CHAPTER 5 CONSULTATION

5.1 Community Consultation

AWPC and its subsidiary PWFI have been meeting, discussing and engaging with interested landowners, local residents and summer home property holders on the proposed Project since early in 2006 when the Project was first considered to be commercially viable. Open houses, focus group meetings, questionnaires and discussion work books have been prepared and distributed; their outcomes documented. AWPC has also regularly consulted with its landowner group over the years recognizing that all but one of these landowners are local community members having a variety of backgrounds, interests and professions. Two additional open houses were held in January 2012 to show interested parties how the project had changed, i.e., the number of proposed turbines had been reduced from 27 to 12 and their siting had been pulled further away from the Gulf Shore Road.

5.2 Open Houses

5.2.1 Open Houses and Meetings in 2006/2007

The first of two Open Houses was held at the Saint Thomas Moore Catholic Church Hall in Pugwash, on November 21, 2006. AWPC representatives were on hand to explain the detail provided on display materials; they also showed a power point presentation describing the proposed project. Approximately 60 people attended. Questionnaires were available; 27 were completed and returned to the proponent. Survey results indicated that those in attendance were generally comfortable with the proposed project; 17 of the respondents in fact indicated that they were in favour of the proposed project. Concerns articulated both on the floor of the meeting and in the written responses included potential noise, construction traffic, aesthetics, vibration, shadow flicker, property values, potential impacts on local wildlife and the extent of proposed set-backs from residential property.

On April 7, 2007 a meeting was held with 18 seasonal residents of the Gulf Shore from the Halifax area to provide them with the information to be presented at a second Open House that was to be held in Pugwash on April 11, 2007. Seasonal residents had expressed their concern that they were missing opportunities to provide input to the planning process either because they had not been notified, or were not available to attend the November meeting. Attendees at the April 7th meeting articulated strong concerns about the project; these related to setback distances, noise,

wildlife, infrasound and general concern that decisions with respect to the project were being made too quickly.

On April 11, 2007, a second Open House was held, again at the Saint Thomas Moore Catholic Church Hall in Pugwash. It was estimated that approximately 130 people attended though not everyone signed in on arrival. AWPC representatives again provided details on the proposed Project via a power point presentation, a site map and display materials. Survey forms were also made available. Twenty-five surveys were completed by attendees; the majority who submitted completed survey forms expressed reservations about the project, or were adamantly opposed. The issues raised were similar to those outlined above; the major concerns appeared to be related to potential noise and the anticipation of negative impacts on property values.

5.2.2 Focus Group Sessions

In order to discuss identified concerns in greater detail on a more one-to-one basis, CBCL Limited initiated two focus group meetings; the first was held in Pugwash on June 19, 2007 and the second in Halifax on June 26. The objectives of these meetings were to:

- provide information on the environmental assessment process for the proposed wind farm and on the regulatory requirements for that process;
- talk about the Project parameters;
- reference the field work that had been done and was planned; and
- discuss issues raised including, but not necessarily limited to, the following: the potential aesthetic impact, noise, flicker, property values and ecological concerns.

In preparation for the meetings, project workbooks were prepared and distributed as a guide for the discussion. Participants were encouraged to voice their concerns and to document them and any other relevant information in the workbooks for further analysis as part of the environmental assessment process. A copy of this Workbook is included in Appendix E.

Issues raised again included aesthetics, noise, property values, general enjoyment of the rural area and shadow flicker. There was an overriding concern that tourism, an economic mainstay of the local economy, would be adversely impacted, because the proposed wind farm would detract from the visual appeal of the Gulf Shore. If that was the case there would be a general decline in the local economy. Concern was also expressed that the environmental assessment process may be biased in the proponent's interests because they are responsible for the completion and financing of the process.

5.2.3 Open Houses in 2012

Open Houses were held at the Saint Thomas Moore Catholic Church Hall in Pugwash on January 17 and 18, 2012, from 3:00 pm to 8:00 pm each day. These events were advertised in the Citizen Record and the Oxford Journal. In addition, individual notices went to property owners. These sessions provided an opportunity for interested stakeholders to reviewed the revised plans for the Pugwash wind farm, ask questions and provide comment directly to representatives of AWPC, its subsidiary PWFI and their project team. Copies of the display material, together with the questionnaire, are provided in Appendix E.

Approximately 130 people attended the two sessions with 85 people signing an attendance sheet on Tuesday, January 17th and 42 people signing on Wednesday, January 18th. Approximately 50 of those in attendance on the Tuesday arrived as protesters carrying placards and demanding that the project be abandoned. They entered the hall in an orderly manner, articulated their concerns and dispersed. Some took the opportunity to examine the display boards and to talk to one or more of the project team. Most completed the questionnaire).

Of those in attendance at the two sessions, 85 people provided written comment in the form of a questionnaire; several others returned theirs by fax or email (at the time of printing. Of the 63 individuals who indicated opposition to the project, all cited one or more of the following concerns:

- impacts to wildlife, including the Wallace Bay National Wildlife Area, bats, deer and coyotes;
- impacts to human health due to noise and flicker effects;
- insufficient setbacks;
- loss of economic growth in the area due to incompatibility with local tourism industry and the cottage/retirement community;
- lowering of existing property values;
- incompatible visual aesthetics;
- incompatible with current way of life;
- potential impact to existing infrastructure (roads) and natural resources (water table) due to project construction;
- potential for future expansion of the proposed wind farm at a later date;
- lack of provisions to secure the developer's commitment to the future decommissioning of the windfall;
- developer's past reputation (Pubnico Point Wind Farm was identified as an example of poor wind farm siting).

Many of those opposed to the project did indicate that they are in support of wind farming, but not in the proposed location.

28 individuals indicated on the questionnaire that they were in support of the project. The following comments or reasons were offered as to why:

- the proposed project looks well thought out;
- they own the land where the WTGs are proposed;
- alternative energy must be encouraged;
- we have a moral obligation to support renewable energy projects;
- great economic opportunity for the area;
- nice to see the wind harnessed and productive; and
- the project will be fine as long as environmental standards are met.

Five of those who completed a questionnaire indicated that they were undecided. Several also suggested that they would be in favour of the project if its development would have a direct impact on electricity rates in the area.

Although the numbers attending on the second day were smaller, there was perhaps a more representative cross section of the community. Attendees included residents from the Irishtown Road, from the village itself and from the Gulf Shore Road. Many took considerable time to review the story boards and discus the issues. Several, including some residents from the Gulf Shore Road, were very interested in the prospect of renewable energy being generated locally; a few had taken personal steps to reduce their energy footprint; and, if all regulatory requirements were met, a substantial cross section were favourably disposed to the project as revised.

5.3 Gulf Shore Preservation Association

The Gulf Shore Preservation Association (GSPA) was created in 2006 in response to the Pugwash Wind Farm as it was originally proposed. Members have been outspoken against wind farming in their general vicinity since the beginning, requesting municipal setbacks of 1,000 to 2,000 m from inhabited properties to "ensure human health and safety". Based on the outcome of the group's 2010 annual general meeting, posted on the Pugwash Wind Farm Internet blog site[12], the GSPA stated the following as their position:

> "The GSPA's position is that commercial wind energy projects are inconsistent with the responsible development of the area, and that any such development on the Gulf Shore would be a serious setback to the community. Opposition to any such development is based on the following:
>
> - Asymmetrical Benefit - Commercial wind energy projects do not promote sustainable growth when inserted directly into an existing community. Such projects are win-lose. They are economically beneficial to outside stakeholders at the expense of those within the community.
> - Conflicting Industries - The commercial wind energy industry conflicts with our current destination tourism, recreational and retirement communities. These critical economic drivers are essential to Pugwash, Wallace and surrounding areas.
> - Margin of Safety Should be Larger, Not Smaller - Given the uncertainty of the environmental, health, and economic impacts, it is irresponsible to site commercial wind energy development projects within existing communities.
> - Negative Community Growth -Uncertainty stifles growth. The commercial wind energy industry maintains that these projects are benign but prospective community members will choose the certainty of no wind turbines over the uncertainty of living with them. Over fifty years of building the community will be undone with this continued threat.
> - Future Community Growth Stopped -Commercial wind energy projects and the related infrastructure consume prime land areas otherwise available for residential and recreational expansion."

[12] As part of their protest efforts against the proposed project, GSPA has created an anti-wind farm Facebook page: http://www.facebook.com/group.php?gid=2411518367&v=info and on online petition: http://www.petitiononline.com/pugwash/petition.html and a Blog site: http://pugwashwindfarm.blogspot.com/

In the summer of 2010, AWPC requested to meet with and present its revised plans for the Pugwash Wind Farm project to the GSPA. AWPC was invited to the GSPA annual general meeting held on August 22, 2010 in Pugwash. AWPC attended this meeting, but due to an unfortunate presentation equipment malfunction and the generally opposing mood of the group, the audience quickly became disinterested in what the proponent had to present. At least 50 members of the GSPA did attend the January 17th and 18th open houses in Pugwash to protest the proposed project; others sent in observations by mail and by e-mail. Their concerns remain the same: the WTGs, though lesser in number, remain too close to the residences and the amenities associated with the Gulf Shore Road.

5.4 Municipality of the County of Cumberland

AWPC presented its proposed project plan to the Municipality of the County of Cumberland for initial review in 2006, and has been in periodic contact with the warden and local representatives as the plans have evolved and changed. As has been stated in section 1.5.3, the Municipality has assertively pursued the articulation of its position with respect to embracing appropriately sited renewable energy projects within their area of responsibility. They have as a result of a very open process adopted a Renewable Energy Strategy and amended their Land Use Bylaw to both accommodate renewable energy projects and take account of concerns raised during their consultation process. The proposed layout for the Pugwash wind farm meets, in fact exceeds, the requirements of the new zoning bylaw.

Although the turbines are larger than those proposed in 2006, they are less than half as many, set back appreciably farther on pasture and forest land approximately 1 km from the Gulf Shore Road, and about 2 km from the Northumberland Links Golf Course in respect of which members of the GSPA had expressed their concern. The Village of Pugwash is roughly 2 km from the proposed site. Table 5.1 provides the distances from the nearest turbine to a number of key locations both on the Gulf Shore Road and in the Village.

Table 5.1: Distances to Key Local Receptors

Location	*Nearest Turbine*	*Distance (km)*
High School	WT1	1.9
East Cumberland Lodge	WT1	1.74
Golf Course	WT8	1.9
Cemetary (Crowly Road)	WT9	3.5
Sports Track	WT9	0.38
Windsor Salt	WT1	2.4
Wallace Bay Provincial Wildlife Area	WT11	2.7
Gulf Shore Provincial Park	WT3	0.96
St. Thomas Moore Church Hall	WT1	2
Hospital	WT 1	1.85

As stated in Section 2.2 and shown on Figure 2.2, the closest residential dwelling to the proposed WTGs is about 680 m from WT1, and belongs to a land holder who is leasing property to the proponent. Four other residential dwellings are about 700 m or more from the nearest turbine while the remaining dwellings in the study area are 800 m, or more from any turbine.

5.5 First Nations

Letters indicating the intent to develop a wind farm at Pugwash, enclosing copies of the materials presented at the January open houses and the Archaeological Resource Impact Assessment (AIRA) have been sent to the Confederacy of Mainland Mi'kmaq, the Union of Nova Scotia Indians and the Native Council of Nova Scotia. A meeting has also been requested and arranged with the Technical Committee of Kwilmuk Maw-klusuagn (KMK) to present the parameters of the project. Because of the busy schedules of all involved, this meeting will take place in mid February. To further ensure that reliance is not placed solely on the predictive modelling undertaken in the ARIA, Membertou Geomatic Solutions have been contracted to undertake a MEK Study. As stated in section 3.3.3 when this is received, the material will be forwarded to NSE.

CHAPTER 6 SCOPE OF THE ASSESSMENT

6.1 Approach

The overall approach to this assessment and the fieldwork is detailed in Chapter 3. Figure 3.1 depicts the steps in the environmental assessment process. The following sections provide a further explanation of how the environmental evaluation was undertaken.

6.2 Scoping: VECs and Socio-Economic Issues

It is impractical, if not impossible, for an assessment to address all of the potential environmental effects that might be directly or indirectly associated with a proposed undertaking. An important part of the assessment process, therefore, is to identify those matters upon which the assessment may be focused to ensure a meaningful and effective evaluation. This process is often referred to as scoping, i.e., an activity designed to identify those components of the biophysical and socio-economic environment which may be impacted by the Project and for which there is public and professional concern (Sadar, 1994). This section references the steps that were taken to focus this assessment and to identify the VECs and socio-economic issues.

As detailed in Chapters 3 and 4, there was both extensive documentary research and the execution of a range of field programs. The resultant database, in conjunction with the consultation undertaken, and the study team's professional expertise and experience, has enabled the definition of the VECs and socio-economic issues. This process has involved internal team discussions to ensure that the requisite interdisciplinary rigor brought focus to the assessment. These discussions have included the participation of the specialists contracted to execute specific field programs and the engineers involved in the prefeasibility studies associated with the siting of the turbines and the access roads. The inputs of stakeholders, including but not limited to the community, neighbours and representatives of pertinent provincial and federal departments, were also considered in the scoping process. The informed professional judgement of this team, particularly those who have executed the various field programs, and the local knowledge that the proponent team brought to the process, were important inputs to the determination of the VECs and socio-economic issues identified in Section 6.3. It is these factors that are subject to evaluation in Chapter 7.

6.3 Potential Pathway and the Definition of VECs and Socio-Economic

Once the boundaries of the Project were determined (section 1.4) and the phases of the Project defined (section 2.3), it is possible to identify those facets that may cause consequences for the receiving environment. This is accomplished by identifying the linkages, or pathways, between the Project and the receiving environment. That is, those components and activities that will be carried out on the site during Project construction, operation and eventual decommissioning that may have the potential to interact with the physical, ecological and/or socio-economic environment. Such pathways will include, but will not be limited to, the generation of sedimentation and emissions, including noise and dust.

The study team has determined the VECs and socio-economic issues that will be subject to assessment based upon its collective knowledge and experience; input received from the Proponent; review of the regulatory requirements and feedback from the community regulatory authorities and others as part of the consultation program and selected field programs. The VECs and socio-economic issues that will be evaluated are identified in Table 6.1.

Table 6.1: Potential VECs and Socio-economic Issues

Physical Components	***Ecological Components***	***Socio-economic Issues***
Ground and surface water quality	Wetlands	Land use
Rural ambiance	Forest cover	Employment and the economy
Radar and Radio Interference	Species of Concern	Property values
	Migratory and breeding birds	Aboriginal use of land
	Bats	Archaeological resources
	Fish habitat	Visual impacts
		Traffic
		Noise
		Health and safety

6.4 Analysis and Evaluation Criteria

The definition of "environment" in the *NS Environment Act* is as follows:

"Environment" means the components of the earth and includes

(i) air, land and water;

(ii) the layers of the atmosphere;

(iii) organic and inorganic matter and living organisms;

(iv) the interacting systems that include components referred to in sub clauses (i) to (iii); and

(v) for the purpose of Part IV, the socio-economic, environmental health, cultural and other items referred to in the definition of environmental effect."

In the provincial legislation *"environmental effect"* means in respect of an undertaking

a) any change, whether positive or negative, that the undertaking may cause in the environment, including any effect on socio-economic conditions, environmental health,

physical and cultural heritage or on any structure, site or thing including those of historical, archaeological, paleontological or architectural significance, and

b) any change to the undertaking that may be caused by the environment, whether that change occurs inside or outside the Province.

