Registration Document

Glen Dhu Power – Wind Project

(East of New Glasgow, NS)

Volume I: Environmental Assessment
And Registration Document

Submitted To:
Nova Scotia Environment
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Halifax, Nova Scotia
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Submitted By:

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August 13, 2008

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1.0 PROJECT SUMMARY

1.1 Introduction

Name of Developer	**Shear Wind Inc.**
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Shear Wind Inc. (SWI), a Nova Scotia based company headquartered in Bedford, NS, proposes to develop, own and operate the Glen Dhu Power Wind Project (the Project) near Barney's River Station, Pictou County, Nova Scotia. Shear Wind Inc., with a regional development office in Calgary, is a publicly held company trading on the TSX-V and one of Canada's fastest growing Canadian-based renewable energy exploration and development companies. Shear Wind has a range of wind farm development projects in various feasibility and development stages in Canada including six major opportunities – three in Alberta, one in New Brunswick, one in Saskatchewan and the proposed Glen Dhu Power project in Nova Scotia. Shear Wind has one operating wind power facility located in Pictou County, Nova Scotia consisting of two Enercon E48 Wind Energy Convertors (WECs).

Engaged in the exploration and development of renewable energy in Canada, Shear Wind is focused on building a strong company based on a secure and sustainable supply of clean energy. The long-term benefits will be increased value for shareholders and reliable supply of renewable energy for customers, complemented by strong community and stakeholder involvement and partnerships.

Shear Wind's Management Team – encompassing an extensive background of domestic and global business expertise with strong entrepreneurial acumen – constitutes highly competent and experienced, financial, managerial and technical capabilities to assure construction and operation of the Glen Dhu wind generation facility.

The managerial capabilities of the Shear Wind team include a wide range of knowledge and experience that includes corporate strategy, business and market development; financial accounting and management; and wind resource exploration, technical planning, engineering and project management. Moreover, the Shear Wind team can draw upon the management resources of their Calgary subsidiary, Vindt Resources Inc., to provide additional depth and experience to the already substantial abilities of Shear Wind.

Manufacturing Partner
Enercon has committed to supply Enercon wind turbine generators (WTGs) as part of the overall corporate and finance structure. Guaranteed delivery in time to begin construction in 2008 with operation set to begin in 2009 is now assured.

Construction Partnering
Enercon will also bring their many years of experience to the table by acting as the Turn Key Contractor for the supply and installation of the WTGs, including the WTGs, medium voltage conversion and foundations. SWI will be responsible for the balance of plant construction for the roads, collection system and substation.

The balance of plant construction will be executed through local contractors. Some of the contracts will be in support of the efforts of Enercon (such as for foundations and local trucking) and some contracts will be stand alone construction packages (such as for road construction, crane pad construction and all balance of plant electrical works).

Operations and Warranty Partnering
The project will be operated under a 12 year renewable contract for the complete operation, maintenance and warranty with Enercon. The contract is known as the Enercon Partner Koncept Agreement. Enercon have a service depot in Nova Scotia for the operation of SWI's and other owners' Enercon existing turbines. It is expected that Enercon will be expanding its Nova Scotia service depot into the Pictou/Antigonish County area to provide support to Glen Dhu Power.

Community Benefits
SWI brings added benefits to the community which includes long-term community benefits. In addition to the economic benefits through the construction and operation phases, SWI will contribute to the community through on going support to other development activities such as tourism. For example, an interpretive centre will be constructed close to the wind farm development to allow interested members of the local community and tourists to the area to learn more about wind generation and the integration of nature and wind in creating a greener and more sustainable environment for future generations. This development will be conceived in cooperation with local organizations such as the Regional Development Authority.

Project Partner Benefits
The SWI agreement with Enercon brings required expertise to the Glen Dhu Project that results in:

- Guaranteed delivery of Wind Generating Turbines
- Guaranteed financing
- Guaranteed pricing and construction management experience
- Guaranteed operational experience
- Guaranteed long term warranty periods
- Improved community benefits

Project Costs, Financing and Insurance

The Project's capital costs are placed at approximately $150 million for Phase 1. Of this, we expect that approximately 30% of the capital costs will be expended in the province of Nova Scotia in the procurement of engineering services, local construction labour and construction materials.

SWI will arrange for the financing of the Glen Dhu Project, through various structures to provide the expected $150 million in capital for Phase 1 planning and design, equipment and materials, construction and commissioning of the Project. Investment in the Project by Shear Wind will be secured by long-term contracts for the purchase of power from the Project. This is enhanced by the potential federal $0.01/kwh "*ecoENERGY for Renewable Power*" program for projects constructed over the period April 1, 2007 through March 31, 2011.

The Project, its investors and construction contractors will carry adequate insurance to provide coverage against liability or damage resulting from the construction or operation of the wind Project. During construction, insurance coverage will include the following:

- Commercial General Liability
- Property: All Risk including Equipment Breakdown
- Builders' Risk
- Business Interruption

The SWI project implementation team will consist of a mix of senior engineers, financial personnel and others with the skills to complete the project on time and on budget.

1.2 Shear Wind Corporate Team

The SWI implementation team will consist of a mix of senior engineers, financial personnel and others with the skills to complete the project on time and on budget. The following are brief bios of the SWI project team members.

The project organization is shown in Figure 1.1. SWI's project support team consists of organization and personnel with specific experience in the design and construction of wind parks. To date the project team has demonstrated a high degree of integration to effectively bring the project to a successful development stage.

Michael Magnus
President and CEO, Shear Wind

Mike Magnus' experience in the areas of corporate strategy development, mergers and acquisitions and business development will ensure strong leadership for Shear Wind.

From 1990 - 2005 Mr. Magnus was Executive Vice-President of Clearwater Seafood Limited Partnership ("Clearwater"), a publicly listed company on the TSX (Toronto Stock Exchange). His direction and responsibility included the development and

overseeing of all initiatives pertaining to marketing, sales, new product development and logistics, both domestically and internationally. Mr. Magnus' successful vision was to build markets and strategic partnerships in countries such as Japan, China, Taiwan, Korea, U.K., France, Scandinavia, Russia, Germany and the U.S. This achievement caused the company to embark on a rapid growth curve with sales growing over the span of 12 years from 100 million dollars to in excess of 350 million dollars.

Additionally, he initiated the foundation of Ocean Nutrition Canada, a naturally based supplier of marine products. His extensive network and strategic foresight worked well in completing various acquisition and startup projects in both Europe and Asia. Prior to Clearwater, Mr. Magnus served in various senior management capacities at Kraft General Foods.

Ian Tillard –PROJECT MANAGER
Chief Operating Officer, Shear Wind
Ian Tillard received a Bachelor of Applied Sciences degree in Mechanical Engineering from the University of Waterloo. Mr. Tillard has six years of wind energy experience in senior technical, planning and managerial roles; specifically as President of Barrington Wind Energy Ltd., a Nova Scotia wind energy exploration and development company.

Mr. Tillard also has 25 years of experience with engineering and project management firms to deliver infrastructure and energy consulting, planning, engineering and construction expertise, with Project Management experience gained while providing project services through a range of medium to large engineering firms, including East Point Engineering, AMEC Americas, and Whitman Benn & Associates. Mr. Tillard provides technical consulting and management skills with a focus on timely project delivery within budgeted targets.

Bill Bartlett – PROJECT FINANCE
Vice President Finance & Corporate Affairs, Shear Wind
Bill Bartlett joined Shear Wind Inc. on December 1, 2006 after spending the prior eleven years within the Clearwater Fine Foods Inc. group of companies. Mr. Bartlett held the position of Controller for Clearwater's Clam Division in Newfoundland and for the latter seven years held the position of Vice President, Finance and Administration for Ocean Nutrition Canada, a global supplier of Omega -3 ingredients to the dietary supplement and health food markets. Previous experience includes senior positions within the hotel, airline and aerospace industries.

He is responsible for the oversight of all financial matters within Shear Wind, including, but not limited to, treasury, financial accounting, financial management, management reporting systems and corporate affairs. Mr. Bartlett received a Bachelor of Business Administration degree from the University of New Brunswick and is a Certified Management Accountant (CMA) being a member of the Society of Management Accountants of Nova Scotia since 1992.

SWI has employed the resources of a number of firms and consultants in the development of the Glen Dhu Project. Table 1.3 lists the personnel, affiliation and area of responsibility of the individuals currently contracted for the implementation and regulatory approval of this project.

1.3 Title of Project

The project title is: Glen Dhu Power

1.4 Project Location

SWI proposes to construct and operate the Glen Dhu Wind Project, near Barney's River Station, Pictou County, approximately 40 km east of New Glasgow, Nova Scotia. Figure 1.2 shows the project location.

1.5 Estimated Capacity of Wind Farm

The proposed Glen Dhu Project will be powered by 30 WTGs, each rated at 2.0 megawatts (MW), for a nominal capacity of 60 MW in total. Based on the wind data, energy production is anticipated in the range of 180 Gwh per year.

1.6 Construction Schedule

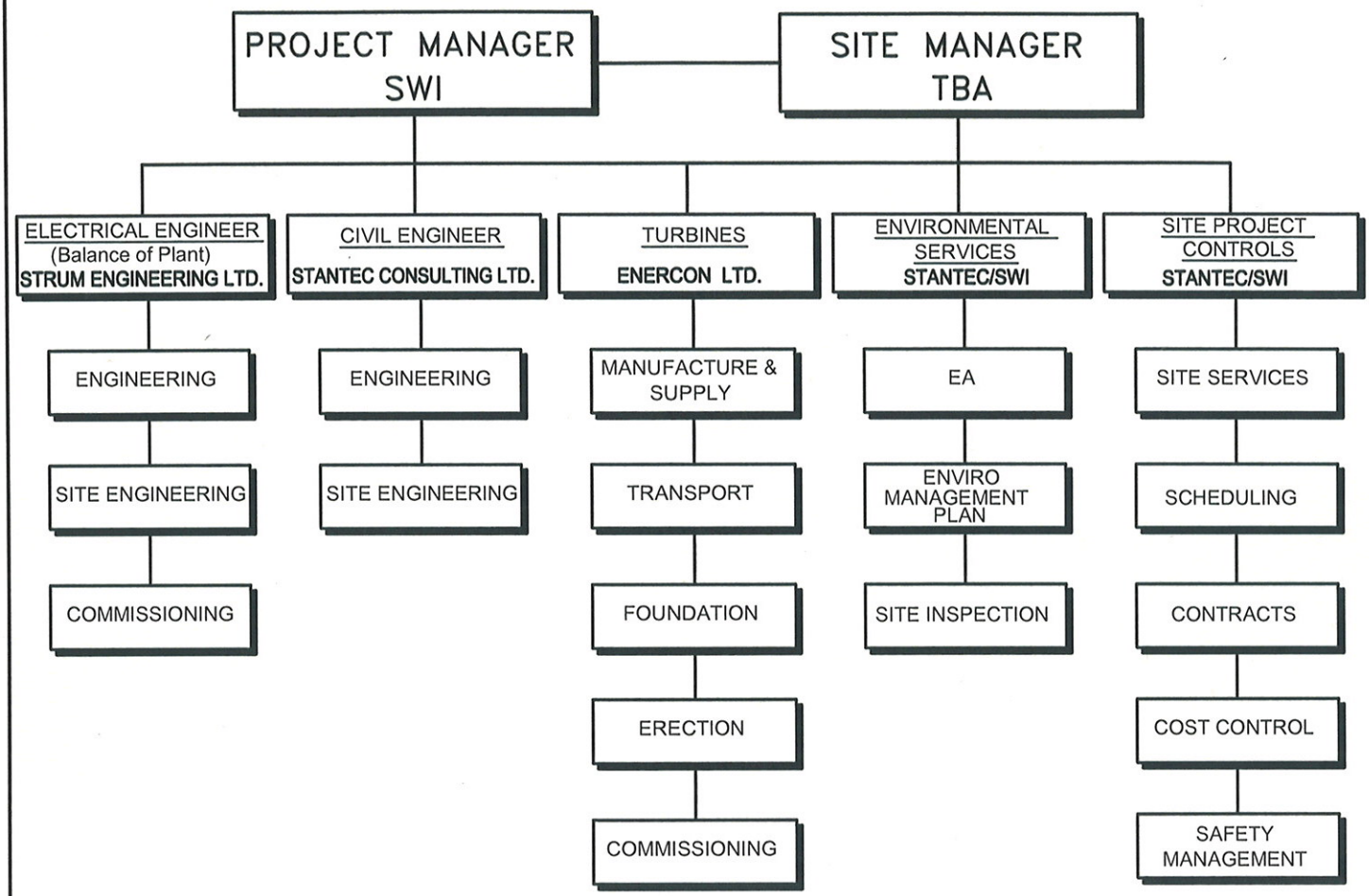
Table 1.1 presents a schedule summary. A more detailed Preliminary Project Schedule is provided in Section 2. The construction schedule runs from June 2008 until December 2010 when the complete project is scheduled to be commissioned. The project will be implemented in two stages: Stage I is the installation of not less than 10 turbines in the period August 2008 to November 2009; and, Stage II is the installation of the balance of the remaining turbines in the period from November 2009 to the end of December 2010.

1.7 NRCan's Involvement in the Project

The federal government announced in April 2007 that they would implement a federally funded initiative to aid in the construction and commissioning of renewable energy projects. This is titled *ecoENERGY Renewable Initiative*. It will provide the developer with $0.01/kwh of production for up to ten years as an incentive to develop these projects. There are many criteria which must be met to qualify for the funding.

SWI submitted an application in August 2007. This application has been approved and therefore involvement of the Canadian Environmental Assessment Agency (CEAA) will be required in the federal portion of the Environmental Assessment process. It is understood that the CEAA will work simultaneously with NSE in the review of the registration document.

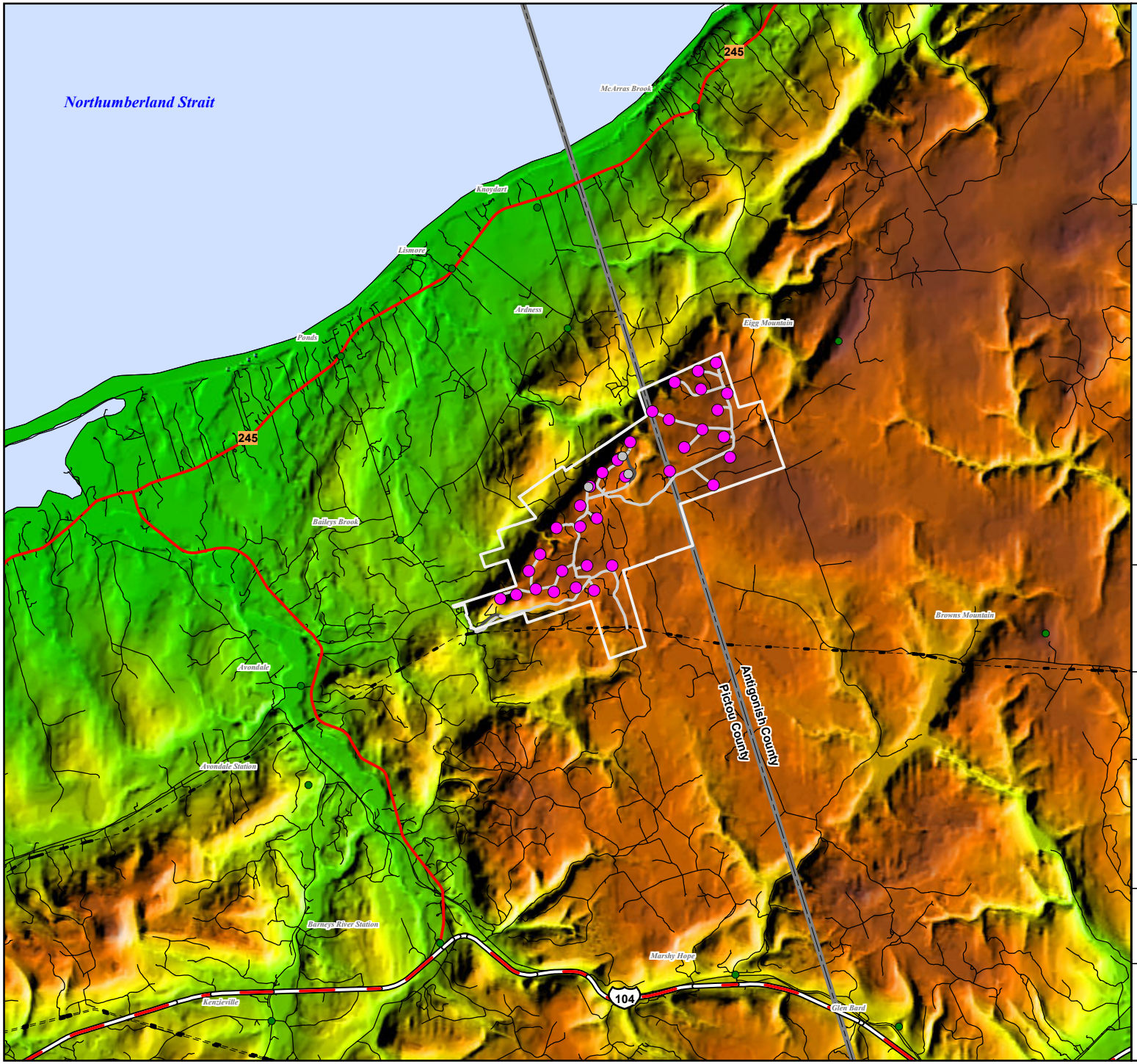
GLEN DHU POWER



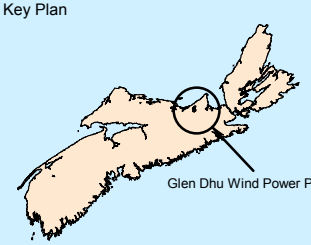
Shear Wind Inc.		Stantec	
ORGANIZATIONAL CHART	DATE	SCALE NTS	JOB NO 21075
GLEN DHU POWER	DRN	CHK	APP
	REVIEWED	DWG NO FIGURE 1.1	REV

Table 1.1: Proposed Milestone Schedule

Activity	Timing
Wind Turbine Supplier Commitment – **Completed**	*March, 2008*
NSPI Wind Farm Award	*April 2, 2008*
PPA Executed	*April 2, 2008*
Engineering / Procurement Activities	*April 7 to June 30, 2008*
Environmental Permit Approval	*October 2, 2008*
STAGE I	
Award Civil & Electrical Site Construction Contracts	*July 1, 2008*
Commence Civil Site Roads & Wind Turbine Sites Contract	*July 15 to August 1, 2008*
Commence Wind Turbine Foundations Contract	*September, 2008*
Commence Electrical Collector & Substation Contract	*September 1, 2008*
Complete Civil Contract	*January, 2009*
Complete Electrical Contract	*September, 2009*
Delivery of WTGs To Site (tentative)	*May, 2009*
Complete Stage I WTG Erection	*October, 2009*
Commissioning, Stage I WTGs	*July to November, 2009*
Wind Farm In-Service Date	*November, 2009*
NSPI RFP Required In-Service Date	*November 30, 2009*
STAGE II	
Commence Civil Site Roads & Wind Turbine Sites Contract	*October, 2008*
Commence Wind Turbine Foundations Contract	*April, 2009*
Commence Electrical Collector Contract	*April, 2009*
Complete Civil & Electrical Contracts	*December, 2009*
Delivery of Wind Turbines To Site (tentative)	*May, 2010*
Complete Electrical Services and Interconnection	*November ,2010*
Complete Wind Turbine Erection	*October, 2010*
Commissioning,	*July to November, 2010*
Wind Farm In-Service Date	*November, 2010*
NSPI RFP Required In-Service Date	*December 31, 2010*



Key Plan



Legend:

- Existing Roads
- Trans Canada Highway
- Local Highways
- Proposed Roads
- Optional Proposed Roads
- Transmission Line
- Project Site
- Proposed WTG's
- Optional WTG Sites

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Figure 1.2
Project Location Plan

DWG No: 1.2_08_05_08
REVISION: 3
SCALE: 1: 100,000
DATE: August 5, 2008
PRODUCED BY: NORTEK/STANTEC

1.8 Agencies Involved in the Environmental Assessment Process

The following agencies and personnel were contacted regarding the terms of reference for the environmental assessment (EA) of the project. Table 1.2 provides a summary of the contacts at the federal, provincial and municipal levels and a summary description of the meeting.

Table 1.2: Provincial, Federal and Municipal Contacts for EA Program

Contact	Affiliation	Description	Date of 1st Contact
Provincial Departments/Agencies			
Helen MacPhail	Nova Scotia Environment (NSE), EA Division	Met to discuss EA process. There has been continuous correspondence between Helen and the team throughout the process to ensure all provincial issues are being addressed	Jan 24, 2007
Bob Olgilvie	NS Dept. of Tourism, Culture and Heritage, Heritage Division	Provided a full desktop environmental screening	Jan 19, 2007
Nelida Young Carol Ann	Nova Scotia Department of Natural Resources (NSDNR)	Contact for leases and easements on provincially owned land	May 8, 2007
Kathleen Johnson, Mark Theriault	NSE, Regional Inspectors	Discussed proper approvals for disturbance and destruction of wetlands and water crossings	Feb 16, 2007
Doug Archibald	NSDNR, Regional Biologist, Pictou and Colchester Counties	Met to discuss project location in regards to SARA, specifically Mainland Moose	April 11, 2007
Mark Pulsifer	NSDNR. Regional Biologist, Antigonish County	Met to discuss project location in regards to Species At Risk Act (SARA), specifically Mainland Moose	April 10, 2007
Federal Departments/Agencies			
Derek McDonald	Canadian Environmental Assessment Agency (CEAA)	Met to discuss EA process and ensure all areas are covered, and to coordinate provincial/federal process, he received copy of draft description to indicate any missing pieces.	Feb 23, 2007
Dan Busby	Senior Biologist, Canadian Wildlife Services (CWS) (since retired)	Shared pertinent info regarding Migratory Birds and role in EA process	Jan 25, 2007
First Nations			
Dr. Don Julian, Director, and Leah Ruddunbauer, Archaeologist	Confederacy of Mainland Mi'kMaq	The meeting was held to introduce the project and to discuss the project location in relation to any First Nations interests or usage of the area.	Feb.10, 2007
Michael Cox	Director, Lands, Environment and Natural Resources, Confederacy of Mainland Mi'kmaq (CMM).	The meeting was held to identify issues of potential concern to the First Nation community prior to the submission of the Registration document.	Feb. 27, 2008

Contact	Affiliation	Description	Date of 1st Contact
Roger Hunka, Cory Francis, Joshua McNeely, Franz Kesick	Native Council of Nova Scotia (NCNS)	The meeting was held to introduce the project and identify issues of potential concern to the First Nation community represented by the NCNS.	June 20, 2008
Municipal/ County Departments/ Agencies/Representatives			
Brian Cullen	Clerk for Municipality of the County of Pictou	Met to discuss any building permits required for turbine construction and setback distances	Nov 26, 2006
Alan Bond	Clerk and Treasurer for the Municipality of the County of Antigonish	Met to discuss any building permits for turbine construction or setback distances required in the county	April 19, 2007
Randy Palmer	Council Member, Municipality of the County of Pictou	Discussed actual distances project is from dwellings, inform him of project progress	April 27, 2007
Clarrie MacKinnon	Pictou West MLA	Met to discuss SWI project and gain support and feedback	March 1, 2007
Charlie Parker	Pictou East MLA	Met to discuss SWI project and gain support and feedback	March 2, 2007

1.9 Author of the Registration

Table 1.3 lists the personnel, affiliation and area of responsibility for the preparation of this Registration Document. Resumes of the key personnel for the preparation of the Registration Document are provided in Appendix A.

Table 1.3: Participants in Preparation of the Registration Document

Name	Position / Affiliation	Area of Responsibility
Michael Magnus	President and CEO, SWI	Responsible for project delivery, corporate strategy development, mergers and acquisitions, business development and oversight of regulatory approvals.
Ian Tillard, P. Eng.	Project Manager and Chief Operating Officer (COO)/ SWI	Responsible for project delivery, scheduling engineering design and technical and environmental approvals.
Bill Bartlett, CMA	Vice President Finance & Corporate Affairs/ SWI	Responsible for the oversight of all project financial matters including; treasury, financial accounting, financial management, management reporting systems and corporate affairs.
Nick Strum, P.Eng.	Electrical Design Engineer/ Strum Engineering Ltd.	Responsible for electrical engineering design, and interconnection with NSPI power grid.
Leo Brooks, M.Eng., P.Eng.	Civil Engineering Design Lead/ Stantec Consulting Ltd.	Responsible for civil engineering design, roads, water crossings, lay down areas, foundation engineering and civil works to mitigate potential environmental impacts.
Lisa Fulton	Public and Community Relations, Environmental Site Manager/ Fulton Energy Research	Responsible for community and regulatory liaison, public awareness program, oversight of environmental contracts, development of EPP for water crossings and preparation of the Registration Document.
Tom Windeyer, B.A.	Registration Coordinator and Socio-economic Assessment/ Stantec Consulting Ltd.	Responsible for the assessment of socio-economic impacts, development of the EPP and EMP and preparation of the Registration Document.

Name	Position / Affiliation	Area of Responsibility
Robert Bancroft, M.Sc.	Terrestrial and Aquatic Biology	Responsible for the description of terrestrial and aquatic environment, assignment of VECs, and analysis of potential environmental impacts on these components for the Registration Document.
John Kearney, Ph.D.	Native and Migratory Birds	Responsible for the description of native and migratory avian species, assignment of VECs, and analysis of potential impacts on these components for the Registration Document.
Hugh Broders, Ph.D.	Native Bats	Responsible for the description of native bat species, assignment of VECs, and analysis of potential impacts on these components for the Registration Document.
Sean Blaney, M.Sc.	Botany	Responsible for the description of terrestrial flora and identification of significant species, assignment of VECs and analysis of potential impacts on these components for the Registration Document.
Steven Davis, Ph.D.	Archeology - Davis Archaeological Consultants Inc.	Responsible for the survey of archaeological resources for the Registration Document, identification of such resources at turbine sites and roads, and consultation on the mitigation of potential impacts for the EPP and EMP.
Norma Prosper	Mi'kmaq Ecological Knowledge Study	Responsible for conducting a Mi'kmaq Ecological Knowledge Study of the Glen Dhu area following the protocols of the Assembly of Nova Scotia Mi'kmaq Chiefs.
Nick Williams	Land	Responsible for the identification of land ownership issues and titles; assistance with field programs identification of project boundaries; historical activities in the project area; and, consultation on the mitigation of potential impacts for the EPP and EMP.

2.0 PROJECT DESCRIPTION

2.1 Presentation of Proponent

The project proponent is Shear Wind Inc. (SWI), a public company with headquarters in Bedford, NS. SWI is one of Canada's fastest growing Canadian based renewable energy exploration and development companies. It is publicly traded on the TSX-V with the ticker symbol of "SWX". SWI is focused on building a strong company based on a secure and sustainable supply of clean energy. The long-term benefits will be increased value for shareholders; reliable supply of renewable energy for customers; complemented by strong community and stakeholder involvement and partnerships.

The company's renewable energy plan is to strategically develop wind energy projects throughout North America by selecting exceptional wind resource properties, and by forming partnerships, joint ventures, and acquisitions to provide the additional resources required for reaching our goals. SWI has a range of wind farm development projects in various feasibility and development stages in Canada including six major opportunities; four in Alberta, one in New Brunswick, one in Saskatchewan and one in Nova Scotia. Each year the company plans to retain a portfolio of opportunities in various stages of development, and will move the most ready projects to construction.

