



November 26, 2010

Draft #1 Renewable Energy Approval (REA) Package Reports Wainfleet Wind Energy Project

To whom it may concern:

Please find the draft Renewable Energy Approval Package (REA) for the Wainfleet Wind Energy Project included in this document. This document contains the reports that are available to the Public as of November 26, 2010. As more documents become available, they will be added to the project website at www.wainfleetwindenergy.ca. **Once a complete draft REA package is available, it will be placed at public viewing locations for a period of at least 60-days.**

This document contains the following reports and plans:

- Project Description
- Wind Turbine Specification
- Construction Plan Report
- Design and Operations Report
- Environmental Effects Monitoring Plan (EEMP)
- Decommissioning Plan Report
- Water Assessment and Impacts Report
- Environmental Impact Statement (EIS)
- Study Area Map
- Site Plan
- Land-use, Natural Heritage, and Ecological Land Classification Maps

Please use the electronic bookmarks to navigate this PDF document.

More About the Proposal: The proposed Wainfleet Wind Energy Project is located in south-western Ontario, entirely in the Township of Wainfleet, in Niagara Region. The study area is found south of the community of Wainfleet, north of the communities of Burnaby and Long Beach, and the community of Ostryhon Corners is located within the study area. A number of maps are provided as part of this package. Pursuant to the Act and Regulation, the project is considered to be a Class 4 wind facility. If approved, this project would have a total name plate capacity of approximately 9.0 megawatts (MW) of renewable energy. Environmental studies have been conducted over an area of approximately 34 km², with between 4 to 5 wind turbines proposed. All wind turbines would be placed in open agricultural fields adhering to the required setbacks from residences, natural heritage, water, and other features required under the REA.

MH has submitted the Natural Heritage Assessment, Cultural Heritage Assessment, and Archaeological Assessments for Ministry review and comment, as required under the Act and Regulation. Once these have been deemed complete, these documents will also be available to you.

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In the near future, you will receive correspondence from us regarding the next consultation events and how you may participate. Following that, we anticipate that this proposal will be eligible for submission to the Ontario Ministry of the Environment (MOE) for a Renewable Energy Approval as early as February 26, 2011. The proposal will then be published on the Environmental Registry at www.ebr.gov.on.ca for a 30-day public review period. The MOE will then make a determination on this proposal.

If you have any thoughts about this proposal, please contact Mr. Jonathan Veale, Environmental Planner, using the contact information provided below.

Yours truly,

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Project Number: 1104036.00

Project Title: WAINFLEET WIND ENERGY PROJECT

Report: Cover-1104036

Title: DRAFT RENEWABLE ENERGY APPROVAL PACKAGE

Client: IPC Energy
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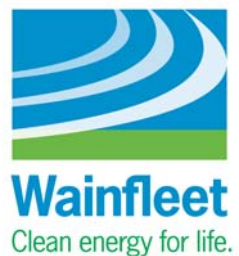
Attention: Mr. Sunny Galia Project Manager

Date: November, 2010
(Draft for public and agency review)

Morrison Hershfield Limited

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Project Number: 1104036.00

Project Title: WAINFLEET WIND ENERGY PROJECT

Report: 000-R03-1104036

Title: PROJECT DESCRIPTION REPORT

Client: IPC Energy
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PREAMBLE

The proposed Wainfleet Wind Energy Project by **Wainfleet Wind Energy Inc**, the proponent is subject to *Ontario Regulation 359/09* Renewable Energy Approvals (REA) under Part V.0.1 of the *Ontario Environmental Protection Act* and is seeking a *Renewable Energy Approval* from the Ministry of the Environment (MOE). This Project Description Report is a required document under the REA and is available from the proponent upon request. This document has been filed with the MOE in accordance with S.14 of the REA.

1.0 PROJECT DESCRIPTION REPORT

1.1 Project Proponent – Wainfleet Wind Energy Inc.

While the Wainfleet Wind Energy Project would represent Wainfleet Wind Energy Inc.'s first foray into the field of wind power generation, the Loeffen family (owners of Wainfleet Wind Energy, Inc.) have a long history of successfully diversifying and employing technology to increase the profitability of their operations. Loeffen Farms has also demonstrated an ongoing commitment to environmental and ecological innovation since its establishment in the 1950s and the move to incorporate green wind power generation to their business reflects the use of innovation and technological advancement while demonstrating the family's ongoing commitment toward sustainable and environmentally friendly operations.

1.2 Project Developer – IPC Energy Inc.

IPC Energy (IPC), the developer, on behalf of the proponent, **Wainfleet Wind Energy Inc.**, is proposing to develop the Wainfleet Wind Energy Project, located south of the Community of Wainfleet, in Wainfleet Township, in Niagara Region, Ontario. IPC Energy works closely with landowners, municipalities and other partners to develop, build and operate energy projects across Canada and internationally, not only for our own projects, but as developers for community projects and other investors. IPC believes that wind energy will provide a safe, viable and economic alternative to other forms of electrical generation as well as becoming a supplement to existing renewable energy such as hydro electric. Wind power is already an important component of energy in Europe, and is becoming a major industry in Canada. More information on IPC can be found at: www.ipcenergy.ca.

IPC Energy is an Ontario based corporation formed in 2004 to provide wind power solutions to farmers and local business groups. It is 100% Canadian owned with its shareholders committed to delivering efficient and cost effective solutions in an environmentally and technically responsible manner. IPC Energy is a fully capable wind park developer covering all phases of the project life cycle from development, to construction and management. IPC is composed of a team of qualified engineers that provide civil, electrical and wind resource assessment to ensure projects provide maximum value with minimum impact on communities and the environment. IPC is developing nine projects that have submitted applications under the initial Feed In Tariff (FIT) program under the Green Energy and Economy Act and has a significant pipeline of projects at various stages of development in Canada and abroad.

The study team may be contacted as follows:

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1.3 Purpose of the Project

The purpose of the Wainfleet Wind Energy Project is to assist the:

- Government of Canada in fulfilling its international commitments, while promoting a sustainable development initiative
- Government of Ontario in achieving its Green Energy Strategy and environmental commitments, while assisting with the Government's coal-fired generation reduction program
- Government of Ontario in fulfilling its goals and principles of establishing a clean and healthy environment, economic growth, and strong communities for the long-term (Provincial Policy Statement)
- Development of stable, long-term electricity pricing for Ontario consumers
- Stimulation of economic and sustainable development in Niagara Region
- Encouragement of innovative and economically viable solutions to climate change

1.4 Energy Source, Classification and Name Plate Capacity

The Wainfleet Wind Energy Project will convert the energy in the wind into electricity using wind turbine generators which will then feed into the Hydro One distribution system. This facility is classified as a **Class 4 Wind Facility** under the Renewable Energy Approval (REA) and is subject to the requirements of O.Reg 359/09. The proposed Wainfleet Wind Energy Project has a name plate capacity of 9.0 megawatts (MW). The location of the Project and components are shown on **Tab 1 (Site Plan)**.

1.5 Project Location and Land Ownership

The proposed Wainfleet Wind Energy Project is located in south-western Ontario, in the Township of Wainfleet, in Niagara Region. The Project Area is located south of the community of Wainfleet, north of the communities of Burnaby and Long Beach, and the community of Ostryhon Corners is located within the Study Area.

More specifically, the Study Area is bound by:

- Side Road 30
- CNR Rail Line
- Brawn Line Road
- Lakeshore Road
- Burnaby Road
- Regional Road #3 (Corners Road)
- Wilson Road



Figure 1: View of the Project Area, a Characteristic View of the Study Area

PROJECT DESCRIPTION REPORT

The landscape of the study area consists of an area of approximately 3400ha and is generally agricultural in land use. Project components will be installed on privately-owned agricultural lots within the study area. **Tab 1 (Site Plan)** presents the project location and boundaries. The land inside the project area is mostly flat, with an elevation of 174 m to 182 m above mean sea level. Within the Project Area, streams are relatively small, some only seasonal. No major rivers are found in the study area. There are some large drains in which water remains year round. All wind turbines are to be placed in open agricultural fields within the required setbacks from residences, natural heritage, water, and other features required under the REA. Most of these fields are tilled and planted seasonally with crops such as corn, oats, and soybeans. Field sizes vary considerably. The landscape is fragmented with open fields, roads, fences, planted crops and vegetation, and settlement areas. Figure 1, above, shows a characteristic view of the study area. There are few woodlots in and around the project area. The diversity of tree species is relatively low.

1.6 Project Facilities, Equipment and Technology

The major components of the project are as follows:

- Meteorological Tower
- It is anticipated that four (4) to five (5) turbines will be built. The **Vestas V100, 1.8 MW** turbine model has been selected as the preferred model.
- Collector systems, micelle mounted transformers and a distribution system to connect to the Hydro One distribution system. Nacelle mounted 690v/27.6 kV step up transformers located in the nacelle housing of each turbine. Buried and overhead 27.6kV electrical collector system, switching station, and ancillaries.
- Turbine access roads
- Temporary staging areas for erection of wind turbines
- A small Supervision Control and Data Acquisition (SCADA)/operations building located at the switching station site

1.6.1 Meteorological Tower

A meteorological tower was installed within the study area to monitor wind speed, wind direction, temperature and humidity. The meteorological tower is approximately 60 m in height and was installed in August, 2009. The tower will remain for the duration of the Project to monitor wind turbine performance and environmental conditions. The tower is supported by guy wires.

1.6.2 Wind Turbines

The Vestas V100, 1.8 MW turbine has been selected as the preferred model for this project. It is anticipated that four (4) to five (5) turbines will be installed. Several alternative turbine locations were studied for environmental impacts and for flexibility to move turbine locations in future, if required. The Wind Turbine Specification Report provides greater detail on the model selected.

All turbines at the Wainfleet Wind Energy Project will meet Transport Canada and NAVCanada requirements for aviation safety/lighting. Further details about the wind turbine proposed will be found in the Wind Turbine Report.

1.6.3 Access Roads and Crane Pads

Access roads, most likely made of packed gravel, will be required to access each wind turbine location. The placement of these roads will seek to minimize impacts on the environment while providing for effective maintenance access to each turbine location. The transportation of machinery, turbine components and other equipment will be done over the existing municipal roads as far as possible. During the construction phase, each wind turbine's access road will end at a crane pad where the turbine will be constructed. The crane will only be required during construction of the turbine. The crane pad will be made of the same material as the access roads. The land used for the crane pad will be restored through standard industry practices and as per applicable rules and regulations at the end of the construction phase. The access roads will be compliant with Ontario and municipal regulations and will be built to support the weight of the equipment and heavy machinery required to build each wind turbine location.

1.6.4 Collector System, Switching Station and Distribution Line

The energy from the Project will be collected via underground cabling and overhead lines and directed to a switching station. The switching station will connect directly to the local distribution system. The turbines will connect to the Hydro One distribution system. The power will be generated at approximately the 27.6 kV voltage level at the turbine step up to a local 27.6 kV collection system by nacelle-mounted transformers located in the nacelle housing of each turbine for Vestas turbines.

1.6.4.1 Collector System

The power generated at each of the wind turbine generators is transported through the collector system. The collector system consists of buried cables and overhead collector lines. In some cases, there may be some shared use with existing Hydro One lines and poles. The collector system will be built to Ontario standards.

1.6.4.2 Switching Station, Communications and SCADA

The switching station will be a chain-linked fenced area measuring approximately 1/4 acres. Within the fenced area, a switching station with a small pre fabricated building for SCADA will be equipped with full Supervision Control and Data Acquisition (SCADA) capabilities. Beside the maintenance building, there will be a switching gear. The maintenance building will have a gravel shoulder surrounding it. The overhead cables coming out of the switching station will attach onto dead-end poles from the fenced area for the switching station and will then attach to a metering pole.

1.6.4.3 Distribution System

Electricity collected at the switching station will be transferred to Hydro One's distribution grid. A distribution line will have to be built to connect the station to the Hydro One grid. An appropriate protection system, as per the best industry practices as well as utility guidelines will be provided.

1.6.5 Maintenance Building

The maintenance building will be located within the fenced area of the switching station. Aside from housing the SCADA system, the maintenance building may also be used as a spare parts warehouse. Maintenance tools used for generator alignment, tools for bolt torque and gearbox oil and tools used for oil filter change will also be stored in the maintenance building. There will be no permanent staff presence; therefore, a sanitation system will not be required. Only trained personnel will be permitted within the fenced in enclosure, including the maintenance building.

1.7 Project Activities

This project includes four main phases:

- 1) Development Phase;
- 2) Construction Phase;
- 3) Operations Phase; and,
- 4) Decommissioning Phase.

The following sections, 1.6.1 to 1.6.4, present an overview of each phase's activities. Details on these phases can be found in the Consultation Report, Construction Plan Report, Design and Operations Report and Decommissioning Plan Report.

1.7.1 Development Phase

This phase of the Project includes all of the assessments and plans required under the Renewable Energy Approvals (REA) requirements and best management practices. These generally include: the land acquisition, wind resource assessment, feasibility study, community relations, permitting, project description, public and agency consultation, natural heritage assessment, cultural heritage assessment, archaeological assessment, noise assessment, environmental impact assessment, construction plan, design and operations report, and decommissioning plan. The Development Phase is a critical step towards ensuring that the project achieves the Purpose outlined in Section 1.2. IPC is committed to deliver efficient and cost competitive energy in an environmentally responsible manner.

The Development Phase is not specifically discussed in the technical reports of the Renewable Energy Approval package, except where relevant for discussions around consultation, design, and environmental considerations for the project.

1.7.2 Construction Phase

This phase of the Project includes all activities from initial work planning, to testing of the wind energy project before commissioning. The main activities during this phase include site prospecting, transportation, new road building, installation of wind turbines including concrete foundations, crane platforms, and installation of the electrical networks and switching station. Further details on the Construction phase are found in the **Construction Plan Report**.

1.7.3 Operations Phase

The operation phase's activities mainly relate to regular maintenance, operation and examination of the Project's facilities. On average, two visits are planned each year per turbine for routine maintenance; however, additional visits may be required. More significant operations and maintenance tasks are planned at 5, 10, and 15 years intervals, as dictated by the life-cycle of the components. A major overhaul after 10 years of operation is generally required. Further details on the Operations phase are found in the **Design and Operations Report**.

1.7.4 Decommissioning Phase

The decommissioning phase of the project includes the disassembly, dismantling, and restoration of each wind turbine location. This will take place once the life cycle of the facility has expired. The decommissioning of the Wainfleet Wind Energy Project may require the dismantling of the components making up the wind energy project, such as the turbines, their concrete foundations, the switching station and the overhead and/or underground electrical network. Decommissioning will take place in accordance with the laws and regulations in effect. Further details on the Decommissioning phase are found in the **Decommissioning Plan Report**.

1.8 Environmental Effects that May Result from the Project

1.8.1 Preliminary Records Review and Pre-Consultation

During the Development Phase of the project a Preliminary Records Review and Pre Consultation with Agencies was undertaken. The purpose of this was to obtain preliminary information about the potential environmental effects that may result from the project. This required that the proponent understand the proximity of the project to environmental components. During this period, the proponent obtained the locations of environmental features and developed an understanding of the geography of project location. This data was incorporated into the various reports and maps of this project.

Tabs 1 to 5 of the Renewable Energy Approval Package shows the proposed site plan, natural heritage maps, ecological land classification, and land use. Further environmental study has informed the proponent's understanding of the existing environmental components and thus the potential environmental effects as the REA progresses. The following reports provide additional guidance on how the project could interact with the environment:

- **Natural Heritage Assessment Report:** The Natural Heritage Assessment provides and inventory of the natural heritage features in proximity to the project. Including, herpetofauna, plants, vegetation, wildlife, bats, and birds. The report determines the significance of environmental features.
- **Water Assessment and Impacts Report:** The Water Assessment and Impacts Report describes the water resources in proximity to the project area and describes how these resources may be impacted by the proposed project. The report also provides mitigation and environmental protection measures to protect water resources and fish and aquatic habitat. The report expands on the Environmental Impact Statement (EIS)
- **Environmental Impact Statement (EIS) Report:** The EIS describes how the project will interact with the environment and describes environmental impacts. The report prescribes mitigation and protection measures for significant environmental features. The EIS is required where any aspect of the project interacts with REA setbacks and significant environmental components.
- **Environmental Effects Monitoring Plan (EEMP) Report:** The EEMP provides a monitoring plan for environmental effects. The purpose of the EEMP is to provide a framework monitoring and determining the environmental effects of the project during construction, operation and maintenance, and decommissioning.

The land use maps and natural heritage maps show known and assessed environmental components, where present, such as:

- Natural Heritage Resources
 - o Waterbodies
 - o Wetlands
 - o Bird Nesting Sites
 - o Wildlife Habitat

PROJECT DESCRIPTION REPORT

- o Woodlots
- o Valley Lands
- o Areas of Natural and Scientific Interest
- o Environmentally Significant Areas
- o Conservation Reserves
- o Provincial Parks
- Noise Receptors
- Provincial and Local Roads
- Areas Protected under Provincial Plans & Policies

1.8.2 General Summary of Environmental Effects

The potential effects of constructing, operating, maintaining, and decommissioning a wind energy project can typically be mitigated through known and accepted practices. Other REA documents describe how this project will reduce or mitigate these potential environmental concerns. The Project Description Report will **identify and describe** which environmental effects that may result from the project. This informed the following reports/studies and guided the proponent to addressing known and potential environmental effects.

The potential environmental impact concerns that may result from the project are typical of concerns related to wind energy facilities in agricultural areas. These concerns generally relate to three Environmental Components: **natural heritage**, the **socio-economic environment**, **cultural heritage** and **archaeological resources**.

In order to assess this, the proponent undertook a four season natural heritage assessment, cultural heritage assessment, archaeological Stage 1 and Stage 2 assessments, and public and agency consultation to understand the socio-economic landscape.

1.8.3 Role of Consultation in Determination of Effects

Consultations with land-owners, federal and provincial agencies, and utilities will take place to inform and describe these potential environmental effects. Consultations are an essential tool to ensuring that developers obtain environmental data that contributes to our understanding of the impacts of wind energy development. The analysis of these environmental and social effects, amongst several others, along with proposed mitigation and monitoring plans will be discussed in detail in the forthcoming reports required subject to the REA process.

1.8.4 Summary Table of Potential Environmental Effects

Table 1, found on the following pages, describes the Potential Negative Environmental Effects of the Proposed Wind Energy project. The table divides these effects into environmental components and provides additional information where applicable. The purpose of **Table 1** is to:

- provide guidance on directing future environmental assessment of the project
- identify necessary environmental studies and reporting requirements
- identify consultation avenues and provide fodder for future discussions with stakeholders
- identify potential negative environmental effects of the project and offer a lens from which to approach each environmental component
- offer a framework to organizing future environmental protection and mitigation measures.

Table 1 – Potential Negative Environmental Effects of the Proposed Wind Energy Project

<u>Environmental Component</u>	<u>Additional Information</u>	<u>Potential Effects</u>
Natural Heritage Resources Natural heritage resources include features such as wetlands, waterbodies, woodlots, valleylands, wildlife habitat, provincial parks, and conservation areas. Each of these features may be categorized into one or more of the environmental subcomponents of Waterbodies, Fish and Aquatic Habitat, and Wildlife and Terrestrial Habitat.		
Waterbodies This includes all water resources found within the study area, including those found on the surface, underground, or at seepage areas. Waterbodies include lakes, permanent streams, intermittent streams, seepage areas, and ground water.	• The project will not impact a ground water seepage area. The project is not anticipated to involve the storage of or consumption of water. • The project will not require the alteration of surface water runoff patterns. • Sedimentation and erosion control measures were included in the Construction Plan and Environmental Effects Monitoring Plan. • Where the project interacts with watercourse and waterbodies, an environmental impact statement is required. • A Water Assessment and Impacts Report has been prepared.	• The project may effect surface water quality and quantities of flow. • If required, dewatering activities may impact natural heritage or water resources. • The project may impact shoreline/riparian water quality and quantity. • An unexpected oil or lubricant spill may impact water quality.

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Table 1 – Potential Negative Environmental Effects of the Proposed Wind Energy Project

Environmental Component	Additional Information	Potential Effects
Fish and Aquatic Habitat This includes all fish and aquatic habitat including those of a seasonal or intermittent nature. This includes all areas where plants, animals and other aquatic organisms live or have the potential to live and find adequate amounts of food, water, shelter, and space to sustain their population, including an area where a species concentrates at a vulnerable point in its life cycle (i.e. spawning or reproduction) and an area that is important to a migratory or non-migratory species.	• A Natural Heritage Assessment Report was prepared as part of this study. • The project must be setback from water courses and thus fish habitat • No shoreline/riparian works are anticipated as part of this project • Large quantities of toxic or hazardous materials are not typically found in the proposed facilities; small quantities are self-contained inside wind turbines or securely stored in a designated facility	• Materials associated with turbines, including oils and lubricants may be spilled during construction, operation, maintenance, or decommissioning and impact water resources, fish, and aquatic habitat • Roads and electrical infrastructure crossing watercourses could impact fish and fish habitat.
Wildlife and Terrestrial Habitat This includes all areas where terrestrial plants, animals and other organism live or have the potential to live and find adequate amounts of food, water, shelter, and space to sustain their population, including an area where a species concentrates at a vulnerable point in its life cycle and an area that is important to a migratory or non-migratory species.	• Wildlife and Habitat studies were undertaken as part of the Natural Heritage Assessment; these studies conformed to MNR requirements. • The project facilities will be located away from significant wildlife habitat (including known bat hibernacula) and designated natural areas • The project will not impact potential habitat for species at risk • The project will not impact vegetation species at risk	• The project could cause habitat loss or mortality to wildlife, including: • Birds; • Bats; • Amphibians; • Other flora and fauna
Socio-Economic Environment The Socio-Economic Environment includes: land uses and resources; areas protected under provincial plans and policies; noise, air, odour and dust; provincial and local infrastructure; public health and safety; aesthetics and landscape; economy and livelihoods; and social justice.		
Land Use and Resources (including, Aboriginal Land Uses and Resources) Refers to land use as defined in the Planning Act (R.S.O. 1990). Includes all lands within 300 meters of the project location. Land uses and resources include: aggregate resources, landfill sites, petroleum wells, recreation areas, forest	• Consultation with land-owners, municipalities, and any aboriginal parties has taken place during this study and will continue to do so. • The project takes place on lands that are optioned to the proponent • The existing land use for the project location is generally	• The project could have a negative effect on residential commercial, or institutional land uses in proximity to the site • The project may impact aboriginal land uses; consultation with Indian and Northern Affairs Canada may be required.

PROJECT DESCRIPTION REPORT

Table 1 – Potential Negative Environmental Effects of the Proposed Wind Energy Project

Environmental Component	Additional Information	Potential Effects
resources, aboriginal land claims, telecommunication (radio/radar), transportation, aerodromes, etc.	agricultural in nature • The project will conform to the land uses permitted under provincial and municipal requirements • Aboriginal land uses may be found in, or proximity to, the study area • The proposed project location does not possess potential for contamination • Consultation with NavCanada and Transport Canada is part of this process	• The project may impact telecommunications and aerodrome facilities; consultation with NavCanada and Transport Canada will be required.
Areas Protected under Provincial Plans and Policies Includes those areas that are defined under the Oak Ridges Moraine Conservation Plan Area, Niagara Escarpment Plan Area, Lake Simcoe Watershed Plan Area, and Green Belt Act.	• The Niagara Escarpment Plan Area remains outside of the study area. • Consultation with the Niagara Peninsula Conservation Authority and Regional Municipality of Niagara will take place during this study.	• The project is not anticipated to impact the Oak Ridges Moraine Conservation Plan Area, Niagara Escarpment Plan Area, Lake Simcoe Watershed Plan Area, and Green Belt Act regulated areas.
Noise Refers to noise receptors as a location at which a discharged noise from a renewable energy generation facility is received. O.Reg 359/09 subsection (4) defines this term.	• A Noise Assessment Study has been conducted as part of this study. • Wind turbines are known to produce noise and a noise assessment will be undertaken as part of the REA process • Setbacks from sensitive noise receptors are required as part of the REA; wind facilities may not be located in proximity to these receptors	• The project may emit noise and effect sensitive noise receptors
Air, Odour, Dust Includes emissions in to the atmosphere that include: nitrogen dioxide, sulphur dioxide, suspended particulates, emissions of green house gasses (GHGs: CO₂, Methane), and other odours and dust.	• On a net basis the project will enhance air quality by reducing GHG emissions from alternative energy sources	• During construction and decommissioning of the facility air quality will be temporarily negatively affected by emissions produced from construction machinery. These emissions include elevated levels of nitrogen dioxide, sulphur dioxide, suspended particulates, emissions of GHGs (CO₂, Methane), and other

PROJECT DESCRIPTION REPORT

Table 1 – Potential Negative Environmental Effects of the Proposed Wind Energy Project

Environmental Component	Additional Information	Potential Effects
		odours and dust.
Provincial and Local Infrastructure	• MTO and local municipalities will be contacted to ensure that provincial and local transportation infrastructure requirements are followed.	• During construction and decommissioning provincial and local roads may be effected by the movement of construction equipment and turbine materials • Local water, sanitary, and stormwater facilities will not be impacted.
Public Health and Safety	• The project will comply with provincial health and safety laws and standards	• Public health and safety will not be impacted by the proposed undertaking
Aesthetics and Landscape Refers to the visual aesthetics and landscape character of the land.	• While rural in nature, the landscape of the study area is largely dominated by industrial/commercial agriculture	• The project may effect the aesthetics of the landscape by transforming it to a more industrial vista
Economy and Livelihoods Refers to the economic activities and employment found in the study area and includes the cultural nature of employment in shaping human identities.	• The project will produce economic activity in Niagara Region and in Ontario • The project is a community power project as the proponent is organized in Niagara Region	• The project may effect the production of economic activity in the area or compete with local industries
Social Justice Refers to the pursuit of a fair and just society. This is characterized by a proportionate distribution of resources where no social group exploits another. Significant net imbalances may diminish the socio-economic goals of the project.	• The project is a community power project where the proponents live and work in close proximity to the proposed facilities • The proposal seeks to provide a net benefit to the local, regional, and provincial socio-economic environment	• The project may provide a disproportionate distribution of resources to one social group or community within society
Cultural Heritage and Archaeological Resources		
Archaeology and Human History These refer to sites within the meaning of O.Reg 170/04 made under the Ontario Heritage Act. These include the historical and material remains of past human activities and inform us about past conditions	• A Stage 1 and Stage 2 Archaeological Assessment was undertaken to determine the archaeological potential • The study conformed to MOTC requirements.	• The project may disturb archaeological remains which speak to the human history of the area during construction

PROJECT DESCRIPTION REPORT

Table 1 – Potential Negative Environmental Effects of the Proposed Wind Energy Project

<u>Environmental Component</u>	<u>Additional Information</u>	<u>Potential Effects</u>
Heritage Resources Refers to real property that is of a cultural heritage value or interest and may include buildings, structures, landscape, or other real property.	• Cultural Heritage Assessment was completed to determine cultural value before any facilities are constructed • The study conformed to MOTC requirements. • The proposal does not include any proposed modification or impacts to known protected properties or heritage resources	• The project will not impact heritage resources.

References

- Ontario Ministry of the Environment (MOE), 2010. *Technical Bulletin One. Guidance for preparing the Project Description Report, as part of an application under O.Reg.359/09*. Draft Document posted for public comment on the Environmental Registry March 1, 2010. Queen's Printer for Ontario. PIBS 7436e.
- Ontario Ministry of the Environment (MOE), 2009. *Ontario Regulation 359/09 Renewable Energy Approvals Under Part V.)1. of the Act. O.Reg.359/09*. Consolidation Period: September 24, 2009 to September 30, 2009. Filed October 1, 2009. Queen's Printer for Ontario.



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Project Number: 1104036.00

Project Title: WAINFLEET WIND ENERGY PROJECT

Report: 001-R03-1104036

Title: WIND TURBINE SPECIFICATION REPORT

Client: IPC Energy
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Date: September 29, 2010
(Draft for public and agency review)

Morrison Hershfield Limited

A handwritten signature in blue ink that reads 'Jonathan Veale'.

Jonathan Veale
Project Manager



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1.0 Wind Turbine Specifications Report

The Wainfleet Wind Energy Project ("the Project") is proposed to consist of five (5) Vestas V100-1.8MW turbines. The turbine model was selected based upon its technical performance, design characteristics, acoustic properties, power output, and site specific considerations.

The purpose of this report is to provide the technical information on the turbines to be used for the proposed Project. The Wainfleet Wind Energy Inc. is proposing a single Class 4 Wind Energy Facility consisting of five 1.8 MW wind turbines for a total nameplate capacity of 9.0 MW in the Township of Wainfleet in Niagara Region of the Province of Ontario.

1.1 Technical Specifications

The Vestas V100-1.8 MW wind turbine is a pitch regulated upwind turbine with active yaw and a three-blade rotor. The Vestas V100-1.8 MW turbine has a rotor diameter of 100 m with a generator rated at 1.8 MW. The turbine utilizes a microprocessor pitch control system called OptiTip®. With these features the wind turbine is able to optimize power output at different wind speeds.

A summary of the technical specifications is presented in **Table 1.1** with additional information provided by the manufacturer is included in **Appendix 1**.

Table 1.1a: Summary of Technical Specifications of the Vestas V100-1.8MW	
Specification	Vestas V100-1.8MW
Nameplate Capacity	1.8 Megawatt
Hub Height (above grade)	95 m
Rotator Diameter	100 m
Blade Length	49 m
Swept Area	7850 m ²
Minimum Wind Speed (cut-in speed)	4.0 m/s
Maximum Wind Speed (cut-out speed)	20.0 m/s
Dynamic Rotational Speed Range	9.3 rpm to 16.6 rpm
Actual Rotational Speed	14.9 rpm

Each Vestas V100 turbine has a nameplate capacity of 1.8 MW and will be built to a hub height of 95 meters. The rotor diameter is 100 meters with swept area of 7850 m².

The minimum operational wind speed (cut-in speed) is 4.0 m/s with a maximum operational speed (cut-out speed) of 20.0 m/s.

The V-100 Turbine is erected on a tubular steel tower which holds the nacelle at 95 meters above the ground. The nacelle houses the hub and electrical components. Each blade is constructed of light weight airfoil shells bonded to supporting beams

WIND TURBINE SPECIFICATION REPORT

and connect to the hub forming a 100 meter rotor. The generator is asynchronous with wound rotor, slip rings and VCUS. The turbine's operational envelope is -20° to +40° C.

Table 1.1b summarizes the Wind Turbine General Specifications.

Table 1.1b: Wind Turbine General Specifications	
	Operational Envelope: -20° to +40° C
Rotor	Rotor Diameter: 100m
	Swept Area: 7850m²
	Speed, Dynamic Operation Range: 9.3 – 16.6 rpm
	Rotational Direction: Clockwise (front view)
Tower	Type: tubular steel tower
	Hub: 95m
Electrical	Frequency: 60 Hz
	Rated Power: 1.8 MW
	Generator: Asynchronous with wound rotor, slip rings and VCUS
Blade	Type: airfoil shells bonded to supporting beam
	Length: 49m
	Max Chord: 3.9m
Nacelle	Height for Transport: 4.0 m
	Height Installed: 5.4 m
	Width: 3.4 m
	Length: 10.4 m
Hub	Material: cast ball shell hub
	Height: 95m
	Diameter: 3.3 m

1.2 Acoustic Emissions Data

The V100 1.8 MW turbine model has a maximum sound power rating of **105.00 dBA**. Additional information on the acoustic data can be found in **Tables 1.2a, 1.2b, 1.2c, and 1.3**. These tables summarize the wind turbine specifications provided in the Manufacture Technical Details provided in **Appendix 1**.

Table 1-2a provides the Sound Power Level Ratings (dBA) for **Mode 0** at a Hub Height of **95 meters**. The table shows the conditions for sound power levels at speeds of **3 m/s to 13 m/s** at **10 meters** with the corresponding wind speed at hub height (HH). The sound power rating does not exceed 105.00 dBA.

Table 1-2a: Sound Power Level Ratings for Mode 0		
Conditions for Sound Power Level	Hub Height 95 meters	Wind speed at hh [m/sec]
LwA @ 3 m/s (10 m above ground) [dBA]	93.8	4.3
LwA @ 4 m/s (10 m above ground) [dBA]	96.4	5.7
LwA @ 5 m/s (10 m above ground) [dBA]	100.7	7.2
LwA @ 6 m/s (10 m above ground) [dBA]	104.4	8.6
LwA @ 7 m/s (10 m above ground) [dBA]	105.0	10.0
LwA @ 8 m/s (10 m above ground) [dBA]	105.0	11.5
LwA @ 9 m/s (10 m above ground) [dBA]	105.0	12.9
LwA @ 10 m/s (10 m above ground) [dBA]	105.0	14.3
LwA @ 11 m/s (10 m above ground) [dBA]	105.0	15.8
LwA @ 12 m/s (10 m above ground) [dBA]	105.0	17.2
LwA @ 13 m/s (10 m above ground) [dBA]	105.0	18.6

Table 1-2b (below) provides the Sound Power Level Ratings (dBA) for **Mode 1** at a Hub Height of **95 meters**. The table shows the conditions for sound power levels at speeds of **3 m/s to 13 m/s** at **10 meters** with the corresponding wind speed at hub height (HH). The sound power rating does not exceed 105.00 dBA.

Table 1-2b: Sound Power Level Ratings for Mode 1		
Conditions for Sound Power Level	Hub Height 95 meters	Wind speed at hh [m/sec]
LwA @ 3 m/s (10 m above ground) [dBA]	93.7	4.3
LwA @ 4 m/s (10 m above ground) [dBA]	95.7	5.7
LwA @ 5 m/s (10 m above ground) [dBA]	99.7	7.2
LwA @ 6 m/s (10 m above ground) [dBA]	103.4	8.6
LwA @ 7 m/s (10 m above ground) [dBA]	105.0	10.0
LwA @ 8 m/s (10 m above ground) [dBA]	105.0	11.5
LwA @ 9 m/s (10 m above ground) [dBA]	105.0	12.9
LwA @ 10 m/s (10 m above ground) [dBA]	105.0	14.3
LwA @ 11 m/s (10 m above ground) [dBA]	105.0	15.8
LwA @ 12 m/s (10 m above ground) [dBA]	105.0	17.2
LwA @ 13 m/s (10 m above ground) [dBA]	105.0	18.6

Table 1-2c provides the Sound Power Level Ratings (dBA) for **Mode 2** at a Hub Height of **95 meters**. The table shows the conditions for sound power levels at speeds of **3 m/s** to **13 m/s** at **10 meters** with the corresponding wind speed at hub height (HH). The sound power rating does not exceed 105.00 dBA.

Table 1-2c: Sound Power Level Ratings for Mode 2		
Conditions for Sound Power Level	Hub Height 95 meters	Wind speed at hh [m/sec]
LwA @ 3 m/s (10 m above ground) [dBA]	93.8	4.3
LwA @ 4 m/s (10 m above ground) [dBA]	96.4	5.7
LwA @ 5 m/s (10 m above ground) [dBA]	100.7	7.2
LwA @ 6 m/s (10 m above ground) [dBA]	103.0	8.6
LwA @ 7 m/s (10 m above ground) [dBA]	103.0	10.0
LwA @ 8 m/s (10 m above ground) [dBA]	103.0	11.5
LwA @ 9 m/s (10 m above ground) [dBA]	103.0	12.9
LwA @ 10 m/s (10 m above ground) [dBA]	103.0	14.3
LwA @ 11 m/s (10 m above ground) [dBA]	103.0	15.8
LwA @ 12 m/s (10 m above ground) [dBA]	103.0	17.2
LwA @ 13 m/s (10 m above ground) [dBA]	103.0	18.6

WIND TURBINE SPECIFICATION REPORT

Table 1-3 provides the Octave Band Spectra showing Octave in Hz from **16 Hz** to **8000 Hz** with the corresponding Sound Power Level in dB(A). Sound Power Level does not exceed **99.7 dB**.

Table 1-3: Octave Band Spectra												
Wind Speed@10m [m/s]	3	4	5	6	7	8	9	10	11	12	13	14
16Hz [dB(A)]	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
31.5Hz [dB(A)]	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
63Hz [dB(A)]	NaN	NaN	NaN	85.2	87.4	87.1	86.7	86.6	NaN	NaN	NaN	NaN
125Hz [dB(A)]	NaN	NaN	NaN	89.6	92	91.7	91.3	91.4	NaN	NaN	NaN	NaN
250Hz [dB(A)]	NaN	NaN	NaN	93	94.7	94.2	93.6	93.5	NaN	NaN	NaN	NaN
500Hz [dB(A)]	NaN	NaN	NaN	95.4	97.1	96.7	96.1	96.1	NaN	NaN	NaN	NaN
1000Hz [dB(A)]	NaN	NaN	NaN	98.2	99.7	99.5	99	99.1	NaN	NaN	NaN	NaN
2000Hz [dB(A)]	NaN	NaN	NaN	96.6	98.2	98.4	98.2	98.2	NaN	NaN	NaN	NaN
4000Hz [dB(A)]	NaN	NaN	NaN	94.6	96.6	97.2	98.7	98.6	NaN	NaN	NaN	NaN
8000Hz [dB(A)]	NaN	NaN	NaN	85.4	89.8	90.3	91.4	92.3	NaN	NaN	NaN	NaN

Table 1-3 Notes:

1. "NaN" indicates data not available due to insufficient data collection at this wind speed.
2. Disclaimers from Vestas: The values are valid for the A-weighted sound power levels
Octave band values must be regarded as informative
Site specific values are not warranted
3. Measurement standard ICE 6140011:2002, using amendments procedure above 95% RP

1.3 Qualifications and Limitations

This summary report was produced, in part, to fulfill the requirements for the Turbine Specifications Report for the Renewable Energy Approval (REA). The contents of this document have been produced using the requirements outlined in O.Reg 359/09 as well as other applicable Acts and Regulations governing these projects.

Morrison Hershfield Limited's assessment was made in accordance with guidelines, regulations and procedures believed to be current at this time. Changes in guidelines, regulations and policies can occur at the discretion of the government and such changes could affect this report.

Morrison Hershfield Limited and the consulting team retained for this Project have prepared this report in accordance with information provided by its Client and their representatives. While we may have referred to and made use of this information and reporting, we assume no liability for the accuracy of this information.

Appendix 1: Vestas V-100 1.8 MW Brochure
(As provided by Vestas to Wainfleet Wind Energy Inc.)

Draft
26-Nov-10

V100-1.8 MW

High energy production for low wind sites



vestas.com

Vestas[®]



Draft
26-Nov-10

A wide-angle photograph of a desolate, arid landscape. The foreground is a vast, flat expanse of dry, brownish ground with scattered small rocks and patches of sparse, dry vegetation. In the middle ground, a thin, winding road or path curves across the landscape towards the right. The background features rolling hills and mountains under a heavy, overcast sky with soft, diffused light. The overall tone is somber and expansive.

WE DELIVER
ON THE PROMISE
OF WIND POWER

Draft
26-Nov-10



A WORKHORSE OF UNRIVALED AVAILABILITY

Truly best of class

The V100-1.8 MW brings together the very best of the 2.0 MW class in a single turbine designed for low wind onshore sites. It features a greater rotor diameter, enabling it to deliver higher output at low wind speeds.

Because of this, the V100-1.8 MW delivers excellent return on investment, even at sites where wind power plants have not previously been profitable. These sites can now be used to produce clean, stable, sustainable and competitive energy.



NEW STANDARDS FOR EFFICIENCY AND RELIABILITY

Unrivalled availability under any conditions

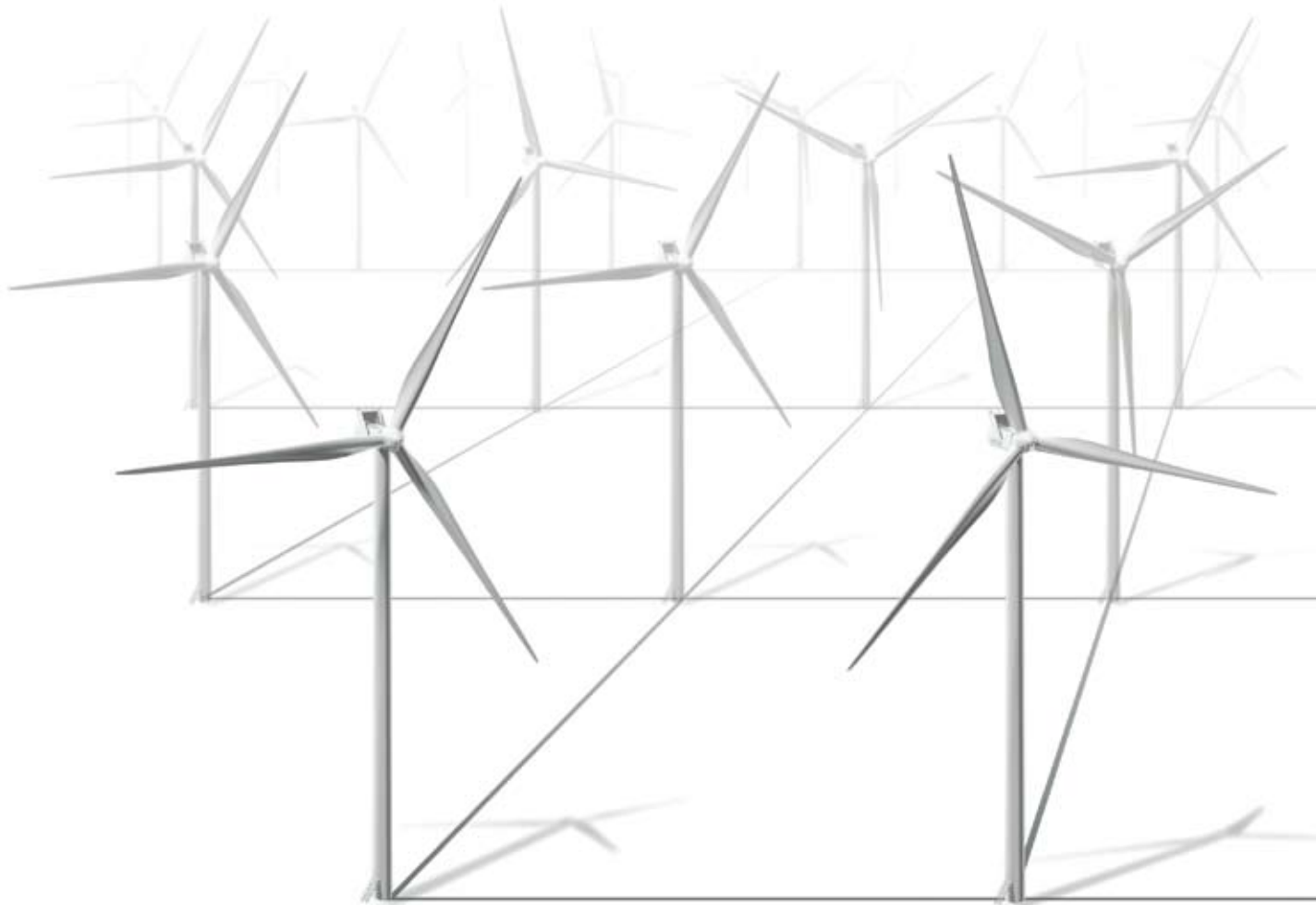
We've made extensive use of our experience with the 2.0 MW class in designing the V100-1.8 MW, producing a turbine that delivers market-leading availability.

The V100-1.8 MW features a modular design, with several turbines sharing innovative, high-performance technology. Our turbines in this class boast a rugged design, grid compliance and high, thoroughly documented performance. Vestas has installed more than 5,000 2.0 MW turbines since 2003 at highly diverse wind sites around the globe. They've proved their solid performance both onshore and offshore, and they have a long track record of documented high availability even in the most extreme conditions.

Mature technology, stable revenue

The V100-1.8 MW is based on a mature, reliable design platform. This enables the V100-1.8 MW to deliver high, stable revenue at low wind sites, where it hasn't previously been possible to harvest wind power so efficiently. Furthermore, the turbine has been designed around a large number of standard components that several suppliers can provide, improving overall reliability and high availability of the turbine.





Flexible grid integration and stable output

Vestas products, such as the V100-1.8 MW, are designed so that your wind park will be fully compliant with applicable grid codes at the point of common coupling. How this is achieved may differ from country to country, but generally, the Vestas advanced grid compliance system provides active and reactive power regulation, frequency regulation and fault ride-through capabilities to support grid levels and stability in the event of grid disturbances.

Enhanced safety and maintenance

The V100-1.8 MW is designed for reliability, safety and convenient maintenance. All rotating parts are shielded, and all the components are positioned to minimise service time and manpower, no matter what service task is involved. The V100-1.8 MW offers a number of features that boost reliability and serviceability, including ingenious solutions for lubricating key components such as the blade-bearing system and the yaw system.



Can be installed almost anywhere

The V100-1.8 MW complies with all the standard limits for weight, width and height. It can be transported to most sites in the world without being subject to special fees and restrictions that can delay or increase the cost of wind power plant construction.

Next-generation software

The V100-1.8 MW is equipped with the latest turbine control and operation software, a state-of-the-art modular software platform developed to run the next generation of Vestas turbines.

Special options

The V100-1.8 MW is available with a number of special options that ensure compliance with local requirements. These options include:

- Condition monitoring system
- Switchgear
- Aviation markings on the blades
- Aviation lights
- Company logo
- Low temperature operation to -30°C
- Ice detection system



DESIGNED FOR A HIGH-YIELD WIND HARVEST

Market-leading aerodynamics

The tried and tested blades on the V100-1.8 MW sweep an area of 7,850 m² and deliver an outstanding rotor-to-generator ratio. This adds up to higher capacity and yield, compared to other turbines in the 2 MW class.

The 49-metre blades have proven their worth since 2006, and have been subjected to static and dynamic testing, as well as being type-certified by Det Norske Veritas.

CoolerTop™ saves energy

The environmentally friendly CoolerTop™ is yet another example of the V100-1.8 MW's state-of-the-art technology. It cools the water used in the turbine's cooling system by channelling wind into the heat exchanger. This boosts reliability, not least by reducing the number of moving parts and electrical components in the cooling system, and it reduces the turbine's own energy consumption.





VESTAS TAKES CARE OF YOUR INVESTMENT ROUND THE CLOCK

Verified component lifetime

At the Vestas Testing Centre and Technology R&D, engineering experts and technicians use state-of-the-art testing methods to ensure that all components and systems meet our standards for safety, performance and reliability throughout their 20-year service life. These tests push the components beyond their specifications. One method is known as Highly Accelerated Life Testing, where some of the testing is conducted in a HALT chamber. Extreme fluctuations in temperatures combined with heavy vibrations are just some of the stress tests the components are subjected to here. This enables Vestas to identify and address design flaws long before the turbines reach the market.

Surveillance 24/7/365

Our surveillance services are manned 24/7 all year round to provide real-time surveillance, remote troubleshooting and other services. These services can also detect potential errors and disruptions before they occur, as data from your turbines is gathered and analysed. This enables us to prepare a plan for preventative maintenance, saving you from unexpected production stops and costly downtime.

Service and maintenance

Vestas has service centres around the globe and we are able to cover your every need, from simple cleaning and planned maintenance to emergency call-outs and on-site inventories customised for your turbines.



Asset management and operation risk mitigation

Your wind turbines have to be maintained with great care to avoid exposing your investment to unnecessary risks. And that is exactly what Active Output Management is designed to ensure – that you get the greatest possible return on your investment in a Vestas wind turbine.

AOM provides a number of advantages, such as detailed plans for service and maintenance, online monitoring, optimisation and troubleshooting, and a competitive insurance scheme. We even offer a full availability guarantee, where Vestas pays compensation if the turbine fails to meet the agreed availability targets.

Project management for effective plants

The better your turbines fit your wind site, the more profitable your plant will be. That's why Vestas offers to take on project management from the initial wind measurements to complete installation of the wind power plant. More than 30 years of international experience and local expertise enable us to complete:

- Wind and site studies
- Designing the wind power project
- Selecting wind turbine types
- Installing the wind farm
- Servicing and maintenance throughout the turbine's service life
- Monitoring and remote troubleshooting.

TECHNICAL DATA FOR V100-1.8 MW

Power regulation

pitch regulated
with variable speed

Operating data

Rated power	1,800 kW
Cut-in wind speed	4 m/s
Rated wind speed	12 m/s
Cut-out wind speed	20 m/s
Wind Class - IEC	IEC S (IEC IIIA average wind and IEC IIA extreme wind)
Max. altitude	1,500 m
Operating temperature range	standard range -20°C to 40°C. low temperature option: -30°C to 40°C

Sound power

(at standard air density 1,225 kg/m³)

5 m/s	95 dB(A)
6 m/s	95 dB(A)
7 m/s	97.9 dB(A)
8 m/s	101.2 dB(A)
9 m/s	104.1 dB(A)
10 m/s	106.5 dB(A)
11 m/s	106.5 dB(A)

Rotor

Rotor diameter	100 m
Swept area	7,850 m ²

Electrical

Frequency	50 Hz/60 Hz
Generator type	asynchronous with wound rotor, slip rings

Main dimensions

Blade

Length	49 m
Max. chord	3.9 m

Nacelle

Height for transport	4 m
Height installed	5.4 m
Cover height	3.5 m
Length	10.4 m
Width	3.4 m

Tower

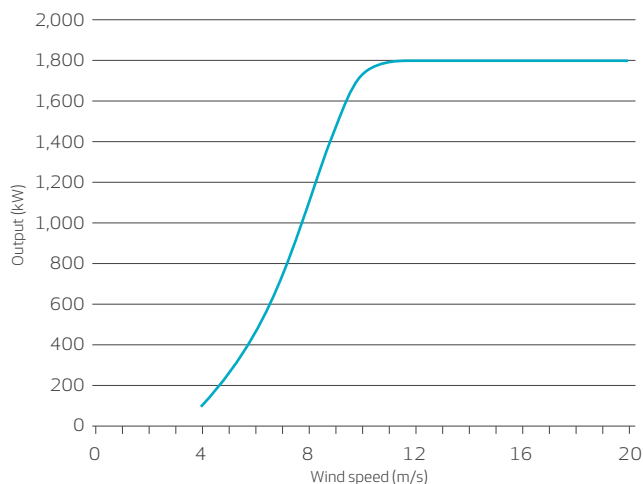
Hub heights	80 and 95 m
Max. section length	24.6 m
Max. diameter	4.2 m

Hub

Max. diameter	3.3 m
Max. width	4 m
Length	4.2 m

Max. weight per unit for transportation	70 metric tonnes

Power curve V100-1.8 MW



All specifications are for informational purposes and are subject to change without notice.

Vestas does not make any representations or extend any warranties, expressed or implied, as to the adequacy or accuracy of this information.

No. 1 in Modern Energy

The world needs ever-greater supplies of clean, sustainable energy. Modern energy that promotes sustainable development and greater prosperity for all our planet's inhabitants. Vestas wind turbines are already generating more than 60 million MWh of electricity every year – enough to power all of Spain, for example – and we are ready to go even further. After more than 30 years in business, Vestas continues to pioneer the wind energy business, achieving breakthroughs that transform our entire industry.



Draft
26-Nov-10

No. 1 in Modern Energy

Vestas Wind Systems A/S

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Appendix 2: Manufacturer Technical Details
(As provided by Vestas to Wainfleet Wind Energy Inc.)

Exhibit D.1.1

V100 1.8MW General Specification

PUBLIC

Draft

26-Nov-10

Class 1

Document no.: 0004-3053 V04

2010-03-24

General Specification

V100–1.8 MW VCUS

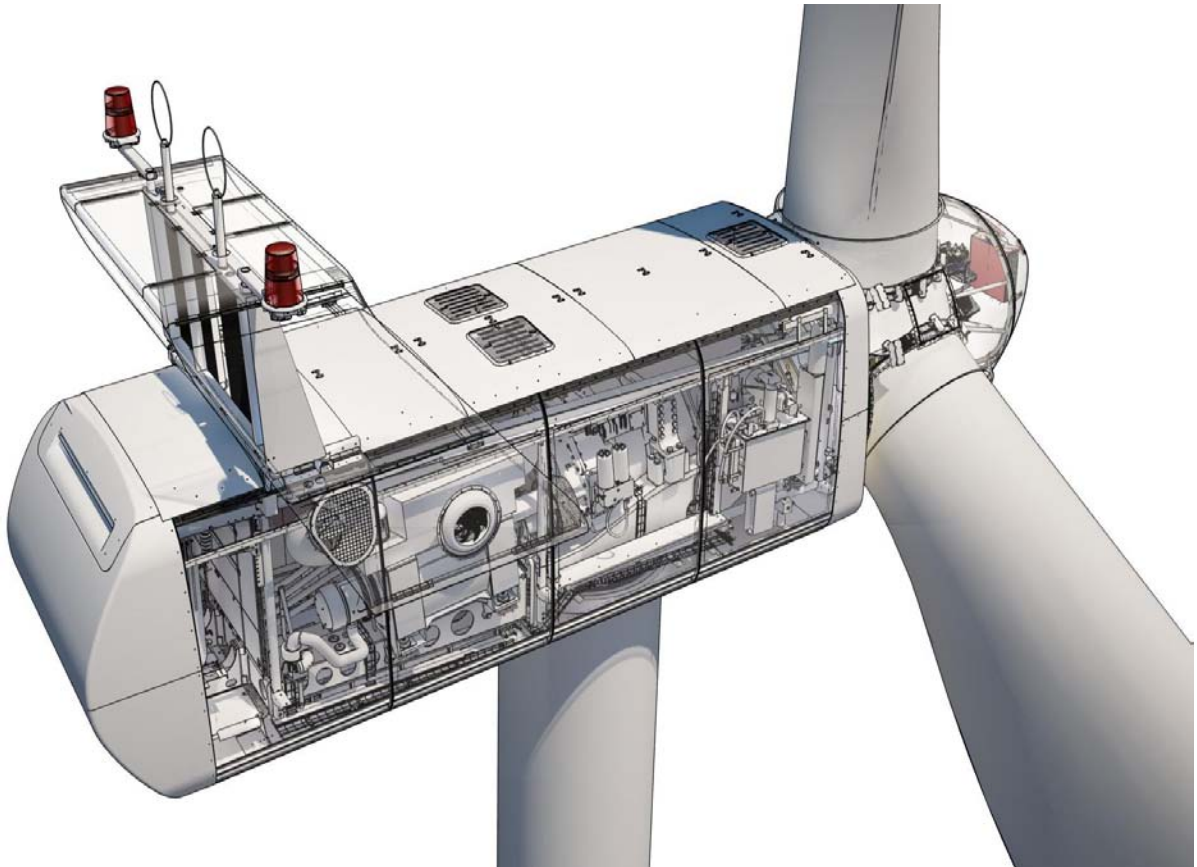


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Buyer acknowledges that these general specifications are for Buyer's informational purposes only and do not create or constitute a warranty, guarantee, promise, commitment, or other representation by supplier, all of which are disclaimed by supplier except to the extent expressly provided by supplier in writing elsewhere.

See section 11 General Reservations, Notes and Disclaimers, p. 36 for general reservations, notes, and disclaimers applicable to these general specifications.

1 General Description

The Vestas V100-1.8 MW wind turbine is a pitch regulated upwind turbine with active yaw and a three-blade rotor. The Vestas V100-1.8 MW turbine has a rotor diameter of 100 m with a generator rated at 1.8 MW. The turbine utilizes a microprocessor pitch control system called OptiTip® and the Variable Speed concepts (VCUS: Vestas Converter Unity System). With these features the wind turbine is able to operate the rotor at variable speed (RPM), helping to maintain the output at or near rated power.

2 Mechanical Design

2.1 Rotor

The V100-1.8 MW turbine is equipped with a 100 meter rotor consisting of three blades and the hub. Based on the prevailing wind conditions, the blades are continuously positioned to help optimise the pitch angle.

Rotor	
Diameter	100 m
Swept Area	7850 m ²
Rotational Speed Static, Rotor	14.9 rpm
Speed, Dynamic Operation Range	9.3 – 16.6 rpm
Rotational Direction	Clockwise (front view)
Orientation	Upwind
Tilt	6°
Hub Coning	2°
Number of Blades	3
Aerodynamic Brakes	Full feathering

Table 2-1: Rotor data.

2.2 Blades

The 49 m Prepreg (PP) blades are made of carbon and fibre glass and consist of two airfoil shells bonded to a supporting beam.

PP Blades	
Type Description	Airfoil shells bonded to supporting beam
Blade Length	49 m
Material	Fibreglass reinforced epoxy and carbon fibres
Blade Connection	Steel roots inserted
Air Foils	RISØ P + FFA –W3
Chord	3.9 m
Blade Root Outer Diameter	1.88 m

PP Blades	
PCD of Steel Root Inserts	1.80 m
R49	0.54 m
Twist (Blade root/blade tip)	24,5°/-0,5°
Approximate Weight	7500 kg

Table 2-2: PP blades data.

2.3 Blade Bearing

The blade bearings are double row 4-point contact ball bearings.

Blade Bearing	
Type	2 row 4-point contact ball bearing
Lubrication	Grease lubrication, automatic lubrication pump

Table 2-3: Blade bearing data.

2.4 Pitch System

The energy input from the wind to the turbine is adjusted by pitching the blades according to the control strategy. The pitch system also works as the primary brake system by pitching the blades out of the wind. This causes the rotor to idle.

Double row 4-point contact ball bearings are used to connect the blades to the hub. The pitch system relies on hydraulics and uses a cylinder to pitch each blade. Hydraulic power is supplied to the cylinder from the hydraulic power unit in the nacelle through the main gearbox and the main shaft via a rotating transfer.

Hydraulic accumulators inside the rotor hub ensure sufficient power to blades in case of failure.

Pitch System	
Type	Hydraulic
Cylinder	Ø125/80 – 760
Number	1 pcs./ blade
Range	-5° to 90°

Table 2-4: Pitch system data.

Hydraulic System	
Pump Capacity	50 l/min
Working Pressure	200 - 230 bar
Oil Quantity	260 l
Motor	20 kW

Table 2-5: Hydraulic system data.

2.5 Hub

The hub supports the 3 blades and transfers the reaction forces to the main bearing. The hub structure also supports blade bearings and pitch cylinder.

Hub	
Type	Cast ball shell hub
Material	Cast iron EN GJS 400-18U-LT / EN1560

Table 2-6: Hub data.

2.6 Main Shaft

Main Shaft	
Type	Forged, trumpet shaft
Material	42 CrMo4 QT / EN 10083

Table 2-7: Main shaft data.

2.7 Bearing Housing

Bearing Housing	
Type	Cast foot housing with lowered centre
Material	Cast iron EN GJS 400-18U-LT / EN1560

Table 2-8: Bearing housing data.

2.8 Main Bearings

Main Bearings	
Type	Spherical roller bearings
Lubrication	Grease lubrication, manually re-greased

Table 2-9: Main bearings data.

2.9 Gearbox

The main gearbox transmits torque and revolutions from the rotor to the generator.

The main gearbox consists of a planetary stage combined with a two-stage parallel gearbox, torque arms and vibration dampers.

Torque is transmitted from the high-speed shaft to the generator via a flexible composite coupling, located behind the disc brake. The disc brake is mounted directly on the high-speed shaft.

Gearbox	
Type	1 planetary stage + 2 helical stages
Ratio	1:92.8 nominal
Cooling	Oil pump with oil cooler
Oil heater	2 kW
Max Gear Oil Temp	80°C
Oil Cleanliness	-/15/12 ISO 4406

Table 2-10: Gearbox data.

2.10 Generator Bearings

The bearings are greased and grease is supplied continuously from an automatic lubrication unit when the nacelle temperature is above -10°C. The yearly grease flow is approximately 2400 cm³.

2.11 High Speed Shaft Coupling

The flexible coupling transmits the torque from the gearbox high speed output shaft to the generator input shaft. The flexible coupling is designed to compensate misalignments between gearbox and generator. The coupling consists of two composite discs and an intermediate tube with two aluminium flanges and a fibre glass tube. The coupling is fitted to 3-armed hubs on the brake disc and the generator hub.

High Speed Shaft Coupling	
Type Description	VK 420

Table 2-11: High speed shaft coupling data.

2.12 Yaw System

The yaw system is designed to keep the turbine upwind. The nacelle is mounted on the yaw plate, which is bolted to the turbine tower. The yaw bearing system is a plain bearing system with built-in friction. Asynchronous yaw motors with brakes enable the nacelle to rotate on top of the tower.

The turbine controller receives information of the wind direction from the wind sensor. Automatic yawing is deactivated when the mean wind speed is below 3 m/s.

Yaw System	
Type	Plain bearing system with built-in friction
Material	Forged yaw ring heat-treated Plain bearings PETP
Yawing Speed	< 0.5°/sec.

Table 2-12: Yaw system data.

Yaw Gear	
Type	Non-locking combined worm gear and planetary gearbox Electrical motor brake
Motor	1.5 kW, 6 pole, asynchronous
Number of Yaw Gears	6
Ratio Total (4 Planetary Stages)	1,120: 1
Rotational Speed at Full Load	Approx. 1 rpm at output shaft

Table 2-13: Yaw gear data.

2.13 Crane

The nacelle houses the service crane. The crane is a single system chain hoist.

Crane	
Lifting Capacity	Max. 800 kg

Table 2-14: Crane data.

2.14 Tower Structure

Tubular towers with flange connections, certified according to relevant type approvals, are available in different standard heights. Magnets provide load support in a horizontal direction and internals, such as platforms, ladders, etc., are supported vertically (i.e. in the gravitational direction) by a mechanical connection.

The hub heights listed include a distance from the foundation section to the ground level of approximately 0.6 m depending on the thickness of the bottom flange and a distance from the tower top flange to the centre of the hub of 1.70 m.

Tower Structure	
Type Description	Conical tubular
Hub Heights (HH)	80 m/95 m
Material	S355 according to EN 10024 A709 according to ASTM
Weight	80 m IEC S 160 metric tonnes* 95 m IEC S 205 metric tonnes**

Table 2-15: Tower structure (Onshore) data.

NOTE */** Typical values. Dependent on wind class, and can vary with site / project conditions.

2.15 Nacelle Bedplate and Cover

The nacelle cover is made of fibre glass. Hatches are positioned in the floor for lowering or hoisting equipment to the nacelle and evacuation of personnel.

The roof is equipped with wind sensors and skylights which can be opened from inside the nacelle to access the roof and from outside to access the nacelle. The nacelle cover is mounted on the girder structure. Access from the tower to the nacelle is through the yaw system.

The nacelle bedplate is in two parts and consists of a cast iron front part and a girder structure rear part. The front of the nacelle bedplate is the foundation for the drive train, which transmits forces from the rotor to the tower, through the yaw system. The bottom surface is machined and connected to the yaw bearing and the yaw-gears are bolted to the front nacelle bedplate.

The nacelle bedplate carries the crane girders through vertical beams positioned along the site of the nacelle. Lower beams of the girder structure are connected at the rear end.

The rear part of the bedplate serves as foundation for controller panels, generator and transformer.

Type Description	Material
Nacelle Cover	GRP
Base Frame Front	Cast iron EN GJS 400-18U-LT / EN1560
Base Frame Rear	Welded grid structure

Table 2-16: Nacelle base-frame and cover data.

2.16 Cooling

The cooling of the main components (gearbox, hydraulic power pack and VCUS converter) in the turbine is done by a water cooling system. The generator is air cooled by nacelle air and the high voltage (HV) transformer is cooled by mainly ambient air.

Component	Cooling Type	Internal Heating at Low temperature
Nacelle	Forced air	Yes
Hub/spinner	Natural air	No (Yes Low Temperature (LT) turbine)
Gearbox	Water/oil	Yes
Generator	Forced air/air	No (heat source)
Slip rings	Forced air/air	Yes
Transformer	Forced air	No (heat source)
VCUS	Forced water/air	Yes
VMP section	Forced air/air	Yes
Hydraulics	Water/oil	Yes

Table 2-17: Cooling, summary.

All other heat generating systems are also equipped with fans and or coolers but are considered as minor contributors to nacelle thermodynamics.

2.17 Water Cooling System

The water cooling system is designed as semi-closed systems (closed system but not under pressure) with a free wind water cooler on the roof of the nacelle. This means that the heat loss from the systems (components) is transferred to the water system and the water system is cooled by ambient air.

The water cooling system has three parallel cooling circuits that cool the gearbox, the hydraulic power unit and the VCUS converter.

The water cooling system is equipped with a 3-way thermostatic valve, which is closed (total water flow is bypassing the water cooler) if the temperature of the cooling water is below 35°C and fully open (total water flow is led to the water cooler) if the temperature is above 43°C.

2.18 Gearbox Cooling

The gearbox cooling system consists of two oil circuits that remove the gearbox losses through two plate heat exchangers (oil coolers). The first circuit is equipped with a mechanical driven oil pump and a plate heat exchanger and the second circuit is equipped with an electrical driven oil pump and a plate heat exchanger. The water circuit of the two plate heat exchangers are coupled in serial.

Gearbox Cooling	
Gear Oil Plate Heat Exchanger 1 (Mechanically driven oil pump)	
Nominal oil flow	50 l/min
Oil inlet temperature	80°C
No. of passes	2
Cooling capacity	24.5 kW
Gear Oil Plate Heat Exchanger 2 (Electrical driven oil pump)	
Nominal oil flow	85 l/min
Oil inlet temperature	80°C
No. of passes	2
Cooling capacity	41.5 kW
Water Circuit	
Nominal water flow	App. 150 l/min (50% glycol)
Water inlet temperature	Max. 54°C
No. of passes	1
Heat load	66 kW

Table 2-18: Cooling, gearbox data.

2.19 Hydraulic Cooling

The hydraulic cooling system consists of a plate heat exchanger which is mounted on the power pack. In the plate heat exchanger the heat from the hydraulics is transferred to the water cooling system.

Hydraulic Cooling	
Hydraulic Oil Plate Heat Exchanger	
Nominal oil flow	40 l/min
Oil inlet temperature	66°C
Cooling capacity	10.28 kW
Water Circuit	
Nominal water flow	App. 45 l/min (50% glycol)
Water inlet temperature	Max. 54°C
Heat load	10.28 kW

Table 2-19: Cooling, hydraulic data.

2.20 VCUS Converter Cooling

The converter cooling system consists of a number of switch modules which is mounted on cooling plates where the cooling water is lead through.

Converter Cooling	
Nominal water flow	App. 45 l/min (50% glycol)
Water inlet pressure	Max. 2.0 bar
Water inlet temperature	Max. 54°C
Cooling capacity	10 kW

Table 2-20: Cooling, converter data.

2.21 Generator Cooling

The generator cooling systems consists of an air to air cooler mounted on the top of the generator and two internal and one external fan. All the fans can run at low or high speed.

Generator Cooling	
Air inlet temperature – external	50°C
Nominal air flow – internal	8000 m ³ /h
Nominal air flow – external	7500 m ³ /h
Cooling capacity	60 kW

Table 2-21: Cooling, generator data.

2.22 HV Transformer Cooling

The transformer is equipped with forced air cooling. The cooling system consists of a central fan, which is located under the service floor, an air distribution manifold and six hoses leading to locations beneath and between the HV and LV windings.

Transformer Cooling	
Nominal air flow	1920 m ³ /h
Air inlet temperature	Max. 40°C

Table 2-22: Cooling, transformer data.

2.23 Nacelle Conditioning

The nacelle conditioning system consists of one fan and two air heaters. There are two main circuits of the nacelle conditioning system:

1. Cooling of the HV transformer.
2. Heating and ventilation of the nacelle.

For both systems, the airflow enters the nacelle through louver dampers in the weather shield underneath the nacelle.

Ad 1: The cooling of the HV transformer is described in section 2.22 HV Transformer Cooling, p. 13.

Ad 2: The heating and ventilation of the nacelle is done by means of two air heaters and one fan. To avoid condensation in the nacelle, the two air heaters keep the nacelle temperature +5°C above the ambient temperature. At start-up in cold conditions, the heaters will also heat the air around the gearbox.

The ventilation of the nacelle is done by means of one fan, removing hot air from the nacelle, which is generated by mechanical and electrical equipment.

Nacelle Cooling	
Nominal air flow	1.2 m ³ /s
Air inlet temperature	Max. 50°C

Table 2-23: Cooling, nacelle data.

Nacelle Heating	
Rated power	2 x 6 kW

Table 2-24: Heating, nacelle data.

3 Electrical Design

3.1 Generator

The generator is a 3-phase asynchronous generator with wound rotor, which is connected to the Vestas Converter Unity System (VCUS) via a slip ring system. The generator is an air-to-air cooled generator with an internal and external cooling circuit. The external circuit uses air from the nacelle and exhausts it out through the rear end of the nacelle.

The generator has six poles. The generator is wound with form windings in both rotor and stator. The stator is connected in star at low power and delta at high power. The rotor is connected in star and is insulated from the shaft. A slip ring is mounted to the rotor for the purpose of the VCUS control.

Generator	
Type Description	Asynchronous with wound rotor, slip rings and VCUS
Rated Power (PN)	1.8 MW
Rated Apparent Power	1.8 MVA (Cosφ = 1.00)
Frequency	60 Hz
Voltage, Generator	690 Vac
Voltage, Converter	480 Vac
Number of Poles	6
Winding Type (Stator/Rotor)	Form/Form
Winding Connection, Stator	Star/Delta
Rated Efficiency (Generator only)	> 96.5 %
Power Factor (cos)	1.0
Over Speed Limit acc. to IEC (2 min.)	2400 rpm
Vibration Level	≤ 1.8 mm/s
Weight	Approx. 8,100 kg
Generator Bearing - Temperature	2 Pt100 sensors
Generator Stator Windings - Temperature	3 Pt100 sensors placed at hot spots and 3 as back-up

Table 3-1: Generator data.

3.2 HV Cables

The high voltage cable runs from the transformer in the nacelle down the tower to the switchgear located in the bottom of the tower (switchgear is not included). The high voltage cable is a 4-core rubber insulated halogen free high voltage cable.

HV Cables	
High Voltage Cable Insulation Compound	Improved ethylene-propylene (EP) based material – EPR or high modulus or hard grade ethylene-propylene rubber – HEPR
Conductor Cross Section	3x70/70 mm ²
Rated Voltage	12/20 kV (24 kV) or 20/35 kV (42 kV) depending on the transformer voltage

Table 3-2: HV cables data.

3.3 Transformer

The transformer is located in a separate locked room in the nacelle with surge arresters mounted on the high voltage side of the transformer. The transformer is a two winding, three-phase dry-type transformer. The windings are delta-connected on the high voltage side unless otherwise specified.

The low voltage windings have a voltage of 690 V and a tapping at 480 V and are star-connected. The 690 V and 480 V systems in the nacelle are a TN-system, which means the star point is connected to earth.

Transformer	
Type Description	Dry-type cast resin
Primary Voltage	6-34.5 kV
Rated Apparent Power	2100 kVA
Secondary Voltage 1	690 V
Rated Power 1 at 690 V	1,900 kVA
Secondary Voltage 2	480 V
Rated Power 2 at 480 V	200 kVA
Vector Group	Dyn5 (option YNyn0)
Frequency	60 Hz
HV-tappings	± 2 x 2.5 % offload
Insulation Class	F
Climate Class	C2
Environmental Class	E2
Fire Behaviour Class	F1

Table 3-3: Transformer data.

3.4 Converter

The converter controls the energy conversion in the generator. The VCUS converter feeds power from the grid into the generator rotor at sub sync speed and feeds power from the generator rotor to the grid at super sync speed.

Converter	
Rated Slip	12%
Rated RPM	1344 RPM
Rated Rotor Power (@rated slip)	193 kW
Rated Grid Current (@ rated slip, PF = 1 & 480V)	232 A
Rated Rotor Current (@ rated slip & PF = 1)	573 A

Table 3-4: Converter data.

3.5 AUX System

The AUX System is supplied from the 690/480 V socket from the HV transformer. All motors, pumps, fans and heaters are supplied from this system.

All 110 V power sockets are supplied from a 690/110 V transformer.

Power Sockets	
Single Phase	110 V (20 A)
Three Phase	690 V Crane (16 A)

Table 3-5: AUX system data.

3.6 Wind Sensors

The turbine is equipped with one ultrasonic wind sensor with built-in heaters.

Wind Sensors	
Type	FT702LT
Principle	Acoustic Resonance
Built-in Heat	99 W

Table 3-6: Wind sensor data.

3.7 Turbine Controller

The turbine is controlled and monitored by the System 3500 controller hardware and Vestas controller software.

The turbine controller is based on four main processors (Ground, Nacelle, Hub and Converter) which are interconnected by an optical-based 2.5 Mbit ArcNet network.

I/O modules are connected either as rack modules in the System 3500 rack or by CAN.