This assessment focuses on the evaluation of potential interactions between the VECs and socio-economic issues and the various Project activities outlined in the Project description, i.e., in Chapter 2. A standard evaluation system has been developed to ensure that potential effects are clearly and completely evaluated. Residual environmental effects are those that remain after mitigation and control measures are applied. The prediction of residual environmental effects follows three general steps:

- determining whether an environmental effect is adverse;
- determining whether an adverse environmental effect is significant; and
- determining whether a significant adverse environmental effect is likely to occur.

Many, if not all potential adverse effects, can be avoided through the application of good engineering and construction practices, the careful timing of activities, and the adherence to appropriate environmental management techniques.

The effects evaluation for each VEC and socio-economic issue is conducted by Project phase, i.e., construction, operation, and decommissioning, as well as malfunctions and accidents. For each phase, the study team identifies those Project activities that may result in a positive or negative effect on the VEC or socio-economic issue. To determine if there are adverse effects, the study team took the following factors into account:

- negative effects on the health of the biota;
- loss of rare and endangered species;
- loss of critical and/or productive habitat;
- fragmentation of habitat;
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;
- reductions in the capacity of resources to meet the needs of present and future generations, including those lands and resources used by aboriginal peoples; and
- interference with the use and enjoyment of property.

The analysis evaluates the interactions between Project activities and the VEC or socio-economic issue and determines the significance of any residual adverse environmental effects, i.e., effects that may persist after all mitigation strategies have been implemented. To determine and appreciate the relevance of residual effects following mitigation, the following definitions of impact have been adhered to:

- *Significant*: Potential impact could threaten sustainability of the resource in the study area and should be considered a management concern - research, monitoring and/or recovery initiatives should be considered; and

- *Negligible*: Potential impact may result in a slight decline of the resource in the study area during the life of the project - research, monitoring and/or recovery initiatives would not normally be required.

As not all consequences of Project development and operation on the identified VECs and socio-economic issues are adverse, the above table has been supplemented by the following two definitions:

- no impact, i.e., where the consequences of the Project have no effects on the specific VEC or socio-economic issue; and
- beneficial impact, i.e., where the consequences of that phase of the Project enhance the specific VEC or socio-economic issue.

6.5 Cumulative Effects

A consideration in any environmental assessment process is how the proposed Project may interact with past, present or likely, i.e., approved, future projects or activities within the defined spatial and temporal timeframes identified. It is, in fact, a way of setting the Project into its broader ecological and regional development context, and it is the Project's interface with this context that is discussed further in the evaluation.

6.6 Effects of the Environment on the Project

Several naturally occurring environmental factors, including fire, extreme weather events and climate change, could to varying degrees have consequences for the development and operation of the Project. These are referenced as appropriate in the evaluation of specific VECs and socio-economic issues in Section 7.5.

CHAPTER 7

ANALYSIS

7.1 VECs and Socio-Economic Issues

The VECs and socio-economic issues that form the basis for this environmental analysis are identified in Table 6.1. For an impact to occur, however, there has to be a link between the Project activities and the VEC or socio-economic issue, i.e., a pathway. Table 7.1 depicts where there is a potential pathway or linkage between the identified VEC or socio-economic issue through site preparation and construction, the operation and maintenance of the turbines and their decommissioning. This table graphically depicts potential interactions where there is a possibility for impact. Where there is no pathway, or linkage, there can be no impact on that VEC or socio-economic issue; a justification of this outcome is provided in the text.

Table 7.1: Potential Interactions Between Project Activities and VECs/Socio-Economic Issues

	Site Preparation and Construction					**Operation and Maintenance**			**Reclamation & Decommissioning**		
	Site preparation	Transportation of WTGs	Assembly of WTGs	Release of hazardous materials	Accidents and malfunctions	Operation and Movement of WTG blades	Release of hazardous materials	Accidents and malfunctions	Dismantling of WTGs	Transportation of WTGs	Accidents and malfunctions
Physical											
Ground and surface water quality	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Rural ambiance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Radio and Radar Interference						✓					

	Site Preparation and Construction					Operation and Maintenance			Reclamation & Decommissioning		
	Site preparation	Transportation of WTGs	Assembly of WTGs	Release of hazardous materials	Accidents and malfunctions	Operation and Movement of WTG blades	Release of hazardous materials	Accidents and malfunctions	Dismantling of WTGs	Transportation of WTGs	Accidents and malfunctions
Biophysical											
Wetlands	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Forest cover	✓				✓			✓	✓		✓
Species of Concern	✓		✓	✓	✓	✓	✓	✓	✓		✓
Migratory and breeding birds	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bats	✓			✓		✓			✓		
Fish habitat	✓										
Socio-economic											
Land use	✓					✓			✓		
Employment and the economy	✓	✓	✓			✓			✓	✓	
Property values						✓					
Aboriginal use of lands						✓					
Archaeological resources	✓										
Visual impacts						✓					
Traffic	✓	✓	✓						✓	✓	
Noise	✓	✓	✓			✓			✓	✓	
Health and safety	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The following sections present the environmental evaluation and identify the residual effects of the proposed Project on the above identified physical and biophysical VECs and socio-economic issues. Recommendations for mitigation are identified where applicable. The analysis also takes into account the consequence of the proposed Project interacting cumulatively with other activities including agriculture and logging in the area.

7.2 Physical VECs

7.2.1 Ground and Surface Water Quality

The maintenance of the quality of the ground and surface waters on site is important to the maintenance of habitat quality particularly that associated with:

- the wetlands that are located in the vicinity of the WTGs; and
- the headwaters of Matheson Brook and Tidemill Brook drain northwards from the area of the WTGs to the Northumberland Strait and westward into the Pugwash Harbour respectively.

Ground and surface water quality has therefore been identified as a VEC.

A significant environmental effect on ground and surface water quality would result if a substantive change attributable to the Project could be identified in ground and surface water quality in the area.

7.2.1.1 Boundaries

The physical boundaries encompass those wetlands and streams in proximity to those areas which will be subject to the construction or upgrading of the access roads, laydown areas and WTG foundations. This work will involve the use of heavy equipment and some excavation of the bedrock; during Project operation the focus will be upon maintenance activities while the eventual decommissioning of the WTGs will again involve the use of heavy equipment. The temporal boundaries are primarily those associated with site preparation and Project construction, but the effects, if mitigative measures are not applied, could be more reaching both spatially and over time. In the broader sense the temporal boundaries relate to the anticipated life of the Project, i.e., 20 or more years.

7.2.1.2 Pathway Analysis

The pathways that may adversely affect ground and surface water quality include:

- the disturbance of sediments during the construction of the WTGs and the associated access roads;
- dust created during construction; and
- the accidental release of hazardous materials such as fuels, oils and lubricants.

All activity, even the construction of the pads, is relatively superficial and will not substantially impact groundwater. Given the nature of the soils in the area (see section 4.1.3), there is no pathway to groundwater.

7.2.1.3 Mitigative Measures

Construction activity will involve clearing and grubbing in addition to excavation, activities that have the potential to cause erosion and the transportation of sediment to adjacent areas, including existing ditches, wetlands and streams. The severity of erosion and sediment transport depends on several factors including precipitation, soil type, slope, vegetation cover and distance. Given that the greater part of the area where construction will occur will remain largely untouched, sedimentation

is not anticipated in most areas to be an issue. This will be reinforced through the use of proven methods to control run-off, erosion and dust including:

- defined procedures for the storage and handling of excavated materials;
- timely re-vegetation, if necessary, of disturbed areas after construction;
- the installation of temporary erosion control measures, e.g., drainage barriers, sediment fences, plastic sheeting, straw or mulches, etc., as necessary; and
- watering of exposed areas to control dust during construction if required.

As referenced in section 2.2.3, there may be locations where the existing culverts will be extended to enable the passage of the crane necessary for the construction of the WTGs. These extensions will be designed and implemented in a manner that all works will take place outside of the waters, and the necessary protective measures will be installed to ensure that there is no impact from the disturbance of sediments on those waters. All necessary permits will be sought from NSE.

Figure 7.1 illustrates the construction sequence and mitigative measures that will be taken to protect the waters and habitat at the culverts.

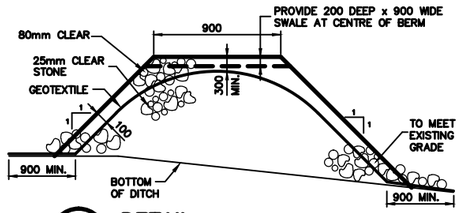
More specifically the following mitigative measures are proposed for the construction, operation and decommissioning phases.

Site Preparation and Construction

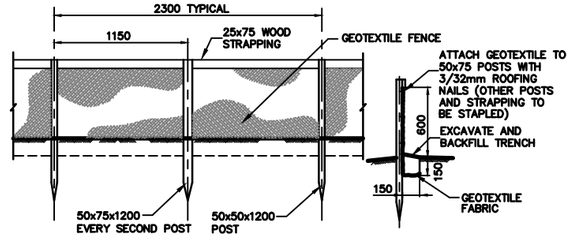
- Installation of erosion and sedimentation control measures and surface water control features, e.g., silt fencing, where appropriate, before land clearing and earth handling;
- Excavation for turbine footings and the storage, handling and disposal of excess materials in an environmentally appropriate manner;
- No equipment to enter into wetlands or brooks;
- Installation of required culvert sections to specified grades and inspections to ensure tight joints;
- Placement of geotextile between existing slope and any new culvert, or extension thereof, to prevent backfill material from falling into the stream bed;
- Placement of backfill at 300 to 450 mm layers and compacted to 95% standard proctor;
- Placement of road gravels;
- Covering exposed surfaces where applicable with straw mulch, or another stabilizer;
- Removal of all temporary culverts upon completion of site works;
- Pull back road bed;
- Re-establishment of take-off ditches; and
- Removal of sediment control fences.

Operation and Maintenance

During the operation and maintenance of the site, storm drainage structures will be monitored and maintained to the extent applicable to prevent sedimentation migrating into the brooks and wetlands from any runoff from the turbine pads.



1 — **DETAIL—SEDIMENT CONTROL BERM**
NTS

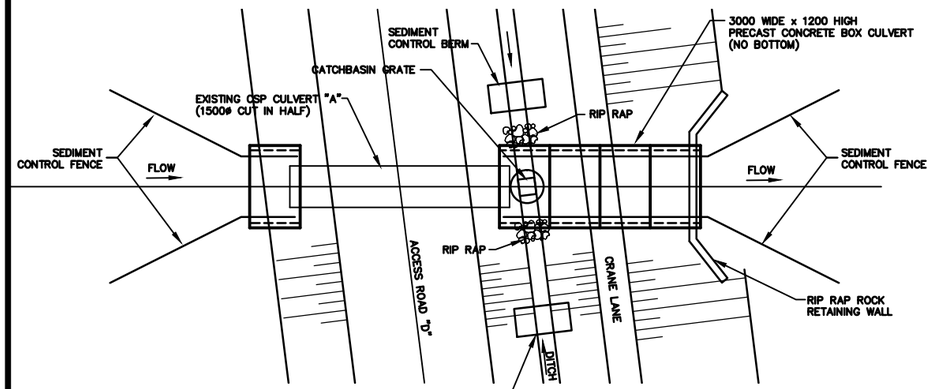


2 — **DETAIL—SEDIMENT CONTROL FENCE**
NTS

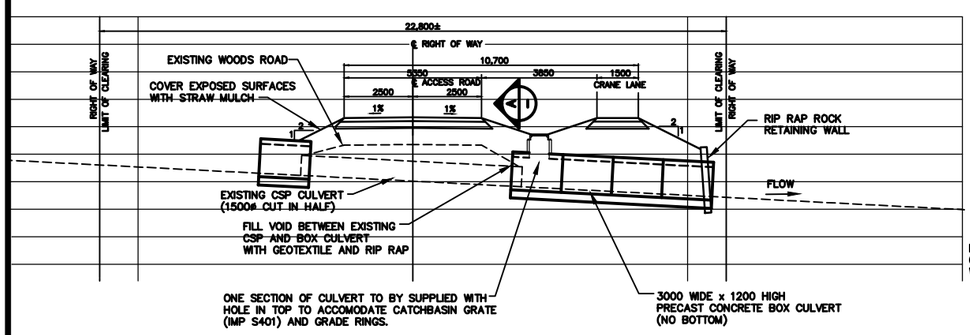
NOTE:
REFER TO CULVERT "A" FIG 2.3 STREAMS AND CULVERTS.

CONSTRUCTION SEQUENCE – TEMPORARY CULVERT INSTALLATION
–ENSURE ALL SEDIMENT AND SILTATION DEVICES ARE IN PLACE AND WORKING.
–EXCAVATE FOR GRAVEL FOOTING. REMOVE EXCAVATED MATERIAL TO APPROVED DISPOSAL AREA
–CONTRACTOR TO ENSURE THAT NO EQUIPMENT OR MATERIAL SHALL ENTER THE STREAM.
–PLACE CLEAR STONE TO DIMENSIONS INDICATED.
–INSTALL CULVERT SECTIONS TO GRADES INDICATED. ENSURE TIGHT JOINTS.
–PLACE GEOTEXTILE BETWEEN EXISTING SLOPE AND NEW CULVERT TO PREVENT BACKFILL MATERIAL FROM FALLING INTO THE STREAM.
–PLACE BACKFILL IN 300–450mm LAYERS AND COMPACTED TO 95% STANDARD PROCTOR.
–PLACE ROAD GRAVELS.
–COVER ALL EXPOSED SURFACES WITH STRAW MULCH.
–REMOVE TEMPORARY CULVERTS UPON COMPLETION OF SITE WORKS.
–PULL BACK ROAD BED
–RE–ESTABLISH TAKE OFF DITCHES
–REMOVE SEDIMENT CONTROL FENCES.

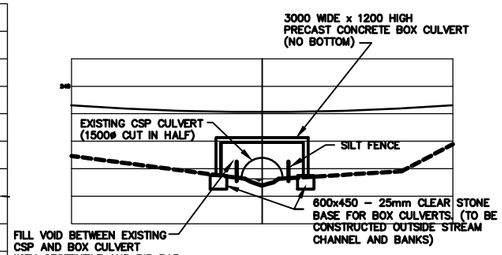
ENVIRONMENTAL MEASURES DURING CONSTRUCTION
- CONTRACTOR RESPONSIBLE FOR EROSION AND SEDIMENT CONTROL
- EROSION AND SEDIMENT CONTROL DEVICES TO BE IN PLACE PRIOR TO START OF CONSTRUCTION. CONTRACTOR MUST MEET NSDE&L REGULATIONS.
- EXPOSED SURFACES MUST BE STABILIZED ON A DAILY BASIS WITH WOOD CHIPS AND STRAW. PARTICULAR ATTENTION SHOULD BE PAID TO RAINFALL FORECASTS AND ASSURING THE SITE HAS ADEQUATE PROTECTION.
- SILT FENCING AND BERMS SHOULD BE MAINTAINED ON A REGULAR BASES. INSTALL ADDITIONAL BERMS, SILT FENCES ETC. AS REQUIRED BY SITE CONDITIONS TO PREVENT SEDIMENT FROM ENTERING STREAMS.
- MAINTAIN A STOCKPILE OF EROSION AND ENVIRONMENTAL PROTECTION MATERIAL ON SITE AT ALL TIMES FOR DAY TO DAY USE INCLUDING THE FOLLOWING;
  - 100m OF SILT FENCE
  - 20 BALES OF STRAW
  - STOCKPILE OF WOODCHIPS AND CLEAR STONE
- STOCKPILES AND STEEP SLOPES OF EXPOSED SITE MATERIAL SHALL BE COVERED WITH PLASTIC SHEETS AS REQUIRED.