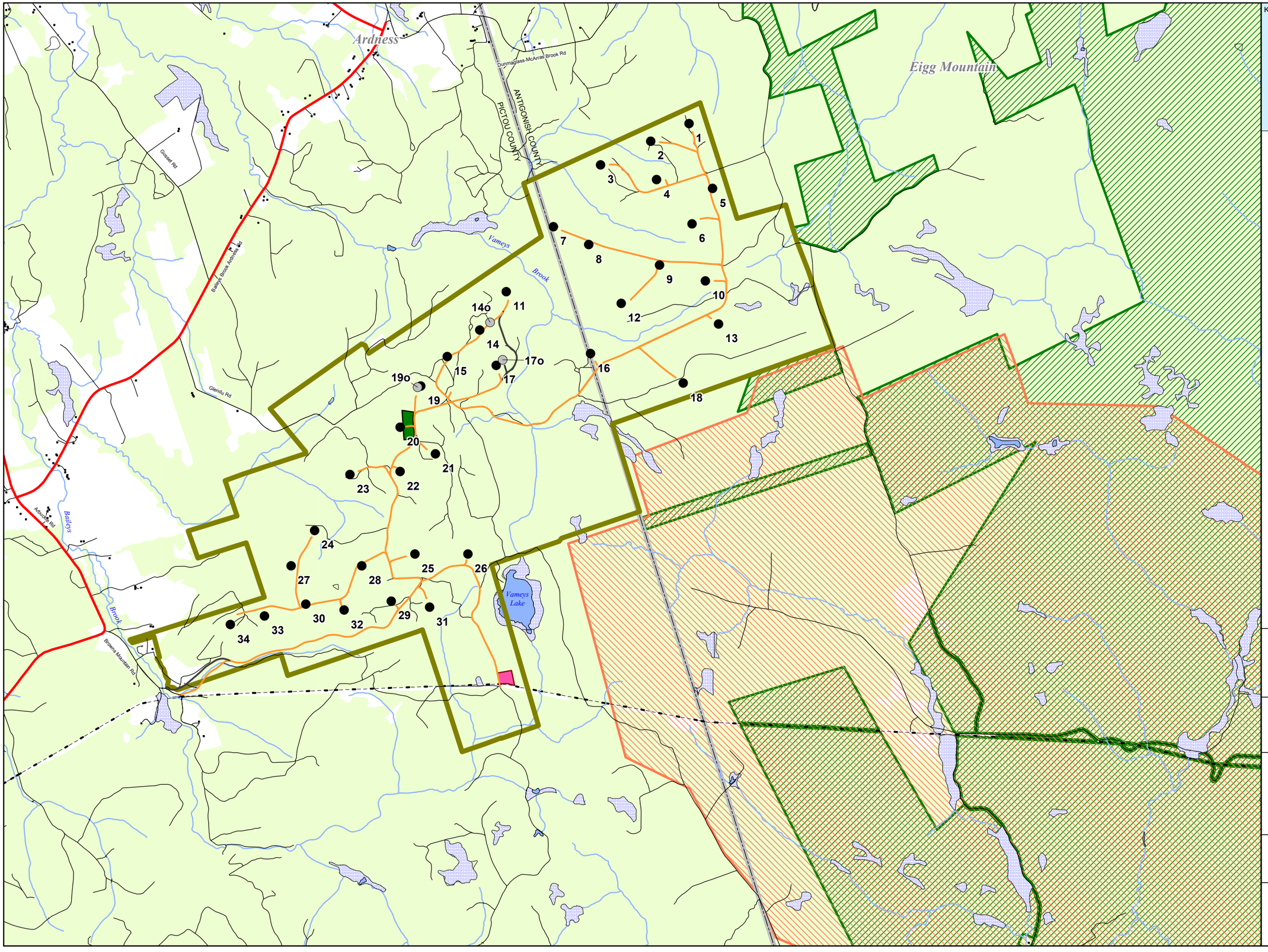
SWI's Management Team encompasses an extensive background of domestic and global business expertise with a strong entrepreneurial acumen. Engaged in the exploration and development of renewable energy in Canada, SWI is headquartered in Bedford and has a regional development office in Calgary.

2.2 Background of Project

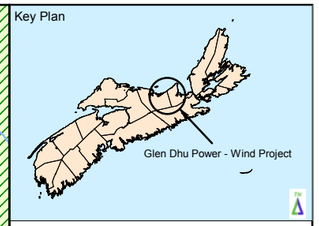
This project was initiated in response to NSPI's request for approximately 130 MW of renewable generation from Independent Power Producers (IPPs) issued on March 12, 2007. In accordance with the NSPI request for proposal (RFP), SWI submitted a Notice of Intent to Submit a Proposal and an Authorization to Disclose Information on the specified date of March 23, 2007.

In its initial search of potential wind power project sites in Nova Scotia, SWI sought locations exhibiting three key characteristics needed for a wind project: significant wind resources, as identified by available wind data; landowners with suitable property (high elevation, isolated/rural acreage) willing to lease lands for a project; and ability to interconnect cost-effectively to the transmission system.

SWI's proposed Glen Dhu development reflects these characteristics in a site comprised of privately owned property located near Barney's River Station in Pictou County, approximately 40 km east of New Glasgow along the Trans Canada Highway. Figure 2.1 shows the project location.



Key Plan



Legend:

Existing Features

- Paved Roads
- Local Roads
- Transmission Line
- Streams
- Forested
- Non Forested
- Water
- General Wetlands
- Eigg Mountain Wilderness Area
- James River Watershed Area

Project Features

- Project Site
- Proposed Roads
- Optional Proposed Roads
- Proposed WTG's
- Optional WTG Sites
- 33 WTG ID
- Laydown Area
- Transformer Station

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Figure 2.1
Site Location Plan

DWG No: 2.1_08_05_08
REVISION: 3.0
SCALE: 1: 30,000
DATE: August 5 2008
PRODUCED BY: NORTEK/STANTEC

SWI has completed a wind resource assessment in this area with the assistance of wind resource assessment specialists (Phoenix Engineering, Calgary; Al-Pro, Germany; and Enercon Ltd.). Enercon is a leading wind engineering firm specializing in wind resource monitoring, assessment, wind turbine manufacturing and wind farm development since 1985.

The Project has collected actual wind speed/direction data at the Project site, beginning December 12, 2006. These data represent measured wind data at four levels on each of three 80-metre instrumented test towers in order to afford an accurate representation of the wind regime. To date, the data depicts annual average wind speeds that will support a viable wind park. The analysis confirms a strong wind resource with net capacity factors expected to be in excess of 36% – indicating excellent year-round potential for energy production.

2.3 Purpose of the Project

As part of its renewable energy initiative issued on March 12, 2007, Nova Scotia Power Incorporated (NSPI) has committed to supplementing its base energy supply with approximately 240 MW (increased from 130 MW at call for RFPs) of renewable generation from Independent Power Producers (IPPs). NSPI issued a Request for Proposals (RFP) from IPPs to identify and select projects to meet this objective.

This project is a response to the NSPI RFP and the subsequent award to SWI as of April 2, 2008 through a Power Purchase Agreement (PPA). Under the terms of the PPA, SWI are to deliver 165,000 MWh (megawatt hours) from wind energy at its Glen Dhu Power-Wind Project, including all attributes such as green tags. The contracted delivery amount equates to approximately 60MW of WTG capacity at this site.

2.4 Summary of the Project

The Glen Dhu Project will see the development of a nominal 60 MW wind farm located in an area of approximately 8 sq. km, including access roads, wind turbine sites, electrical collector lines and substation. The Glen Dhu Power Wind Project is located near Barney's River Station, approximately 40 km east of New Glasgow in Pictou County, Nova Scotia. The project site is adjacent to the Trans-Canada Highway No. 104. Figure 2.1 shows the project site, preliminary layout for the WTGs, access roads and important area features.

Land for the turbine locations, power line corridors and access roads will be leased from existing landowners consisting of private individuals, corporations and Crown lands belonging to the province. The presence of the project facilities will not significantly alter the present land use activities carried out by land owners. In order to access some locations with high wind energy capacity, SWI will purchase some land. The purchase agreement will be conditional on providing the rights to the timber on such land to the existing owner. Other than the road allowances, power lines and turbine sites, SWI will

have no other responsibility for the stewardship of private lands, or Crown lands. SWI will take responsibility for environmental issues related its undertaking. The integration of environmental policies with other land use practices of private land owners is beyond the scope of SWI's responsibility.

Access to the project site will be off of Brown's Mountain Road in Bailey's Brook off of Barney's River Road (Exit 29 north off of Highway 104). A Nova Scotia Power 138kV transmission line crosses the project site providing easy access to interconnect the wind farm cost-effectively to the transmission system. The project location, near Highway 104 and within 2 km of a rail siding, will allow the transportation and handling of the long tower components and turbine blades in a convenient and safe manner.

The project site is situated in a sparsely populated rural and agricultural setting. The land proposed for the site is predominantly used for timber operations and contains a number of existing logging roads and trails. The access roads and wind turbine sites are located primarily on privately owned land parcels that are set back from residences, roads and other public areas. SWI has applied to the province for the lease of two parcels of provincial Crown land for turbine sites and access roads. The nearest house will be approximately 640m from the closest proposed turbine location. Shear Wind has secured long-term lease arrangements with individual landowners. Land rights for the Project's substation, collector system and associated transmission facilities have also been obtained.

The Glen Dhu Project will be powered by 30 WTGs, each rated at a minimum 2.0 megawatts (MW), for a nominal capacity of 60 MW in total. The proposed turbines will be Enercon E-82 which may be supplemented with Enercon E-70 machines in the final design where specific wind conditions warrant. The Enercon E-70 turbine is essentially the same technology as the E-82 with shorter blades. Micro-siting work is ongoing with Enercon to determine the characteristics and ideal application at each turbine site. For purposes of this application the Enercon E-82 is used to represent the primary design option. Under normal conditions, the WTGs will operate 24 hours per day, 7 days per week.

The major components of each Enercon E-82 wind turbine include a "rotor" measuring 82 metres in diameter, made up of: three individual blades each measuring approximately 41 metres in length; a "nacelle" that attaches to the rotor and contains the gearbox, a direct drive axle pin arrangement with few moving parts, generator, and other controls; and a tower made of tubular structural steel in four sections, with a height of 78 metres. Figure 2.2 shows the Enercon E-82 WTG and a summary of the technical specifications as provided by Enercon. Other features of the Enercon turbine include: a remote control system with real-time monitoring of the unit's operation, electrical system interface and safety systems; unique electronics that provide transmission efficiencies and enable harmonious interconnection with the local grid; and variable speed control that enables aerodynamic efficiency and reduces loads to the drive train, thereby reducing maintenance cost and providing longer turbine life. The Enercon E-82 WTG utilizes the

highest standards of the industry for operational efficiency and safety. Enercon E-82 WTGs are used worldwide. Appendix B, Section 1a and Appendix B, Section 1b provide detailed descriptions of Enercon E-82 WTGs design specifications.

Power output from the Glen Dhu Project will be collected on-site using several overhead distribution class 35kV collection circuits, with overhead-to-underground transitions at the wind turbine generator sites. The generated output will then be delivered to the project intertie substation located adjacent to NSPI 138kV transmission line L-6511. At this point power output is stepped up to 138kV, then metered and delivered into the NSPI grid system at the point of common coupling on 138kV transmission line L-6511.

A Preliminary Assessment for the Project conducted by NSPI and dated August 17, 2007, indicates spare capacity in L-6511 that will readily accommodate the Glen Dhu Project, with some system upgrades.

The Project will include three phases of activities: Construction Phase; Operations Phase, and Decommissioning Phase.

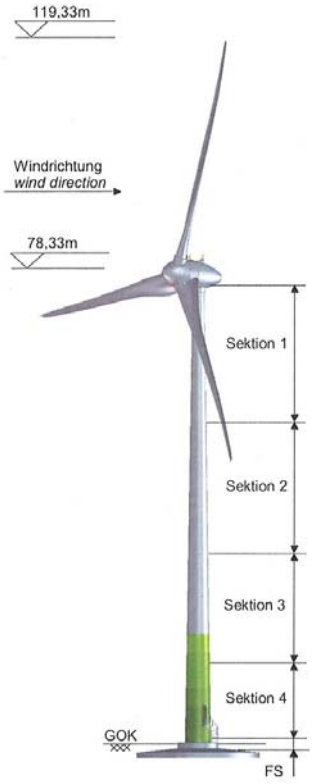
The Construction Phase will take place over a three year period from 2008 through to 2010. The project is being constructed in two stages; no less than10 WTGs to be installed in 2009 and the remaining (no more than 20) WTGs to be installed in 2010. Preparation work (roads, foundation and electrical) for the two stages will be done in 2008 and 2009, for each stage respectively. Construction will consist of the following task elements:

- Pre-construction Activities: site, power line and road alignment surveying; and geotechnical investigations.
- Construction Activities: clearing and grubbing; road preparation and drainage development; site preparation including mass excavation and foundation construction; wind turbine installation; power line and transformer installation; interconnection to the existing 138 kV power line; and commissioning tests.

The Operations Phase of the project is anticipated to be a minimum of thirty years. Activities over this period will include the provision of electrical power to the NSPI grid and maintenance of the installation.

The Decommissioning Phase will take place at the end of the life cycle of the project (30+ years). Decommissioning will consist of the removal of surplus above grade equipment and utilities, rehabilitation of significant environmental alterations using native species of vegetation where indicated, and restoration of the sites by natural succession.

ENERCON ENERGY FOR THE WORLD	Gewichte und Abmessungen *Weights and Dimensions* E-82/S/77/4F/01	Page 1 of 1



Gesamthöhe ab Gelände *Total height from territory*	119,33 m
Nabenhöhe ab Gelände *Hub height above ground*	78,33 m
Turmlänge ab Fundamentoberkante *Tower height above upper foundation edge*	77,10 m
Bauart / *Design*	Stahlturm / *steel tower*
Windzone WZ (DIBt)	DIBt III[1]
WTGS Class (IEC 61400-1/ NVN 11400-0)	IEC II A[1]
Anzahl der Sektionen / *Number of sections*	4 + Fundamentsektion / *4 + foundation section*

	Länge *length*	D_{oben} *diamt$_{op}$*	D_{unten} *diam$_{bottom}$*	Gewicht weight
	m	m	m	to
Sektion 1 / *section 1*	24,00	2,00 / 2,21[3]	2,71	ca. 35
Sektion 2 / *section 2*	21,80	2,71	3,35	ca. 48
Sektion 3 / section 3	18,20	3,35	3,91	ca. 55
Sektion 4 / *section 4*	12,35	3,91	4,30	ca. 61
Fundamentsektion / *foundation section*	2,00	4,30	4,51 / 4,853[3]	ca. 15
Gesamtgewicht Turm / *total weight tower*				ca. 214

[1] Typenprüfung vorhanden /*Certification Report available*
[2] Typenprüfung in Arbeit/ *Certification report in process*
[3] Flanschaußendurchmesser / *outside flange diameter*

Document information:			
Author/ date:	AS / 28.02.06		
Department:	WRD	Translator / date:	-
Approved / date:	MKR / 30.10.06	Revisor / date:	AS / 30.10.06
Revision / date:	02	Reference:	WRD-K-04-GuA.E-82.S.77.4F.01-Rev02_0-ger-eng.doc

Figure 2.2a: Enercon E-82 Wind Turbine Generator (WTG) and Dimensions

TECHNICAL DATA E-82 2000 kW

Rated power:	2000 kW
Rotor diameter:	82 m
Hub height:	78 m, 98 m, 108 m
Prototype:	Autumn 2005
Series production:	From 3rd quarter 2006
Turbine concept:	Gearless, variable speed, variable pitch control
Rotor	
Type:	Upwind rotor with active pitch control
Direction of rotation:	Clockwise
Number of blades:	3
Swept area:	5281 m²
Blade material:	Fibreglass (epoxy resin); integrated lightning protection
Rotational speed:	Variabel, 6–19,5 rpm
Tip speed:	25–80 m/s
Pitch control:	ENERCON blade pitch system, one independent pitching system per rotor blade with allocated emergency supply
Drive train with generator	
Hub:	Rigid
Main bearings:	Dual-row tapered/single-row cylindrical roller bearings
Generator:	ENERCON direct-drive synchronous annular generator
Grid feeding:	ENERCON converter
Braking systems:	– 3 independent blade pitch systems with emergency supply – Rotor brake – Rotor lock
Yaw control:	Active via adjustment gears, load-dependent damping
Cut-in wind speed:	2.5 m/s
Rated wind speed:	12.0 m/s
Cut-out wind speed:	22–28 m/s
Remote monitoring:	ENERCON SCADA

Specifications subject to change/March 2005

1 Main carrier
2 Yaw motors
3 Annular generator
4 Blade adaptor
5 Rotor hub
6 Rotor blade

Calculated power curve

Wind (m/s)	Power P (kW)	Power coefficient Cp (-)
1	0.0	0.00
2	3.0	0.12
3	25.0	0.29
4	82.0	0.40
5	174.0	0.43
6	321.0	0.46
7	532.0	0.48
8	815.0	0.49
9	1180.0	0.50
10	1612.0	0.50
11	1890.0	0.44
12	2000.0	0.36
13	2050.0	0.29
14	2050.0	0.23
15	2050.0	0.19
16	2050.0	0.15
17	2050.0	0.13
18	2050.0	0.11
19	2050.0	0.09
20	2050.0	0.08
21	2050.0	0.07
22	2050.0	0.06
23	2050.0	0.05
24	2050.0	0.05
25	2050.0	0.04

ρ = 1,225 kg/m³

E82

The new ENERCON E-82 sets yet another milestone in the success story of the highly economical use of wind energy. Especially designed for medium wind strengths, the E-82, with its large rotor diameter and the efficient ENERCON rotor blade design, guarantees optimal yield and considerably reduces the costs per kWh of wind energy. Furthermore, the E-82 fulfils the current grid connection stipulations due to its sophisticated grid feed system, which enables it to be integrated in all types of supply and distribution structures.

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Figure 2.2b: Enercon E-82 Wind Turbine Generator (WTG) Summary of Specifications

2.5 Detailed Project Description

Project Layout and Site Constraints

The selection of locations of the WTGs within the project boundary is an important factor in the efficient conversion of wind energy. Locations are selected using sophisticated computer analysis of the site specific wind data collected by SWI over the past 16 months, in conjunction with regional wind data available from Environment Canada. These data are evaluated in a computer model which uses features of the site and surrounding area including; elevation, topographic contours and vegetation characteristics. The computer analysis identifies the optimum conditions for wind energy conversion from which wind turbine locations are selected.

As part of the turbine site selection process, constraints will be applied. The constraints consist of physical features which prohibit construction, environmental features with potential negative impacts, and administrative constraints such a local bylaws and provincial and federal regulations. Table 2.1 shows the site constrains and setbacks used in the identification of turbine locations.

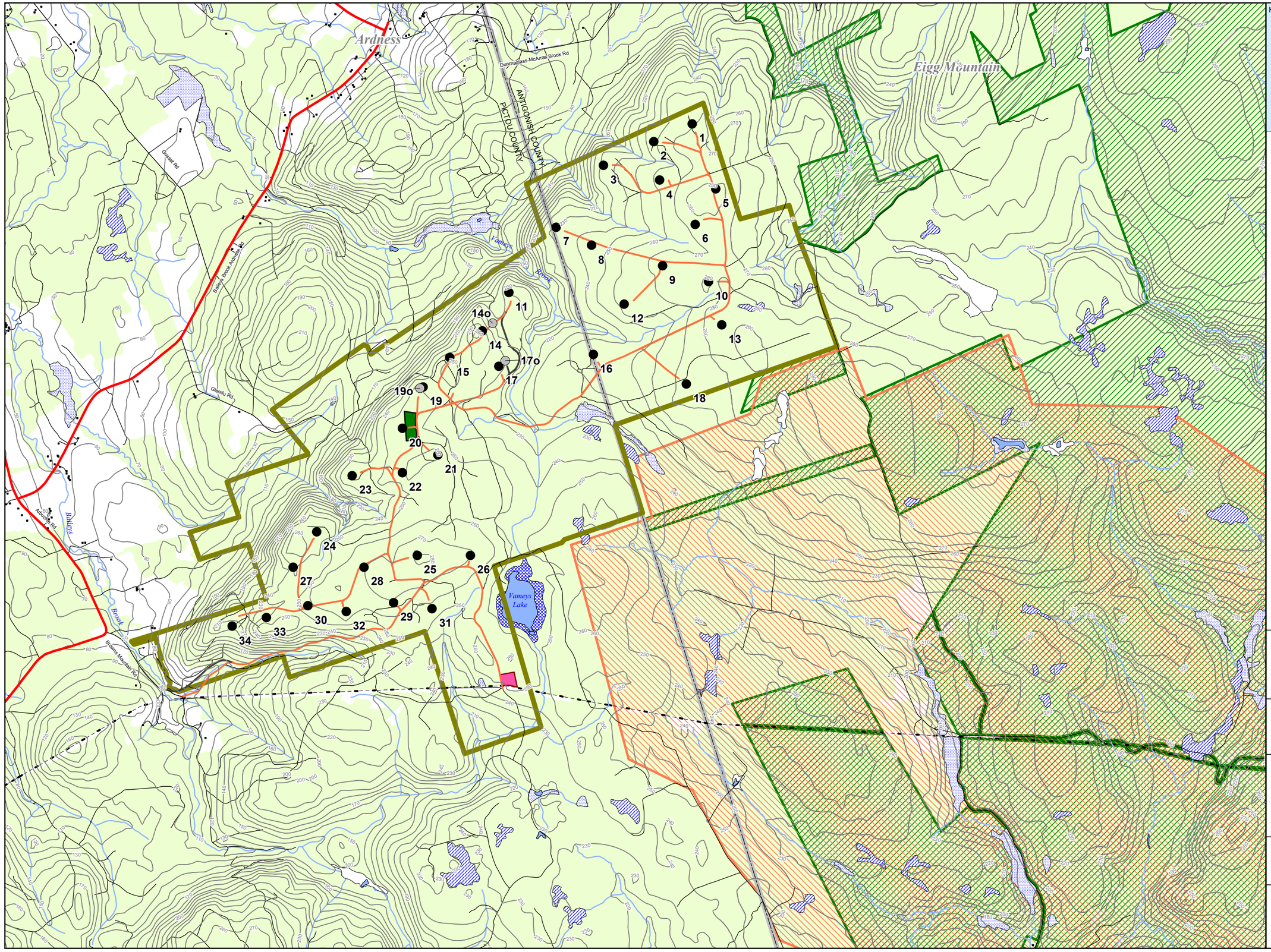
Table 2.1: Site Constraints and Setbacks

Feature	Setback Point	Setback	Source
Project Boundaries	Base of Tower	Base of tower to tip of vertical blade: 120 m (approximate)	Pictou County By-law Potential Antigonish County By-law
Transmission Lines	Base of Tower	Base of tower to tip of vertical blade + 40m = 160 m (approximate)	NSPI
Lakes	Nearest edge of cleared area	30 m	NSE
Streams	Nearest edge of cleared area	30 m	NSE
Maintained Roads	Base of Tower	300 m	Pictou County By-law Potential Antigonish County By-law
Dwellings	Base of Tower	600 m	Pictou County By-law Potential Antigonish County By-law
Slopes Steeper than 15% rise	From top of slope to Base of Tower	100 -150 m	Construction Constraint, as well as recommendation of Birder

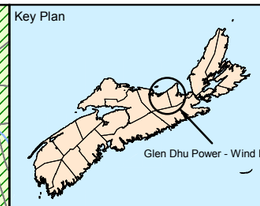
The areas where the constraints apply are mapped as exclusion zones and have been applied to the site selection process. The locations selected for the turbines are more than 100 meters from the nearest stream. Figure 2.3 shows applied exclusion zones of the property.

Construction Activities

Shear Wind plans to construct the Glen Dhu Wind Farm in two stages over a 3 year period. In 2008, SWI will award the wind turbine supply, transport, erection and commissioning contract to Enercon and will commission the engineering design work on roads, wind turbine sites, foundations, electrical collector lines, intertie substation and transmission line interconnection. Year 2008 will also see the commencement of site activities for roads, turbine sites and electrical systems. Stage 1, in 2009, will see the installation and placement into service of up to 10 wind turbines with an approximate in-service date of November 2009. Stage 2 in 2010 will see the installation of the balance of the wind turbines, no more than 20 machines, with an approximate in-service date of November 2010. Section 1, Table 1.1 provides a summary of the project milestones.



Key Plan



Legend:

Existing Features

- Paved Roads
- Local Roads
- Transmission Line
- Streams
- Forested
- Non Forested
- Water
- General Wetlands
- Beaver Flowages
- Open Bogs
- Treed Bogs
- Lake Wetlands
- Eigg Mountain Wilderness Area
- James River Watershed Area

Project Features

- Project Site
- Proposed Roads
- Optional Proposed Roads
- Proposed WTG's
- Optional WTG Sites
- Laydown Area
- Transformer Station

10 m Contour Interval

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Glen Dhu Power-
Wind Project
Registration Document

Figure 2.3
Wind Turbine Plan, Access and Site Topography

DWG No: 2.3_08_05_08
REVISION: 2.0
SCALE: 1: 30,000
DATE: August 5, 2008
PRODUCED BY: NORTEK/STANTEC

The following sections describe the project activities in the general sequence in which the work will be initiated. Once initiated, and access roads are established, activities will be conducted concurrently to the extent required to meet the project milestones. Environmental management of construction practices to be followed by the Contractor(s) will be based on the environmental protection practices identified in the following Codes of Practice:

- *Standard Specification for Municipal Services*: Nova Scotia Road Builders Association; Consulting Engineers of Nova Scotia, Joint Committee on Contract Documents.
- *Standard Specification, Division 1 General Requirements, Section 5 Environmental Protection*: Nova Scotia Department of Transportation and Public Works, February 2008.
- Erosion and Sediment Control Handbook for Construction Sites: Nova Scotia Department of Environment and Labour, 1988.

An Environmental Protection Plan will be prepared to address site specific laydown areas, fueling locations, waste management practices and other procedures to be followed by the Contractor and site personnel. The Project Site Manager will conduct inspections to ensure the environmental procedures are in place and being followed in day-to-day activity.

2.5.1 Access Road Construction

2.5.1.1 Surveying and Siting Operations

Road alignments, grades and elevations, turbine locations and laydown areas require surveying prior to commencement of the work. The project site access will consist of a private connector road off of Brown's Mountain Road in Bailey's Brook off of Barney's River Road (Exit 29 north off of Highway 104).

Surveying will also be required for the following installations:

- Existing access roads,
- Road intersections and turns (to assess for the turning radius of long loads)
- Additional access roads from the major roads to the turbine sites
- Turbine sites
- Laydown areas
- Power line corridors, and
- Transformer Station.

Access roads to the site follow existing woods roads and are already predominantly clear. The survey method will use GPS satellite technology which

requires little clearing of trees and undergrowth and does not require extensive clearing for "line-of-site" surveying.

2.5.1.2 Clearing and Grubbing

Clearing of vegetation will be required on all new access roads, turbine sites, lay-down areas and power line corridors. Grubbing will be required at locations where permanent installations are to be sited. To the extent possible, the access road system follows existing public, private and woods roads. Up-grading of the existing roads will be required to permit the large and heavy loads for the WTG equipment. The use of existing roads is intended to reduce the requirements for clearing and thereby minimize ecological habitat fragmentation.

Clearing generally involves the use of typical equipment used in forest harvesting such as chainsaws, tree harvesters and skidders. Merchantable timber will be removed from the locations and sold. Limbs and non-merchantable material will be chipped, left in brush piles or buried for natural decay; depending on the site conditions. Although being conducted on private lands, when conducting clearing and grubbing operations, the Contractor will follow the provisions of the Nova Scotia Transportation and Public Works, *Standard Specification, Division 1 General Requirements, Section 5 Environmental Protection.*

2.5.1.3 Delivery of Equipment

The WTG installation will require the use of heavy construction equipment, bulk construction materials, a large crane and the importation of large components of the WTG. Equipment, components and bulk materials will transported over public roads, principally Highway 104 to the site access roads which are on leased property on which SWI has obtained lease agreements or rights-of-way.

Construction equipment used in the site road construction will be provided by local contractors in the province of Nova Scotia. This equipment will consist of trucks, excavators, graders, dozers, roller/compactors and other such equipment needed for the upgrade and construction of access roads and for the preparation of crane pads, lay down areas and WTG foundations.

Depending on availability, bulk materials such as gravel and rock fill will be sourced from local borrow pits from private sources on the sites or at nearby locations. For economic reasons such sources provide lower fuel costs and transportation time.

Construction of the WTGs requires a very large crane which may be sourced from outside the province. Such cranes cannot be transported as a single unit but are trucked to the site in components which are then assembled for the erection of each WTG. Typically, the crane is partly disassembled before moving between WTG sites due to the width and weight of the assembled crane unit. The crane components are moved by truck.

The components of the WTGs will be transported to Nova Scotia by ship and landed at one of the ports in the local region. The components will be transferred from the ship to trucks and moved over local roads from the selected port to Highway 104 and then onto to Barney's River Road, east onto Bailey's Brook Road, north onto Brown's Mountain Road to the project area. The trucking operations over public roads will require a *Special Move Permit - Over Dimension* and a *Special Move Permit - Over Weight* from NSDTPW. Applications for such permits are being prepared and will be finalized in conjunction with the Project Schedule. Sections 2.5.4 and 2.5.5 provide additional details on the transportation requirements and WTG assembly schedule. It is anticipated that each WTG will require approximately 61 truck loads for the delivery of major equipment, components and construction materials.

2.5.1.4 Temporary Storage Facilities

Temporary storage of bulk materials will be required in the project area. These locations will be established by the Site Engineer and Contractor and site assessed for potential ecological, archaeological and Aboriginal resources prior to use. These sites will be restored following the procedures outlined in Section 2.5.9 Site Restoration Activities.

2.5.1.5 Fencing/Gates

The transformer substation and electrical facilities associated with the intertie substation located adjacent to existing NSPI line L-6511 and the nearby NSPI-supplied 138kV ring bus switching station will be fenced and gated for security and public safety.

Landowners who want to control access to their property may erect fences and gates at their discretion.

2.5.1.6 Construction Equipment Parking

Areas will be designated for parking and fueling of Contractors' construction equipment in accordance with the specified environmental Codes of Practice and site specific procedures of the Environmental Protection Plan (EPP) site guidelines following assessment of these areas by the project archaeologist, MEK advisor and the site project team ecologist.

Under the terms of the Construction Contract, equipment parking will only be allowed on these designated sites and any new sites will require review and approval from the site manager prior to being used.

