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NEXTERA ENERGY CANADA, ULC SUMMERHAVEN WIND ENERGY CENTRE APPLICATION FOR A RENEWABLE ENERGY APPROVAL

Construction Plan Report

Submitted to:
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REPORT

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1.0 INTRODUCTION

This Construction Plan Report (the Report) has been prepared to provide information to the public, Aboriginal communities, municipalities and local authorities regarding the proposed Summerhaven Wind Energy Centre (the Project). The Report is a required component of an Application for a Renewable Energy Approval (REA Application) under Ontario Regulation (O. Reg.) 359/09[1] made under the *Environmental Protection Act (EPA)*.

This Report has been prepared in accordance with O. Reg. 359/09 and Technical Bulletin Three: Guidance for preparing the Construction Plan Report (MOE, 2010). Table 1 summarizes information to be included in the Report based on Table 1 of O. Reg. 359/09 and directs readers to the associated section(s) of this document.

Table 1: Construction Plan Report requirements under O. Reg. 359/09

Requirement as per O. Reg. 359/09	Report section where information can be found
Details of any construction and installation activities	Section 2
The location and timing of any construction or installation activities for the duration of the construction or installation	Section 2
Any negative environmental effects that may result from construction or installation activities within a 300 m radius of the activities	Section 3
Mitigation measures in respect of any negative environmental effects mentioned in paragraph 3	Section 3

Additional information about the Project can currently be found in the Design and Operations Report (Golder, 2011a), Decommissioning Plan Report (Golder, 2011b), and Project Description Report (Golder, 2011c). A description of the Site Plan design is provided in the Design and Operations Report. As it is broadly applicable to all of the REA Reports, and to avoid redundancy, the Site Plan diagram has been provided as a stand-alone document (the Site Plan Report).

Technical studies associated with the REA Application requirements were initiated in 2007 and extended into 2010. Additional information about the Project and results of technical studies and assessments of negative environmental effects are available in the following reports:

- Wind Turbine Specifications Report (Golder, 2011d);
- Natural Heritage Assessment Report (Golder, 2011e);
- Stage 1 Archaeological Assessment Report (Golder, 2010a);
- Heritage Assessment Report (Golder, 2011j);
- Noise Study Report (Golder, 2011f);
- Water Assessment Report (Golder, 2011g);
- Site Plan Report (Golder, 2011h); and
- Consultation Report (Golder, 2011i).

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[1] As amended by O. Reg. 521/10 which came into force on January 1, 2011.

Stage 2, Stage 3 and Stage 4 Archaeological Assessment Reports are not required as part of the REA Application for this Project (Ministry of Energy and Infrastructure, 2010) and are typically not publically available documents due to the confidential nature of the content. Stage 2, Stage 3 and Stage 4 Archaeological Assessment Reports will however be made available to the Ministry of Tourism and Culture (MTC) for review and their issuance of a Comment Letter in advance of construction, and hard copies of this information will be provided to Aboriginal communities with an interest in the Project, as identified by the Director, and as agreed to by individual Aboriginal communities.

The quantities provided in this Report are approximations based on NextEra Energy Canada's best available knowledge of Project construction requirements. However, based on unforeseeable circumstances during the Construction Phase, some of these numbers may change. Uncertainty related to construction activities, given that the construction contractor has not yet been chosen, may necessitate some modifications. The intention is to adhere to the construction activities and operational plans as they have been laid out in this Report.

1.1 Project Summary

The Project consists of the site preparation, construction, operation, and decommissioning of 59 wind turbine generators with a total installed nameplate capacity of 131.04 MW. The Project will be owned and operated by NextEra Energy Canada, ULC (NextEra Energy Canada) and will be located in the vicinity of Nanticoke, Haldimand County, Ontario (Figure 1, end of Report). The Project lifespan from obtaining the REA Approval to the end of Decommissioning is estimated to be 27 years. A summary of the Project vital statistic is presented in Table 2.

Turbine towers will be constructed on a concrete foundation. Underground and overhead cables will interconnect individual turbines and eventually connect to the substation (see Site Plan Report). The operation of the wind turbines will be monitored remotely from a Project operations building located near the substation. Once tested and commissioned, the turbines will require scheduled visits for maintenance during the Operations Phase. Maintenance will include complete inspection of the turbine's components and the tower, functionality testing, replacement of worn parts, bolt tightening and lubrication of moving parts. Routine preventative maintenance activities will be completed as per manufacturer requirements.

The Project Area (Figure 1) encompasses approximately 22,583 ha of privately owned land parcels. Land use is predominantly cash-crop agriculture (i.e., farming for corn, soybeans, wheat), although some areas are pasture (predominantly for cattle) and several wooded areas are present. Selkirk Provincial Park and Haldimand Conservation Area are located along the shore of Lake Erie south of the Project Area. The Grand River runs northeast of the Project Area and an Imperial Oil refinery is directly southwest.

The location of the Project was predicated by interest expressed by local landowners. Haldimand County is also attractive for wind development due to its proximity to Lake Erie, which results in favourable wind conditions for wind power production.

Table 2: Summary of Project Vital Statistics

General		
Project Name	Summerhaven Wind Energy Centre	
Project Ownership and Operation	NextEra Energy Canada, ULC	
Project Lifespan (approval to decommissioning)	27 years	
Project Nameplate Capacity	131.04 MW	
Project Area (as shown in Figure 1)		
Location of Project	Privately-owned land near Nanticoke, Ontario	
Total Project Area	22,583 ha	
Total Area of Project Location	298 ha	
Turbines	**Siemens 101**	**Siemens 93**
Total Number	58	1
Rating	2.221 MW	2.221 MW
Number of Blades	3	3
Blade Length	49 m	45 m
Hub Height	80 m	80 m
Rotor Diameter	101 m	93 m
Cut-in Wind Speed	4 m/s	4 m/s
Cut-out Wind Speed	25 m/s	25 m/s
Rated Wind Speed	12 – 13 m/s	12 – 13 m/s
Swept Area	8,000 m^2	6,800 m^2
Foundation Dimensions	Approximately 17 m × 17 m × 3 m	Approximately 17 m × 17 m × 3 m
Access Roads		
Length of 7.3 m-Wide Roads	11 km	
Length of 11 m-Wide Roads	36.9 km	
Electrical Transformers and Cables		
34.5 kV Collector System Cables	132 km (60 km, overhead, 54 km underground trenched, 3 km underground directional drilled)	
230 kV Transmission Cables	7.7 km (overhead)	
Other Project Structures and Facilities		
Transforming Substation Size	2 ha	
Switchyard Area	2 ha	
Operations Building Size	465 m^2, adjacent 200 m^2 parking area	
Temporary Land Use (Construction Phase)		
Construction Field Offices and Temporary Storage	4.3 ha	
Turbine Workspace (each turbine)	1360 m^2, including 100 m^2 crane pad	
Transforming Substation Workspace	5.2 ha	
Switchyard Area Workspace	2 ha	

2.0 DESCRIPTION OF CONSTRUCTION AND INSTALLATION ACTIVITIES

All construction and installation work will meet or exceed local regulations and standards (e.g., the Ontario Electrical Safety Code, Ontario Building Code). Construction and installation activities for the Project are broken down into the following Project Phases:

- Site Preparation;
- Component Installation and Connection; and
- Post-Installation Activities.

Under these headings, Project construction and installation activities are described in detail in the following sections. The Site Plan Report shows the disturbance areas associated with construction and installation activities for all Project infrastructure that is detailed in the Design and Operations Report.

A summary of the general timing of the Project construction and installation activities is provided in Table 3. Construction is expected to span 6 months from the start of excavations to completion of turbine and cable installation. The construction schedule was designed to account for minor delays that could result from an extended regulatory process, delayed component arrival and adverse weather conditions.

Table 3: Timing of Project Construction and Installation Activities

Project Phase and Activity	Estimated Start Date	Duration
Site Preparation		
Surveying and geotechnical investigations	Preliminary surveying in Spring 2012 Pre-construction surveying in Summer 2012	■ 1 – 2 weeks for preliminary surveys ■ 2 – 3 weeks for pre-construction surveys
Land clearing	Summer 2012	■ 2 – 3 months
Access roads		■ 1 – 2 months
Temporary storage/laydown areas		■ 1 – 2 months
Component Installation and Connection		
Turbine foundations	Spring to Fall 2012	■ 4 months
Turbine assembly and installation		■ 3 months
Collector system		■ 2 – 3 months
Transforming substation & operations building		■ 6 months
Meteorological towers		■ 4 – 5 days
Post-Installation Activities		
Clean-up and Reclamation	Fall 2012	■ Concurrent with construction activities ■ Completed 1 – 2 months after Component Installation and Connection Phase
Turbine Commissioning		■ 1 – 2 months

2.1 Site Preparation

The Site Preparation Phase includes all of the preliminary surveys and planning work required to develop the Project. It also includes land clearing and the creation of access roads and temporary storage/laydown areas prior to constructing major Project components in the Component Installation and Connection Phase. Project activities that will be undertaken in the Site Preparation Phase are summarized in Table 4. Further details about materials brought on-site, construction equipment used, timing, temporary uses of land, and materials generated at and transported from the Project Area during the Site Preparation Phase are provided in Sections 2.1.1 to 2.1.5. Details on construction disturbance areas and other Project vital statistics are presented in Table 2.

Table 4: Summary of Site Preparation Activities

Project Activity	Description	Equipment Required	Materials Required
Surveying and geotechnical investigations	■ The boundaries of the construction areas, including turbine sites, crane pads, transforming substation and operations building site, switchyard area, access and collector system routes, transmission line routes, and temporary workspaces will be surveyed and staked. ■ All existing buried infrastructure, such as pipelines and cables, will be located and marked by private contractors who will be responsible for locates using the Ontario One Call service. ■ A licensed archaeologist will be responsible for ensuring that any archaeological resources requiring protection, as identified in the Stage 2 or Stage 3 Archaeological Assessment Reports, are clearly marked as no work areas, and an exclusion fence will be constructed. ■ Geotechnical information will be gathered from a truck-mounted drill rig that will drill boreholes at predetermined sampling locations (turbine and selected monopole sites). This will be used to design the foundations as appropriate and establish baseline soil and hydro-geological conditions for soil management activities during excavation and backfilling. ■ Based on borehole data obtained by Inspec-sol in September 2008, and a records review of groundwater levels within the Project Area (see Appendix A), it was determined that there was a low likelihood of encountering	■ 4 – 5 light trucks ■ 1 – 2 truck-mounted drill rigs (10 ton or similar)	■ Survey stakes and exclusion fencing

Project Activity	Description	Equipment Required	Materials Required
	groundwater during excavations. Any instances where excavations do encounter groundwater will likely result in water takings less than 50,000 L per day.		
Land clearing	■ The Project will be located primarily on properties that are under active agriculture and are already mostly cleared of natural vegetation. ■ On all construction sites, the topsoil (and subsoil, where necessary) will be removed and temporarily stockpiled ■ Minimal removal of vegetation will be required to prepare the site for the construction of access roads, collector systems, substation, and other ancillary facilities. Negligible vegetation cutting or clearing will occur within any Significant Natural Features as identified in the Natural Heritage Assessment Report.	■ 15 – 20 deliveries with flatbed trucks (16 m or similar) ■ 2 – 3 light trucks ■ 2 – 3 tracked bulldozers (20 ton or similar) ■ 2 excavators (20 – 25 ton or similar) ■ 2 – 3 loaders (3 ton or similar) ■ 2 tandem dump trucks (30 ton or similar) ■ 2 compactors (15 ton or similar) ■ 2 graders (15 ton or similar) ■ 2 water trucks (15,000 L or similar)	■ Fuel and lubricating grease for construction equipment
Access roads	■ Gravel access roads will be constructed where no existing right-of-ways are situated to allow access to turbine and infrastructure sites during construction and Project operation. ■ There will be two access road widths (see Table 2) where the larger width will be required for any access roads used by track-mounted/crawler cranes for turbine assembly and installation. ■ Where access roads will cross water bodies the appropriate DFO Operational Statements will be followed	■ May be concurrent with, and may use the same equipment and materials as, land clearing activities	■ Approximately 0.25 –1 m of pit run gravel (2.1 tons/m^3) ■ Approximately 0.15 – 0.3 m of 0 – ¾ inch gravel (3.7 tons/m^3) ■ Approximately 0.6 kg/m^2 of geotextile material

Project Activity	Description	Equipment Required	Materials Required
	(DFO, 2009) or a Letter of Advice or Authorization will be obtained through consultation with DFO and Long Point Region Conservation Authority (LPRCA). Access roads and collector system cables will cross approximately 24 water bodies. Proposed water crossings are summarized in the Natural Heritage Assessment Report and the Water Assessment Report. ■ Access road locations have been determined through constraint mapping exercises, consultation with landowners, and discussions with local planners and County engineers. ■ The alignment of access roads will typically follow property boundaries for much of their distance and will be located to minimize loss of arable land, disturbance to agricultural operations and limit the number of watercourse crossings.		
Temporary storage/laydown areas	■ There will be a centralized workspace area for field offices, as well as temporary storage/laydown areas around each turbine, around the substation and the switchyard area (see Site Plan Report and Table 2). ■ Designated fuelling areas which meet safety and regulatory requirements may be established.	■ May be concurrent with, and may use the same equipment and materials as, land clearing activities	■ 5 – 7 trailers for field offices ■ Approximately 0.6 m depth of compacted crushed gravel for crane pads

2.1.1 Materials Brought On-site

During surveying and geotechnical investigations, field crews will use light trucks to transport crew members on-site to mark out the boundaries of all construction and workspace areas. Surveying materials, stakes, fencing and equipment will be transported to the Project Area once pre-construction surveying activities commence, and will be temporarily stored at the survey sites for the duration of surveying activities. Fencing will be used to exclude machinery and workers and protect identified Significant Archaeological Resources in close proximity to construction activities.

Access roads will require gravel and, where necessary, geotextile material. Aggregate will be transported on-site using dump trucks. Crane pads at each turbine site will require compacted crushed gravel, and access roads will require pit run gravel for the foundations and ¾ inch gravel for the running surface. Gravel and geotextiles will be transported to and used directly at their end locations.

New culverts or culvert upgrades may be required to cross watercourses. The location of proposed new watercourse crossings and type are discussed in detail in the Natural Heritage Assessment Report and Water Assessment Report.

Trailers will be brought on-site by the selected construction contractor to the centralized temporary storage/laydown area (see Site Plan Report) for the duration of construction and installation activities. Field offices will obtain power from Haldimand Hydro, and portable generators will only be used in the event of a power outage. Accommodation for construction teams will be rented off-site at existing facilities.

Refer to Table 4 for details on materials brought on-site.

2.1.2 Construction Equipment Used

All work crews will drive automobiles (typically light trucks) to reach Project work sites. County and provincial roads will be used for transportation of components and equipment to and from the construction sites, onto existing or new right-of-ways and constructed access roads. Flatbed trucks will be used to transport tracked bulldozers, excavators, loaders, dump trucks and compactors and graders to the Project Area for Site Preparation activities.

Geotechnical sampling of turbine sites will require a truck-mounted drill rig which is a self-contained unit that will be driven to each sampling location.

Clearing of land in temporary storage/laydown areas, along access routes and in areas where directional drill or punch and bore crossing will be used will require tracked bulldozers and excavators to strip topsoil and subsoil, as required. Compactors and graders will be used to create an even travel surface where gravel is laid down (e.g., access roads).

All large construction equipment will run on diesel fuel. For a detailed description of emissions of noise and dust from equipment, see Section 3.2.1.

Refer to Table 4 for details on construction equipment.

2.1.3 Timing and Operational Plans

Surveying and geotechnical investigations are the first activities of the Site Preparation Phase, followed by clearing of land for, and construction of, access roads and temporary storage/laydown areas. Once roads and temporary storage/laydown areas are constructed, additional equipment and materials can be brought into the Project Area for the Component Installation and Connection Phase activities. All activities will be undertaken in accordance with Haldimand County by-laws for consistency with times of day when agricultural machinery would normally be in operation in order to minimize disruptions (e.g., noise) to the local environment.

Significant archaeological resources (as identified in the Archaeological Assessment Reports) that are in close proximity to construction activities will be clearly marked, and fencing will be erected around sites within disturbance areas.

Drilling time for geotechnical sampling is subject to subsurface conditions at each site. Results of geotechnical sampling will determine the requirements for turbine foundation dewatering during foundation construction. In order to determine the likelihood that dewatering would be required during foundation excavation and construction, a records review and analysis was initiated by Golder and is summarized in Section 3.5. Infrastructure sites will be re-surveyed and staked prior to construction (pre-construction surveying).

For construction of access roads, topsoil will have been stripped during land clearing activities. Geotextile material (as required) and gravel will then be laid down and compacted.