The turbine control system serves the following main functions:

- Monitoring and supervision of overall operation.
- Synchronizing of the generator to the grid during connection sequence in order to limit the inrush current.
- Operating the wind turbine during various fault situations.
- Automatic yawing of the nacelle.
- OptiTip® - blade pitch control.
- Noise emission control.
- Monitoring of ambient conditions.
- Monitoring of the grid.

The turbine controller hardware is built from the following main modules:

Module	Function	Network
CT3603	Main processor. Control and monitoring (nacelle and hub).	ArcNet, CAN, Ethernet, serial
CT396	Main processor. Control, monitoring, external communication (ground).	ArcNet, CAN, Ethernet, serial
CT360	Main processor. Converter control and monitoring.	ArcNet, CAN, Ethernet
CT3218	Counter/encoder module. RPM, Azimuth and wind measurement.	Rack module
CT3133	24 VDC digital input module. 16 channels.	Rack module
CT3153	24 VDC digital output module. 16 channels.	Rack module
CT3320	4 channel analogue input (0-10V, 4-20mA, PT100).	Rack module
CT6061	CAN I/O controller	CAN node
CT6221	3 channel PT100 module	CAN I/O module
CT6050	Blade controller.	CAN node
Balluf	Position transducer	CAN node
Rexroth	Proportional valve	CAN node

Table 3-7: Turbine controller hardware.

3.8 Uninterruptible Power Supply (UPS)

The UPS supplies power to critical wind turbine components.

The actual back up time for the UPS system is proportional to the power consumption. Actual back-up time may vary.

UPS		
Battery Type	Valve-Regulated Lead Acid (VRLA)	
Rated Battery Voltage	2 x 8 x 12 V (192 V)	
Converter Type	Double conversion online	
Rated Output Voltage	230 V AC	
Rated Output Voltage	230 V AC	
Converter Input	230 V +/-20%	
Back-up Time*	Controller system	30 seconds
	Safety systems	35 minutes
Re-charging Time	Typical	Approx. 2.5 hours

Table 3-8: UPS data.

NOTE * For alternative back-up times, consult Vestas!

4 Turbine Protection Systems

4.1 Braking Concept

The main brake on the turbine is aerodynamic. Braking the turbine is done by feathering the three blades. During emergency stop all three blades will feather simultaneously to full end stop and thereby slowing the rotor speed.

In addition there is a mechanical disc brake on the high speed shaft of the gearbox. The mechanical brake is only used as a parking brake, and when activating the emergency stop push buttons.

4.2 Short Circuit Protections

Breakers	Generator / Q8 ABB E2B 2000 690 V	Controller / Q15 ABB S3X 690 V	VCS-VCUS / Q7 ABB S5H 400 480 V
Breaking Capacity I_{cu}, I_{cs}	42, 42 kA	75, 75 kA	40, 40 kA
Making Capacity I_{cm} (415V Data)	88 kA	440 kA	143 kA
Thermo Release I_{th}	2000 A	100 A	400 A

Table 4-1: Short circuit protection data.

4.3 Overspeed Protection

The generator RPM and the main shaft RPM are registered by inductive sensors and calculated by the wind turbine controller in order to protect against over-speed and rotating errors.

The turbine is also equipped with a VOG (Vestas Overspeed Guard), which is an independent computer module measuring the rotor RPM, and in case of an overspeed situation the VOG activates the emergency feathered position (full feathering) of the three blades.

Overspeed Protection	
VOG Sensors Type	Inductive
Trip Levels	17.3 (Rotor RPM) / 1597 (Generator RPM)

Table 4-2: Overspeed protection data.

4.4 EMC System

The turbine and related equipment must fulfil the EU EMC-Directive with later amendments:

- Council Directive 2004/108/EC of 15 December 2004 on the approximation of the laws of the Member States relating to Electromagnetic Compatibility.
- The (Electromagnetic Compatibility) EMC-Directive with later amendments.

4.5 Lightning System

The Lightning Protection System (LPS) consists of three main parts.

- Lightning receptors.
- Down conducting system.
- Earthing System.

Lightning Protection Design Parameters			Protection Level I
Current Peak Value	$i_{\max}$	[kA]	200
Total Charge	Q_{total}	[C]	300
Specific Energy	W/R	[MJ/Ω]	10
Average Steepness	di/dt	[kA/μs]	200

Table 4-3: Lightning design parameters.

NOTE The Lightning Protection System is designed according to IEC standards (see section 7.7 Design Codes – Lightning Protection, p. 26). Lightning strikes are considered a major force, i.e. damage caused by lightning strikes is not warranted by Vestas.

4.6 Earthing (also known as grounding)

The Vestas Earthing System is based on foundation earthing.

Vestas document No. 0000-3388 contains the list of documents regarding Vestas Earthing System.

Requirements in the Vestas Earthing System specifications and work descriptions are minimum requirements from Vestas and IEC. Local and national requirements may require additional measures.

4.7 Corrosion Protection

Classification of corrosion categories for atmospheric corrosion is according to ISO 9223:1992.

Corrosion Protection	External Areas	Internal Areas
Nacelle	C5	C3 and C4 Climate strategy: Heating the air inside the nacelle compared to the outside air temperature lowers the relative humidity and helps ensure a controlled corrosion level.
Hub	C5	C3
Tower	C5-I	C3

Table 4-4: Corrosion protection data for nacelle, hub and tower.

5 Safety

The safety specifications in this safety section provide limited general information about the safety features of the turbine and are not a substitute for Buyer and its agents taking all appropriate safety precautions, including but not limited to (a) complying with all applicable safety, operation, maintenance, and service agreements, instructions, and requirements, (b) complying with all safety-related laws, regulations, and ordinances, (c) conducting all appropriate safety training and education and (d) reading and understanding all safety-related manuals and instructions. See section 5.13 Manuals and Warnings, p. 23 for additional guidance.

5.1 Access

Access to the turbine from the outside is through the bottom of the tower. The door is equipped with a lock. Access to the top platform in the tower is by a ladder or service lift. Access to the nacelle from the top platform is by ladder. Access to the transformer room in the nacelle is equipped with a lock. Unauthorised access to electrical switch boards and power panels in the turbine is prohibited according to IEC 60204-1 2006.

5.2 Escape

In addition to the normal access routes, alternative escape routes from the nacelle are through the crane hatch.

The hatch in the roof can be opened from both the inside and outside.

Escape from the service lift is by ladder.

5.3 Rooms/Working Areas

The tower and nacelle are equipped with connection points for electrical tools for service and maintenance of the turbine.

5.4 Platforms, Standing and Working Places

The bottom tower section has three platforms. There is one platform at the entrance level (door level), one safety platform approximately three metres above the entrance platform and finally a platform in the top of the tower section.

Each middle tower section has one platform in the top of the tower section.

The top tower section has two platforms. A top platform and a service lift platform - where the service lift stops - below the top platform.

There are places to stand at various locations along the ladder.

The platforms have anti-slip surfaces.

Foot supports are placed in the turbine for maintenance and service purposes.

5.5 Climbing Facilities

A ladder with a fall arrest system (rigid rail or wire system) is mounted through the tower.

Rest platforms are provided at maximum intervals of 9 metres along the tower ladder between platforms.

There are anchorage points in the tower, nacelle, hub and on the roof for attaching a fall arrest equipment (full body harness).

Over the crane hatch there is an anchorage point for the emergency descent equipment. The anchorage point is tested to 22.2 kN.

Anchorage points are coloured yellow and are calculated and tested to 22.2 kN.

5.6 Moving Parts, Guards and Blocking Devices

Moving parts in the nacelle are shielded.

The turbine is equipped with a rotor lock to block the rotor and drive train.

It is possible to block the pitch of the cylinder with mechanical tools in the hub.

5.7 Lighting

The turbine is equipped with light in the tower, nacelle and in the hub.

There is emergency light in case of loss of electrical power.

5.8 Noise

When the turbine is out of operation for maintenance, the sound level in the nacelle is below 80 dB(A). In operation mode ear protection is required.

5.9 Emergency Stop

There are emergency stops in the nacelle and in the bottom of the tower.

5.10 Power Disconnection

The turbine is designed to allow for disconnection from all its power sources during inspection or maintenance. The switches are marked with signs and are located in the nacelle and in the bottom of the tower.

5.11 Fire Protection/First Aid

A 5 kg CO₂ fire extinguisher must be located in the nacelle at the left yaw gear. The location of the fire extinguisher, and how to use it, must be confirmed before operating the turbine.

A first aid kit must be placed by the wall at the back end of the nacelle. The location of the first aid kit, and how to use it, must be confirmed before operating the turbine.

Above the generator there must be a fire blanket which can be used to put out small fires.

5.12 Warning Signs

Additional warning signs inside or on the turbine must be reviewed before operating or servicing of the turbine.

5.13 Manuals and Warnings

Vestas OH&S manual and manuals for operation, maintenance and service of the turbine provide additional safety rules and information for operating, servicing or maintaining the turbine.

6 Environment

6.1 Chemicals

Chemicals used in the turbine are evaluated according to Vestas Wind Systems A/S Environmental system certified according to ISO 14001:2004.

- Anti-freeze liquid to help prevent the cooling system from freezing.
- Gear oil for lubricating the gearbox.
- Hydraulic oil to pitch the blades and operate the brake.
- Grease to lubricate bearings.
- Various cleaning agents and chemicals for maintenance of the turbine.

7 Approvals, Certificates and Design Codes

7.1 Type Approvals

The turbine is type certified according to the certification standards listed below:

Certification	Wind Class	Hub Height
Statement of Compliance	IEC S*	80 m
	IEC S*	95 m

*Refer to section 9.1 Climate and Site Conditions, p. 28 for details.

Table 7-1: Type approvals.

7.2 Design Codes – Structural Design

The structural design has been developed and tested with regard to, but not limited to, the following main standards.

Design Codes – Structural Design	
Nacelle and Hub	IEC 61400-1:1999 EN 50308 ANSI/ASSE Z359.1-2007
Bedframe	IEC 61400-1:2005
Tower	IEC 61400-1:2005 Eurocode 3 DIBt: Richtlinie für Windenergieanlagen, Einwirkungen und Standsicherheitsnachweise für Turm und Gründung, 4th edition.

Table 7-1: Structural design codes.

7.3 Design Codes – Mechanical Equipment

The mechanical equipment has been developed and tested with regard to, but not limited to, the following main standards:

Design Codes – Mechanical Equipment	
Gear	Designed in accordance to rules in ISO 81400-4
Blades	DNV-OS-J102 IEC 1024-1 IEC 60721-2-4 IEC 61400 (Part 1, 12 and 23) IEC WT 01 IEC DEFU R25 ISO 2813 DS/EN ISO 12944-2

Table 7-2: Mechanical equipment design codes.

7.4 Design Codes – Electrical Equipment

The electrical equipment has been developed and tested with regard to, but not limited to, the following main standards:

Design Codes – Electrical Equipment	
High Voltage AC Circuit Breakers	IEC 60056
High Voltage Testing Techniques	IEC 60060
Power Capacitors	IEC 60831
Insulating Bushings for AC Voltage above 1kV	IEC 60137
Insulation Co-ordination	BS EN 60071
AC Disconnectors and Earth Switches	BS EN 60129
Current Transformers	IEC 60185
Voltage Transformers	IEC 60186
High Voltage Switches	IEC 60265
Disconnectors and Fuses	IEC 60269
Flame Retardant Standard for MV Cables	IEC 60332
Transformer	IEC 60076-11
Generator	IEC 60034
Specification for Sulphur Hexafluoride for Electrical Equipment	IEC 60376
Rotating Electrical Machines	IEC 34
Dimensions and Output Ratings for Rotating Electrical Machines	IEC 72 & IEC 72A
Classification of Insulation, Materials for Electrical Machinery	IEC 85
Safety of Machinery – Electrical Equipment of Machines	IEC 60204-1

Table 7-3: Electrical equipment design codes.

7.5 Design Codes – I/O Network System

The distributed I/O network system has been developed and tested with regard to, but not limited to, the following main standards:

Design Codes – I/O Network System	
Salt Mist Test	IEC 60068-2-52
Damp Head, Cyclic	IEC 60068-2-30
Vibration Sinus	IEC 60068-2-6
Cold	IEC 60068-2-1
Enclosure	IEC 60529
Damp Head, Steady State	IEC 60068-2-56
Vibration Random	IEC 60068-2-64
Dry Heat	IEC 60068-2-2
Temperature Shock	IEC 60068-2-14
Free Fall	IEC 60068-2-32

Table 7-4: I/O Network system design codes.

7.6 Design Codes – EMC System

To fulfil EMC requirements the design must be as recommended for lightning protection, see section 7.7 Design Codes – Lightning Protection, p. 26.

Design Codes – EMC System	
Designed according to	IEC 61400-1: 2005
Further robustness requirements according to	TPS 901785

7.7 Design Codes – Lightning Protection

The LPS is designed according to Lightning Protection Level (LPL) I:

Design Codes – Lightning Protection	
Designed according to	IEC 62305-1: 2006 IEC 62305-3: 2006 IEC 62305-4: 2006
Non Harmonized Standard and Technically Normative Documents	IEC/TR 61400-24:2002

Table 7-5: Lightning protection design codes.

7.8 Design Codes – Earthing

The Vestas Earthing System design is based on and complies with the following international standards and guidelines:

- IEC 62305-1 Ed. 1.0: Protection against lightning – Part 1: General principles.
- IEC 62305-3 Ed. 1.0: Protection against lightning – Part 3: Physical damage to structures and life hazard.
- IEC 62305-4 Ed. 1.0: Protection against lightning – Part 4: Electrical and electronic systems within structures.
- IEC/TR 61400-24. First edition. 2002-07. Wind turbine generator systems - Part 24: Lightning protection.
- IEC 60364-5-54. Second edition 2002-06. Electrical installations of buildings - Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors.
- IEC 61936-1. First edition. 2002-10. Power installations exceeding 1kV a.c.- Part 1: Common rules.

8 Colour and Surface Treatment

8.1 Nacelle Colour and Surface Treatment

Surface Treatment of Vestas Nacelles	
Standard Nacelle Colours	RAL 7035 (light grey)
Gloss	According to ISO 2813

Table 8-1: Surface treatment, nacelle.

8.2 Tower Colour and Surface Treatment

Surface Treatment of Vestas Tower Section		
	External:	Internal:
Tower Colour Variants	RAL 7035 (light grey)	RAL 9001 (cream white)
Gloss	50-75% UV resistant	Maximum 50%

Table 8-2: Surface treatment, tower.

8.3 Blades Colour

Blades Colour	
Blade Colour	RAL 7035 (Light Grey)
Tip-End Colour Variants	RAL 2009 (Traffic Orange), RAL 3000 (Flame Red), RAL 3020 (Traffic Red)
Gloss	< 20%

Table 8-3: Colours, blades.

9 Operational Envelope and Performance Guidelines

Actual climatic and site conditions have many variables and must be considered in evaluating actual turbine performance. The design and operating parameters set forth in this section do not constitute warranties, guarantees, or representations as to turbine performance at actual sites.

NOTE As evaluation of climate and site conditions is complex, it is needed to consult Vestas for every project.

9.1 Climate and Site Conditions

Values refer to hub height:

Extreme Design Parameters	
Wind Climate	IEC S
Ambient Temperature Interval (Normal Temperature Turbine)	-30° to +50°C
Extreme Wind Speed (10 min. average)	42.5 m/s
Survival Wind Speed (3 sec. gust)	59.5 m/s

Table 9-1: Extreme design parameters.

Average Design Parameters	
Wind Climate	IEC S
Wind Speed	7.5 m/s
A-factor	8.45 m/s
Form Factor, c	2.0
Turbulence Intensity acc. to IEC 61400-1, including Wind Farm Turbulence (@15 m/s – 90% quantile)	18%
Wind Shear	0.20
Inflow Angle (vertical)	8°

Table 9-2: Average design parameters.

9.1.1 Complex Terrain

Classification of complex terrain acc. to IEC 61400-1:2005 Chapter 11.2.

For sites classified as complex appropriate measures are to be included in site assessment.

9.1.2 Altitude

The turbine is designed for use at altitudes up to 1500 m above sea level as standard.

Above 1500 m special considerations must be taken regarding e.g. HV installations and cooling performance. Consult Vestas for further information.

9.1.3 Wind Farm Layout

Turbine spacing is to be evaluated site-specifically. Spacing in any case not below three rotor diameters (3D).

DISCLAIMER

As evaluation of climate and site conditions is complex, consult Vestas for every project. If conditions exceed the above parameters Vestas must be consulted!

9.2 Operational Envelope – Temperature and Wind

Values refer to hub height and as determined by the sensors and control system of the turbine.

Operational Envelope – Temperature and Wind	
Ambient Temperature Interval (Normal Temperature Turbine)	-20° to +40° C
Cut-in (10 min. average)	4 m/s
Cut-out (100 sec. exponential average)	20 m/s
Re-cut in (100 sec. exponential average)	18 m/s

Table 9-3: Operational envelope - temperature and wind.

9.3 Operational Envelope – Grid Connection *

Values refer to hub height and as determined by the sensors and control system of the turbine.

Operational Envelope - Grid Connection		
Nominal Phase Voltage	$U_{P, nom}$	400 V
Nominal Frequency	f_{nom}	60 Hz
Max. Steady State Voltage Jump	+/- 2 %	
Max. Frequency Gradient	+/- 4 Hz/sec	
Max. Negative Sequence Voltage	3 %	

Table 9-4: Operational envelope - grid connection.

The generator and the converter will be disconnected if:

	U_P	U_N
Voltage above 110 % of nominal for 60 sec.	440 V	759 V
Voltage above 115 % of nominal for 2 sec.	460 V	794 V
Voltage above 120 % of nominal for 0.08 sec.	480 V	828 V
Voltage above 125 % of nominal for 0.005 sec	500 V	863 V
Voltage below 90 % of nominal for 60 sec.	360 V	621 V
Voltage below 85 % of nominal for 11 sec.	340 V	586 V
Frequency is above [Hz] for 0.2 sec.	63.6 Hz	
Frequency is below [Hz] for 0.2 sec.	56.4 Hz	

Table 9-5: Generator and converter disconnecting values.

NOTE * Over the turbine lifetime, grid drop-outs are to occur at an average of no more than 20 times a year.

9.4 Performance – Fault Ride Through

The turbine is equipped with a reinforced Vestas Converter System in order to gain better control of the generator during grid faults. The controllers and contactors have a UPS backup system in order to keep the turbine control system running during grid faults.

The pitch system is optimised to keep the turbine within normal speed conditions and the generator speed is accelerated in order to store rotational energy and be able to resume normal power production faster after a fault and keep mechanical stress on the turbine at a minimum.

The turbine is designed to stay connected during grid disturbances within the voltage tolerance curve in Figure 9-1, p. 30.

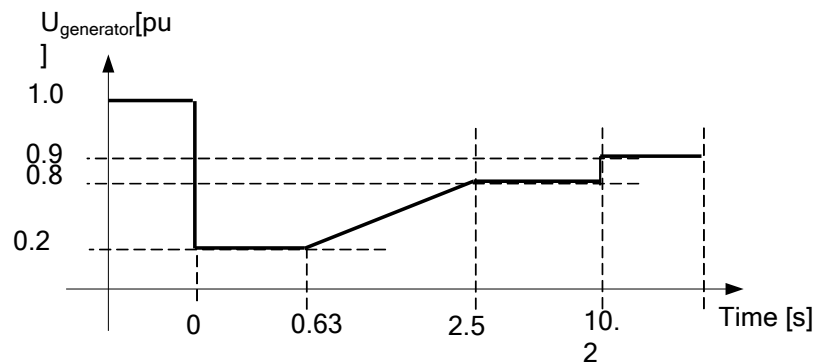


Figure 9-1: Low voltage tolerance curve for symmetrical and asymmetrical faults.

For grid disturbances outside the protection curve in Figure 9-2, p. 31, the turbine will be disconnected from the grid.

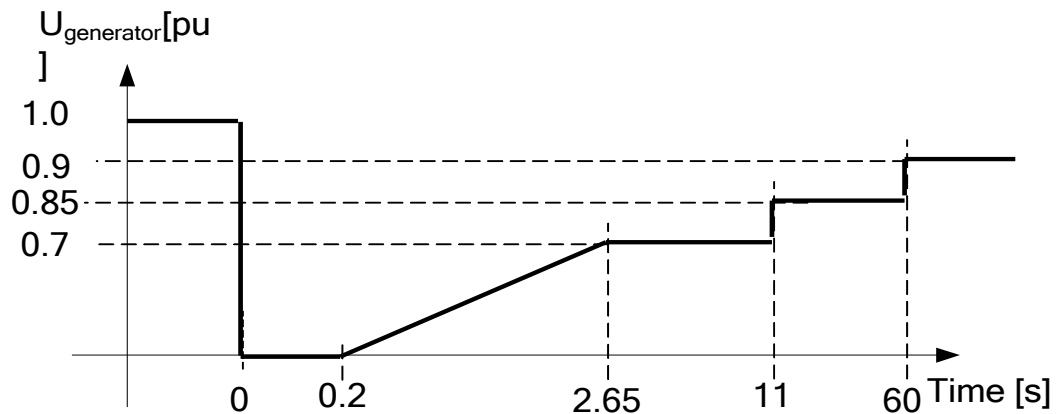


Figure 9-2: Default low voltage protection settings for symmetrical and asymmetrical faults.

Power Recovery Time	
Power recovery to 90% of pre-fault level	Max 1.0 sec

9.5 Current Contribution

During the grid dip the generator is typically magnetized from the converter. The controller setpoints are set to keep the reactive current exchange with the grid close to zero and keep as much torque on the generator as possible.

9.6 Performance – Multiple Voltage Dips

The turbine is designed to handle re-closure events and multiple voltage dips within a short period of time, due to the fact that voltage dips are not evenly distributed during the year. As an example 6 voltage dips of duration of 200 ms down to 20% voltage within 30 minutes will normally not lead to a problem for the turbine.

9.7 Performance – Active Power Control

The turbine is designed for control of active power via the VestasOnline™ SCADA system.

Max. Ramp Rates for External Control	
Active Power	0.1 pu/sec

To protect the turbine active power cannot be controlled to values below the curve in Figure 9-3, p. 32.

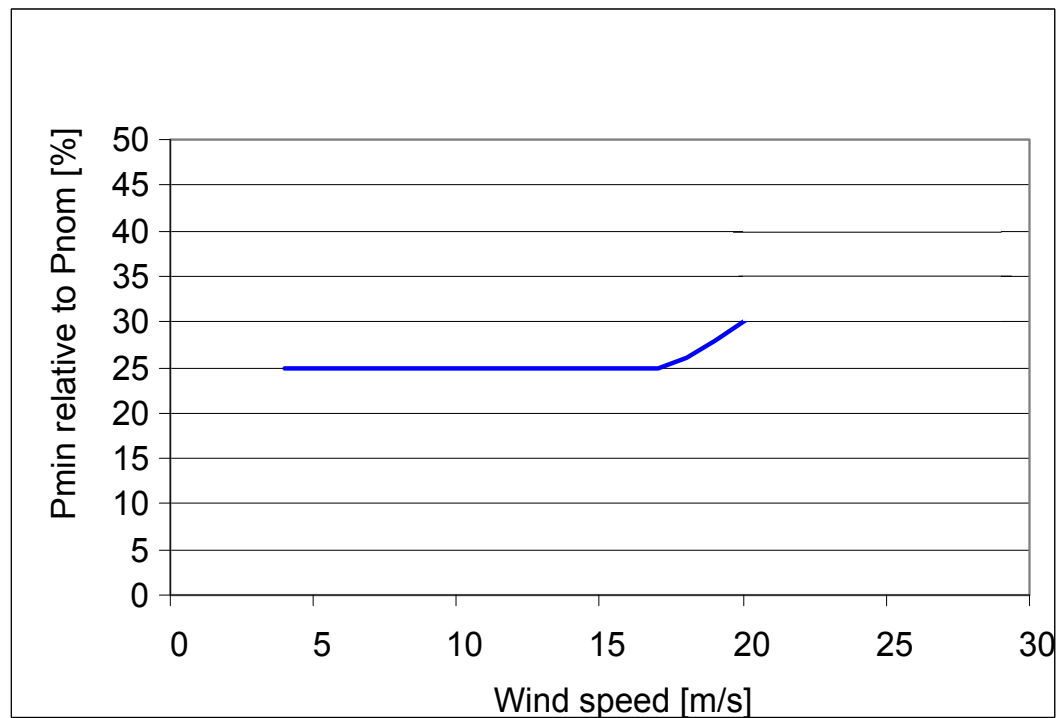


Figure 9-3: Minimum active power output dependant of wind speed.

9.8 Performance – Frequency Control

The turbine can be configured to perform frequency control by decreasing the output power as a linear function of the grid frequency (over frequency).

Dead band and slope for the frequency control function are configurable.

9.9 Performance – Own Consumption

The consumption of electrical power by the wind turbine is defined as consumption when the wind turbine is not producing energy (generator is not connected to the grid). This is defined in the control system as Production Generator (zero).

The following components have the largest influence on the power consumption of the wind turbine:

Own Consumption	
Hydraulic Motor	20 kW
Yaw Motors 6 x 1.75 kW	10.5 kW
Oil Heating 3 x 0.76 kW	2.3 kW
Air Heaters 2 x 6 kW (std) 3 x 6 kW (LT)	12 kW (Standard) 18 kW (Low Temperature)
Oil Pump for Gearbox Lubrication	3.5 kW
HV Transformer located in the nacelle has a no-load loss of	Max. 3.9 kW

Table 9-6: Own consumption data.

9.10 Operational Envelope Conditions for Power Curve, C_t Values (at Hub Height)

See appendix section 12.1 Mode 0, p. 37, 12.2 Mode 1, p. 41 and 12.3 Mode 2, p. 45 for power curve, C_t values and noise level.

Conditions for Power Curve, C_t Values (at Hub Height)	
Wind Shear	0.10 - 0.16 (10 min. average)
Turbulence Intensity	8 - 12% (10 min. average)
Blades	Clean
Rain	No
Ice/Snow on Blades	No
Leading Edge	No damage
Terrain	IEC 61400-12-1
Inflow Angle (Vertical)	$0 \pm 2^\circ$
Grid Frequency	60 ± 0.5 Hz

Table 9-7: Conditions for power curve, C_t values.

10 Drawings

10.1 Structural Design – Illustration of Outer Dimensions

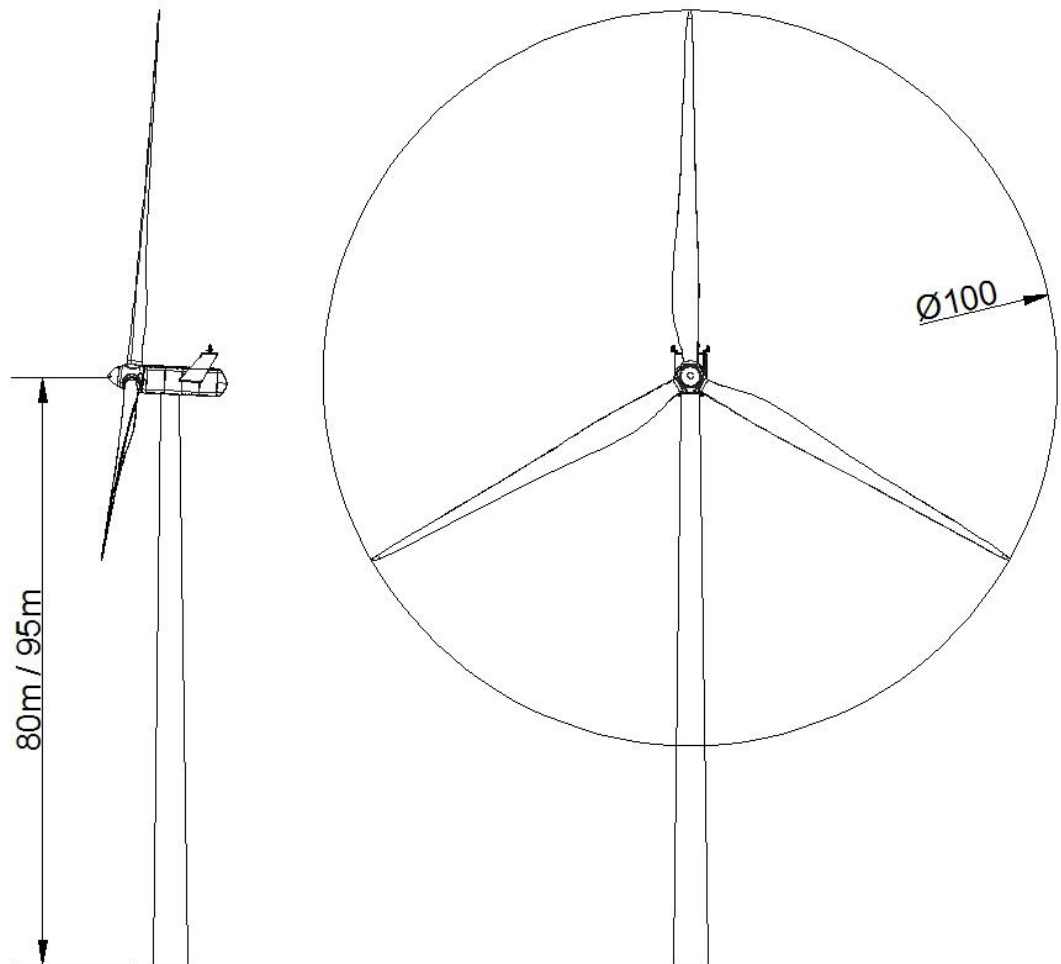


Figure 10-1: Illustration of outer dimensions – structure.

10.2 Structural Design – Side View Drawing

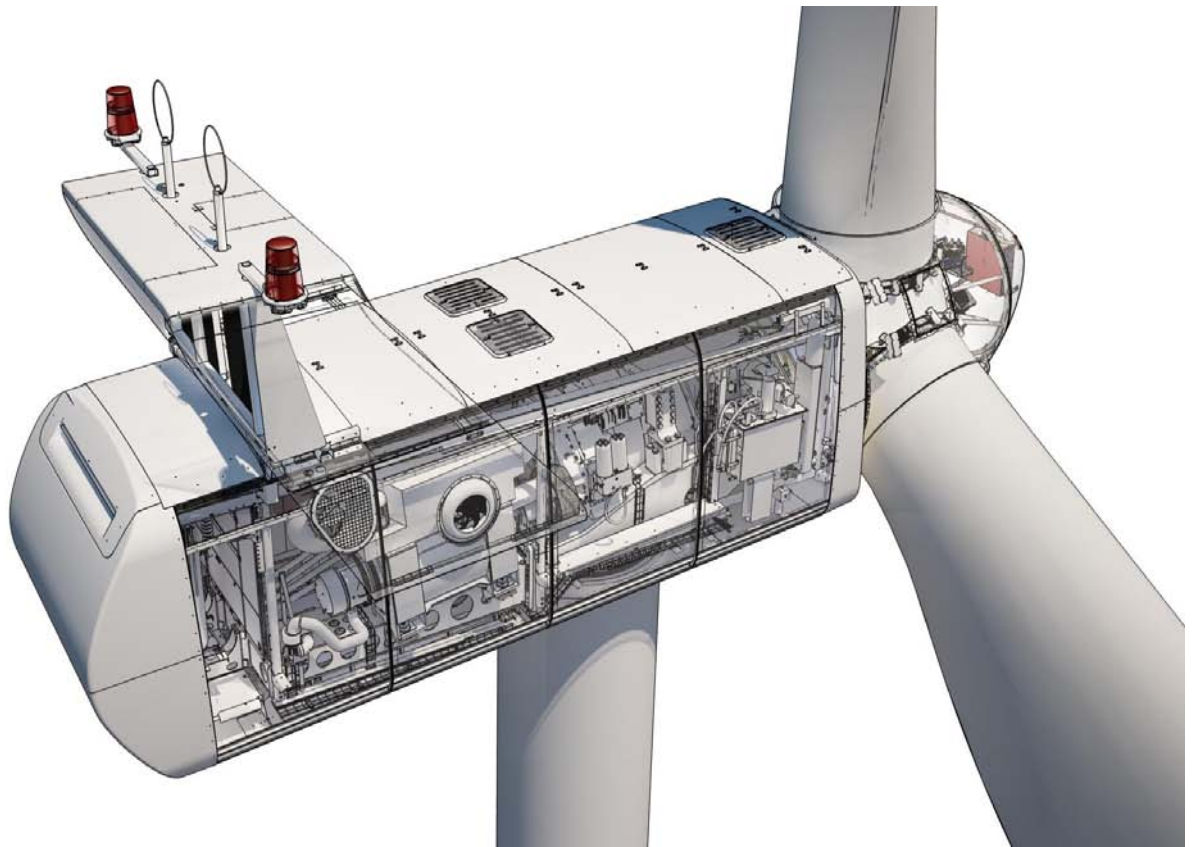


Figure 10-2: Side view drawing.

11 General Reservations, Notes and Disclaimers

- These general specifications apply to the current version of the V100 wind turbine. Updated versions of the V100 wind turbine, which may be manufactured in the future, may have general specifications that differ from these general specifications. In the event that Vestas supplies an updated version of the V100 wind turbine, Vestas will provide updated general specifications applicable to the updated version.
- Periodic operational disturbances and generator power de-rating may be caused by combination of high winds, low voltage or high temperature.
- Vestas recommends that the grid be as close to nominal as possible with little variation in frequency.
- A certain time allowance for turbine warm-up must be expected following grid dropout and/or periods of very low ambient temperature.
- The estimated power curve for the different estimated noise levels (sound power levels) is for wind speeds at 10 minute average value at hub height and perpendicular to the rotor plane.
- All listed start/stop parameters (e. g. wind speeds and temperatures) are equipped with hysteresis control. This can, in certain borderline situations, result in turbine stops even though the ambient conditions are within the listed operation parameters.
- The earthing system must comply with the minimum requirements from Vestas, and be in accordance with local and national requirements, and codes of standards.
- Lightning strikes are considered a major force, i.e. damage caused by lightning strikes is not warranted by Vestas.
- For the avoidance of doubt, this document 'General Specifications' is not, and does not contain, any guarantee, warranty and/or verification of the power curve and noise (including, without limitation, the power curve and noise verification method). Any guarantee, warranty and/or verification of the power curve and noise (including, without limitation, the power curve and noise verification method) must be agreed to separately in writing.

12 Appendices

Power Curve, Ct values and Sound Power Levels for Mode 0 to 2 are defined below.

12.1 Mode 0

12.1.1 Mode 0, Power Curve

Mode 0, Power curve														
Wind speed [m/s]	Air density kg/m ³													
	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
3	13	9	9	9	10	10	11	11	11	12	12	13	14	15
3.5	53	34	36	38	39	41	43	45	46	48	50	52	55	57
4	112	80	83	86	89	92	95	98	101	104	106	109	115	118
4.5	181	136	140	144	148	152	156	160	165	169	173	177	185	189
5	260	198	203	209	215	220	226	232	237	243	248	254	265	271
5.5	353	270	278	285	293	300	308	315	323	330	338	345	360	368
6	462	356	365	375	385	395	404	414	424	433	443	453	472	481
6.5	581	443	455	468	481	493	506	518	531	544	556	569	594	606
7	736	563	579	595	611	626	642	658	673	689	705	720	751	767
7.5	911	700	720	739	758	777	796	816	835	854	873	892	930	949
8	1108	856	879	902	925	948	971	994	1017	1040	1063	1086	1131	1153
8.5	1321	1028	1055	1082	1110	1137	1163	1190	1216	1243	1269	1295	1347	1372
9	1524	1212	1243	1273	1304	1335	1363	1392	1421	1449	1474	1499	1547	1570
9.5	1679	1397	1429	1460	1491	1522	1547	1572	1597	1622	1641	1660	1695	1710
10	1766	1566	1591	1616	1641	1666	1682	1699	1716	1733	1744	1755	1773	1780
10.5	1800	1689	1705	1721	1737	1753	1762	1770	1779	1788	1792	1796	1802	1804
11	1811	1764	1772	1779	1786	1794	1797	1800	1803	1807	1808	1809	1812	1813
11.5	1815	1796	1799	1802	1805	1808	1809	1811	1812	1813	1814	1814	1815	1815
12	1815	1808	1810	1811	1812	1814	1814	1814	1815	1815	1815	1815	1815	1815
12.5	1815	1813	1814	1814	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
13	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
13.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
14	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
14.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
15	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
15.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
16	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815

Mode 0, Power curve														
	Air density kg/m ³													
Wind speed [m/s]	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
16.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
17	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
17.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
18	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
18.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
19	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
19.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
20	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815

Table 12-1: Mode 0, power curve.

12.1.2 Mode 0, Ct values

Mode 0, Ct values														
Wind speed [m/s]	Air density kg/m ³													
	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
3	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874
3.5	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891
4	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877
4.5	0.847	0.847	0.847	0.847	0.847	0.847	0.847	0.847	0.847	0.847	0.847	0.847	0.847	0.847
5	0.820	0.820	0.820	0.820	0.820	0.820	0.820	0.820	0.820	0.820	0.820	0.820	0.820	0.820
5.5	0.806	0.806	0.806	0.806	0.806	0.806	0.806	0.806	0.806	0.806	0.806	0.806	0.806	0.806
6	0.802	0.802	0.802	0.802	0.802	0.802	0.802	0.802	0.802	0.802	0.802	0.802	0.802	0.802
6.5	0.814	0.814	0.814	0.814	0.814	0.814	0.814	0.814	0.814	0.814	0.814	0.814	0.814	0.814
7	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807	0.807
7.5	0.804	0.804	0.804	0.804	0.804	0.804	0.804	0.804	0.804	0.804	0.804	0.804	0.804	0.804
8	0.795	0.800	0.800	0.799	0.799	0.799	0.799	0.798	0.798	0.797	0.796	0.796	0.794	0.793
8.5	0.768	0.786	0.784	0.783	0.782	0.780	0.779	0.777	0.776	0.774	0.772	0.770	0.766	0.764
9	0.716	0.756	0.754	0.751	0.749	0.746	0.743	0.739	0.736	0.732	0.727	0.721	0.710	0.704
9.5	0.636	0.713	0.708	0.703	0.698	0.693	0.685	0.678	0.670	0.663	0.654	0.645	0.627	0.617
10	0.545	0.657	0.648	0.639	0.630	0.621	0.610	0.599	0.589	0.578	0.567	0.556	0.535	0.524
10.5	0.459	0.587	0.576	0.564	0.552	0.540	0.528	0.517	0.505	0.493	0.482	0.471	0.449	0.439
11	0.389	0.514	0.501	0.488	0.475	0.462	0.451	0.440	0.428	0.417	0.408	0.398	0.380	0.372
11.5	0.333	0.442	0.430	0.418	0.406	0.395	0.385	0.376	0.366	0.357	0.349	0.341	0.325	0.318
12	0.288	0.381	0.370	0.360	0.350	0.340	0.332	0.324	0.316	0.308	0.301	0.294	0.282	0.276
12.5	0.251	0.330	0.322	0.313	0.305	0.296	0.289	0.282	0.275	0.269	0.263	0.257	0.246	0.241
13	0.222	0.289	0.282	0.275	0.267	0.260	0.254	0.248	0.242	0.236	0.231	0.227	0.217	0.213
13.5	0.197	0.256	0.249	0.243	0.237	0.230	0.225	0.220	0.215	0.210	0.206	0.201	0.193	0.189
14	0.176	0.227	0.222	0.216	0.211	0.205	0.201	0.196	0.192	0.187	0.184	0.180	0.173	0.169
14.5	0.158	0.203	0.199	0.194	0.189	0.184	0.180	0.176	0.172	0.168	0.165	0.161	0.155	0.152
15	0.142	0.183	0.178	0.174	0.170	0.165	0.162	0.158	0.155	0.151	0.148	0.145	0.140	0.137
15.5	0.129	0.165	0.161	0.157	0.153	0.150	0.146	0.143	0.140	0.137	0.134	0.132	0.127	0.124
16	0.117	0.150	0.146	0.143	0.139	0.136	0.133	0.130	0.127	0.125	0.122	0.120	0.115	0.113
16.5	0.107	0.137	0.133	0.130	0.127	0.124	0.121	0.119	0.116	0.114	0.112	0.109	0.105	0.103
17	0.098	0.125	0.122	0.119	0.116	0.114	0.111	0.109	0.107	0.104	0.102	0.100	0.097	0.095
17.5	0.091	0.115	0.112	0.109	0.107	0.104	0.102	0.100	0.098	0.096	0.094	0.092	0.089	0.087
18	0.084	0.105	0.103	0.101	0.098	0.096	0.094	0.092	0.090	0.088	0.087	0.085	0.082	0.081
18.5	0.077	0.097	0.095	0.093	0.091	0.089	0.087	0.085	0.083	0.082	0.080	0.079	0.076	0.075

Mode 0, Ct values														
	Air density kg/m ³													
Wind speed [m/s]	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
19	0.072	0.090	0.088	0.086	0.084	0.082	0.081	0.079	0.078	0.076	0.075	0.073	0.071	0.069
19.5	0.067	0.084	0.082	0.080	0.078	0.077	0.075	0.074	0.072	0.071	0.069	0.068	0.066	0.065
20	0.062	0.078	0.076	0.075	0.073	0.071	0.070	0.069	0.067	0.066	0.065	0.063	0.061	0.060

Table 12-2: Mode 0, Ct values.

12.1.3 Mode 0, Sound Power Levels

Sound Power Level at Hub Height, Mode 0		
Conditions for Sound Power Level	Verification standard: IEC 61400-11 Ed. 2. Wind shear 0.15 Max turbulence at 10 meter height: 16% Inflow angle (vertical): 0 ± 2° Air density: 1.225 kg/m ³	
Hub Height	80 m	95 m
LwA @ 3 m/s (10 m above ground) [dBA]	93.8	93.8
Wind speed at hh [m/sec]	4.2	4.3
LwA @ 4 m/s (10 m above ground) [dBA]	96.0	96.4
Wind speed at hh [m/sec]	5.6	5.7
LwA @ 5 m/s (10 m above ground) [dBA]	100.1	100.7
Wind speed at hh [m/sec]	7.0	7.2
LwA @ 6 m/s (10 m above ground) [dBA]	103.9	104.4
Wind speed at hh [m/sec]	8.4	8.6
LwA @ 7 m/s (10 m above ground) [dBA]	105.0	105.0
Wind speed at hh [m/sec]	9.8	10.0
LwA @ 8 m/s (10 m above ground) [dBA]	105.0	105.0
Wind speed at hh [m/sec]	11.2	11.5
LwA @ 9 m/s (10 m above ground) [dBA]	105.0	105.0
Wind speed at hh [m/sec]	12.6	12.9
LwA @ 10 m/s (10 m above ground) [dBA]	105.0	105.0
Wind speed at hh [m/sec]	13.9	14.3
LwA @ 11 m/s (10 m above ground) [dBA]	105.0	105.0
Wind speed at hh [m/sec]	15.3	15.8
LwA @ 12 m/s (10 m above ground) [dBA]	105.0	105.0
Wind speed at hh [m/sec]	16.7	17.2
LwA @ 13 m/s (10 m above ground) [dBA]	105.0	105.0
Wind speed at hh [m/sec]	18.1	18.6

Table 12-3: Sound power level at hub height: Mode 0.

12.2 Mode 1

12.2.1 Mode 1, Power Curves

Mode 1, Power curves														
Wind speed [m/s]	Air density kg/m ³													
	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
3	13	9	9	9	10	10	11	11	11	12	12	13	14	15
3.5	53	34	36	38	39	41	43	45	46	48	50	52	55	57
4	112	80	83	86	89	92	95	98	101	104	106	109	115	118
4.5	180	134	139	143	147	151	155	159	163	167	171	175	184	188
5	256	195	200	206	211	217	223	228	234	239	245	250	261	267
5.5	346	265	273	280	287	295	302	310	317	324	332	339	354	361
6	453	349	358	368	377	387	396	406	415	425	434	444	463	472
6.5	576	439	451	464	476	489	501	514	526	539	551	564	588	601
7	728	558	573	589	604	620	635	651	666	682	697	713	744	759
7.5	902	693	712	731	750	769	788	807	826	845	864	883	920	939
8	1098	847	870	893	916	939	961	984	1007	1030	1053	1075	1120	1143
8.5	1312	1019	1046	1073	1100	1127	1154	1180	1207	1234	1260	1286	1338	1364
9	1519	1204	1234	1265	1296	1326	1355	1384	1413	1443	1468	1494	1542	1565
9.5	1678	1392	1423	1455	1486	1518	1543	1569	1594	1619	1639	1658	1693	1709
10	1766	1562	1588	1613	1638	1664	1681	1698	1715	1732	1743	1754	1773	1780
10.5	1799	1687	1703	1720	1736	1753	1761	1770	1779	1788	1791	1795	1801	1803
11	1811	1764	1772	1779	1787	1794	1798	1801	1804	1807	1808	1810	1812	1813
11.5	1814	1796	1799	1802	1805	1809	1810	1811	1812	1813	1813	1814	1815	1815
12	1815	1809	1810	1811	1812	1813	1814	1814	1814	1815	1815	1815	1815	1815
12.5	1815	1813	1814	1814	1814	1815	1815	1815	1815	1815	1815	1815	1815	1815
13	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
13.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
14	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
14.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
15	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
15.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
16	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
16.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
17	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
17.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
18	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815

Mode 1, Power curves														
	Air density kg/m ³													
Wind speed [m/s]	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
18.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
19	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
19.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
20	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815

Table 12-4: Mode 1, power curve.

12.2.2 Mode 1, Ct values

Mode 1, Ct values														
	Air density kg/m ³													
Wind speed [m/s]	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
3	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874
3.5	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890	0.890
4	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863
4.5	0.809	0.809	0.809	0.809	0.809	0.809	0.809	0.809	0.809	0.809	0.809	0.809	0.809	0.809
5	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764
5.5	0.741	0.741	0.741	0.741	0.741	0.741	0.741	0.741	0.741	0.741	0.741	0.741	0.741	0.741
6	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733
6.5	0.766	0.766	0.766	0.766	0.766	0.766	0.766	0.766	0.766	0.766	0.766	0.766	0.766	0.766
7	0.755	0.755	0.755	0.755	0.755	0.755	0.755	0.755	0.755	0.755	0.755	0.755	0.755	0.755
7.5	0.750	0.749	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750
8	0.748	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.748	0.748	0.748	0.747
8.5	0.735	0.745	0.744	0.744	0.743	0.742	0.741	0.741	0.740	0.739	0.738	0.737	0.734	0.733
9	0.699	0.729	0.727	0.726	0.724	0.722	0.720	0.717	0.715	0.712	0.708	0.703	0.694	0.689
9.5	0.631	0.699	0.695	0.691	0.687	0.683	0.676	0.669	0.663	0.656	0.648	0.639	0.622	0.613
10	0.544	0.652	0.643	0.634	0.626	0.617	0.607	0.597	0.586	0.576	0.565	0.555	0.533	0.522
10.5	0.458	0.585	0.574	0.562	0.551	0.539	0.527	0.516	0.504	0.492	0.481	0.470	0.448	0.438
11	0.388	0.514	0.501	0.488	0.475	0.462	0.451	0.440	0.428	0.417	0.408	0.398	0.380	0.371
11.5	0.333	0.442	0.430	0.418	0.406	0.395	0.385	0.376	0.366	0.356	0.349	0.341	0.325	0.318
12	0.288	0.381	0.370	0.360	0.350	0.340	0.332	0.324	0.316	0.308	0.301	0.294	0.282	0.276
12.5	0.251	0.331	0.322	0.313	0.305	0.296	0.289	0.282	0.275	0.269	0.263	0.257	0.246	0.241
13	0.222	0.289	0.282	0.275	0.267	0.260	0.254	0.248	0.242	0.236	0.231	0.227	0.217	0.213
13.5	0.197	0.256	0.249	0.243	0.237	0.230	0.225	0.220	0.215	0.210	0.206	0.201	0.193	0.189
14	0.176	0.227	0.222	0.216	0.211	0.205	0.201	0.196	0.192	0.187	0.184	0.180	0.173	0.169

Mode 1, Ct values														
Wind speed [m/s]	Air density kg/m ³													
	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
14.5	0.158	0.203	0.199	0.194	0.189	0.184	0.180	0.176	0.172	0.168	0.165	0.161	0.155	0.152
15	0.142	0.183	0.178	0.174	0.170	0.165	0.162	0.158	0.155	0.151	0.148	0.145	0.140	0.137
15.5	0.129	0.165	0.161	0.157	0.153	0.150	0.146	0.143	0.140	0.137	0.134	0.132	0.127	0.124
16	0.117	0.150	0.146	0.143	0.139	0.136	0.133	0.130	0.127	0.125	0.122	0.120	0.115	0.113
16.5	0.107	0.137	0.133	0.130	0.127	0.124	0.121	0.119	0.116	0.114	0.112	0.109	0.105	0.103
17	0.098	0.125	0.122	0.119	0.116	0.114	0.111	0.109	0.107	0.104	0.102	0.100	0.097	0.095
17.5	0.091	0.115	0.112	0.109	0.107	0.104	0.102	0.100	0.098	0.096	0.094	0.092	0.089	0.087
18	0.084	0.105	0.103	0.101	0.098	0.096	0.094	0.092	0.090	0.088	0.087	0.085	0.082	0.081
18.5	0.077	0.097	0.095	0.093	0.091	0.089	0.087	0.085	0.083	0.082	0.080	0.079	0.076	0.075
19	0.072	0.090	0.088	0.086	0.084	0.082	0.081	0.079	0.078	0.076	0.075	0.073	0.071	0.069
19.5	0.067	0.084	0.082	0.080	0.078	0.077	0.075	0.074	0.072	0.071	0.069	0.068	0.066	0.065
20	0.062	0.078	0.076	0.075	0.073	0.071	0.070	0.069	0.067	0.066	0.065	0.063	0.061	0.060

Table 12-5: Mode 1, Ct values.

12.2.3 Mode 1, Sound Power Levels

Sound Power Level at Hub Height, Mode 1		
Conditions for Sound Power Level	Verification standard: IEC 61400-11 Ed. 2. Wind shear 0.15 Max turbulence at 10 meter height: 16% Inflow angle (vertical): $0 \pm 2^\circ$ Air density: 1.225 kg/m^3	
Hub Height	80 m	95 m
LwA @ 3 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	93.7 4.2	93.7 4.3
LwA @ 4 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	95.3 5.6	95.7 5.7
LwA @ 5 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	99.1 7.0	99.7 7.2
LwA @ 6 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	102.9 8.4	103.4 8.6
LwA @ 7 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	105.0 9.8	105.0 10.0
LwA @ 8 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	105.0 11.2	105.0 11.5
LwA @ 9 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	105.0 12.6	105.0 12.9
LwA @ 10 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	105.0 13.9	105.0 14.3
LwA @ 11 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	105.0 15.3	105.0 15.8
LwA @ 12 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	105.0 16.7	105.0 17.2
LwA @ 13 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	105.0 18.1	105.0 18.6

Table 12-6: Sound power level at hub height: Mode 1.

12.3 Mode 2

12.3.1 Mode 2, Power Curves

Mode 2, Power curves														
Wind speed [m/s]	Air density kg/m ³													
	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
3	13	9	9	9	10	10	11	11	11	12	12	13	14	15
3.5	53	34	36	38	39	41	43	45	46	48	50	52	55	57
4	112	80	83	86	89	92	95	98	101	104	106	109	115	118
4.5	181	136	140	144	148	152	156	160	165	169	173	177	185	189
5	260	198	203	209	215	220	226	231	237	243	248	254	265	271
5.5	353	270	278	285	293	300	308	315	323	330	338	345	360	367
6	462	355	365	375	384	394	404	413	423	433	442	452	471	481
6.5	581	443	455	468	480	493	506	518	531	543	556	568	594	606
7	735	563	579	594	610	626	642	657	673	688	704	720	751	766
7.5	908	697	717	736	755	774	793	812	831	851	870	889	926	945
8	1090	840	863	886	909	932	954	977	999	1022	1045	1067	1113	1135
8.5	1271	981	1008	1034	1061	1087	1113	1140	1166	1192	1218	1244	1297	1323
9	1437	1112	1142	1172	1201	1231	1261	1290	1320	1349	1379	1408	1465	1494
9.5	1580	1227	1260	1293	1325	1358	1390	1423	1455	1487	1518	1549	1607	1634
10	1689	1331	1367	1402	1437	1473	1506	1540	1573	1607	1634	1661	1709	1729
10.5	1757	1425	1462	1499	1536	1573	1604	1635	1666	1697	1717	1737	1768	1780
11	1792	1512	1549	1585	1622	1659	1683	1708	1732	1757	1768	1780	1797	1802
11.5	1805	1592	1624	1657	1690	1722	1738	1755	1771	1787	1793	1799	1808	1811
12	1811	1666	1691	1715	1740	1764	1774	1783	1792	1802	1805	1808	1812	1813
12.5	1813	1726	1742	1757	1773	1789	1794	1799	1804	1809	1810	1812	1814	1814
13	1814	1765	1774	1784	1793	1802	1805	1807	1810	1812	1813	1814	1815	1815
13.5	1815	1786	1791	1797	1803	1808	1810	1811	1813	1814	1815	1815	1815	1815
14	1815	1802	1805	1808	1811	1813	1814	1814	1814	1815	1815	1815	1815	1815
14.5	1815	1812	1812	1813	1814	1815	1815	1815	1815	1815	1815	1815	1815	1815
15	1815	1813	1813	1814	1814	1815	1815	1815	1815	1815	1815	1815	1815	1815
15.5	1815	1814	1814	1814	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
16	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
16.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
17	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
17.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
18	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815

Mode 2, Power curves														
	Air density kg/m ³													
Wind speed [m/s]	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
18.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
19	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
19.5	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815
20	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815	1815

Table 12-7: Mode 2, power curve.

12.3.2 Mode 2, Ct values

Mode 2, Ct values														
	Air density kg/m ³													
Wind speed [m/s]	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
3	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874	0.874
3.5	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891	0.891
4	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.877
4.5	0.847	0.847	0.847	0.847	0.847	0.846	0.847	0.847	0.847	0.847	0.847	0.847	0.847	0.847
5	0.818	0.818	0.818	0.818	0.818	0.817	0.818	0.818	0.818	0.818	0.818	0.818	0.818	0.818
5.5	0.801	0.801	0.801	0.801	0.801	0.801	0.801	0.801	0.801	0.801	0.801	0.801	0.801	0.801
6	0.796	0.796	0.796	0.796	0.796	0.796	0.796	0.796	0.796	0.796	0.796	0.796	0.796	0.796
6.5	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811
7	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
7.5	0.783	0.783	0.783	0.783	0.783	0.782	0.783	0.783	0.783	0.783	0.783	0.783	0.783	0.783
8	0.747	0.747	0.747	0.747	0.747	0.747	0.747	0.747	0.747	0.747	0.747	0.747	0.747	0.747
8.5	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695	0.695
9	0.634	0.634	0.634	0.634	0.634	0.634	0.634	0.634	0.634	0.634	0.634	0.634	0.634	0.634
9.5	0.569	0.570	0.570	0.570	0.570	0.570	0.570	0.570	0.570	0.570	0.570	0.569	0.567	0.565
10	0.505	0.513	0.513	0.513	0.513	0.513	0.513	0.513	0.512	0.512	0.509	0.507	0.500	0.496
10.5	0.441	0.462	0.462	0.462	0.462	0.462	0.460	0.458	0.456	0.454	0.450	0.445	0.435	0.428
11	0.381	0.417	0.416	0.415	0.415	0.414	0.410	0.407	0.403	0.400	0.394	0.388	0.375	0.368
11.5	0.330	0.377	0.375	0.373	0.371	0.369	0.364	0.359	0.354	0.349	0.342	0.336	0.323	0.317
12	0.287	0.342	0.339	0.335	0.331	0.328	0.322	0.316	0.311	0.305	0.299	0.293	0.281	0.275
12.5	0.251	0.310	0.305	0.300	0.295	0.290	0.285	0.279	0.273	0.267	0.262	0.257	0.246	0.241
13	0.222	0.279	0.274	0.268	0.263	0.258	0.252	0.247	0.241	0.236	0.231	0.226	0.217	0.213
13.5	0.197	0.250	0.245	0.240	0.235	0.229	0.224	0.220	0.215	0.210	0.206	0.201	0.193	0.189
14	0.176	0.225	0.220	0.215	0.210	0.205	0.201	0.196	0.192	0.187	0.184	0.180	0.173	0.169

Mode 2, Ct values														
Wind speed [m/s]	Air density kg/m ³													
	1.225	0.95	0.975	1	1.025	1.05	1.075	1.1	1.125	1.15	1.175	1.2	1.25	1.275
14.5	0.158	0.203	0.198	0.193	0.189	0.184	0.180	0.176	0.172	0.168	0.165	0.161	0.155	0.152
15	0.142	0.182	0.178	0.174	0.169	0.165	0.162	0.158	0.155	0.151	0.148	0.145	0.140	0.137
15.5	0.129	0.165	0.161	0.157	0.153	0.150	0.146	0.143	0.140	0.137	0.134	0.132	0.127	0.124
16	0.117	0.150	0.146	0.143	0.139	0.136	0.133	0.130	0.127	0.125	0.122	0.120	0.115	0.113
16.5	0.107	0.137	0.133	0.130	0.127	0.124	0.121	0.119	0.116	0.114	0.112	0.109	0.105	0.103
17	0.098	0.125	0.122	0.119	0.116	0.114	0.111	0.109	0.107	0.104	0.102	0.100	0.097	0.095
17.5	0.091	0.115	0.112	0.109	0.107	0.104	0.102	0.100	0.098	0.096	0.094	0.092	0.089	0.087
18	0.084	0.105	0.103	0.101	0.098	0.096	0.094	0.092	0.090	0.088	0.087	0.085	0.082	0.081
18.5	0.077	0.097	0.095	0.093	0.091	0.089	0.087	0.085	0.083	0.082	0.080	0.079	0.076	0.075
19	0.072	0.090	0.088	0.086	0.084	0.082	0.081	0.079	0.078	0.076	0.075	0.073	0.071	0.069
19.5	0.067	0.084	0.082	0.080	0.078	0.077	0.075	0.074	0.072	0.071	0.069	0.068	0.066	0.065
20	0.062	0.078	0.076	0.075	0.073	0.071	0.070	0.069	0.067	0.066	0.065	0.063	0.061	0.060

Table 12-8: Mode 2, Ct values.

12.3.3 Mode 2, Sound Power Levels

Sound Power Level at Hub Height, Mode 2		
Conditions for Sound Power Level	Verification standard: IEC 61400-11 Ed. 2. Wind shear 0.15 Max turbulence at 10 meter height: 16% Inflow angle (vertical): $0 \pm 2^\circ$ Air density: 1.225 kg/m^3	
Hub Height	80 m	95 m
LwA @ 3 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	93.8 4.2	93.8 4.3
LwA @ 4 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	96.0 5.6	96.4 5.7
LwA @ 5 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	100.1 7.0	100.7 7.2
LwA @ 6 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	103.0 8.4	103.0 8.6
LwA @ 7 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	103.0 9.8	103.0 10.0
LwA @ 8 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	103.0 11.2	103.0 11.5
LwA @ 9 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	103.0 12.6	103.0 12.9
LwA @ 10 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	103.0 13.9	103.0 14.3
LwA @ 11 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	103.0 15.3	103.0 15.8
LwA @ 12 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	103.0 16.7	103.0 17.2
LwA @ 13 m/s (10 m above ground) [dBA] Wind speed at hh [m/sec]	103.0 18.1	103.0 18.6

Table 12-9: Sound power level at hub height: Mode 2.

Draft
26-Nov-10



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Project Number: 1104036.00

Project Title: WAINFLEET WIND ENERGY PROJECT

Report: 005-R02-1104036

Title: DESIGN AND OPERATIONS REPORT

Client: IPC Energy
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Date: October, 2010
(Draft for public and agency review)

Morrison Hershfield Limited

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DESIGN AND OPERATIONS REPORT

1.0 Introduction

The Wainfleet Wind Energy Project (“the Project”) Design and Operations Report has been prepared in accordance with the requirements of the Ministry of the Environment’s Renewable Energy Approvals Regulation (“the Regulation”), O.Reg 359/09, specifically with consideration of *Item 4* of the requirements outlined in *Table 1* of the Regulation.

The proposed Wainfleet Wind Energy Project is to be situated in the Township of Wainfleet, in Niagara Region of Ontario. The Project would consist of five (5) Vestas V-100 1.8 megawatt wind turbines producing a nameplate capacity of 9.0 megawatts. If approved, the wind turbines would be erected for the purpose of capturing energy from the wind, a renewable resource, and converting it into clean, useable electricity. This electricity will be transported to consumers via interconnection facilities, including transformers and distribution lines. The footprint of these facilities is captured and described in reports prepared for this Renewable Energy Approval (REA).

The Wainfleet Wind Energy Project Design and Operations Report:

- Details and describes the elements of the Site Plan for the project location
- Outlines conceptual plans, specifications and descriptions related to the design of the Wainfleet Wind Energy Project, including a description of the noise emission characteristics of the turbines to be used
- Illustrates conceptual plans, specifications, and descriptions related to the operation of the Wainfleet Wind Energy Project, including disposal of waste
- Defines the Communications Plan to be followed during the facility’s operation
- Specifies an Emergency Management Plan to be followed during facility’s operation

As required under *O.Reg. 359/09* the following sections of this report provides specific details on the previously listed items with regards to the Wainfleet Wind Energy Project facility design and operations.

1.1. General Project Schedule

Table 1 provides an overview of key project activities and projected dates.

Table 1: General Project Schedule	
Activity	Date (Month, Year)
Begin Renewable Energy Approval	October, 2009
Submit Renewable Energy Approval Application	December, 2010
Obtain Renewable Energy Approval	April/May, 2011
Commence Construction	June, 2011
Begin Operations, Commissioning (Commercial Operation)	October, 2011

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2.0 Site Plan

The Site Plan for the Wainfleet Wind Energy Project is attached as **Tab 2 with Tab 3 (Land Use Maps)** showing the adjacent land uses in this report. This site plan includes the following applicable items as required by Table 1 of *O. Reg. 359/09*:

- All wind turbines, structures, roads, utility corridors, rights of way and easements associated with the project
- Any heritage or archaeological resources within 125 meters of the project location
- All noise receptors within the study area and project location
- Land contours
- Water bodies and wetlands

The site plan shows five (5) wind turbines, one interconnection point, a utility corridor that follows the right of way of municipal roads and new roads associated with the project.

No heritage or archaeological resources were found within 125 meters of the project location; however, the Stage 2 Archaeological Assessment and Cultural Heritage Assessment Report, both part of the REA application package, describe this in further detail. These reports and the Environmental Impact Statement provide heritage and archaeological mitigation measures that were applied to the design & operations, construction, and decommissioning of the facility. The Stage 1 and Stage 2 Archaeological Assessment Report was prepared by A.M. Archaeological Associates Limited while the Cultural Heritage Assessment Report was prepared by Unterman McPhail Associates.

A Noise Assessment Report was completed by HGC Engineering. This report assessed impacts to noise receptors within the study area and specifically those impacted by the proposed turbines.

The Land-use maps provided in **Tab 3** of the REA Package show noise receptors, all proposed facilities, elevation contours, noise and land-use setbacks, water bodies, wetlands, optioned properties, lots, and other relevant land-use elements.

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3.0 Facility Design Plan

This section describes the proposed facility's design and the technology selected in greater detail. The purpose of this section is to provide those interested in the project with an understanding of the physical design of the facility.

The Wainfleet Wind Energy Project, if approved, will generate clean and renewable electricity for the benefit of the public. The project will also help in achieving Ontario's goals for less dependence on fossil fuels and reductions to green house gas emissions. This project would produce sufficient electricity to power the equivalent of approximately 2500 homes.

Generally, the design of the facility calls for up to five (5) Vestas V-100 1.8 megawatt wind turbines that would produce a total nameplate capacity of 9.0 megawatts of renewable energy. Each wind turbine would stand approximately 95.0 meters at hub height with 50.0 meter blades. The total height of each turbine is 145.0 meters above ground level including the tower, nacelle, and blades, with an access road connecting the turbine to municipal roads. Electricity would be produced by the wind turning the rotor and converting the kinetic energy in wind in to electrical energy with the help of generator located in the nacelle. The electricity would then be 'stepped-up' to 27.6 kilovolts in a nacelle mounted transformer. This electricity would then be conveyed to the electrical grid by way of the collector system, switching station, and distribution line.

3.1 Project Facilities, Equipment and Technology

The major components of the project are as follows:

- Meteorological Tower
- It is anticipated that four (4) to five (5) turbines will be installed. The **Vestas V100, 1.8 megawatt (MW)** turbine model has been selected as the preferred model.
- Nacelle mounted transformers, collection system, and a distribution system to connect to the Hydro One distribution system. Nacelle mounted 690v/27.6 kV step up transformers located in the nacelle housing of each turbine. Buried and overhead 27.6kV electrical collector system, switching station, and ancillaries.
- Turbine access roads
- Crane pads, temporary staging areas for assembly and erection of wind turbines
- A small Supervisory Control and Data Acquisition (SCADA)/operations building located at the switching station site

3.1.1 Meteorological Tower

A meteorological tower was installed within the study area to monitor wind speed, wind direction, temperature and humidity. The meteorological tower is approximately 60 m in height and was installed in August, 2009. The tower will remain for the duration of the Project to monitor wind turbine performance and environmental conditions. The tower is supported by guy wires. **The Meteorological Tower is shown on the Site Plan (Tab 2) and Land Use Map (Tab 3) of this package.**

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3.1.2 Wind Turbines

The Vestas V100, 1.8 MW turbine has been selected as the preferred model for this project. It is anticipated that up to five (5) turbines will be installed. Several alternative turbine locations were studied for environmental impacts and for flexibility to move turbine locations in future, if required. The **Site Plan (Tab 2)** and **Land Use Maps (Tab 3)** show the lay out of the proposed facility. The **Wind Turbine Specification Report** provides greater detail on the model selected.

All turbines at the Wainfleet Wind Energy Project will meet Transport Canada and NAVCanada requirements for aviation safety/lighting.

Wind Turbines will be located according to the coordinates found in **Table 3** of this report and shown in **Tabs 1 through 5** of the REA Package.

3.1.3 Access Roads and Crane Pads

Access roads, made of packed gravel, will be required to access each wind turbine location. These roads were placed to minimize impacts on the environment. All new access roads will be constructed on private participating landowner's lots within the project area, and will provide access to each turbine for construction, operation and maintenance activities. The transportation of machinery, turbine components and other equipment will be done over the existing municipal roads as far as possible. During the construction phase, each wind turbine's access road will end at a crane pad where the turbine will be constructed. The crane will only be required during construction of the turbine. The crane pad will be made of the same material as the access roads. The land used for the crane pad will be restored through standard industry practices and as per applicable rules and regulations at the end of the construction phase. The access roads will be compliant with Ontario and municipal regulations and will be built to support the weight of the equipment and heavy machinery required to build each wind turbine location.

Access roads are shown and located according to **Tabs 1 through 5** of the REA Package.

3.1.4 Collector System, Switching Station and Distribution Line

The energy from the wind turbines will be collected via underground cabling and overhead lines and directed to a switching station. The switching station will connect directly to the local distribution system. The turbines will connect to the Hydro One distribution system. The power will be generated at approximately the 690V voltage level at the turbine step up to a local 27.6 kV collection system by nacelle-mounted transformers of each turbine of the Vestas V-100 wind turbines.

Collector systems, switching station and distribution line are shown and located according to **Tabs 1 through 5** of the REA Package.

3.1.4.1 Collector System

The power generated at each of the wind turbine generators is transported through the collector system. The collector system consists of buried cables and overhead collector lines. In some cases, there may be some shared use with existing Hydro One lines and poles. The collector system will be built to Utility and Ontario standards.

3.1.4.2 Switching Station, Communications and SCADA

The switching station will be a chain-linked fenced area measuring approximately 1/4 acres. Within the fenced area, a switching station with a small pre fabricated building for SCADA will be equipped with full Supervisory Control and Data Acquisition (SCADA) capabilities. Beside the maintenance building, there will be a switching gear. The maintenance building will have a gravel shoulder surrounding it. The overhead cables coming out of the switching station will attach onto dead-end poles from the fenced area for the switching station and will then attach to a metering pole.

3.1.4.3 Distribution System

Electricity collected at the switching station will be transferred to Hydro One's distribution grid. A distribution line will have to be built to connect the station to the Hydro One grid. An appropriate protection system, as per the best industry practices as well as utility guidelines will be provided.

3.1.5 Maintenance Building

The maintenance building will be located within the fenced area of the switching station. Aside from housing the SCADA system, the maintenance building may also be used to store small parts and maintenance tools. There will be no permanent staff presence; therefore, a sanitation system will not be required. Only trained personnel will be permitted within the fenced in enclosure, including the maintenance building.

1.1.1 Wind Turbine Technologies

The Vestas V100-1.8 MW wind turbine is a pitch regulated upwind turbine with active yaw and a three-blade rotor. The Vestas V100-1.8 MW turbine has a rotor diameter of 100 m with a generator rated at 1.8 MW. The turbine utilizes a microprocessor pitch control system called OptiTip® and the Variable Speed concepts (VCUS: Vestas Converter Unity System). With these features the wind turbine is able to operate the rotor at variable speed (RPM), helping to maintain the output at or near rated power. (*Vestas, 2010*). A summary of the technical specifications of this model are found in the **Wind Turbine Specification Report**.

Each Vestas V100 turbine has a nameplate capacity of 1.8 MW and will be built to a hub height of 95 meters. The rotor diameter is 100 meters with all of the three 49 meter blades seeping an area of 7850 m². The minimum operational wind speed (cut-in speed) is 4.0 m/s with a maximum operational speed (cut-out speed) of 20.0 m/s. The V-100 Turbine is erected on a tabular steel tower which holds the nacelle including hub at 95 meters above the ground. The nacelle houses the gear box, generator, hydraulic motors, transformer and electrical components. Each blade is constructed of light weight airfoil shells bonded to supporting beams and connect to the hub. The generator is asynchronous with wound rotor, slip rings and VCUS. The turbine's operational envelope is -20° to +40° C.

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Table 2 summarizes the Wind Turbine General Specifications.

Table 2: Wind Turbine General Specifications	
	Operational Envelope: -20° to +40° C
Rotor	Rotor Diameter: 100m
	Swept Area: 7850m²
	Speed, Dynamic Operation Range: 9.3 – 16.6 rpm
	Rotational Direction: Clockwise (front view)
Tower	Type: tubular steel tower
	Hub: 95m
Electrical	Frequency: 60 Hz
	Rated Power: 1.8 MW
	Generator: Asynchronous with wound rotor, slip rings and VCUS
Blade	Type: airfoil shells bonded to supporting beam
	Length: 49m
	Max Chord: 3.9m
Nacelle	Height for Transport: 4.0 m
	Height Installed: 5.4 m
	Width: 3.4 m
	Length: 10.4 m
Hub	Material: cast ball shell hub
	Height: 95m
	Diameter: 3.3 m

The project's five turbines will have a poured concrete foundation, which will include reinforcing steel bars at the base of each individual turbine. A mounting ring will also be installed as part of the turbine foundation to secure the base of the tower in place. The foundation diameter will be approximately 18 meters. Exact specifications of the turbine foundations will be dependant on the results of a geotechnical investigation and detailed design of the proposed facility.

The Wainfleet Wind Energy Project's construction and decommissioning activities will also require a crane pad and laydown area near the base of each turbine. Details regarding these structures have been provided in the **Construction Plan Report**. The site layout area for the Wainfleet Wind Energy Project including the placement of all such structures was designed to ensure that there was no encroachment on setback requirements prescribed in *O. Reg. 359/09* for natural heritage features or water bodies within close proximity to the project location. Where the proposed facility interacts with any REA setbacks the **Environmental Impact Statement** provides a description of potential impacts and mitigation measures.

DESIGN AND OPERATIONS REPORT

3.1.6 Wind Turbine Locations

The coordinates for each wind turbine in the proposed Wainfleet Wind Energy Project are presented in **Table 3**, below.

Table 3: Coordinates of Each Turbine (NAD 83, UTM Zone 17)		
Turbine Number	Latitude	Longitude
1	631359	4751252
2	631758	4750750
3	631921	4750541
4	632750	4748389
5	632706	4748817

3.2 Interconnection Facilities

The power generated at each of the wind turbine generators is transported through the collector system. The collector system consists of buried cables and overhead collector lines. In some cases, there may be some shared use with existing Hydro One lines and poles. The collector system will be built to Utility/Ontario standards.

