CHAPTER 2 PROJECT DESCRIPTION

2.1 Project Background

2.1.1 Project History

In 2004, AWPC identified an area to the east of the community of Pugwash as potentially having a harvestable wind regime and that was reasonably close to the NSPI transmission grid. AWPC began wind resource testing in late 2004. Contractual relationships with various landowners were formalized over the ensuing years.

Between 2005 and 2007, AWPC instigated a range of ecological field programs and undertook consultation with the Municipality of the County of Cumberland and other parties with an interest in the Project. In the fall of 2006 a preliminary layout was created which envisioned the construction and operation of twenty-seven 2MW turbines on towers approximately 80 m high. This layout and AWPC's overall plans were shared with the community in an Open House held in November, 2006, and another in the spring of 2007; focus group meetings were also hosted in both Pugwash and Halifax (see Chapter 5 for further particulars).

AWPC's commercial objective from the outset was, and still is, to sell renewable energy to NSPI or another off-taker, pursuant to a power purchase agreement; the latter are usually awarded subsequent to a Request for Proposals (RFP) process. In 2007, NSPI launched such an RFP, and although it closed in the summer of that year, it was originally expected to be much earlier. It was in anticipation of that RFP that AWPC chose the timing for its first open house in November 2006.

As AWPC proceeded with the open houses and focus group sessions, it became clear that there were a number of factors associated with the preliminary layout that caused concern, particularly among those who had properties along the Gulf Shore Road. The following were among those concerns:

- The number of turbines proposed;
- The proximity of some of the turbines to residential properties and therefore the possibility of noise causing disturbance to the enjoyment of these properties; and
- The presence of what was considered by some as an "industrial" development in what was thought of first and foremost as a recreational and tourist area.

As a result of the foregoing concerns, AWPC suspended its plan to submit a proposal to the 2007 NSPI RFP enabling the company to consider the concerns that had been articulated. In 2008-2009, while temporarily pausing its effort on the Pugwash Wind Farm, AWPC spearheaded the Nuttby Mountain Wind Farm in Colchester County. The Nuttby Mountain Wind Farm has been built and in operation since 2010.

During 2010 and 2011, the Municipality of the County of Cumberland embarked on a process to consider revisions and updates to the Land Use Bylaw to take into consideration the specific characteristics of a wind farm and to ensure that such development could be accommodated without detriment to neighbouring uses if specified criteria were addressed. This municipal process involved considerable public input from interested individuals and groups across the municipality. AWPC observed this process to ensure that revisions to its plans were consistent with the letter and spirit of the municipality's revised Planning Strategy and Land Use Bylaw.

Taking into consideration the issues that had been raised through the consultation process and the work undertaken by the Municipality with respect to the development of its revised Planning Strategy, Regional Energy Strategy and the Land Use Bylaw, AWPC went back to the drawing board and substantially reworked the layout of the proposed wind farm. First and foremost the number of proposed turbines has been reduced from 27 to 12, and the layout has been substantially drawn back from the Gulf Shore Road (see Figure 2.1). A detailed noise impact analysis was an integral part of the redesign of the layout for the wind farm. AWPC imposed a conservative sound limitation with respect to the predicted sound levels expected at receptors (habitable dwellings) around the wind farm, i.e., 40 dBA. Further micro-siting undertaken through work in the field in the fall of 2011 has minimized the anticipated impacts on wetlands in accordance with provincial requirements; has ensured that neither turbine foundations nor access roads impact fish habitat; and has ensured that the proposed layout not only meets, but exceeds the setback and buffering requirements of the recently approved Land Use Bylaw (see Figure 2.2).

2.1.2 Political and Economic Context

Climate change is now considered a serious global environmental threat. Its potential impacts include global warming, sea level rise, increased extreme weather events and altered rainfall patterns. Climate change is a direct consequence of elevated greenhouse gas (GHG) concentrations in the atmosphere and its associated feedback mechanisms. Canada ranks 15th out of 17 OECD countries for GHG emissions per capita. Although originally a signatory to the Koyoto Protocol having committed to GHG emission targets of 6 per cent below 1990 levels between 2008 and 2012, Canada's emission level continue to grow due to our increased use and production of petroleum based energy (Conference Board of Canada, 2011). While both the Government of Canada and of Nova Scotia have set goals and provided incentives for investment into renewable energy resources, we as a society have a long way to go before our resource management is considered sustainable.

In Nova Scotia, wind energy is playing a leading role in achieving Nova Scotia's goal under its Renewable Energy Standards, which call for an increase in electricity generated by renewable energy to 25% by 2015 with the goal of achieving 40% by 2020. Under that mandate, NSPI has

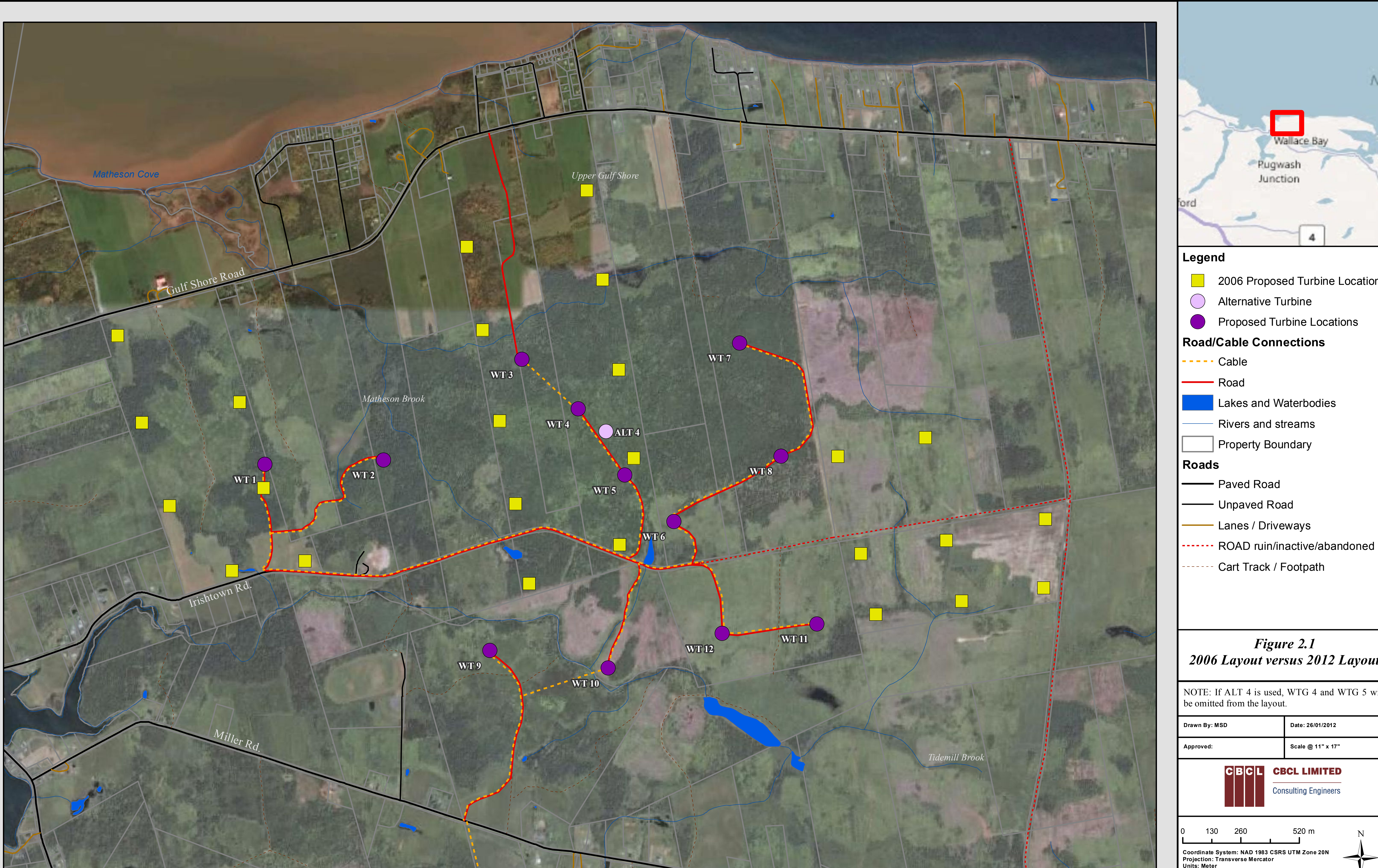


Figure 2.1
2006 Layout versus 2012 Layout

NOTE: If ALT 4 is used, WTG 4 and WTG 5 will be omitted from the layout.

