncommon to common early spring migrant.
Fox Sparrow	Common early spring migrant.
Dark-eyed Junco	Widespread common early spring migrant.
Red-winged Blackbird	Common early spring migrant.
Common Grackle	Widespread common early spring migrant.
Brown-headed Cowbird	Common early spring migrant.
Yellow Headed Blackbird	Rare early spring migrant.
Baltimore Oriole	Rare early spring migrant.
Pine Grosbeak	Uncommon early spring migrant.
Rose Breasted Grosbeak	Rare early spring migrant.
Blue Grosbeak	Rare early spring migrant.
Indigo Bunting	Rare early spring migrant.
Purple Finch	Widespread common early spring migrant.
White-winged Crossbill	Uncommon early spring migrant.
Pine Siskin	Uncommon to common early spring migrant.
American Goldfinch	Widespread common early spring migrant.
House Sparrow	Widespread common year-round resident.

Note: * Species of special status: Species listed as Red or Yellow in NS General Status of Wild Species Report, as Endangered under Nova Scotia Endangered Species Act, or as Special Concern by COSEWIC.

TABLE 4.4.21 Diurnal Species Recorded on or Near Proposed Turbine Sites

Species	Status
Green Winged Teal	Present daily in early spring in small numbers in Chapel Gully near the mouth of Winter Creek.
American Black Duck	Present daily in early spring in small numbers in Chapel Gully near the mouth of Winter Creek.
Ruffed Grouse	Common year round resident commonly encountered on or near most sites in early spring.
Spruce Grouse	Common year round resident, most commonly encountered near Sites 2d, 5d & 10d.
Great Blue Heron	Widespread common early spring migrant found feeding along the shores of Chapel & Spinney Gully.
Great Egret	Rare but regular early spring migrant sighted feeding in Chapel Gully near the mouth of Winter Creek.
Herring Gull	Common year-round resident commonly encountered in spring feeding along the shores of Chapel & Spinney Gully.
Belted Kingfisher	Uncommon early spring migrant found sighted feeding in Chapel Gully near the mouth of Winter Creek.
Red Breasted Nuthatch	Common year-round resident found in early spring on or near all proposed sites.
Brown Creeper	Uncommon year-round resident most frequently encountered in spring on or near Sites 5d & 6d.
American Crow	Common year-round resident found in early spring on or near all proposed sites.
Common Raven	Common year-round resident frequently sighted flying high above all proposed sites in early spring at a height of greater than 500 meters.
Blue Jay	Common year round resident commonly encountered on or near all sites in early spring.
Black-capped Chickadee	Common year round resident commonly encountered on or near all sites in early spring.
Boreal Chickadee	Common year round resident commonly encountered on or near all sites in early spring.
Golden-crowned Kinglet	Uncommon year-round resident encountered on or near most sites in early spring.
American Robin	Widespread common early spring migrant encountered on or near all sites in early spring.
Song Sparrow	Widespread common early spring migrant, most commonly encountered near Sites 1d, 6d, 7d, 8d .
White-throated Sparrow	Uncommon to common early spring migrant encountered on or near most sites in early spring.
Fox Sparrow	Common early spring migrant most commonly encountered near Sites 4d, 6d, 7d, 8d, 10d, 12d.
Dark-eyed Junco	Widespread common early spring migrant encountered on or near all sites in early spring.
Common Grackle	Widespread common early spring migrant most commonly encountered near Sites 1d & 2d.
Pine Grosbeak	Uncommon early spring migrant most commonly encountered near Sites 4d & 5d.
Purple Finch	Widespread common early spring migrant encountered on or near most sites in early spring.
Pine Siskin	Uncommon to common early spring migrant encountered on or near most sites in early spring.
American Goldfinch	Widespread common early spring migrant encountered on or near most sites in early spring.

4.4.7.2.2 Spring Waterfowl Migration Results

Documentation of the spring waterfowl migration was one of the primary goals of the early spring surveys. A complete list of all waterfowl and water related birds can be found in Table 4.4.22. This table also lists the number of birds observed and the locations of greatest waterbird activity. The status of the various waterfowl & water related birds can be found in Table 4.4.20. It is likely that nearly all of the waterfowl surveyed were spring migrants as the numerous winter waterfowl recorded in the region this past winter had departed the Canso area approximately two weeks before the early spring surveys were carried out.

TABLE 4.4.22 Details on Waterfowl and Water Related Birds Found in the Canso Area During Early Spring Surveys

Species	Locations				
	Near Proposed Turbines	Canso to Dover	Hwy 316	Hwy 16	Large Bodies of Freshwater
Red-throated Loon	---	---	---	3	---
Common Loon*	---	9	---	35	1 pair on Three Mile Lake
Pied-billed Grebe	---	---	---	---	1 on Ice Lake
Horned Grebe	---	---	---	3	---
Red-necked Grebe	---	---	---	19	---
Great Cormorant	---	12	---	---	---
Double-crested Cormorant	---	2	---	---	---
Canada Goose	---	---	3	---	---
Green Winged Teal	2	6	6	---	4 on Little Kavanaugh
Blue Winged Teal	---	2	---	---	---
American Black Duck	4	18	10	6	---
Mallard	---	---	2	---	---
Northern Pintail	---	---	---	---	---
American Wigeon	---	---	---	---	---
Ring-necked Duck	---	8	---	1	8 on Little Kavanaugh
Greater Scaup	---	---	---	---	---
Lesser Scaup	---	---	---	---	---
Common Eider	---	3230	5	50	---
Harlequin Duck*	---	6	---	---	---
Long Tailed Duck	---	4	---	---	---
Black Scoter	---	100	---	---	---
White-winged Scoter	---	151	---	---	---
Surf Scoter	---	200	---	---	---
Common Goldeneye	---	1	---	48	---
Barrows Goldeneye*	---	---	---	1	---
Bufflehead	---	---	---	7	---
Hooded Merganser	---	---	---	---	---
Common Merganser	---	---	6	19	---
Red Breasted Merganser	---	22	27	44	---
American Woodcock	---	1	---	---	---
Great Blue Heron	1	5	8	1	---
Great Egret	3	3	---	---	---
Snowy Egret*	---	1	---	---	---
Cattle Egret	---	1	---	---	---
Glossy Ibis	---	3	---	---	---
Northern Gannet	---	1772 +	1200 +	500+	---
Great Black-backed Gull	---	1000 +	500+	1000+	---
Lesser Black-backed	---	1	---	---	---

TABLE 4.4.22 Details on Waterfowl and Water Related Birds Found in the Canso Area During Early Spring Surveys

Species	Locations				
	Near Proposed Turbines	Canso to Dover	Hwy 316	Hwy 16	Large Bodies of Freshwater
Gull					
Herring Gull	35	1000 +	500+	1000+	---
Ring Billed Gull	---	10	4	---	---
Iceland Gull	---	20	8	---	---
Glaucous Gull	---	1	---	---	---
Common Gull	---	1	---	---	---
Black Guillemot	---	52	---	3	---
Belted Kingfisher	1	1	1	---	---
Total Species	**6**	**31**	**14**	**17**	**4**

Note: * Species of special status: Species listed as Red or Yellow in NS General Status of Wild Species Report, as Endangered under Nova Scotia Endangered Species Act, or as Special Concern by COSEWIC.

4.4.7.2.3 Species of Special Status Detected During the Early Spring Waterfowl and passerine migration

During the early spring passerine and waterfowl migration surveys (Mid April 2005), six species of concern listed by NSDNR (Appendix E) were found in the greater Canso area, but none on a turbine location or within 500 m of a proposed turbine.

These six species of concern found in the Canso area were:

- Common Loon (Yellow; ACCDC: S4B, S4N)
- Harlequin Duck (Red, Endangered, Special Concern, S2N)
- Barrow's Goldeneye (Yellow, Special Concern; S1N)
- Razorbill (Yellow; S1B, SZN)
- Snowy Egret (Yellow, ACCDC SAN) and
- Northern Goshawk (Yellow, ACCDC S3B; COSEWIC)

In addition to the species of concern listed by NSDNR, NSESA and COSEWIC, there are several species that are considered "uncommon throughout or with restricted range but abundant locally (S3)" in Nova Scotia by ACCDC (2005). Note that the ACCDC evaluates breeding (B), migrating (M) and non-breeding (N) population segments separately. These species are:

Red-necked Grebe (S3S4M), Northern Pintail (S2B), Greater Scaup (S3N), Lesser Scaup (S2N), Common Goldeneye (S2B), Red Breasted Merganser (S2S3B), Glaucous Gull (S3N), Black Guillemot (S3), Eastern Phoebe (S2 S3B), Indigo Bunting (S2 S3B), Black-backed Woodpecker (S3S4) and Boreal Chickadee (S3S4) (Table 4.4.20). Of these species, only the Boreal Chickadee (S3S4) was found on or near proposed turbines (Table 4.4.21).

Also, all raptors are protected under the Nova Scotia Wildlife Act. Thirteen species of birds of prey were found in the Canso area (Table 4.4.20). Boreal owls were only found 40 km from the project site.

4.4.7.2.4 Notes on the Information Gathered on Early Spring Migrants

Rare species are frequently attracted to the Canso area in early spring. Many of these rarities have a tendency to gather near green spaces and feeders in the communities of Canso, Hazel Hill, Little Dover and Fox Harbour. Hills near the proposed turbine sites and fresh/brackish water areas such as Chapel Gully near the mouth of Winter Creek, are also regularly used by these rarities, as well as by regular early spring migrants, as feeding and resting sites. Currently only the new Site 5d is perched on one of these hills and may provide the possibility of strikes from early spring land migrants.

During the early spring surveys two species of waterfowl, one species of rare wader (3 individuals), and one common wader were observed flying into the brackish water area near the mouth of Winter Creek which lies between several of the proposed turbine sites. Over a dozen flights were observed and in each case these birds gained access to this area by flying up the length of Chapel Gully, thus presenting no possibility of blade strikes. Flying up the gully appears to be an established flight route for these species in early spring. It is unknown as to why the shorter across-land route from the coast was not taken. One species that did take this route at a height just above tree level, was the belted kingfisher, thus presenting a possible strike risk.

4.4.7.3 Main Spring Migration 2005

In addition to the early spring migration survey (Section 4.4.7.1 and 4.4.7.2) a second spring migration was conducted in May 2005 in order to record birds during the peak migration season.

4.4.7.3.1 Spring Migration Methodologies

Bird Surveys were carried out in May 2005 (week of May 15th) for the purpose of gathering data on migrating bird species that pass through or near the proposed wind farm project during their northward migration. Data was also gathered on migrating species that were returning or newly returned to the Canso area for the purposes of breeding.

The primary focus of the surveys was to gather data on migrating passerines. In addition, surveys were conducted in a manner that would allow observers to obtain data on other groups of migrating birds including late migrating waterfowl, birds of prey, shorebirds, waders, aerialists, and non-passerine land birds (for information on surveys designed specifically to gathering data on waterfowl, water related birds, owls and on a wide range of early land migrants refer to earlier sections in this report).

The timing of the May surveys was chosen to take place during the peak of the spring passerine migration in Nova Scotia and specifically planned to coincide with the peak of activity in the greater Canso area based upon past experiences of surveyors, local informants and historical records.

Surveys were designed to gather data on the locations used by spring migrants, to discover how those locations were used and to record the species and number of individuals that were present. This included, but was not limited to, gathering data on potential spring migration corridors, spring stop over sites, landfall sites, feeding sites for migrating species, as well as any significant daytime roosting sites or detectable nighttime resting sites.

To supplement these surveys, data was gathered though consultation with local bird enthusiasts.

During the spring migration surveys, all 12 proposed sites were surveyed (see Figure 2.3). In addition, surveys were carried out in all woodlands and green spaces that occurred within two kilometers of the turbine sites. This area included the Chapel Gully Park, Glasgow Head, Glasgow Camp, Betsy's Point and the towns of Canso and Hazel Hill.

Most surveys were conducted in the early morning hours (i.e., between an hour before sunrise and about 10:30am) to document the arrival of passerines which are primarily night migrants. These birds feed heavily upon arriving on land during the first few hours of daylight and the cooler morning hours. Shorter surveys were carried out later in the day (i.e., between late morning and afternoon to early evening) to record non-passerine land and water related diurnal migrants.

All surveys were undertaken on days of ideal weather conditions consisting of no precipitation and winds of less than 30 kilometers per hour.

When flocks or individual birds were encountered in flight near sites where turbines may be built, height of the individuals as well as their direction of movements was noted.

Surveys were primarily carried out on or near the proposed turbine sites but data were also gathered from the greater Canso area so that offsite comparisons could be made. These surveys were conducted primarily by vehicle and included spot checks of potential interesting areas as well as sites that have produced significant bird migration in previous springs within a 10 to 20 kilometer radius of the town of Canso.

All surveys were carried out by experienced birders, each with more than 25 years of birding knowledge and trained in the methods of scientific bird observation and data collection. Bird species were primarily detected and identified by song, call notes, sight, and flight patterns.

At all times, special emphasis was placed on gathering information on species at risk or species of special status. In addition, surveys were conducted in a manner that would provide as little disturbance as possible to these and other species present.

4.4.8 Spring Migration Survey Results

Bird surveys were carried out in the Canso area in 2004 during the months of July, August, September and October, and in 2005 during the months of January, March, April and May. Each survey was specifically designed to target major groups of birds at crucial times of the year when habitats in the Canso area would be most needed by those species (see earlier sections in this report).

The 2005 May migration surveys targeted the peak of the spring passerine migration.

In total, 180 species have been documented as occurring in the Canso area in the month of May during the period of the main spring migration in Nova Scotia (Appendix N, Table N-1).

Table N-1 (Appendix N) provides a complete list of all the species known to use the Canso area during the month of May, i.e., these are species that have been recorded during the AMEC surveys, or have been identified based on literature reviews and anecdotal evidents. Table N-1 also contains data on their general status and relative abundance.

Species actually recorded at and in the vicinity of the sites during the May 2005 migratory bird surveys are presented in Table N-2 (Appendix N). This table contains records of 132 bird species.

Table N-3 (Appendix N) contains information on all 65 species of birds that were discovered to be using land and habitats found on or very near the sites of the proposed turbines and/or observed in flight passing over the proposed sites.

4.4.8.1 Species of Special Status Observed during Spring Migration on or Near the Turbine Sites

During the spring passerine and waterfowl migration surveys (May 2005), three species of concern listed by NSDNR (Appendix E) were found on or near the proposed turbine locations:

- Black Crowned Night Heron (NSNDR Yellow Rank; ACCDC S1B Rank);
- Long-eared Owl (NSDNR Yellow Rank; ACCDC S1S2 Rank); and
- Boreal Chickadee (ACCDC S3S4).

It is of note, that all raptors are protected under the Nova Scotia Wildlife Act. Four species of birds of prey were found on or near the turbine sites during the May migration survey (Table N-3).

The Black Crowned Night Heron was observed near the mouth of Winter Creek. One individual of Long-eard Owl was hearded near Sites 10d, 11d, and 12d and the Boreal Chickadee was found on or near all proposed sites.

4.4.8.2 Passerine Migrant Activity

As with the April surveys, all of the species observed flying in and out of the mouth of Winter Creek in May did so by flying along Chapel Gully, thus presenting little or no chance of potential strikes with turbine blades. The one exception was the Belted Kingfisher which flew in all directions at heights just above the tree tops. Migration activity was somewhat higher at Site 5d than at most other sites.

During the May surveys no migration corridors, landfall sites or other important migration activity was observed on or near proposed turbine sites other than the sites noted above.

4.5 AQUATIC ENVIRONMENT

4.5.1 Surface Hydrology

4.5.1.1 Freshwater Resources

Freshwater resources within the Study Area are broken down into two watershed areas. Ice Lake watershed covers approximately 510 hectares and drains to the northwest into Chedabucto Bay. Hazel Lake watershed covers approximately 2090 hectares and drains to the southeast via Winter Creek and south via Gasperaux Brook into the Atlantic Ocean.

Winter Creek originates in a pond in the big bog just east of Hazel Lake and drains into Chapel Gully, while Gasperaux Brook originates in Hazel Lake and flows southsoutheast towards the ocean, crossing through small lakes. There also is a small stream serving as a tributary to Winter Creek. This stream was not included in government maps of the area. It originates in the same big bog as Winter Creek.

Ice Lake is located just south of highway 16 and northwest of the study area. Other freshwater resources include several small bogs in low-lying areas. There also is a small, unnamed stream about 150 m south of Turbine #4d, which drains into Spinney Gully.

The eastern most extension of Hazel Lake is about 400 m west of the nearest Turbine (# 5d). This turbine also is about 200 m south of the big bog where Winter Creek and its tributary originate, and 1.4 km east of Gaspereaux Brook.

Winter Creek and its tributary are small shallow (5 cm-35 cm) streams with an average width of 1 m, but often narrower than that. Also, there are stretches with underground flow. During the field visits, it was never found to have dried up. Winter Creek flows past three turbines: it is about 200 m north of Turbine 5d, 120 m northwest of Turbine 3d, and about 100 m west and 50 north of Turbine 2d. Winter Creek enters a wetland (“Wetland 1”) about 150 – 200 m northeast of Turbine 2 d. Close to Winter Creek, the wetland can be described as “floating”. More information on Winter Creek and its tributary can be found in section 5, “Fish Habitat”.

Information on Wetland 1 and three other wetlands, which were identified and described during the field visits, can be found in section 4.3.1.3, Appendix A and in the Wetland Data sheets in Appendix B. Adjustments to the project design have been made in order to avoid these four wetlands, both in view of the Federal Government’s commitment to wetland conservation (“Federal Policy on Wetland Conservation”) and the value for species of concern (even though no species at risk were found during the surveys).

4.5.1.2 Marine Water Resources

Marine water resources include a salt marsh (NSDNR Significant Habitat) at the head of Chapel Gully, marine wetlands and cobble beaches along the coast of Spinney Gully, estuarine wetlands, Glasgow Harbour and the Atlantic Ocean.

The nearest turbines are about 300 m from Spinney Gully (# 10d), 120 m from the salt marsh (#1d) and about 100-150 m from the Canso Harbour coast (Turbine # 6d-8d).

4.5.2 Sediment Quality

During the fish habitat survey, the substrate in Winter Creek and its tributary were recorded. Besides rocks and rubble, with some very large boulders located sporadically throughout the surveyed portion of watercourse, there was a fine layer of sands and fines throughout the watercourse.

4.5.3 Fish and Fish Habitat

4.5.3.1 Fish Species at Risk in Nova Scotia

Nine species of fish are listed by several agencies as species at risk in Nova Scotia (Priority species list in Appendix D). For Atlantic Salmon, both the anadromous and the landlocked populations are listed. The following Priority list species occur in Eastern Nova Scotia, or information on their distribution is not available (Table 4.5.1).

TABLE 4.5.1 Short List of Fish Species at Risk in Eastern Nova Scotia

Scientific Name	Common Name	COSEWIC*	NS General Status	NS Endangered Species Act*
Salmo salar	Atlantic Salmon (Landlocked populations)	--	Red	--
Acipenser oxyrhynchus	Atlantic Sturgeon	--	Red	--
Margariscus margarita	Pearl Dace	--	Yellow	--
Salvelinus fontinalis	Brook Trout (Char)	--	Yellow	--
Alosa pseudoharengus	Gaspereau (Alewife)	--	Yellow	--
Apeltes quadracus	Fourspine Stickleback	--	Yellow	--

* as of September 2004

An evaluation of habitat requirements for these species showed, that Four-Spine Stickleback is mainly a marine species in brackish water or occurs in lakes. This habitat is only available outside of the proposed wind farm area. In addition, there is no habitat for Atlantic salmon (landlocked populations) and Atlantic sturgeon at the project site. Therefore, only three species have an elevated potential to occur at the wind farm site (Table 4.5.2).

TABLE 4.5.2 Fish Species at Risk with Elevated Potential to Occur in the Project Area

Scientific Name	Common Name	COSEWIC*	NS General Status	NS Endangered Species Act*
Margariscus margarita	Pearl Dace	--	Yellow	--
Salvelinus fontinalis	Brook Trout (Char)	--	Yellow	--
Alosa pseudoharengus	Gaspereau (Alewife)	--	Yellow	--

* as of September 2004

4.5.3.2 Fish species at risk known to occur in the Canso area

Both the ACCDC and the Nova Scotia Museum have no records of fish species at risk in the Canso area, including a 5 km radius around the project site. Research of the SigHab database (NSDNR) showed that there are relatively few polygons indicating fish species within a 50 km radius around the project site (Appendix C). However, since these negative results may partly be due to a lack of surveys or reports of this area, a fish species survey was carried out together with the fish habitat survey.

4.5.3.3 Fish and Fish Habitat Field Survey Methodology

From September 8th to 10th, 2004, a fish and fish habitat survey was conducted on Winter Creek and a tributary to Winter Creek near Canso Nova Scotia. The survey was undertaken by G. Bell, Environmental Technologist, S. Cox, Biologist, and M. Sensen, Botanist. A presence/absence electrofishing survey for fish species was conducted along Winter Creek and its tributary, including some fishing in the part of Winter Creek, which crosses Wetland 1.

In addition to the test fishing, water quality data were collected. Both the pH and the concentration of Dissolved Oxygen (DO) of the water were measured at multiple locations along the watercourse, using a YSI 85 Water Quality Meter and a LaMotte Wide Range pH Test Kit.

The fish habitat survey was conducted using a New Brunswick Department of Natural Resources and Fisheries & Oceans Canada Survey form. This survey recorded habitat features such as overhanging vegetation, undercut banks, stream types, widths, substrate composition as well as embeddedness. The riparian area was characterized using bank heights, shade over the stream, erosion and bank vegetation. Details can be found on the field data sheets in Appendix H.

4.5.3.4 Fish and Fish Habitat Field Survey Results

4.5.3.4.1 Fish

There were no fish species found in either watercourse during the electrofishing survey.

4.5.3.4.2 Fish Habitat

Winter Creek was characterized as a small (average width 1 m) slow moving stream. The substrate was comprised of rocks and rubble, with some very large boulders located sporadically throughout the surveyed portion of watercourse. There was a fine layer of sand and fines throughout the watercourse. There were areas of underground flow due to the location and size of some of the boulders (Appendix H). No apparent spawning or critical habitat was identified within the stream. Photos of the watercourse can be found in Appendix I.

The Winter Creek tributary flows from a large bog at the boundary of the proposed site. This stream flows underground in areas and through areas of sphagnum moss. There is very little fish habitat available within this tributary as most of the flow is underground (Appendix H). Photos of the watercourse can be found in Appendix I.

4.5.4 Surface water quality

Winter Creek and its tributary are the only bodies of fresh surface water in the project foot print. During the fish habitat survey (Section 4.5.5), both the pH and the concentration of Dissolved Oxygen (DO) of the water were measured at multiple locations along the watercourse, using a YSI 85 Water Quality Meter and a LaMotte Wide Range pH Test Kit.

The pH throughout these two watercourses was at 4.5 units, which is low for a fish populated watercourse (Table 4.5.3). Also, the concentration of Dissolved Oxygen (DO) is low with 5.4-7.1

mg/L. A DO of about 6 mg/L is necessary for the bare survival of fish, and a DO of 8-10 mg/L would be desirable (J. Bagnall, personal communication).

TABLE 4.5.3 Water Quality Data for Winter Creek, September 2004

Site ID (GPS)	Temperature [°Celsius]	Conductivity as Special Conductance [µS]	Dissolved Oxygen [mg/L]	pH	Location
WC1	18.6	72.3	5.4	4.5	At Road crossing on small tributary of Winter Creek
NEWXNG	15.1	77.0	6.5	4.5	At new crossing on small tributary of Winter Creek
Confluence	15.4	N/A	7.1	4.5	Confluence of Winter Creek and small tributary
WC15	14.3	70.0	7.0	4.5	Near downstream limit of survey on Winter Creek
WC7	14.7	70.1	5.7	4.5	Upstream limit of survey on Winter Creek

Note : Water quality measurements were collected using a YSI 85 Water Quality Meter and LaMotte Wide Range pH Test Kit.

4.6 SOCIO-ECONOMIC CONDITIONS

The proposed Canso Wind Farm is located close to the Town of Canso, Guysborough County, Nova Scotia. A large part of the wind farm infrastructure is located within the Town limits, including the substation, several wind generators and the entrance to the access road.

4.6.1 Demographic Information

Demographic Data were extracted from the Statistics Canada 2001 and 1996 Census, Community Profile (accessed Dec. 16, 2004). Detailed Data from the Census are included in Appendix J. The federal census data are augmented by data obtained from the Nova Scotia Department of Finance and the Nova Scotia Department of Health.

4.6.1.1 Population

Statistics Canada reports that in 2001, the total population in the Town of Canso was 992 inhabitants, compared to 1,127 inhabitants in 1996 and 1,228 inhabitants in 1991. This represents a decline of 12.0% (-8. 2 % from 1996 to 1991) (Appendix J). This trend continued to 2003, resulting in a total decline since 1996 of 16.8 % (NS Dept. of Finance, Nova Scotia Statistical Review 2004). In comparison, Nova Scotia's population declined by only 0.1 % in the same time frame (it gained 1.0 % between 1991 and 1996). The population decline in Canso can at least partly be attributed to the general decline of the fisheries sector. Fisheries has previously been a major source of income in Canso, both through fishing and fish processing. The "Seafreeze" fish plant in Canso today is only seasonally in operation (e.g. Snow Crab processing in July, for a limited number of days per week).

In 2001, the median age of the population in the Town of Canso was 41.9 years, which is higher than the median age in all of Nova Scotia (38.8 years). This is also higher than in 1996, for both Canso and Nova Scotia (36.0 years Canso, 36.4 % in NS). In 2001, 84.4 % of the population was 15 years or older, compared to 81.8 in Nova Scotia, and 15.08 % of the population is 65 years and older (13.94 % in Nova Scotia). Statistics Canada also reports that in 2001, only 10 people in Canso belong to a visible minority group (1.03 %) (Nova Scotia: 3.85%). They are all Canadian Born Chinese. There is no immigration from foreign nationalities. There are no aboriginal individuals in Canso, while the average for Nova Scotia is 1.9 % of the population %)(Statistics Canada, 2004 a, b: see Appendix J).

4.6.1.2 Income

The income data and Labour Force Indicators reflect the economic difficult times in Canso. In 2001, the median income of all persons 15 years and over was significantly lower than both in Nova Scotia as well as in 1996 in Canso, with $12,224 (NS 18,735) in 2001 and $18,926($ 21,009) in 1996.

In 2001, the portion of income that constitutes "Earnings" was significantly lower in Canso than in Nova Scotia as a whole: only 63 % in Canso versus 71.4 % in NS. In addition, the portion of income coming from "Government Transfers" is almost double in Canso than it is in Nova Scotia: 31.6 % vs. 16.1 % in Nova Scotia, 5.3 % of the income is of "other money". "Government transfers" include Employment Insurance benefits, CPP, Old Age Security pension, Child Tax Benefits, etc. The median household income in 2001 was $ 33,898 in Canso ($39,908 in NS) (Statistics Canada, 2004 a, b).

520 persons had "earnings" in the year before the census (i.e. 2000). The persons made on average $ 18,383 ($ 26,632 in NS), while the average earnings for full time employment were $ 27,098 ($ 37,872 in NS). This is significantly less than the Nova Scotia Average. Numbers for 1996 are not available (Statistics Canada, 2004 a).

4.6.1.3 Labour Force Indicators

Like the income data, the Labour Force Indicators reflect the economically difficult times in Canso and apparent continuing decline (Statistics Canada, 2004a, b; for details see Appendix J).

In the 2001 Census, the participation rate, i.e. the labor force in May 2001 expressed as a % of the population 15 years and over, was 60.5 % in Canso. While these values are similar to the values for Canso in 1996 (58.4%) and to NS over all (61.6 % in 2001, 61.0 in 1996), there are significant differences when looking at employment and unemployment rates. The employment rate (number of employed persons as percentage of the population 15 years and over) in Canso was significantly lower than in the Nova Scotia over all (41.9 % vs. 54.9 %), while the unemployment rate (% of labour force) was almost triple of that in Nova Scotia (31.7 % vs. 10.9 %). This is also significantly higher than it was in 1996 in Canso: 20.2 % in Canso (13.3 % in Nova Scotia over all) (Statistics Canada, 2004a, b).

4.6.1.4 Labour Force by Industry

In 2001, 440 of the 545 working persons in Canso were classified as "experienced labour force" (i.e. 80.73 %). Most of the experienced labour force worked in the "manufacturing and construction industry" (27.28 %), followed by "Health and Education" and "other services" (both with 18.19 %), "wholesale and retail" (14.77 %), "agriculture and other resource based industries" (14.77%), and "business services" (4.55 %) (Statistics Canada, 2004a). When looking at the distribution of employed people in terms of occupation, the majority has an occupation in "Sales and Service" (27.28%), "occupations unique to processing, manufacturing and utilities" (25 %) and "occupations unique to primary industry" (18.18 %) (Statistics Canada, 2004a).

4.6.1.5 Education

In Canso, the majority of the population 35 years and over, left school with less than a high school certificate (47.5 % of the 35-44 year olds, 61.7 % of the 45-64 year olds). In the age group of the 20-34 year olds, this is reduced to 16.7 %, while the majority has a high school graduation certificate and/or some postsecondary education (41.7 %). In this age group, 25% have a university certificate, diploma or degree. This compares to 7.9 % of the 35-44 year old and 6.7 % of the 45-64 year old. Also, only 21.1 % of the 35-44 year old and 11.7 % of the 45-64 year old have a high school graduation certificate and/or some postsecondary education (Statistics Canada, 2004a).

The comparison with the same data for all of Nova Scotia reveals an interesting trend. While the education level for the 35-64 year old persons is significantly lower than for Nova Scotia over all (almost twice as many without high school certificate in Canso), in the age group of the 20-34 year olds, however, significantly more persons have a high school certificate and/or some postsecondary education than in all of Nova Scotia (41.7 % vs. 28.3 %). In this age group, 25 % (vs. 22.8 %), have a university certificate, diploma or degree, and 16.7 (vs. 13.9 %) have a trades certificate or diploma. The level of people leaving school without a high school graduation certificate now is similar in Canso and in all of Nova Scotia (16.7 % vs. 16.1 %) (Statistics Canada, 2004a). For more details see Appendix J.