2.5.2 Road Design and Layout

The road system must be designed and constructed to accommodate the heavy imposed loads from the equipment transporters, cranes and other material delivery vehicles required for the delivery and erection of the towers and wind turbines. Other heavy vehicles such as concrete delivery trucks and normal tractor trailer

deliveries will also require adequate road systems to ensure safe and trouble free delivery.

Where possible, the road system utilizes the existing roads. The road system totals 22 kilometers of which 12 kilometers are existing roads, upgraded and 10km are new roads. Figure 2.4 shows the road system required to transport equipment and to access the turbine locations.

Sections of provincially owned paved and graveled roads may require upgrades such as widening the road, reducing the gradients where grades exceed 10% and revising horizontal curves to a minimum turning radius of 30 meters. This work will be carried out as per the provincial approved standards and specifications. Surfaces will be crowned and compacted to stabilize soils and facilitate rapid drainage. As well, the road beds, existing culverts and watercourse crossing structures, if deemed necessary, will have to be upgraded to accommodate the tower and wind turbine transporters.

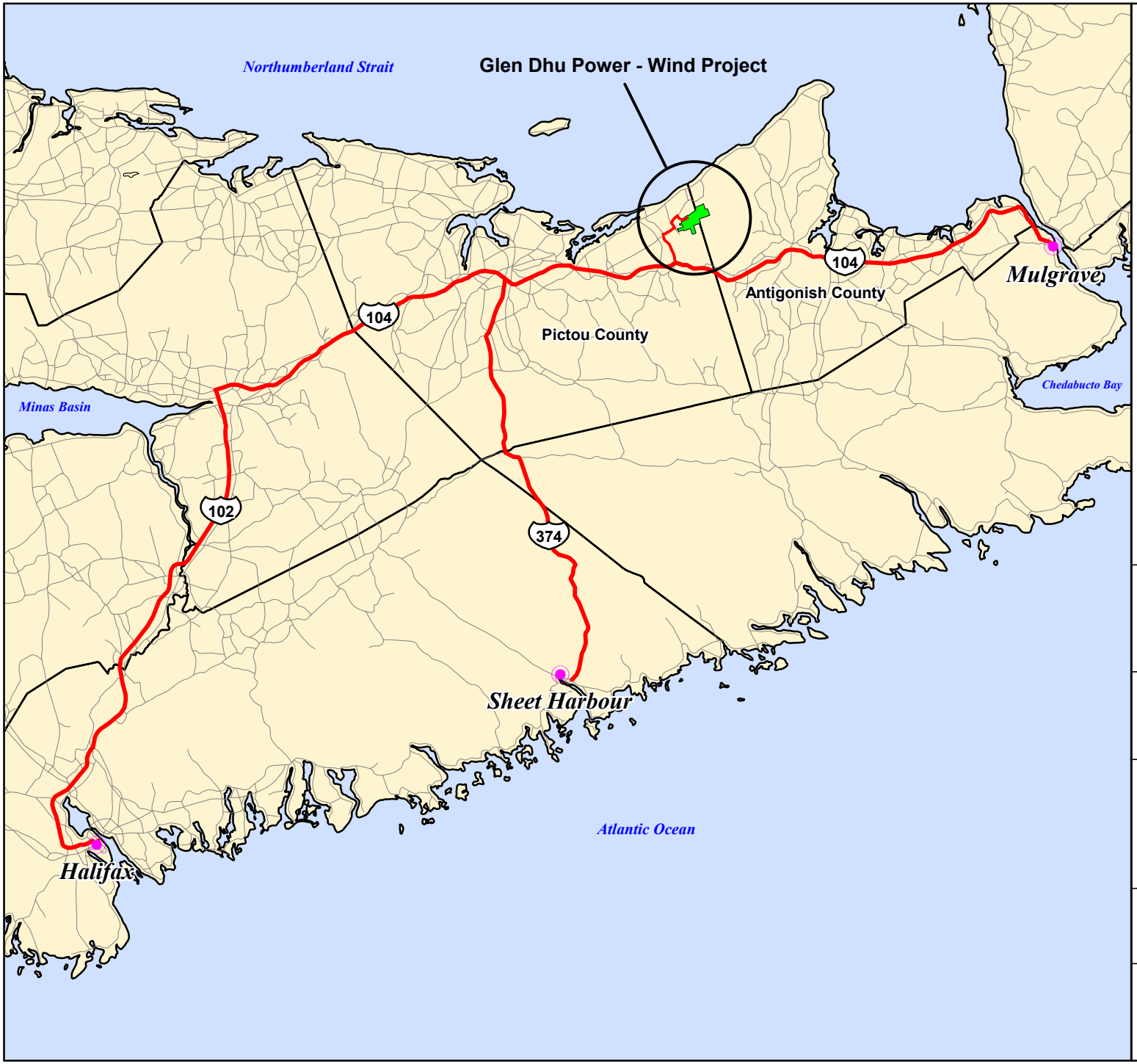
Similarly, on existing logging roads, the roads will require upgrades such as widening the road, reducing the gradients where grades exceed 10% and revising horizontal curves to a minimum turning radius of 30 meters. Again, the road beds, existing culverts and watercourse crossing structures, if deemed necessary, will have to be upgraded to accommodate the transporters, cranes and other heavy construction vehicles. Figure 2.5 provides an access road plan showing the water crossings and culvert locations on the site access roads.

For new on-site roads to the specific wind turbine locations, the roads will be cleared, grubbed and constructed to standards, specifications and requirements as deemed necessary by the representatives of the heavy load transporter companies in order to accommodate all types of construction equipment. Figure 2.6 shows the design of a typical access road section with ditch and check dam details.

Culvert sizes were determined using the 100 year peak flow and based on the drainage area up-gradient of the crossing, a standard headwater depth of 1.5m and a rainfall coefficient of 1.75. The calculation of culvert size was based on the methodology provided in the Nova Scotia Environment, Watercourse Alteration Certification Training Manual, November 2007, *Headwater Depth for Round CSP & SPCSP Pipe Culverts with Inlet Control*. Figures 2.7 (A to D) provide typical design details for various sized culverts which will be required for forest roads. Figure 2.8 shows typical erosion and control barrier designs for constructions sites which meet the requirements of the Codes of Practice. Figure 2.9 shows the design of an open bottom culvert which may be used at major water crossings. This design permits spanning the stream without interrupting the flow or modifying the watercourse.

2.5.3 Borrow Pits

Construction of roads and foundations will require a supply of aggregate material for fill. There are a least six existing borrow pits on the leased properties and a large borrow pit on nearby private lands of sufficient capacity to meet the requirements for the project. These borrow pits offer the most economical sources for fill and aggregate which will minimize trucking costs and reduce the consumption of diesel fuel. Private landowners will receive compensation for materials removed from their borrow pits.



Legend:

- Transportation Routes
- Main Roads
- Entry Port
- Nova Scotia
- Salt Water
- Project Site

TN

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Nortek Resource Solutions Inc.

Glen Dhu Power-Wind Project Registration Document

Figure 2.4
Transportation Routes For WTG Equipment

DWG No: 2.4_07_11_08
REVISION: 2
SCALE: 1: 100,000
DATE: July 11, 2008
PRODUCED BY: NORTEK/STANTEC

N

KNOWN MINOR STREAM CROSSING
OPTIONAL ROAD ALIGNMENT
OPTIONAL TURBINE LOCATION FOR SITE 14
OPTIONAL ROAD ALIGNMENT
POSSIBLE TURBINE LOCATION FOR SITE 15
OPTIONAL ROAD ALIGNMENT
OPTIONAL TURBINE LOCATION FOR SITE 19
OPTIONAL ROAD ALIGNMENT
OPTIONAL TURBINE LOCATION FOR SITE 17
KNOWN MAJOR STREAM CROSSING
KNOWN MAJOR STREAM CROSSING
KNOWN MINOR STREAM CROSSING
KNOWN MINOR STREAM CROSSING
KNOWN MINOR STREAM CROSSING
KNOWN MINOR STREAM CROSSING
OPTIONAL ROAD ALIGNMENT
OPTIONAL ROAD ALIGNMENT
KNOWN MAJOR STREAM CROSSING

AUG. 2008
133330018

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Legend

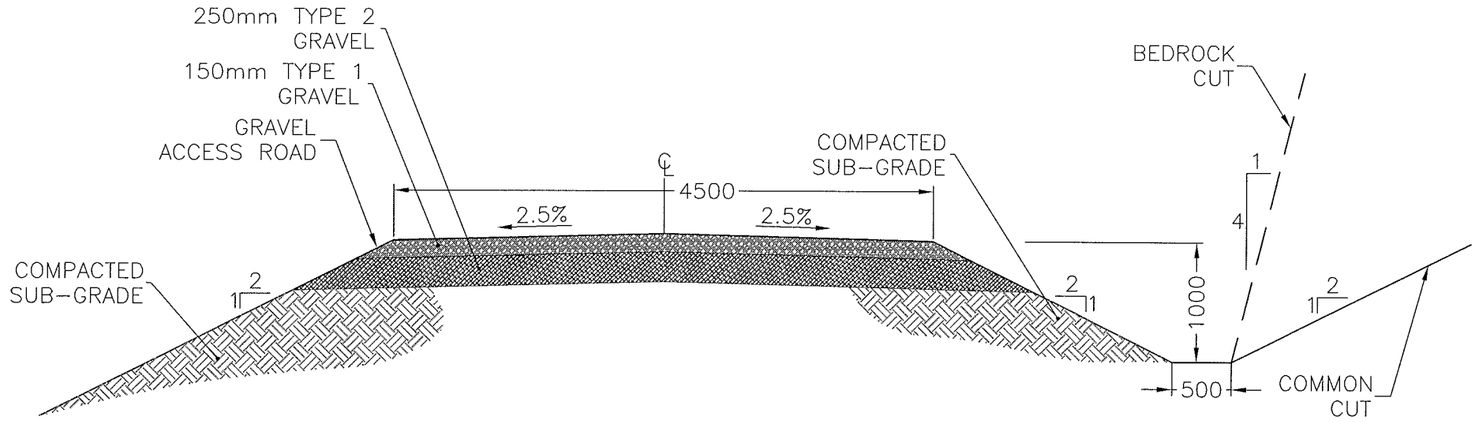
- WIND TURBINE SITE
- EXISTING ROADS
- STREAMS
- PROPOSED ACCESS ROADS

SHEAR WIND
GLEN DHU POWER – WIND PROJECT
REGISTRATION DOCUMENT

FIGURE 2.5

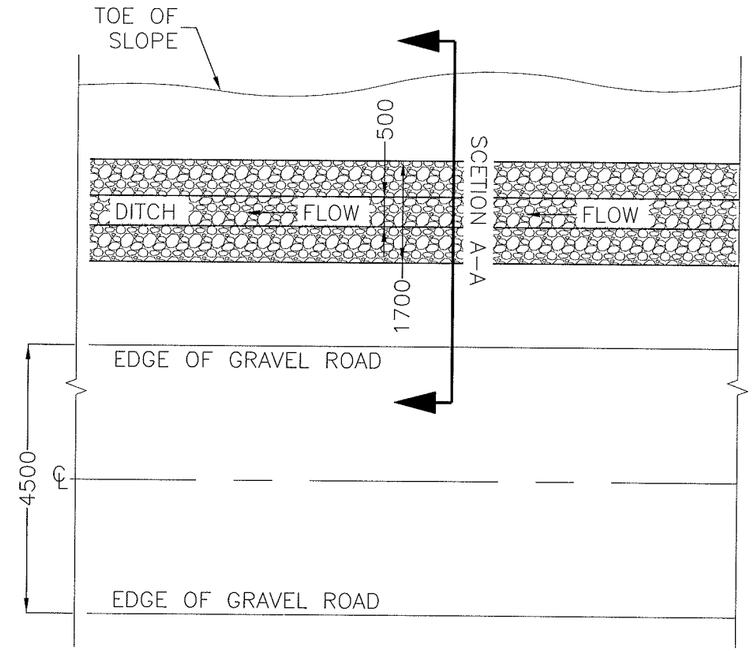
ACCESS ROADS AND CULVERTS

CADD NAME (FULL PATH)



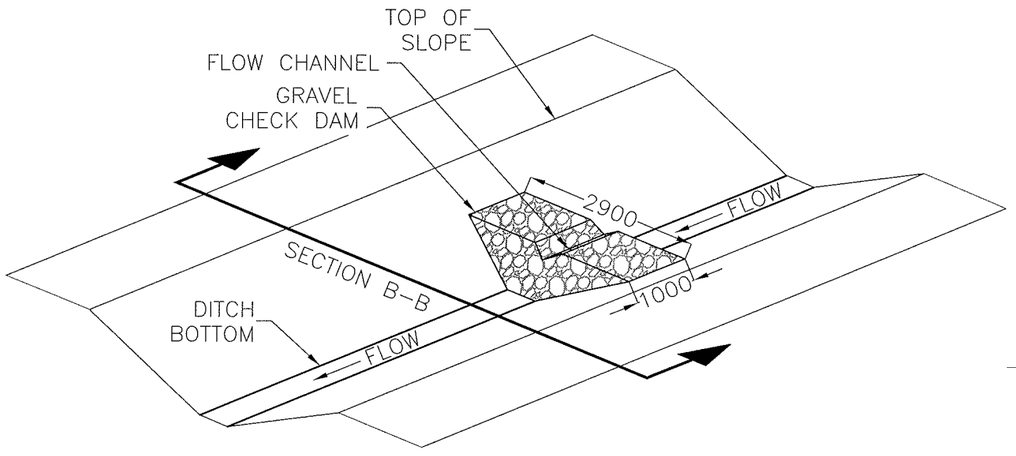
TYPICAL ACCESS ROAD SECTION

SCALE 1:50



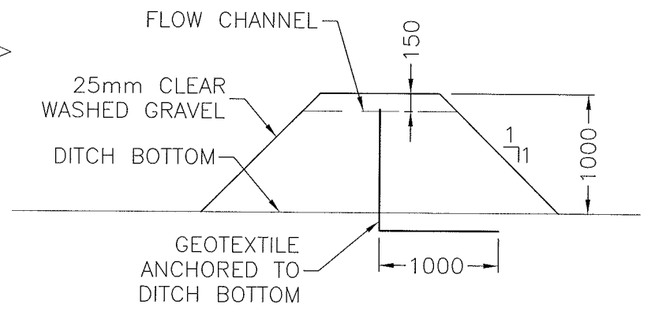
PLAN–ROCK LINED DITCH

SCALE 1:50



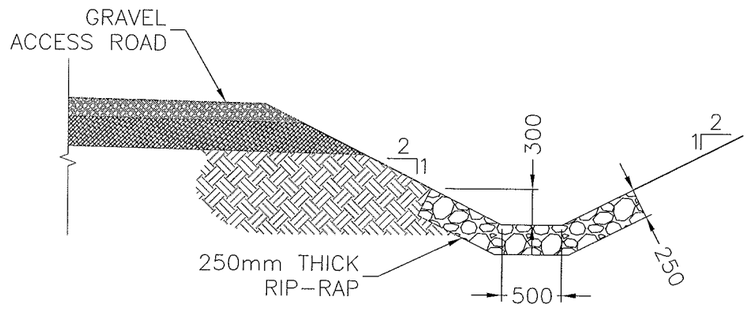
PLAN– TYPICAL GRAVEL CHECK DAM

SCALE 1:100



SECTION B–B

SCALE 1:50



SECTION A–A

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April 18, 2008
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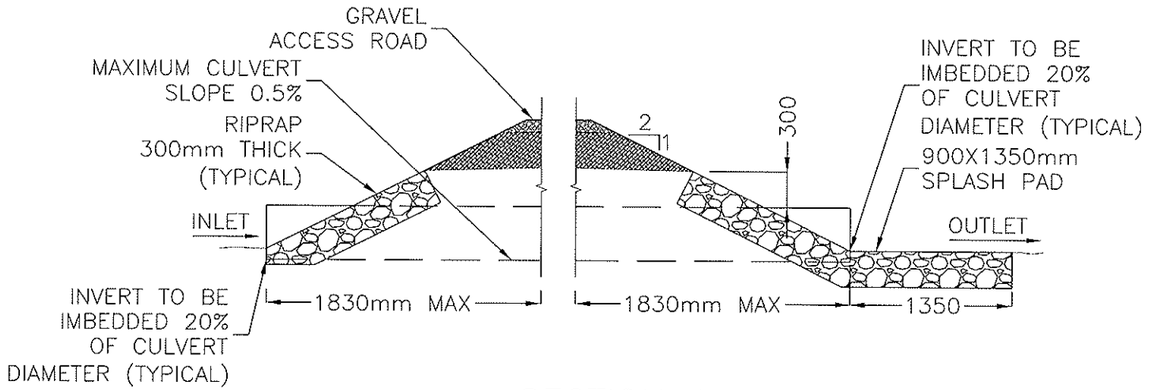
Legend

Notes

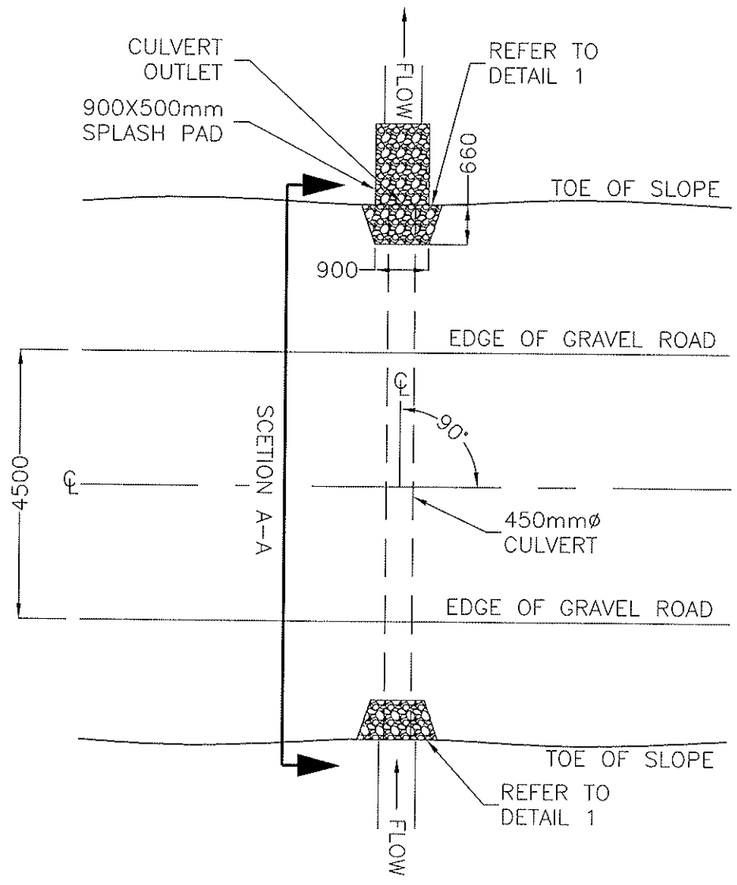
Client/Project
SHEARWIND
GLEN DHU WIND FARM

Figure No.
2.6

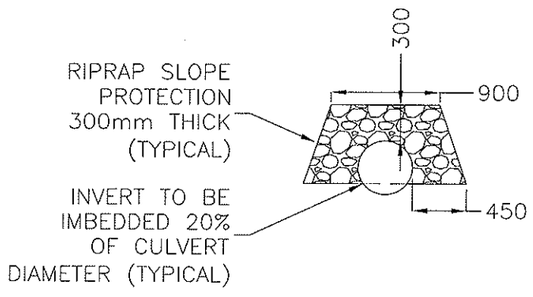
Title
TYPICAL ACCESS ROAD
CROSS-SECTION AND DITCH DETAILS



SECTION A–A
SCALE 1:50



PLAN 450mmø CULVERT
SCALE 1:100



DETAIL 1
SCALE 1:50

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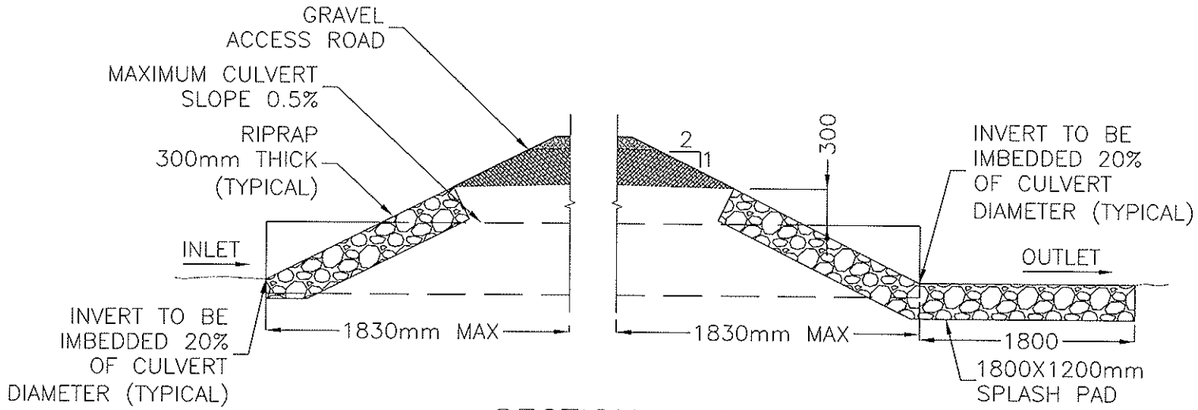
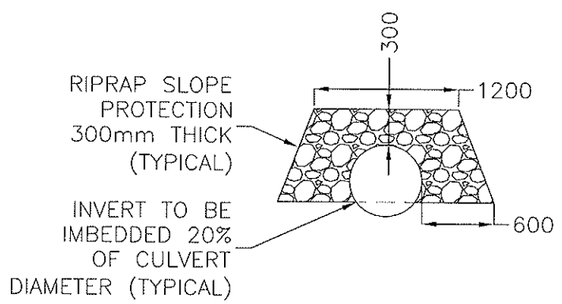
Client/Project
SHEARWIND
GLEN DHU WIND FARM

Figure No.
2.7a

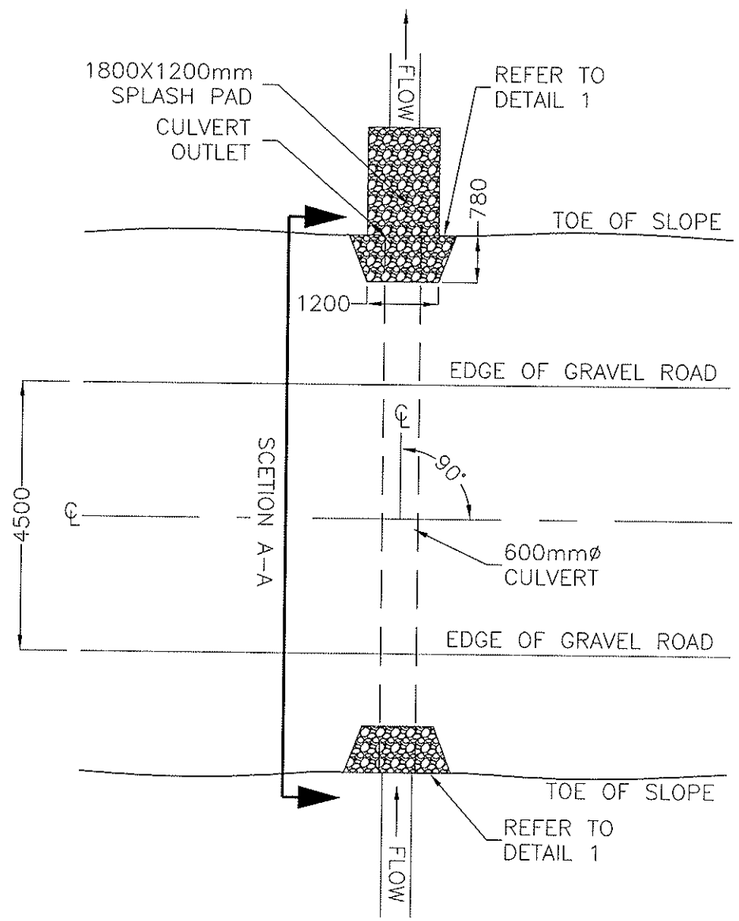
Title
TYPICAL 450mmØ CULVERT
INSTALLATION FOR ACCESS ROADS



SECTION A–A
SCALE 1:50



DETAIL 1
SCALE 1:50



PLAN 600mmø CULVERT
SCALE 1:100

CADD NAME (F:\JOBS\21075\DWG\CIVIL\DESIGN\133521075-C-502.DWG

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Legend

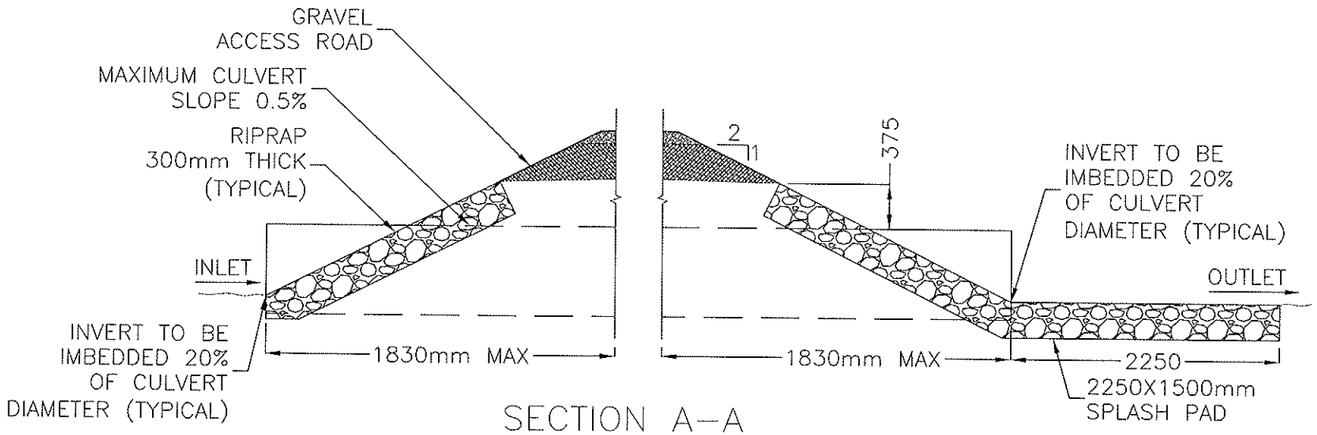
Notes

April 15, 2008
133521075

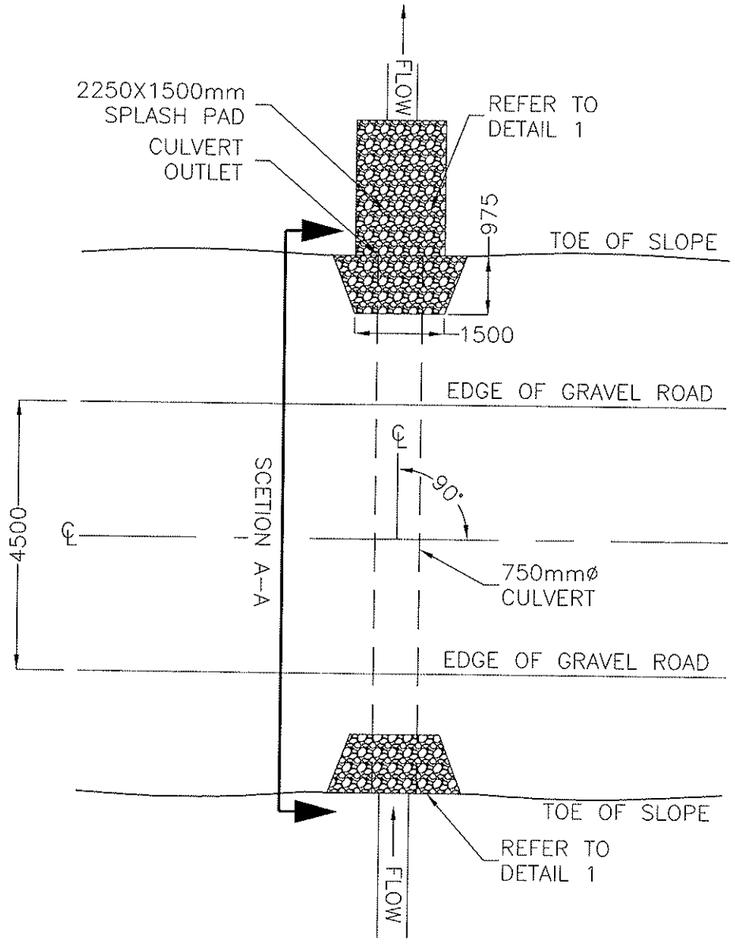
Client/Project
SHEARWIND
GLEN DHU WIND FARM

Figure No.
2.7b

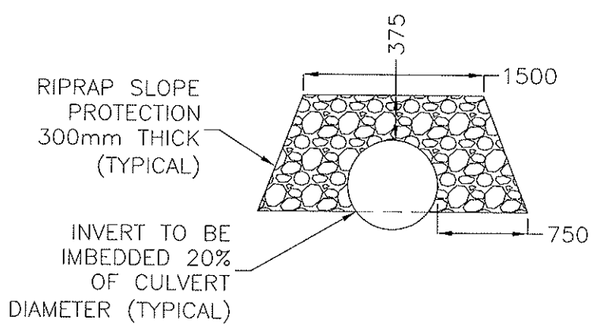
Title
TYPICAL 600mmØ CULVERT
INSTALLATION FOR ACCESS ROADS