Where access roads will cross watercourses that are known or assumed to contain fish or fish habitat, the appropriate DFO Operational Statements for constructing access across the watercourse will be followed (DFO, 2009). A list of the DFO Operational Statements that may be applicable is provided below, noting that individual crossings are likely to refer to only two or three individual statements:

- Notification Form;
- Timing Windows;
- Temporary Stream Crossings; and
- Clear Span Bridges;

Protection of fish and fish habitat will be achieved by adhering to DFO Operational Statements listed above. Adjustments to the timing windows relative to the Operational Statement for Timing Windows will be discussed and agreed to in consultation with the LPRCA and the Department of Fisheries and Oceans (DFO) prior to commencing construction. Construction across intermittent watercourse crossings will be timed to occur during dry conditions, to the extent possible. If not feasible, or in the case of permanent watercourses, isolated working conditions will be achieved by temporary dam installation and pumping following the crossing technique agreed to with the Long Point Region Conservation Authority (LPRCA). Regardless of the approach taken, appropriate approvals will be acquired from DFO to meet the Policy for the Management of Fish Habitat objective of no net loss of fish habitat.

For additional information on watercourse crossings, potential environmental effects and mitigation measures, refer to the Natural Heritage Assessment Report and the Water Assessment Report.

2.1.4 Temporary Uses of Land

Construction and installation activities will utilize temporary storage/laydown areas for field offices and centralized storage (see Site Plan Report). In addition, temporary storage/laydown areas around each turbine will include gravelled crane pads to provide a support area for assist cranes and boom trestles used to erect turbine components.

Personnel trucks, equipment, construction material, stripped soil, fuels/lubricants and any other materials delivered to the site will be stored in temporary storage/laydown areas until used. Field offices, associated generators, portable toilets and other temporary structures will be used during Construction and Installation activities.

Lands used for temporary storage/laydown will be converted from active agricultural prior to construction, with a few access roads that will cross pasture, windbreaks/hedgerows and other vegetated communities.

Soil management will be incorporated into the creation and use of these areas to facilitate site reclamation (see details in Section 2.1.5 below). All temporary workspaces will be converted back to their previous land use after the Component Installation and Connection Phase (see Section 2.3.4).

2.1.5 Materials Generated at/Transported from Project Area

Small amounts of spoil material from borehole drilling during geotechnical surveys may be re-distributed on disturbed areas at the drill site.

Topsoil and/or subsoil stripped from access roads and temporary storage/laydown areas may be re-used on-site, where feasible. Stockpiles may be covered with plastic sheeting or tarps to prevent erosion and propagation of noxious weeds.

Sanitary sewage from portable toilets will be collected by a licensed hauler and disposed of off-site.

2.2 Component Installation and Connection

The Component Installation and Connection Phase includes construction and assembly of major Project components including turbines, the transforming substation, switchyard area and collector system. Project activities that will be undertaken are summarized in Table 5. Further details on materials brought on-site, construction equipment used, timing and operational plans, temporary uses of land, and materials generated at and transported from the Project Area during the Component Installation and Connection Phase are provided in Sections 2.2.1 to 2.2.5. Details on construction disturbance areas and other Project vital statistics are presented in Table 2.

Table 5: Summary of Component Installation and Connection Activities

Project Activity	Description	Equipment Required	Materials Required
Turbine foundations	■ Soil stockpiles, separated into subsoil, topsoil and other major horizons, where present, will be temporarily maintained at each turbine site within the prescribed work area. Distribution of subsoil and topsoil after construction activities are completed is discussed in Section 2.2.5. ■ If excavations extend below the groundwater table, dewatering will occur and water will be pumped out to an acceptable receiving area (see Section 2.1.3). At present it is predicted that the daily volume will not exceed 50,000 L per day based on a records review and assessment of local well depths, geology and ground water levels (see Section 3.5). ■ Formwork and rebar will be installed and concrete pumps or elevators will be used to place the concrete. Formwork will be struck after approximately 24 hours and the excavated area will be back-filled and compacted until only the tower base portion of the foundation is left above ground.	■ May use the same equipment and materials as land clearing activities in the Site Preparation Phase ■ Approximately 1,400 deliveries using 16 m^3 concrete trucks (or similar) ■ 15 – 20 deliveries using flatbed trucks (16 m or similar) for rebar, mounting assemblies and forms ■ Truck-mounted crane or rough terrain forklift	■ Approximately 16,000 m^3 of concrete ■ formwork and rebar

Project Activity	Description	Equipment Required	Materials Required
Turbine assembly and installation	■ Components for each turbine include the tower, nacelle, rotor, hub, blades and pad-mounted transformer. ■ Turbine towers will arrive in sections that will be assembled and erected on-site.	■ 600 – 720 deliveries using specialized 34 – 60 m transport vehicles ■ 3 cranes (800 – 1000 ton crane with two assist cranes)	■ Turbine towers (delivered in 3 sections) ■ Nacelles ■ Rotors and hubs ■ Pad-mounted transformers
Collector system	■ The collector system will be a mixture of overhead and underground cables that connect individual turbines to each other or junction boxes, and then connect to the transforming substation. ■ Overhead cables and transmission lines will require installation of wood, steel or concrete monopoles to a depth of 2 – 5 m. ■ Underground cables will be installed using a combination of ploughing/trenching (to a depth of approximately 1.1 – 1.2 m and with an individual trench a width of approximately 1 m), and directional drilling or punch and bore crossings (to a depth of approximately 1 – 1.5 m below the channel bed with underground drill bore diameter disturbance of < 1 m per drill path, and drill pad/bell hole disturbance areas up to 10 m x 10 m). Where the underground cable must be spliced, a splice pit will be excavated that is approximately 1.5 m deep, 1 m wide, and 1 – 2 m long. Trenches and splice pits will be backfilled immediately. ■ Where appropriate, high voltage warning markers will be installed, such as in locations where underground cables cross public roads or are situated in multi use servicing corridors. Where underground cable will cross watercourses the appropriate DFO Operational Statements will be followed (DFO, 2009) or a Letter of Advice or Authorization will be obtained through consultation with DFO and LPRCA.	■ May use the same equipment and materials as land clearing activities in the Site Preparation Phase ■ 30 deliveries using flatbed trucks (16 m or similar) ■ 2 – 3 cable reel trucks ■ 1 – 2 boom trucks ■ 1 – 2 auger trucks	■ Approximately 1,500 wood, steel or concrete monopoles ■ Approximately 129 km of 34.5 kV utility cable ■ Approximately 10 km of 230 kV utility cable

Project Activity	Description	Equipment Required	Materials Required
Transforming substation and switchyard area	■ The transforming substation will be constructed and connected (using overhead transmission lines) to the main 230 kV Hydro One transmission line via a switchyard area (see Site Plan Report). ■ A secondary containment system will be installed around transformers to reduce the potential for contamination of the environment in the even of a leak. ■ High voltage warning cable markers will be installed at the substation, where required.	■ 3 – 4 light trucks ■ 1 excavator (20 – 25 ton or similar) ■ 1 loader (3 ton or similar) ■ 2 tandem dump trucks (30 ton or similar) ■ 1 compactor (15 ton or similar) ■ 1 grader (15 ton or similar)	■ isolation switch ■ circuit breaker, ■ step-up power transformer ■ transmission switch gear ■ instrument transformers ■ grounding and metering equipment ■ metal fences
Operations building	■ The operations building will contain all facilities and infrastructure related to daily operations of the Project, including a small office, washroom, mess facilities, storage areas and associated parking (see Site Plan Report).	■ May use the same equipment required for the transforming substation	■ concrete, rebar, brick, mortar ■ plumbing, electrical and telecommunication systems ■ Approximately 2.1 tons/m^3 of pit run gravel
Meteorological towers	■ Three meteorological towers were installed previously by NextEra Energy Canada and AET, but stations used for pre-development wind resourcing studies have been determined to be insufficient for long term monitoring during Project Operations. ■ Four additional meteorological towers (wind measurement masts) will be constructed in the Project Area. ■ There will be two Field Permanent Meteorological Towers (FPMT1 and FPMT2) and two SCADA Meteorological Towers (SMT2 and SMT4). SMT2 and SMT4 (see Site Plan Report) will be connected to the SCADA system which connects the individual turbines, substation, and meteorological towers to the Operations Building.	■ May use the same equipment required for the transforming substation	■ Tower components ■ Approximately 10 m^3 concrete for foundation

2.2.1 Materials Brought On-site

Turbine foundations will be constructed using steel formwork, rebar and ferro-concrete. Concrete will be delivered to temporary storage/laydown areas around each turbine site just prior to use.

Turbine components will be delivered to temporary storage/laydown areas adjacent to each turbine site just prior to installation by specialized tractor trailer combinations.

The overhead collector system and transmission lines will use wood, steel or concrete monopoles to be installed along roads and right-of-ways. Utility cable will be required for underground and overhead lines, and junction boxes and associated materials will be delivered with other collector system, transmission line and substation components to temporary storage/laydown areas.

The transforming substation will include an isolation switch, circuit breaker, step-up power transformer, transmission switch gear, instrument transformers, grounding and metering equipment. Components will be supplied by General Electric. The operations building will include a small office, mess facilities, washroom, and storage areas. These sites will be gravelled to facilitate drainage and provide a small parking area, and metal fences will be installed around the perimeters.

The switchyard area will contain a Project switching station and a Hydro One Networks Inc. (HONI) switching station. The HONI switching station will include three separate buildings and will connect to the main N1M circuit via two 230 kV tap egresses. Project-owned switchyard area components will be supplied by General Electric.

The four new meteorological tower(s) will be of tube type construction supported by guy wires. Sections will be assembled on-site and erected immediately.

Refer to Table 5 for details on materials and construction equipment.

2.2.2 Construction Equipment Used

Typical equipment to be used for installation of the turbines, substation, switchyard area, operations building, and buried cables includes tracked bulldozers, excavators, compactors, graders, concrete pumps or elevators, tippers and dumpers, a large tracked crane and smaller assist cranes. In areas where underground cables will cross watercourses or other natural features via directional drilling or punch and bore methods, specialized drill rigs will be used.

Bulldozers and loaders will be used to compact turbine foundations, and dump trucks will remove surplus excavated material. A truck-mounted crane or rough terrain forklift will be used to place formwork and rebar into the excavated foundation.

A crawler crane will be used for tower, nacelle and blade installation, and two smaller cranes will assist with erecting the turbine towers.

Collector system and transmission line monopoles will be installed by mobile cranes in holes created using a truck-mounted auger. Cables will be strung in place using boom trucks and specialized cable reel trucks.

Construction of the substation and operations building will require a bulldozer, loader and excavator to clear the soil surface and excavate the foundation, and dump trucks to remove excavated materials. The same concrete pump/elevator used for turbine foundations will be used for the substation and meteorological tower foundation(s), and a compactor and grader will be used once excavated soils are backfilled.

Construction equipment, fuel and lubricants will be delivered to temporary storage/laydown areas by large truck and trailer combinations. Project components will be delivered as needed throughout the Component Installation and Connection Phase, and, to the extent practical will be timed so that materials are delivered to each turbine site just before they are needed for construction.

Refer to Table 5 for details on construction equipment.

2.2.3 Timing and Operational Plans

Construction activities will commence once all necessary permits (REA, building permits, etc.) have been obtained, the materials and workforce have been mobilized, and the weather conditions are conducive to begin construction. Many construction tasks will overlap as foundations can be started once one or more access roads have been built, and turbines can be installed once one or more foundations have been installed and the concrete has set. The construction of the collector system, transmission line, transforming substation and switchyard area can occur while turbine foundations are being built and turbines are being installed.

All necessary activities will be undertaken as required by Haldimand County noise by-laws. These hours are generally consistent with times of day when agricultural machinery would normally be in operation.

The primary roads used for equipment and component delivery will be a combination of highways, arterial roads and County right-of-ways. In some cases temporary lane widening will be required to allow for a sufficient turning radius for delivering turbine blades. A Traffic Management Plan (TMP) will be created by the Project Manager for the selected construction contractor in conjunction with Haldimand County and the Ministry of Transportation, as required, and will be established for the purposes of ensuring safety while minimizing interference with existing road uses. Transportation routes, safety measures, and the potential for rehabilitating County roads will be identified, as applicable, during pre-Construction, Construction, and post-Construction stages.

To develop the pre-Construction stage of the TMP, the Construction Project Manager will meet with Haldimand County to review the location of the construction field offices and temporary storage/laydown area, the expected use of abutting roads, and any road improvements or changes needed for access points or drain crossings in accordance with criteria established by Haldimand County. The Project Manager will identify the expected number of days of construction and the hours of construction, and will advise Haldimand County of any unexpected changes to transport routes or timing due to delays. The Project Manager will work with Haldimand County to determine best routes and timing related to school bus routes. The Project Manager and the Haldimand County roads superintendent will inspect the proposed access routes to the construction sites to confirm the road conditions, sight lines, signage locations, drain crossings, and need for possible road improvements. This inspection will form the base line for future road rehabilitation as required. The Project Manager and Haldimand County will determine a reasonable deposit in the form of a letter of credit, surety bond or parental company guarantee to ensure rehabilitation of any road damage.

During the Construction stage of the TMP, the Construction Project Manager will manage traffic in accordance with all Provincial and County laws in the applicable jurisdiction. The Project Manager will ensure that the appropriate signage is posted at the entrance and exit to the construction site, warning of the activity. The Project Manager will provide the necessary personnel to ensure safe ingress, egress, and traffic flow, to and through the Project Area as needed. The TMP will ensure safe turning movements to and from the site to avoid the need to back onto public roads. During construction, all signage, signalling and related controls will be undertaken in accordance with the *Manual of Uniform Traffic Control Devices, Ministry of Transportation Division 5, Temporary Conditions, April, 1987*. The Construction Project Manager will ensure that roads are maintained and cleaned as needed in accordance with County standards. On a weekly basis, the Construction Project Manager will ensure that no construction debris or mud from the construction sites is left on public roadways. The Construction Project Manager will report any damage resulting from construction activity to Haldimand County.

During the post-Construction stage of the TMP, the Construction Project Manager will undertake an inspection of public roads used during construction with Haldimand County staff to identify any required maintenance or damage. The results of the inspection will be documented. Where road damage is identified, the Construction Project Manager will obtain estimates to repair the road to the pre-construction condition. The Construction Project Manager will also restore any temporary construction site access points and remove any temporary road improvements related to the Project. Haldimand County will return the deposit upon satisfactory inspection of the public roads and any repair work within three months of the end of construction.

2.2.3.1 Turbine Foundations

Turbine sites will be stripped of topsoil and subsoil using tracked bulldozers and excavators. In the event that dewatering activities are required during foundation construction then dewatering will be conducted in such a way as to manage sedimentation (i.e., through discharge via piping to a sump area at the lowest point of disturbance). The likelihood of dewatering during foundation construction was determined to be minimal based on topographic and surficial geology mapping, MOE Water Well Records, planned excavation depths, and historical geotechnical boreholes (see Section 3.5).

Formwork and rebar will be installed to reinforce the foundation, and will be inspected. Concrete will be poured from concrete trucks with concrete strength testing completed on a predetermined number of loads. Formwork will be struck after the concrete has met the desired strength and the excavated area will be backfilled and compacted until only the tower base portion of the foundation is left above ground. Large bolts will be set into the concrete, which will be used to anchor the turbine tower to the foundation. These stages of turbine foundation construction are illustrated in Plate 1.

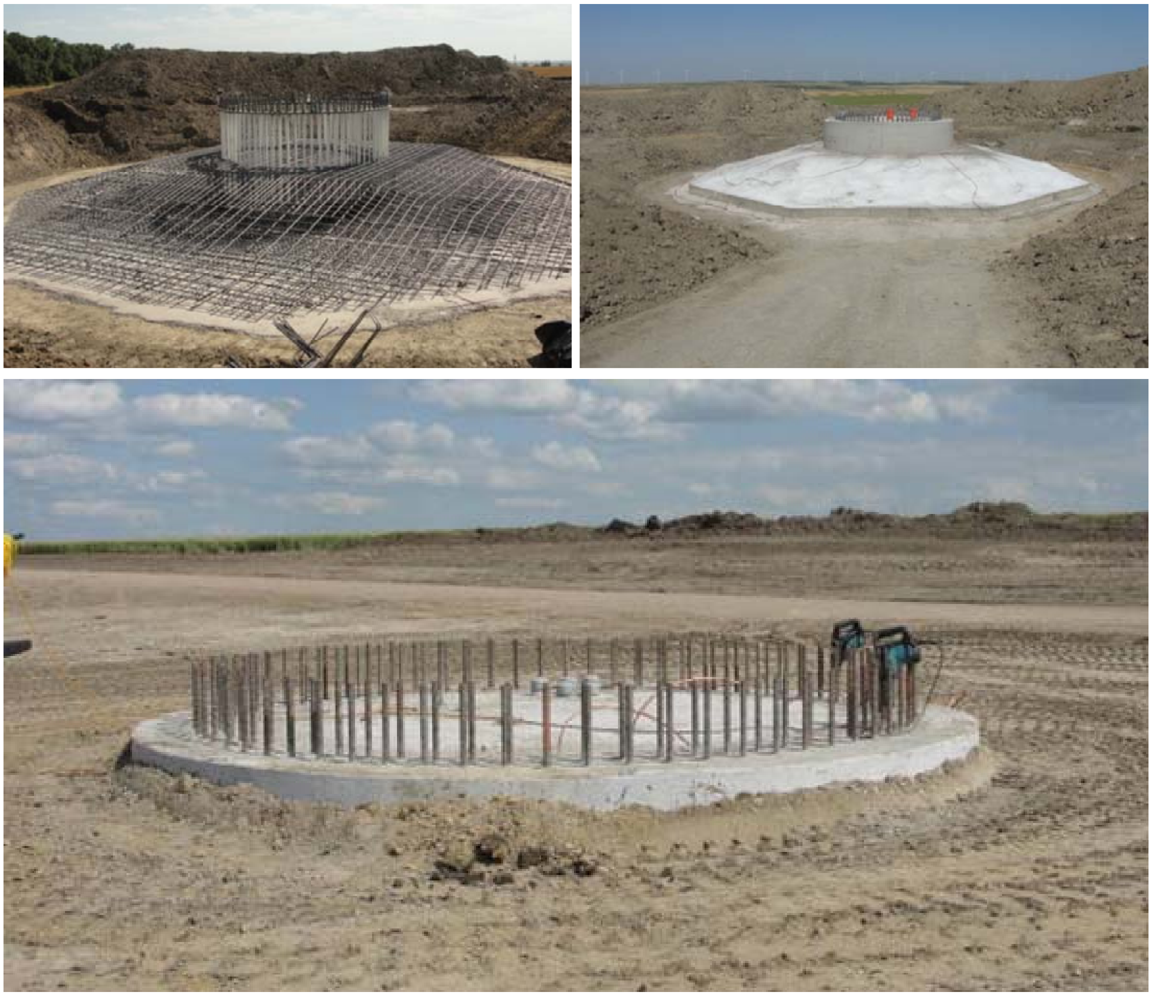

Plate 1: Illustration of Turbine Foundation Construction Stages

2.2.3.2 Turbine Assembly and Installation

The wind turbine towers will be delivered in sections and will be assembled on-site. The first tower section will be bolted to the foundation using holding-down bolts that are set in the concrete, and the remaining sections will be lifted one at a time where they will subsequently be attached in place. Next, the nacelle will be lifted into place on the tower. Once the blades are attached to the nose cone on the ground, the assembled rotor is then lifted and connected to the nacelle. In some circumstances, a single blade lifting technique may be utilized where space or high wind constraints prevent the blade and nose cone assembly from being lifted in one piece. The pad-mounted transformers will be secured to the foundation.