4.6.1.6 Other Data

Two more sets of data can be interpreted as reflecting on the economic situation.
98.7 % of the 395 dwellings in Canso were built before 1991 (86.5 % in NS). The average value of the dwellings is low compared to the average in Nova Scotia ($ 42,936 vs. $101,515). However, roughly 77 % of the 395 dwellings in Canso (1996: 405) are owned by the occupants (vs. 70.75% in Nova Scotia) (Statistics Canada, 2004a).

Also, Guysborough County has a negative migration balance between 1997 and 2003: while 480 persons migrated into the County, 860 migrated out. Most of the migrants (in and out) moved to or from other parts of Nova Scotia (NS Dept. of Finance, 2004 a).

4.6.2 Health and Life Expectancy

The Town of Canso belongs to the District Health Authority (DHA) 7, the Guysborough Antigonish Strait Health Authority (GASHA). GASHA consists of the counties Antigonish, Guysborough and Richmond, as well as the southern third of Inverness County. The population in GASHA is about 5 % of the population in Nova Scotia. GASHA, like Canso, has seen a continuing decline in population numbers over the years (5.9 % since 1991). Different from the Town of Canso, about 1.9 % of the population in GASHA in 2001are aboriginal persons (GASHA, 2002).

The life expectancy in this health district is 75.1 years for men and 81.1 years for women, which is slightly higher than the average for Nova Scotia (74.8/80.6) and slightly lower than the national average (75.7/81.4) (GASHA, 2002).

4.6.3 Economic Profile

The NS Department of Finance (2002 a) mentions only the Eastern Memorial Hospital as a major employer in Canso. In addition, the “Seafreeze” fish processing plant provides employment, though the plant currently provides only seasonal income and on a part-time basis. There is one motel to accommodate travelers. It offers rooms and house keeping units, as well as a restaurant. In addition, there are two schools, a pharmacy, a CO-OP store, a gas station, a food-takeout and a pub. During the summer months, Parks Canada operates an Interpretive Centre and ferry service to Grassy Island National Historic Site. There also is a recently established Call Centre.

The numbers shown in the section “Labour force by industry” (see Section 4.6.1.) indicate, that primary and secondary industries provide employment to a significantly larger portion of the experienced workforce than in Nova Scotia overall. In Canso, 14.77 % of the labour force work in “agriculture and other resource based industries” and 27.28 % in “manufacturing and construction industries”, while in Nova Scotia overall, the proportions are 6.55 % and 16.04 % respectively. Only about 57 % work in tertiary industry, i.e. service industry, compared to about 77 % in Nova Scotia overall (Statistics Canada, 2004 a).

Data on businesses by sector are available for Guysborough County (NS Department of Finance, 2002 b). In 2002, there were 353 businesses in Guysborough County that maintained employee payrolls (preliminary data based on Statistics Canada Business Register 2001). Businesses which had only contracted workers, or which employed family members or the business owner, are not included in these statistics. 13.6 % of these businesses were in the sector “Fishing and Hunting”, 12.12 % in “Construction”, 11.62 % in the “Retail Trade”, 11.33 % in “Other Services”, 8.5 % in “Manufacturing”, 7.65 % in “Logging and Forestry”, 7.08 % in “Accommodation, Food and Beverage Services”, 5.95 % in “Health and Social Services”, 4.82 % in “Business Services”, 4.25 % in “Transportation and Storage”, 3.97 % in “Agriculture and Related Service”, and 2.27 % in “Wholesale Trade”. Several other sectors have 2 % or less of all businesses and are not listed here. In summary, 25.8 % of businesses are in the primary industries, 20.7 % in secondary industries, and the majority with about 53.5 % is in tertiary industries.

Resource based industries are vulnerable to declines in the resource. The decline in fisheries due to declining fin-fish stocks therefore had negative effects on the Town of Canso.

4.6.4 Municipal/Community Infrastructure

The Town of Canso provides municipal water and sewage services. The Town’s drinking water source is Southwest Lake, also called Wilkins’ Lake. It is located about 2.5 km outside of the Town limits towards Guysborough, adjacent to and south of Highway 16. The easting is 651500 UTM, the northing 5021500 UTM (Topographic Sheet 11/F06). The water is drawn from the lake, soda and chlorine are added, and then it is pumped to the water tank near the Town centre, from where it is distributed. A recent study (2003) commissioned by the Town of Canso showed that there is little potential for development of groundwater as a municipal drinking water source (CBCL, 2003). The sewage treatment plant is located off Union Street, near the Hospital and the breakwater. Electricity is provided by Nova Scotia Power INC., using overhead wires. A substation is located adjacent to the fish processing plant near Water Street.

Solid waste is collected with waste stream separation. Town residents bring their bottles and glass jars to a bottle exchange, which also used to take card board and paper. The landfill site is located off Highway 16 near Lincolnville.

Fire protection is provided with volunteer fire fighters. The fire station is located west of the Town centre, off Union Street. The RCMP station is located at Main Street/ Sterling Street. There is no Town police force.

Canso has two schools. The elementary school, for students up to grade eight, is located in Hazel Hill, about 1 km from the Town centre and 500 m outside of the Town limits. The high School is located in the Canso Town centre.

Of the five Hospitals in Health District 7 (GASHA), the Eastern Memorial Hospital is located in Canso. Eastern Memorial hospital has eight medical beds. It provides 24-hour emergency services, core laboratory and x-ray services, physiotherapy, palliative care services, social work services, foot care clinics, nutritional clinics, and a number of other visiting clinics (GASHA, 2002). Attached to the Hospital is the “Canso Seaside Manor”, a seniors’ home that also has nurses on staff.

Canso has a federal public wharf, located adjacent to the “Seafreeze” fish plant, as well as a private marina off Union street.

4.6.4.1 Recreational infrastructure

Within the Town limits, there are a number of recreational facilities. The Town of Canso provides an arena, rink and public swimming pool complex, as well as ball fields. Adjacent to this area, the Stan Rogers Festival Grounds are located. Chapel Gully trail is located south of the Town, and partially outside of the Town limits (see Section 4.6.5.2.). These areas are outside of the project footprint.

4.6.5 Land Use

A review of SNSMR’s Property Online Database was carried out to determine the current land-use within the Study Area and adjacent areas. The majority of land use is undeveloped barren lands with the exception of scattered recreational areas (e.g. Chapel Gully Trail, Stan Rogers Festival Grounds, Canso Arena/Baseball Fields, campground, cottage/camp, and summer camp), and some scattered residential properties along the north boundary (Figure 3). There are no mines, pits or quarries in the project area.

4.6.5.1 Recreational Land Use

In addition to the recreational infrastructure described in Section 4.6.4.1 (rink, pool, ball field), there are other areas in the Town and in the project footprint that are used for recreational purposes.

The land southeast of the Town of Canso includes two peninsulas known as Glasgow Head and Betsy's Point. This area is undeveloped for the most part, except for a summer camp for children, a small cottage/camp, and a primitive campground. The children's camp consists of a number of houses, and is used during the summer vacation time. The "Heart's Content" campground consists mainly of markers on trees along the access road to the peninsulas. The markers indicated where the tents should be set up between the trees. A few metal barrels for garbage disposal have been set up. During all field visits, no campground use was observed, though it is said to be heavily used during the Stan Rogers Festival. Garbage observed in the woods below the campground confirms occasional use of the campground. Locals consider the campground as "not being used any more". There is a RV park at the waterfront near the Marina.

Parts of the access road exposed to the ocean are obviously very susceptible to wave action and erosion, particularly during winter storms. In 2004, the road connection to Betsy' Point was severely damaged and it had to be repaired in the spring.

A small part of Turf Bog (the wet area that runs parallel to the access road to Glasgow Head) appears to be at lower elevation than sea level and could possibly be inundated during storm surges. The larger, cleared portion could be classified as a shrubby bog (Section 4.3.1.4.) and currently contains an electrical distribution line to the children's summer camp.

4.6.5.1.1 Chapel Gully Coastal Trail

The Chapel Gully Coastal Trail is located just west of Chapel Gully and Glasgow Head. The trail can be accessed from a small parking area at the top of the hill on Wilmot Drive. The trail is a wilderness hiking loop of 5 km length that begins at the salt marsh and leads to the tree covered barrens and along the coast back to the salt marsh. There is also a shortcut, which avoids coastal areas. The trail is owned by the Town of Canso and is part of the Nova Scotia Shared-Use Trail system in Guysborough County. The trail can be used year round, though it is not cleared in the winter. The trails consist partly of 1 metre wide paths with gravel/natural duff surface or boardwalk, and partly of narrow footpaths with natural cover. An observation tower has been erected on the barrens. Several picnic sites are scattered along the trail. Parts of the trail pass over private lands, for which the Town obtained a letter of authority. The trail passes by several archaeological sites.

The park is used for hiking and birding by both residents and tourists. Several Town residents go for daily walks on the trail as part of their fitness scheme. In the winter, the trail may be used for Cross Country skiing. Bicycles and motorized vehicles are not allowed. Chapel Gully Trail and the Town of Canso are well known birding areas. Some tourists come specifically for the bird viewing opportunities.

4.6.5.1.2 Other Areas

The western part of the study area, which contains the most of the proposed turbines, consists of barrens and forests of mostly short, stunted trees. These areas, particularly the coastal areas, are used for hunting by the local population, as indicated by shotgun shell casings and a make shift camp observed at the coast a few hundred meters from the ATV trail (i.e. outside of the project footprint). The coastal areas are outside of the project footprint. Also, a network of narrow, often hardly visible trails is present in the area. Prey are mainly migrating ducks (shot at the coast), as well as rabbits caught by snaring.

4.6.5.2 Land Use in Areas Adjacent to the Project Footprint

The area adjacent to the project footprint in the north, northeast and northwest is part of the Town of Canso. It consists predominantly of private residences. The Town hospital with attached senior's residence is located north of the project footprint, and west of the Chapel Gully Trail Head along Union Street. The distance to the closest turbine is ca. 500 m. The distance between any private residence and any of the turbines is at least 290 m. The fish plant is located at the far end of Union Street, about 1.3 km from the trail head/proposed access road to the project.

There are six gravel pits within 2 km west of the Town boundaries, all with access from Highway 16. These gravel pits are outside of the project footprint and the study area.

An ocean bay called Glasgow Harbour is located south of the project and Chapel Gully Trail, while the area west of the project consists of forested and barren lands containing a large bog. Winter Creek, the small stream that runs through the project area, originates in that bog. The areas south and west of the project footprint are not used industrially, agriculturally or residentially. Recreational uses may be possible, such as hunting, hiking, berry picking, where access is possible.

4.6.5.3 Past Land Use

There is no evidence of agricultural or industrial uses of the land in the study area. Therefore, contaminations of the site from past land uses are highly unlikely. Along the coast within the Chapel Gully Trail system, there are remains of three building structures, which are described in the Section 4.6.9. The forested parts of the land have been logged several times. The trees growing there now are not old.

4.6.6 Land use for Traditional Purposes by Aboriginal Persons

There are no Indian Reserves within the project footprint or in adjacent areas. There are no indications of current use of the project area and its resources by First Nations persons, based on document reviews carried out by AMEC and the archaeological consultant, as well as consultations of the latter with local aboriginal bands. However, past uses of the area by First Nations are likely (see Section 4.6.9 and Appendix K).

4.6.7 Protected Areas

Grassy Island Fort National Historic Site is a Parks Canada protected area located approximately 1 kilometer north of the Study Area across Canso Harbour. The site features the remains of 18th century fortifications and the remains of colonial New England fishing villages. The island was also the site of several French-British battles. There is a hiking trail on Grassy Island. Grassy Island is not expected to be a constraint for this project, however it should be considered during the environmental assessment.

The Canso Coastal Barrens Wilderness Area is a NSDEL protected area located approximately 10 kilometers southwest of the Study Area. Physical features of the wilderness area include islands, inlets, bays, salt marshes, peninsulas, harbours, lagoons, headlands, and beaches. The area provides significant habitat for rare plants, several breeding and migratory birds, seals, and whales. The location of the Study Area with respect to the Wilderness Area is not expected to be a constraint, however, it should be considered during the environmental assessment.

4.6.8 Other Sensitive Sites

The salt marsh located at the head of Chapel Gully within the trail loop is considered a Significant Habitat by NSDNR (NSDNR Wetland Atlas, 1991). The western margin of the salt marsh is at least 200 m east of the proposed Turbine 1d, and will also be avoided by the access road.

Black Duck Trail in the Dover Day Use Park is located in Dover, about 5 km west of the nearest Turbine (Turbine # 5d).

Areas registered as “significant habitats” in the NSDNR Significant Habitat Data Base are described in section 4.3.2 (NSDNR, 2005).

4.6.9 Cultural Resources: Heritage Sites, Archaeological Sites and other Cultural Resources

There are few heritage or archaeological sites in the Canso area. All of them are located outside of the project footprint. Grassy Island National Historic Site is located in Canso Harbour (see Section 4.6.6). Archaeological sites are described below. Existing information indicates that Betsy’s Point peninsula also is a historically significant area. However, since there are no proposed turbines to be constructed on, this area was not included in the Archaeological Resource Impact Assessment.

4.6.9.1 Archaeological Investigation

The specific scope of work for the Archaeological Investigation involves completing an Archaeological Resource Impact Assessment (Category C) in accordance with the *Special Places Protection Act*, and documenting the findings.

The Archaeological Resource Impact Assessment (Category C) of the study area was accomplished through the following:

- Submission of a Heritage Research Permit Application;
- Conduct a desktop review of available documentation relating to the historic use of the Study Area;
- Consult with First Nations regarding aboriginal resources within the Study Area; and
- Conduct a field investigation consisting of a pedestrian survey and subsurface testing of the Study Area.

4.6.9.2 Methodology

The first step in the archaeological assessment was to develop an acceptable research design through consultation with the Nova Scotia Museum of Natural History. As requested by the Nova Scotia Museum of Natural History, an archaeological resource impact assessment was carried out for the Study Area. Davis Archaeological Consultants Limited (DAC) was retained by AMEC to obtain a Category C - Archaeological Resource Impact Assessment Permit and carry out the associated work. The follow information is a summary of the report "Archaeological Resource Impact Assessment – Canso Wind Farm, Heritage Research Permit A2004NS53 (Davis Archaeological Consultants Limited, 2004) (Appendix K).

Prior to undertaking field investigations, a limited search of secondary sources was conducted in order to assist in the identification of potential archaeological resources, and gain a fundamental understanding of past land use within the Study Area and adjacent lands. DAC included a First Nations liaison that consulted with local aboriginal bands to identify concerns for aboriginal resources.

4.6.9.2.1 Field Investigation

The study area was surveyed on foot by three qualified archaeologists, paying particular attention to those areas that would be impacted by construction of the turbines and access roads. Potential areas of concern surrounding the immediate Study Area identified through the historical review were also surveyed to confirm their location in relation to the Study Area.

Ground surfaces were surveyed for evidence of archaeological features. Subsurface surveys included 40-centimetre by 40-centimetre shovel tests, and 20-centimetre by 20-centimetre trowel tests. Maritime Archaeological Resource Inventory (MARI) forms were used to record archaeological features within the Study Area.

4.6.9.3 Field Investigation Results

Reconnaissance began on the east side of the study area along the gravel extension of Union Street. The ground surface was surveyed for evidence of archaeological features. In addition, the erosional faces of the bank adjacent to the shore as well as along the west side of the road cut were surveyed for artifacts and buried cultural deposits. This resulted in the discovery of surficial remains of an early nineteenth century homestead including a house, a possible well and associated outbuilding, and a linear stone property boundary. These features are located on the Hart's Content campground near the top of Christy's Hill in the vicinity of camping lot # 28 (Fig. 4.1). This site, named the Burns site, was recorded on a standard Nova Scotia Museum Maritime Archaeological Resource Inventory (MARI) form, photographed and mapped.

Opposite the Burns site to the east, the erosional face of the bank produced two hand-forged iron hinges and fragments of machine-made clear bottle glass. Four 40-centimetre by 40-centimetre shovel tests were conducted at five-metre intervals and excavated to an orange/brown sandy sterile loam. No additional artifacts were encountered.

On the west side of Chapel Gully, three archaeological sites were recorded with the assistance of Mr. Harry Dollard, senior member of the Chapel Gully Trail committee and long-time resident of Canso. These sites included the nineteenth-century Pestilence House used for quarantine of diseased immigrants, and the Euloth House likely built in the 1840s. Neither of these sites was tested, as they are not slated for impact. The third site is of indeterminate function and age. Although it is not located within the impact zone, a single 20-centimetre by 20-centimetre trowel test was conducted within the feature in an attempt to determine its age. No subsurface artifacts were discovered although a sherd of semi-vitrified earthenware was found on the surface as well as fragments of a purple-tinted blown glass lamp chimney on the west side of the road, opposite the feature.

No additional archaeological features were encountered within the area surveyed. However, the areas of turbine numbers 1 to 5 could not be properly surveyed as the ground was too rugged and wet and the area too heavily treed and covered in insurmountable brush to obtain access.

As there are no proposed turbines to be constructed on Betsy's Beach area, this area was not included in the impact assessment. However, historic research as well as consultation with local informants and representatives at the Whitman House Museum has shown that this is a historically significant area, having been settled at least as early as 1781. Several archaeological features are purported to exist on the Betsy's Point peninsula. Further Details of the field survey findings, including MARI sheets, can be found in Appendix K.

5.0 IMPACT ASSESSMENT, MITIGATION AND RESIDUAL EFFECTS ASSESSMENT

5.1 GEOLOGY/HYDROGEOLOGY/GROUNDWATER

The bedrock in the Canso area is divided between rock of the Meguma/Goldenville formation (greywacke, quartzite, slate, schist and gneiss types), and granite or granodiorite. The Meguma/Goldenville formation occupies a relatively narrow strip of land north of the project (Geological Map of Nova Scotia, 1979). The rock is classified as GO_{Gg} (metamorphosed Goldenville Formation schist). George Island bedrock is made up of the similar material (GO_{Gg} Goldenville pervasively injected with granite). Goldenville formation rock consists mainly of greywacke and minor beds of green and grey slate (Howells and Fox, 1998). The slate in the Goldenville formation may contain sulphide minerals such as pyrite, pyrrothite, arsenopyrite or another mineral that is a source of sulphide (Howells and Fox, 1998).

Exposure of sulphide-containing rocks to oxygen (atmospheric conditions), e.g. through construction activities, can lead to Acid Rock Drainage (ARD) (Howells and Fox, 1998). ARD is characterized by low pH (pH 2-4) and a high content of dissolved metals (Howells and Fox, 1998), in particular aluminum, 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 concentration in the rocks varies. Rocks with high concentrations of sulphides have the potential to lead to ARD (Howells and Fox, 1998). This is the case with the black slates of the Halifax Formation of the Meguma group, which contain up to 10 % (per volume) of sulphide minerals (Haysom et al., 1997; Howells and Fox, 1998). The Goldenville formation, however, contains only minor thin beds of grey and green slate in areas of gold occurrence (Sangster, 1990 in Howells and Fox, 1998). Elsewhere, in the Beaverbank-Rawdon area, the metasandstones and slates of the Goldenville formation only contain traces of sulphides (Haysom et al., 1997). Therefore, there is only a very small likelihood for ARD formation from rocks of the Goldenville formation.

Only a small part of the project footprint at the northern boundary is potentially located near rocks of the Goldenville formation. Based on the distribution of rocks depicted in the Nova Scotia Geology map, and the outcrops visible during the field surveys, most of the proposed wind farm is certainly not located on Goldenville Formation bedrock, but on granite. Also, it is not known whether the Goldenville rocks in the Canso area contain slate at all, i.e. whether there is potential for ARD formation. Based on the relatively good quality of the groundwater in Canso (CBCL, 2003), particularly with regard to iron, it is not anticipated that ARD may be a concern (Zentelli and Fox, 1979).

A detailed geological survey of the project footprint has not been carried out yet. Samples will be obtained during the geological survey, which will reveal whether there is potentially ARD producing slate present in the project footprint or not. Any rock containing 0.4 % sulphide by weight or more is to be considered sulphide bearing material and has to be treated according to the regulations (Environment Act, 1995, regulation 57-95, c1). Should such rock be present, the following assessment will be used to mitigate the effects.

5.1.1 Pathways and Activities

Acid rock drainage (ARD) may potentially occur during the construction phase of the project at a small number of locations. Since it is unlikely that rock will be newly disturbed during the decommissioning phase, the potential for ARD during that phase is very limited to nil.

Construction of turbine foundations, ancillary buildings such as the control room and transformer room, as well as the road needs excavation and potentially blasting. Also, it is planned to use excavated material for road construction on site when ever possible. During this process, rock will be exposed to oxygen, moisture, bacteria and air temperatures. Therefore, acid rock drainage may occur, if the rock contains sulphide in sufficient quantity.

During the operational phase, there is no potential for renewed exposure of ARD-producing rock.

5.1.2 Boundaries

The spatial boundaries are defined by the areas used for certain turbine wind farm infrastructure, as well as areas that will receive the surface water run-off from these sites. Based on the project layout in relation to the location of the slate as indicated in the Geology Map, only turbine # 1d, the control and transformer building and the start of the project access road off Wilmot Drive are potentially located near Goldenville formation rock, which may contain slate. Due to the large scale of the Geology Map of Nova Scotia, it is not possible to see exactly where the Goldenville bedrock ends in relation to the turbine locations. The other turbines and structures are either located on granite or on glacial till, and are therefore of no concern.

If the bedrock at these few locations has the potential to lead to ARD, the receptors of the run-off will be located mostly south and southeast of the sources. This assumption is based in the inclination of the land as indicated by the topographical maps, which is obvious during site visits. For Turbine 1d, its laydown area, the ancillary buildings and the start of the access road, the sensitive receptors in those areas would be the saltmarsh at the head of Chapel Gully, as well as potentially the mouth of Winter Creek. Wetland three is located higher than Turbine 1, and therefore is not likely to receive any runoff.

The temporal boundaries depend on the time it will take to oxidize all the sulphide in the exposed bedrock, i.e. potentially unlimited time, if there are no mitigation measures.

5.1.3 Impact Assessment

The size and severity of a potential impact of Acid Rock Drainage (ARD) depends the presence of sulphide, the amount of sulphide in the rock, the amount of rock exposed and the type of habitat or the type of receptor receiving the ARD. ARD may have negative effects on ground water, surface water, wetlands and fish.

Wetlands and watercourses are the receptors that are most sensitive to ARD, due to the toxic effect of the metals, particularly aluminum, on fish and other animals. Potential receptors are the saltmarsh at the Head of Chapel gully and possibly the mouth of Winter Creek. If rock with ARD potential were used for the construction between turbines 1d, 2d and 3d, and potentially for the start of the access road, more acidic runoff may reach Winter Creek and the salt marsh, and potentially the eastern edge of Wetland 1.

If the rock contains enough sulphides to cause ARD, negative effects on the wetland and watercourses are likely. However, negative effects are not likely on fish, since there are no fish in Winter Creek, and fish in Chapel Gully would not be poisoned. Since the Town supplies most residences with water (see Section 4.6.4), it is unlikely that any ground water supply would be impacted should there be a potential for ARD. In addition, all private residences that are near any of the turbine locations are serviced by the municipal water supply system. Therefore, water supply to residences is not adversely affected.

The amount of rock excavated is about 1046 m^3 for the one turbine pad (20 m diameter, 2m deep below grade), the foundation of the 420 m^2 transformer building and the 7X14 m control building. It is unlikely that excavation to the bedrock level is necessary for the road construction beyond the coastal ridge. Therefore, the amount of potentially acidic rock is very limited, and the effects on the wetlands are likely not significant.

5.1.4 Mitigation

If any rock with ARD potential is discovered during the geotechnical survey or during blasting for construction, the first choice for mitigation is avoidance of this area by adjusting the project layout. Therefore, a geologist will assess the exposed rock during the geotechnical survey to determine whether the rock has the potential for causing ARD. If the potential exists, rock samples should be sent to a laboratory for ABA (Acid Base Accounting). About 2 samples per site are sufficient. Also, if the amount of sulphide bearing rock to be disturbed is greater than 500 m^3, government administrators will be notified. Sulphide bearing material refers to materials with a sulphide sulfur content equal to or greater than 0.4 % (weight) (Environment Act, 1995, regulation 57-95, c1).

If there is rock with ARD potential, and avoidance of the rock is not possible, the rock will be treated according to the sulphide bearing Material Disposal Regulations (Environment Act, 1995, regulation 57-95, c1).

Rock containing sufficient sulphides to cause ARD will not be used for the construction of the road. If the material is in excess of 500 m^3 in situ (or 1300 tonnes), the material has to be removed from the site immediately, and disposed off in an approved disposal site (Environment Act, 1995, regulation 57-95, c1) to eliminate the risk for surface fresh water or ground water, as well as wetlands. If the rock is no potential source of ARD, it can safely be used for the construction of the access roads.

In addition to these limitations for the use of ARD rock in the construction of the roads, surface run off from the turbine and building sites should be prevented, greatly reduced or collected at a central location for treatment, and exposure of the rock should be limited (Environment Act, 1995, regulation 57-95, c1). Generally, ARD rock is encapsulated in soil to prevent the formation of acids. Several methods are available, including covering the ARD rock with a layer of lime, followed by topsoil. It may be necessary to use geotextiles to cover the rock, or to install drains in the topsoil. Rock can be covered with shotcrete (Fox et al., 1997) or clay and topsoil

(Zentilli and Fox, 1997). Effluent can be treated with lime before discharge (Fox et al., 1997; Zentilli and Fox, 1997).

5.1.5 Residual Impacts

No significant adverse impacts are likely after implementation of the mitigation measures. Additional mitigation measures are not necessary. However, a site visit should be performed after an appropriate time to search for any indications of acid rock drainage, to ensure that the mitigation measures were sufficient.

5.2 AIR QUALITY

Air quality can be adversely affected by the formation of dust and exhaust fumes. Adverse effects of exhaust fumes are not likely, because the number of additional vehicles during all phases of the project is not likely to be enough to cause air quality problems, since the wind is strong and likely to dissipate any exhaust fumes before they reach the nearest residences. The assessment will therefore focus on dust formation.

5.2.1 Pathways and Activities

Dust can result from several activities during the construction and decommissioning phases of the project. During the construction phase, dust can result from clearing and grubbing the land, excavation and blasting, construction of roads, excavation and construction of foundations and buildings (control building and electrical substation) and delivery of equipment (construction machinery, turbine parts, power poles, etc.)

During the decommissioning phase, deconstruction activities such as the removal of turbine foundations, buildings, waste, the associated traffic and also earth movements for site remediation may cause dust.

The activities during the operational phase are not a source of significant amounts of dust.

5.2.2 Boundaries

Spatial boundaries are the project site and the inhabited areas north and northwest of the project site, i.e. the Town of Canso. The temporal boundaries are the limited number of weeks in the fall of 2005 and spring of 2006, when the construction activities occur, as well as a limited number of weeks during the de-commissioning phase.

5.2.3 Impact Assessment

5.2.3.1 Construction and Decommissioning

During the construction and de-commissioning 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. While Canso is small, and the number of people with breathing related health problems can be expected to be small, the local seniors residence and care facility is located quite close to the project site, about 400 m from the nearest turbine, and 200 m from Union Street, which will carry all the traffic to and from the project site. Therefore, adverse effects from dust are likely.

However, construction is planned for the fall and the spring. Both are seasons of the year when the soil tends to be moist, and precipitation events are frequent (particularly in the spring), which reduces the amount of dust production. Therefore, impacts from dust formation on air quality are considered to be not significant.

5.2.3.2 Operation

In theory, dust could result from soil depleted of vegetation, and from gravel access roads. However, since the vegetation cut in the lay-down areas will be allowed to grow back (except for some of the graveled areas kept as services access) and there will be very little traffic on the gravel roads due to the limited requirements for maintenance of the facilities, dust development is not likely during the operation phase.

In summary, dust associate with the wind farm project is not considered to cause significant impacts.

5.2.4 Mitigation

Since dust is not considered to result in significant impacts, mitigation measures are not necessary. However, construction supervisors should consider dust abatement measures on certain days, to prevent complaints about nuisance. This may include watering the gravel roads in the project area or soil that is moved. Also, speed limits (40 km/h) should be imposed and enforced, trucks should not be loaded with soil above the freeboard of the truck, and drop heights should be minimized when loading the trucks. Land should be moistened before clearing, and areas to be blasted should be covered with mats. These mitigation measures would also minimize the effect of dust on the vegetation and wetlands.

5.2.5 Residual Impacts

No significant adverse impacts are likely.

5.3 WETLANDS AND SURFACE WATER QUALITY

Wetlands are the subject of the federal wetlands conservation policy, and are potentially home to a number of rare plant species, and the four-toed salamander.

5.3.1 Pathways and Activities

Wetlands can be impacted by direct destruction, fragmentation, disturbance and erosion, disruption of hydrology, loss of species diversity, introduction of invasive species and release of hazardous materials. These impacts can be the result of short term activities during the construction phase and decommissioning phases, as well as long-term activities during the operation of the wind farm, including activities related to access to and use of the wetlands by the public. These activities can impact the wetland itself directly, the hydrology, the soil and the vegetation.

The construction and existence of roads and turbine pads and high impact activities of the public, such as ATV and dirt bike use (particularly “mud-bogging”) can destroy wetlands directly, and lead to fragmentation of larger wetlands, as well as loss of rare species and their habitat.

The existence of roads and turbine pads (i.e. operational phase) can disrupt the natural hydrology, which would result in the destruction of the wetlands as they are now. Wetlands depend on a certain level of soil humidity. If the water regime is changed, so will the vegetation and the character of the wetland. If water levels drop, soil will dry out, and the vegetation will change to forest. An increase of water levels may turn the existing wetlands into bogs or ponds. Hydrology can also be disrupted by ruts formed when vehicles drive in wetlands, or multiple people walking, since ruts can increase drainage when formed on a slope.

Wetlands and water courses can also be impacted by erosion both by the removal of soil, and the deposition of soil. Most of the erosion would occur during the construction phase.