SECTION A–A
SCALE 1:50



PLAN 750mmø CULVERT
SCALE 1:100



DETAIL 1
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ORIGINAL SHEET – ANSI B

Stantec Consulting Ltd.
#1 South 130 Eileen Stubbs Avenue
Dartmouth NS
B3B 2C4
Tel. 902.434.7331
Fax. 902.462.1660
www.stantec.com

Legend

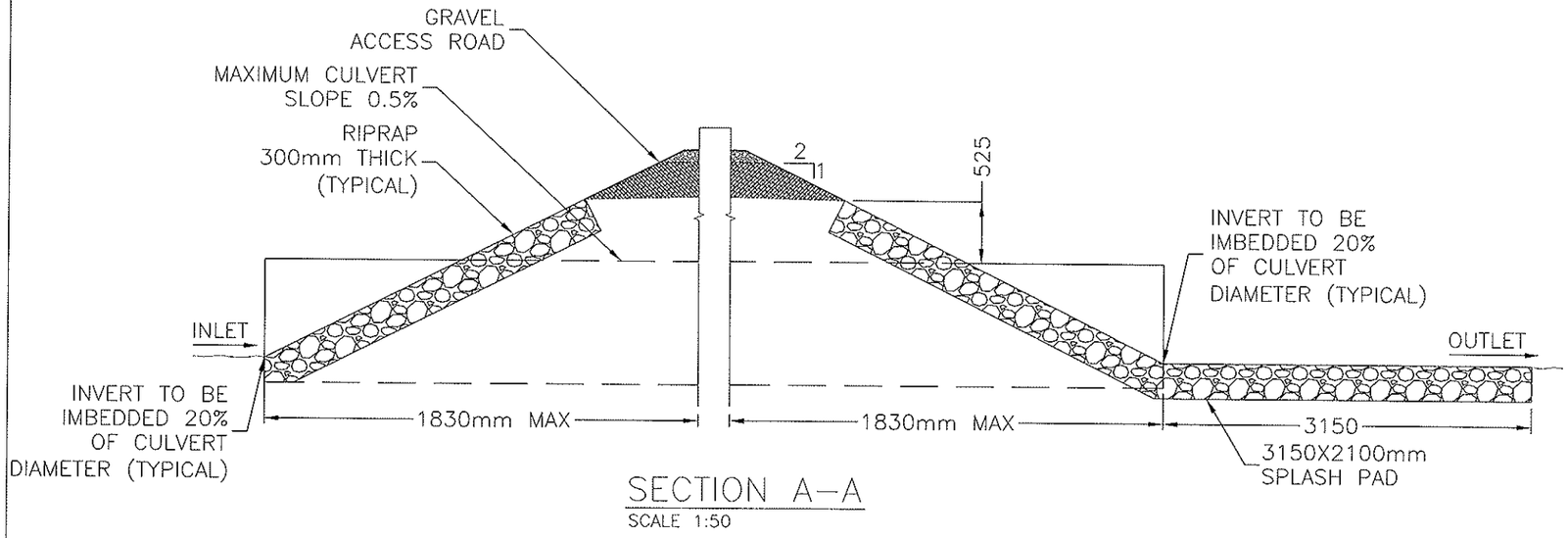
Notes

April 15, 2008
133521075

Client/Project
SHEARWIND
GLEN DHU WIND FARM

Figure No.
2.7c

Title
TYPICAL 750mmØ CULVERT
INSTALLATION FOR ACCESS ROADS



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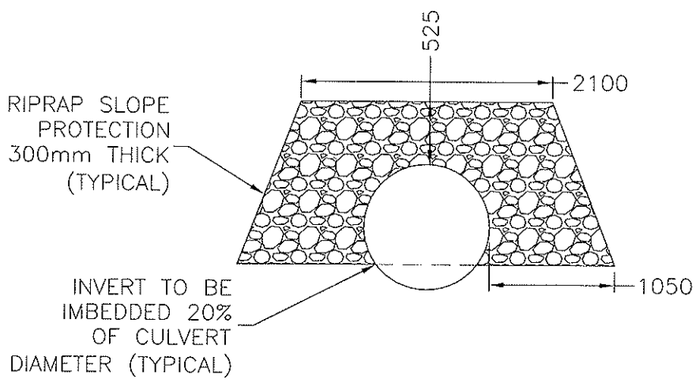
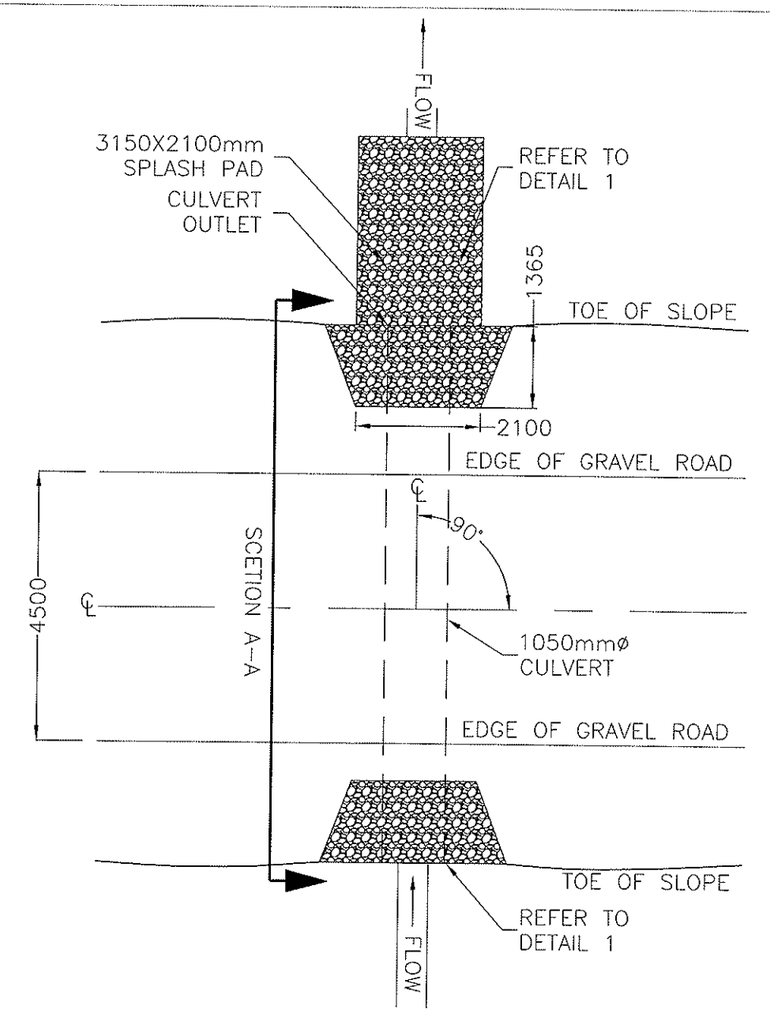


DETAIL 1
SCALE 1:50



PLAN 1050mmø CULVERT
SCALE 1:100

CADD NAME (F:\JOBS\21075\DWG\CIVIL\DESIGN\133521075-C-504.DWG

ORIGINAL SHEET - ANSI B

Stantec Consulting Ltd.
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Legend

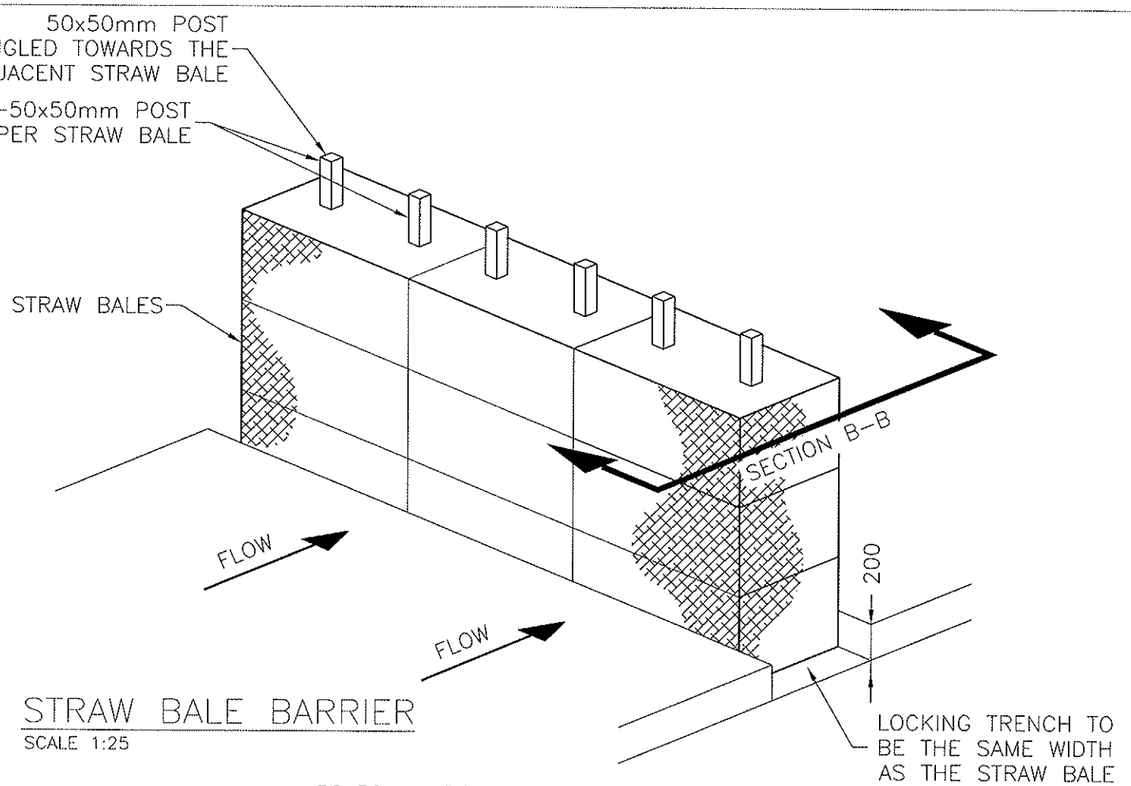
Notes

April 15, 2008
133521075

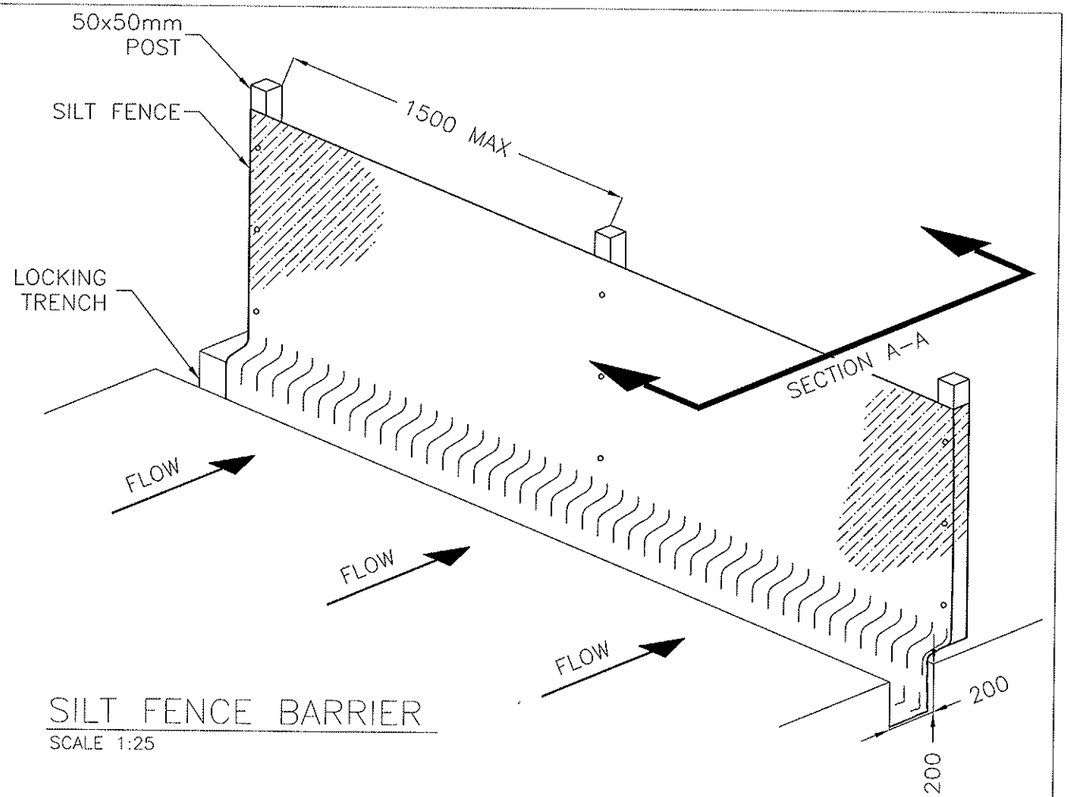
Client/Project
SHEARWIND
GLEN DHU WIND FARM

Figure No.
2.7d

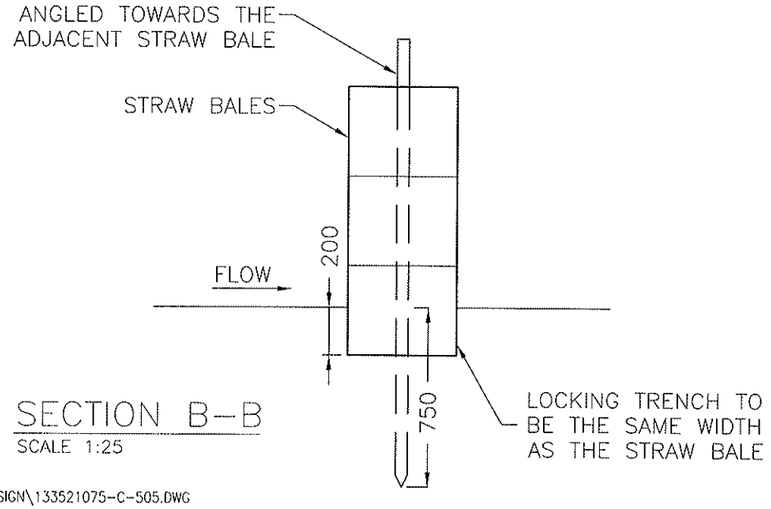
Title
TYPICAL 1050mmØ CULVERT
INSTALLATION FOR ACCESS ROADS



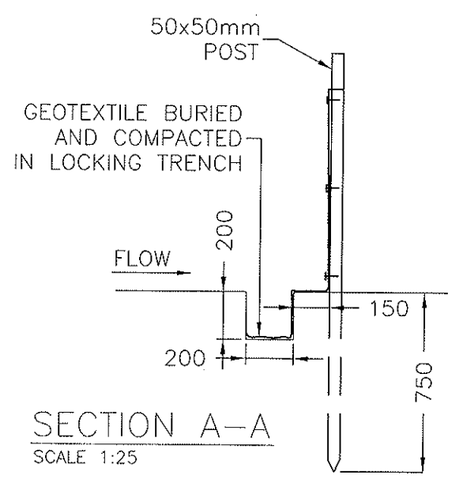
STRAW BALE BARRIER
SCALE 1:25



SILT FENCE BARRIER
SCALE 1:25



SECTION B–B
SCALE 1:25



SECTION A–A
SCALE 1:25

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April 16, 2008
133521075

ORIGINAL SHEET – ANSI B

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Legend

Notes

Client/Project
SHEARWIND
GLEN DHU WIND FARM

Figure No.
2.8

Title
TYPICAL EROSION AND SEDIMENTATION CONTROL BARRIERS FOR CONSTRUCTION SITES

Key Plan

Glen Dhu Power - Wind Project

Legend:

Existing Features

- Paved Roads
- Local Roads
- Transmission Line
- Streams
- Forested
- Non Forested
- Water
- General Wetlands
- Eigg Mountain Wilderness Area
- James River Watershed Area

Project Features

- Project Site
- Proposed Roads
- Optional Proposed Roads
- Proposed WTG's
- Optional WTG Sites
- 33 WTG ID
- Laydown Area
- Transformer Station

TN

10 m Contour Interval

Shear Wind Inc.

Stantec

Nortek Resource Solutions Inc.

Glen Dhu Power- Wind Project Registration Document

Figure 2.9
Site Facilities Plan

DWG No: 2.9_08_07_08
REVISION: 3.0
SCALE: 1: 22,000
DATE: August 7, 2008
PRODUCED BY: NORTEK/STANTEC

2.5.4 Foundation Construction

The turbine towers will be supported by reinforced concrete gravity base type foundations. For description and visual purposes, the following is an example of one of the engineer-stamped specifications typically used for Enercon E-82's with soil conditions similar to those found in the Glen Dhu Project area.

Each gravity base will be founded on a 75mm thick lean concrete pad which will be placed at the depth indicated in the geotechnical report for the project. The gravity bases will be octagon shaped with a circular central pier. The octagon base will have maximum dimensions across the base of 17 metres by 17 metres. The central pier will have a diameter of 4780mm. The footing thickness will be tapered toward the centre of the foundation from a minimum thickness of 450mm at the outer edge to 2320mm at the edge of the circular pier. The circular central pier will extend a further 650mm above the tapered base. It will project 175mm above finished grade. If the contractor so decides, a construction joint may be placed horizontally between the top of the tapered section of the base and the circular pier section. The top of the circular pier section will be sloped to drain toward the centre of the pier, and a 100mm diameter PVC pier drain will be installed in the pier to drain to the edge of the pier.

The turbine tower will be secured to the gravity base by a double row of 36mm diameter anchors, a total of 144 anchors, each 2800mm in length, will be used. The anchors will be Williams 150ksi All-thread Bar Anchors. They will be connected to a circular steel embedment ring in the concrete base and will be supplied with heavy hex nuts and hardened washers at both ends of the anchor. PVC sleeves will be used around each anchor. A steel template ring will be used to set the anchors. A minimum of 10% of the anchors will be tension tested.

The design requirements for foundations depend on the geotechnical features specific to each site. As such, the design requirements may vary between sites and therefore the transport of materials to the sites will vary as well. It is anticipated foundations requiring the largest quantities of concrete will require the following supplies: one-two truck loads of steel; one truckload carrying the foundation section; and approximately 40 truckloads of concrete. Each foundation will require a construction period of approximately one week and, therefore, the construction period for the first 10 turbines in Stage I will be a 10 week period from September 2008 to January 2009. The remaining 20 turbine foundations for Stage II will be constructed over a 20 week period between April 2009 and December 2009. Trucking activities will greatest during the concrete pour when a continuous supply is required to ensure the integrity of the concrete base.

2.5.5 Tower and Turbine Assembly and Installation

In addition to turbine supply, Enercon will be responsible for the transport of the tower sections and nacelles to the site, erection of the towers, and assembly of the

wind turbines. Enercon will also retain responsibility for the commissioning and initial operation (trial operation) of the wind turbines. Appendix B, Section 2 provides details on Access Roads and Crane Platforms for the tower and turbine assembly, cranes and transport logistics.

Appendix B, Section 3 provides descriptive text and photographs of the installation of an Enercon E-70 as an example of the installation process, site configuration and equipment moving requirements for a large WTG. The Enercon E-82 systems proposed for Glen Dhu Project are of a similar configuration with a larger blade diameter.

The WTGs arrive at the port of entry in component form and the components are transported from to each site by tractor trailer. Each turbine will require approximately 14 tractor trailer loads to move the components to its respective site. Due to the size of some components, over-size and over-weight permits will be required from NSTPW to transport some loads over provincial highways. The tentative date for delivery of the ~10 turbines for Stage I is May 2009. Delivery of the ~20 turbines for Stage II is scheduled to be completed by May 2010.

Small cranes and ancillary equipment such as office trailers, portable equipment storage containers or sheds, and portable toilets will be required on site. A large crane with the capacity to lift the components into position for assembly will also be required. As a single unit, this crane is too large for transport on public roads and therefore is brought to the site in component form. The crane components are then assembled on the site. It will require 20-30 truck loads to move the large crane components to and from the work area during the two stages of erection. The crane will be on-site from approximately May to October 2009 for Stage I and from May to October 2010 for Stage II. Where environmental conditions and width of the access roads allow, the crane will be moved between sites in a semi-assembled state. Where road grades and water crossings which restrict the width of the roads are present, the crane will be disassembled moved and then re-assembled at the next site.

2.5.6 Interconnection from Turbines to Substation

To harness the power which will be created, the generator of each wind turbine is connected via an underground cable to an overhead distribution class circuit, which generally will be placed on the outside edge of the road easement. Thus the collection system and the road system will use the same easement. The collector system which includes approximately 22 kilometers of circuitry delivers the generated power and energy output to a central location or intertie substation where the collection voltage, nominally at 34.5 kV, is stepped up to the 138kV transmission line voltage.

2.5.7 Substation Construction

The Glen Dhu Project will include an intertie substation located adjacent to existing NSPI line L-6511. The design and installation of the Ring Bus Switching Station will be the responsibility of NSPI.

The substation interfaces with one node of an NSPI supplied 138kV ring bus switching station, which will be inserted into the line. The intertie substation will be located adjacent to the NSPI 138kV transmission line (L-6511). The project substation will include one fully instrumented, 36/48/60MVA wye-delta-wye configured step-up power transformer designed and built to the current edition of standard CSA C88 power transformers and reactors, a common 138kV revenue metering pack, a three phase set of 138kV post potential transformers dedicated to a two zone phase and ground distance line back-up protection scheme. Ring bus node and transformer protection will be provided and will use current transformers from the two relevant NSPI 138kV circuit breakers and current transformers from the secondary side of the step-up transformer. One 138kV motorized disconnect will be provided for purposes of transformer isolation and reclosing of the node breakers in the event of a transformer fault. The generation collection system will consist of a 35kV substation bus with two fully protected and controlled 35kV circuit breakers each interconnected to a collector circuit. The 35kV bus will also have a set of 35kV fused switches to serve as a point of interconnection for station service power, and space reserved for the installation of a circuit breaker for a static VAR compensator system as/if required. The substation will have a fenced area of approximately 60m x 40m and another 2m border at substation elevation extending beyond the fenced area.

2.5.8 Substation to Power Line

The substation is connected to the Nova Scotia Power grid at the Point of Interconnection (POI) where the power and energy enter the Nova Scotia Power electrical grid system. The power generated from each turbine and the combined wind farm output are closely monitored for quality using modern SCADA systems and is directly linked to Nova Scotia Power's central control facility located in Ragged Lake, on the outskirts of Halifax.

The connection of the wind farm substation will be done through a NSPI designed and supplied protection system in a NSPI substation, as identified in the NSPI supplied Interconnection Feasibility Study Report and which will subsequently be detailed through a NSPI supplied facilities report. The NSPI system will be located on the same site as the SWI Intertie Substation.

The connection from the Intertie Substation to the NSPI 138kV transmission line L-6511 is approximately 1 to 2 span lengths, a relatively short distance, estimated to be less than 100m. The Wind Farm and utility interconnection electrical configuration is indicated on Figure 2.10 single line diagram 012-119-E-3000. The proposed power system and all associated electrical components and protection and control systems will meet all technical requirements of the "NSPI Request for Proposals for 130MW of Renewable Energy" document and any related feasibility assessments or system impact studies carried out by NSPI. All components and equipment employed in the project will be ANSI/IEEE and CSA certified and compliant.

As indicated on the referenced single line diagram, the Point of Interconnection (POI) will be at the 138kV level, on NSPI line L-6511, generally at E560504.262 and N5055069.304 again at the point nearest to these coordinates which is technically acceptable to both NSPI and to the requirements of the Project.

Shear Wind has submitted Generator Interconnection Requests and has executed an Interconnection Feasibility Agreement with NSPI. Shear Wind has received from NSPI an Interconnection Feasibility Study Report No. GIP-114-FEAS-R2, dated August 17, 2007, for the 66 MW at Glen Dhu. Shear Wind will submit further documents to NSPI in accordance with the NSPI Standard Generator Interconnection Procedures.

2.5.9 Permitting Requirements

Table 2.2 lists the permits and approvals required for project activities and the present status of the various submissions for these permits. The preparation of the respective applications has been initiated and submissions will occur as the respective elements of the design are finalized. SWI will provide copies of the applications and permits to NSDEL on the completion of each permit.

DWG. No. 023-452-E-3000C

DWG. No. 023-452-E-3000C

NSPI LINE L-6511 TO TRENTON (30M)

138kV LINE NSPI LINE L-6511 TO LOCHABER ROAD (4C)

NSPI SHEAR WIND INC.

NSPI SHEAR WIND INC.

34.5kV 1200A BUS

12 WTG's

12 WTG's

LEGEND

- X TEST SWITCH (ABB TYPE FT-1)
- 21 DISTANCE PHASE FAULT PROTECTION
- 21N DISTANCE GROUND FAULT PROTECTION
- 24 VOLTS PER HERTZ PROTECTION
- 25 LINE LOAD VERIFICATION PROTECTION (USED TO PERMIT DEAD BUS CLOSURE)
- 27 UNDERVOLTAGE PROTECTION
- 46 NEGATIVE PHASE SEQUENCE (CURRENT) PROTECTION
- 49 TRANSFORMER WINDING THERMAL PROTECTION (2 STAGE FAN CONTROL, ALARM, TRIP)
- 50 INSTANTANEOUS OVERCURRENT PROTECTION (50N, 50P, 50Q)
- 51 TIMED OVERCURRENT PROTECTION (51Q1, 51P, 51Q)
- 50N/51N INSTANTANEOUS AND TIMED NEUTRAL OVERCURRENT PROTECTION
- 50G/51G INSTANTANEOUS AND TIME GROUND OVERCURRENT PROTECTION
- 51G TIME GROUND OVERCURRENT PROTECTION
- 51N NEUTRAL OVERCURRENT PROTECTION
- 51T TRANSFORMER TERTIARY OVERCURRENT PROTECTION
- 51TG TERTIARY GROUND INST. OVERCURRENT PROTECTION
- 51V VOLTAGE RESTRAINED/CONTROLLED OVERCURRENT PROTECTION
- 59 OVERVOLTAGE PROTECTION
- 63 TRANSFORMER SUDDEN PRESSURE PROTECTION
- 81O/U OVER/UNDER FREQUENCY PROTECTION
- 86 LOCKOUT RELAY (86G, 86T1, 86T2)
- 87 CURRENT DIFFERENTIAL PROTECTION (87G, 87T, 87N)
- 94 AUXILIARY TRIP RELAY (SUDDEN PRESSURE)
- 26/T TRANSFORMER OIL TEMPERATURE (ALARM AND TRIP)

POWER CIRCUIT BREAKER

GROUP OPERATED, 3 PHASE DISCONNECT SWITCH

GROUP OPERATED, 3 PHASE LOAD BREAK SWITCH

SINGLE POLE DISCONNECT SWITCH

MOTOR OPERATED DISCONNECT

FUSED CUT-OUT

CVT CAPACITIVE VOLTAGE TRANSFORMER

NOTES

1. 34kV BREAKERS EQUIPPED WITH INTERNAL VOLTAGE SENSORS ON LINE AND LOAD SIDES FOR DEAD BUS/LINE LINE PROTECTION FEATURES.