2.2.3.3 Collector System

The collector system will be a mixture of overhead and underground cables. Overhead routes will be constructed using wood, steel or concrete monopoles. Collector cables will be primarily installed along Project access roads and County roads but will also follow direct lines between turbines in cases where this is more practical. Project infrastructure, including collector cables is shown in the Site Plan Report.

The Project will require overhead transmission lines to be installed or upgraded on a combination of existing monopoles or new monopoles, subject to agreement with Haldimand Hydro and Hydro One. The transmission line will allow the transfer of electricity from the Project substation to an existing Hydro substation via a switchyard area.

Overhead lines will be used to connect the junction points from groups of turbines to a single junction box terminating at the substation. Once holes are dug, the monopoles will be installed and then “dressed” (made ready to accept circuits) and strung with transmission cables using boom trucks and specialized reel trucks.

Depending on the contractor selected, separate crews may be used to auger the holes and to dress and string the cables.

The majority of underground cables will be installed using a combination of ploughing and trenching (either by trenching machine or backhoe) depending on terrain. Typically, underground cables are trenched over short distances where maneuverability of the ploughing equipment is difficult or where it has been identified that ploughing poses an unacceptable hazard to existing tile drainage or other underground services. A track-mounted plough mechanism, which cuts a narrow trench (plough seam), will be used to install the underground cables. Depending on equipment availability, a wheel-ditcher or Ditch Witch (a wheel-like or bar-like mechanism similar to a chainsaw) will be used to cut the plough seam. This plough seam will be excavated to a depth of approximately 1.1 – 1.2 m and a width of approximately 1 m, into which the cable is placed. Once the cable has been covered with sand, a backhoe or small bobcat will be used to push the soil back into place and re-contour the disturbed area. In most cases, soil will be backfilled immediately to prevent loss from erosion, but where temporary storage of soil is required, topsoil and subsoil will be stored separately (adjacent to the trench) to minimize changes to soil properties after replacement.

In some instances, underground cables will cross watercourses or other natural features using directional drilling or punch and bore methods that will install underground cables beneath the root systems of vegetation or beneath watercourses and waterbodies so as to minimize the potential disturbance with the function of these features and/or species and habitat within them. Directional drilling is a trenchless technology that generally involves a boring head and a spoil removal system. The head contains a transmitter which enables the user to know the location, depth, and attitude of the steering head. This information is used to steer the head by a variety of techniques (e.g., rod pushing, hydro-jet drilling, and pneumatic/rotary air drilling). This method relies on very sophisticated downhole instrumentation to continuously monitor the position and orientation of the steering head. Monitoring of the drilling operations, including assessment of potential frac-outs of drilling muds (if these are suspected), will be conducted. The implementation of directional drilling (or punch and bore crossings) will generally follow industry practices outlined in the reference Guideline Planning Horizontal Directional Drilling for Pipeline Construction (September 2004) which is available from the Canadian Petroleum Producers Association. Refer to the Natural Heritage Assessment Report and the Water Report for a description of which natural features and waterbodies will be crossed using these methods, and for typical and plan drawing of specific locations where these methods will be employed.

Where underground cables must be spliced (e.g., at the end of a reel or to pass underneath another utility line or pipe) a splice pit is typically required. These pits are roughly 1 m deep, 1 m wide, and up to 5 m long). At these locations, the topsoil will be stripped and stockpiled. After the procedure is complete, soil will be replaced and contoured.

The depth at which underground cables are buried will not interfere with normal agricultural practices but will cause a short term temporary disturbance. All underground cabling situated on private lands will be mapped and Ontario One Call and the landowner will be notified of the cable locations. NextEra Energy Canada will also create an operations staff contact number for landowners to request information regarding the location of underground cables on their property (see Design and Operations Report). This number would also be available to Ontario One Call, the wider community and relevant local and County authorities. For areas where the underground cable leaves private lands, the locations will be indicated by standard cable markers, consistent with Ontario One Call colour codes. All cable installation works on County lands will be done in conjunction with relevant authorities and to the appropriate required standards.

Where underground cables will cross watercourses, the appropriate DFO Operational Statements for constructing access across the watercourse and installing the cable underground or overhead, as shown in the Site Plan Report, will be followed (DFO, 2009). A list of the DFO Operational Statements that may be applicable is provided below, noting that individual crossings are likely to refer to only two or three individual statements:

- Notification Form;
- Timing Windows;
- High Pressure Directional Drilling;
- Punch and Bore Crossings;
- Temporary Stream Crossings;
- Isolated or Dry Open-cut Stream Crossings;
- Overhead Line Construction; and
- Maintenance of Riparian Vegetation in Existing Rights of Way.

Crossings of watercourses will also comply with requirements of the Navigable Waters Protection Act and the Minor Works and Waters (Navigable Waters Protection Act) Order, where applicable. Additional guidance provided by Transport Canada in the brochures, Submarine cables_TP14592B, and Temporary works_TP14893B (available on the Transport Canada website) will also be followed where criteria apply to specific crossings.

2.2.3.4 Transforming Substation and Switchyard Area

The locations of the substation and switchyard area are shown in the Site Plan Report. The sites will be prepared using tracked bulldozers and excavators to strip topsoil and subsoil, as required, to create an even work surface. Soil management will be incorporated into this process to facilitate site reclamation. Existing vegetation (agricultural crops) will be stripped with the topsoil, which will be stockpiled separately from stripped subsoil in a temporary workspace adjacent to the site.

A secondary containment system will be installed around the transformer so that in the unlikely event of an oil leak, soil contamination is avoided. Once construction has been completed, a fence will be constructed to control access to the switchyard area. The sites will be gravelled and contoured for effective surface drainage using previously stripped subsoil and topsoil stored on-site.

Substation grounding will follow the Canadian Electrical Code (CEC), and high voltage warning generator line markers will be installed at the substation and elsewhere as may be required (e.g., where underground cables cross County roads).

The location of the Hydro One transmission line is shown in the Site Plan Report.

2.2.3.5 Operations Building

The operations building will be located on privately owned lands and will include a small office, mess facilities, a washroom, and associated parking and storage areas. The primary purpose of the operations building is to monitor the day-to-day operation of the Project and to provide any required support to Project maintenance. All County and provincial standards will be followed in the construction of the operations building.

2.2.3.6 Meteorological Towers

One meteorological tower has previously been permitted and installed by NextEra Energy Canada and two meteorological towers were permitted and installed by AET in order to conduct baseline wind resource assessment studies.

Four additional meteorological towers (wind measurement masts) will be constructed in the Project Area. There will be two Field Permanent Meteorological Towers (FPMTs) and two SCADA Meteorological Towers (SMTs). SMT2 and SMT4 (see Site Plan Report) will be connected to the SCADA system which connects the individual turbines, substation, and meteorological towers to the Operations Building. The tower site(s) would be prepared using the same methods described in Section 2.2.3.4.

2.2.4 Temporary Uses of Land

The same temporary storage/laydown areas created and used during the Site Preparation Phase (described in Section 2.1.4) will be used during the Component Installation and Connection Phase. All temporary workspaces will be converted back to their previous land use during the Post-Installation Activities Phase (see Section 2.3.4).

In addition, during the Component Installation and Connection Phase, temporary water lines for turbine foundation dewatering may be required. In these cases, the discharge location will be situated in a sump area usually placed at the lowest point of disturbance. The discharge of groundwater from work areas will avoid discharge to adjacent water bodies/watercourses.

2.2.5 Materials Generated at/Transported from Project Area

During turbine foundation and substation construction, excavated subsoil and topsoil will be stored in piles on-site at each temporary storage/laydown area until they are replaced during clean-up and reclamation activities in the Post-Installation Activities Phase (see Section 2.3). Any excess subsoil will be distributed to nearby participating farms to be used by the landowner at their discretion, and excess clean topsoil will be re-distributed to adjacent lands as appropriate.

Packing frames for the turbine components and cabling spools will be returned to their respective vendors or will be recycled. Plastics from other containers and packaging will be disposed of through the local landfill and recycling facilities where appropriate. Construction materials and scrap metals (e.g., gravel, copper wiring, and conductor) will be removed and sold by NextEra Energy Canada to a local scrap metal dealer. Oils, fuel and lubricants used in maintenance and operation of construction equipment will be stored temporarily in accepted containment systems and will subsequently be removed by a licensed contractor. The licensed contractor will be required to dispose of these wastes through conventional waste-oil and hazardous waste disposal streams.

Refer to the Decommissioning Plan Report for details on the types and locations of waste management facilities to be used.

Portable toilets will be maintained and emptied by a licensed contractor who will be responsible for disposing of these wastes at a certified facility.

2.3 Post-Installation Activities

The Post-Installation Activities Phase includes clean-up from Construction and Installation activities, conversion of temporary storage/laydown areas back to their state prior to the Site Preparation Phase, and turbine commissioning activities in preparation for commercial operation. Project activities that will be undertaken in the Post-Installation Activities Phase are summarized in Table 6. Further details on materials brought on-site, construction equipment used, timing and operational plans, temporary uses of land, and materials generated at and transported from the Project Area during the Post-Installation Activities Phase are provided in Sections 2.3.1 to 2.3.5. Details on construction disturbance areas and other Project vital statistics are presented in Table 2.

Table 6: Summary of Post-Installation Activities

Project Activity	Description	Equipment Required	Materials Required
Clean-up and Reclamation	■ Construction debris will be collected and disposed of at approved locations. ■ If spills occurred during construction, spill-affected areas will be remediated as appropriate. An adequate amount of emergency oil spill kits will be maintained on-site during the construction and operation of the Project. ■ Areas where soils have been stripped will be replaced and re-contoured using stockpiled materials, and disturbed areas (including trenches and plough seams) will be re-seeded, subject to crop rotation and relative timing of works. ■ Site clean-up and reclamation will occur concurrently with construction activities.	■ 3 – 4 light trucks ■ 1 – 2 tracked bulldozers (20 ton or similar) ■ 2 – 3 loaders (3 ton or similar) ■ 1 – 2 tandem dump trucks (30 ton or similar) ■ 1 – 2 graders (15 ton or similar)	■ Fuel and lubricating grease for equipment
Turbine Commissioning	■ Once the turbines and transforming substation are fully installed and Hydro One is ready to accept grid interconnection, electrical, mechanical and communications systems will be tested and inspected. ■ If grid interconnection is not available at the time of commissioning, temporary diesel-powered generators with associated load banks will be used to complete turbine commissioning activities.	■ May require two 1,500 kW generator sets (or similar) with associated load banks	■ May require fuel and lubricating grease for generators

2.3.1 Materials Brought On-site

Turbines will be commissioned using two 1,500 kW generator sets with associated load banks or connected with the substation, as necessary.

Unless all soil stockpiles have been depleted, no additional clean fill will be brought into the Project Area during clean-up and reclamation activities.

2.3.2 Construction Equipment Used

Construction debris and any spill-affected soils will be collected and disposed of off-site using the same equipment used during the Component Installation and Connection Phase, including bulldozers, loaders and dump trucks.

Refer to Table 6 for details on construction equipment.

2.3.3 Timing and Operational Plans

All clean-up and reclamation activities and turbine commissioning activities will be undertaken as required by Haldimand County noise by-laws. These hours are generally consistent with times of day when agricultural machinery would normally be in operation.

2.3.3.1 Clean-up and Reclamation

Site clean-up and reclamation will be conducted concurrently with construction, and will be implemented as soon as possible following installation of Project infrastructure.

All construction debris will be collected and disposed of at an approved location (see Decommissioning Plan Report for details on the types and locations of waste management facilities). Temporary storage/laydown areas and temporary access roads will be converted back to their previous land use. Where required, subsoil will be ripped to alleviate compaction, and stripped subsoil and topsoil stored on-site will be replaced. All areas with disturbed soil (including trenches and plough seams for underground cable installation) will be re-seeded with vegetation occurring prior to disturbance, at the discretion of landowners.

During construction, industry best practices for spill prevention will be utilized and an adequate amount of emergency oil spill kits will be maintained on-site during construction and operation of the Project. Spills will be handled in accordance with the MOE’s Spills and Discharges Reporting Protocol as required under Sections 15 and 92 of Ontario’s *Environmental Protection Act*. Any spill-affected areas will be immediately contained and undergo remediation as appropriate. Any impacted soils will be removed from the site and disposed of at an approved facility, and soils will be replaced with stockpiles from clearing and excavation activities.

All vehicles and construction equipment will be removed from the Project Area.

2.3.3.2 Turbine Commissioning

Prior to commencement of final commissioning, a Commissioning and Testing Plan will be developed by NextEra Energy Canada in conjunction with Siemens, the Ontario Power Authority and Haldimand Hydro.

Turbine commissioning will occur once wind turbines have been fully installed and may take place in sequential order prior to the planned commercial operation of the Project. If this takes place prior to the transmission interconnection being available, the use of temporary diesel-powered generators may be required to complete pre-commissioning activities, as described previously.

The commissioning will necessitate testing and inspection of electrical, mechanical, and communications operability. A detailed set of operating instructions must be followed in order to connect with the electrical grid.

2.3.4 Temporary Uses of Land

Temporary storage/laydown areas will be utilized during clean-up and reclamation activities, concurrent with their conversion back to prior land use. Workspaces used for field offices and those around turbine sites, the substation, switchyard area and meteorological tower sites will be restored to their previous condition as described in Section 2.3.3.1.

2.3.5 Materials Generated at/Transported from Project Area

All construction debris, including lumber, rebar, concrete, cabling, crates and packaging, and any spill-affected soils, will be collected and disposed of at an approved location (see Decommissioning Plan Report for locations). All reasonable efforts will be made to minimize waste generated and to recycle materials including returning packaging material to suppliers for reuse/recycling (see Section 2.2.5).

3.0 DESCRIPTION OF POTENTIAL NEGATIVE ENVIRONMENTAL EFFECTS, MITIGATION MEASURES AND ENVIRONMENTAL EFFECTS MONITORING PLANS

The creation of O. Reg. 359/09 has resulted in a streamlined process of assessment for renewable energy projects, including wind projects. This process results in a focussed assessment that concentrates on aspects of these projects that require management in order to ensure that adverse environmental effects are mitigated to the extent possible.

The new regulation requires compilation of baseline information for a number of environmental components, including:

- Noise receptors (nearby residents);
- Water bodies;
- Natural features;
- Archaeological resources; and
- Built heritage resources.

Baseline information for each of these environmental components has been documented and will be included in respective reports that will accompany the REA Application. O. Reg. 359/09 also requires that setbacks be maintained from water bodies, certain natural features, and noise receptors. If natural feature setbacks are not adhered to, an Environmental Impact Study (EIS) must be conducted that demonstrates that the Project will not result in adverse affects on water bodies, certain natural features, or noise receptors. Based on the baseline information collected, the following features or receptors were identified in the Project Area and evaluated to determine if they adhered to O. Reg. 359/09 setbacks:

- Noise receptors;
- Water bodies (lakes, permanent or intermittent streams, seepage areas);
- Woodlands;
- Wetlands;
- Wildlife habitat;
- Valleylands;
- Provincial parks;
- Conservation reserves; and
- Provincially significant areas of natural and scientific interest (earth and life sciences).

Based on the noise receptors, natural features and water bodies that are present in the Project Area, Table 7 summarizes the setback requirements outlined in O. Reg. 359/09, and the section of the REA Application where additional effects assessment was undertaken. It is noted that development may occur in several of these setback areas as long as the additional studies identified in O. Reg. 359/09 are conducted and confirmation is provided by MNR or MOE.