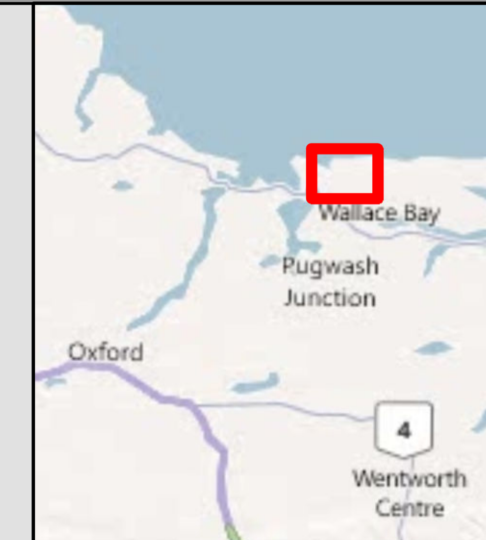
Drawn By: MSD	Date: 26/01/2012
Approved:	Scale @ 11" x 17"

CBCL LIMITED
Consulting Engineers

0 130 260 520 m

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Units: Meter

N



Legend

- Pugwash_Buildings_and_Dwellings
- Alternative Layout
- 2012 Proposed Turbine Locations
- Proposed Substation

Road/Cable Connections

- Road
- Cable

Roads

- Paved Road
- Unpaved Road
- Lanes / Driveways
- ROAD ruin/inactive/abandoned
- Cart Track / Footpath
- 165 metre buffer
- 600 metre buffer
- 700 metre buffer
- 800 metre buffer
- 900 metre buffer
- 1000 metre buffer
- Lakes and Waterbodies
- Rivers and streams
- Property Boundary

Figure 2.1
Set Backs from Properties

NOTE: If ALT 4 is used, WTG 4 and WTG 5 will be omitted from the layout.

Drawn By: MSD	Date: 26/01/2012
Project # 111257.00	Scale @ 11" x 17"

CBCL LIMITED
Consulting Engineers

0 135 270 540 m

N

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Units: Meter

established mechanisms by which they will buy "clean energy", including wind power, from selected producers in an effort to meet its own emission targets. At present, the total installed capacity of wind farms across Nova Scotia is over 284 MW (NSP, 2011).

In April 2010, the Province released the Renewable Electricity Plan outlining the detailed program that Nova Scotia will follow to reach the legislated requirement of 25 percent renewable electricity generation by 2015, as well as the further goal of 40 percent by 2020. In accordance with the plan, the Minister of Energy, following consultation with interested parties, has appointed the Power Advisory LLC, as Nova Scotia's independent Renewable Electricity Administrator (REA). The REA is currently conducting a competition for renewable electricity projects having issued a draft RFP: *Request for Proposals for 300 GWh of Renewable Energy from Independent Power Producers* dated December 21, 2011. While NSPI will retain responsibility for the actual purchase of the renewable energy, the REA will issue this RFP, oversee the competition, evaluate bids and determine the winner based on a comprehensive review of the submissions that takes into account the technical soundness of the submission, environmental considerations, the permitting progress and the consultation process. The revised Pugwash Wind Farm is being advanced in response to the above-mentioned RFP.

2.1.3 Project Justification and Purpose

Wind power is commonly cited as an "environmentally friendly" renewable resource because it does not contribute direct atmospheric emissions, has minimal economic expenditure following commissioning and uses limited land area for its operation. Although energy generated from wind is a relatively new addition to the commercial energy market in Canada, during the last decade, the capacity of wind energy has increased by a minimum of 20% annually. As of December 2011 there were 4,963 MW of installed capacity across the country, providing energy to approximately 1.2 million homes (CanWEA, 2011). 2011 will be recorded as a record year for the wind industry in Canada with almost a 1,000MW of capacity installed.

The purpose of the proposed works, i.e., the construction of up to 12 wind turbines, or WTGs, on lands on either side of the Irishtown Road to the east of the Village of Pugwash is to use wind energy to generate electricity for sale to NSPI. The proposed turbines will add to the clean energy generated in the province, and its successful generation will contribute to NSPI's initiatives to achieve its greenhouse emissions targets. It is a project that has been designed to address the province's political goals of reducing greenhouse gas emissions and of moving NSPI closer to meeting its mandate of accommodating increasing amounts of renewable energy on the grid.

2.1.4 Alternatives and Other Considerations

Renewable energy alternatives to wind may include sources such as tidal, biomass and run-of-river hydro. Each satisfies the regulatory commitments for renewable energy and each has its own particular benefits and challenges. Producers of energy from these other renewable sources are also invited to participate in the Nova Scotia RFP for renewable energy to ensure that the potential value to electricity ratepayers of such alternatives will not be overlooked.

There are a limited number of areas that can be used effectively for the generation of wind energy. For any site to be considered commercially viable for a wind farm, it must have at least the following attributes:

- Situated in a location that has a proven financially viable wind resource;
- Located in proximity to the end user or the off-taker, i.e., NSPI's electrical grid, at a physical location where the planned capacity of the wind farm can be technically accommodated in the grid and preferably in an area where additional load is welcomed or needed;
- Access to the necessary lands at an economical cost; and
- General accessibility.

AWPC over the past decade has examined several locations in Nova Scotia and New Brunswick with respect to the development of wind power. They instigated the development of the first commercial wind farm at Pubnico Point in southwest Nova Scotia and subsequently were active participants in the development of the wind farm at Nuttby Mountain. After due consideration the site at Pugwash not only accommodates the attributes identified above, but the reconfigured project, i.e., 12 as opposed to 27 WTGs and pulled further away from the Gulf Shore Road, addresses the concerns articulated in 2006 and 2007 by local residents and meets the specifications of the recently amended Municipal Bylaw.

2.2 Principal Project Components

2.2.1 The Wind Turbine Generators (WTGs)

The proponent proposes to install 12 WTGs as depicted on Figure 1.2. The specific manufacturer for the turbines has not yet been confirmed. The information provided and the specifications of the WTGs are therefore general to a number of WTG models. The proponent will install a WTG that has a capacity of 2 to 3 MW. The planned maximum height of each WTG is 157 m (measured from grade to the tip of a vertically extended blade) with a tower height of approximately 99 m and a blade swath diameter of 101 to 113 m. As depicted in Figure 2.2, each of the WTGs is located appreciably more than the minimum of 600 m from the nearest residence[2] as required by the recently approved amendments for WTGs in the Land Use Bylaw.

Depending on the WTG manufacturer chosen, the electrical output of the generator located at the top of the unit will be a low-voltage, three-phase, 60 Hz, delivered to a low-voltage main breaker which will provide both protection and isolation to the unit. From the main breaker, mechanically protected and electrically isolated 1000V cables will connect to a transformer located either inside the WTG, or mounted on a concrete pad approximately 5 m from the base of the WTG.

Access to 10 of the proposed WTGs will be from the Irishtown Road; access to WT3 will be from the Gulf Shore Road while access to WT9 will be from Miller Road. Avoidance where possible of sensitive environmental habitat, particularly wetlands and stream crossings, were key factors in determining these access configurations. Existing access roads will be used wherever possible and,

[2] The nearest residence is approximately 665 m from WT1 and belongs to a land owner who is leasing property to the proponent.

where necessary, new access roads will be constructed to enable construction, subsequent servicing and maintenance of the project components.

2.2.2 Foundations and Lay Down Areas

Each WTG is situated on and affixed to a concrete foundation. The final engineering of the WTG foundations will be determined in response to the results of geotechnical investigations and the structural requirements of the selected WTGs. The size of each foundation pad is expected to be approximately 20 m x 20 m; that is an area of 48,000 m^2 for the 12 turbine foundation pads. Each foundation footprint will be excavated and foundation forms and rebar installed prior to pouring concrete. Once the concrete has cured the area around the foundation will be backfilled.

To enable the construction of a WTG, an area adjacent the identified foundation locations will be levelled to create laydown areas. These gravel covered areas will be used as a place for the temporary storage of the components of the WTG, i.e., tower sections, blades, etc. These areas will also accommodate the cranes that will be used to erect and assemble the WTGs; the areas will be used to facilitate subsequent maintenance, component replacements, possible refit work and ultimate decommissioning. Each laydown area will be configured to use the least amount of space and generally will involve a gravelled area of about 80 x 80 m which may include the area for the WTG foundation; some additional areas may be cleared of vegetation to enable the placement and assembly of blades and other components.