There is potential for introduction of invasive species, both during construction and post-construction. Seeds, roots or “rootable” fragments of invasive species may be stuck to construction equipment and shoes of workers. Post-construction, the public may carry these propagules into the wetlands during a simple walk, but particularly if they drive vehicles such as ATVs and mountain bikes into the wetlands. Invasive species such as purple loosestrife (*Lythrium salicaria*), are known to severely degrade wetland habitat.

Another potential pathway involves dust and minerals from road runoff. Most fugitive dust will be formed during the construction phase from construction and movement of construction equipment, but some dust may also escape during the operation phase, (e.g. from the movement of maintenance vehicles). The dust may cover native vegetation and smother it, but dust can also deposit minerals into the wetlands. As some wetlands, such as bogs, are characterized by very low amounts of minerals, mineral input may change the wetland character; for example a bog may become a fen. At the very least, some plants adapted to very low mineral levels may become overgrown by competitors when loosing their adaptive advantage. Increased input of minerals could also result from increased surface water run –off entering wetlands.

During the operation phase, the species diversity in wetlands could potentially be reduced if herbicides are used for the maintenance of the access roads. Also, spills from toxic chemicals could have negative impacts on plants and wildlife in the wetlands during all phases of the project.

5.3.2 Boundaries

Spatial boundaries include the project footprint, and adjacent areas that are connected hydrologically with the project footprint, both inside and outside of the project area. The temporal boundary includes the proposed construction, operation, and decommissioning of the Project. Construction of the proposed Project will occur over a one year period, while the operation of the Project is expected to last for a minimum of 25 years.

5.3.3 Impact Assessment

All wetlands have been characterized and mapped during the design phase of the wind farm project and have subsequently been avoided by adjusting the project lay-out. Therefore direct destruction and fragmentation of wetlands as a result of the construction of turbines and access roads ways will not occur. This includes the saltmarsh at the Head of Chapel Gully, (NSDNR significant habitat GU 859). In addition, the project footprint has been minimized (i.e. the amount of road to be built is reduced to the minimum) thus reducing the area that could potentially be impacted.

Impact on wetlands via the changes in the water regime are however possible. Most of the project area has a gently undulating topography. Surface water from rain, or water draining from the wetlands, will follow the slopes and natural drainage channels. If these natural drainage paths are interrupted, the hydrological regimes in the wetlands may be disturbed, resulting in changes to the wetlands and their vegetation, including loss of rare species and their habitat. The access roads, and to a lesser degree, the turbine pads have the potential to change the flow of surface water when crossing the drainage channels. Since soil covers are thin, water transport in deeper soil layers cannot be affected by the roads. However, considering the topography, the location of the wetlands and the roads, interruption of natural surface drainage is likely, and the effects would be adverse. The potential effect could include loss of species at risk or their habitat, which is considered a significant impact. Mitigation measures are recommended below.

Impacts of the wetlands from erosion, invasive species, herbicide use, spills of toxic materials and public access are also likely and adverse, and should be addressed by the mitigation measures recommended below.

5.3.4 Mitigation

All wetlands were avoided by adjusting the wind farm layout (Turbine 6d may be located in wet area adjacent to Turf Bog). Therefore, compensation measures are not expected to be required. In addition, vegetation growth will generally be regulated by physical cutting. Approved herbicides will be used for the maintenance of the access road only if necessary.

5.3.4.1 Water Quality

Natural surface drainage, both via defined pathways such as streams, and undefined pathways, should be un-altered from the construction of access roads and turbine pads. Diversion and channeling (concentration) of run-off (the latter can lead to erosion and increased mineral input) should be prevented where possible.

The most likely effect of construction on surface water quality and quantity is due to erosion and runoff. During the grubbing and grading operations for the access road and preparation of the turbine sites, large areas of soil may be exposed to the elements for a period of time. This may result in the erosion and deposition of mineral soils in nearby surface waters. Winter Creek is the only surface water stream crossed by the access road. Appropriate erosion and sediment control measures should be implemented on site to prevent erosion and subsequent site runoff into surface waters and/or wetlands. Where necessary and practical, drainage should be directed away from the area of construction into a wooded area and allowed to dissipate.

The proposed Project layout was adjusted in order to reduce the number of potential surface water crossings to one. This crossing will be constructed using a culvert of sufficient size to accommodate water flows related to extreme events.

Where the access road cuts across diffuse natural drainage paths, and particular noticeable drainage channels for surface water, drainage structures should be installed. These drainage structures should be designed to dissipate the hydraulic energy and maintain flows at velocities sufficiently low enough to prevent transport of native soil material. This would prevent drying up of the areas down gradient, and pond-formation in the areas up gradient, as well as prevent erosion from increased concentrated water flows this would prevent erosion from increased concentrated water flows and decrease the potential for mineral input into the wetlands.

Generally, the organic soil cover is thin in the project area, therefore the roads in the project area should not lead to compression of soil resulting in decreased diffuse water drainage. Also, the crushed rock used for road construction should allow for regular diffuse surface run-off to seep through. This can be enhanced by using permeable road fill (clean shotrock) near the soil surface for additional cross drainage. Geotextile may have to be used to maintain the pore space in the permeable road fill.

An environmental effects monitoring program should be implemented immediately post-construction to identify any vegetation changes that could be a sign of disrupted hydrologic regime (see Section 6.0).

5.3.4.2 Erosion

Erosion should be prevented by keeping ground disturbance to a minimum, and stabilizing or revegetating disturbed areas con-currently with construction activities. Preferably, natural vegetation should be put back in place (after being stored onsite), but hydroseeding with commercially available seed mixes has been proven successful (Maritimes and Northeast Pipeline Project Environmental Effects Monitoring, 1999-2004). While these seed mixes may contain non-native plants, experience has shown that native wetland species gradually replace the species in the seed mixes while the wetlands recover. Some grasses and legumes in the seed mixes however were still present in dry areas after five years, though interspersed with native species that had returned. Weed species are rarely found in the seed mix.

In order to prevent destruction of wetland and watercourse habitat directly, or indirectly from erosion etc., standard erosion control practices such as the use of silt fences and cofferdams should be utilized during construction, and should be monitored and remain in place until the areas are 80% re-vegetated. In addition, public access to the wetlands should be controlled. Access to the project area with ATV and mountain bikes should be prohibited, and indicated as so by the use of signs. It should be noted, however, that there is access to the project area using the existing emergency fire road, which is frequently used by ATVs (Figure 2.3.). Access to that road is direct from the Town of Canso. ATV use within Wetland 4 was apparent during the field surveys in 2004. Wetland 4 had several trails that connected Canso to Hazel Hill or other communities. Previous ATV use is also evident in Wetland 1. Turf bog and wetland 3 show no indication of ATV activity.

Recreational visitors to the area should be provided with guidance material encouraging the use of existing trails in order to avoid wetland disturbance.

5.3.4.3 Invasive Species

The introduction of invasive species during the construction phase should be prevented by cleaning and inspecting the construction equipment from vegetation and soil residues before entering the project site. At a minimum, this should be done when the equipment was previously used in other wet or wetland areas. This mitigation has previously been successfully carried out during the construction of the Maritimes and Northeast Natural Gas Transmission Pipeline.

Preventing the introduction of invasive species during the operation of the Project would include the cleaning of the maintenance vehicles prior to accessing the site, as well as minimizing the public access to the project property. Also, during earlier field visits, no purple loosestrife was noted in the Canso area, thus reducing the likelihood of its introduction by local residents.

Rather, a program of monitoring and removal of noxious weeds should be established. The vegetation should be monitored at an appropriate time of the year for the presence of any noxious weeds. Since the biggest threat to wetlands is from purple loose strife, the monitoring should be carried out in late summer, likely August, when it is in bloom (see Section 6.0). Any invasive plants found should be dug up and properly destroyed in order to avoid further distribution.

5.3.4.4 Toxic Spill

Impacts from spills of toxic materials, which could be carried into the wetlands and water courses by surface water run-off, should be avoided by immediately cleaning the spills up. Contractors / operators will be required to establish and implement a site- and project-specific Environmental Management Plan (EMP). The EMP will have to include:

- Inventory of hazardous materials to be used at the construction site, e.g., fuels, lubricants, cement, wet cement, concrete additives and agents, preservatives, solvents, paints and wastes such as waste oil;
- Spill prevention plan;
- Contingency plan (spill containment, clean up protocols, equipment)
- Fuel and lubricant storage, and location for equipment servicing (outside of at least a 30m buffer from wetlands and water courses)
- Explicit prohibition of deposition of a deleterious substance into waters frequented by fish (pursuant to Section 36, Fisheries Act);
- Reporting protocol.

5.3.5 Residual Impacts

No significant adverse impacts are likely.

5.4 SIGNIFICANT HABITATS

There are two significant habitat areas within 5 km from the project site (see Section 4.3.2). No significant adverse impacts are likely.

Adverse effects on location GU 858 (an island) are not likely as the identified significant habitat site is approximately 3 km from the proposed wind farm.

Also, adverse effects on GU 859 (salt marsh) are not likely, as the salt marsh is approximately 100 m from the closest proposed turbine location and was avoided by the project layout.

Mitigation measures recommended for the protection of wetlands would also mitigate potential indirect impacts on the salt marsh.

5.5 SPECIES AT RISK

5.5.1 Flora

No flora species at risk were observed during the field surveys conducted in 2004. However, changes were made to the locations of several proposed turbine sites and the access road location that were not completely covered in the 2004 surveys. It is recommended that these sites are re-evaluated for flora species at risk. Based on the avoidance of wetlands and the relatively low diversity and uniform nature of the available habitat observed in 2004, it is expected that the potential for flora species at risk is low. Therefore, it is anticipated that no significant adverse effects on plant species are likely. Field surveys of those locations to be carried out in the summer of 2005 will verify this assumption.

5.5.2 Mammals

The species at risk surveys indicated that there is no suitable habitat for most mammalian species at risk, with the exception of moose, lynx and bats. There are no confirmed and documented previous sightings for any of these species in the Canso area. During the field surveys, no indications of moose and lynx presence were discovered. Therefore, significant adverse effects to moose and lynx are unlikely.

5.5.2.1 Bats

Bats are of concern for wind power developments, because several reports show that bats may be killed at wind farms. In Nova Scotia, six bat species are listed “Yellow” in the NS DNR General Status of Wildlife Report, though only three have the potential to occur in the project area.

Bat mortality at wind farms is generally low, but can be quite high for reasons that are not well known. Several wind farms in the US have reported bat mortalities, and this mortality can exceed the bird mortality (Keeley et al., 2001; Environment Canada, 2004). For example, a wind farm in West Virginia reported about 400 bat carcasses in 2003 (Environment Canada, 2004). Most dead bats were solitary, tree-roosting species, with hoary bats being the most frequent victim across the US, followed by Red Bat and Silver-haired bat (Erickson et al., 2002; 2004 Environment Canada, 2004; BLM,2004). However, there are regional differences in victim species composition (Batcon, 2004). In western US, silver haired bats are in second place after hoary bat (BLM,2004). All three species occur in Nova Scotia. In total, only 9 of the at least 39 species of bats in the USA have been found as victims of turbine collisions (BLM,2004). In a study of four wind farms, 86 % of bat deaths occurred in late August to early October, indicating that migrating bats account for most of the collisions (Keeley et al., 2001). Environment Canada (2004), includes the dispersal period with the fall migration period.

However, bat mortality and its causes have only recently become a topic for research (Keeley at al., 2001, in Sea Breeze, 2004). Therefore, not much is known about reasons for bat mortality, its extent and what management options exist to reduce bat mortality. Keeley et al. (2001) report on four recent studies of bat mortality. Bat mortality has exceeded bird mortality in a few cases.

Reports on bat fatalities are scarce, and the numbers of deaths vary considerably from wind farm to wind farm. While there were only three reported bat fatalities between April 1998 and February 2000 at the Altamont Pass, which is infamous for its high number of bird strikes (Thelander and Rugge, 2000, in Sea Breeze, 2004), a recent report from West Virginia found more than 50 bats per turbine per year (Windpower Monthly 2003, in Sea Breeze, 2004). It is assumed that the high number in the latter case is due to the fact that the turbines were set up in the prime bat habitat of mature interior forest. Other reports found 34 dead bats in a two months period in Wisconsin (Keeley at al., 2001) and 22 bat deaths or injuries in Australia (Hall and Richards, 1972, in Keeley et al., 2001). Also, a wind farm in PEI reported three Little Brown Bat carcasses in 2002 (Environment Canada, 2004).

On a per-turbine basis, bat mortality estimates range from less than 1 to almost 50 per turbine per year. In a comparison of 7 facilities, Erickson et al. (2002), state that the highest mortality rate per turbine up to that date was found at Buffalo Mountain, TN, with 10 victims per turbine. Reported bat fatality rates at the remaining 6 wind farms ranged from 0.07 (Buffalo Ridge MN, Phase 1) and 0.74 (Vansycle, Oregon), to 2.32 (Buffalo Ridge, MN, Phase 3). Some of these data are adjusted for searcher bias (Keeley et al., 2001; Erickson et al., 2002). Kerns and Kerlinger (2004, in BLM, 2004) find a range from 0.74 (Vansycle) to 3.21 (Nine Canyon, Washington State). However, the bat mortality rate at the Mountaineer Wind Energy Centre in West Virginia was estimated at 47.53 bats per turbine for the period of April to November 2003 - most of them from August 18 to September 30 (Kerns and Kerlinger, 2004, in BLM, 2004). Another review reports averages from 12 studies of 1.2, 1.7 and 46.3 bats/turbine per year, for a total average of 3.4 bats per turbine per year (NWCC, 2004). The numbers may be higher depending on searcher efficiency and scavenger removal rates (Batcon, 2004).

However, not all wind farms in the Eastern US have high bat mortality rates. A comparative study of several wind farms in the eastern US by Johnson and Strickland (2004, in BLM, 2004) showed four facilities with no fatalities, and one with a single dead little brown bat. The number of turbines ranged from 2 to 11. Young and Erickson (2003, in BLM, 2004) state that mortality could vary depending on regional migratory patterns, patterns of local movements through the area, and the response of bats to turbines, individually and collectively. The following paragraphs review available information on factors influencing bat collision risk.

There is little information available on factors that influence the collision risk of bats with turbines. It appears that there is no significant difference between lit and unlit turbines (Ericsson et al., 2002; Johnson et al., 2003 and Ericsson et al. 2003b in BLM, 2004). Lighting required by the FAA for air-traffic safety appears to have no effect (Batcon, 2004).
On the other hand, hoary bat and eastern red bat have been found to prefer foraging around lights, as these attract moths, thus conceivably increasing collisions risks, <u>if</u> the air safety lighting attracts insects (Erickson et al., 2002). It is possible that bats may be attracted to

structures that make unusual sounds, attract insects with lights or offer potential roosting sites (Keeley et al., 2001).

Johnson and Strickland (2004, in BLM, 2004) found no bat fatalities at two wind farms located in farmland, and two with no fatalities in forested area. Another facility with only one fatality was also located in forested area. Therefore, it appears that the high fatality rate at the Mountaineer Site cannot just be attributed to its location in the forested area, but may be connected to other factors, such as habitat quality. However, other reviews suggest that bat mortality is highest in or near forests, especially along hilltops; moderate on open areas close to forests, and lowest in grassland or farmland (Batcon, 2004). Also, the risk in forested areas may extend to include summer in addition to fall and spring migration (Batcon, 2004), though present data do not confirm this suggestion.

For the Buffalo Ridge wind farm (MN), it has been estimated that there is one bat fatality for every 70 passes by a wind turbine, which were recorded (Johnson et al., 2002, in Erickson et al., 2002). Migrating bats may not use echolocation or may fly too high, thus not being recorded (ibid.) However, when comparing turbines with fatalities and turbines without fatalities, there was no significant difference in activity (i.e. in number of passes). This was found at two wind farms (Johnson et al., 2002 and Nicholson, 2001, both in Erickson et al., 2002). The average number of passes per turbine per night in summer and fall were found to be 2.2 and 2.6, respectively, in a study at two facilities. The number of passes decreased with distance from woodland, and increased with the "proportion of residential woodland" within 100 m from a turbine (Erickson et al., 2002). At Buffalo Ridge, activity at the turbines was very low with 2.2 passes per night, while activity in woodlands and wetlands, i.e. more suitable habitats, was 15 times higher (33.1 passes) (Johnson et al. 2002, in Erickson et al., 2002).

Bats have been found to collide with structures other than turbines, such as television and communication towers (Erickson et al, 2002; Curry and Kerlinger, 2005), cable-anchored communication towers (Keeley et al., 2001), lighthouses, buildings/windows and powerlines (Erickson et al., 2002), and they have been found impaled on barbed wire fences (Erickson et al., 2002; DeBlase and Cope 1967, in BLM, 2004). Batcon (2004) suggests that bats rarely appear to strike meteorological towers or non-operational turbines. On the other hand, Erickson et al. (2002), review findings that in laboratory experiments, bats were better able to avoid moving objects than stationary ones, and avoided twine of 3 mm diameter. Also, they can detect objects up to 100 m away by echolocation. One European study showed that bats were foraging within 1 m from the tower, without any collisions (Bach et al., 1999, in Keeley et al., 2001). Bats appear to investigate both moving or non-moving turbine blades. They avoid moving blades, and the ratio of avoidance to contact is high (Horn et al., 2004).

While Keeley et al. (2001) state that it is not known yet whether young of the year are at higher risk than adult bats, Erickson et al. (2002) report that the majority (68-100 %) of bats killed at any time of the year are adult bats. Young bats start to disperse from their parents in late summer (Keeley et al.), and are known to have less ability to echolocate and fly than adults (Erickson et al.), thus being seemingly at higher risk for collisions.

Erickson et al., (2002) state that there appears to be a difference in the collision risk between different species of bats. It is possible, that differences in flight speed and maneuverability have an influence on the collision risk. Hoary bats are known to fly fast, but are not very maneuverable. This may explain why they provide such a high proportion of the victims.

Erickson points out that big brown bats and little brown bats experience little to no collisions, despite the presence of large breeding colonies. At other wind farms, large numbers of long-eared myotis, long-legged myotis and little brown bats or eastern big-eared bats and little brown bats were found, but no collisions. However, his review is not clear regarding the correlation of these findings with the status as breeding and migrating bats, though the timing of mortality peaks suggests migrating bats. This would be important, since most studies find that breeding bats are at very low risk. Keeley et al. (2001) report that 143 deaths, i.e. 85 % of deaths, involved members of the genus *Lasiurus* (e.g. hoary bat and red bat) in four studies across the US, but reasons for this could not be determined. It is assumed that they collide with turbine blades or guy wires. The authors point out that *Lasiurus* sp. are not the most common species in the US, but large and often strikingly coloured, thus potentially more likely to be found in carcass searches (searcher bias) (Keeley et al., 2001).

The risk to migrating or dispersing (summer colonies) bats is much larger than to resident, breeding, commuting or foraging bats (Keeley et al., 2001; Erickson et al., 2002). During breeding season, collision mortality is almost non-existent, even if a large number of bats are detected near the turbines (Erickson et al., 2002). Erickson et al. (2002) state that some bat mortality may occur at most wind farms where bats are present, but that the bulk of victims are migrating tree and foliage roosting bats. Also, they conclude that resident breeding bats are virtually not impacted even if there are relatively large populations close to the wind plants. Interestingly, very few spring migrants become victims of turbines, but many bats succumb during fall migration and breeding colony dispersal (hoary bats and other species). Potentially, spring migrants use different migration routes than fall migrants (Erickson et al, 2002).

Currently, there seems to be no negative impact on resident breeding bats in the US At the population level (Erickson et al., 2002). However, an article published in Windpower Monthly (November 2004) states that a study carried out in the summer of 2004 at the Meyersdale wind farm in Pennsylvania and the Mountaineer wind farm in West Virginia found that the number of bat deaths is bigger than previously expected. The reports suggest that there may be significant impacts on bat populations in some areas (Keeley et al., 2001).

It has been noticed that most collisions occur during migration and inclement weather conditions (Van Gelder 1956 in Erickson et al., 2002). The reason for this is unknown, but it has been speculated that migrating bats turn off their "sonar" (Curry and Kerlinger 2005) or at least reduce the number of echolocation calls while traveling through open areas (Van Gelder, 1956 in Keeley et al., 2001). . However, bats do have good vision, and use it for long distance orientation. If they migrate without use of echolocation, as evidence suggests, thus flying through wind farms by sight, the same factors that cause bird collisions may be influencing bat collisions (Erickson et al., 2002). Keeley et al. (2001) found that over 75 % (or 84 %) of fatalities were related to bad weather events, and the victims were species that were common in the area. They also point out that heavy rain interferes with echolocation, thus bats generally do not emerge during heavy rain. Bats may look for shelter at the turbines if they get caught in bad weather.

Another reason may be the type of area bats use for migration. Most *Lasiurus* species migrate long distances. Hoary bats, for example, can fly long distances and potentially migrate from Alaska to Central America. Therefore, they may be more likely to fly through open areas or at rotor blade height (Keeley, et al., 2001). Most of the other common bat species, e.g. the genus *Myotis*, may be less likely to fly through open areas or at heights where wind turbine blades are located, as they are not known to travel such long distances as *Lasiurus* sp. (Keeley et al., 2001).

As bats generally do not forage above 25 m, which is the lowest height of the blades on modern wind turbines (Erickson et al., 2002), it can be expected that the rate of bat mortality at modern wind farms is lower than at older facilities. Depending on the species, bats generally forage from 1m above ground to tree top level, or up to 5 m, 6 m or 10 m (Erickson et al. 2002). However, some species have been observed to occasionally fly as high as 30-200 m (Erickson). Many migrating bats, however, regularly fly much higher than 100 m or between 46 and 100 m (Altringham, 1996; Allen, 1939; both in Erickson et al., 2002).

Curry and Kerlinger (2005) drew several conclusions from the available data for more than a dozen wind farms across the US, including the following. Apparently, the number of bats killed is generally low, except in Minnesota and Wisconsin, where there may be “moderate” numbers. Many cases involved migrating bats, suggesting that migrating bats turn off their “sonar”, resulting in collisions with towers. Generally, members of only about seven species are involved, most of them common, tree-dwelling species, with widespread geographic distribution. Endangered and threatened species were not involved, and impacts on populations seem unlikely (Curry and Kerlinger, 2005). However, several bats that are considered threatened in Nova Scotia are considered secure in the US, or even Quebec (NatureServe, 2005).

The main trends regarding bat mortality according to BLM (2004) are: firstly, the majority of bat mortalities tends to be tree-dwelling vesper bats; secondly, most mortality involves migrant or dispersing bats rather than resident breeding bats (Keeley et al., 2001; Johnson et al, 2003 and Johnson and Strickland, 2004, both in BLM, 2004).

As has been experienced with avian mortality, proper design and siting of wind farms can be expected to reduce bat mortality to relatively insignificant levels (Defenders of Wildlife, 2005).

5.5.2.1.1 Pathways and Activities

If bats are present in the project area, they could potentially be impacted by activities during the construction and the operational phase of the project. Impacts from the decommissioning phase are not expected, since all the work would be done during the day, when bats are not active, and there would be no destruction of vegetation where some bat species may roost.

During the construction phase, bats could potentially be affected indirectly by reduction on quality and quantity of habitat. They could also be impacted directly through killing of individuals during the land clearing activity. Foraging would not be impacted, as the construction would only be carried out during the day.

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 (NS Museum, 2004). The presence of people in the area on a regular basis due to surveillance of the turbines and turbine maintenance or as visitors, as well as spills of toxic chemicals and spraying of herbicides or pesticides could potentially impact on bats.

5.5.2.1.2 Boundaries

The spatial boundaries are the project site, in particular the turbine sites, the roads and the ancillary infrastructure such as the control building. Temporal boundaries are the construction phase, i.e. late summer 2005 to spring 2006, as well as the operational phase, i.e. 20 –25 years from the start of the first turbines in late fall 2005. This timeframe will have to be extended if refurbishment of the turbines occurs.

5.5.2.1.3 Impact Assessment

In Nova Scotia, six bat species are listed "Yellow" in the NSDNR General Status of Wildlife report (Appendix E). While none of these species has been reported previously from the Canso area, little brown bat and Northern long eared bat are likely to occur in Canso, while Eastern pipistrelle may occur, but is not likely (see Section 4.3.4) (A. Hebda and H. Broders, personal communication). A habitat assessment resulted in the finding that there is potential summer foraging and roosting habitat for all six bat priority species. There are no caves nearby which could be used as hibernacula or for daytime roosting by certain species. Habitat quality is likely low (see Section 4.3.4). Tall trees are only found in the southern part of the project area, near turbine 10d-12d, and around turbine 5d, where a number of snags occur. Therefore, the number of bats is expected to be generally low. While no indications for the presence of bats were found during the field surveys, local sources confirm the presence of a small number of bats in the Town of Canso and near the wind farm area. Many bats are solitary and the likelihood to see them in a large area such as the project area is low. Little brown bats have been previously identified by a local naturalist, though the identification is not confirmed. As most northern bats migrate south for the winter, or migrate to suitable hibernacula, both resident bats and migrating bats can potentially be affected.

Impacts on bats could result from direct effects such as death of individuals related to project infrastructure, or indirect impacts due to loss or alteration of habitat. Whether an impact is significant depends on the number of bats impacted and the vulnerability of the species. Death and displacement of bats could potentially affect populations, if the number of individuals in Canso and in Nova Scotia is very low.

<u>Construction</u>

During the construction phase, bats could potentially be impacted by the destruction of habitat, or directly through killing of individuals during the land clearing activity.

Construction is scheduled to start in late summer, and will continue off and on during the fall, the winter and the spring. During late fall, winter and spring, bats would be hibernating. Several species move south for hibernation, other species seek shelter in caves, including the three species that could occur in Canso (A. Hebda, H. Broders, 2005, personal communication). Therefore, it is not likely that hibernating bats will be present in the area during construction.

Though a few stragglers (both resident and migrant) may still be in the area, potential nursery trees have been abandoned and there will be no flightless young at that time of the year. Bat foraging activities will not be impacted by noise, as there will be no construction activities at night. Therefore, direct impacts due to construction activities on resident or migrating bats are not expected.

Therefore, potential impacts on bats during the construction phase appear only possible as a result of habitat destruction or alteration. Habitat may be used for foraging, breeding, roosting and wintering. However, since there are no caves within the project footprint, wintering habitat is not impacted. The amount of woodland that actually is cut down to accommodate the turbines and roads is small compared to the total project area (0.5 %, see Section 5.6). Bats thus would have ample opportunity to use adjacent woodland. Also, the number of bats in the area is likely low, because the habitat does not appear to be of high quality. There are few tall trees and snags that could be used for roosting. In addition, little brown bats are generalist, known to live in forests and human dominated environments. It hunts over water and open areas including forest trails. Eastern pipistrelle prefer to hunt over water, and would therefore not hunt in the project area, except maybe over Chapel Gully. While Northern long-eared bats are a forest interior species, they hunt over forest trails (Broders et al., 2003) and accept buildings for roosting, as do Eastern pipistrelle and little brown bats. Therefore, impacts on bats from destruction, alteration or fragmentation of habitat are not likely.

Most bats prefer foraging near trees or water (review in Erickson et al., 2002), however Northern long eared bats forage over forest trails, while little brown bats forage over water or along forest edges or trails (Broders et al., 2003; BLM, 2004). The siting of turbines and the associated roads in wooded areas necessitates clearing of trees, thus increasing the amount of edge habitat in the area. Though the area cleared for the turbines is relatively small, this potentially may attract these bats. Since studies indicate the collision risk for resident bats is virtually zero, both during foraging (Bach et al., 1999, in Erickson et al., 2002) and during the commute between foraging sites and roosting sites (see above), the presence of the wind farm may be beneficial to the resident population of these three species, by increasing potential foraging habitat quality. Eastern pipistrelles tend to avoid deep woods, and Northern long eared bats can be found foraging over forest clearings, in addition to foraging in or above the canopy of woodland (NatureServe, 2005). The three species therefore are not likely to be negatively effected by these small parcels of cleared land.

<u>Operation</u>

During the operational phase, bats could be impacted by collisions with turbines or other infrastructure such as buildings and power lines, or by noise from the turbines if it interferes with foraging. The presence of people in the area on a regular basis, spills of toxic chemicals as well as spraying of herbicides could also potentially affect bats. Death and displacement of bats could potentially impact local populations, if populations are small.

Since bats are nocturnal, it is not likely that they would be negatively affected by the presence of humans during the day. Turbine inspections, maintenance or general visits to the wind farm would only occur during the day. Also, several bats species have adapted to use attics or similar structures for roosting, indicating that these species are tolerant of human beings. Therefore, impacts from the presence of humans are not expected.

The immediate clean up of spills of toxic chemicals is part of the management plan and wetland mitigation for the wind farm. Therefore, adverse effects on bats from spills are not likely.

Wind turbines are known to produce sounds. As bats use ultrasound (20 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 (NS Museum, 2004). Also, the sounds emanating from wind farms could potentially result in bats avoiding the area, or may attract bats to the turbines (Keeley et al., 2001), thus 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 is unlikely that bats would avoid a wind farm because of sounds. There seems to be no interference with 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 (Erickson et al., 2002). Therefore, sound emissions from turbines are not expected to adversely affect foraging activities or lead to displacement of bats.

Bat Collisions

As outlined in the background information overview, there is a potential risk to bats from collisions with turbines or ancillary structures. The risk for resident bats is different from the risk to migrating bats. Therefore the impact assessment will be carried out for resident and migrating bats separately.

Collision Risk of Resident Bats

Though there is a risk of fatal collisions with turbines when bats are present, most published reports show that mortality is generally low, though numbers may vary with the location of the wind farm. Moreover, Erickson et al. (2002) state 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 bat make across wind turbines (one mortality for every 70 passes) (Johnson et al., 2002, in Erickson et al., 2002). It can be assumed that the bat activity in the project area is dependent on the number of bats present. In Canso, the number of bats living and foraging in the area is likely low, since the habitat appears to be of low quality, due to lack of roosting trees or roosting structures, and maybe high winds. Even if there is some diurnal movement, which can span 5-10 km (A. Hebda, personal communication) between roosting sites (potentially in the Town of Canso) and foraging sites near the turbines, collision risk is low because, bats generally forage below 25 m height (Erickson et al., 2002). As this is the lowest blade height for the turbine model chosen for the Canso wind farm, bats are expected to rarely fly within the blade height, particularly since the trees in Canso are very short. Little brown bats and Northern long eared bats were typically caught near ground level (Broders at al., 2003). While Eastern pipistrelle “fly high” when foraging (Broders et al., 2003), they hunt over open water, and therefore are not likely to be found near turbines. Therefore, the risk from turbine strikes to resident bats at the project site is considered low.