Table 7: Project Adherence to O. Reg. 359/09 Setback Requirements

Setback Requirement	Section of Application Where Additional Assessment is Undertaken (if Required)
Minimum setback of 550 m from Points of Reception (i.e., non-participating)	Noise Study Report
30 m + turbine blade length (80 m total) (cables/transmission lines) or 120 m (turbines/transformers) from the average annual high water mark of lakes, permanent or intermittent streams and seepage areas	Natural Heritage Assessment Report Water Assessment Report
120 m from provincially significant wetlands	
120 m from significant wildlife habitat	
120 m from significant valleylands	
120 m from provincial parks	
120 m from conservation reserves	
120 m from provincially significant areas of natural and scientific interest (life science)	
50 m from provincially significant areas of natural and scientific interest (earth science)	

Following REA Technical Bulletin Three: Guidance for preparing the Construction Plan Report (MOE, 2010), the sections below provide a summary of all potential negative environmental effects that could arise from construction or installation of the Project, including details on the following:

- Potential negative effects of all construction activities within 300 m of the Project Area, even if the setback requirements are met;
- The nature and magnitude of each effect;
- Any proposed mitigation measures; and
- Where considered appropriate, environmental effects monitoring plans.

For potential environmental effects where monitoring plans are proposed, tables at the end of each section summarize the above information, and further levels of detail are referenced in the applicable reports included with the REA Application.

3.1 Stormwater Run-off Impacts

3.1.1 Potential Effects

Construction and installation activities for the Project may result in negative effects to the surrounding environment from stormwater run-off. Potential changes to surface drainage patterns (water quantity and flow paths) can negatively affect surface water quantity and quality, especially after storm events. These changes can result from vegetation removal, excavation, soil stockpiling, soil compaction from machinery, and re-grading and contouring land.

Run-off from stockpiles of gravel and soil for access road and turbine foundation construction, and entry/exit points for directional drilling or punch and bore crossings, may result in sedimentation of nearby lands and watercourses, and vegetation removal can facilitate the movement of sediment. Soil compaction from construction equipment, especially in temporary storage/laydown areas, crane pads and access roads, can reduce water infiltration and result in greater movement of water by overland flow, thereby increasing run-off to surface water bodies and potentially increasing sedimentation. Increased surface runoff can lead to higher stream flow which may result in downstream erosion and sedimentation. Reduced infiltration due to soil compaction can also affect shallow groundwater recharge, potentially resulting in a measurable decline in local groundwater levels.

3.1.2 Mitigation Measures

Stockpiles of gravel and topsoil will be covered with plastic sheeting wherever possible to prevent erosion and run-off. Vegetation removal will be minimal, and will be avoided wherever possible adjacent to water bodies. Silt fencing will also be used adjacent to watercourses and wetlands, as required. Permanent gravelled surfaces (i.e., some access roads, transforming substation site) will be contoured for effective surface drainage. Subsoil will be ripped in areas where significant compaction has occurred, and areas with disturbed soil (e.g., trenches and plough seams) or areas that are re-graded with topsoil will be re-seeded to help stabilize the soil and prevent erosion.

Considering that the infrastructure sites and temporary uses of land for Construction and Installation activities in the Project Area represent 1.2% of the total Project Area, it is unlikely that there will be significant negative effects resulting from stormwater run-off. As a result, the above mitigation measures are considered sufficient to control any significant negative effects due to stormwater run-off, and residual effects monitoring plans will involve minimal follow-up.

3.1.3 Residual Effects Monitoring Plan

Table 8 presents measures that will be used to monitor the effectiveness of proposed stormwater run-off mitigation strategies for the duration of Construction and Installation activities. Contingency measures are also defined in the unlikely case that performance objectives are not met.

Table 8: Summary of Stormwater Run-off Environmental Effects Monitoring Plan

Potential Negative Effect	Performance Objectives	Mitigation Measures	Monitoring Plan and Contingency Measures	Methods and Sampling Protocols
Sedimentation in water bodies from excavation site and/or soil stockpile run-off	Change in turbidity or Total Suspended Solids (TSS) within Canadian Council of Ministers of the Environment (CCME) criteria for aquatic life	■ Stockpiles of soil and gravel covered with plastic sheeting ■ Installation of silt fencing around excavation sites/soil stockpiles or affected water bodies ■ Disturbed areas contoured for effective surface drainage ■ Installation of drainage ditches/culverts to divert overland flow ■ Minimal vegetation removal adjacent to or over water bodies ■ Decompaction of compressed soils through deep tillage after construction ceases ■ Implementation of Sediment and Erosion Control Plan consistent with agency standards and industry Best Management Practices (BMPs)	■ Field monitoring of turbidity; with supplemental TSS grab samples for laboratory analysis ■ Routine drainage inspections and following storm events <u>Contingency Measures</u>: ■ Provisional work stoppages at discretion of the Environmental Compliance Monitor ■ Installation of additional silt fencing around affected water bodies	■ Field and laboratory water quality analysis following manufacturer instructions and approved analytical and QA/QC procedures

3.2 Fugitive Dust and Noise Emissions

3.2.1 Potential Effects

Operation of construction equipment, excavation activities, and temporary exposure of soil stockpiles has the potential to generate fugitive dust and noise emissions. These emissions will be highest during land clearing and other activities that involve significant levels of material handling (e.g., aggregate laydown for access road construction and preparation for the installation of buried cables). Fugitive dust and noise emissions would be short-term and approximate those emitted by agricultural equipment, so this is not deemed to be a significant negative effect requiring further consideration.

The noise levels associated with heavy machinery and construction activities may result in sensory disturbance to local residents and wildlife and, under exceptional circumstances, habitat alienation, displacement, or desertion, particularly with birds (desertion of nests, eggs or young). However, the level of activity and noise may not be dissimilar from current noise conditions within certain times of the year from agricultural machinery.

3.2.2 Mitigation Measures

Fugitive dust will be managed by the implementation Best Management Practices (BMPs), which will help reduce the potential for fugitive dust generation and off-site movement, including:

- Implementing a speed limit that will lead to reduced disturbance of dust on paved and unpaved surfaces;
- Applying dust suppressants to unpaved areas (i.e., unpaved roads, storage piles), which may include the use of water. The frequency of application will be determined based on-site conditions during the construction process, and will be adjusted based on climatic factors;
- Staging land clearing and heavy construction activities to reduce the opportunity of simultaneous operation of large dust generating equipment;
- Re-vegetation of cleared areas, as soon as possible, and maintenance of the vegetation to ensure growth;
- Installing wind fences, if possible, in areas where they may be required, and scheduling excavations or activities involving the movement of soil and/or gravel on days with low wind; and
- Implementing a complaint response program, whereby complaints received from the public are recorded and investigated. The investigations should be focused on determining the cause of the complaint and, if necessary, mitigation measures should be implemented. Details on the complaint response program are provided in the Design and Operations Report.

Noise emissions will be managed by ensuring that relevant Project construction activities will be undertaken as required by Haldimand County noise by-laws. These hours are generally consistent with times of day when agricultural machinery would normally be in operation.. Generators used for turbine commissioning activities will also operate to comply with Haldimand County noise by-laws, and sound barriers and/or the use of a generator within acoustically rated enclosures will be used to minimize any potential noise effects. Generators used to power temporary field offices will also have sound barriers erected and/or include enclosures to reduce noise effects at the nearest noise receptors. All construction equipment will be kept in good repair and will operate in accordance with local by-laws, MOE publication NPC-115 and manufacturer recommendations.

An Environmental Compliance Monitor will be on-site for the duration of construction activities to ensure that environmental regulations are being adhered to by construction contractors.

3.2.3 Residual Effects Monitoring Plan

Table 9 presents measures that will be used to monitor the effectiveness of the proposed fugitive dust and noise mitigation strategies for the duration of Construction and Installation activities. Contingency measures are also defined in the unlikely case that performance objectives are not met.

Table 9: Summary of Fugitive Dust and Noise Environmental Effects Monitoring Plan

Potential Negative Effect	Performance Objectives	Mitigation Measures	Monitoring Plan and Contingency Measures	Methods and Sampling Protocols
Fugitive dust is an environmental nuisance to local residents and nearby woodlots/ vegetation	No persistent dust films (observable build-up) on nearby properties or vegetation	■ Implementing a speed limit for construction equipment and trucks on-site ■ Applying dust suppressants to unpaved areas ■ Avoiding simultaneous operation of dust generating equipment ■ Re-vegetating cleared areas as soon as possible ■ Installing wind fences, as required	■ Qualitative monitoring of wind conditions and dust accumulation ■ Monitoring complaints through the Project operations staff contact number (see Design and Operations Report) <u>Contingency Measures</u>: ■ Reducing the number of equipment in operation at any one time ■ Suspending operation of dust-producing equipment during days when wind/ atmospheric conditions may result in dust build-up	■ Regular visual inspections by a construction Environmental Compliance Monitor
Dust emissions reduce surface water quality	No persistent dust films on adjacent water bodies, no measurable change in Total Suspended Solids (TSS)	■ Same as above	■ Same as above	■ Same as above

Potential Negative Effect	Performance Objectives	Mitigation Measures	Monitoring Plan and Contingency Measures	Methods and Sampling Protocols
Construction noise can be disruptive to local residents	Adherence to Haldimand County noise by-laws	■ Activities that may be considered disruptive as noted in County Noise by-laws will be scheduled to be consistent with noise by-laws ■ Noise emissions from construction equipment will be in accordance with MOE publication NPC-115 ■ Avoiding simultaneous operation of noisy construction equipment, where possible	■ Observing wind conditions and noise levels ■ Monitoring complaints through the Project operations staff contact number (see Design and Operations Report) Contingency Measures: ■ Request construction contractor to reduce the amount of equipment or the duration of their operation	■ If complaints about construction noise are received, on-site staff will conduct site visits as necessary to observe noise levels in areas where complaints were received and will communicate with landowners and the construction team to seek an acceptable resolution

3.3 Destruction of Vegetation and Habitat

3.3.1 Potential Effects

The majority of land within the Project Area consists of fields under active cultivation, so there is limited potential for destruction of native vegetation and habitat from Construction and Installation activities. No tree removal is required in significant natural features and minimal tree removal will be required for access road and cable and transmission line construction. Minor removal of riparian vegetation may occur at watercourse crossings where these are required in areas where riparian vegetation exists, however any such vegetation removal has been presented in the Natural Heritage Assessment Report which has received confirmation from MNR.

Clearing of vegetation has the potential to result in habitat loss or fragmentation, which may affect wildlife corridors or movement. Woodlot areas could potentially represent locally important or valued ecosystems or vegetation, and there is a potential for rare, threatened or endangered species or their habitats to occur within the Project Area.

Installation of underground cables and/or culverts through watercourses has the potential to disrupt fish habitat, cause erosion and sedimentation through disturbance to the shoreline and bed of water bodies, and destroy habitat through the removal of riparian (bank) vegetation and other habitat types that provide cover, shade and food. Further discussion of potential effects on aquatic habitats is presented in Section 3.4.

Temporary storage/laydown areas will result in soil compaction, which will need to undergo remediation during conversion to prior land use after the Component Installation and Connection Phase. For installation of underground cables, excavation/trenching operations may result in changes to soil properties and some loss of productivity due to mixing of subsoil in the surface soil horizons. However, by limiting the width of the trenches to approximately 1 m, the amount of land area affected will be minimized.

Further discussion on potential effects of the destruction of vegetation and habitat is contained within the Natural Heritage Assessment Report.

3.3.2 Mitigation Measures

Wildlife and habitat records reviews and field surveys were undertaken to identify significant natural features so this information could be used in developing the Project layout in order to maintain a 120 m setback from these features, wherever possible. Significance of natural features was determined based on the composition, function and attributes of the features using recognized techniques and current provincial guidelines. Results of significant natural feature and wildlife surveys are contained in the Natural Heritage Assessment Report. No vegetation cutting or clearing will occur within any identified significant natural feature, but the Natural Heritage Assessment Report includes environmental impact studies (EIS), which document predicted net impacts to significant features/habitats for Project infrastructure located within the 120 m setback distance.

Construction activities occurring in close proximity to woodlots will use tree protection fencing to avoid disturbance or damage. In addition, any vegetation removal will be done outside of identified breeding seasons.

Wherever possible, access roads and temporary storage/laydown areas will take advantage of existing road infrastructure and/or buildings, in order to avoid potential damage to agricultural lands or destruction of vegetation. In areas where significant compaction has occurred, subsoil will be ripped, as necessary, to alleviate compaction, and stripped subsoil and topsoil will be replaced. During installation of underground cables, where temporary storage of soil is required, topsoil and subsoil will be stored separately to minimize changes to soil properties following replacement of soil. In addition, soils will not be imported to the Project Area and pre-existing soil conditions will be taken into account during redistribution of soils so that pre-disturbance soil characteristics are maintained to the extent possible. Geotechnical sampling during the Site Preparation Phase will include representative soil quality sampling and analysis to establish baselines.

Due to the limited amount of vegetation removal within the Project Area, the above mitigation measures, and those discussed within the Natural Heritage Assessment Report, are considered sufficient to address any potential significant negative effects. More detailed mitigation measures for specific natural feature types and species guilds are provided in the Natural Heritage Assessment Report, which must be reviewed and approved by the MNR.

3.3.3 Residual Effects Monitoring Plan

Where vegetation must be removed to facilitate construction, areas that are replanted will be monitored to ensure the survival of the reseeded or revegetated areas until such time that it is verified that the replanted vegetation is functionally established or has reached free growing stage. The densities of seeding and planting will allow for an identified level of survival/mortality and where mortality thresholds are exceeded, additional replanting and monitoring will occur. At watercourse crossings within the Regulation Limit or that may effect fish habitat provided by riparian vegetation, the residual effects monitoring requirements, if any, will be determined by the LPRCA and DFO and adhered to by NextEra Energy Canada.

3.4 Impacts on Water Bodies

3.4.1 Potential Effects

Construction of watercourse crossings, land clearing and site grading near watercourses, and removal of riparian vegetation, if necessary (i.e. over the span of the crossing) has the potential to increase sediment run-off, decrease bank stability and cause changes in chemical properties and temperatures, which can negatively affect fish or their habitat including spawning and patterns of movement. The magnitude of effects is largely dependant on the characteristics of the watercourse, sensitivity of aquatic communities, crossing technique and the mitigation techniques employed.

There is also the potential for fuel, oil/lubricant leakages or spills, or loss of directional drilling fluid which could contaminate the waterbody being crossed or nearby downstream water bodies. Impacts related to spills are discussed in Section 3.6.

Impacts on water bodies from discharge of water during dewatering of turbine foundations are discussed in Section 3.5, and effects related to stormwater run-off and sedimentation are discussed in Section 3.1.

A more detailed discussion of potential effects on water bodies is contained within the Natural Heritage Assessment Report and Water Assessment Report.

3.4.2 Mitigation Measures

Desktop studies and field surveys of water bodies within the Project Area were undertaken to identify significant water features so this information could be used in developing the Project layout. Classification of water features was determined based on the composition, function and attributes of the features using recognized techniques and current provincial guidelines. Results of these investigations are contained in the Water Assessment Report.

Following REA guidelines, a minimum setback of 30 m from the Project location to water bodies and watercourses was considered during turbine siting. The Project layout development attempted to avoid watercourse crossings to the extent possible. However, where crossings are required and the watercourse is determined to be fish habitat (i.e., there is a potential for harmful alteration, disruption or destruction of habitat), the crossing technique first considered will be from a DFO Operational Statement (listed in Section 2.2.3.3) so that a review of fish and fish habitat will not be required. The Long Point Region Conservation Authority will be consulted for activities occurring inside of their Regulation Limit boundaries. Additional information on watercourse crossings as they relate to fish habitat will be provided to the LPRCA/DFO to assist in their review of permit applications for works in the Regulation Limit and in fish habitat. The Water Assessment Report also includes an environmental impact study (EIS) which documents predicted net impacts to water bodies where the Project location is located within the 30 m and 120 m distances outlined in O. Reg. 359/09. For the largest watercourse crossings a directional drill or punch and bore crossing has been proposed. Both of these methods are used commonly within the petroleum industry at watercourse crossings and possess industry and agency accepted protocols for the crossing design, construction implementation, environmental monitoring and site reclamation.

To mitigate potential effects from directional drilling and punch and bore crossings, all applicable DFO Operational Statements will be followed. In addition, efforts have been made to design the entry and exit points and work areas for the drilling operations such that they are kept outside of the natural feature and that a minimum 10 m no-work zone and buffer area between the entry/exit point and the natural feature boundary is maintained.

In general, removal of riparian vegetation will be avoided, if possible, and silt fencing will be used adjacent to watercourses and wetlands to prevent run-off and sedimentation effects. All equipment refuelling and maintenance activities will occur in temporary storage/laydown areas and temporary workspaces along access routes in order to localize any potential fuel, oil/lubricant leakages or spills to areas away from water bodies and watercourses. In addition, geotechnical sampling during the Site Preparation Phase will include representative water quality sampling of groundwater and nearby surface waters to establish baselines.

3.4.3 Residual Effects Monitoring Plan

For details on residual environmental effects monitoring plans for effects on water bodies, refer to the Water Assessment Report included with the REA Application.