The energy from the Project will be collected via underground cabling and overhead lines and directed to a switching station. The switching station will connect directly to the local distribution system. The turbines will connect to the Hydro One distribution system. The power will be generated at approximately the 690V voltage level at the turbine step up to a local 27.6 kV collection system by nacelle-mounted transformers of each turbine for Vestas turbines.

3.3 Noise Setbacks

Noise receptors within 1,500 meters of the Wainfleet Wind Energy Project's turbine locations have been identified. A complete list of noise receptors have been provided in the **Noise Assessment Report** prepared by HGC Engineering. This list of coordinates was compiled by IPC Energy and HGC Engineering through site visits, records review, and geographic information systems (GIS). GIS was used to verify the accuracy of each receptor's coordinates.

(More to be included upon completion of the Noise Assessment Report.)

The maximum Sound Power Level for the Vestas V-100 1.8 megawatt turbine generator model is 105 dBA. The Wainfleet Wind Energy Facility will be comprised of up to five (5) wind turbines. Section 55 of *O. Reg 359/09* states that the minimum setback requirement between any turbine and noise receptor in this case is 550m, unless a noise impact assessment is completed. Setback distances and coordinates for all noise receptors within 1,500m of a turbine is presented in the Noise Assessment Report. The placement of project's five (5) turbines adheres to the minimum setback distances required and therefore a Noise Impact Assessment was not required. A Noise Impact Assessment is included with the REA Application documents as part of the Noise Assessment Report.

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3.4 Waste Management

The project will not produce toxic or hazardous materials during construction. Some petroleum, oils, and lubricants (POL) and other fluids, that may be considered toxic, may be brought on site for turbine construction, operations, and maintenance. Excess POL waste removed from the project site will be disposed or recycled according to provincial and municipal environmental waste management standards. Non-hazardous waste material will be handled by the municipal waste management system.

Excess materials required during construction will be reused where possible and recycled as an alternative to reuse. Some materials may be sent to the municipal landfill where necessary. Wainfleet Wind Energy Inc. and its constructor will conform to municipal and provincial disposal requirements for landfill waste and transport of excess construction materials.

3.4.1 Solid Waste

Solid waste generated as a result of construction of the Wainfleet Wind Energy Project will be produced from the assembly of the turbine and tower structures, foundations, subsurface cables, and vegetation cleared as required for equipment access to the site. The preferred method of disposing of solid waste for the constructed facility is reuse and recycling. In the event that materials cannot be reused or recycled, waste materials will be transported to the nearest waste disposal site as required. Operations and maintenance operation should not generate solid waste; however, if they do, this will be treated as during construction.

Cranes will be necessary to assemble the turbines and towers. All associated components will be brought onsite using a flatbed truck. The foundation of each turbine will be poured to a depth of one meter below ground level. Any concrete sections and associated structural steel remaining from the turbine foundation will be transported off-site. All holes created from the construction of the turbine foundations will be filled, and top-soil will be re-applied.

Waste materials generated from the assembly of the turbine foundation will be reused, recycled or transported to the nearest waste disposal facility will be made in consultation with a waste management company at the time construction activities occur.

Clearing of the surrounding environment during the construction phase will be kept to a minimum. The clearing of land to undertake construction activities will not utilize any slash and burn methods.

3.4.2 Sewage

Temporary bathroom and washing facilities will be required during the construction and decommissioning phases of the Wainfleet Wind Energy Project. These temporary facilities will be portable self-contained units constructed in compliance with Ontario's Environmental Protection Act to ensure that no sewage effluent is released untreated into the environment. All temporary wash and bathroom facilities will have holding tanks, and pumped and emptied as required. The Wainfleet Wind Energy Project Facility will not generate any sewage as a result of its operation as no permanent washroom facilities are part of this project.

DESIGN AND OPERATIONS REPORT

3.4.3 Liquid Waste

Liquid waste generated as a result of construction activities of the Wainfleet Wind Energy Project may include fuel, oil and lubricants found inside the wind turbines, as well as the machinery equipment brought onsite during the construction process.

The storage and use of any fuels, oils and lubricants during the operation of the project's facility will comply with all applicable provincial and federal regulations, codes, and guidelines. The disposal and cleanup of any liquid waste will be disposed or recycled according to provincial and municipal environmental waste management standards. Non-hazardous waste material will be handled by the municipal waste management system.

3.5 *Consultation and the Design*

Wainfleet has consulted and will continue to consult with municipal, agency, and public stakeholders to ensure that the design and operations of the project provide a net benefit to the public interest and offer no negative impacts to adjacent land uses.

Wainfleet Wind Energy Inc. will continue to consult with adjacent land users, local roads board, local municipality, federal agencies, provincial agencies, police and emergency services, and otherwise make suitable notice of the operation of the facility to those impacted by such activities.

The **Consultation Plan Report**, prepared before the REA Package is submitted to the Ministry of the Environment describes the consultation undertaken to arrive at the final proposed site design. **The Consultation Plan Report is not included as part of the draft REA Package.**

4.0 Operation and Maintenance Details

The activities required for the Operations and Maintenance phase will be discussed in this section on a per turbine basis. All activities found listed under “Operations & Maintenance” in **Table 4**, below, will be described in this report.

The project is expected begin construction during **June, 2010** pursuant to REA approval and subject to the requirements of government agencies. Construction activities will be initiated and completed at each turbine location between then and **October, 2011**.

This phase of the project includes the following activities:

- Environmental effects monitoring
- Turbine operation and electricity production
- Annual and semi-annual maintenance
- Repairs, as required
- Community relations

The scope of this project is summarized in **Table 4**, which provides each phase (Construction, Operation and Maintenance, and Decommissioning) with the corresponding activities that will be undertaken. The Operations & Maintenance phase is most relevant to this report; however, the Construction, and Decommissioning phases are presented to demonstrate the relationships among all phases of the project.

Table 4: Description of Each Phase	
Phase	Activities
Construction	• Surveying and geotechnical work • Access road construction and modification • Delivery of equipment • Foundation construction • Tower and turbine assembly and installation • Interconnection from turbines to substations • Switching station construction • Electrical tapline construction • Site clean-up and restoration • Turbine commissioning
Operation & Maintenance	• Environmental effects monitoring • Turbine operation and electricity production • Annual and semi-annual maintenance • Repairs, as required • Community relations
Decommissioning	• Land clearing • Road construction/modification • Removal of turbines and ancillary equipment • Removal of electrical taplines • Site restoration and rehabilitation

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The operations phase of the Wainfleet Wind Energy Project will include the following steps described below. The anticipated life expectancy of this project is approximately 20 years. It is expected that continuous operations will occur at the facility without any major interruptions to operational activities.

1. **Operation:** The Vestas V-100 turbine model blades will turn at a rate of 9.3 to 16.6 revolutions per minute. Turbine operations will cease in the events of mechanical malfunction, extreme weather conditions and during periods of maintenance. Supervisory Control and Data Acquisition (SCADA) systems and an operations building located at the switching station site will be used to capture real-time turbine feedback and monitor performance outputs.
2. **Maintenance:** Each wind turbine will have regular scheduled inspection and maintenance performed, which includes routine oil changes, motor maintenance, and lubricant and fluid replacement. To maintain proper operational output and safety standards of the facility, all turbine generators will be supervised by certified technicians in a manner that is consistent with the schedules recommended by selected equipment manufacturers. It is expected that each turbine will be serviced twice a year. Occasionally, central components of the wind turbines may require replacement such as the turbine blades. Any required replacement of turbine components will be consistent with the methods used during the construction phase. Once the turbines have reached their operating life expectancy, usually on average of 25 years, the old turbines will either be refurbished to extend the lifetime of the facility or the project will be decommissioned at the end of the contract period. All aspects of the project's facility, including roads and maintenance buildings will be maintained during the operations phase of the project. Provisions for regular grounds-keeping will also be carried out to ensure that there is year round access to the site.
3. **Environmental Effects Monitoring:** After construction of the project has been completed bird and bad surveys will be undertaken for environmental monitoring purposes during the facility's operation. The *Environmental Effects Monitoring Plan* in **Appendix A** of this report describes these activities.

The Wainfleet Wind Energy Project's *Environmental Effects Monitoring Plan* found in **Appendix A** of this report provides detailed information regarding the potential environmental impacts and mitigation methods associated with operational activities of this project.

4.1 Erosion Control and Operations and Maintenance

In the event that erosion prone areas become evident during the operations and maintenance of the facility Wainfleet Wind Energy will take necessary actions to re-vegetate or replant the affected areas. Wainfleet Wind Energy Inc. is responsible to undertake environmental effects monitoring as part of the EEMP following construction and through the life of the project to one year following decommissioning. Where erosion prone areas have become evident revegetation and replanting may be required.

DESIGN AND OPERATIONS REPORT

4.2 Sewage

The Wainfleet Wind Energy Project Facility will not generate any sewage as a result of its operation.

5.0 Communication Plan

5.1 Status Updates

As the project progresses through the construction, operation, and decommissioning phases Wainfleet Wind Energy Inc. will share project status updates with the Township of Wainfleet as well as the Region of Niagara. Updates will either be sent via mail or email. Similar updates will also be posted on the Wainfleet Wind Energy Project's website for interested parties and members of the public.

5.2 Emergency Notification

In the event of emergencies, the appropriate emergency response bodies will be notified. The *Environmental Effects Monitoring Plan* in Section 6 of this report provides details regarding emergency notification for the Wainfleet Wind Energy Project.

5.3 Protocol For Responding To Public Inquiries

The protocol that Wainfleet Wind Energy Inc. will abide by in response to any public inquiries with regards to this project will be as follows:

- A log will be kept of all public inquiries by Wainfleet Wind Energy Inc. for a minimum of 2 years.
- All public inquiries will be responded to within a reasonable timeframe by the project operator.
- All responses and actions taken as a result of public inquiries will be recorded in a log by the project operator.
- The appropriate agencies or authorities (i.e. the Ministry of Environment for noise issues) will be contacted by the project operator as required.

5.4 Contact Information

Wainfleet Wind Energy Inc. will provide all applicable project contact information, including mailing address, phone number, and email address to the local and regional municipalities and aboriginal communities within the area. Project contact information will also be provided on the projects website for public reference.

DESIGN AND OPERATIONS REPORT

The following organizations and/or individuals identified below may be contacted in the event of emergency situations at the Wainfleet Wind Energy Project's facility or to address regulatory issues. Contact information for the Project's Operators has also been provided. This list will be posted in the base of each turbine, and it will be carried by maintenance personnel employed by Wainfleet Energy Inc. during the operation phase of the project.

Table 1: Key Contact List for Wainfleet Wind Energy Project Facility		
Agency	Area	Phone Number
Emergency Contacts		
Ambulance/Police/Fire/Rescue		9-1-1
Wainfleet Fire Department & Emergency Services		9-1-1
Niagara Regional Police	Port Colborne Detachment	(905) 735-7811
Ontario Provincial Police (O.P.P.)	Niagara Detachment	(905) 356-1311
Environmental Emergencies & Spills		
Ministry of Environment, Spills Action Centre	Ontario	1-800-268-6060
Local Hospitals with Emergency Services		
Niagara Health System- Port Colborne General Site		(905) 378-4647
Niagara Health System- Welland Hospital Site		(905) 378-4647
Regulatory and Municipal Contacts		
Ministry of Natural Resources	Guelph District	519-826-4955
Ontario Ministry of Culture	St. Cathrines Office	1-800-263-2441

6.0 Environmental Effects Monitoring Plan

The Environmental Effects Monitoring Plan is found in **Appendix A** of this report

The Wainfleet Wind Energy Project's *Environmental Effects Monitoring Plan* (EEMP) has been developed by Morrison Hershfield (MH) to describe the environmental protection measures required for all activities associated with the Wainfleet Wind Energy Project. The *Environmental Effects Monitoring Plan* outlines the necessary monitoring protocols required to make certain that mitigations measures are effective and adequate. This plan should be considered a supporting document to the rest of the *Design and Operations Report* and fulfills the requirements outlined by *Ontario Regulation 359/09 - Renewable Energy Approvals* under the *Green Energy Act*.

This *EEMP* is applicable to all employees of Wainfleet Wind Energy Inc. working on the operation and maintenance phases of the Wainfleet Wind Energy Project and provides guidance to Wainfleet Wind Energy Inc.'s contractors and subcontractors on environmentally safe standards for project activities during operation and environmental monitoring of the project.

6.1 Project Commissioning and Scheduling

Wainfleet Wind Energy Inc. is expecting project operations to commence by October 2011. During the construction, operation and decommissioning phases of the Wainfleet Wind Energy Project environmental monitoring procedures will be carried out.

6.2 Purpose and Objectives of the EEMP

This *Environmental Effects Monitoring Plan* has been prepared to provide the required protection measures for all project activities associated with Wainfleet Wind Energy Project.

The purpose of the *Environmental Effects Monitoring Plan* is:

- To ensure that Wainfleet Wind Energy Inc.'s commitments to minimizing environmental effects are met.
- To provide a description of the environmental concerns related to the operation, maintenance, and decommissioning of the Wainfleet Wind Energy Project and instructions for mitigation of the potential impacts of these activities.
- To provide concise and clear instructions for implementing mitigation measures for the protection of environmental resources, and minimizing potential adverse environmental effects. To provide a means of tracking and recording actual effects of the project on valued ecosystem components.
- To ensure that the Wainfleet Wind Energy Project operations meet all provincial, federal and municipal requirements.
- To provide a reference document for planning and/or conducting operation, maintenance or decommissioning activities that may have an impact on the environment.

DESIGN AND OPERATIONS REPORT

The Environmental Effects Monitoring Plan is intended to be a supporting document of the REA application that provides guidelines for the protection of valued ecosystem components during operation, maintenance and decommissioning activities. Background information contained within the Environmental Effects Monitoring Plan is covered in more detail in the other technical reports of the REA Package

7.0 Consultant Legal Statement

Morrison Hershfield Limited ("MH") produced this report in accordance with our Proposal and information provided by IPC Energy ("the Client") and is based upon statements by the Client on the proposed design, construction, operations, maintenance, and decommissioning of the proposed wind energy project. The information and statements contained herein are for the sole benefit of the Client for the purposes of the Renewable Energy Approval.

The contents of this report are based upon our understanding of guidelines, regulations, and statutes which we believe to be current at this time. Changes in guidelines, regulations, statutes, and enforcement policies can occur at any time, and such changes could affect the conclusions and recommendations of this report.

While we have referred to and made use of reports and specifications prepared by others, we assume no liability for the accuracy of the information contained within those reports and specifications.

Appendix A: Environmental Effects Monitoring Plan



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Project Number: 1104036.00

Project Title: WAINFLEET WIND ENERGY PROJECT

Report: 003b-R02-1104036

Title: ENVIRONMENTAL EFFECTS MONITORING PLAN
(EEMP) REPORT

Client: IPC Energy
2550 Argentia Road Suite 105
Mississauga, Ontario
L5N 5R1

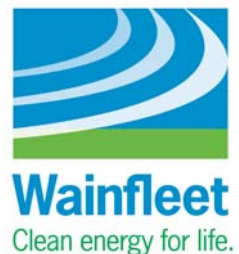
Attention: Mr. Sunny Galia Project Manager

Date: September, 2010

Morrison Hershfield Limited

A handwritten signature in blue ink that reads 'Erin McLachlan'.

Erin McLachlan
Terrestrial Ecologist and Environmental Planner



Environmental Effects Monitoring Plan

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Environmental Effects Monitoring Plan

1.0 BACKGROUND

1.1 PURPOSE OF ENVIRONMENTAL EFFECTS MONITORING PLAN

This Environmental Effects Monitoring Plan has been prepared to provide the specific methods and procedures that will be implemented to monitor the effectiveness of the mitigation measures for all project activities associated with the Wainfleet Wind Energy Project, as per Section 6.6.2 of the *Approval and Permitting Requirements Document for Renewable Energy Projects* (MNR, 2009). This document will ensure that **Wainfleet Wind Energy Inc.'s** commitments to minimizing environmental effects are met and that this project meets all provincial, federal and municipal requirements.

This Environmental Effects Monitoring Plan is applicable to all employees of **Wainfleet Wind Energy Inc.** working on the operation and maintenance phases of the **Wainfleet Wind Energy Project**. The plan will provide guidance to Wainfleet Wind Energy Inc.'s contractors and subcontractors on environmentally safe standards for project activities during construction, operation, and decommissioning phases and environmental monitoring of the project.

1.2 PROJECT SITE DESCRIPTION

The study area consists of approximately 3400 hectares of primarily agricultural fields. The land inside the study area is mostly flat, with an elevation of 174m to 182m above mean sea level.



Figure 1. Wainfleet Wind Energy Project Study Area

2.0 ROLES AND RESPONSIBILITIES

2.1 ROLES AND RESPONSIBILITIES FOR IMPLEMENTATION OF EEMP

The EEMP document for the Wainfleet Wind Energy Project will be upheld by the proponent, Wainfleet Wind Energy Inc., the Project Manager and individual Plan Holders. Responsibilities for the implementation and environmental monitoring of the EEMP are described below.

2.1.1 THE PROPONENT

Wainfleet Wind Energy Inc. as the proponent of the Wainfleet Wind Energy Project is responsible for ensuring that they and their agents or representatives diligently adhere to the procedures and practices outlined in the EEMP, as well as legal and regulatory conditions of approvals. The proponent is responsible for:

- Appointing a Project Manager to oversee the environmental monitoring of the project;
- Retain qualified professionals to confirm that environmental monitoring is correctly conducted during all phases and stages of the project; and
- Ensure that the regular reporting and documentation of the execution of the EEMP by qualified professional(s) is undertaken.

2.1.2 PROJECT MANAGER

The Project Manager as an employee of the proponent, Wainfleet Wind Energy Inc., is the primary party responsible for all aspects of the Project, including environmental, health and safety performance. Specific environmental responsibilities of the Project Manager are as follows:

- Ensure adequate plans and resources are in place to achieve minimal environmental impacts;
- Ensure compliance with relevant regulations, authorizations, permits and protocols;
- Review incident reports as they are submitted and advise on the proper course of action to be taken to deal with unexpected environmental conditions or events;
- Ensure ongoing communication with appropriate regulatory agencies and other interested parties on behalf of the proponent; and
- Facilitate compliance with the Environmental Effects Monitoring Plan as outlined in this document.

2.1.3 SITE SUPERVISOR

Wainfleet Wind Energy Inc. will designate a Site Supervisor to oversee all operations at the site. The responsibilities of the Site Supervisor are as follows:

- Review and approve EEMP revision requests;
- Conduct a review of the EEMP on an as needed basis and update as required;
- Have regulatory authorities review changes of a significant nature;

Environmental Effects Monitoring Plan

- Ensure EEMP document control and revisions;
- Consult with Project Manager and appropriate regulatory authorities with regards to the implementation of EEMP and any compliance issues; and
- Ensure that all construction sub-contractors are aware of and comply with all the requirements contained in this document.

2.1.4 CONSTRUCTION MANAGER

The Construction Manager will be responsible for the day to day coordination of construction activities on behalf of the contractor retained by Wainfleet Wind Energy Inc. The responsibilities of the Construction Manager are as follows:

- Familiarize themselves and their personnel with the EEMP;
- Provide training for all personnel working on site including subcontractors, trades people, and suppliers, and ensure that they have knowledge of the requirements contained in the EEMP;
- Issue copies of the EEMP to appropriate personnel and work site locations;
- Familiarize themselves and their personnel of any revisions made to the EEMP;
- Initiate changes to improve the quality of the EEMP; and
- Enforce the compliance of the EEMP with all personnel and subcontractors

2.2 TRAINING REQUIREMENTS

The Construction Manager will be responsible for advising all construction personnel (including subcontractors) of the necessary measures outlined in the EEMP and ensure that proper training or instruction of individuals is provided in the following areas:

- Correct and sanitary methods of garbage disposal in designated disposal locations;
- Hazardous materials and POLs (Petroleum, Oils and Lubricants) will be used only by personnel who are trained and qualified in the handling of these materials, and will only be used in accordance with manufacturer's instructions and government regulations. The Workplace Hazardous Materials Information System (WHMIS) program will be implemented and all employees involved with hazardous materials will be appropriately trained. WHMIS training is the responsibility of the Contractor.
- All workers will receive a brief environmental orientation from the Construction Manager or his/her designate prior to initiating work at the site.
- Project personnel will be trained in the use of on-site fire fighting equipment (*i.e.*, fire extinguishers) and locations of such equipment will be known to all personnel.

2.3 ENFORCEMENT AND COMPLIANCE OF EEMP

The Project Manager will be responsible for day-to-day field monitoring and for ensuring that the EEMP is implemented and complied with. The Site Supervisor and Construction Manager will liaise with the Project Manager and assist in ensuring that compliance with the EEMP and other permits is achieved. The Site Supervisor and Construction Manager

Environmental Effects Monitoring Plan

have the authority to make recommendations to improve inadequate environmental measures, or, if need be, to make recommendations to management to have the work, or a portion of work, suspended.

In situations where insufficient environmental protection results in an immediate threat to the environment, the MNR will be notified and consulted immediately. While awaiting response from MNR, interim measures may be implemented under the supervision of the Site Supervisor. Where danger to the environment is not an immediate threat, the necessary remedies will be implemented within 48 hours from receipt of notification of the circumstances. Failure to meet this requirement can result in suspension of the work, or a portion of the work, through the issuance of an Environmental Suspension Order. After an Environmental Suspension Order has been issued, work may recommence when the measures are completed to correct the noncompliance.

Specific issues or requests raised by Provincial and Federal regulatory bodies will be discussed with the Project Manager for consideration of changes to the work, and beneficial environmental effects resulting from the changes. Additionally, issues raised by such other bodies will be considered for future incorporation into the EEMP.

3.0 FACILITY OPERATION

The *Environmental Impact Statement, Natural Heritage Assessment Report* for the Wainfleet Wind Energy Project provides a detailed discussion of the project's potential impacts to the area's surrounding ecosystem components. Some of these concerns relate directly to the operation of the turbines and require the implementation of mitigation measures during the operational phase of the project.

3.1 FACILITY MAINTENANCE ACTIVITIES

3.1.1 TURBINE MAINTENANCE

Regular turbine maintenance for the Wainfleet Wind Energy Project is scheduled to occur at least twice per year. Maintenance activities will involve structural and mechanical inspections of the tower and turbine, as well as the necessary changing of hydraulic and lubricating fluids.

During scheduled routine maintenance visits inspections for leaks of hydraulic or lubricating fluids will also be conducted. Maintenance visits and associated activities for each turbine is expected to be conducted over a period of approximately 2 business days per turbine, with weather permitting. Within the first year of commenced operations, it is expected that additional maintenance time will be necessary to fine-tune each turbine.

Potential Impacts

The layout of the project's facility and location of turbines was designed to avoid direct impacts to natural areas, wildlife, and watercourses. However, potential impacts of turbine maintenance activities include:

- Turbine maintenance activities that include the use of oils, lubricants and other fluids may be considered toxic or hazardous, depending on quantities required and handling procedures.

Environmental Effects Monitoring Plan

- The toxic or hazardous fluids and their associated containers have the potential to contaminate soil, groundwater, and/or surface waters if not properly handled and disposed of appropriately.

Mitigation

Recommended mitigation measures to prevent spills and leaks include:

- The inspection and maintenance of wind turbines will be conducted by a minimum two-person team.
- Maintenance equipment will cross watercourses only at designated crossing sites.

The following procedures are designed to minimize the potential for spills or leakage of hazardous fluids associated with turbine maintenance activities onto vegetation, and into the surrounding soil and ground or surface waters:

Storage and disposal of petroleum, oils and lubricants (POLs)

- The transportation of petroleum, oils and lubricants (POLs) will be conducted in compliance with the *Transportation of Dangerous Goods Act*.
- POL storage will be done in compliance with applicable provincial and federal regulations, codes and guidelines.
- POLs will be stored within the base of the tower for the duration of each service visit.
- Upon completion of turbine maintenance activities, all POLs including waste will be removed from the site.
- Fire extinguishers will be located near any POL storage areas.
- There will be no smoking permitted within 50m of any POL storage area.
- “No Smoking” signs will be displayed at all POL storage sites and refueling areas.
- All generated waste POLs as a result of turbine maintenance will be held in a tank or other closed container and will be disposed of in accordance with proper waste management procedures.
- Greasy or oily rags or materials subject to spontaneous combustion will be deposited and kept in an appropriate receptacle until they can be disposed of at an approved waste disposal facility.
- A spill kit, including absorbent material, will either be stored in the base of the turbine tower or will be brought to the site during maintenance visits.

Servicing and Inspections

- During the twice annual maintenance visits inspections of oil and hydraulic systems will be undertaken.
- If any leak is found during maintenance activities they will be immediately reported to the Ontario Ministry of Environment, Spills Action Centre at 1-800-268-6060.

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- The project's turbine systems will be monitored remotely using a Supervision Control and Data Acquisition (SCADA) system. Technicians will determine when additional inspections are required on an as needed basis.
- No turbine maintenance activities will take place within 120m of a wetland or watercourse unless specified in the Environmental Impact Statement and appropriate mitigation measures have been provided.

Emergency Response

Although mitigation measures have been made to prevent any spills or accidents associated with turbine maintenance activities, there is still a possibility of accidents resulting in the release of hazardous materials into the environment. In the event that a spill occurs, action will be taken as outlined in **Section 5.2** of this EEMP.

3.1.2 ACCESS ROAD MAINTENANCE

Grading activities will be undertaken during the project's operations to maintain proper function of unpaved access roads by removing ruts, potholes and washboard conditions. Grading will also help maintain proper drainage of the project's facility and keep road surface conditions stable.

Potential Impacts

The layout of the turbines, access roads and transmission facilities was designed to avoid direct impacts to natural vegetation communities and to minimize potential impacts to Natural Areas and watercourses. However, potential impacts to vegetation, natural areas, and watercourses may include:

- Grading activities will loosen the top of the exposed road, which has the potential to cause erosion of the surface.
- If grading activities is not undertaken properly it can reduce the ability to control drainage runoff, which can cause sedimentation.
- Grading activities often generate dust.

Mitigation Measures

Recommended mitigation measures to protect natural vegetation communities, natural areas and watercourses include:

- During grading activities every effort to avoid surrounding vegetation areas should be made.
- Grading of areas where little to no vegetation is present after periods of heavy rain should be avoided to reduce runoff conditions.
- In the event that a berm is created at the edge of the road as a result of grading activities it will be collected and properly disposed of off-site
- Graded areas will be maintained to have a higher elevation than the drainage ditch path.

Environmental Effects Monitoring Plan

A contingency plan to manage any failure of erosion control measures is included in **Section 5.1**.

3.1.3 DITCH MAINTENANCE AND SHOULDERING

Ditch maintenance and shouldering activities are carried out in order for effective drainage of the roadbed to occur and to correct deficiencies that are a result of erosion, nonconformity in grade, water ponding on roadway, and restrictive vegetative growth that impedes drainage of the roadbed.

Potential Impacts

The layout of the turbines, access roads, and transmission facilities was designed to avoid direct impacts to natural vegetation communities and to minimize potential impacts to Natural Areas and watercourses. However, potential impacts to vegetation, natural areas, and watercourses may include:

- Erosion caused by exposed soil areas and the associated sediment-laden runoff effects on water quality, aquatic ecosystems and environmentally sensitive areas.

Mitigation Measures

Recommended mitigation measures to protect natural vegetation, watercourses and associated wildlife habitat include:

- A Buffer Zone of 120 m will be maintained between the end of ditching and any surrounding wetlands or water bodies.
- A check dam will be maintained at the end of the ditch (where the ditch meets the Buffer Zone).
- Additional erosion control structures such as rockfill, straw bales or rip rap may be installed further up the ditch as required.
- Natural drainage will be maintained whenever practical.
- Sediment deposited in the ditch will be removed when it reduces the capacity of the channel. Removed material and sediment will be disposed at a location more than 120 from a wetland, water body, to prevent any material from washing into these water bodies.
- If any petroleum-contaminated material is found in the ditch will be immediately reported to the Project Manager and the Ontario Ministry of Environment, Spills Action Centre.
- Any further sensitive features (e.g. watercourses, environmentally sensitive habitats) identified during pre-construction and construction activities will be protected during maintenance activities.

A contingency plan to manage the failure of erosion control measures has been included in **5.1**

Environmental Effects Monitoring Plan

3.1.4 SURFACING

With regards to this EEMP, surfacing activities during the operation of the Wainfleet Wind Energy Project concern the placement of aggregate on an unsealed road surface to restore grade levels and to shape shoulders.

Potential Impacts

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts on natural vegetation and watercourses. However, potential impacts to vegetation and watercourses include:

- The potential of sedimentation and accidental contamination of watercourses and aquatic habitats due to the handling and placement of aggregate.
- Impacts on air quality due to dust.

Mitigation Measures

Recommended mitigation measures to protect environmental effects associated with road surfacing include:

- Any aggregate placement will be conducted in such a manner to ensure road surface drainage flows from the centre of the surface to the drainage control structures (i.e., ditching).
- Any aggregate materials placed must be compacted to reduce moisture penetration.
- As required, water will be applied as a dust suppressant.
- Sensitive features (e.g. watercourses, environmentally sensitive habitats) identified during pre-construction and construction phases will be protected during maintenance activities.

A plan to manage failure of sedimentation control measures has been included in **Section 5.1**.

3.1.5 SNOW REMOVAL

As part of the Wainfleet Wind Energy Project's operational activities snow removal and the application of sand and/or salt will be necessary during the winter months to maintain safe conditions for maintenance activities.

Potential Impacts

The turbine layout, access roads, and transmission facilities was designed to avoid direct impacts to the natural environment and surrounding watercourses. However, potential impacts include:

- Saline runoff into watercourses as a result of excessive salt application.
- Excess sand application can cause blockages in drainage structures and can contribute to sediment-laden runoff into watercourses.

Mitigation Measures

Environmental Effects Monitoring Plan

Recommended mitigation measures to protect the surrounding natural environment and watercourses include:

- A professional service provider should be used for the removal of snow and ice on the facility's access roads.
- Wainfleet Wind Energy Inc. will ensure that the employed contractor adheres to the Best Management Practices as described in Environment Canada's *Best Management Practices for Salt Use on Private Roads, Parking Lots and Sidewalks*.
- The amount of sand and/or salt used at the project's facility should be kept minimal to that which is needed to ensure the safety of maintenance staff.
- Sand should be used primarily as the means of maintaining safe driving and working conditions during winter months. Salt should only be used as required.
- As much snow as possible should be plowed from the road before salt is applied.
- Salt application will be limited to targeted areas requiring extended treatment to ensure that minimal amounts of salt are used.
- Snow cleared from the project's access roads and site surfaces will not be relocated within 120m of any wetland, waterbody, or environmentally sensitive area.

3.1.6 SWITCHING STATION MAINTENANCE

During the project's operation switching station maintenance will also be required. Associated maintenance activities include the testing of circuit breakers, switchgear, ground grid systems, batteries, chargers, oil, insulating liquids and safety systems.

Potential Impacts

The layout of the projects turbines, access roads, and transmission facilities was designed to minimize direct impacts to the surrounding natural areas and watercourses. However, impacts may include:

- During switching station maintenance activities the use of toxic or hazardous oils and/or insulating fluids may be required and can pose an environmental hazard and safety risk if not handled properly.
- Toxic or hazardous fluids and their associated containers could potentially contaminate soil and/or ground water or surrounding water courses if not disposed of appropriately.

Mitigation Measures

The recommended mitigation measures to be followed to minimize the potential for spills or leakage of hazardous fluids are identical to the mitigation and emergency response measures that have been developed for the maintenance of the project's turbines described in **Section 5.0**.

3.1.7 TURBINE AND SWITCHING STATION CLEANING

In the event that dust or debris accumulates on the facility's equipment hindering operations or the ability to perform maintenance activities manual cleaning will be carried

Environmental Effects Monitoring Plan

out. Generally, the accumulation of dust and debris will be prevented by natural wind and rain events. Turbine blades will have to be cleaned of the dirt occasionally in order for the blades to perform at optimum efficiency. This will occur during normal maintenance.

Potential Impacts

The layout of the turbines, access roads, and transmission facilities was designed to avoid direct impacts to the surrounding natural areas. However, potential impacts may include:

- Cleaning procedures associated with the facility's turbines or switching station has the potential to cause cleaning materials and siltation to enter the aquatic environment.

Mitigation Measures

Recommended mitigation measures include:

- In the event that accumulations of dirt and debris are excessive, deck surfaces will be scraped or swept prior to blowing with compressed air or flushing.
- All material scraped loose will be collected and disposed of appropriately.
- All necessary precautions will be taken to prevent the discharge of any harmful substance into a watercourse, and all empty cleaner containers will be disposed of in an appropriate manner.
- The risk of negative environmental effects due to the introduction of foreign materials into the environment will be minimized by removal and proper disposal of waste material.
- Maintenance equipment will cross watercourses only at designated crossing sites.

3.2 ENVIRONMENTAL PROTECTION MEASURES FOR MATERIALS, EQUIPMENT, AND FACILITIES

3.2.1 PETROLEUM, OILS, LUBRICANTS, AND OTHER HAZARDOUS MATERIALS

A variety of potentially hazardous materials will be in use or stored during construction, maintenance and decommissioning phases for the proposed wind energy project. Potentially hazardous materials routinely used include: petroleum fuel, oils, lubricants, hydraulic fluids, acetylene, paints and solvents. The procedures and requirements of the Workplace Hazardous Materials Information System (WHMIS) program will be in place to protect employees and are generally applicable to the protection of the environment. These WHMIS procedures and requirements reinforce the proper handling, storage, and control of hazardous or toxic materials thereby reducing the potential for accidental release and consequent potential environmental effects.

Potential Impacts

The layout to turbines, access roads, and transmission facilities was designed to avoid direct impacts to natural vegetation and aquatic and marine habitat. However, potential impacts may include:

Environmental Effects Monitoring Plan

- In the event that there is uncontrolled release of hazardous materials in to the environment through accidental spillage it could have adverse effects on terrestrial, aquatic and marine habitat and species, soil, groundwater quality and human health and safety.

Mitigation Measures

Recommended mitigation measures to minimize the potential of any petroleum, oil and lubricants (POLs) spills on soil, vegetation, surface water, and groundwater include:

Storage of POLs:

- Fuel transport will be conducted in compliance with the *Transportation of Dangerous Goods Act*.
- Mobile fuelling trucks will be used to minimize the requirements for on-site storage of POLs.
- Diesel fuel and gasoline may be stored on site in limited quantities as required for one day's use. Fuel drums will be stored upright on a deck with drip trays for the collection of spilled substances.
- Where possible, vehicle maintenance will be performed off site, at a nearby commercial fuelling station, in order to minimize the amount of lubricants and oils stored on site.
- On-site POL storage will be in a ventilated, lockable steel container. The container will be equipped with galvanized steel drip trays for the collection of spilled substances.
- The on-site POL storage container shall be located on level terrain, at least 120 m from any water body, watercourse or wetland.
- Spill decks will be used for transferring products to smaller containers.
- Fire extinguishers will be located near POL storage areas. A spill kit, including absorbent material, will either be stored in the base of the tower or will be brought to the site during maintenance visits.
- POL storage areas will be identified by signs.
- Smoking will not be permitted within 50 m of any POL storage area. "No Smoking" signs will be displayed at all POL storage sites and refueling areas. On-site signage will indicate the location of smoking areas.

Equipment Fuelling:

Only equipment that is not easily transported will be refueled on site. All other vehicles and equipment will be refueled at a commercial fuelling station.

- When refueling equipment, operators will:
 - Use designated fuelling locations;
 - Use drips trays;

Environmental Effects Monitoring Plan

- o Use leak free containers and reinforced rip and puncture proof hoses and nozzles;
 - o Be in attendance for the duration of the procedure; and
 - o Seal all storage container outlets except the outlet currently in use.
- Fuelling must be done at least 120 m from a wetland or water body.
- The Contractor will make daily inspections of hydraulic and fuel systems on machinery.
- All leaks will be immediately reported to the MOE, Spills Action Centre at 1-800-268-6060.
- Servicing of equipment will not be allowed within 120 m of a wetland or water body.
- Fuelling attendants will be trained in the requirements under the Fuel and Hazardous Material Spills Contingency Plan in **Section 5.0** of this EEMP.

POL Waste Disposal:

- Waste POLs will be stored in a ventilated, lockable steel container. The container will be equipped with galvanized steel drip trays for the collection of spilled substances.
- Waste solvents and oils will be stored separately.
- All used oil and petroleum products will be removed as required and disposed in an acceptable manner in accordance with government regulations, and requirements, including but not limited to *O Reg 347/09* S. 17.2.
- Waste oil will be collected separately and offered for recycling or stored for collection by an appropriate special waste collection and disposal company.
- Greasy or oily rags or materials subject to spontaneous combustion will be deposited and kept in an appropriate receptacle until disposed of at an approved waste disposal facility.
- POL waste disposal will be the responsibility of the Contractor.

3.2.2 SOLID WASTE DISPOSAL

As part of the Wainfleet Wind Energy Project there is anticipation that some waste will be generated as a result of construction, maintenance and decommissioning phases of the project. Waste streams have been provisionally classified as domestic waste, paper, cardboard, wood and scrap steel and metals. This section concerns general measures to be undertaken for waste minimization, recycling and disposal.

Detailed information regarding anticipated volumes of waste generated throughout different stages in the project are provided by Vestas in the *Design and Operations Report*.

Potential Impacts

Environmental Effects Monitoring Plan

The potential impacts regarding waste disposal for the Wainfleet Wind Energy Project Include:

- If solid waste is not properly controlled and disposed of it can pose human health and safety concerns.
- Uncontrolled hazardous waste can contaminate soils, surface and groundwater, and can be toxic to local vegetation, fish and wildlife, if ingested in sufficient quantities.

Mitigation Measures

Recommended mitigation measures to minimize the potential environmental effects of solid waste disposal include:

- The Contractor, with approval from the Site Supervisor will designate and use areas for the transfer and limited temporary storage of hazardous materials and special wastes during construction. These sites are to be properly labeled and appropriately controlled.
- Temporary waste storage areas are to be located a minimum of 120 m from a wetland, water body, or other environmentally sensitive area.
- All waste will be handled in accordance with relevant provincial and federal requirements, including but not limited to *O Reg 347/09 S. 17.2*.
- Waste material will not be dumped on-site.
- Waste and debris will be prevented from entering any water bodies, wetlands, watercourses or other environmentally sensitive area.
- Waste disposal and storage facilities and areas will be properly protected from the elements in accordance with all applicable legislation and regulation to ensure that run-off will not form nor enter any watercourses, water bodies or wetlands.

4.0 ENVIRONMENTAL FEATURES MONITORING

4.1 BIRDS

The bird study consisted of five components: a winter bird survey, a short-eared owl survey, a spring shorebird and waterfowl survey and a breeding bird survey and a potential significant wildlife habitat survey.

A total of 17 raptor species were observed during winter studies, with density averaging 19 per 100 km, which is classified as “very low density.” The low number of raptors observed is probably a reflection of poor habitat for these species in the project area. Approximately 55 Wild Turkeys were observed feeding on corn 400m from the large deciduous swamp near Turbine 5.

No Short-eared Owls were observed during targeted surveys. Very few sites provide potential habitat and it is not likely that wintering birds are present.

The spring migration study showed concentrations of 15 different migrating species, with Ring-billed Gull (*Larus delawarensis*) and Canada Goose (*Branta canadensis*) being the most abundant species. None of the species are classified as species at risk, by MNR or COSEWIC.

Environmental Effects Monitoring Plan

During the breeding season point count surveys, 51 different breeding species were identified. None of the species are classified as species at risk, by MNR or COSEWIC.

During the potential species at risk habitat survey, no Red-headed Woodpecker, Whip-poor-will or Hooded Warbler habitat was found within 120m of the project works.

No colonial bird nesting sites, waterfowl stopover and staging areas, shorebird migratory stopover areas, raptor winter feeding and roosting areas or Turkey Vulture summer roosting areas were found within 120m of the project works. A large field adjacent to a wetland near Turbine 4 could function as waterfowl nesting habitat, but is not within 120m of the project works. Some of the forest cover along the watercourses may function as landbird migratory stopover areas and the large deciduous swamp near Turbine 5 could function as a wild turkey wintering range.

Potential Impacts

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts to natural vegetation communities and to minimize potential impacts to birds and bird habitat. However, potential impacts to birds and bird habitat may include:

Turbine operation will likely result in a small number of bird fatalities as a result of collisions with the turbines, particularly during spring and fall migration and during poor weather conditions.

Turbine lighting may increase the mortality rate of nocturnal birds.

Overhead transmission lines may disrupt bird movement.

Bird habitat may be fragmented or otherwise impacted during the construction of the turbines, access roads and associated infrastructure.

Birds may be displaced from their habitat due to loss of feeding, breeding or migratory stopover habitat or from human activity, structures or noise.

Mitigation Measures

Recommended mitigation measures to protect birds and bird habitat include:

The Migratory Birds Convention Act prohibits the destruction of active nests of migratory birds. All construction activities will be carried out in a manner that ensures compliance with this regulation.

Lighting at the project site will only be used for air navigation and safety purposes, as required by Transport Canada. It is anticipated that negative impacts to birds will be minimized by this method of turbine lighting.

No construction activities will be permitted from March 1st- August 1st to protect nesting raptors.

The existing forests within the project area will not be reduced in area or fragmented to protect their habitat functions.

Transmission lines will not be built over water or migration routes. Lines will be placed close to trees and below the level of the tree tops wherever feasible.

Environmental Effects Monitoring Plan

The decommissioning plan includes the prompt removal of turbines and infrastructure once the facility is no longer operational. The areas will be restored and revegetated with native species following project decommissioning.

Monitoring

Post-construction monitoring surveys will include standardized carcass searches, weekly, during the spring and fall migration periods to assess the frequency of avian collision mortalities, as per the Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (Environment Canada, 2007) and Wind Turbine and Birds: A Guidance Document for Environmental Assessment (Environment Canada, 2007).

Scavenger studies and searcher efficiency trials will also be implemented in accordance with the guidance provided in Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (Environment Canada, 2007). The post-construction mortality survey will be designed in consultation with Environment Canada - Canadian Wildlife Service and the Ontario Ministry of Natural Resources.

Post-construction monitoring reports will be submitted to Ministry of the Environment for each monitoring year.

Contingency Plan

The effectiveness of the mitigation measures will be evaluated during the first two years of operation and modified as required. If the monitoring program demonstrates a high number of fatalities, impacts to a Species at Risk or high disturbance effects, additional monitoring to determine the cause of these impacts may be required.

4.2 Mammals

The mammal study consisted of three components: an investigation for potential bat maternity colonies, bat hibernacula and deer wintering areas.

One forest was identified as a potential bat maternity colony due to the abundance of suitable roosting trees. The forest was monitored for bat activity (visually) at dusk during the roosting season and bat activity was observed. An acoustic monitoring program was initiated using an ANABAT SD2 broadband bat detector to monitor bat activity from 7:00 pm- 7:00 am for 10 nights in spring 2010 (June 7th- 16th). Over the 10-night study, bat activity was observed on five nights representing two to four bat species (little brown bat and/or small-footed bat, as well as big brown bat and/or silver-haired bat). These bats cannot be distinguished acoustically, as the calls have very similar frequency, call shape and duration. (See Section 4.0 for a discussion of this area.)

No potential bat hibernacula were identified within 120m of the project area. No additional areas of deer wintering habitat (besides those areas already identified by the Ministry of Natural Resources) were identified within 120m of the project area.

Potential Impacts

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts to natural vegetation communities and to minimize potential impacts to bats and their habitat. However, potential impacts to bats and bat habitat may include:

Environmental Effects Monitoring Plan

- Turbine operation will likely result in a small number of bat fatalities (<10 bats/turbine/year) as a result of collisions with the turbines and barotrauma (internal hemorrhaging caused by rapid air pressure reduction near the moving turbine blades). The majority of bat fatalities at wind power sites occur in the late summer and early fall, and long-distance migratory bats (i.e. hoary bat, eastern red bat, silver-haired bat) appear to be most vulnerable to collisions with moving turbine blades (MNR 2010).
- Bats may be displaced from their habitat due to loss of feeding, breeding or migratory stopover habitat or from human activity, structures or noise.

Mitigation Measures

Recommended mitigation measures to protect bats and bat habitat include:

- Clearing of riparian zones will be minimized in order to preserve water quality and aquatic insect abundance.
- Landscape features important to bats will be maintained, including forested ridges, wetlands and forest edges.
- Snags and old, dying trees will be left standing, where feasible, to provide roosting opportunities.
- During tree clearing activities, if a bat roost is encountered, activities should cease and the Ministry of Natural Resources should be contacted immediately.

Monitoring

Post-construction monitoring will be carried out at the Wainfleet Wind Energy Project site for three years following project commissioning, as per the MNR document Bats and Bat Habitats: Guidelines for Wind Power Projects (Draft, March 2010).

Post-construction monitoring will begin once the majority of turbines (>50%) are operational and will consist of carcass searches every three days at 4 of the 5 turbine locations during the migratory season (May 1- September 30). One turbine location will be used as a control site for experimental trials.

Carcass searches will be conducted in transects (5.0 - 6.0 meters apart), either in a rectangular or circular shape around the wind turbine. The search radius will include the entire area within a 50 meter radius of the turbine. These searches will identify the number of bats killed per turbine per year. All carcasses found will be photographed and the following data will be recorded: date, time, location, species, sex (if known), carcass condition, specific injuries, searcher name, distance to turbine, ground cover, distance to plot centre.

The number of bat carcasses found during the survey must be corrected for two variables: the removal rate of carcasses by scavengers (and other means) and searcher efficiency. These trials will be conducted at the control turbine location (i.e. the turbine not being searched regularly).

Scavenger Correction Factor

Environmental Effects Monitoring Plan

Scavenger Correction Factor is determined through experimental trials where a minimum of ten marked carcasses are randomly placed near the control turbine and are monitored until they are removed to determine average carcass removal time. These trials should be conducted at least once per month during the bat mortality studies in a variety of weather conditions. The overall scavenger correction factor will be calculated as described in Appendix A.

Searcher Efficiency

Searcher efficiency trials will be conducted for all searchers. These trials are conducted by placing a minimum of ten marked carcasses (or decoys) randomly near the turbine and comparing the number of planted carcasses to the actual number the searcher found. The searchers should not know when they are participating in an efficiency trial. Searcher efficiency will be calculated for each searcher as described in Appendix A.

The carcasses of silver-haired bat, hoary bat and Eastern red bat found during mortality searches can be collected and frozen (and thawed) for use in carcass removal and searcher efficiency trials. Other species should not be used, because of white-nose syndrome contamination risks. All searchers should have recent rabies pre-exposure vaccinations.

Post-construction monitoring reports will be submitted to Ministry of the Environment for each monitoring year.

Contingency Plan

Should the post-construction monitoring report indicate an annual mortality greater than anticipated, operational monitoring shall be implemented from sunset to sunrise from July 15th to September 30th for the duration of the project, as per the MNR document Bats and Bat Habitats: Guidelines for Wind Power Projects (Draft, March 2010).

4.3 Herpetofauna

The herpetofaunal study consisted of three components: amphibian call surveys, a potential species at risk habitat survey and a significant wildlife habitat survey.

Five species of amphibians were observed during amphibian call surveys. There are several old fields and forested areas near watercourses that could serve as potential Milksnake habitat. Since no Milksnakes were observed during herpetofauna studies and the project area does not contain specialized Milksnake habitat features, the potential milksnake habitat is not considered significant.

Potential Impacts

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts to natural vegetation communities and to minimize potential impacts to herpetofauna and their habitat. However, potential impacts to herpetofauna and their habitat may include:

Herpetofauna may be displaced from their habitat due to loss of feeding, breeding or hibernation habitat or from human activity, structures or noise.

Mitigation Measures

Recommended mitigation measures to protect herpetofauna and their habitat include:

Environmental Effects Monitoring Plan

- Conscientious design, installation and maintenance of sediment control measures wherever there is a risk to siltation of surface waters.
- Timely revegetation of exposed soils, both for temporary work areas and final grades (existing vegetation on embankments shall be maintained as long as possible and new slopes shall be stabilized as soon as possible by seeding and mulching).
- Vegetation removal will be minimized.
- The contractor will be required to specify construction access routes and fuelling areas to avoid watercourse and groundwater contamination and siltation.
- Storage of hazardous materials will not occur within 120m of any environmentally sensitive areas, including waterbodies or wetlands.
- Sediment will not be disposed of within 120m of any environmentally sensitive areas, including waterbodies or wetlands.
- Ensure that the construction team is able to identify Milksnakes and other Species at Risk.

Contingency Plan

Should a Milksnake or other Species at Risk be observed during construction, all activities in the surrounding area of the sighting should halt and the Ministry of Natural Resources should be contacted to determine the appropriate mitigation measures or monitoring procedures.

4.4 Watercourses

There are four watercourse crossings intersected by taplines and one seasonal watercourse (Casey Drain) located approximately 100m from a proposed turbine location. Casey Drain does not provide fish habitat near the vicinity of the proposed turbine. The watercourses are part of three different watershed systems: Casey Drain Watershed, Old Mill Race Creek Watershed and Welland River Watershed. Casey Drain has low sensitivity. Old Mill Race Creek Watershed is a moderately sensitive watercourse and provides habitat for one Species at Risk: Grass Pickerel (*Esox americanus vermiculatus*) which is listed as Special Concern under the Federal *Species at Risk Act* and the Provincial *Endangered Species Act*. The Welland River is a highly sensitive watercourse and provides habitat for two Species at Risk: Grass Pickerel (*Esox americanus vermiculatus*) and River Redhorse (*Moxostoma carinatum*) which are listed as Special Concern under the Federal *Species at Risk Act* and the Provincial *Endangered Species Act*.

Potential Impacts

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts to the watercourses. However, potential impacts to the watercourses and fisheries habitat include:

- Sedimentation and accidental contamination of watercourses, groundwater and wetlands;
- Loss of riparian vegetation;

Environmental Effects Monitoring Plan

- Increase in siltation;
- Removal of channel morphology (pools, riffles, and runs);
- Removal of in-stream vegetation for fish shelter and food supply and;
- Loss of fish habitat following a significant flow reduction downstream.

Mitigation Measures

Recommended mitigation measures to protect the watercourses and fisheries habitat include:

- All in-water works will need to strictly follow the MNR timing windows for Old Mill Race Creek (March 1st-July 1st), Welland River (March 1st-July 1st) and Casey Drain (March 1st-June 1st).
- Conscientious design, installation and maintenance of sediment control measures wherever there is a risk to siltation of surface waters.
- Where access roads cross drainage channels, appropriate culvert design and construction will be undertaken in consultation with Niagara Peninsula Conservation Authority.
- Timely revegetation of exposed soils, both for temporary work areas and final grades (existing vegetation on embankments shall be maintained as long as possible and new slopes shall be stabilized as soon as possible by seeding and mulching).
- Vegetation removal will be minimized.
- The contractor will be required to specify construction access routes and fuelling areas to avoid watercourse and groundwater contamination and siltation.
- The contractor will be reminded of the requirement to report contamination spills (including the discharge of sediment into waterways) as per the Environmental Protection Act and the Fisheries Act. All toxic chemicals and contaminants must be disposed of off-site in approved disposal sites under appropriate MOE regulation.
- Storage of hazardous materials will not occur within 120m of any environmentally sensitive areas, including waterbodies or wetlands.
- Sediment will not be disposed of within 120m of any environmentally sensitive areas, including waterbodies or wetlands.

Monitoring

Environmental supervision is required during construction to ensure adherence to the prescribed mitigation measures and for early identification of runoff and erosion issues.

Post-construction monitoring will be carried out at the Wainfleet Wind Energy Project one year after construction has been completed. The post-construction monitoring will consist of an inspection of all watercourses, drainage facilities and seeded or replanted areas.

Contingency Plan

Environmental Effects Monitoring Plan

The effectiveness of all mitigation measures will be noted and corrected or altered as required. Should there be an accidental spill (including the discharge of sediment into waterways), the contractor will report it immediately as per the *Environmental Protection Act* and the *Fisheries Act*.

4.5 Vegetation/ Natural Areas

Small portions of three MNR-designated provincially significant wetlands are within 120m of the project works.

Small portions of two municipality-designated significant woodlots are within 120m of the project works. These woodlands are deciduous swamp communities, which are sensitive to changes in hydrology. Portions of the significant woodlots within the project area contain old growth characteristics.

One of the deciduous swamp communities is an Oak Mineral Deciduous Swamp: a provincially rare vegetation community.

A total of 6 regionally rare plant species were observed in the project area: Soft Agrimony (*Agrimonia pubescens*), Poke Milkweed (*Asclepias exaltata*), Drooping Woodreed (*Cinna latifolia*), Mountain-holly (*Ilex mucronata*), Wood Lily (*Lilium philadelphicum*), and Giant Ragweed (*Ambrosia trifida*).

Potential Impacts

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts to natural vegetation communities and to minimize potential impacts to the Natural Areas. However, potential impacts to the vegetation and natural areas may include sedimentation and accidental contamination of groundwater and wetlands.

Mitigation Measures

Recommended mitigation measures to protect the vegetation and natural areas include:

- Timely revegetation of exposed soils, both for temporary work areas and final grades (existing vegetation on embankments shall be maintained as long as possible and new slopes shall be stabilized as soon as possible by seeding and mulching).
- Vegetation removal will be minimized.
- The contractor will be required to specify construction access routes and fuelling areas to avoid wetland and groundwater contamination and siltation.
- Storage of hazardous materials will not occur within 120m of any environmentally sensitive areas, including wetlands.
- Sediment will not be disposed of within 120m of any environmentally sensitive areas, including wetlands.
- Monitoring
- Environmental supervision is required during construction to ensure adherence to the prescribed mitigation measures

Environmental Effects Monitoring Plan

- Post-construction monitoring will be carried out at the Wainfleet Wind Energy Project one year after construction has been completed. The post-construction monitoring will consist of an inspection of all vegetation communities within 120m of the project works.

Contingency Plan

The effectiveness of all mitigation measures will be noted and corrected or altered as required.

4.6 Lighting Control

There will be lighting requirements associated with the project's equipment operation. As required by Transport Canada standards and regulations, some of projects wind turbines will be equipped with lights throughout the project's operational life for aeronautical safety.

Potential Impacts

- The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts to the surrounding wildlife. However, potential impacts to wildlife include:
- Turbine lighting may increase the mortality rate of nocturnal birds, as they maybe attracted to lights.

Mitigation Measures

Recommended mitigation measures to protect birds and bird habitat include:

- Lighting at the project site will only be used for air navigation and safety purposes, as required by Transport Canada. It is anticipated that negative impacts to birds will be minimized by this method of turbine lighting.
- Lighting of the turbines during operation will be kept to the minimum required by Transport Canada for aeronautical safety.

4.7 Noise

As part the operations phase of the project, and the commissioning of turbine operations it is anticipated that the facility will generate detectable levels of noise. Mechanical noise generated as a result of the movement of gears and mechanical parts will be contained within the nacelle by sound insulating and isolating materials. Aerodynamic noise caused by the movement of air around the turbine blades will account for the noise level emitted by each turbine.

It is anticipated that during the construction and decommissioning phases of the project noise will be generated as a result of associated activities. Further details regarding Noise have been discussed in the Noise Assessment Report of the REA Package.

Potential Impacts

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts to the natural environment and surrounding residential communities. However, potential impacts to surrounding residential communities include:

Environmental Effects Monitoring Plan

- Projected noise levels generated as a result of project's turbine operations has been acknowledged as an issue of public concern by the local residents of the Township of Wainfleet. A Noise Assessment Study was undertaken using worst-case scenario conditions. Results of the Wainfleet Wind Energy Project's Noise Assessment Study indicate that noise levels at non-participating receptors surrounding the project's proposed turbine locations will be within the sound level limits of 40 dBA established by the Ministry of the Environment.
- The Noise Assessment Study submitted to the Ministry of Environment as part of the Wainfleet Wind Energy Project's REA Application concluded that noise level criteria was met at every non-participating noise receptor.

Mitigation Measures

Recommended mitigation measures to protect the surrounding residential communities include:

- Conscientious design of project facilities and turbine layout to adhere to minimum setback requirements and sound power levels established by regulatory agencies.
- If the turbine is producing more noise at a non participating receptor, the turbines could be operated in the reduced noise mode.

Monitoring

After operations commence a noise monitoring program will be established and administered by Wainfleet Wind Energy Inc. to ensure that generated sound emissions as a result of project operations do not exceed the established acceptable noise level limits. It is not expected that noise level limits generated from the project's operation will change unless there is damage to turbine equipment, such as a damaged turbine blade or malfunction in the gear box or generator or yaw system or the main bearings. Due to continual real-time monitoring of turbine performance any change in performance outputs would be immediately recognized the by Supervision Control and Data Acquisition (SCADA) monitoring system and would immediately be addressed by the project management team.

The monitoring program will also provide local residents with the opportunity to file a noise complaint with the project's operator. The project operator will be responsible for recording all noise complaints received by the public and responding to them within a reasonable time period. In the event that multiple noise complaints are received additional acoustic monitoring will be undertaken to determine the necessary action required to address complaints.

5.0 Unplanned Events and Contingency Plans

5.1 Erosion Control Failure

Minimizing erosion and the related potential sedimentation of receiving water bodies is a critical environmental management concern for this project. Erosion control methods will be applied where there is the potential for erosion due to rain, flowing water, steep slopes,

Environmental Effects Monitoring Plan

and/or highly erodible soils. This program contains measures to prevent failure of erosion control structures.

Potential Effects

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts to the surrounding natural environment and watercourses. However, potential impacts may include:

- Associated sediment-laden runoff and the resulting effects on water quality, aquatic ecosystems, and environmentally sensitive areas such as wetlands.

Mitigation Measures

The following recommended mitigation measures will be implemented to minimize the potential environmental effects in the event of erosion control failure:

Emergency Response Action Plan

- Supplies for any emergency response will be on hand at all times. This may include, but is not necessarily limited to, straw bales, filter fabric, and silt curtains.
- If siltation of the nearby watercourses is observed, the Construction Manager will be notified and the source of the siltation identified. Siltation generally results from ineffective preventative measures.
- Construction operations that are determined to further aggravate the problem will be suspended.
- Sources of erosion will be isolated, contained and controlled by the implementation of such measures as straw bales or brush mats. Erosion control structures will be repaired immediately.
- If the release has affected, or has the potential to affect, a sensitive area (e.g. a wetland or watercourse), it will be the responsibility of the Site Supervisor to contact and consult with the appropriate regulatory authorities (e.g. MNR, Fisheries and Oceans Canada) as required for notification and planning.
- To ensure that erosion and sediment control measures are in effective working order, their condition will be monitored periodically.
- Accumulated sediment will be removed upon reaching a depth of one-half the effective height of the control measure or a depth of 300 mm immediately upstream of the control measure.
- For all erosion control measures, accumulated sediment will be removed as necessary to perform maintenance repairs.
- Accumulated sediment will be removed immediately prior to the removal of erosion control structures.
- The sediment removed will be deposited at a distance greater than 120 m from any watercourse or water body in an area that will not result in erosion and runoff into the watercourse or water body, as approved by the Construction Manager.

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5.2 Fuel and Hazardous Materials Spills

A Fuel and Hazardous Material Spill Contingency Plan has been prepared to describe the appropriate response system that Wainfleet Wind Energy Inc. will follow in the event that there is an accidental release of petroleum, oils, or lubricants (POLs) or other hazardous materials into the natural environment.

Potential fuel or hazardous materials can be spilt as a result of fuel transfers from storage containers to machinery and vehicles. Possible hazardous material spills can be associated with hydraulic fluids, lubricating oil, solvents, anti-freeze, and paint.

The purpose of Fuel and Hazardous Material Spill Contingency Plan is to minimize:

- The pollution of any land or water feature;
- The affected area;
- Degree of disturbance associated with spill clean-up; and
- Danger to persons.

Potential Effects

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impact to the natural environment and minimize the potential impacts to wildlife, vegetation, and watercourses. However, potential effects may include:

- Damage and contamination to nearby vegetation, soil, surface water, groundwater, wildlife, aquatic organisms, and human health.

Mitigation Measures

Recommended mitigation measures to prevent the occurrence of Fuel and Hazardous Materials Spills and the associated potential effects include:

- A full-time employee of Wainfleet Wind Energy Inc. will become the facility's Health and Safety Officer and will attain WHMIS certification and Occupational First Aid training.
- The handling of hazardous materials will be carried out by only trained and qualified personnel.
- All hazardous material will be handled in accordance to the manufacturer's instruction and government regulations.
- The WHMIS program will be implemented in accordance with the Ontario *Occupational Health and Safety Act* and Regulations.
- All employees dealing with hazardous materials will be trained in the use of safety equipment, spill prevention equipment, and emergency response procedures.
- All hazardous materials will be stored and handled in accordance with applicable provincial and federal regulations, codes, and guidelines.
- All hazardous material containers will be properly labeled in compliance with the requirements of WHMIS.

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- Material Safety Data Sheets (MSDS) will be available for all hazardous materials in use or stored on-site.
- Storage of hazardous materials will not occur near environmentally sensitive areas, such as within 120m of wetlands or water bodies.
- All necessary precautions will be implemented to prevent the spillage and release of hazardous materials to the environment.
- The removal and disposal of hazardous materials from the project site will be in accordance with government regulations and requirements
- Appropriate waste collection and disposal companies will be used to relocate the hazardous materials to an approved waste disposal facility.
- Regular inspection of work equipment will be conducted to ensure that items such as hoses and safety equipment are in proper working order.

Contingency and Response Plan

- If and when it is safe to do so, the individual who discovers the leak or spill will make an immediate effort to stop and contain the leak or spill.
- During construction, any leak and spill must be reported immediately to the Construction Manager.
- The Construction Manager will be responsible for the immediate contact of the Ministry of Environment, Spills Action Centre to report a spill. The number to be used is 1-800-268-6060.
- A Spill Report Form, which has been prepared for this project must be filled out and include:
 - A description of the source, including the name of the owner or operator;
 - The nature, extent, duration and environmental impact of the release;
 - The cause or suspected cause of the release; and
 - Any remedial action taken or to be taken to prevent a recurrence of the leak or spill.
 - The site Contractor will have the full authority to take appropriate action without unnecessary delay. The Spill Report will be prepared by the Contractor immediately following the discovery of the spill or leak and forwarded to the Project Manager.
- The responsibility for managing the clean-up effort in accordance with this contingency plan will be that of the construction Contractor.
- The construction Contractor will, in consultation with the appropriate regulatory authorities (See **Appendix B**):
 - Deploy on-site personnel to contain the spilled material using a dyke, pit, or absorbent material;

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- o Assess site conditions and environmental impact of various cleanup procedures;
- o Choose and implement an appropriate cleanup procedure;
- o Deploy on-site personnel to mobilize pumps and empty drums (or other appropriate storage) to the spill site;
- o Dispose of all contaminated debris, cleaning materials, and absorbents by placing in an approved disposal site.

Spill Cleanup Resource List:

As part of the Operational Phase of the project, the following items will be kept available at an appropriate location within the project's facilities in preparation of the need to respond to an accidental release of a fuel and/or hazardous materials:

- Absorbent materials (e.g. sorbent pads, Sorb-All, peat moss).
- Small equipment such as shovels, rakes, tool kit, sledgehammer, buckets, stakes, tarpaulins, one empty drum, and protective equipment.
- **Section 5.6** of this EEMP contains the contact list for spill response.

5.3 Wildlife Encounters

During the construction phase of the project there may be potential for interactions between wildlife and construction site personnel. This plan outlines the appropriate measures to be taken if encounters occur.

Potential Effects

The layout of turbines, access roads, and transmission facilities and associated construction activities was designed to minimize the potential impacts to wildlife and encounters with humans. However, potential impacts to wildlife may include:

- Distress for both the animal and employee
- Serious injury could result to site workers in some instances
- Threats to personnel include encounters with wildlife, especially rabid animals and those with young.
- Any bites from animals are potentially dangerous
- Distressed animals can potentially alter feeding and breeding behaviour
- Physical injury or death to wildlife could also occur.

Mitigation

Recommended mitigation measures to protect both wildlife and humans from encounters include:

- All construction site personnel will remain within designated work areas and will be briefed in the following measures.

Contingency and Response Plan

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- No person on the work site will attempt to harass wildlife
- All construction equipment and vehicles will yield the right-of-way to wildlife, if it is safe to do so
- If a disruption or injury to wildlife occurs as a result of an encounter the Site Supervisor will contact the MOE Spills Action Centre and have the on-call Conservation Officer paged
- If dead animals are encountered (including birds or bats), they will be removed and disposed, as soon as possible, in consultation with a local Provincial Wildlife Officer.
- If an injured or dead bird or bat is encountered, the following information will be recorded:
 - o date and time it was found,
 - o location (GPS coordinates, if available, or description of location in the absence of precise coordinates),
 - o photograph taken if possible,
 - o state of decomposition,
 - o estimated number of days since death,
 - o injury sustained (if identifiable),
 - o cause of injury (if known), and
 - o species.

This information will be kept on file with Wainfleet Wind Energy Inc. for incorporation into the post-construction bird and bat monitoring programs.

5.4 Fires

During the operations phase of the Wainfleet Wind Energy Project there is a low potential that an unexpected fire to occur. This contingency plan details the fire prevention measures to be used as well as response action plans.

Potential Impacts

The layout of turbines, access roads, and transmission facilities was designed to avoid direct impacts to the natural environment and wildlife in the event of a fire. However, potential impacts may include:

- Alteration or destruction of terrestrial habitat
- Direct mortality of wildlife
- Fire fighting chemicals and spilled materials could enter surrounding watercourses and adversely affect aquatic habitats
- Fires could also adversely affect air quality
- Fires pose risks to human health and safety

Environmental Effects Monitoring Plan

Mitigation Measures

Recommended mitigation measures to protect the natural environment, wildlife, and human health and safety as a result of fire include:

Personnel Training:

- All staff working on the project site will be trained in the use of on-site fire-fighting equipment, fire prevention and response, including emergency services phone numbers (see Section 5.0 of this document) and locations of on-site fire-fighting equipment.

Prevention:

- All flammable waste will be disposed of on a regular basis.
- There will be no smoking within 50 m of flammable product storage or usage. Areas for disposal of smoking material will be clearly posted.
- Fire-fighting equipment, sufficient to suit on-site fire hazards, will be maintained in proper condition and to the manufacturer's standards.

Contingency and Response Plan

- Notification of nearby personnel will happen immediately.
- Immediate steps will be taken by on-site personnel to extinguish the fire using appropriate equipment.
- Notification of the Project Manager and Site Supervisor.
- In the event that the fire cannot be contained, the local Fire Department will be contacted at 9-1-1.
- In case of related medical emergencies, emergency medical assistance will be requested from 9-1-1.

5.5 Accidents and Malfunctions

5.5.1 Aeronautical Obstruction

The Wainfleet Wind Energy Project's (5) five turbines will reach a maximum height of 145 m from the base of the tower to the tip of the highest blade. This may cause a potential hazard to low-flying aircraft.

Potential Impacts

The layout of the project's turbines was designed to avoid direct impacts to low flying aircrafts and permit the safe use of flight paths within the vicinity of the project site by meeting Transport Canada safety standards and regulations. However, potential impacts to aeronautical operations include:

- Aircraft collision with the wind turbine or its tower or abrupt avoidance maneuvers could result in the injury or death of the passengers aboard the aircraft, tower maintenance personnel if they are present, and any other people in the vicinity of the tower.

Environmental Effects Monitoring Plan

Mitigation

Recommended mitigation measures to prevent the occurrence of aeronautical obstruction include:

- Compliance with current Transport Canada regulations requiring lighting for structures between 90 and 150 m tall within two nautical miles of a VFR route (Visual Flight Rules) or any structure taller than 150m.
- The Wainfleet Wind Energy Project wind turbines will be built and maintained in compliance with Transport Canada lighting regulations.
- All aircraft warning lights will be inspected during turbine maintenance visits.
- The operation of aircraft warning lights will be monitored between maintenance visits by the automated SCADA system (Supervisory Control and Data Acquisition).

5.5.2 Ice Fall and Ice Throw

There is potential for ice to accumulate on wind turbine blades during events of freezing rain or when super-cooled cloud droplets are intercepted by the turbine blades. As a result there is potential for the ice to either fall or be thrown from the turbine blades. The risk of ice fall or ice throw is generally only present during days of the year when weather conditions provide the opportunity for ice buildup at the height of the turbine blades. The potential hazard of ice falling from a stationary turbine blade is comparable to the hazard of ice falling from a communication tower or transmission line.

Potential Impacts

The layout of the project's turbines, access roads, and transmission facilities was designed to avoid direct impacts caused by ice fall or ice throw. However, potential impacts may include:

- Human health and safety
- Safety of property located within the vicinity of the project location

Mitigation Measures

Recommended mitigation measures in protection of any human health or safety risks associated with ice fall or ice throw include:

- All wind turbines will be equipped with sensors that will detect imbalances within the rotor system such as that which would result from ice build-up. The sensor will cause the turbine to stop rotating and remain offline until the imbalance has been corrected, which will significantly reduce the chance of ice throw.
- Signs will be posted along access roads and at the base of the tower warning of the potential for ice fall.
- Any work on the turbines during icing condition will stop and staff will leave the site cautiously.

Environmental Effects Monitoring Plan

- Staff may have to work during the icing conditions in case of turbine repair or maintenance. However they will use appropriate safety gear in order to avoid injuries from ice throw.

5.5.3 Injury of Site Personnel

While undertaking turbine maintenance activities associated with the Wainfleet Wind Energy Project staff will be required to enter the turbine.

Potential Impacts

Potential impacts to the safety of project maintenance staff include:

- The potential risk of injury to maintenance workers includes activities associated with the climbing of the turbine tower and working inside the turbine nacelle itself.
- Maintenance staff will be elevated up to 100m above ground level in a confined space, which will be difficult for local emergency rescue and response teams to access.

Mitigation

Recommended mitigation measures to protect turbine maintenance staff from injury include:

- Required turbine maintenance and other associated activities will be performed by two or more trained staff members at all times who are familiar with the turbine manufacturer's turbine rescue procedures.
- The Vestas V-100 Safety Instruction document will be followed at all times by project staff.
- Workers are to carry two-way radios or cell phones to maintain communications between the nacelle and the base of the tower.
- If a maintenance worker becomes injured and cannot climb down the tower on their own, other staff members present will conduct rescue operations until the injured party has reached ground-level. Local emergency response teams will be contacted to transport the injured staff members to the nearest hospital for medical treatment.
- Local emergency response services will be contacted before staff commences any rescue procedures.
- Proper rescue response procedures will be developed by Wainfleet Wind Energy Inc. in consultation with the turbine manufacturer.

Environmental Effects Monitoring Plan

5.6 Key Contact List

The following organizations and/or individuals identified below may be contacted in the event of emergency situations at the Wainfleet Wind Energy Project's facility or to address regulatory issues. Contact information for the Project's Operators has also been provided.

This list will be posted in the base of each turbine, and it will be carried by maintenance personnel employed by Wainfleet Energy Inc. during the operation phase of the project.

Table 1: Key Contact List for Wainfleet Wind Energy Project Facility		
Agency	Area	Phone Number
Emergency Contacts		
Ambulance/Police/Fire/Rescue		9-1-1
Wainfleet Fire Department & Emergency Services		9-1-1
Niagara Regional Police	Port Colborne Detachment	(905) 735-7811
Ontario Provincial Police (O.P.P.)	Niagara Detachment	(905) 356-1311
Environmental Emergencies & Spills		
Ministry of Environment, Spills Action Centre	Ontario	1-800-268-6060
Local Hospitals with Emergency Services		
Niagara Health System- Port Colborne General Site		(905) 378-4647
Niagara Health System- Welland Hospital Site		(905) 378-4647
Regulatory and Municipal Contacts		
Ministry of Natural Resources	Guelph District	519-826-4955
Ontario Ministry of Culture	St. Cathrines Office	1-800-263-2441

6.0 Conclusion

The mitigation measures outlined in this report have been designed to minimize the impacts to the natural features of the project area. Specific post-construction monitoring programs have been designed to monitor the effectiveness of these mitigation measures. Each monitoring program is designed with a contingency plan to correct or alter mitigation measures that are not successful. Post-construction monitoring reports will be submitted to Ministry of the Environment for each monitoring year.