PLAN— TEMPORARY CULVERT "A & B" EXTENSION
N.T.S. (ROAD "D" STATION 3+926)



SECTION—TEMPORARY CULVERT "A & B" EXTENSION
N.T.S. (ROAD "D" STATION 3+926)



A — **SECTION**
N.T.S.

NOTE:
CULVERT "B" SIMILAR TO CULVERT "A" EXCEPT THE CRANE LANE AND CULVERT EXTENSION WILL BE ON THE UPSTREAM SIDE OF THE ROAD ONLY

CBCL LIMITED
Consulting Engineers
ISO 9001 CERTIFIED

CONSTRUCTION SEQUENCE AND MITIGATIVE MEASURES

Date	Scale	Contract	Figure
01/24/2012	AS NOTED	111257.00	7.1

Reclamation and Decommissioning

The mitigative actions during reclamation and decommissioning will be comparable to those executed during the construction phase, including the installation of site specific erosion and sedimentation control measures and the management of storm drainage from disturbed areas. Work will involve:

- Removal of any temporary culverts upon completion of the site works, pulling back of the road bed and the re-establishment of the take-off ditches; and
- Removal of the sediment control structures.

Accidental releases of hazardous materials could occur during any phase of the Project and might include petroleum products, solvents and paints. Accidental releases of other chemicals could occur from storage facilities or vehicles. The severity of an accidental event would depend on the chemical characteristics and volume of the release and its proximity to a brook or wetland. Relatively small amounts of fuel and hydraulic fluid spilled during the operation of construction equipment, or the servicing of the turbines, are the most likely types of accidental releases. Standard practices for the handling, storage and use of potentially hazardous materials will be enforced through all phases of the Project. The following mitigative measures will also be applied:

- all hazardous materials to be used at the site will be labelled according to WHMIS regulations;
- vehicle maintenance and refuelling will be prohibited within 30 m of all water courses and wetlands;
- frequent inspection and maintenance of all equipment used on the site will be undertaken to identify and repair fuel leaks;
- used oil, filters and other products associated with equipment maintenance shall be collected and disposed of in accordance with regulatory requirements; and
- all spills shall be immediately reported to the Environmental Emergency # 1-800-565-1633 (after hours) or 902-424-3600.

Given the use of proven sedimentation control measures, including those advocated in the “Erosion and Sedimentation Control Handbook for Construction Sites”, the distances from the WTG sites to the brooks in the area and the further development of standard practices for the handling, storage, use and disposal of potentially hazardous materials as part of a comprehensive EPP program, it is highly unlikely that sedimentation will pose a hazard to ground and surface waters. In summary, through the use of standard and accepted industry procedures and mitigative measures, adherence to applicable regulations and guidelines, and waste management planning, the construction of the proposed Project will be undertaken in an environmentally responsible manner and is unlikely to result in a significant adverse effect on surface and ground water quality.

Project interactions with surface and ground water during Project operation are anticipated to be minimal. The most likely interface is an accidental release of a hazardous material during turbine maintenance or when machinery is necessary to facilitate repairs. In summary, by adhering to applicable regulations and guidelines, implementing mitigation measures and applying good management practices as referenced above, the operation of the proposed Project is unlikely to result in a significant adverse effect on surface and ground water quality.

The decommissioning of the Project would involve the dismantling and removal of the WTGs and the reasonable rehabilitation of the Project site as detailed in section 2.3.3. As referenced, the concrete pads at the site would remain in place. In summary, the reclamation and decommissioning of the site is unlikely to result in a significant adverse impact on surface and groundwater quality. Beyond the accidental release of a hazardous material, malfunctions could perhaps involve a need to replace components of one or more WTGs, or other components of the wind farm. The measures adopted to minimize erosion or sedimentation during construction would be likewise adopted to address the consequences of any earth works required to resolve malfunctions in equipment.

7.2.1.4 Cumulative Effects

There are no known development activities that will take place in or in the vicinity of the site that might act cumulatively with the proposed Project to cause a significant adverse effect on the surface or ground water quality. The property owners, however, will continue to farm the lands and to harvest the forest cover and to do so will use heavy equipment. These ongoing activities together with the ATV and snowmobile traffic that accesses the area on occasion will continue to cause some level of ground disturbance and generation of silt to surface and ground water in the area.

7.2.1.5 Residual Effects

The Project is not anticipated to have a significant residual environmental effect on the surface and ground waters of the area, i.e., on either the wetlands or the headwater brooks. The impact is predicted to be negligible.

7.2.2 Rural Ambiance of the Area

The proposed site for the wind farm is approximately 2 km to the east of the Village of Pugwash; the 12 WTGs are sited on either side of the Irishtown Road in all cases at least 1 to 2 km south of the Northumberland coast. In several senses, the area has a very distinct rural ambiance. The land involved is currently used for agricultural and logging purposes, rural uses of land traditional to the area and to the entire Gulf Shore coast; these uses will continual uninterrupted. The larger area is also a recognized destination for tourists and has become over the years a favoured location for cottagers and a destination for retirees who seek the ambiance and attributes of the Gulf Shore. These latter trends have brought new investment to the area and their importance to the economy of the Municipality of the County of Cumberland is recognized. In summary, rural ambience can be defined from two perspectives: the perspective of those who have worked the fields and woods for generations and those, some for several generations, who have holidayed and/or retired to enjoy the attributes of the coast and the views that exist over the Northumberland Strait; both exist.

Several aspects of the proposed development may contribute to a perceived change in one or other of these rural ambiances: the structures themselves, lighting and noise are perhaps the most important. Several aspects that relate to the consequences for the rural ambience of the area are addressed specifically in other sections, e.g., noise and viewscapes.

This section will look at lighting and the less tangible associations of rural ambience as well as the fact that the latter might change.

A significant environmental effect on the rural ambience of the study area would result if the development and operation of the WTGs, i.e., the Project, was demonstrated to sustainability change or disrupt the way of life of those living, working and enjoying the rural attributes of this area.

7.2.2.1 BOUNDARIES

The physical boundaries include an area that is greater than the WTG sites, encompassing the coast and the Village of Pugwash. The temporal boundaries relate to the anticipated life of the project, i.e., 20 or more years.

7.2.2.2 PATHWAY ANALYSIS

As indicated in section 2.2.5.1, the WTGs do have to be marked in accordance with TC's Obstruction Marking and Lighting standards (Standard 621.19). To meet these requirements and in recognition of the proponent's preference to have a flash with a distinct off period, the proponent is considering the use of a LED based technology pointed within the TC acceptable range with all lighting synchronized. The purpose of the lighting is to provide an effective means of indicating the presence of objects that could present a hazard to aviation safety. The lighting of necessity will be visible for some considerable distance including from the Village of Pugwash and the coast. It should not pose discomfort to those living in proximity to it, nor to the residents of the Gulf Shore and the Village of Pugwash.

Change is always taking place in any environment, including the rural environment. Sometimes it is changes to agricultural practices, such as the introduction of larger machinery or the introduction of new crops; sometimes it is the introduction of new structures, such as silos. Such changes introduce new elements into the landscape and over time they become accepted. Today, travelling the rural roads of the Municipality of Cumberland and other areas of the province, one will see abandoned barns and other structures and in places evidence that famers are diversifying their incomes through construction evidenced by the presence of cranes and other related heavy equipment in what were once farm sheds. This is change.

On the Gulf Shore coast, change has also taken place. Throughout the 19th and early part of the 20th century, the intensification of coastal use was based on the conventional economic model of growth, where infrastructure development, e.g., harbours, railways and road networks drove the coastal economy. This development attracted labour and settlement followed. This was the genesis of the land use pattern around Pugwash. Today, much coastal development follows a different model, with the main trends related to residential, recreational and industrial development. While increased urbanization is leading to population decline in much of rural Nova Scotia, the demand for oceanfront and ocean view locations has tempered this trend along the coast. Small summer cottages have been replaced by larger more permanent all year residences and recreational activities have occupied coastal sites. As depicted on Figure 4.2, this has happened along the Gulf Shore. This too is change, and as the province through the Provincial Oceans Network strives to establish effective management strategies for the coastal area, the consequences of these development patterns are being examined.

Figure 7.2: An example of coastal cottage and recreational development, Fox Harbour, NS. (Source: Nova Scotia Geomatics Centre Datalocator 1995 & 2005, retrieved 3 February 2009 from www.nsgc.gov.ns.ca/datalocator)

The development and operation of the Pugwash wind farm will introduce new structural elements into the landscape; it will also, if developed, contribute to the attainment of provincial and municipal objectives with respect to the accommodation of renewable energy. The proposed 12 WTGs are located 1 to 2 km and more landward of the coast, accommodated within agricultural and wooded land; they will alter the current rural perspective, but it is one change of many occurring. Given their siting, they neither impede access to, or current use of, the coastal area for residential or recreational purposes. For those travelling on the Gulf Shore, by car or bike, they may well see the turbines as they glance inland, but the turbines will not inhibit their enjoyment of, or access to, the coast or the general area for recreational purposes.

7.2.2.3 Mitigative Measures

The lighting of the wind farm is a legislative requirement. Beyond attaining the best technology to address the requirements while simultaneously striving to minimize the impact to wildlife, there are no mitigative measures proposed.

The WTGs have been sited at some considerable distance from the nearest residences and in accordance with the requirements of the recently amended Municipal By-law. The WTGs will introduce a change in the landscape, in the rural ambiance, but it is but one change of many. No additional mitigation is proposed.

7.2.2.4 Cumulative Effects

As indicated above, change and adaptation is a constant process, but there are no known development initiatives proposed for the project area that would act cumulatively with the proposed wind farm to cause a significant adverse impact on the rural characteristics and ambience of the area; no cumulative effects are anticipated.

7.2.2.5 Residual Effects

The development of the WTGs as proposed and the lighting required to ensure their safe operation are not predicted to have a significant residual effect on the general population's ability to enjoy the rural characteristics and attributes of the area. The impact is predicted to be negligible.

7.2.3 Radio and Radar Interference

As detailed in section 4.4.6, contact was made with the following agencies that operate radar and related systems that may, under certain circumstance, be impacted by the operation of the WTGs. These systems are used for predicting the weather, the Canadian Air Defence system and air traffic control systems. Contact was made with the following:

- DND Air Defence and Air Control Radar Systems;
- Canadian Coast Guard;
- Meteorological Service of Canada; and
- NAV Canada.

These are important national systems. A significant environmental effect would result if there was a failure of one such system that could be attributed to the Project. The temporal boundaries relate to the anticipated life of the Project, i.e., 20 or more years.

7.2.3.1 Boundaries

The area of interest with respect to each of the above relates to the operating area of their respect systems in relation to the footprint of the proposed Project. The temporal boundaries relate to the anticipated life of the Project, i.e., 20 or more years.

7.2.3.2 Pathway Analysis

The analysis with respect to each of the above is undertaken by the authority involved. Also as detailed in section 4.4.6, with the exception of NAV Canada, all the referenced parties have

responded indicating that the proposed Project will have no impact on their operating systems. NAV Canada will likely respond by mid-February. Their response will be forwarded to NSE on receipt.

7.2.3.3 Mitigative Measures

No mitigative measures are required based on the responses received.

7.2.3.4 Cumulative Effects

There are no known development activities that will take place in or in the vicinity of the proposed wind farm that may act cumulatively with the Project to cause a significant adverse effect on the referenced operating systems.

7.2.3.5 Residual Effects

Based on the reponses from the agencies that have replied to date, the construction, operation and decommissioning of the wind farm will not result in a significant adverse impact on communications and radar systems. There is expected to be no impact.

7.3 Biophysical VECs

7.3.1 Wetlands

Wetlands provide distinctive habitat and serve as an important link between freshwater and terrestrial ecosystems. The intent of the new Provincial Wetland Conservation Policy (Nov, 2011) is the "no-net-loss" of wetland functions. This policy is achieved through three main avenues: avoidance; mitigative design; and compensation for the loss of wetland habitat. NSDNR Wet Area Mapping was used to focus field investigations with the proponent making every effort through the configuration, site verification and iterative reconfiguration of turbine laydown areas and access roads, to avoid wetlands. Every turbine location and access road alignment was investigated for the presence of wetlands. Unfortunately, because of the nature of the Study Area, property setback and wind analysis requirements, it will be impossible to avoid every wetland encountered on site. That being said, the Proponent has minimized the impact on wetlands by managing to avoid all wetland habitat, but two areas associated with turbines WT4 and WT12. Several other wetlands will be traversed by access roads. Those wetlands that will be impacted by construction will be formally delineated as per NSE approved procedures as part of compiling the Wetland Alteration Approval Applications. Sections 3.2.2.1 and 4.2.3.8 detail the extent of the wetland field work undertaken and provide information on the extent of wetlands on site (see Figure 4.2). The intent of the proposed layout is to ensure the retention of as much existing wetland habitat as possible, while meeting other project requirements. It is understood that compensation will be part of the approval to alter any wetland in accordance with NSE's policies.

A significant environmental effect on wetlands would result if there was a substantive change to the wetlands in the area that could be attributed to the Project.

7.3.1.1 Boundaries

The spatial boundaries are limited to the physical extent of the wetlands themselves and the physical relationships between these areas and the WTGs and access roads. The temporal boundaries are primarily those associated with Project construction.

7.3.1.2 Pathway Analysis

The pathways that could have an adverse impact on the wetlands include the grubbing and clearing of land for the turbines and the access roads, the construction process itself and the associated disturbance of sediments and dust that may be associated with such activities. Other pathways include the accidental spilling of fuels, lubricants, or hydraulic fluids and pedestrian and vehicular access into the wetlands.

Construction activity can affect a wetland in several ways. The movement of heavy machinery, for example, can result in the physical disturbance of plant communities and substrates. Other activities such as clearing and grubbing, trenching and backfilling, if inappropriately undertaken, could result in the sedimentation of inundated portions of a wetland. Trenching could alter the hydrologic regime by changing groundwater flows. In turn, this could result in increased or decreased water levels depending on whether groundwater is directed into the wetland or drained from it. In dry weather, excessive dust could be blown into wetland areas influencing nutrient loading of the systems. Wetland flora and wildlife species could also be affected by accidental spills of fuels, lubricants or hydraulic fluids.

7.3.1.3 Mitigative Measures

As referenced above, effective planning for the proposed wind farm has enabled the siting of both the turbines and the access roads to be undertaken in a manner that will minimize the amount of direct impact on any wetland. Indirect impacts in the absence of effective mitigation could be associated with the consequences of construction on surface waters. The latter are addressed in Section 7.2.1 above. Further mitigative measures for this VEC would include the delineation and functional assessment, by qualified personnel, of all wetlands that may be directly impacted by the construction of this project. This would involve the application of wetland delineation procedures and specific protocols in the field as outlined by the US Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987) and approved by NSE. Wetland determination and delineation is focused on establishing the wetland-upland edge and is based upon the presence of positive indicators for the following three parameters:

- hydric soils;
- hydrophytic vegetation; and
- wetland hydrology.

A positive indicator must typically be present for all three parameters in order to definitively identify any given site as a wetland.