3.5 Impacts Related to Water Takings

Applicants for a REA do not require a Permit to Take Water (PTTW) from the MOE under the *Ontario Water Resources Act* and the Water Taking and Transfer Regulation (O. Reg. 387/04), as specified in Technical

Bulletin 3: Guidance for preparing the Construction Plan Report (MOE, 2010). However, turbine foundation dewatering activities will be guided by PTTW requirements. If the volumes of 50,000 L/day were exceeded and a PTTW was required, dewatering activities would be classified as a Category 2 Water Taking, as they are short-term and non-recurring.

Dewatering of excavated turbine foundations may be required, depending on groundwater levels at each turbine site. Foundation excavation will be undertaken to a depth of 3.5 m, and any groundwater encountered above this depth will require dewatering. Reviews of historical water well records from the MOE provide preliminary indications of historically observed groundwater depths in the Project Area, and geotechnical sampling (borehole drilling) undertaken during construction surveying activities will determine actual dewatering requirements at each turbine site.

3.5.1 Potential Effects

Where required, dewatering for turbine foundation construction has the potential to temporarily alter shallow groundwater flow to waterbodies, watercourses and wetlands. Although dewatering activities would only occur until foundations are completed (approximately 4 months) or until groundwater levels receded to a suitable depth, a measurable change in local well levels and groundwater flow in the immediate vicinity of excavations and potentially for a period of 7 months afterward (4 months of drawdown from dewatering plus 3 months of water level recovery) could occur.

Subsequent release of pumped water from foundation dewatering to discharge areas can cause overland sediment transport to waterbodies, while direct discharge to waterbodies could introduce suspended sediments, resuspend bedload materials, and affect water course hydrology and water temperature near the point of discharge.

The withdrawal of surface water for construction activities such as dust suppression and land reclamation (e.g. hydroseeding) will be limited to volumes of <50,000 L/day. The water to be utilized will be obtained in water trucks from an MOE approved source, pumped using a suitably sized and screened water intake to reduce the risk of fish impingement.

In order to determine the likelihood that dewatering would be required during foundation excavation and construction, a desktop study was initiated that consisted of a review of the following information:

- Available topographic and surficial geology mapping from MNR NRVIS database;
- Available Ontario Ministry of the Environment (MOE) Water Well Records (WWR) in the vicinity and within the Site;
- Planned excavation depths for the wind turbine foundation construction; and
- Logs of five geotechnical boreholes (two within the Site and three within a 5 km surrounding area of the Site) (Inspec-sol, 2008).

3.5.1.1 Local Geology

Near surface soils throughout the assessed area, which have been mapped by the Ontario Geological Survey (OGS), are provided in Appendix A. Based on the OGS mapping, the shallow overburden consists predominantly of clayey soils of glaciolacustrine origin. The underlying bedrock consists of Palaeozoic limestone and dolostone. The bedrock and glaciolacustrine soils consisting of sand and silt are exposed along some of the larger stream tributaries within the area.

The OGS mapping is consistent with the conditions encountered in the Inspec-sol borehole logs (referred to as BH-1 to 5), which show soils consisting mainly of clay. Silty clay and clayey silt soils extend from near ground surface to the top of bedrock, which is encountered from approximately 1.4 to 8.0 m below ground surface (bgs) in the vicinity of the Project Area.

Groundwater was encountered at the location of BH-1 at a depth of 6.7 m bgs. With the exception of BH-1, located over 3 km from the Project Area, Inspec-sol reported that all other boreholes (BH-2 to BH-5) were dry and open before the start of rock coring.

3.5.1.2 Topography

Ground surface elevation contours in the vicinity of the Project Area are provided in Appendix A. Local terrain is flat-lying, ranging in elevation from approximately 180 to 215 metres above sea level (masl). Several surface water courses are located in the vicinity of the Project Area, ultimately draining towards the south into Lake Erie.

3.5.1.3 Groundwater Elevation

MOE Water Well Records located in and around the Project Area and reported groundwater levels are shown in Appendix A. The records have a location accuracy of approximately 100 m. Depths to groundwater have been summarized in Appendix A. Based on these data, it appears that the depth to groundwater in and around the Project Area ranges from 0.3 to 32 m bgs, with a median depth of approximately 5.49 m bgs locally.

3.5.1.4 Potential for Construction Dewatering

Based on the assessment provided above, there is a relatively low potential that the depth of these excavations will intercept the water table (or saturated ground) under conditions that will require foundation dewatering for construction purposes other than management of precipitation catchment.

In the event that the proposed construction intercepts the water table where groundwater inflows occur, construction dewatering will be required to remove what groundwater inflow and/or remove direct precipitation into the excavation. Considering the shallow depth of dewatering and the low permeability soils, dewatering rates are not expected to exceed 50,000 L/day. In order to confirm that the water table elevation is below the base of the excavation and whether or not dewatering will be necessary, the installation of piezometers into the shallow overburden (to a depth of approximately 4 m bgs) at each of the proposed construction locations would be required.

3.5.2 Mitigation Measures

All reasonable and practical measures will be used to manage takings efficiently to maximize the availability of water for existing or potential uses and to sustain ecosystem integrity. Natural functions of the local ecosystem will be protected by monitoring local groundwater levels, and utilizing pumping systems and pipelines to minimize erosion, sedimentation, flooding and surface water quality effects.

If possible, the initial discharge point will be a constructed sump area or a vegetated buffer or woodlot with a low slope to reduce flow rates and minimize erosion of the soil surface.

3.5.3 Residual Effects Monitoring Plan

Table 10 presents measures will be used to monitor the effectiveness of mitigation strategies for water takings throughout Construction and Installation activities. Contingency measures are also defined in cases where performance objectives are not met.

Table 10: Summary of Environmental Effects Monitoring for Surface Water Resources

Potential Negative Effect	Performance Objectives	Mitigation Measures	Monitoring Plan and Contingency Measures	Methods and Sampling Protocols
Interference with wetlands, watercourses, natural hazards	Obtain permit approval from LPRCA and conform to permit terms.	■ Minimize extent, duration and magnitude of works within Regulation Limit. ■ Limit grade cahgnes to that approved by LPRCA ■ Placement of silt fences, creation of work and machine exclusion zones, sediment and erosion control measures.	■ On site monitoring of compliance to permit conditions and implementation of mitigation and best management practices by third party environmental monitor. <u>Contingency Measures</u>: ■ Environmental inspector empowered with ability to stop work of prime contractor until corrective mitigation measures taken	■ Observational and photographic monitoring; mitigation and compliance monitoring summary reports provided by qualified third party environmental monitor.
Sedimentation of water bodies from turbine foundation dewatering discharge	Change in turbidity or Total Suspended Solids (TSS) within Canadian Council of Ministers of the Environment (CCME) criteria for aquatic life	■ Using pumping systems and pipelines to minimize erosion, sedimentation or surface flooding ■ Making the initial point of discharge a constructed sump area or a vegetated buffer or woodlot with a low slope to reduce flow rates and minimize erosion	■ Monitoring water bodies directly or indirectly receiving dewatering discharge <u>Contingency Measures</u>: ■ Moving dewatering pipes away from water bodies so that more infiltration to the surface soil system can occur ■ Installing flow dissipaters to reduce erosion potential of water exiting at the point of discharge and to encourage sheet flow ■ Installation of silt fencing or hay/straw bales around discharge point	■ Visual assessment of changes in stream flow rates and turbidity by a construction Environmental Compliance Monitor ■ If turbidity increase observed, obtain three samples for TSS analysis at upstream background, discharge and downstream sample points and compare to CCME criteria for aquatic life

Potential Negative Effect	Performance Objectives	Mitigation Measures	Monitoring Plan and Contingency Measures	Methods and Sampling Protocols
In the event that dewatering is required (>50m^3/day), changes in water quantity in private wells near dewatered turbine foundations	No measurable change in water quantity	■ Using results of Appendix A to guide dewatering activities (e.g., informing residents ahead of time where local effects are anticipated)	■ If private wells are located within 100 m of a turbine foundation requiring dewatering, at the landowner's request, the well(s) may be monitored for changes in water quantity and/or quality Contingency Measures: ■ If there is a measurable change in water quantity, NextEra Energy Canada will provide a temporary potable water supply until dewatering is completed or other corrective measures are taken	■ At landowner's request, measurements of private well water for levels

3.6 Fuel Spills

3.6.1 Potential Effects

Accidental spills or releases of fuel or lubricating oils may occur during equipment refuelling, component or equipment maintenance or operation, and have the potential to contaminate ground and surface water and soils.

3.6.2 Mitigation Measures

Implementation of Best Management Practices (BMPs) associated with the use of construction vehicles in the Project Area will reduce the chances of accidental spills of contaminants. The following BMPs will be used to prevent fuel spills and leaks:

- Proper maintenance of vehicles and construction equipment;
- Regular inspection of vehicles and the construction site to ensure BMPs and other mitigation measures are being used consistently and in the correct manner to reduce the likelihood of any spills;
- Conducting refuelling and maintenance in designated areas;
- Maintenance of a supply of spill control materials (absorbent material, absorbent booms, etc.) in locations where construction equipment is maintained and used;
- Proper training of workers for spill prevention and containment;
- Regular review of the spill response plan by all construction workers;
- Removal of accumulated sediment from control measures (ponds, fencing, etc.) at completion of Construction and Installation activities or after significant accumulation; and
- Minimizing construction during wet weather.

In addition, an oil containment system will be installed at the transforming substation to prevent soil contamination in the event of a leak. Details on the containment system and potential leaks related to Project operation are presented in the Design and Operations Report.

Any spills will be handled in accordance with the MOE's Spills and Discharges Reporting Protocol as required under Sections 15 and 92 of the Ontario *Environmental Protection Act*.

3.6.3 Residual Effects Monitoring Plan

Table 11 presents measures that will be used to monitor the effectiveness of fuel spill mitigation strategies for the duration of Construction and Installation activities. Contingency measures are also defined in cases where performance objectives are not met.

Table 11: Summary of Fuel Spills Environmental Effects Monitoring Plan

Potential Negative Effect	Performance Objectives	Mitigation Measures	Monitoring Plan and Contingency Measures	Methods and Sampling Protocols
Contamination of water bodies from fuel/oil spills	Prevent spills of Volatile Organic Compounds (VOCs) or Polycyclic Aromatic Hydrocarbons (PAHs) to the environment	■ Proper maintenance and regular inspections of equipment and vehicles ■ Regular inspections of construction sites to ensure that BMPs are being used consistently and correctly ■ Readily available spill control materials at all construction sites ■ Proper training of workers and regular review of spill response plans ■ Minimizing construction activities during wet weather	■ Inspections of equipment and ground surfaces where equipment is used for spills or leakages ■ Inspection of nearby water bodies for oily films <u>Contingency Measures</u>: ■ Immediate containment and remediation of contaminated area using appropriate spill containment and clean-up measures ■ Removing and/or replacing leaking/malfunctioning equipment ■ Relocation of construction activities and/or equipment away from affected water body	■ Daily inspections by on-site personnel and a construction Environmental Compliance Monitor ■ Where evidence of spills exists (oily films/residue), containment and remediation using absorbent materials, booms and other materials will occur immediately ■ In cases of larger spills with a risk of contamination of sediment and downstream areas (in the case of watercourses), three samples for VOC and PAH measurements of surface water and sediment will be taken in that bisect the water body (cross-sectional to flow gradient for watercourses) at the origin of the spill, and also 50 m downstream for watercourses ■ If sediment samples indicate contamination associated with the spill, the area of contamination will be discerned, and affected sediment will be removed, following spill clean-up measures agreed to with MOE, MNR and DFO

Potential Negative Effect	Performance Objectives	Mitigation Measures	Monitoring Plan and Contingency Measures	Methods and Sampling Protocols
Contamination of soil from fuel/oil spills	Prevent spills which may lead to petrochemical residues being transported to soil or water supply	■ Same as above	■ Inspections of equipment and ground surfaces where equipment is used for spills and/or leakages Contingency Measures: ■ Immediate containment and remediation of contaminated area using appropriate spill containment and clean-up measures ■ Removing and/or replacing leaking/malfunctioning equipment	■ Daily inspections by on-site personnel and a construction Environmental Compliance Monitor for visible spills ■ Where evidence of spills exists, soil will be removed and disposed of at the appropriate waste disposal facility

3.7 Impacts on Heritage and Archaeological Resources

3.7.1 Potential Effects

Archaeological resources have been identified in the Project Area, and there is potential for construction activities to have negative effects on heritage buildings, structure or sites, archaeological resources, or cultural heritage landscapes if these areas are not avoided or preserved. Damage to archaeological resources could occur during excavation activities, should they be located in the area being excavated.

As outlined in the Heritage Assessment Report, there are two protected properties (the Cottonwood Mansion and the Hoover Log House) and/or cultural heritage resources at the Project location (i.e., within 250 m of the Project Area). Above ground Project-related cables are proposed to run in front of the Cottonwood Mansion, however the cables are to be located on the opposite side of the road from the mansion, along a pre-existing hydro line and therefore no impact is anticipated. A Heritage Impact Assessment was conducted for the Hoover Log House, and results of this assessment have been reviewed by the MTC, as outlined in the MTC Comment Letter (see Heritage Assessment Report).

3.7.2 Mitigation Measures

Following Sections 19 – 23 of O. Reg. 359/09, for archaeological and built heritage resources within 250 m of the Project Area, potential effects must be identified and assessed and permission from the appropriate authority (County, Ontario Heritage Trust and/or the Ministry of Tourism and Culture) must be obtained.

Stage 1 Archaeological Assessments have been conducted, including a desktop review of available archaeological information and a site visit. In areas with identified archaeological potential, a more detailed Stage 2 Archaeological Assessment is being undertaken by qualified archaeologists to confirm the presence of archaeologically significant resources. Should archaeological resources be discovered, appropriate mitigation measures will be assessed, which depending on the resource, could include any of the following:

- Preservation in-situ, requiring changes to Project layout;
- Removal and preservation; and
- Further assessment (i.e., Stage 3 Archaeological Assessment and possibly Stage 4 Archaeological Assessment).

All further details of the investigation will be summarized in a Stage 2 Archaeological Assessment Report and Heritage Assessment Report submitted to the Ministry of Tourism and Culture for review and approval. Stage 3 and Stage 4 Archaeological Assessment Reports, where required, will also be made available to the Ministry of Tourism and Culture (MTC). Comments on the completed Stage 1 Archaeological Assessment Report are included in the REA Application.

A Heritage Assessment has also been conducted, including a desktop review of available heritage information and several site visits. If protected properties and/or cultural heritage resources were determined to have cultural heritage value or interest, a comprehensive Heritage Impact Assessment was done for each individual instance. Based on comments received from MTC on the draft Heritage Assessment Report, the Hoover Log House was the only outstanding property for which a Heritage Impact Assessment was required. All details of this investigation are presented in the Heritage Assessment Report which was submitted to the Ministry of Tourism and Culture for review and approval. Comments on the completed Heritage Assessment Report are included in the REA Application.

3.7.3 Residual Effects Monitoring Plan

Once the Stage 3 Archaeological Assessment has been completed, archaeological monitoring by a licensed archaeologist is proposed during construction to avoid effects during the construction phase on any archaeological sites recommended for further Stage 4 Archaeological Assessment. No residual effects on built heritage resources are anticipated, so no follow-up monitoring is proposed.

3.8 Land Use and Resources

3.8.1 Potential Effects

There will be a temporary loss of agricultural land for field offices, equipment and materials storage, and Project component construction and assembly (see Site Plan Report) for the duration of the construction period. However, these areas will be small relative to the size of agricultural land within the Project Area, and these lands will be returned to agricultural use after Construction and Installation activities have concluded.

Use of local waste management facilities for disposal of construction debris may cause disruption for these facilities and for local residents if capacities are met or exceeded.

3.8.2 Mitigation Measures

Prior to commencing construction activities, NextEra Energy Canada will estimate construction waste volumes and the capacities of local disposal facilities to determine the quantities and types of materials that can be disposed of locally, and the timing of disposal. For a description of receiving waste management facilities, refer to the Decommissioning Plan Report.

3.8.3 Residual Effects Monitoring Plan

Table 12 presents measures that will be used to monitor the effectiveness of mitigation strategies for effects on land use and resources for the duration of Construction and Installation activities. Contingency measures are also defined in cases where performance objectives are not met.

Table 12: Residual Environmental Effects Monitoring Plan for Land Use and Resources

Potential Negative Effect	Performance Objective	Mitigation Measures	Monitoring Plan and Contingency Measures	Methods and Sampling Protocols
Disposal of construction materials meets or exceeds capacities of local waste management facilities	■ No disruption of waste management facilities or their use by local residents	■ Estimate construction waste volumes and capacities of local waste disposal facilities	■ Communicate with waste management facilities that may be used during construction Contingency Measures: ■ Change the timing or quantities of disposal ■ Dispose of select materials at other locations outside of the region that have capacity ■ Entirely shift disposal to facilities outside of the immediate region that have capacity	■ Monthly communication with waste disposal facilities about capacities and anticipated intake
Reduction in agricultural land	■ No significant economic reduction in agricultural yields on lots containing Project infrastructure	■ Using existing right-of-ways where possible for access roads ■ Where possible, utilizing County roads to minimize access road construction	■ Discussion with Haldimand County and local residents Contingency Measures: ■ Width reduction of access roads at selected locations as agreed to by NextEra Energy Canada prior to the completion of the Construction Phase	■ Receiving feedback through the NextEra construction manager

3.9 Impacts on Provincial and Local Infrastructure

3.9.1 Potential Effects

Transportation of equipment and heavy turbine components on local roads may result in damage to roads.