There will be no impacts from collisions with guy wires, since these will not be used for the attachment of turbines. The risk form collisions with powerlines is considered negligible, since reports of deaths from power line collisions are generally scarce, and the local informant did not mention any finds of dead bats in Canso, even though they forage around street lights.

Collision Risk of Migrating Bats

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 it is believed they may turn off or reduce their echolocation calls and rely on sight (Curry and Kerlinger 2005; Van Gelder, 1956 in Keeley et al., 2001). Also, long distance migrants such as *Lasiurus sp*. may be more likely to fly through open areas or at heights that would bring them into contact with turbine blades or cables used for anchoring of 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, and an assessment for significance of potential impacts has to consider this, and the size of the populations.

Generally, the whole population of little brown bats migrates south for the winter (NatureServe 2005), though some little brown bat individuals may stay behind (Burt and Grossenheider, 1980). Little brown bats seem to hibernate locally in Nova Scotia, based on the number of hibernating bats found in caves (Moseley, 1997)). Eastern pipistrelle and Northern long-eared bat are listed as non-migrating in NatureServe, but Burt and Grossenheider state that some Eastern pipistrelle individuals may migrate. In Nova Scotia, both species appear to hibernate locally (Broders et al., 2003). Seasonal local or regional movements are likely for Northern long-Eared bat, though information is scarce (NatureServe, 2005). Eastern pipistrelle and little brown bats migrate to hibernacula up to a few hundred kilometers. Hibernacula in NS are located south and southwest of Canso, in Hants County and Halifax County (Moseley, 1997), as well as in Guysborough County (A. Hebda, personal communication.) Many little brown bats (e.g. 15,000 in one cave), some Northern long-eared bats and a few Eastern pipistrelle have been found in these hibernacula (Moseley, 1997).

Based on this information, it appears that Northern long-eared bats, Eastern pipistrelle and Little brown bats could potentially migrate through the wind farm area, if they occur north of Canso and hibernate south of it. Therefore, the number of migrating bats moving through the area could potentially be large. However, Eastern pipistrelle reach their northern limit in Nova Scotia (Burt and Grossenheider (1980); Broders et al., 2003), and are not likely to occur in Cape Breton or Newfoundland (H. Broders, personal communication). They do not occur in Northern New Brunswick, and only just graze Southern Quebec (Burt and Grossenheider, 1980). Little brown bats and northern long-eared bats live as far north as Newfoundland (NatureServe, 2005; Broders et al., 2003), and the little brown bat is also known from Labrador (Government of Newfoundland and Labrador, 2005).

Of the two species living north of the project site in Newfoundland and Labrador, Northern long eared bats do not migrate for the winter, while little brown bats may or may not, depending on the author (Natureserve, 2005; Erickson et al., 2002). However, bats, like birds, generally try to minimize the flight distances, and can be expected to follow similar flight paths as birds (A. Hebda, personal communication). Therefore, it can be assumed that bats try to fly to the closest hibernaculum. While there are records that little brown bats fly to the center of the continent, it is suspected that in the Atlantic region the migration may be more restricted due to the number of potential hibernation sites. There are several potential sites in Cape Breton, which have not been investigated yet, as well as in Guysborough County (A. Hebda, personal communication). It is likely that very few bats head out over the ocean (safewind, 2004; H. Broders, personal communication, 2005). Therefore, bats from Labrador are unlikely to detour through Nova Scotia, and bats from Newfoundland are likely to fly via Labrador. Consequently, the number of bats that potentially pass through the project area for migration is greatly reduced, effectively being restricted to local little brown bats and Northern long-eared bats. Though the numbers of bats migrating through the wind farm areas is likely small, there is a small potential for collisions with turbines.

Since there is little knowledge about the factors that determine the collision risk for bats (see above) and the numbers of migrating bats at the wind farm location, it is difficult to estimate whether the impact will be significant for the populations or not. Based on known mortality rates at wind farms, mortality can on average be 3.4 bats/turbine per year (range from 0.74 to 46.3) (Keeley et al., 2001; NWCC, 2004). For the eight turbines in Canso, this may result in 27.2 deaths per year, ranging from 5.9 to 370.4 collision victims. However, since low numbers of bats are expected, the number of collisions is likely at the low end of the range.

The population of little brown bats in Nova Scotia is estimated to be 300,000 (Moseley, 1997; A.Hebda, personal communication, 2005). NatureServe (2005) lists its subnational rank as “apparently secure“ for Nova Scotia, Newfoundland and New Brunswick, and as “secure” for Prince Edward Island. Northern long-eared bats are the second most common bat in Nova Scotia (A. Hebda, personal communication), and may rival little brown bats in numbers, contrary to common belief (H. Broders, personal communication). Both species are listed Yellow because of their habit to aggregate in a limited number of locations for hibernation, which makes them disproportionately sensitive to disturbance (A. Hebda, personal communication).

Because of the quite large numbers of certain bats in Nova Scotia, it is likely that populations of little brown bats will not be negatively impacted on a provincial scale, even though the reproduction rate is 1 young per year per female. Females are reproductive at least for 12 years, and maybe longer, since these bats may live to 20 or 30 years (NatureServe, 2005). Northern long-eared bat populations are also not likely to be impacted on a provincial scale. Eastern pipistrelles are not likely to occur in Canso, but should a bat of this species be killed at the turbines, the impact on the population would be much larger, since the number of these bats in Nova Scotia is small. Eastern pipistrelles generally have two young per year (NatureServe, 2005). Therefore, any Eastern pipistrelle killed at a wind turbine could be significant for the local population, and possibly for the provincial population. However, in the United States, this species is secure (S4, S5) (NatureServe, 2005). However, the likelihood for a collision of Eastern pipistrelle with a turbine in Canso is extremely small, as they are not likely to occur.

5.5.2.1.4 Mitigation

It is recommended that the removal of tall trees and snags should be limited to the areas where it is absolutely necessary for the project construction in order to protect bat roosting areas.

It is recommended that monitoring of the turbines for bat strikes be carried out for a limited time, particularly during the migration period in spring and late summer, early fall (i.e., April/May and August/September). If there are bat mortalities, they should be identified to species, when possible and reported to the local NSDNR office. If mortalities occur in numbers that may cause concern, discussions with NSDNR should be conducted on potential mitigation measures. A further literature survey should be carried out, which may uncover new research results, which may be used for the development of mitigation measures.

Mitigation measures put in place to protect birds may also help bats, if the assumption that they navigate by sight during migration is correct (see above).

5.5.2.1.5 Residual Impacts

No significant adverse impacts are likely. There is potential that there will be bat mortalities due to the project, however these mortalities are expected to be small in number and will not affect the overall population of bats in the area.

For Eastern pipistrelle, the residual impacts could be medium, but the likelihood of impacts is small.

5.5.3 Herpetiles and Invertebrates

Species at risk surveys for herpetiles, mollusks, lepidotera and odonata did not identify any species of concern. Though the flying times for the different species of butterflies could not all be covered with field surveys, the wetlands which could potentially hold the food plants for these species have been avoided in the project layout wherever possible. Impacts on potential breeding habitat for odonata have also been avoided by avoiding wetlands, limiting the crossing of Winter Creek to one and implementing sedimentation control measures during construction.

Therefore, no significant adverse impacts are likely to species at risk and critical habitat for these species.

5.6 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 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.

5.6.1 Pathways and Activities

Birds can potentially be impacted by a number of structures and activities related to all project phases of a proposed wind farm. The potential impacts vary with the project phase. Impacts from the decommissioning phase will be largely similar to impacts from the construction phase, though the impacts will be less intense.

5.6.1.1 Construction and Decommissioning

During construction and decommissioning phase, the activities related to construction of roads, buildings, turbines and utility lines, such as clearing and grading and turbine assembly, or their removal, can result in temporary disturbance of birds due to noise, visual impacts and the presence of humans (workers in the area). This disturbance is mainly temporary. Also, land will be used for the footprint of the turbines, buildings, power lines, road and lay-down areas, resulting in a temporary or permanent loss, fragmentation, alteration or degradation of breeding, feeding and resting habitat. Also, there may be a risk for exposure to contaminants, particularly to hazardous materials such as oil from building or turbine equipment or equipment refueling.

Other potential pathways may be 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 that may result in habitat degradation. Also, construction may lead to direct injury or death of adult birds, nestlings or eggs through collisions or the destruction of nests, depending on the timing of the construction activities.

During the construction and de-commissioning phase, the biggest effects on birds are expected from the disturbance of habitat (BLM, 2004).

5.6.1.2 Operation

During the operations phase, birds may be impacted by the turbines, wind tower and ancillary buildings, as well as by the maintenance activities.

Birds are at risk of direct injury or death from collisions with turbines and overhead powerlines, as well as electrocution from powerlines. The risk will be different depending on the species, due to differences in avoidance behaviour, flight patterns, food source, etc. Birds may also be attracted to lights on turbines (if required), and lights used to illuminate the substation and other ancillary structures, potentially leading to increases in collisions, electrocution, or other sources of premature death.

Also, the operating turbines may prove to be a barrier to bird movement due to avoidance. Finally, the presence of humans in the area for regular surveillance of the turbines, maintenance and repair activities on turbines and roads as well as humans as visitors, may result in disturbance of birds, and may lead to avoidance of potential breeding habitats and permanent displacement. Disturbance and interference with normal behaviour such as feeding, migration and breeding, may also be caused by turbine noise (BLM, 2004).

Potential impacts in each project phase and the related project activities or structures are summarized in the following table (5.1). Project boundaries are included as well.

TABLE 5.1 Potential Impacts of Wind Farm Projects on Birds[1]

Potential Impact	Project Activity or Structure	Pathway	Duration and Physical Boundaries
Construction Phase/Decommissioning Phase			
Habitat loss, alteration and degradation (resulting in loss of birds)	Site clearing and grading, construction of turbines and roads. Construction equipment travel	Habitat destruction, habitat fragmentation; introduction of invasive plant species resulting in habitat degradation; changes to the water regime resulting in habitat degradation	Long-term in the project foot-prints (tower pads, roads, ancillary structures[2] Short-term or long-term in lay-down areas, depending on whether original habitat can be or should be restored.
Direct injury or mortality	Site clearing and grading, construction of turbines and roads, construction equipment travel	Nests or eggs destroyed by land clearing during breeding season; collisions with construction equipment	Short-term, but may have long-term effects; project footprint.

TABLE 5.1 Potential Impacts of Wind Farm Projects on Birds[1]

Potential Impact	Project Activity or Structure	Pathway	Duration and Physical Boundaries
Disturbance of normal behaviour: foraging and breeding; Habitat avoidance: disturbance/displacement / exclusion of birds	Site clearing and grading, construction of turbines and roads, construction equipment travel	Noise from construction activities including blasting and equipment travel, resulting in habitat avoidance; presence of humans; habitat destruction	Short-term; project area
Disturbance of normal behaviour: migration and commuting	Site clearing and grading, construction of turbines and roads, construction equipment travel	Disruption of migratory movements; avoidance of construction areas for resting and feeding due to noise, presence of humans, habitat destruction.	Short-term; project area
Mortality or health impacts from exposure to toxic contaminants	Accidental spills during equipment refueling; Leakage of stored fuels or toxic chemicals (such as transmission oil for the turbines)	Exposure to toxic chemicals, including gasoline from planned releases or spills	Short-term and restricted to the location where the spill occurred
Respiratory health	Site clearing and grading, construction of turbines and roads, construction equipment travel	Emissions of fugitive dust	Short-term; project area
Drinking water supply	Site clearing and grading, construction of turbines and roads, construction equipment travel	Erosion and run-off	Short-term, but may extend beyond project area.
Operation and Maintenance			
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 or changes to the water/drainage regime due to roads or erosion	Short-term and long-term; in the project footprint (tower pads, roads, ancillary structures[2]; hydrological effects may extend beyond the project area.
Direct injury or mortality	Presence and operation of turbines, power lines, and transmission lines; turbine lights	Collisions with the structures, electrocution from power lines; 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	Human access	Legal or illegal hunting	Long-term; project area
Direct injury or mortality to nest and young	Maintenance of right of way, turbine site and substation site maintenance	Mowing or cutting of vegetation	Short-term, but repeatedly; restricted to project area
Disturbance of migration and daily movements (barrier effect)	Presence and arrangement of turbines	Turbine size, arrangement, and wing 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 wing 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

TABLE 5.1 Potential Impacts of Wind Farm Projects on Birds[1]

Potential Impact	Project Activity or Structure	Pathway	Duration and Physical Boundaries
			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, vehicle fuel or pesticides/herbicides used for maintenance	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	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.	Long-term; project area and potentially beyond

Note: [1] Table is based on BLM, 2004
[2] Since the power lines will follow the route of the access roads, and the substation is near existing power lines, there will be no new utility corridors.

It should be noted that a wind farm can have positive impacts on birds. These may include the creation or enhancement of habitat; increasing the access to prey for raptors (e.g. due to vegetation management); and reducing the effects of climate change.

5.6.2 Boundaries

5.6.2.1 Construction and Decommissioning

The spatial boundaries are given by the area within which the birds react to the sounds and sight of the activities, or by the land area that is used for construction. This area will vary depending on the species of bird. Generally, impacts would be mostly restricted to the immediate project area (BLM, 2004), as the biggest impacts in this phase are expected from changes to the habitat.

Temporal boundaries are the construction phase/decommissioning phase. However, since the construction will be in phases and will move from one site to another, the disturbance will not be equal in all areas of the wind farm at the same time (Table 5.1).

5.6.2.2 Operation

The spatial boundaries during the operation phase are described by the "sphere of influence" of the turbines and the roads, as well as the area that is impacted by the noise or sight of humans, vehicles and turbines (i.e. the area within which the birds react to the sounds and sight of the activities). This area will vary depending on the species of bird, resulting in some spatial variability. The spatial boundary for the impact from collisions is the sweep diameter of each turbine. However, if there are barrier effects from the turbines, the boundary may encompass the whole wind farm footprint, or particular lines of turbines.

Temporal boundaries for effects during the operations phase are the duration of the operations phase (long-term), but some effects may be short-term. There is some variability, since the wind farm may be refurbished at the end of its normal 25 year lifetime.

5.6.3 Impact Assessment

Any bird using the wind farm area may be impacted by the wind farm related structures and activities. The field surveys carried out in the Canso area in 2004 and 2005 have shown that there are breeding birds, non-breeding but resident birds, migratory birds, and wintering birds which use the wind farm at different times of the year. Among the breeding and migrating birds, there was a comparatively small number of species of conservation concern (4.4).

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. Effects are generally small (Kingsley and Whittam, 2003).

The potential impacts and their significance are known to differ between breeding/resident birds and migrating birds. Therefore, the assessment will be carried out for both groups separately where necessary. Also, some potential impacts vary with different groups of birds. For example, raptors appear to have a higher risk of collisions than songbirds. A summary table relating impacts and bird species groups is available for Europe (Langston and Pullan, 2003). Therefore, the impact assessment will look at the different groups of birds separately, if differences are known.

5.6.3.1 Impact Assessment – Habitat Loss

During the construction of the wind farm, habitat will be lost, altered and fragmented. This will be the biggest impact on birds during this project phase (BLM, 2004).

Avoidance of areas can be considered to be in effect a loss of habitat, even though the habitat is not destroyed. In this section, loss of habitat by destruction, as well as modification and degradation are considered, while avoidance will be dealt with in a later section.

During the construction of the wind farm, there will be loss of habitat, as a certain area of land will be used for turbine pads, access roads and the substation. This will result in permanent loss of breeding habitat, as well as feeding and resting habitat for non-breeding and migrating birds. Other land will be used for lay-down areas. Habitat on this land will be altered and disturbed, and may return to the original vegetation immediately after the end of construction, or may initially re-grow with altered vegetation (hydro-seeding). This impact will consist of a short-term loss of breeding 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. Trees with a diameter of 15 cm or more (C. Stevens, personal communication) are suitable for owl breeding. If such trees are cut down, owl habitat is essentially destroyed in those areas, and a few owls may have to move away from the project site due to competition for the remaining trees, if the remaining habitat is at its carrying capacity. However, a loss of the owl population is not expected.

Generally, the impact of habitat loss and alteration due to the Canso wind farm project would be considered small, since the amount of habitat that will be disturbed is very small compared to the total project footprint. The land used for permanent wind farm infrastructure, based on an 8 – turbine layout and a road width of 10 m, is 32,820 m^2. Roughly 6,500 m^2 will be used for lay-down area. Both together equal about 0.5 % of the total project area (6,750,000 m^2).

Breeding, feeding and resting birds, including migrating birds, will be permanently or temporarily displaced from the destroyed or altered habitat. However, since the area lost is so small, the likelihood for significant adverse effects on the birds is considered nil, unless unique habitat and/or habitat occupied by a protected species is affected. Due to adjustments of the project layout in response to results of field surveys, no such habitat will be permanently or temporarily destroyed.

Care was taken that no unique habitat types were destroyed. All habitat found on turbine locations is available in surrounding areas. Habitat in Chapel Gully Park, for example, is similar or identical to habitat in the project area. Therefore, no bird species should be permanently displaced from the project area. The limited variety of habitats in the project area (see Habitat and vegetation survey) facilitates this approach. Therefore, feeding and resting birds can easily move a short distance to find suitable habitat, and the overall small reduction in habitat area should not result in negative impacts due to restriction of the food supply, which could result in competition and maybe loss of birds. There may be displacement of some breeding birds due to competition for suitable territory, if the remaining habitat is at its carrying capacity, which is not known.

The pre-construction bird surveys carried out in 2004-2005 showed that there is a small number of protected bird species or bird species of conservation concern present in the project area (see Section 4.4.). As indicated above, feeding and resting birds, including migrating birds, are not likely to be negatively impacted. However, loss of breeding habitat could potentially have significant effects on breeding of rare species.

Five bird species of special status were discovered on or near turbine sites during the breeding bird surveys in spring 2004, and two species in 2005 (see Sections 4.4.3.3 and 4.4.3.5). Of these, common loons were spotted flying high above the turbine locations, and Philadelphia Vireos are non-breeding summer strays. Boreal chickadees are common breeders in the Canso area, and black-backed woodpeckers were found feeding near a few turbine locations, but do breed at a distance from the project area (Section 4.4.3.3). Therefore, these four species should not be negatively impacted by effects on their habitat. However, there were breeding long–eared owls within the 100 m radius around the original turbine 4 location (2004). Therefore, this location was abandoned and the turbine now is located west of the original site. Long–eared owls require stands of tall trees for nesting. This type of habitat is only available near the southern rim of the project site (i.e. between turbine 10/10d, and 4, and again near turbine 5d). Long-eared owls were heard about 200-300 m west of turbine 10d. Such habitat has been avoided, and will be avoided should more adjustments to the project layout be necessary, e.g. after the geo-technical surveys.

In summary, significant impacts on birds from destruction or alteration of habit due to construction are not likely, particularly if breeding habitats of rare species continue to be avoided.

During both construction and operation of the wind farm, bird habitat can potentially be altered and degraded through changes in the hydrological regime and the introduction of invasive species. This, in turn could potentially impact the diversity and abundance of bird species in the area. These effects could be significant if large areas, unique habitats or habitats for rare species, particularly breeding habitat, are disturbed. These effects would be most pronounced in areas adjacent to the infrastructure (invasive vegetation, pond formation), or in wetlands upgradient or downgradient from the project infrastructure. Considering the small size of the project footprint, the availability of similar habitat in adjacent areas, the mitigation measures suggested for habitat and wetland protection (Section 5.3), and the species of rare birds breeding in the project area, significant impacts from habitat alteration and degradation in the project area are not likely.

Construction of the wind farm infrastructure, especially roads will lead to habitat fragmentation. Effects depend on the type and abundance of the affected habitat and the species of birds using it. Generally, birds preferring interior forest habitat are known to be particularly vulnerable to habitat fragmentation. However, habitat in the project area consists of low and tall shrubs, interspersed with limited areas of short trees. There are few areas with tall trees. Also, much of the area has been disturbed before, by clear cutting or fire, and the project footprint is small. Therefore, significant adverse effects are not likely.

5.6.3.1.1 Mitigation – Habitat Loss

Suggested mitigation measures include avoidance and reduction measures. Compensation will not be necessary. Avoidance of important habitat areas (rare species breeding) has already been implemented in the project lay-out. Also, the area used for the project footprint has been minimized in the project layout (turbine pad, road length, etc). In addition, care should be taken that trees with a width of 15 cm or more, are not cut down unnecessarily. Construction activities should not encroach on habitat at Chapel Gully Trail. Measures to prevent or minimize impacts on the hydrological regime and the introduction of invasive plant species as discussed and outlined in the section on wetlands (Section 5.3) will mitigate bird habitat effects as well. There are no further recommendations.

5.6.3.1.2 Residual Impacts – Habitat Loss

The implementation of the mitigation measures will likely leave minimal effects on the local long-eared owl population, no effects on regional long-eared owl populations, and no significant residual effects on other habitats and birds species. Additional mitigation measures are not necessary. However, it should be considered whether direct habitat loss as described here, and habitat loss from avoidance, are additive (Langston and Pullan, 2003).

5.6.3.2 Impact Assessment – Disturbance and Avoidance

The sight and sound of humans and vehicles and other engines are known to disturb birds, as does the presence/noise of turbines. These effects therefore can occur during construction phase as well as the operation phase, which includes maintenance activities and turbine monitoring visits by wind farm personnel.

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 sensitivity to disturbance varies from species to species, and may also vary with the type of behaviour that is influenced. Studies in the Netherlands showed that the density of breeding birds near roads was reduced from areas more distant from roads (from BLM, 2004). Monitoring studies of wind farms showed that, in a given species, the birds were much less sensitive to turbine presences as a breeding bird than as a migrating, but resting bird (windenergie.de, 2005). Sounds produced by the turbine may also disturb birds, but many birds quickly adapt to the sounds and turbine presences, and move back closer to the turbines, particularly for breeding. Also, birds do not hear as well as generally thought, and therefore are not likely to avoid wind farms due to turbine noise (Dooling and Lohr, 2001, in Sea Breeze, 2004). The total area avoided on the long term therefore is smaller than the areas initially avoided, for most species.

Again, the level of habituation varies with the species. If certain birds do not habituate, and wind farms are large, the area of exclusion is large and may be significant. Negative effects can result if the displaced species is a species at risk and there are no suitable habitats, or if there are no sufficient amounts of suitable habitats nearby to accommodate displaced birds.

Disturbance effects may be significant, particularly for off shore wind farms or developments in habitats such as prairie grouse. This is because sea birds and prairie grouse species seem to be particularly sensitive to disturbance (Kingsley and Whittam, 2003). Disturbance effects may have an even more significant impact than direct mortality (Kingsley and Whittam, 2003), however, they get much less attention, including from the public.

Kerlinger (2001, in Kingsley and Whittam, 2003) , after reviewing available data for US and Europe, states that relatively few studies look at disturbance. Though they are “inconclusive”, they show that in certain situations, bird behaviour is affected by wind farms.

Since disturbance and avoidance vary from species to species, and may also vary depending of 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 be larger for previously undisturbed areas. Though the frequency of pre-construction visitors in the project area is not known, ATV use and paths give evidence that this area is essentially not “previously undisturbed”. Since data on disturbance and avoidance are scarce, the assessment of these effects is charged with a high degree of uncertainty.

<u>Human Presence</u>

The sight of humans and vehicles, as well as the human-related noises, are highly likely to scare away birds. The severity of the effect will differ depending in the species and the frequency of the disturbance. Disturbance effects from human access to areas near the turbine sites (similar habitat) have been previously observed: after the construction of the board walk for the Chapel Gully Trails, which increased the number of people using the barrens, local birders noticed a permanent reduction in the number of birds breeding and feeding in the area within the Trail system (T. K., personal communication). It is likely, that migrating birds also try to avoid areas near the Chapel Gully Trail paths when humans are present. As the habitat in this area is similar to the habitat in the project area, the species composition was likely the same, thus indicating that the same effects can be expected in the wind farm area. Adverse effects on birds therefore are likely.

During the construction of the wind farm, the presences of humans and equipment, as well as the noise and lights associated with this presence and activities, is highly likely to disturb birds and make them move a short or longer distance to avoid the areas where construction is taking place. However, construction will encompass about three to four months at the end of 2005 and about three months in early spring of 2006. The impacts on birds during the construction period therefore are short term. In addition, construction will be “moving”, thus limiting the impacts on each individual area even more. Therefore, all food supplies should be accessible eventually, so that birds do not have to leave the Canso area, but can just move around within the project area. Also, construction will be carried out outside of the breeding season, which is a critical point in a birds’ lifecycle. By preventing impacts on breeding birds, which may have resulted in destroyed or abandoned nests, or a lack of food for the young when parents avoid certain feeding areas or hide from intruders, the severity of potential impacts has been greatly reduced.

Due to the timing and movement of the construction work, both breeding and migrating birds should not be affected significantly, since food and quiet areas will be available. Wintering birds, which would suffer the most from disturbances since they would spend extra energy on flight, should not be affected, as construction ceases in the winter. Therefore, significant impacts from habitat avoidance during construction of the wind farm are not likely, as impacts are small, limited to short term intervals and limited areas.

During the operation of the wind farm, people and vehicles will be using the new roadways regularly to inspect the turbines. In addition, it is highly likely, that visitors (i.e. the public) will take advantage of the access roads to explore the newly accessible areas, which previously was relatively sheltered from human intrusion due to the lack of comfortable paths. ATV riders used the former emergency access road (near turbine 3 and 4) to access these backwoods and the coast. Hunters and trappers (snares) used narrow and often hardly visible trails that criss-cross the wind farm area for their purposes. As expressed during the Open House meetings, Town people are interested in using the access roads, and even to include them as a part of the Chapel Gully Trail system.

Therefore, impacts from the presence of humans during the operational phase, and likely beyond (even if the access-roads are re-claimed), are likely. However, these disturbances are very short term and intermittent, and generally at low noise levels (human speech: 60dB(A), see Section 5.9). Therefore, there should be no lasting effects (BLM, 2004). However, the observed reduction of bird numbers on Chapel Gully Trail, appear to contradict this statement. Since there are no data available on disturbance effects of human beings in conjunction with wind turbines, just data on the effects of the existence of wind farms, the assessment of the significance of this effect will be included in the assessment of the presence of wind farm infrastructure (see below). In addition, avoidance behaviour and habituation varies from species to species, and there are no data available on avoidance of humans that distinguish between species.

Construction Noise

Construction equipment produces loud noise of 81-85 dB(A) within about 15 m and diminishes to the mid 40 dB(A) at about 1524m from the construction site. Heavy truck traffic at 80 km/h is estimated at 55 dB(A) (BLM, 2004). Research has shown that noise can affect a wide range of bird behaviour, including behaviour related to reproduction, such as song learning, territorial defense, territorial selection, foraging and fledging success (reviewed in BLM, 2004). Some studies on the effects of continuous noise (e.g. from roads) on bird populations showed that a number of species reacted with lower population densities at distances from 20 m to 3,530 m from the road. About 60 % of the forest species and 58 % of the grassland species investigated showed such effects (BLM, 2004). Reijnen et al. (1996, in BLM, 2004) calculated threshold effect sound levels of 47 dB(A) for all species combines and 42 dB(A) for the most sensitive species. These sound levels would be at or below the sound levels created by truck traffic at 76 m distance and construction equipment at 762 m distance. Noise has negative, but usually temporary, effects on raptors (BLM, 2004).

Therefore, adverse effects from wind farm construction are likely, but will be short term and therefore are not significant.

Turbine and Maintenance Noise

During the operation of the wind farm, noise is generated by the turbine operation and maintenance activities. Since vehicle traffic for turbine visits, as well as maintenance activities such as vegetation cutting are either infrequent, and/or very short-term and/or have low noise levels, significant adverse effects on birds are not likely (BLM, 2004). Minor short-term annoyance is likely, but not significant (BLM, 2004).

Turbine noise, however, is produced constantly over the lifetime of the project, and could potentially result in significant impacts on birds due to habitat avoidance and interference with behavioural activities.

Studies of wind farm effects on bird populations showed that certain birds, such as grassland species, showed that population density was lower at a distance of 80 m from the turbines than at distances of 180 m and in control areas. While adverse effects are obvious, it is not clear whether avoidance was due to the turbine noise, access roads or turbine blade movement (BLM, 2004). Studies of other noise sources, such as gas compressors, suggest that bird population densities near wind farms may be reduced when continuous noise levels are at 40 dB(A) or above, and greatest reductions are in areas with noise of 50 dB(A) or more (LaGory et l., 2001, in BLM, 2004). Population densities were reduced by up to 25 % in areas with noise levels of about 50 dB(A) (Lee and Griffith, 1978; in BLM, 2004).

Birds do not hear as well as generally assumed. In particular, they do not detect high and low frequencies as well as humans do (SeaBreeze, 2004). Noise measurements at existing wind farms showed that blade noise on a moderate wind day is spread out evenly over the frequencies birds can hear (1-5 kHz), thus blending into the background noise (e.g. from the wind itself), so that it would be in-audible to birds beyond 25 m from the base of the turbine

(Dooling, 2002, in BLM, 2004). Birds may not be able to distinguish between blade noise and ambient noise if the difference is within 1.5 dB(A) (BLM, 2004).

Due to changes to turbine blade design, modern wind turbines produce much less noise than older models. In Canso, blade noise would be about 58-60 dB(A) at the base of the turbine, which is equal to the noise produced to talking people or a busy general office (see Section 5.9). While these noise levels are above the threshold limit of 40 dB(A) for continuous noise, these levels would not be continuous (variation in wind intensity), and on many days they would be indistinguishable from wind noise. Also, many bird species would be able to habituate. Since sounds from the Town and people on the trail are audible at several turbine locations, it can be expected that a number of the species occurring in part of the project area are not very sensitive to sounds. Therefore, while there likely are adverse effects on some species, resulting in avoidance of areas near the turbine, significant impacts are not likely for most bird species. Since noise effects lead to reduced population densities, and not exclusion of all birds (see above: Lee and Griffith, 1978), the most likely effect is a shift in species composition, with species able to habituate having an advantage. Significant impacts therefore would only be likely if a rare or protected species would not be able to habituate, and suitable habitat would not be available for them at a short distance.