Appendix A

Calculations

Environmental Effects Monitoring Plan

The overall scavenger correction factor (S_c) will be calculated as follows:

$$S_c = \frac{n_{\text{visit 1}} + n_{\text{visit 2}} + n_{\text{visit 3}}}{n_{\text{visit 0}} + n_{\text{visit 1}} + n_{\text{visit 2}}}$$

S_c is the overall scavenger correction factor

$n_{\text{visit 0}}$ is the total number of carcasses placed

$n_{\text{visit 1}}$ is the total number of carcasses remaining on visit 1

$n_{\text{visit 2}}$ is the total number of carcasses remaining on visit 2

$n_{\text{visit 3}}$ is the total number of carcasses remaining on visit 3

Searcher efficiency (S_e) will be calculated for each searcher as follows:

$$S_e = \frac{\text{number of carcasses found}}{\text{number of carcasses placed} - \text{number of carcasses scavenged}}$$

S_e is the searcher efficiency

The weighted average of overall searcher efficiency (S_{eo}) will be calculated as follows:

$$S_{eo} = S_{e1}(n_1/T) + S_{e2}(n_2/T) + S_{e3}(n_3/T) \dots$$

S_{eo} is the weighted overall searcher efficiency

S_{e1} is the searcher efficiency for searcher 1

S_{e2} is the searcher efficiency for searcher 2

S_{e3} is the searcher efficiency for searcher 3

n_1 is the number of turbines searched by searcher 1

n_2 is the number of turbines searched by searcher 2

n_3 is the number of turbines searched by searcher 3

T is the total number of turbines searched by all searchers

Percent area searched (P_s) will be calculated as follows:

$$P_s = \frac{\text{actual area searched}}{\pi r^2}$$

P_s is the percent area searched

r is the radius (50m)

Corrected mortality estimates (C) will be calculated as follows:

$$C = \frac{c}{(S_e \times S_c \times P_s)}$$

Environmental Effects Monitoring Plan

C is the corrected number of bat fatalities
c is the number of carcasses found
 S_e is searcher efficiency
 S_c is the overall scavenger correction factor
 P_s is the percent area searched

Appendix B

Spill Reporting Guides

**Spills Reporting -
A Guide to Reporting Spills and Discharges**

As required by the

**(Ontario) Environmental Protection Act
(s.92 and s.15)**

and

**Ontario Regulation 675/98
Classification and Exemption of Spills and Reporting
of Discharges**

May, 2007

**Spills Reporting -
A Guide to Reporting Spills and Discharges**

As required by the

**(Ontario) Environmental Protection Act
(s.92 and s.15)**

and

**Ontario Regulation 675/98
Classification and Exemption of Spills and Reporting of
Discharges**

May, 2007

Spills Action Centre

Ontario Ministry of the Environment

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This document has been produced for information purposes only.
Consult the official Statutes of Ontario for specific and most current references.

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THIS DOCUMENT IS PROVIDED FOR INFORMATION PURPOSES ONLY AND IS NOT INTENDED AS ADVICE. USERS SHOULD SATISFY THEMSELVES WITH RESPECT TO THEIR FULL OBLIGATIONS REGARDING SPILLS REPORTING, SPILL PREVENTION AND CONTINGENCY PLANNING, AND SHOULD ENGAGE TECHNICAL EXPERTS AND LEGAL COUNCIL. THE MINISTRY OF THE ENVIRONMENT IS NOT RESPONSIBLE FOR ANY DAMAGES WHATSOEVER ARISING FROM THE INTREPETATION OF INFORMATION PRESENTED IN THIS DOCUMENT.

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SPILLS AND DISCHARGES REPORTING

As required by the

(Ontario) Environmental Protection Act
(s.92 and s.15)

and

Ontario Regulation 675/98

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OTHER RELEVANT MINISTRY OF THE ENVIRONMENT DOCUMENTS:

- **PLANNING FOR SPILL CONTINGENCIES - suggestions for industry and municipalities**
- **MOE's EMERGENCY RESPONSE PLAN**
- **ONTARIO REGULATION 224/07 – SPILL PREVENTION AND CONTINGENCY PLANS**
- **GUIDELINE FOR IMPLEMENTING SPILL PREVENTION AND CONTINGENCY PLANS**

IN ONTARIO

REPORT

SPILLS (S.92 EPA) AND DISCHARGES (S.15 EPA)

TO THE

MINISTRY OF THE ENVIRONMENT'S

SPILLS ACTION CENTRE

1 - 800 - 268 - 6060
(TOLL-FREE, PROVINCE-WIDE, 24/7)

416 - 325 - 3000
(TORONTO AREA)

SPILLS MUST ALSO BE REPORTED TO THE

MUNICIPALITY IN WHICH A SPILL OCCURS

Spills and Discharges Reporting

1. INTRODUCTION

The Ministry of the Environment (“Ministry”) is responsible for achieving and maintaining environmental quality that will protect human health and the ecosystem, and will contribute to the well-being of the people of Ontario.

When a spill or a discharge of contaminants into the natural environment occurs, Canadian federal and provincial agencies that administer safety, transportation and environmental legislation and related programs generally hold the discharger responsible for dealing with problems created by the discharge. In Ontario, specific notification, cleanup and liability provisions for spills of pollutants are addressed in Part X of the (Ontario) *Environmental Protection Act*, R.S.O. 1990, Chapter E.19 (“EPA”).

Ontario Regulation 675/98 Classification and Exemption of Spills and Reporting of Discharges was amended to prescribe specific reporting details for both Part X spills and discharges that must be reported under s.15(1) of the EPA. Examples of such discharges would be pollutants seeping from a river bank caused by historical contamination or discharges such as sewage treatment plant bypasses occurring during storm events which may cause adverse effects.

The primary purpose of this Guide is to offer practical guidance of the reporting provisions for spills that must be reported under s. 92 of the EPA, discharges that must be reported under s.15(1) of the EPA and O. Reg. 675/98. Chapters 4 through 10 of this Guide discuss the various discharge reporting requirements and spill classification and exemptions for Part X spills.

2. THE ENVIRONMENTAL PROTECTION ACT, PART X, SPILLS

Part X was added to the EPA during the 1970s after the costs for the cleanup of a series of significant spills were left to the taxpayer. Subsequent litigation was based, in large part, on common law principles, because then-available environmental legislation did not definitively address duties and responsibilities for spills. The current Act devotes an entire segment to spills, Part X, and assigns clear reporting and cleanup duties. Part X also addresses other related topics including the rights of municipalities to respond, and rights of other parties affected by spills. The cornerstone of Part X is the definition of a spill and the reporting and cleanup duties of involved parties.

Part X of the EPA establishes three basic elements: the duty to report a spill, the duty to clean up, and accountability.

More specifically, s. 92 of the EPA requires the discharger to **report** a spill to the Ministry, to the municipality, where the discharger is not the owner, to the owner of the spilled pollutant, and under some circumstances to others. O. Reg. 675/98 further requires that the discharge telephone the Spills Action Centre (“SAC”) and provide information to the person who answers the call. In general terms, s. 92 of the EPA sets out that those who spill, those who cause or

permit a spill, and those who had control of the pollutant that spills, are made responsible for reporting the event to SAC as quickly as possible. Similarly, s. 92 of the EPA states that spills must also be reported as quickly as possible to the municipality in which the spill occurred.

Furthermore, under s. 93 of the EPA, there is a duty to contain and **clean up** the pollutant, and to restore the spill site to essentially pre-spill conditions where this can reasonably be expected. Those who had control of the spilled pollutant, and the owner of the pollutant, are both given responsibility for containment and cleanup where the spill causes or is likely to cause the adverse effects (as defined in s.1 of the EPA), regardless of contributing circumstances.

Section 99 addresses **accountability** by extending rights to third parties for the recovery of costs and expenses, as well as loss and damages, from the person who had control of the spilled pollutant and the owner of the pollutant spilled without having to prove fault or negligence. Another aspect of accountability, is that municipalities, under ss.100 and 100.1 of the EPA, are given the authority to respond to spills, the right to enter property for the purpose of response, and the right and a mechanism, the Municipality's Order, to recover costs from those the Act holds accountable for the spill. Finally, there is a mechanism (see ss. 94 and 97 of the EPA) that allows the Crown to intervene or pre-empt inadequate response efforts at the expense of those held accountable.

Other sections of Part X enhance, or rely on, the three basic elements: reporting, cleanup, and accountability.

3. DEFINITIONS

Several terms are defined specifically for the purpose of Part X. This Chapter will set out some of the most commonly used defined terms. Other Part X terms, as well as terms defined elsewhere in the EPA on which Part X relies, are reproduced in Annex I of this Guide. Terms that apply to other discharges reportable under s. 15(1) of the EPA are also included in Annex I.

A “spill” is defined in Part X to be a specific subset of discharges. A “spill” is a discharge into the natural environment, from or out of a structure, vehicle or other container, that is abnormal in quality or quantity in light of all the circumstances of the discharge. In more general terms, a spill is essentially any accidental, abnormal or inadvertent release of a pollutant discharged into the natural environment from or out of a man-made container. It is important to note that the definition of a spill itself does not include small quantity exemptions. Rather, these exemptions are found in O. Reg. 675/98.

Part X defines a “pollutant” to be a subset of the term “contaminant”. A “pollutant” is a contaminant other than heat, sound, vibration or radiation. A contaminant is defined in s. 1 of the EPA as any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that causes or may cause an adverse effect. Note that “adverse effect” is also defined in s.1 of the EPA (see Annex I for this and other relevant definitions).

4. SPILLS AND EPA SUBSECTION 15(1) DISCHARGES THAT MUST BE REPORTED

Part 2 of O. Reg. 675/98 is entitled Reporting of Discharges and prescribes the notification requirements for both ss. 15 and 92 of the EPA.

Section 92 of the EPA was amended by the *Environmental Enforcement Statute Law Amendment Act, 2005* (commonly referred to as Bill 133). Prior to the amendment, the obligation to report spills under s. 92 only applied to a spill of a pollutant that causes or is likely to cause an adverse effect. The amendment broadened the application of s. 92 by removing the reference to causes or is likely to cause an adverse effect. The section now applies to every spill of a pollutant. However, O. Reg. 675/98, discussed in Chapters 9 and 10 of this Guide, provides a number of exemptions to section 92. An important exemption provided in Ontario Regulation 675/98 permits a person, through the development of a spill prevention and contingency plan, to identify those spills that are not subject to 92 because they satisfy the regulation's requirements for "non-reportable" spills. The purpose of the exemption in combination with the amendment to section 92 is to encourage persons to develop spill prevention and contingency plans.

In the case of s.15 (1) of the EPA, a discharge must be reported if it is out of the normal course of events and it causes or is likely to cause an adverse effect (and the person is not otherwise required to notify the Ministry under s. 92 of the EPA). The discharger must determine whether the potential risks that arise from events such as storm related sewage bypasses (e.g. potential health impacts to downstream water users) meet the criteria in s.15(1) and need to be reported.

Cleanup requirements established under Part X arise for spills of pollutants that cause or are likely to cause adverse effects as defined by the EPA. Therefore, awareness of the potential adverse effects for substances that spill is important with respect to response. For instance, spills of oils into a creek may impact wildlife, vegetation and limit potential uses by the public.

5. WHO MUST REPORT SPILLS (s.92) AND DISCHARGES (s.15(1))

The reporting provisions of Part X of the EPA are found in Section 92 of the EPA. Section 92 imposes reporting duties on:

- a) the person that spills or who causes or permits the spill,
- b) the person who had control of the pollutant immediately prior to the spill, and
- c) police officers and employees of a municipality or other public authorities who may have been informed of or who are investigating a spill unless they have reasonable grounds for believing that such notice to the Ministry has been made (s. 92(4)).

The reporting provisions for s. 15(1) of the EPA place the reporting duties on the person who discharges or causes or permits the discharge of a contaminant. This person and persons described in a) and b) above are collectively referred to as the discharger in this Guide. The reporting details required of the discharger are found in Chapter 8 of this Guide.

Persons addressed in c) above are collectively referred to as persons in the public service in this Guide. Section 13 of O. Reg. 675/98 requires that these persons provide their name and telephone number and should attempt to provide the name and telephone number of the discharger. The only other details required of persons in the public service are the date and time of the spill or discovery of the spill and its location although it would be helpful if these persons also provided their best assessment of the consequences of the spill.

Chapter 6 of this Guide outlines in more detail who must report to whom, and uses examples to illustrate the circumstances under which these notification requirements apply.

6. WHO MUST BE NOTIFIED

Notification to the Ministry (ss. 15(1) and 92(1)(a) of the EPA),

Subsection 13(2) of O. Reg. 675/98 requires that reports must be made to the Ministry by speaking with a person at the Ministry's SAC. SAC operates 24 hours per day, every day of the year and is responsible for:

- receiving reports of spills and other events that require immediate reporting to the Ministry,
- determining the adequacy of reported spills response activities,
- facilitating or triggering a response where it appears the response is inadequate, and
- activating an Ministry field response (on-site assessment), as required.

A Province-wide, toll-free telephone number is available to industry and the public for the reporting of spills and other events that require the Ministry to be notified immediately, and for reporting other urgent environmental matters. The Centre's province-wide telephone number **800-268-6060** is widely advertised, as is its Toronto number **416-325-3000**.

Notification to the municipality (s. 92(1)(b) of the EPA)

In addition to notifying the Ministry, Part X of the EPA also requires every spill to be reported to the municipality in which the spill occurs. Larger municipalities advertise a telephone number for such reporting duties in local telephone directories. Smaller municipalities may direct such calls to their respective works or engineering department, while some municipalities may not have formalized a mechanism for receiving such reports. The responsibility for locating an appropriate municipal contact point in the event of a spill rests with the parties given notification responsibilities under Part X, namely, the person who spills or causes or permits the spill, and the person who had control of the pollutant immediately prior to the spill.

Notification to the owner (s. 92(1)(c) of the EPA)

Part X of the EPA requires that the person report the spill to the owner of the spilled pollutant if the person required to report is not the owner of the pollutant spilled. This reporting requirement would apply to the person who spills or who causes or permits the spill, and the person who had control of the pollutant immediately prior to the spill. Similar to other reporting provisions of Part X, the owner must be notified "forthwith". The reason for this notification requirement (notifying the owner) is that s. 93 of the EPA (the section that establishes response

and cleanup duties) holds both the owner and the person who had control of the pollutant immediately prior to the spill jointly responsible for cleanup.

An example of where the person in control of the pollutant that was spilled may be a different party to the owner is readily found in the transportation industry. By way of illustration, Part X holds both the transport operator involved in an accident in which something is spilled and the owner of the pollutant spilled as a result of that accident responsible for an appropriate and timely response and cleanup. In transportation accidents, the owner of any spilled cargo is most probably located far away from the spill site, while the transport operator involved is on-site. In this example, the requirement imposed on the transporter to notify the owner of the spilled pollutant ensures that the owner is given fair opportunity to become involved in response decisions as the owner of the spilled pollutant may be required to share the costs associated with any spill response.

Notification to the person in control (s. 92(1)(d) of the EPA)

For spills where the person who is required to report is not the person who had control of the pollutant immediately prior to the spill, Part X requires the person who spills, or causes or permits the spill, to notify the person who has control of the pollutant if he knows or is able to ascertain readily the identity of the person having control of the pollutant. This requirement is intended to ensure that the response required to be undertaken under Part X can be triggered by the parties given that responsibility, namely the person in control and the owner of the pollutant spilled.

For instance, if a subcontractor's equipment ruptures a tank or cracks a pipe at a facility, such as a bulk terminal, which then discharges a pollutant, Part X requires the equipment operator to notify forthwith the person in charge of the facility.

The above example also highlights that Part X addresses "persons". The reader should note that Part X addresses individuals, as well as municipalities, corporations and other organizations, and holds every person involved in a spill accountable for their actions.

7. WHEN TO REPORT SPILLS AND DISCHARGES

Both ss.15 (1) and 92 of the EPA, requires that notification be made "forthwith". Courts have interpreted this term to mean as quickly as possible under the circumstances.

In the case of Part X spills, the duties for the persons required to notify SAC and others come into force "immediately when the person knows or ought to know that the pollutant is spilled" (s. 92(2) of the EPA) but this does not mean that the spill needs to be reported immediately. Forthwith should be taken to mean without undue delay, that is, as soon as possible. Reasonable delay may include setting in motion mitigative measures such as initial efforts to stop or contain the spill, the notification of first responders and potentially affected parties, and the gathering, without pause, of information critical to the Ministry's understanding and assessment of the event.

It should be noted that there have been successful convictions for the failure to report spills “forthwith” where notifications were made a couple of hours after the spill. As such, it is generally recommended that notification be made as soon as possible, and in most cases, no later than a couple of hours after the duty to notify becomes effective.

It is strongly suggested that a first call to the Ministry, made as quickly as possible under the circumstances, is appropriate and satisfies the intent of Part X reporting requirements, even if only preliminary or sketchy details are initially available. Section 13(4) of O. Reg. 675/98 requires that the information listed in that section be provided “to the best of the person’s knowledge”. Additional information about the spill then must be reported as more details of the event become available (see ss. 13(5) and 13(6) of O. Reg. 675/98).

8. REPORTING

Part 2 of O. Reg. 675/98 sets out the information that must be provided when notifying the Ministry under ss 15(1) and 92 of the EPA. All information listed in s. 13(3) of the regulation must be provided to the Ministry. The information in s. 13(4) also must be provided, unless it qualifies under s. 13(6) as not being relevant under the circumstances of the discharge. Note that the onus is on the person reporting to demonstrate that information is not relevant.

The person notifying SAC should exercise judgement in determining the amount of information sufficient to make the first call to SAC. Note that not all of the information listed in ss. 13(3) and (4) of O. Reg. 675/98 need be provided at the time of the initial call. Subsection 13(5) allows for further information to be provided at a later time in order to satisfy the requirements of the regulation. The initial notification is intended to provide the Ministry and others with information to assess the Ministry’s role and the necessity of a response to the discharge; the information requirements are not intended to delay notification by the person reporting or to take away from the response to a discharge.

In the case of a spill, circumstances may dictate that additional information is required by the Ministry beyond what is provided for in the regulation. Section 92(3) of the EPA allows the Ministry to require this information to be provided at any time. The request for additional information may deal with more specific information regarding the pollutants or the circumstances of the spill beyond what is required by the regulation.

Persons who report spills under s.92 of the EPA and discharges under s. 15(1) of the EPA must fulfill the prescribed reporting requirements stipulated in Part 2 of O. Reg. 675/98, described in detail below. If the reporting party becomes aware of missing information that is required under O. Reg. 675/98 then the information must be provided forthwith (s.13(5) of O. Reg. 675/98). If initial information provided to SAC changes significantly then updated information must be reported forthwith upon this new information becoming known to the discharger (s.13(7) of O. Reg. 675/98). For example if a spill is initially reported as contained on-site but later information becomes available that some pollutants have escaped containment and entered a water course then this new information must be reported to SAC or as directed forthwith.

Mandatory Reporting Details

- The caller's name and telephone number and position within corporation or municipality if applicable.
- The location of the discharge.
- The date and time the discharge was discovered and, if known, occurred.
- The name, telephone number and role of each person contacted and/or responsible for coordinating a response to the discharge. (Not intended to include every crew member).
- The duration of the discharge and whether the discharge is continuing.
- The identity and quantity of the pollutants discharged and any known hazards of the pollutant or its constituents. Hazards may typically be found on the Material Safety Data Sheet (MSDS) for the pollutant.
- If the person required to notify is a "regulated person" under the EPA (i.e. is subject to O. Reg. 222/07 - Environmental Penalties), the person must identify whether the pollutant spilled is a "toxic substance" under that regulation.
- The location of the source of the pollutant and the best available information regarding the cause of the discharge. It is understood that information regarding cause may change and any significant revision should be reported as per s.13 (7) of O. Reg. 675/98. If the cause is not known when the spill is reported, then a description of the steps that are being taken or will be taken to determine the cause.
- A description of any adverse effects that occurred or may occur. These effects may include but not be limited to any personal or public safety or health threats, potential impacts to well or water intakes, impacts to private property offsite from the spill location, impacts to fish and wildlife habitat or flood plain areas, other environmental impacts, or any other of the adverse effects described in the EPA.

Reportable Details if Relevant

- A description of any conditions that aggravated or mitigated the adverse effects, or that may do so, including weather, surface water and groundwater conditions. Windspeed and direction may be particularly relevant to spills to air and precipitation may aggravate spills to land.
- If the discharge of the pollutant is to other properties, whether the owners or occupants of the properties affected by the discharge will provide access to a person who is required under the EPA or by an order to take steps to prevent, eliminate or ameliorate any adverse effects that are caused or may be caused by the discharge. For example If a spill of a liquid pollutant flows offsite from Company A to Company B property then Company A, the discharger, should be allowed access to Company B property to carry out their s. 93 EPA cleanup responsibility.
- Any other pollutants that were or may be discharged into the natural environment as a result of the circumstances that gave rise to the notification and any adverse effects that resulted or may result from the discharge of such pollutants. Examples would be a chemical reaction between a spilled pollutant and other stored materials or creating an unsafe environment for workers who are in care and control of hazardous materials or processes.
- Any actions that were taken or will be taken to prevent, eliminate or ameliorate any adverse effects, and if the discharge is a spill, any actions taken to satisfy the person's

duty under section 93 of the EPA and the name and telephone number of every person responsible for carrying out these actions. Where one person is coordinating the action of others only the name of the coordinator is required. As well, any circumstances, including weather or traffic conditions that may interfere with these actions.

9. CLASSIFICATION OF SPILLS O. Reg. 675/98

O. Reg. 675/98 classifies eleven types of spills, circumstances, industry type or activities, and exempts these, under specified conditions, from all or part of Part X duties and responsibilities.

Of the eleven classes of spills, three are exempted from Part X entirely, including reporting and cleanup requirements. Two additional classes of spills are exempted from all reporting requirements of Part X while other Part X duties and responsibilities remain for these two classes. The remaining six classes of spills are exempted from most Part X reporting requirements, and retain other Part X duties and responsibilities.

All eleven classes of spills created by O. Reg. 675/98 remove the requirement for police officers and all other public service or public sector employees to notify the Ministry.

All but two classes of spills created by the O. Reg. 675/98 carry a variety of conditions that must be met for the applicable exemption to apply.

O. Reg. 675/98 also encourages those who manage substances that may spill to evaluate potential risks within their operations and to develop appropriate spill contingency plans. A “Class X Spill” under O. Reg. 675/98 is one addressed in a spill contingency plan that meets certain standards for relatively small and manageable spills. The requirement for immediate reporting is waived for such spills. This encourages the development of acceptable spill contingency plans that establish reportable threshold quantities for some substances that might spill under certain conditions and where the impact of such a spill is minimized, for instance, by backup containment or secondary containment and other restraint mechanisms. Such contingency plans should facilitate decision-making processes for employees and others when spills occur. The development of these plans also offers those who may experience spills the opportunity to review the risks of their activities, to organize an effective response structure, and to train staff. All of this has the overall beneficial effect of facilitating spill prevention.

As of September 1, 2008, all Class X exemptions must comply with the requirement prescribed in the Spill Prevention and Contingency Plan regulation (“O. Reg. 224/07”). Prior to September 1, 2008, as part of the transition to O. Reg. 224/07, facilities have the option of seeking a Class X exemption using either the Canadian Standards Association standard CAN/CSA-Z731-03 (Emergency Planning for Industry), an equivalent standard approved by a Director as appropriate for the industry or by adhering to all the elements of O. Reg. 224/07, including s. 6(2).

A Part X reporting requirement summary, and a summary of the classification and exemption of spills introduced by O. Reg. 675/98, is offered in Annex II of this Guide.

10. REGULATION 675/98 CLASSIFICATION AND EXEMPTIONS

Class I: Approved Discharges

A Class I spill is a discharge of a pollutant that is approved by any Ministry approvals instrument, such as a certificate of approval, license or permit. Approved discharges are exempt from all of Part X of the EPA if all requirements in conjunction with the applicable approvals instrument are met, and the discharge does not contravene any other part of the EPA, other provincial or federal legislation, or municipal by-laws.

Assuming that no other regulatory mechanisms are contravened, Class I spills include such discharges as treated wastewaters in accordance with applicable approvals instruments, and the normal application of approved pesticides in an approved manner.

Class II: Discharge of Water

A Class II spill is a discharge of water caused by natural events from a man-made reservoir, or potable water released from municipal water mains. Discharges of water are exempt from all of Part X. This exemption removes all duties and liabilities associated with Part X for events such as the accidental release of water from reservoirs that might fail, and for accidental failures of municipal water mains.

The exemption from Part X of the EPA for a discharge of water from a reservoir applies to events where the resultant is an increase in the quantity of water downstream of the release, but the exemption does not apply to things or pollutants, such as silt, that may be carried by the released water. The release of water from municipal water mains is limited to potable water. Super-chlorinated water from water mains that may be released in disinfection efforts, and other maintenance, repair or testing practices that result in the release of water other than drinkable water, would not qualify for this exemption.

Class III: Household Fires

A Class III spill is a discharge of combustion products from fires of household materials. Class III spills apply to pollutants from fires where materials involved in the fire are of a quantity and quality that would normally be found in 10 or fewer households. Class III spills are exempt from all of Part X. This exemption is intended to remove the duties and responsibilities of Part X from events such as house fires and other relatively small fires, while maintaining these duties for fires (and really large fires) at industrial or chemical facilities, including fires that may occur in accidents within the transportation sector.

Class IV: Planned Spills

A Class IV spill is a discharge of a pollutant that has been pre-approved by the Ministry for one of two possible purposes. One type of pre-approved spill involves the unavoidable result of planned and essential maintenance of water systems as well as wastewater systems or pollution

REGULATION 675/98 CLASSIFICATION AND EXEMPTIONS (Continued)

abatement equipment. The other type of planned spill is a pre-authorized discharge for research or for training purposes.

Once the Ministry's consent has been obtained in advance of the planned release, these types of spills are exempt from all immediate reporting requirements under Part X of the EPA. All other Part X duties and responsibilities remain unaltered by the exemption.

An example of planned spill for water systems may involve routine and systematic cleaning of water mains. This is achieved by flushing and/or swabbing selected sections of water mains; a process that releases accumulated sediments and (normally) directs these to nearby storm drains. Of course, if the swabbing efforts result in the release of significant quantities of silt that threaten the receiving watercourse, the notification exemption would not apply. Examples of the second type of Class IV spill may involve the planned release of controlled and relatively small quantities of materials for research purposes, and where small quantities of substances such as coloured vegetable oils may be used in spill response training efforts or for periodic spill response exercises.

Class V: Refrigerants

A Class V spill involves refrigerants that are already regulated by the Ministry under O. Reg. 189/94. A Class V spill of less than 100 kilograms of a substance to which O. Reg. 189/94 applies is exempt from the reporting provisions of Part X of the EPA if there are no side effects at the site where the discharge takes place. Records of Class V spills must be maintained which, in combination with other regulated inventory controls, allows the Ministry to monitor these refrigerants.

Class VI: Motor Vehicles

Fluids under 100 litres, other than fluids transported as cargo, that may be released from the operating systems of motor vehicles, such as fuels or radiator fluids in motor vehicle accidents, are defined as Class VI spills. Since existing response systems to motor vehicle accidents take care to minimize the potential effect of such spills, it is not necessary for the Ministry to track these spills as well. Subject to three conditions, Class VI spills, therefore, are not required to be reported to the Ministry by the persons who own the vehicles involved nor by the police officers or other public servants who may investigate the event. The three conditions that must be met for the reporting exemption to apply are:

- the spill of operating system fluids does not enter and is not likely to enter directly or indirectly water or a watercourse, as defined by the *Ontario Water Resources Act*,
- the spill does not cause and is not likely to cause adverse effects other than those that are readily remediated through cleanup and restoration of surfaces prepared for vehicular traffic or adjacent paved, gravelled and sodded areas, and
- arrangements for remediation are made immediately.

REGULATION 675/98 CLASSIFICATION AND EXEMPTIONS (Continued)

The duty to notify the municipality, the owner and the person in control remain, as these requirements may apply to the circumstances of a Class VI spill. However, the municipality is

probably already notified if the spill is the result of a traffic accident. The requirement to notify the owner and person in control remains for events where the person who spills or caused the spill is a party other than the owner or person in control. All other Part X duties and responsibilities remain unaltered as well by the exemption.

Class VII: Electrical Utilities

A spill of mineral oil, other than a PCB liquid, of less than 100 litres from electrical transformers or capacitors owned by a municipal or provincial utility is classified as a Class VII spill. Subject to four conditions, Class VII spills need not be reported to the Ministry. Police officers or other public servants who may investigate or are otherwise aware of the spill also do not have to notify the Ministry. The four conditions that must be met for the reporting exemption to apply are:

- the spill of mineral oil does not enter and is not likely to enter directly or indirectly water or a watercourse, as defined by the *Ontario Water Resources Act*,
- the spill does not cause adverse effects other than those that are readily remediated through cleanup and restoration of paved, gravelled or sodded surfaces,
- arrangements for remediation are made immediately, and
- records of the spill are maintained.

All other Part X duties and responsibilities remain unaltered by the exemption, including the duty to notify the municipality, the owner and the person in control as these requirements may apply to the circumstances of a Class VII spill.

Class VIII: Petroleum Sector

The spill of gasoline or an associated product of not more than 100 litres in areas restricted to the public, or not more than 25 litres in areas with public access, at a location defined as a bulk plant, marina, private outlet or retail outlet in O. Reg. 217/01 Liquid Fuels under the Technical Standards and Safety Act 2000, is classified as a Class VIII spill. Subject to four conditions, Class VIII spills need not be reported to the Ministry or to the municipality. Police officers or other public servants who may investigate or are aware of the spill also do not have to notify the Ministry. The four conditions that must be met for the reporting exemption to apply are:

- the spill of the gasoline or an associated product does not enter and is not likely to enter directly or indirectly water or a watercourse, as defined by the *Ontario Water Resources Act*,
- the spill does not cause adverse effects other than those that are readily remediated through cleanup and restoration of paved, gravelled or sodded surfaces,
- arrangements for remediation are made immediately, and
- records of the spill are maintained.

REGULATION 675/98 CLASSIFICATION AND EXEMPTIONS (Continued)

All other Part X duties and responsibilities remain unaltered by the exemption, including the duty to notify the owner and the person in control as these requirements may apply to the circumstances of a Class VIII spill.

Class IX: Transportation of dangerous Goods

Spills of goods and materials regulated as “dangerous goods” by the federal *Transportation of Dangerous Goods Act* and parallel provincial legislation, where the spill is below the minimum quantity for immediate reporting according to applicable transportation rules, are classified as Class IX spills. Subject to four conditions, Class IX spills are exempted from the Part X reporting requirements as these duties apply to notifying the Ministry and the municipality. Police officers or other public servants who may investigate a Class IX spill also do not have to notify the Ministry. The four conditions that must be met for the Part X reporting exemptions to apply are:

- the spill of dangerous goods does not enter and is not likely to enter directly or indirectly water or a watercourse, as defined by the *Ontario Water Resources Act*,
- the spill does not cause adverse effects other than those that are readily remediated through cleanup and restoration of paved, gravelled or sodded surfaces,
- arrangements for remediation are made immediately, and
- records of the spill are maintained.

All other Part X duties and responsibilities remain unaltered by the exemption, including the duty to notify the owner and the person in control as these requirements may apply to the circumstances of a Class IX spill.

Class X: Contingency Plans

A Class X spill is an accidental spill described as “non reportable” in an acceptable spill contingency plan. For Class X spills, spill contingency plans are currently acceptable if they adhere to the Canadian Standards Association standard CAN/CSA-Z731, Emergency Planning for Industry, an equivalent standard approved by a Director as appropriate for the industry or by adhering to all the elements of O. Reg. 224/07, including s. 6(2). As of September 1, 2008 Class X Contingency Plans must meet the requirements of the Ministry’s Spill Prevention Spill Contingency Regulation O. Reg. 224/07. Subject to several conditions, Class X spills need not be reported to the Ministry or to the municipality, and police officers or other public servants who may investigate the spill also do not have to notify the Ministry.

The conditions that must be met for the reporting exemption to apply are:

- the contingency plan is in effect before the spill,
- the spill is of a pollutant, and its associated quantity less than the reportable quantity, specified in the plan,
- the spill is not entering or likely to enter any waters (surface or groundwater)

REGULATION 675/98 CLASSIFICATION AND EXEMPTIONS (Continued)

- the plan describes the spill as not likely to cause adverse effects, based on experience, other than adverse effects that can be readily remediated through cleanup and restoration of paved, gravelled or sodded surfaces,
- the spill was not deliberate on the part of the owner or person in control,
- any concerns of the Ministry regarding the plan have been withdrawn by the Ministry before the spill,
- the plan will result in preventing adverse effects, other than those readily remedied through cleanup and restoration of paved, gravelled or sodded surfaces,
- arrangements for remediation are made and carried out immediately, and
- records of the spill are maintained for five years (commencing September 1, 2008).

All other Part X duties and responsibilities remain unaltered by the exemption, including the duty to notify the owner and the person in control as these requirements may apply to the circumstances of a Class X spill.

If adverse effects result and planned remediation is not effective or is not arranged and carried out forthwith as stipulated in the spill contingency plan, the reporting exemptions for Class X spills do not apply, and spills that would otherwise “not be reportable” must be then reported in accordance with s. 92 of the EPA requirements. In such eventualities, the Ministry must also be notified in writing within 30 days of the spill of corrective measures taken or the revisions made to the spill contingency plan to prevent the failure of the plan from recurring.

Class XI: One-Window Reporting

A Class XI spill is one that is reportable to more than one provincial or federal agency. Subject to three conditions, Class XI spills need not be reported to the Ministry, and police officers or other public servants who are aware of or may investigate the spill also do not have to notify the Ministry. The conditions that must be met for the reporting exemption to apply are:

- a memorandum of understanding exists between the Ministry and the other agency with respect to resolving duplicate reporting,
- the spill meets all conditions specified in the memorandum of understanding, and
- records of the spilled pollutant are maintained.

All other Part X EPA duties and responsibilities remain unaltered by the exemption, including the duty to notify the owner and the person in control, as well as the duty to notify the municipality, as these requirements may apply to the circumstances of the spill.

As of the date of this document, SAC serves as the contractual reporting desk for Environment Canada for events reportable to Environment Canada under the *Fisheries Act* and for matters subject to immediate reporting requirements under the *Canadian Environmental Protection Act*. The primary purpose of the arrangements between the Ministry and Environment Canada is to minimize duplicate reporting for similar types of events addressed by provincial as well as federal statutes. Thus, the notification of a spill, as defined in the EPA, made forthwith to SAC that is also an event within the reporting requirements of the *Fisheries Act* satisfies the reporting requirements of both statutes. SAC also takes reports on behalf of Environment Canada for

REGULATION 675/98 CLASSIFICATION AND EXEMPTIONS (Continued)

matters reportable within Ontario under the *Canadian Environmental Protection Act*, thus notifications made to SAC effectively satisfies the reporting requirements applicable to all three statutes (within Ontario).

SAC also serves as the contractual reporting desk for Ontario's Technical Standards and Safety Authority ("TSSA") for a variety of events and mishaps reportable to TSSA. This includes spills that may occur at bulk terminals, service stations, etc., and that might otherwise be reportable to both agencies. The arrangements between SAC and TSSA effectively means that an event reportable to TSSA that is also a spill reportable to the Ministry would have been reported to both agencies with a single report made forthwith to SAC.

Annex I

Definitions of terms related to the EPA - Part X, Spills

Several words and terms are defined specifically for the purpose of Part X of the EPA. The following definitions are reproduced as presented in Part X, s, 91(1) of the EPA:

Section 91(1):

"municipality" means an upper-tier municipality, a lower-tier municipality or a single-tier municipality;

"owner of the pollutant" means the owner of the pollutant immediately before the first discharge of the pollutant, whether into the, natural environment or not, in a quantity or with a quality abnormal at the location where the discharge occurs, and "owner of a pollutant" has a corresponding meaning;

"person having control of a pollutant" means the person and the person's employee or agent, if any, having the charge, management or control of a pollutant immediately before the first discharge of the pollutant, whether into the natural environment or not, in a quantity or with a quality abnormal at the location where the discharge occurs, and "person having control of the pollutant" has a corresponding meaning;

"pollutant" means a contaminant other than heat, sound, vibration or radiation, and includes any substance from which a pollutant is derived ["contaminant" is defined in s. 1(1) of the EPA, see also page 15 of this Guide);

"practicable" means capable of being effected or accomplished;

"regional municipality" means the corporation of a metropolitan area, regional area or district area;

"restore the natural environment", when used with reference to a spill of a pollutant, means restore all forms of life, physical conditions, the natural environment and things existing immediately before the spill of the pollutant that are affected or that may reasonably be expected to be affected by the pollutant, and "restoration of the natural environment", when used with reference to a spill of a pollutant, has a corresponding meaning;

"**spill**", when used with reference to a pollutant, means a discharge,

into the natural environment,

from or out of a structure, vehicle or other container, and

that is abnormal in quality or quantity in light of all the circumstances of the discharge, and where used as a verb has a corresponding meaning;

"**substance**" means any solid, liquid or gas, or any combination of any of them.

Section 91(3):

"**Practicable**" In determining what is practicable for the purposes of this Part [Part X of the EPA], regard shall be had to the technical, physical and financial resources that are or can reasonably be made available.

Part X of the EPA also relies on several other words and terms which are defined in the general provisions of the EPA, namely in s. 1, and which apply to the entire EPA. Some of these words and terms are of particular importance to the spills component of the Act and are highlighted here for the benefit of the reader.

Section 1:

(1) In this Act,

"**adverse effect**" means one or more of,

- a) impairment of the quality of the natural environment for any use that can be made of it,
- b) injury or damage to property or to plant or animal life,
- c) harm or material discomfort to any person,
- d) an adverse effect on the health of any person,
- e) impairment of the safety of any person,
- f) rendering any property or plant or animal life unfit for use by man,
- g) loss of enjoyment of normal use of property, and
- h) interference with the normal conduct of business.

"**contaminant**" means any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that causes or may cause an adverse effect;

"**discharge**", when used as a verb, includes add, deposit, leak or emit and, when used as a noun, includes addition, deposit, emission or leak;

"inspection" includes an audit, examination, survey, test and inquiry;

"local municipality" means a city, town, village or township;

"Minister" means the Minister of the Environment;

"Ministry" means the Ministry of the Environment;

"municipality" means the corporation of a county, metropolitan area, regional area, district area, city, town, village, township or improved district and includes a local board thereof and a board, commission or other local authority exercising any power with respect to municipal affairs or purposes, including school purposes, in an unorganized township or unsurveyed territory;

"natural environment" means the air, land and water, or any combination or part thereof, of the Province of Ontario;

"person" includes a municipality as defined in this subsection;

Section 2

"Secondary discharge within building"

A contaminant that is discharged into the air within a building or structure as a result of the discharge of the same or another contaminant in another building or structure shall be deemed to be discharged into the natural environment by the owner or the person who has the charge, management or control of the contaminant discharged in the other building or structure.

ONTARIO MINISTRY OF THE ENVIRONMENT

SPILLS ACTION CENTRE

1 - 800 - 268 - 6060
(TOLL-FREE, PROVINCE-WIDE, 24/7)

416 - 325 - 3000
(TORONTO AREA)

Annex II

Ontario Regulation 675/98 - Classification and Exemption of Spills - Summary

Class of spill	Nature or type of discharge, and circumstances or activity where Part X-related exemptions apply	Exemptions	Conditions that must be met for exemption to apply
I	<u>Approved discharge</u> ; authorized by and in accordance with a C of A, a provisional C of A., order, license, etc.	Exempted from all of Part X of the EPA** including reporting and cleanup.	⇒ must have been in compliance with all orders or other requirements made under Ministry legislation; and ⇒ the spill does not contravene any other part of the EPA and other legislation including municipal by-laws.
II	<u>Discharge of water</u> ; water from reservoirs formed by dams where the discharge is caused by natural events, and potable water from water mains.	Exempted from all of Part X of the EPA** including reporting and cleanup.	⇒ none
III	<u>Household fires</u> ; combustion products from a fire of materials in quantity not greater than normally found in residential properties of 10 or fewer households.	Exempted from all of Part X of the EPA** including reporting and cleanup.	⇒ none
IV	<u>Planned spills</u> ; pre-authorized and unavoidable discharges involving planned maintenance procedures to water or waste systems, or pre-authorized discharges for research or training purposes.	Exempted from all reporting requirements of Part X of the EPA**.	⇒ application for Ministry consent is made at least 15 days prior to the release or spill, and ⇒ adverse effects must be monitored and a report must be filed with the Ministry within 5 days of the spill. • With regard to obtaining prior Ministry consent: ◇ Ministry is required to give consent if potential risks and adverse effects are deemed acceptable, and ◇ Ministry may stipulate additional conditions.
V	Refrigerants; a spill of less than 100 Kg of a substance to which O. Reg. 189/94 applies.	Exempted from all reporting requirements of Part X of the EPA**.	⇒ no adverse effect to take place at location of discharge, ⇒ keep records. ***

Class of spill	Nature or type of discharge, and circumstances or activity where Part X-related exemptions apply	Exemptions	Conditions that must be met for exemption to apply
VI	<u>Motor Vehicles</u> ; spills of 100 litres or less of fluid, other than fluids transported as cargo, from fuel or other operating systems of motor vehicles.	Exempted from the requirement to notify the Ministry and from having to provide additional information to the Ministry. Police and other public servants need not notify the Ministry. The duty to notify the municipality in which the spill occurs as well as the owner and the person in control of the pollutant spilled remains.	⇒ the spill does not enter and is not likely to enter directly or indirectly water or a watercourse, ⇒ the spill does not cause and is not likely to cause any adverse effects other than those that are readily remediated through cleanup and restoration of surfaces prepared for vehicular traffic or adjacent paved, gravelled or sodded areas, and ⇒ arrangements for remediation are made immediately.
VII	<u>Electrical utilities</u> ; spills of 100 litres or less of mineral oil, excluding PCB liquid, from transformers or capacitors owned by municipal or provincial utilities.	Exempted from the requirement to notify the Ministry. Also exempted from having to provide additional information to the Ministry. Police and other public servants need not notify the Ministry. The duty to notify the municipality, the owner and the person in control of the pollutant spilled, as applicable, remains.	⇒ the spill does not enter and is not likely to enter directly or indirectly water or a watercourse, ⇒ the spill does not cause and is not likely to cause any adverse effects other than those that are readily remediated through cleanup and restoration of paved, gravelled or sodded surfaces, ⇒ arrangements for remediation are made immediately, and ⇒ keep records. ***
VIII	<u>Petroleum sector</u> ; gasoline or associated product spills at a bulk plant, marina, and private or retail outlet of 100 litres or less in areas restricted from public access, and 25 litres or less in areas with public access.	Exempted from the requirement to notify the Ministry and the municipality in which the spill occurs. Also exempted from having to provide additional information to the Ministry. Police and other public servants need not notify the Ministry. The duty to notify the owner and the person in control of the pollutant spilled, as applicable, remains.	⇒ the spill does not enter and is not likely to enter directly or indirectly water or a watercourse, ⇒ the spill does not cause and is not likely to cause any adverse effects other than those that are readily remediated through cleanup and restoration of paved, gravelled or sodded surfaces, ⇒ arrangements for remediation are made immediately, and ⇒ keep records. ***
IX	<u>Transportation of dangerous goods</u> ; spilled goods or materials, otherwise regulated by the federal TDG Act and Regulations and the parallel provincial act and regulations, at a quantity below the minimum reportable as stipulated by the federal transportation rules.	Exempted from the requirement to notify the Ministry and the municipality in which the spill occurs. Also exempted from having to provide additional information to the Ministry. Police and other public servants need not notify the Ministry. The duty to notify the owner and the person in control of the pollutant spilled, as applicable, remains.	⇒ the spill does not enter and is not likely to enter directly or indirectly water or a watercourse, ⇒ the spill does not cause and is not likely to cause any adverse effects other than those that are readily remediated through cleanup and restoration of paved, gravelled or sodded surfaces, ⇒ arrangements for remediation are made immediately, and ⇒ keep records. ***

Class of spill	Nature or type of discharge, and circumstances or activity where Part X-related exemptions apply	Exemptions	Conditions that must be met for exemption to apply
X	<u>Contingency plans</u> ; accidental spills of materials below reportable quantities as specified in a contingency plan that meets CSA or other acceptable standards. (As of September 1, 2008 all Contingency plans must meet the requirements of the Ministry's Spill Prevention Spill Contingency Regulation).	Exempted from the requirement to notify the Ministry and the municipality in which the spill occurs. Also exempted from having to provide additional information to the Ministry. Police and other public servants need not notify the Ministry. The duty to notify the owner and the person in control of the pollutant spilled, as applicable, remains.	⇒ the contingency plan is in effect before the spill, ⇒ the spill involves a material, and its associated quantity less than the reportable quantity, specified in the plan, ⇒ the spill is not entering or likely to enter any waters (surface or groundwater) ⇒ the plan describes the spill as not likely to cause any adverse effects based on experience, ⇒ the spill was not deliberate on the part of the owner or person in control, ⇒ any concerns of the Ministry regarding the plan have been withdrawn by the Ministry before the spill, ⇒ the plan will result in preventing adverse effects other than those that are readily remediated through cleanup and restoration of paved, gravelled or sodded surfaces, ⇒ arrangements for remediation are made immediately, and ⇒ keep records. ***
XI	<u>One-window reporting</u> ; spills reportable to more than one provincial or federal agency.	Exempted from the requirement to notify the Ministry immediately, but the Ministry retains the right to request information. Police and other public servants need not notify the Ministry. The duty to notify the municipality in which the spill occurs as well as the owner and the person in control of the pollutant spilled remains.	⇒ the spill meets all conditions of the memorandum of understanding that exists between the Ministry and another agency with respect to resolving duplicate reporting of spills, and ⇒ keep records. ***

Note: * The summary cannot reflect all details of O. Reg. 675/98. The reader is urged to review O. Reg. 675/98 in detail

** The term EPA in this summary refers to the *Environmental Protection Act*, R.S.O. 1990, c. E. 19.

*** Details of records to be prepared and kept for two years (5 years in the case of Class X spills as of September, 2008) as specified in s. 12 of O. Reg. 675/98 and include: date, time, location and duration of the release; identity and quantity of the pollutant; circumstances of the spill; containment and clean-up efforts utilized; disposal and re-use method used within compliance of s. 96 of the EP; and specifics of any adverse effect observed. Records for Class 5 spills, refrigerants, need only include: date, time, location and duration of the release; identity and quantity of the pollutant; and the circumstances of the spill. Spills not captured by O. Reg. 675/98 must be reported to the Ministry, to the municipality in which it occurred, and to others (s. 92 of the EPA).

Ministry of the Environment

Responding to Spills and Emergencies

Introduction

Spills of hazardous materials and other pollutants can threaten people, property and the environment. The Ministry of the Environment (MOE) serves primarily as a regulatory agency. MOE can also be called upon to help deal with environmental concerns resulting from spills and to provide information and advice to fire departments and other first response agencies.

Municipalities often provide containment and cleanup measures for spills to their roadways and drainage systems. The primary responsibility for public health and safety in an emergency resulting from a spill or a fire rests with the municipality. A fire chief or local medical officer of health can initiate public safety measures including evacuation or shelter-in-place orders.

Ministry Mandate

MOE's regulatory mandate for spills arises largely out of Part X of the **Environmental Protection Act**, which requires spills to be reported forthwith. Part X also requires the owner of the spilled material, and the person who had control of a material when it was spilled to promptly clean up and restore the environment. The ministry ensures that the cleanup and disposal of spilled materials is done in an environmentally acceptable manner.

When those under statutory duties cannot or will not respond adequately, the Minister has the authority under the *Environmental Protection Act* to order those responsible for the spill to clean

up the site. Should they fail to comply with such orders; the ministry can undertake the cleanup and recover costs.

By *Order in Council* under the **Emergency Management and Civil Protection Act**, the Minister has responsibility for spill and drinking water emergencies. To this end, the Ministry has developed an Emergency Management Program that includes an Emergency Response Plan, a Continuity of Operations Plan and an Emergency Operations Centre.

The Ministry is committed to providing timely services for receiving, assessing and coordinating responses to spills. These service commitments are facilitated by the Spills Action Centre (SAC), and a province-wide Ministry field response capacity in MOE's Operations Division. Further support is provided by a network of additional resources available from other parts of the Ministry.

Spills Action Centre (1-800-268-6060)

The role of Spills Action Centre (SAC) is to receive reports of spills and other environmental matters and initiate or co-ordinate a response as required. SAC is staffed on a 24-hour basis and can be reached with a province-wide, toll-free telephone number (1-800-268-6060).

SAC has access to extensive chemical database systems and often provides clean up advice over the phone. Depending on the nature and impact of an incident, SAC can activate various levels of ministry response as follows.

District-level Response

The ministry's first level of field response is provided by environmental officers working out of the ministry's district or area offices. For example, an accident involving a tanker truck that has spilled a load of chemicals onto a highway, the District response staff assess the situation and determine what actions need to be taken and what additional resources may be needed.

Outside of regular working hours, each district office has an on-call environmental response person who is sent out by SAC if certain criteria are met. Depending on the location of an event, an after-hours District-level field response person is generally within about two hours.

Regional-level Response

A Regional-level ministry response is triggered to supplement the District-level response with technical support and other resources through the ministry's five regional offices. For example, Region-level ministry support may be required for a significant chemical fire. Regional assistance or expertise may include:

- Staff, equipment and technical expertise for complex incidents;
- Air or water monitoring or modeling and interpretation (a picture of existing and projected conditions);
- Support, guidance and approval to initiate directions, approvals or orders under the *Environmental Protection Act*.

An after-hours, regional-level ministry field response can be expected within three to four hours, subject to the availability of equipment and staff.

Additional Ministry Resources

When an emergency requires additional MOE support beyond those available at the regional and district levels, the ministry may call upon the following resources:

- The **Drinking Water Management Division** staff can be called upon to assist when spills or spill emergencies threaten drinking water supplies.
- The **Environmental Monitoring and Reporting Branch** (EMRB) may provide on-site specialized air monitoring at prolonged industrial or chemical fire using one of its two mobile trace atmospheric gas analyzers (TAGA). TAGA measurements may be used to determine when it is safe for residents to return home. EMRB may also be called upon to provide meteorology, as well as air and water modeling support.
- The **Standards Development Branch** can provide information on chemical and physical properties of contaminants and pesticides, and can provide expertise on toxicology and air and water standards.
- The **Laboratory Services Branch** can conduct rapid analysis of samples, which may be important for making decisions regarding response actions and cleanup procedures.
- The **Waste Management Policy Branch** advises on the safe transportation and disposal of wastes from spills and emergencies.
- **Communications Branch** provides communications support beyond that which is available at the Regional offices.

For More Information, Contact:

MOE Emergency Management Coordinator:
(416) 325-1995, or

Spills Action Centre at: 1-800-268-6060

Appendix C
Environment Canada
Recommended Protocols for Monitoring
Impacts of Wind Turbines on Birds

Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds

FINAL
February 19, 2007

Environment Canada
Canadian Wildlife Service

Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds

prepared by
**Canadian Wildlife Service
Environment Canada**

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Introduction

Uses of this document

To fulfil the requirements of a federal environmental assessment, the proponent of a wind-powered generating station (whether a large wind energy installation or a single turbine), may be required to gather baseline information on the birds that use and move through the area to be developed, and to provide follow-up information on the actual impact of the installation on the birds of the area (for more details see Environment Canada's *Wind Turbines and Birds: a Guidance Document for Environmental Assessment*, available at: http://www.cws-scf.ec.gc.ca/publications/eval/index_e.cfm).

The current document has been developed to provide proponents with information on the types of protocols likely to be useful for baseline studies and follow-up monitoring at proposed wind energy sites to evaluate impacts of wind turbines on birds.

However, proponents should not use this document on its own without consulting biologists from the Canadian Wildlife Service of Environment Canada (CWS). The most appropriate protocols for a project depend on the particular location and the risk factors at that location. Only some of the protocols in this document are likely to be required at any given site; conversely, some circumstances (e.g., offshore installations) may require protocols not covered in this document.

Pre-construction monitoring typically can be completed in one year, except in areas with particularly high uncertainty such as offshore installations. However, at any site, additional monitoring may be required if inappropriate protocols are used and inadequate data are collected in the first year. This could cause delays in approval. CWS biologists, if consulted in the early planning stages of a project, can help determine which protocols are most appropriate for a particular installation, and the appropriate level of effort to invest in each, thus greatly reducing the risk that data will not be adequate for the assessment.

While only those species of birds specified in the *Migratory Birds Convention Act, 1994* (MBCA) are under federal jurisdiction, this guide suggests study methods that are suitable for gathering information on all bird species. Some protocols, particularly post-construction mortality monitoring studies, may also be appropriate for monitoring impacts to bats. Bats have been found to be particularly vulnerable to wind energy installations in some areas. However, this document does not specifically address monitoring requirements for bats, and in particular does not address pre-construction monitoring for bats. Proponents are reminded that bats and all non-MBCA bird species are under provincial or territorial jurisdiction; the protocols suggested in this document are not meant to replace information provided by provincial or territorial authorities. Proponents are urged to contact the relevant provincial or territorial authorities to determine what requirements or expectations they may have with respect to bat monitoring pre- or post-construction.

Field data collection

It is very important that field workers hired to perform surveys outlined in this document are skilled at identifying birds by song and call and by sight. This requires knowledge of all the bird species that might be found in any particular habitat and the skill to identify individual bird songs from a chorus of mixed-species bird songs. Generally, if a person is a regular participant in the annual Breeding Bird Survey (a continental bird survey programme administered in Canada by the CWS) or any other national bird survey programme that requires an equivalent or better ability, and is familiar with birds in the region where the survey is being undertaken, then he or she is probably capable of undertaking this work. Proponents are responsible for ensuring that field staff carrying out bird surveys have adequate skills.

If a skilled field worker familiar with songs is not available, it may be possible to use electronic recording devices to record bird songs for later analysis. This approach has been adopted by a number of monitoring programs, including the Alberta Biodiversity Monitoring Program and is described in further detail under “**microphone point counts**” in Appendix 1. With present technology, this still requires a person skilled in identifying bird songs to do the final identification, but the interpretation can be done outside of the breeding season when field experts may be more readily available, and does not require the expert to travel to the field site. A field worker must still be available who is able to identify birds visually for surveys of species that are rarely detected by song, such as waterbirds or raptors, or for surveys outside of the breeding season when most birds are not singing.

Using the same field workers to carry out the pre-construction baseline studies and the follow-up surveys is recommended as a means to help standardise comparisons. Even a highly skilled observer will not manage to detect every bird that is singing at the same time, and the proportion of birds detected varies among observers. As a result, many trend analysis programs, including those for the Breeding Bird Survey, only analyse trends in data collected by the same observers. Proponents should be aware that the personnel used by a contracting company may vary from year to year, and that using the same company does not guarantee the same personnel. Furthermore, despite initial intentions, it may sometimes happen that the same personnel are not available for follow-up surveys.

For this reason, it is desirable for field work to include a means of estimating detection probabilities or observer validation in the protocols. For surveys based on bird songs (such as point counts), one way to do this is to make recordings of some or all of the point counts using appropriate equipment, and have the recordings analysed independently (see **microphone point counts** in Appendix 1). Digital copies of any recordings should be submitted with the Environmental Assessment and deposited with the monitoring data base (see next section) along with appropriate documentation on the date, time, location, weather conditions, and equipment used. These can later be interpreted by one or more additional experts if it is necessary to compare observers.

This is most likely to be a concern if the site contains habitat that supports significant numbers of breeding songbirds. CWS biologists can advise whether this is likely to be the case.

Reporting requirements

Proponents are required to include the results of pre-construction surveys in their Environmental Impact Assessments. Post construction survey and monitoring results are required to be written up and submitted to the CWS as part of follow-up.

Proponents are also asked to make available raw survey data from standardized protocols for both pre- and post-construction monitoring. The Canadian Wind Energy Association (CanWEA) and the CWS are collaborating to develop a database for the collection of bird-related data from Canadian wind energy projects, particularly for data collected using protocols recommended in this document. This national database will be used by CWS researchers to increase understanding of environmental effects of turbines on birds including the potential for cumulative effects related to habitat displacement or direct mortality. The results of these analyses will be particularly valuable for informing future monitoring requirements, in particular determining which monitoring data are most useful for predicting impacts (by comparing pre- and post-construction data), and Environment Canada will also use the results to update these protocols and the companion document *Wind Turbines and Birds: a Guidance Document for Environmental Assessment*, to make the EA process as efficient as possible. Analyses can also provide information on potential mitigation measures if significant adverse impacts are detected.

Provisions will be made to ensure that proprietary interests are protected for all data submitted. While it is desirable to provide some results for the public, this will be at a very general level, to protect the concerns of individual proponents. Any released data will not be linked to particular projects and will not provide sensitive information without the consent of the proponent.

Normally, data from pre-construction baseline studies would not be deposited into the shared database until after EA approval and the start of construction, even though the results and data are required to be a part of the information submitted through the environmental assessment process¹. Post-construction raw data and results should be deposited annually into the shared database and thereby reported to the CWS.

During the initial development phase, provision of data to this database by proponents will be on a voluntary basis, though it is hoped that most companies will participate. Once the database is fully operational and all parties (CanWEA, CWS and industry) are satisfied that it meets their needs for information storage and security, then it may become an expectation of EA approval that all companies would submit their data.

¹ This data base is unlikely to be ready until early 2007. In the meantime, proponents should retain all their raw data so that they can be entered in the database once it is available.

Proponents may want to consider including data entry into the database as part of the contracted requirements of the company or persons hired to perform the studies.

Pre-construction (baseline) sampling methods

This section provides an overview of the types of sampling that might be expected pre-construction as part of the Environmental Impact Assessment process. For sampling methods highlighted in **bold**, further details on protocols are given in Appendix I.

Note that the amount of sampling required will vary considerably among sites, depending on the size of the site, the nature of the habitats at the site, and the numbers and species of birds expected, as reflected in the Level of Concern scores (see Environment Canada's *Wind Turbines and Birds: a Guidance Document for Environmental Assessment* for details on the Level of Concern scores). For some sites, very little sampling will be required. As noted in the introduction, proponents should consult with the CWS prior to commencing surveys to determine the appropriate choice of protocols and level of effort.

Breeding season

Breeding season surveys should be designed to determine which species regularly use the area for nesting, for foraging during the breeding season, or for raising their young, and to obtain measures of abundance of bird species using the area. Such data will be used to predict the potential impact to breeding birds of developing turbines on a site and (when combined with post-assessment monitoring) to quantify the actual impact, if construction proceeds, in order to test the predictions.

Area searches are an effective means for developing a species list for a site. This method involves visiting all of the different habitat types in an area, at various times of day and year when different species are most readily detected. A list is kept of all bird species encountered, preferably with an estimate of numbers and information on any breeding evidence found (e.g., nests, carrying food, territorial behaviour, etc.). This is essentially the same approach as is used for regional Breeding Bird Atlases which have been used to map the distribution of breeding birds in several provinces of Canada (for example, see the Ontario Breeding Bird Atlas guide to participants available on: <http://www.birdsontario.org/atlas/atlasmain.html>). In its simplest form, an area search does not require standardized effort, although the amount of effort should be recorded.

Quantitative estimates of bird abundance can involve a variety of protocols. For most songbirds, the most widely used method involves **point counts**. For monitoring turbine sites, 10-minute point counts are recommended, spread through the project area. For projects with more than 10 turbines proposed, this would normally require at least 20 point counts in each major natural habitat type; this can be scaled back for small projects (< 10 turbines) or if the area of natural habitat likely to be affected is small. Point counts should be repeated twice over the course of the breeding season to ensure that both early and late breeders are detected. Some bird surveys involve shorter point counts (3 minutes or 5 minutes) but those are generally more appropriate for large scale

surveys (e.g., province-wide) rather than for specific sites of interest such as wind energy installations. Because of minimum spacing requirements between point count stations, 20 stations may not fit within either the entire project area or within a particular habitat type, in which case the sampling can be reduced accordingly. Particularly if the project involves any potentially important habitats for songbirds, it is highly recommended that at least some of the point counts be concurrently recorded using microphones and digital recorders so that later analysis of recordings can be used to adjust for variation among observers (see section on **microphone point counts** for more information on benefits and limitations of this approach).

For surveys involving birds not readily detected by song (such as waterfowl or shorebirds or birds on migration), an alternative quantitative measure is a **standardized area search**. This involves selecting a particular area (which may be the complete study area or carefully selected smaller plots) and recording all individuals of each species encountered during a standardized visit. This is most effective for species readily detected visually (such as waterfowl or shorebirds) or if the study area is relatively small. A variation on this method involves **line transects** which can be of either fixed width or variable width.

Colonial species often require special survey methods to count, or estimate, the total number of nests in the colony. However, contractors should be aware that many colonial waterbirds are quite sensitive to disturbance, and it is usually inadvisable to enter colonies during the nesting season. If a waterbird colony is present at the site (e.g., gulls, terns, herons, cormorants, seabirds) the contractor should make a rough estimate of numbers without actually entering the colony and then contact the CWS for advice on how to proceed. The appropriate advice will depend on the location of the colony, the area it covers, the species present in the colony, and the estimated number of birds in the colony.

For some secretive bird species, such as marsh birds and some raptors, especially owls, **playback methods** may be required to determine presence / absence or to estimate numbers. These involve playing recordings of the birds' territorial calls at the edge of suitable habitat during the appropriate time of day and year, and listening for a response. In most cases, such surveys can be qualitative, to determine presence or breeding evidence, unless the project area includes a large wetland or important habitat for a species at risk that is difficult to detect. In that case, a more quantitative survey may be recommended: contact the CWS for more details on designing a study to suit a particular area.

Non-breeding Season

Areas that contain habitats that may be important for migrants as stopover sites or wintering areas should be surveyed to determine whether they support large numbers of birds in these seasons. Some areas may also have high concentrations of birds flying through them, in which case there is a concern whether they may be flying at heights comparable to the blades of the wind turbines. Depending on the habitats present in an area, the geographic location of the area, and prior knowledge of when birds travel

through the general area, this may involve surveys during both spring and autumn migration as well as in winter.

Passage Migration

Birds flying through the project site on migration may be at risk of colliding with turbines. **Passage migration counts** are done to determine the number of birds flying through or over an area. Quantitative monitoring of passage migration will normally only be required if there is particular reason to believe migration will be concentrated at a site (e.g., large numbers of migrants known to pass through, wind energy installation is on a ridge top or within mountain passes, or data from similar areas elsewhere suggest migrants may be concentrated). For diurnal migrants, such as raptors, some songbirds, or some waterbirds, this can involve standing at a suitable vantage point and recording the numbers of each species passing by, taking note of whether they are flying through areas where turbines are proposed to be built. Many songbirds, as well as owls and some waterbirds, migrate mainly at night. Full quantification of nocturnal migration typically requires **radar** but an index of migration activity can often be obtained by **acoustic monitoring**.

Migration rates vary considerably from one day to the next, depending on weather conditions, so fairly intensive surveys (several days per week) are required to get a quantitative understanding of migration at a site. If daily coverage is not possible then efforts should be concentrated on days when weather conditions are favourable for large-scale migration. Information on migration volume, derived from analyses of weather radar data may help to calibrate local studies.

Migration Stopover

For quantitative surveys of stopover use, a variation on an area search called a **stopover count** is usually recommended in which one or more standardised transects are walked, and all birds seen or heard within a specified distance of the transect are recorded. The distance should be chosen such that birds can be readily identified within that distance, and will not be counted twice from different transects or different parts of the transect. In some areas or for some species (e.g., birds), it may be appropriate to also count birds beyond that distance. Transect(s) should be selected to sample all major habitats present on the site. Time of day and time of tide (for coastal areas) should be standardized to the time when birds are most readily counted. For songbirds, early morning is generally preferable, although raptors may be more readily detected later in the day.

In most cases, these surveys should be made approximately once a week throughout the spring and autumn migration season. In some circumstances, it may be necessary to modify this protocol to involve more intensive (e.g., daily) surveys during peak migration periods for particular species of concern.

If significant concentrations of birds are present (such as migrating raptors or large flocks of waterbirds), **behavioural studies** should also be undertaken to assess whether the behaviour of birds using the area leads to a risk of collision with turbines.

One approach, sometimes called a watch count, requires the observer to be stationed at a particular vantage point and to count the number of times birds move through potential turbine locations or other areas of concern.

Overwintering

Counts during the winter (e.g., November to March) should be carried out if the habitat characteristics lead to an expectation of, or if there is a history of, significant use of the area by overwintering birds (e.g., songbirds, raptors, waterfowl). **Standardized area searches** are the most effective survey method, using protocols similar to those recommended for migration stopover studies. As with migration stopover studies, if significant numbers of birds are present, searches should be complemented with **behavioural studies** to determine whether birds flying through areas will be within the future blade-swept area if turbines are built.

Winter visits should be done once or twice per month to estimate numbers of birds using an area, although more frequent visits may be needed for behavioural studies in areas with known concentrations of birds.

Offshore locations

At offshore locations, specialized survey methods may be required. Although there is some concern about direct mortality from turbines, the greatest problem, at least based on the European experience, appears to be displacement of seabirds from areas that may be important for feeding or commuting. This could potentially have population level consequences if large portions of a population are excluded from high quality habitat or forced to fly much longer distances around a site. Surveys must be designed to assess usage of the area throughout the year, for commuting, migration and foraging. In addition to monitoring bird activity, this may require monitoring of food supplies. Appropriate survey methods may include shipboard line transects, platform-based observations, and radar monitoring. The preferred combination will depend upon how much is known about the area and what risks are anticipated. Given limited knowledge about most sites, two years of pre-construction monitoring may be necessary to assess annual variation. Because offshore wind energy installations have not yet been developed in Canada, standard guidelines are not yet available on the amount of monitoring required—this will need to be determined on a case by case basis. Once further experience has been obtained, standards for these surveys will be included in future updates to this document. Whichever methods are chosen, data should be recorded in a standardized fashion for that method, as described below, to ensure the data can be compared with results from other locations, and stored in the standardized data base.

Bats

There is increasing evidence that some wind energy installation, even in agricultural settings, can intercept and kill large numbers of bats. As a result, it may be important to monitor prospective wind energy installation sites to determine whether any of the sites present an elevated risk for substantial bat mortality.

Bats fall outside of federal jurisdiction unless they are a species at risk, and proponents should contact the relevant provincial or territorial wildlife department to determine what requirements they may have for monitoring of bats or bat activity. Several provinces are in the process of developing written guidelines. Links will be provided to these documents as they become available. Alberta has completed a document:

Lausen, C. E. Baerwald, J. Gruver, R. Barclay. March 2006. Bats and Wind Turbines. Pre-siting and pre-construction survey protocols. Appendix 5 *In*: Vonhof, M. 2002. Handbook of Inventory Methods and Standard Protocols for Surveying Bats in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, Alberta. Revised 2005.

Information on obtaining this document is available at
<http://www.srd.gov.ab.ca/fw/bats/ABAT.html>

Some of these protocols may also be relevant in other jurisdictions, but this must be determined in consultation with the relevant authorities.

Some monitoring techniques relevant for birds will also provide information on bats, especially **radar monitoring** and post-construction **carcass searches**. These are mentioned under the respective sections outlining those techniques.

Overview of post-construction follow-up studies

This section provides an overview of the types of sampling that can be expected post-construction as part of the Environmental Impact Assessment process. The precise requirements will be determined as a condition of the approval process. For sampling methods highlighted in **bold**, further details on protocols are given in Appendix I.

Breeding season

At sites that support reasonable densities of native breeding birds (as demonstrated by pre-construction assessment), follow-up monitoring should be undertaken using the same techniques to those used during pre-construction assessment. The purpose of these surveys is to determine the consequences of the turbines to species diversity, to evaluate the predictions made during the EA process, to evaluate the cumulative effects of the industry on bird diversity and numbers, and to detect significant changes in numbers at single sites. If baseline studies indicated a very low level of native bird diversity and numbers (as might be expected of installations within industrial parks or intensive row crops) then follow-up breeding season studies are unlikely to be required. This should be determined through consultation with the CWS.

If post-construction surveys are required, then normally at least two or three years of breeding season surveys would be needed to differentiate any possible effects of the turbines from natural year-to-year variation, and to separate short-term from long-term effects. In areas of lower concern, it may be appropriate to start these surveys the second year after construction, and limit surveys to two years. If results appear to be significant, but vary substantially among years, then in some cases additional surveys

may be requested to consider longer term effects (e.g., repeat surveys 5 or 10 years later). Breeding season surveys are not especially onerous, and could be expected to require no more than 4-10 person-days of field work each year, except on very large sites.

Non-breeding Season

If baseline studies during the non-breeding season suggest that the area is important for birds at these times of the year (determined through consultation with the CWS), then similar studies to those performed in the baseline work should be repeated to gauge the consequences of the turbines' presence on birds during these times.

Carcass searches

Carcass searches are important, even on sites determined to be of a low level of concern, to evaluate the correctness of the predictions, and to test for the possibility of unexpected risk factors. For example, on some sites where pre-construction surveys suggested a low-risk area, there nevertheless was substantial unanticipated mortality observed for bats.

As a minimum standard, 6 to 8 weeks of carcass searches during the spring migration period and 8 to 10 weeks during the fall migration period should be planned for. At sites with a low level of concern, one year of data would normally be sufficient, but at sites in the highest levels of concern, two or three years of monitoring might be required. These requirements may be extended if substantial mortality is observed, particularly to evaluate any mitigation measures that may have been introduced. If turbines are in areas that support significant breeding or wintering populations of species with an elevated risk of mortality from turbines (e.g., raptors or Species at Risk with aerial displays), then carcass searches may be required during the breeding season or in winter.

Collision studies

In some areas (offshore, bogs, marshes, etc.) carcass searches are impossible or highly impracticable, and alternative methods for estimating collision mortality may be required. **Radar** has been proposed as one approach. Another approach combines microphones attached to turbines (to detect the sound of collisions) with infra-red video (to identify the species colliding). Protocols for such techniques have been developed in Europe, but have not been widely tested. As a result, an overview of these approaches is included here, but proponents requiring these approaches will need to develop an appropriate protocol, in consultation with the CWS. Proponents constructing a wind energy installation in an area that would require radar-based or other technological approaches to estimating collision rates should be aware that the costs of post-construction monitoring may be significantly higher than in areas where carcass searches are possible.

Appendix 1. Details of selected sampling protocols

This Appendix provides further details on some of the sampling protocols that are likely to be appropriate for bird monitoring in the context of wind energy environmental assessment.

Note that, whichever sampling methods are used, a complete written field protocol describing the exact sampling methods should be provided as part of the documentation and reporting. This documentation should include precise coordinates of all locations surveyed (preferably from GPS).

Area searches

- Area searches are intensive searches with the goal of finding as many bird species as possible present in an area and providing very general information on bird abundance and status.
- Area searches must be undertaken by a qualified biologist or contractor skilled at recognition by song (during the breeding season) and by sight (at all times of year) of all bird species likely to occur in an area.
- The minimum searching effort for obtaining a list of breeding species in an area would normally be a few hours for a small wind energy installation, ten or more hours for a medium wind energy installation, twenty or more for a large, and more than twenty for a very large wind energy installation (for details on what constitutes a small, medium etc. wind energy installation see Environment Canada's *Wind Turbines and Birds: a Guidance Document for Environmental Assessment*). For very large wind energy installations, a useful rule of thumb is to determine, from bird range maps or breeding bird atlas data, combined with habitat information, the number of species that might be expected in the area. Searching should continue for at least 20 hours, or until at least 80% of the expected number of species have been found (on the assumption that remaining species are probably present in very low numbers).
- For breeding season studies in areas with a variety of natural habitats, multiple visits increase the chances of detecting species that breed early or late in the season. Searches can be made more efficient by concentrating at times of peak bird activity (early morning for most songbirds, late morning or early afternoon for soaring raptors, early evening for owls and other nocturnal species).
- The procedure is to search through all the main habitat types in the area and record all birds seen and heard and to estimate the number of individuals detected on each visit. In addition, for breeding season studies, any evidence of breeding should be recorded.
- Data recorded should include:
 - The level of effort for each visit (date, start time, finish time, hours of searching, and some measure of the area searched, such as the distance covered, or a map of the area that was searched);
 - A complete list of species detected on each visit/each day;

- If possible (especially for standardized searches—see below), an estimate of the number of individuals actually detected (by sound or by sight);
- For breeding season surveys, data on any breeding evidence detected, using standard breeding bird atlas codes (Appendix 2);
- A basic description of the habitats covered;
- These data should be retained for entry into the data base.; and,
- In addition, summary data should be calculated for the EA report that indicate all species detected at each season, with estimates of peak numbers, and total sampling effort.