Figure 2.10: Single Line Diagram 012-119-E-3000

REFERENCE DRAWINGS	DWG. NO'S	REFERENCE DRAWINGS	DWG. NO'S	NO.	DATE	LOCATION	REVISIONS	MADE BY

NO.	DATE	LOCATION	REVISIONS	MADE BY
A06	2007-09-28		ISSUED FOR PROPOSAL	HE
A01	2008-03-18		ISSUED FOR CLIENT REVIEW	HE
P01	2007-03-16		ISSUED FOR PERMIT, ROADS	HE

STRUM ENGINEERING ASSOCIATES LTD.
DARTMOUTH & SYDNEY, NOVA SCOTIA

DRAWN: PM | CHECKED: KLR | PROJECT MANAGER:

SCALES: N.T.S. | QA/QC: N. STRUM

CLIENT: SHEAR WIND INC. BEDFORD, NOVA SCOTIA

TITLE: GLEN DHU WIND FIELD INTERTIE SUBSTATION PROTECTION CONTROL METERING SINGLE LINE DIAGRAM

DATE: 2007-03-16 | DWG. No. 023-452-E-3000C | REV. A02

ACAD FILE: E3452E3000.dwg

Table 2.2: Table of Project Approvals and Schedule

Item	Approvals And Permits	Status	Submission Date	Anticipated Approval Date
1	NSDNR[5]: Application for Crown Land	Submitted	Mar. 25, 2008	NA
2	Nova Scotia Environmental Assessment Regulations and Canadian Environmental Assessment Act	Submission of Registration Document/ Environmental Assessment	August 13, 2008	October 1, 2008
3	Fisheries Act, Navigable Water Protection Act, Permits under the Nova Scotia Environment Act	Preliminary service roads and potential water crossings have been identified. Final road and water crossing designs will incorporate stream and wetland protection measures for approvals by NSE[1], DFO[2] and TC[3] and documented in EIS	July 18, 2008	Approval Pending
4	Transport Canada, Canadian Aviation Regulations, Tower lights and Markings	Under review, pending design completion and environmental review.	July 15, 2008	Aug. 29, 2008
5	NSDTPW[4] : Breaking Soil of Highways Permit	To be reviewed pending the final design of service roads.	Aug. 25, 2008	Oct.10, 2008
6	NSDTPW[4] : Building Near A Highway and Access to Property Permit	To be reviewed pending finalization of the turbine locations and design of power lines and access roads.	Aug. 25, 2008	Oct.10, 2008
7	NSDTPW[3] : Use of Right - of - Way for Pole Lines Permit	To be reviewed pending finalization of the turbine locations and design of power lines and access roads.	Aug. 25, 2008	Oct.10, 2008
8	NSDTPW[4] : Special Move Permit - Over dimension	Application for a permit will follow finalization of the design and work plan schedule.	Jan., 2009	May, 2009
9	NSDTPW[4] : Special Move Permit- Over weight	Application for a permit will follow finalization of the design and work plan schedule.	Jan., 2009	May, 2009
10	NSDNR[5] : Travel in Woods During Woods Closure Permit	As required during potential closure periods.	As required	?
11	NSDNR[5] : Crown Lands Access Road Construction Permit	Pending the final design of service roads with respect to Crown Lands.	As required	?
12	NSDNR[5] : Inland Aggregate Removal Permit (Not More Than 5000 Cubic Metres or 7000 Metric Tonnes)	Pending design completion and identification of potential aggregate borrow pits.	Oct, 2008	Nov, 2008
13	NSDNR[5] : Survey of Crown Lands Boundary Approval	Pending finalization of the turbine locations, power lines and access roads.	As required	?
14	NSE[1] : Electrical Wiring Permit	Pending design completion.	?	?
15	Blasting Permit	Only as needed depending on bedrock conditions	As Required	?
16	Building Permits as required by Antigonish and Pictou Counties	Pending design completion.	Aug 25, 2008	Nov, 2008

Notes: 1= Nova Scotia Environment; 2 = Department of Fisheries and Oceans; 3 = Transport Canada (Navigable Waters Protection Act); 4 = Nova Scotia Department of Transportation and Public Works; 5 = Nova Scotia Department of Natural Resources.

2.5.10 Environmental Protection

An Environmental Protection Plan (EPP) and Environmental Management Plan (EMP) has been prepared to address environmental issues related to the Glen Dhu Project. The EPP has been incorporated in the design of the project facilities and will guide the installation of the physical components of the project. The Environmental Management Plan (EMP) has been developed as a guide for contractors in conducting site specific activities and to provide procedures to be followed during the pre-construction and construction phases of the project. These documents are described in detail in Section 6.1: Mitigation Measures and will address the following key environmental concerns from the construction phase of the project:

- **Cut Vegetation (Brush and Slash):** Cut vegetation left on site can pose a fire hazard and if left in a watercourse can degrade aquatic habitat or obstruct fish passage. These materials will be chipped and the chips distributed in appropriate areas away from water courses and wetlands.
- **Ditching:** Ditches increase channeling of water, sediment run-off and can potentially impact aquatic ecosystems and other environmentally sensitive areas. Ditches that are to remain on site will be properly designed and maintained in accordance with the *Erosion and Sedimentation Control Handbook.*
- **Exposed Soils Left On Site:** Soil exposure from site clearing and road construction increases with risks of soil erosion, flooding and impact to aquatic ecosystems. Natural drainage will be maintained where practical and exposed soils will be seeded using native non-invasive, herbaceous species or receive a straw/hay application. If seeding is not possible due to lateness in the season, the exposed soils will be completely covered for over-wintering with either mulch or an erosion control blanket. Erosion control material will be removed during the following spring, and the area will be seeded.
- **Excavated and Aggregate Materials Left on Site:** These materials, if left on site, increase the potential for erosion with associated sediment-laden run-off, impacts to aquatic ecosystems and dust emissions from aggregate piles. No excavated material will be disposed of in an environmentally sensitive area or in the setback zone (30m) of a watercourse/wetland. Handling of sand, aggregate, stones, soil or other materials, will be done in a manner which avoids producing dusty conditions. Any noticeable unconsolidated stone concentration is to be removed to an approved location.
- **Altered Watercourses:** The alteration of watercourses during the construction phase may have a permanent impact on surface hydrology and nutrient supply. Any watercourse alteration will be designed to maintain the original hydrologic regime and ecological habitat. Such designs will be submitted for regulatory approval before construction.
- **Solid Waste:** Solid waste streams commonly generated at the construction site generally comprise domestic waste, paper, cardboard, wood, scrap steel

and metals. These materials will be properly collected and disposed of by the contractor on a continuous basis during the course of the work.

- **Hazardous Materials:** Hazardous materials include fuels, lubricants, hydraulic fluids, acetylene, paints and solvents. The release of such flammable, toxic and corrosive materials to the environment through accidental spillage or improper handling can pose severe and acute impacts to the environment and human health. These materials will be stored in a safe manner at designated locations only. Fueling of equipment will be conducted at designated sites only. Hazardous or toxic materials are to be handled and disposed of in accordance with guidelines in the Workplace Hazardous Materials Information System (WHMIS) program. The Contractor will implement and maintain an Emergency Response Plan and spill control supplies to address potential hazardous substance releases during the work. Releases will be reported in accordance with provincial and federal environmental regulations.
- **Archaeological and Aboriginal Resources:** During the construction phase, items of significant historical and social value could be unearthed which must be removed and/or preserved in accordance with Provincial regulations. All work will be suspended until the proper procedures have been followed and permission to resume construction has been given by the archaeologist.

The contents of this document will provide the basis for environmental protection during the conduct of the work and on completion of the construction phase of the project.

2.5.11 Wind Farm Operations and Maintenance

The Glen Dhu Power- Wind Farm will be brought online in two stages. The first 10 WTGs of Stage I will commence operation by November 30, 2009 and the second stage of 20 WTGs will be operational by December 30, 2010. Upon complete commissioning of the Glen Dhu Wind Farm, the operational phase of the project will involve the generation capacity from 30, 2 MW turbines and transmission of this electrical energy into NSPI's grid. Only approved SWI and Enercon staff and contractor personnel will have access to the equipment at the site.

The design of the E- 82 rotor, generator and grid feed unit allows for excellent generating efficiency, adaptability to various weather conditions, flexibility, durability and safety. All operational parameters of the turbines are detailed in Appendix B, Section 1.

Turbine Operation

Under normal operating conditions, the Enercon E-82 turbines operate independently through telemetry of site data to a remote centre which controls each WTG. The normal period of operation is 24 hours per day, 7 days per week. Intermittent shutdowns occur when wind conditions are below the threshold of operation or when wind speeds exceed the safe operating conditions. When these

high wind speeds occur, the control system shuts down the turbine and blade rotation ceases. Operations are also interrupted during the servicing of equipment on the WTG.

The control systems for the turbines allow for continuous and automatic adjustment to changing wind patterns (see Appendix B, Section 1). Under normal operations, wind conditions are continuously identified, rotor speed, generator excitation and output are optimized and sensor messages are recorded.

When external temperatures are high during summer months, the generator fan inside the nacelle switch is on to provide additional cooling to the electrical equipment. During operation at partial load, the speed and power output are continuously adjusted. As wind speed increases, the rotor speed and power output will increase.

If rotor speeds drop too low because of the lack of wind, the turbine automatically switches to idle mode and then restarts automatically when the cut- in wind speed is reached (see Appendix B, Section 1).

Equipment Shutdown
In the event of extreme or unsuitable weather conditions, emergencies and maintenance activities, the turbines can be quickly shut down by manually activating the start /stop switch or by automatic shutdown. (See Appendix B, Section 1) The idle turbines are secured through the use of state of the art rotor braking, locking and pitch control systems (see Appendix B, Section 1).

Storms and Lightning
Even though the E- 82 components are designed to withstand wind speeds over 31 m/s, if an average wind speed of 31 m/s or a top value or 34 m/s is exceeded, the E- 82 automatic control mode stops and the turbines will switch to idle mode (see Appendix B, Section 4).

Survival wind speed is 59.5 m/s.

Lighting protection systems efficiently divert almost all possible lightning strikes with no damage to the turbine or electrical transmission equipment. Earth and lightning protection systems are discussed in Appendix B, Section 5**.**

Transmission Equipment
The E-82 transformer stations, switchgear, cables and substation will be operated and maintained according to specifications detailed in Appendix B, Section 1.

The substation is connected to the NSPI grid at the Point of Interconnection (POI) where the power and energy are transmitted and conveyed to customers along the NSPI electrical network. The power generated from each turbine will be closely

monitored for quality using modern SCADA systems and will be directly linked to NSPI's central control facility located in Ragged Lake, on the outskirts of Halifax.

Like the turbines, this equipment is designed for minimal maintenance and automatic or manual start up and shutdown. All electrical equipment will be ANSI/IEEE and CSA certified and compliant.

Road System

The approximately 22 kilometers of access roads at the site that will be used during the construction and operational phases will be maintained in accordance with provincial standards and design specifications detailed in Appendix B, Section 3 and Section 4. As there is minimal scheduled maintenance required for the turbines and transmission equipment, these roadways would be free of pedestrian and vehicular traffic most of the time. Only authorized personnel will have access to the site. Transport vehicles using the access roads will not exceed the maximum axle load of 10 tonnes.

During winter, snow clearing on the access roads will be conducted on an "as needed" basis in order to reduce potential environmental impacts on species of concern which can be negatively impacted by interference from humans or predators at that time of year. Roads and culverts will be maintained in good order to prevent erosion and to maintain surface water flow.

Lighting Systems

Lighting for turbines is required for aeronautical safety. The selection of a lighting system must consider the risk of attracting birds and bats and the potential for the disturbance of the aesthetic setting of nearby residences. To address the issue of compliance and to reduce potential environmental risks, the specifications for the proposed lighting system have been submitted to Transport Canada for an aeronautical evaluation. To minimize attracting birds and insects to turbine locations, there will be no base-level lighting system.

The proposed lighting systems will be installed on selected turbines in compliance with Transport Canada's requirements for Aeronautical Obstruction Clearance. An Aeronautical Obstruction Clearance Form #26-0427 has been submitted to Transport Canada with additional information regarding the locations, elevations and layout of the turbine locations (see Appendix C, Section 11). The lighting system design follows Transport Canada's Standard 621.18 Standards Obstruction Markings (the Standard).

The proposed Glen Dhu wind farm has 30 WTG's, which may be considered a cluster of structures under Section 2.5.5 of the regulation. For this purpose, the lighting system will be placed on the turbines which define outer perimeter of the wind farm and key turbines within that perimeter to identify overall figuration of

the site layout. Therefore, not all turbines will be lighted thereby by reducing the potential attraction for avian species and reducing potential visual distractions for neighbouring properties. Table 2.4 provides the coordinates of the WTGs and indicates the proposed layout of the aeronautical obstruction lighting.

The evidence on bird mortalities at manmade structures indicates that lights contribute to the incidence of bird mortalities [(1)]. There is limited evidence in the literature which suggests that short duration, flashing white lights of reduced intensity may decrease the potential attraction of birds. Following this evidence and in compliance with the Standard, the proposed lighting will be medium intensity, white, flashing, omni-directional obstruction lights as specified in Chapter 6 and Table 6-1 of the Standard. Appendix B of the Standard identifies this as CL-865 with a flash rate of 40 flashes per minute (fpm). The design specifications are shown in Table 2.3.

Table 2.3 Design Specification for Proposed Lighting System

Type	Beam Spread (degrees)		Intensity Step	Intensity (candelas)	Flash rate (fpm)	Flash Duration
	Horizontal	Vertical				
CL-865	360	3 (minimum)	Day& Twilight	20,000 +/- 25%	40	Less than 10 ms
CL-865	360	3 (minimum)	Night	2,000 +/- 25%	40	Between 100 and 250ms

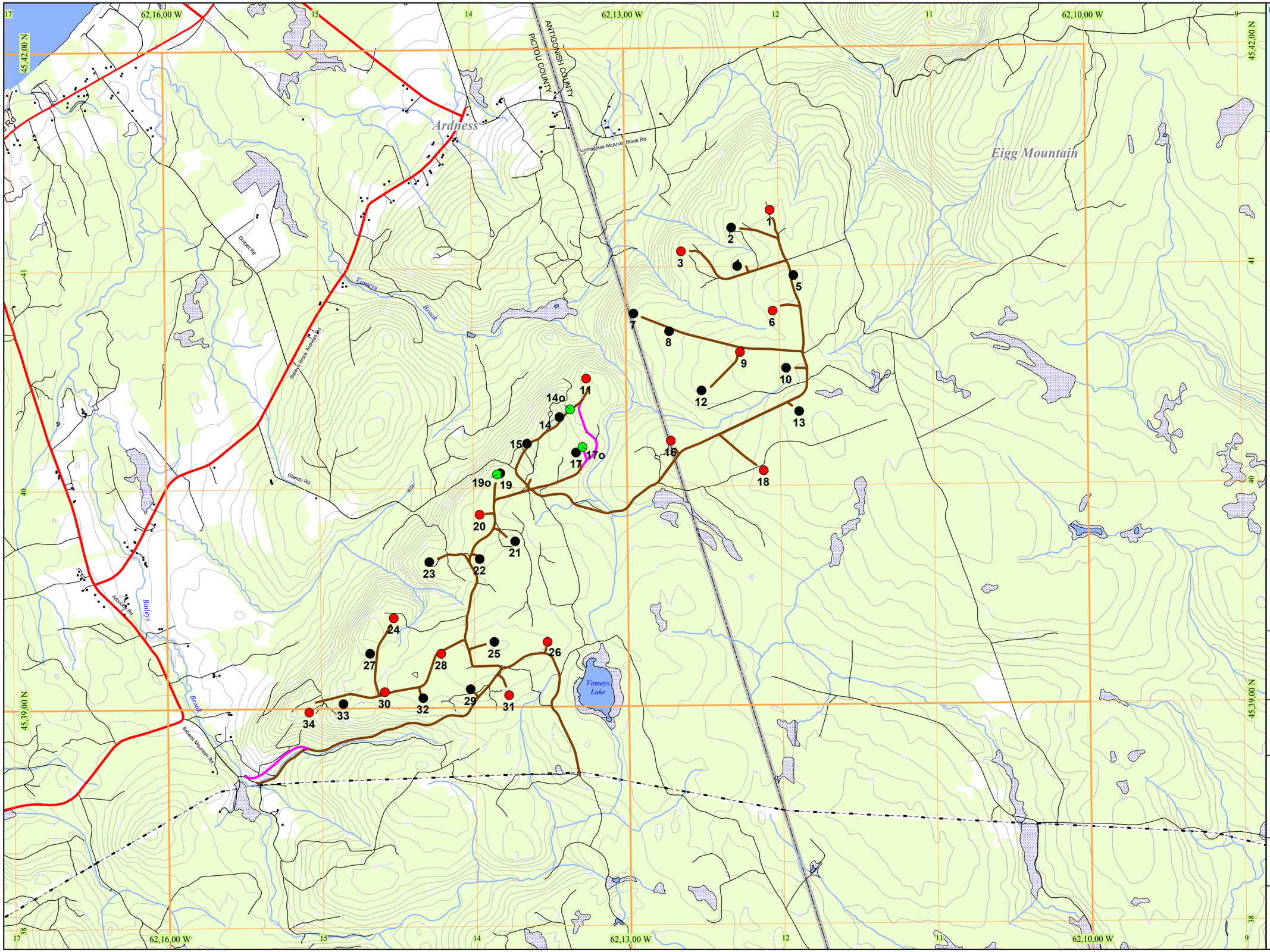
Bats navigate acoustically and are not subject to attraction to lights. They may, however, feed on flying insects which may be attracted to continuous light. The use of flashing lights will serve to reduce the attraction for insects and therefore bats particularly at the elevations (+80m AGL) of the top the nacelles where the lights are located. The absence of base-level lighting will minimize the attraction of the sites to insects and the potential attraction for feeding bats.

(1) US Federal Communication Commission, *Notice of Inquiry Comment Review Avain/Communication Tower Collisions*, September 2004

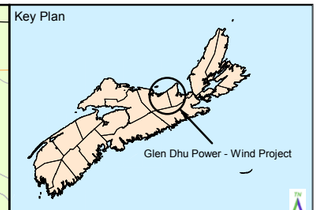
Table 2.4: Glen Dhu Turbine Coordinates and Aeronautical Lighting Plan

Label	Wind Turbine Number	Aeronautical Lighting	UTM East (WGS 84, Zone 20)	UTM North (WGS 84, Zone 20)	Latitude (N) (WGS 84)			Longitude (W) (WGS 84)			Elevation (El)	Hub elevation (El+ 78 m)	Elevation of Vertical Blade (El + 41m)
					deg.	min.	sec.	deg	min.	sec.	[m asl]	(m asl)	(m asl)
1	WEC 1	Y	562125	5059750	45	12	8	62	41	19	269	347	388
2	WEC 2		561800	5059600	45	12	23	62	41	14	259	337	378
3	WEC 3	Y	561375	5059400	45	12	43	62	41	8	234	312	353
4	WEC 4		561850	5059275	45	12	21	62	41	3	266	344	385
5	WEC 5		562325	5059200	45	11	59	62	41	1	281	359	400
6	WEC 6	Y	562150	5058900	45	12	7	62	40	51	277	355	396
7	WEC 7		560975	5058875	45	13	1	62	40	51	231	309	350
8	WEC 8		561275	5058725	45	12	48	62	40	46	246	324	365
9	WEC 9	Y	561875	5058550	45	12	20	62	40	40	274	352	393
10	WEC 10		562264	5058416	45	12	2	62	40	35	281	359	400
11	WEC 11	Y	560575	5058325	45	13	20	62	40	33	233	311	352
12	WEC 12		561550	5058225	45	12	35	62	40	29	263	341	382
13	WEC 13		562375	5058050	45	11	57	62	40	23	287	365	406
14	WEC 14		560350	5058000	45	13	31	62	40	23	255	333	374
14o	WEC 14		560438	5058063									
15	WEC 15		560075	5057775	45	13	43	62	40	15	248	326	367
16	WEC 16	Y	561290	5057800	45	12	47	62	40	16	245	323	364
17	WEC 17		560490	5057700	45	13	24	62	40	13	242	320	361
17o	WEC 17		560544	5057747									
18	WEC 18	Y	562075	5057550	45	12	11	62	40	7	274	352	393
19	WEC 19	Y	559850	5057525	45	13	54	62	40	7	247	325	366
19o	WEC 19	Y	559823	5057515									
20	WEC 20	Y	559675	5057175	45	14	2	62	39	56	255	333	374
21	WEC 21		559975	5056950	45	13	48	62	39	49	261	339	380
22	WEC 22		559675	5056800	45	14	2	62	39	44	259	337	378
23	WEC 23		559250	5056775	45	14	22	62	39	43	247	325	366
24	WEC 24	Y	558950	5056300	45	14	36	62	39	28	259	337	378
25	WEC 25		559800	5056100	45	13	57	62	39	21	279	357	398
26	WEC 26	Y	560250	5056100	45	13	36	62	39	21	270	348	389
27	WEC 27		558750	5056000	45	14	45	62	39	18	249	327	368
28	WEC 28	Y	559350	5056000	45	14	18	62	39	18	270	348	389
29	WEC 29		559600	5055700	45	14	6	62	39	8	269	347	388
30	WEC 30	Y	558875	5055675	45	14	40	62	39	8	257	335	376
31	WEC 31	Y	559925	5055650	45	13	51	62	39	7	256	334	375
32	WEC 32		559200	5055625	45	14	25	62	39	6	267	345	386
33	WEC 33		558525	5055575	45	14	56	62	39	5	242	320	361
34	WEC 34	Y	558236	5055502									

Notes: m asl = metres above sea level (rounded to nearest metre)



Key Plan



Legend:

Existing Features

- Paved Roads
- Local Roads
- Transmission Line
- Streams
- Forested
- Non Forested
- Water
- Wetlands

Project Features

- Proposed Roads
- Alternate Roads
- Proposed Lit WTG's
- Proposed Unlit WTG's
- Alternate WTG Sites, Unlit
- 33 WTG ID

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Figure 2.11
Aeronautical Lighting Plan

DWG No: A.1_08_07_08
REVISION: 3.0
SCALE: 1: 30,000
DATE: August 7, 2008
PRODUCED BY: NORTEK/STANTEC

2.5.12 Decommissioning and Abandonment Plans

It is unlikely that the project will be decommissioned in the foreseeable future as the demand for renewable energy is in a state of rapid growth and the costs of non-renewable energy sources continue to climb. The life cycle for the proposed WTGs is approximately 30 + years. The most likely scenario at the end of this life-cycle will be the replacement of the existing equipment. The existing systems would be removed from the site and sent for recovery and recycling of components. Existing foundations would be modified and adapted to meet the requirements of the replacement systems

When site decommissioning and abandonment takes place, the decommissioning phase will consist of the removal of surplus above grade equipment and utilities, rehabilitation of significant environmental alterations using native species of vegetation where indicated, and restoration of the sites by natural succession.

It is anticipated that the property owners will want to retain the main access roads through their properties and, therefore, the main access roads will not be decommissioned unless otherwise directed by the property owner. Entrance roads to the various sites will be re-vegetated as indicated above unless otherwise directed by the property owner.

2.5.13 Future Phases of the Project

Future phases of the project include the possibility of the installation of more wind turbine generators. This will require NSPI to announce another RFP and require SWI to meet the qualifications set out in the document. There are currently no announcements to indicate when this RFP will be called, but mandatory provincial renewable energy guidelines calling for 20% of Nova Scotia's power to be generated by renewable power production by 2013 would mean another RFP would be called in time to commission the power generation prior to the deadline.

SWI has secured enough land south of the Glen Dhu site to construct a Phase 2 project south of Highway 104. This project would be able to house between 25 and 45 more turbines. There have already been environmental screening processes, desktop studies, and some field work performed in the area of the future Phase 2 site.

3.0 SCOPE OF THE ASSESSMENT

3.1 Scope of the Project and its Assessment

This document has been prepared following the *Proponent's Guide to Wind Power Projects*, (NSDEL May 2007) and *Proponent's Guide to Environmental Assessment*, (NSDEL February 2001, revised October 2003). For purposes of assessment, under the terms of the Nova Scotia Environmental Assessment (EA) Regulations, this wind power project is a Class 1 undertaking. The purpose of this document is to register the undertaking with EA Administrator for regulatory review of the project leading to ministerial approval for the project.

Copies of the Registration Document have been placed at locations which are accessible to the public and are the closest public locations to the Project. They are the Lismore Variety Café in Lismore, and the Lower Barney's River Gas Bar and Agency Liquor Store in Lower Barney's River. Within seven days of the formal submission of this document, SWI placed a public notice in the prescribed format in newspapers with local and province-wide circulation to advise the public of the undertaking and locations for accessing the registration document.

Prior to this formal submission, SWI has held discussions with stakeholders and regulators at the regional, provincial and federal levels. The purpose of these discussions was to gain insight into potential public and regulatory issues related to the project activities.

3.2 Consultations with Provincial and Municipal Governments, Aboriginal Groups, Public and Other Stakeholders

A community engagement plan has been developed to inform the public of the project and to provide details to address questions and possible public concerns. As discussed in Section 1.7, contacts have been initiated with personnel from various levels of government (see Table 1.2) to discuss the project in terms of the regulatory approvals process and address a process for public engagement. The community consultation process is an ongoing program and will continue over the pre-construction and construction phases of the project. SWI will work with the municipalities and the province to provide public access to the project plans and details as the project develops. As part of this program, consultations have been held with the following non-government stakeholders:

- Pictou County ATV Club: contacted club president to inform him of proposed project and to hear any concerns the club may have with effects to their recreational use of the project area.

- Pictou County Sno-Riders (snowmobile Club): contacted club president to inform him of proposed project and to hear any concerns the club may have regarding their recreational use of the proposed project area.
- Federation of Nova Scotia Woodlot Owners: contacted executive Director Andrew Fedora to get an opinion of WTGs and their relations to woodlots/woodlot owners in Nova Scotia. A letter was written and adopted by the committee on January 24, 2007 (Appendix C, Section 1).
- Nova Scotia Wild Blueberry Growers Association: contacted club president, Mr. Dave Percival to inform him of the project and to hear any concerns from association members regarding potential loss of livelihood in the project area. No objections were made on their behalf.
- Confederacy of Mainland Mi'kmaq (CMM): met with Dr. Don Julian, Director, and their in-house archaeologist, Leah Ruddunbauer, to discuss the project location in relation to any First Nations interests or usage of the area. He was provided with a detailed PID list, as well as a four-cornered set of coordinates to check their database for any land issues. SWI has contacted him several times since the meeting and no concerns have been mentioned.
- Since that time, SWI has initiated further contact with First Nations through Twila Gaudet with the Mi'kmaq Rights Initiative and Michael Cox with the Confederacy of Mainland Mi'kmaq.
- Native Council of Nova Scotia (NCNS): met with Roger Hunka, Cory Francis, Joshua McNeely and Franz Kesick to discuss the project location in relation to any First Nations interests or usage of the area. The proponent provided information on the project location and scope. Issues related to environmental impacts and ecological resources of concern to First Nations were discussed. As follow-up, SWI provided a copy of this document to the NCNS.

3.3 Identification of Issues

CEAA

It is the role of the CEAA, when triggered in the Environmental Assessment process by the application from SWI to ecoENERGY Renewable Initiative, to evaluate the EA for regulatory compliance as well as ensure proper permitting is completed. The issues Derek McDonald had concerning this project dealt with the following:

- Under Transport Canada: to make sure the transportation of the large loads comply with regulations set out for oversized loads, such as permitting, and that SWI has permission to haul these loads over the roads;
- Under Nav-Canada: to ensure SWI complies with any aeronautical obstruction clearance regulations, as well as lighting on the turbines;
- Under CWS: to ensure the EA is done according to the *Migratory Birds Convention Act* and following the CWS article *Wind Turbines and Birds: Protocols for Monitoring Birds for the Purpose of Wind Turbines*;

- Under DFO and Canadian Coast Guard: *Fisheries Act* and *Navigable Waters Protection Program,* if required; and to identify any species of concern in the project area which fall under the *Species at Risk Act (SARA).*

CWS
Dan Busby, formally the Director for the CWS for Breeding Birds, was consulted during the early stages of the project. He assisted in determining what issues were of importance to the CWS. The issues and concerns were (Appendix C, Section 2):

- Development of a proper knowledge base for all aspects of the Bird Study, including desktop work;
- The actual Breeding Bird and Migratory Bird studies;
- The reporting format to be used by the contract ornithologist/ birder; and
- With regards to bats, the issues were whether there are known hibernacula in the area, or if the project lies within a migratory flight path.

NSE – Environmental Assessment Division
The Environmental Assessment process is overlooked primarily by NSE. The contact for this office is Helen MacPhail. She was able to give an overview for submitting an EA which contains all pertinent studies and information required. The main issues are:

- First Nations consultation;
- SARA;
- Public consultation;
- Archaeological significance studies (desktop and field surveys);
- Nova Scotia Department of Transportation and Public Works (NSDTPW) permitting;
- Municipal permitting and setback guidelines;
- NSE permitting and compliance; and
- Proper formatting of the registration document.

NSE
NSE has guidelines and regulations for watercourse crossings and alterations, which must be complied with for all installations of culverts and bridges. This project entails upgrading and building road systems to deliver and access each turbine location. During the construction Shear Wind will have to, inevitably, replace, upgrade or install new crossings. The issues raised by NSE included:

- Maintaining regulatory guidelines for all crossings; and
- Permitting for any alterations of wetlands.

SWI will ensure compliance with all regulations regarding water crossings and alterations for the province of Nova Scotia (Appendix C, Section 3).

Nova Scotia Department of Tourism, Culture and Heritage – Heritage Division
This department was consulted at the preliminary stages of the project for the initial desktop report on any historically, archaeologically, or environmentally significant findings within the project boundaries. The screening report detailed the following issues:

- Historic period archaeological sites relating to 19th Century settlement of the area;
- Records of species of concern in nearby areas; plants known from the vicinity of the project area to be considered; and
- Archaeological and heritage issues are to be studied by qualified individuals and reported along with the EA.

Nova Scotia Department of Natural Resources
The project lies within two regions covered by DNR; Antigonish County, and Pictou and Colchester Counties. SWI met with the Regional Biologists for both areas. Their concerns were:

- Mainland moose;
- Bat populations;
- Breeding and migratory birds; raptors; other species listed on either SARA or COSEWIC;
- Land clearing;
- Noise constraints; and
- Road building activities.

First Nations
On February 27, 2008, project personnel met with Michael Cox, Director, Lands, Environment and Natural Resources, Confederacy of Mainland Mi'kmaq (CMM). The meeting was held to identify issues of concern to the First Nation community prior to the submission of the Registration document. Subsequently, a meeting was held with Ms. Norma Prosper of the Confederacy of Mainland Mi'kmaq and the terms and scope of a Mi'kmaq Ecological Knowledge Study were developed. This study has been initiated in April/May 2008 and a report will be completed by early Fall 2008.