As avoidance behaviour and habituation varies from species to species, and studies on species differences generally investigate avoidance of wind turbines without distinguishing between potential causes (height, movement, noise), the assessment of the significance of this effect will be included in the assessment of the presence of wind farm infrastructure (see below).

<u>Turbine Presence</u>

Few studies document disturbance effects of wind turbines on birds, which may result in habitat avoidance and changes in population densities. The existing studies do not distinguish between the effects of height, movement and noise. Available data indicate that the extent of avoidance and habituation differs between bird species. Sensitive species include divers, raptors, wildfowl and waders, but breeding passerines generally are not significantly affected (Crockford 1992, Gill et al., 1996, Percivall, 2000, Langston and Pullan, 2003; in: Lewis Wind Power, 2004). The following discussion is based on three reviews (Kingsley and Whittam, 2003; Langston and Pullan, 2003; www.windenergie.de, 2005). Langston and Pullan (2003) apparently summarize information for birds during a variety of activities (i.e. breeding, resting, migrating), but the study summarized in windenergie.de (2005) distinguishes between breeding birds and resting (migratory) birds (Table 5.2). While the information is for European species, the data may give some indications for North American species, since behavioural similarities are likely. On the other hand, data also indicate that there are differences between closely related species (Kingsley and Whittam, 2003). In some studies, sea birds and prairie grouse species are particularly easily disturbed by wind turbines (Kingsley and Whittam, 2003). However, in Europe, Red grouse was not greatly affected by turbines, and may even nest close to the turbine base (Bioscan, in Lewis Wind Power, 2004). Data appear to indicate that some breeding birds are less sensitive to displacement than migrating birds.

The birds found in Canso represent several different species groups.

TABLE 5.2 Disturbance Effects on Birds

Species Group and/or species	Disturbance displacement*	Barrier to movement *	Sensitivity to Disturbance ** Breeding Birds	Sensitivity to Disturbance ** Resting migratory or wintering birds
Gaviidae – loons	+	+	n.a.	n.a.
Podicipedidae – grebes	+	---	n.a	n.a.
Sulidae – gannets and boobies	---	---	n.a.	n.a.
Phalacrocoracidae – shag	---	---	n.a	n.a.
Ciconiiformes – herons and storks	---	---	n.a.	n.a.
Anserini – swans and geese (incl. barnacle goose and brants)	+	---	n.a	high (2 geese), medium-high (2 geese, one swan)
Anatinae – ducks (eider, long-tailed duck, common scoter)	+	+	n.a.	low (eider, mallard); medium – high (2 sp.), high (1 sp.)
Charadriiformes – waders (certain plovers, godwit, European Curlew)	+	+	Low to medium	Medium –high (plovers: high)
Gruidae – cranes	+	+	n.a.	High
Sternidae – terns	---	---	n.a.	n.a.
Gulls – laridae	n.a.	n.a.	n.a.	low to ‘medium’ (2 species), high (1 species)
Alcidae - alcids/auks (guillimot)	+	---	n.a.	n.a.
Accipitridae – raptor (certain kites, vultures, eagles)	+	---	Low	low (2 species), low to ‘medium?’ (1 sp.)
Otididae – busards	+	---	low and low to ‘medium?’	n.a.
Strigiformes – owls	---	---	n.a.	n.a.
Tetraonidae – grouse	+	---	n.a.	n.a.
Passeriformes – passerines	----	---	Low	mostly low, some low-medium;

Source: * Langston and Pullan, 2003; ** windenergie.de, 2005
Note: + species or species groups that are particularly sensitive, or potentially so, to wind farms
--- generally indicates lack of data rather than no vulnerability.
n.a. not available
Low Species does not react or moves a short distance. Population changes are within the natural variation.
Medium=Species shows clear special movement up to about 200 m. Population diminishes, but there is no exclusion.
High Species moves clearly more than 200 m; populations are lost, and there are areas where the species is excluded (missing) .

Waterfowl

Several studies investigating disturbance effects of wind turbines on waterfowl indicated that disturbance effects are apparently the most important effects of wind turbines on waterfowl. Diving ducks avoid turbines, especially in poor weather. Eiders avoid flying or landing within 100 m of a turbine (Kingsley and Whittam, 2003). However, no other difference in abundance, foraging or movement was noted (Kingsley and Whittam, 2003). Another author did not find clear avoidance behaviour in migrating eiders (windenergie.de, 2005). Similarly, swans and ducks were observed to ensure sufficient distance from turbines. On the other hand, avoidance was very species-specific, with even closely related species reacting differently. While pink-footed geese were reluctant to feed within 100 m of a turbine, Barnacle geese fed as close as 25-50 m of a turbine, and Canada Geese foraged right at the base of turbines (Kingsley and Whittam, 2003). Studies in Europe also found disturbance displacement (Table 5.2). The effects on resting migratory or wintering birds ranged from hardly noticeable to high, with reduced population densities and exclusion areas noticeable for more than 200 m (windenergie.de, 2005).

In Canso, a number of waterfowl found throughout all seasons, breeding, migrating and wintering. Based on the above information, disturbance effects on some species are likely, while other species will not be effect. Since several of the species found in Canso are of conservation concern, impacts are potentially significant, if important habitat is lost for these species. Significant impacts on other species are not likely. Protected waterfowl species found in the project area are common loons (observed in all surveys, but not breeding in the project area), Barrow's golden eye and harlequin duck (both observed during migration and wintering surveys).

While disturbance and avoidance effects have been found on a loon species, as well as several duck species (Table 5.2), the "sphere of influence" was highly variable from species to species, and no data are available on the three species of interest. However, since the turbines are located at least 100 m (turbine 6-8d) or more from the coast, the species of concern are not breeding in the project area, and there is plenty of suitable habitat available at distances of more than 200 m from the turbines, significant impacts are not expected. In addition, the species of interest might well show no avoidance or may habituate.

<u>Aerialists and Seabirds</u>

Cormorants can react to short-term disturbance during the construction of a wind farm, but returned when construction ended (Percival 2001 in Kingsley and Whittam, 2003). Gulls may show avoidance behaviour during certain times of the year (Winkelman, 1995, in Kingsley and Whittam, 2003).
Data from Europe suggest that most gulls show no noticeable displacement, but at least one species showed high sensibility (*Larus argentatus*). Also, guillemots showed displacement reactions (Langdon and Pullan, 2003). It is not clear if terns did not show displacement or were not studied (Table 5.2).

In Canso, no seabirds or aerialist were found breeding in the project area. In the breeding season, few were found feeding within 5 km from the project area, including all three protected tern species. The terns were also present in coastal areas near the project area during fall migration, but those birds were likely predominately the resident birds. No terns were present during winter or early spring (see Section 4.4). Based on the above information, adverse effects on seabirds and aerialists from avoidance of the turbine area are not likely, partly because most turbines are more than 100 m from the coastal areas where the birds were seen. Since the Terns did not breed on or near the turbines, significant effects on terns are not expected, even if they should react with avoidance, as there is no loss of critical breeding habitat.

Shorebirds and Waders

European studies showed that Purple sandpipers were not disturbed by either construction or operation of a wind farm. Other European studies report contradictory observation: while some report that shorebirds avoided turbines by as much as 500 m, others did not find any differences in distribution. However, the discrepancy may be related by to availability of suitable habitat. If there was an option to move to another site distant from the turbines, birds may move (Kingsley and Whittam, 2003). This may be applicable to other species with specific habitat requirements (Kingsley and Whittam, 2003). Shorebirds are easily disturbed by predators and people.

Wind turbines placed close to nesting colonies of herons may interfere with the breeding due to disturbance (Kingsley and Whittam, 2003). Langston and Pullan (2003) find displacement in certain shorebirds and waders (European golden plover, black-tailed godwit, European curlew). Another author found no reaction or a medium, tempered reaction of breeding waders, resulting in a reduction of population densities up to 200 m in some species (windernergie.de, 2005), while migrating and resting birds showed medium to high effects. Interestingly, some of the species were studied as breeding and as migrating birds, and showed a higher sensitivity as a migrating bird, including exclusion from areas within 200 m of the turbines (windererergie.de, 2005) (Table 5.2).

In Canso, a number of shorebirds and waders were found during the breeding bird and fall migration surveys (Section 4.4). Only willets were found breeding within the project site, but some other species were found breeding or feeding along the coastline, none a protected species (Sections 4.4.3.3.1 and 4.4.3.3.3). A larger number of species and individuals were found along the shoreline within 2 km from the turbines during fall migration, including one protected species, the semipalmated sandpiper (4.4.4). These were seen at 400-960 m distance from the proposed turbine sites; in addition, there is no shorebirds migration corridor located near the turbines, since most birds move from island to island, off the coast (except spotted sandpiper).

Few shorebirds and waders were found wintering along the shoreline within 2 km (Section 4.4.5), with purple sandpipers (listed S3N by ACCDC) as the only common winter visitor in this group. During early spring migration, several species of shorebirds and waders were registered within 2 km of the turbines, including snowy egrets. The latter are a protected species. They occur in Canso as a rare, but regular spring migrant (Section 4.4.7).

Based on the available information, displacement effects on some shorebirds are likely, while other species will not be effected. However, since breeding birds are less sensitive than migrating birds, and the turbines are generally at least 100 m from the coastal areas or the or salt marsh (breeding wimbrels), disturbance is judged to be not significant. This includes two species of conservation concern, the semipalmated sandpiper (protected) and purple sandpipers (S3N by ACCDC). The reasons are that the semipalmated sandpipers frequent areas at more than 400 m distance from the nearest turbines, and purple sandpipers are known to be not disturbed by wind turbines, nor their construction (Kingsley and Whittam, 2003). The snowy egret was also not in the project area.

Diurnal Raptors

Data on disturbance effects are scarce. However, disturbance effects leading to displacement were reported by Langston and Pullan (2003), as well as by winderengie.de (2005), for members of the *Otididae* (buzzards) and *Accipitridae* (Table 5.2). However, the report in windenergie.de (2005) finds no noticeable displacement for most raptors, both as breeding and migrating birds, while other species show no effects or an unclear, medium reaction (i.e., potentially a reduced population density within 200 m (winderergie.de, 2005)).

In Canso, a number of diurnal raptor species were found both within the project area and in surrounding areas during all seasons, though the species composition changes over the year (Section 4.4). One of the diurnal raptors is listed as Yellow by NSDNR (Northern Goshawk), which was only found as an uncommon early spring migrant. No diurnal raptors were reported as breeding birds, or as wintering birds near turbine locations (Table 4.4.17).

Based on the available information, there is a small potential for displacement effects in some of the species, but likely not in all species. However, these effects are likely not significant, because raptors generally appear to show no strong adverse effects. This is also suggested by the reports of raptors as regular victims of collisions with turbines. Also, some reports indicate that raptors actually are attracted to turbines for perching while hunting, and even nesting, when lattice towers are used (Kingsley and Whittam, 2003). Though all raptors are protected under the *Nova Scotia Wildlife Act*, significant impacts on raptors are not expected, since they seem to have a high tolerance to turbines and may not frequent the turbine locations.

Nocturnal Raptors (Owls)

There are no data available on whether disturbance effects on owl exist or not. However, the fact that owls are among the victims of collision with turbines suggests that they do not avoid turbines, or do not move far away. However, it is likely that different species of owls may not show the same reaction.

During the field surveys carried out in and around the project areas, three species of owls were identified as breeding on or near turbine sites (Section 4.4.6), with 20 individuals counted, including a pair of long-eared owls. Another two species were found 10 km and 40 km, respectively. All owl species are protected under the *Nova Scotia Wildlife Act*, and long-eared owls are also listed as Yellow with NSDNR (Appendix E). Owls other than long-eared owls were found breeding on or near site 1d, 6d, 7d, 9d and potentially 2d, and the long-eared owls breed between Turbine 11d, 10d and 12d. All most all sites were used as feeding areas for by owls, mostly Northern saw-whet owls. Site 5d contained suitable owl breeding habitat.

Since there are no data available on how owls react to disturbance from turbines, it has to be assumed that adverse effects are likely. Due to the extensive use of the area by owls, disturbance effects on owls could be significant if breeding habitat is lost, particularly for the long-eared owls. Mitigation measures should be considered.

Passerines, Non-aligned Birds, and Gamebirds

Disturbance effects on breeding forest songbirds have been noted, though disturbance effects on most birds was low, as several species nested within 20-30 m of the turbine (Kerlinger, 2003, in Kingsley and Whittam, 2003). A few species, including Swainson's thrush, were found to have moved further into the forest, away from the turbine and the clearing cut for it. Therefore, it is not known if these birds avoided the turbine or the clearing.

Many grassland species, however, show displacement effects, with breeding density diminished within 100-200 m of turbines, and reductions of over 50 % within 50 m of the turbines (Leddy et al., 1999, in Kingsley and Whittam, 2003). At other locations, though, grassland songbirds such as horned lark did not show signs of disturbance, as they were feeding under the turbines (Kerlinger 2003, in Kingsley and Whittam, 2003). It is not known yet whether breeding species will habituate to the turbines (i.e. return to areas they initially avoided). In general, grassland gamebirds avoid tall structures since those serve as perches for predators. Turbines therefore have significant disturbance effects on these ground dwelling grassland birds. Prairie-chickens were found to avoid nesting within 400 m of roads or 300 m of power lines (Manes et al., 2002, in Kingsley and Whittam, 2003).

Langdon and Pullan (2003) report displacement of two grouse species, while another author found low sensitivity (i.e. no changes or barely noticeable changes in population densities) for songbirds breeding in vegetation or on the ground (windenergie.de, 2005). Song birds outside the breeding season showed low to medium sensitivity, though these data are for different species than the breeding birds (windenergie.de, 2005) (Table 5.2).

In Canso, a considerable number of passerine and other land birds were found throughout all seasons (i.e. breeding, migrating and wintering (Section 4.4)). During migration, the number of individuals multiplied, and new species arrived (Sections 4.4.4, 4.4.7). Based on the above information, disturbance effects on some species are likely, while most species will not be affected.

Since several of the species found in Canso are of conservation concern, impacts are potentially significant, if important habitat for these species is lost. Significant impacts on other species are not likely, even though there may be several species that may avoid open areas as those created by turbine pads and roads.

Boreal Chickadee (S3S4), black-backed woodpecker (S3/S4) and Philadelphia Vireo (S2B) were found on or near turbine sites during breeding birds surveys, though only Boreal Chickadees were breeding, and Philadelphia vireos are strays that should not be a concern at the project location. During early fall migration, the numbers of insect –eating passerines swelled, but there were no rare species, and the birds did not frequent any proposed turbine locations except areas near the coastal turbines 6, 7a and 8 (similar to 6d, 7d and 8d now) (Table 4.4.9). During late fall migration, four species of conservation concern were identified among the migrants: Bobolink (Yellow), Eastern Meadowlark (Yellow), Eastern Bluebird (Yellow), and Northern Mockingbird (S3B), though the number of individuals was very low and none were found on or near turbine locations, but in the Town of Canso. In general, few late fall migrants frequented the proposed turbine sites. No turbines are located in the corridor with high bird activities which was identified as running along the ridge which holds the Town of Canso, but turbine 1d is within 100 –200 m from it.

During the winter surveys, only Boreal Chickadee were found on or near turbine sites, while Black-backed Woodpecker, Northern Mockingbird, Horned Lark (S2B), and Northern Shrike (S3N) were found in surrounding areas (Section 4.4.5). In general, few birds frequented the proposed turbine sites, though this was partly attributed to the lack of a good food supply in the winter of 2004/2005, with the number of birds known to be higher in other years. During the early spring migration, Boreal Chickadees were found on or near proposed turbines, and Black-backed Woodpeckers were detected in the Canso area (Section 4.4.7).

Based on the available information, displacement effects will not result in significant impacts for any passerines, because the usage of turbine locations by passerines and other land birds is low, and most passerines are not disturbed by turbines (see above). Since data appear to suggest that some migrating birds may be more sensitive to disturbance by turbines than breeding birds, it may be possible that they will avoid making land fall near turbine 6d to 8d. However, Glasgow Camp is nearby, which has similar habitat, and birds will not have to spend more energy to reach this point. Therefore, it is not expected that there will be a reduction in fall migrants in Canso Town or on Chapel Gully Trail due to the avoidance of turbines. Also, significant impacts on species of concern are not expected, since most of them do not frequent proposed turbine locations, neither for breeding nor during migration. Boreal Chickadees (S3S4 ACCDC) are common breeders in the area, and no unique habitat will be destroyed. These birds therefore can move into adjoining areas.

5.6.3.2.1 Mitigation – Disturbance and Avoidance

Mitigation measures follow the hierarchy of avoidance, reduction and mitigation. Since most project activities and structures are not expected to result in significant disturbance and avoidance effects, suggested mitigation measures focus on a limited number of effects.

<u>Human Presence</u>

In order to minimize effects from human presence during the operational phase, both as worker or as visitor, visits to the area should be restricted. Minimization of the project footprint has been considered in the project lay-out. Workers should be encouraged to refrain from entering areas where no work is done, particularly areas where the vegetation is unchanged, as those areas likely hold the largest number of birds.

Restricting the access of the public to the access roads would be desirable, but would not be accepted by the public, nor would it be enforceable, considering the lack of natural barriers. There are plans to incorporate the access roads into the Chapel Gully Trail system (see above). Kingsley and Whittam, (2003) suggest not to promote wind farms to tourists, but considering the economic hardship in Canso, and plans by the Town of Canso, this would not be accepted in Canso. Therefore, as a compromise, the public should be encouraged to refrain from visits on the access roads during breeding season, the most critical stage in a birds' lifecycle. This would regulate access from May to the end of July. In particular, the far end of the wind farm, close to turbine 10d-12d, and 4 d, should be avoided, as this is near the breeding habitat of the long-eared owls.

<u>Turbine Presence</u>

Since there are no data on avoidance of turbines by owls, mitigation measures should be considered, though they can only be on a general scale. Long-eared owls are the biggest concern, and mitigation by avoidance of the breeding habitat has already been put in place. Turbines were moved to preserve that habitat, and now have up to several hundred metres distance. This should ensure that these owls do not have to leave the project area even if they are disturbed by the turbines. However, considering the surprisingly high density of Northern saw-whet owls in all of the project area, they can't be accommodated by moving turbines. Should these owls be disturbed by turbines, a reduction in breeding pair numbers cannot be avoided.

5.6.3.2.2 Residual Impacts – Disturbance and Avoidance

Should some bird species be disturbed by turbines, a reduction in population density for those species is likely. However, the residual adverse impact is expected to be low, as populations can return to pre-construction levels after the de-commissioning of the wind farm.

5.6.3.3 Impact Assessment – Barrier Effect

A special version of avoidance is the "barrier effect". The barrier effect is caused by a line of turbines, and describes the effect that some birds try to avoid flying over this line, and instead choose to detour around them. Both migration and daily commutes (e.g. between breeding area and feeding area) can be affected. The impact of this effect varies, depending on the amount of energy the birds have to extend to make the detour. The effect would be observable particularly with migrating birds, or with birds which have to travel across the wind farm regularly to move from nesting sites to feeding sites and back. Not all bird species show a barrier effect, and the number of turbines required to result in a barrier effect also varies. Barrier effects are known from loons, some ducks, some waders, and cranes (Langston and Pullan, 2003) (Table 5.2).

Since there are few data available, the effect on the birds in Canso is hard to predict. However, since the number of turbines is small and there are no long lines of turbines, the likelihood of a barrier effect is considered small. Also, the distance between the turbines is often 400 m or more, which encourages birds to fly through (Percival, 2001, in Kingsley and Whittam, 2003).

Most or all birds breeding on and around the wind farm area usually forage in the vicinity of their nests, as they are passerines. Shorebirds have not been observed to cross the area frequently, as they are not separated from either feeding or breeding grounds by the wind farm. They also do not fly across this area during the migration. Similarly, waterfowl do not fly across the project area during migration. The only species known or expected to make regular commutes in the project area is the pair of great horned owls, which foraged and may nest near turbine 2, but is likely to also forage on the coastal islands (Section 4.4.6), and the belted kingfisher, which will likely nest in the coastal erosion face near turbine 6d to 8d, but was frequently observed feeding in Chapel Gully. The owls could reach the feeding area by flying around the turbine park, accessing the area around turbine 2 from the south, if they are sensitive to barriers effects, which is not known. Since the location of their nest is not known, it is possible that they access the project area from that direction already. Based on the available information, significant impacts on bird populations from barrier effect are not expected.

5.6.3.4 Impact Assessment – Mortality or Health Impact from Exposure to Contaminants

Accidental spills of fuel, lubricants, transmission oil, transformer oil, etc. from construction equipment or wind farm infrastructure, as well as the use of herbicides for vegetation control with herbicides have a potential to expose birds to toxic substances.

Any exposure to toxic substances, either directly or indirectly via contaminated soil or water, has the potential to lead to negative impacts on the birds. However, significant impacts are only likely if a large number of birds are affected, or if several individuals of a species of conservation concern are affected, as these would have an impact on population level. As spills are generally on a small scale, and only small amounts of these substances are present on site (except for turbine related oils), such impacts are not expected. In addition, mitigation measures will be put in place, which are aimed at protecting other VECs, most notably water resources and wetlands, and human health. Spills will be cleaned up immediately and thoroughly using on-site spills kits and following the spill/emergency response plan. Vehicles will not be refueled on site, whenever possible. Vegetation control with herbicides will not be carried out, or will be carried out using licensed herbicides, on few occasions. Therefore, significant impacts on birds from exposure to toxic substances are not expected.

5.6.3.5 Impact Assessment – Respiratory Health

Formation of excessive dust during clearing and grubbing, the construction of the access roads, turbines and ancillary buildings, could lead to respiratory problems similar to those observed in humans. However, dust abatement techniques, which were suggested as mitigation measure for the protection on human health, will be put in place. In addition, birds will likely leave the areas close to the construction site due to disturbance, and therefore avoid exposure. Effects on birds from dust inhalation are not likely.

5.6.3.6 Impact Assessment – Drinking Water Supply

The drinking water supply used by birds could be impacted by erosion and run-off from construction sites, or by erosion due to wind farm infrastructure. The pathways and mitigation measures have been described in Section 5.3, Wetlands. Since only a very small part of Winter Creek will be crossed by road construction, and mitigation measures will be put into place to protect Winter Creek and wetlands from sedimentation, an impact on the water supply for the birds is not likely.

5.6.3.7 Impact Assessment – Fire

Increased human access to the land in the project area is likely to increase the risk of fire, cigarettes, campfires or hot engine parts which are all known as potential fire starters. Fire could impact birds through direct mortality (deaths of young or eggs), destruction of habitat and habitat degradation. The latter can result from changes to the vegetation reclaiming the burnt areas, which likely will have a different composition than the current vegetation, and may contain invasive species. Habitat changes could affect breeding, food, shelter, and protection from predators.

In case of a fire, adverse effects on birds are likely. The significance of these effects depends on the bird species, the lifecycle stage affected, and the amount of habitat destroyed.

Significant effects on most birds are not likely, unless the whole population of a species is destroyed, particularly a species of conservation concern. Since adult birds can flee, this is not likely. However, birds may re-locate to other areas, until the habitat has recovered, which may take years or even decades. Nests and flight-less young of birds may be killed, though nests in tall trees may escape destruction. Raptor populations are generally not affected by fire, or may respond favourably to the burnt habitat, which exposes the prey and may increase the prey populations (BLM, 2004).

Since fire would also have significant effects on the wind farm infrastructure, fires would be fought vigorously as soon as they were spotted, likely by wind farm personnel. Since access to the area now is easy due to the access roads, and the fire engines in the Town of Canso are close by, it can be expected that any land area destroyed by fire would be small certainly much smaller than the area destroyed in the last fire. Therefore, significant effects that would effect birds on the population level are not expected.

5.6.3.8 Impact Assessment – Direct Bird Mortality or Injury

Wind farm developments have been associated with three major risks for direct bird injury and deaths: bird strikes (collisions), electrocution, and increased predation. Of these, the deaths due to collisions with the turbines are of major interest to the public. Deaths resulting from collisions with ancillary facilities, such as power lines, guy wires, and wind towers, are documented and significant, but are rarely “noticed” by the public. Bird mortality from collisions is seen as the most significant adverse effect of wind farms on wildlife (NWCC, 1999; in Sea Breeze, 2004). Minor sources of wind farm related deaths can potentially be caused by vegetation removal during breeding season, and legal or illegal hunting.

The risk of bird deaths from collisions with wind turbines and ancillary structures has received intense scrutiny, reflected in a large and ever increasing number of scientific studies carried out or commissioned by a variety of people and organizations, ranging from independent university scientists to wind industry associations. Most wind power projects now have intensive environmental effects monitoring programs, which will add more data to help in the design of modern developments to incorporate more environmental considerations focusing on birds.

These studies highlight that the bird mortality from wind turbines varies, but is generally very low. Certain taxonomic groups and species are at greater risk than others. Other factors influencing the risk include the location of the turbine (landscape), the size of turbine, size of the wind farm, other technical details, the number of birds present, the behaviour of the birds, the food source, weather conditions, etc. Therefore, the risk for birds can vary considerably from one wind farm project to another.

The attention to bird strikes was initiated by the high numbers of bird fatalities incurred at one of the first major wind farm projects in California. At the Altamont Pass in California, an extraordinary number of birds gets killed each year - more than half of them raptors, including the protected golden eagle (Orloff and Flannery, 1992; Erickson et al., 2002; in Kingsley and Whittam, 2003). However, outside of California, only about 2.7 % of birds killed at wind farms are raptors (Erickson et al., 2001, in Kingsley and Whittam, 2003).

In general, the number of deaths is much lower, and some wind farms do not find any dead birds. Erickson et al. (2001) reviewed the available data on wind farms in the US. He estimated that on average, 2.19 birds per turbine each year are killed across the US - without considering the variation between the wind farms. Across the US, an average of 0.033 raptors per turbine are killed each year. If wind developments in California are excluded, the average number drops to 1.83 birds per turbine and year (corrected for searcher efficiency and scavenging). The average for raptors drops to 0.006 raptors per turbine each year. Based on 15,000 turbines in the US and 2.19 birds per turbine, this equates to a total of 33,000 birds per year, of which 26,600 are killed in California. While this number may seem high, it is very small considering the millions of birds passing through these areas. It is also very small when considering the high number of birds killed due to other human activities (see below).

Erickson et al. (2001) also find that the number of victims per turbine is highly variable, ranging from 0 to a high of 4.45 birds per turbine per year (summary in BLM, 2004). The latter is a very high number, which was found at Buffalo Ridge Phase III in Minnesota, and included an unparalleled incident where 14 passerines were killed at 2 turbines. The estimated fatality rates reported are conservative estimates because they include fatalities that are unrelated to collisions with turbines, such as predation or collisions with vehicles (BLM, 2004).

Kerlinger (2001, in Kingsley and Whittam, 2003) reviewed studies from the US and Europe. He confirms that in general, the number of birds killed is low, and that there are no wind farms on either continent where ecologically significant mortality was caused - potentially except the Altamont pass wind farm in California. Kingsley and Whittam (2003) state that they consider mortality rates above the average of 2.19 birds per turbine to be high, those below to be low.

Several factors influence the risk of collisions of birds with turbines:

- Bird density is one of the seemingly most obvious factors. In areas with a large number of birds, the probability of collisions is increased. However, only one study (EVEAERT, 2003 - in Kingsley and Whittam, 2003) has found a direct relationship, while generally, a high bird density does not necessarily result in high mortality.
- Topographical features such as elevation, ridges, slopes, valleys, and peninsulas may increase the risk, e.g. through a funneling effect. This may be particularly noticeable for neotropical migrants or raptors, and where there are large numbers of birds (Kingsley and Whittam, 2003). In California, it was shown that topography significantly influenced raptor mortality (Anderson et al., 2000, in Kingsley and Whittam, 2003).
- The number of turbines/scale of the wind farm: large wind farms kill more birds than small wind farms. In fact, all four reviewed wind farms with 11 or less turbines reported no bird fatalities (BLM, 2004). However, there is no correlation between the turbine number and the mortality rate per turbine for larger wind farms (i.e., large wind farms do not kill disproportionately more birds per turbine than smaller farms (Kingsley and Whittam, 2003).
- Differences in turbine technology may contribute to higher risks. Generally, it is assumed that older turbines, which rotate faster (up to over 60 rpm), present a higher risk, but there is no conclusive data for this notion. However, new turbines with a larger rotor diameter and a capacity of 600 kW to 1.5 MW appear to have a similar per turbine raptor mortality rate as smaller turbines, however, on the basis of rotor-swept area (RSA) or per wattage, the mortality rate is about 3 -7 times lower (Kingsley and Whittam, 2003; BLM, 2004). Since one large turbine may replace several small turbines in terms of capacity, it can be expected than modern wind farms have a lower overall mortality rate. Birds including raptors may be able to see rotors that move less rapidly better than fast moving rotors (motion smear) (BLM, 2004). Larger turbines generally move slower (15-30 rpm), though the tip speed is still high (Kingsley and Whittam, 2003).