Standardized area searches

- Standardized area searches are a quantitative variation on an area search in which the area being searched and the search effort are strictly standardized and the number of individuals of each species detected during the sampling period is recorded to provide an index of abundance.
- For recording songbirds during the breeding season, especially in forested habitats, these are harder to standardize than **point counts**. However, they may be the best available option for counts outside the breeding season, for sampling species that are not readily detected by song, or when surveying sites that are too small to fit more than a few point counts.
- Usually these involve sampling only a portion of the study area, unless the study area or the particular habitats of concern (e.g. wetlands or tidal mudflats) can all be sampled on a single survey session. One variation on standardized area searches is a fixed width transect, in which a route (transect) is selected, and all birds within a fixed distance of the transect are recorded. The appropriate transect width depends on habitat and species of interest: for songbirds in heavily vegetated areas, few birds are detected more than 100m away; for raptors or waterbirds in open areas, birds may be detected and identified at distances of 1 km or more with good optical equipment. Square, circular or rectangular plots up to 1 km² have also been used in various circumstances; the area(s) to be surveyed can be any shape, provided that the shape is clearly documented, the effort is standardized, and the same areas are surveyed on each occasion.
- Data recorded should be the same as for other area searches (see above).

Line transects (distance sampling)

- A line transect is a form of distance sampling which, if assumptions are met, can be used to provide density estimates.
- The most important assumptions are that transects are placed randomly with respect to habitat, that distance between the transect line and the bird can be accurately estimated, that all birds very close to the transect are detected, that the birds do not move before being detected, and that they are not counted more than once.
- Random placement of transects is usually only possible in fairly uniform areas. In terrestrial habitats, this is most likely to be possible in grasslands or low shrub areas, but can also sometimes be done in forested areas.

- Line transect sampling can be a particularly useful technique for shipboard surveys in marine environments (but distance sampling methods can not be used to estimate density for water bird surveys conducted from a beach or shoreline, because the distribution of birds with respect to the coast is usually not random).
- Transects may be any length that can be conveniently surveyed within the optimal survey times (which would be early morning for songbirds, but may be more flexible for marine birds).
- This method involves travelling along the transect at a fairly uniform speed, and recording the shortest (perpendicular) distance from the transect to the position where each bird was first detected (note that this would normally be less than the distance between the observer and the bird).
- Data can be grouped into distance categories (e.g., 25m distance bands), but if possible, it is preferable to estimate actual distances. If necessary, these can always be grouped during data analysis. If birds are present in flocks or groups, then the distance to the centre of each flock should be recorded, along with the estimated number of birds in the flock.
- The position of birds along the transect should be recorded as well, usually by dividing the transect into segments, and recording which segment each bird was observed. Segments could be from 100 – 500m long depending on the total transect length and range of habitats traversed.
- Data recorded for each transect survey should include:
 - start location and ending location for each segment on the transect as well as the whole transect (or details, preferably in the form of a GIS shape file, of the complete path of the transect if it is not a straight line);
 - date, start time, and end time for each individual survey; and,
 - individual records for each bird (or flock) with its distance from the transect, segment number, and flock size.
 - Alternatively, records can be kept of the total number of birds of each species in each distance band for each segment along the transect.

Behavioural studies (watch counts)

- These may be required when species at risk, raptor concentrations, or flocks of other birds are present in or around a site, to determine whether their behaviour might lead to a significant risk of mortality from wind energy installations.
- Behavioural studies are intended primarily to determine how birds are using the area, especially to determine whether they are regularly flying through areas that will be swept by blades after the turbines are built, or are using sites or habitats that will be directly affected by the construction process.
- The optimal protocols depend on the species being observed as well as the topography of the site; a customized design will be required in most cases. This design should be developed by the contractor and submitted to the CWS for review before implementation. A typical study might involve finding a suitable vantage point from which birds can be observed and recording the movements of birds and the major habitats that they are using at different times throughout the day.

- Observations should only be undertaken at the appropriate season, on days when significant numbers of the species of interest are present in the area, and should typically be undertaken on multiple days to assess day-to-day variation in activity.
- Data recorded will depend on details of the sampling protocol but, as a minimum, should include information on dates and times when surveys were undertaken, as well as summary statistics on how often birds, and how many birds flew through potential turbine locations, whether they were flying within, above or below the blade height of turbines to be installed, and how often they used sites that would be disturbed by construction.

Point counts

- To be effective, point counts must be placed at well-chosen locations, carried out by experienced observers (unless microphones are being used to record them – see next section) and performed at the appropriate time of day in appropriate weather conditions.
- Point Count Placement:
 - Point count locations may be chosen either randomly or systematically (e.g., at regular intervals along a route) within the target habitats. If they are placed systematically, then the starting point of the route should be randomly chosen, if possible. Point count locations should be chosen to emphasize areas near prospective turbine sites as much as possible. Point counts should generally not be placed on roadsides, but it is acceptable to select a starting point for a route along an access road.
 - If the area consists of relatively large areas of homogeneous habitat, then point counts should be placed within each major habitat type, ideally with the centre point at least 100m from the habitat edge.
 - If the project area consists of a fragmented mosaic of habitats (e.g., small fields interspersed with hedgerows and small woodlots) such that it would be hard to place many points >100m from a habitat edge, it may be more effective to consider the whole landscape as one “habitat” and place point counts randomly or systematically within it.
 - Every major habitat type within the project area (pine forest, hardwood forest, scrub, grassland, field, etc.) likely to support significant numbers of breeding birds should be included.
 - At least 20 stations are normally required to sample a habitat adequately, spaced at least 250m apart in forest, or 500m apart in open habitat. These stations may be distributed among several different blocks of habitat.
 - The number of stations per habitat can be reduced if the total area of a particular habitat within the project site is too small to support 20 stations.
 - If the project is in the large to very large category (see Environment Canada’s *Wind Turbines and Birds: a Guidance Document for Environmental Assessment*) and is situated primarily in one major habitat type, or if the habitat is very heterogeneous, then 20 stations may be insufficient to cover the breadth of the geographic area and sample the diversity of microhabitat types; for small projects, with limited areas of

natural habitat, 20 stations per habitat type may be unnecessary – contact the CWS for guidance on sample size in all of these cases.

- Once station locations have been selected, they can be grouped into routes in a way that allows for maximum efficiency of visits – it is not necessary to visit all stations for a particular habitat type on the same day.
- Post-construction monitoring seeks to assess the impact of turbines on bird abundance and distribution.
 - Two alternative designs for point count placement can be considered:
 - One approach is to survey the exact same locations as were surveyed during pre-construction. This approach gives information on the overall, landscape-level impact of the turbines, but less information on the specific impact of the turbines.
 - Another approach is to select new point count locations in relation to the turbines (e.g., points close to turbines, 250m away from turbines and 500m away from turbines). The number of points and number of turbines sampled would depend on their configuration and on the diversity of habitats in which they are located. Stations should be selected so that some are downwind of turbines, based on prevailing wind direction, while others are upwind, as the noise impacts, and hence disturbance effects on birds may differ.
 - An ideal design would incorporate both approaches, by selecting pre-construction point count locations in relation to proposed turbine sites based on the above design. However, this may not always be possible for various reasons, including uncertainty at the time of the initial surveys in the eventual location of the turbines.
 - The appropriate design for a particular site should be determined at the time of EA approval, in consultation with the CWS.
 - The extent and intensity of monitoring expected will depend on the species richness and densities present in the site pre-construction.
- Each station must be georeferenced by GPS.
- The habitat within 100m of the station should be described in qualitative terms, unless a complete habitat map for the area has been prepared and the points can be placed on that habitat map. The habitat description should incorporate summary information on habitat structure (e.g., forest, marsh, field), dominant vegetation types within the habitat (e.g., major tree species), and, for forest or shrub habitats, an estimate of stand age and average stand height.
- The habitat coding system used by the Ontario Nest Records Scheme is recommended for coding the major structural habitat types in most parts of Canada. It is described in the Scheme's manual at <http://www.birdsontario.org/onrs/instructions.html>.
- Point count timing and survey conditions:

- Point counts must be performed in the early morning during the breeding season, between dawn (one half hour before sunrise) and about 4 hours after sunrise. Later in the season, singing drops off more quickly – surveys in late June and early July should usually be completed within 3 hours of sunrise.
- The peak breeding season varies geographically, but in most parts of Canada it extends from late May to early July. Consult the CWS for the optimal dates for a particular region.
- Each station should be surveyed twice, once early in the season, and once later in the season (at least 10 days after the first survey at a particular station).
- Point counts should be performed when there is as little wind as possible, because wind affects the observer's ability to hear birds. Usually, this means that wind speeds should be 3 or less on the Beaufort scale. However, in areas where the wind rarely drops below 4, even in the early morning (e.g., in some parts of the prairies or mountain ridges) this restriction may have to be relaxed.
- It is important to always begin point counts as early as possible in the morning (but not earlier than one half-hour before local sunrise), when the wind is generally calm so that windy conditions that may arise later in the morning can be avoided.
- Point counts should not be if it is raining unless precipitation is not more than a light drizzle (birds tend to stop singing in the rain).
- During post-construction point counts, in some areas, the sound of the turbines may affect the ability to hear birds. If this is a problem, it may be necessary to stop turbines near the point location while the point count is being undertaken; if wind conditions are low enough for point counts, then energy production from the turbine is likely to be minimal at that time anyway. Failure to control turbine noise during post-construction surveys may lead to under-detection of birds and over-emphasis of the impact of turbines on bird communities.
- If turbine noise is a problem and can not be adequately controlled, then the CWS should be consulted to determine whether an alternative point placement design may be feasible.
- Data recording:
 - At each station, the surveyor should listen for ten minutes, recording all species seen or heard, along with an estimate of the number of individuals of each species.
 - The surveyor should estimate the distance to each bird using a scale of 0-50m, 50-100m and further than 100m. Birds that move during the survey should be recorded in the closest distance category that they entered during the survey. Distances can often be difficult to judge when a bird is only heard singing in dense habitats, in which case the observer should provide a best estimate. This will still be valuable for differentiating birds that are close from those that are very distant.

- Data that need to be reported are the number of birds of each species detected in each distance band. It is often easiest to track individual birds if they are first mapped onto a circular diagram using a standard set of symbols, and then the number of individuals counted up afterwards.
- Birds that fly over without stopping should be recorded separately as “fly-overs”
- Additional information that should be recorded include:
 - weather conditions (temperature, wind speed (on a Beaufort scale), % cloud cover, and presence of any precipitation should be recorded)
 - date and time of day.
 - GPS coordinates of the point location
 - Name of the observer doing field work
- A sample data form is included as Appendix 3 of this document, but it is not necessary to use this form provided that all of the relevant data are recorded. Use of some sort of data form is desirable to ensure that all required data are recorded in the appropriate format, thus facilitating later computer data entry.

Microphone point counts

- Use of stereo microphones and digital recorders to record bird songs on point counts has several advantages:
 - When skilled birders able to identify all the bird songs in the region are not available, microphones can be used to record birds on the point counts, and these can later be interpreted by a skilled birder after the field season;
 - Recordings allow evaluation of observer effects, especially if there are changes in observers between pre- and post-construction monitoring. Even skilled birders differ in the proportion of birds present at a point count that they detect and it is important to calibrate among observers if the observers change; and,
 - In addition, if any bird songs are heard during a count that cannot be identified by the primary observer, the recordings can be compared with reference material or sent to another skilled birder for validation.
- Tests of these approaches are discussed in Rempel, Hobson, Holborn, Van Wilgenburg, and Elliott. 2005. Bioacoustic monitoring of forest songbirds: interpreter variability and effects of configuration and digital processing methods in the laboratory. *J. Field Ornithol.* 76(1):1–11.
- This approach has been adopted by a number of standardized programs, including the Alberta Biodiversity Monitoring Program (protocol details are available in their terrestrial monitoring methods document, available on their web site: <http://www.abmp.arc.ab.ca/ReportsDocuments/Protocols.htm>).
- For these reasons, especially in areas expected to have significant numbers of breeding birds (e.g., native habitats such as forest or prairie), it may be desirable to use recordings as a standard approach for point counts. This can either be done on a subset of points, concurrently with a skilled observer, to allow for

measuring observer variability or can be done for all point counts, in which case observers can be used who are less skilled in bird song identification.

- However, it is also important to be aware of some of the limitations of microphones. In particular, as described below, they are very sensitive to external noise, such as wind (especially in areas with a lot of trembling aspen), vehicle noise, etc.
- If point counts must be conducted under windy or noisy conditions (e.g., there are few mornings during the breeding season with wind speeds below 3 on the Beaufort scale, or there is substantial traffic noise even in the very early morning) then microphones may not be an effective solution.
- A variety of recording units are potentially suitable for recording point counts. The key features are that the unit should have stereo microphones with sufficient sensitivity to detect birds singing at approximately the same distance that a skilled observer would be able to hear them. Each microphone should be partially directional (to enhance the stereo effect, thus facilitating counts of the number of individuals), but between them, the microphones should have an omnidirectional pickup, so that birds in all directions can be detected.
- Recordings should be made onto a digital recorder, in either high quality format (e.g., uncompressed CD quality), or in compressed formats (e.g., MP3) which seem to be generally adequate; recordings can also be made directly to computers by connecting microphones through sound cards.
- Digital recordings have the advantage that copies are readily made, and computer software for visualizing sonograms can be used to facilitate data analysis (although, unfortunately, software has not yet been developed for reliable automated identification).
- Two companies in Canada currently produce complete packages designed for field work that meet these standards (Riverforks: <http://www.riverforks.com> and Environment Audio Recording Systems (E.A.R.S.): <http://www.earscanada.com/>). Both of their systems are designed to be weather resistant.
- However, other systems could be readily designed for less cost using separately purchased components that would have suitable characteristics. Because the actual characteristics of different systems may vary, it is important that pre- and post-construction monitoring be carried out using comparable equipment.
- Record levels should be adjusted to avoid saturation (which leads to distortion). A high pass filter should be incorporated into the system to reduce noise from very low frequencies, which usually represent environmental noise rather than bird songs (only a few species such as grouse produce low frequency sounds). If possible, a standard volume calibration tone should be recorded, to allow standardization of playback volumes.
- For recording, microphones must be mounted on a tripod approximately 1-2 m above the ground in such a way that no vegetation will rub against them. The recorder should normally be positioned a few metres away from the microphones to avoid interference, and to minimize the impact of incidental noise. The operator should check that everything is properly connected by listening through headphones connected to the system prior to the start of the point count.

- At the start of each recording, the operator should announce the date, start time, and GPS coordinates of the station, followed by “start” or something similar. At the end of the 10-minute period, the operator should announce “stop” before turning off the recording (beeps from a stop watch can serve the same purpose). This will assist the analyst, and ensure that the time period of the recording matches that of the field operator, if a standard point count is being undertaken at the same time.
- The operator must minimize making any noise during the recording. Microphones are particularly sensitive to noise from crunching of gravel, leaves or other vegetation underfoot. If the operator is simultaneously conducting a point count, it is best to stand at least 5 m, and preferably 10 m away from the microphones, to minimize noise on the recording while observing birds.
- If insect noise is a major problem on the recordings, it may help to spray an insect repellent on the wind shields of the microphones.
- Microphones are generally more sensitive to environmental noise than human ears, especially at higher frequencies. Rustling of leaves, particularly trembling aspen, as well as vehicle noise can be particularly problematic. In areas with a lot of aspens, this may require conducting recordings under lower wind conditions than would be acceptable for a human listener.
- When analysing recordings from a stereo microphone setup, it is not possible to determine reliably the distance away from each bird, so it is necessary to group all birds into an unlimited distance category. Otherwise, data recorded for a microphone recording should be the same as those recorded for a regular point count.
- If point counts are conducted by an observer, as well as by recording, the data from both the observer and the recording should be entered separately into the data base. It is very important that the recordings be interpreted by somebody who does not know (or remember) what was recorded by the observer. Conversely, the observer should NOT modify what he reported on a point count in the field based on interpretation of the recordings. Otherwise, it is not possible to use the recordings to calibrate observers, and the results will not be comparable among observers. The only exception is if an observer heard a call that could not be identified in the field, and the recording was used to determine the identity, or if an observer realizes that he/she clearly mis-identified a song, in which case the identification can be corrected.
- Proponents are responsible for analysis of all recordings by a skilled analyst and for providing data on the species detected on the recording. In future, it may also be possible to store copies of the digital recordings with the data base—copies should be kept on file, on a hard drive or other storage medium (e.g., CD or DVD), for later addition to the data base, and in case they are required for re-analysis for comparison with post-construction data.

Playback counts

- Playback of recordings is used primarily to detect secretive species, such as owls or marsh birds, or to obtain more information on particular species, such as

Species at Risk, where the presence of even a few individuals of a species may be of concern.

- In many cases, it is sufficient to do this qualitatively, to detect the presence of particular species, through integration into an area search protocol.
- Quantitative surveys may be expected in some areas, such as if an area contains extensive wetlands that might contain significant numbers of marsh birds. Nationally standardized protocols for marsh bird monitoring, using playback, are currently being developed. A number of regionally appropriate standard protocols exist for nocturnal owls.
- If a Species at Risk is expected in an area, the most appropriate protocols should be discussed with the CWS before initiating surveys. Quantitative playback surveys for a Species at Risk may be required if the area is known to contain significant habitat for the species – these would need to be designed in conjunction with a CWS biologist and/or the appropriate recovery team for the species.
- Playback counts involve:
 - Playback of recordings of territorial songs or calls of target species that are of particular concern and may be expected in the habitat. Each playback should be followed by a period of silent listening to detect responses. Multiple recordings may be played (either repeats of the same species, or different species), followed by silent listening.
 - Playback must be done at the appropriate time of day:
 - Early morning for most songbirds
 - Early morning or evening for marsh birds
 - After dark for most owls
 - Playback should also be done at the appropriate time of year, depending on the species and region. The peak calling period for many owls can be one to two months earlier than the main breeding season for songbirds. Marsh birds tend to be most vocal early in the breeding season.
 - Playback can be attempted in any patches of habitat suitable for the target species. The appropriate spacing will depend on the distribution of habitats. For habitats that are difficult to enter (e.g., wetlands) it is usually acceptable to use playback from the edge of the habitat.
 - Unless following a protocol that has been previously approved specifically for a quantitative survey, playback of calls for a Species at Risk should be stopped as soon as the species presence has been confirmed, to minimize disturbance to the species.

Stopover counts

- The purpose of stopover counts is to estimate the abundance of birds using the project area as a stopover site on migration, whether for resting or for foraging. The optimal design of a stopover count will depend on the nature of the habitats in the area, and the types of species that might be expected.
- The usual sampling method will be a variation on the **standardized area search** methods.

- For large open area birds (waterfowl, shorebirds, other waterbirds, etc.), a route should be developed that provides a vantage point over all of the major habitat areas where birds might be expected.
 - In a large project area, this may involve a route of several kilometres, with driving in between observation sites.
 - The objective of this survey should be to estimate the total number of individuals of each species present in the area on a particular visit.
 - If the study area consists of several discrete patches of important habitat, then the number of individual birds of each species on each site should be recorded separately. This information may be important for turbine placement.
 - Data recorded for these surveys should include a map of the route and the major observation sites, the date, the start and end time of each visit.
 - Most waterbirds can be counted at any time during the day. However, in some areas birds may make daily movements from a roost site in one area to a foraging site in another area. Similarly, in tidal areas, birds may move among locations in response to tidal cycles. In these cases, counts should be timed to coincide with peak numbers present within the study area.
 - If significant numbers of birds are located, then **behavioural studies** (see relevant section) should be considered to determine whether the behaviour of these birds is likely to put them at risk from the wind turbines.
- For songbirds, routes should be selected that sample the major habitats likely to be used by songbirds in the region.
 - Routes can be placed along existing trails or roads. Foraging migrants are most readily detected at edges of habitats, in hedgerows, etc.
 - A good quantitative design is to set out transects approximately 500 m long along trails or roads, placing at least two per major habitat type (e.g., forests, shrubland, grassland, etc.). Individual transects may traverse multiple habitats. However, transects can be any length, provided that the same routes are visited each time.
 - Transects should be walked approximately twice a week in the early morning (sunrise to up to no more than 4 hours after sunrise) during the peak migration period for the species of interest.
 - In most cases, it is sufficient to record the total number of birds of each species detected along the transect, using **standardized area search** methodology.
 - In some habitats, it may be appropriate to use **line transect** methodology and record the distance to each bird, or the number of birds in fixed distance categories (e.g. 25m distance bands), separately counting different segments of the transect.

Passage migration counts

- Passage migration counts are used to estimate the numbers of birds flying through an area during migration periods. These will normally only be needed when there is a clear risk factor or significant unknowns.

- For most songbirds, the spring migration period runs from early April to late May, the fall period from the end of August to the middle of October, although this varies by region, latitude and altitude. Migration of waterfowl may commence in March, while migration of eagles and some northern migrants extends into November.
- For raptors and other diurnal migrating birds the following protocol is recommended:
 - Select an observation point from which a clear view is available of one or more potential turbine locations in areas that may represent migration concentration sites (e.g., ridge tops).
 - Record the species and heights of all passing birds in relation to the height of the proposed turbines. Codes can be used for incompletely identified species (e.g., *Accipiter* sp.).
 - Start at about 9 a.m. and record continuously for 6 hours, dividing the observations into one hour blocks. This will make the data comparable to most raptor monitoring stations.
 - If daily observations are not possible, then observations should be carried out for at least 10 days spread over the peak migration period for species thought to be at risk (consult local naturalists for this information). Within this period, dates should be chosen with weather conditions favourable for migration (e.g. no precipitation, light to moderate tail winds).
 - Record weather conditions (temperature, wind speed and direction, sky cover, precipitation), date, time of day, GPS coordinates of the observation point, and the approximate area and direction over which most observations were made.
- For night-migrating birds or bats, passage migration counts require technological approaches including either radar or acoustic monitoring or both. These are described in further detail in subsequent sections.

Acoustic monitoring of migrating birds

- Many species of songbirds regularly make flight calls during nocturnal migration; many calls can be identified to species. Microphones and digital recorders can be used to monitor these species during migration. However, not all species call during migration, and little is known about how often individual birds call and how much this varies from night to night or with weather conditions. To get a complete picture of the number of birds migrating through another area, acoustic monitoring may need to be combined with other techniques such as **radar**, infrared video devices, or observations with a ceilometer (a bright light pointed straight up into the sky). Nevertheless, acoustic monitoring alone may sometimes be sufficient for understanding regional variation in the concentrations of migrating birds or the heights of birds.
- A variety of systems have been used for monitoring nocturnal migrants ranging from single microphones connected to a digital recorder that provide an index of bird activity, to arrays of 4 or more microphones connected to a computer that can be used to calculate the height and position of each bird's call.

- Note that acoustic systems used for monitoring birds are not suitable for monitoring bats, because of the difference in frequency range of their calls.
- In general, systems that monitor height are likely to be more relevant to wind energy installation monitoring than systems that only provide an index of total numbers.
- National standards for have not yet been developed for acoustic monitoring. At present this technique is most likely to be required only in the context of a research project. If nocturnal flight call monitoring is required for a particular project, then a protocol should be worked out in conjunction with the CWS.

Radar monitoring

- Marine radar units can be used to monitor activity of birds and bats within a relatively large area (a few kilometres radius) from a single location.
- However, radar has the disadvantage that targets can rarely be positively identified to species. Methods for distinguishing birds from bats, based on flight patterns, are being developed, but have not been fully tested.
- A variety of systems have been developed for automated data collection and processing. This is particularly important for monitoring over longer time periods, such as a complete migration season. However, most of these automated systems are relatively expensive, and only a few consulting companies have expertise with this technology. Each company uses different approaches for automated processing of data and estimating trajectories and/or heights of flying birds and bats. Most of these approaches have not yet been compared and cross-validated; it is not yet possible to recommend one system over another.
- As such, radar is not generally being required for monitoring unless there are particular risk factors involved, such as a suspected migration corridor for bats or birds, concerns about particular Species at Risk, or concerns about waterbird movements at proposed offshore installations.
- If radar is required, the ideal sampling scheme would involve monitoring on a daily basis through the main migration period for species of concern, especially if a fully automated system can be deployed.
- If this is not possible, because of limited availability of technology or other logistic constraints, then less intensive sampling may be acceptable. Various sampling schemes can be considered, depending on logistical constraints such as the remoteness of the site and the availability of radar. If daily coverage is not possible, the next most preferred option would involve monitoring at regular intervals throughout the season (e.g. one or two nights per week, preferably concentrated on nights when weather conditions are favourable for migration—tail winds that are not too strong, no precipitation). Another option would involve sampling for a few days in a row at longer intervals, e.g. for 2-3 days every two weeks. If data are available on the likely peak migration period for species of concern, then continuous monitoring for 1 or 2 weeks during this period may also be acceptable.
- Regardless of the sampling scheme, monitoring should continue through the night, either recording continuously (preferred) or for periodic intervals such as 15-30 minutes per hour.

- Data that are recorded should include:
 - Technical information on the equipment used, including information on maximum range, minimum and maximum altitude at which targets can be detected at various distances, methods used for data analysis, etc.
 - For each bird or bat target detected, data should include information on its identity to the extent possible (e.g., bird vs. bat), its trajectory (including direction of travel and position in relation to potential turbine sites), and altitude (if known).
 - Data can then be summarized in various ways to indicate overall bird and bat activity, how this changes over the night and the season, and how it varies across the study area.
 - Summary data should be provided as part of the Environmental Impact Assessment. Raw data (i.e., information on individual tracks) should be retained for inclusion in a central data base, once appropriate data standards have been developed.
- As with acoustic monitoring, the uncertainty in protocols is such that this technique is most likely to be required only in the context of a research project. If radar monitoring is required for a particular project, then the most suitable protocol should be worked out in conjunction with the CWS.

Carcass searches

- These can be expected to be the most intensive and potentially costly part of the follow-up programme, involving many hours of work.
- To calculate total mortality associated with a turbine, in addition to searching for carcasses, it is necessary to estimate:
 - The proportion of carcasses that fell outside the search area;
 - The proportion of carcasses within the search area that are removed by scavengers between visits; and,
 - The proportion of carcasses remaining that was found by the observer.
- In most cases, carcass searches should be conducted every 3 days at a site, to minimize loss of carcasses due to scavenging, and to estimate more reliably the actual date/weather conditions when mortality took place. In some circumstances (e.g., presence of many, very efficient scavengers) it may be necessary to increase the frequency. Conversely, if carcass removal trials indicate that most carcasses persist for a week or more, then less frequent searches may be acceptable. For this reason, scavenging rate should be estimated early in the process (see below).
- The minimal duration of carcass searches for passage migrants would typically be 6 weeks during the spring migration period and 8 weeks during the fall migration period.
 - The peak period of migration varies by region, but generally most spring migration is from early April to the end of May, while the fall season extends from early August to the middle of October. Migration of waterfowl or some raptors may extend outside these seasons.
- If significant numbers of raptors, species with aerial mating displays, or other birds that during baseline behavioural studies showed a propensity for flying at

the height of the blades are present at other times of year (e.g., breeding season or over-winter), then additional carcass searching should be undertaken during the period these birds are present. For breeding season, this would normally be a 6-week period. In winter, this would depend on when birds are present in the area, and could be anywhere from 4 – 12 weeks. Optimal search intervals may vary with time of year and weather conditions.

- Carcass searching does not generally require bird experts and can usually be done by well-trained technicians, who could be locally-hired personnel.
- Trained dogs can greatly increase the efficiency of carcass searches, particularly if the search area has significant vegetation. Dogs can search a larger area more rapidly than human observers, and tend to find a higher percentage of carcasses. This will make for more accurate and more reliable estimates of total mortality. Particularly at large wind energy installations, proponents should always consider the use of dogs, if possible.
- Visual carcass searching tends to be most efficient in bright light conditions, with a light breeze (which can cause feathers to flutter), and when it has not rained recently (rain tends to flatten feathers).
- Carcass searches should focus on the area where the search is most efficient – this will usually be the gravel pad at the base of the turbine, roads extending from it, and any areas of ground nearby that are either covered with short vegetation (e.g. grasses or low forbs) or are bare. Finding carcasses in forests or scrub is extremely difficult, even with dogs.
- Once a search area has been selected, searching should be undertaken uniformly throughout the search area, so that all parts of it are searched equally intensively.
- If necessary, a stratified design can be undertaken in which searching is most intensive in areas where carcasses are most likely to be detected, with less intensive searching farther away. For a typical 80m turbine, with 40m blades, most birds seem to fall within 80m of the towers, while most bats fall within 50m; however, the intensive survey area could be smaller still, especially if this would allow increasing the numbers of turbines visited, or if the stratum near the turbine is much easier to search.
- One form of stratified design is to search a small intensive area on every visit, and to search a larger, less intensive area only on occasions when a greater-than-typical number of carcasses is discovered in the intensive area (in some cases this may mean a single carcass). This design is suitable for migrants, because most birds may be killed only under specific weather conditions, which could lead to many birds being killed on a single night.
- For smaller sites (1-10 turbines), every turbine should be searched. For larger sites, a subset of turbines should be selected to cover representative areas throughout the wind energy installation, and searched in a similar fashion.
- It is not necessary to search every turbine on the same day. For example, a third of the selected turbines could be visited each day, such that each turbine is sampled every 3 days. The order of visits should be the same each cycle, so that the sampling interval (e.g. 3 days) is the same for each turbine.

- It is generally preferable to search a larger number of turbines, but with a smaller search area at the base of each turbine, than to search intensively at only a few turbines. This is because it is possible that only a few turbines may cause problems for birds.
- In some areas, it may be appropriate to sample some turbines every 3 days, and others at longer intervals, on a rotating schedule, to ensure that mortality at selected turbines is not being overlooked.
- Whenever possible, searches should begin as soon after sunrise as practical, to minimize carcass loss from early morning scavengers.
- Regardless of the area searched, it will almost always be necessary to calculate a correction factor to allow for carcasses that fall in areas that were not searched. Statistically sound corrections must take into account the fact that the expected number of carcasses varies in relation to distance from the turbine as well as prevailing wind directions on every night since the last carcass search.
- The make these calculations, the following data must be recorded:
 - The area in which searching was undertaken at each turbine, as well as the date, start time and end time for each search (separately for each turbine). If the search area was symmetrical around the turbine, this can be easily recorded as the diameter of the circle around the turbine. If the search area was irregular in shape (e.g. the base pad plus part of an access road), then a scale diagram of the search area must be prepared. If a stratified search was undertaken, the area of each stratum must be recorded.
 - For every carcass found, record:
 - the date and time it was found;
 - the state of decomposition, to help estimate the number of days since death;
 - the extent and type of injury sustained (if identifiable);
 - the species (or the best estimate of species, if it is in too poor condition to identify completely);
 - the distance and direction from the nearest turbine as well as GPS coordinates of the carcass (to serve as a verification check); and,
 - The substrate on which the victim was found.
 - Information on average wind strength and direction on each night since the last search is also required.
- **Scavenger trials:** It is also necessary to correct for carcasses that were scavenged before the search period.
- Carcass removal experiments to estimate scavenging rates must be conducted:
 - at least twice during each season when searches are being undertaken, as the suite of scavengers is likely to change through the year; and
 - with carcasses that resemble native birds and are freshly dead or were frozen when freshly dead.
 - Examples are blackbirds and starlings from provincial control programmes, turbine victims, quails and quail chicks from farmers, and dark chicks from industrial chicken farms or breeders (the dark chicks are unsuitable as meat chickens because their skin is also

darkly coloured; the chicks may be given away or sold for a reduced price).

- Bats are normally only available as turbine victims.
- Carcasses should be laid out in the search area, georeferenced by GPS, and then looked for on the day of the next carcass search. Carcass persistence should be examined over various intervals, either by setting out carcasses at different intervals before the search (e.g., some immediately after the previous search, others the day before), or by setting them out the night before a search, but then leaving all carcasses in place for up to 2 weeks, checking them on each search occasion for their persistence.
- Carcasses should be distributed at all turbines where searches are undertaken, with no more than one or two carcasses per turbine. Carcasses should be distributed across the range of different substrates being searched, roughly in proportion to their proportions in the search area (e.g. if 20% of the search area is a gravel pad and 80% is grass, then 20% of the carcasses should be placed on the gravel pad, and 80% in grass).
- Scavenger trials should be repeated annually, as the numbers and efficiency of scavengers, especially vertebrates such as raccoons, foxes, crows, etc. may change among years.
- **Searcher efficiency trials:** All observers, even those with trained dogs, will overlook some carcasses. This percentage will vary depending on the observer, the habitat and the area being searched, etc.
- Searcher efficiency must be tested for every individual or team involved in searching for carcasses (including teams using dogs). Searcher efficiency values are not transferable to a different individual or team or to a different substrate.
 - Unknown to the searcher, another person sets out carcasses on the previous evening within the area to be searched the following day.
 - Carcasses should be placed at random locations within the search area. The location of the carcasses must be recorded, so that they can be retrieved if they were not located by the searcher.
 - If a stratified design is in use, then separate trials must be undertaken in areas being intensively searched and those with lower intensity searching.
 - If bats have been found as victims they should be included as test carcasses. Whenever possible, use carcasses of native species that may be expected at the turbine site, so that the searcher will not recognize them as being part of a trial. If they remain in good condition, carcasses may be re-used for multiple trials.
 - No more than one or two carcasses should be placed in the search area of any given turbine on a single visit.
 - Trials need not cover every turbine, but should be distributed across substrates as for scavenger trials.
 - At least 20 carcasses should be used when testing observers.

- These should be spread over multiple visits, so that the observer does not become aware that a test is underway. The best design involves testing that is undertaken continuously, with one or a few carcasses placed prior to each visit. This is most practical if more than one observer is involved in carcass searching, in which case each observer can place one or more carcasses within the areas being searched by the other observer. This has the advantage that it keeps human searcher efficiency high, because the searcher will be “on guard” during every search session.
- Any carcasses that were not found should be retrieved immediately after the search to determine whether they were scavenged or overlooked. Optionally, they may then be left in place as part of a scavenger efficiency trial, unless they are required for further searcher efficiency trials.
- Data recorded for searcher efficiency trials should include, for each bird:
 - Date, time and location it was placed, along with the species; and,
 - Date and time it was searched for and whether it was found, overlooked or scavenged, along with the name of the searcher. If the carcass remained, record its condition (intact, partially scavenged or decomposed).
- It may also be possible to develop a design that combines searcher efficiency and scavenger trials, provided that these trials involve at least some birds placed the night before (so they are still fresh) and some placed on the previous visit.
- A variety of statistical approaches have been used to estimate total mortality, incorporating all necessary correction factors. Because these are likely to improve over time, as further data are accumulated, all proponents are asked to retain all raw data to allow for flexible reanalysis in future.
- The shared database being developed by the CanWEA and the CWS will incorporate routines to estimate total mortality from each site using the best available statistical methods, provided that all raw data (not averages or lumped data) are deposited in the data base. This would include all information described in this section (information on search effort, search area, each carcass found, scavenger trials, observer efficiency trials and daily weather conditions). Proponents are strongly encouraged to deposit their data in this data base to ensure that these calculations can be adequately standardized across projects. This will also allow for simple re-analysis if better statistical techniques become available in the future.
- Provincial / territorial and federal permits are required to handle and collect dead birds or parts thereof. Please apply for these permits well before the carcass counts are to be done.
- The CWS can provide additional help with design of carcass searches.

Estimating collisions using other methods

- In some cases, where carcass searches are not practical (e.g., sites over water or wetlands), other techniques may be necessary to estimate mortality.
- Some of these techniques include radar, thermal imaging equipment, video equipment, or direct observations of birds.

- In most cases, neither radar nor thermal imaging equipment can be used to identify the species of birds involved, unless there are only a few species of concern with very different flight patterns or sizes.
- Effective use of any high tech approach requires sophisticated computer algorithms to process large amounts of data automatically, because many hundreds of hours of recordings may need to be scanned to detect collisions.
- For this same reason, visual observations are unlikely to be effective except in very unusual circumstances, or as part of a research project to understand bird behaviour around turbines.
- With radar, detecting collisions depends on following a track that disappears when it reaches the turbines – but it is not known how often tracks may disappear for other reasons, or whether all incoming birds will necessarily be detected.
- Thermal imaging methods may be able to observe collisions directly, but can only view a limited area, usually only a portion of one turbine.
- A system specifically designed to measure bird collision rates has been developed that combines microphones placed in the turbine structure (to detect the sounds of a collision) with a video camera (to record what hit the turbine). A computer is programmed to store video images from shortly before and after any unusual sounds (which may represent a collision). Tests have shown that it can effectively detect artificial collisions (e.g. tennis balls), but further testing is required to determine how well it will detect actual bird collisions (Verhoef, Westra, Korterink, and Curvers . 2003. *WT-Bird, a novel bird impact detection system*. Unpublished report. Available at: <http://www.ecn.nl/docs/library/report/2002/rx02055.pdf>). Replacing the video camera with a thermal imaging system may be required to detect nocturnal collisions.
- At present, none of these technologies is sufficiently developed to provide standardized protocols. These techniques would normally only be required under exceptional circumstances (e.g., offshore installations), or as part of a special research project.
- As the technologies are developed, it may be appropriate to recommend their use more widely in the future.

Appendix 2. Codes for breeding evidence

The following codes should be used for breeding evidence, in association with breeding season area searches. These codes are those used for the Ontario or Maritimes breeding bird atlases. Further details are available from their web sites:

Ontario Breeding Bird Atlas (<http://www.birdsontario.org/atlas/atlasmain.html>)

Maritimes Breeding Bird Atlas (<http://www.mba-aom.ca/english/index.html>). These were selected to allow for consistency in the national data base.

OBSERVED

- X Species observed in its breeding season (no evidence of breeding). Presumed migrants should not be recorded.

POSSIBLE BREEDING

- H Species observed in its breeding season in suitable nesting habitat.
S Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat.

PROBABLE BREEDING

- P Pair observed in their breeding season in suitable nesting habitat.
T Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart, at the same place.
D Courtship or display between a male and a female or 2 males, including courtship feeding or copulation.
V Visiting probable nest site.
A Agitated behaviour or anxiety calls of an adult.
B Brood patch on adult female or cloacal protuberance on adult male.
N Nest-building or excavation of nest hole. (woodpeckers and wrens). Both groups may build dummy or roosting nests so nest-building alone is not enough to confirm breeding.

CONFIRMED BREEDING

- NB Nest building or adult carrying nesting material (for all species except wrens and woodpeckers)
DD Distraction display or injury feigning.
NU Used nest or egg shell found (occupied or laid within the period of the study).
FY Recently fledged young or downy young, including young incapable of sustained flight.
AE Adults leaving or entering nest site in circumstances indicating occupied nest.
FS Adult carrying faecal sac.
CF Adult carrying food for young.
NE Nest containing eggs.
NY Nest with young seen or heard.

Appendix 3. Sample data sheet for ten-minute point counts

Location (Site Name): _____ UTM Map no.: _____

Date: ____/____/20__ Observer: _____

Wind (Beaufort scale): _____ Sky: _____ Precipitation: _____ Temp: _____ °C

Comments: _____

Point Count Station

[illegible][illegible]

[illegible]



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Project Number: 1104036.00

Project Title: WAINFLEET WIND ENERGY PROJECT

Report: 003-R04-1104036

Title: CONSTRUCTION PLAN REPORT

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Date: October, 2010

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Tab 6: Project Correspondence

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1.0 Project Overview

The Wainfleet Wind Energy Project (“the Project”) Construction Plan Report is prepared in accordance with the requirements of the Ministry of the Environment’s Renewable Energy Approvals Regulation (“the Regulation”), O.Reg 359/09, specifically with consideration of *Item 1* of the requirements outlined in *Table 1* of the Regulation.

The proposed Wainfleet Wind Energy Project is to be situated in the Township of Wainfleet, in Niagara Region of Ontario. The Project would consist of five (5) Vestas V-100 1.8 megawatt wind turbines producing a nameplate capacity of 9.0 megawatts. If approved, the wind turbines would be erected for the purpose of capturing energy from the wind, a renewable resource, and converting it into clean, useable electricity. This electricity will be transported to consumers via interconnection facilities, including transformers and distribution lines. The footprint of these facilities is captured and described in reports prepared for this Renewable Energy Approval (REA).

The proposed undertaking includes three (3) phases: 1) Construction; 2) Operation and Maintenance, and 3) Decommissioning of the facility and its associated infrastructure. Each of these phases is described in separate reports.

Infrastructure for the purposes of the REA and this Project includes turbines, access roads, collector switching station low voltage electrical taplines, poles, subsurface cables, temporary staging areas, and an operations/SCADA building. Low voltage step-up transformers are found inside each wind turbine’s nacelle housing and therefore pad mounted transformers are not part of the footprint of this facility.

This report will detail the construction activities, the duration, the environmental effects, and mitigation measures. The wind turbine locations are presented in **Table 1-A**. The general project schedule is found in **Table 1-B**, with the description of each phase of the project found in **Table 1-C**.

Table 1-A: Coordinates of Each Turbine (NAD 83, UTM Zone 17)		
Turbine Number	Latitude	Longitude
1	631359	4751252
2	631758	4750750
3	631921	4750541
4	632750	4748389
5	632706	4748817

1.1. General Project Schedule

Table 1-B provides an overview of key project activities and projected dates.

Table 1-B: General Project Schedule	
Activity	Date (Month, Year)
Begin Environmental Field Surveys	October, 2009
Begin Renewable Energy Approval	April, 2010
Submit Renewable Energy Approval Application	December, 2010
Obtain Renewable Energy Approval	April/May, 2011
Commence Construction	May/June, 2011
Commercial Operation	October, 2011

2.0 Construction Details

The activities required for the construction phase will be discussed in this section on a per turbine basis. All activities found listed under “Construction” in **Table 1-C** will be described in this report.

The project is expected begin construction during May/**June, 2011** pursuant to REA approval and subject to the requirements of government agencies. Construction activities will be initiated and completed at each turbine location between then and October, **2011**.

This phase of the project includes the following activities:

- Surveying and geotechnical work
- Access road construction and modification
- Delivery of equipment
- Foundation construction
- Tower and turbine assembly and installation
- Interconnection from turbines to switching station
- Substation construction replace all sub stations with switching station
- Testing and commissioning of switching station and collection system
- Electrical tapline construction
- Site clean-up and restoration
- Turbine testing and commissioning

The scope of this project is summarized in **Table 1-C**, which provides each phase (Construction, Operation and Maintenance, and Decommissioning) with the corresponding activities that will be undertaken. The construction phase is most relevant to this report; however, the Operations and Maintenance, and Decommissioning phases are presented to demonstrate the relationships among all phases of the project.

Table 1-C: Description of Each Phase	
Phase	Activities
Construction	• Surveying and geotechnical work • Access road construction and modification • Delivery of equipment • Foundation construction • Tower and turbine assembly and installation • Interconnection from turbines to substations • Substation construction • Electrical tapline construction • Site clean-up and restoration • Turbine commissioning
Operation & Maintenance	• Environmental effects monitoring • Turbine operation and electricity production • Annual and semi-annual maintenance • Repairs, as required • Community relations

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Decommissioning	• Land clearing • Road construction/modification • Removal of turbines and ancillary equipment • Site restoration and rehabilitation

1.1. Construction Schedule

The approximate construction schedule is presented in **Table 1-D**. The schedule provided is based upon a successful REA approval by April/May, **2011**. This schedule may be adapted as dictated by regulatory approvals and permit requirements.

Table 1-D: Approximate Construction Schedule	
Activity	Date
Surveying and geotechnical	May/2011
Access road construction and modification	June, 2011
Delivery of equipment	July/Aug 2011, 2011
Foundation construction	June/July, 2011
Tower and turbine assembly and installation	July-August, 2011
Interconnection from turbines to substations	July-September, 2011
Substation construction	July-Sep 2011
Electrical tapline construction	July-Sep 2011
Site clean-up and restoration	Sep-Nov. 2011
Turbine testing and commissioning	Sep-Oct 2011

2.1. Surveying and Geotechnical Study

A land survey of all turbine locations, interconnection routes and access roads will be completed before construction by a registered Ontario Land Surveyor. A geotechnical survey involving bore-hole samples and in situ testing will be undertaken before the construction of the tower foundations. It is anticipated that these studies will take place during **May/June, 2011**.

A Stage 1 Archaeological Assessment of the study area was undertaken by A.M. Archaeological Associates Limited (AMA) in **May, 2010**. The Stage 1 assessment determined that the study area possessed potential for significant archaeological remains. Based upon this assessment, AMA was retained to undertake a Stage 2 Archaeological Assessment, which included ploughing of most project locations and field study. Some sites did not require ploughing as the top soil was sufficiently visible. The Stage 2 study was completed in **August, 2010** and both reports have been forwarded to the Ministry of Tourism and Culture (MOTC) for approval. The MOTC's correspondence regarding this is found in **Tab 10**. During the Stage 2 Archaeological Assessment all of the proposed turbine locations were determined to have low potential for archaeological remains.

The Ministry of Tourism and Culture's Confirmation Letter is found in **Tab 10**, indicating that MOTC is satisfied with the Archaeological Assessments completed by AMA.

If, during construction, deeply buried archaeological remains are discovered, the proponent will cease construction and immediately notify MOTC and the Niagara Regional Police (*if human remains are found*).

2.1.1. Roads and Land Clearing

Access roads are purpose built roads that connects the site entrance to the existing municipal road. All project locations are found on open agricultural lots; therefore, minimal vegetation clearing will be required. Where roads and project infrastructure intersect with hedge rows, some vegetation will be removed. Where applicable, the Environmental Impact Statement (EIS) describes any mitigation measures for these areas. At these locations, the Natural Heritage field study determined that there will be no impacts to significant habitat or wildlife.

Clearing requirements are for each turbine location, laydown areas, temporary staging areas, substation, and for the construction of access roads and electrical taplines. Areas where land clearing will take place are found on the Site Plan found in **Tab 2** and described in the Design and Operations Report. At each location, gravel surfaced roads will be constructed. The roads will be designed and constructed to support heavy equipment and vehicles required for transportation, construction and erection

Road construction includes the excavation of topsoil and some subsoil and installation of geotextile and/or aggregate materials. The geotechnical assessment will determine the best approach based on the existing in-situ soil conditions for each site.

The proponent will seek to minimize road construction impacts by minimizing the required area of road construction and by adhering to REA setbacks. It should be noted that during the design of the project, significant effort was undertaken to avoid constructing new roads. Where possible existing roads will be used or improved. Roads were also located to avoid interactions with Natural Heritage setbacks.

All access roads will conform to and be compliant with provincial and municipal regulations and will be built to support the weight of the equipment and heavy machinery required to build each wind turbine location. Municipal and provincial permits and approvals will be obtained, as required, prior to construction.

All access roads will be constructed before any wind turbine components will be delivered to or installed on the site. The construction of access roads will observe the following design constraints:

- All roads will be five (5) meters wide with an additional 1 one (1) meter compacted shoulder on each side for a total width of seven (7) meters.
- Roads will be compacted for either a) fifteen (15) metric ton per axle load in wet or dry conditions. This value is based upon a single axle equipped with dual wheels or super-single tires, tire pressure of eight hundred (800) kPa and a maximum rut depth of thirteen (13) millimeters; or, b) a minimum load bearing capacity of two hundred and fifteen (215) nominal kPa.
- Roads will have a vertical grade of no greater than eight percent (8%).
- Roads must have a maximum lateral cross-fall grade of two percent (2%) and a

minimum lateral cross-fall grade of zero point five percent (0.5%) to allow for positive drainage away from the road surface.

- All vertical curves must have longitudinal radii (convex or concave) must not be less than two hundred (200) meters and irregularities in access roads shall have a maximum relative rise or fall of no more than one hundred and fifty (15) millimeters within and thirty meter (30m) section.
- The intersection of access roads and public roads should be modified to accommodate long loads by constructing temporary access with a minimum forty five (45) meter outside turning radius and a maximum inside turning radius of forty (40 meters with suitable culverts.
- Culverts will conform to municipal and NPCA requirements and approvals. Temporary access will be removed and restored following construction.
- Road paths will be clear of vegetation and free from overhead obstructions
- Roads, crane pads, and laydown drainage systems must be designed to control and dissipate the flow of surface water along the roads so as to self drain.
- Roads must be maintained in good condition for site traffic (graded, watered, flat, rut free, etc...) through out the life of the project.
- Roads must be marked with snow poles where and when applicable.
- Embankments will be constructed to maintain stability through out the project life span.

2.1.2. Turbine Site and Crane Pad Construction

Each wind turbine's access road will terminate at a crane pad where the turbine will be constructed. A crane will be required to erect the turbine during construction. A crane pad will be used to support the crane and will be temporary. The crane pad will be made of the same construction material as the access roads and subject to the conditions of the geotechnical assessment. Following construction, the crane pad will be restored using standard industry practices and subject to provincial and municipal requirements as applicable. Restoration is anticipated to be completed in **November, 2011**.

Each turbine location will need to be cleared and levelled before construction. The lay down of turbine components will take place within the proposed access road and may extend into a 50 meter by 50 meter area located around each turbine location. This area will be cleared, levelled, and be made accessible during the Construction Phase. Normally, topsoil is removed and stored for restoration and reclamation efforts.

Crane pads will be constructed in conjunction with access roads at each turbine location. Each crane pad is approximately 20 meters by 40 meters in area. The topsoil at the crane pad will be removed and 600 millimetres of crushed gravel will be compacted.

If any deeply buried archaeological remains are found, then the Ministry of Tourism and Culture will be contacted. If archaeological remains are found, then turbine locations may be relocated, in coordination with appropriate agencies and stakeholders.

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Excavated materials, such as topsoil will be reused as appropriate during post-construction restoration. Construction equipment for turbines and associated infrastructure generally includes graders, bulldozers, trucks, and cranes.

The turbine site plan is shown in **Tab 2**.

Construction of the turbine site and crane pad will observe the following design constraints:

- Crane pad working surface dimensions will be constructed at each location will be a minimum of twenty (20) meters by forty (40) meters.
- Crane pads will have a minimum inside turning radius on curves of eight (8) meters and a minimum outside turning radius of twenty (20) meters when using a crane with an aspect ratio of 1:1. Cranes with larger aspect ratios must be modified to accommodate the crane turning radius.
- Crane pads will be compacted for a ground bearing capacity for a one point five (1.5) meter wide strip load of two hundred and forty (240) kPa in wet or dry conditions.
- Crane pads on grades of greater than six percent (6%) must have a ground bearing capacity of two hundred and seventy (270) kPa in wet or dry conditions.
- Crane pad shoulders will be compacted to the same grade as the centre of the pad
- Crane pads will have a maximum side slope grade of two percent (2%)
- The grade of direction will not exceed eight percent (8%)
- Shoulder slopes must be no greater than forty-five (45⁰) degrees.
- Crane pads and shoulders will be graded so as to self drain, and must not allow water to accumulate
- Crane pads must be free of obstruction and shall provide a clear corridor of no less than ten (10) meters wide.
- Crane pad must be maintained through out construction to ensure snow removal, dust prevention, and re-compaction after environmental conditions or mechanical damage.
- The crane pad, turbine site, and laydown/storage areas will conform to Vestas Site Preparation Specifications and Installation Manual.

2.2. Delivery of Equipment

The wind turbines components (tower, blades, and nacelle) will be transported to the site by cargo truck, and will be stored and assembled on site. Turbine components will be delivered on authorized oversized vehicles. Heavy construction equipment used to assemble the tower and turbine will also be delivered by truck and assembled on site.

A Traffic Management Plan will be produced by the proponent in accordance with Ministry of Transportation standards. Use of municipal roads will be subject to municipal design and operating restrictions .

2.3. Foundation Construction

Topsoil will be removed and stockpiled before excavation for construction of the turbine foundations. A backhoe will be used to excavate an area of 3 meters deep by 20 meters wide by 20 meters long for the foundation. Topsoil and subsoil will not be mixed and will be stored separately. Where possible, excess fill will be used for on-site grading purposes.

The foundation will be constructed of poured concrete and reinforcing rebar steel. Wooden forms will be used to contain wet concrete and will be removed once the concrete is cured. A mounting ring for the turbine tower will be attached to the foundation. The mounting ring is used to support and connect the turbine tower to the foundation. Foundation construction will take approximately one month for all five turbine locations.

Each foundation will be left to cure for approximately one month before tower erection. Quick curing foundation methods may be employed at some sites where appropriate to geotechnical conditions. Quick curing foundations will conform to provincial building standards.

The foundation design, including the foundation type and dimensions, will depend on the results of a site specific geotechnical assessment of the turbine locations.

- At each wind turbine location, a Lay-Down area must be provided adjacent to the access road of sufficient area to permit any turbine equipment being delivered to the Crane Pad to be offloaded and stored pending erection and installation of the same. Vegetation from this area must be cut short and a graded working area must be provided with a forty-five (45) meter radius from the center of the turbine foundation with burms removed.
- Any portion of the Lay-Down area, or other travel path between the access roads and the Lay-Down area, over which delivery trucks are expected to travel in order to deliver the relevant Turbine Equipment must satisfy the requirements set for site access roads .
- The maximum construction site required by the constructor at each foundation is seventy (70) meters by seventy-six (76) meters (the "Construction Site"); the Construction Site includes a Crane Pad area of twenty-four (24) meters by eighteen (18) meters, which may have a maximum slope of two percent (2%) in any direction.
- The Crane Pad, the construction site and the access road parallel to the construction site should be all be at the same grade
- The remainder of the Construction Site must be clear of vegetation, rocks and other obstructions that may impede access by erection equipment.
- Any areas utilized for main component storage should be designed to provide a nominal ground bearing capacity of two hundred and fifteen (215) kPa.
- Shoulder slopes, if required, for Crane Pad must be no greater than forty-five degrees (45°). The Pad area must be graded to drain all water away from Crane Pad.

- The Proponent is responsible for ensuring that the construction site at each tower foundation is frequently and routinely maintained as necessary to ensure that the surface remains in good condition suitable for truck and tracked crane traffic; such maintenance includes snow removal and dust prevention.

2.4. Turbine Assembly and Installation

The turbines will be erected using a large crane supported on the crane pad area adjacent to each turbine site. The wind turbine (including the tower, blades, and nacelle) will be assembled using the crane. This activity will take approximately one month for five turbines. Following construction, the crane pad will be restored for agricultural use.

- Provision will be made for the safe and proper lay-down and storage of wind turbine components at, or adjacent to the crane pad, within the operating radius of the main crane and operating radius of the assist crane.
- If the main crane has a Lattice Boom, then a boom construction area will be required. This must be along side the crane path, with a width of fifteen (15) meters and a length of one hundred forty (140) meters.
- When lattice jib is used, the rigging area for the main crane must have a minimum length equal to wind turbine hub height plus twenty percent (20%) of the hub height added to this length parallel to the site road. The usable width must be a minimum of seven (7) meters.
- Off-loading area for nacelle must be a minimum five (5) meters by fifty (50) meters and within the working radius of the main crane.
- Off-loading area for blades must be twelve (12) meters by fifty-eight (58) meters and within the working radius of the main crane.
- Provisions must be made for the safe and proper lay-down and storage of parts in a suitable secure location. Parts include and are not limited to: lifting tools, service platforms (lifts), uninterruptable power supply, tower cables, nose cone parts, stairs, steps, ladders, boxes of bolts, and thirteen point eight (13.8) meter parts containers.
- Compounds, storage and lay-down areas must be clear of all debris, and the area must be level and free draining, and to have the same bearing capacity and proof testing as the crane pad.

2.5. Interconnection from Switching Station

The generated power from the Project will be collected via underground cabling and overhead lines and directed to a switching station. The switching station will connect directly to the Hydro One distribution system. The turbine will generate power at the 690 volts which will then be stepped up to the 27.6 kilovolt level of the local collector system by nacelle-mounted transformers located in the nacelle housing of each turbine. Pad mounted transformer stations are not required. The local collector system gathers the power generated by turbines via underground cables and delivers it to a switching station which represents the operating demarcation point between the hydro utility and the

generator. This station is also used for housing metering, line communication, and operating controls.

2.6. Electrical Switching Station

The substation site will be excavated to allow for the installation of gravel substrate and the construction of a concrete foundation. The foundation will be approximately 6 meters by 6 meters. Substation equipment will be grounded to a grounding grid installed in the gravel substrate. Substation equipment will be mounted on the concrete foundation and connected to the adjacent outgoing distribution line. The substations will be fenced, locked, and secured to prevent unauthorized access. The site plan provided in **Tab 2** provided the location of the electrical substation.

2.7. Electrical Tapline and Distribution System

The power generated at each of the wind turbine generators is transported through the collector system. The collector system consists of buried cables and overhead collector lines. In some cases, there may be some shared use with existing Hydro One lines and poles. The collector system will be built to applicable standards and codes.

Electricity collected at the switching station will be connected to Hydro One's distribution grid. The existing Hydro One distribution line may have to be extended to connect the switching station location to the existing distribution grid. An appropriate protection system, as per the best industry practices as well as utility guidelines will be provided.

2.8. Site Clean-up and Restoration

After the turbines have been constructed and the crane pad is no longer required, all construction areas will be rehabilitated. Any disturbed portions of the site will be remediated and re-vegetated. Topsoil removed during construction will be replaced/re-applied. Erosion prone areas will receive new plantings or seeding. Natural regeneration will be encouraged to achieve regeneration. This activity will take approximately one month with new vegetation growth taking longer.

2.9. Temporary Storage Facilities

Temporary storage of topsoil may be required during construction. Excavated topsoil that is required for site clean-up and restoration will be stored on lands immediately adjacent to the turbine location. While excess topsoil may be stored off site until decommissioning. Topsoil and subsoil will not be mixed, nor will topsoil be contaminated with any other material.

2.10. Operations and Maintenance Building

The operations and maintenance requirements for this project will be minimal. A small 3 meter by 3 meter building will be used for housing switches, DVAR, metering, Supervision, Control and Data Acquisition (SCADA). The purpose of this building is to monitor and control the operation of the facility and to provide storage space for maintenance equipment.

The maintenance building will be located within the fenced area of the switching station. Aside from housing the Supervisory, Control and Data Acquisition (SCADA) system, the

maintenance building may also be used as a spare parts warehouse. Maintenance tools used for generator alignment, tools for bolt torque and gearbox oil and tools used for oil filter change will also be stored in the maintenance building. There will be no permanent staff presence; therefore, a sanitation system will not be required. Only trained personnel will be permitted within the fenced in enclosure, including the maintenance building. The building is prefabricated and will be transported to the site.

2.11. Turbine Commissioning

Turbine commissioning takes place before the turbine begins producing electricity for the grid. This includes interconnection testing between the turbine and point of interconnection. Before the turbine can begin providing electricity to the grid, a battery of tests must be undertaken to confirm that the system conforms to regulatory and technical requirements. Interconnection to the electrical grid will be undertaken as a final step. Any required physical or technical adjustments may be carried out on the turbine at this point. The purpose of these tests is to confirm that the turbine is operating within technical specifications, codes and contractual expectations. This activity will be scheduled, but will ultimately depend on weather conditions. Turbine commissioning will take approximately two weeks for five turbines.

3.0 Construction Equipment

Construction of each turbine will require heavy equipment. Some equipment typical of construction includes *backhoes, trucks, crane, air compressor, concrete pump, concrete vibrator, concrete breaker, bull dozers, generators, loaders, etc...* Heavy equipment will produce noise and **Table 1-F** describes potential noise emissions for each type of equipment. It should be noted that not all of the equipment listed in Table 1-F will be used at each turbine. Construction equipment will vary depending on the tasks required for each activity (road construction, taplines, or the turbine itself).

The Noise Assessment Report provides greater detail on noise emissions for this project. All construction noise will be temporary in nature. Late night construction is not anticipated for this project and, if required, a Noise By-law exemption will be requested from the Township. The constructor will minimize noise disturbance impacts by restricting the use of noise emitting equipment to normal daytime hours.

Table 1-E: Typical Equipment and Noise Generated During Construction	
Equipment	Noise (dBA)
Air Compressor	81
Backhoe	85
Concrete Pump	82
Concrete Vibrator	76
Concrete Breaker	82
Dozer	80
Generator	78
Load	79
Paver	88
Water Pump	76
Trucks	88
Pile Drivers	101

Source: Bolt, Beranek and Newman, 1971

1.2. Required Turbine Components and Construction Materials

Turbine components include tower, nacelle, blades, generator, hub, transformers, electrical cabling, and interconnection equipment. Construction materials include wood, steel, poles, concrete, gravel aggregate, geotextiles, and culverts. Where possible, materials will be obtained locally from within Niagara Region. Materials will be selected by the constructor and will be suitable for the site specific conditions. Construction equipment and machinery will be powered with diesel or gasoline. Portable generators and pumps may be required.

All Materials will be stored at each individual turbine site and, if required, at the staging areas. Trucks will bring all materials to the project site. Oversized trucks will be required to transport turbine structures and blades. The number of trips made by delivery vehicles will depend on the final selection of transport vendors and the capacity and availability of their vehicles. Transport of materials will occur between **June 2011** and **November 2011**. The frequency of delivery will be dependent upon the construction staging listed in **Table**

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1-D and determined by the constructor.

Some chemicals will be required on-site for construction. These include concrete mixtures required for foundations and fuel for heavy equipment. Fuel will be handled in accordance with the mitigation measures provided for in **S.5.0** of this report.

The Environmental Effects Monitoring Plan (EEMP) and Design and Operations Report provide clarification on handling and storage requirements for chemicals. These reports also specify response measures to be followed in the event of a hazardous materials spill.

4.0 Additional Procedures

4.1. *Disposal of Construction Materials*

The project will not produce toxic or hazardous materials during construction. Some petroleum, oils, and lubricants (POL) and other fluids, that may be considered toxic, may be brought on site for turbine maintenance. Excess POL waste removed from the project site will be disposed or recycled according to provincial and municipal environmental waste management standards. Non-hazardous waste material will be handled by the municipal waste management system.

Excess construction materials will be reused where possible and recycled as an alternative to reuse. Some materials may be sent to the municipal landfill where necessary. The constructor will conform to municipal and provincial disposal requirements for landfill waste and transport of excess construction materials.

4.2. *Waste Management*

The project will not produce toxic or hazardous materials during construction. Some petroleum, oils, and lubricants (POL) and other fluids, that may be considered toxic, may be brought on site for turbine construction. Excess POL waste removed from the project site will be disposed or recycled according to provincial and municipal environmental waste management standards. Non-hazardous waste material will be handled by the municipal waste management system.

Excess materials required during construction will be reused where possible and recycled as an alternative to reuse. Some materials may be sent to the municipal landfill where necessary. The constructor will conform to municipal and provincial disposal requirements for landfill waste and transport of excess construction materials.

4.2.1. Solid Waste

Any solid waste generated as a result of construction of the Wainfleet Wind Energy Project will be produced from the assembly of the turbine and tower structures, foundations, subsurface cables, and vegetation cleared as required for equipment access to the site. The preferred method of disposing of solid waste for the constructed facility is reuse and recycling. In the even that materials cannot be reused or recycled, waste materials will be transported to the nearest waste disposal site as required.

Cranes will be necessary to assemble the turbines and towers. All associated components will be brought onsite using a flatbed truck. The foundation of each turbine will be poured to a depth of one metre below ground level. Any concrete sections and associated structural steel remaining from the turbine foundation will be transported off-site. All holes created from the construction of the turbine foundations will be filled, and top-soil will be re-applied.

Waste materials generated from the assembly of the turbine foundation will be reused, recycled or transported to the nearest waste disposal facility will be made in consultation with a waste management company at the time construction activities occur.

Clearing of the surrounding environment during the construction phase will be kept to a minimum. The clearing of land to undertake construction activities will not utilize any slash and burn methods.

Upon the completion of construction activities, the turbine assembly areas, access roads, and other areas cleared as required for construction activities will be reseeded or replanted with species similar to those found in the surrounding area. These areas will undergo natural regeneration to their original state. Where erosion prone areas exist, replanting in the surrounding area may be required to minimize the impacts of erosion.

4.2.2. Liquid Waste

Liquid waste generated as a result of construction activities of the Wainfleet Wind Energy Project may include fuel, oil and lubricants found inside the wind turbines, as well as the machinery equipment brought onsite during the construction process.

The storage and use of any fuels, oils and lubricants during the operation of the project's facility will comply with all applicable provincial and federal regulations, codes, and guidelines. The disposal and cleanup of any liquid waste will be in accordance to the procedures outlined in the Design and Operations Report for the Wainfleet Wind Energy Project.

4.3. *Abandonment Procedures*

In the event that construction of the facility and associated work is not completed, exposed soils may be subject to erosion due to wind or storm water run-off, which may respectively result in the creation of dust and sedimentation impacts. Wainfleet Wind Energy Inc. is responsible to undertake environmental effects monitoring as part of the EEMP following construction and through the life of the project. Where erosion prone areas have become evident revegetation and replanting may be required.

4.4. *Consultation and Construction*

Wainfleet Wind Energy Inc. will consult with adjacent land users, local municipality, federal agencies, provincial agencies, police and emergency services, and otherwise make suitable notice of the construction of the facility to those impacted by such activities.

4.5. *Emergency Response and Communications Plan*

In the event an emergency occurs during construction phase of the Wainfleet Wind Energy Project all appropriate authorities will be notified. Any Emergency Response and Communication required during the construction phase of the project will follow the guidelines and procedures documented in the *Design and Operations Report*.

5.0 Environmental Impacts and Mitigation of Construction

An Environmental Impact Statement (EIS) has been prepared for this project and is included as part of the REA Package. Please review the EIS in conjunction to this report. This report has been prepared to evaluate the significance of natural heritage features at the project site and to document how mitigation measures will ensure that there will be no negative environmental effects. The evaluation is based on information obtained during the records review, agency consultation and field studies conducted on-site. This document outlines the potential negative impacts on natural heritage features as a result of constructing and operating wind turbines and the supporting project infrastructure and proposes mitigation measures to address these impacts. Monitoring plans will also be established to evaluate the success of the mitigation measures proposed (Also, see the **Environmental Effects Monitoring Report**).

The project complies with Ontario Regulation 359/09 – Renewable Energy Approvals (REA) under Part V.0.1. of the Environmental Protection Act. The EIS document satisfies the reporting required under the Natural Heritage Section. As the lands are not within the Oak Ridges Moraine, Protected Countryside, or the Niagara Escarpment, those sections of Ontario Regulation 359/09 do not apply. Field reviews and background information checks identified all natural heritage features, and confirmed whether these features were Significant. Where the project was within the required setbacks given under Ontario Regulation 359/09, mitigations measures are proposed to address and negative environmental effects to natural heritage features.

The EIS identifies any environmental effects monitoring requirements to be included in the environmental effects monitoring plan report and describes how the construction plan report will address any negative environmental effects. These mitigations and requirements ensure that there will be no negative effects as a result of the proposed project.

6.0 Environmental Monitoring

Environmental monitoring involves providing good leadership and management structures to maintain a situational understanding of the environmental effects that occur during construction. This section describes how environmental monitoring, as described in the Environmental Effects Monitoring Plan (EEMP) relates to the Construction Phase of the project.

6.1. *Leadership and Management Structures*

The Proponent is responsible for providing leadership and management for the implementation of the Environmental Effects Monitoring Plan (EEMP). The Proponent and their agents or representatives are responsible to ensure that they diligently adhere to the procedures and practices outlined in the EEMP as well as legal and regulatory conditions of approvals. Once construction is completed, the proponent will confirm that environmental restoration efforts were correctly completed.

The Proponent will appoint a Project Manager to oversee the environmental monitoring for this project. During all phases and stages of the project, the Proponent must retain qualified professionals to confirm that environmental monitoring is correctly conducted. The qualified environmental monitoring professional(s) must regularly report and document the execution of the EEMP.

Wainfleet Wind Energy Inc. is committed to working with all stakeholders to reduce or eliminate the impacts of this proposed project. Wainfleet Wind Energy Inc. affirms its commitment to implement the EEMP and ensure the effectiveness of the environmental impact statement. Wainfleet Wind Energy will ensure that the environmental concerns and mitigation measures described in the Renewable Energy Approval Application are addressed and implemented in the field.

6.2. *Environmental Effects Monitoring Plan (EEMP)*

The Environmental Effects Monitoring Plan is found as part of the **Design and Operations Report**. The Wainfleet Wind Energy Project's *Environmental Effects Monitoring Plan* (EEMP) has been developed by Morrison Hershfield (MH) to describe the environmental protection measures required for all activities associated with the Wainfleet Wind Energy Project. The *Environmental Effects Monitoring Plan* outlines the necessary monitoring protocols required to make certain that mitigations measures are effective and adequate. This plan should be considered a supporting document to the rest of the *REA Package* and fulfills the requirements outlined by *Ontario Regulation 359/09 - Renewable Energy Approvals* under the *Green Energy Act*.

This *EEMP* is applicable to all employees of Wainfleet Wind Energy Inc. working on the operation and maintenance phases of the Wainfleet Wind Energy Project and provides guidance to Wainfleet Wind Energy Inc.'s contractors and subcontractors on environmentally safe standards for project activities during operation and environmental monitoring of the project.

6.3. *Project Commissioning and Scheduling*

Wainfleet Wind Energy Inc. is expecting project operations to commence by October, 2011. During the construction, operation and decommissioning phases of the Wainfleet Wind Energy Project environmental monitoring procedures will be carried out.

6.4. *Purpose and Objectives of the EEMP*

This *Environmental Effects Monitoring Plan* has been prepared to provide the required protection measures for all project activities associated with Wainfleet Wind Energy Project.

The purpose of the *Environmental Effects Monitoring Plan* is:

- To ensure that Wainfleet Wind Energy Inc.'s commitments to minimizing environmental effects are met.
- To provide a description of the environmental concerns related to the operation, maintenance, and decommissioning of the Wainfleet Wind Energy Project and instructions for mitigation of the potential impacts of these activities.
- To provide concise and clear instructions for implementing mitigation measures for the protection of environmental resources, and minimizing potential adverse environmental effects. To provide a means of tracking and recording actual effects of the project on valued ecosystem components.
- To ensure that the Wainfleet Wind Energy Project operations meet all provincial, federal and municipal requirements.
- To provide a reference document for planning and/or conducting operation, maintenance or decommissioning activities that may have an impact on the environment.

The Environmental Effects Monitoring Plan is intended to be a supporting document of the REA application that provides guidelines for the protection of valued ecosystem components during operation, maintenance and decommissioning activities. Background information contained within the Environmental Effects Monitoring Plan is covered in more detail in the other technical reports of the REA Package

7.0 Summary

The proposed Wainfleet Wind Energy Project can be constructed with minimal impacts to the environment provided that the constructor adheres to the environmental mitigation measures provided here and within the Environmental Impact Statement. Furthermore, environmental monitoring will reduce the risk of potential environmental impacts by outlining procedures based on regulations and good construction practices for waste management, health and safety, emergency response and training.

The Environmental Impact Statement (EIS) of the REA application package describes the potential impacts of the project on significant features and where the project interacts with REA setbacks. The EIS provides mitigation and impact reduction measures where applicable. Impacts resulting from construction of overhead and underground crossings of watercourses by electrical lines are discussed in the Water Bodies Impact Assessment Report, where appropriate mitigation measures to reduce these impacts are also described. Environmental monitoring plans have been developed and are discussed in the Environmental Effects Monitoring Plan included within the Design and Operations Report included in the REA package.

8.0 Consultant Legal Statement

Morrison Hershfield Limited ("MH") produced this report in accordance with our Proposal and information provided by IPC Energy ("the Client") and is based upon statements by the Client on the proposed design, construction, operations, maintenance, and decommissioning of the proposed wind energy project. The information and statements contained herein are for the sole benefit of the Client for the purposes of the Renewable Energy Approval.

The contents of this report are based upon our understanding of guidelines, regulations, and statutes which we believe to be current at this time. Changes in guidelines, regulations, statutes, and enforcement policies can occur at any time, and such changes could affect the conclusions and recommendations of this report.

While we have referred to and made use of reports and specifications prepared by others, we assume no liability for the accuracy of the information contained within those reports and specifications.

Draft
26-Nov-10



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Project Number: 1104036.00

Project Title: WAINFLEET WIND ENERGY PROJECT

Report: 005-R03-1104036

Title: DECOMMISSIONING PLAN REPORT

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(Draft for public and agency review)

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1.0 Project Overview

The Wainfleet Wind Energy Project (“the Project”) Decommissioning Plan Report is prepared in accordance with the requirements of the Ministry of the Environment’s Renewable Energy Approvals Regulation (“the Regulation”), O.Reg 359/09, specifically with consideration of *Item 3* of the requirements outlined in *Table 1* of the Regulation.

The proposed Wainfleet Wind Energy Project is to be situated in the Township of Wainfleet, in Niagara Region of Ontario. The Project would consist of five (5) Vestas V-100 1.8 megawatt wind turbines producing a nameplate capacity of 9.0-megawatts. If approved, the wind turbines would be erected for the purpose of capturing energy from the wind, a renewable resource, and converting it into clean, useable electricity. This electricity will be transported to consumers via interconnection facilities, including transformers and distribution lines. The footprint of these facilities is captured and described in reports prepared for this Renewable Energy Approval (REA).