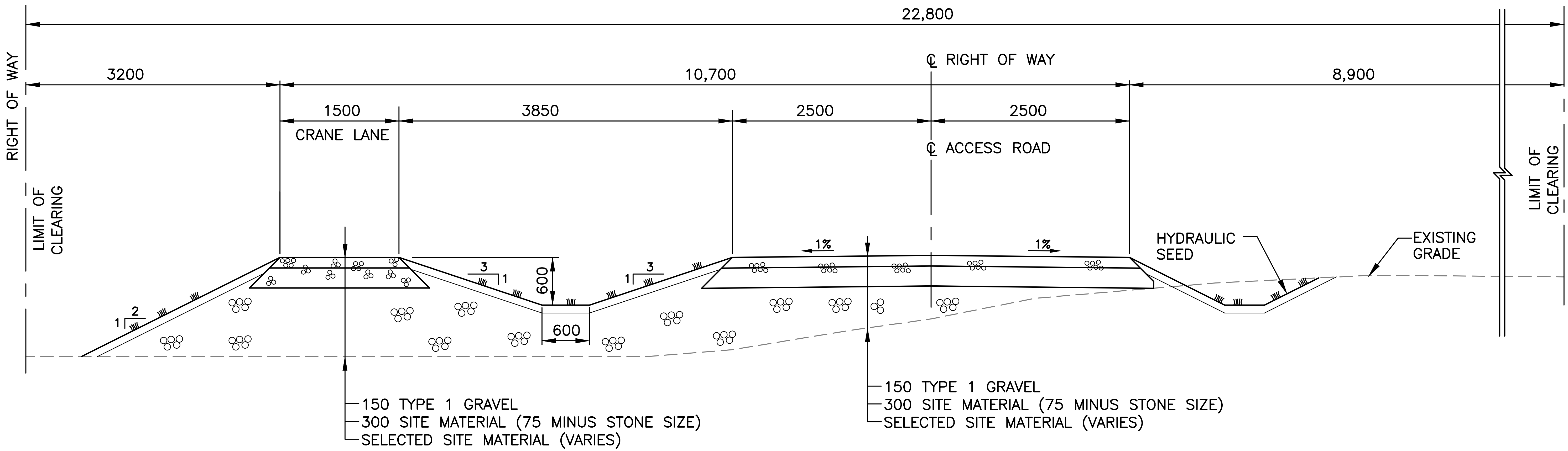
2.2.3 Access roads and Transportation of WTG Components

In addition to the components referenced above, access is required to each of the turbine locations. Access as indicated above to all but two of the WTGs is from the Irishtown Road. Given the size and weight of some of the flatbed trucks that will be used, the Proponent and their engineers will work closely with the road authorities to ensure that the roads have the capacity to accommodate the loads. The intent is to select a cost effective and efficient means of transportation and to work with all authorities to ensure safety for all involved including road users. Where possible, on-site access to the individual WTG sites will utilize existing roads, which will be upgraded as necessary to accommodate the transportation of the over-sized trailers carrying the turbine components and crane for WTG installation. The construction of approximately 8 km of new access roads will be required. These roads will be approximately 10 to 11 m wide. Figure 2.3 depicts a typical cross section of a new access road.

To the extent possible, watercourses and wetlands have been avoided; this has influenced the final layout of the access roads. Where wetlands could not be avoided, the necessary Wetland Alteration Approvals will be sought from NSE after release from the environmental assessment process. Based on the proposed access layout, it is anticipated that several small, non-fish bearing watercourses may require culvert installations with the necessary Watercourse Alteration Approvals.

2.2.4 Connection to the Grid

The wind farm will be connected to the NSPI transmission grid (see Figure 1.2). To keep the cables to a reasonable and economical size, a 34.5 kV transmission system has been selected; three single-phase direct-buried underground cables will be connected to the 69-34.5 kV transformers at each



* ALL SOFT/WET BOG AREAS TO BE EXCAVATED AND REPLACED WITH SUITABLE PIT RUN OR SURGE ROCK.

CBCL LIMITED
Consulting Engineers
ISO 9001 CERTIFIED

TYPICAL CROSS SECTION OF ACCESS ROAD			Figure 2.3
Date 01/19/2012	Scale 1:50	Contract 111257.00	

DRAWING FILENAME: DETAILS.DWG LAYOUT NAME: DWG 4 DATE: 1/26/2012 11:36 AM CAD OPERATOR: MDOUGLAS

WTG and then to one of two overhead powerlines running alongside the road system, similar to the existing NSPI overhead powerlines in the area. These two overhead lines will collect the electrical energy generated by all 12 WTGs and carry it from the Irishtown Road, near the centre of the proposed wind farm, cross-country to Highway 6, where they will run in parallel (installed together on a single set of poles) along the Rabittown Road to a new 69-34.5 kV high-voltage substation. The latter, located at the intersection of the Rabittown Road and the Crowley Road, will be approximately 1 km south of the Canadian Salt Pugwash salt mine and 200 m from the existing NSPI 69 transmission line.

The new substation will be an outdoor, completely fenced-in facility typical of many substations throughout the province. The primary function of the substation is to transform the voltage of the electrical energy generated at the wind farm from the cable collection voltage, i.e., 34.5 kV, to transmission voltage at 69 kV using one or two transformers. In addition, the substation will contain various electrical protection devices and NSPI accessible communication equipment to monitor and protect both the wind farm and the grid side of the interconnection. The electrical energy will be delivered to the NSPI 69kV transmission line at the closest connecting point. All high-voltage electrical infrastructure will be constructed to meet or exceed the Canadian Electrical Code, applicable CSA Standards and NSPI standards.

2.2.5 Lighting of WTGs

The wind turbines will be marked in accordance with Transport Canada's (TC) Obstruction Marking and Lighting Standards (Standard 621.19). These guidelines have specific directions for marking wind turbines. In short, they require WTGs to be marked at least every 900 m around the perimeter of the wind farm with synchronized red flashing beacons atop the nacelles. The intensity and direction of the lighting is also governed by these standards. The proponent recognizes that when satisfying the lighting requirements as imposed by the TC standards it must also be mindful of the Environment Canada (EC) (through the Canadian Wildlife Service (CWS)) preference to have a flash with a distinct off period. Accordingly, the proponent is considering the use of a LED based technology pointed within the TC acceptable range with all lighting synchronized.

2.3 Project Activities

In determining the scope of the Project for the environmental assessment, the Proponent must give consideration to what is involved in the construction of the principal structural elements including the towers, the necessary cable linkages to the grid and the substation, the operation of the WTGs and their eventual decommissioning.

2.3.1 Construction

The transportation of equipment with the dimensions of the tower sections and blades of a WTG is still a relatively rare occurrence in Nova Scotia. Discussions are ongoing, and the transportation of these components will necessitate careful planning with all pertinent authorities including NSTIR and possibly the RCMP. The intent is to select a cost effective and efficient means of transportation and to work with the requisite authorities to ensure safety for all involved including the public.

During the construction phase, temporary facilities will be provided on site to provide both for the needs of the construction crews and for the storage of equipment. Consideration is being given to the development of a small, but permanent, administrative/operations building that would be used throughout the operating life of the wind farm. The siting and scale of such a structure has not yet been determined.

Construction and preparation for construction will involve a number of activities including:

- undertaking of a number of site, grid construction and geotechnical surveys;
- development and implementation of an erosion control plan to mitigate against sediment transfer during construction activities;
- upgrading of the Irishtown Road and the clearing and preparation of the access roads and WTG lay-down pads;
- mobilization of construction equipment to site;
- construction of access roads and turbine pad areas;
- excavation to accommodate the concrete foundations;
- preparation of the building forms for the foundations, the pouring of the reinforced concrete foundations and the attachment of the mounting ring for each tower;
- transportation of the WTG components, i.e., tower, nacelle and blades, to the site on flatbed trucks potentially from Pugwash Harbour, where the components may arrive via ship;
- the placement of the tower sections by crane, which will then be sequentially bolted into place;
- the placement of the nacelle, containing the gear box (dependent on final WTG choice), generating and yaw mechanism, onto the top of the tower;
- the assembly, or partial assembly, of the rotor, i.e., the blades of the turbine, on the ground to be lifted to the nacelle by crane and bolted into place;
- placement of the individual turbine transformer within, or in proximity to, the tower base;
- the trenching for and placement of the electrical cables and the backfilling of the trenches;
- installation of overhead poles and wires for the cable collection system interconnecting the turbines to the NSPI transmission grid;
- construction of the substation and interconnection facilities near the transmission grid; and
- demobilization and site remediation which will include the restoration of vegetation as appropriate around the towers and construction areas.