Once the project is built, the direct impact of its operation and maintenance on any wetland is anticipated to be minimal. The most likely pathway for impact is an accidental release of a hazardous material during turbine maintenance, when machinery is necessary on site to facilitate

repairs, or, to a lesser extent, when dust is generated from travel along the access roads for servicing of the turbines. Through the application of good management practices, the operation of the proposed Project is unlikely to result in a significant adverse effect on the wetlands at Pugwash.

The decommissioning of the Project would involve the dismantling and removal of the turbines and the reasonable rehabilitation of the Project site. There would be no excavation involved and, as referenced in Section 2.3.3, the foundations of the turbines would be left in situ. In summary, the decommissioning of the site, though involving the transportation in heavy equipment of large structural components, would be less invasive than the construction program and would be conducted in accordance with all applicable regulatory requirements in an environmentally responsible manner.

Beyond the accidental release of a hazardous material, malfunctions could involve the need to replace components on one or more WTGs, or other components of the wind farm. The measures advocated to address spills and minimize sedimentation would be applied as appropriate.

Malfunctions and accidents are not predicted to have a significant adverse effect on the wetlands.

7.3.1.4 Cumulative Effects

There are no known works that are proposed in the vicinity of the proposed Pugwash wind farm that would interact cumulatively with the construction and operation of the wind farm to have an adverse impact on the wetlands in the area. Agriculture and forest harvesting practices, including the use of farm vehicles and logging equipment, will continue to be used in and around the project area. Some of this activity would likely use the new access roads so there may be less impact, e.g., rutting, in some areas than there has been in the past. Once the WTGs and access roads have been constructed and are in operation, and the mitigative measures referenced above have been implemented, the proposed Project will not act cumulatively with other activities to cause a significant adverse impact on the wetlands; no cumulative effects are anticipated.

7.3.1.5 Residual Effects

The Project is not anticipated to have a significant residual environmental effect on the wetland habitat, i.e., the impact will be negligible.

7.3.2 Forest Cover

As detailed in section 4.2.2 and 4.2.3 and depicted on Figure 4.2, the Pugwash site is an integral part of the Northumberland Lowlands, a low-lying area in northern Nova Scotia adjacent to the Northumberland Strait where elevations rarely exceed 50 m. Black and red spruce forests make up the natural vegetative cover of this landscape. Early successional species including balsam fir, red maple, white birch and aspen typically colonize disturbed areas where forest harvesting and fire has occurred. Small stands of tolerant hardwoods are limited to the better drained, upper slopes and hilltops, while occurrences of tamarack grow on abandoned farmland. White spruce follow alder and eastern white cedar can be found growing on imperfectly drained soils. Intermingled in the heterogeneous forest are agricultural lands, fields and pastures, old and new, carved from the forest. The forests in the vicinity of the WTGs, are actively harvested and will most likely continue to

be harvested. Even though fragmented by agricultural intervention, this forest cover provides valued habitat for a range of wildlife including birds and has therefore been recognized as a VEC.

The softwood and mixedwood forests are the most important for wildlife habitat, while the clearcuts are considerably larger in area. A significant environmental effect on forest cover could result if a change attributable to the Project resulted in a substantive loss of this cover.

7.3.2.1 Boundaries

The areas of concern with respect to forest cover include:

- those areas that will have to be cleared to accommodate the WTGs that will not be located in areas of most recent clearcut; and
- those areas that will have to be cleared to accommodate the new access roads.

These areas are all an integral part of the footprint of the Project. The temporal boundary is in the first instance the period associated with the construction of the Project when there will be clearing to enable the works to proceed. In the longer term the forest cover in some areas will regenerate and will continue to be modified through ongoing practices in the area. Fire, possible in the area as a result of warm summer moisture loss and windthrow of shallow-rooted trees due to imperfectly drained soils, is the most likely accidental event to pose a threat to the forest cover.

7.3.2.2 Pathway Analysis

The development of the Project will require trees and associated vegetation to be cleared. Although such clearing will occur in an area potentially suited for tree harvesting as is the present practice, the clearing will further aggravate the fragmentation of the forest cover and degrade the habitat conditions for wildlife.

The dominant cover type over most of the area, under an undisturbed scenario, would be that of a softwood forest. Currently, this softwood matrix is interspersed with both new clear cuts and planted stands of conifer trees in the older clear cuts. The turbine sites and roads will be new areas of permanent non-forest. In addition to the activities associated with the development and operation of the Project, the area is a 'working forest' and will be subject to ongoing management during all phases of the Project.

Connectivity of forest cover at Pugwash is already considerably compromised. There is, for example, an existing network of logging roads and agricultural lands, which encroach upon the forest ecosystem. This encroachment continues today with clearcuts and forest harvesting as recently as the summer of 2011.

7.3.2.3 Mitigative Measures

During project construction, the fragmentation of the remaining forested areas will be mitigated by clearing only the minimum required area for the construction of the required roads, turbine pads and laydown areas. Further, as indicated in section 2.4, the plan is to undertake site clearing during the winter, i.e., between December to March. This ensures that the cover and vegetation that

needs to be cleared, will be removed before the start of the bird breeding season thereby causing minimal disruption to birds that return to the area.

Staff will be trained to respond appropriately to accidental events, including the occurrence of fire. The Contingency and Safety Plan will detail appropriate response measures (see section 7.7).

7.3.2.4 Cumulative Effects

As stated above, this site is actively logged. The clearing required to accommodate the turbines and approximately 8 km of new access road will interact cumulatively to further fragment the forest cover in the Project area. The nature of the remaining cover will continue to evolve as this Project and the forestry practices in the area interact.

7.3.2.5 Residual Effects

Overall, fragmentation will be offset over time by the eventual regeneration (whether natural or artificial) of the existing clearcut areas, aside from those cleared for the construction of the Project. Forest productivity in the area is conducive to regeneration of all areas through natural or artificial means, as is evident in the old agricultural fields now reclaimed by white spruce forests. It is likely that the level of fragmentation resulting from the Project will be minimal in comparison to the past and ongoing fragmentation due to forestry.

The Project is not anticipated to have a significant residual effect on forest cover, i.e., the impact will be negligible.

7.3.3 Species of Concern

Under federal and provincial legislation, an environmental assessment must consider impacts of the proposed Project on listed flora and wildlife species, as well as their critical core habitat, and residences of individuals of that species. A list of the potential species of concern that may reside on, or migrate through or over, the Project area was compiled from the legislated designated lists, ACCDC and the NSDNR General Status Ranks. This list is referenced and discussed in section 4.3.

As protection of species at risk is ecologically and socially important, as well as being required by legislation, Species of Concern have been identified as a VEC.

A significant environmental effect on a Species of Concern would result if an identified species or their habitat was irreversibly harmed by works attributable to the Project.

7.3.3.1 Boundaries

The spatial boundaries of this analysis include the lands necessary to the Project's development and adjacent lands that may provide habitat for Species of Concern. The temporal boundary is the duration of the wind farm's operation, i.e., 20 or more years.

7.3.3.2 Pathway Analysis

The possible pathways associated with the project that may have adverse effects on listed species include the physical disturbance to the habitat necessary to their life cycle and those activities that

may impact other VECs including water quality. The following sections identify potential interactions with listed species that have been identified in the study area.

Birds

Of the 29 species of conservation concern identified in the ACCDC short list (Appendix A), only three were observed in the field, i.e., the Northern Goshawk *(Accipiter gentilis),* the Greater Yellowlegs *(Tringa melanoleuca)* and the Solitary Sandpiper *(Tringa solitaria),* but none were considered to be breeders in the area of the proposed WTGs. Two Northern Goshawks were observed in September 2006 during the watch undertaken for shorebirds, waterfowl and raptors; two Greater Yellowlegs and five Solitary Sandpipers were observed in the same time period. While the NSDNR ranks the Northern Goshawk as YELLOW in its General Status ranking, ACCDC ranks the Northern Goshawks as S3S4; S3 denotes the species is "uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences)"; S4 denotes "usually widespread, fairly common, and apparently secure with many occurrences, but of longer term concern, e.g., watch list, 100 plus occurrences". The Greater Yellow legs and the Solitary Sandpiper are both ranked as GREEN in NSDNR's Status Rankings and as S3B S5M and S1?B S4S5M respectively in the ACCDC ranks.

As indicated in section 4.3.1, three additional birds of conservation concern were identified in the field, but had not appeared in the ACCDC short list; these were the Grey Jay *(Perisoreus Canadenis),* the Boreal Chickadee *(Poecile hudsonicus)* and the Common Nighthawk *(Chordeiles minor).* All are categorized as YELLOW under the NSDNR General Status List. Of the three the Common Nighthawk was considered a probable breeder in the area, while the Gray Jay and the Boreal Chickadee were considered possible breeders; none are confirmed breeders. The Common Nighthawk is protected under the *Migratory Birds Convention Act.* Although widely distributed and considered secure in Canada, it is considered sensitive in Nova Scotia.

There is an increasingly expanding literature on how birds react to wind turbines. One pertinent reference is Powlesland, 2009. With respect to shorebirds, such as the Greater Yellowlegs and solitary Sandpiper, he references work that suggests on the one hand that shorebirds avoid WTGs by as much as 500 m, while other installations have no significant effect on shorebird distribution. Powlesland cautions that the causes of such apparent inconsistencies in behaviour are unknown, but could relate to the relative abundance and proximity of other suitable habitat. Neither of the above mentioned species was identified by Dalzell as breeders in the immediate project area. It is also posited by Powlesland that birds breeding near WTGs have lower collision rates than non-residents as they tend to become familiar with their surroundings including the presence of the WTGs. The relationship between the WTGs and bird populations is complex and there remain unknowns.

Plants

As indicated in section 4.3.2.2, of the 36 short-listed vascular plant species of conservation concern, three species were found on site. In addition, two additional species not specified on the ACCDC short list were also found on site. These species are:

- *Polygonum arifolium* – Halberd-Leaf Tearthumb;
- *Fraxinus nigra*- Black Ash;

- *Carex lupulina* – Hop Sedge;
- *Bidens connate* – Purple-Stem Swamp Beggar-Ticks; and
- *Rubus vermontanus* – Green Mountain Blackberry.

Of the above, the latter three species, i.e., the Hop Sedge, the Purple-Stem Swamp Beggar-Ticks and the Green Mountain Blackberry are secure rather than sensitive in the Province. The other two, i.e., the Halberd-Leaf Tearthumb and the Black Ash are considered more sensitive. The population of the Halberd-Leaf Tearthumb found by Blaney in 2006 is almost certainly the largest in the province and warrants further investigation. It is spread over several hectares to the west of the proposed access road to WT3 off the Gulf Shore Road. A single specimen of Black Ash was found in the same vicinity. This area will not be disturbed by the proposed site works.

7.3.3.3 Mitigative Measures

As acknowledged in section 4.3.1.4, there is suitable habitat for each of the referenced bird species in the vicinity of the WTGs and beyond. Clearing will remove a minor portion of that habitat, an activity that will take place during the winter months. This timing will be less disruptive to those species that might breed in the area, including those identified as being of special concern, as during the breeding season they will disperse and nest in habitat in the area that has not been cleared.

Because of the size of the population of Halberd-Leaf Tearthumb found by Blaney (2006) to the west of the proposed access road to WT3, a detailed site survey of the alignment of the proposed access road will be conducted in July 2012 prior to any alignment clearing. The proponent will communicate the results to NSDNR. The single specimen of Black Ash will not be disturbed.

The minimization of the project footprint, including the reduction in the number of turbines proposed and avoidance of valued habitat including wetlands, to the extent possible, and streams together with the commitment to a rigorous EPP will serve to protect the habitat in the area and the species that depend upon it.

7.3.3.4 Cumulative Effects

There are no known development activities that will take place in or in the vicinity of the study area that might act cumulatively with the proposed project to cause a significant adverse effect on Species at Risk. As property owners in the immediate vicinity of the proposed WTGs will continue to farm the land and harvest timber, there will continue to be incremental changes that occur within the spectrum of habitat depicted on Figure 4.2.

7.3.3.5 Residual Effects

The project is not anticipated to have a significant residual effect on Species at Risk. The impact is predicted to be negligible.

7.3.4 Migratory and Breeding Birds

As indicted in sections 4.3.1.1, 4.3.1.2 and 4.3.1.3, numerous birds breed, visit and fly over the project area; migratory and breeding birds have therefore been identified as a VEC.

As detailed, work undertaken in the field included bird breeding counts, a standardized area search, morning fall stopover counts and a fall watch for raptors, waterfowl and shore birds. This resulted in 55 species of breeding birds during the point counts and areas searches (see Table 4.8). Migration stop over use in the fall of 2006 was found to be low, i.e., <25 birds/day, and the entire area was estimated to contain fewer than 300 birds during the height of the migration period. 29 raptors were observed in approximately 30 hours of observation; these represent very low counts in what should have been prime time for fall raptor migration; the ornithologist concluded that the area did not serve as a significant fall raptor migration corridor. In addition three species of waterfowl were observed, i.e., the Canada Goose, the American Black Duck and the Common Merganser. Greater numbers of these species had also been anticipated.

A significant environmental effect on migratory and breeding birds would result if a substantive change in their numbers or their habitat could be attributed to the Project.

7.3.4.1 Boundaries

The boundaries associated with the determination of breeding and migratory birds takes in the area proposed for the WTGs and the associated access roads and the immediately adjacent lands. The pertinent temporal boundary for the assessment of project impacts on avian species is the duration of the project, i.e., 20 or more years.

7.3.4.2 Pathway Analysis

The two primary pathways that may cause detrimental impacts to birds are:

- The destruction of habitat during project construction; and
- The operation of the WTGs throughout the operating life of the project.

Clearly there will be a footprint where the WTGs are located and where the new access roads are constructed. There were three species of conservation concern that may have been breeding in the immediate area: the Grey Jay, the Boreal Chickadee and the Common Nighthawk. Construction activity will disrupt lands in the area for a limited period of time, i.e., weeks during the winter of 2012/2013, when the ground is cleared and for a period in the late summer and fall of 2013 during the construction of the WTGs. During the breeding season and spring migration there will be no site work taking place. Beyond the access roads, the sites of the WTGs and the laydown areas, the balance of the area, i.e., the greater portion of the area, will not be disturbed. Given the timing of the proposed clearing and associated construction, there will be no disturbance of nests; birds will likely return and breed in the area undisturbed through the spring and early summer of 2013. In the circumstances, project construction is unlikely to severely impact the numbers of diversity of bird species breeding in the project area.

In addition to the small portion of overall habitat lost to the WTGs and access roads, the effects of the rotating turbine blades and the question regarding whether or not birds are attracted to WTG marking lights should be considered. As indicated above, the Project site appears to be located such that it should not have a significant impact on migrant and resident bird populations. With respect to lighting, the proponent is striving to strike a balance between the demands of aviation safety and the CWS preference for intermittent lighting with a distinct off period. It is also widely thought that

birds that are resident in the vicinity of wind farms quickly become acclimatized to them (Kingsley and Whittam, 2001).

7.3.4.3 Mitigative Measures

Project design and the timing of construction works could be considered the first components of effective mitigation. Since 2006 when the project was first conceived, considerable effort has been made to minimize the Project's footprint on the landscape. The number of WTGs has been reduced from 27 to 12 with the result that there is a lesser footprint and consequently lesser habitat disturbance. Further the clearing of vegetation for both the access roads and the turbine sites will take place during the winter months, prior to the spring migration and the breeding season. These are important measures that result in a better Project profile and fewer adverse consequences for the area's habitat and the avian species that depend upon it.