The Renewable Energy Approval examines three phases: 1) Construction; 2) Operation and Maintenance, and 3) Decommissioning of the facility and its associated infrastructure. Each of these phases is described in separate reports. This report describes the Decommissioning of the facility. Generally, unless specified, this report describes the decommissioning on a turbine basis.

Infrastructure for the purposes of the REA and this Project includes turbines, access roads, collector system, switching station, electrical tap lines, poles, surface cables, temporary staging areas, and an operations building. Transformers are located inside each wind turbine’s nacelle housing and therefore pad mounted transformer substations are not part of the footprint of this facility.

This report will detail the decommissioning activities, the duration, the environmental effects, and mitigation measures. The report will also detail the decommissioning activities, the duration, the environmental effects, and mitigation measures. The wind turbine locations are presented in **Table 1-A**. The general project schedule is found in **Table 1-B**, with the description of each phase of the project found in **Table 1-C**. The **numbered tabs** of the REA package provide additional details.

Table 1-A: Coordinates of Each Turbine (NAD 83, UTM Zone 17)

Turbine Number	Latitude	Longitude
1	631359	4751252
2	631758	4750750
3	631921	4750541
4	632750	4748389
5	632706	4748817

1.1 General Project Schedule

Table 1-B provides an overview of key project activities and projected dates.

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Table 1-B: General Project Schedule	
Activity	Date (Month, Year)
Begin Renewable Energy Approval	April, 2010
Submit Renewable Energy Approval Application	December, 2010
Obtain Renewable Energy Approval	April/May, 2011
Commence Construction	May/June, 2011
Commercial Operation	October , 2011

1.1 Scope of the Project

The scope of the Wainfleet Wind Energy Project includes the construction, operation and maintenance, and decommissioning of the facility and its associated infrastructure, including turbines, access roads, collector switching station, low voltage electrical tap lines, poles, surface cables, temporary staging areas, and an operations building.

The scope of project activities is summarized in **Table 1-C**, which provides each phase (Construction, Operation and Maintenance, and Decommissioning) with the corresponding activities that will be undertaken. However, the decommissioning phase is most relevant to this report.

Table 1-C: Description of Each Phase	
Phase	Activities
Construction	• Surveying and geotechnical work • Access road construction and modification • Delivery of equipment • Foundation construction • Tower and turbine assembly and installation • Interconnection from turbines to Switching station • Switching station construction • Electrical tap line construction • Site clean-up and restoration • Turbine commissioning
Operation & Maintenance	• Environmental effects monitoring • Turbine operation and electricity production • Annual and semi-annual maintenance • Repairs, as required • Community relations
Decommissioning	• Land clearing • Road construction/modification • Removal of turbines and ancillary equipment • Removal of electrical tap lines • Site restoration and rehabilitation

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2.0 Decommissioning Procedure

The approximate end of lifecycle of each turbine is 25 years. Following this time, it may be possible to extend the lifecycle of some or all of the turbines by replacing or upgrading old components. The earliest anticipated decommissioning of the entire facility could begin at the end of the FIT contract period in April 2030 unless the contract is extended. It will become necessary at this point in time to decommission the entire facility and either remove or replace the turbines.

The decommissioning of the **Wainfleet Wind Energy Project** will conform to standard industry practices in force at the time of decommissioning. **Wainfleet Wind Energy Inc.** will remove all of the main components (including, turbines, nacelles, blades, collector system, Switching station, etc.) of the facility. All components will be recycled and/or reused where possible. Each turbine site will be reclaimed to a suitable land-use.

Turbine foundations will be removed and the land reclaimed. The type of foundation material used will determine the approach to removing it. Generally, foundations of each turbine will be broken down into removable pieces to a depth of one metre below ground level using heavy equipment. Each concrete section and associated structural steel will be removed from the turbine foundation and transported off-site. This material may be recycled or used as fill depending on the condition of the material removed. All holes created from the removal of the turbine foundations will be filled, and top-soil will be re-applied to provide for suitable reclamation.

It should be noted that decommissioning includes the removal of all project components, including, collector system, switching stations, low voltage electrical tap lines, surface cables and poles. These components will be recycled, reused, or disposed of appropriately and in conformity with the practice in effect at that time. Buried cables may be abandoned in accordance with Ministry practices and applicable regulations in effect.

Consultation will be required during the decommissioning of the facility to ensure that no negative impacts are observed. Wainfleet Wind Energy Inc will work with impacted land users and agencies to coordinate the removal components and land reclamation.

Disturbed portions of the facility will undergo natural re-vegetation, seeding or replanting to return the site to pre-facility conditions. Particular attention will be paid to areas prone to erosion. Post-decommissioning site drainage will be retained according to pre-existing conditions.

Before decommissioning can occur, environmental monitoring will take place. This will include those action items listed in the Environmental Effects Monitoring Plan (EEMP). Generally, this entails surveys to identify bird nesting areas to ensure that there is as little disturbance as possible to the surrounding wildlife during decommissioning of the project. Environmental effects monitoring may recommend additional environmental mitigation where required. Each element of the decommissioning phase is described more extensively in the subsections below. Environmental effects caused by the decommissioning phase of the project will be mitigated as described in the EEMP and Environmental Impact Statement.

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The subsections below corresponded to the activities described in earlier phases of the project. The **Design and Operations Plan Report** and **Construction Plan Reports** are useful references in holistically understanding this undertaking.

2.1 Land Clearing

A decommissioning pad-staging area will be constructed immediately adjacent to the turbine. This 25 meter by 25 meter areas will be cleared, graded and constructed using aggregate material to support the weight of heavy machinery that is required to dismantle each turbine. It is expected that this activity will take approximately two months for each of the projects five turbines. This area will adhere to the REA setbacks for water bodies, natural heritage, and land use. The area used during the construction phase as a crane pad to erect each turbine will be used for this purpose.

2.2 Road Construction/Modification

The existing access roads used during the operation phase of the project will be upgraded as required overtime with aggregate material if deemed necessary, based on the geotechnical conditions of the facility. Before decommissioning can take place, roads will be checked and improved to confirm accessibility for equipment required for decommissioning. This activity is expected to take approximately three (3) weeks.

2.3 Removal of Turbines and Ancillary Components

Each turbine and its components will be disassembled on site and will be confined to the construction footprint already established during the construction phase. All turbine components and parts will be removed and either reused or recycled where possible. Removal of turbines and ancillary components will take approximately two months for all five turbines.

Turbine foundations will be removed and the land reclaimed. The type of foundation material used will determine the approach to removing it. Generally, foundations of each turbine will be broken down into removable pieces to a depth of one metre below ground level using heavy equipment. Each concrete section and associated structural steel will be removed from the turbine foundation and transported off-site. This material may be recycled or used as fill depending on the condition of the material removed. All holes created from the removal of the turbine foundations will be filled, and top-soil will be re-applied to provide for suitable reclamation.

2.4 Removal of Electrical Tap Lines

Low voltage electrical tap lines, surface distribution cables, and poles will be removed from the site and recycled, reused or disposed of appropriately.

2.5 Restoration of Land and Water

The landscape adjacent to the project location consists of an area of approximately 3400ha and is generally agricultural in land use. The land inside the project area is mostly flat, with an elevation of 174 m to 182 m above mean sea level. Within the project location, streams are relatively small, some only seasonal. No major rivers are found in the study area. There are some large drains in which water remains year round. Most of these fields are tilled and

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planted seasonally with crops such as corn, oats, and soybeans. Field sizes vary considerably. The landscape is fragmented with open fields, roads, fences, planted crops and vegetation, and settlement areas. There are few woodlots in and around the project area. The diversity of tree species is relatively low.

The Wainfleet Wind Energy Project site will be remediated to its pre-facility condition following the disassembly and removal of all project infrastructure. Areas of the facility that have been disturbed will undergo natural revegetation or will be replanted with species similar to those found in the surrounding area. All top soil that is stripped during decommissioning activities will be re-applied. These activities will take approximately two weeks. Vegetation will re-grow over the following summer season.

2.5.1 Restoration of Land

Specific areas of the project's facility that will require remediation include turbine and laydown areas, Switching station, access roads, and electrical tap line corridors. Disturbed portions of the facility will undergo natural re-vegetation, seeding or replanting to return the site to pre-facility conditions. Particular attention will be paid to areas prone to erosion. Planting designs will be completed by a qualified landscape architect. Post-decommissioning site drainage will be retained according to pre-existing conditions.

2.5.2 Restoration of Waterways

Watercourse and water body impacts will be minimal. The layout of the project facility was designed to minimize environmental impacts to waterways located within close proximity to the facility. The Water Report provides greater detail on this. During decommissioning it is expected that surrounding watercourse will not need to be restored because they will not be impacted.

If contamination of surface and groundwater occurs due to accidental spills or erosion during the decommissioning phase, risks will be minimized by the implementation of the Environmental Effects Monitoring Plan (EEMP). In all cases MOE and the appropriate agencies will be notified so that the incident can be corrected and investigated.

The EEMP includes plans for fuel, oil, and lubricant handling and storage. Storage and use of these materials during construction, operation and decommissioning phases of the project will comply with all applicable provincial and federal regulations, codes, and guidelines. Please see the Wainfleet Wind Energy Project EEMP for response measures to be followed in the event of a hazardous materials spill.

2.6 Waste Management

The project will not produce toxic or hazardous materials during decommissioning. Some petroleum, oils, and lubricants (POL) and other fluids, that may be considered toxic, may be brought on site for turbine decommissioning. Excess POL waste removed from the project site will be disposed or recycled according to provincial and municipal environmental waste management standards. Non-hazardous waste material will be handled by the municipal waste management system.

Excess materials required during decommissioning will be reused where possible and recycled as an alternative to reuse. Some materials may be sent to the municipal landfill

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where necessary. The constructor will conform to municipal and provincial disposal requirements for landfill waste and transport of excess construction materials.

2.6.1 Solid Waste

Any solid waste generated as a result of decommissioning of the Wainfleet Wind Energy Project will be produced from the dismantling of the turbine and tower structures, foundations, surface cables, and vegetation cleared as required for equipment access to the site. The preferred method of disposing of solid waste for the decommissioned facility is reuse and recycling. In the event that materials cannot be reused or recycled, waste materials will be transported to the nearest waste disposal site as required.

Cranes will be necessary to dismantle the turbines and towers. All associated components will be removed offsite using a flatbed truck. Turbine towers and parts will be reused if possible or recycled accordingly.

The foundation of each turbine will be broken down into pieces to a depth of one metre below ground level using heavy equipment. The concrete sections and associated structural steel removed from the turbine foundation will be transported off-site. All holes created from the removal of the turbine foundations will be filled, and top-soil will be re-applied.

Waste materials generated from the dismantling of the turbine foundation will be reused, recycled or transported to the nearest waste disposal facility will be made in consultation with a waste management company at the time decommissioning activities occur. Any surface cables and poles will be removed from the site and reused, recycled or disposed of accordingly.

Clearing of the surrounding environment during the decommissioning phase will be kept to a minimum. Regenerated construction staging and laydown areas used during the construction phase of the project may need to be cleared again for decommissioning activities. The clearing of land to undertake decommissioning activities will not utilize any slash and burn methods.

Upon the completion of decommissioning activities, the turbine disassembly areas, reclaimed access roads, and other areas cleared as required for decommissioning activities will be reseeded or replanted with species similar to those found in the surrounding area. These areas will undergo natural regeneration to their original state. Where erosion prone areas exist, replanting in the surrounding area may be required to minimize the impacts of erosion.

2.6.2 Liquid Waste

Liquid waste generated as a result of decommissioning activities of the Wainfleet Wind Energy Project may include fuel, oil and lubricants found inside the wind turbines, as well as the machinery equipment brought onsite during the decommissioning process.

The storage and use of any fuels, oils and lubricants during the operation of the project's facility will comply with all applicable provincial and federal regulations, codes, and guidelines. The disposal and cleanup of any liquid waste will be in accordance to the procedures outlined in the Design and Operations Report for the Wainfleet Wind Energy Project.

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2.7 Consultation and Decommissioning

Wainfleet Wind Energy Inc. will consult with adjacent land users, local roads board, local municipality, federal agencies, provincial agencies, police and emergency services, and otherwise make suitable notice of the decommissioning of the facility to those impacted by such activities.

2.8 Emergency Response and Communications Plans

In the event an emergency occurs during decommissioning phase of the Wainfleet Wind Energy Project all appropriate authorities will be notified. Any Emergency Response and Communication required during the decommissioning phase of the project will follow the guidelines and procedures documented in the *Design and Operations Report*.

2.9 Abandonment during Decommissioning

In the event that decommissioning of the facility and associated work is not completed, exposed soils may be subject to erosion due to wind or storm water run-off, which may respectively result in the creation of dust and sedimentation impacts. Wainfleet Wind Energy Inc. is responsible to undertake environmental effects monitoring as part of the EEMP following one year after decommissioning. Where erosion prone areas have become evident revegetation and replanting may be required.

2.10 Decommissioning Notification

A Decommissioning Notification will be given to all appropriate stakeholders and authorities at the commencement of decommissioning activities. Notification of Decommissioning and associated activities will be communicated as documented in the Design and Operations Report.

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3.0 Environmental Monitoring

Environmental monitoring involves providing good leadership and management structures to maintain a situational understanding of the environmental effects that occur during construction. This section describes how environmental monitoring, as described in the Environmental Effects Monitoring Plan (EEMP) relates to the Decommissioning Phase of the project.

3.1 Leadership and Management Structures

The Proponent is responsible for providing leadership and management for the implementation of the Environmental Effects Monitoring Plan (EEMP). The Proponent and their agents or representatives are responsible to ensure that they diligently adhere to the procedures and practices outlined in the EEMP as well as legal and regulatory conditions of approvals. Once decommissioning is completed, the proponent will confirm that environmental restoration efforts were correctly completed.

The Proponent will appoint a Project Manager to oversee the environmental monitoring for this project. During all phases and stages of the project, the Proponent must retain qualified professionals to confirm that environmental monitoring is correctly conducted. The qualified environmental monitoring professional(s) must regularly report and document the execution of the EEMP.

Wainfleet Wind Energy Inc. is committed to working with all stakeholders to reduce or eliminate the impacts of this proposed project. Wainfleet Wind Energy Inc. affirms its commitment to implement the EEMP and ensure the effectiveness of the environmental impact statement. Wainfleet Wind Energy will ensure that the environmental concerns and mitigation measures described in the Renewable Energy Approval Application are addressed and implemented in the field.

3.2 Environmental Effects Monitoring Plan

The Environmental Effects Monitoring Plan is found as part of the **Design and Operations Report**. The Wainfleet Wind Energy Project's *Environmental Effects Monitoring Plan* (EEMP) has been developed by Morrison Hershfield (MH) to describe the environmental protection measures required for all activities associated with the Wainfleet Wind Energy Project. The *Environmental Effects Monitoring Plan* outlines the necessary monitoring protocols required to make certain that mitigations measures are effective and adequate. This plan should be considered a supporting document to the rest of the *REA Package* and fulfills the requirements outlined by *Ontario Regulation 359/09 - Renewable Energy Approvals* under the *Green Energy Act*.

This *EEMP* is applicable to all employees of Wainfleet Wind Energy Inc. working on the operation and maintenance phases of the Wainfleet Wind Energy Project and provides guidance to Wainfleet Wind Energy Inc.'s contractors and subcontractors on environmentally safe standards for project activities during operation and environmental monitoring of the project.

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3.3 Project Commissioning and Scheduling

Wainfleet Wind Energy Inc. is expecting project operations to commence by October 2011. During the construction, operation and decommissioning phases of the Wainfleet Wind Energy Project environmental monitoring procedures will be carried out.

3.4 Purpose and Objectives of the EEMP

This *Environmental Effects Monitoring Plan* has been prepared to provide the required protection measures for all project activities associated with Wainfleet Wind Energy Project.

The purpose of the *Environmental Effects Monitoring Plan* is:

- To ensure that Wainfleet Wind Energy Inc.'s commitments to minimizing environmental effects are met.
- To provide a description of the environmental concerns related to the operation, maintenance, and decommissioning of the Wainfleet Wind Energy Project and instructions for mitigation of the potential impacts of these activities.
- To provide concise and clear instructions for implementing mitigation measures for the protection of environmental resources, and minimizing potential adverse environmental effects. To provide a means of tracking and recording actual effects of the project on valued ecosystem components.
- To ensure that the Wainfleet Wind Energy Project operations meet all provincial, federal and municipal requirements.
- To provide a reference document for planning and/or conducting operation, maintenance or decommissioning activities that may have an impact on the environment.

The Environmental Effects Monitoring Plan is intended to be a supporting document of the REA application that provides guidelines for the protection of valued ecosystem components during operation, maintenance and decommissioning activities. Background information contained within the Environmental Effects Monitoring Plan is covered in more detail in the other technical reports of the REA Package

4.0 Summary

The proposed Wainfleet Wind Energy Project can be decommissioned with minimal impacts to the environment provided that the decommissioner adheres to the environmental mitigation measures provided here and within the Environmental Impact Statement. Furthermore, environmental monitoring will reduce the risk of potential environmental impacts by outlining procedures based on regulations and good practices for waste management, health and safety, abandonment, and emergency response and training.

The Environmental Impact Statement (EIS) of the REA application package describes the potential impacts of the project on significant features and where the project interacts with REA setbacks. The EIS provides mitigation and impact reduction measures where applicable. Impacts resulting from the decommissioning of overhead and underground crossings of watercourses by electrical lines are discussed in the Water Bodies Impact Assessment Report,

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where appropriate mitigation measures to reduce these impacts are also described. Environmental monitoring plans have been developed and are discussed in the Environmental Effects Monitoring Plan included within the Design and Operations Report included in the REA package.

5.0 Consultant Legal Statement

Morrison Hershfield Limited (“MH”) produced this report in accordance with our Proposal and information provided by IPC Energy (“the Client”) and is based upon statements by the Client on the proposed design, construction, operations, maintenance, and decommissioning of the proposed wind energy project. The information and statements contained herein are for the sole benefit of the Client for the purposes of the Renewable Energy Approval.

The contents of this report are based upon our understanding of guidelines, regulations, and statutes which we believe to be current at this time. Changes in guidelines, regulations, statutes, and enforcement policies can occur at any time, and such changes could affect the conclusions and recommendations of this report.

While we have referred to and made use of reports and specifications prepared by others, we assume no liability for the accuracy of the information contained within those reports and specifications.



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Project Number: 1104036.00

Project Title: WAINFLEET WIND ENERGY PROJECT

Report: 002-R03-1104036

Title: WATER ASSESSMENT AND IMPACTS REPORT

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Date: September 29, 2010
(Draft, For Public and Agency Review)

Morrison Hershfield Limited

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Jonathan Veale
Project Manager

A handwritten signature in blue ink, reading 'Kelly Sadlier'.

Kelly Sadlier
Aquatic Ecosystems Biologist



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1.0 Introduction

Morrison Hershfield has been retained by IPC Energy to complete a Water Assessment and Impact Report as part of a Renewable Energy Approval (“REA”) for a proposed wind farm located in the Niagara Region, Ontario. The project involves the development of up to 5 turbines with a hub height of 95m resulting in the total nameplate production of 9.0 Mega-Watts (“MW”)

This report has been prepared to document the potential negative impacts on waterways as a result of constructing wind turbines and the supporting project infrastructure. As such, mitigation measures will be proposed and described to address any potential negative impacts on waterbodies that may result from the project construction. Monitoring plans will also be established to evaluate the success of the mitigation measures proposed.

2.0 Methodology

An aquatic field survey was conducted December 2009 and April 2010 to produce a complete characterization of the watershed and watercourse conditions within the project study area. Field investigations encompassed the following aquatic habitat parameters:

- Waterbody type (coldwater, warmwater);
- Habitat information/locations;
- Stream morphology (including shoreline habitat);
- Fish species present within the study area (including species at risk);
- “Critical” or important habitat areas including potential spawning areas, good nursery cover, and feeding areas; and
- Potential impacts, habitat compensation or enhancement opportunities.

Background information for the watercourse crossings was obtained from the following sources:

- Ministry of Natural Resources (MNR), Vineland
- Regional Municipality of Niagara
- Niagara Peninsula Conservation Authority (NPCA)
- Township of Wainfleet

A summary of the MNR data is provided in **Appendix C**.

3.0 Project Site Investigation

3.1 Watershed Summary

Within the study limits are two watersheds; Welland River and Casey Drain watersheds. The waterways and drainage within these watersheds flow through predominately agricultural land, and are often channelized to accommodate the land use. As such, the

waterways are often following marginal tree lines or cross through forest stands between agricultural fields.

The MNR classification system was used to identify the fish habitat type. Type I and Type II are used to identify the sensitivity. Type I is considered high sensitivity due to the area limiting the overall productive capacity, or the presence of sensitive fish species and/or habitat; these areas require a higher degree of protection. Type II is moderately sensitive, the habitat is important to the fish community but it is below its productive capacity; good opportunities for habitat compensation in these areas exist.

During the field investigations, electrofishing was not completed; however, MNR provided fish species data which is provided for each watershed **Table 1.0**.

Welland River Watershed

Welland River is situated north of the Wainfleet project limits in Niagara Region, southern Ontario. The headwaters of the Welland River originate south of Hamilton, Ontario and drain into Niagara River. Old Mill Race Creek is an important tributary of Welland River, a waterway which flows through rural and urban communities and drains into Lake Erie. During the field investigation, Welland River was highly degraded likely as a result of agricultural activity and urban development. Destabilization of stream embankments, poor riparian communities in several locations has likely decreased the overall health of the watercourse.

Welland River was classified as a Type I watercourse by NPCA, a highly sensitive watercourse. Type I is considered high sensitivity due to the area limiting the overall productive capacity, or the presence of sensitive fish species and/or habitat; these areas require a higher degree of protection. In addition, NPCA recorded the presence of Grass Pickerel (*Esox americanus vermiculatus*) and River Redhorse (*Moxostoma carinatum*) which are listed as Special Concern under the Federal *Species at Risk Act* and the Provincial *Endangered Species Act*.

The restricted timing windows for all in-water works are March 1st to July 1st as indicated by the MNR. However, Grass Pickerel is a species of special concern provincially and federally, and is known to occasionally spawn in the fall. Therefore, additional restrictions from September 1 to November 30 also apply.

Old Mill Race Creek Watershed

Old Mill Race Creek has three main drainage branches on the east side of Highway 3 near Wainfleet and one drainage branches west of Highway 3 and Abbey Road. Old Mill Race Creek split and flows south-east of Dixie Road. The channel then branches east of Malowany Road and continues to travels south-westerly where the channel forks for the fourth time just west of Highway 3 and Abbey Road.

This permanent creek flows through a landscape of agriculture fields. Segments of deciduous and coniferous trees are found along the edges of these fields. All investigated tributaries are situated within the study area where they flow through a landscape of gently rolling topography. The watercourse appears to have been excavated and channelized to flow within the existing ditch line west of Sideroad 22, it likely functioned as a linear agricultural drain. Primarily the substrate consisted of fine granular material.

Aquatic vegetation of various grasses (*Poaceae sp.*) and cattail species provided some instream habitat and cover. The riparian community was comprised of various shrubs, and grass species providing minimal overhead cover and shade input. This watercourse appeared to have unstable banks making it susceptible to erosion and sediment inputs. Channelization, intensive agriculture and insufficient riparian cover contribute to the poor fish habitat within this watershed.

Old Mill Race Creek was classified as a Type II watercourse by MNR, a moderately sensitive watercourse. The Type II designation is the result of the potential presence of sensitive species during certain times of the year as well the overall fish community is considered below potential due to habitat related issues. In addition, NPCA recorded the presence of Grass Pickerel (*Esox americanus vermiculatus*) which is listed as Special Concern under the Federal *Species at Risk Act* and the Provincial *Endangered Species Act*.

The restricted timing windows for all in-water works are March 1st to July 1st as indicated by the MNR. Although the section of the creek within the site boundaries is considered Type II, there are sensitive species present within the watershed that must be protected.

Casey Drain Watershed

Casey Drain is located at the south end of the project limits, and drains into Lake Erie. During the field investigation, significant portions of Casey Drain consisted of an agricultural riparian community which contributed to the poor fish habitat cover, bank instability, and channelization of the watercourse. The intensive agriculture and insufficient riparian cover contribute to the poor fish habitat within this watershed. This waterway is susceptible to carrying higher sediment and chemical loads from agricultural activity.

MNR had no existing fishery data for Casey Drain; however, NPCA classified this watercourse to have low sensitivity. The low sensitivity classification from NPCA is due to the species present and/or the absence of adequate coldwater habitat characteristics. As such, in-water works timing windows (March 1st to June 1st) as indicated by MNR will apply.

Table 1.0: Existing Fish Species Present Summary

Watercourse	Fish Community/Species Present	Habitat Sensitivity	Timing Restrictions
Welland River	NPCA: banded killifish, bigmouth buffalo, black bullhead, black crappie, blackside darter, bluegill, bluntnose minnow, bowfin, brook silverside, brown bullhead, central mudminnow, channel catfish, common carp, common shiner, creek chub, emerald shiner, fathead minnow, freshwater drum, gizzard shad, golden redhorse, golden shiner, goldfish, grass pickerel, greater redhorse, green sunfish, Johnny darter, largemouth bass, logperch, mimic shiner, northern pike, pumpkinseed, quillback, rainbow smelt, rainbow trout, river redhorse, rock bass, round goby, rudd, shorthead redhorse, smallmouth bass, spottail shiner, striped shiner, tadpole madtom, tessellated darter, walleye, white bass, white crappie, white perch, white sucker, yellow bullhead, and yellow perch	NPCA: High	NPCA: March 1-July 1
Old Mill Race Creek	MNR: black bullhead, bluegill, brown bullhead, central mudminnow, common carp, golden shiner, goldfish, green sunfish, johnny darter, largemouth bass, northern pike, pumpkinseed, tadpole madtom, white crappie and yellow perch. NPCA: black bullhead, black crappie, brown bullhead, central mudminnow, common carp, fathead minnow, freshwater drum, golden shiner, grass pickerel, green sunfish, johnny darter, largemouth bass, northern pike, pumpkinseed, tadpole madtom, white	MNR: Moderate NPCA: Moderate	MNR: March 1 – July 1 NPCA: March 1 – July 1
Casey Drain	<i>MNR: no information available</i> NPCA: brown bullhead, pumpkinseed, emerald shiner, largemouth bass, goldfish, central mudminnow, golden shiner, fathead minnow, and bluntnose minnow.	NPCA: Low	NPCA: March 1 – June 1

3.2 Findings

One of the five proposed turbines (Turbine 4) is located within the 120m of a marked watercourse. The remaining turbine locations do not have any waterways or wetlands within the 120m buffer surrounding the turbine base. The electrical tapline route was assessed to identify wetlands, streams, and other waterbodies within 120m of the proposed turbine location. However, the tapline design could not avoid all water bodies. Details of watercourses crossed by the tapline and access roads, as well as details of the turbine located within the 120m buffer are found in the following sections.

3.2.1 Streams within 120m of Turbine Base

Turbine 4 is the only proposed turbine located within 120m of a waterway. At this location the turbine would sit approximately 100m north of the watercourse; commonly known as Casey Drain. This seasonal drain originates east of Station Road and then drains into Lake Erie approximately 1800m downstream. In accordance with ArcView 9.0 Geographic Information System (GIS) mapping, significant portions of Casey Drain consist of an agricultural riparian community which contributed to the poor fish habitat cover, bank instability, and channelization of the watercourse. The intensive agriculture and insufficient riparian cover contribute to the poor fish habitat within this watershed. This waterway is susceptible to carrying higher sediment and chemical loads from agricultural activity. As this waterway is seasonal, it is not expected to provide habitat for fish species in the near vicinity of the proposed turbine location.

3.2.2 Stream Crossings by Electrical Taplines and Access Roads

3.2.2.1 Electrical Tapline/Access Roads

The electrical tapline is approximately 7km in length extending parallel to Feeder Road North/South; then traveling south onto Brawin Road; east onto Abby Road; routing south along Sideroad 22; east onto Concession Road 1; and finally south onto Station Road. This tapline would cross several waterways and agricultural land. The access roads will also follow the same path as the tapline, providing access to the site during construction and for post construction access requirements.

Crossing 1

The tapline would originate at the electrical transfer station north of Mill Race Creek near Feeder Road North. The tapline would route south crossing Mill Race Creek (42°55'24"N 79°22'27"W), to then travel west parallel to Feeder Road South for approximately 1.2km. Mill Race Creek appears to have been channelized to flow between Feeder Road North and Feeder Road South. This watercourse is highly susceptible to highway runoff. During the time of investigation, there was little to no flow present. A dense population of aquatic vegetation of various grasses and cattail species (*Typhaceae sp.*) filled the channel. The riparian community was comprised of various shrubs, and grass species providing minimal overhead cover and shade input. As such, the channelization, dense instream vegetation, no flow, and insufficient riparian cover contribute to the poor fish habitat within this watershed. Due to the poor conditions upstream and downstream, this section of Mill Race

Creek may only support a warmwater baitfish community. A new culvert crossing would be proposed at this location.

Crossing 2

The tapline would then route in a southerly direction onto Brawin Road where it would cross a pre-existing crossing of a small Feeder of Old Mill Race Creek, where a culvert already exists (42°55'08"N 79°23'18"W). Upstream of the water crossing, this watercourse receives flows from a tributary traveling east parallel to Feeder Road South and another tributary which appeared to have been channelized to flow along the edge of agricultural fields and a small forest. The downstream reach, the watercourse flowed east immediately south side of Feeder Road South. The Feeder of Old Mill Race Creek is a channelized waterway with little riparian cover, minimal flow and is heavily influenced by agricultural activity. Instream aquatic vegetation is limited to duckweed (*Lemnaoideae sp.*) and grass species. This creek is considered potential fish habitat for species tolerant to perturbations and warm water temperatures. The tapline would then continue south within the right-of-way at this location.

Crossing 3

The tapline continues south along Brawin Road for about 1.2km at Abbey Road intersection. The tapline would then route in a southerly direction on a farm access road (Sideroad 22) to connect Turbines 1, 2 and 3. The tapline would cross a pre-existing water crossing (42°54'31"N, 79°22'59"W) located north of Turbine 2 and 3, and south of Turbine 1. This water crossing serves exclusively as an agricultural swale with no flow present.

Crossing 4

South of Turbine 1 approximately 0.31km on Sideroad 22 the tapline crosses another watercourse (42°53'37"N, 79°22'41"W). This channelized watercourse known as Feeder of Old Mill Race Creek is situated between agricultural fields. The channel is about 1.5-2m in width with minimal water present. The riparian community is limited to grasses, sedges, cattails and low land shrub species. Substrate was comprised of fine granular material. A significant portion of the waterway was obscured by vegetation. Feeder of Old Mill Race Creek intersects with another drainage system to the south which travels within the drainage ditch of Sideroad 22. This feeder is susceptible to carrying higher sediment and chemical loads from agricultural runoff. It is likely this culvert also conveys water during stormwater events and spring freshets. This section of Feeder of Old Mill Race Creek is considered potential fish habitat for warmwater baitfish species.

The tapline continues to travel south on Sideroad 22 for about 1.0km then routes to the east on Concession Road 1 for another 0.91km. The tapline would then travel south on Station Road for 1.6km to connect Turbines 4 and 5. For this length of Option 2 there are no water crossings.

4.0 Impact Assessment of Overhead Crossings by Electrical Lines

Where possible the overhead electrical lines will use the existing right-of-ways and structures, however new electrical lines or poles may be required. In the event that new

lines are required there are potential impacts to the environment as a result of the installation. Construction equipment will be used for activities such as clearing the right-of-way and installing the poles. The equipment has inherent environmental concerns as they introduce various petroleum products onto the work site that have the potential to spill or leak into the environment. In addition, clearing the land for the right-of-way has the potential to cause erosion and sedimentation into near-by watercourses. The following techniques will be incorporated into the construction to reduce the impacts on the environment and the fish and fish habitat on the site.

4.1 Negative Environmental Effects

4.1.1 Petroleum, Oils and Lubricants

A variety of potential materials will be stored on site, or will be used to install the turbines and overhead electrical wires. Among these materials, petroleum products such as fuel, oil, and other lubricants will be required to operate and maintain the construction equipment. The federal standard for hazardous materials, Workplace Hazardous Materials Information System (WHMIS) will be applied for all applicable materials. This communication standard provides a system to properly, handle, store and control all hazardous or toxic materials. The precautions taken when following the WHMIS standards not only help to protect the workers, but it also aids in prevention of spills and accidental releases of materials.

Accidental uncontrolled release is the major concern with petroleum, oils and other lubricants. The resulting impacts can affect all aspects of the environment including; terrestrial, surface water, ground water, living biota, and the atmosphere. The accidental release of substances can greatly alter or destroy entire ecosystems, as well as negatively affect human health and safety. In particular, materials released near a watercourse have a high potential to negatively affect fish and fish habitat.

Mitigation

The following mitigation measures are to substantially reduce or eliminate the potential for an accidental release of petroleum, oil or lubricants into the environment.

Machinery Operation

- No heavy equipment is to enter a watercourse, waterbody, or wetland.
- Re-fuelling should occur at one designated site that is 30m from a watercourse or wetland.
- All equipment to be maintained offsite when possible, to minimize the quantity of hazardous materials required on-site. If service must occur on-site it must be 30m from a watercourse or wetland.

Storage

- Fuel transport will comply with the *Transportation of Dangerous Goods Act*.
- Fuel and diesel may be stored on-site in limited quantities for the operation of construction equipment.

- All petroleum, oil, and lubricants must be stored in a lockable, ventilated, steel container that is located 120m from any watercourse, waterbody, or wetland.
- The storage container will be equip with drip trays to capture any spilled substances.
- Spill decks will be used when transferring materials.
- Fire extinguishers and spill kits will be kept on-site at all times near the storage lockers and within reasonable distance of the operating construction equipment.
- Storage containers will be clearly identified with signage, and smoking will not be permitted within 50m of the storage container.
- Construction material, excess material, construction debris, and empty containers shall be stored at least 30m from the watercourse and watercourse banks to prevent their entry into the watercourse, and be removed frequently to a proper receiving facility.

Spills

- Any person or persons, who discover a leak or spill, if safe, should attempt to stop and contain the material.
- All spills or leaks must be reported to the on-site supervisor and the Ontario Ministry of Environment, Spills Action Centre, 1-800-268-6060.
- The Contractor has the responsibility of organizing and executing a spill containment and clean up plan in accordance with any regulatory bodies (where appropriate).
- Appropriate spill response materials must be on-site in an accessible location throughout the duration of the project; materials should include but are not limited to: absorbent materials and equipment (picks, shovels, stakes, buckets, empty drum).

4.1.2 Erosion Control

Sedimentation into surrounding waterways is one of the major concerns for any works, particularly those that involve land clearing and using heavy machinery. Erosion control is the primary method to prevent negative impacts to the surrounding waterbodies, therefore the following mitigation measures for all works should be implemented to prevent any further degradation of the waterways.

The introduction of sediment into the waterways from erosion is of concern due to the negative impacts on the aquatic ecosystem. High levels of sedimentation are potentially deadly for many aquatic species.

Mitigation

The following mitigation measures will be implemented to eliminate the impacts that are associated with sedimentation and erosion.

- Minimize vegetation removal.
- Sediment and erosion control measures will be left in place until vegetation growth is sufficient (80%).

- Timely re-vegetation of exposed soils with native vegetation, both for temporary work areas and final grades (existing vegetation on embankments shall be maintained as long as possible and new slopes shall be stabilized within 30 days by seeding and mulching).
- Sediment control fence to be installed along the channel margins to prevent the entry of sediment into the watercourse.
- Temporary silt fence barrier along the perimeter of the designated work area to limit construction impacts on the watercourse.
- Conscientious design, installation and maintenance of sediment traps within construction area drainage swales for any dewatering.
- Installation and maintenance of appropriately designed flow check dams in all temporary and permanent drainage swales.
- Accumulated sediment in the control devices should be removed frequently to ensure the success of the device. The collected sediment should be removed and placed in an area at least 120m away from a waterway.
- Existing roads and farm access lanes will be used wherever possible.
- Any new stream crossings will be designed to reduce the loss of riparian habitat, maintain fish passage, and support high flow events.

Monitoring

Assessments of the areas that are re-vegetated will occur in the spring and fall once the construction is completed. The success of the native plantings and any long term erosion control measures will be monitored. If any failures are documented, seeds or plants will be installed in areas of re-vegetation that are unsuccessful. Any erosion control devices that are not performing as designed, will be re-designed and altered to provide proper erosion control.

4.1.3 Fish and Fish Habitat

Any works that are in a waterway or near a waterway must follow *the Fisheries Act* to prevent any harmful alteration, destruction or disruption (HADD) of fish and/or fish habitat. Installing electrical lines overhead and under waterways have the potential to cause a HADD. Accidental spills or leaks, as well as erosion are the two primary concerns for this project. The Department of Fisheries and Oceans (DFO) has an operational statement, *Operation Statement for Overhead Line Construction* that gives guidance on the proper methodologies to avoid a HADD. A full copy of the Operational Statement is provided in Appendix E.

Mitigation

The following mitigation measures are taken directly from the DFO *Operational Statement for Overhead Line Construction*.

1. Installing overhead lines under frozen conditions is preferable in all situations. On wet terrains (e.g., bogs), lines should be installed under frozen conditions, where possible, or using aerial methods (i.e., helicopter).

2. Design and construct approaches so that they are perpendicular to the watercourse wherever possible to minimize loss or disturbance to riparian vegetation.
3. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or overhead line structures.
 - 3.1. Wherever possible, locate all temporary or permanent structures, such as poles, sufficiently above the HWM to prevent erosion.
4. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to accommodate the overhead line. This removal should be kept to a minimum and within the road or utility right-of-way.
5. Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. A Temporary Stream Crossing Operational Statement is also available.
 - 5.1. If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
 - 5.2. Grading of the stream banks for the approaches should not occur.
 - 5.3. If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation is likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
 - 5.4. Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the Ontario In-Water Construction Timing Windows).
 - 5.5. Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.
6. Operate machinery on land and in a manner that minimizes disturbance to the banks of the watercourse.
 - 6.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
 - 6.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
 - 6.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
 - 6.4. Restore banks to original condition if any disturbance occurs.

7. Install effective sediment and erosion control measures before starting work to prevent entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.
 - 7.1. Avoid work during wet, rainy conditions or use alternative techniques such as aerial methods (i.e., helicopter) to install overhead lines.
8. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.
9. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.
 - 9.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.

Monitoring

Watercourses will be monitored at all crossing locations for up to one year after construction is completed. Monitoring will note any erosion or bank degradation at the waterway crossing locations.

4.2 Residual Impacts

No residual effects are anticipated if all the above mitigation strategies are followed. Accidental spills or leaks will be prevented through proper handling techniques and the use of WHMIS to monitor and control substances onsite. Erosion control measures will prevent sedimentation of the waterways and reduce damage to the surrounding landscape. These measures will also prevent any HADD from occurring in the adjacent waterways, thus protecting the fish and fish habitat in the area.

5.0 Impact Assessment of Underground Crossings by Electrical Lines

In some areas of the project site, underground electrical lines will be required; some of these lines will likely cross under waterways. As such, Horizontal Pressure Directional Drilling (HPDD) would likely be used for such instances. The use of HPDD has various environmental concerns which have been clearly outlined by the DFO and included in this report. Some associated risks include the use of machines and land clearing activity which may result in the accidental release of deleterious substances into the environment and erosion. The following section will further discuss these environmental risks and provide mitigation and monitoring strategies.

5.1 Negative Environmental Effects

5.1.1 Petroleum, Oils and Lubricants

A variety of potential materials will be stored on site, or will be used to install the turbines and overhead electrical wires. Among these materials, petroleum products such as fuel, oil, and other lubricants will be required to operate and maintain the construction equipment. The federal standard for hazardous materials, Workplace Hazardous Materials Information System (WHMIS) will be applied for all applicable materials. This communication standard provides a system to properly, handle, store and control all hazardous or toxic materials. The precautions taken when following the WHMIS standards not only help to protect the workers, but it also aids in prevention of spills and accidental releases of materials.

Accidental uncontrolled release is the major concern with petroleum, oils and other lubricants. The resulting impacts can affect all aspects of the environment including; terrestrial, surface water, ground water, living biota, and the atmosphere. The accidental release of substances can greatly alter or destroy entire ecosystems, as well as negatively affect human health and safety. In particular, materials released near a watercourse have a high potential to negatively affect fish and fish habitat.

Mitigation

The following mitigation measures are to substantially reduce or eliminate the potential for an accidental release of petroleum, oil or lubricants into the environment.

Machinery Operation

- No heavy equipment is to enter a watercourse, waterbody, or wetland.
- Re-fuelling should occur at one designated site that is 30m from a watercourse or wetland.
- All equipment to be maintained offsite when possible, to minimize the quantity of hazardous materials required on-site. If service must occur on-site it must be 30m from a watercourse or wetland.

Storage

- Fuel transport will comply with the *Transportation of Dangerous Goods Act*.
- Fuel and diesel may be stored on-site in limited quantities for the operation of construction equipment.
- All petroleum, oil, and lubricants must be stored in a lockable, ventilated, steel container that is located 120m from any watercourse, waterbody, or wetland.
- The storage container will be equip with drip trays to capture any spilled substances.
- Spill decks will be used when transferring materials.
- Fire extinguishers and spill kits will be kept on-site at all times near the storage lockers and within reasonable distance of the operating construction equipment.
- Storage containers will be clearly identified with signage, and smoking will not be permitted within 50m of the storage container.

- Construction material, excess material, construction debris, and empty containers shall be stored at least 30m from the watercourse and watercourse banks to prevent their entry into the watercourse, and be removed frequently to a proper receiving facility.

Spills

- Any person or persons, who discover a leak or spill, if safe, should attempt to stop and contain the material.
- All spills or leaks must be reported to the on-site supervisor and the Ontario Ministry of Environment, Spills Action Centre, 1-800-268-6060.
- The Contractor has the responsibility of organizing and executing a spill containment and clean up plan in accordance with any regulatory bodies (where appropriate).
- Appropriate spill response materials must be on-site in an accessible location throughout the duration of the project, materials should include but are not limited to: absorbent materials and equipment (picks, shovels, stakes, buckets, empty drum).

5.1.2 Erosion Control

Sedimentation into surrounding waterways is one of the major concerns for any works, particularly those that involve land clearing and using heavy machinery. Erosion control is the primary method to prevent negative impacts to the surrounding waterbodies, therefore the following mitigation measures for all works should be implemented to prevent any further degradation of the waterways.

The introduction of sediment into the waterways from erosion is of concern due to the negative impacts on the aquatic ecosystem. High levels of sedimentation are potentially deadly for many aquatic species.

Mitigation

The following mitigation measures will be implemented to eliminate the impacts that are associated with sedimentation and erosion.

- Minimize vegetation removal.
- Sediment and erosion control measures will be left in place until vegetation growth is sufficient (80%).
- Timely re-vegetation of exposed soils with native vegetation, both for temporary work areas and final grades (existing vegetation on embankments shall be maintained as long as possible and new slopes shall be stabilized within 30 days by seeding and mulching).
- Sediment control fence to be installed along the channel margins to prevent the entry of sediment into the watercourse.
- Temporary silt fence barrier along the perimeter of the designated work area to limit construction impacts on the watercourse.
- Conscientious design, installation and maintenance of sediment traps within construction area drainage swales for any dewatering.

- Installation and maintenance of appropriately designed flow check dams in all temporary and permanent drainage swales.
- Accumulated sediment in the control devices should be removed frequently to ensure the success device. The collected sediment should be removed and placed in an area at least 120m away from a waterway.
- Existing roads and farm access lanes will be used wherever possible.
- Any new stream crossings will be designed to reduce the loss of riparian habitat, maintain fish passage, and support high flow events.

Monitoring

Assessments of the areas that are re-vegetated will occur in the spring and fall once the construction is completed. The success of the native plantings and any long term erosion control measures will be monitored. If any failures are documented, seeds or plants will be installed in areas of re-vegetation that are unsuccessful. Any erosion control devices that are not performing as designed, will be re-designed and altered to provide proper erosion control.

5.1.3 Fish and Fish Habitat

Horizontal Pressure Directional Drilling

Using Horizontal Pressure Directional Drilling (HPDD) is the common practice for installing cables and pipes under streams. The process for using HPDD involves drilling a pilot bore hole underneath the watercourse, back-reaming the bore hole to the drill rig while pulling the pipe along through the hole. The process is lubricated by drilling mud, which is a mixture of fresh water and bentonite.

The risks associated with HPDD are primarily the escape of the lubricating fluid through either a spill, or the rupture of drilling mud to the surface. The collapse of a bore hole can force the drill mud to the surface causing a spill, or another concern is frac-out. Frac-out is the rupture of drilling mud to the surface as a result of high drilling pressure.

In addition, there is often damage to riparian vegetation due to the equipment being located close to waterway edges. This can also lead to erosion and sedimentation of the waterway. Following erosion control methods, as well as planning a route that causes the least damage to riparian vegetation is effective to prevent negative environmental impacts.

In compliance with the *Fisheries Act*, the DFO has released an Operational Statement specifically for HPDD. The following are the measures set by the DFO to protect fish and fish habitat when using HPDD. A full copy of the Operational Statement is provided in Appendix E.

1. Use existing trails, roads or cut lines wherever possible, as access routes to avoid disturbance to the riparian vegetation.
2. Design the drill path to an appropriate depth below the watercourse to minimize the risk of frac-out and to a depth to prevent the line from becoming exposed due to natural scouring of the stream bed. The drill entry and exit points are far enough from the banks of the watercourse to have minimal impact on these areas.

3. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to access the construction site. This removal should be kept to a minimum and within the road or utility right-of-way.
4. Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. A *Temporary Stream Crossing Operational Statement* is also available.
 - o 4.1. If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
 - o 4.2. Grading of the stream banks for the approaches should not occur.
 - o 4.3. If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation are likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
 - o 4.4. Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the *Ontario In-Water Construction Timing Windows*).
 - o 4.5. Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.
5. Operate machinery on land above the ordinary high water mark (see definition below) and in a manner that minimizes disturbance to the banks of the watercourse.
 - o 5.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
 - o 5.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
 - o 5.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
 - o 5.4. Restore banks to original condition if any disturbance occurs.
6. Construct a dugout/settling basin at the drilling exit site to contain drilling mud to prevent sediment and other deleterious substances from entering the watercourse. If this cannot be achieved, use silt fences or other effective sediment and erosion control measures to prevent drilling mud from entering the watercourse. Inspect these measures regularly during the course of construction and make all necessary repairs if any damage occurs.
 - o 6.1. Dispose of excess drilling mud, cuttings and other waste materials at an adequately sized disposal facility located away from the water to prevent it from entering the watercourse.

7. Monitor the watercourse to observe signs of surface migration (frac-out) of drilling mud during all phases of construction.

Emergency Frac-out Response and Contingency Planning

8. Keep all material and equipment needed to contain and clean up drilling mud releases on site and readily accessible in the event of a frac-out.
9. Implement the frac-out response plan that includes measures to stop work, contain the drilling mud and prevent its further migration into the watercourse and notify all applicable authorities, including the closest DFO office in the area (see Ontario DFO office list). Prioritize clean up activities relative to the risk of potential harm and dispose of the drilling mud in a manner that prevents re-entry into the watercourse.
10. Ensure clean up measures do not result in greater damage to the banks and watercourse than from leaving the drilling mud in place.
11. Implement the contingency crossing plan including measures to either re-drill at a more appropriate location or to isolate the watercourse to complete the crossing at the current location. See *Isolated or Dry Open-cut Stream Crossings* Operational Statement for carrying out an isolated trenched crossing.
12. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with preferably native grass or shrubs.
13. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.
 - o 13.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.

The above noted mitigation measures are constraints of operation for all HPDD; however if another if there are unforeseen circumstances and another method is required for burying the taplines such as; punch or bore crossing, or isolated open-cut crossing the Operational Statement from DFO should be followed. The appropriate Operational Statements for the two aforementioned methods are: *Punch & Bore Crossings* and *Isolated or Dry Open-cut Stream Crossings* respectively.

5.2 Residual Impacts

Implementing the outlined techniques to prevent spills of oils and other petroleum substances, erosion, and HPDD frac-out and spills will prevent any negative residual effects. The measures will protect the surrounding environment, as well as the fish and fish habitat in adjacent waterways.

6.0 Conclusion

The land use within the Wainfleet corridor was predominantly agricultural, with a mixture of pastureland and crops as well as urban development. Portions of Mill Race Creek and Casey Drain watersheds have been straightened/channelized, widened and sometimes deepened to increase land drainage and agricultural production or urban development. As such these watercourses are susceptible to negative impacts on fish habitat including: loss of riparian vegetation; increase in siltation; removal of channel morphology (pools, riffles, and runs), removal of in-stream vegetation for fish shelter and food supply and; loss of fish habitat following a significant flow reduction downstream. In addition, these watercourses are susceptible to receiving sediment and chemical loads from agricultural runoff, sometimes causing adverse impacts downstream. However, in conjunction with MNR fisheries management plans, potential enhancement measures can be implemented to improve the riparian habitat and in-stream quality of the watercourses.

Mill Race Creek and Casey Drain support a variety of fish species, including Grass pickerel which is listed as Special Concern under the Federal *Species at Risk Act* and the Provincial *Endangered Species Act*. To preserve the fish habitat in the region, all in-water works will need to follow appropriate mitigation measures and strictly follow the MNR timing windows for Mill Race Creek (March 1st-July 1st) and Casey Drain (March 1st-June 1st) to protect fish and fish habitat. In conjunction with timing windows the MNR management plan for the tributaries of Welland River watershed must also be considered for project works.

In conclusion, the environmental impact assessment determined the following negative environmental effects for the overhead and underground electrical tapline routes and access roads over water crossings within the Wainfleet corridor include:

- Erosion and sedimentation;
- Potential for leaks and spills of hazardous material entering the soil or water resulting from improper storage or handling of deleterious substances; and
- Potential for the alteration, disruption or destruction of fish and/or fish habitat.

Following all recommended mitigation measures illustrated in this report; it is anticipate no negative residual effects will occur from the water crossings required for the Wainfleet project. In addition, monitoring plans are in place to ensure the success of the proposed mitigation measures has addressed all impacts.

Table 1
Summary of Wainfleet Water Crossings

Table 1: Summary of Wainfleet Water Crossings**Definitions of Mitigation Measures:**

Crossing Number / ID	Location	Permanent/ Intermittent/ Ephemeral/ Drainage	Fish Habitat	Other Description	Potential Impacts	Mitigation Measures	Culvert Dimensions
Casey Drain south of Turbine 4 (~100m)	42°52'33"N 79°22'26"W	Intermittent	Potential	Channelized along field edge, cultivated on either side	Erosion Oil/petroleum product leaks/spills Change in slope/grade in surrounding area	ERC STOR SPL EQP VEG RVEG MON	
Crossing 1	42°55'24"N 79°22'27"W	Permenant	Potential	Channelized, dense instream vegetation	Erosion Oil/petroleum product leaks/spills Change in slope/grade in surrounding area Change in channel morphology Change in shade input	ERC STOR SPL EQP VEG RVEG CD MON RISC RBS	
Crossing 2	42°55'08"N 79°23'18"W	Intermittent	Potential	Minimal water, serves primarily as drainage for the area, instream vegetation	Erosion Oil/petroleum product leaks/spills Change in slope/grade in surrounding area	ERC STOR SPL EQP VEG RVEG CD MON	
Crossing 3	42°54'31"N 79°22'59"W	Drainage	No	Agricultural swale	Erosion Oil/petroleum product leaks/spills Change in slope/grade in surrounding area	ERC STOR SPL EQP VEG RVEG CD MON	
Crossing 4	42°53'37"N, 79°22'41"W	Intermittent	Potential	Minimal water, variable flow as a result of runoff collection and drainage ditch connection	Erosion Oil/petroleum product leaks/spills Change in slope/grade in surrounding area	ERC STOR SPL EQP VEG RVEG CD MON RISC RBS	

Abbreviations

ERC	Implement standard erosion control methods at all staging and work sites.
STOR	Temporary storage of materials in a secure manner to prevent materials from entering the water.
SPL	Spill management plan and application of WHMIS to prevent spills.
EQP	Storage and operation of equipment and all associated materials (Lubricants, oil etc) in a steel container onsite, and refueling in an area that is greater than 30m from a waterbody.
VEG	Minimize vegetation removal, and use proper techniques to minimize damage and erosion.
RVEG	Where land has been cleared design and implement a re-vegetation/rehabilitation using native plantings and topsoil when possible.
RISC	Rehabilitate instream cover by placing woody debris, cobbles, boulders and/or instream vegetation.
RBS	Rehabilitate the bed substrate and morphology, introduce pools, and riffles where possible upstream and downstream of placed materials (ie. culverts)
CD	Culvert design to accommodate the flow anticipated for the crossing, embedded with substrate in the bottom, and maintains the low flow channel.
MON	Monitor the mitigation techniques during construction to ensure the structures are working properly and are maintained.

APPENDIX A

Photographic Record



Turbine 1 proposed location (spring)



Crossing 4 – Feeder of Old Mill Race Creek looking west; south of Turbine 1
(summer)



Crossing 4 – Feeder of Old Mill Race Creek looking west; south of Turbine 1
(spring)



Crossing 4 – Feeder of Old Mill Race Creek looking east; south of Turbine 1
(summer)



Crossing 4 – Feeder of Old Mill Race Creek looking east; south of Turbine 1 (spring)



Turbine 2 – Met Tower (winter)



Turbine 2 – Met Tower (spring)



Near Crossing 4 - Feeder of Old Mill Race Creek along Side Road 22
immediately west of Turbine 2 (winter)



Near Crossing 4 - Feeder of Old Mill Race Creek along Side Road 22
immediately west of Turbine 2 (spring)



Turbine 5 location- no associated watercourse; looking east (spring)



Turbine 4 – looking east (winter)



Turbine 4 – looking east (Spring)



Casey Drain – south of Turbine 4 looking towards Station Road (winter)



Casey Drain – south of Turbine 4 looking towards Station Road (spring)



Casey Drain – south of Turbine 4 looking east (spring)

APPENDIX B

Field Notes

GPS
Co-ord
for finest
stand

IPC Turbine Number & Location:		Environmental Feature	Dist.(m) to Turbine	GPS Co-ord of Feature
HAE #2		Groundwater Evidence (120m)		
Date: April 27 /10		☐ Watercress		
Time: 10:55 am		☐ Iron Staining		
GPS Co-ordinates:		☐ Seepage		
Comments:		☒ Forest Stand (30m) #1		17T 0604832 4775076
#1. Shared treeline w turbine #4		☒ #3	77m	17T 0604864 4775179
#2. forested bw area connected to waterway		☒ Waterway (30m)	170m	
#3 Tree line- thin, poplars				
#4 Extension of tree line #1, fairly wide. diversity of trees. 160m from turbine * GPS point on FF				
#5 N. end v. sparse, S. of E/W Treeline #3 is much more dense 38-40m from turbine 17T 0604976 4775201				
#6 Treeline + water course 17T 0605060 4774998 Taken near treeline #5 - v. little cover/veg.				

Radius of Detailed Site Survey:	
☐ 200m	☐ 300m ☐ 350m

Detailed Map of Environmental Features:

doer + raccoon tracks

Moving -> North (in sod farm)
North East (into corn field)

IPC Turbine Number & Location:
HAF/W. Lincoln #3

Date: April 28/10
Time: 9:00 AM
GPS Co-ordinates:

Comments:
Accessed from 116 Rd. (property agreement)

① - Turbine location is in on a ridge in the marked area or to the west.

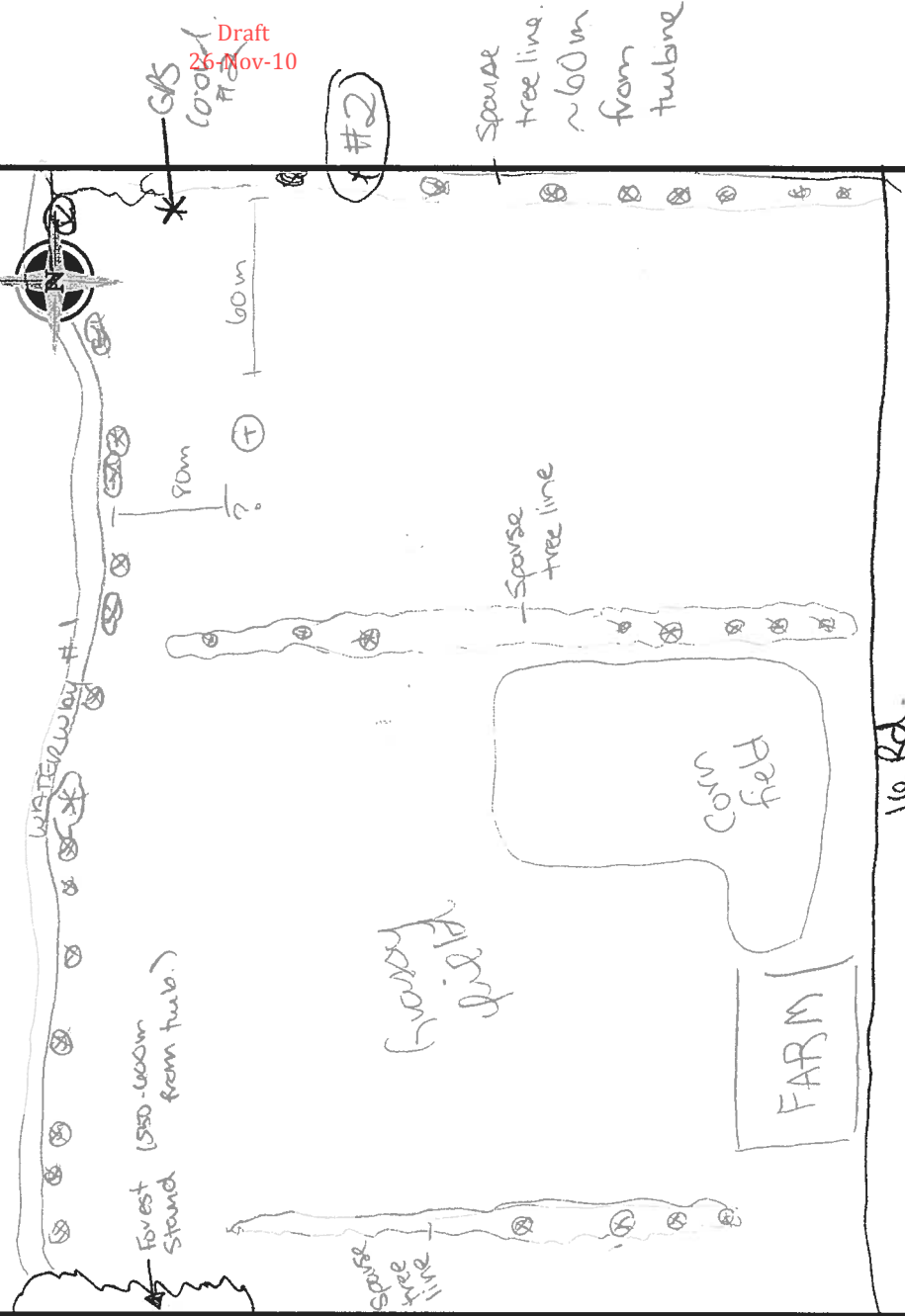
#1 - Waterway is flowing grasses in the channel
 Wetted width - 3m
 channel width - 30cm
 Depth ~ 10cm
 - trees/shrubs only on S. side of ch.

Forest stand to the west ~ 550-600m from turbine

#2 - Sparse tree line to east of turbine
 10cm - 60m
 17T 0606359 4774909

Environmental Feature		Dist.(m) to Turbine	GPS Co-ord of Feature
☐ Groundwater Evidence (120m)			
☐ Watercress			
☐ Iron Staining			
☐ Seepage			
☐ Forest Stand (30m)			
☒ Waterway (30m)		85m	17T 0606236 4774994
Radius of Detailed Site Survey:		☐ 200m ☐ 300m ☐ 350m	

Detailed Map of Environmental Features:



Draft
26 Nov-10

IPC Turbine Number & Location:		Environmental Feature		Dist(m) to Turbine	GPS Co-ord of Feature
HAF - #4		Groundwater Evidence (120m)			
Date: April 21 2010		☒ Watercross		X	
Time: 12:40		☒ Iron Staining			
GPS Co-ordinates:		☒ Seepage / 40m			
		☒ Forest Stand (30m)			
		☒ Waterway (30m)			
		Radius of Detailed Site Survey:		☐ 200m	☐ 300m
				☐ 200m	☐ 350m

Detailed Map of Environmental Features:

① Forest stand

② Treatise

Boris Road (Farmers Rd)

Waterway

4774053

4774057

large forest stand

Comments:

① 1/2 forest stand - large + significant (deer paths / raccoons)

② 40m from proposed turbine - 17T 06041211 4774053

③ gas line - petroleum pipe line 103m 17T 0604052 4774175

④ 17 06041563 47741215

270m from proposed turbine

- no hydrocarbons / no drainage features

Recommendation - some approx 40m from hydrocarbons with south, east & west

needs to move east cause too close to ① forest stand

- Disturb (with hydro)

IPC Turbine Number & Location:		Environmental Feature	Dist.(m) to Turbine	GPS Co-ord of Feature
#5	HAF / W LINCOLN	Groundwater Evidence (120m)		
Date: April 27 2010		☐ Watercress		
Time: 11:30		☐ Iron Staining		
GPS Co-ordinates:		☐ Seepage		
		☐ Forest Stand (30m)		
		☐ Waterway (30m)		
		Radius of Detailed Site Survey:	☐ 200m ☐ 300m ☐ 350m	
Detailed Map of Environmental Features:				
Comments: - communication tower on U d ③ 274m from proposed site 177 060614 4773101 - Deering feature → 229m ② are south line connector line flow - turbid - tree line 215m → not 120m. features - no watercourse - - south foot - tree line to straight ① drainage channel with 58m of proposed turbid site 177 0606292 4773226 ③ tree line 192m → 177 0606119 4773237 - Recommend → north - east from tree line ④ on with west ⑥ farm house (chicken approx 130m away) - no problem appears for access roads - may use farmers path.				

5th Contour

APPENDIX C

MNR Data

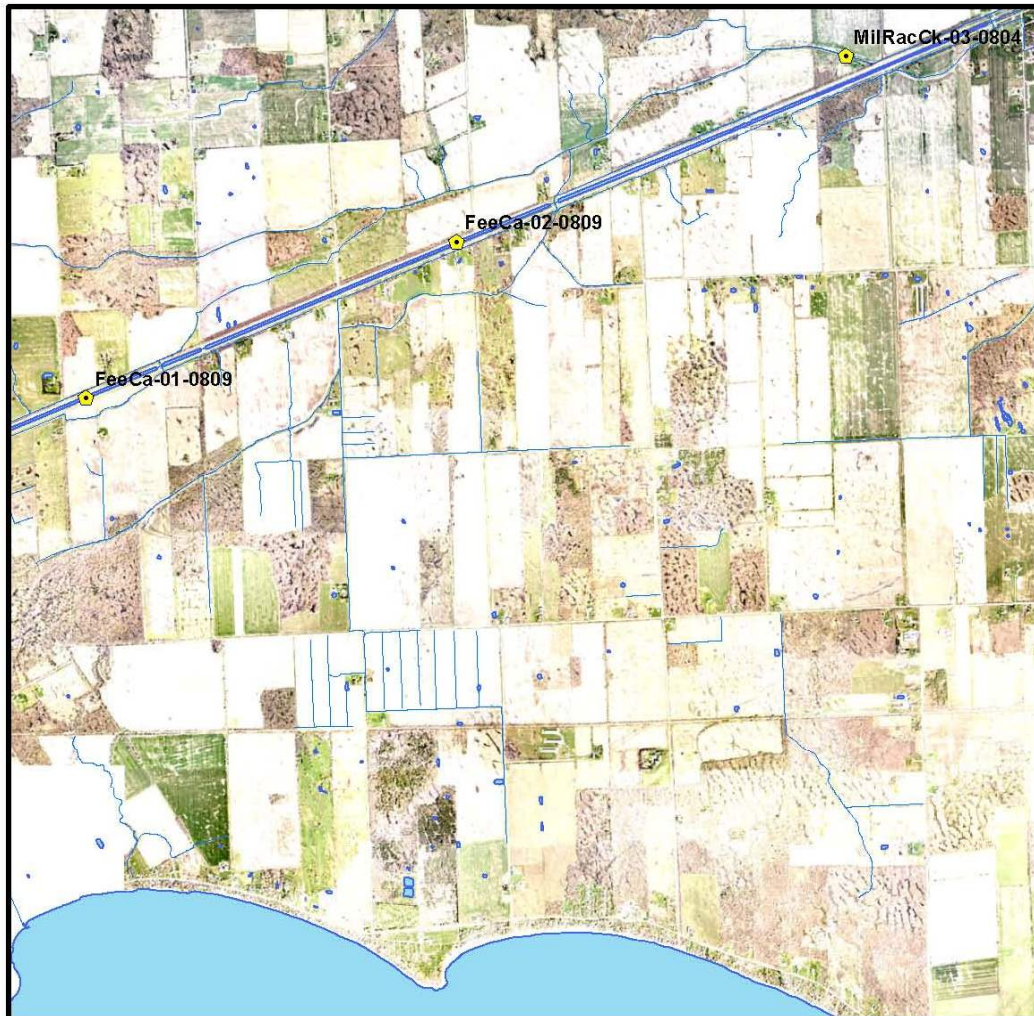
Wainfleet Study Area

		GPS Coordinates & Station	FeeCa-01-0809	FeeCa-02-0809	MillRacCk-03-0804
Common Name	Scientific Name		626771, 4751187	628982, 4752122	631308, 4753228
Bullhead Species	<i>Ameiurus spp.</i>				4
Black Bullhead	<i>Ameiurus melas</i>		4	6	8
Bluegill	<i>Lepomis macrochirus</i>		2		
Brown Bullhead	<i>Ameiurus nebulosus</i>		5	4	58
Central Mudminnow	<i>Umbra limi</i>			12	24
Common Carp	<i>Cyprinus carpio</i>				5
Fathead Minnow	<i>Pimephales promelas</i>			3	
Golden Shiner	<i>Notemigonus cryoleucas</i>		24	31	13
Goldfish	<i>Carassius auratus</i>		300		
Green Sunfish	<i>Lepomis cyanellus</i>			32	94
Johnny Darter	<i>Etheostoma nigrum</i>				2
Largemouth Bass	<i>Micropterus salmoides</i>		1	2	1
Northern Pike	<i>Esox lucius</i>				1
Pumpkinseed	<i>Lepomis gibbosus</i>		13		40
Tadpole Madtom	<i>Noturus gyrinus</i>				21
White Crappie	<i>Pomoxis annularis</i>		6		
Yellow Perch	<i>Perca flavescens</i>		10		

Chart shows fish species captured at each survey site (UTM coordinates for each site listed in chart)

Legend

-  Fisheries Data Points
-  NRVIS Waterline
-  NRVIS Waterpoly



1:33,507
0 1,500
meters

Produced by:
Yaglan,
Guelph District Office,
Ontario Ministry of Natural Resources,
1 Stone Rd. W., Guelph, ON N1G 4Y2

Produced on: September 10, 2009

Projection: UTM Zone 17N
Date: NAD 1983 (spheroid: GRS_1980)
Filename: Fish.mxd

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This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources (OMNR) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

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Map of Fisheries Survey Stations within the Highlighted Wainfleet Bog Area

APPENDIX D

Correspondence with Regulatory Agencies

Correspondence

Don't need any software, just go in windows explorer and manually change the extension from .zippy to .zip. then unzip using winzip or winrar.

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: Monday, April 19, 2010 11:21 AM
To: Lee, Jeff
Subject: RE: Hydrology Information

Hi Jeff,

I was just trying to use the data you sent, but I am unsure how to convert the .zippy file to a .zip file, do you need specific software?

Thanks,
Josephine

From: Lee, Jeff [mailto:jlee@npca.ca]
Sent: Friday, March 19, 2010 9:23 AM
To: Campbell, Jayme; Josephine Gilson
Subject: RE: Hydrology Information

Josephine;

Here is the requested data in ESRI grid format. The file is a compressed zip file for which the extension was changed from .zip to .zippy. please change file extension to .zip before unzipping. If you have any questions do not hesitate to contact me.

Cheers,

Jeff

From: Campbell, Jayme
Sent: Thursday, March 18, 2010 11:06 AM
To: 'Josephine Gilson'
Cc: Lee, Jeff
Subject: RE: Hydrology Information

Josephine,

Here is the data license agreement.
Jeff Lee will forward you the data files tomorrow morning.

Jayme D. Campbell, P.Eng.
Hydrogeologist/Engineer
Niagara Peninsula Conservation Authority
250 Thorold Road West, 3rd Floor
Welland, Ontario

L3C 3W2
Phone: 905-788-3135 ext.261
Fax: 905-788-1121
www.npca.ca
www.sourceprotection-niagara.ca

This information is being provided to support source protection planning under the Clean Water Act. This information may contain personal information and recipients are required to handle it securely and appropriately as specified under the Municipal Freedom of Information and Protection of Privacy act (MFIPPA). If you have received this information inadvertently or incorrectly, please delete the information and contact the sender to let them know this has occurred.

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: Thursday, March 18, 2010 9:09 AM
To: Campbell, Jayme
Subject: RE: Hydrology Information

Jayme,
Yes, those two maps would work wonderfully! Thank you for the warning, but these will at least provide us with a good start.
How large are the files? If they are too big for email then I can look into our FTP site and if it can be used.
Thanks again for your help,
Josephine

From: Campbell, Jayme [jcampbell@npca.ca]
Sent: Wednesday, March 17, 2010 3:55 PM
To: Josephine Gilson
Subject: RE: Hydrology Information

Josephine,
Would the ArcGIS files for these two maps meet your needs?
Caveat is these are done mostly from MOE water well records and are coarse in scale, i.e. you'd best complete your own local-scale mapping from some field investigation.

Jayme D. Campbell, P.Eng.
Hydrogeologist/Engineer
Niagara Peninsula Conservation Authority
250 Thorold Road West, 3rd Floor
Welland, Ontario
L3C 3W2
Phone: 905-788-3135 ext.261
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From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: Tuesday, March 16, 2010 7:19 AM
To: Campbell, Jayme
Subject: Hydrology Information

Good Morning,

I am interested in obtaining some hydrologic data for two sites, one in West Lincoln and the other in Wainfleet Townships. The two sites are proposed for wind turbine farms with 5 -7 turbines on each site. The client has requested that we complete a groundwater seepage study, and I was hoping to obtain a shape file of the high-water table levels for each area. The maps attached to this email indicate the locations of the sites (HAF is the West Lincoln Twp site) which are both quite large areas of land.

If you could please confirm that you have obtained this email and if you will be able to provide me with this information I would greatly appreciate it. Please do not hesitate to email or phone me if you have any further questions or concerns.

Kind Regards,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com



Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

From: Barrett, Ian [mailto:ibarrett@npca.ca]
Sent: Monday, March 15, 2010 3:06 PM
To: Josephine Gilson
Cc: Campbell, Jayme
Subject: RE: Hydrology Information

Hi Josephine,

I would recommend contacting Jayme Campbell in our office. Jayme is our Hydrogeologist and would be able to answer any groundwater related questions you may have.

Ian

Ian Barrett, M.Sc.
Aquatic Biologist
Niagara Peninsula Conservation Authority
250 Thorold Road West, 3rd Floor
Welland, ON

L3C 3W2
Phone 905-788-3135 Ext. 229
Fax 905-788-1121

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: Monday, March 15, 2010 12:54 PM
To: Barrett, Ian
Subject: Hydrology Information

Hi Ian,

I am looking for contact information for someone within NPCA for someone that could provide me with hydrological data, primarily the high water table mapping (preferably in a GIS compatible shape file). In addition to the fisheries study, the client has asked us to look for any groundwater seeps within the site boundary during field visits, hence the request.

Thanks for your help.

Josephine

From: Barrett, Ian [mailto:ibarrett@npca.ca]
Sent: Tuesday, March 02, 2010 3:50 PM
To: Josephine Gilson
Subject: RE: Fisheries Information

Hi Josephine,

I have filled in the attached table as best as possible. Since the location of sites could not be specified, I have included information for the watersheds where works may take place. The species listed in the table do not occur in all watercourses identified in your study areas, however this is the best available information based on the detail provided.

Let me know if you have any questions.

Ian

Ian Barrett, M.Sc.
Aquatic Biologist
Niagara Peninsula Conservation Authority
250 Thorold Road West, 3rd Floor
Welland, ON
L3C 3W2
Phone 905-788-3135 Ext. 229
Fax 905-788-1121

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: Monday, March 01, 2010 10:35 AM
To: Barrett, Ian
Cc: Kelly Sadlier
Subject: Fisheries Information

Good Morning Ian,

I am just putting together my current fisheries information to incorporate into a report for the client, and I am interested in how the data request for the two sites is coming along and the anticipated completion date.