2.3.2 Operation and Maintenance

Operation and maintenance can be divided into two distinct categories. Operations are the day-to-day observation, guidance and control of the facility. This involves ensuring the facility and the operation thereof complies with various contracts and obligations to which the proponent is bound, including any environmental assessment release decision and attached conditions. The proponent intends to have at least one full-time individual dedicated to the Project to assist in the guidance of these activities together with the proponent's larger off-site wind energy team. This 'front-line' individual will be accessible to the community and to other relevant interested parties.

Maintenance of the wind farm will be done by trained technicians staffed by the wind turbine supplier at least for the duration of the warranty and service contract between the proponent and the supplier. This may involve two or three full time positions based on or near the site as well as involvement from regionally based personnel. The maintenance role keeps the wind turbines fully serviced and attends to any warranty matter, i.e., the replacement of defective parts if necessary. The proponent's operations team essentially oversees this work as the owner of the wind farm.

The wind turbines will all be operational on a continual basis except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities. Each turbine will be subject to periodic maintenance and inspection; regular maintenance may involve oil changes, and any waste products, e.g., waste oil, will be disposed of in accordance with municipal, provincial and federal waste management regulations.

Finally, the operations team will engage other suppliers as appropriate to maintain and service what are commonly referred to as the "balance of plant" components. These include the cable collection system, substation, interconnection, etc. The servicing requirements for these more static components are not as frequent and accordingly the specialized appropriate service personnel will be called in as required.

2.3.3 Decommissioning

It is planned that the Project will operate for at least 20 years supplying renewable energy to NSPI, pursuant to a long term contract, for use by Nova Scotians including residents in the Pugwash and Gulf Shore areas. After the initial term, it is anticipated that the Proponent will negotiate a renewal of its power purchase agreement, replace and renew components as necessary and continue to supply renewable energy to NSPI for many more years. It is possible at some future date that the Project will no longer be used to generate renewable energy as presently planned, nor have another permitted use at that time. If so, the Project will be decommissioned as required by, and in accordance with, the following regimes:

- The Land Use Bylaw of the Municipality of the County of Cumberland; and
- Each Option and Lease Agreement with the host landowners.

Paragraph 10.2(r) of the Land Use Bylaw states:

> *Decommissioning: In accordance with a decommissioning plan prepared by the applicant for a Development Permit, all above ground components of the large scale wind turbine or the wind power project, including all buildings and storage facilities, wind turbines wind testing facilities and above ground accessory infrastructure (such as overhead transmission lines and substation) shall be removed from the site (unless it can reasonably established that there is another probable near term future use for any of the said components) and the applicable surface site areas, except for roads, shall be restored to a reasonable natural state within 18 months of the time at which the wind turbines cease to produce power continuously for a period of six months or in a case where construction of the large scale wind turbine or wind power project is not completed, the time at which the development of the wind power project ceases*.

A decommissioning plan, as contemplated in this Bylaw provision, will be prepared and submitted to the Municipality prior to any work commencing on the Project. It should also be noted that the Proponent is required to provide the Municipality with a status report identifying future plans for the site if it discontinues power production for a year (see 10.2(q) of the Bylaw).

In addition to the Land Use Bylaw requirements, all of the Option and Lease Agreements between the Proponent and each host landowner specifically require the Proponent to remove the components of the wind farm at the end of the lease term, or earlier if the agreement is terminated. Each agreement requires the Proponent to remove the turbines and other components generally in circumstances where the proponent ceases to operate the Project for a period of 12 months. Further, each landowner has the contractual entitlement to enter on the lands, seize and remove the said components and realize their value to complete a proper decommissioning of the site in the unlikely event that the Proponent fails to honour its obligations.

The obligations imposed on the Proponent under these separate, but complimentary regimes will ensure that the Project is properly decommissioned at the end of its useful life.

Decommissioning will consist of the following steps:

- Arranging for the dismantlement of the turbines by engaging appropriate contractors and securing permits and other needed authorizations;
- Informing the community of the decommissioning events to occur and the timing;
- Removing components of the turbines by crane and transporting to offsite locations for salvage recovery and disposal as appropriate;
- Recycling and selling items able to be reused in wind energy facilities or other applications;
- Recovering value by selling certain components as salvage materials; and
- Restoring the site to the condition required by the lease agreements and municipal bylaws including ensuring that the foundation remains below grade and replacing a reasonable amount of overburden over that area.

Environmental regulations concerning the proper handling and disposal of all relevant materials will be followed during the complete decommissioning process.

The above steps will apply to all components of the wind farm including the turbines, poles and overhead wires and the substation unless another probable near-term use is anticipated for any such particular component (such as using part of the cable collection system to deliver power to other facilities or uses that are in the area at the time). The access roads will remain on the lands.

2.4 Construction Schedule

NCWF plans to construct and install the wind farm in one distinct phase, primarily through 2013.

Although the final construction schedule will be dependent on the receipt of the requisite approvals and authorizations, it is anticipated that site clearing and the commencement of road construction will occur between December 2012 and March 2013, i.e., in a period that will minimize disturbance to wildlife particularly breeding birds and cause less disturbance to the ground. Turbine delivery and erection of the turbines, installation of the cables and connection into the NSPI grid are anticipated to be completed in the late spring into the summer and fall of 2013. It is intended that actual turbine construction will be planned for a period when there is a reasonable prospect of relatively calm dry weather, i.e., generally between July and October. Should the turbine supplier not be able to deliver the required turbines in time to complete the referenced schedule, some of the Project construction and commissioning may occur in 2014.

2.5 Anticipated Emissions and Waste Streams

The proposed wind farm will not generate air emissions and anticipated discharges are limited to the waste oils that will be used during the course of regular maintenance. These wastes will be managed and disposed of in accordance with all applicable regulations.

2.5.1 Site Runoff

During the construction phase of the Project, the control of silt-laden run-off will be addressed through the use of sound environmental and engineering practices. Erosion and Sediment Control Plans will be prepared as part of the project's Environmental Protection Plan (EPP) and implemented during and following construction until disturbed soils have been re-vegetated, or stabilized by other permanent cover. Construction debris will be managed on site, or at offsite disposal locations, in an approved manner. Solid wastes will be recovered for reuse or recycling as required by provincial legislation.

2.5.2 Hazardous Wastes

A limited number of hazardous materials will be used during the construction and operation of the proposed wind farm. Prior to commercial operation, an EPP will be developed and implemented to ensure that all staff working at the wind farm are appropriately trained to handle, store and dispose of these materials which may include one or more of the following:

- Corrosion and fouling inhibitors;
- Paints;
- Industrial cleaners; and
- Lubricating oils and fuels.

All hazardous materials will be stored and handled according to relevant federal and provincial regulations. Staff will receive the required training as specified by law.

2.5.3 Other Emissions

Public concern has been expressed that exposure to electric and magnetic fields (EMFs) can be associated with health risks. EMFs are created when electrical charges flow through any object that conducts electricity. For a transmission line, these fields are created by electric current flowing through a wire. The flow of electric current creates a magnetic field in the space around the wire, but the strength of that field decreases rapidly with increasing distance from the wire. According to Health Canada's website, and the paper *Federal-Provincial-Territorial Radiation Protection Committee Response Statement to Public Concerns Regarding Electric and Magnetic Fields (EMFs) from Electrical Power Transmission and Distribution Lines*, issued on November 8, 2008, "For magnetic fields, the contribution from power lines to the levels in most homes and other buildings is very small to negligible when compared to the fields in close proximity to operating electrical appliances, i.e., stove ranges, electric blankets, etc.,] and building wiring.” The Health Canada website does note that the International Agency for Research on Cancer (IARC) has evaluated the scientific data and has classified the EMF produced by the transmission and use of electricity as being "possibly carcinogenic" to humans. IARC based this classification on the following:

- human health population studies show weak evidence of an association with childhood leukemia; and
- a large database of laboratory study results show inadequate evidence of an association with cancer in animals.

Health Canada goes on to state “To put this into context, it is important to understand that the "possibly carcinogenic" classification is also applied to coffee, gasoline engine exhaust and pickled vegetables, and is often used for agents that require further study. In summary, when all of the studies are evaluated together, the evidence suggesting that EMFs may contribute to an increased risk of cancer is very weak” (Health Canada, 2010). This topic is further discussed in Section 7.4.8.