The proposed WTGs will have a maximum height of 157 m to the tip of the extended blade and are therefore of a height less likely to interfere with bird passage. It has been noted, for example, that the majority of migrating birds fly between 150 m and 450 m above ground level (Belrose, 1971). Radar studies have largely confirmed these visual observations with the majority of nocturnal bird migration appearing to occur between 500 m to 700 m above the ground (Able, 1970; Alerstam, 1990; Gauthreaux, 1991 and Cooper and Ritchie, 1995).

Although it is known that wind turbines will from time to time kill birds, it is also important to put such kills into perspective. The following paragraph addresses this issue:

> "One American study estimated that an average of 2.19 birds is killed annually at each wind turbine in the United States. Outside of California, the estimated fatality rate drops to 1.83 (there is no published study on the impacts of wind turbines on birds in Canada). Therefore, based on 15,000 American wind turbines in operation, approximately 33,000 birds are killed each year by wind turbines including 26,000 in California alone. Although 33,000 is a lot of dead birds, the overall impact is small when compared to the millions of birds that travel over wind farms each year; not to mention the millions to hundreds of millions of birds that die due to collisions with transmission lines, vehicles, buildings and communication towers each year. Even if there were a million turbines in North America, they would not likely contribute to more than a few per cent of all bird collision deaths attributed to human structures" (Whittam and Hingsley, 2003).

7.3.4.4 Cumulative Effects

There are no known development activities that will take place in or in the vicinity of the site that may act cumulatively with the proposed Project to cause a significant adverse effect on migrating and breeding birds.

7.3.4.5 Residual Effects

In summary, although there may be some minimum impact on birds, the construction, operation and decommissioning of the wind farm is unlikely to result in a significant impact on this VEC. The impact will be negligible.

7.3.5 Bats

To date very little is known about the real implications of wind farm development on populations of some, non-migratory bat species. Little is known about the regional movements of bats to hibernacula sites during their locational migrations in the fall and spring. Ten of the greater than 500 echolocation call sequences recorded were attributable to the hoary bat. These calls, however, were all recorded at the same location within a very short time frame, i.e., approximately six minutes, and are therefore likely representative of a single individual. No calls were recorded for any of the other three migratory species. Location records for all of the migratory species in the province are patchy with off-shore accounts suggesting only occasional movements through the province (Broders et al*.,* 2003b; van Zyll de Jong, 1985). The small number of recorded call sequences from migratory species was not unexpected.

A significant effect on bats**,** specifically those species identified at the site**,** could result if a substantive change in the numbers or habits could be attributed to the operation of the Project.

7.3.5.1 Boundaries

The pertinent spatial boundary is the area occupied by the WTGs; the pertinent temporal boundary is the duration of the wind farm's operation, i.e., 20 or more years.

7.3.5.2 Pathway Analysis

Bats can be impacted by the proposed works through the disturbance of habitat and through the motion of the turbine blades, i.e., as the result of collision and/or change in air pressure.

Migratory species of bats have received the greatest attention because they make up the large majority of fatalities at existing wind turbine developments. Past evidence (Broders et al., 2003b), as well as the field work undertaken at Pugwash in 2007, suggest that there is likely no significant movements of migratory bat species (hoary, red, silver-haired or big brown bats) through the region. As a result, the proposed WTGs likely will not have a major impact on migratory species populations in the region, given their sporadic and patchy distribution.

Bat activity recorded at the proposed site was dominated by Myotis species (little brown bat and northern long eared), which typically forage at heights below the level of the turbine blades. Because the proposed wind farm at Pugwash is located in a largely wooded area and bat mortalities have recently been noted at other forested wind developments in eastern North America, there may be a risk of the mortality of Myotis bats at this site. Nevertheless, there was no evidence to suggest that significant numbers of bats were moving through the study area during the migratory period, i.e., no evidence that Pugwash was an integral part of an important migratory corridor.

7.3.5.3 Mitigative Measures

No specific mitigation measures are recommended.

7.3.5.4 Cumulative Effects

There are no known development activities that will take place in or in the vicinity of the Project site that may act cumulatively with the proposed Project to cause a significant adverse effect on bats.

7.3.5.5 Residual Effects

Although there are many unknowns associated with the movements of bats, based on the field work done and the research undertaken, the construction, operation and decommissioning of the wind farm is not anticipated to result in a significant adverse impact on this VEC. The impact, if any, is anticipated to be negligible.

7.3.6 Fish Habitat

As referenced in section 4.1.2, the Tidemill Brook and the Matheson Brook are the two principal streams that drain out of the immediate area where the turbines are to be constructed. In this latter area these streams and their tributaries provide poor fish habitat and intermittent water flow. The proponent has, however, gone to some considerable effort to avoid such stream; this in turn has influenced the final layout of the access roads. As indicated in section 2.2.3, it is anticipated that several small, non-fish bearing watercourses may require culvert installations.

A significant environmental effect on fish habitat could result if a substantive change attributable to the Project was identified downstream from the project site.

7.3.6.1 Boundaries

The spatial boundaries are limited to the headwaters of those small streams in proximity to the WTG sites and the associated access roads. The temporal boundaries are primarily those associated with project construction and decommissioning.

7.3.6.2 Pathway Analysis

The pathways that could have an adverse impact on fish habitat are those activities that would occur during the construction and decommissioning phases of the project and that could adversely impact surface water quality in the project area, i.e., those discussed in section 7.2.1.

7.3.6.3 Mitigative Measures

The mitigative measures identified in section 7.2.1 to protect water quality of the small streams and surface waters on site will also serve to protect the fish habitat that may exist downstream of the site.

7.3.6.4 Cumulative Effects

As indicated in section 7.2.1.4, there are no known development activities that will take place at or in the vicinity of the site that might act cumulatively with the proposed Project to cause a significant adverse effect on the water quality and therefore on the quality of downstream fish habitat. It is, however, pointed out that the property owners will continue to farm and harvest the wood and to do so will use heavy equipment. This ongoing activity together with ATV usage will continue to cause some level of ground disturbance and generation of silt to the surface waters in the area.

7.3.6.5 Residual Effects

If the mitigative measures identified above to protect the quality of the surface waters in the area are undertaken, the Project is not anticipated to have any impact on downstream fish habitat.

7.4 Socio-Economic Issues

7.4.1 Land Use

With the exception of the Pugwash Horse Raceway, land use in close proximity to the proposed turbines is restricted to agriculture and forestry. The village of Pugwash is located approximately 2 km to the west, and there is considerably residential development located along the Gulf Shore Road. Both the village and the lands along the Gulf Shore Road attract significant visitation from tourists and those that vacation in the area on an annual basis. Since the development of a wind farm in this location will introduce a new use into the existing mix of uses, land use has been identified as a socio-economic issue to be evaluated. The development of the wind farm has also been cited as not only being incompatible with existing uses, but predicted to have a negative impact on cottage and recreational use in the area.

A significant effect on land use would result if current land uses and development trends in the general area were irreversibly changed as a consequence of the development, operation and decommissioning of the Project.

7.4.1.1 Boundaries

The spatial area of greatest relevance includes those lands within 5 km of the WTGs; the temporal boundary would extend over the life of the Project, i.e., over 20 years.

7.4.1.2 Pathway Analysis

As has been stated the primary land use activity in the immediate vicinity of the proposed WTGs, i.e., within 600 – 1,000 m with the exception of the Horse Raceway and the community landfill, is forestry and agriculture; the forested areas are intermittently logged and the cleared areas are grazed by cattle. From the rutting that is visible on some of the tracks in the area, the lands off the Irishtown Road are also accessed by ATVs, but there are no official trails. All existing activities will continue.

The larger issue, one that has been raised during the consultations, is that the development of the 12 WTGs as proposed is inherently an inappropriate use of land that should either be retained in current usage, or developed in accordance with another as yet unarticulated vision. As depicted in Figure 7.2, which reflects land use change in a comparable area only a few kilometers to the east, development has taken place on the coast over a 10 year period, because of the attributes of the coast; development has not occurred on the lands to the south of the Gulf Shore Road because the demand for development in that location over this time period did not exist. A comparable situation exists between the Project site and the coast. Agricultural land is reverting to forestry. A few land owners are working hard to maintain productive agriculture, but there is generally no noticeable demand for cottages or related recreational uses in the area proposed for the WTGs. There may over time be increased demand for some new residential development on the Irishtown Road and other locations south of the Gulf Shore, but inevitably the greater demand for building lots will continue to be along the Gulf Shore Road, because this is the area where views can be enjoyed over the Northumberland Strait. It is the relationship with the coast that attracts, not the use of the land 2 km and more to the landward of the coast.

The Project will augment the mix of uses in the area on lands that have agricultural and forestry value. It is not expected that the development of the 12 WTGs will not cause development patterns, and therefore land use patterns, to change either in the Village of Pugwash, or along the Gulf Shore Road.

7.4.1.3 Mitigative Measures

Apart from minimizing the footprint of the proposed works, no specific mitigative measures are proposed to protect existing land use in the area.

7.4.1.4 Cumulative Effects

There are no other known works that would act cumulatively with the proposed project to impact land use in the area; no cumulative impacts are anticipated.

7.4.1.5 Residual Effects

Based on the above analysis, the project is not anticipated to have a significant residual effect on land use in the study area; the impact is expected to be negligible.

7.4.2 Employment and the Economy

The development of the wind farm will not only generate taxes for the Municipality of the County of Cumberland, its construction, including the preparation of the site, will generate some local employment for a limited period. It has also been suggested that the development of the proposed Project will adversely impact visitation to the area and therefore the economy of the Village of Pugwash and this part of the municipality. Employment and the economy have therefore been identified as socio-economic factors to be evaluated.

A significant effect on employment and the economy would result if a substantive change in either could be attributed to the Project.

7.4.2.1 Boundaries

The spatial area of interest is the acceptable commuting distance to the project site and the municipality to which taxes will be paid, i.e., the Municipality of the County of Cumberland. The temporal boundary is the life of the project, i.e., 20 or more years.

7.4.2.2 Pathway Analysis

The development of the proposed project will generate some employment. Labour will be required both to clear the vegetation for the new access roads, the proposed WTG sites and lay down areas and also to construct the WTGs. Although contractors have not yet been selected for this work, based on experience at comparable sites, it is estimated that between 30 to 40 people could be employed during the peak construction period. Some of this labour will be drawn from the local area. Throughout construction, those working on the site will also seek services and supplies for gas, accommodations and related items to more sophisticated equipment and services both in the immediate area and from elsewhere in the province and beyond. These expenditures will bring benefit to a range of suppliers.

After the WTGs are up and operational, there will be a need for one or two skilled persons with applicable training to maintain the WTGs and to assist with the management of the site. Some of the required work will be undertaken by the manufacturer of the WTGs, but there will also be a need for local services. The employment generated will not be great, but as the industry expands in the province, the opportunities for services being provided from the local market area also increases. Further, since the host landowners are all, but one, locally resident, there will be an incremental economic benefit flow directly into the community throughout the life of the Project.

The economy of any area is dependent upon many factors including its natural resources and attributes and its people. As stated in section 7.2.2.2, the factors that instigate economic growth change over time, and this is reflected in the economy of the Village of Pugwash and in the surrounding area. The natural attributes of a safe anchorage that led to the development of Pugwash Harbour have perhaps been superseded in importance by the attributes of scenic coastal views that attract residential investment to the Gulf Shore. The direct and indirect economic benefits that such investment and related tourism and recreational expenditures bring to the area is recognized, but so too is the value that is being attributed to sources of renewable energy such as wind. The importance of the latter is recognized by the Province and by the Municipality. What might be termed the "old" economy, i.e., farming, fishing and the extraction of natural resources such as salt, co-exists in the study area with the economy derived from retirement living, second homes and cottages and related services; both will co-exist with investment in renewable energy. The development of 12 WTGs in the area will add further diversification to the local economy as opposed to having immediate and irreversible negative consequences.

A very important tax beneficiary will be the Municipality of the County of Cumberland; the monies that are paid over the life of the project will guarantee a fixed flow of revenue into the municipal operating budget, a valuable asset when budgets at all levels of government are being squeezed.

7.4.2.3 Mitigative Measures

No mitigative measures are necessary.

7.4.2.4 Cumulative Effects

There are no known works in the vicinity of the project site and surrounding area that would act cumulatively with the project to impact employment and the economy.

7.4.2.5 Residual Effects

Based on the evaluation undertaken, the execution of the project as detailed will create a limited number of employment opportunities during construction, i.e., in the short term, and will create an enduring tax base for the Municipality and add another dimension to the local economy in the longer term. The impact will be beneficial.

7.4.3 Property Values

Whenever a new use, particularly an industrial or commercial use, is introduced into an area, there is sometimes concern that such a use will cause a decrease in property values. It is a difficult subject, because there are many variables that affect property value. Thus empirically isolating the impacts

of one variable, in this instance a wind farm, is difficult if not impossible. It is possible to theorize about variables such as landscape aesthetics in a scenic area, and whether or not a change in such a landscape would lower property value, but it would remain only one of the variables involved. Property values have been identified as a socio-economic issue to be considered in the evaluation.

The proposed Project is located amidst agricultural and forested land approximately 2 km west of the Village of Pugwash and 1,000-1,500 m from the coast. As detailed in sections 2.2 and 5.4, the nearest dwelling to a proposed turbine is approximately 665 m distant from WT1; it is situated on one of the properties leased by the proponent. The remaining dwellings are 700 m, or more, from any turbine. Most properties along Gulf Shore Road are in the range of 1,000 m distant with those towards the golf course being 2 km or more away.

Property values fluctuate for a variety of reasons including, but not limited to the demand for property in an area, and the nature and age of the property involved. Values can both increase and decrease over time. Whether or not the development and operation of a wind farm might influence such trends is difficult to determine and there are only a few studies that explore this issue. The findings of a study undertaken by Sterzinger et al., in 2003 in the US suggested that the development of a wind farm had no adverse impacts on property values within a radius of 5 km of such a development. For their study, Sterzinger et al., compiled data on US wind farms commissioned between 1998 and 2001 that had a capacity of 10 MW or greater. Property sales records for an area within 8 km of the wind farm site were compiled for three years prior to commissioning and for three years subsequent to commissioning to determine change. For comparison, sales records were also compiled for the same period from communities comparable to that for each wind farm. A total of 10 wind farms were examined. Overall, property values increased at the same rate in the wind farm communities as they did in those communities without wind farms. Nine of the 10 projects showed a greater increase in property values after commissioning compared to the period prior to commissioning. Indeed, communities near a wind farm actually experienced greater increases to property values than those without a nearby wind farm. These findings suggest that there is no support for the notion that the development of wind farms decreases property values.

The British Wind Energy Association posted a news article in March 2007 that concluded that the effect of wind farms on property values is neutral or positive. This conclusion was based on an independent study conducted by the Royal Institute of Chartered Surveyors and Oxford Brookes University which found that there was no clear relationship between the location of a wind farm and property values in the surrounding area. Two more recent studies, one conducted in Ontario (CANWEA, 2010) and one in Central Illinois (Hinman, 2010) confirm the above conclusions. In the Executive Summary to the latter study, the following was stated:

> "The examination results provided evidence that a "locational effect" exists such that before the wind farm was even approved, properties located near the eventual wind farm area were devalued in comparison to other areas. Additionally, the results show that property value impacts vary based on different stages of wind farm development. These stages of wind farm development roughly correspond to the different levels of risk as perceived by local residents and

potential homebuyers. Some of the estimation results support the existence of 'wind farm anticipation stigma theory' meaning that property values may have diminished in 'anticipation' of the wind farm. Wind farm anticipation stigmas likely due to the impact associated with a fear of the unknown, a general uncertainty surrounding the proposed wind farm project regarding the aesthetic impacts on the landscape, the actual noise impacts from the wind turbines, and just how disruptive the wind farm will be. However, during the operational stage of the wind farm project, as surrounding property owners living close to the wind turbines acquired additional information on the aesthetic impacts on the landscape and actual noise impacts of the wind turbines to see if any of their concerns materialized, property values rebounded and soared higher in real terms than they were prior to wind farm approval. Thus, this study presents evidence that demonstrates close proximity to an operating wind farm does not necessarily negatively influence property values or property value appreciation rate."