Concerns were:

- Presence of traditional hunting, fishing areas;
- Presence of traditional gathering areas for botanicals used in food, medicinal and spiritual practices;
- Locating any tangible native artifacts; and
- Addressing historical use of the area known through the First Nations elders passed down by word of mouth through generations.

Municipality of the County of Pictou

Recently, the Pictou County Council introduced a Land-use By-law specifically directed at the construction of both large and small-scale wind turbine generators. Prior to this time, a local wind developer had submitted a draft set of by-laws for the municipality to review which were based on various scenarios including local land parcel sizes, population demographics and Canadian Wind Energy Association's (CANWEA) recommendations.

Prior to the implementation of the by-law, SWI had also consulted with the county on setback distances for wind turbines in the municipality (Appendix C, Section 4). A meeting was held with Brian Cullen, Clerk for the Municipality of the County of Pictou regarding zoning for wind turbines within Pictou County, on November 28, 2006. He was presented with a preliminary figure of 30 turbines in the Glen Dhu project site and asked to comment on whether those areas were subject to zoning or planning criteria for the county. Mr. Cullen wrote a letter stating that there was currently no land use planning or zoning by-laws that would restrict the development of wind turbines in the county of Pictou (see Appendix G – 1 letter from the Municipality of Pictou).

Over the next few months the Municipality hired an outside consulting firm to help develop a set of by-laws to be voted on. Fulton Energy Research, on behalf of Shear Wind Inc, played an active role throughout this entire process, attending meetings, submitting comments, and maintaining contact with municipal council, clerk and warden.

In March 2007 the Municipality held three open house sessions regarding the proposed by-laws drafted by 3G Consultants. The Proponent then submitted a letter of concern with the draft document along with recommendations. On June 13, 2007 a final draft was circulated to those involved in the process of developing the by-law (appendix G – 2) (letter from Municipality of the County of Pictou). On September 13, 2007 a public hearing was held, simultaneously with a second hearing and vote on the matter in which the council voted 11 – 3 in favour of passing the bill. The final version of the Municipal Planning By-Law can be found in Appendix G – 3, Section 4.

A summary of the setback distances is: 300m from a maintained road; 600 m from a dwelling; and turbine height plus blade length away from external property boundary lines. In conversations with SWI, the Municipality was avid about keeping communication between the developer and the county for the following issues:

- Setback distances from residences, government roads, and property lines;
- Noise emissions;
- Road construction;
- Safety issues such as ice throw, turbine blade failure, turbines falling over, transportation of the turbine components;
- Decommissioning of non-functioning turbines;
- Visual influence;
- Property values; and

- Public concerns.

Municipality of the County of Antigonish
The proposed project also falls within the Municipality of the County of Antigonish. Twelve of the 30 turbines will be located within Antigonish County with an additional two turbines very close to the county boundary. There is currently no by-law or guideline for construction of wind farms in the county, but it is anticipated that a by-law will be implemented in the near future.

Alan Bond, municipal Clerk and Treasurer was contacted in early April 2007 to inquire about the existence or lack of a setback guideline or by-law considered for the Antigonish County concerning wind turbines. A meeting followed on May 23, 2007. During this meeting, Mr. Bond was informed of the intent of SWI to construct a wind farm, its progress so far, the newly drafted Pictou County setback distances, as well as a visual representation of commercial scale wind turbines and some information about them. The following issues were also discussed:

- setback distances from residences, government roads, and property lines;
- noise emissions;
- road construction;
- safety issues such as ice throw, turbine blade failure, turbines falling over;
- transportation of the turbine components;
- decommissioning of non-functioning turbines;
- visual influence;
- property values; and
- public concerns.

It was clear that at that time, the county had yet to consider what stand to take on implementing a by-law to deal with the prospect of future wind development in Antigonish (appendix G – 4) (email from Alan Bond to Lisa Fulton).

The Municipality of Antigonish has since contracted the Eastern District Planning Commission to draft a by-law for the matter. Two public open house sessions were held and comments were received to the Planning Advisory Committee. They recommended amendments to the current draft based on comments received. As of July 17, 2007, this is the most up-to-date information available for the municipality of Antigonish and the implementation of a zoning by-law for installation of wind turbines.

James River Watershed Stewardship Board
Initial siting of turbine locations included two 100 acre parcels of land owned by the Town of Antigonish and located within the James River Watershed Protected Area. The protected area of the James River Watershed supplies potable water for the Town of Antigonish, approximately 25 km east of the project boundary and is governed by the Town Council. Through various meetings with council, it was agreed to lease the two

parcels of land to SWI for the placement of WTGs and access roads. In negotiating the lease, the following issues and concerns were identified:

- setbacks from streams and water courses;
- relative locations of turbines within the watershed;
- EMP and EPP;
- revenue created from rent;
- enhancement of awareness and concern for James River Watershed;
- non-tangible environmental return for the Town of Antigonish; and
- assistance in future discussions with the town's electrical utility on matters involving an alternative power supply.

Subsequently, revisions to the turbine siting plan eliminated these sites from the present phase of the project. Eliminating the proposed turbine sites within the James River Watershed removes potential environmental issues concerning potential impacts on the watershed and the protection of the Town of Antigonish water supply.

Members of Legislative Assembly for Nova Scotia
MLA's for both Pictou East and Pictou West were consulted for their input and any concerns they may have with the construction of a wind farm in Pictou County. They raised the following issues:

- Municipal revenue from the wind farm;
- Employment opportunities for local workers;
- Reduction of Greenhouse Gas emissions;
- Financial incentives for landowners; and
- Public consultation process.

Positive support from Clarrie MacKinnon was expressed in a letter dated June 20, 2007 (Appendix C, Section 6).

As identified in previous sections, SWI has initiated contact and discussions with a large number of public authorities, regulators, stakeholders and the public. The environmental review process following the submission of this Registration Document will provide additional opportunities for public and regulatory review and concerns and issues related to the project. SWI will initiate such contacts as required to harmonize the project with regulatory guidelines and objectives and will review and address these issues through mitigative measures as documented in the Environmental Protection Plan (EPP) and Environmental Management Plan (EMP). During the project, SWI will initiate a public information program to hear concerns and provide information and the opportunity for open public discussion.

3.4 Identification of Species of Concern

A list of possible species of concern for this proposed development area was obtained from an online database provided by the Atlantic Canadian Conservation Data Center (AC CDC). These data came in a large file (considering the 100 km radius requirement) and has been shortlisted for close vicinity of center point (Appendix C, Section 7). Consultations were arranged with Wildlife Division staff and Regional Biologists. Databases for these species were reviewed to determine if their habitats included the exposed hilltop sites where the machines could be erected.

Vascular Plants
Field studies (2007 and 2008) were undertaken by one of Eastern Canada's most recognized botanists to determine if any of the rare vascular plant species on the records located within 100 km of the site existed within the proposed development area. Each site was pre-programmed into GPS units; then visited. Photographs and notes recorded species composition, forest stand ages and obvious disturbance, and histories of plant communities that were located. In addition to the turbine sites, other different or interesting habitats were assessed when they were encountered. A vascular plant list was compiled for the site as a whole, with estimates of relative species abundance given (see Appendix D, Section 1 and Section 2).

Invertebrates
A review of invertebrate species of concern was undertaken with a data search to establish habitat preferences to be compared with the sites where towers for wind energy generation would be erected.

Birds
Information was gathered through telephone interviews, documents and databases available on the internet and field surveys of the proposed sites. The field surveys included 16 area searches, 12 standardized area searches, and 41 point counts. Methodologies were those recommended and used by Environment Canada and Canadian Wildlife Service to provide data on species present, breeding status, relative abundance and habitat use.

Bats
Anabat II detection systems were used at ground level to sample the echolocation calls of bats. These units monitored commuting or foraging activities at two locations along forest edges. They were connected to a CF Storage ZCAIM (Titley Electronics Ltd., NSW Australia). The sampling period corresponded with fall migration activities. Echolocation calls were identified qualitatively by comparison with known sequences of known species recorded in this and other geographic regions. Identifications were made using frequency-time graphs in ANALOOK software (see Appendix D, Section 4).

Fisher
A small population of fisher inhabits this region.

Moose

This area has historically been moose habitat. A small population of endangered mainland moose remains in the Cape George – Beaver Mountain area where this development is proposed. No sign of the presence of moose were note in staff site visits. The presence of whitetail deer was commonly noted in the project area.

The Moose PG1 Survey was conducted in May of 2008. The survey involved walking specified transects and searching one meter on either side of the transect for moose pellet piles.

The transect locations were identified by DNR's Regional Biologists covering the two counties in which the proposed Glen Dhu Project lies. These locations can be seen in Figure 3.1. Due to the sensitivity involved regarding Mainland Moose in Nova Scotia, all information will provided to DNR.

Ardness
Eigg Mountain
Dunmaglass-McArras Brook Rd
PICTOU COUNTY
ANTIGONISH COUNTY
Guysted Rd
Vameys Brook
Bailey's Brook Ardness Rd
Glendu Rd
Ardness Rd
Baileys Brook
Browns Mountain Rd
Vameys Lake
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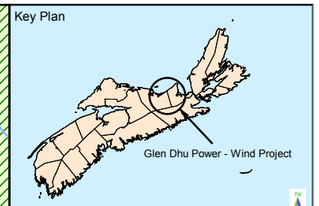
Key Plan



Legend:

Existing Features

- Paved Roads
- Local Roads
- Transmission Line
- Streams
- Forested
- Non Forested
- Water
- Wetlands
- Eigg Mountain Wilderness Area
- James River Watershed Area

Project Features

- Project Site
- Proposed Roads
- Optional Proposed Roads
- Proposed WTG's
- Optiona WTG Sites
- Moose Transects
- 6 Transect ID

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Figure 3.1
Transect Locations for Moose PGI Survey

DWG No: 3.1_08_07_08
REVISION: 3.0
SCALE: 1: 30,000
DATE: August 07, 2008
PRODUCED BY: NORTEK/STANTEC

4.0 DESCRIPTION OF EXISTING ENVIRONMENT

4.1 Geophysical Environment

The Pictou/Antigonish Highlands, where this project is located, is underlain by a block of old crustal rocks that have been bisected by several faults. The average elevation of this Highland is about 245 metres. Some candidate sites are located along the top of the 200 metre tall scarp of the Hollow Fault, which extends from Cape George almost to New Glasgow. The prominence of the scarp slope along the border of the Pictou-Antigonish Highlands, and its exposure to prevailing westerly winds off the Northumberland Strait, makes these sites prone to wind. Figure 1.2 highlights this topographic feature of the site.

4.1.1 Physiography and Topography

The proposed Glen Dhu Wind Project is located in the highland area north of Highway 104 between New Glasgow and Antigonish. The topography features highland areas with elevations which range up to 300m above sea level intersected by numerous steep sided valleys and streams. Highland areas may have perched wetlands of various sizes (typically less than 1 hectare) which form the headwaters of the streams. The terrain is largely tree covered and has been extensively logged over the past century. The area has an extensive network of forest roads which provide access for much of the forest operations, as well as a large number of frequently used trails for recreational purposes. Over the years, culverts and bridges of various sizes and types have been installed in these roads to provide drainage and to minimize the potential for washouts.

Figure 4.1 shows the topography, streams and wetlands of the subject area with the existing forest roads.

4.1.2 Soils and Bedrock Geology

SWI commissioned Jacques Whitford Engineering to conduct a preliminary geotechnical assessment of the proposed area to assess the suitability of the soils and bedrock to support the footings for wind turbines. A copy of their report entitled, *Preliminary Geotechnical Assessment, Proposed Wind Farms, Glen Dhu Wind Farm, Barney's River, Nova Scotia* is attached in Appendix C, Section 8 of this document. The findings of this report indicate that soils of the subject area are considered *"generally suitable for spread footings construction for this application"*.

Areas of exposed surface bedrock and bedrock with a shallow overburden are also present which would require the placement of grouted rock anchors to secure turbine towers. Geotechnical studies are required at each of the proposed turbine locations to assess the site specific soils and geology prior to preparing the engineering design for the foundations specific to each turbine site.

Ardness

Eigg Mountain

Dunmaglass-McArras Brook Rd

PICTOU COUNTY

ANTIGONISH COUNTY

Glasset Rd

Bailey's Brook-Ardness Rd

Glendu Rd

Vameys Brook

Baileys Brook

Ardness Rd

Blooms Mountain Rd

Vameys Lake

1 2 3 4 5 6 7 8 9 10 11 12 13 14o 14 15 16 17o 17 18 19o 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

Key Plan

Glen Dhu Power - Wind Project

Legend:

Existing Features

- Paved Roads
- Local Roads
- Transmission Line
- Streams
- Forested
- Non Forested
- Water
- General Wetlands
- Beaver Flowages
- Open Bogs
- Treed Bogs
- Lake Wetlands
- Eigg Mountain Wilderness Area
- James River Watershed Area

Project Features

- Project Site
- Proposed Roads
- Optional Proposed Roads
- Proposed WTG's
- Optional WTG Sites
- 33 WTG ID
- Laydown Area
- Transformer Station

TN

10 m Contour Interval

Shear Wind Inc.

Stantec

Nortek Resource Solutions Inc.

Glen Dhu Power-Wind Project Registration Document

Figure 4.1
Site Topography, Streams and Wetlands

DWG No: 4.1_08_07_08
REVISION: 3.0
SCALE: 1: 30,000
DATE: August 07, 2008
PRODUCED BY: NORTEK/STANTEC

4.1.3 Seismicity

Natural Resources Canada (NRCAN) is responsible for measuring and documenting seismic activity in Canada. A review of earthquake information was conducted on the NRCAN website at:

http://www.earthquakescanada.nrcan.gc.ca/zones/eastcan_e.php (Appendix C, Section 9).

The Northumberland shore area is part of the North American Plate and is, therefore, in a stable geological formation. The information indicates that earthquake activity has not been recorded in the region of the Glen Dhu site.

4.1.4 Groundwater and Potable Water Resources

Groundwater resources within the project area are not used to supply residential potable water. The project area is adjacent to the James River Watershed which supplies water for the Town of Antigonish, which is approximately 25 km east of the project boundary. The project will not require access to or use of groundwater. The James River water supply protection area lies to the east of the project site. The upper reaches of the northwest tributary and the water supply protection area are in close proximity to the eastern boundary of the projects leased properties. Figure 2.3 shows the project property lines and the natural and protected boundaries of the watershed property and the Eigg Mountain Wilderness Area.

The Town of Antigonish has reviewed the project in relation to the potential siting of WTGs within the two parcels of land on the western edge of the watershed lands. Council voted in favour of allowing WTG development on these lands. Subsequent re-siting of the turbine locations has eliminated these sites for this phase of development. As such, the boundary of the watershed lies outside the project boundary

4.2 Aquatic Environment

The shore of Vamey's Lake is adjacent to one of the leased properties for the project. There are no other significant lakes in the project area. The highlands are intersected by streams fed by tributaries originating in uplands areas. In some areas, the tributaries flow from small (less than 1 hectare) perched wetlands. Existing surface water drainage is constrained by private woods roads which crisscross the project area. For approximately the past 150 years, the project area has been logged a number of times and wood harvesting operations are presently conducted on many wood lots. The network of woods roads has developed over the years with various sized culverts to provide drainage. The access roads are, to a great extent, on private land and are maintained on an as needed basis by the land owners.

Surface water drainage is maintained by culverts of various sizes in the roads. The locations of culverts and bridges have been determined by surface water drainage and the need for road access to forest stands. To a large extent, surface water flow is maintained by these culverts which have been placed to prevent or reduce erosion and undermining. In some areas, surface water drainage which is interrupted by the presence of the woods roads is directed down-gradient in road side ditches. In most cases, these ditches direct the drainage to a culvert or stream. Such anthropogenic activities have altered the natural habitat of the area and resulted in modifications to natural ecosystems.

The waterways on the upland areas of Pictou-Antigonish Highlands are headwater streams for relatively small watersheds, relatively sterile with respect to nutrient inputs, but nevertheless have good pH levels. There are few lakes or wetlands, and the aquatic habitats are mainly home to speckled trout and sticklebacks.

4.2.1 Aquatic Habitats

No stream habitat surveys were found in a literature review of the library of the Inland Fisheries Division, NS Department of Fisheries and Aquaculture for this region.

These waterways begin with small headwaters on the upland, followed by a characteristically steep descent over the scarp into the lower-gradient streams and rivers of the valleys below. Cool summer temperatures and the small area of these watersheds render them relatively sterile compared to more complex, larger watersheds throughout continental North America.

The aquatic habitats on the upland areas near the candidate sites are stream habitats. These include riffles (0.5m deep, 0.3 metres/second in velocity), flats (0.5m deep, 0.3 metres/second velocity) and pools (0.5 m deep, 0.3 metres/second velocity).

Vamey's Lake, formerly called Leech Lake is the only lake close to the candidate sites. It has not been surveyed by the Inland Fisheries Division, NS Department of Fisheries and Aquaculture.

4.2.2 Aquatic Fauna

Typical stream invertebrates for this upland region include snails, unsegmented flatworms, earthworm-like *Oligochaetes*, leeches, spiders, crustaceans (scuds) *Diptera* larvae and pupae, aquatic hard-winged beetles, water boatmen and backswimmers, water striders, stoneflies, dragonflies, caddis, damselflies and mayflies.

The cool atmosphere and relatively high rates of rainfall/snowfall make these upland streams good habitats and summer refuge for brook trout (also called speckled), *Salvelinus fontinalis*. Freshwater fish species found within the lower reaches of these watersheds include breeding populations of introduced brown

trout *Salmo trutta*, occasional introduced rainbow trout *Oncorynchus mykiss* that have not developed self-sustaining populations, white sucker *Catostomus commersoni*, sticklebacks (Order Gasterosteiformes), golden shiner *Notemigonus crysoleucas*, yellow perch *Percha flavescens* and banded killifish *Fundulus diaphanus*. In addition to freshwater species, anadromous fish species include Atlantic salmon *Salmo salar*, brook and speckled trout, brown trout, rainbow trout, rainbow smelt *Osmerus mordax*, and blueback herring *Alosa aestivalis*. In Barney's River there are also alewife or gaspereau *Alosa pseudoharengus*. Sea run components of species or species tend to use the lower reaches of the waterways below the scarp.

The catadromous American eel *Anguilla rostrata* inhabits the lower reaches of these watersheds, and also ascends these waterways to inhabit the upland brooks. In addition, speckled trout and sticklebacks inhabit the upland reaches of these watersheds. Brook trout populations above the scarps tend to be freshwater only and not anadromous in habit.

Fish passage from the valley or coastal plain below to upland headwater streams is frequently blocked by waterfalls (e.g. James River). Where fish passage exists, such as in Barney's River, upstream habitats become important summer thermal refuges for speckled trout, which prefer water temperatures in the range of 7.2 – 12.8 C and can tolerate 0.5 – 22.2 C. In the lower parts of these waterways, summer water temperatures in widened channels, combined with low water levels, can yield temperatures that reach beyond speckled trout upper tolerance limits and prove lethal to trout.

4.2.3 Aquatic Vegetation

No aquatic vegetative census has been taken of these streams or Vamey's Lake. Primary energy inputs to the streams would be leaf-fall in the autumn. The likely vegetative plant species, based on DNR surveys (Bancroft, B. pers. comm) which have been conducted on similarly-located quiet waters, would include the following: *Nuphar luteum* (yellow water lily); *Vallisneria americana* (eelgrass) Pipeworts, which grow in mats or sediments; *Lobelia dortmanna*; *Carex lacustris* (Lake sedge); *Sparganium* (Bur-reed); *Myriophyllum alterniflorum* (Little watermilfoil); *Isoetes* (Quillworts); and moss and algae.

4.2.4 Surface Hydrology

Surface water on the upland takes the form of brooks, streams and rivers. The conductivity of stream water ranges between 28 and 54 micromhos/cm, while the pH averages 6.4. The normal dendritic watershed drainage pattern is interrupted in this landscape by fault lines where valleys have formed in areas of differential erosion.

Principal waterways that drain from the candidate upland sites to the north and west into the Northumberland Strait are Vamey's Brook, Bailey's Brook and

Barney's River. Waterways that drain from the upland to the south and east are the James and Beaver Rivers. The latter two eventually join the West River, Antigonish County, which in turn empties into St. Georges Bay.

There are a few lakes in this region. Vamey's Lake, a headwater lake formerly called Leeches Lake, is the only lake situated near the candidate sites. No lake survey has been conducted by the Nova Scotia Department of Fisheries and Aquaculture, Inland Fisheries Division, on Vamey's Lake.

4.2.5 Surface Water/ Sediment Quality

This Highland is underlain principally by soils of the Thom catena. These have developed from a dark grayish-brown sandy loam till derived from shales, gray conglomerate and metamorphic material. On the upland, these soils have an undulating topography that is dissected by steep slopes. Overall drainage is good due the porous nature of the soil. The stoniness of the soil is variable. On slopes and over the summer, the soil dries out. Poorly drained depressions occur where the topography combines or the subsoil is tight enough to restrict the movement of water.

Sediments tend to be sandy through to cobble-size particles. Surface water takes the form of streams. Erosion is severe on some of the steeper slopes, and gullying is evident in many places.

4.3 Terrestrial Environment

4.3.1 Vegetation

The forests that are naturally found on the plateaus of these uplands or highlands, as they are variously called, are removed from the direct effects of the Atlantic Ocean. They are influenced by generally well-drained soils, abundant precipitation and relatively cooler temperatures. Yellow birch, sugar maple and beech were the predominant original tolerant hardwood forest on the uplands. Pockets of red spruce, white spruce, balsam fir and hemlock were scattered on the upland flats, and formed stands of conifers on the lower slopes and valley bottoms.

On the candidate site locations, which are all on private land, some forest stands have been repeatedly high graded (cutting the best) in the past or more recently clear-cut (cutting everything). Where farms had been established and subsequently abandoned, white spruce has grown in on the fields. This has resulted in a reversal of forest succession which, in combination with the high exposure to wind on these sites, has generally left the candidate sites containing a mix of original as well as disturbance forest species.

Hardwoods still predominate on well-drained sites, but trembling aspen, largetooth aspen, white birch, gray birch, pin cherries as well as red maples are

now more common. Wetter soils have speckled alders, balsam fir, white birch as well as black and white spruce. Norway spruce and red pine plantations were found on some locations.

A field inventory of the vascular plants was undertaken by Sean Blaney and David Mazerolle of the Atlantic Canada Conservation Data Centre (AC CDC). A full vascular plant list as a whole was compiled for the initial project area from the scarp slope in the Pictou-Antigonish Highlands south to the Beaver Mountain area. For this survey, a list of all rare species records found within 100 km of the project area was assembled prior to the survey being undertaken in June and July, 2007. All rare species were noted. Descriptions of the plant communities within the project area are given. Notes on proposed locations for placement of WTGs on each site relative to the plant communities are listed. The 36 sites which apply to the immediate project area are: GD02 to GD06, GD08 to GD11, GD15 to GD 20, GD22, GD24, GD30, GD33, GD36, GD46, and GD50 to GD 65. Figure 1of Appendix D, Section 1 shows the location of these sites.

Since this survey, the site optimization and selection process has changed the project area and turbine location to the highland area along the scarp face. Thirty-six of the initial 75 proposed turbine locations assessed in this study can be used to characterize the present project area. The site specific plant inventories may not be on WTG sites in the final design; however, the study provides a valid characterization of the plant communities represented in the project area. Site specific plant surveys have been conducted by Sean Blaney on the final sites and access roads in June 2008 and these data has been used in the micro-siting stage of the design and the preparation of the final layout configuration for access roads and turbine laydown areas.

4.3.2 Wetlands

The vascular plant survey conducted by Sean Blaney and David Mazerolle identified forest swamps, alder swamps, seeps and open marshy areas on the proposed wind generator placement sites (See Appendix D, Section 1, Table 1). Subsequent to this survey, turbine locations have been revised to optimize local wind energy patterns. The initial assessment of wetlands identified turbine sites which required adjustments to avoid wetland areas. For the revised project site, surveys of the final WTG locations have been conducted by the Sean Blaney in June 2008 and this data has been used in the micro-siting stage of the design and the preparation of the final layout of each turbine location.

4.3.3 Wildlife

The wildlife in this region is supported by the climate, geophysical features, and habitats previously described. The latter include mature hardwood, softwood and mixed wood habitats, old field white spruce, and small streams with few bogs or lakes. There are cutovers and plantations. Large mammalian species in this area include black bear, moose, white-tailed deer, coyote, bobcat, otter, fisher,

snowshoe hare, mink, muskrat, short-tailed weasel, beaver, porcupine, northern flying squirrel, red squirrel, and chipmunk.

The occasional striped skunk, red fox and raccoon might also be found in these uplands. Woodchucks may be still using old house foundations on abandoned farm sites. Cougars have been reported in the Cape George area in past decades although their presence has yet to be officially scientifically substantiated. Smaller mammals - a variety of mice, voles, shrews and the star-nosed mole inhabit the forest floor and woody debris on it. Two species of bats - the northern long-eared and little brown bat are common in eastern Nova Scotia.

Breeding bird notes were compiled by Sean Blaney and David Mazerolle when they did field surveys for vascular plants during June and July, 2007. These are referenced in Appendix D, Section I.

John F. Kearney and Associates was commissioned to field survey and compile an avian environmental assessment for these sites to assess the sensitivity of bird populations to the construction phase and deployment of wind machines. These surveys included the following: Migration Stop-over, Diurnal Passage, Nocturnal Passage, a Winter survey as well as a Breeding Bird Survey.

The Kearney study is listed in Appendix D Section 3. A total of 80 breeding bird species were noted on the site. Birds were seen on disturbed habitats such as clear-cut, regenerating and early succession habitats. No major concentrations of birds occurred in the study area during the migration period. Edge habitats were favoured by most migratory species. Few birds (19 species) wintered on the Pictou-Antigonish Highlands area where the proposed turbines would be located.

Wet areas and the riparian land around them in this area form important habitats for a variety of amphibians - frogs, and salamanders. Northern spring peeper, green frog, wood frog, northern leopard frog, blue-spotted salamander, yellow-spotted salamander, and eastern redback salamander are probable inhabitants. This is based on references and personal field experience during the authors work as a Regional Biologist in the two counties during the 1970's and 1980's. The Maritime garter snake is also a certain inhabitant of the area.

4.3.4 Species of Concern

In Nova Scotia, it is required that any data search conducted for the listing of species of concern be done with results for a 100km radius around a center point. This desktop search was performed by Stefan Gerriet of the AC CDC in Sackville, New Brunswick. The findings contain all recorded species found dead or alive, and indicators such as nesting areas, or other evidence to indicate the presence of the species. Due to the sheer size of this file (over 750 pages of excel files) it is not present in this document.

Because of the location of the project being within range of coastline under the restrictions of the search, a shortlist of a smaller radius search was compiled and can be seen in Appendix C, Section 7. A spreadsheet compiled by Sean Blaney lists all reported botanical species in the vicinity of the project area (Appendix D, Section 1, Table 3).

Plants

Appendix D, Section 1, Table 4 contains the coordinates for the 75 locations checked by Sean Blaney and David Mazerolle in June and July of 2007. A visual representation of these locations can be viewed in Appendix D, Section 1, Figure 1.

A vascular plant inventory presented in Appendix D, Section 1 documents that 25 of the initial WTG sites present very little plant concern. Of these initial sites, 13 fall within the boundary of present revised project area. The 75 metre radius development footprint in these instances encompasses old fields, recent clearcuts, or clearings like logging roads and landings.

It was noted in the vascular plant study, that 19 of the original turbine sites were within 75 m of wetlands or streams. Of these locations, 6 fall within the boundary of the present project area. Wetland areas offer potential habitat for vascular plants some of which may be species of concern.

The development footprint of 17 of the initial project sites falls entirely or almost entirely in mature forest (75 + years). In most cases, this is deciduous and primarily sugar maple stands. While these stands are not considered rare, if the turbines can be placed in less mature stands this will be done to reduce impacts on natural heritage values.

The remainder of the sites were located in lesser quality stands or in younger age categories. Recommendations have been made by Blaney and Mazerolle for adjustments in siting to minimize the ecological footprint of disturbance when clearing occurs during the construction phase. Vegetation surveys of each of the final WTG locations have been conducted and these data have been used in the final layout designs.

A rare species of plant called the Broad-Lipped Twayblade was found between sites GD02 and GD53. This site is not a proposed turbine location, but any new road construction or clearing for power lines shall avoid this area.

S3S4 Braun's Holly-fern and a forest community that included ironwood and white ash were located on a ridge top southwest of original site GD59. Reducing impacts in this area has been done by moving any development corridors southward away from the west-facing slope.

Invertebrates
Invertebrates noted for consideration by AC CDC include three dragonfly species. The Maine Snaketail lives along clear, moderately rapid, rocky streams and rivers in forests, often where they drain lakes or swamps. The Subarctic Darner finds its habitat along mossy bog ponds, deep fens with well-defined edges, and northern swamps. The Petit Emerald's normal habitat is on marshes, bog lakes and ponds, and streams in cedar swamps.

There are two damselfly species - the Amber-winged Spreadwing, which is found around swamps and ponds and the Azure Bluet, which favours well-vegetated, usually fishless ponds, boggy pools, and vernal pools.