2.6 Environmental Management

The objective of environmental management is to implement safe, environmentally responsible, and sound engineering, construction, operation, and training practices. NCWF is committed to articulate and adhere to systems, procedures, practices and materials to ensure that the development and operation of the Pugwash Wind Farm is executed in a manner that protects the environment and facilitates the safety of all who work or visit the site. To the extent practical NCWF will seek to eliminate pollution at source. The principle components of an environmental management system include the preparation of the following:

- Environmental Protection Plan (EPP); and
- Contingency and Safety Plan.

The intent of the environmental management and protection system is to:

- define environmental, health and safety responsibilities and accountabilities for personnel;
- ensure compliance with regulations, goals and objectives;
- establish minimum standards for a contractor safety and the implementation of environmental
- encourage protocols in the field;
- establish safe work practices and procedures documentation that ensure basic precautions for maintenance procedures;
- prevent accidents, injuries or illnesses in the performance of work;
- define environmental practices and procedures that establish minimum standards for all operations that have a potential to cause environmental problems;
- define minimum safety training standards to ensure that all personnel are aware of potential hazards and know safe work practices and emergency procedures; and
- establish an accident/incident reporting system that standardizes prompt reporting of all injuries and environmental incidents.

2.6.1 Environmental Protection Plan (EPP)

A project site specific EPP will be developed to ensure the application of environmental protection measures and good engineering practices through construction, e.g., the deployment of techniques to control erosion and sedimentation and measures to prevent spills of hazardous materials. The EPP will expand upon measures identified in this environmental assessment and will accommodate recommendations from the regulatory authorities. These requirements will be brought to the attention of all personnel working on the site, e.g., contractors.

2.6.2 Contingency and Safety Plan

The goal of the Contingency and Safety Plan is to reduce the frequency, extent and duration of accidental events and to reduce the risk to the environment and public safety from such events. A contingency and safety plan will be developed in consultation with relevant federal and provincial agencies for both the construction and operation of the Project. The plan will designate personnel responsible for specific actions, and ensure that an effective communications and reporting system is in place.

These plans can only be finalized once the Project design is finalized.

2.7 Malfunctions and Accidents

NCWF is cognizant that malfunctions and accidents pose a risk to human health and safety and to the environment; therefore the proponent is committed to ensuring that all requisite protocols are established to:

- minimize the risk to human health and safety during both construction and operation; and
- minimize the risk to the environment during both construction and operation.

Although the construction and operation of a wind farm requires working with structural elements that are still relatively new to this region, it employs techniques and technologies that are familiar to the construction industry. The likelihood of serious malfunctions or accidents associated with a wind farm that would pose a risk to human health and safety or the environment are less than those associated with many other forms of power generation.

CHAPTER 3 ENVIRONMENTAL WORK PROGRAM

3.1 Overview and Approach

The environmental assessment methodology has been developed to meet the requirements of the assessment regulations of the *Nova Scotia Environment Act*. The approach also reflects the technical and professional competency of the study team and their ability to address specific issues in a rigorous and pragmatic manner. In general, the approach has been designed to produce an environmental assessment document that:

- focuses on issues of greatest concern whether these have been identified by the study team, by the public or by the regulators;
- clearly addresses regulatory requirements; and
- integrates engineering design and mitigative measures into a framework that will enable, as the engineering proceeds, the preparation of a comprehensive environmental management strategy.

Figure 3.1 depicts the key steps in the assessment process.

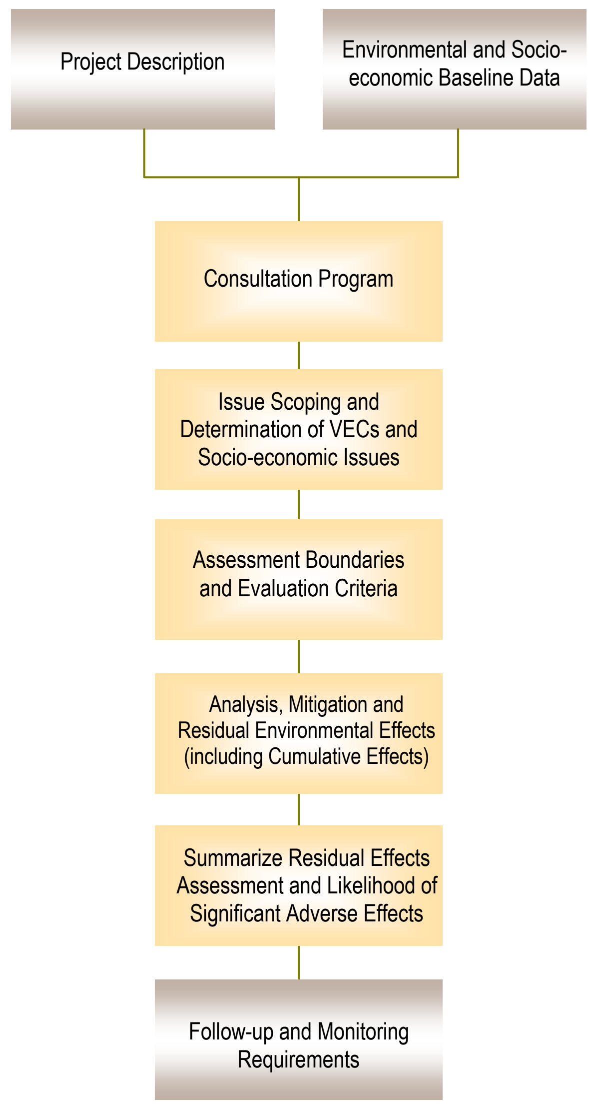


Figure 3.1: Environmental Assessment Process

The preparation of the Project description and the environmental and socio- economic baseline are the two fundamental building blocks necessary for the environmental analysis. The former is derived from the work undertaken by the Proponent and their engineering team. The latter is derived from the review and compilation of pertinent secondary data sources and the execution of selected field programs. The integrity of these building blocks is critical to the credibility of the subsequent analysis; the preparation of the two, however, is often iterative. This allows the environmental assessment, particularly the field programs[3], to be used as a planning tool and to influence Project design.

To compile the environmental and socio-economic baseline, the study team drew on its collective knowledge and experience and considered input and opinions expressed by the community, the relevant regulations and guidelines and pertinent research including the field work undertaken. Reference has also been made to environmental work executed by the Proponent in other areas, but particularly with respect to the lessons learnt from the development and operation of the wind farm at Pubnico Point in southwest Nova Scotia and that at Nuttby Mountain in Colchester County. This work has generated a substantial data base and enabled the identification of matters that warrant evaluation. The assessment examines the potential effects of each Project phase, i.e., construction, operation and decommissioning, as well as malfunctions and accidents, with regard to each identified VEC or socio-economic issue. VECs represent "key" or "indicator" species, communities, species groups or ecosystems, as well as specific media, e.g., water or air, that may transport environmental effects. Social, cultural or economic factors, or issues, may also be affected by the proposed works and are identified as such.

The final selection of VECs and socio-economic issues that provide the focus of this assessment reflect an informed understanding of the consequences of the proposed works in the physical, ecological and socio-economic context of the receiving environment. These were determined through reference to pertinent literature, through consultation, as a result of work done on other like projects and through the execution of the field programs. The local consultation undertaken has been extensive; there have also been meetings with environmental regulatory staff at the provincial and federal levels. Chapter 5 provides an account of the consultation undertaken.

3.2 Ecological Research and Field Work Undertaken

Environmental assessment is a process that is executed early in Project planning to enable environmental factors to influence decisions and detailed engineering. It is in part a planning tool, the underlying intent of which is to ensure that all works associated with the Project's construction, operation and decommissioning are executed in a manner that causes minimal harm to the physical, ecological and socio-economic environments.

3.2.1 Secondary Data Research

The initial step in the environmental assessment process for this Project was to compile, review and evaluate secondary data essential to the definition of the field programs and to the scoping of the environmental assessment. In broad terms, this phase of the work included the following:

- acquisition of data sets from various government sources including Nova Scotia Department of Natural Resources (NSDNR);
- the acquisition and examination of aerial photographs;
- review of key texts, e.g., the Natural History of Nova Scotia (Davis and Browne, 1996);

[3] Illustrative of this iterative process has been the work executed through the fall of 2011 when the identification and field confirmation of wetlands influenced the micrositing of the turbine locations and the alignment of the access roads. This process also enabled the avoidance of streams and therefore areas of potential fish habitat.

- consideration of the *Species at Risk Act* (*SARA)*, the *Nova Scotia Endangered Species Act*[4] and examination of the listings compiled by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the Atlantic Canada Conservation Data Centre (ACCDC) and NSDNR; and
- compilation of demographic and related data from Statistics Canada, and provincial and municipal databases to facilitate the preparation of the socio-economic profile.