3.9.2 Mitigation Measures

A Traffic Management Plan will be created if required, as outlined in Section 2.2.3. The selected construction contractor will consult with the County and MTO, as required, to ensure that road damage resulting from equipment and component delivery is avoided where possible and suitable mitigation and repair measures are in place. A survey to determine the roads/travel routes within the Project Area that are capable of accommodating the oversized vehicles and heavy loads associated with Construction and Installation activities will be conducted in conjunction with the County prior to delivery of Project components and construction machinery. Given the availability of alternate routes, any required upgrading or other construction works are not likely to substantially affect traffic congestion or travel times.

3.9.3 Residual Effects Monitoring Plan

The proposed mitigation measures are deemed sufficient to prevent any potential negative effects on provincial and local infrastructure. Therefore, no follow-up monitoring is proposed.

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Report Signature Page

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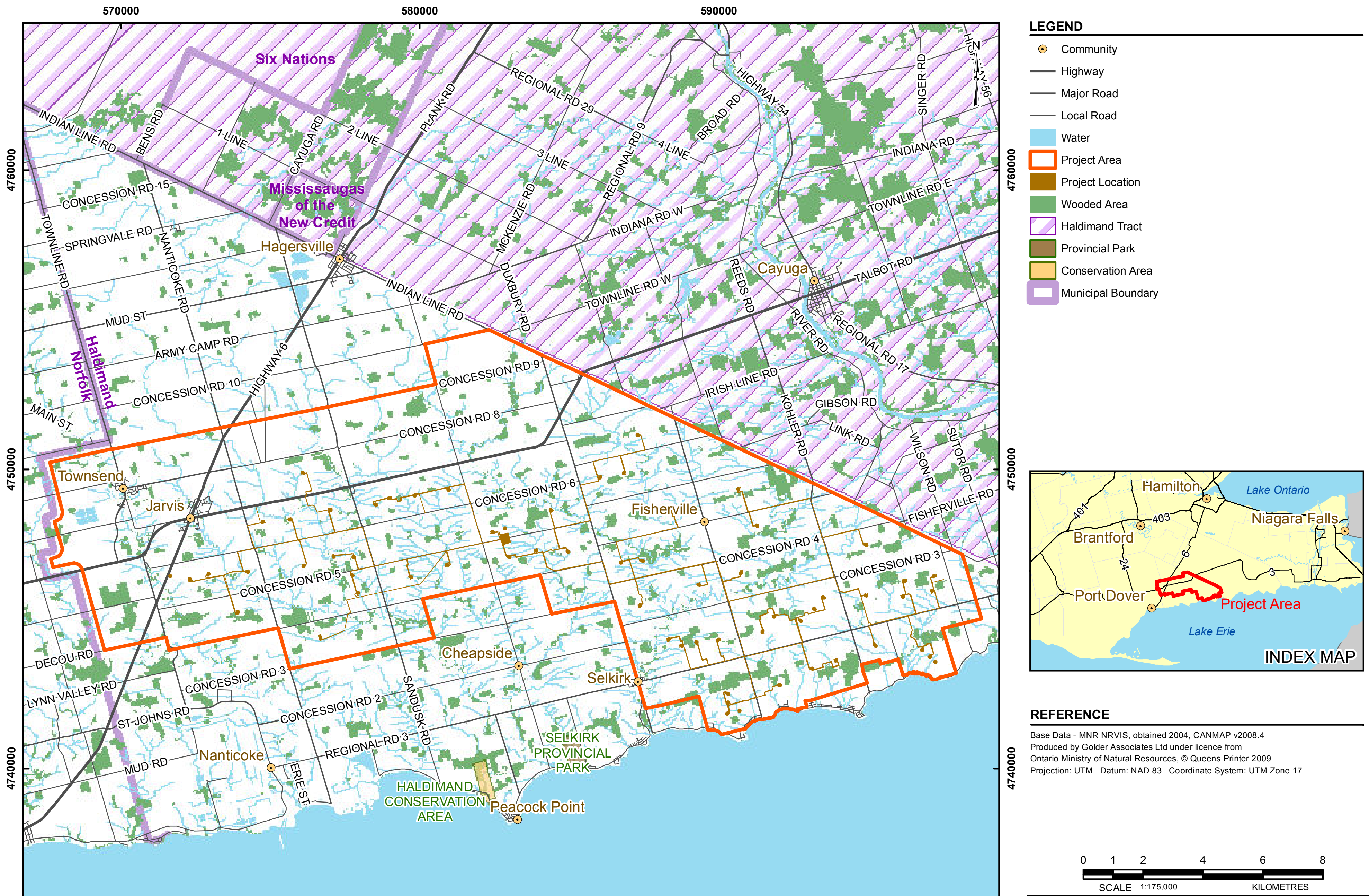
FIGURE 1

Project Area



REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2008.4
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: UTM Datum: NAD 83 Coordinate System: UTM Zone 17

0 1 2 4 6 8
SCALE 1:175,000 KILOMETRES

PROJECT
Summerhaven Wind Energy Centre

TITLE
PROJECT AREA

PROJECT NO. 10-1151-0035			SCALE AS SHOWN	REV.
DESIGN	PP	7 Apr. 2010		
GIS	BC	26 Sep. 2010		
CHECK	PP	26 Sep. 2010		
REVIEW	JW	26 Sep. 2010		

Golder Associates
Mississauga, Ontario

FIGURE: 1

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APPENDIX A

Desktop Review of Groundwater Elevation Near Nanticoke, Ontario

TECHNICAL MEMORANDUM

DATE February 24, 2011 **PROJECT No.** 10-1151-035

TO John Ruffell
Golder Associates Ltd.

CC Jeff Wright

FROM Alex Ivanoff, P.Geo. **EMAIL** aivanoff@golder.com

DESKTOP REVIEW OF GROUNDWATER ELEVATION.
SUMMERHAVEN WIND ENERGY CENTRE, COMMUNITY OF NANTICOKE, ONTARIO

NextEra Energy Canada, ULC (NextEra Energy Canada) is proposing to install 59 wind turbines within a 22,583 ha area, referred to as the Summerhaven Wind Energy Centre (the Project). The location of the Project and the wind turbines are shown on Figure 1. The purpose of this desktop review was to determine if foundation construction for the proposed wind turbines will intercept groundwater, and if so, what potential dewatering rates would be required in support of foundation construction.

As part of this desktop study, the following information was reviewed:

- Available topographic and surficial geology mapping from MNR NRVIS database;
- Available Ontario Ministry of the Environment (MOE) Water Well Records (WWR) in the vicinity and within the Project area;
- Planned excavations depths for the wind turbine foundation construction; and
- Logs of five geotechnical boreholes (two within the Project area and three within a 5 km surrounding area of the Project area) that were provided to Golder by NextEra Energy Canada. The logs are provided in Attachment A.

An assessment of groundwater levels and potential dewatering requirements was made based on a review of the above information.

Local Geology

Near surface soils throughout the Project area, which have been mapped by the Ontario Geological Survey (OGS), are shown on Figure 1. Based on the OGS mapping, the shallow overburden consists predominantly of clayey soils of glaciolacustrine origin. The underlying bedrock consists of Palaeozoic limestone and dolostone. The bedrock and glaciolacustrine soils consisting of sand and silt are exposed along some of the larger stream tributaries within the area.

The OGS mapping is consistent with the conditions encountered in the Inspec-sol borehole logs (referred to as BH-1 to 5), which show soils consisting mainly of clay. Silty clay and clayey silt soils extend from near ground surface to the top of bedrock, which is encountered from approximately 1.4 to 8.0 m below ground surface (bgs) in the vicinity of the Project area.

Groundwater was encountered at the location of BH-1 at a depth of 6.7 m bgs. With the exception of BH-1, located over 3 km from the Project area, Inspec-sol reported that all other boreholes (BH-2 to BH-5) were dry and open before the start of rock coring.

Topography

Ground surface elevation contours in the vicinity of the Project area are shown on Figure 2. Local terrain is flat-lying, ranging in elevation from approximately 180 to 215 m above sea level (asl) with a very gentle southward regional slope, consistent with the primary directions of drainage. The surface watercourses located in the vicinity of the Project area draining towards the south into Lake Erie.

Groundwater Elevation

MOE Water Well Records located in around the Project area and reported groundwater levels are shown in Figure 2. The records have a location accuracy of approximately 100 m. Depths to groundwater have been summarized in Table 1. Based on these data, it appears that the depth to groundwater in and around the Project area ranges from 0.3 to 32 m bgs, with a median depth of approximately 5.49 m bgs locally.

Potential for Construction Dewatering

Golder has been advised by Inspec-sol that the foundation excavations required for construction of the wind turbines will be approximately 20 m in diameter with a depth of 3.5 m bgs. Based on the assessment provided above, there is a relatively low potential that the depth of these excavations will intercept the water table (or saturated ground) under conditions that will require foundation dewatering for construction purposes other than management of precipitation catchment.

In the event that the proposed construction intercepts the water table, where groundwater inflow occurs, construction dewatering will be required to remove what groundwater inflow occurs and remove direct precipitation into the excavation. Considering the shallow depth of dewatering and the low permeability soils, dewatering rates are not expected to exceed 50 m^3/day. As such, an MOE Permit to Take Water (PTTW) is not likely to be required to support construction. In order to confirm that the water table elevation is below the base of the excavation and whether or not dewatering will be necessary, the installation of piezometers into the shallow overburden (to a depth of approximately 4 m bgs) at each of the proposed construction locations would be required.

Limitations

This technical memorandum, which has been prepared for NextEra Energy Canada, represents a desktop review to determine the general depth to groundwater in the vicinity of the Summerhaven Wind Energy Centre. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the sole responsibility of such third parties.

This report is based on data and information collected by Inspec-sol and provided to Golder by NextEra Energy Canada. Golder has completed no independent field investigation to assess hydrogeological or environmental conditions. Golder has relied in good faith on the data and information provided by NextEra Energy Canada and on other materials as noted in this report. Golder has assumed that the information provided was factual and accurate. Golder accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

References

Ontario Geological Survey. 2006. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 – Revised.

Inspec-sol. 2008. Borehole Logs. Prepared for: TCI Renewables Ltd. September 30, 2008.

ADI/

Attachments:	Table 1	Summary of MOE Water Well Record Information
	Figure 1	Surficial Geology
	Figure 2	MOE Wells and Groundwater Elevations
	Attachment A	Borehole Logs (Inspec-sol, 2008)

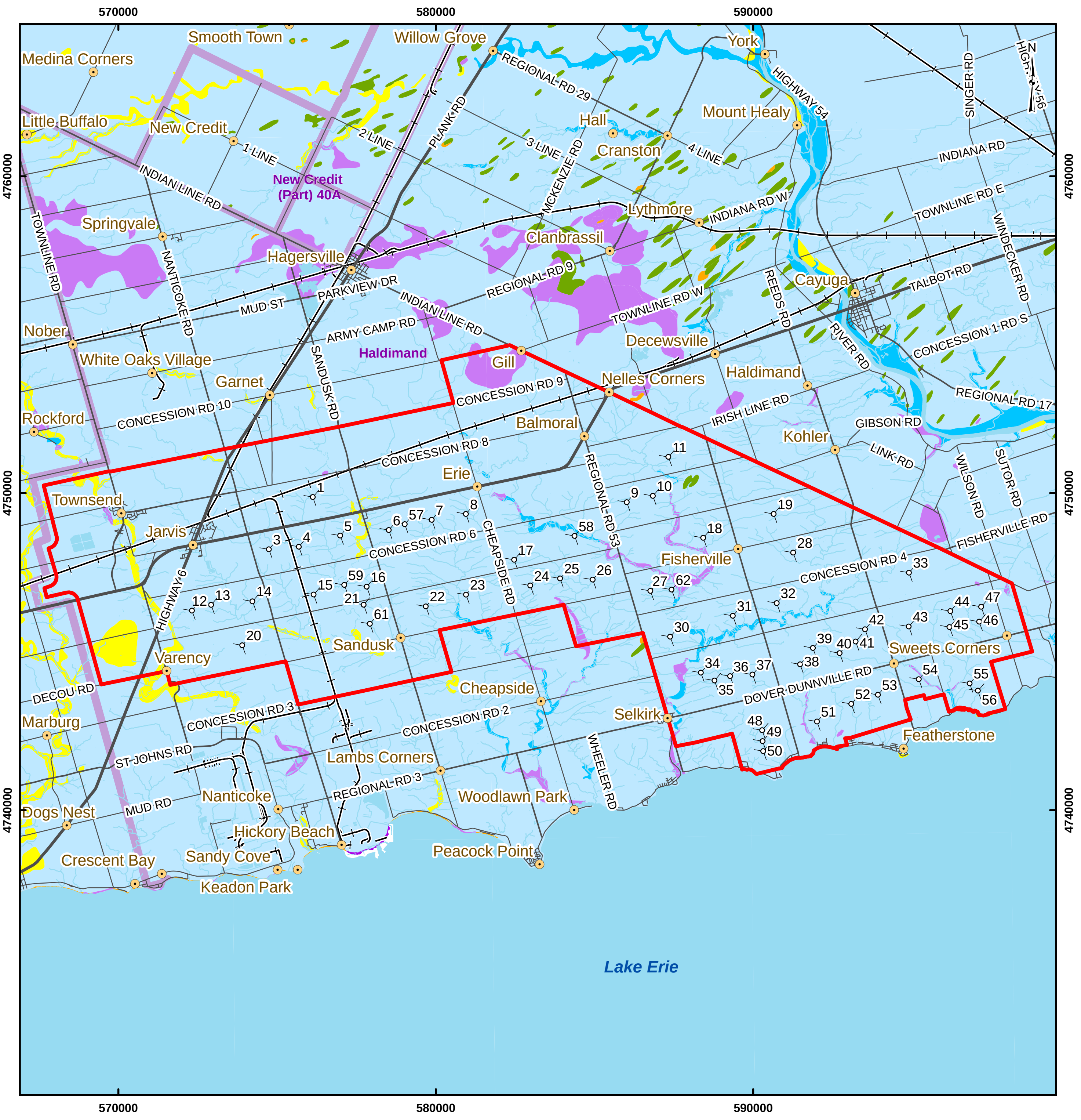
\\mis1-s-filesrv1\data\active\2010\1151\10-1151-0035 nextera - wind farm rea - nanticoke\4 - working rea reports\1 - construction report\version 3\appendix a\10-1151-0035 nextera memo summerhaven 24feb11.docx

Table 1: Summary of MOE Water Well Record Information

Well ID	Date	Ground Elevation[1] (m)	GW elevation[2] (m)	Depth to Water (m)
2600144	10/16/1941	219.76	210.92	8.84
2600145	9/23/1943	217.93	209.09	8.84
2600302	2/9/1953	214.27	210.62	3.66
2600303	10/16/1962	214.27	206.04	8.23
2600328	11/22/1958	215.80	207.87	7.92
2600343	12/24/1960	187.45	178.92	8.53
2600495	8/12/1950	177.09	174.35	2.74
2600509	1/19/1961	178.61	174.65	3.96
2600511	3/23/1962	178.92	174.96	3.96
2600522	6/10/1950	176.78	174.04	2.74
2600523	7/4/1950	177.39	174.65	2.74
2600524	4/28/1959	177.09	172.82	4.27
2600525	5/2/1959	176.78	173.13	3.66
2600526	10/9/1959	178.31	173.13	5.18
2600527	7/13/1963	177.39	173.13	4.27
2600528	7/13/1967	177.39	174.35	3.05
2600532	4/30/1957	177.39	176.78	0.61
2600533	7/13/1957	177.09	175.26	1.83
2600539	7/11/1957	177.39	174.96	2.44
2600543	6/24/1950	175.26	172.52	2.74
2600546	6/7/1960	175.26	173.43	1.83
2600555	6/23/1958	179.22	176.17	3.05
2600597	4/2/1957	203.00	202.69	0.30
2600598	9/24/1964	203.00	192.33	10.67
2600962	8/18/1966	176.78	171.30	5.49
2601062	6/2/1964	203.61	197.51	6.10
2601062	6/2/1964	203.61	197.51	6.10
2601245	11/9/1968	207.26	191.11	16.15
2601246	11/14/1968	182.88	175.56	7.32
2601275	11/5/1968	179.83	175.87	3.96
2601276	4/11/1968	213.36	209.70	3.66
2601278	6/10/1968	202.69	191.11	11.58
2601279	6/28/1968	204.22	190.80	13.41
2601281	4/17/1968	207.26	197.82	9.45
2601286	8/29/1968	202.69	192.02	10.67
2601303	12/30/1968	216.41	207.87	8.53
2601305	10/16/1968	217.02	207.87	9.14
2601314	10/12/1968	207.26	192.02	15.24
2601315	10/16/1968	207.26	182.88	24.38
2601321	7/12/1968	179.83	176.78	3.05
2601324	8/28/1968	201.17	181.36	19.81
2601336	4/8/1969	210.31	205.44	4.88
2601353	8/1/1969	207.26	201.17	6.10
2601354	9/15/1969	187.45	177.09	10.36
2601365	10/23/1969	188.98	181.66	7.32
2601366	10/9/1969	176.78	173.74	3.05
2601369	11/5/1969	216.41	209.70	6.71
2601373	12/12/1969	219.46	217.63	1.83
2601384	6/30/1969	178.31	175.26	3.05
2601385	8/10/1969	178.31	173.74	4.57
2601389	5/2/1970	195.07	179.83	15.24
2601390	6/9/1970	219.46	214.58	4.88
2601394	5/11/1970	207.26	200.56	6.71
2601395	5/13/1970	183.79	181.05	2.74
2601396	5/28/1970	188.98	186.54	2.44
2601398	6/12/1970	182.88	176.78	6.10
2601417	10/6/1970	181.36	176.48	4.88
2601418	9/22/1970	182.88	179.22	3.66
2601419	9/12/1970	199.64	194.16	5.49
2601420	9/5/1970	198.12	192.02	6.10
2601421	5/19/1970	178.31	175.87	2.44
2601422	8/12/1970	198.12	190.50	7.62
2601426	9/18/1970	201.17	188.98	12.19
2601427	10/19/1970	207.26	198.12	9.14
2601461	7/8/1971	210.31	206.65	3.66
2601462	7/5/1971	216.41	208.79	7.62
2601470	8/9/1971	216.41	207.57	8.84
2601479	8/30/1971	211.84	209.09	2.74
2601481	8/15/1971	188.98	181.97	7.01
2601489	11/2/1971	195.07	192.33	2.74
2601490	11/16/1971	195.68	178.31	17.37
2601493	10/19/1971	213.36	207.87	5.49
2601509	12/16/1971	196.60	193.24	3.35
2601510	12/3/1971	213.36	210.31	3.05
2601511	12/10/1971	176.78	173.13	3.66
2601528	4/12/1972	195.07	185.62	9.45
2601530	3/21/1972	209.09	206.96	2.13
2601533	1/31/1972	210.92	206.04	4.88
2601536	3/6/1972	213.97	203.30	10.67
2601540	6/2/1972	204.22	195.38	8.84
2601545	7/10/1972	201.78	193.24	8.53
2601592	6/25/1973	213.36	204.22	9.14
2601595	6/8/1973	204.83	199.64	5.18
2601596	6/15/1973	204.83	200.25	4.57