- At night, birds have been killed at turbines that are not operating (Kingsley and Whittam, 2003).
- Turbines with lattice towers appear to pose a greater risk for raptors (Orloff and Flannery 1992, in Kingsley and Whittam, 2003), potentially due to the attraction of the lattices for perching. Modern turbines usually have tubular steel towers, thus eliminating this risk. However, Anderson et al. (2000, in Kingsley and Whittam, 2003) could not show significant differences between different turbine types.
- Taller towers have a larger distance between the rotor and the ground, thus birds are less likely to fly through the rotor swept area (BLM, 2004). If turbines are too tall, however, there may be collision issues with long-distance migrants (Kingsley and Whittam, 2003).
- Lighting at or near the turbines: Aviation markers on turbines, required by Transport Canada, were found to attract birds, with steady red lights being the most attractive. Blinking red marker lights in poor visibility appear to disorient birds. Birds may fly around turbines until exhausted, or they may be attracted to the turbines and collide with the lit turbines and nearby unlit turbines. Quickly flashing white strobe lights seem to be un-attractive (BLM, 2004). In one study, quickly flashing red strobe lights also did not attract birds. Also, bright sodium vapour lights at a substation were fingered in the death of a number of birds at the neighbouring, unlit turbine, within a single night. When the light was turned off, no more collisions occurred (Kingsley and Whittam, 2003).
- Reduced visibility due to fog, rain, low clouds or darkness, contribute to collisions, with 93 % of fatalities correlated to inclement weather in one study (BLM, 2004).
- Wires: birds often die of collisions with wires, such as guy wires or overhead powerlines (see below).
- Location/position of the turbines within the wind farm: End-row turbines and turbines within 500 m of a canyon appear to pose more risk to raptors than other turbines at the Altamont pass (Orloff and Flannery, 1992 in Kingsley and Whittam, 2003).
- Long-range migrants are less likely to collide with turbines, unless bad weather forces them to fly low, or during takeoff and landing. The risk to resident birds may be higher, because they fly lower and spend more time in the area (BLM, 2004).
- Spatial arrangement of the turbines, including spacing (BLM, 2004).

Another factor contributing to collision may be that birds likely do not hear turbines as well as humans, especially in windy (noisy) conditions (BLM, 2004).

Also, the presence of the wind farm may make some species, particularly raptors, more susceptible to collisions due to changes in the environment. For example, disturbed soil may attract small burrowing animals, which are prey for raptors, and thus may attract raptors (NWCC, 2002, in BLM, 2004).

Generally, there also is a high risk from collisions with ancillary structures such is powerlines, windtower, guy wires, that may even be higher than the risk for collisions with turbines. At the Altamont Pass, 55 % of dead raptors were killed by collisions with turbines, 8 % by electrocution, 11 % by collisions with wires, and for 26 % the cause of death is undetermined (Orloff and Flannery, 1992, in: Kingsley and Whittam, 2003). At Foot Creek Rim, each meteorological tower killed about 8.1 birds per year, while each turbine was estimated to kill 1.5 birds (Young et al., 2003 in BLM, 2004).

It should be noted that the relative abundance of a species does not correlated to the relative frequency of fatalities (Thelander and Rugge, 2000 in BLM, 2004). However, common, year-long residents including house sparrows, rock doves and starlings are often the most common victims (Erickson et al., 2001, 2003a in BLM, 2004).

The avian victims at wind farms come from different taxonomic groups, including raptors, passerines, waterfowl and shorebirds (Erickson et al., 2001). Relatively few species were found as victims. Vulnerability to wind turbine collisions is species-specific, since only few species in a bird group were found as collision victims in a study comparing data from five studies. For example, only one of 37-44 waterfowl species was found to collide with turbines, while about one third of all raptor species present were among the victims at the Altamont Pass (BLM, 2004). Therefore, assessments should be specific for species, habitat and facility location (BLM, 2004).

5.6.3.9 Bird Mortality from Wind Turbines in Perspective

A comparison of mortality rates from wind turbines with bird mortality from other sources related to human activities shows that the estimated number of bird deaths from wind turbines is much less than the estimated number of deaths from other sources, which can be hundreds of millions of birds across the USA (Erickson et al., 2001).

While these numbers are not meant as a justification for ignoring bird deaths caused by turbines, they put the numbers into perspective. The impact of these birds deaths on the population varies. The loss of even a small number of individuals can be devastating for a species at risk from extirpation, while in large secure populations, these deaths can be suffered without long term effects. Wind farms should still be located and designed in ways that minimize threats to birds, and the best available techniques and management methods (e.g. type of lighting) should be used for the same purpose.

5.6.3.9.1 Impact Assessment

Construction and Decommissioning

During the construction phase, the potential for bird mortality is very limited. In effect, direct deaths or injuries during this phase are restricted to destruction of nests and young, and harm to adults that may defend the nests. If the construction is conducted outside of the breeding season, as it is planned for the Canso wind farm, the adverse effects on birds due to mortality is highly unlikely.

Similarly, the potential for bird mortality during the decommissioning phase is very low. Some vegetation would likely have to be removed to accommodate the cranes and lay down areas for the turbine disassembly. This vegetation may hold nests or young birds. However, the amount of vegetation which may have to be removed would be very limited, and vegetation removal could and should be conducted outside of the breeding season.

Operation

During the operational phase, mortality of birds can occur due to collisions with turbines, collisions with overhead wires and electrocution, as well as increased predator pressure.

Turbine Collisions

Waterfowl and Water Birds

Waterfowl mortality through collisions with turbines is a minor concern, since there are few reports of collisions. There have been several observations of ducks, scoters, trumpeter swans and other waterfowl avoiding wind farms by a large margin by flying much higher or detouring (Kingsley and Whittam, 2003). Fatalities of dabbling ducks were found near staging, breeding and wintering areas, and highest mortality was found at sites where ducks are present year round (Kingsley and Whittam, 2003). Large open water bodies near wind farms will lead to some waterfowl mortality, but only 10-20 % of all victims are waterfowl or shorebirds. Large flocks of Canada Geese have been observed near turbines, but only one fatality (Erickson et al., 2002, in BLM, 2004). Also, large numbers of waterfowl near wind farms do not result in large numbers of mortality, including from migrating birds. In addition, it was reported that eider duck collision rates at a wind farm in the UK declined within a few months and in following years, since the eiders obviously learned to avoid the turbines. Coots, grebes and rails have been found as collision victims, but in very small numbers (Kingsley and Whittam, 2003).

Based on the available information adverse effects from collision with turbines are not likely at the Canso wind farm. Waterfowl and water birds rarely collide with turbines, because they show avoidance behaviour. In addition, field surveys showed that waterfowl generally do not fly across the proposed wind farm area, and rather fly up Chapel Gully (Section 4.4.7.2). Therefore, significant adverse effects on waterfowl from collisions are not expected, even though several species of conservation concern were found (Section 4.4.7.2.3).

Aerialists and Seabirds

Although few studies have been conducted on the aerialists and seabird groups, very few birds become victims of collisions with wind turbines, though they often were abundant near wind farms (Kingsley and Whittam, 2003). For example, cormorants were found to fly in large numbers across several wind farms, including large wind farms, but only one fatality occurred in several years (Kingsley and Whittam, 2003). Only one study found high numbers of collisions at three shoreline wind farms in Belgium with 3 large or 14 medium and 23 small to medium turbines. Eighteen (18), 35 and 24 carcasses were found per turbine per year, most of them migrating birds rather than the resident breeding gulls and terns (Everaert, 2003 in Kingsley and Whittam, 2003). Also, there are very few reports of dead gulls (except at the locations in Belgium), even though they appear vulnerable because they often fly within turbine blade height and occur in high density. In Belgium, the chance of collisions of gulls with turbines were calculated as 1 in 750 to 1 in 3,700. In the UK, few gulls collide with turbines, despite travelling through wind farms frequently. Collisions are thought to occur mainly when food piracy of local gulls on migrant gulls occurs (Kingsley and Whittam, 2003). Terns appear to be not affected by turbine collisions, but turbines should not be installed where they may interfere with feeding and movement of terns (Kingsley and Whittam, 2003).

Based on available information, collisions of sea birds and aerialist with turbines are not likely at the proposed wind farm. Field surveys showed that these birds do not move close to the shoreline, both as breeding and as migrating birds. While all species of terns are protected, and are present in the areas surrounding the wind farm, collisions are unlikely, because the terns were not observed near proposed turbine sites and they are known to avoid collisions with turbines. Since the proposed turbine locations are generally more than 100 m from the coastline, the risk of collisions with sea birds and aerialists is extremely low, and significant adverse effects are not expected.

Shorebirds and Waders

Studies of shorebirds at coastal wind farms in Europe found that shorebirds are at a very low risk of collisions with turbines, even if high numbers of birds are present. This includes areas with large numbers of wintering birds, staging areas and wind farms that are crossed by migrating shorebirds. Shorebirds readily avoid turbines. Also, they fly at high altitude when migrating or commuting, and climb and land rapidly. However, turbines should not be placed near staging areas, as shorebirds are easily disturbed and may collide with turbines when fleeing a threat (Kingsley and Whittam, 2003).

There have been few fatalities among herons, and effects on populations have not been found, but turbines should not be placed near nesting colonies (Kingsley and Whittam, 2003).

In Canso, shorebirds and waders were found at all times of the year (i.e. as breeding birds and as migrating birds), including one protected species. However, few were found breeding or feeding in the project area (Section 4.4) and none at a turbine location. Also, flight movements and feeding activities were generally along the coastline, or flight was high above the turbine height (Table 4.4.4.2). In addition, shorebirds are known to avoid turbines. Therefore, collisions are not likely and significant adverse effects on shore birds are not expected.

Raptors

Raptor mortality attracts the most attention as most of the species are protected, and their abundance is low. The number of raptors killed at wind turbines is generally very low, except at the Altamont Pass. For example, at a wind farm with a bird mortality rate of 1.5 birds per turbine per year, the raptor mortality rate was 0.03 per turbine each year (BLM, 2004), and most victims were passerines. At other wind farms, bird mortality rates are 4.45 and 2.31 compared with raptor mortality rates of 0.0 and 0.01 (see summary in BLM, 2004). Therefore, a relatively high proportion of raptors are killed at some wind farms in California, while many others have very low rates. Raptor mortality outside of California is 2.7 % of all bird mortality (i.e. six birds (Kerlinger, 2001, in Kingsley and Whittam, 2003).

Raptors are of concern because they often fly at the height of the rotor swept area (Kingsley and Whittam, 2003). Also, their populations are often small and breeding rates low, and mortality at wind turbines thus may have significant negative effects on the population (Kingsley and Whittam, 2003; BLM, 2004).

Factors that contribute to raptor mortality in California include unusually high raptor density, topography and potentially, and older turbine technology (Kingsley and Whittam, 2003). End-row turbines, turbines within 500 m of a canyon and turbines with lattice-towers were proposed as factors increasing collision risk for raptors at Altamont Pass. However, there is no statistical proof yet that tubular towers and lower blade speed reduce raptor bird mortality (Kingsley and Whittam, 2003). The most important factor appears to be topography. Landscape features such as elevation, ridges and slopes are very important factors related to raptor mortality in areas where these birds are abundant.

The incidence of collisions increases when the turbines are installed in areas where raptors spend a lot of time (Hoover 2002, in BLM, 2004). However, the relative abundance of a species and the relative frequency of collisions are not correlated (BLM, 2004). Also, the correlation between overall raptor nest density and fatalities is very low. Few species surveyed during nest surveys were found as victims at newer wind farms (Johnson et al., 2003, in BLM, 2004). Thus, the likelihood of collisions cannot be safely predicted. The factors influencing the susceptibility are not well known.

While a large number of raptors are killed at the Altamont Pass, raptors in general are known to be able to avoid turbines easily when simply flying or soaring, even when they are close to the blades and at the same height (e.g. Osborn et al., 1998; W.K. Brown, 2003, both in: Kingsley and Whittam, 2003; Young et al., 2003 b, in BLM, 2004). Few raptors were killed at a wind farm in Alberta despite a large number of birds being present (Kingsley and Whittam, 2003). Interestingly, deadly collisions at Tarifa, Spain, occurred on days with good visibility (Kingsley and Whittam, 2003).

Though it is obvious that raptor collisions are not a problem at most locations and new wind farms, each proposed project site should be evaluated carefully, and high risk areas should be avoided. Also, environmental changes at the wind farms may make certain species more susceptible to collisions, including raptors, if they are attracted to an increase in prey organisms (see above).

In Canso, a number of diurnal raptor species were found in the project area and surrounding areas during all seasons, including the protected Northern Goshawk (NSDNR Yellow), though no diurnal raptors were found near turbine locations during the winter. Also, an osprey nest was found near turbine 5d, though it could not be established yet whether it is still used for breeding. Since raptors are known to be among collision victims, and numbers of victims can be high under certain conditions (see above), adverse effects are likely. The significance of adverse effects is determined by the number of deaths, the species and the vulnerability of the population.

Of the bird fatalities in California, 42% were diurnal raptors and 11 % were owls. These numbers drop to 2.7 % and 0.5 % as an average for all US wind farms outside of California. Average raptor fatalities across the USA have been estimated at 0.033 % per turbine per year, and 0.006 per turbine per year for all areas outside of California.

For the eight turbines in Canso, this equates to 0.048 (or 0.264) raptor fatalities per year, or one dead raptor in about 20 years (or about 5 years), for all eight turbines combined. This mortality rate is not considered significant.

With the use new generation turbines with a larger rotor diameter, and thus slower rotational speed in Canso, the mortality rate is expected to be about 3-7 times lower than at older types such as used at the Altamount Pass (BLM, 2004). The mortality rate can be assumed to be at the low end of this range, ignoring the estimates that include the California numbers. In addition, small wind farms with less than 11 turbines often have no bird strikes of any species (Kingsley and Whittam, 2003). Also, factors that would increase the risk to raptors, such as high usage or density of diurnal raptors in the project area, or topography with ridges, high elevations, etc., are not present. Therefore, it can be expected that the proposed wind farm will experience no more than 1 raptor fatality during a 20 year lifespan, and likely will have no fatalities. Significant adverse effects on diurnal raptors are not expected. However, mitigation measures should be implemented that prevent raptors from being attracted to turbines (e.g. by prey), and the Osprey nest should be avoided.

Owls

There is little information regarding interaction of owls with turbines. It is known that owls often fly at or below the turbine height, and that between 0 and 10-15 % of collision victims are owls, with the average for the USA (excluding California) standing at 0.5 % (Kingsley and Whittam, 2003). Several species of owls, which have been found as victims of turbine collisions, also occur in Canso, including long-eared owl and great-horned owl.

Also, the population of northern saw-whet owls is unusually large. Therefore, adverse effects from collisions are likely. The significance of adverse effects is determined by the number of deaths, the species and the vulnerability of the population.

Based on an average bird mortality of 1.83 birds per turbine per year for the USA outside of California, of which 0.5 % are owls, a mortality rate of 0.07 owls per year for all eight turbines combined can be expected, or one owl in almost 15 years. A calculation based on the averages including California (2.19 birds, and 10-15 % owls) would result in 1.75 to 2.63 owls per year for all eight turbines.

Considering that Canso will use new generation turbines with a larger rotor diameter, and thus slower rotational speed, the mortality rate is about 3-7 times lower than at older types such as used at the Altamount Pass (BLM, 2004). The mortality rate can be assumed to be at the low end of this range, at 0.6 to 0.8 owls per year. In addition, small wind farms with less than 11 turbines often have no bird strikes of any species (Kingsley and Whittam, 2003).

However, the status of the owl populations has to be considered when assessing the significance of the loss. Long-eared owls are listed as Yellow by NSDNR. Only one breeding pair was discovered, near turbine10-12. Any deaths of this owl could have negative effects on the population level. However, the breeding habitat has been avoided due to adjustments to the project layout. While this provides a buffer around the suspected nest site, it is not known how big the hunting area is. Therefore, it cannot be predicted whether this avoidance is enough to prevent the owls from venturing out between the turbines. Also, it is not known whether they frequently fly at the level of the turbine blades. Therefore, it is not possible to conclude whether there are significant effects on the population of this owl or not.

While there are many saw-whet owls, it is known that these owls generally fly very low, and thus will fly below the turbine rotors most of the time. Also, the since the population density is so high, there should be no negative effects of mortality on population level (both local and provincial), even if it were one owl per year. Sine these owls are breeding in the whole project area, their breeding habitats cannot be avoided by project layout adjustments.

There is one breeding pair of long-eared owls in the project area. This species is protected under Nova Scotia Wildlife act, but ACCDC considers the population in Nova Scotia as secure. This owl is suspected to nest in the area surrounding turbine 2d, and frequently travels to the coastal islands. It is not known if it usually flies at the height of the rotor blades. Therefore, collisions of this owl with a turbine are possible. The loss would have a significant negative impact on the local population, but not on the provincial population. Due to its large hunting range, areas used by this owl cannot be avoided by project design.

Passerines, Non-aligned Species, and Game-birds

Both migratory and resident passerine species furnish the bulk of turbine collision victims, with more than 80 % of carcasses (Erickson et al., 2001); about half of the victims were nocturnal migrants. Seventy eight percent (78%) of fatalities at wind farms involve protected songbirds (including migratory birds) (Erickson et al., 2001). No large episodes of mortality have been recorded yet. Mortality at meteorological towers has been estimated to be four to five times as high. The average mortality of passerines has been estimated to be about 1.2-1.8 birds per turbine per year (mid-range).

The number of collisions is highly variable between sites, and often, there is no relationship between the number of birds moving though an area and the number of victims (Kingsley and Whittam, 2003). At some locations, very few or no carcasses were found in areas with a high abundance of breeding birds and migrating birds (Kingsley and Whittam, 2003).

Population level effects have not been detected yet (Kingsley and Whittam, 2003) and are not expected, because of the low fatality rates of most species and the high population sizes of common species such as starling, American robin, and others (Young and Erickson, 2003). One calculation for a Californian wind farm calculated that about 1 in every ten thousand passerines passing through the area would be killed by a turbine, which was not biologically significant (Erickson et al., 2002; BLM, 2004). Habitat disturbance is likely to have a larger effect on certain species than collisions (Erickson et al., 2003, in BLM, 2004).

Nocturnal migrants usually fly at 150 m or above (i.e. above most turbines), however, during the day they migrate at lower elevation, or they move between or near the vegetation (i.e. between 20 and 30 m) to rest and feed. Therefore, they are in danger of colliding with turbines at dawn and dusk, as they change the height of their movement at those times (Kingsley and Whittam, 2003). Though migrants move at high altitude, there have been reports of mass collision events at structures other then turbines, such as buildings and power lines, which are shorter than turbines. Lights attracting the birds, as well as fog and rain or low cloud ceiling, sometimes in conjunction with the siting of the structure on a ridge, have been implicated as factors contributing to those events (Kingsley and Whittam, 2003). Inclement weather forces birds to fly closer to the ground (Kingsley and Whittam, 2003). At wind farms, multiple kills occur very rarely, and the numbers of victims are much lower than for collisions (e.g. with meteorological towers). Again, lights and bad weather were factors in these events. Birds were killed only at turbines adjacent to a brightly lit substation, while there were no deaths at turbines lit by red strobe lights at a greater distance from the substation. Interestingly, one report shows collisions with a non-operational turbine in bad weather; the turbine was lit with a single light in 10 m height (Kingsley and Whittam, 2003).

Most of the birds that collide with tall structures, such as buildings and communication towers are passerines (Kingsley and Whittam, 2003).

Doves and pigeons appear to be susceptible to collisions. Species with an aerial courtship display, such as horned larks, Vesper Sparrow and Bobolink, are likely also at greater risk, because the fly high during those displays. At one wind farm, 47 % of collision victims were horned larks. Woodpeckers and game birds usually fly below the blade sweep and are not usually at risk, which is reflected in low numbers of reported victims (Kingsley and Whittam, 2003).

In Canso, considerable numbers of passerines are present at all times of the year. Many migrating passerines move through the area in the fall, and the number of species multiplies at those times (Section 4.4). Based on the above information, adverse effects from collisions with turbines are likely.

Since several passerine species are of conservation concern, impacts are potentially significant, if large numbers of birds are lost. Significant impacts on other species are not likely. However, all migrating insect – eating passerines are protected under the *Migratory Birds Convention Act*.

Based on an average passerine mortality rate of 1.2-1.8 birds, 9.6-14.4 dead passerines per year can be expected for all eight turbines of the wind farm. However, it is quite possible that there will be no deaths at all, since the wind farm is small. Also, the coastal turbines were moved a short distance inland to increase the distance from migrants making landfall, and areas of high bird activity are no longer near the turbine locations (Section 4.4.4.2.9). Similarly, a corridor of high bird activity (feeding and resting) along the ridge in the outskirts of the Town is outside the project area. As passerines generally move through the vegetation, unless they migrate, the collision risk has been reduced by the adjustments to the project layout. Therefore, it is likely that the number of bird strikes is lower than the calculated 9.6-14.4 birds. Fog occurs mainly from April through July (Section 4.2.2.1). While this time frame includes the peak of the spring migration, there are likely little adverse effects on migrating passerines, because the fog is generally formed during the morning and dissipates later in day. Night migrating passerines therefore would not be affected.

Effects on local and provincial/regional populations of most passerine species are not likely, even if the number of victims should be as high as 14.4 per year (Kingsley and Whittam, 2003). However, there are a number of species of conservation concern among the breeding, migrating and wintering birds, though no species is listed as red. Potentially, significant impacts on these species would be possible if all the passerine victims were furnished by these species. However, usually the most common victims are also the most common species. Therefore, significant effects on passerine species of concern are not expected.

Collisions with Overhead Wires and Electrocution

Electrocution of birds along electric transmission lines and distribution lines has frequently been reported (Bevanger, 1994, in BLM, 2004). Deaths from collisions with electrical lines are usually included in these numbers. Birds from 15 orders, 41 families 129 genera and 245 species were among the victims, but raptors (*Ciconiformes*-vultures, *Falconiformes*-falcons and *Strigiformes*-owls), *Gruiformes* (quail and grouse) and *Passeriformes* (passerines) are most often reported

Bevanger, 1994 in BLM, 2004). Large birds also may be electrocuted when they touch two electrical conductors or one conductor and one grounded wire (NWCC 2002, in BLM, 2004). One author (Stemer, 2002, in: BLM, 2004) suggested that inclement weather, such as seasonal fog and rain combined with wind, increases the risk of electrocution.

Raptors and common ravens often use transmission towers for breeding. Breeding success is similar or higher than success at other nesting sites, so design changes have been made to attract even more birds (Steenhof et al., 2004, in BLM, 2003).

Since the power lines and communication cables in the wind farm area will be run above ground, bird mortality from electrocution and collisions with power lines is likely.
The significance of the impact is influenced by bird species, location of migratory routes, and local weather. Impacts could be significant if the number of victims of an individual species is high, or several individuals of a species of conservation concern were the victims.

However, in the absence of data on the numbers of birds killed at power lines, it assumes that the number of potential deaths is lower than the number for collisions with turbines. Therefore, significant impacts on birds are not expected. The long-eared owls breeding in the southern part of the project area are the exception, since the population in the Canso area is small. Any loss of a long-eared owl could potentially be significant. However, since burying the cables is likely not feasible due to the shallow soil over the bedrock, bird flappers should be installed to improve the visibility of the power line to birds.

Predator Pressure

The construction of wind farms results in changes to the habitat in a small percentage of the project area. In those areas, vegetation will be cleared, exposing the ground, and any ground dwelling birds or mammal are exposed to the view of predators. Also, cleared areas for access roads, turbine pads and lay-down areas increase the amount of edge habitat. While many birds prefer edge habitat for breeding, the nests in these areas and the activities of the adult prey birds are also more exposed to the view of predators, which often like to patrol those edges. In addition, raptors often use power poles for perching. Older wind tower designs with lattice towers were often used for perching. New models have tubular steel towers, and the top of the tower is often designed to discourage perching.

Wind farms may attract predators for these reasons. Therefore, they are likely to have adverse effects on the prey species and potentially the raptors (due to collisions). The magnitude of the effects is dependent on the number of predators and the size of the affected habitat. If species of conservation concern are among the prey birds, effects could be significant.

While there are bird species of conservation concern in Canso, none are listed red or endangered. Also, these species of conservation concern dwell amongst a large number of common birds. Therefore, it is unlikely that predation would lead to significant adverse effects.

5.6.3.9.2 Mitigation (All Direct Mortalities)

While significant impacts from turbine collisions are not expected, with the potential exception of long-eared owls, a number of mitigation measures are known to reduce collision risks even more. Some of these measures have been implemented in the project design and the turbine design already, while others, such as underground power lines, are not feasible due to shallow soil over bedrock. Instead, bird deterrents should be installed.

The following mitigation measures were implemented during project design:

- Field studies were carried out to identify areas which have high bird use, particularly by migrating birds and raptors (e.g. migration corridors, flight paths, raptor nest sites and other areas of high raptor activity), so that these could be avoided in the project layout.
- Appropriate design and siting avoids high risk bird areas, such as areas with high raptor density or certain topographical features (Kingsley and Whittam, 2003). Migrating bird landfall sites and breeding habitat of protected species were mostly avoided.
- Active raptor nests should be avoided and receive a buffer.
- Areas with high bird use should be avoided through micrositing alternatives
- Layout should minimize the number of road cuts and lay-down areas since raptors often patrol edge habitat.
- Perching and nesting opportunities should be prevented on turbines, transmission lines and meteorological towers. The turbines in Canso will have tubular steel towers, not lattice towers.
- Guy wires have been avoided for turbine towers.
- There are no landscape features that are known to attract raptors.

Mitigation measures which could be used during project implementation:

- Vegetation clearing will not be carried out between May and August.
- Bird nesting activity should be identified prior to vegetation clearing even though the breeding season will be avoided (see above). Mitigation measures in accordance with the MBCA will be implemented if necessary.
- Bird deterrents should be installed on transmission lines
- Habitat restoration should not create areas of high prey density (mammals and birds), which would attract raptors.
- Vegetation around the turbines ideally should consist of native plants which do not attract small mammals or do not provide food for passerines (e.g. short shrubs such as sheep laurel). Mountain Ash (large crop for robins) should be avoided. However, to protect owls, it may be necessary to avoid any vegetation cover in the bird strike zone (C. Stevens, personal communication).
- Mowed lawn should be avoided.
- Minimum amount of aviation lighting required by Transport Canada (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. TC decision is pending.
- Strong lights, such as sodium vapour lights which are often used for security at substation buildings, should be avoided or shielded.

5.6.3.9.3 Residual Impacts

After the implementation of the mitigation measures, the potential for collisions and predation will be reduced. While there still may be collisions and predation, significant residual adverse effects would be unlikely. The level of residual effects therefore is considered to be low. The one exception are the long-eared owls. They could experience a decline in population during the lifetime of the project. However, it is expected that upon decommissioning of the wind farm, the general habitat conditions will be comparable to those observed during the bird surveys and that near-by populations will re-populate the Project site. Therefore, the significant adverse residual effects would be moderate.

5.7 FISH AND FISH HABITAT

Fish and fish habitat initially were of concern since a small stream runs through the project site. Fish and fish habitat are protected by statute. Also, representatives from DFO indicated concern during the initial meeting between developers, consultants and regulators in 2004. Therefore, fish and fish habitat was initially considered to be a VEC.

However, field surveys carried out in the September 2004 indicated that there are no fish in Winter Creek nor its tributary. Also, Winter Creek and its tributary provide very little fish habitat. No apparent spawning or critical habitat was observed in Winter Creek.

Therefore, fish and fish habitat are not considered a VEC and are not assessed for environmental impacts. Also, the project layout was adjusted so there is only one stream crossing in order to minimize any potential impacts on the stream.

5.8 ARCHAEOLOGICAL AND HERITAGE RESOURCES

Initially, Archaeological Resources were considered to be a VSC, since Canso and environs has a long history of use by humans. Settlements established by people of European origin on Grassy Island and Canso itself were among the first settlements in Nova Scotia. Also, the area had previously been used by First Nations People. Therefore, the presence of archaeological resources was highly likely. These resources potentially could be disturbed by activities during the construction phase of the project, particularly the construction of roads, turbine foundations and lay-down areas. Because of this history, and concerns raised by regulators and the Nova Scotia Museum, an archaeological field survey was carried out spring 2004 (DAC, 2004).

The survey showed that there were several locations with archaeological resources; however none of the resources were close enough to a turbine or an access road to be impacted by project activities. Therefore, archaeological resources are no longer considered a VSC and have not been submitted to a full Impact Assessment.   However, DAC was unable to access the areas surrounding sites 3, 4 and 5 due to thick brush and wetlands. Based on DAC's expert opinion, there is low potential for archaeological resources within these areas. DAC does recommend that these areas be surveyed by a qualified archaeologist once an access road into these areas has been surveyed but prior to it being excavated and graded to minimize the potential of impact to resources during road construction. Turbine locations that have been added or adjusted after the spring 2004 survey (i.e., 1d, 5d, 11d and 12 d) will be examined at the same time as the access roads mentioned previously.

The DAC Field Survey resulted in several recommendations, which should be followed throughout the project implementation:

- There was one site discovered with archaeological significance adjacent to site 6. The site has been named the Burns site and is located east of Site 6 within the Hart's Content campground. Initially it was thought that the Burns site would be within the impact zone of the turbine, however a follow up survey verifying the proposed location of site 6 with a GPS has confirmed that both the Burns site and the campground are outside of the 100 metre impact zone for construction. If the Burns site is to be impacted by the project, DAC recommends that the site be excavated by a qualified archaeologist according to standards approved by the Nova Scotia Museum.
- Three other sites of archaeological significance were found within the Chapel Gully Trail area (the Canso Pestilence House, the Euloth House, and the Spinney Gully site), however these areas are outside the Study Area and there are no recommendations for further mitigation. However, should any of these areas be proposed for future construction of the wind farm, it is recommended that a qualified archaeologist further evaluate these areas and mitigation procedures are undertaken.
- The peninsula on which Betsy's Beach is situated is archaeologically sensitive and there is concern among residents of the community of Canso to protect these resources from destruction. Betsy's Beach is outside the proposed wind farm Study Area; however, it is recommended that this area be protected from any future wind farm development.

The Nova Scotia Museum agrees with all of DAC's recommendations, including that with regards to the Burns site. A copy of the letter from the Nova Scotia Museum is attached in Appendix L.

5.9 AESTHETICS – QUIET ENJOYMENT OF THE AREA

Noise produced by the wind turbines is a frequent concern with people living close to wind farms. Several inquiries at the open house in February 2005 show that some people in Canso share this concern.

Noise results from the conversion of wind energy into sound when interacting with the rotors. Other project activities also result in noise. Sound is measured in decibel (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 20 kHz. Noise regulations usually use a scale with units in dB(A). This scale is thought to be more reflective of human hearing, as it filters out lower frequencies, which are less damaging.