Since *SARA* is legislation of general application, the requirements of that Act are addressed in this provincial Class 1 assessment. In addition, the provincial environmental assessment process requires a "Species at Risk" review. *SARA,* in conjunction with the provincial *Endangered Species Act,* provides the regulatory framework pertinent to the protection of valued rare and endangered species.

In Nova Scotia, species of concern are tracked and designated at four levels. *SARA* and the *Nova Scotia Endangered Species Act* provide legislative designations while the NSDNR - General Status Ranks and the ACCDC provide technical tracking lists. The NSDNR-General Status Ranks are, by design, high level in nature. The results of the General Status Assessment provide more in-depth scientific assessment approaches and a "first-step tool" to help identify priorities, i.e., establish a list of priority species, for more detailed status evaluations, inventory, research and management. The ACCDC is a member of NatureServe, an international non-profit organization that provides science and technical support to various Conservation Data Centres (CDC). The ACCDC provides objective data and expertise about species and ecological conservation concerns in Atlantic Canada.

A list of the potential species of concern that may reside in, or migrate through, the study area was compiled from the legislated designated lists, the ACCDC and the NSDNR General Status Ranks.

The methodology followed to determine potential species of concern was the protocol developed by NSDNR, *Standards and Processes Applied to Provincial Environmental Impact Assessment, Wild Species Priorities Inventory and Mitigation Standards for Reporting*. The protocol provides a framework through which listed species can be ruled in or out of an environmental assessment based, in the first instance, on geographical occurrence, and secondly, on the presence or absence of appropriate habitat within the Project area. The observed distance of each species from the study area (as noted in the ACCDC guidance list) was also taken into consideration. Additional sources used to determine the regional distribution and habitat preferences for birds included the *Atlas of Breeding Birds of the Maritime Provinces* (Erskine, 1992) and *Eastern Birds* (Peterson, 1980). For plants, a key reference was *Roland's Flora of Nova Scotia* (Zinck, 1998).

[4] The Nova Scotia Endangered Species Act identifies the following classifications:

- Endangered – a species that faces imminent extinction or extirpation and is listed as an endangered species pursuant to Section 12;
- Threatened – a species that is likely to become endangered if the factors affecting its vulnerability are not reversed and is listed as a threatened species pursuant to Section 12; and
- Vulnerable – a species of special concern due to characteristics that make it particularly sensitive to human activities or natural events and that is listed as a vulnerable species pursuant to Section 12.

A list of sightings of rare and endangered species within 100 km of Pugwash was acquired from the ACCDC both in 2006 and 2011. The 2011 report lists 471 taxa of species of conservation concern broken out into 288 vascular plant species, 23 nonvascular species, 74 vertebrates and 86 invertebrates. Based on the habitat requirement for each species, a Short List (Appendix A) of 85 taxa of conservation concern that are ranked as S1, S2 or S3 at the sub-national level [5] and identified by NSDNR as having a ranking of either RED, YELLOW or GREEN[6], was generated from the larger ACCDC list. This list of species was divided by taxon, i.e., birds, plants, etc.; this provided both guidance for the development of field methodologies and as a reference for the assessment. Table 3.1 presents the breakdown by taxon; 42 species on the Short List were ranked as being RED or YELLOW by NSDNR.

Table 3.1: Short List Species Count by Taxon

Taxon	*Total Number of Species*	*Number of RED or YELLOW Species*
Plants	36	23
Birds	29	9
Mammals	0	0
Fish	1	1
Invertebrates	17	8
Herpetofauna	2	1

The execution of this analysis provided a framework of relevance to the definition of selected field programs, to the identification of VECs and to their evaluation.

Based on the review of the secondary databases and the initial mapping generated from the NSDNR forest GIS database, as well as the interpretation of recent aerial photography, representative forest cover types and general habitats were identified and ground-truthed. Although large areas have been logged, and continue to be logged, the area accommodating the wind farm is largely forested.

---

[5] SRANK: Sub-national rarity rank of species, using CDC/NatureServe methods: **S1** - **Extremely rare**: May be especially vulnerable to extirpation (typically 5 or fewer occurrences or very few remaining individuals); **S2 - Rare**: May be vulnerable to extirpation due to rarity or other factors (6 to 20 occurrences or few remaining individuals); **S3 - Uncommon**, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences). (Atlantic Canada Conservation Data Centre website: http://accdc.com/Data/ranks.html#subnational)

[6] **RED** (At Risk or Maybe at Risk) - Species for which a formal detailed risk assessment has been completed (COSEWIC assessment or a provincial equivalent) and that have been determined to be at risk of extirpation or extinction. Species that maybe at risk of immediate extirpation or extinction and are therefore candidates for interim conservation action and detailed risk assessment by COSEWIC or the Province.
YELLOW (Sensitive) - Species that are not believed to be at risk of immediate extirpation or extinction, but which may require special attention or protection to prevent them from becoming at risk.
GREEN (Secure) - Species that are not believed to be at risk, or sensitive. This category includes some species that have declined in numbers but remain relatively widespread or abundant. (NSDNR Website: http://www.gov.ns.ca/natr/wildlife/genstatus/background.asp).

The habitats that make up the study area are:

- Softwood Forest;
- Harwood Forest;
- Mixedwood Forest;
- Clearcut;
- Agriculture;
- Old Field;
- Brush/ Scrub;
- Wetland;
- Urban; and
- Watercourses.

These habitats are further described in Section 4.2.3. This database and the mapping compiled provided the reference material for and facilitated the design of the field programs that were executed in 2006 and 2011.

3.2.2 Field Programs Executed

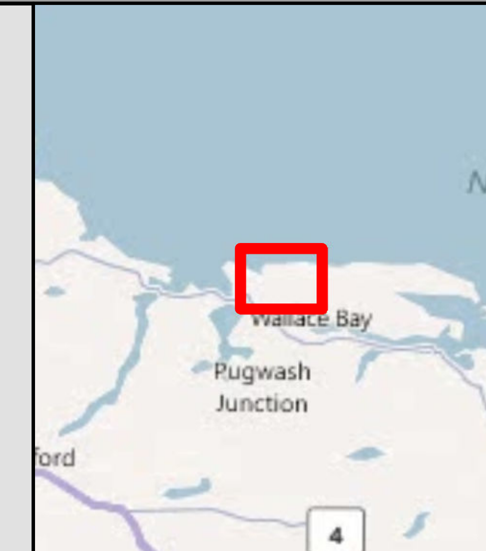
To augment the work referenced above, a number of specific field programs were undertaken. Much of this work was undertaken in 2006; additional field programs were undertaken in the fall of 2011. The specific field programs are identified in Table 3.2 and outlined in the following sections.

Table 3.2: Field Programs Undertaken

Field Program	***Program Description***	***Lead Researcher***
General ecological field investigations	Ecological reconnaissance, including the identification of wetlands, habitats and streams	Clinton Pinks, CBCL Limited
Bird breeding surveys, spring and fall migrations	Field work to identify breeding and migratory bird population	Brian Dalzell, Atlantic Bird Surveys
Winter bird surveys	Field work to identify winter avian populations	Chris Kennedy, CBCL Limited
Botanical surveys	Field investigations for priority field species	Sean Blaney, ACCDC
Bat monitoring program	Field investigation to determine the importance of the area for bats	Hugh Broders, Saint Mary's University
Surveys for freshwater mussels and wood turtles	Field investigation to validate secondary sourced research	Ross Hall

3.2.2.1 General Ecological Field Investigations

There have been since 2006, and more specifically through the fall of 2011, numerous visits made to the site to identify and confirm the ecological habitats in and adjacent to the proposed project area and to undertake field work. Key locations in the execution of the field work are depicted on Figure 3.2. In the period since the original field work was executed, the number of proposed WTGs has been reduced from 27 to 12, and the siting of this lesser number has been pulled back from the Gulf Shore Road (see Figure 2.1). Field initiatives in the fall of 2011 have been designed to facilitate the siting of the 12 turbines now proposed, to maximize the suitability of each site with respect to the wind regime, to minimize the impact on wetlands, to ensure adequate set-backs from property lines and dwellings, and to avoid streams and running water to avoid impact to potential fish habitat.



Legend

- Alternative Turbine
- Proposed Turbine Locations
- Viewshed Analysis Locations
- Bat Detection Systems
- Stream Assessments
- Migratory Bird Survey
- Fall/Winter Habitat Assessments
- Vascular Plant Inventory
- Rivers and streams

Figure 3.2
Field Programs

NOTE: If ALT 4 is used, WTG 4 and WTG 5 will be omitted from the layout.