I understand from your last correspondence that you would have preferred road intersections; however, as the turbine locations are currently to-be-determined I am unable to provide that kind of detail, I only have the general site boundaries where the turbines will be located somewhere within the limits. Since both projects are only in the preliminary stages, the locations on the Wainfleet map are only proposed and have not been confirmed.

If you could let me know if I can still process my request as well as the anticipated completion date I would greatly appreciate it. If you have any further questions or concerns please do not hesitate to contact me. Thank you in advance.

Regards,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com



Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

From: Josephine Gilson
Sent: Wednesday, February 17, 2010 7:44 AM
To: 'Barrett, Ian'
Subject: RE: Fisheries Information

Good Morning Ian,

The mapping that I provided in the original email has entire general area where the turbines will potentially be located, as for the exact location of each turbine that is currently undefined. As there is no exact locations determined currently, and as per the clients request I am interested in all the water bodies within the study area. I apologize for not attaching the template for the data table, it has been included with this email. Thank you very much for your help on this matter.

Kind Regards,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com



Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

From: Barrett, Ian [mailto:ibarrett@npca.ca]
Sent: Tuesday, February 16, 2010 2:56 PM
To: Josephine Gilson
Subject: RE: Fisheries Information

Hello Josephine,

I have reviewed the mapping outlining the study areas and it is unclear where your sites are located. I can locate some of the sites in the Wainfleet area, but there is no indication of where your sites are located in West Lincoln. In order to process the request, I will need more accurate mapping indicating the location of proposed works. The locations can be either municipal address or roadway intersection.

Also, in the letter accompanying your request you referred to a table which was to be completed. I was not able to find any table within your correspondence. Can you include the table with the revised mapping/details?

Let me know if you have any questions.

Ian

Ian Barrett, M.Sc.
Aquatic Biologist
Niagara Peninsula Conservation Authority
250 Thorold Road West, 3rd Floor
Welland, ON
L3C 3W2
Phone 905-788-3135 Ext. 229
Fax 905-788-1121

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: Thursday, February 11, 2010 3:00 PM
To: Barrett, Ian
Subject: Fisheries Information

Good Afternoon Mr. Ian Barrett

I am contacting you in regards to a data request for fisheries information at two locations, one near Wainfleet and the other near Vineland. Please see the attached formal request and mapping.

I would greatly appreciate confirmation that you have received this request, and if possible an estimated date of completion.

If you require any further information please do not hesitate to contact me.

Kind Regards,

Josephine A. Gilson, B.Sc.

Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com



Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
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Josephine

Sorry about the delay,

I've heard back from Anne and for the fisheries data you are referring to, the date is the last two digits of the Sample Station Name. So for example, 0809 means August 2009.

If you have any other questions, please let me know.

Cheers,

April

April Nix
Planning Intern
Ministry of Natural Resources, Guelph District
1 Stone Road West
Guelph ON, N1G 4Y2
(P) 519-826-4939
(F) 519-826-6849
email: april.nix@ontario.ca

From: Stone, Mike (MNR)
Sent: March 23, 2010 9:30 AM
To: Yagi, Anne (MNR)
Cc: Nix, April (MNR)
Subject: FW: Fisheries Data - Energy Application

Hi Anne. I gather David may be off on a contract break. He recently provided the attached as part of an information request. The consultant is looking for sample dates. Can you advise if this information is available.

Thanks,
Mike

From: Stone, Mike (MNR)
Sent: March 23, 2010 9:11 AM
To: Denyes, David (MNR)
Cc: Nix, April (MNR)
Subject: FW: Fisheries Data - Energy Application

Hello David,

Please see the consultant's request for further details on the information you previously provided. Can you please respond to the consultant indicating whether or not this information is available. If you could please cc April and I on any response you provide that would be appreciated.

Thanks,
Mike

--
Mike Stone
District Planner
Ministry of Natural Resources
Guelph District

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: March 18, 2010 9:32 AM
To: Stone, Mike (MNR)
Subject: Fisheries Data - Energy Application

Good Morning Mike,
Please see the below email. If you could let me know if this is something you can help me with I would greatly appreciate it.
Kind Regards,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com

Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

From: Josephine Gilson
Sent: Thursday, March 18, 2010 9:27 AM
To: April.Nix@ontario.ca
Subject: FW: Fisheries Data Request

Good Morning April,
I have recently been working with David Deneyes to aquire information for two sites one in West Lincoln and the other in Wainfleet Twp. The attached is the information that David supploded me with, however I was hoping that you could provide me with the date for each sample occurance that is sited in the table (i.e. the date of each source of data in the table). This is additinal information that I did not previously request from David. I am interested as we are trying to obtain a Scientific Collectors Permit and would like to know how recent the sample data is.

If you have any question or concerns please do not hesitate to contact me. I would appreciate if you could please confirm that you recieved this email, as well as an estimated time that you can provide me with the requested details.

Kind Regards,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com

Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

From: Denyes, David (MNR) [David.Denyes@ontario.ca]
Sent: Thursday, February 11, 2010 2:17 PM
To: Josephine Gilson
Cc: Nix, April (MNR)
Subject: RE: Fisheries Data Request

Hello Josephine,

Here is the fisheries data that you requested for the Wainfleet and Vineland Study areas. I've attached site maps with the coordinates so you know where each station was located. I'm also working on creating wetland maps for these areas. I can send that information to you, shortly!

David Denyes

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: February 11, 2010 1:56 PM
To: Denyes, David (MNR)
Cc: Kelly Sadlier
Subject: RE: Fisheries Data Request

Good Afternoon David,

I am contacting you to inquire about the data request I sent in mid January for two wind turbine sites, one in Wainfleet area and the other in Vineland area (original email is below). Could you please provide me with an estimate when you will be able to send the requested information?

Thank you in advance,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com



Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

From: Denyes, David (MNR) [mailto:David.Denyas@ontario.ca]
Sent: Friday, January 15, 2010 8:38 AM
To: Josephine Gilson
Subject: RE: Fisheries Data Request

Hello Josephine,

I'm confirming that I have received your fisheries information request. You can expect to have a response back from me within 20 days. However, I will try to have the MNR data request completed sooner than that.

David

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: January 14, 2010 10:37 AM
To: Denyes, David (MNR)
Cc: Kelly Sadlier
Subject: Fisheries Data Request

Good Morning Mr. Deneyes,

I am contacting you in regards to a data request for fisheries information at two locations, one near Wainfleet and the other near Vineland. Please see the attached documentation and mapping.

I would greatly appreciate confirmation that you have received this request, and if possible an estimated date of completion.

If you require any further information please do not hesitate to contact me.

Kind Regards,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com



Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

You need to speak directly with Anne. She will not allow the permit to be issued until she knows why you need additional data.

Beverly Stevenson
F&W Technical Specialist
519-482-3361

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: March 18, 2010 9:05 AM
To: Stevenson, Beverly (MNR)
Subject: RE: Fish application?

Hi Beverly,

I am aware that there is existing fisheries data for the area and I have already been in contact with the MNR and NPCA and received the existing fisheries data. In addition to existing data we will be collecting our own data in the field and therefore we will need a Scientific Collection Permit.

Thank you for your help on this,
Josephine Gilson

From: Stevenson, Beverly (MNR) [beverly.stevenson@ontario.ca]
Sent: Thursday, March 18, 2010 8:45 AM
To: Josephine Gilson
Subject: RE: Fish application?

Hi Josephine

I have spoken to the area biologist regarding the application. She has existing fish data for that area. Please contact Anne Yagi at 905-562-1196 or anne.yagi@ontario.ca to see if the data that already exists is sufficient for your needs or not.

Beverly Stevenson
F&W Technical Specialist
519-482-3361

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: March 12, 2010 3:02 PM
To: Stevenson, Beverly (MNR)
Subject: RE: Fish application?

Beverly,
The VHS survey and application are attached to this email. I totally missed the application the first time around - thanks for the reminder!
If there is anything else you need please let me know!
Thanks

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com



Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

From: Stevenson, Beverly (MNR) [mailto:beverly.stevenson@ontario.ca]
Sent: Friday, March 12, 2010 1:11 PM
To: Josephine Gilson
Subject: RE: Fish application?

I should have looked at your application package first. Can you also complete the application form? It wasn't in the e-mail that Anne sent to me.

Beverly Stevenson
F&W Technical Specialist

519-482-3361

From: Stevenson, Beverly (MNR)
Sent: March 12, 2010 1:09 PM
To: 'JGilson@morrisonhershfield.com'
Subject: RE: Fish application?

Hi Josephine

Could you please forward a copy of the map to me? It must be less than 10 megs to make it through our e-mail system. Also, you are required to complete a VHS risk assessment. See the attached form.

Beverly Stevenson
F&W Technical Specialist
519-482-3361

From: Yagi, Anne (MNR)
Sent: March 12, 2010 12:44 PM
To: Stevenson, Beverly (MNR)
Subject: FW: Fish application?

It was sent to me. Except for a map which was too big to send. Have them send it to you directly

Anne Yagi
Management Biologist
Niagara Area Office/Guelph District
4890 Victoria Ave North
Vineland Station ON
L0R 2E0
Phone: 905 562-1196
Fax: 905 562-1154
E-mail: anne.yagi@ontario.ca

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: March 12, 2010 11:03 AM
To: Yagi, Anne (MNR)
Cc: Kelly Sadlier
Subject:

Good Morning,

Pleased see the attached correspondence and supporting documentation.

Kind Regards,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com

Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

Hello Josephine,

I have attached a copy of the Fisheries Management plans for the two study areas. These apply to the watershed and not a specific tributary (ie Welland River West, 20 Mile Creek). I have attached the data for 40 Mile Creek as well. Most of this data is historic and the locations were vague. Also, today (March 5) is the last day of my contract. If you have any more questions about the data you will have to contact Anne Yagi. She can be reached at anne.yagi@ontario.ca or by phone at 905 -562- 1196.
Thanks!

David

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: March 5, 2010 11:24 AM
To: Denyes, David (MNR)
Subject: RE: Fisheries Data Request

Hello David,
I apologize, but I have one more question :)
One tributary which is part of the 40 Mile Creek Watershed falls within the site boundaries for the Vineland location, however there is no information provided in your previous info package. Would it be possible to get info for the 40 Mile Creek Watershed?
I'm sorry to bug you again - hopefully this is the last time!!
Have a good weekend!
Josie Gilson

From: Denyes, David (MNR) [mailto:David.Denyas@ontario.ca]
Sent: Thursday, March 04, 2010 4:20 PM
To: Josephine Gilson
Subject: RE: Fisheries Data Request

Hello Josephine,

You were correct in that Sinkhole creek was classified as Type 1 fish habitat because of its connection to Twenty Mile Creek. A healthy population of Grass Pickerel were found within the 20 Mile Creek system and they may also inhabit Sinkhole creek at certain times of the year because of this direct linkage. Sinkhole creek is a feeder tributary of the Twenty Mile Creek System. The headwater areas of sinkhole creek are classified as type II habitat. I'm also working on the MNR Fisheries management plans for these two study areas and will send this to you shortly.

David Denyes

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: March 4, 2010 11:59 AM
To: Denyes, David (MNR)
Subject: RE: Fisheries Data Request

Hello David,

I am reviewing the data you sent, and I have a question pertaining to the Sinkhole Creek Watershed. It has been classified as Type I and Type II, and I am uncertain as to why it has been classified as Type I. The species captured are not listed provincially or federally and are common species. Is the classification based on the connection to Twenty Mile Creek?

Thanks so much for your help!

Josie

From: Denyes, David (MNR) [mailto:David.Denyas@ontario.ca]
Sent: Thursday, February 11, 2010 2:18 PM
To: Josephine Gilson
Cc: Nix, April (MNR)
Subject: RE: Fisheries Data Request

Hello Josephine,

Here is the fisheries data that you requested for the Wainfleet and Vineland Study areas. I've attached site maps with the coordinates so you know where each station was located. I'm also working on creating wetland maps for these areas. I can send that information to you, shortly!

David Denyes

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: February 11, 2010 1:56 PM
To: Denyes, David (MNR)
Cc: Kelly Sadlier
Subject: RE: Fisheries Data Request

Good Afternoon David,

I am contacting you to inquire about the data request I sent in mid January for two wind turbine sites, one in Wainfleet area and the other in Vineland area (original email is below). Could you please provide me with an estimate when you will be able to send the requested information?

Thank you in advance,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com



Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
Dir: 416 499 3110 x1367 | Fax: 416 499 9658
morrisonhershfield.com

From: Denyes, David (MNR) [mailto:David.Denyas@ontario.ca]
Sent: Friday, January 15, 2010 8:38 AM
To: Josephine Gilson
Subject: RE: Fisheries Data Request

Hello Josephine,

I'm confirming that I have received your fisheries information request. You can expect to have a response back from me within 20 days. However, I will try to have the MNR data request completed sooner than that.

David

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: January 14, 2010 10:37 AM
To: Denyes, David (MNR)
Cc: Kelly Sadlier
Subject: Fisheries Data Request

Good Morning Mr. Deneys,

I am contacting you in regards to a data request for fisheries information at two locations, one near Wainfleet and the other near Vineland. Please see the attached documentation and mapping.

I would greatly appreciate confirmation that you have received this request, and if possible an estimated date of completion.

If you require any further information please do not hesitate to contact me.

Kind Regards,

Josephine A. Gilson, B.Sc.
Aquatic Ecosystem Biologist
jgilson@morrisonhershfield.com



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Josephine:

I trust that we will be provided with a much more formal opportunity to be involved in the site selection process over the coming months.

You should be aware that the Region's Natural Heritage features will not be the most current mapping. New PSW mapping is being completed by MNR as we speak. Therefore, please ensure to contact MNR for the most recent mapping.

Please feel free to contact us in the future. I look forward to being kept informed on this process.

Sincerely,
Brian Treble

From: Adam Huycke
To: 'Josephine Gilson' <JGilson@morrisonhershfield.com>
Cc: Brian Treble
Sent: Mon Mar 15 15:17:51 2010
Subject: RE: Records Review for a Renewable Energy Project

Good Afternoon Josephine:

Please except this email as the Township's Planning Department's response to your request for information. Township Planning Staff are of the understanding that the Region of Niagara will be providing you with information regarding the natural feature that exist within you study area. Should you require any further assistance from Planning Staff please do not hesitate to ask.

Sincerely,

Adam Huycke, B.A. (Hons.), CPT,
Planning Technician
Secretary Treasurer of the Committee of Adjustment
Township of West Lincoln
318 Canborough Street
P.O. Box 400
Smithville, ON
L0R 2A0
Phone: 905-957-3346
Fax: 905-957-3219

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From: Brian Treble
Sent: March 11, 2010 10:21 AM

To: 'Josephine Gilson'
Cc: Adam Huycke; Trevor Hall
Subject: RE: Records Review for a Renewable Energy Project

Josephine:

I hereby confirm receipt of your email.

I would anticipate that we should be able to have your information request filled by early next week.

Finally, our Director of Public Works and Engineering is Trevor Hall

(thall@westlincoln.ca). Please feel free to contact him by email or phone 905-957-3396.

Brian

Brian Treble
Director of Planning and Building
Township of West Lincoln
318 Canborough Street
P.O. Box 400
Smithville, Ontario
L0R 2A0
Phone: 905-957-3346
Fax: 905-957-3219
btreble@westlincoln.ca

From: Josephine Gilson [mailto:JGilson@morrisonhershfield.com]
Sent: Thursday, March 11, 2010 9:19 AM
To: Brian Treble
Cc: Kelly Sadlier
Subject: Records Review for a Renewable Energy Project

Good Morning Mr. Brian Treble,

I am contacting you in regards to obtaining a records review for a site within the West Lincoln Township that has been proposed for a wind farm. The data request is to fulfill the requirements of the Renewable Energy Approvals (REA) Regulation, which indicates that we must contact the planning board to obtain information.

In particular I am interested if the project site contains; any natural features and/or areas of scientific interest (earth science).

I have attached a map of the site location for your reference. The five proposed turbines will be located within the site boundaries, however the exact locations are yet to be determined as more information is required.

In addition, the REA Regulation requests that we contact the local roads board, if you have any information as to whom I could contact in regards to road works, that would be great.

I would greatly appreciate a brief email to confirm that you have received this email, as well as an estimated time of delivery for the information. If you have any questions or concerns please do not hesitate to contact me via email or

phone. Thank you very much for your time and I look forward to hearing from you.

Josephine A. Gilson, B.Sc.

Aquatic Ecosystem Biologist

jgilson@morrisonhershfield.com



Suite 600, 235 Yorkland Blvd. | Toronto, ON M2J 1T1
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morrisonhershfield.com

APPENDIX E

DFO Operational Statements



HIGH-PRESSURE DIRECTIONAL DRILLING

Fisheries and Oceans Canada
Ontario Operational Statement

Version 3.0

For the purpose of this Operational Statement, the term High-Pressure Directional Drilling (HPDD) means trenchless methods of crossing a watercourse using pressurized mud systems. HPDD is used to install cables and pipelines for gas, telecommunications, fibre optics, power, sewer, oil and water lines underneath watercourses and roads. This method is preferable to open-cut and isolated crossings since the cable or pipeline is drilled underneath the watercourse with very little disturbance to the bed or banks. HPDD involves drilling a pilot bore hole underneath the watercourse towards a surface target, back-reaming the bore hole to the drill rig while pulling the pipe along through the hole. This process typically uses the freshwater gel mud system composed of a mixture of clean, freshwater as the base, bentonite (clay-based drilling lubricant) as the viscosifier and synthetic polymers.

The general order of preference for carrying out a cable or pipeline stream crossing in order to protect fish and fish habitat is: a) a punch or bore crossing (see *Punch & Bore Crossings* Operational Statement), b) HPDD crossing, c) dry open-cut crossing, and d) isolated open-cut crossing (see *Isolated or Dry Open-cut Stream Crossings* Operational Statement). This order must be balanced with practical considerations at the site.

One of the risks associated with HPDD is the escape of drilling mud into the environment as a result of a spill, tunnel collapse or the rupture of mud to the surface, commonly known as “frac-out”. A frac-out is caused when excessive drilling pressure results in drilling mud propagating toward the surface. The risk of a frac-out can be reduced through proper geotechnical assessment practices and drill planning and execution. The extent of a frac-out can be limited by careful monitoring and having appropriate equipment and response plans ready in the event that one occurs. HPDD can also result in excessive disturbance of riparian vegetation and sedimentation and erosion due to operation of equipment on the shoreline or fording to access the opposite bank.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to incorporate into your project in order to avoid negative impacts to fish habitat. You may proceed with your

high-pressure directional drill project without a DFO review when you meet the following conditions:

- the crossing technique will not damage the stream bed and thereby negatively impact fish or fish habitat,
- the crossing is not a wet open-cut crossing,
- you have an emergency frac-out response plan and a contingency crossing plan in place that outline the protocol to monitor, contain and clean-up a potential frac-out and an alternative method for carrying out the crossing, and
- you incorporate the *Measures to Protect Fish and Fish Habitat when High-Pressure Directional Drilling* listed below in this Operational Statement.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in a violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact your Conservation Authority, or the DFO office in your area (see Ontario DFO office list) or Parks Canada if the project is located within its jurisdiction, including the Trent-Severn Waterway and the Rideau Canal, if you wish to obtain an opinion on the possible options you should consider to avoid contravention of the *Fisheries Act*.

You are required to respect all municipal, provincial or federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in this Operational Statement must also comply with the *Species at Risk Act* (www.sararegistry.gc.ca). If you have questions regarding this Operational Statement, please contact one of the agencies listed above.

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Measures to Protect Fish and Fish Habitat when High-Pressure Directional Drilling

1. Use existing trails, roads or cut lines wherever possible, as access routes to avoid disturbance to the riparian vegetation.
2. Design the drill path to an appropriate depth below the watercourse to minimize the risk of frac-out and to a depth

to prevent the line from becoming exposed due to natural scouring of the stream bed. The drill entry and exit points are far enough from the banks of the watercourse to have minimal impact on these areas.

3. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to access the construction site. This removal should be kept to a minimum and within the road or utility right-of-way.
4. Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. A *Temporary Stream Crossing* Operational Statement is also available.
 - 4.1. If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
 - 4.2. Grading of the stream banks for the approaches should not occur.
 - 4.3. If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation are likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
 - 4.4. Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the *Ontario In-Water Construction Timing Windows*).
 - 4.5. Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.
5. Operate machinery on land above the ordinary high water mark (see definition below) and in a manner that minimizes disturbance to the banks of the watercourse.
 - 5.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
 - 5.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
 - 5.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
 - 5.4. Restore banks to original condition if any disturbance occurs.
6. Construct a dugout/settling basin at the drilling exit site to contain drilling mud to prevent sediment and other deleterious substances from entering the watercourse. If this cannot be achieved, use silt fences or other effective sediment and erosion control measures to prevent drilling mud from entering the watercourse. Inspect these measures regularly during the course of construction and make all necessary repairs if any damage occurs.
 - 6.1. Dispose of excess drilling mud, cuttings and other waste materials at an adequately sized disposal

facility located away from the water to prevent it from entering the watercourse.

7. Monitor the watercourse to observe signs of surface migration (frac-out) of drilling mud during all phases of construction.

Emergency Frac-out Response and Contingency Planning

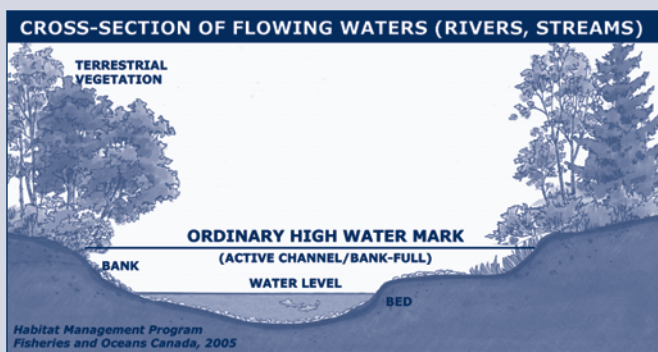
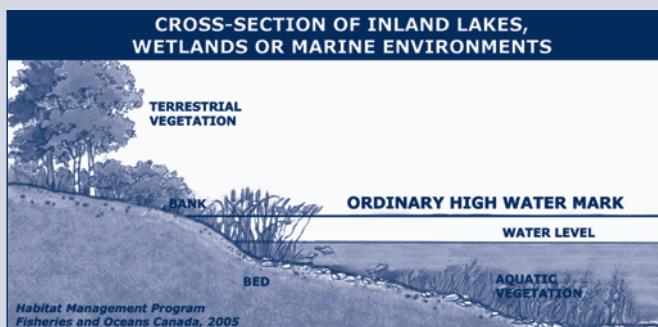
8. Keep all material and equipment needed to contain and clean up drilling mud releases on site and readily accessible in the event of a frac-out.
9. Implement the frac-out response plan that includes measures to stop work, contain the drilling mud and prevent its further migration into the watercourse and notify all applicable authorities, including the closest DFO office in the area (see Ontario DFO office list). Prioritize clean up activities relative to the risk of potential harm and dispose of the drilling mud in a manner that prevents re-entry into the watercourse.
10. Ensure clean up measures do not result in greater damage to the banks and watercourse than from leaving the drilling mud in place.
11. Implement the contingency crossing plan including measures to either re-drill at a more appropriate location or to isolate the watercourse to complete the crossing at the current location. See *Isolated or Dry Open-cut Stream Crossings* Operational Statement for carrying out an isolated trenched crossing.
12. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with preferably native grass or shrubs.
13. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.
 - 13.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.

Definition:

Ordinary high water mark – The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the “active channel/bank-full level” which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial

vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (Full Supply Level).

For the Great Lakes this refers to the 80th percentile elevation above chart datum as described in DFO's *Fish Habitat and Determining the High Water Mark on Lakes*.



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OVERHEAD LINE CONSTRUCTION

Fisheries and Oceans Canada
Ontario Operational Statement

Version 3.0

Overhead lines are constructed for electrical or telecommunication transmission across many watercourses that range in size from small streams and ponds to large rivers, lakes and reservoirs. This Operational Statement applies to selective removal of vegetation along the right-of-way to provide for installation and safe operation of overhead lines, and passage of equipment and materials across the water body.

Although fish habitat occurs throughout a water system, it is the riparian habitat that is most sensitive to overhead line construction. Riparian vegetation occurs adjacent to the watercourse and directly contributes to fish habitat by providing shade, cover, and spawning and food production areas. It is important to design and build your overhead line project to meet your needs while also protecting riparian areas. Potential impacts to fish and fish habitat include excessive loss of riparian vegetation, erosion and sedimentation resulting from bank disturbance and loss of plant root systems, rutting and compaction of stream substrate at crossing sites, and disruption of sensitive fish life stages.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to incorporate into your project in order to avoid negative impacts to fish habitat. You may proceed with your overhead line project without a DFO review when you meet the following conditions:

- it does not require the construction or placement of any temporary or permanent structures (e.g. islands, poles, crib works, etc.) below the ordinary high water mark (HWM) (see definition below), and
- you incorporate the *Measures to Protect Fish and Fish Habitat when Constructing Overhead Lines* listed below in this Operational Statement.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in a violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case,

you should contact your Conservation Authority, or the DFO office in your area (see Ontario DFO office list) or Parks Canada if the project is located within its jurisdiction, including the Trent-Severn Waterway and the Rideau Canal, if you wish to obtain an opinion on the possible options you should consider to avoid contravention of the *Fisheries Act*.

You are required to respect all municipal, provincial or federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in this Operational Statement must also comply with the *Species at Risk Act* (www.sararegistry.gc.ca). If you have questions regarding this Operational Statement, please contact one of the agencies listed above.

We ask that you notify DFO, preferably 10 working days before starting your work by filling out and sending the Ontario Operational Statement notification form (www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/prov-terr/index_e.htm) to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when Constructing Overhead Lines

1. Installing overhead lines under frozen conditions is preferable in all situations. On wet terrains (e.g., bogs), lines should be installed under frozen conditions, where possible, or using aerial methods (i.e., helicopter).
2. Design and construct approaches so that they are perpendicular to the watercourse wherever possible to minimize loss or disturbance to riparian vegetation.
3. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or overhead line structures.
 - 3.1. Wherever possible, locate all temporary or permanent structures, such as poles, sufficiently above the HWM to prevent erosion.
4. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to accommodate the overhead line. This removal

should be kept to a minimum and within the road or utility right-of-way.

5. Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. A *Temporary Stream Crossing Operational Statement* is also available.

- 5.1. If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
- 5.2. Grading of the stream banks for the approaches should not occur.
- 5.3. If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation is likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
- 5.4. Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the *Ontario In-Water Construction Timing Windows*).
- 5.5. Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.

6. Operate machinery on land and in a manner that minimizes disturbance to the banks of the watercourse.

- 6.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
- 6.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
- 6.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
- 6.4. Restore banks to original condition if any disturbance occurs.

7. Install effective sediment and erosion control measures before starting work to prevent entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.

- 7.1. Avoid work during wet, rainy conditions or use alternative techniques such as aerial methods (i.e., helicopter) to install overhead lines.

8. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.

9. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g.,

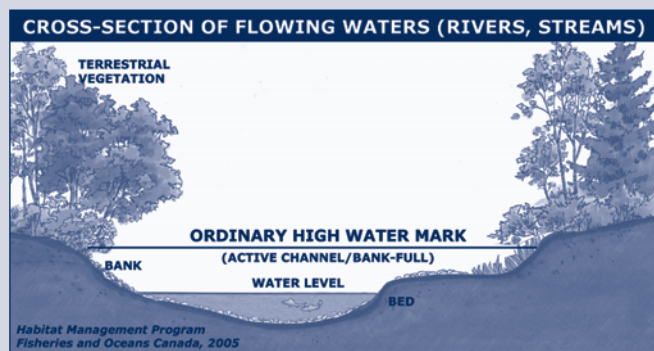
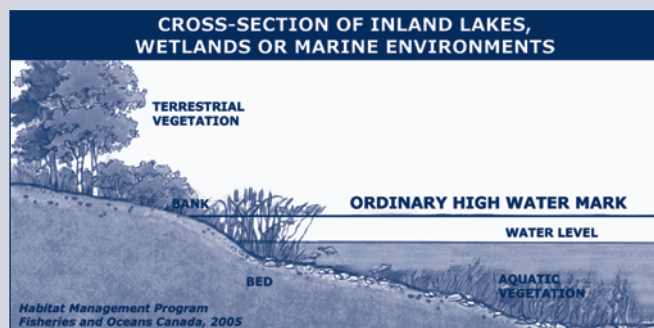
cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.

- 9.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.

Definition:

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Project Number: 1104036.00

Project Title: WAINFLEET WIND ENERGY PROJECT

Report: 012-R02-1104036

Title: ENVIRONMENTAL IMPACT STATEMENT REPORT

Client: IPC Energy
2550 Argentia Road Suite 105
Mississauga, Ontario
L5N 5R1

Attention: Mr. Sunny Galia Project Manager

Date: September, 2010

Morrison Hershfield Limited

Erin McLachlan
Terrestrial Ecologist and Environmental Planner



Environmental Impact Statement Report

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1.0 Introduction

Morrison Hershfield has been retained by IPC Energy to complete an Environmental Impact Statement as part of an environmental assessment screening for a proposed wind farm located in the Niagara Region, Ontario. The project involves the development of 5 turbines with a hub height of 95m resulting in the production of 9.0 MW.

This report has been prepared to evaluate the significance of natural heritage features at the project site and to document how mitigation measures will ensure that there will be no negative environmental effects. The evaluation is based on information obtained during the records review, agency consultation and field studies conducted on-site. This document outlines the potential negative impacts on natural heritage features as a result of constructing wind turbines and the supporting project infrastructure and proposes mitigation measures to address these impacts. Monitoring plans will also be established to evaluate the success of the mitigation measures proposed (See the **Environmental Effects Monitoring Report**).

The project complies with Ontario Regulation 359/09 – Renewable Energy Approvals (REA) under Part V.0.1. of the Environmental Protection Act. This document satisfies the reporting required under the Natural Heritage Section. As the lands are not within the Oak Ridges Moraine, Protected Countryside, or the Niagara Escarpment, those sections of Ontario Regulation 359/09 do not apply. Field reviews and background information checks identified all natural heritage features, and confirmed whether these features were Significant. Where the project was within the required setbacks given under Ontario Regulation 359/09, mitigations measures are proposed to address and negative environmental effects to natural heritage features. It identifies any environmental effects monitoring requirements to be included in the monitoring plan report and describes how the construction plan report will address any negative environmental effects. These mitigations and requirements ensure that there will be no negative effects as a result of the proposed project.

The proposed project area is in the Township of Wainfleet, in the Niagara Region (Figure 1). It is a predominately farming township and is located on the north shore of Lake Erie. The study area is dominated by agricultural fields, has several creeks running through and has a few forested areas and marshy areas.

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Figure 1: Study area within the Township of Wainfleet

1.1 Renewable Energy Approvals Setbacks

The following two tables include all the required setbacks from natural heritage features and additional natural heritage features with no designated setbacks. According to Ontario Regulation 359/09 – Renewable Energy Approvals under Part V.0.1. of the Environmental Protection Act, these features must be addressed in this Environmental Impact Statement.

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Table 1: SETBACKS FROM NATURAL FEATURES

Natural Features	Setback in meters from natural feature	Feature within the setback area?	Identity of Feature within Setback
Provincial park or conservation reserve	120	NO	
Area of natural and scientific interest (earth science)	50	NO	
Area of natural and scientific interest (life science)	120	NO	
Provincially significant wetland	120	YES	The Swamps near turbine 4 and 5 are part of a provincially significant wetland
Significant valleyland	120	NO	
Significant woodland	120	YES	Several woodlands in the project area are designated as Significant; Turbine 4 and 5 and the tapline along Brawn Road are Significant
Significant wildlife habitat	120	YES	See Table 3 below for details
Average annual high water mark of a lake, other than a lake trout lake that is at or above development capacity	120	NO	
Average annual high water mark of a lake trout lake that is at or above development capacity	300	NO	

Environmental Impact Statement Report

Natural Features	Setback in meters from natural feature	Feature within the setback area?	Identity of Feature within Setback
Average annual high water mark of a permanent or intermittent stream	120	YES	Four (4) streams are intersected along the tapline.
Seepage area	120	NO	

Table 2: ADDITIONAL NATURAL FEATURES AND RESOURCES

Natural Feature	Potentially affected by the project?	Identity of the Natural Feature
Fish and fish habitat	YES	The seven (7) streams which are intersected along the tapline provide direct or contributing fish habitat.
Rare vegetation communities as defined by the MNR's Natural Heritage Information Centre	YES	Oak Mineral Deciduous Swamp near turbine 4 is considered to be Provincially rare
Species and habitat protected under the Endangered Species Act, 2007	NO	
Wildlife and their habitat including the nests and eggs of birds, beaver dams, and dens of black bears and some furbearing mammals	YES	The nests and eggs of birds may be found in all areas of the project, and other species as detailed below in the significant wildlife habitat
Mineral aggregate resources	NO	
Petroleum resources, wells, and works	NO	
Crown forest resources	NO	
Hazard Lands	NO	
Connectivity of Natural Features	YES	Taplines are in between natural features and turbines may intersect migratory routes for birds, insects and bats
Existing wildlife management plans and/or fisheries management plans	YES	Fish Management Plan

Environmental Impact Statement Report

Table 3: Significant Wildlife habitat and presence in proximity to the Proposed Project Area

Rare Vegetation Communities:	Present?
• Alvars	
• Tall-grass prairies	
• Savannahs	
• Rare forest types	√
• Talus slopes	
• Rock barrens	
• Sand barrens	
• Great Lakes dunes	
Specialized Habitats for Wildlife:	
• Habitat for area-sensitive species	
• Forests providing a high diversity of habitats	√
• Old-growth or mature forest stands	√
• Foraging areas with abundant mast	
• Amphibian woodland breeding ponds	√
• Turtle nesting habitat	
• Specialized raptor nesting habitat	
• Moose calving areas	
• Moose aquatic feeding areas	
• Mineral licks	
• Mink, otter, marten, and fisher denning sites	
Highly Diverse Areas	
Cliffs	
Seeps and Springs	
Seasonal Concentrations of Animals	
• Bat Hibernacula or significant habitat	
• White-tailed deer winter	
• Moose late winter habitat	
• Reptile hibernacula or significant habitat	√
• Amphibian summer habitat or breeding ponds	√
• Bullfrog concentration areas	
• Raptor wintering areas	
• Wild Turkey Winter Range	√
• Turkey Vulture summer roost	
• Waterfowl breeding/staging areas	√
• Colonial Bird nesting sites	
• Heronries	
• Landbird Migratory stopover areas	√
• Butterfly Migratory stopover areas	√

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Information from the SWHTG regarding seasonal concentrations of animals is attached in **Appendix A**. It contains a detailed description of their characteristics.

2.0 Project Background

An introduction to the proposed Wainfleet Wind Energy Project is given in the accompanying Natural Heritage Assessment Report. The Natural Heritage Assessment Report documents the results of the Records Review process, the Site Investigations, and the expected impacts as well as proposed mitigations and any net effects. Net effects are those negative environmental effects caused by the project and related activities that will remain after mitigation and impact management measures have been applied.

3.0 Natural Heritage Evaluation of Significance

3.1 Methodology

The natural heritage features were evaluated using the Significant Wildlife habitat Technical Guide (SWHTG) (MNR, 2000) and Ministry of Natural Resources protocols for terrestrial and aquatic evaluations. All natural features were evaluated within the proposed project area and all adjacent areas up to 120 m as to their presence or absence. As the project area may extend into areas outside of those delineated on Figure 1 during construction, areas up to 200 m were reviewed. A detailed description of the methodology and results can be found in the Natural Heritage Report (Morrison Hershfield, 2010) and the Water Assessment Report (Morrison Hershfield, 2010).

3.2 Results

The following provides a synopsis of the findings in the Natural Heritage Report (Morrison Hershfield, 2010). As the Renewable Energy Approvals requires a thorough assessment of the natural features, this synopsis includes all important ecological features which may be potentially affected by the proposed project. The information below is focused on the features that overlap or are within 200 m of the proposed project and are contained in the tables in Section 1 of this report.

3.2.1 Provincially Significant Wetlands

The forested wetlands and associated marshes near Station Road and south of Concession 1 are designated as Provincially significant (Figure 2). The forested wetlands and marshes are part of the Emerson Road Woods Provincially Significant Wetlands, with a combined area of approximately 330 ha. The area is characterized by an interface where poorly drained clay soils meet silty loamy sands. It is mainly flat and shows some slough/ridge topography in areas where clay is dominant. The canopies of the wooded areas are Deciduous Swamp with a complex microtopography and a canopy that was highly variable and successional. Associated with the forested wetlands were several Mineral Marshes, including Cattail Mineral Shallow Marsh and a Mineral Meadow Marsh. Parts of the wetland function as the nesting area of colonial waterbirds and active feeding areas for the great blue heron. Other resources from this area include bullfrogs, and furbearers such as raccoon, red fox, and weasel. During the 2010 study, no rare, endangered, or threatened species were noted within 200 m of the project area. No bullfrog habitat was noted, and also

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no colonial waterbird nesting areas existed within 200 m of the project area. As well, great blue heron feeding areas within 200 m of the project area were marginal.

3.2.2 Significant Woodlands

Several forested areas were designated as Significant by the Niagara Peninsula Conservation Authority and the local municipality. They are all found along Station Road, and are mainly forested deciduous swamps and two areas with Deciduous Forest (Figure 3).

Along Station Road, there are several Black Ash Mineral Deciduous Swamps (SWD2-1). The small Black Ash Mineral Deciduous Swamp to the west of Station Road and north of Abbey Road contains soft agrimony, a regionally rare species. Poke milkweed and pignut hickory, also regionally rare, are found in the other Black Ash Mineral Deciduous Swamps. Both do not occur within 25 m of the road, and will not be affected if construction and disturbance are limited to the road. However, the vegetation in the Deciduous Swamps is sensitive to changes in hydrology.

Along Station road and north of the Gord Harry Conservation Trail and the proposed location for Turbine 4 is a Red Maple Mineral Deciduous Swamp (SWD3-1). Within this forest are pignut hickory, drooping woodreed, mountain-holly, and wood lily, all regionally rare species.

3.2.3 Significant Wildlife Habitat

Forests providing a high diversity of habitats

As discussed in Section 3.2.2, there is a high diversity of forest habitats near the proposed project area which are found within the significant woodlands (Figure 3). The drier and fresher forested areas contain regenerating and mature forests and a wide variety of woody and herbaceous vegetation. As they are near the coastal area of the Great Lakes, contains several wetland types including swamps, marshes and small areas of open water, many watercourses, and meadows, the diversity of habitats provided would be considered significant.

Old-growth or mature forest stands

Within the all of the forested areas within Niagara Peninsula Natural Areas which have Significant Woodland designation (Figure 3), there are many trees which have reached maturity. Portions of all the contiguous woodlots contain old growth, which is defined as a self-perpetuating community composed of primarily late seral species and show uneven stand age distribution and including large old trees (generally older than 120 years) without open-grown characteristics.

Amphibian woodland breeding ponds

All of the Swamp forests contain ephemeral wetlands, and several contained standing water and mature adult frogs and toads during the mid-summer field review (Figure 4 for location of Swamp forests).

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Amphibian breeding habitat

There were many woodland ponds and several marsh type wetlands which provide amphibian breeding habitat for a variety of species. Within 200 m of the proposed project area, no bullfrog breeding habitat were noted, however, breeding habitat for all other frog and toad species was noted within the ephemeral wetlands, permanent wetlands, and any waterbodies such as artificial ponds.

Wild turkey wintering range

A potential Wild Turkey wintering range was identified during the field reviews within the forested areas in the wooded areas to the east of Station Road (Figure 4). Approximately 55 Wild Turkeys were observed feeding on corn 400m from near this site in February 2010. Within this forested area were small stands of coniferous vegetation, which is important to wild turkeys for roosting during the winter. The adjacent forested areas would provide shelter and food, and although no springs were noted during the field reviews, there are several watercourses which may remain open during the winter which would provide water during the winter months.

Colonial nesting birds

Colonial nesting habitat was noted by the Natural Heritage information Centre to be within the Emerson Road Woods Provincially Significant Wetlands. The 2010 breeding bird surveys conducted by Morrison Hershfield did not note any of the colonial nesting birds to be breeding or nesting within 200 m of the proposed project area.

Deer wintering areas

Deer wintering areas are characterized as having undisturbed forests with 60% cover; conifer cover is preferred. The Ministry of Natural Resources has identified and designated deer wintering areas (Figure 3).

Landbird migratory stopover areas

Landbirds may be potentially using the forest cover along the watercourses within the study area as stopover areas. Although predominately agricultural which is negatively correlated with migratory bird use, the area has a patchwork of forested areas that are generally within 500 m of each other. As the closest part of the project is proposed to be within 1.8 km of Lake Erie and contains a mix of forested, watercourse, and agricultural areas, this area would be considered moderately important as a landbird migratory stopover (Nature Conservancy, 2006). This was not corroborated by the migratory bird survey, which noted that the area is used heavily by waterfowl and shorebirds, but not by significant numbers of landbirds. This habitat is not considered significant.

Waterfowl breeding/staging areas

The area directly southeast of the proposed location of turbine 4 contains large wetlands and/or grassy/shrubby areas and has been considered as a potential waterfowl breeding area (Figure 4). The spring surveys recorded a total of 91 species. During spring migration the Wainfleet project area is obviously used extensively by numbers of both waterfowl and gulls, and to a much lesser extent by shorebirds. Although numbers of waterfowl and gulls

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seem large, it should be stressed that these birds were distributed over a relatively large land area. Although waterfowl and gulls were regularly found at specific locations (due to wet conditions), the distribution of birds throughout the study area was generally uniform. Thus no single location (or locations) exists that would regularly attract large numbers of birds on an annual basis.

Reptile hibernacula

Reptiles will hibernate in rock piles, rock crevices, karst topography, and in the substrate of shallow waterbodies and wetlands. Some species of turtle will also use muskrat or beaver lodges to hibernate. Snake species may use rodent burrows, along the roots of rotting stumps and through rock crevices. Upland habitat adjacent wetlands provides potential hibernation habitat. The creation of gravel-based roads adjacent wetlands may also attract nesting reptiles and a potential increase in road mortality.

Some of the species which may be present are Blanding's turtle, snapping turtle, northern map turtle, eastern musk turtle, common five-lined skink, milksnake, eastern ribbonsnake, gray ratsnake, and massasauga.

Morrison Hershfield biologists searched for congregations of snakes near potential hibernacula on sunny, warm days in the spring and observed all forests, waterbodies, watercourses, and areas adjacent to them for turtles. During all surveys, roads were surveyed for road mortalities or living individuals, as was all areas within 200 m of the proposed project area. None were noted and no breeding evidence was seen. This does not preclude their potential presence; however, based on the lack of any sightings or evidence, it is unlikely that there are significant numbers of any of the reptile species within the study area.

Bat habitat

One forest was identified as a potential bat maternity colony due to the abundance of suitable roosting trees. An acoustic monitoring program was conducted in spring 2010 (June 7th- 16th). Over the 10-night study, bat activity was observed on five nights representing two to four bat species (little brown bat and/or small-footed bat, as well as big brown bat and/or silver-haired bat). These bats cannot be distinguished acoustically, as the calls have very similar frequency, call shape and duration. The site is not within 1km of a known migration route (i.e. forested ridge, escarpment, Great Lake shoreline) or any other known bat conservation features (i.e. karst topography, hibernacula). This habitat is not considered significant.

Migratory butterfly stopover areas

Butterfly stopover areas are typically old fields with preferred nectar bearing plants and/or milkweed within 5km of a Great Lake shoreline. Several hay fields and old fields were noted adjacent the proposed sites for turbine 4 and 5 however, they did not contain significant numbers of nectar bearing plants or milkweed, nor was significant use by butterflies noted during the field review.

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3.2.4 Watercourses

As there are four (4) streams which are intersected by the taplines, the project is within 120 m of the average annual high water mark of a permanent or intermittent stream (Figure 3).

3.2.5 Fish and Fish Habitat

Details about the fish and fish habitat are found in the Water Assessment Report, (Morrison Hershfield, 2010).

Turbine 4 is the only proposed turbine located within 120m of a waterway. At this location the turbine would sit approximately 100m north of the watercourse; commonly known as Casey Drain. This seasonal drain originates east of Station Road and then drains into Lake Erie approximately 1800m downstream. Significant portions of Casey Drain consist of an agricultural riparian community which contributed to the poor fish habitat cover, bank instability, and channelization of the watercourse. The intensive agriculture and insufficient riparian cover contribute to the poor fish habitat within this watershed. This waterway is susceptible to carrying higher sediment and chemical loads from agricultural activity. As this waterway is seasonal, it is not expected to provide habitat for fish species in the near vicinity of the proposed turbine location.

The tapline is approximately 7km in length extending parallel to Feeder Road North/South; then traveling south onto Brawn Road; east onto Abby Road; routing south along Sideroad 22; east onto Concession Road 1; and finally south onto Station Road. This tapline would cross several waterways and agricultural land (Figure 3). The access roads will also follow the same path as the tapline, providing access to the site during construction and for post construction access requirements.

Crossing 1

The tapline would originate at the electrical transfer station north of Mill Race Creek near Feeder Road North. The tapline would route south crossing Mill Race Creek (42°55'24"N 79°22'27"W), then travel west parallel to Feeder Road South for approximately 1.2 km. Due to the channelization, dense instream vegetation, no flow, and insufficient riparian cover, Mill Race Creek currently provides poor fish habitat. Due to the poor conditions upstream and downstream, this section of Mill Race Creek may only support a warmwater baitfish community.

Crossing 2

The tapline would then route in a southerly direction onto Brawn Road where it would cross a pre-existing crossing of a small feeder of Old Mill Race Creek, where a culvert already exists (42°55'08"N 79°23'18"W). Due to channelization, low riparian cover, low diversity of instream vegetation, and minimal flow which is heavily influenced by agricultural activity, this creek provides potential fish habitat for species tolerant to perturbations and warm water temperatures.

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Crossing 3

The tapline continues south along Brawn Road for about 1.2km at Abbey Road intersection. The tapline would then route in a southerly direction on a farm access road (Sideroad 22) to connect Turbines 1, 2 and 3. The tapline would cross a pre-existing water crossing (42°54'31"N, 79°22'59"W) located north of Turbine 2 and 3, and south of Turbine 1. This water crossing serves exclusively as an agricultural swale with no flow present.

Crossing 4

South of Turbine 1 approximately 0.31 km on Sideroad 22 the tapline crosses another channelized watercourse (42°53'37"N, 79°22'41"W) known as a feeder of Old Mill Race Creek. It is narrow (1.5-2 m wide), is situated between agricultural fields, has minimal water present and the riparian community consists of grasses, sedges, cattails and shrub species. Substrate was comprised of fine granular material. A majority of the waterway was obscured by vegetation. This feeder of Old Mill Race Creek intersects with another drainage system to the south which travels within the drainage ditch of Sideroad 22. This feeder is susceptible to carrying higher sediment and chemical loads from agricultural runoff. It is likely this culvert also conveys water during stormwater events and spring freshets. This section of feeder of Old Mill Race Creek is considered potential fish habitat for warmwater baitfish species.

There are no water crossings for the section accessing turbine 4 and 5 of Option 2.

3.2.6 Rare Forest Types

The Oak Mineral Deciduous Swamp near turbine 4 is considered to be Provincially rare (S3 designation) (Figure 4). It is approximately 6.7 ha and contains trees of mixed ages. The canopy ranges from 25 to 30 metres in height and the largest trees are approximately 150 cm in diameter and without open grown characteristics, indicating that this forest is an old growth community. Species include bur oak, white oak, pin oak, green ash, red maple, white elm, pignut hickory, shagbark hickory, and to a lesser extent, basswood and American beech. The groundcover is dense and varied except in areas with ephemeral ponding. The soil is moister to the northern part of this woodlot, and the forest is more mature with a shadier understory towards the centre.

3.2.7 Wildlife and their habitat including the nests and eggs of birds

The area contains diverse habitat and many bird species have been confirmed to be using the area for breeding.

3.2.8 Connectivity of Natural Features

The immediate area within a few kilometers supports a variety of woodlots, wetlands and other ecologically important natural features. This includes Fletcher Woodlot, situated west of Sideroad 24 and north of Concession 1, a 30-hectare wetland which supports various biological communities ranging from successional meadow to mature deciduous forest. Intermittent sloughs and numerous ponds are scattered throughout, resulting from the poor natural drainage of the loam and clay soil.

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To the south of the project area is the Provincially Significant Emerson Road Wetland which also contains the Emerson Road Woodlot Life Science Site and the Burnaby Bush Life Science site – both are not Provincially recognized, however, are part of the Provincially recognized Emerson Road Wetland. These woodlots contain mature forests with a moderately dense understory and sparse ground cover. The woodlots vary between drier and wetter areas, which provides ecologically important habitat for many species.

As the area is adjacent one of the Great Lakes, these natural areas contribute to the connections to coastal areas and migratory routes, and may provide stopping over or staging areas for many species, or habitat for all life stages of permanent residents.

3.2.9 Existing Fisheries Management Plans

The Ministry of Natural Resources has management plans for the aquatic habitat in this area. The goals are to provide potential enhancement measures by improving the riparian habitat and the in-stream quality of the watercourses.

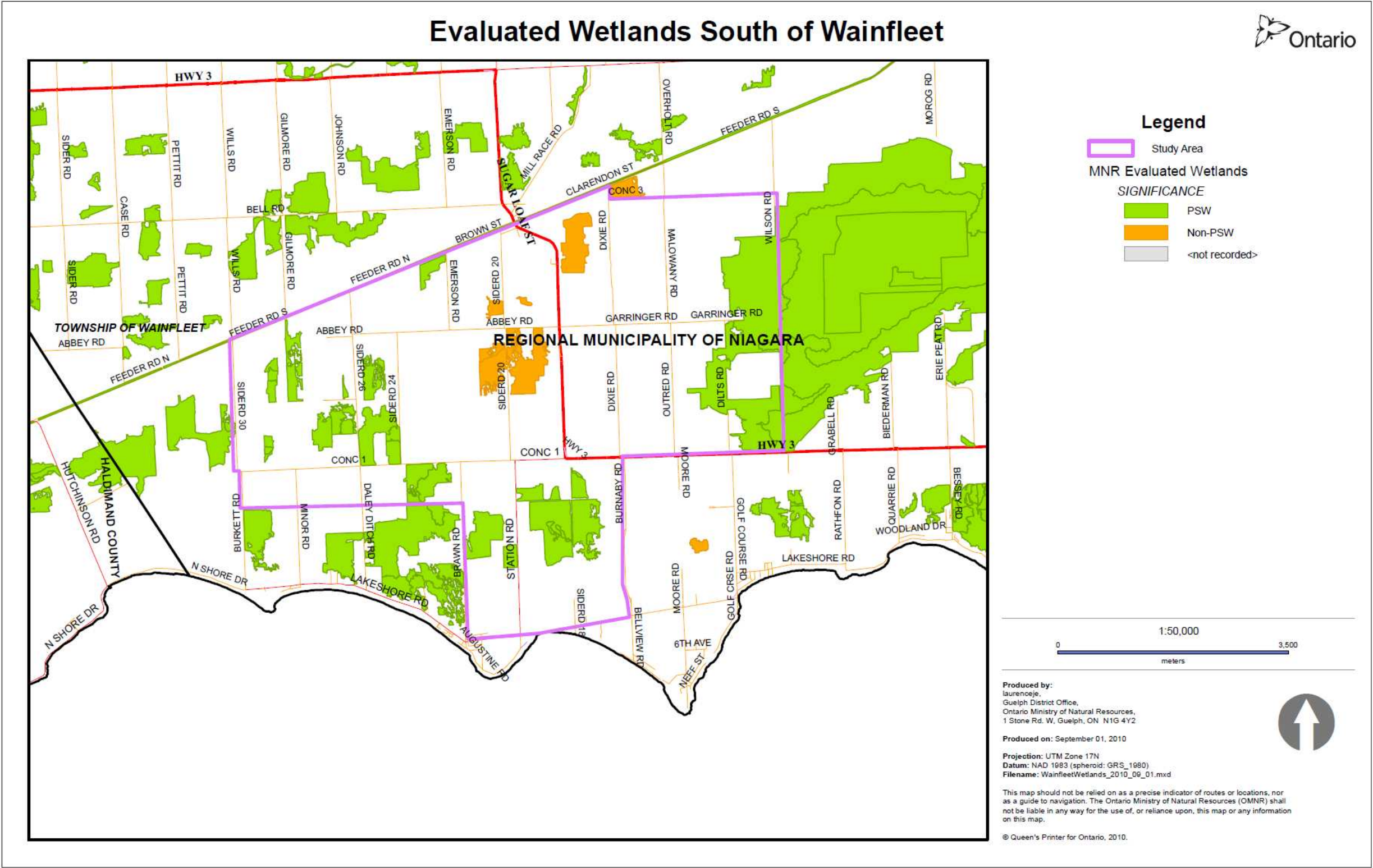


Figure 2: Significant Wetlands

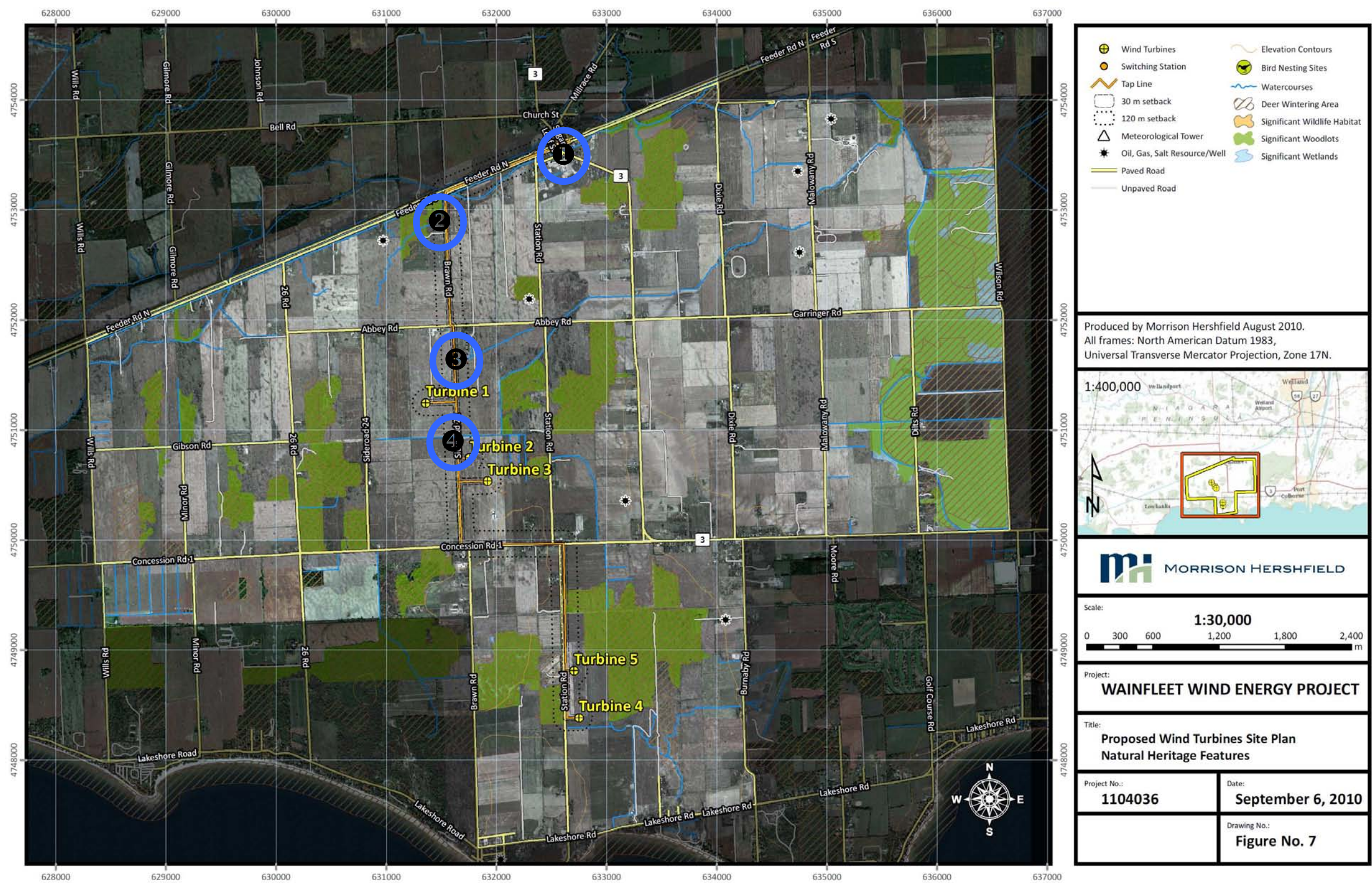


Figure 3: Significant Woodlands, Deer Wintering Areas

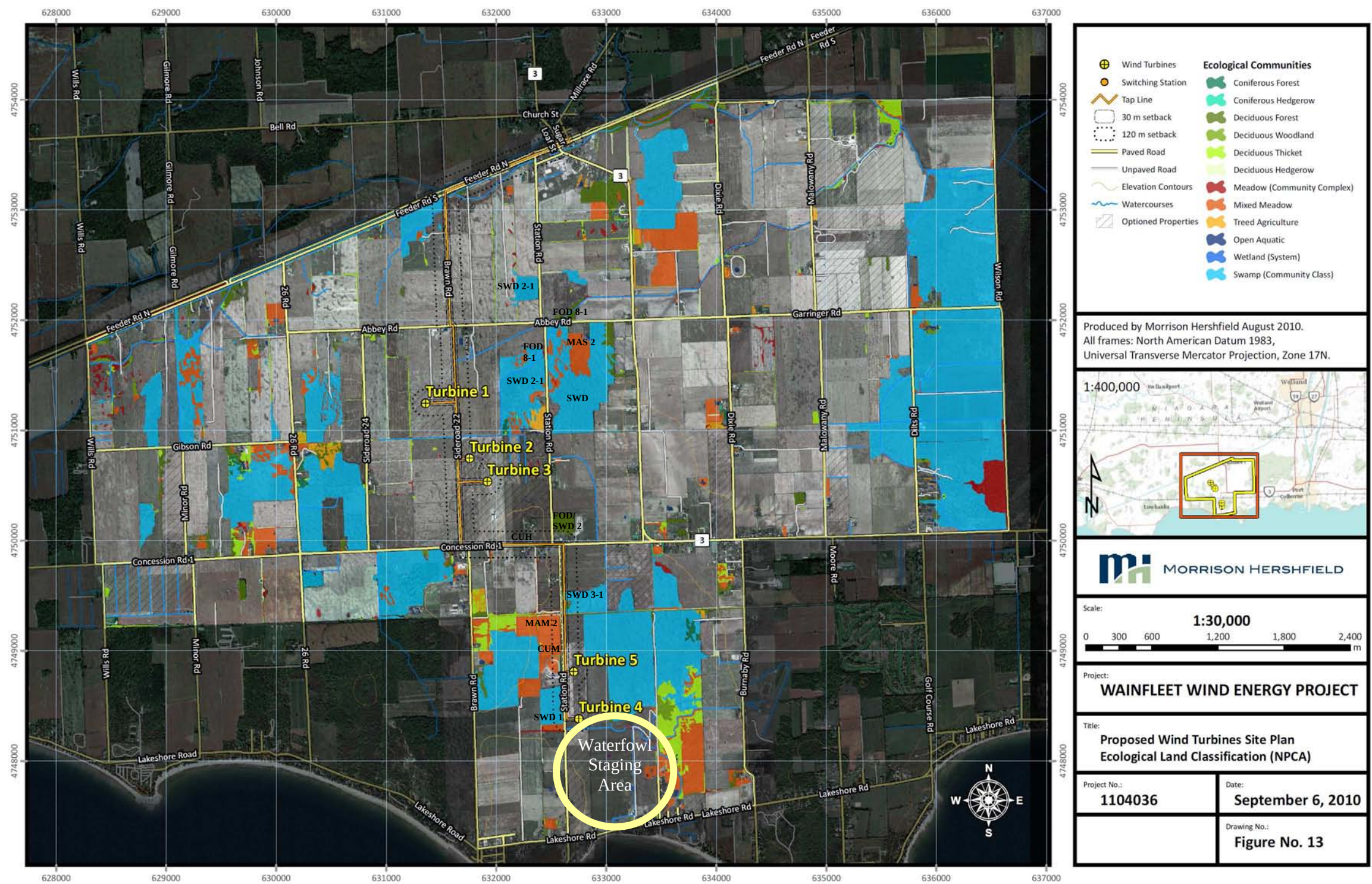


Figure 4: Ecological Land Classifications, Rare Forest Types, and Waterfowl Staging Area.

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4.0 Impact Assessment

Impacts were assessed for all three (3) phases of the proposed undertaking – Construction, operation, and decommissioning. The recommended mitigations are detailed in the Construction Plan Report, and the table below is taken from that report and gives a description of each phase. Greater detail for the activities is provided in the **Construction Plan Report**.

Table 4: Description of Each Phase

Phase	Activities
Construction	• Surveying and geotechnical work • Access road construction and modification • Delivery of equipment • Foundation construction • Tower and turbine assembly and installation • Interconnection from turbines to substations • Substation construction • Electrical tapline construction • Site clean-up and restoration • Turbine commissioning
Operation & Maintenance	• Environmental effects monitoring • Turbine operation and electricity production • Annual and semi-annual maintenance • Repairs, as required • Community relations
Decommissioning	• Land clearing • Road construction/modification • Removal of turbines and ancillary equipment • Removal of electrical taplines • Site restoration and rehabilitation

With respect to the protection of natural features, the Construction Plan Report provides some inherent protections related to soil storage and chemical handling.

Where taplines are buried or turbine foundations are constructed, excavation will be required to a depth below the frost line. Where taplines are located on overhead collector lines and hydro poles, either existing poles will be used, or excavation may be required to provide the footing for newly erected poles. Where temporary storage of the soil will be required, the soil will be stored immediately adjacent to the excavation site. Topsoil and subsoil will not be mixed nor will topsoil be contaminated with any other material.

Some chemicals such as fuel and concrete mixtures will be required for on-site construction of the turbine footings and maintenance buildings. During construction, the storage facilities will be located within a fenced area and any maintenance equipment will be stored in a fenced pre-fabricated maintenance building. Only trained personnel will be permitted within the fenced areas.

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The impacts are broken down by the natural heritage features which require protection under the Renewable Energy Approval Assessment. These features are displayed on Figure 5, below.

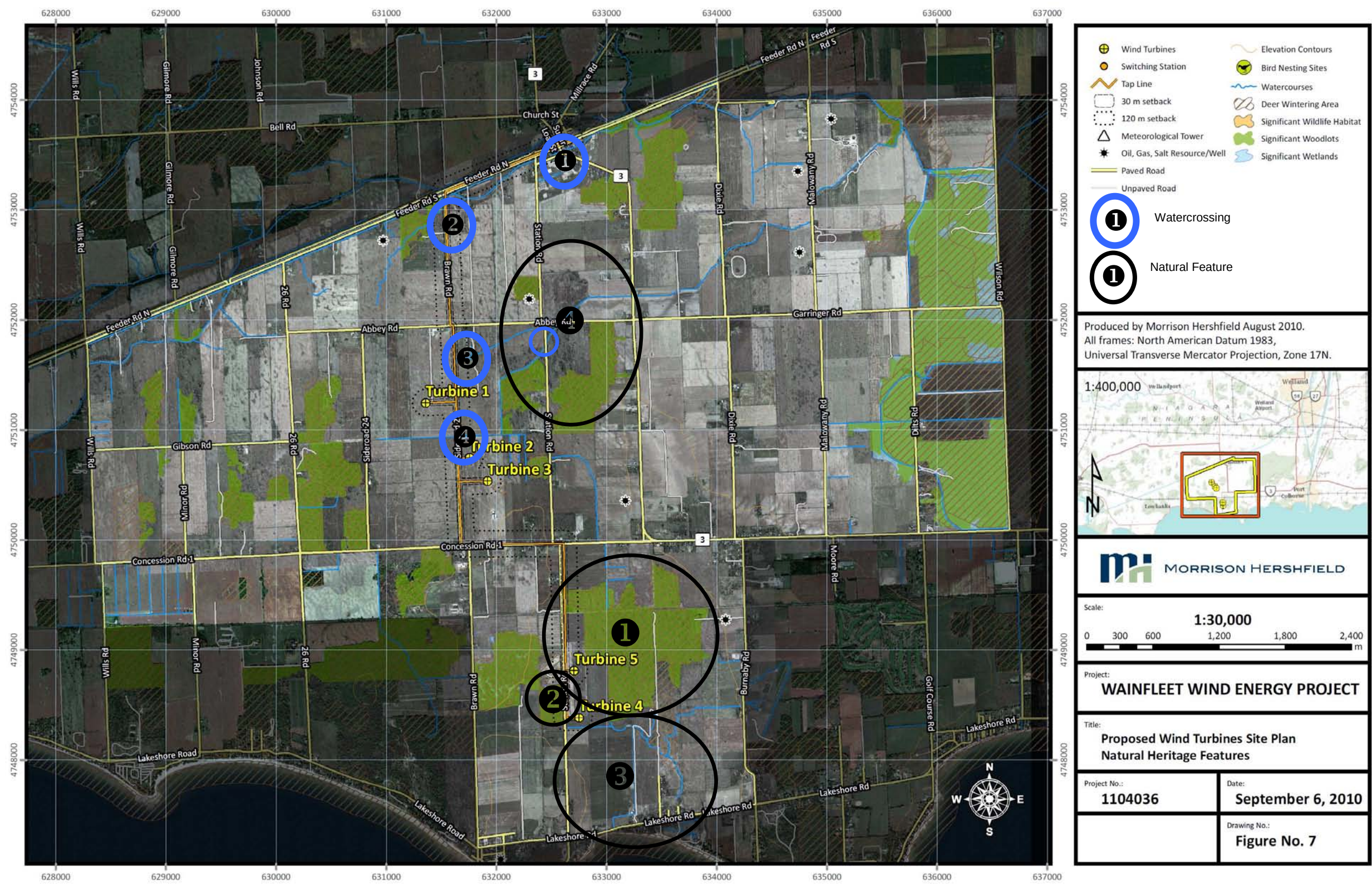


Figure 5: Natural Features

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4.1 Natural Feature 1

This natural feature is a large deciduous swamp that represents a Provincially Significant Wetland, a Significant Woodlot, MNR-designated Significant Wildlife Habitat (deer wintering area) and Potential Significant Wildlife Habitat (wild turkey habitat). To the east of Station road and north of the Gord Harry Conservation Trail and the proposed location for Turbine 4 is a Red Maple Mineral Deciduous Swamp (SWD3-1). Within this forest are drooping woodreed, mountain-holly, and wood lily, all regionally rare species. It further provides amphibian breeding habitat, connections to other natural features, a high diversity of habitats, old growth or nature forest, and nesting for colonial birds.

4.1.1 Potential Impacts

Petroleum, Oils and Lubricants

During borehole excavation, which is to be carried out at each turbine location, equipment may leak, or spills may occur during re-fueling. This is also not expected to have any effect on Natural Feature 1, however, general mitigations will protect against impacts due to accidental hazardous materials spills.

Construction and Turbine Noise

In this area, existing roadways will be used for access. During construction, the site will be surveyed and geotechnical work will be conducted. As the construction work is temporary and will occur over a few days, this work is not expected to have any effects on this Natural Feature due to noise.

Heavy equipment and wind turbine components will be transported to the site by oversized vehicles. They will be stored and assembled on-site. No construction is expected to occur at night, but if it is conducted between and including dusk and dawn during the breeding bird or amphibian periods, the noise may have a negative effect on their capability to locate a breeding partner, or they may avoid some breeding areas which are affected by the noise. Wild turkeys are also sensitive to noise and will avoid areas with human disturbance.

Vegetation Clearing and Soil Grubbing

Vegetation removal may be required to allow for excavation. Damage may occur to the trunk and roots of trees not targeted for removal. As well, the removal of roadside vegetation may result in sunscald on south facing trees and allow the transport of windblown debris and seeds into natural areas.

Another potential impact during vegetation removal and grubbing is damage to bird's nests during the breeding season and other wildlife such as snakes, turtles, anurans (frogs and toads) and small mammals.

If grubbing is required prior to excavations, these exposed areas will be more prone to soil erosion.

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Excavations and Backfilling for Tapline Installation

Where taplines are buried or turbine foundations are constructed, excavation will be required to a depth below the frost line. Where taplines are located on overhead collector lines and hydro poles, either existing poles will be used, or excavation may be required to provide the footing for newly erected poles. Where temporary storage of the soil will be required, the soil will be stored immediately adjacent to the excavation site. Topsoil and subsoil will not be mixed nor will topsoil be contaminated with any other material. Expected impacts are the potential for disturbance tolerant species to dominate the disturbed soils and displace native beneficial species. Many disturbance tolerant species are non-native and/or aggressively invasive and do not provide quality habitat or food for wildlife.

Trenching may alter surface and subsurface drainage patterns. As the adjacent swamps contain vegetation which is sensitive to soil moisture changes, any changes to hydrology may have a negative effect on the adjacent moisture, and may also result in the premature drying out of ephemeral and permanent ponds, which are required by amphibians for breeding and the maturation of juveniles.

Wildlife may be accidentally trapped within open trenches or may be accidentally run over or harmed during equipment operation.

Silt and erosion may result during excavations or soils storage. This can have a negative effect on the adjacent forested wetlands by smothering vegetation. The silted areas may provide a disturbed surface which may allow the invasion of aggressive and disturbance tolerant non-native vegetation within natural areas.

Toxic Materials

Accidental contamination may occur during the handling and storage of toxic products such as fuel and concrete mixtures.

4.1.2 Mitigation Measures

Construction and Turbine Noise

Recommended mitigations for noise include restricting the production of loud noise volumes during dusk, night and dawn during the breeding bird and amphibian periods. These are typically April 21 – July 31 and April 1st to June 15th respectively for this area. As well, it is recommended that noise volume be kept to a minimum when working during winter to avoid disturbing wild turkeys. Thus the preferred timing of construction or operation of loud machinery in this area is during full daylight hours during spring, and at any time during summer or fall.

Vegetation Clearing and Soil Grubbing

To avoid encouraging the establishment of invasive and disturbance tolerant non-native species near the natural feature, excavated soils which must be stored for a period longer than 45 days should be covered or seeded with a cover crop. As well, once they are replaced, they should be re-seeded with a native seed mix suited to the site conditions and complementary to the adjacent natural feature. To avoid erosion and silting, the erosion

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control measures must be used to ensure that excavated areas and storage piles do not erode and the resulting silt does not enter natural areas.

Vegetation removals must be kept to a minimum adjacent the natural features, and mature trees should be retained wherever possible. To protect any trees/vegetation from damage which is not slated for removal, construction fencing (snow fencing or otherwise) which is clearly visible will be erected to indicate the perimeter of the work area. No disturbance, excavation, stockpiling, vehicle operation, or soil compaction will be allowed outside of the work area perimeter. If roots are encountered during the trench excavation, they will be cut off cleanly and kept moist by using mulch or soil until the trench is backfilled. To further protect the trees to be retained, the Contractor will not be permitted to park construction equipment or vehicles, to repair or refuel vehicles, store construction materials, or stockpile earth materials within 5 m of any tree that is not identified for removal. These activities will be generally kept outside of the forested areas.

To avoid the loss of rare species, it is recommended that an arborist review the area prior to vegetation removal to flag trees which are to be retained and provide suitable buffers. These buffers must be clearly delineated with flagging or snow fencing and all equipment operators must be notified of restrictions to operating any equipment within these areas.

All trees not designated for removal shall be considered specimen trees and shall be protected or repaired as specified in OPSS 565 (**Appendix B**). According to the Regional Tree and Forest Conservation Bylaw No. 30-2008, a tree is defined as any living species of woody perennial plant, including its root system, which has reached or can reach a height of at least 4.5 meters at physiological maturity.

Where the development of the project requires the removal of any trees, all efforts must be taken to keep removal to a minimum. To avoid unnecessary damage to the regionally rare pignut hickory and wild raisins within hedgerows and forested areas along taplines, all areas of vegetation removal should be surveyed prior to clearing to ensure that a minimum of vegetation is removed.

All tree removal within woodlots of 1 ha or greater must be in accordance with the Regional Tree and Forest Conservation By-law No. 30-2008, which is implemented by the Niagara Peninsula Conservation Authority (NPCA) within West Lincoln. The designation applies to all wooded areas within 200 meters of the taplines and turbines, but does not apply to any hedgerows. The full by-law can be found at the NPCA website and is attached in **Appendix C**.