The wind farm is located in a rural area. In the Town of Canso, the only major sources of anthropogenic noise includes residential vehicles and fishing boats, the fish plant, which operates for a few weeks during the summer, and foghorns. Canso is a small town with low traffic volume therefore the back ground noise level is expected to be low. Noise monitoring carried out in April 2005 showed the ambient noise levels at four locations near the proposed wind farm to be between 36 and 50 dB(A) during the day, 40-47 db(A) in the evening and 36-44 dB (A) in the night (see Section 4.2.4). The noise consists mainly of natural sounds such as the wind, vegetation moved by wind, waves and animal sounds (e.g. birds), and some vehicle traffic. Residents in quiet rural areas may be more sensitive to noise than people in noisier, urban areas. Noise resulting from project activities may therefore be considered intrusive for some individuals living in or visiting Canso. In addition, Canso and particularly the Chapel Gully Trail, are well known to birders as a birding hot spot. As the Trail is located close to the wind farm site, visitors to the Trail will be exposed to sounds originating from the project activities.

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 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 be larger downwind of the source than upwind. As well, sound is carried further downwind than upwind from the sources. 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 itself, 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 (US-PEIS, 2004). Tonal noise (containing discrete tones) stands out much more against background noise. While changes in noise levels of 3 dB are hardly 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).

5.9.1 Pathways and Activities

Noise associated with the wind farm project can result from activities during all project phases: construction, decommissioning and operation.

5.9.1.1 Construction and Decommissioning

During the construction and decommissioning phases, noise generated will be typical for construction activity such as transporting materials, clearing the work sites, and building the access roads, turbine foundations, turbines, and ancillary structures, as well as site clean up and re-vegetation. The noise will be caused by the operation of heavy construction equipment, such as backhoes, bulldozers, rollers, flatbed trailers, cranes, dump trucks, ready-mix trucks and field compressors. Also, the operation of pickup trucks or other smaller vehicles used to ferry workers will result in noise. In addition, construction activities such as blasting, drilling and grading used during the road and turbine foundation construction generate noise. Table 5.3 contains some examples of typical noise levels associated with construction equipment.

TABLE 5.3 Noise Levels at Various Distances from Typical Construction Equipment

Equipment	dB(A) at 15/30 m+	dB(A) at 76 m*	dB(A) at 152 m*	dB(A) at 305 m*	dB(A) at 762 m*	dB(A) 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 db(A) with each doubling of distance.
Source: * HMMNH (1995) in BLM,2004
+ CBCL , 2003

5.9.1.2 Operation

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.

5.9.2 Boundaries

The spatial boundaries are set by the distance that the noise originating from the construction, operational and de-commissioning activities carries. This distance can be influenced by the presence and type of vegetation, wind direction, etc. The temporal boundaries vary with the project phase (construction, operation, de-commissioning). During the construction phase, there will be mainly two episodes of 2-4 months duration when the majority of construction activities take place. Deconstruction work during the de-commissioning phase is likely to proceed without interruption, thus resulting in noise being generated for a period of about 6 months. The operational phase will last for 20-25 years, and may be extended through refurbishment.

5.9.3 Impact Assessment

5.9.3.1 Construction and Decommissioning

The noise levels associated with construction equipment will likely vary considerably, depending on the type, model, size, and condition of the equipment, the condition of the area, and the construction schedule. Also, construction projects generally proceed in stages, and there are daily variations in activities. Each of the phases will have a different mix of equipment as the source of the noise. Therefore, the noise levels and the impact of the noise can be expected to vary considerably over the period of the construction phase. Typical noise levels from construction equipment range from about 80 to about 90 dB(A) at 15 m distance (Table 5.3).

For comparison, typical sound levels associated with various common environments are generally much lower, with a few exceptions (Table 5.4). Humans whispering produce about 30 dB(A), talking about 60 dB(A) (CBCL, 2003 b).

TABLE 5.4 Noise Levels Associated with Common Environments and Sources

Location/Source	**Sound Level [dB(A)]**
Rural Residential ++	38–46/40**
Suburban Residential++	48–52
Urban Residential++	58–62
Rural night - time background+	20-40/30**
Quiet bedroom+	35
Rustling leaves*	10
Busy general office+	60
Car at 65 km/h at 100 m+	55
Truck at 50 km/h at 100 m+	65
Pneumatic Drill at 7 m+	95
Jet aircraft at 250 m+	105
Threshold of pain+	140

Sources: + Sea Breeze 2004
++ CBCL, 2003 b
* BLM, 2004
** Harris, 1979; in BLM, 2004.

Considering the noise levels of 80-90 dB(A) which may result from construction activities, and the level of current, pre-construction noise in Canso (36 to 50 dB(A) during the day, 39-44 dB(A) during the night), there is some potential for construction noise to exceed the NSDEL limits of 65 dB(A) for daytime noise during construction near Wilmot Drive, as well as through truck traffic.

Sensitive receptors for the noise will be foremost the people living in residences closest to the site, people living along the transport route used for the delivery and removal of equipment (Union Street and highway 16), visitors to Chapel Gully trail, and wildlife on the construction site. The impacts of noise from construction activities on wildlife are discussed elsewhere (5. 5 and 5.6). However, there is a variety of human receptors which could be impacted at different levels.

Noise levels will be highest during the day (i.e., when elevated noise levels are most tolerated, since people are not disturbed in their sleep, and the construction noise is partly masked by background noise). Nighttime noise is expected to drop to background levels, since there is no plan for construction during the night. Also, construction noise will be limited to a short time: one phase of about 2-3 months in the fall of 2005 and another 2-4 months in the spring of 2006. During the decommissioning phase, work likely will proceed uninterrupted for about 4-5 months.

The spring and fall construction schedule will help to reduce the significance of potential impacts. During the fall and particularly the spring, people will spend much less time outside of their house or with open windows, both of which will decrease the exposure to noise. The Children's Summer Camp on Betsy's Head will not be in operation during the time when construction takes place, resulting in no impacts. However, visitors to Chapel Gully trail will be exposed to the construction noise, which has the potential to spoil their enjoyment of the area.

The noise levels at Chapel Gully Trail will likely range from 70-75 dB(A) for construction off Wilmot Drive and people at the Trail Head, to below background levels for construction at distant turbines (4d, 5d) and people on the trail sections closest to those construction sites. This is likely to result in annoyance in visitors coming for the enjoyment of the area, though people coming for exercise may not be annoyed.

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. The impacts on visitors to Chapel gully trail may range from not significant to significant. While there may be short-term annoyance, adverse effects on the health of individuals are not expected.

5.9.3.2 Operation

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 effects of operational noise, particularly from turbines, on wildlife, including birds, are dealt with elsewhere (see Section 5.6). Often, habituation can be expected.

Based on available information, there is some potential for noise impacts from the wind turbines in Canso on some receptors. The significance of the impact will depend on various factors.

The sound levels registered by the receptors (people) depend on the level of noise created at each turbine, the number of turbines, and the distance from the turbines. The potential impact depends on the noise level, but also on the amount of background noise at the receptor's location. Background noise from natural and anthropogenic sources may drown out the sounds associated with the wind turbines. Modern turbines do not produce the more intrusive humming or whistling sounds, which were connected with early WTG models. Therefore, noise should not be a source of concern (Eyre, 1995 and Legerton, 1995, in Sea Breeze, 2004). As a rule, any noise levels resulting from the operation of WTG will be too low to cause health impacts. Impacts on receptors therefore could only be due to annoyance.

For the Canso Wind farm, noise contour maps were developed based on information obtained from the turbine manufacturer. Several noise contour maps were developed using different possible project layouts. The following discussion is based on a "worst –case scenario", using a project layout where two turbines are within a few hundred meters from the nearest residences, with the assumption of no vegetation cover between the turbines and the residences, and a wind speed of 8m/s at 10 m height (Fig. 5.1).

Under the worst conditions, the noise produced by the eight turbines will reach 58-60 dB(A) at the base of the turbines, and about 52 dB(A) in the center of a cluster of three turbines (Figure 5.1). The sound levels at the hospital will reach 44 dB(A), and at the residences nearest to wind farm (i.e. nearest to Turbine 1d and 6d), the sound levels will be 44-46 dB(A).

The maximum sound levels at residences are well below the NSDEL Noise Guidelines (55 –65 dB(A)) at all times. In addition, the sound levels are within the typical sound levels in rural residential areas (Table 5.4). The sound levels are similar to the current pre-construction sound levels detected at the Children's Camp and the residence nearest Turbine 6, and below the existing daytime and sound levels at the hospital. During the evening and the night, the sound levels will be slightly higher (3-6 dB(A) than the current background noise at the hospital, however, humans are not likely to be able to discern this increase (US-PEIS, 2004). Therefore, significant noise impacts on the residential areas are not expected, even if wind noise and vegetation effects are not considered.

At the children's camp on Betsy's Head, the sound levels under worst conditions would reach 42-44 dB(A), which is equal to or below the current pre-construction noise levels of 44-47 dB (A) (Table 4.2.3). Therefore, adverse effects are not likely.

The sound level reaching the Town centre will be below 38 dB(A) and will be drowned out in the background noise. While the sound levels reaching the ball field/Stan Rogers Festival ground (40-42 dB(A)) will be higher than the current sound levels (35.7-40 dB(A)), the difference will be not discernable by most humans, particularly not during the festival.

At Chapel Gully Trail, the highest possible noise at the Trail Head will be 52 dB(A), 46 dB(A) at the rest of the western branch of Chapel Gully Trail, and about 40 dB(A) at the Spinney Gully coast. For most of the trail area, the sound levels will be between 40 and 46 dB (A), which is similar to the current noise levels at the Children's camp, and within the sound levels typical of rural residential areas. While people are likely to hear the turbines, it is unlikely that they will be annoyed, because the sound level is low and the sounds are low pitched.

At the former Hart's Content campground and the private camp, both near the road to Betsys' Head, sound levels will reach 52-54 db(A) and 56 dB(A). These levels are above current sound levels at neighbouring location (Table 4.2.3), and could lead to annoyance. However, since the campground is not used any more, and the camp is rarely used, significant impacts are not expected. In addition, both hare located on private land, and the landowner has requested that the turbines be located in the vicinity.

Noise associated with the substation consists of a constant low-frequency, tonal, humming noise which originates from the transformer, and switch gear noise from the operation of circuit breakers at 132 kV or above (BLM, 2004). Switch gear noise is of very short duration, but its frequency depends on the particular utility company and its procedures of regular testing, maintenance and rerouting. However, switch gear noise is generally infrequent, and impacts therefore are temporary and minor. 80 MW and 160 MW transformers would result in 43 and 46 dB at 150 m distance, or 33 and 36 dB at 500 m distance. Modern transformers and switch gear both produce much less noise than older models (BLM, 2004).

The 25 kV switchgear and the 15 MVA transformer that will be used at the Canso wind farm will likely produce less noise than the above mentioned numbers. Therefore, they are not likely to result in adverse effects. The noise will essentially blend into the background noise levels, which range from 35 to 50 dB(A), even if the receptor is near the substation building. Since the nearest residences, and particularly the hospital and senior's residence are at least 150 m from the substation, and visitors to Chapel Gully will only be in hearing range of the substation for a few minutes while walking to the trail, significant adverse effects are not expected, and mitigation is not necessary.

5.9.3.2.1 Vehicle/Turbine Maintenance

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 both the residential areas and Chapel Gully Trail, impacts on residents and Trail visitors 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.

5.9.3.2.2 Wind Turbines

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. Impulsive tonal aerodynamic noise is primarily related to “downwind turbines”, which are older models, and will not be used in Canso. Tonal low frequency aerodynamic noise (20-100 Hz) also can be avoided by engineering design (BLM, 2004). The wind turbines used in Canso are large upwind turbines with variable speed, which operate at generally lower speed and with pitch control. These factors all contribute to a decrease in the amount of noise generated (BLM, 2004). For example, variable speed turbines operate at slow speed in low winds, which reduces the amount of aerodynamic noise. At higher speeds, the increased turbine noise will be masked by the noise from the increased wind itself. A single modern wind turbine with a power rating of 1-1.4 kW will produce a sound level of 58-62 dB(A) at a distance of 50 m, which is equivalent to the sound level of people talking at 1 m distance. At 600 m downwind, the sound level would be 36-40 dB(A), i.e. equivalent to rural residential background (Rogers and Manwell, 2002, in BLM, 2004).

As sound is carried with the wind, locations downwind from the turbines will experience a higher noise level than locations upwind, as well as for a longer distance from the turbines.

Wind generated noise increases more rapidly with wind speed than aerodynamic noise (e.g. by 2.5 dB(A) per 1m/s compared to 1 dB(A) per 1m/s for aerodynamic noise (Hau, 2002 in BLM, 2004). Therefore, at a wind speed of 10 m/s, wind generated noise is higher than aerodynamic noise (BLM, 2004). Sound levels between 32 and 45 dB are equivalent to the background noise caused by wind at a speed of 10 m/s. Any sounds at that level, caused by the WTG, would be drowned out be the wind (The Working Group on Wind Turbine Noise, 1996; in Sea Breeze, 2004). Therefore, noise issues are more frequently a concern at low wind speeds (Fegeant, 1999, in BLM, 2004). However, since the amount of noise generated by the turbines is lower at lower wind speeds, and it is not carried as far as at high wind speeds, a setback distance of sufficient size would minimize any impacts on potential receptors.

Noise levels at various distances from the wind farm and at various wind speeds can be calculated using the Danish Wind Industry Association's Sound Level Calculator (DWIA, 2005). Using this calculator, the noise level within a wind farm with 273 turbines at moderately high wind speeds (10 m/s), is expected to be at 54-60 dB, which is similar to the noise in an urban environment (Sea Breeze, 2004). At regular to low wind speeds (4 m/s), the sound level is expected to be similar to that in a suburban environment, at 48-54 dB(A) (Table 5.4). Note that an increase in 10 dB(A) actually is a sound intensity increase of 10 times, since the decibel scale is a logarithmic scale used to mimic the human response to sound. The noise level drops sharply with increasing distance. Within 1.5 km of the, the noise level would reach about 35 dB, the equivalent of a quiet bedroom (Sea Breeze, 2004). For the 17 WTG wind farm in Pubnico, NS, the noise in the center of the wind farm was calculated to be about 45-49 dB(A), and to drop below 45 dB(A) within 200 m. This is equivalent to the noise in rural residential environments (CBCL, 2003 b). The Canso wind farm will have no more than 8 turbines.

5.9.4 Mitigation

5.9.4.1 Construction and Decommissioning

Construction and decommissioning activities should be limited to daytime working hours. Also, there should not be any construction on weekends, particularly Sundays. The latter is also likely to reduce the impact on visitors to Chapel Gully Trail to a low level. Construction and decommissioning work should preferably be carried out in winter and early spring, which also would reduce impacts from dust and impacts on wildlife and vegetation.

While the transport of material through the Town of Canso cannot be avoided, the fact that the turbines are set back at least 290 m (Turbine 1d and 6d) from the nearest residences, and more than 600 m for any other turbine, 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 will be performed. Using engine break should be discouraged.

This schedule, together with the short term duration of the construction activities and the distance between source and receptors, are expected to reduce the impact on residents and Trail visitors to a low level. Further mitigation measures are not necessary.

5.9.4.2 Operation

As avoidance is the best mitigation, the wind farm layout was designed with a set back distance of at least 290 m between the turbines and the nearest residences. This measure will reduce noise to the level of the rural environment, similar to current noise levels in most locations, making operational noise inaudible. In addition, the turbines will automatically switch off at high wind speeds, thus eliminating higher noise levels at very high wind speed.

5.9.4.3 Residual Impacts

With the implementation of the above noted mitigation measures, significant adverse residual effects are unlikely.

FIGURE 5.1 Noise Model

FIGURE 5.2 Visual Impacts

FIGURE 5.3 Visual Impacts

5.10 AESTHETICS: VISUAL RESOURCES

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 "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 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 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).

5.10.1 Pathways and Activities

During construction phase, visual impacts may be caused by road construction, and by the accompanying disturbance of the soils and vegetation, leveling and grading the terrain, and stockpiling of soil for further use. These activities may leave visible as scars in the landscape. The same effect will result from the construction of the ancillary buildings, and the turbine pads and turbines, and lay-down areas. Dust created by the construction activities, including vehicle traffic, may enhance the visual impacts. Vehicle traffic, both from small vehicles ferrying workers and from trucks delivering equipment and turbine parts, may also result in visual impacts. During the decommissioning phase, the same activities and potential impacts are possible, since soil will be moved to reclaim the roadways, turbine pads and ancillary building areas.

During the operation phase, visual impacts are possible from the presence and operation of the turbines, and to a small degree, from the visits of the maintenance workers as well as occasional major maintenance work or repairs using large equipment.

5.10.2 Boundaries

Spatial boundaries are the project area, and the area in which the turbines are visible. The temporal boundaries are set by the construction and decommissioning phase, because the visual impacts will seize once the wind farm infrastructure has been removed and the land reconstructed.

5.10.3 Impact Assessment

Activities during the construction and decommissioning phase are not likely to result in significant visual impacts, because a large part of the project area is not visible from the Town or Chapel Gully Trail, due to vegetation and the low relief of the landscape. Therefore, the visible area is limited to the areas near Chapel Gully trail and Wilmot drive (i.e. Turbine 1d, 9d and 10d). Construction at Turbines 6d and 8d will be sheltered from view by vegetation. Dust abatement techniques which will be used to mitigate potential health effects of the dust created by soil movement will also minimize visual impacts. Therefore, significant visual effects from the construction phase are not likely.

The wind turbines in Canso will be highly visible in the landscape. They will be visible from the ocean, parts of the town of Canso, and likely from the neighbouring community of Hazel Hill (distant). Adverse visual effects are therefore likely. Because of their size, colour and exposed location, wind turbines cannot be reduced or concealed. Significant visual impacts are therefore likely. However, it depends largely on the attitude or opinion of the viewer whether these impacts are negative or positive.

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).

Figure 5.2 and 5.3 show computer simulations of the view of the wind farm from the Town of Canso. It is evident that some, but not all turbines will be partially visible from the Town, while all turbines are visible from the entrance of Chapel Gully Trail on Wilmot Drive. Therefore, significant visual impacts can be expected. The impacts will likely be adverse to some viewers, while for others, the impact will be positive.

5.10.4 Mitigation

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, not 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
- Information of 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 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 access materials and any 'fugitive' litter from the project area;
- Avoid posting commercial signs.

Some of these mitigation measures have also been recommended as mitigation measures in conjunction with other VECs.

5.10.5 Residual Impacts

Residual adverse effects are likely despite the implementation of mitigation measures. However the level is considered to be low, since the resource (visual landscape) will recover after the decommissioning of the project.

5.11 SAFETY

Safety of the workers and the public is a concern during the construction, operation and decommissioning phases of the wind farm. Safety hazards to the public and to the workers on site can be caused via several pathways associated with the project. While some of the occupational hazards are the same as in any other facility, other occupational hazards are typical of wind farms. Though these occupational hazards can be minimized by adhering to safety standards and wearing protective equipment, injuries or fatalities can still occur.

Public safety concerns are mostly specific for wind farms. Public health can be influenced by several activities connected to the wind farm construction and operation. These impacts concern air quality and are discussed in the air quality impact assessment (see Section 5.2.), as well as noise impacts (see Section 5.9), ice, and breakage and traffic.

Occupational Health and safety are protected through both the federal and provincial Occupational Health and Safety Acts.

5.11.1 Pathways and Activities

5.11.1.1 Construction and Decommissioning

During the construction and decommissioning phases, 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.

Hazardous construction activities include clearing and grubbing of the land, excavation and blasting, 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, and energizing the turbines.

During the decommissioning phase, the hazards are posed by accidents during the deconstruction activities, in particular, removal of power lines, turbines, buildings, waste, and the site remediation. These activities are hazardous for the workers on site, and not the public, which is banned from the site.

5.11.1.2 Operation

During the operational phase of the wind farm, potential hazards arise from activities due to routine maintenance of turbines and ancillary facilities, icing of the turbines and breakage of the turbines.

Therefore, during the operational phase, there are both occupational and public safety concerns. Maintenance activities, such as exchanging the transmission oils in the nacelle, pose a hazard to the workers on the site. The potential formation of ice on the turbines, and the potential for breakage of turbines or turbine wings, poses a hazard to any person near the turbines (i.e. workers and the public).

5.11.2 Boundaries

With regards to accidents, the spatial project boundaries are limited to the project site for all of the above mentioned construction, deconstruction and maintenance activities. However, regarding accidents during the transport of materials and turbine parts to and from the project site, the spatial project boundaries have to be extended to include the roads to and from the supply or waste disposal sites.
Temporal boundaries are the short periods of construction and deconstruction activities, as well as the short periods of yearly maintenance work during the operational phase of the wind farm.

Regarding the hazards from icing or breakage of the wind turbines, the spatial boundary is the project site, and the time boundary coincides with the lifetime of the project, i.e. 20-25 years. If the wind generators are refurbished at the end of their normal lifetime, the temporal boundary has to be extended accordingly.

The spatial boundaries for shadow flicker are set by the length of the shadow cast by each turbine, and depend on the geographical location (latitude), daytime and the time of the year. In northern latitudes, shadows are longer than in southern latitudes. Similarly, shadows in the winter and at the beginning or end of the day are longer than shadows in the summer and at noon. The temporal boundary includes the operational phase of the project (20-25 years), and may be extended if the turbines are refurbished.

The spatial boundaries for traffic accidents are the Town of Canso, as well as Highway 16, which runs from the TransCanada Highway 104 at Tracadie/Monastery to Canso. The temporal bounds include the weeks of the construction and decommissioning activities.

5.11.3 Impact Assessment

5.11.3.1 Occupational Safety

Occupational Safety concerns accidents involving staff and workers during construction, operation and decommissioning of the wind farm.

Some occupational hazards are similar to the hazards in the heavy construction and electrical power industry. Others, however, are typical for wind farm projects, such as: rotating/spinning equipment, high winds, energizing system, heights (BLM, 2004), and especially 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 world wide and in the US (Sorensen 1995; 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.

The construction and decommissioning activities, including the operation of heavy equipment, have the potential to lead to accidents, which may cause physical harm to the workers involved. The potential for accidents during the operations phase is smaller, but cannot be neglected. Risks to occupational health and safety can be minimized during all phases of the project, if workers follow safety standards and use appropriate protective equipment. Still, accident may occur. These accidents may be significant to the individual based on the severity and the potential irreversibility of the consequences.

During the construction and maintenance of a wind farm, there is potential for exposure to hazardous substances. This risk, however, is considered small, as the amounts of chemicals are small, and the effects can be mitigated easily by wearing standard protective equipment.

5.11.3.1.1 Mitigation

During construction and decommissioning phases of the Project, the general public should be kept off site at all times.

As pointed out earlier, there are specific hazards related to the erection, energizing, operation and maintenance of the turbines. The International Electrotechnical Commission (IEC) has published minimum safety requirements for wind turbine generator systems (WTGSs) (IEC, 1999). The IEC requires that the WTGS 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, 1999, 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.

Mitigation measures aimed at reducing hazards related to general construction, maintenance and decommissioning activities include the following:
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 blasting, excavation, road and foundation excavation, power line installation, etc, must be appropriately trained to perform the task. If blasting is required, standard warning signs have to be put up at an appropriate distance around the blasting site.

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. Generally, Eastern Memorial Hospital is only a relatively short distance from the project site, and access to the site will be relatively easy once the access roads are constructed. Both facts will help to reduce the negative effects on the individual.

5.11.3.1.2 Residual Impacts

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.

5.11.3.2 Icing

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 0º Celsius, while there is humidity in the air (including rain, fog or drizzle). These conditions are relatively frequent along Nova Scotia'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) 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). Typically, icing on the rotors and nacelle leads to automatic rotor shutdown. Restart happens only when the ice has thawed off, 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 out 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). Observations put the mass of pieces found on the ground between 0.1 and 1 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).

To date, no fatalities have been reported as a result of icing (AWEA, 2005). AWEA also states that ice throw is of little danger to the public since the set backs 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 (AWEA, 2005). 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. A European group has studied the question of ice throw. They recommend a set back distance which is 1.5 times the sum of the turbine hub height and its rotor diameter (AWEA, 2005).

Ice build up on tall structures may be an issue for occupational safety of the workers during the construction and decommissioning phase. However, turbine construction is scheduled for the fall of 2005 and spring of 2006. Deconstruction is not likely to be carried out during the winter. Therefore, air temperatures should be above freezing, thus preventing ice formation. Also, during both phases, the turbines blades will not be rotating, thus avoiding ice throw. In addition, workers will be trained on the hazards due to ice build up on tall structures.

Ice throw will be no hazard to the public during the construction and decommissioning phases, since the public will be banned from the project area during these phases, and the turbines will not be rotating. Therefore, adverse effects from ice build up are not likely during the construction and decommissioning phases.

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 is 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.

Approximately 10-20 freezing day events have been estimated as the average per year for the wind farm in Pubnico, NS (CBCL, 2003 b). For the Canso area, on average, 7 days with ice formation per year have been found during an 8-year observation period. The majority of icing incidents are in February and March (2.3 and 2.6 days, respectively) (MSC, 2005, personal communication).

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

5.11.3.2.1 Mitigation

All workers will be trained on the hazards due to ice build up on tall structures.

During construction and decommissioning phases of the Project, the general public should be kept off site at all times.

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. Based on the recommendation by the European group mentioned above (1.5 times the sum of the rotor diameter and the hub height), this safety zone should be 225.75 m for the WTG used in Canso. While the Owners manual provided by the wind turbine manufacturer does not provide guidance, experience gained with wind farms in Ontario indicates that a minimum distance of 150-200 m should be maintained to residences (I. Tillard, personal communication).

The turbines at Canso are set back by at least 290 m from residences and roads (1d and 6d-8d). This should provide sufficient distance to avoid flying ice. However, part of Chapel Gully trail is located within this distance, as are the access roads and the road to Betsy's Head, which his rarely used. Therefore, it is recommended that operations personnel set up warning signs or warning flags on days where ice build up is potentially possible, to prevent people from using the western part of the trail and the access roads. If the signs or flags are ignored, other options will be discussed with the regulators. Operations personnel must be trained to recognize the conditions that lead to ice build up, in order for this warning system to be operated effectively.

If warning signs or flags only are set up, follow-up monitoring should be carried out to find out whether the public accepts the warning. If the warning signs are ignored, other options have to be considered to keep people from entering the western part of the trail and the access roads on days with ice build up. The warning signs or flags should also be installed in the emergency access road south of the wind farm area, since people may access the project area by following that road and then walking down one of the many hunting or deer trails. Warning signs should also be set up at the road to Glasgow Head (Turbine 6d-8d). The latter two could be permanent signs.

5.11.3.2.2 Residual Impacts

A sufficient safety distance of the turbines from residences and roads, as well as the successful implementation of a warning sign system for Chapel Gully Trail, is expected to reduce the impacts after mitigation to a low level.

5.11.3.3 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 traveled 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 during all of the 20 years that the wind industry is in operation (AWEA, 2005). Also, lightning strikes have been known to cause for breakage. In addition to breaks in rotor blades, the turbine tower could potentially collapse.

During both phases, the rotors will be shut off, resulting in low risk of rotor blade parts being thrown off. However, there is a 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. In the Canso, there are about 5-10 days per year have lightning flashes (MSC, 2005). Some of these are cloud-to-cloud flashes and therefore are not dangerous. On an area basis, Nova Scotia averages 0.2-0.7 lighting flashes per year per square kilometer (MSC, 2005). For the project area (1.5.X 4.5 km), this equates to 1.35-4.725 potential lighting strikes per year. While the turbine area is much smaller than the project area, this probability cannot safely be reduced since the turbines are tall and therefore likely to “attract” any lightning striking the project area.

Therefore, adverse effects from breakage are likely. Turbine parts may fly several hundred meters. However, the distance of Chapel Gully Trail from the nearest turbines is only about 100 m. People using Chapel Gully Trail therefore may be impacted by pieces thrown off turbine 1d, 9d and 10d, which are near the western branch of the trail and the observation tower. In addition, there are hunting and deer trails criss-crossing the land between the turbines. Similarly, the road to Betsys’ Head runs within 100 m Turbine 6d-8d. People and vehicles on that road may therefore be impacted if breakage should occur. Also, the nearest residences are only about 290 m from Turbine 1d and 6d. While most turbine parts would not fly that far, there is a small potential for impacts on nearby residences.

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

5.11.3.3.1 Mitigation

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 (and was sufficient in Ontario, see above). A set-back of at least 500 m from residences and roads would eliminate any possibility of impacts.

Signs at the start of the trail will alert visitors to safety hazards connected to wind turbines, particularly the danger of lightning strikes, and advise the public to leave the trail area via the distant, northern-eastern path in case of 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. Signs should also be mounted along the road to Glasgow Head, and at the Emergency Road/ATV trail, where it crosses into the project area.

If flags are installed at the start of the trail 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 & Safety Policy 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.

5.11.3.3.2 Residual Impacts

The residual effects after implementation of the safety measures are considered to be low, if visitors to the trail obey the safety advisory on the signs posted at the start of the trail.

5.11.3.4 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).

While most people are un-effected by shadow flicker, there have been reports of people being negatively affected by it, including 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. Early wind turbines were generally smaller, and some models had only two wings. 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.

The size of the shadow cast by a WTG depends mainly on the rotor size: the shadow increases with rotor size. The height of the turbine is of minor importance. An increase in height means that the shadow is cast over larger area. However, this has the positive effect that any one location within the shadowed area is exposed for a shorter time than if it were located in a smaller shadow (DWIA - Danish Wind Industry Association, 2005).

The shadow will be darkest in a column shaped area in the center of the shadow, and the shadow north of the turbine will be shortest. In the northern hemisphere, there is no shadow south of a turbine (DWIA, 2005).

Shadow flicker is considered an important issue in Europe, but not the USA. One reason for this is the geographical location (latitude). The American Wind Association (AWEA, 2004) states, that shadow flicker is not a problem for the USA for the majority of the year, with the exception of Alaska, where the sun is low in the sky for most of the year.

Canso is not much further north than the US. However, there is 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 (Burton, 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 (Burton 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.

Therefore, the impact from shadow flicker is not considered to be significant.