2601620	8/25/1973	213.97	201.78	12.19
2601626	3/1/1973	210.92	204.22	6.71
2601628	10/9/1973	199.34	187.15	12.19
2601631	7/31/1973	185.93	168.55	17.37
2601632	7/31/1973	185.93	171.30	14.63
2601633	10/16/1973	179.83	175.87	3.96
2601634	10/18/1973	180.44	175.87	4.57
2601637	9/21/1973	209.09	205.13	3.96
2601638	10/12/1973	179.83	177.39	2.44
2601641	10/19/1973	179.83	175.87	3.96
2601643	2/8/1973	182.88	178.31	4.57
2601644	6/23/1973	180.44	177.39	3.05
2601645	6/30/1973	177.39	173.74	3.66
2601650	4/4/1973	214.58	212.14	2.44
2601654	8/4/1973	176.78	174.35	2.44
2601671	2/16/1974	200.56	199.34	1.22
2601673	6/24/1974	209.70	207.57	2.13
2601674	8/13/1974	215.80	207.57	8.23
2601687	8/21/1974	213.36	209.70	3.66
2601694	5/30/1974	210.31	201.17	9.14
2601698	10/30/1974	177.39	171.60	5.79
2601700	11/20/1974	179.83	176.48	3.35
2601701	11/29/1974	176.78	174.65	2.13
2601720	3/7/1975	218.24	215.80	2.44
2601723	4/16/1975	178.00	176.17	1.83
2601730	6/20/1975	199.95	182.57	17.37
2601731	6/30/1975	200.56	186.23	14.33
2601742	7/24/1975	205.44	196.29	9.14
2601751	9/25/1975	187.15	174.96	12.19
2601752	10/3/1975	203.00	200.56	2.44
2601757	11/19/1975	214.58	209.09	5.49
2601759	10/15/1975	210.92	201.78	9.14
2601760	11/20/1975	201.17	190.20	10.97
2601765	1/28/1976	201.17	193.24	7.92
2601782	2/3/1975	187.15	183.49	3.66
2601784	2/11/1975	188.37	184.71	3.66
2601785	9/27/1975	186.54	175.87	10.67
2601815	10/22/1976	176.78	174.35	2.44
2601857	6/28/1977	201.78	198.12	3.66
2601858	6/3/1977	182.27	179.83	2.44
2601859	7/11/1977	176.78	173.74	3.05
2601877	11/7/1977	211.84	211.23	0.61
2601879	9/22/1977	217.02	209.70	7.32
2601906	7/29/1978	202.69	197.21	5.49
2601912	8/30/1978	188.98	174.04	14.94
2601915	8/31/1978	179.83	170.38	9.45
2601921	9/15/1978	211.84	198.12	13.72
2601944	1/18/1979	207.26	199.34	7.92
2601949	6/6/1979	201.17	198.12	3.05
2601969	10/2/1979	207.26	196.90	10.36
2601993	4/2/1980	207.26	198.12	9.14
2602005	11/27/1980	210.31	178.31	32.00
2602011	10/2/1980	188.98	185.93	3.05
2602013	6/19/1980	176.78	172.82	3.96
2602019	12/6/1980	219.46	215.80	3.66
2602020	12/27/1980	202.69	192.94	9.75
2602032	4/27/1981	195.07	188.98	6.10
2602050	8/21/1981	213.36	205.44	7.92
2602072	5/15/1982	210.31	198.12	12.19
2602074	8/12/1982	219.46	212.75	6.71
2602079	8/27/1982	201.17	192.02	9.14
2602083	8/7/1982	213.36	208.18	5.18
2602099	7/16/1982	213.36	207.87	5.49
2602113	10/25/1983	182.88	169.47	13.41
2602122	5/3/1984	207.87	207.26	0.61
2602155	5/22/1985	185.01	177.70	7.32
2602156	4/22/1985	199.95	192.33	7.62
2602166	10/2/1985	202.08	199.64	2.44
2602211	10/2/1986	217.93	212.45	5.49
2602226	6/12/1987	187.15	175.56	11.58
2602229	6/9/1987	210.92	184.10	26.82
2602291	8/15/1988	210.01	185.62	24.38
2602344	9/5/1989	195.99	192.33	3.66
2602354	10/16/1989	181.97	176.48	5.49
4402670	3/30/1971	207.26	188.98	18.29
4403292	6/7/1974	203.61	181.05	22.56
4404015	9/20/1978	202.69	199.64	3.05
4404164	10/18/1979	204.22	198.73	5.49
4404296	5/22/1980	204.22	187.45	16.76
4404625	8/13/1982	201.17	196.60	4.57
Median:		**201.2**	**191.0**	**5.5**

Notes:
1. Based on digital elevation model (DEM)
2. As reported in Ontario Ministry of Environment (MOE) Water Well Records

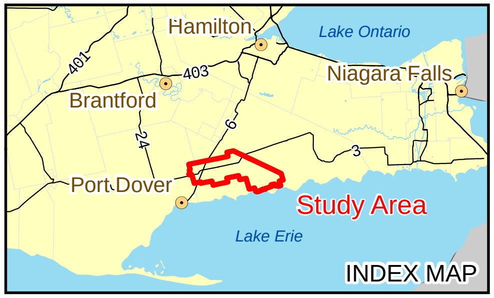


LEGEND

- Turbine
- Highway
- Major Road
- Local Road
- Watercourse
- Waterbody
- 🟥 Project Area

Surficial Geology themed by Material

- 🟪 Paleozoic Bedrock
- 🟥 Precambrian Bedrock
- 🟦 clay
- 🟩 diamicton
- 🟪 fill
- 🟧 gravel
- ⬜ organic deposits
- 🟨 sand
- 🟦 silt



REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2008.4
Surficial Geology - MRD128-Surficial Geology of Ontario, 2006
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2009
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

0 1 2 4 6 8
SCALE 1:175,000 KILOMETRES

PROJECT

Summerhaven Wind Energy Centre

TITLE

SURFICIAL GEOLOGY

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1151-0035			SCALE AS SHOWN	REV.
DESIGN	PP	7 Apr. 2010	FIGURE: 1	
GIS	PP	28 Sep. 2010		
CHECK	ADI	28 Sep. 2010		
REVIEW	RB	28 Sep. 2010		

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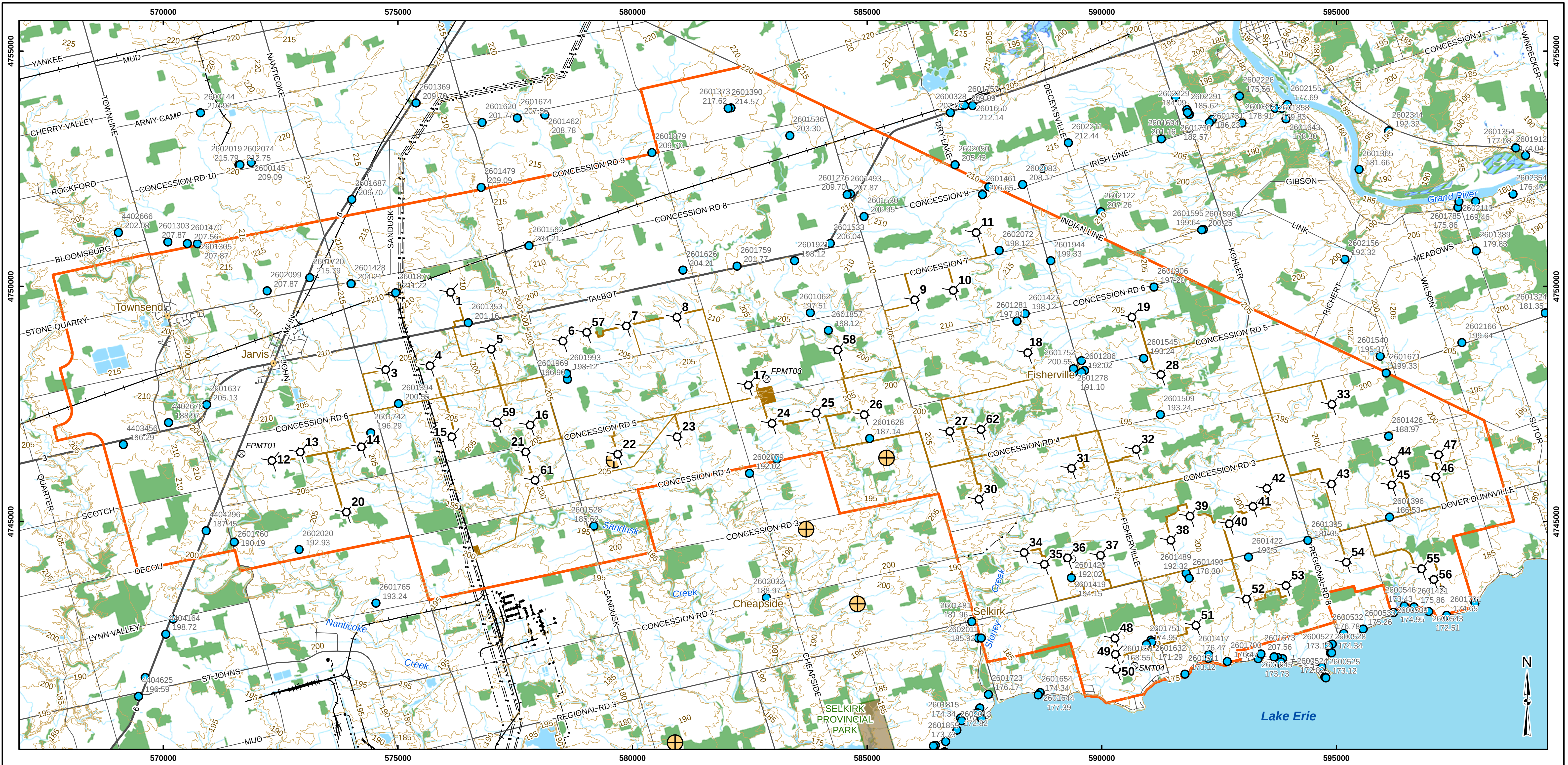


1 0.5 0 1 2 3 4

SCALE 1:80,000 KILOMETRES

LEGEND

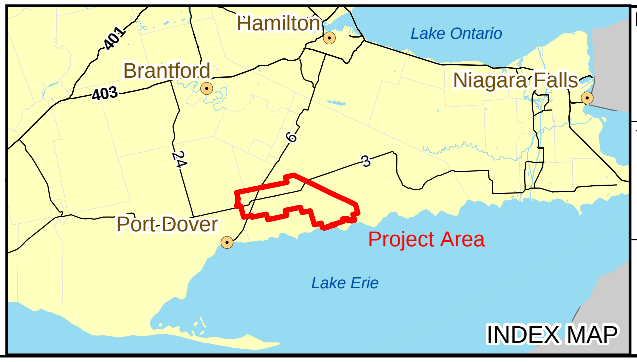
- Turbine
- Borehole
- ● MOE Well
- Highway
- Major Road
- Local Road
- Ground Surface Contour (5m interval)
- Hydro One Transmission Line
- Railway
- Watercourse
- Waterbody
- Project Location
- Project Area

MOE Well Label

MOE Well ID
1234567
172.48
Groundwater Elevation

REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2008.4
Water Wells - MOE, 2009
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2010
Projection: UTM Datum: NAD 83 Coordinate System: UTM Zone 17



PROJECT

Summerhaven Wind Energy Centre

TITLE

GROUNDWATER ELEVATION

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1151-0035		SCALE AS SHOWN	REV.
DESIGN	JR	27 Aug. 2010	
GIS	BC	23 Sep. 2010	
CHECK	PP	26 Sep. 2010	
REVIEW	JW	26 Sep. 2010	

FIGURE: 2

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Attachment A

Borehole Logs

REFERENCE No.: T050051-A2 ENCLOSURE No.: 1

BOREHOLE No.: BH-1 (Draft)

ELEVATION: N/M

BOREHOLE LOG

Page: 1 of 2

CLIENT: TCI Renewables Ltd.

PROJECT: Preliminary Geotechnical Investigation - Nanticoke Wind Energy Project

LOCATION: Nanticoke, Haldimand County, Ontario

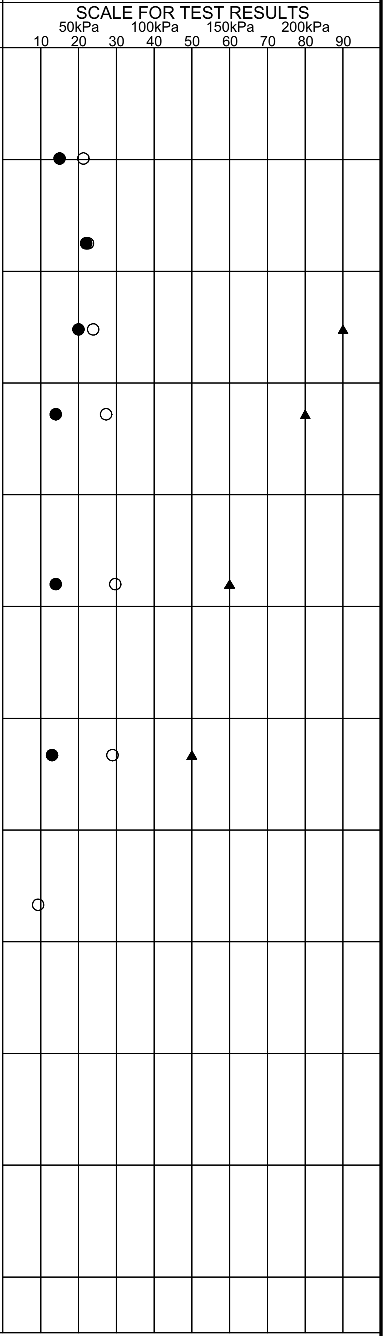
DESCRIBED BY: Abdul Khan CHECKED BY: Bruce Polan

DATE (START): September 30, 2008 DATE (FINISH): September 30, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Unit Weight	Penetration Index / RQD
metres	N/M		GROUND SURFACE			%	kg/m³	N
			FILL : CLAYEY SILT - dark brown, with topsoil, organics, grass roots, moist-wet (reworked earth)					
1.0			FILL : CLAYEY SILT - Brown, trace sand, trace roots, moist-wet to moist (reworked earth)	☒	SS-1	61		15
			CLAYEY SILT - mottled grey-brown, stiff, trace sand, trace gravel, fibrous rootlets, slightly weathered, moist very stiff, no gravel, intermittent fine-grained sand lenses	☒	SS-2	50		22
2.0			SILTY CLAY - mottled grey-brown, very stiff, frequent sand lenses, moist	☒	SS-3	50		20
3.0			brown, stiff, interbedded with silt red pigmentation below 3.35 m bgs	☒	SS-4	56		14
4.0								
5.0			mottled grey-brown, laminated, occasional gravel, moist to moist-wet	☒	SS-5	72		14
6.0				☒	SS-6	56		13
7.0			SANDY SILT TILL - brown, hard, trace clay, trace gravel, moist wet seam at 7.7 m bgs	☒	SS-7	100		R
8.0 9.0			BEDROCK : LIMESTONE - grey, slightly cherty, slight fossillerferous, with intermittent shale, horizontal and inclined natural bedding planes, moderate fractured, layered Core Recovery = 98 % RQD = 79 %	▮	RC-1	98		
10.0			Core Recovery = 100 % RQD = 72 %	▮	RC-2	100		
11.0			End of borehole at 10.98 m bgs. Groundwater at 6.7 m bgs measured before rock drilling. Rock coring using					



NOTES:

BOREHOLE LOG BH LOGS.GPJ INSPEC_SOL.GDT 10/9/08

REFERENCE No.: T050051-A2 ENCLOSURE No.: 1

INSPEC·SOL

BOREHOLE No.: BH-1 (Draft)

ELEVATION: N/M

BOREHOLE LOG

Page: 2 of 2

CLIENT: TCI Renewables Ltd.