Drawn By: MSD	Date: 26/01/2012
Approved:	Scale @ 11" x 17"

CBCL LIMITED
Consulting Engineers

0 165 330 660 m

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Units: Meter

N

Confirmation of Habitat Types
Initial mapping based on the secondary databases was ground truthed by CBCL Limited to confirm the habitat delineations identified. Where necessary, the mapped classifications were updated to reflect the on-the-ground conditions.

Wetlands and Surface Water
The Pugwash site is largely characterized by very little relief, a high water table, imperfectly drained soils and poor drainage. Impact to wetlands and watercourses from site development can be both costly and logistically problematic from a construction perspective. Every effort to avoid wetlands and watercourses was therefore sought in the early stages of site configuration. Spatial analysis using GIS tools was conducted as part of the configuration of the turbines. The best available GIS information from existing government sources was accessed and used to develop the base map for the study area; the following specific sources were used:

- NSDNR Wetlands Database;
- NSDNR Wet Areas Mapping (WAM);
- NSDNR Forest Cover Database;
- NSDNR Significant Habitat Database; and
- NSGC 1:10,000 Topographic data.

By overlaying this spatial information onto a base map of the study area, areas of high probability for wetlands, watercourses and other areas of ecological significance can be identified and the necessary field programs better orchestrated. Further information is provided in sections 4.2.3.8 and 7.3.1.

Fish Bearing Streams and Stream Crossings
A fish habitat assessment was conducted in the fall of 2011 wherever the existing or proposed access roads crossed, or might cross, the streams on the site. Photographs were taken, GPS coordinates of each possible crossing were recorded and brief descriptions prepared. This description included the percentage of vegetative cover along the banks and instream, the substrate composition, flow characteristics, the absence, or presence of fish and fish spawning habitat, i.e., redds and water clarity; the condition of the existing culverts, and the pH and temperature of the water. The findings are presented in Section 4.2.4.

3.2.2.2 Avian Field Program
Brian Dalzell, ornithologist, consulted with Dan Busby of the CWS on June 20, 2006, with respect to the field work that should be undertaken at the site of the proposed wind farm. The following program representing field observations over one year was agreed to and undertaken:

- area search to document as many breeding birds as possible to be undertaken in June and July, 2006;
- point counts: 20 point counts were established in major habitat types, mainly mature or semi-mature coniferous and deciduous and/or mixed forest. As per the requirements of the CWS publication “Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds”, each 10 minute count was conducted twice over the course of the breeding season;

- migration stopover counts – through August 2006 one trip per week, through September two trips per week and in October one trip per week were made to assess the quality and volume of migrant stopover bird usage. A 2 to 3 km transect at the eastern end of the project area was walked with all possible migrants heard or seen within 100 m of the transect recorded; and
- watch points for shorebirds, waterfowl and raptors – because the proposed wind farm is located in an area that is in proximity to water on three sides, i.e., Pugwash Basin/Harbour approximately 4.5 km to the west, the Northumberland Strait approximately 2.5 km to the north and Wallace Bay approximately 4 to 6 km to the east, two watch points, one on a high point of land to the west and a second to the east, were established to watch for shorebirds and waterfowl that might transit the project site. One hour was spent at each site timed to coincide with a rising tide when shorebirds would be most likely to head overland to traditional roosting sites. The counts were conducted on the same days as the migration stopover counts.

The results of the work undertaken to date are presented in section 4.3.1. A winter bird monitoring program has also been instigated which will involve time in the field from December 2011 to March 2012. The results of this program will be provided to NSE and NSDNR on its conclusion.

3.2.2.3 Flora Field Program

In early August 2006, the botanist (Sean Blaney) spent 12 hours on site and covered 17.4 km on foot. The focus of his search efforts were on the footprint of the proposed wind farm as it was then configured (see Figure 2.1), but he also moved beyond the identified linear corridors to inspect different or interesting habitats, which were recorded by GPS every 15 seconds while moving track on a Garmin GPS 76Cx unit.

Blaney compiled a full vascular plant list for the site as a whole and made estimates of species' relative abundance in the following terms:

- Rare – seen in small numbers in three or fewer locations;
- Uncommon – seen in small numbers in approximately four to eight locations, potentially in larger numbers at one or two locations;
- Fairly common – seen in small numbers in approximately eight to 12 locations, potentially in larger numbers at several of the locations; and
- Common – seen at more than 12 (estimated) locations.

These categories were not intended to represent precise descriptions of abundance, but to provide some measure of relative abundance. For plant species tracked by ACCDC (those ranked S1, S2, S3 or S3S4 in Nova Scotia), locations were recorded by GPS; habitat descriptions and more precise estimates of local abundance were prepared. The results of this program are provided in Section 4.3.2.

3.2.2.4 Bats

The intent of the ultrasonic bat survey that was undertaken in the late summer of 2006 was to document the species composition and use of the Project site by bats prior to the construction of the turbines. Dr. Broders deployed two Anabat II detection systems to sample the echolocation calls of the bats. Each system consisted of an ultrasonic Anabat II detector interfaced to a CF Storage

ACAIM (Titley Electronics Ltd., NSW Australia). The systems were calibrated to reduce the variability in their sensitivity using the methods suggested by Larsen & Hayes (2000). The seasonal timing of the sampling period corresponds to the end of the fall migration activity by migratory species, i.e., mid-July to late September (Erickson *et al.,* 2002) and movement of resident species to local hibernacula.

Location #1

Location #2

Activity was monitored at two locations in the vicinity of the meteorological tower (Location #1: 452130 E and 5079949 N; and Location #2: 451993 E and 5079974 N – UTM NAD83 Zone 20 format). These locations are depicted on Figure 3.2. Both detectors were placed along north to south forest edge adjacent to a field. Detector #1, i.e., Location #1, was placed on the ground and oriented northward. The second detector was suspended from a tree on pine constructed supports such that the microphone was unobstructed by surrounding vegetation, thereby maximizing the quality of the recorded calls by reducing interference; this installation was oriented southward (see photographs). Monitoring began on the evening of August 21st and was completed on the morning of September 7th, 2006.

Identification of many bat species is possible because of the distinctive nature of their echolocation calls (Fenton & Bell, 1981; O'Farrell *et al*., 1999). Species were qualitatively identified from echolocation sequences by comparison with known echolocation sequences recorded in this and other geographic regions. In the case of species in the genus Myotis (northern long-eared and little brown bats), identification did not extend to the species level as their calls are too similar to be separated. Identifications were accomplished using frequency time graphs in ANALOOK software (C. Corben, www.hoarybat.com). A bat pass, defined as a continuous series of greater than two calls (Johnson *et al*., 2004), was used as the unit of activity.

3.2.2.5 Search for Wood Turtles and Fresh Water Mussels

Surveys for the presence of wood turtles are best done either in late April and early May when they surface from aquatic hibernation and can be observed basking in the sun on river banks, or in June when the mature females move to sand or gravel banks to lay eggs. Matheson and Tidemill Brooks that traverse portions of the site were visited in June and again in August.

Matheson Brook flows under the Gulf Shore Road, flows into a salt marsh and into the Northumberland Strait. Starting at the paved road, the wildlife biologist followed Matheson Brook upstream for 1.6 km. At any fork in the stream the larger tributary was followed. At the time of the survey, Matheson Brook had a very low water flow for approximately the first 800 m; the stream had no flow for the next 800 m and, apart from a few remaining pools, was drying up. Tide Mill Brook was searched in the vicinity of the Sanitary Transfer Station that is located at the end of the paved portion of the Irishtown Road. A large upper portion of this brook was also intermittent at the time of the survey.

The results of the survey are provided in section 4.3.5 and 4.3.6.

3.3 Additional Research Undertaken

3.3.1 Land Use

Information on land use in and adjacent to the area was determined from observations in the field, through conversations with people at the open houses held and from consultations with those who own and use the properties involved. The observations made in the field were also used to identify viewpoints that could be used in the visual assessment (see Section 3.3.3).

3.3.2 Archaeological Program

An archaeological program desk top study of the proposed development area was conducted by Davis Archaeological Consultants Limited in June 2007 under Heritage Research Permit A2007NS36 and included the consultation of historic maps, manuscripts and published sources as well as the Maritime Archaeological Resource Inventory. An exercise in predictive modelling was also conducted to help determine the potential for First Nations archaeological resources. As indicated in section 2.1.1, although located within the same general area, the number of turbines now proposed has been reduced and their locations changed (see Figure 2.1). Indeed, as the proponent took measures to avoid wetlands where possible while accommodating the technical requirements of power generation, the locations of the proposed turbines moved between September and December 2011. This resulted in two field reconnaissance visits being made to the study area by the archaeological team.