A significant impact on property values would result if a substantive decline in property values, greater than any comparable shift in property value in the area, could be attributed to the development and operation of the proposed wind farm.

7.4.3.1 Boundaries

The spatial boundaries are difficult to define, but may be assumed to include properties within the view shed of the wind farm. Property value beyond that boundary would be unlikely to be affected by the presence of the Project. Sterzinger et al., for example, adopted the premise that wind developments could have a visual impact within 8 km of the turbines; they suggested that although WTGs may be visible beyond that distance, they do not tend to be highly noticeable, and at that distance they have relatively little influence on the landscape's overall character and quality.

7.4.3.2 Pathway Analysis

Most people in the local area are some 700 m to 6 km distant from the proposed Project with most residences to the north of the Gulf Shore Road being approximately 1,000 m distant. Although there may be some disturbance or nuisance caused to such properties through the period of construction, it is the longer timeframe associated with the operation of the wind farm that would have an effect, if any, on property value. As stated above, it is difficult to determine whether the development and operation of a wind farm within a certain distance of a property would be the key variable influencing a change in the value of a specific property. If, as is the case with the proposed wind farm there are only 12 WTGs set approximately 700 - 1,000 m or more distant from most residential properties and on the landward side of the Gulf Shore Road, it would appear unlikely that the development would have a detrimental impact on property value.

7.4.3.3 Mitigative Measures

Other than the important increased setback from residences achieved through the redesign of the wind farm, there are no specific mitigative measures through site preparation and construction that would influence whether or not there would be a detrimental impact on property values. The period of construction is time limited and the impact, if any, would be negligible. No further measures are proposed or are conceivable that would influence property values.

The decommissioning and transportation of equipment may cause some temporary nuisance effects for properties adjacent the works and access roads, but no specific mitigative measures are warranted or possible that would influence property values.

7.4.3.4 Cumulative Effects

There are no other known works proposed in the area that would act cumulatively with this Project to impact property values; no cumulative effects are anticipated.

7.4.3.5 Residual Effects

Based on the above analysis and the negligible residual effects predicted for either the biophysical VECs or other social and economic issues, the Project is not anticipated to have an effect on property values; no impact is predicted.

7.4.4 Aboriginal Use of Land

As indicated in section 3.1 of the ARIA, the Pugwash Basin and associated rivers and tributaries are believed to be suitable locations for First Nations exploitation. Although the land where the Project will be sited is essentially land-locked, i.e., there is no direct contingency to the coast or a navigable waterway, the area would have been accessed and used by First Nations prior to European settlement.

A significant effect on the aboriginal use of land would result if their access to the land or the resources associated with the land was substantially inhibited or the resources themselves adversely impacted.

7.4.4.2 Boundaries

The boundaries of immediate interest encompass the lands that will accommodate the WTGs. The MEK study that has been commissioned will consider a greater land area, an area that will encompass, for example, Pugwash Harbour and the coast. The temporal boundary is the life of the Project, i.e., 20 or more years.

7.4.4.3 Pathway Analysis

The potential pathways to link the Project to the aboriginal use of land and resources parallel those identified for the evaluation of habitats and ecological features.

There is little question that First Nations used the lands and waters around Pugwash Harbour. This is verified by the predictive modelling undertaken for the ARIA. The latter document (see Appendix B) predicts the likely presence of First Nations archaeological resources in proximity to the tidal reaches of Tidemill Brook, but given the characteristics of the brook as it extends into the study area, the predicted potential for finding pre-contact archaeological resources declines. It is considered to be low in the lands associated with the development of the WTGs and the access roads. Since all of the land necessary to the development of the wind farm is privately owned and will remain in private ownership, and since there is no adjacent access to water, it is considered unlikely that First Nations access this land for traditional purposes. This will likely be confirmed by the results of the MEK study that is currently underway.

7.4.4.4 Mitigative Measures

The mitigative measures proposed for the different phases of the Project including the preparation of the EPP and those identified to protect specific VECs will serve to protect any resources in the areas that are of value to First Nations peoples. In large measure, the plants that are often identified as important resources in the context of traditional Mi'kmaq use are also widely available throughout the province.

7.4.4.5 Cumulative Effects

There are no known works within the boundaries referenced that would act cumulatively with the Project to impact the aboriginal use of land and resources: no cumulative effects are anticipated.

7.4.4.6 Residual Effects

The proponent will review the MEK study when it is received from Membertou Geomatics Solutions and will take its content into consideration. The MEK study will at the same time be forwarded to NSE. Based on the information currently available and on the implementation of the recommended mitigative measures for other VECs and socio-economic issues, the proposed Project is anticipated to have no impact on the aboriginal use of land and resources in the vicinity of the proposed Project.

7.4.5 Archaeological Resources

Archaeological resources are protected by legislation and have therefore been identified as a socio-economic factor to be evaluated. As detailed in section 4.4.4, one area of potential archaeological interest was identified as a result of the field work undertaken. This is the area in the vicinity of the possible location of an old stone bridge and large stone mounds located to the west of WT2. Although the mounds are not of significance on their own, they could be indicators of the presence of an old homestead in the area, perhaps on or near the crest of the low hill around which the mounds are located. If this is the case, construction of the access road in this area has the potential to disturb a more significant resource.

A significant effect on archaeological resources is defined as a loss, or the destruction, of a cultural resource either of European or pre-contact association.

7.4.5.1 Boundaries

The spatial boundaries of the analysis on archaeological resources relate to the lands that will be directly impacted by the proposed works. The temporal boundaries relate to the anticipated life of the Project, i.e., 20 or more years.

7.4.5.2 Pathway Analysis

The possible pathways associated with the Project that may cause adverse effects on archaeological resources include potential disturbance to the location of a possible abandoned homestead. As indicted in section 4.4.4, no evidence of such a homestead was found during the archaeological field reconnaissance, but professional opinion suggests that a homestead was probably located in this area, likely on the low hill, at some time in the past. Depending on the final configuration of the proposed access road to the west of WT2, the potential archaeological site may be disturbed by the construction of the proposed access road.

7.4.5.3 Mitigative Measures

Should the proposed access road pass over the low the low hill on which the stone mounds are located, archaeological testing is recommended. This testing would be undertaken at 5 m intervals through that section of road that passes through the area of elevated potential. Dependent upon the road width, this may result in two or three rows of test units. Testing should be completed after the centreline of the road has been staked or otherwise marked and the proposed width has been determined to ensure that testing is conducted throughout the relevant impact area. If any significant archaeological resources were encountered during the testing, the Heritage Division of the Nova Scotia Museum would be contacted to determine suitable mitigation procedures.

The current road layout, however, skirts the hill in question by passing along its western and northern edges. If this road layout is adhered to, and if no other disturbance is to occur on the hill, it is recommended that archaeological monitoring be conducted on this portion of the road as a precaution in the event that archaeological resources are encountered or disturbed during road construction.

7.4.5.4 Cumulative Effects

There are no other known works proposed to be undertaken within the boundary of the proposed assessment that would act cumulatively with the Project to impact archaeological resources: no cumulative effects are anticipated.

7.4.5.5 Residual Effects

Based on the avoidance of the stone mounds and the execution of archaeological monitoring as a precaution, the proposed Project would have no residual effect on archaeological resources in the area; no impact is predicted.

7.4.6 Visual Impact

WTGs are highly visible in most landscapes due to their size, and they can, therefore be intrusive. As such, visual impact has been identified as a socio-economic factor to be evaluated. 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). There are views in Nova Scotia and elsewhere that are highly valued as reflective of the locality and that attract visitors to the area, i.e., views can have an intrinsic economic value. In some circumstances, steps can be taken through bylaws to protect such scenic resources from adverse effects. The views across the coast to the Northumberland Strait have value to those who live and visit the area, i.e., the views, for example, from the Gulf Shore Road northwards out to the sea. These views are recognized by many, including those working to encourage tourism in the area, but there are no bylaws in place that would protect these or any other views in the area.

A significant visual impact would involve substantive intrusion into a view of provincial or national significance and having a recognized economic value in the local economy.

7.4.6.1 BOUNDARIES

The visual impact of the proposed Project extends some distance from the site itself. Two factors come into play:

- Distance and topography; and
- Vegetation and manmade structures that may block the line of sight to one or more of the turbines.

Figure 3.2 depicts an area of several kilometers around the proposed wind farm and identifies four points from which images were taken looking towards the proposed wind farm. The further away from the proposed turbines, the smaller they will appear and the less intrusive they will be on the line of sight, i.e., spatial boundaries encompass the area from which the turbines are visible. The temporal boundaries relate to the time period the turbines are in place, i.e., the operating life of the proposed Project.

7.4.6.2 PATHWAY ANALYSIS

As indicated on Figure 3.2, four viewpoints were selected for detailed analysis:

- Viewpoint a) located at cottages on the Gulf Shore Road;
- Viewpoint b) located at the Northumberland Links Golf Club;
- Viewpoint c) located on the bridge across the Tidemill Brook; and
- Viewpoint d) located at a point on the Irishtown Road.

From each of these locations, the "viewer" is looking back towards the location of the proposed wind farm and away from the coast. Indeed, as the proposed turbines are located more than 1 km from the coast, there is no key location, or viewing platform, from which it would be possible to look through the wind turbines to the coast and the Northumberland Strait. The following paragraphs provide a fuller account of the anticipated views from each of the above locations.

a) *View from Cottages on the Gulf Shore Road*
   The perspective in Figure 7.2a is taken from Dan R Drive, a residential area characteristic of the development between the Gulf Shore Road and the coast. From this viewpoint the wind farm spreads over about one quarter of the available panoramic view. Most WTGs are not visible because of the screening tree growth and rising topography in the fore and mid-ground of the view. The closest turbine to this viewpoint is WT 7, which is approximately 1,200 m distant.

b) *View from the Northumberland Links Golf Club*
   As depicted in Figure 7.2b, this perspective was taken from the parking lot at the Northumberland Links Golf Club on the Gulf Coast Road to the northeast of the proposed wind farm. The wind farm is only partially visible due to the tree growth in the foreground which provides screening and the rising topography in the mid-ground of the view. The closest WTGs in this image are WT 7 and WT 8 visible to the left side of the image; these turbines are approximately 2,500 m away from the viewpoint. Most wind towers are not visible and only a few of the rotors can be seen.

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Figure 7.2a: Digital Image Simulation - View from Cottages on the Gulf Shore Road

Note: For Viewing Point Location Key Map See Figure 3.2

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Figure 7.2b: Digital Image Simulation - View from the Northumberland Links Golf Club

Note: For Viewing Point Location Key Map See Figure 3.2

c) *View from the Bridge across Tidemill Brook*

As depicted on Figure 7.2c, this perspective is taken from the bridge on Route 6 that crosses Tidemill Brook to the southwest of the proposed wind farm. The entire wind farm, which is approximately 1,700 m distant from this viewpoint, spreads over about one third of the available panoramic view from the point at which the photograph was taken. As there are no objects or vegetation in the foreground to screen the WTGs, they are visible above the tree tops on the horizon.

d) *View from a Point on the Irishtown Road*

The Irishtown Road will provide the primary access road to the wind farm site. As depicted on Figure 7.2d, two-thirds of the WTGs can be seen from this location and the wind farm spreads over about two-thirds of the available panoramic view; WT9 – WT12 are not visible because of the screening effect of the trees. The closest WTG in this image is WT1 which is approximately 450 m away from the viewpoint.

7.4.6.3 Mitigative Measures

The visual impact of the Project cannot be totally avoided. A number of mitigative measures, however, have been considered by the turbine manufacturers in the design of their products and by the proponent in the layout of the wind farm. These include:

- The reduction in the number of proposed WTGs from 27 to 12 in the design and reconfiguration of the wind farm between 2007 and 2012;
- Tubular towers presenting an aesthetic design balance;
- Off white, or essentially a very light grey in colour, and non-reflective, i.e., non shiny;
- Minimizing the lighting on the turbines to what is required for safety;
- Minimizing the project footprint and implementing erosion control measures; and
- Removing all construction debris and associated litter thereby maintaining a clean and tidy site.

7.4.6.4 Cumulative Effects

There are no known works in the vicinity of the Project site that would act cumulatively with the project to impact the visual frame of reference.

7.4.6.5 Residual Effects

Based on the analysis that has been carried out, the mitigation that has been referenced, the proposed project is anticipated to have a negligible visual impact on the area. It does not impose at all on the important scenic views over the coast to the Northumberland Strait and will be accommodated to varying degrees in the middle distance inland from most vantage points along the Gulf Shore Road and other vantage points in the vicinity of the Village of Pugwash. It will, as demonstrated, introduce a new element into the landscape, but given the subjective nature of the topic, there may be many in the community that perceive the sight of the proposed turbines in the distance as attractive and as contributing positively to the environment and to the local and provincial economies.

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Project 111257.00 Date: January 2012

Figure 7.2c: Digital Image Simulation - View from the Bridge across Tidemill Brook

Note: For Viewing Point Location Key Map See Figure 3.2

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Figure 7.2d: Digital Image Simulation - View from a Point on the Irishtown Road

Note: For Viewing Point Location Key Map See Figure 3.2

Project 111257.00 Date: January 2012

7.4.7 Traffic

Access to the Project site for the construction of all but two of the WTGs will be via the Irishtown Road from Route 6; one WTG will be accessed from the Gulf Shore Road and one from Miller Road. All roads that will be used to accommodate the movement of the turbine components will be evaluated as to their capacity, and some select upgrading may be necessary to facilitate the movement of the large loads that will be involved. Traffic was identified as an issue of local concern and has therefore been recognized as a socio-economic factor to be evaluated.

A significant effect would be if there was substantial damage incurred to the road system or substantive inconvenience to the movement of local traffic on the Gulf Shore Road, Route 6 or elsewhere in the vicinity of the Project site.

7.4.7.1 Boundaries

The spatial boundaries are those roads that will be used through the construction and decommissioning phases of the Project. The temporal boundaries are those associated with the same phases of the Project.

7.4.7.2 Pathway Analysis

During both construction and decommissioning, the roads referenced above will be accommodating both increased volumes of traffic on a daily basis and heavier loads. The transportation of the major WTG components will involve the use of numbers of very large flatbed trucks. Their movement on the narrow local roads will be slow, and there will be inconvenience caused to the travelling public, particularly during the higher volumes of traffic experienced in the summer and fall months, for defined, but limited periods of time.

7.4.7.3 Mitigative Measures

The proponent will work closely with NSTIR, the Municipality and the community to evaluate what works, if any, need to be done to the roads to ensure the integrity of the road structures, the safety of the travelling public and to minimize inconvenience to road users. On the recommendations of the authorities, including the RCMP, the roads will be posted and flagged during key transportation events.

7.4.7.4 Cumulative Effects

There are no known works proposed in the area that would act cumulatively with this Project to acerbate construction traffic; no cumulative effects are anticipated.