PROJECT: Preliminary Geotechnical Investigation - Nanticoke Wind Energy Project

LOCATION: Nanticoke, Haldimand County, Ontario

DESCRIBED BY: Abdul Khan CHECKED BY: Bruce Polan

DATE (START): September 30, 2008 DATE (FINISH): September 30, 2008

LEGEND

☒ SS	Split Spoon
▨ ST	Shelby Tube
▯ RC	Rock Core
▼	Water Level
○	Water content (%)
⊢⊣	Atterberg limits (%)
● N	Penetration Index based on Split Spoon sample
• N	Penetration Index based on Dynamic Cone sample
△ Cu	Shear Strength based on Field Vane
□ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Unit Weight	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
metres	N/M		GROUND SURFACE			%	kg/m^3	N	
12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0			diamond bit drill. Borehole backfilled with auger cuttings and bentonite pellets; surface sealed with bentonite. Continuous gas monitoring with 4-gas monitor due to potential gas pockets. No gas detected during drilling. N/M - refers to "Not Measured" 50/100 - denotes 50 blows per 100 mm sampler penetration m bgs - refers to "metres below ground surface" R - refers to "split spoon refusal"						

NOTES:

REFERENCE No.: T050051-A2 ENCLOSURE No.: 2

INSPEC·SOL

BOREHOLE No.: BH-2 (Draft)
ELEVATION: N/M

BOREHOLE LOG

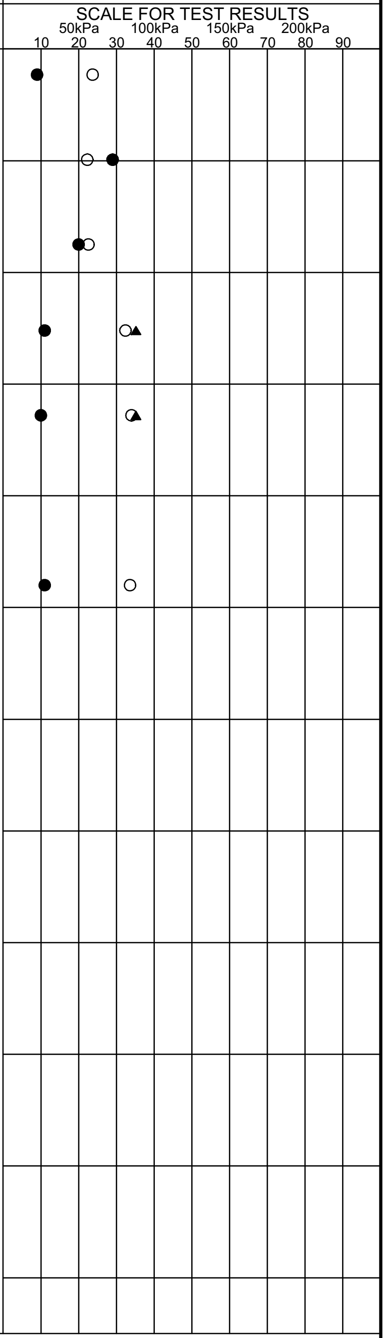
Page: 1 of 1

CLIENT: TCI Renewables Ltd.
PROJECT: Preliminary Geotechnical Investigation - Nanticoke Wind Energy Project
LOCATION: Nanticoke, Haldimand County, Ontario
DESCRIBED BY: Abdul Khan CHECKED BY: Bruce Polan
DATE (START): September 26, 2008 DATE (FINISH): September 26, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Unit Weight	Penetration Index / RQD
metres	N/M		GROUND SURFACE			%	kg/m³	N
			FILL : CLAYEY SILT - dark brown, trace to some topsoil, trace grass roots/fibres, moist (reworked earth)	☒	SS-1	72		9
1.0			CLAYEY SILT - mottled grey-brown, very stiff, isolated grey silt lenses, moist	☒	SS-2	39		29
2.0			slightly weathered	☒	SS-3	50		20
			SILTY CLAY - brown to mottled grey-brown, stiff, laminated, occasional pea gravel, moist	☒	SS-4	56		11
3.0			brown, slightly weathered, intermittent grey silt seams	☒	SS-5	61		10
4.0 5.0				☒	SS-6	78		11
6.0 7.0			BEDROCK : LIMESTONE - grey, cherty, natural horizontal and inclined bedding planes, joints and folds, highly fossillerferous and porous at 7.0 m bgs with hydrocarbon odour and black pigmentation Core Recovery = 94 % RQD = 75 %	▮	RC-1	94		
8.0			no hydrocarbon odour below 7.3 m bgs Core Recovery = 97 % RQD = 82 %	▮	RC-2	96		
9.0 10.0 11.0			End of borehole at 8.94 m bgs. Borehole dry before rock coring. Rock coring using diamond bit drill. Borehole backfilled with auger cuttings and bentonite pellets; surface sealed with bentonite. Continuous gas monitoring with 4-gas monitor due to potential gas pockets. No gas detected during drilling. N/M - refers to "Not Measured" m bgs - refers to "metres below ground surface"					



NOTES:

REFERENCE No.: T050051-A2 ENCLOSURE No.: 3

INSPEC·SOL

BOREHOLE No.: BH-3 (Draft)

ELEVATION: N/M

BOREHOLE LOG

Page: 1 of 1

CLIENT: TCI Renewables Ltd.

PROJECT: Preliminary Geotechnical Investigation - Nanticoke Wind Energy Project

LOCATION: Nanticoke, Haldimand County, Ontario

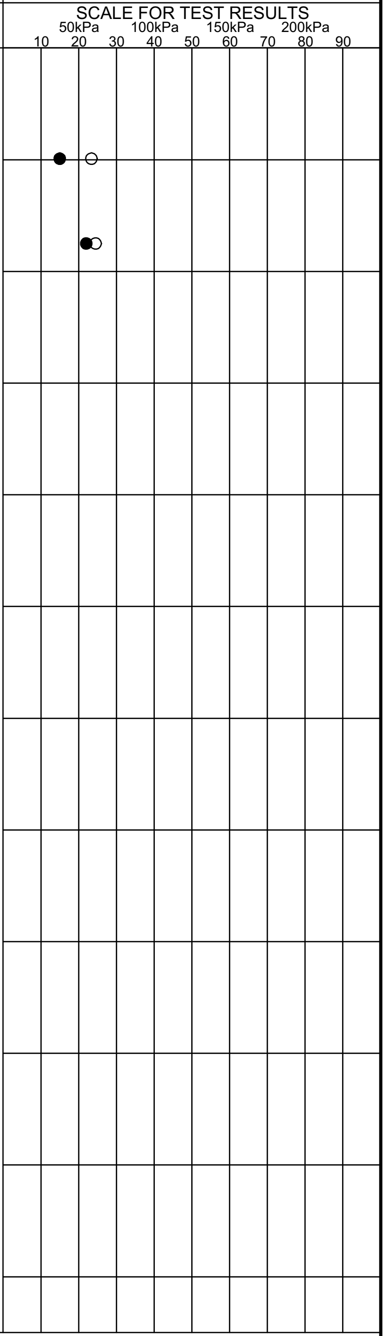
DESCRIBED BY: Abdul Khan CHECKED BY: Bruce Polan

DATE (START): September 25, 2008 DATE (FINISH): September 25, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Unit Weight	Penetration Index / RQD
metres	N/M		GROUND SURFACE			%	kg/m³	N
			FILL : CLAYEY SILT - dark brown to brown, some topsoil, moist (reworked earth)					
1.0			SILTY CLAY - mottled grey-brown, stiff, laminated, moist	☒	SS-1	56		15
			very stiff, isolated sand lenses	☒	SS-2	17		22
2.0			BEDROCK : LIMESTONE - grey, cherty, fossillerferous, mostly horizontal bedding planes, occasional inclined bedding planes, slightly fractured, some shale interbeds slightly weathered	▮				
3.0			Core Recovery = 100 % RQD = 46 %	▮	RC-1	100		
4.0			less fractured	▮				
			Core Recovery = 58 % RQD = 82 %	▮	RC-2	83		
5.0			End of borehole at 5.03 m bgs. Borehole dry before rock coring. Rock coring using diamond bit drill. Borehole backfilled with auger cuttings and bentonite pellets; surface sealed with bentonite.					
6.0			Continuous gas monitoring with 4-gas monitor due to potential gas pockets. No gas detected during drilling.					
			N/M - refers to "Not Measured" m bgs - refers to "metres below ground surface"					
7.0								
8.0								
9.0								
10.0								
11.0								



NOTES:

REFERENCE No.: T050051-A2 ENCLOSURE No.: 4

INSPEC-SOL

BOREHOLE No.: BH-4 (Draft)

ELEVATION: N/M

BOREHOLE LOG

Page: 1 of 1

CLIENT: TCI Renewables Ltd.

PROJECT: Preliminary Geotechnical Investigation - Nanticoke Wind Energy Project

LOCATION: Nanticoke, Haldimand County, Ontario

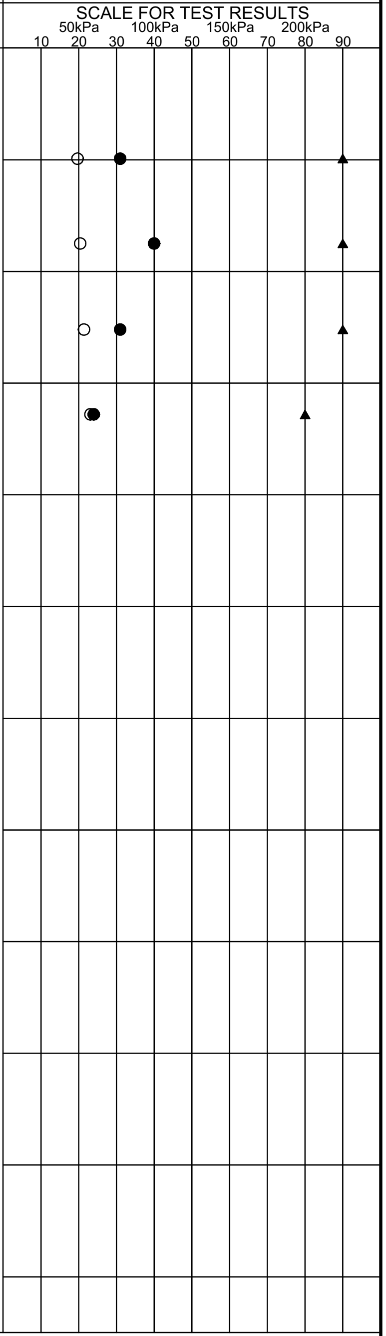
DESCRIBED BY: Abdul Khan CHECKED BY: Bruce Polan

DATE (START): September 24, 2008 DATE (FINISH): September 25, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Unit Weight	Penetration Index / RQD
metres	N/M		GROUND SURFACE			%	kg/m³	N
			TOPSOIL - with grass root mat					
			FILL : CLAYEY SILT - brown, trace sand, moist (reworked earth)					
			SILTY CLAY - mottled grey-brown, hard, trace sand, moist					
1.0				☒	SS-1	56		31
				☒	SS-2	50		40
2.0				☒	SS-3	61		31
3.0				☒	SS-4	56		24
4.0			BEDROCK : LIMESTONE - grey, slighty cherty, fossillerferous, mostly horizontal bedding planes, occasional inclined bedding planes, slightly fractured with dark grey shale, some shale interbeds Core Recovery = 96 % RQD = 87 %	▮	RC-1	96		
5.0								
6.0			Core Recovery = 100 % RQD = 79 %	▮	RC-2	100		
7.0			End of borehole at 6.86 m bgs. Borehole dry before rock coring. Rock coring using diamond bit drill. Core stuck at 5.34 m bgs. Borehole abandoned and redrilled at new location 6 m east of original location. SPT sampling pertains to original drilled location. Boreholes backfilled with auger cuttings and bentonite pellets; surface sealed with bentonite. Continuous gas monitoring with 4-gas monitor due to potential gas pockets. No gas detected during drilling. N/M - refers to "Not Measured" m bgs - refers to "metres below ground surface"					
8.0								
9.0								
10.0								
11.0								



NOTES:

REFERENCE No.: T050051-A2

ENCLOSURE No.: 5

INSPEC·SOL

BOREHOLE No.: BH-5 (Draft)

ELEVATION: N/M

BOREHOLE LOG

Page: 1 of 1

CLIENT: TCI Renewables Ltd.

PROJECT: Preliminary Geotechnical Investigation - Nanticoke Wind Energy Project

LOCATION: Nanticoke, Haldimand County, Ontario

DESCRIBED BY: Abdul Khan

CHECKED BY: Bruce Polan

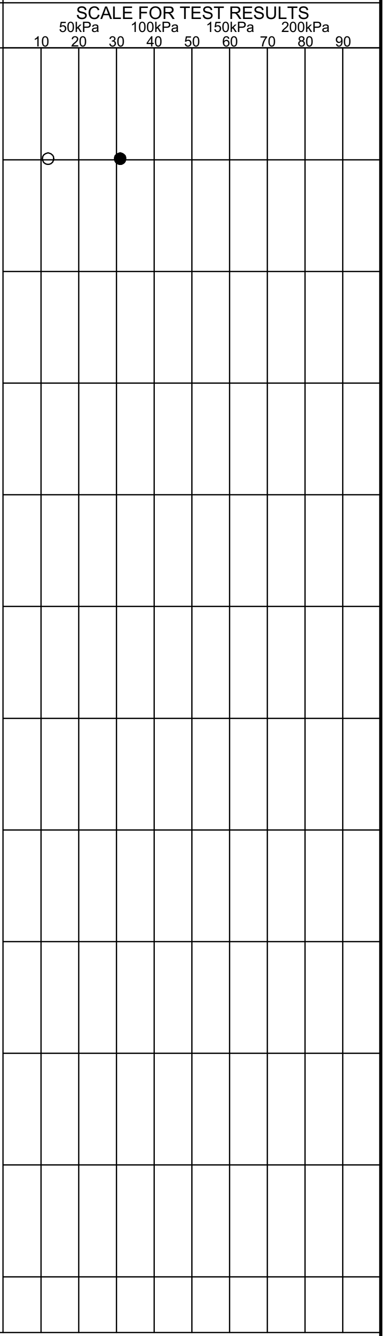
DATE (START): September 29, 2008

DATE (FINISH): September 29, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Unit Weight	Penetration Index / RQD
metres	N/M		GROUND SURFACE			%	kg/m³	N
			FILL : CLAYEY SILT - dark brown, trace sand, trace to some topsoil, organics, roots, moist (ploughed earth)					
1.0			SILTY CLAY - mottled grey-brown, hard, trace sand, occasional gravel, intermittent fine-grained sand lenses, moderately weathered, moist	☒	SS-1			31
2.0			BEDROCK : LIMESTONE - grey, slighty cherty, slightly fossillerferous, mostly horizontal bedding planes with intermittent inclined bedding planes, moderately fractured with dark grey shale interbeds Core Length = 1.24 m (1.37-2.61 m) Core Recovery = 91 % RQD = 33 %	▮	RC-1	91		
3.0			existence of clayey silt seams below 2.6 m bgs; water loss during drilling Core Length = 0.76 m (2.61-3.37 m) Core Recovery = 97 % RQD = 53 %	▮	RC-2	97		
			Core Length = 0.28 m (3.37-3.65 m) Core Recovery = 82 % RQD = 0 %	▮	RC-3	82		
4.0			Core Length = 0.46 m (3.65-4.11 m) Core Recovery = 50 % RQD = 0 %	▮	RC-4	50		
5.0			Core Length = 0.16 m (4.11-4.27 m) Core Recovery = 75 % RQD = 0 %	▮	RC-5	75		
6.0			End of borehole at 4.27 m bgs. Borehole dry before rock coring. Rock coring using diamond bit drill. Diamond bit kept sticking in casing due to presence of clayey silt seams thereby preventing inflow of cutting water through the bit. Core lengths were recovered in piece lengths beyond 2.61 m bgs. Borehole backfilled with auger cuttings and bentonite pellets; surface sealed with bentonite. Continuous gas monitoring with 4-gas monitor due to potential expected gas pockets. No gas detected during drilling. N/M - refers to "Not Measured" m bgs - refers to "metres below ground surface"					
7.0								
8.0								
9.0								
10.0								
11.0								



NOTES:

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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