Because archaeological resources may have been recorded in the study area since the 2007 exercise, the Maritime Resource Inventory was consulted again in late 2011 as part of this assessment. The predictive model was also updated to reflect the potential of archaeological resources within the potential areas of impact. The final field reconnaissance of the proposed turbine sites, the access roads, cable connection system and the location of the proposed substation was conducted in December 2011. This assessment was conducted under a Category C Heritage Research Permit A2011NS108 issued by the Nova Scotia Heritage Division. The archaeological report prepared, which is provided in its entirety in Appendix B, conforms to the standards required by the Heritage Division pursuant to the requirements of the *Special Places Protection Act.* The findings of the work undertaken are also summarized in section 4.4.4.

3.3.3 Mi'kmaq Ecological Knowledge

Membertou Geomatics Solutions was contracted in late 2011 to undertake a Mi'kmaq Ecological Study (MEKS) for an area encompassing the proposed wind farm site. The MEKS will be developed following the guidelines of the Mi'kmaq Ecological Knowledge Study Protocol (MEKP) which was ratified on November 22, 2007 by the Assembly of Nova Scotia Mi'kmaq Chiefs. This work, which will not be completed until the spring of 2012, will involve:

- Historical Review and Research including the review of existing documentation pertaining to the site;
- Review of Traditional Use Data to provide information on historical Mi'kmaq use and occupation of the study area and surrounding lands;
- Present Day Use – interviews with representatives of various Mi'kmaw communities who may possess knowledge of the current Mi'kmaq use of the lands in the area; and
- Mi'kmaq Significant Species Survey – a site survey by a custodian of Mi'kmaq Knowledge to identify species of significance to the community, be it medicinal, food or spiritual in use.

This study will be forwarded to NSE on receipt.

3.3.4 Visual Assessment Methodology

Wind turbines are highly visible in most landscapes due to their size, and they can, therefore, be intrusive to some. 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 that are highly valued as reflective of the locality and that attract visitors to an area, i.e., views can have an intrinsic economic value. Local views had been identified as a concern by local interests since 2006.

Figure 3.3: Methodology – Visual Impact Assessment

A desktop study undertaken by CBCL Limited identified critical locations for the visual impact assessment. These locations include scenic views from public roads, provincial parks and recreational assets in the vicinity of the study area. The methodology used to simulate the visual impact of the proposed wind farms on the landscape is outlined on Figure 3.3 and explained further below.

Steffen Käubler in October 2011, took photographs in the vicinity of the proposed wind farm from various locations surrounding the site (see Figure 3.2). At each site, he noted the GPS location, the height at which the camera was held, the direction in which the camera was pointing, the time of day and all camera settings. The photographs were later "stitched" together digitally to facilitate the assessment of full panoramic views from each location.

Based on contour data for the site, a digital terrain model (DTM) was created. 3D models of the proposed turbine were inserted into the DTM, and rendering cameras were placed in the DTM in accordance to the GPS-recorded view points and camera settings used in the field. Additional reference points, such as trees and buildings, were inserted in the DTM to enable alignment of the topography of the site and to determine the correct height and spread of the turbines. Lighting conditions were adjusted to ensure realistic turbine appearance and the wind direction was set in each simulation to ensure the axis of the rotor of the turbines is approximately parallel to the direction in which the photograph was taken (to ensure the turbines in the photomontages are fully visible).

Four locations (Point 004, 009 and 013) were chosen for visual impact simulations. Both wireframe (see Figure 3.4) and rendered views (Figure 3.5) were exported from the digital model and superimposed over the field photography to simulate the expected visual impact of the Pugwash Wind Farm. CBCL Limited considers the photomontages presented in this report to be realistic representations of the proposed wind farm. The results are presented in Section 7.4.5.

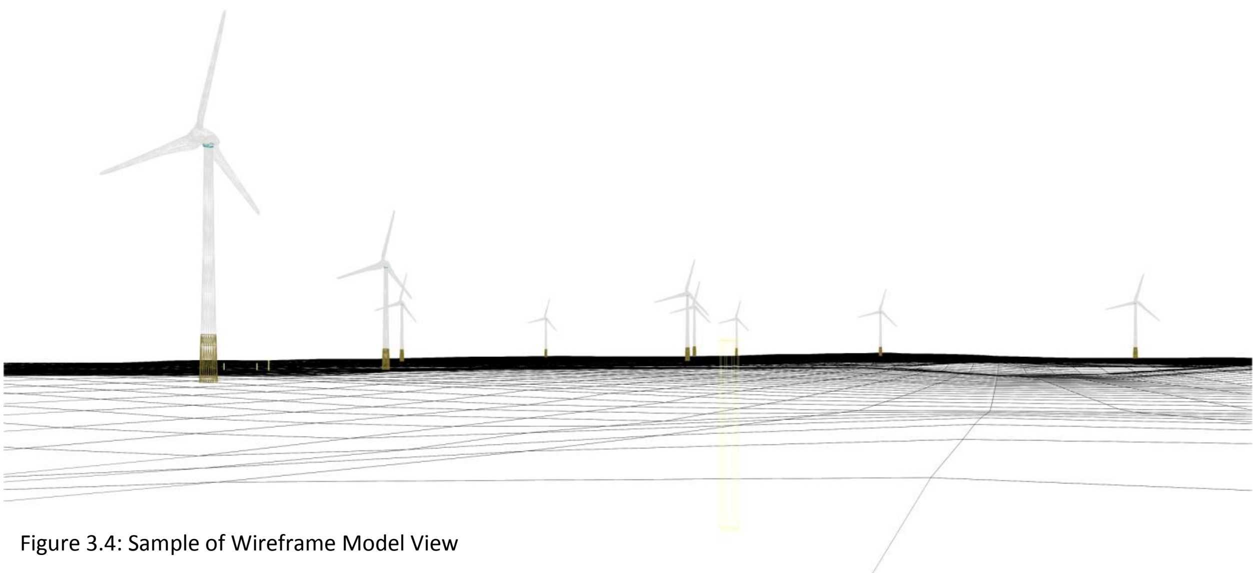


Figure 3.4: Sample of Wireframe Model View

Figure 3.5: Sample of Rendered Photomontage

3.3.5 Noise Modeling

Garrad Hassan was retained by the proponent to prepare a noise impact assessment of the project. The objectives were:

- To confirm the sound level limit requirements of the Municipality of the County of Cumberland;
- To predict the noise levels generated by the project at points of reception within 1.5 km of the turbines and 500 m of the substation; and
- To compare the predicted sound levels from the project with the sound level limits.

The predicted overall (cumulative) sound pressure levels at each critical noise receptor for the aggregate of all wind turbines and the substation were calculated based on the ISO 9613 method using the CadnaA software. Further detail on the methodology applied can be found in their report which is reproduced in its entirely in Appendix C. The findings and results are summarized in sections 4.4.7 and 7.4.7.

3.3.6 Shadow Flicker Modeling

Garrad Hassan was retained by the proponent to independently assess the impact of the shadow flicker effects in the vicinity of the proposed wind farm. Shadow flicker is defined as the modulation of light levels resulting from the periodic passage of a rotating wind turbine blade between the sun and the viewer. The effect is most noticeable inside buildings, where the flicker appears through a window opening. The likelihood and duration of the effect depends on a number of variables, namely:

- Orientation of the building relative to the turbine;
- Wind direction: the shape and intensity of the shadow are determined by the position of the sun relative to the blades(the turbine rotor continuously yaws to face the wind so the rotor plane will always be perpendicular to the wind direction;

- Distance from the turbine: the farther the observer from the turbine, the less pronounced the effect;
- Turbine height and rotor diameter;
- Time of day and year: position of the sun relative to the horizon;
- Weather conditions: cloud cover reduces the occurrence of shadow flicker;
- Vegetation and other obstacles that help to mask shadows; and
- Operational status of the turbines.

The duration of the shadow flicker experienced at a specific location can be determined using a purely geometric analysis which takes into account the relative positions of the sun throughout the year, the wind turbines at the site and the position of the viewer. The method was used to determine the duration of the shadow flicker events generated by the proposed WTGs. Further detail on the methodology applied can be found in the report which is reproduced in its entirety in Appendix D. The findings and the results are summarized in sections 4.4.8 and 7.4.9.