7.4.7.5 Residual Effects

Based on the above analysis, the construction traffic necessary to facilitate the development of the wind farm will cause inconvenience and some congestion on local roads: but this will be for a limited period of time. There will be no impact on traffic patterns during the day to day operations of the Project. The impact is considered negligible.

7.4.8 Noise

Noise produced by WTGs is a recognized concern often identified by people when they first learn of the possible development of a wind farm in or near their community. It has been a concern raised by many who live in the vicinity of the proposed Project. Noise from a WTG is caused in part from the conversion of wind energy into sound when interacting with the blades and in part from other mechanical sources. The impact of noise depends on a range of factors that influence sound propagation including, but not limited to, the following:

- Distance from the source, i.e., the bulldozer or WTG, etc.;
- Height of the source;
- Atmospheric conditions, including humidity;
- Intervening topography or structures;
- Vegetation; and
- Background wind noise levels.

As referenced in sections 3.3.4 and 4.4.7, noise modelling was undertaken to determine potential noise levels from the WTGs at 181 building locations within 1.5 km of a WTG, and 500 m from the proposed substation; the full results of that analysis are provided in Appendix C.

7.4.8.1 Boundaries

The geographical area of interest with respect to the noise that will be generated has been defined by the distance of 1.5 km from a wind turbine that was used in the analysis. This captures residences on the Gulf Shore Road, the Irishtown Road and the Miller Road. The temporal boundary is the anticipated life of the Project, i.e. 20 or more years.

7.4.8.2 Pathway Analysis

All phases of the Project will generate noise, i.e., construction, project operation and decommissioning. During the construction and decommissioning phases, the anticipated noise will be that generated by typical construction activity including the transportation of materials, site works including the building of access roads, turbine pads, etc. The noise will be caused by transportation of heavy equipment such as back hoes, bulldozers, flatbed trailers, cranes, dump trucks ready mix trucks and smaller vehicles.

Typical dBA levels in a rural environment are 38 – 46 dBA, in a suburban environment 48 – 52 dBA and in an urban residential area 58 – 62 dBA. The nearest occupied residence is approximately 665 m distant from a turbine site. Construction noise will be heard at this distance and may be heard at 1 km, but it is unlikely at this distance to be an ongoing nuisance. Such noise may, however, temporarily disrupt the activities of fauna and birds at or in the vicinity of the construction activities on site.

Garrad Hassan has modelled the predicted noise from the turbines and has demonstrated that the project will comply with all applicable noise guidelines. The dwelling with the highest calculated sound pressure level of 39.9 dBA, well under the Guidelines for Noise Measurement and Assessment established by NSE, is located 665 m from WT1; it will likely be lower than the ambient rural noise

most of the time; back ground noise from natural and anthropogenic sources would likely drown out the sounds associated with the WTGs.

7.4.8.3 Mitigative Measures

To mitigate the noise from construction activities, construction and decommissioning will be limited to daytime working hours whenever reasonably possible and all machinery will be fully serviced.

With the reconfigured layout, the WTGs have been pulled back from the Gulf Shore Road (see Figures 2.1 and 2.2). The established setbacks exceed, in most cases substantially, those required by the recently amended Land Use Bylaw and these distances will absorb the incremental noise generated to the level of a typical rural environment. No further mitigation is required.

7.4.8.4 Cumulative Effects

There are no known development activates that will take place in or in the vicinity of the Project that might act cumulatively with the proposed Project to increase noise levels; no cumulative effects are anticipated.

7.4.8.5 Residual Effects

The noise that will be generated by the Project is not predicted to have a significant residual effect on the wildlife or on the residents in the surrounding area: the impact is predicted to be negligible.

7.4.9 Health and Safety

Regard for public health and safety and the occupational safety of workers is very important to the Proponent and to all associated with the development and operation of the proposed Project. Considerations discussed in this section include ice throw, EMFs, shadow flicker and occupational and site safety. Health and safety has been identified as a socio-economic issue to be addressed as it is a concern of Health Canada and it was raised by attendees at the Open House(s).

A significant effect on health and safety would result if the health or safety of those involved in the construction and operation of the wind farm, those who use the lands at the project site or those who reside in proximity to the wind farm was appreciably compromised.

Ice Fall or Throw

Under certain atmospheric conditions, it is possible for ice to form on the wind turbine blades. Generally, icing occurs at temperatures below 0°C when there is humidity in the air. The type, amount and density of ice depend on both meteorological conditions and the dimensions and type of structure (moving/static). To the extent such icing may occur, it can break free in a warming of temperatures or by movement of the blades and fall or be thrown to the ground. The aerodynamic blades, however, are sensitive to even minor changes in the blade profile, and braking systems, pitch controls and/or related speed controls respond to changes and automatically shut down operation of the turbine if an imbalanced blade movement is detected. Ice accumulation is an event that could cause such an imbalance and therefore be indirectly detected by the wind turbine operational systems.

Given the meteorological conditions in the area 15 to 25 freezing rain events may not be uncommon in an average year. However, for the reasons noted above, it is not necessarily the case that ice accumulation on wind turbine blades will occur with this frequency. If ice does form on the blades on occasion or occasions through the winter period, the risks of any safety concern are then a function of proximity of the wind turbine to residences and persons in the area and any mitigation measures undertaken by the proponent. It is noteworthy to consider the work done by Garrad Hassan as described in the report entitled *Recommendations for Risk Assessment of Ice Throw and Blade Failure in Ontario*. In this work, it was found (in the Ontario context) that the risk of a fixed dwelling situated 250 m from a turbine being struck by ice fragments is equivalent to 1 in 300 years and the risk to an individual being struck in the vicinity of the dwelling is equivalent to 1 in 500,000 years. There are no residential dwellings within 600 m of a proposed WTG. The horse race track and the municipal transfer facility are more than 250 m distant. The risk is to people who are for whatever reason in substantially closer proximity to a WTG.

Electric and Magnetic Fields

Power frequency electric and magnetic fields (EMFs) are present everywhere electricity flows. All electric wires and the lighting, appliances and other electrical devices they supply are sources of electric and magnetic fields. Although they are often referenced together as EMFs, electric fields and magnetic fields are actually distinct components of electricity. Most of the public interest regarding possible health effects is related to magnetic fields. So usually, when the term EMF level is used, it is the magnetic field strength that is being referred to. Both electric and magnetic fields, whether it is a power line or an appliance such as a hair dryer, dishwasher or microwave oven, are strongest at their sources; these fields, including those associated with the WTGs and the proposed substation, decrease rapidly as you move away from the sources and become indistinguishable from background levels.

Shadow Flicker

Shadow flicker is the visual impact that results when the blade of a wind turbine passes between the sun and a particular point of observation, i.e., the receptor, and interrupts the sun's rays causing a flicker effect. Whether such flicker occurs at all and to what extent it does is dependent on many factors including weather conditions, i.e., whether the sun is shining or not, geographical position, topography and time of day. The duration and severity of shadow flicker effects also varies depending on the time of the year and wind conditions. Finally the distance of the WTG from a receptor will also influence the impact, since light perception diminishes with distance. The primary impact of shadow flicker is annoyance. As detailed in Model Wind Turbines By-Laws and Best Practices, "shadow flicker from wind turbines usually has a frequency range of between 0.5 Hz to 1.25 Hz which is well below the level of concern for this health issue (Noble Environmental Power, Department of Business Enterprise and Regulatory Reform, UK)."

As referenced in sections 3.3.6 and 4.4.8, Garrard Hassan modelled shadow flicker for the proposed project: the report is provided in full in Appendix D. Assuming conservative criteria, dwelling # 76 would experience the most shadow flicker with a onetime maximum duration of 36 minutes on December 24th and a total of nine hours per year. As noted in the report, the calculation is based on

a conservative approach, i.e., assuming no property specific mitigating factors, such as vegetation, at the receptor.

Occupational and Site Safety

Occupational safety issues are primarily associated with the construction and decommissioning activities associated with the handling and operation of large machinery and WTG components. Nevertheless, safety issues must also be considered as they pertain to the operational phase and the potential use of the area by local people.

7.4.9.1 Boundaries

The spatial area associated with the above safety issues is primarily an area in proximity to the WTGs and their immediate surroundings; the exception is the larger area that should be taken into account when dealing with shadow flicker, i.e., an area up to 900 m from a WTG. The temporal boundary involves the construction, operational and decommissioning phases of the proposed Project.

7.4.9.2 Pathway Analysis

Ice Throw

Ice may accumulate on wind turbine blades under conditions of freezing rain, or melting snow, but the number of occasions that this is likely to occur in any year are small. Safety issues, however, can arise if anyone is in the vicinity of a turbine when ice slides, or is thrown off the blades.

Electric and Magnetic Fields

As referenced above, both electric and magnetic fields decrease rapidly as you move away from the source and become indistinguishable from background levels. The term “extremely low frequency” is used to describe any frequency below 300 Hz, and power frequency EMF (such as that from components of the Pugwash Mountain Wind Farm) has a frequency of 60 Hz, placing it in the extremely low frequency category. It is at the lower end of the spectrum near DC electricity and well below the microwave, or RF (radio frequency) radiation emitted by cellular phones and radio broadcast transmitters. Epidemiological studies have failed to establish a cause and effect relationship between electromagnetic energy and health concerns. As a consequence, there are no Canadian government guidelines for exposure to EMFs at extremely low frequencies. Health Canada does not consider guidelines necessary because the scientific evidence is not strong enough to conclude that typical exposures cause health problems. Based on the evidence there is no obvious pathway between the proposed Project and the articulated public concern with respect to EMFs.

Shadow Flicker

As referenced above shadow flicker can be an issue of concern within narrowly defined parameters. The results of the modelling indicated minimal shadow flicker. The distances involved to receptors, the vegetated nature of the lands and the fact that light perception diminishes with distance, serve to mitigate against the possibility of a shadow flicker effect.

Occupational and Site Safety

The assembly and maintenance of WTGs pose the range of occupational health and safety issues associated with any major construction project that involves the use of heavy equipment and the assembly of large structures. Ensuring the safety of all parties on site is a priority of NCWF and all associated with the proposed Project and, as will be referenced below, the Proponent will take steps to ensure site safety for all concerned.

7.4.9.3 Mitigative Measures

The mitigative measures proposed for the different phases of the Project in conjunction with the preparation of a comprehensive EPP will also ensure that the health and safety of the workforce, those accessing the lands at the Pugwash wind farm and those residing in proximity to the site are protected. More specifically the following mitigative measures are proposed:

- training including training on the hazards associated with ice forming on tall structures;
- a flag placement protocol which will necessitate the posting of a falling ice warning if, and when, ice is identified as an issue. This necessitates that operational staff are trained to be aware of the conditions likely to lead to ice accumulation on the WTGs and the risk of ice falling;
- establishment of a comprehensive EPP and a Contingency and Safety Plan; the latter will detail the training and the protective equipment required for all who access the site; and
- access to the site will be restricted to authorized personnel throughout the period of construction.

No specific mitigative measures are required or proposed with respect to either EMFs or shadow flicker, because neither is considered to pose a concern for health or safety.

7.4.9.4 Cumulative Effects

There are no other known works that will take place within the vicinity of the proposed wind farm site that would act cumulatively with the proposed Project to impact upon health and safety; no cumulative effects are anticipated.

7.4.9.5 Residual Effects

Based on the analysis undertaken and the implementation of the recommended mitigative measures, the proposed project is unlikely to have a significant adverse effect on health and safety; the anticipated effect is considered to be negligible.

7.5 Other Matters

There are two recurrent concerns that have been raised through the consultation process that are important, but do not relate specifically to the environmental assessment process. One is the question of decommissioning and the second is whether the proponent intends to expand the Project at some future date. As detailed in section 2.3.3, decommissioning is addressed through the following regimes:

- The Land Use Bylaw of the Municipality of the County of Cumberland; and
- Each option and lease agreement that has been signed with the host landowners.

With respect to future Project expansion, the proponent is committed to constructing a maximum of 12 turbines in accordance with the plans as described in this environmental assessment. As part of the reconfiguration of the Project, the proponent reduced the Project size in response to the feedback received from local residents in the course of its planning and development work and, as a result, achieved a greater separation between the WTGs and residences. The proponent has no plans to install any additional turbines in the midst of the Project, or within the separation distances that have been achieved between the Project and existing residences.

7.6 Effects of the Environment on the Project

Several environmental factors, e.g., fire, extreme weather, including climate change, could have an adverse effect on the Project. These factors have all influenced the design criteria for the turbines and the layout of the proposed wind farm.

7.6.1 Boundaries

The spatial boundaries for these effects are restricted to the area of the wind farm. Temporal boundaries include all Project phases: construction, operation and decommissioning. Fire and extreme weather events could adversely impact the Project schedule, but such events are likely to be of short duration. Fire in the area could be instigated by both natural events, e.g., a lightning strike, or by humans.

Extreme weather events, including such events as might be aggravated by global warming, including ice formation, high winds, hail or lightening strikes, could damage the turbines.

7.6.2 Pathway Analysis

Fire and extreme weather could conceivably damage the installed facilities, reduce productivity and/or cause the turbines to be shut down.

7.6.3 Mitigative Measures

The design and operation of the WTGs include measures to address the consequences of extreme weather events. For example, the turbines and transformers are equipped with temperature related alarms. In addition, there are fire watches maintained during the most sensitive dry summer months in the region. It is therefore likely that any fire would be quickly detected and a prompt emergency response instigated. The turbine towers are also sufficiently high that damage to the nacelle in the event of a fire is unlikely. Any damage to power transmission in such circumstances would be quickly repaired.

During high wind events, or ice formation, the design of the WTGs is such that the wind turbines will cut out. These factors have been taken into consideration in the operational and commercial planning of the Project. The turbine towers will be equipped with lightening protection, and damage to WTGs from such an event is considered very rare.

In conclusion, extreme weather events are unlikely to pose a significant adverse effect on project construction, operation or decommissioning.

7.6.4 Cumulative Effects

There are no known other works taking place in the area, or in the vicinity, that might act cumulatively with severe weather events to increase the likelihood of an adverse environmental effect on the Project.

7.6.5 Residual Effects

Extreme environmental events are not anticipated to have a significant residual environmental effect on the Project, i.e., the impact is predicted to be negligible.

7.7 Summary of the Potential Environmental Impacts

Residual environmental effects are those predicted to remain after the proposed mitigative measures have been implemented. Table 7.3 summarizes those effects for the proposed Project for each VEC or socio-economic issue. The effect is presented in terms of nature of effect, magnitude, reversibility, duration, timing and aerial extent. These are defined as:

- nature of effect, i.e., positive (+) or negative (-);
- magnitude of effect on background levels, i.e., small, moderate or large;
- reversibility of the effect, i.e., reversible or irreversible;
- timing of the effect during construction or operation, i.e., long or short term; and
- aerial extent of the effect, e.g., immediate area of construction is considered local.