All dragonfly and damselfly species begin their life cycles as fertilized eggs which are laid in water. They become aquatic larvae and reach a nymph stage before emerging from the water. Breeding territories are established by adult males along shorelines and streams, where they attract females to lay their eggs in the water. Vamey's Lake is the only suitable lake site in these proposed areas. Riparian zones around it will remain undisturbed by the development of WTG sites. Other sites include small streams nearby and a variety of small wetlands. The proposed development should not harm these rare species, if they in fact exist in the area. Since the adults like to fly in more calm air and closer to the ground, they would tend to avoid the strong winds associated with the blades at 60 metre and higher elevations.

Two butterfly species are noted on AC CDC's list- the Acadian Hairstreak and an Anglewing butterfly called the Hoary Comma. The Acadian Hairstreak is found on or near willows along stream courses and in marshes. The Hoary Comma is found in open boreal woodland near stream courses. Neither species, if they exist on these sites, should be affected negatively by this development. The strong winds associated with these sites would discourage their presence at elevations when the blades are rotating at 60 m above the ground level.

One freshwater mussel, the Brook Floater is cited in the literature as a possibly occurring within 100 km. Mussels have a larval stage called glochidia that they release when fish are moving by. The glochidia attach to the fish for a ride upstream. Fish passage up the steep scarps to the uplands is very limited on many of the streams in this region, preventing anadromous (sea-run) fish that might bring glochidia from reaching the upland with them. The nature of the proposed locations on hill tops should not present a threat to this aquatic dweller. Any new road construction must take appropriate and adequate care in crossing riparian areas beside streams, and new stream crossings will be built to current acceptable standards.

Vertebrates
Species flagged by government agencies and the AC CDC for consideration on

these proposed development sites include one reptile - the wood turtle (Clemmys insculpta).

Wood turtle life cycles require slow-moving, meandering intervale streams and rivers like the St. Mary's River which have considerable amounts of sand and gravel. Although Wood turtles are found in adjacent woodlands over the summer, they tend to range out from these intervale habitats. None of these critical habitats exist near the proposed sites, nor does the range map for Wood turtle distribution in Nova Scotia indicate their presence in this area. If one were to look for Wood turtles in this region, they would more likely be located in the lowland valley of Barney's River.

Animals such as bats and birds that could inadvertently fly into the blades of wind machines at times when visibility is poor - at night or during times of fog - are a concern. A study entitled "Bat Species Composition and Activity at the Proposed Glen Dhu Wind Development Site" by Dr. Hugh Broders and Lynne Henderson was commissioned and subsequently completed in November, 2007. Broders and Henderson concluded that this candidate area is not an important migration corridor for the two bat species that are present in the area.

Breeding bird notes were compiled by Sean Blaney and David Mazerolle when they did field surveys for vascular plants during June and July, 2007. Four significant species were noted: Gray jay, boreal chickadee, common goldeneye, and olive-sided flycatcher. The first three have General Status ranks of sensitive because of recent declines in population, although they are still common breeding birds in Nova Scotia.

Four common goldeneye were seen on Vamey's Lake. Common goldeneye breeding in Nova Scotia is rare, with a S2B rank. (As a field biologist who has worked in the area for several decades, the author (Bob Bancroft) is more familiar with the presence of ring-necked ducks than common goldeneye on Vamey's Lake.). No evidence of breeding other than the potential of this habitat was noted. Gray jays and boreal chickadees were present in coniferous forest. Single olive-sided flycatchers were heard singing near the original turbine locations GB25 and GB63.

John F. Kearney and Associates was commissioned to conduct a field survey and compile a preliminary avian assessment for these sites to assess the sensitivity of bird populations to the construction phase and deployment of wind machines (See Appendix D, Section 3). Based on criteria developed by the Canadian Wildlife Service of Environment Canada this Glen Dhu Wind Farm ranks as a Category 4 site. There were 28 possible breeders, 34 probable breeders and 28 confirmed breeders giving a total of 90 species of breeding birds located during the 2007/ 2008 breeding season in a study area that was approximately 5,550 hectares in size. As shown in Appendix D, Section 3, monitoring by Kearney and Associates

continued through the summer of 2007 and a fall migration survey was completed in 2007. Avian assessments continued until July, 2008.

The results of these two studies and data from the Maritime Bird Breeding Atlas indicate that two species (Peregrine falcon and Rusty blackbird) listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as "special concern" were each seen once during fall migration. Three other bird species located in this area during the breeding season are listed as "threatened" under the federal (COSEWIC) guidelines.

There are a number of "yellow status" species, as conferred by the Nova Scotia government, indicating certain species that are sensitive to human activities or natural events. Species noted in these surveys are northern goshawk, chimney swift, olive-sided flycatcher, gray jay, boreal chickadee, and Canada warbler. Northern goshawks are forest raptors that should not be disturbed during their breeding season in their breeding territories. Chimney swifts are listed as "threatened" by COSEWIC. Two swifts were seen in flight by Kearney in early July, 2008, at the extreme southwest corner of the study area. That places them south of the turbine array being proposed in this document. Gray jay populations are suffering from the effects of global warming. Increased temperatures and shorter winters are causing their winter food caches to rot.

Olive-sided flycatchers were noted eight times by Kearney during spring migration, and on twelve breeding point counts. Olive-sided flycatchers are listed as threatened by COSEWIC. So is the Canada warbler, which Kearney detected on four occasions.

The rare species records provided by the AC CDC within a 100 km radius of the site generate a number of other possibilities for wildlife in the area.

Bird species on that list, such as the piping plover and black-crowned night herons do not use upland forest habitats removed from the sea and therefore were not found in the surveys. Others like the rare whip-poor-will could use the habitat but were not located. There may be insufficient open country in this upland forest for long-eared owls to hunt. Common goldeneye have a large breeding territory across northern Canada. They need large trees with nesting cavities close to clear, cold water. In case a breeding population of common goldeneye exists at Vamey's Lake, large trees close by the shore, and the lake shore riparian area, will be avoided during the construction phase.

Mammals

Moose
Mainland moose (*Alces alces americana*) were designated "endangered" in 2003 under the Nova Scotia Endangered Species Act. These candidate wind power

sites are associated with historical moose habitats, and may well have moose still using them.

Field investigations were tentatively scheduled, weather permitting, to fly these sites by helicopter during winter to determine if moose as well as white-tailed deer are currently present in and around the proposed locations. Winter weather conditions required for this survey did not occur. As an alternative, pellet surveys on suitable transects across the project area were conducted in May 2008. NSDNR Regional Biologists were consulted in the selection and density of the survey transects. The findings were reported to NSDNR on the completion of the surveys. There were no indications of the presence of moose within the project area.

The issues that are continuing to place this population in "endangered status" are complex. Basic demographic data (population size, structure, reproduction and mortality) are lacking. As well, it is difficult to accurately identify the dominant cause-effect factors limiting the population.

As a student, this biologist assisted William H. Prescott with his field work for a master's thesis at Acadia University. Published in 1968, it was a study of winter concentration areas and food habits of Nova Scotia mainland moose in the late 1960's. It concluded that in northeastern Nova Scotia, a habitat of widely diversified vegetation types was the critical factor influencing the use of areas for winter concentration. Typical areas had a belt of open mixed wood along the upper one-third of the slope, usually above 150 m, and lying between the hardwood-dominated hilltops and the softwood-dominated lower slopes. Shelter in the absence of food was not favoured by moose. In wintering areas that were surveyed in the Cape George area, moose moved freely and frequently up and down these steep valley slopes associated with the streams and used the adjacent hardwood uplands as well. Later, as the "Lands and Forests" regional biologist for the eastern mainland from 1973-1988, this biologist continued to note this habit, but also located other moose living entirely on the upland during winter helicopter surveys.

Moose were far more plentiful in those decades, and winters were more conducive to achieving flying census results on a more regular basis. For a variety of reasons, including generally milder winters, a moose census has not been flown in this area by NSDNR staff since 1995. Sightings, tracks and pellet piles, noted and mapped since 1995, give every indication that this area is moose habitat to the small population that remains in the Cape George area. Therefore, moose are a serious concern with respect to this proposed development.

The many challenges faced by mainland moose have been documented by the Mainland Moose Recovery Team, a team of experts that was assembled to develop a recovery plan for the species. This team was officially formed in

March, 2007. The number of moose on the mainland has declined even though hunting them has been banned since 1981. As a member of the Recovery Team, a number of issues and mortality factors that were raised at team meetings are certainly relevant to the small moose population left in the Cape George area.

Historically, moose populations have collapsed in the past. In 1672 Nicolas Denys wrote that moose had been exterminated on Cape Breton Island by First Nations peoples. Whether population collapses are actually caused by hunting alone is an open question. In recent times, moose have also declined in provincial sanctuaries where hunting is prohibited.

The influx of white-tailed deer into Nova Scotia through the early part of the twentieth century has significant implications for moose populations, in part because of interspecific competition, but also because the deer carry a nematode parasite, *P. Tenuis* that often is fatal in moose. Dodds noted that winter concentrations of moose in elevated areas of northeastern Nova Scotia were separated from deer populations that wintered in valleys below, and that this offers a reasonable explanation for the lower infection rates for these moose. A similar phenomenon works on the Cape Breton Highlands. Mild winters in the past three decades have enabled white tailed deer to wander these uplands on some winters. During winter aerial moose surveys in the early 1980's, groups of deer were seen resting on some of the highest lands along this scarp where the snow had blown clear.

Poaching is a factor that becomes critical when populations levels are low. As a former conservation officer, and as a working biologist living in Antigonish County with access to local knowledge, this biologist is certain that poaching abetted by the use of four-wheel drives, snowmobiles and all-terrain vehicles remains a serious factor inhibiting moose population recovery in the Cape George area.

Acid rain has indirectly affected moose populations by depositing and leaching heavy metals like cadmium and mercury into soils and waterways. These are taken up by terrestrial and aquatic plants that are subsequently consumed by the moose that occupy acidified landscapes.

Neurological diseases and nutrient deficiencies are also suspect causes for the demise and are currently under investigation. Ectoparasites, like the moose tick, are present in this population.

Aquatic vegetation is sought by moose to supplement terrestrial diets for added nutrients. Females (cows) may be pregnant or feeding young, while males (bulls) need massive amounts of nutrients to grow antlers on an annual basis. The general dearth of shallow lakes, swamps and large wetlands with aquatic plants in this upland area is notable. That reinforces the notion that Prescott presented

regarding a diversity of terrestrial vegetation being particularly important to moose in this region from a nutritional perspective.

Other factors of concern include access and human presence. Aside from protected areas like national parks, moose that are subjected to hunting or poaching pressures tend to avoid landscapes that have steady human activities. Roads, forestry operations and human encroachment have created alterations and fragmentation of their habitats. A moose would have a challenge to cross Highway 104 within this proposed development region.

Summer thermal cover may be important as well. Moose are well adapted to winter conditions, but not as able to cope with hot summers that have become more common. Moose in Nova Scotia are near the southern edge of their North American range.

The northwest part of the State of Minnesota is also part of the southern range periphery. Its moose population has declined since 1984. Researchers there identified infectious pathogens including *P. Tenuis,* negative effects of climate change, increased food competition with deer, illegal hunting (poaching) and predation by black bears and wolves as causative agents in the decline. In Nova Scotia, coyotes may be occupying the niche once taken by wolves. That study concluded that "the southern distribution of moose may become restricted in areas where climate and habitat conditions are marginal, especially where deer are abundant and act as reservoir hosts for parasites." Predictions are that the Minnesota population will not persist over the next 50 years. A modified version of these negative forces may also be operating on the moose population of Nova Scotia.

Fisher

A small population of fishers, *Martes pennanti,* exists in the Cape George region. A medium-sized, dark brown-to-black member of the weasel family, fishers are also found in other parts of Pictou and Antigonish County, as well as the province. Although not designated under the Nova Scotia Endangered Species Act, fishers have general status ranking of yellow - meaning that they are sensitive to human activities or natural events. Fishers are a native species but were reintroduced to the eastern mainland during the 1960's. Easily trapped, they inhabit mature-mixed wood and second growth forests. They are adept hunters of squirrels, snowshoe hares, ruffed grouse and porcupines. Fishers travel regular territorial routes, and may cover a circuitous route of up to160 km every week or two. They utilize hollow trees as den sites.

4.3.5 Parks and Significant Natural Areas

The Eigg Mountain - James River Wilderness Area lies to the east of the proposed sites above the Trans Canada Highway 104, (see Figure 4.2). The region of Eigg Mountain has excellent examples of old growth hardwood and mixed wood

uplands. It is inhabited by moose, fisher and goshawk. The James River watershed is south of the Eigg Mountain area and is the water source for the Town of Antigonish.

Arisaig Provincial Park lies to the north on the west coast of Cape George, with significant cliff outcrops along the shore that span a great deal of geologic time and include fossils. The park offers picnic sites and the opportunity to investigate the shore.

Beaver Mountain Provincial Park is located east of the proposed development sites to the south of Highway 104. The park offers camping sites, picnic sites, nature watching, and hiking, skiing, and snowshoe opportunities on trails that include a beaver pond.

4.4 Atmospheric Environment

4.4.1 Climate

The Nova Scotia climate is considered a modified continental climate which is influenced by the local topography and surrounding water masses of the Atlantic Ocean, Gulf of St. Lawrence and Bay of Fundy. These water bodies have a strong influence on the movement of weather systems, air temperature, wind regimes and precipitation. Site specific conditions can influence local climatic conditions creating microclimates within small locations which may be significantly different than the surrounding area. Such microclimates may have an influence on the ecology of the region.

Elevation has a strong influence on the climate of these Highlands. The climate characteristically has wide daily and seasonal temperature ranges, and precipitation rates that exceed 1200 mm. Traditional winters have been long and cold, beginning with frost in November, followed by snowfalls that often exceed 300 cm. These uplands are often cloudy and the relative humidity tends to be high.

Tables 4.4.1 and 4.4.2 present the climate normals for temperatures and precipitation respectively. These data were collected at the Environment Canada weather station at Collegeville, which is the closest observation point to the subject area.

The subject site is located in the regions referred to as the Northumberland Shore and Northern Nova Scotia on the north eastern portion of mainland Nova Scotia. Climatic conditions and seasonal features are a result of the water temperatures of the Northumberland Strait and the highland topography of the area of the proposed site. Typical conditions for this area include: delayed springs; warm

summers; extended fall and cold winters. Precipitation in the region is lower than the provincial average. (ref. Natural History of Nova Scotia).

Table 4.4.1: Temperature Normals (1971- 2000) for the Glen Dhu Area as measured at Collegeville[1]

Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr.
Daily Average (°C)	-6.6	-6.6	-2.1	3.3	9.2	14.4	18.2	17.9	13.5	8	2.9	-3.1	5.8
Daily Maximum (°C)	-1.5	-1.6	2.6	7.9	15	20.5	24	23.5	18.9	12.7	6.8	1.2	10.8
Daily Minimum (°C)	-11.6	-11.6	-6.8	-1.4	3.4	8.2	12.4	12.3	8	3.1	-1	-7.5	0.6
Extreme Maximum (°C)	17	15.5	23	27.8	33.9	35	36.1	**38.3**	34.4	28.3	25.6	20.6	
Extreme Minimum (°C)	-34.4	**-37.2**	-30.6	-23.3	-8	-4.4	-1.1	-0.6	-6.7	-10	-18.9	-30.5	
Days with Maximum Temperature													
<= 0 °C	18.8	17.2	10.3	1.3	0	0	0	0	0	0	2.8	13.3	63.7
> 0 °C	12.2	11	20.7	28.7	31	30	31	31	30	31	27.2	17.7	301.5
> 10 °C	1.3	0.87	2.7	9.2	24.1	29.2	31	31	29.7	21.2	7.9	2.9	191.1
> 20 °C	0	0	0.03	0.43	5	15.1	25.1	24.3	10.8	1.5	0	0.03	82.2
> 30 °C	0	0	0	0	0.21	0.47	1.3	1	0.07	0	0	0	3.1
> 35 °C	0	0	0	0	0	0	0.03	0	0	0	0	0	0.03
Days with Minimum Temperature													
> 0 °C	1.2	1.1	3	8.4	23	28.5	31	31	27.7	20.6	11.1	2.8	189.5
<= 2 °C	30.4	27.8	29.6	25.6	12.4	3.1	0.13	0.37	4.9	13.8	22.6	29.6	200.3
<= 0 °C	29.8	27.2	28	21.6	8	1.5	0	0	2.3	10.4	18.9	28.2	175.8
< -2 °C	27.6	24.9	22.6	11.3	3.1	0.2	0	0	0.3	3.9	11.7	23.4	129
< -10 °C	17.6	15.3	8.4	0.5	0	0	0	0	0	0	1	10.2	53
< -20 °C	3.5	3.9	1.1	0	0	0	0	0	0	0	0	1	9.6
< - 30 °C	0.07	0.27	0	0	0	0	0	0	0	0	0	0.03	0.37

Notes: From Environment Canada: Canadian Climate Normals, Collegeville, Lat: 45° 28.800'N, Long. 62°1.200' W, Elevation 76.2 m. **Bold:** Extreme Maximum or Minimum value

Table 4.4.2: Precipitation Normals (1971- 2000) for the Glen Dhu Area as measured at Collegeville[1]

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr.
Rainfall (mm)	78.3	51	80.1	81.2	106.5	99.7	89.8	102.1	112.2	145	133.3	96.6	1175.7
Snowfall (cm)	47.2	45.3	36.2	17.7	2.5	0	0	0	0	1.3	12.2	46.2	208.5
Precipitation (mm)	125.5	96.3	116.3	99	109.1	99.7	89.8	102.1	112.2	146.3	145.5	142.8	1384.3
Average Snow Depth (cm)	15	18	14	2	0	0	0	0	0	0	1	6	
Median Snow Depth (cm)	14	18	14	1	0	0	0	0	0	0	0	4	
Snow Depth at Month-end (cm)	15	24	4	0	0	0	0	0	0	0	1	16	5
Extreme Daily Rainfall (mm)	87.6	56.4	78.7	53.3	54.6	198.1	104.1	**203.2**	104.1	115.1	98.6	100.2	
Extreme Daily Snowfall (cm)	38.1	40.6	**45.7**	38.1	25.4	0	0	0	0	17.8	34.3	40.6	
Extreme Daily Precipitation (mm)	87.6	61	78.7	53.3	54.6	198.1	104.1	**203.2**	104.1	115.1	98.6	100.2	
Extreme Snow Depth (cm)	**132**	114	119	56	15	0	0	0	0	10	30	70	
Days with Rainfall													
>= 0.2 mm	6.1	4.4	6.5	8.8	10.7	10.4	9.6	9.4	10.4	12.5	12	7.6	108.3
>= 5 mm	4.3	3	4.5	5.1	6.1	6.2	5.2	5	5.9	6.8	7.1	5.1	64.3
>= 10 mm	2.8	1.7	2.9	3.3	3.5	3.3	3.2	3	3.6	4.8	4.6	3	39.7
>= 25 mm	0.93	0.57	0.83	0.43	0.93	0.7	0.63	1	1.1	1.5	1.3	1	11.1
Days with Snowfall													
>= 0.2 cm	8.3	7.2	6.1	2.8	0.24	0	0	0	0	0.2	2.4	7.9	35.1
>= 5 cm	3.7	3.5	2.9	1.5	0.21	0	0	0	0	0.07	1.1	3.3	16.3
>= 10 cm	1.5	1.5	1.2	0.63	0.07	0	0	0	0	0.03	0.3	1.4	6.5
>= 25 cm	0.1	0.23	0.1	0.03	0.03	0	0	0	0	0	0	0.13	0.62
Days with Precipitation													
>= 0.2 mm	13.1	10.4	11.3	10.9	10.9	10.4	9.6	9.4	10.4	12.7	13.9	14.3	137.1
>= 5 mm	7.6	6.5	7.1	6.5	6.3	6.2	5.2	5	5.9	6.9	8.1	8.5	79.7
>= 10 mm	4.3	3.4	4.4	4	3.6	3.3	3.2	3	3.6	4.8	4.9	4.5	47.1
>= 25 mm	1.2	0.87	1.1	0.47	0.97	0.7	0.63	1	1.1	1.5	1.4	1.2	12.2

Notes: From Environment Canada: Canadian Climate Normals, Collegeville, Lat: 45° 28.800'N, Long. 62°1.200' W, Elevation 76.2 m. **Bold:** Extreme Maximum or Minimum value

4.4.2 Extreme Storm Events

The province of Nova Scotia is subject to occasional extreme weather conditions as a result of tropical storms and hurricanes which move out of the Caribbean and northward along the coast of the United States. Occasionally, the tracks of hurricanes and tropical storms contact the coast of Nova Scotia and southern New Brunswick. Under these circumstances, the Glen Dhu Project area may encounter strong winds and high levels of precipitation.

To assess these occurrences, storm and hurricane data from Environment Canada's Canadian Hurricane Centre (CHC) for the ten year period 1997 to 2006 was reviewed. Table 4.4.3 provides data on the annual number of storms occurring within the CHC area of responsibility and the number of storms which made land fall near or approached the subject area.

Table 4.4.3: Regional Hurricane and Tropical Storm Occurrences[1]

Year	Number of Storms Tracked in Region	Number of Storms Making Landfall in Region	Name	Date of Storm	Maximum Wind Speed at Caribou in Storm Period[2] Kph, (*m/s*)	Wind Direction at Caribou in Storm Period[2] (degrees true)
2006	5	1	Beryl	July 18-23	54 (*15*)	300
2005	6	1	Ophelia	Sept. 13-18	44 (*12.2*)	50
2004	8	0	Na	Na	Na	Na
2003	8	1	Juan	Sept. 25-29	**85 (*23.6*)**	140
2002	8	1	Gustav	Sept. 8-12	59 (*16.4*)	320
2001	6	1	Karen	Oct. 12-15	57 (*15.8*)	180
2000	8	1	Michael	Oct. 15-19	63 (*17.5*)	300
1999	6	1	Harvey	Sept. 21-23	72 (*20*)	320
1998	9	0	Na	Na	Na	Na
1997	4	0	Na	Na	Na	Na
Total	68	7	Na	Na	Na	Na

Notes: 1. Environment Canada: Canadian Hurricane Centre, Hurricane Season Review, 1997-2006. http://www.alt.ec.gc.ca/weather/hurricane/index_e.html
2. Environment Canada: Caribou Point (Aut), Nova Scotia. http://www.climate.weatheroffice.ec.gc.ca/climateData/canada_e.html
Na – not applicable
Bold – maximum value for storm occurrences

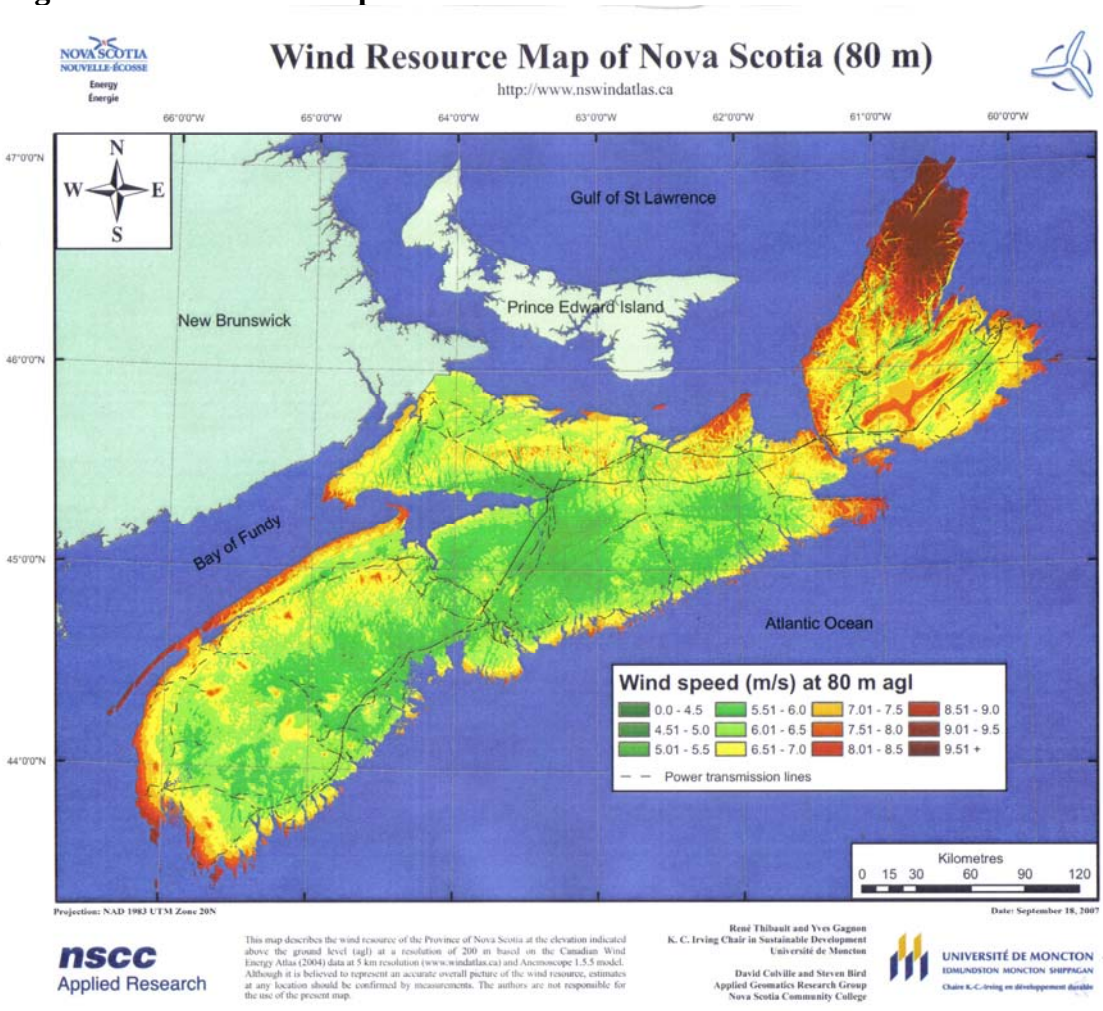
Environment Canada compiles statistical values for various weather parameters at various locations where long term weather observations have been made. Thirty year statistical values are not available from the weather station at Caribou Point, NS. The closest station to the project area which provides thirty year wind statistics is Charlottetown Airport. The Canadian Climate Normals (1971-2000)

for Charlottetown Airport indicate a maximum hourly wind speed of 105 kph (29.2 m/s) on January 4th, 1954 and a maximum gust of 177 kph (49.2m/s) on December 19th, 1963. These wind conditions are well below the Enercon E-82 survival wind speed of 214 kph (59.5 m/s).

4.4.3 Wind Resources

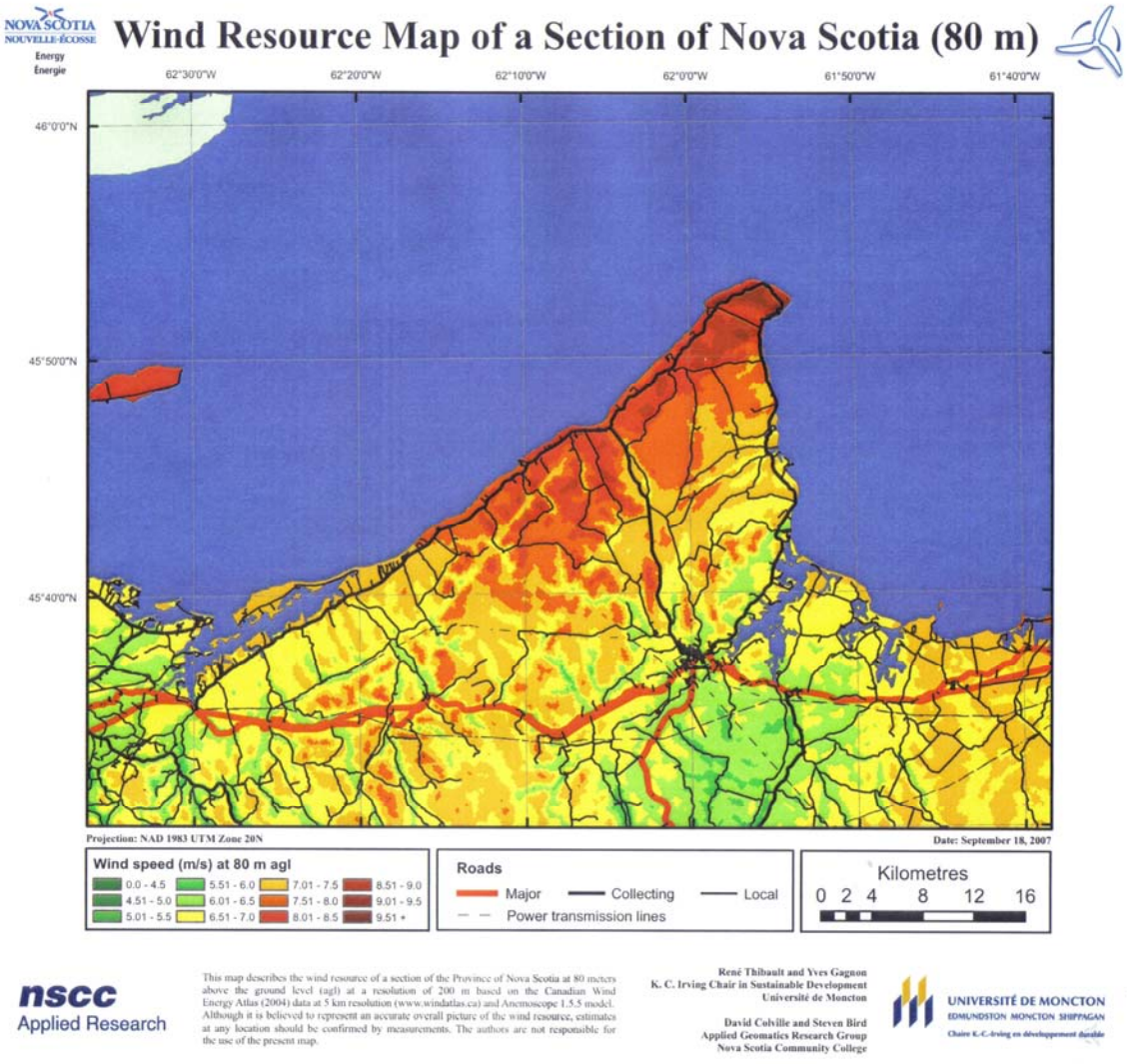
The wind conditions in many coastal areas of the province are considered to have significant potential resources of wind energy. Figure 4.2 shows a wind resource map of the province which was prepared under the auspices of the Nova Scotia Department of Energy (http://www.nswindatlas.ca). This map indicates that wind speeds exceed 7.0 m/s at 80 m of elevation over most of the in the subject area. Figure 4.3 shows the detailed wind condition in the study area. Wind speeds of more than 8.0m/s are indicated in many highland locations in the region. The Glen Dhu site lies within an area with significant wind resources.