5.11.3.4.1 Mitigation

A minimum distance of 10 rotor diameters is recommended to reduce shadow flicker (Burton et al., 2001). For the turbines in Canso, this would mean a distance of 705 m. The turbines in Canso are set back by a minimum of 290 m for Turbine 1d and 6d, respectively, and over 700 m for the remaining turbines. The distance for turbine 1d and 6d is not sufficient to prevent turbine shadows on a house. However, due to the location of the residences in relation to the turbines, the shadow will fall on a residence only for a short time per day, if the sun shines. Also, the shadows may not even reach the houses, particularly in the summer, as shadows are short around noon.

5.11.3.4.2 Residual Effects

Due to implementation of the set back distance, residual adverse effects are considered low.

5.11.3.5 Traffic Accidents

During the construction and decommissioning phases, there will be an increase in traffic in Canso and on the roads leading to Canso. Traffic related to the wind farm 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.

Increased traffic during certain phases of the project could conceivable lead to a higher risk of traffic related accidents for the public.

The increase in the number of vehicles of different types during the construction and decommissioning phases of the project can potentially result in a higher number of traffic related accidents. Therefore, adverse effects are likely.

These accidents may cause injury to the persons involved, or even death. At the minimum, there is 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.

Of particular concern is the fact that there is at least one school located along highway 16, and there are likely school bus stops along this highway. Also, there is a school in Canso. While this school is not directly located along the traffic route, the fact that it is located in the Town makes it more than likely that children will be walking to the school. This could result in accidents when crossing the road.

This increase in traffic is limited to the times when construction activities occur. The construction phase is expected to stretch out over 2-3 months starting September 2005, followed by 2–3 months in the spring of 2006. During the first phase, the majority of traffic will consist of lorries carrying road construction and foundation construction materials materials to and from the construction site. The excavation equipment will only be transported for two days, once at the start, and once at the end of the construction in the fall. The flatbed trailers delivering heavy lifting equipment and turbine parts will be operating for a few days within a two or three week window in late fall, and then again for a more extended period in the spring, when the remaining 8 turbines will be delivered.

The same type and amount of traffic will be found during the de-commissioning phase. Should refurbishment of the turbines occur, the traffic would be somewhat less than during the construction, since transport of earth moving equipment and road building material would be very limited.

The impact from the increased traffic during the construction phase is considered significant and warrants mitigation measures.

During the operation phase, the traffic is not expected to increase significantly. Repairs to the turbines would necessitate heavy lifting equipment and transport of turbine parts. However, repairs are expected to be rarely necessary. In any case, repairs would be on individual turbines, so that the heavy vehicles will be on the roads only for one to two days.

5.11.3.5.1 Mitigation

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 in the Town of Canso and 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.

5.11.3.5.2 Residual Impacts

Since the increase in traffic volume is limited to a short time period, if the above mitigation measures are put in place, residual effects are considered low.

5.12 LOCAL ECONOMY

The existing local economy in Canso is in a phase of depression, with a high unemployment rate and few business opportunities (Sections 4.6.1 and 4. 6.3). Local residents expressed interest in the employment and business opportunities during the open house session. Towns people and Town Council hope that the wind farm will attract new industries or businesses.

5.12.1 Pathways and Activities

During the construction phase, general construction work such as clearing the vegetation, grading, building roads and foundations for the turbines and substation building will be carried out. Workers, equipment and materials will be needed. During the de-commissioning phase, workforce and equipment needs will be similar to those of the construction phase, but there will be a higher need for waste removal.

During the operational phase, site and turbine maintenance, such as vegetation control, road maintenance, turbine and ground cleaning, will be carried out. Workforce, equipment and materials will be needed.

5.12.2 Boundaries

Spatial boundaries are the greater project area including the Town of Canso, and may extend into the adjacent towns, such as Guysborough. Economic impacts related to the manufacturer and the long-distance transport will not be considered, since the focus is on the local economy. The temporal boundary encompasses the construction phase, operation phase and decommissioning phase. Due to the potential for refurbishment of the wind farm after its normal 25-year lifespan, there is a degree of variability in the temporal boundaries.

5.12.3 Impact Assessment

The construction and operation of the wind farm in Canso is likely to have impacts on the local economy. These impacts will be positive impacts.

During the construction, and decommissioning phase, there will be numerous tasks that fall in the category “general construction”, which does not require training specific for wind turbines.

Therefore, it can be expected that at least some workers will be hired locally. The workers assembling the turbines will be specialists, however. Also, it is likely that 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 chose to cook for themselves.

During the operation phase, there is likely opportunity for local residents to gain long-term employment due to the maintenance of the wind farm and site security. There may be a need for training. Some intermittent employment requiring no wind-farm specific training is likely available due to road maintenance, vegetation control, and general site maintenance. Also, the presence of the wind farm, offering electricity at long-term predictable pricing and predictable availability, has the potential to attract new businesses or industry, as both Town Council and residents hope.

Also, wind farms are known to attract tourists. While not all wind farms have been visited by tourists, there are several reports of increased numbers of visitors. For example, the number of visitors at the Atlantic Wind Test Site in PEI, increased from 1,200 in 1998 to about 65,000 after new wind turbines were installed in 2001, not including school bus tours (CBCL, 2003 B). In Australia, a number of wind farms along a popular scenic tourist drive which attracts 150,000 visitors per year is promoted to those tourists as an attraction amongst other scenic or historical points of interest. While data are not available yet, there are some indications that tourists will put wind farms on their itinerary: an open house at a tourist information centre, which was advertised only locally, attracted 400-500 people; a car counter at another development counted 30,000 cars in 3 months; and commercial bus tours to the wind farms are offered (AusWEA, 2005). Similarly, boat tours to off-shore wind farms are offered in Denmark, and the UK's first wind farm in Cornwall has 350,00 visitors during its first eight years (Yes2Wind, 2005), Since Canso has three attractions of interest to tourists (Grassy Island National Historic Site; Chapel Gully Trail, and the Stan Rodgers Festival), the addition of a fourth site is likely to encourage more people to make the almost 1-hour trip from the Trans Canada Highway to Canso. It should be noted that BWEL is not in the business of promoting tourism.

Property prices are not likely to drop after the installation of the wind farm. On the contrary, a study in Australia found no drop and some increase in residential property prices adjacent to a new wind farm (AusWEA, 2005). Two studies undertaken in the US come to the same conclusion (BLM, 2004). One of these studies found increase in property values within the view shed of the wind farm. Public opinion surveys in the UK showed that 72-78 % of respondents did not notice any change in house prices near wind farms (Yes2Wwind, 2005).

Rental fees for the land carrying the turbines, as well as the increased tax base from business, materials and labour will increase the tax income to of the town.

5.12.4 Mitigation

No mitigation is necessary.

5.12.5 Residual Impacts

Significant positive impacts on the local economy are expected during all phases of the project.

5.13 ACCIDENTS AND MALFUNCTIONS

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 petroleum, oils, lubricants, 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.

The effects of potential accidents and malfunctions, as well as suggested mitigation measures, have been dealt with during the assessment of impacts on the VECs of concern (see above). Here, a short summary is provided.

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 for 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 also possible. While herbicides will only be used on rare occasions, and only approved herbicides will be used, spills are possible.

Spills and leaks of any of these substances may have adverse effects on the VECs named above. Depending on the size of the spill, the impact may be significant.

Ice Throw and turbine breakage could also lead to significant impacts.

With respect to emergency repairs, Section 7.1 (c) of CEAA states that: notwithstanding section 5, an environmental assessment of a project is not required where, “the project is to be carried out in response to an emergency and carrying out the project forthwith is in the interest of preventing damage to property or the environment or is in the interest of public health or safety."

5.13.1 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 CSA publication “Emergency Planning for Industry (CAN/CSA-Z731-99).

The recommended mitigation measures include:

- Reducing the need for hazardous substances by substituting for less harmful ones.
- Incorporating 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 1-800-563-1633).
- 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.

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. NSDEL, DFO).

Frequent investigation of the turbines and transformers will ensure that any leaks are discovered promptly. Leaks will be repaired, and spills will be cleaned up immediately.

Warning signs set up during critical weather conditions will advice the public and visitors to stay beyond a 200-500 m safety buffer from the turbines to prevent adverse impacts from potential turbine breakage or ice throw (see 5.11).

5.13.2 Residual Impacts

With the implementation of mitigation measures, significant adverse residual effects due to accidents are unlikely to occur.

Barrington Wind Energy Ltd. is committed to develop and implement an Environmental Protection Plan. This plan will include contingency measures to address potential accidents or malfunctions.

5.14 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

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

5.14.1 Pathways and Activities

Fire, extreme weather and global climate change can adversely effect the project due to damage to the wind farm infrastructure and reduced productivity due to cut out or shut-down of the turbines.

5.14.2 Boundaries

The spatial boundaries for these effects are restricted to the project area, and in particular the wind farm infrastructure. Temporal boundaries are set by the start of construction phase and the end of the decommissioning phase. There is some temporal variability, because the turbines may be refurbished after the end of their normal 25-year lifespan.

5.14.3 Impact Assessment

5.14.3.1 Fire

Fire has occurred in the project area before. Reports by local sources were confirmed by the vegetation characteristics and the presence of the emergency road/ATV trail in the western part of the project area. Fires could be started by lightning strikes or by humans visiting the wind farm or the areas surrounding the wind farm, which includes coastal and forested areas. Therefore, adverse affects from fire are likely.

However, wind farm personnel are available in the Town of Canso at all times. There are many temperature related alarms on the turbines and transformers, which are relayed to the staff in town, head office in Halifax and NSPI Ragged Lake Centre. Also, the site is highly visible. Therefore, it is likely that any fire will be discovered quickly. Since the fire station in the Town of Canso is near the wind farm (about 2-3 km distance), and the access road to the turbines allows quick access to even the most remote turbine, significant damage is unlikely. The fire response procedures will be reviewed with the Town of Canso fire department. Also, turbine towers are tall enough to prevent damage to the nacelle. Damage to power poles can be repaired quickly.

Significant adverse effects of fire on the wind farm are not expected.

5.14.3.2 Extreme Weather

Extreme weather events can damage the turbines, e.g. by ice formation, hail or lightning strikes. Also, during extreme high winds or ice formation, the wind turbines will cut out, thus not producing energy and revenue.

Based on the climate data available (4.2.2), some extreme weather events are likely. However, the effects on the turbines have been considered during the project designs, and losses to productivity are not a concern. Wind conditions in Canso are such that a few hours or days without productivity will have no significant adverse effects.

Freezing precipitation is rare, and occurs on average on 7 days per year (Section 4.2.2.2). Lightning strikes, which could result in damage to the turbines, are also relatively rare events, with 5-10 days with lighting per year and a lightning density of 0.2-0.7 flashes per square kilometre (4.2.2.3 and 5.7). Damage to turbines is an even more rare event.

The turbine towers will be equipped with lightning protection. The turbines are designed to withstand severe weather. Even hurricanes like Juan in October 2003 are unlikely to damage turbines. The wind turbines at Pubnico Point were not damaged during that hurricane.

Significant adverse effects of extreme weather events on the project are not likely.

5.14.3.3 Global Climate Change

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 1.4 – 5.8 ºC over the next century. In Canada the temperatures could rise by 5-7 ºC (Environment Canada, 2004 c). The increases are predicted to differ depending on the region, with the highest increases in the North. The increase in temperature is attributed to Green House Gas (GHG) emissions, and carbon dioxide is the most important GHG.

The increase in average temperatures will be accompanied by 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 (Environment Canada, 2004 d).

While the rest of Canada will experience a rise in temperature, the predictions for Nova Scotia call for a continuation of the slight cooling trend experienced over the last 50 years (Environment Canada, 2005).

Predictions for sea-level rises show that the rise will vary from location to location. While there are no data for Nova Scotia, the levels at the West Coast are predicted to rise between 30 cm at the north coast of BC to 50 cm at the north Yukon coast within the next 50 years (Environment Canada, 2005). Canso is located in an area of moderate sensitivity to sea-level rise (Geological Survey of Canada, 1998, in Environment Canada, 2004 d).
In addition, the land in the Maritimes has been subsiding by about 20 cm per century since the last ice age (Environment Canada, 2004 d).

Based on this information, the wind farm project in Canso may be impacted by increased erosion (coastal turbines), flooding due to storm surges and sea-level rise, flooding from increased precipitation, increase in the number of days with ice-formation, and increased number of severe weather occurrences.

Impacts would be likely and would likely be significant. Therefore, mitigation measures, predominantly avoidance, were included in the turbine design and in project design phase. For example, turbine 6d to 8d were moved to the western rim of the coastal drumlins to avoid coastal erosion. Severe precipitation events were considered when calculating the diameter of the culvert for the crossing of Winter Creek. Wetlands were avoided. All turbine locations, and particularly turbine location 1d to 5d and 9d to12 d, are located on land high enough to accommodate a sea-level increase of 50 cm or more. Turbine design accommodates severe weather such as storms. Lost productivity due to turbines that shut down due to wind and ice has been considered when calculating the economic viability.

Therefore, residual adverse effects from climate change on the project are not expected.

5.15 CUMULATIVE EFFECTS ASSESSMENT

The CEAA also requires consideration of cumulative effects that are likely to occur in respect to the Project. The Act does not define cumulative environmental effects, but 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 environmental assessments 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 (CEA, 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 Canadian Environmental Assessment Agency (1999) provides a reference guide entitled 'Cumulative Effects Assessment Practitioners Guide'.

5.15.1 Boundaries

For the purpose of identifying and assessing cumulative effects, the spatial dimensions of the study area remain the same. The temporal boundaries, however, are extended to include past, current, and known planned or reasonably foreseeable projects.

5.15.2 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. Also, a "combination of different individual environmental effects of the project acting on the same environmental component" can result in cumulative effects (Natural Resources Canada, 2003, WPPI).

5.15.2.1 Other Projects in the Area

The only known past activities in the area that may have influenced the VECs in the project area is the cutting of trees that has been carried out (local source of information). Current projects and activities in the area are limited to the fish plant and the use of Chapel Gully Trail. All of these activities and projects have likely influenced either habitat, wetlands and birds, and have resulted in the status of these VECs as described in Baseline description. Therefore, their effects have been considered in the Environmental Impact assessment carried out above.

While town representatives hope that the wind farm will attract new businesses, there are no projects known to be planned for Canso or surrounding areas. All large projects known to be in planning or implementation stages are more than 50 km distance from Canso (NSDEL, 2005):

- The Keltic Petrochemical Inc. Liquefied Natural Gas Plant, located on the North shore of Isaac's Harbour in the Goldboro Industrial Park, Guysborough County; about 75 km distance.
- Bear Head Liquefied Natural Gas Terminal, by Access NorthEast Energy Inc., located at Bear Head in the Point Tupper/Bear Head Industrial Park, Richmond County; about 55-60 km distance.

- Highway 104 at Antigonish, by the Nova Scotia Department of Transportation and Public Works; about 110 km.

Therefore, interactions of environmental effects of other future projects with the residual effects of the proposed wind farm are not expected. However, there may be some interaction between the residual effects of the wind farm project.

As outlined in the impact assessment, one of the residual effects of the wind farm project is the increase of public access to the project area, which will likely result in disturbance of birds. If tourists visit the wind farm, the number of humans will even be increased above current Trail visitor numbers. Another residual impact is the risk of collisions of birds with the turbines and other infrastructure.

While both effects by themselves were judged to result in a low level of residual effects after mitigation measures were put in place, except for collision risk of long-eared owls, both effects may add up and result in a reduced number of birds in the area, as birds avoid the area and some of the remaining birds may be killed. However, birds from adjacent areas are likely to move into the project area to replace any birds that were killed, unless the species is rare and there are no such birds in adjacent areas. This is not the case for most of the species listed by NSDNR and SARA (see field surveys). While long-eared owls were not detected in nearby areas, it is likely that they are present.

Therefore, cumulative effects are expected to be low.

5.16 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS AND CUMULATIVE EFFECTS

In this section, the impact assessments carried out in Section 5.1 to 5.15 is summarized in two tables. A summary of the predicted environmental impacts is provided in Table 5.5. A summary of the cumulative effects assessment is provided in Table 5.6.

TABLE 5.5 **Summary of Environmental Impacts**

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact (WPPI)
Construction and Decommissioning Activities					
Turbine, road, and ancillary building construction • Operation of heavy equipment and smaller vehicles. • Blasting, drilling, and grading.	Geology/ Hydrogeology/ Groundwater	• Acid rock drainage	• Adjust project layout to avoid areas of sulphide rich rock • Treat rock if avoidance is impossible • Remove material if it is greater than 500 m^3 • Reduce runoff from rock and limit its exposure	None expected	Minimal
Turbine, road, and ancillary building construction • Operation of heavy equipment and smaller vehicles. • Blasting, drilling, and grading.	Air Quality	• Formation of dust and exhaust fumes	• Use dust abatement techniques • Impose and enforce speed limits on access roads • Do not load trucks with soil above the freeboard • Minimize drop heights when loading trucks • Moisten land before clearing; • Cover areas to be blasted with mats	No residual effects expected	Minimal
Turbine, road, and ancillary building construction • Operation of heavy equipment and smaller vehicles. • Blasting, drilling, and grading.	Wetlands (incl. surface water quality)	• Fragmentation • Disturbance, erosion and run-off • Disruption of hydrology • Loss of species diversity • Introduction of invasive species • Mineral input (dust) • Water quality impairments	• Avoid wetland areas • Reduce footprint • Do not use herbicide for access road maintenance • Do not divert or channel run-off • Reduce number of stream crossings • Install drainage structures (culverts, permeable road fill) to allow water to pass under roads	None expected	Minimal

TABLE 5.5 **Summary of Environmental Impacts**

Project Activities	Environmental Components Subject to Impacts	Impacts	Mitigation Measures	Residual Environmental Effects	Level of Residual Impact (WPPI)
			• Install erosion control structures (silt fences, etc.) • Re-vegetate areas devoid of vegetation • Control public access to wetlands (ATVs, mountain bikes) • Clean construction equipment of soil residues before entering the site • Implement a field monitoring program to study invasive weeds and the water regime • Contractor to develop and implement Environmental Management Plan (EMP); EMP to include: • Inventory of hazardous materials to be used at the construction site, e.g., fuels, lubricants, cement, wet cement, concrete additives and agents, preservatives, solvents, paints and wastes such as waste oil; • Spill prevention plan; • Contingency plan (spill containment, clean up protocols, equipment) • Fuel and lubricant storage, and location for equipment servicing (outside of at least a 30m buffer from wetlands and water courses) • Explicit prohibition of deposition of a deleterious substance into waters		

TABLE 5.5 **Summary of Environmental Impacts**

Project Activities	**Environmental Components Subject to Impacts**	**Impacts**	**Mitigation Measures**	**Residual Environmental Effects**	**Level of Residual Impact (WPPI)**
			frequented by fish (pursuant to Section 36, Fisheries Act); • Reporting protocol.		
Turbine, road, and ancillary building construction • Land clearing	Species at Risk: Bats	• Reduction of quality and quantity of habitat • Killing of individuals during land clearing activity	• Limit removal of tall trees and snags to areas absolutely necessary for construction • Timing of work	None expected	Minimal
Turbine, road, and ancillary building construction • Operation of heavy equipment and smaller vehicles • Blasting, drilling, and grading • Site clearing • Presence of humans • Accidental spills of oil, fuel	Birds	• Avoidance and changes to migratory movement caused by noise, visual impacts, and human presence • Loss, fragmentation, or degradation of breeding, feeding, and resting habitat • Habitat degradation by invasive species • Changes to the water regime by erosion and runoff • Exposure to toxic chemicals • Respiratory health effects from dust • Potential mortality of adults, young and eggs from collisions, or nest destruction • Fire	• No clearing between May and August • Bird nesting activity should be identified prior to vegetation clearing. Mitigation measures in accordance with the MBCA will be implemented if required. • Avoid important habitat and migration areas; also prevent encroachment of construction activities into Chapel Gully Trail Park • Minimize project footprint • Do not unnecessarily cut down trees of 15 cm or more in diameter • Minimize impacts on the hydrological regime • Avoid construction or decommissioning during breeding season • Do not create areas of high prey density during habitat restoration • Use native plants or no vegetation at all around turbines • Avoid mowed lawn	None expected on birds in general Minimal effect on the local long eared owl population	Minimal

TABLE 5.5 **Summary of Environmental Impacts**

Project Activities	**Environmental Components Subject to Impacts**	**Impacts**	**Mitigation Measures**	**Residual Environmental Effects**	**Level of Residual Impact (WPPI)**
			• No guywires		
Turbine, road, and ancillary building construction • Operation of heavy equipment and smaller vehicles • Blasting, drilling, and grading.	Aesthetics-quiet enjoyment of the area (residents, visitors)	• Noise • Visitors to Chapel Gully may be annoyed	• 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	None expected	Minimal
Turbine, road, and ancillary building construction • Operation of heavy equipment and smaller vehicles • Blasting, drilling, and grading. • Site clearing	Visual resources (Residents and visitors)	• Dust created by construction • Scars to the landscape by cleared land and buildings	• Large part of area is hidden from view by vegetation • Use of dust abatement techniques	No significant effects expected	Minimal
Turbine, road, and ancillary building construction • Operation of heavy equipment and smaller vehicles • Blasting, drilling, and grading. • Site clearing • Materials delivery	Health and Safety (Workers, residents and visitors)	• Potential physical harm to workers (accidents) • Exposure to hazardous substances • Ice buildup on tall structures • Rotors may drop off, tower collapse • Accidents from increased traffic	• Timing of work • Properly train workers involved with heavy equipment, blasting, excavation, power line installation • Develop a health and safety program • Put in place emergency response procedures • Train workers to adhere to safe driving rules in order to prevent traffic accidents • Make local residents aware of times when there will be increased traffic • Warning sign (blasting)	None expected for icing and breakage Minimal Impacts are expected For Occupational safety and traffic impacts	Minimal

TABLE 5.5 **Summary of Environmental Impacts**

Project Activities	**Environmental Components Subject to Impacts**	**Impacts**	**Mitigation Measures**	**Residual Environmental Effects**	**Level of Residual Impact (WPPI)**
Construction	Local Economy	Positive impact: work, income, taxes	None	Positive	Positive
Operation Activities					
Turbine operation • Substation • Vehicle traffic	Air Quality	• Dust created from soil depleted of vegetation and from gravel access roads	• Allow vegetation cut in the lay down areas to grow back	None expected	Low
Turbine and transformer presence, road maintenance (toxic chemicals present)	Wetlands	• Reduced species diversity • Toxic effects from chemicals substances	• Avoid herbicide use • Immediate spill clean up	None expected	Low
Turbine operation • Presence of power lines, buildings, and turbines • Presence of humans • Exposure to toxic chemicals	Species at risk: Bats	• Collisions with turbines, buildings, or power lines • 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	• Carry out monitoring for bat strikes • Turn off turbines during few nights of fall migration	Small number of mortality (little brown bats and potentially northern long-eared bats) every year for the lifetime of the wind farm Eastern pipistrelle unlikely to occur	Low: (Little brown bats, northern long-eared bats) (Eastern pipistrelle: could be medium, but unlikely to occur
Turbine operation • Human presence • Maintenance of site • Presence of turbines • Accidental oil, fuel, toxic substance spills • Turbine and infrastructure lighting	Birds	• Direct mortality or injury from collisions with overhead power lines and turbines • Electrocution from powerlines • 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)	• 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, transmission lines, and meteorological towers	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 effect, contaminant	Low

TABLE 5.5 **Summary of Environmental Impacts**

Project Activities	**Environmental Components Subject to Impacts**	**Impacts**	**Mitigation Measures**	**Residual Environmental Effects**	**Level of Residual Impact (WPPI)**
		• Erosion and runoff affecting water supply • increased predator pressure (exposed prey) • fire	• No guywires • Install bird deterrents • 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	exposure, dust, water regime; fire	
Turbine operation • Presence and operation of turbines	Long-eared Owl	• Death or injury from collisions with overhead power lines and turbines	• Adjust project layout to avoid breeding area • Other mitigation measures: see "birds"	Any deaths could have a significant negative effect on the local population (only one breeding pair present), but re-population for adjacent areas is likely	Moderate
Turbine operation • Substation • Vehicle traffic	Aesthetics: quiet enjoyment of the area (residents and visitors)	• No significant impacts expected • Impacts only due to annoyance as noise levels are too low to cause health impacts	• Ensured a set back distance of at least 200-280 m • Turbines automatically shut down at very high wind speeds	None expected	Low
Turbine operation • Presence and operation of turbines	Visual Resources (Residents and visitors)	• Turbines in the natural landscape • Strong steady lighting may	• Use tubular towers • Create aesthetic balance in the design	Residual effects are likely despite mitigation measures,	Low

TABLE 5.5 **Summary of Environmental Impacts**

Project Activities	**Environmental Components Subject to Impacts**	**Impacts**	**Mitigation Measures**	**Residual Environmental Effects**	**Level of Residual Impact (WPPI)**
• Visits by maintenance workers • Repairs using large equipment		cause "skyglow" • Glare • Negative impressions caused by "untidy" turbine arrangement, garbage, leaks from nacelles, idle turbines or turbines with parts missing	• Use light grey colour, non reflective, not shiny steel • Use identical turbine model for all turbines • Arrange turbines in clusters • Do not arrange turbines in long lines • Do not locate turbines on elevated land points • Minimize lighting on the turbines • Minimize project footprint, implement erosion control and dust abatement • Repair turbines immediately • Clean turbines • Remove excess materials and litter • Avoid posting commercial signs • Integrate information on wind energy and wind farm technology with information provided by interpretive walks and hikes in the area;	but visual landscape will recover after decommissioning	
Turbine operation • Presence and operation of turbines • Maintenance work • Repairs using large equipment	Health and Safety (workers, residents, visitors)	• Accidents (physical harm) • Exposure to hazardous substances • Ice being thrown from blades • Breakage • Shadow flicker	• Properly train workers involved with equipment, handling, power lines, etc. • Develop a health and safety program • Make available an emergency procedures plan covering possible component failures • Set up warning signs and/or flags to alert public of danger • Consider public training session	Impacts are expected to be low for all factors	Low

TABLE 5.5 **Summary of Environmental Impacts**

Project Activities	**Environmental Components Subject to Impacts**	**Impacts**	**Mitigation Measures**	**Residual Environmental Effects**	**Level of Residual Impact (WPPI)**
			• Have a minimum distance of 10 rotor diameters to prevent shadow flicker on residences • Set back distance of 225.75 m to prevent ice impacts • Setback distance of minimum 200 m to reduce breakage impacts (ideally 500 m to prevent impacts) • Train personnel to recognize dangerous weather conditions		
Operation	Local Economy	Positive impact: employment opportunities, income, taxes, contribution to power supply	None	Positive	Positive

TABLE 5.6 **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	None	None
All	All	Fish plant; Chapel Gully Trail use	None	None
Bird population	Turbines, power lines (Collisions)	Visitors/Public access	• Disturbance from public access may add to losses from collisions • Birds may move in from adjacent areas	Low

6.0 ENVIRONMENTAL EFFECTS MONITORING

An environmental effects monitoring program (EEM) involves taking repeated measures of environmental variables or components to detect changes caused by external influences directly or indirectly attributable to a Project's activities over time. EEM can include either a direct monitoring of VECs or monitoring of environmental parameters known to be important to the VECs.

EEM studies are normally undertaken to fulfill the following objectives:

- verify EA 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 be site specific and include documentation of the following, as appropriate:

- Wetland monitoring program to identify vegetation community changes/hydrological regime, additional ATV use, invasive plant species and noxious weed surveys. Wetland survey plots will be delineated at the start of the wetland monitoring program.
- The sediment and erosion control structures will be monitored until the adjacent cleared land around Winter Creek is at least 80% re-vegetated;
- The turbine locations will be monitored for mortalities of bird and bat species due to collision with the turbines blades, or other project interactions. EC and CWS will be consulted in developing the monitoring details and data will be provided to interested regulating agencies; and
- The proposed EEM program will be submitted to DFO, Environment Canada and the NS DNR prior to completion of construction for review and comment.

The monitoring program for birds will be developed following the guidelines and references provided in Kingsley and Whittam (2003).

7.0 CONCLUSIONS

The proposed Canso Wind Farm will consist of eight wind turbines with a total production rating of 12 MW. The project area is located south of the Town of Canso in Guysborough County, NS.

An environmental impact assessment was carried out to identify potential environmental effects of the three project phases, construction, operation and decommissioning to satisfy requirements of the Nova Scotia Environment Act and the Canadian Environmental Assessment Act. Natural Resources Canada is expected to provide funding under the Wind Power Production Initiative (WPPI) Program. Following regulations in CEAA, the effects of Accidents and Malfunctions as well as effects of the environment on the project were also assessed. An Open House to inform the public and gather local input was held on February 24, 2005, in Canso.

The proposed project is located south of the town of Canso in an area of land with gently rolling topography and characteristics of coastal barrens. The project area is bordered by marine water to the south and east. There are several wetlands, which were identified during field surveys, one stream, but no lakes or ponds. The Project layout was adjusted to avoid these wetlands, in accordance with the “Federal Policy on Wetland Conservation”. There is only one stream crossing.

Field investigations and database searches were carried out to describe archaeological resources, habitat, delineate wetlands, identify rare plants and animals, survey breeding, wintering and migrating birds, and survey fish species and fish habitat. The surveys covered the thirteen potential turbine sites, of which eight will be chosen, and the general project area. However, potential turbine locations 1d, 5d, 11d and 12d were moved several hundred meters or were introduced after the end of the breeding bird and flora surveys in 2004. Therefore, these locations will be surveyed at appropriate times in the summer of 2005.

There are no archaeological resources, fish, rare plants or habitat critical to rare species in the project footprint. There are no animals of conservation concern listed by NSDNR or by COSEWIC, with the exception of several bird species and the potential for a few bat species. The fall migration surveys showed that the Canso area is an important location for migrating birds. A number of rare species are attracted to food supplies in the town of Canso, but very few were found in the project area.

This report addresses the environmental effects of the construction, operation and decommissioning project phases. While there is additional work to be carried out (flora and breeding birds surveys for location 1d, 5d, 11d and 12d, and archaeological surveys for these sites and site 3d), the information to date has shown that no significant adverse residual impacts on the VECs are likely. While there is potential for low to medium adverse effects on long-eared owls, the likelihood is small.

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 green house gas emissions and air pollutants. The Canso Wind Farm, if approved, would contribute to the reduction of greenhouse gas emissions required to meet Canada’s targets under the Kyoto protocol.

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