Table 7.3: Residual Effects Assessment

VEC or Issue	*Nature*	*Magnitude*	*Reversibility*	*Timing*	*Extent*
Ground and Surface Water Quality	-	Small	Reversible	Short	Local
Radio and Radar Interference	NI	N/A	N/A	N/A	
Rural Ambience	-	Small	N/A	Long	Local
Wetlands	-	Small	Reversible	Short	Local
Fish Habitat	NI	NI	N/A	N/A	
Forest Cover	-	Small	Reversible	Long	Local
Species of Concern	-	Small	Reversible	Long	Local
Migratory and Breeding Birds	-	Small	Reversible	Long	Local
Bats	-	Small	Reversible	Long	Local
Land Use	-	Small	N/A	Long	Local
Employment and the Economy	+	Moderate/small	N/A	Short/long	Regional
Property Values	NI	N/A	N/A	N/A	N/A
Aboriginal Use of Lands	NI	N/A	N/A	N/A	N/A
Archaeological Resources	-	Small	N/A	Short	Local
Visual Impacts	-	Small	Reversible	Long	Local
Traffic	-	Small	Reversible	Short	Local
Noise	NI	N/A	N/A	N/A	N/A
Health and Safety	-	Small	Reversible	Long	Local

NI = No Impact
N/A = Not Applicable

This is an important Project. Given the nature of such an investment, numerous studies have been executed and detailed engineering and associate work is ongoing to ensure that all necessary issues are addressed and that both corporate and regulatory decision makers have the information that they require to make decisions in a timely manner. It is a progressive and iterative process. Environmental work continues to be executed and will be an integral work stream throughout detailed engineering and construction.

Because the adverse residual effects are primarily small to moderate in magnitude, reversible and local, it is concluded that the undertaking can be executed with negligible residual effects on VECs and socio-economic issues with the application of standard and accepted industry practices and procedures, adherence to applicable regulations and guidelines, and proactive environmental protection planning, including implementation of the mitigative measures as identified.

7.8 Environmental Management and Monitoring

While it is anticipated that the residual environmental effects of the proposed works will be negligible based on the work that has been conducted, the Proponent will prepare an EPP to address potential issues and concerns and to ensure that the necessary work through Project construction and decommissioning is undertaken with due regard to environmental considerations and safety. The proponent also undertakes to honour all commitments made in this environmental assessment and to comply with all applicable laws and regulations. As indicted in Table 7.5, most, if not all, potential adverse effects, can be avoided through the application of good engineering and construction practices, the careful timing of activities and the adherence to appropriate environmental management techniques. All work in and around the site will be undertaken in accordance with the standards and protocols set out in the *Erosion and Sedimentation Handbook for Construction Sites.*

An EPP will be developed for both the construction and operations phases of the Project. The underlying objective of the construction EPP is to reduce environmental impacts during this period and consists of routine activities including:

- contingency procedures in the event of an erosion control failure;
- procedures to address fuel and hazardous material spills;
- procedures to address fire; and
- procedures to address archaeological finds.

The EPP for construction will detail inspection and reporting requirements, include detail of the applicable permits, approvals and authorizations and incorporate a key contact list. The EPP for the operation of the wind farm will articulate guidelines for equipment maintenance activities, the storage, handling and disposal of petroleum, oils and lubricants and the safe storage and handling of hazardous materials.

A Contingency and Safety Plan will also be prepared. This provides detail of the response system that will be implemented to respond to an accidental event including the release of petroleum, oils

lubricants or any other hazardous material. It will reference the need for personnel training, preventative measures, the response plan and a spill clean-up recourse list. The Contingency and Safety Plan will also detail necessary responses to address fire.

Finally, to ensure that work is carried out with minimal consequences for the environment and as a check on the evaluation that has been undertaken, a number of specific environmental effects monitoring programs will be designed and undertaken. Such programs can include either a direct monitoring of specific VECs or the monitoring of the environmental parameters known to be important to the VECs. Such studies are normally undertaken to address the following objectives:

- to verify predictions and evaluate the effectiveness of mitigation measures;
- to detect undesirable changes in the environment; and
- to improve the understanding of environmental cause and effect relationships.

The following specific programs are proposed and will be further detailed subsequent to release from the environmental assessment process:

i) the monitoring of the erosion control structures throughout the site during construction until the disturbed sites have been stabilized;
ii) the establishment of a community liaison committee or similar body to inform and engage the community at various stages of the Project; and
iii) the design of a carcass monitoring program at the turbine locations for a period of two years subsequent to Project start up.

EC and CWS will be consulted in the development of the necessary protocols and the results will be provided to interested regulating agencies.

CHAPTER 8 CONCLUSIONS

This environmental assessment was conducted to determine the potential environmental effects of the construction, operation and decommissioning of a proposed wind farm to the east of the Village of Pugwash in the Municipality of the Community of Cumberland to satisfy the requirements of a Class I assessment pursuant to the Nova Scotia *Environment Act.*

Development of this project was initiated in 2004 when AWPC identified the area as potentially having a harvestable wind regime and proximity to the NSPI transmission grid. From there the proponent began testing the wind resource and over the ensuing months and years entered into discussions with various landowners. Between 2005 and 2007, AWPC instigated a number of ecological field programs and opened a dialogue with the Municipality of the County of Cumberland and other parties with an interest in the project. This initial work led to the development of an initial layout which was taken to open houses and a number of other meetings in the community and beyond in the latter part of 2006 and 2007. This first conceptual layout accommodated 27 WTGs on lands located generally between the Irishtown Road and the Gulf Shore Road.

As a consequence of these meetings in 2006 and 2007, it became apparent that there were a number of factors associated with the preliminary layout that caused concern, particularly to those who had properties along the Gulf Shore Road. This caused the proponent to pause. The proponent also observed during this period of reflection that the Municipality of the County of Cumberland was considering revising the Municipal Planning Strategy and Land Use Bylaw in order "to recognise the benefits of renewable energy; the County's renewable energy resources and development opportunities, particularly for wind power".

The proponent then reviewed the parameters of the wind farm in light of the concerns that had been raised and the work that the Municipality was undertaking. The Municipality's goals were to encourage the development of renewable energy projects within their boundaries and to establish criteria within a bylaw that would ensure that such projects were acceptable to the majority of residents. The process undertaken by the Municipality was a very open one that sought and received input from residents from all parts of the Municipality, including Pugwash and area. In late 2011 the Municipal Planning Strategy and Land Use Bylaw were amended; this bylaw is now in effect, and the proponent has revised the project, i.e., the Pugwash wind farm, to comply in all

respects with this newly amended Bylaw and to reasonably accommodate the concerns of the area residents.

First and foremost the number of proposed WTGs has been reduced from 27 to 12; these turbines are set back on pasture and forest land, which will continue to be used for agriculture and wood harvesting, approximately 1 km from the Gulf Shore Road. The closest residential dwelling is about 680 m from WG1 and belongs to a land holder who is leasing property to the proponent. Four other dwellings are about 700 m or more from the nearest turbine while the balance is 800 m more from any turbine. The revised Municipal setback requirement is "600 m or three times height from all habitable buildings on a neighbouring property"; this requirement has been fully met or exceeded.

The proponent plans to generate up to 33 MW of electricity annually which would be fed into the NSPI transmission grid. To facilitate the development the Proponent has entered into lease agreements with the owners of the land parcels involved. The land is presently used for agricultural purposes, mainly as pasture, and for the harvesting of wood logs. These activities will continue.

The environmental assessment considered biophysical and socio-economic factors. In addition to an extensive search of the literature and pertinent databases, the study team consulted with regulatory agencies and acknowledged experts in pertinent disciplines. A number of specific field programs were executed; these included field work with respect to birds, bats, vegetation, wetlands, archaeology and viewscapes. Garrad Hassan out of Montreal conducted an analysis and modelling with respect to both noise and shadow flicker; the resultant reports are provided in their entirety in the appendices. Eighteen VECs or socio-economic issues were subject to analysis. The significance of the residual effects, i.e., after mitigation has been applied, is predicted for each of the identified VECs or socio-economic issues. The potential for the project to interact cumulatively with other projects and activities taking place in the area was also factored into the evaluation.

The passage of time which allowed consideration of the issues raised in 2006 and 2007 and also the work undertaken by the Municipality of the County of Cumberland led to the reconfiguration and betterment of the project. Subject to adherence to all pertinent regulations and the application of referenced mitigative measure, the conclusion of this environmental assessment is that no significant adverse residual environmental effects are likely as a result of the Project. The generation of electricity from a renewable resource in the proposed fashion is in accordance with both federal and provincial government articulated strategies and would contribute to a reduction of GHGs. The project would also at a local level further substantiate the Municipality's articulated commitment to encourage and facilitate the development of renewable energy within its boundaries.

REFERENCES

Able, K. P. 1970. A Radar Study of the Altitude of Nocturnal Passerine Migration. Bird-Banding 41(4):282-290.

Alerstram, T. 1990. Bird Migration. Cambridge University Press.

Arnett, E., editor. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas, USA.

Atlantic Canada Conservation Data Centre. October, 2011. Data Report 4613: Pugwash, NS. Prepared by S.H. Gerriets.

Bellrose, F. C. 1971. The Distribution of Nocturnal Migration in Air Space. Auk 88:397-424.

Blaney, S. August, 2006. A vascular plant inventory of the proposed wind turbine array, Pugwash, Nova Scotia, with notes on breeding birds. Prepared for Cobequid Area Wind Farms Inc. Pp. 29. Unpublished.

BLM (Bureau of Land Management). 2004. Draft Programmatic Environmental Impact Statement on Wind Energy Development on BLM – Administered Lands in the Western United States. US Department of the Interior, Bureau of Land Management. September 2004. (http://www.windeis.anl.gov/eis/guide/index.cfm)

Broders, H., G. Quinn, and G. Forbes. 2003a. Species status, and the spatial and temporal patterns of activity of bats in southwest Nova Scotia, Canada. Northeastern Naturalist **10**:383-398.

Broders, H. G., C. S. Findlay, and L. Zheng. 2004. Effects of clutter on echolocation call structure of Myotis septentrionalis and M. lucifugus. Journal of Mammalogy **85**:273-281.

Broders, H. G., G. J. Forbes, S. Woodley, and I. D. Thompson. 2006. Range extent and stand selection for forest-dwelling northern long-eared and little brown bats in New Brunswick. Journal of Wildlife Management **70**.

Canadian Wind Energy Association. 2010. Wind Energy Study – Effect on Real Estate Values in the Municipality of Chatham-Kent, Ontario.

Cooper, B. A. and R. J. Ritchie. 1995. The Altitude of Bird Migration in East-central Alaska: a Radar and Visual Study. Journal of Field Ornithology. 66(4):590-608.

Cumberland Regional Economic Development Association (CREDA). CREDA files – October 2010. http://www.creda.net/whats_happening/file/2010_10.html

Davis, D. and S. Brown.1996. The Natural History of Nova Scotia. Volumes I & II. Published by the Province of Nova Scotia and the Nova Scotia Museum.

Erickson, W., G. Johnson, D. Young, D. Strickland, R. Good, M. Bourassa, K. Bay, and K. Sernka. 2002. Synthesis and comparison of baseline avian and bat use, raptor nesting and mortality information from proposed and existing wind developments. West, Inc., Cheyenne, WY.

Erskine, A.J. 1992. Atlas of Breeding Birds of the Maritime Provinces. Co-published by Nimbus Publishing and the Nova Scotia Museum. Halifax, NS.

Fenton, M., and G. Bell. 1981. Recognition of species of insectivorous bats by their echolocation calls. Journal of Mammalogy **62**:233-234.

Gauthreaux, S.A. Jr. 1991. The Flight behaviour of Migrating Birds in Changing Wind Fields: Radar and Visual Analyses. American Zoologist 31:187-204.

Health Canada. 2010. Electric and Magnetic Fields at Extremely Low Frequencies. http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/magnet-eng.php

Hinman, Jennifer L. 2010. Wind Farm Proximity and Property Values: A pooled Hedonic Regression Analysis of Property Values in Central Illinois. Illinois State University.

Johnson, G. D., M. K. Perlik, W. P. Erickson, and M. D. Strickland. 2004. Bat activity, composition, and collision mortality at a large wind plant in Minnesota. Wildlife Society Bulletin **32**:1278-1288.

Jung, T., I. Thompson, R. Titman, and A. Applejohn. 1999. Habitat selection by forests bats in relation to mixedwood standtypes and structure in central Ontario. Journal of Wildlife Management **63**:1306-1319.

Lacki, M., and J. Hutchinson. 1999. Communities of bats (Chiroptera) in the Grayson Lake Region, northeastern Kentucky. Journal of the Kentucky Academy of Science **60**:9-14.

Larson, D., and J. Hayes. 2000. Variability in sensitivity of Anabat II bat detectors and a method of calibration. Acta Chiropterologica **2**:209-213.

Marlin, A., C. Veinotte, G. Zwicker. 2010. Pugwash and Area Community Master Plan. Rural and Small Town Programme, Mount Allison University, Sackville, N.B.

Nedeau, Ethan J, Mark A. McCollough and Beth I. Swartz. 2000. The Freshwater Mussels of Maine. Maine Department of Inland Fisheries and Wildlife. State House Station #41. Augusta, Maine.

Neily, P.D., Quigley, E., Benjamin, L., Stewart, B. and T.Duke. April, 2003. Ecological Land Classification for Nova Scotia: *Volume 1 - Mapping Nova Scotia's Terrestrial Ecosystems.* Nova Scotia Department of Natural Resources. Renewable Resources Branch. Report DNR 2003 -2. Website: http://www.gov.ns.ca/natr/forestry/ecological/pdf/ELCrevised2.pdf

Nova Scotia Community Counts. 2011. Pugwash Community Profile. Province of Nova Scotia. http://www.gov.ns.ca/finance/communitycounts/profiles/community/default.asp?gnew=&table=&acctype=0&chartid=&mapid=&dcol=&sub=&ptype=geo&tid=&gview=3&glevel=com&yearid=2006&gnum=com1110

Nova Scotia Department of Natural Resources. 2011. Ecosection Codes for Soil Drainage, Soil Texture and Topographic Landform. http://www.gov.ns.ca/natr/forestry/gis/pdf/elc.pdf

Nova Scotia Department of Natural Resources. 2011. - Forest Inventory - Geographic Information Systems website (http://www.gov.ns.ca/natr/forestry/gis/forest-inventory.asp). (Note: Although the shapefile itself is current, the Pugwash area hasn't been photo-interpreted since 1995)

Nova Scotia Transportation and Infrastructure Renewal. 2009. Traffic Volumes Primary Highway System 1999-2008.

Nova Scotia Transportation and Infrastructure Renewal. 2009. Traffic Volumes Secondary Roads Book 1999-2008.

O'Farrell, M., and W. Gannon. 1999. A comparison of acoustic versus capture techniques for the inventory of bats. Journal of Mammalogy **80**:24-30.

Peterson. 1980. Eastern Birds.

Sadar, M.H. and Associates. 1994. Environmental Impact Assessment. Carleton University Press.

Sasse, D. B., and P. J. Pekins. 1996. Summer roosting ecology of northern long-eared bats (*Myotis septentrionalis*) in the White Mountain National Forest. Pages 91-101 in R. Barclay, and R. Brigham, editors. Proceedings of the Bats and Forests Symposium of the British Columbia Ministry of Forests, Victoria, BC, Canada.

The Municipality of the County of Cumberland. 2011. Study Regarding the Service Delivery and Financial Impact of the Dissolution of the Village of Pugwash. http://www.pugwashvillage.com/UARB%20copy%20of%20Cumb%20Co%20study.pdf

The Municipality of the County of Cumberland. 2008. Pugwash Land Use Bylaw.

The Municipality of the County of Cumberland. 2010. Pugwash Secondary Planning Strategy.

van Zyll de Jong, C. 1985. Handbook of Canadian mammals No. 2 Bats. National Museum of Natural Sciences, Ottawa.

Whittem, Becky and Andrea Kingsley. 2003. Shades of Green: A Bird's Eye View of the Wind Energy. Bird Watch Canada. Spring 203 no 23.

Zink. 1998. Roland's Flora of Nova Scotia.