Figure 4.2: Provincial Map of Wind Resources



SWI has completed a wind resource assessment in this area with the assistance of wind resource assessment specialists, Al-Pro of Germany. Al-Pro is a leading wind engineering firm with world wide experience in wind resource monitoring, assessment and wind farm design and with specific experience with the WTGs manufactured by Enercon.

Figure 4.3: Wind Resource Map of the Glen Dhu Site and Surrounding Area



The Project has collected actual wind speed/direction data at the Project site, beginning December 12, 2006. These data represent measured wind data at four levels on each of three 80-metre instrumented test towers in order to afford an accurate representation of the wind regime. The analysis confirms a strong wind resource that will support a viable wind park, with net capacity factors expected to

be in excess of 36% – indicating excellent year-round potential for energy production.

4.4.4 Air Quality

Air quality issues in Nova Scotia are typically associated with the combustion of fossil fuels both in the province and from industrial centers in central Canada and eastern and central regions of the United States. Under the Air Quality Regulations (N.S. Reg. 28/2005), the Province has established ground level emission criteria for carbon monoxide (CO), hydrogen sulphide (H_2S), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3) and total suspended particulate. These regulations also provide restrictions on burning and the sulphur content of heavy fuel oils and refinery fuels and establish criteria for gasoline volatility, emissions caps and industry reporting.

Acid rain is created by the presence of oxides of sulphur and nitrogen in precipitation. Environmental impacts, attributed to acid rain from the US and central Canada, have occurred in areas of the province where there has been long term deposition. Control or reduction of this contaminant depends on extra-provincial and international agreements to reduce such emissions and can be considered a long term environmental objective.

4.5 Socio-economic Environment

4.5.1 Population/ Demographics/Labour Force and Economic Profile

The project location spans the boundary between Antigonish County and Pictou County and therefore the socio-economic influence of the project should be considered in both counties. The Nova Scotia Department of Finance compiles economic statistics for the various regions of the province and this project is located in Region 22 North Shore. Figure 4.4 shows the Census regions in Nova Scotia. Region 22 is comprised of Antigonish, Colchester, Cumberland, Guysborough, and Pictou Counties. Some statistics are further defined by counties, subdivision areas within counties and municipalities. Figure 4.5 shows the Sub-divisions within Region 22.

The project area falls within statistical areas defined as Census Subdivision A of Antigonish County, and Subdivision C of Pictou County. The population was reported as 8,062 and 9,268 respectively. Antigonish County showed a modest growth rate of 0.6% in the period 1996 to 2006 however Subdivision A had an increase of 4.2% in the same period. The population of Pictou County decreased by 5.8% in the period and Subdivision C had a decrease of 4 % in population. Overall the population of the North Shore Census region declined by 3.5% in the period 1996-2006 which reflects the province-wide trend of declining populations in rural areas. In the ten year period between 1996 and 2006, the median age of the provincial population has increased from approximately 36 to 41 years. (S*ource:* NS Department of Finance, Nova Scotia Statistical Review 2006)

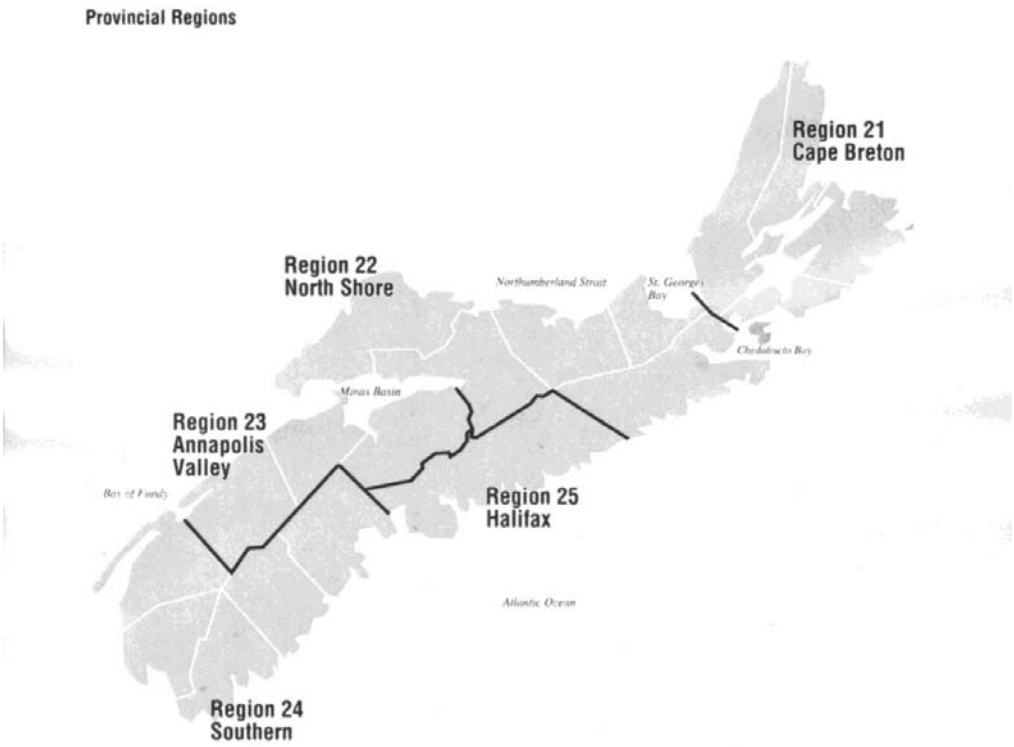


Figure 4.4: Economic Regions of Nova Scotia (adapted from NS Department of Finance, Nova Scotia Statistical Review 2006)

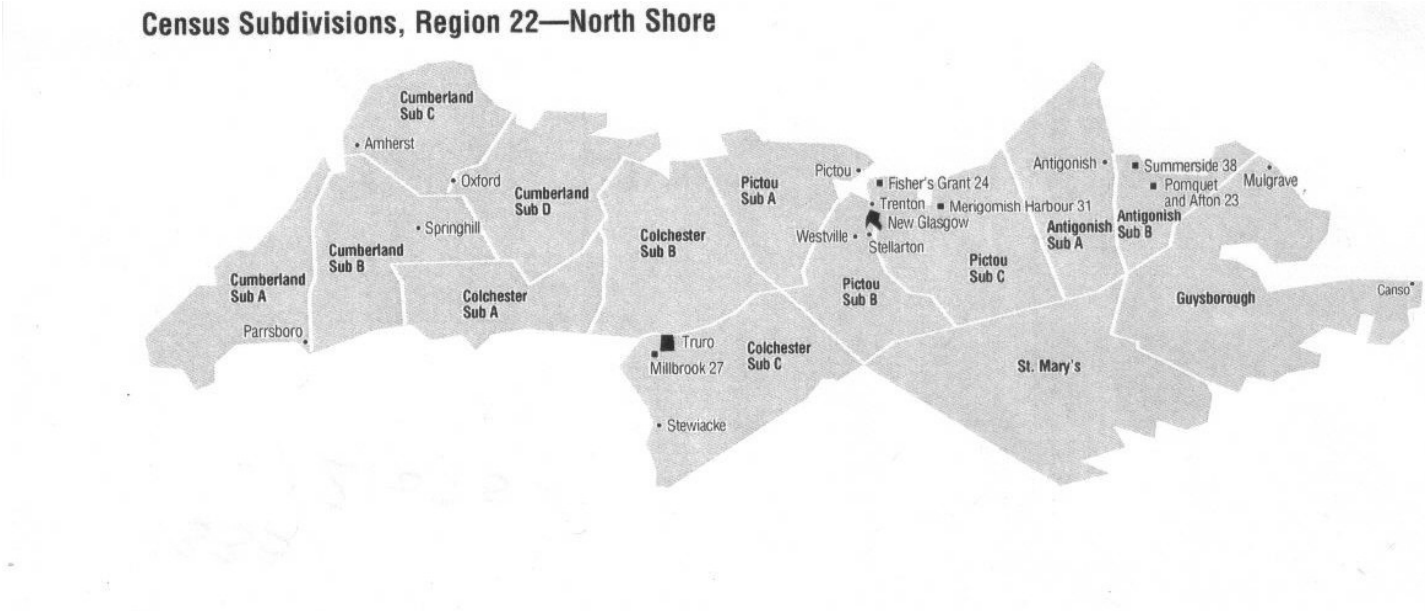


Figure 4.5: Census Subdivisions within Region 22 (adapted from NS Department of Finance, Nova Scotia Statistical Review 2006)

Region 22 North Shore has approximately 8,800 employer businesses. The North Shore Region reflects a relatively diverse economy with the Sales and Service sector and the Transport and Construction sector providing the greatest levels of employment (18,700 and 13,200 persons respectively). The Health Care sector, Government and Education sector and Manufacturing sectors each employ slightly more than 6,000 individuals in the Region. The Management Sector, Business and Finance Sector, and Primary Industry Sector each employ in the order of 5,000 individuals. Despite a decline on population, the size of the labour force in the region has increased over the past five years. (*Source: NS Department of Finance, Labour Market Monthly, July 2007).*

In the past year, employment in Region 22 showed a decline in the participation rate and employment rate of 2.4% and 2.9% respectively. The unemployment rate increased by 1.1% during this period; however, the unemployment rate in the region has declined over the past five years. Antigonish and Pictou Counties provide approximately 12.6% and 29.4% respectively of the total labour force in Region 22. Based on the population proportions within each county, it may be inferred that Census Subdivision A of Antigonish County represents approximately 5% and Subdivision C of Pictou County represents 5.8% of the employment numbers by sector in Region 22.

In 2006, Region 22 had the second lowest average income ($24,674. per tax filer) and the lowest value of building permits (approximately $134 million) of the five regions.

Construction activity is a significant measure of the economic investments in the province or region. The Nova Scotia Department of Finance, Economics & Statistics Division publishes the *Nova Scotia Construction Activity Report* three times per year. This document provides a breakdown of present and proposed construction activity by county. Construction activities for the counties of Pictou and Antigonish were reviewed from the November 2007 report. Not all projects are assigned a dollar value.

In Antigonish County, one commercial development and seven institutional or government projects have been identified as current or proposed projects. In Pictou County, five commercial, 6 industrial, 14 government or institutional and 2 residential construction projects are cited. SWI's Glen Dhu project is listed as one of the industrial projects. Three projects in the above list are related to the twinning of Highway 104.

The Nova Scotia Statistical Reviews (2006) list employment by occupation and include construction related employment under the category: *Trades, transport and equipment operators and related occupation.* In 2005, this sector employed 13,200 individuals in Region 22 which represents approximately 20% of the provincial work force in this category and approximately 18% of all occupations

in the work force in the Region. Over the period 2000-2005, salaries in the construction sector increased by 4.3% compounded annually. The construction sector represents a significant element of the economy of Region 22.

4.5.2 Land Use

The land area represented by Region 22, North Shore, covers approximately 16,527 sq. km with a population density of 9.7 persons per sq. km. This Region has the largest area and the lowest population density of the five statistical subdivisions in the province. The immediate project area is rural consisting largely of farmland and forest.

The area has been extensively logged over the past century and a network of private and forest roads provide access within the boundaries of the project area. The production of forest products in Region 22 exceeded 2.5 million cu. m. in 2006. This leads all other regions and represents approximately 41% of total provincial forest production.

Forty-one percent of the farms in the province are located in Region 22. In 2001, Antigonish County had 235 on 73,883 acres and Pictou County had 274 farms on 74,498 acres. The number of farms in Antigonish and Pictou Counties represents approximately 6% and 7% respectively of operating farms in the province. Based on total receipts (excluding forest products), the farms of Antigonish and Pictou Counties produced 5% and 3.5% respectively of the total gross farm receipts in the province.

In 2001, there were 143 farms in the two counties which had total receipts for forest products of approximately $2.0 million. This value represents 28% of the value of forest products from Region 22.

Because of the extensive use of the project area for forestry, there is a well developted network of existing unpaved roads within the Project boundaries. These roads are on private property or Crown lands and are not serviced or maintained by the province.

Highway 104 provides the major all weather inter-provincial highway link to the project area. Provincial Highway 245 provides access to a network of local roads which connect the northern side of the project area.

4.5.3 Cultural Resources, Aboriginal Heritage and Archaeological Sites

Davis Archaeological Consultants Limited (Davis) was commissioned to conduct a desktop review of the historical resources of the project area. Davis conducted this research under Heritage Research Permit A2007NS45 (Appendix E, Section "Appendix A") and provided their report entitled: *Glen Dhu Wind Farm: Archaeological Resource Impact Assessment.* This report is presented in Appendix E.

The findings of the study indicate that human settlement of the Glen Dhu area began in the last half of the eighteenth century and was most active in the nineteenth century. There is a high potential for the presence of archaeological resources from this settlement period. In terms of Mi'kmaq heritage resources, highland areas present a lower potential for presence of historical resources; however, there is a medium to high potential for such resources in valleys in the area.

A field survey was done in June, 2008 by Davis Archaeological Consultants Ltd. on the final layout of the wind farm. The findings of this report can be seen in Appendix E, Section 2. April MacIntyre and associates examined the 34 possible locations as well as proposed access roads. There were no significant finds throughout the entire area which needed to be registered with the Special Places office in Nova Scotia.

4.5.4 Existing Sound Levels

A background sound level monitoring program was conducted from October 22 to October 24, 2007 at locations within the boundaries of the proposed Glen Dhu Wind Farm. The purpose of this program was to measure typical sound levels within the proposed project boundary and to compare these levels to guidelines established by Nova Scotia Environment. The hourly sound level readings are shown in Table 4.5.1. The report and findings of this monitoring program are attached to this document in Appendix E.

The sound levels measured in this test represent a small sample of the ambient sound levels in the proposed project area. The data indicate that there are ambient sources of sounds which may exceed the provincial night time guidelines. These sounds may be generated by wind in the trees and may vary from site to site depending on the type of vegetation, local topography and localized wind velocities. It is noted that the trees in the study areas were largely deciduous and in their fall foliage condition at the time of the study.

The sound level measurements collected in the 48 hour period in October 2007 at four locations within the Glen Dhu Wind Farm site are considered representative of typical background sound levels for the area in autumn conditions. The locations selected are near the boundaries of the proposed wind farm and are considered to reflect the conditions to which on-site or neighbouring human and ecological receptors would be exposed. Under some wind conditions with fall foliage present, background sound levels can exceed provincial guidelines for night time sound levels.

Table 4.5.1: Hourly Sound Level Values For Selected Glen Dhu Sites (dBA)

Date/Time	NSE Guideline	Site #1	Site #2	Site #3	Site #4
10/22/07 12:00	65	40.4	-	-	-
10/22/07 13:00	65	37.4	37.2	-	-
10/22/07 14:00	65	36.4	34.6	36.3	-
10/22/07 15:00	65	35.7	33.4	34.7	35.9
10/22/07 16:00	65	37.2	33.4	38.8	36.8
10/22/07 17:00	65	37.2	34.1	34.2	35.7
10/22/07 18:00	65	37.3	33.8	35.4	35.8
10/22/07 19:00	60	37.8	32.9	38.6	37.7
10/22/07 20:00	60	42.0	33.8	40.9	39.7
10/22/07 21:00	60	43.5	38.2	40.8	40.2
10/22/07 22:00	60	43.5	37.6	46.1	37.6
10/22/07 23:00	55	43.6	34.6	44.1	37.7
10/22/07 24:00	55	45.2	40.2	45.6	38.7
10/23/07 1:00	55	45.7	41.0	42.0	37.7
10/23/07 2:00	55	43.9	37.4	37.1	37.9
10/23/07 3:00	55	40.1	34.4	41.2	37.0
10/23/07 4:00	55	41.4	33.3	40.5	36.7
10/23/07 5:00	55	42.9	35.0	42.7	38.2
10/23/07 6:00	55	49.2	45.9	42.6	41.9
10/23/07 7:00	65	50.4	43.6	50.7	43.1
10/23/07 8:00	65	52.0	46.2	52.2	44.8
10/23/07 9:00	65	51.5	46.9	45.6	45.6
10/23/07 10:00	65	46.1	48.6	47.6	43.0
10/23/07 11:00	65	45.4	48.6	51.2	44.5
10/23/07 12:00	65	47.1	49.1	46.1	46.8
10/23/07 13:00	65	46.7	47.2	50.9	47.8
10/23/07 14:00	65	43.9	46.5	49.1	46.7
10/23/07 15:00	65	44.9	50.3	55.2	45.5
10/23/07 16:00	65	50.8	50.8	56.9	45.9
10/23/07 17:00	65	50.0	48.7	57.2	48.7
10/23/07 18:00	65	47.5	48.1	55.7	47.7
10/23/07 19:00	60	53.9	54.5	58.7	50.5
10/23/07 20:00	60	60.0	56.9	60.6	52.2
10/23/07 21:00	60	58.6	56.5	60.5	53.7
10/23/07 22:00	60	60.5	56.6	61.1	56.7
10/23/07 23:00	55	59.3	57.9	61.8	55.6
10/23/07 24:00	55	60.7	58.6	61.0	53.8
10/24/07 1:00	55	59.5	59.1	60.6	55.6
10/24/07 2:00	55	57.4	53.7	60.4	54.1
10/24/07 3:00	55	52.4	52.4	59.1	52.2
10/24/07 4:00	55	48.8	45.8	53.0	44.9
10/24/07 5:00	55	44.6	42.7	45.7	41.8
10/24/07 6:00	55	48.9	52.7	45.6	51.5
10/24/07 7:00	65	41.0	40.3	44.2	41.2
10/24/07 8:00	65	41.7	41.7	42.0	42.4
10/24/07 9:00	65	43.9	41.6	43.1	43.1
10/24/07 10:00	65	39.3	36.3	40.7	39.4
10/24/07 11:00	65	39.1	35.3	40.2	39.6
10/24/07 12:00	65	40.3	36.2	42.9	39.5
10/24/07 13:00	65	-	34.5	37.1	37.1
10/24/07 14:00	65	-	-	37.2	36.1
10/24/07 15:00	65	-	-	-	36.2

Note: Shading denotes exceedances of NSE Sound Level guidelines

4.5.5 Recreation Areas

The project area provides outdoor recreation largely for the local population. The principal focus of recreational activities includes: hunting, fishing, snowmobiling and driving ATVs on forest roads as well as trails maintained by various recreational associations. Landowners control public access at their discretion.

The area provides scenic views for tourists particularly in the fall season when the hardwoods are in colour. The landscape and topography offer photographic opportunities from Highway 104 and local roads. However, much of the project area is on private land and, as such, is not accessed by many individuals from outside the immediate region.

4.5.6 Safety Issues

Public risk has been identified as a significant safety issue related to the project. Public risk is considered within the context of the present site conditions and those project activities which alter normal uses of public property and roads. Outside the public domain, accidents which result in financial losses to the proponent, personal injury or fatalities to site workers, contractors or employees are considered be the responsibility of the proponent and the proponent's insurers. It is in the best interest of the proponent to address safety issues where the public is concerned as well as accidents and safety issues where the sole liability lies with the proponent. The proposed sites are located on privately leased lands and are therefore considered private property with controlled public access.

Construction Activities

The existing conditions of the subject area provide informal public access to private lands on woods roads. During construction activities, public access on many of these woods roads may be curtailed. A number of private roads will receive upgrading and improvements in order to handle the long and heavy loads of the turbine components. During the operations phase of the project, these roads will provide access for turbine maintenance activities and informal public use may be restored. Improvements to these roads will provide less risk to the public when informal access is available.

The greatest safety risks for the project are associated with turbine construction activities and lifting operations to place the tower, nacelle and turbine blades. Construction activities will be conducted under a site specific health and safety plan (SSHSP) which will cover occupational health and safety procedures for construction workers and all site related activities. The SSHSP will contain a provision to prohibit public access to construction sites as a risk reduction measure.

Potential incremental public risk may result from increased vehicle traffic to and from the site on the public roads and highways. The SSHSP will require contractors to meet all the provisions for the safe operations of vehicles and

equipment on public roads as required under the various applicable regulations of the Nova Scotia Motor Vehicle Act. Appropriate permitting and safety precautions will be followed during the movement of large pieces of equipment over public roads and highways.

The accident data has been reviewed to assess potential public risks which are relevant to the Glen Dhu Project and to assess measures required to reduce such risks. Turbines of smaller sizes have significant physical differences from the large turbines and therefore accident data for turbines of greater than 1 megawatt have been selected as representative of the types of turbines for the project. Safety issues for this evaluation relate to public safety.

The design of the structures, foundations, electrical components and interconnections will have appropriate engineering certification and insurance standards. Construction activities will be conducted in compliance with the Nova Scotia Construction Safety Act and Regulations. During site preparation and erection of the turbines, the public will not be permitted on the sites. Therefore, the safety issues surrounding the proponent's on-site liabilities do not fall in the public domain and are not considered to be a public safety evaluation.

Worker safety is an important consideration. Enercon will have responsibility for the assembly and erection of the turbines. Enercon is a world leader in the manufacturing and installation of large wind turbines and bring world class experience and expertise to the stage of the project.

Operation Activities

Potential safety risks related to the operation of wind turbines include: risks for personnel conducting maintenance operations; risks associated with the structural failure of moving components; fire risk; and risk of ice throw. Safety issues have been raised by some non-government organizations in other jurisdictions. Public information and media reports regarding a wide range of accidents related to wind turbines have been documented by Caithness Wind Farms.
www.caithnesswindfarms.co.uk/

Table 4.5.2 shows turbine accidents which have been categorized by type, number of occurrences, date, and cause. These factors were selected to provide an objective method to review the relevance of the information. For example, windmills of less than 50 kw have typically high rotational speeds in strong winds which have significantly higher stress loads on blades, rotating parts and bearings than the slower rotating large 2.0 MW Enercon E-82 units proposed for this site. Therefore, accident data from this category has been removed to address the issue in terms of "large" turbines.

In addition to the impeccable safety reputation of the Enercon WTGs some of the specific site factors will reduce the risk of incidents of concern for public safety.

The site layout includes setback distances that are regulated by the County of Pictou who have recently enacted regulations for wind turbines. In addition, the road network is through private lands and the roads are not accessible to the public.

There is some correlation between the date of manufacture of the turbines and towers and the frequency of accidents. Older equipment can be expected to have higher failure frequencies. The wind industry has conducted significant research and systems testing to reduce systems failures.

Table 4.5.2: Public Liability Accidents at Wind Turbines Greater than 1 MW in Size

Accident Type[1]	Number of Public Risk Accidents Involving Wind Turbines of all Sizes	Number of Public Risk Accidents Involving Turbines Identified as Larger Than 1MW	Number of Public Risk Accidents Involving Enercon E 82 Turbines
Tower Collapse[2]	38	6	0
Ice Throw[3]	22	1	No data
Blade Failure[4]	79	16	0
Visual Distraction[5]	4	-	No data
Environmental Damage[6]	10	2	0
Fire[7]	6	0	0
Transport Accidents[8]	7	-	No data
Total	166	25	No accidents known or reported for E-82 Turbines

Notes: - Turbine size not identified in data set

1. Accident data source: Wind Turbine Accident Compilation, 1975-2006, Caithness Windfarms Information Forum 2007, www.Caithnesswindfarms.co.uk. Data for 1 MW or greater machines selected where available in the dataset.
2. Tower Collapse: Accidents in which a turbine tower breaks and falls over, or when parts of the turbine, such as the nacelle or rotor, fall directly downward. Accidents in which parts are thrown (i.e. ice and blade parts), rather than dropped are not included under this accident type. The public and their property in the immediate vicinity of the turbine are considered at risk for a Tower Collapse.
3. Ice Throw: Accidents in which ice is thrown from the turbine blades, which places the public and their property, within a kilometer of the turbine, site at risk.
4. Blade Failure: Accidents in which parts or all of a turbine blade are thrown, which places the public and their property, within a kilometer of the turbine site, at risk.
5. Visual Distraction: Accidents in which motor vehicle drivers are distracted at the first sight of a turbine, causing collisions and other accidents.
6. Environmental Damage: Accidents in which turbines place natural resources at risk (i.e. oil leaks, fire thrown from rotor, etc.)
7. Fire: Accidents involving fire in which the public and their property are at risk, and in which a forest fire is not a risk.
8. Transport Accidents: Any accidents involving the transport of turbine parts en route to the turbine site.

4.5.7 Visual Landscape

The landscape of the project area offers views of forest covered hills and steep sided ravines interspersed with farm lands and cleared areas. The vegetation cover has been and continues to be modified by forestry operations, replanting and natural succession. The project area sits within an area that provides scenic views of various natural features of this coastal region.

Section 5 provides an assessment of the visual impacts on this environment through the use of photo montages and computer generated analysis of view-planes based on current vegetation cover.

4.5.8 Lighting for Aviation Safety

Lighting for Aviation Safety is regulated through the Federal Department of Transport and Nav-Canada. A proposed Aeronautical Lighting Plan (see Section 2.5.11 and Figure 2.11) has been submitted to Transport Canada for their consideration and approval (see Appendix C, Section 10). The project aviation lighting will be installed as per DOT requirements.

4.6 Valued Ecological Components

A list of Valued Ecological Components (VECs) has been prepared from the issues raised in the scoping phase of the project and from the background and field studies conducted in the study area. The selected VECs represent those elements of the biophysical environment and the socio-economic environment which were identified as significant issues on a local, regional, provincial or national perspective. The identified VECs are the basis of the assessment of potential impacts (either positive or negative) resulting from the project activities. Table 4.6.1 shows the list of issues or criteria used in this evaluation and the VECs identified for the Glen Dhu Project.

Table 4.6.1: Valued Ecological Component Selection and Rationale

Criteria	Selected as a VEC	Rationale
Geophysical Environment		
Physiography and Topography	Yes	Area identified as high wind energy resource
Surficial Soils and Bedrock	Yes	Structural engineering requirement.
Seismicity	No	No earthquakes recorded in area.
Biophysical Environment (Aquatic)		
Aquatic Fauna	Yes	Aquatic fauna not influenced by project activities.
Aquatic Vegetation	Yes	Aquatic flora not influenced by project activities.
Surface Hydrology	Yes	Access roads must consider surface water drainage
Surface Water Quality	Yes	Construction activities must consider erosion control.
Biophysical Environment (Terrestrial)		
Vegetation	Yes	Potential presence of rare or endangered species
Wetlands	Yes	Project sites avoid wetland areas
Wildlife (Common)	No	Historical logging operations have influenced habitat
Species of Concern	Yes	Birds, bats, mainland moose and fishers are identified as issues
Parks and Significant Natural Areas	Yes	Project sites are on private lands. Parts of the Eigg Mountain Wilderness Area and the James River Watershed

Criteria	Selected as a VEC	Rationale
		are adjacent to the boundaries of the project area.
Atmospheric Environment		
Climate	Yes	Wind climate is a condition of project sustainability
Air Quality	Yes	Global issue for renewable energy initiative and the reduction of emissions from fossil fuel combustion
Socio-Economic Environment		
Population/ Demographics/ Labour Force and Economic Profile	Yes	Project is considered to have an economic influence in the region.
Land use	Yes	Changes to land use identified as a public issue
Cultural Resources, Aboriginal Heritage and Archaeological Sites	Yes	Project area may have heritage/archaeological sites
Existing Sound Levels	Yes	Social and ecological issues identified
Recreation Areas	No	Sites are on private lands
Safety Issues	Yes	Public safety identified as a public issue
Visual Landscape	Yes	Viewscapes identified as a public issue
Radio Communication, Aviation	Yes	Compliance issue