It is further highly recommended that overhead taplines or Horizontal Pressure Directional Drilling be used adjacent the natural feature to avoid extensive damage to root systems and minimize soil disturbance. Where branches and roots must be pruned to facilitate the installation of overhead wires and poles, cuts should be made cleanly and in accordance with professional arboricultural methods.

Woody material from on-site may be chipped and used for mulch, or shredded bark mulch may be used. If mulch is applied, it must be applied to a 50 to 100 mm thick layer (depth after settling). All excavated root wads and woody material less than 300 mm will be chipped or removed from the site, and all other woody material will be either removed or

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left on-site and in contact with the forest floor in the wooded areas to provide wildlife habitat.

Excavations and Backfilling for Tapline Installation

To avoid the potential for vegetation and soil damage caused by below-ground tapline installation, overhead tap-lines are recommended. If this is not practical, Horizontal Pressure Directional Drilling (HPDD) is recommended in areas that are within 120 m of this natural feature. Although there are impacts related to HPDD due to soil compaction and damage to vegetation, if the equipment is located to an area beyond the dripline of mature trees, this damage is expected to be minimal.

In order to mitigate the transport of sediment during vegetation removal and soil disturbance, environmental protection measures (such as straw bale flow checks, rock flow check dams, silt fence barriers, erosion control blankets and seeding) will be incorporated into the final design and installed during construction by the Contractor. Ontario Provincial Standard Specification (OPSS) 577 (**Appendix D**) provides construction specifications for these measures.

To reduce damage to retained vegetation and reduce potential soil compaction, the Contractor will be instructed to:

- Clearly mark all areas beside natural features where equipment may not be operated or stored, or any other materials stored;
- Not operate any equipment or construction vehicles within wetlands; and
- Plan and stage the construction to ensure that a minimum of vegetation is removed during construction for equipment access, stockpiling, and equipment operations.

If excavations are carried out, all heavy equipment should be kept out of natural areas and located outside of the flagged areas and the silt fencing. Excavated soils must be piled outside of the flagged areas and continuous, over-lapping silt fencing must be installed between the soil piles and the natural feature.

To mitigate wildlife losses during construction, Contractor will be instructed to:

- Advise workers not to damage or harm snakes, turtles, or other wildlife and must inform the Contract Administrator if any are encountered;
- Work in the immediate area must be halted until the wildlife is out of danger;
- Prohibit working within 30 m of wetland or watercourse with a water depth of greater than 0.5 m during the hibernation period for reptiles and amphibians, which occurs generally between October 1st and April 15th;
- Perform a general sweep of the work area prior to work to flush out any hiding wildlife;

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- Perform visual surveys of both machinery and work area prior to commencing work since wildlife may be found basking or hiding on/under equipment, rocks, road and/or other debris piles;
- Take extra care when trenching adjacent to wetlands, watercourses, or waterbodies;
- Create a slope at the end of the any open trenched areas with a slope no greater than 1:1 to allow for wildlife egress if the become trapped; and
- Inspect the trench before backfilling and release any wildlife that is still within the trench.

To ensure no damage occurs to breeding birds, the Contractor will be instructed to ensure that all migratory bird nests are protected in accordance with the *Migratory Bird Convention Act* (1994) during the active nesting season, which bans all activities that are harmful to migratory birds, their eggs or their nests. The active nesting season extends from April 1st to July 1st. The Contractor will be instructed to adhere to the following recommendations:

- Prior to construction, inspect the construction area for nests and eggs and advise the Contract Administrator of any locations of nests and eggs immediately;
- Notify the Contract Administrator if any nest(s) or egg(s) is/are found, who shall contact the Environmental Office and the environmental consultant responsible for birds; and
- Not destroy nests or eggs of protected migratory birds.

Toxic Materials

To avoid contamination of natural areas, all chemicals should be stored in areas greater than 120 m from the natural features, and a spill prevention program must be developed and carried out. All toxic products required during construction, operation and decommissioning must be transported, handled, disposed or recycled according to provincial and municipal waste management standards.

4.1.3 Residual Impacts

If mitigations are carried out, no residual impacts are expected.

4.2 Natural Feature 2

This Oak Mineral Deciduous Swamp woodlot is a Significant Woodlot and MNR-designated Significant Wildlife Habitat (deer wintering area and bird and amphibian breeding habitat). It contains the rare pignut hickory and is a rare community type (S3). This Swamp woodlot further provides significant wildlife habitat in terms of amphibian breeding habitat, and connections to other natural features.

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4.2.1 Potential Impacts

Construction and Turbine Noise

The potential impacts are the same as for Natural Feature 1, although in this case, as the area provides deer wintering habitat, excessive noise during the winter period may have a negative effect on deer as opposed to wild turkeys. As well, noise produced during bird and amphibian breeding periods may cause a negative impact on breeding success.

Clearing and Grubbing

Clearing and grubbing will be required in areas where excavation for the taplines will occur, where poles will be erected, and for equipment access and storage of equipment and materials. Negative impacts are the same as for Natural Feature 1.

Excavations and Backfilling for Tapline Installation

Similar to Natural Feature 1, the vegetation is sensitive to changes in hydrology; thus, damage to vegetation and wildlife habitat may occur if excavations are required and result in changes to the hydrology.

Other impacts are also the same as those for Natural Feature 1:

- Trenching may further encourage the potential for disturbance tolerant species to dominate the disturbed soils and displace native beneficial species.
- Wildlife may be accidentally trapped within open trenches or may be accidentally run over or harmed during equipment operation.
- Silting, erosion, and soils compaction may result during excavations or soils storage.

Toxic Materials

As with Natural Feature 1, accidental contamination may occur during the handling and storage of products such as fuel and concrete mixtures.

4.2.2 Mitigation Measures

Recommended mitigations are the same as for Natural Feature 1.

4.2.3 Residual Impacts

If mitigations are carried out, no residual impacts are expected.

4.3 Natural Feature 3

This natural feature is an MNR-designated Significant Wildlife Habitat (waterfowl stopover area). It is located within an agricultural area directly adjacent the Provincially Significant wetland.

4.3.1 Potential Impacts

As the proposed turbine is within 120 m of a waterfowl stopover area, impacts include displacing some of the waterfowl as studies have shown that birds may avoid turbines. However, birds are aware of the turbine location even during periods of low or no visibility,

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and collisions are rare, particularly with waterfowl (Osborn, et al. 1998; Rogers *et al.* 1977, Howell & Noone 1992, Still *et al.* 1994, Mossop 1998). They may expend additional energy to avoid the turbines, however this generally constitutes less than 0.5% of the required energy needs during migration depending on the number and spatial distribution of the turbines (REFERENCES).

4.3.2 Mitigation Measures

As there is a high availability of similar staging areas in proximity to this site and along the northern shore of Lake Erie, the impacts to staging waterfowl are expected to be minimal.

4.3.3 Residual Impacts

There may be a small reduction in the number of waterfowl using the staging area to the south of the proposed location for turbine 4.

4.4 Natural Feature 4

The tapline is proposed to be adjacent the significant woodland along Station Road north of Abbey Road. The Black Ash Mineral Deciduous Swamp (SWD2-1) and Deciduous Swamp (SWD2) contain soft agrimony, a regionally rare species. It further provides significant wildlife habitat in terms of amphibian breeding habitat, and connections to other natural features.

4.4.1 Potential Impacts

Impacts to this Natural Feature are the same as that for Natural Feature 2.

4.4.2 Mitigation Measures

Recommended mitigations are the same as for Natural Feature 2.

4.4.3 Residual Impacts

If mitigations are carried out, no residual impacts are expected.

4.5 Watercourses

The Wainfleet corridor consists of four locations where electrical taplines would cross a watercourse and one turbine (Turbine # 4) location where the waterway is within 120m of the turbine base. There are inherent risks associated with the construction and erection of turbines and the associated infrastructure, these risks are discussed below.

4.5.1 Potential Impacts

Toxic Materials and Pollutants

A variety of potential materials will be stored on site, or will be used to install the turbines and overhead electrical wires. Among these materials, petroleum products such as fuel, oil, and other lubricants will be required to operate and maintain the construction equipment. The federal standard for hazardous materials, Workplace Hazardous Materials Information System (WHMIS) will be applied for all applicable materials. This communication standard provides a system to properly, handle, store and control all hazardous or toxic materials. The precautions taken when following the

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WHMIS standards not only help to protect the workers, but it also aids in prevention of spills and accidental releases of materials.

Accidental uncontrolled release is the major concern with petroleum, oils and other lubricants. The resulting impacts can affect all aspects of the environment including; terrestrial, surface water, ground water, living biota, and the atmosphere. The accidental release of substances can greatly alter or destroy entire ecosystems, as well as negatively affect human health and safety. In particular, materials released near a watercourse have a high potential to negatively affect fish and fish habitat.

Clearing and Grubbing

Sedimentation into surrounding waterways is one of the major concerns for any works, particularly those that involve land clearing and using heavy machinery. Erosion control is the primary method to prevent negative impacts to the surrounding waterbodies, therefore the following mitigation measures for all works should be implemented to prevent any further degradation of the waterways.

The introduction of sediment into the waterways from erosion is of concern due to the negative impacts on the aquatic ecosystem. High levels of sedimentation are potentially deadly for many aquatic species.

Overhead Line Construction

Any works that are in a waterway or near a waterway must follow *the Fisheries Act* to prevent any harmful alteration, destruction or disruption (HADD) of fish and/or fish habitat. Installing electrical lines overhead and under waterways have the potential to cause a HADD. Accidental spills or leaks, as well as erosion are the two primary concerns for this project. The Department of Fisheries and Oceans (DFO) has an operational statement, *Operation Statement for Overhead Line Construction* that gives guidance on the proper methodologies to avoid a HADD. A full copy of the Operational Statement is provided in **Appendix E**.

Horizontal Pressure Directional Drilling

Using Horizontal Pressure Directional Drilling (HPDD) is the common practice for installing cables and pipes under streams. The process for using HPDD involves drilling a pilot bore hole underneath the watercourse, back-reaming the bore hole to the drill rig while pulling the pipe along through the hole. The process is lubricated by drilling mud, which is a mixture of fresh water and bentonite.

The risks associated with HPDD are primarily the escape of the lubricating fluid through either a spill, or the rupture of drilling mud to the surface. The collapse of a bore hole can force the drill mud to the surface causing a spill, or another cause of surface rupture is frac-out. Frac-out is the rupture of drilling mud to the surface as a result of high drilling pressure.

In addition, there is often damage to riparian vegetation due to the equipment being located close to waterway edges. This can also lead to erosion and sedimentation of the waterway. Implementing erosion control methods and planning a route that causes the

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least damage to riparian vegetation are effective in preventing negative environmental impacts.

In compliance with the *Fisheries Act*, the DFO has released an Operational Statement specifically for HPDD. The following are the measures set by the DFO to protect fish and fish habitat when using HPDD. A full copy of the Operational Statement is provided in Appendix E.

4.5.2 Mitigation Measures

Toxic Materials and Pollutants

The following mitigation measures are to substantially reduce or eliminate the potential for an accidental release of petroleum, oil or lubricants into the environment.

Machinery Operation

- No heavy equipment is to enter a watercourse, waterbody, or wetland.
- Re-fuelling should occur at one designated site that is 30m from a watercourse or wetland.
- All equipment to be maintained offsite when possible, to minimize the quantity of hazardous materials required on-site. If service must occur on-site it must be 30m from a watercourse or wetland.

Storage

- Fuel transport will comply with the *Transportation of Dangerous Goods Act*.
- Fuel and diesel may be stored on-site in limited quantities for the operation of construction equipment.
- All petroleum, oil, and lubricants must be stored in a lockable, ventilated, steel container that is located 120m from any watercourse, waterbody, or wetland.
- The storage container will be equipped with drip trays to capture any spilled substances.
- Spill decks will be used when transferring materials.
- Fire extinguishers and spill kits will be kept on-site at all times near the storage lockers and within reasonable distance of the operating construction equipment.
- Storage containers will be clearly identified with signage, and smoking will not be permitted within 50m of the storage container.
- Construction material, excess material, construction debris, and empty containers shall be stored at least 30m from the watercourse and watercourse banks to prevent their entry into the watercourse, and be removed frequently to a proper receiving facility.

Spills

- Any person or persons, who discover a leak or spill, if safe, should attempt to stop and contain the material.

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- All spills or leaks must be reported to the on-site supervisor and the Ontario Ministry of Environment, Spills Action Centre, 1-800-268-6060.
- The Contractor has the responsibility of organizing and executing a spill containment and clean up plan in accordance with any regulatory bodies (where appropriate).
- Appropriate spill response materials must be on-site in an accessible location throughout the duration of the project; materials should include but are not limited to: absorbent materials and equipment (picks, shovels, stakes, buckets, empty drum).

Erosion Control during Clearing and Grubbing

The following mitigation measures will be implemented to eliminate the impacts that are associated with sedimentation and erosion.

- Minimize vegetation removal.
- Sediment and erosion control measures will be left in place until vegetation growth is sufficient (80%).
- Timely re-vegetation of exposed soils with native vegetation, both for temporary work areas and final grades (existing vegetation on embankments shall be maintained as long as possible and new slopes shall be stabilized within 30 days by seeding and mulching).
- Sediment control fence to be installed along the channel margins to prevent the entry of sediment into the watercourse.
- Temporary silt fence barrier along the perimeter of the designated work area to limit construction impacts on the watercourse.
- Conscientious design, installation and maintenance of sediment traps within construction area drainage swales for any dewatering.
- Installation and maintenance of appropriately designed flow check dams in all temporary and permanent drainage swales.
- Accumulated sediment in the control devices should be removed frequently to ensure the success device. The collected sediment should be removed and placed in an area at least 120m away from a waterway.
- Existing roads and farm access lanes will be used wherever possible.
- Any new stream crossings will be designed to reduce the loss of riparian habitat, maintain fish passage, and support high flow events.

Overhead Line Construction

The following mitigation measures are taken directly from the DFO *Operational Statement for Overhead Line Construction*.

1. Installing overhead lines under frozen conditions is preferable in all situations. On wet terrains (e.g., bogs), lines should be installed under frozen conditions, where possible, or using aerial methods (i.e., helicopter).

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2. Design and construct approaches so that they are perpendicular to the watercourse wherever possible to minimize loss or disturbance to riparian vegetation.
3. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or overhead line structures.
 - 3.1. Wherever possible, locate all temporary or permanent structures, such as poles, sufficiently above the HWM to prevent erosion.
4. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to accommodate the overhead line. This removal should be kept to a minimum and within the road or utility right-of-way.
5. Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. A Temporary Stream Crossing Operational Statement is also available.
 - 5.1. If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
 - 5.2. Grading of the stream banks for the approaches should not occur.
 - 5.3. If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation is likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
 - 5.4. Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the Ontario In-Water Construction Timing Windows).
 - 5.5. Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.
6. Operate machinery on land and in a manner that minimizes disturbance to the banks of the watercourse.
 - 6.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
 - 6.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
 - 6.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
 - 6.4. Restore banks to original condition if any disturbance occurs.

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7. Install effective sediment and erosion control measures before starting work to prevent entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.

7.1. Avoid work during wet, rainy conditions or use alternative techniques such as aerial methods (i.e., helicopter) to install overhead lines.

8. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.

9. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.

9.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.

Horizontal Pressure Directional Drilling

The following mitigation measures are taken directly from the DFO *Operational Statement for Overhead Line Construction*.

1. Installing overhead lines under frozen conditions is preferable in all situations. On wet terrains (e.g., bogs), lines should be installed under frozen conditions, where possible, or using aerial methods (i.e., helicopter).

2. Design and construct approaches so that they are perpendicular to the watercourse wherever possible to minimize loss or disturbance to riparian vegetation.

3. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or overhead line structures.

3.1. Wherever possible, locate all temporary or permanent structures, such as poles, sufficiently above the HWM to prevent erosion.

4. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to accommodate the overhead line. This removal should be kept to a minimum and within the road or utility right-of-way.

5. Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. A Temporary Stream Crossing Operational Statement is also available.

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- 5.1. If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
- 5.2. Grading of the stream banks for the approaches should not occur.
- 5.3. If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation is likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
- 5.4. Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the Ontario In-Water Construction Timing Windows).
- 5.5. Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.
6. Operate machinery on land and in a manner that minimizes disturbance to the banks of the watercourse.
 - 6.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
 - 6.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
 - 6.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
 - 6.4. Restore banks to original condition if any disturbance occurs.
7. Install effective sediment and erosion control measures before starting work to prevent entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.
 - 7.1. Avoid work during wet, rainy conditions or use alternative techniques such as aerial methods (i.e., helicopter) to install overhead lines.
8. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.
9. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.
 - 9.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved

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4.5.3 Residual Impacts

No residual effects are anticipated if all the above mitigation strategies are followed. Accidental spills or leaks will be prevented through proper handling techniques and the use of WHMIS to monitor and control substances onsite. Erosion control measures will prevent sedimentation of the waterways and reduce damage to the surrounding landscape. These measures will also prevent any HADD from occurring in the adjacent waterways, thus protecting the fish and fish habitat in the area.

5.0 Conclusion

The mitigation measures and recommendations described in this report are expected to reduce the impacts of the proposed project on the functions and/or integrity of natural features on the site during construction, operation, and decommissioning process. The environmental monitoring recommendations in the associated Environmental Effects Monitoring Report will be followed through during and after construction to ensure the continued or delayed effects of the project are minimized. As well, all recommendations for protection of significant habitat according to the Ministry of Natural Resources Significant Wildlife Habitat Technical Guide have been adhered to. The protection of all other natural features complies with those required by the local municipality and Conservation Authority.

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APPENDIX A
Significant Wildlife Habitat Characteristics

Primary locations of seasonal concentrations of wildlife.

Type of Seasonal Concentration	Primary Location of Habitat	Notes/Key Requirements
Bat hibernacula	specific site—cave, mine	- often in forested area - undisturbed habitat is essential
White-tailed deer winter yard	forests with at least 60 % canopy closure	- conifer cover (white cedar, hemlock) particularly important in southern Ontario - corridor required; undisturbed habitat is important
Moose late winter habitat	coniferous forests	corridor required
Reptile hibernacula	site specific	- often in large forested areas, depending on species - rocky outcrops, talus slopes - corridor required
Amphibian summer habitat	wetlands, shorelines, other riparian areas	corridor required
Bullfrog concentration areas	permanent wetlands, shorelines, other riparian areas	permanent water
Raptor wintering areas	undisturbed fields for hunting small mammals (mice, voles)	adjacent forests for roosting of some species; undisturbed habitat is important
Wild turkey winter range	- coniferous forests - spring and seeps	- pockets of conifers may suffice - nearby food source
Turkey vulture summer roost	specific site	undisturbed habitat is important
Waterfowl breeding/staging/areas	- wetlands - shorelines of water bodies with emergent vegetation	- larger wetlands preferred for staging and moulting - grassy/shrubby areas for nesting
Colonial bird nesting sites (gulls, terns, double-crested cormorants)	islands, shoals, peninsulas, and some shorelines	- undisturbed habitat during nesting season is essential - treed swamps
Heronries	- wetlands (swamps) - lake and river shorelines - forests	undisturbed habitat during nesting season is essential
Colonial bird nesting sites (heronries, marsh birds)	wetlands	undisturbed habitat during nesting season is essential
Landbird migratory stopover area	- open water shorelines with adjacent mature forests, old-fields and grasslands - forest cover along watercourses, forested ravines	Great Lakes shorelines and adjacent lands within 5 km (especially Lake Erie & Lake Ontario) are very important
Shorebird migratory stopover areas	shorelines of water bodies (rivers, large lakes), marshes	- key is undisturbed shorelines - Great Lakes shorelines (especially Lake Erie & Lake Ontario) are very important
Butterfly migratory stopover areas	- shorelines of large lakes - forest, old field, and undisturbed open lands	- Great Lakes shorelines and adjacent lands within 5 km (especially Lake Ontario & Lake Erie) are very important - Fields with milkweed very important habitat for monarch butterflies

Type of Habitat	Primary Location of Habitat	Notes/Key Requirements
Marten and fisher denning sites	large forests, especially mature and unfragmented	- area-sensitive species - corridor required - large undisturbed areas are important
Moose aquatic feeding area	- weedy shorelines and bays with adjacent forest cover - wetlands	- requires forested corridor - undisturbed areas are important
Moose calving sites	- forested islands - shorelines, especially peninsulas	- requires forested corridor - undisturbed areas are essential
Moose mineral lick	forest openings with adjacent forest	- specific site that is very hard to find - forested corridor required - undisturbed areas are important
Black bear/mammal foraging area	- specific sites with abundance of berries, grasses, mast-producing trees - relatively mature, undisturbed forests	forested corridor required
Osprey nesting habitat	- forested shorelines (often along large lakes) - wetlands - islands	- undisturbed areas are important - shallow-water feeding areas
Woodlands supporting amphibian breeding ponds	forests; often associated with wetlands, but may be in upland forests	corridor required
Old-growth or mature forest stands	forests	exceedingly rare, therefore the oldest forests in the planning area are usually the best candidates
Sites supporting area-sensitive species	largest areas of unfragmented forests, grasslands, wetlands	- mature, closed canopy forests with multiple vegetation strata preferred by many species of forest birds - minimum size of these areas may be at least 30 ha, but may be larger than 100 ha
Waterfowl nesting, staging habitat	wetlands, water bodies, and adjacent grasslands within 120 m of water	undisturbed habitat during nesting season is important
Mink and otter feeding/denning sites	- shorelines of lakes, rivers, creeks (riparian areas) - wetlands	- corridor required - undisturbed habitat may be required
Turtle nesting areas	shorelines (sand/gravel), wetlands	- corridor required - undisturbed nesting habitat is preferred
Raptor hunting areas	undisturbed open fields	minimum of 15 ha, preferably larger than 30 to 50 ha
Areas of high diversity	- often forested areas - often larger natural areas with diversity of habitats including wetlands	sites may have remarkable diversity of just one group (e.g., plants, insects), several groups (e.g., plants, birds, reptiles, amphibians), or several community types (e.g., forest, wetland)
Cliffs	anywhere – associated with geological features such as the Niagara Escarpment	cliffs in undisturbed natural areas may have value to more wildlife species
Caves	anywhere – associated with specific geological features	larger, natural caves are more common in areas of limestone
Seeps and springs	- often in forested land with slopes - headwater areas	usually hard to find, specific sites with several natural heritage values

Table 10-7. General habitat requirements of selected species of conservation concern.

Species/Guild of Conservation Concern	Forest	Wetland	Grassland	Shoreline
Five-lined skink	Abundant down woody debris, other ground structure (e.g., rocks)			ground debris
Eastern Massasauga rattlesnake	larger forests with abundant down woody debris, rocky openings	hibernates in karst habitat wetlands	hunts in wet meadows	may feed in riparian habitat
Eastern hognose snake	larger forests with abundant down woody debris			sandy soil, with toad and other amphibian prey, adjacent to larger forests
Black rat snake	larger forests with abundant down woody debris			
Wood turtle	river flood plains, flowing water			
Eastern spiny softshell turtle		abundant aquatic vegetation and moderately deep water		abundant aquatic vegetation
Spotted turtle		aquatic vegetation		
Amphibians	woodland breeding ponds			
Fowler's toad				sandy areas
Bullfrogs				- aquatic vegetation - permanent water
Area –sensitive birds (See habitat matrices– Appendix G)	large unfragmented forests with diversity of vertical structure	large swamps, marshes, bogs, or fens	large, unfragmented areas of grassland	
Southern flying squirrel	mature deciduous woods			
West Virginia white butterfly	- moist mature deciduous forest with riparian features - toothwort			
Karner blue butterfly			grasslands with lupines	- lupine - beach dunes
Frosted elfin butterfly			prefers pine-oak savannah	beach dunes
Numerous other butterflies (e.g., monarch)			grasslands for food and host plants	

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APPENDIX B **OPSS 565**



**ONTARIO
PROVINCIAL
STANDARD
SPECIFICATION**

**METRIC
OPSS 565
NOVEMBER 2007**

**CONSTRUCTION SPECIFICATION FOR
THE PROTECTION OF TREES**

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565-A	Commentary

565.01 SCOPE

This specification describes the measures required to protect trees not designated for removal.

565.01.01 Specification Significance and Use

This specification has been developed for use in provincial- and municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities and the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

565.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

565.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Barrier means a fence placed around a single tree or group of trees to protect them from removal and injury.

Dripline means the location on the ground surface directly beneath the theoretical vertical line from the tips of the outermost branches of the trees.

565.07 CONSTRUCTION

565.07.01 Operational Constraints

Trees not designated for removal shall not be damaged and shall be protected from flooding and sediment deposits from construction operations.

Equipment and vehicles shall not be operated within the dripline of trees not designated for removal unless specified in the Contract Documents. In such cases, operation of equipment shall be kept to the minimum necessary to perform the work required.

Equipment or vehicles shall not be parked, repaired, or fuelled within the dripline of any tree not designated for removal.

Construction materials and earth shall not be stockpiled within the dripline of any tree not designated for removal.

565.07.02 Barrier for Tree Protection

Barriers for tree protection shall be a minimum height of 1.2 m consisting of material approved by the Contract Administrator, supported by steel posts. The number of steel posts shall be enough to keep the material from sagging and the fence erect.

The barriers shall be erected at the dripline of trees or woodlot edges within the Working Area, prior to commencement of construction operations at locations specified in the Contract Documents. Where a clearance zone of 1.5 m cannot be established between the barrier at the dripline and the limit of grading, the barrier may be placed within the dripline, subject to the approval of the Contract Administrator. When the barrier is placed within the dripline,

- a) a minimum distance of 0.75 m shall be maintained between the trunk of the tree and the barrier, and
- b) a distance of 1.5 m shall be maintained between the barrier and the limit of grading.

When the trunks of trees are less than 4.5 m apart, the trees shall be considered a woodlot and the barrier shall be placed so it forms a continuous barricade around the woodlot as specified in the Contract Documents.

A barrier is not required where an existing fence serves the same purpose. At such locations, the barrier shall terminate at the existing fence so that a continuous barricade is provided between the trees and the area of work.

The barriers shall be maintained erect and in good repair throughout the duration of construction operations without breaks and unsupported sections and shall be removed upon completion of the work.

565.07.03 Tree Repair

Trees not designated for removal that are damaged by construction operations shall be repaired as follows, within 5 Days of the damage:

- a) Branches 25 mm or greater in diameter that are broken shall be cut back cleanly on the tree side of the break or to within 10 mm of their base, if a substantial portion of the branch is damaged.
- b) Roots 25 mm or larger in diameter that are exposed shall be cut back cleanly to the soil surface.
- c) Bark that is damaged shall be neatly trimmed back to uninjured bark without causing further injury to the tree.

565.07.04 Management of Excess Material

Management of excess material shall be as specified in the Contract Documents.

565.09 MEASUREMENT FOR PAYMENT

565.09.01 Actual Measurement

565.09.01.01 Barrier for Tree Protection

Measurement shall be in linear metres measured along the length of the barrier. Overlaps shall not be measured.

565.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

565.10 BASIS FOR PAYMENT

565.10.01 Barrier for Tree Protection - Item

Payment at the Contract price for the above item shall be full compensation for all labour, Equipment, and Material required to do the work.

Progress payments shall be based on the following percentage of the Contract price:

- 60% for supply and erection
- 25% for maintenance
- 15% for removal

When there is not a separate item for Barrier for Tree Protection, payment at the Contract price for the applicable tender items of the Contract that necessitate the placing of barriers for tree protection shall include full compensation for all labour, Equipment, and Material to do the work of protecting and repairing trees not designated for removal.

**Appendix 565-A, November 2007
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should specify the following in the Contract Documents:

- Locations of barriers for tree protection at trees or woodlot edges. (565.07.02)

The designer should determine the following are required and, if so, the requirements should be included in the Contract Documents:

- The need to operate equipment and vehicles within the dripline of trees not designated for removal. (565.07.01)

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

OPSD 220.010 Barrier for Tree Protection

Environmental Impact Statement Report

APPENDIX C
Regional Tree and Forest Conservation By-law No. 30-2008

THE REGIONAL MUNICIPALITY OF NIAGARA

BY-LAW NO. 30-2008

A BY-LAW TO PROHIBIT OR REGULATE THE
HARVESTING, DESTRUCTION OR INJURING
OF TREES IN WOODLANDS IN THE
REGIONAL MUNICIPALITY OF NIAGARA AND
TO REPEAL BY-LAW 47-2006, AS AMENDED

WHEREAS Section 135(2) of the *Municipal Act, 2001*, S.O. 2001, c. 25, as amended, permits the enactment of a by-law by the Council of The Regional Municipality of Niagara to prohibit or regulate the destruction or injuring of trees in Woodlands;

AND WHEREAS pursuant to Section 135(7) of the *Municipal Act*, a municipality may require that a permit be obtained to injure or destroy trees in Woodlands designated in the by-law and impose conditions on a permit, including conditions relating to the manner in which destruction occurs and the qualification of persons authorized to injure or destroy trees;

AND WHEREAS Regional Council deems it desirable to enact a Tree and Forest Conservation By-law for the purposes of:

- preserving and improving the Woodlands in the Regional Municipality of Niagara through Good Forestry Practices;
- promoting Good Forestry Practices that sustain healthy Woodlands and related natural habitats and environments;
- helping to achieve the goal of 30% forest cover in the Niagara Region;
- minimizing the destruction or injuring of trees in Woodlands;
- regulating and controlling the removal, maintenance and protection of trees in Woodlands;
- minimizing and guarding against dangerous conditions which may result in injury;
- protecting, promoting and enhancing the aesthetic values of Woodlands;
- contributing to human health, recreation, enjoyment and quality of life through the maintenance of woodland cover;
- providing for the production of wood and other products derived from trees;
- supporting the objective of the Regional Policy Plan to maintain, restore and, enhance the ecological health, integrity and biodiversity of the Core Natural Heritage System and its contributions to a Healthy Landscape as defined in the Regional Policy Plan; and
- enhancing and implementing processes and decisions made with respect to applications made under the *Planning Act*, R.S.O. 1990, c. P.13, as amended.

AND WHEREAS Section 447.4(1) of the *Municipal Act* permits a municipality to enter into agreements with a person or body in relation to matters of mutual interest for the purpose of coordinating the enforcement of by-laws;

AND WHEREAS Regional Council has approved entering into an agreement with the Niagara Peninsula Conservation Authority (the "NPCA") wherein the NPCA will administer and enforce this Tree and Forest Conservation By-law;

NOW, THEREFORE, the Council of the Regional Municipality of Niagara hereby enacts as follows:

1. DEFINITIONS

In this By-law:

- 1.1 "Agricultural Use" means the commercial production of crops and/or raising of livestock for human use and includes ploughing, seeding, harvesting, leaving land fallow as part of a conventional rotational cycle, production of tree fruits and grapes, grazing, animal husbandry, and buildings and structures associated with these activities;
- 1.2 "Area Municipality" means any one of the municipalities of the Town of Fort Erie, Town of Grimsby, Town of Lincoln, City of Niagara Falls, Town of Niagara-on-the-Lake, Town of Pelham, City of Port Colborne, City of St. Catharines, City of Thorold, Township of Wainfleet, City of Welland, and the Township of West Lincoln;
- 1.3 "Basal Area" means the area of the cross-section of the stem or trunk of a tree taken at a point of measurement 1.37 metres above the highest point on the tree where the ground meets the stump;
- 1.4 "Board" means the Board of Directors for the NPCA;
- 1.5 "Building Permit" means a building permit issued by an Area Municipality under the *Building Code Act, 1992*, S.O. 1992, c.23, as amended;
- 1.6 "Bumper Tree" means a poor quality, low value tree that grows in close proximity to higher value trees and is located along skid roads to protect residual trees from damage during logging and skidding operations;
- 1.7 "Business day" means any day falling on or between Monday and Friday of each week but does not include statutory holidays;

- 1.8 “Circumference” means the measurement of the perimeter or outer boundary of a stem or trunk of a tree at a specified point of measurement with such measurement including the bark;
- 1.9 “Coppice growth” means clump growth where more than one tree stem grows from a single tree stump and the point of measurement for such growth means that point on each stem measured immediately above the point of fusion, provided such point of fusion is less than 1.37 metres above the highest point of undisturbed ground at the base of the coppice or clump growth;
- 1.10 “Damage” means lasting injury to trees remaining after the completion of the injuring or destroying of trees and caused by the harvesting, injuring or destroying of any trees, that has the effect of inhibiting or terminating growth and may include but is not limited to:
- 1.10. a broken branches in the crown of a tree;
 - 1.10. b the breaking off or splitting of the stem of any tree and the noticeable tipping of any tree;
 - 1.10. c the splitting of, removal of or damage to the bark of a tree; or
 - 1.10. d damage to the root structure of a tree;
- except that damage does not include injury to Bumper Trees;
- 1.11 “DBH” or “Diameter at Breast Height” means the diameter of the stem of a tree measured at a point that is 1.37 metres above the ground;
- 1.12 “Diameter” means the diameter of the stem of a tree measured at a specified point of measurement with such measurement including the bark of the stem;
- 1.13 “Ecological Functions” means the natural processes, products or services that living and non-living environments provide or perform within or between species, ecosystems and landscapes, including hydrological functions and biological, physical, chemical and socio-economic interactions;
- 1.14 “Farmer” means a person who has a current and valid farm registration number under the *Farm Registration and Farm Organizations Funding Act, 1993*, S.O. 1993, c. 21, as amended;
- 1.15 “Forest Management Plan” means a course of forest management action prescribed for a particular woodland area after specific assessments and evaluations have been made by a Registered Professional Forester or a member in good standing of the Ontario Professional Foresters Association in accordance with the Ministry of Natural Resources document “A Silvicultural Guide to Managing Southern Ontario Forests”, as amended from time to time;

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- 1.16 “Good Forestry Practices” means:
- 1.16.a the proper implementation of harvest, renewal and maintenance activities known to be appropriate for the forest and environmental conditions under which they are being applied and that minimize detriments to forest values, including: significant ecosystems; important fish and wildlife habitat; soil and water quality and quantity; forest productivity and health; vulnerable, threatened and endangered species as regulated by Provincial or Federal statute and the aesthetic and recreational opportunities of the landscape;
 - 1.16.b the cutting and removal of hazardous, severely damaged, diseased and insect-infested trees which must be removed in order to prevent contamination or infestation of other trees or because they no longer contribute to the achievement of forest values;
 - 1.16.c in the case of hazardous, damaged, diseased or insect-infested trees, the maintenance of a Woodland after the cutting and removal is completed unless it is determined through a report prepared by a Registered Professional Forester or a member in good standing of the Ontario Professional Foresters Association that trees must be removed and a Woodland would not be maintained but in no case shall clearcutting be allowed; and,
 - 1.16.d the forestry management practices as set out in the Ministry of Natural Resources document “A Silvicultural Guide to Managing Southern Ontario Forests”;
- 1.17 “Heritage Tree” means a tree identified and designated by the Council of an Area Municipality as having heritage significance;
- 1.18 “NPCA” means the Niagara Peninsula Conservation Authority;
- 1.19 “Negative impact” means any impairment, disruption, destruction or harmful alteration to any living plant or animal or to their habitat or Ecological Functions;
- 1.20 “Officer” means an individual appointed by the NPCA for the administration and enforcement of this By-law;
- 1.21 “Owner” means a person having any right, title, interest or equity in land or any such person’s authorized representative;
- 1.22 “Own Use” means use that does not include a commercial sale, exchange or other disposition of trees destroyed or injured;
- 1.23 “Permit” means a permit to injure or destroy trees issued under Sections 5 and 6 of this By-law;

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- 1.24 "Person" means an individual or a corporation and their respective heirs, executors, administrators or other duly appointed representatives;
- 1.25 "Point of Measurement" means the point on a tree trunk measured above the highest point at which the ground meets the tree. For Coppice Growth the Point of Measurement shall be at the point on the tree trunk where the tree stems separate provided that such point of separation is less than 1.37 metres from where the ground meets the tree;
- 1.26 "Prescription" means a written course of forest management action prescribed for a particular woodland area by a Registered Professional Forester or a member in good standing of the Ontario Professional Foresters Association after specific assessments and evaluations have been made by a Registered Professional Forester or a member in good standing of the Ontario Professional Foresters Association;
- 1.27 "Region" means the Regional Municipality of Niagara;
- 1.28 "Regional Council" means the Council of the Region;
- 1.29 "Registered Professional Forester" refers to that term as defined in the *Professional Foresters Act, 2000*, S.O. 2000, c.18, as amended;
- 1.30 "Sensitive Natural Area" means lands that are in a Woodland and:
- 1.30.a within the Environmental Protection designation of the Natural Heritage System and adjacent lands, as defined in the Regional Policy Plan; or
 - 1.30.b within a Natural Area as designated in the Niagara Escarpment Plan;
- 1.31 "Significant Community Tree" means a tree identified and designated by the Council of an Area Municipality as having community significance;
- 1.32 "Silviculture" means the theory and practice of controlling forest establishment, and the composition, growth and quality of forests to achieve the objectives of forest management;
- 1.33 "Total Basal Area" means the sum of the Basal Areas of individual trees;
- 1.34 "Tree" or "Trees" means any living species of woody perennial plant, including its root system, which has reached or can reach a height of at least 4.5 meters at physiological maturity;

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- 1.35 “Tree Marker” means a person certified to mark trees as a result of successfully completing the Ministry of Natural Resources Tree Marker course; or a Registered Professional Forester; or a member in good standing of the Ontario Professional Foresters Association;
- 1.36 “Tree Saving Plan” means a plan, prepared for the purpose of protecting and preserving trees on properties where development or disturbance of the natural forest cover is to occur. Such plans shall attempt to retain as many trees as possible and as a minimum shall include all of the following:
- 1.36.a an inventory and graphic display of trees on the property including location, size, species, general age distribution health and any individual trees or grouping of trees with particular significance such as but not limited to age, species and size;
 - 1.36.b identification of natural features and functions present, whether they should be protected, and if not, why;
 - 1.36.c a statement identifying whether any threatened or endangered species are present and if so, how they are to be protected;
 - 1.36.d a description and a map of the trees to be removed and retained including written reasons why the trees are to be removed or retained;
 - 1.36.e an indication as to how the trees to be retained will be marked or otherwise identified as trees to be protected;
 - 1.36.f the layout of the proposed development superimposed on the woodland area, including existing and proposed grades, services/utilities, roads, surface drainage and building envelopes;
 - 1.36.g the specific measures to be used during and after construction or site disturbance to protect and preserve individual trees or clumps of trees identified for retention, including but not limited to fencing around the dripline, the avoidance of storage or dumping of materials over root zones and operation of equipment over root zones;
 - 1.36.h a tree replanting program using native species;
 - 1.36.i a statement indicating that the plan conforms to the Region’s Tree and Forest Conservation By-law; and
 - 1.36.j consideration of the relationship between an Environmental Impact Study, prepared as part of a development application, and requirements of the Regional Policy Plan;
- 1.37 “Wildlife” means all wild mammals, birds, reptiles, amphibians, fishes, invertebrates, plants, fungi, algae, bacteria and other wild organisms;

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1.38 "Woodland" or "Woodlands" means land on one or more properties with a density of at least:

- 1.38.a 1,000 trees, of any size, per hectare;
- 1.38.b 750 trees, measuring over five (5) centimetres in diameter at DBH, per hectare;
- 1.38.c 500 trees, measuring over twelve (12) centimetres, in diameter at DBH, per hectare; or
- 1.38.d 250 trees, measuring over twenty (20) centimetres, in diameter at DBH, per hectare;

but does not include:

- 1.38.f a cultivated fruit or nut orchard;
- 1.38.g a plantation established for the purpose of producing Christmas trees and which is being actively managed and harvested for the purposes for which it was planted, except that this does not refer to plantations that have ceased being managed or harvested for their intended purpose for a period of 15 years or more; or
- 1.38.h a bona fide tree nursery that is being actively managed and harvested for the purposes for which it was planted.

2. APPLICATION OF THE BY-LAW

This By-law shall apply to:

- 2.1 all Woodlands having an area of one (1) hectare or more;
- 2.2 all Woodlands having an area of less than one (1) hectare, upon delegation of such authority by an Area Municipality to the Region; and
- 2.3 Heritage Trees and Significant Community Trees identified and designated by the Council of an Area Municipality, upon delegation of such authority by an Area Municipality to the Region.

3. GENERAL PROHIBITIONS

3.1 No person through their own actions or through any other person shall injure or destroy any Tree located in Woodlands:

- 3.1.a Unless exempted by Section 4; or
- 3.1.b Unless in possession of a valid Permit issued by the NPCA under Sections 5 and 6 of this By-law and in accordance with its terms or conditions.

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3.2 No person through their own actions or through any other person shall:

- 3.2.a Contravene the terms or conditions of a Permit issued under this By-law;
- 3.2.b Fail to comply with an order issued under Section 8 of this By-law; or
- 3.2.c Remove or deface any order that has been posted pursuant to Section 8 of this By-law.

3.3 No person through their own actions or through any other person shall injure or destroy any Tree that has been designated by the Council of an Area Municipality as a Heritage Tree or a Significant Community Tree, provided that the authority to regulate such trees has been delegated to the Region by the Area Municipality.

4. **EXEMPTIONS**

Despite Section 3 of this By-law, this By-law does not apply to:

- 4.1 activities or matters undertaken by a municipality or a local board of a municipality;
- 4.2 activities or matters undertaken under a licence issued under the *Crown Forest Sustainability Act, 1994*, S.O. 1994, c.25, as amended;
- 4.3 the injury or destruction of trees by a person licensed under the *Surveyors Act*, R.S.O. 1990, c. s.29, as amended, to engage in the practice of cadastral surveying or his or her agent, while making a survey;
- 4.4 the injury or destruction of trees imposed after December 31, 2002:
 - 4.4.a as part of a Tree Saving Plan required as a condition of approval in a plan of subdivision that has received draft approval under Section 51 of the *Planning Act*;
 - 4.4.b as part of a Tree Saving Plan required as a condition on a consent approved under Section 53 of the *Planning Act*;
 - 4.4.c as a requirement in a Tree Saving Plan approved and included in an site plan control agreement or a subdivision agreement entered into under Sections 41 and 51 respectively of the *Planning Act*;
 - 4.4.d in a development agreement between an Owner and an Area Municipality;
 - 4.4.e as a condition to a development permit authorized by regulation made under Section 23(b) of the *Niagara Escarpment Planning and Development Act*, R.S.O. 1990, c. N.2, as amended; or
 - 4.4.f as a condition to a development permit authorized by regulation made under section 70.2 of the *Planning Act* or as a requirement of an agreement entered into under the regulation;

- 4.5 the injury or destruction of trees by a transmitter or distributor, as those terms are defined in section 2 of the *Electricity Act*, S.O. 1998, c.15, Sched. A, as amended, for the purpose of constructing and maintaining a transmission system or a distribution system, as those terms are defined in that section;
- 4.6 the injury or destruction of trees undertaken on land described in a licence for a pit or quarry or a permit for a wayside pit or wayside quarry issued under the *Aggregate Resources Act*; R.S.O 1990, c. A.8, as amended;
- 4.7 the injury or destruction of trees undertaken on land in order to lawfully establish and operate or enlarge any pit or quarry on land:
 - 4.7.a that has not been designated under the *Aggregate Resources Act* or a predecessor of that Act; and
 - 4.7.b on which a pit or quarry is a permitted land use under a by-law passed under section 34 of the *Planning Act*;
- 4.8 the injury or destruction of trees that is required in order to erect any building, structure or thing, including yard areas, in respect of which a Building Permit has been issued and has taken into consideration the protection of trees surrounding the structure or work within the building envelope, provided that only those trees necessary to accommodate the building structure or thing, including yard areas, are removed;
- 4.9 the injury or destruction of trees that is required in order to install and provide utilities, including a private waste disposal system, to the construction or use of the building, structure or thing in respect of which a Building Permit has been issued;
- 4.10 the injury or destruction of trees that is required in order to install, provide or maintain a driveway of sufficient width for vehicular access to the building, structure or thing in respect of which a Building Permit has been issued;
- 4.11 the injury or destruction of trees on lands, including buffer lands, used for the purpose of a licenced waste disposal site that has been approved, where applicable, under the *Environmental Protection Act*, R.S.O. 1990, c. E.19, as amended, the *Ontario Water Resources Act*, R.S.O. 1990, c. O.40, as amended, the *Environmental Assessment Act*, R.S.O. 1990, c. E.18, as amended, the *Planning Act*, and/or the *Niagara Escarpment Planning and Development Act*;
- 4.12 the injury or destruction of trees for the construction of drainage works under the *Drainage Act*, R.S.O. 1990, c. D.17, as amended;

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- 4.13 the injury or destruction of trees that:
- 4.13.a are dead;
 - 4.13.b are diseased, as identified in a Prescription or Forest Management Plan; or
 - 4.13.c pose a hazard to human safety or property;
- 4.14 the injury or destruction of trees by an Owner of a Woodland who may harvest, destroy or injure trees for his or her Own Use on his or her property provided that:
- 4.14.a the Owner, prior to the cutting, has advised the Officer of the proposed cutting;
 - 4.14.b the Owner has been the registered owner of the Woodlands for at least two (2) years prior to the date of the commencement of the destruction or injury of the trees;
 - 4.14.c Good Forestry Practices are employed in accordance with the Ministry of Natural Resources document "A Silvicultural Guide to Managing Southern Ontario Forests";
 - 4.14.d the destruction or injuring, in that part of the Woodland where trees have been destroyed or injured, does not reduce:
 - 4.14.d.i the number of trees per hectare below that necessary to constitute a Woodland; and
 - 4.14.d.ii the total basal area to below 20 square metres per hectare; and
 - 4.14.e the harvesting, injury or destruction of trees does not involve a Sensitive Natural Area, in which case a Permit under this By-law is required, except that for the purposes of this section no fee is required; or
- 4.15 the harvesting, injury or destruction of trees by a Farmer that involves the clearing of all or part of a Woodland for agricultural use on land that is owned by the Farmer doing the clearing and is part of a farm operation or farm corporation that has existed for at least three (3) years prior to such clearing.
- The clearing shall be carried out in accordance with Normal Farm Practices as defined in the *Farming and Food Production Protection Act, 1998*, S.O. 1998, c. 1, as amended, provided that:
- 4.15.a the land that is cleared is put into agricultural use within three (3) years of the date on which such clearing commences;
 - 4.15.b prior to the clearing, the Farmer advises the Officer of the proposed clearing. For the purposes of this section the marking of trees, a Forest Management Plan or a Prescription, a fee and a Permit are not required; and

- 4.15.c the land being cleared for agricultural use is outside the Urban Areas as defined in the Regional Policy Plan, and is designated and zoned for agricultural use in the Official Plan and Zoning By-law of the Area Municipality and, where applicable, in the Niagara Escarpment Plan;

except where the injuring or destruction of trees involves a Sensitive Natural Area in which case a Permit is required pursuant to the provisions of Sections 5 and 6 of this By-law, but no fee shall be required.

5. PERMITS

5.1 GOOD FORESTRY PRACTICES PERMITS

- 5.1.a Upon application by an Owner, the NPCA may issue a Good Forestry Practices Permit to permit the harvesting, injuring or destruction of trees in accordance with Good Forestry Practices provided that:

5.1.a.i a Prescription or Forest Management Plan, identifying accepted silviculture techniques and environmental protection measures where a Sensitive Natural Area is involved, has been authored by a Registered Professional Forester or a member in good standing of the Ontario Professional Foresters Association who is authorized to prepare Prescriptions or Forest Management Plans and the Prescription or Forest Management Plan has been submitted with the application for a Permit as per Section 6;

5.1.a.ii the trees to be cut are marked by a certified Tree Marker in accordance with a Prescription or Forest Management Plan and only such trees are cut; and

5.1.a.iii the injuring or destruction of trees will not reduce the number of trees per hectare below the minimum number of trees per hectare required to be considered a Woodland;

or provided that:

5.1.a.iv a plan, using Good Forestry Practices and including the identification of the trees to be cut, has been prepared to the satisfaction of the Officer by a certified Tree Marker with previous experience marking trees in Niagara Region and the plan has been submitted with the application for a Permit as per Section 6;

- 5.1.a.v the trees to be cut are marked by a certified Tree Marker in accordance with the plan under paragraph 5.1.a.iv and only such trees are cut; and
- 5.1.a.vi the injuring or destruction of trees will not reduce the number of trees per hectare below the minimum number of trees per hectare required to be considered a Woodland.

6. PERMIT APPLICATION PROCESS

- 6.1 Every person who intends to injure or destroy trees personally or through another person, where a Permit to do so is required under this By-law, shall first complete and submit an application for a Permit in the form approved by the NPCA from time to time.
- 6.2 Any person who submits an application under Section 6 shall post and display a copy of the Permit as issued pursuant to this By-law, in the immediate area where the destruction or injury of the trees is to occur, in a position that is clear and visible to all persons.
- 6.3 Applications for Permits will be processed only if:
 - 6.3.a the appropriate application form, approved by the NPCA from time to time, has been completed in full, duly signed and submitted to the NPCA;
 - 6.3.b the requirements that must be submitted with an application have been included;
 - 6.3.c applications are in keeping with the general purpose and intent of this By-law; and
 - 6.3.d except as otherwise stated in this By-law, the prescribed application fee, as set forth in Schedule "A" has been paid in full.
- 6.4 A Permit application that does not meet the requirements of clauses 6.3.a, 6.3.b and 6.3.c will be returned to the applicant with the prescribed fee within 30 days.
- 6.5 A Permit may be:
 - 6.5.a issued by the NPCA to the Owner for a term of up to one (1) year from the date of issue and shall not be transferable; or
 - 6.5.b renewed one time only by the NPCA for one term of up to one (1) year contiguous with the expiry date of the original Permit and after a written request from the Owner for renewal is made to the NPCA who must be satisfied that there are reasonable grounds for the renewal.

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- 6.6 NPCA may impose conditions to a Permit that relate to, but which are not restricted to:
- 6.6.a the manner and timing in which harvesting, injury or destruction is to occur;
 - 6.6.b the species, size, number and location of trees to be injured or destroyed or to be planted;
 - 6.6.c the marking of trees to be cut with paint;
 - 6.6.d the qualifications of persons authorized to injure or destroy trees;
 - 6.6.e the submission of additional information required before the Permit becomes effective;
 - 6.6.f measures to be implemented to mitigate the direct and indirect effects of the injuring or destruction on Sensitive Natural Areas; and
 - 6.6.g a follow-up fuelwood (firewood) harvest.
- 6.7 When denying a Permit, the NPCA will notify the applicant in writing by registered mail. The Board shall provide written reasons for its decision to the applicant.

7. APPEALS TO REGIONAL COUNCIL

- 7.1 An applicant for a Permit under Section 6 may appeal to Regional Council if the NPCA refuses to issue a Permit, within 30 days after the refusal.

8. ORDERS TO DISCONTINUE ACTIVITY

- 8.1 Where an Officer is satisfied that a contravention of this By-law has occurred, the Officer may make an Order requiring the person who contravened the By-law or who caused or permitted the injuring or destruction of trees in contravention of the By-law to stop the injuring or destruction of trees. The order shall set out:
- 8.1.a the municipal address or the legal description of the land;
 - 8.1.b reasonable particulars of the contravention; and
 - 8.1.c the period within which there must be compliance with the order.
- 8.2 An Order issued under this section may be served personally or by registered mail to the last known address of:
- 8.2.a the Owner of the Woodland; and
 - 8.2.b the person identified as injuring or destroying trees.
- 8.3 Where service of an Order is made by registered mail, service shall be deemed to have been served on the fifth day after the order is mailed.

- 8.4 Where service cannot be carried out under subsection 8.2, it is deemed sufficient if the Officer places a placard containing the terms of the Order in a conspicuous place on the affected lands. The placing of the placard shall be deemed to be sufficient service of the Order on the person to whom the Order is directed. The placard shall not be removed without the approval of the Officer.
- 8.5 If the person to whom the Order is directed is not satisfied with the terms of the Order, the person may appeal to the Board by filing a notice of appeal by personal service or registered mail to NPCA within 30 days of the date of the Order.
- 8.6 Where an appeal has been filed, the Board shall, at a public hearing, consider the appeal and a report from the Officer concerning the appeal.
- 8.7 Before conducting a hearing under this section, the NPCA shall give notice to the applicant and to such persons as the NPCA considers should receive notice and in the manner directed by the NPCA.
- 8.8 After hearing an appeal, the Board may confirm or revoke any Order issued under this By-law or may issue a Permit with conditions, provided that in the opinion of the Board, the general intent and purpose of this By-law has been maintained.
- 8.9 The proceedings at the hearing held by the Board shall be in accordance with the provisions of the *Statutory Powers Procedure Act*, R.S.O. 1990, c. S.22, as amended. The decision of the Board under this section shall be final.

9. PENALTY

- 9.1 Any person who contravenes any provision of this By-law, or an Order issued under section 8 is guilty of an offence and is liable:
- 9.1.a on first conviction, to a fine of not more than \$10,000 or \$1,000 per tree, whichever is greater; and
 - 9.1.b on any subsequent conviction, to a fine of not more than \$25,000 or \$2,500 per tree, whichever is greater.
- 9.2 Despite subsection 9.1, where the person convicted is a corporation:
- 9.2.a the maximum fines in clause 9.1.a are \$50,000 or \$5,000 per tree; and
 - 9.2.b the maximum fines in clause 9.1.b are \$100,000 or \$10,000 per tree.

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- 9.3 If a person is convicted of an offence for contravening this By-law or an Order issued under section 8, the court in which the conviction has been entered, and any court of competent jurisdiction thereafter, may order the person to rehabilitate the land or to plant or replant trees in such a manner and within such period as the court considers appropriate, including any silvicultural treatment necessary to re-establish the trees.

10. ENFORCEMENT

- 10.1 Regional Council hereby delegates to the NPCA the authority to enforce this By-law, to issue Permits under this By-law and to impose conditions to such Permits.
- 10.2 The Board may appoint from time to time by resolution, persons it deems qualified and necessary to act as Officers to administer and enforce the provisions of this By-law.
- 10.2 An Officer, appointed by resolution of the Board, or any person authorized by an Officer, may at all reasonable times enter upon and inspect any land and Woodland for the purposes of enforcing this By-law, determining compliance with this By-law, determining compliance with terms and conditions of a Permit issued under this By-law, determining compliance with an Order issued under Section 8 of this By-law or laying charges under this By-law.
- 10.3 Any person who obstructs or interferes with an Officer, or any person or agent authorized by an Officer, in the discharge of his or her duties under this By-law, shall be considered in violation of this By-law.

11. TREE FOREST CONSERVATION BY-LAW ADVISORY COMMITTEE

- 11.1 The NPCA will establish a Tree and Forest Conservation By-law Advisory Committee, which shall be a technical advisory committee to the NPCA. Representation on the committee shall include, at a minimum, representatives from the Area Municipalities, Niagara North Federation of Agriculture, Niagara South Federation of Agriculture, the Niagara Woodlot Association, and logging industry.
- 11.2 The Tree and Forest Conservation By-law advisory Committee shall review and provide advice on matters of tree and forest conservation as requested by the NPCA.

12. ADMINISTRATION

- 12.1 Schedule "A" shall form part of this By-law.
- 12.2 If any section or part of this By-law is found by any court of competent jurisdiction to be illegal or beyond the power of Regional Council to enact, such section or part shall be deemed to be severable and all other sections or parts of this By-law shall be deemed to be separate and independent therefrom and to be enacted as such.
- 12.3 The short title of this By-law is the "Tree and Forest Conservation By-law".
- 12.4 By-law 47-2006 of the Regional Municipality of Niagara and all amendments thereto, are hereby repealed.
- 12.5 Despite subsection 11.4, By-law 47-2006, as amended, shall continue to apply to proceedings in respect of offences that occurred before its repeal.
- 12.6 This by-law shall come into force on July 31, 2008.

THE REGIONAL MUNICIPALITY OF NIAGARA



(Peter Partington, Regional Chair)

(Pam Gilroy, Regional Clerk)

Passed: April 10, 2008

**REGIONAL MUNICIPALITY OF NIAGARA
TREE AND FOREST CONSERVATION BY-LAW
SCHEDULE A – FEES**

Application for a Good Forestry Practices Permit	\$0.00

Application for a Special Permit	\$0.00

Environmental Impact Statement Report

APPENDIX D **OPSS 577**



**ONTARIO
PROVINCIAL
STANDARD
SPECIFICATION**

**METRIC
OPSS 577
NOVEMBER 2006**

**CONSTRUCTION SPECIFICATION FOR
TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES**

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577-A	Commentary

577.01 SCOPE

This specification describes the requirements for the installation, maintenance, and removal of temporary erosion and sediment control measures and the removal of sediment accumulated by the control measure.

577.01.01 Significance and Use of Appendices

Appendices are not a mandatory part of this specification unless invoked by the Owner.

Appendix 577-A is a commentary appendix to provide designers with information on the use of this specification in a Contract.

577.02 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 206 Grading

Ontario Provincial Standard Specifications, Material

OPSS 1004 Aggregates - Miscellaneous
OPSS 1801 Corrugated Steel Pipe Products
OPSS 1840 Non-Pressure Polyethylene Plastic Pipe Products
OPSS 1860 Geotextiles

Canadian General Standards Board

148.1 No 7.3-92 Methods of Testing Geosynthetics and Geomembranes - Grab Tensile Test for Geotextiles
148.1 No 10-94 Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size

577.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Downstream means downhill and down-gradient.

Earth means earth as defined in OPSS 206.

Inflection Point means the point where a turbidity curtain changes angle to a significant degree.

Upstream means uphill and up-gradient.

Waterbody means as defined in the Contract Documents.

Watercourse means as defined in the Contract Documents.

577.05 MATERIALS

577.05.01 Straw Bales

Straw bales shall consist of wheat or oat straw, be dry and firm, be tied tightly in at least two places, show no evidence of straw or tie decay, and be free of sediment. They shall be of agricultural rectangular conformation and dimensions, approximately 600 x 600 x 1200 mm.

577.05.02 Geosynthetics

577.05.02.01 Geotextile

Geotextile shall be free of holes, tears, and punctures.

577.05.02.02 Silt Fence Geotextile

Geotextile for silt fence shall be according to OPSS 1860, Table 3.

577.05.02.03 Rock Flow Check Dam Geotextile

Geotextile for rock flow check dams shall be a woven, Class II geotextile according to OPSS 1860. The filtration opening size (FOS) shall be no greater than 300 µm.

577.05.02.04 Turbidity Curtain Geosynthetic

Turbidity curtain geosynthetics shall have a grab tensile strength of at least 990 N, meeting CAN/CGSB 148.1, No. 7.3 and be one of geotextile or geomembrane.

Geotextile shall be a woven material. The filtration opening size (FOS) shall be no greater than 300 µm, meeting CAN/CGSB 148.1, No. 10.

Geomembrane shall be a low-permeability synthetic material or a geotextile impregnated with elastomeric spray.

577.05.03 Stakes

Stakes shall be of sufficient strength to satisfy control measure performance and maintenance requirements. Stakes for light-duty sediment barriers and anchoring straw bales shall be a minimum of 1.2 m in length. Stakes for all other control measure applications shall be a minimum of 1.5 m in length.

577.05.04 Control Measure Support

Control measure support shall be a separate product or one bonded to silt fence geotextile and be either plastic or wire mesh.

577.05.05 Sandbags

Sandbags shall be made from heavy gauge plastic, agricultural burlap, or silt fence geotextile. Heavy gauge plastic shall contain stabilizers or inhibitors resistant to deterioration by ultraviolet radiation. Sandbags shall be approximately 450 x 350 x 150 mm when filled. Sandbags shall be filled with sand or gravelly sand, containing little or no silt or clay.

577.05.06 Turbidity Curtain Hardware

577.05.06.01 Floatation

Turbidity curtain floatation shall be a material that has sufficient buoyancy to provide the curtain with continuous support and a minimum of 50 mm freeboard.

577.05.06.02 Load Lines

Turbidity curtain load lines shall be 8 mm steel cable or 19 mm nylon or polypropylene rope.

577.05.06.03 Ballast

Turbidity curtain ballast shall be 8 mm steel chain.

577.05.06.04 Anchors

Turbidity curtain anchors shall be mushroom or kedge anchors with a minimum mass of 34 kg for firm mud bottoms or self-burying Danforth anchors with a minimum mass of 5 kg for sandy bottoms.

577.05.06.05 Mooring Buoys

Turbidity curtain mooring buoys shall have provision for the mooring line to be securely attached and be sufficiently buoyant to remain afloat under normal load conditions.

577.05.06.06 Mooring Lines

Turbidity curtain mooring lines shall be 19 mm nylon or polypropylene rope.

577.05.06.07 Adjustment Lines

Turbidity curtain adjustment lines shall be 13 mm nylon or polypropylene rope.

577.05.07 Rock

Rock for rock flow check dams shall be according to the requirements for rip-rap and gabion stone according to OPSS 1004.

577.05.08 Chutes

577.05.08.01 Corrugated Pipe

Corrugated pipe chutes shall be 300 mm in diameter, non-perforated, corrugated steel pipe or polyethylene plastic pipe according to OPSS 1801 and OPSS 1840 respectively.

577.05.08.02 End Sections

End sections for the inlet and outlet of chutes shall be according to OPSS 1801, regardless of the material type of the pipe used.

577.07 CONSTRUCTION

577.07.01 General

Work in the waterbodies and on waterbody banks shall be as specified in the Contract Documents.

577.07.02 Operational Constraints

577.07.02.01 Dewatering

Dewatering effluent shall be controlled to prevent passage of sediment into a waterbody. Discharge of dewatering effluent to dewatering traps shall be controlled to avoid exceeding trap capacity and to limit scour and washout.

577.07.02.02 Chutes

When chutes are specified in the Contract Documents, the chute and associated berm barrier shall be constructed in the same day.

577.07.02.03 Turbidity Curtain and Cofferdam

Equipment shall not be operated in a waterbody outside a turbidity curtain or cofferdam other than hand held equipment or boats.

577.07.02.04 Construction and Removal

The construction and removal times for temporary erosion and sediment control measures shall be as specified in the Contract Documents.

577.07.03 Light-Duty Sediment Barriers, General

Light-duty sediment barriers are light-duty straw bale barriers or light-duty silt fence barriers.

Light-duty sediment barriers shall be constructed and maintained as specified in the Contract Documents.

Light-duty sediment barriers shall be constructed as specified in the Contract Documents, without gaps and without undermining to prevent sediment passage through, under, or around the barrier.

When light-duty sediment barriers are specified in the Contract Documents, the Contractor has the option to select either of the light-duty sediment barriers or any combination of them. When a specific light-duty sediment barrier is specified in the Contract Documents, there shall be no option of substitution for the control measure.

Light-duty sediment barriers shall include protection placed against the downstream side at the low points of the barrier so that any overflow of the barrier is prevented from causing soil scour and erosion.

577.07.03.01 Light-Duty Straw Bale Barriers

Light-duty straw bale barriers shall be constructed as specified in the Contract Documents.

When straw bale barriers are to be constructed on sod, erosion control blanket, or existing turf, they shall be placed and staked so there are no gaps between the bales and the underlying cover.

The ends of adjacent bales shall be placed tightly against one another without gaps.

Straw bales shall be placed completely around catch basins and ditch inlets without gaps. When a double row of straw bales is specified in the Contract Documents, the straw bales shall be placed such that the joints between the straw bales of each row are not in-line with the joints of the straw bales of the adjacent row.

Stakes securing the bales shall be driven through the bales without breaking the bale ties or otherwise disturbing bale firmness and shape.

Straw bale barriers shall be maintained such that bales remain firm, intact, in original shape, and without decay.

Maintenance shall include the replacement of each bale at intervals not exceeding 45 Days.

577.07.03.02 Light-Duty Silt Fence Barriers

Light-duty silt fence barriers shall be constructed as specified in the Contract Documents.

A trench shall be excavated to anchor the geotextile along the entire length of the barrier.

The geotextile shall be attached firmly, without sagging, to the upstream side of the stakes. It shall be placed without gaps or breaks along its length. Where the geotextile is joined to provide a continuous run, the ends shall be securely fastened and overlapped a minimum of 500 mm.

The trench shall be backfilled and compacted to existing grade to hold the base of the geotextile firmly in place.

577.07.04 Heavy-Duty Sediment Barriers, General

Heavy-duty sediment barriers are heavy-duty silt fence barriers, berm barriers, or sandbag barriers.

Heavy-duty sediment barriers shall be constructed as specified in the Contract Documents, without gaps and without undermining to prevent sediment passage through, under, or around the barrier.

When heavy-duty sediment barriers are specified in the Contract Documents, the Contractor has the option to select any of the heavy-duty sediment barriers or any combination of them. When a specific heavy-duty sediment barrier is specified in the Contract Documents, there shall be no option of substitution for the control measure.

Heavy-duty sediment barriers shall include protection placed against the downstream side at the low points of the barrier so that any overflow of the barrier is prevented from causing soil scour and erosion.

577.07.04.01 Heavy-Duty Silt Fence Barriers

Heavy-duty silt fence barriers shall be constructed as specified in the Contract Documents.

Control measure support shall extend the entire height and length of the silt fence without gaps.

Heavy-duty silt fence barriers shall be maintained vertically without tears and without sagging.

577.07.04.02 Berm Barriers

Berm barriers shall be constructed as specified in the Contract Documents.

577.07.04.03 Sandbag Barriers

Sandbag barriers shall be constructed as specified in the Contract Documents

Sandbags within each row shall be placed with the sides of the bags butted tightly against one another without gaps. The ends of sandbags in adjacent rows shall be butted tightly against one another without gaps.

When sandbag barriers are constructed on earth surfaces, the trench into which the sandbags are placed shall be backfilled around the sandbags to existing grade and compacted.

When sandbag barriers are to be constructed on sod, erosion control blanket, existing turf, or bedrock, they shall be placed so there are no gaps between the sandbags and the underlying surface.

Sandbag barriers shall be maintained with undamaged bags that are firmly seated.

577.07.05 Flow Check Dams

Flow check dams are straw bale flow check dams, silt fence flow check dams, sandbag flow check dams, or rock flow check dams.

Flow check dams shall be constructed as specified in the Contract Documents without gaps and without undermining to prevent sediment passage through, under, or around the flow check dam.

When flow check dams are specified in the Contract Documents, the Contractor has the option to select any of the flow check dams or any combination of them. When a specific flow check dam is specified in the Contract Documents, there shall be no option of substitution for the control measure.

Flow check dams shall include protection placed against the downstream side at the lowest point of the flow check dam so that any overflow of the flow check dam is prevented from causing soil scour and erosion.

577.07.05.01 Straw Bale Flow Check Dams

Straw bale flow check dams shall be constructed as specified in the Contract Documents.

577.07.05.02 Silt Fence Flow Check Dams

Silt fence flow check dams shall be constructed as specified in the Contract Documents.

Silt fence flow check dams shall be maintained vertically without tears and without sagging.

577.07.05.03 Sandbag Flow Check Dams

Sandbag flow check dams shall be constructed as specified in the Contract Documents.

577.07.05.04 Rock Flow Check Dams

Rock flow check dams shall be constructed as specified in the Contract Documents without gaps and without undermining to prevent sediment passage through or under the rock flow check dam.

577.07.06 Excavated Sediment Traps

Excavated sediment traps shall be constructed as specified in the Contract Documents to prevent sediment passage from the upstream to the downstream side of the excavated trap and so that the majority of the sediment is collected in the excavated basin.

Excavated sediment traps shall be constructed as a single control measure consisting of an excavated basin and a rock flow check dam.

A temporary fence shall be erected around the excavated sediment trap to restrict public access.

577.07.07 Chutes

Chutes shall be constructed as specified in the Contract Documents.

Chutes shall be constructed as a single control measure consisting of a corrugated pipe, two end sections, and an excavated sediment trap constructed at the outlet end of the pipe.

The pipe inlet shall be placed through a berm barrier in such a manner that flow is directed to the pipe inlet without scouring of the berm. The toe plate of the inlet end section shall be fully imbedded into the ground surface.

The pipe outlet shall be placed such that the outlet end section discharges into the excavated sediment trap and the toe plate of the outlet end section is fully imbedded into the edge of the trap.

Pipes shall be maintained in place without gaps and without undermining so that water is conveyed from the upstream side of the berm and collected in the sediment trap.

577.07.08 Dewatering Traps

Dewatering traps shall be constructed as specified in the Contract Documents to prevent sediment passage beyond the perimeter of the trap.

Dewatering traps shall be constructed as part of a single control measure consisting of an excavated basin, surrounded by a light-duty sediment barrier, with a rock flow check dam at the point of water outlet.

The shape of the dewatering basin may be varied to suit the characteristics of the area surrounding it.

The sediment barrier and rock flow check dam shall be constructed a minimum of 1 m from the edges of the excavated basin.

Construction of the sediment barrier shall be according to the requirements for light-duty sediment barriers with the following exceptions:

- a) End runs are not required.
- b) The rock flow check dam shall be located at the low point of the light-duty sediment barrier.

A temporary fence shall be erected around the excavated sediment trap to restrict public access.

577.07.09 Turbidity Curtains

Turbidity curtains shall be constructed as specified in the Contract Documents with the entire top edge above the water surface. Turbidity curtains shall be free of tears and gaps, and the bottom edge of the curtain shall be continuously in contact with the watercourse bed so that sediment passage from the enclosed area is prevented.

Turbidity curtains shall be constructed according to the following:

- a) Breaks may be made in the lower sleeve to facilitate pulling of the ballast, provided they are a maximum 100 mm in size and spaced at minimum 3 m intervals.
- b) Where turbidity curtain geosynthetic is joined to provide a continuous run, the sections shall be connected to provide a continuous seal and prevent the escape of turbid water between the sections.
- c) The turbidity curtain shall be of sufficient width to account for water depth and wave action.
- d) The turbidity curtain shall be prepared for installation by furling and tying with furling ties every 1.5 m for the entire length of the curtain.
- e) Anchor locations shall be established as necessary to maintain the turbidity curtain in place and functioning.

The sequence of installation shall be according to the following:

- a) Tie-downs shall firmly anchor the turbidity curtain to the shoreline.
- b) One end of the furled curtain shall be firmly attached to the upstream tie-down.
- c) The furled curtain shall be launched and placed.
- d) The remaining end of the furled curtain shall be attached to the downstream tie-down.
- e) Each anchor shall be attached to the turbidity curtain load line with a mooring line.

- f) At inflection points, mooring buoys shall be attached to the mooring line at a distance of 1 m from the load line.
- g) The furling ties shall be released to allow the turbidity curtain ballast to sink to its maximum depth.
- h) The location and depth of the ballast shall be adjusted as necessary using the adjustment lines.

Equipment is permitted in the Working Area enclosed by the turbidity curtain.

Folds in the turbidity curtain which form next to the floatation collar shall be regularly monitored and cleared of collected sediment.

577.07.10 Cofferdams

Cofferdams shall be constructed as specified in the Contract Documents and to provide the following:

- a) Isolate the Working Area from the waterbody.
- b) Prevent release of sediment and debris to the remaining waterbody.

Equipment is permitted in the Working Area enclosed by the cofferdam.

577.07.11 Monitoring

All temporary erosion and sediment control measures shall be monitored to ensure they are in effective working order. The condition of these shall be monitored prior to any forecast storm event and following a storm event.

577.07.12 Maintenance

All temporary erosion and sediment control measures constructed under this specification shall be maintained in an effective, functioning, stable condition.

577.07.13 Sediment Removal

The work shall consist of the removal and management of accumulated sediment.

Sediment that is accumulated by the temporary erosion and sediment control measures shall be removed in a manner that avoids escape of the sediment to the downstream side of the control measure and avoids damage to the control measure. Sediment shall be removed to the level of the grade existing at the time the control measure was constructed and be according to the following:

- a) For light-duty sediment barriers and flow check dams, accumulated sediment shall be removed once it reaches the lesser of the following:
 - i. A depth of one-half the effective height of the control measure. For flow check dams, the effective height shall be determined relative to the lowest point of the flow check dam.
 - ii. A depth of 300 mm immediately upstream of the control measure.
- b) For heavy-duty sediment barriers, excavated sediment traps, and dewatering traps, accumulated sediment shall be removed once it reaches one-half the effective height or depth of the control measure.

- c) For all control measures, accumulated sediment shall be removed as necessary to perform maintenance repairs.
- d) Accumulated sediment shall be removed immediately prior to the removal of the control measure.

577.07.14 Control Measure Removal

Ditch, permanent slope, and any other embankment cover specified elsewhere in the Contract Documents to be placed within the area controlled by the temporary erosion and sediment control measure shall be in place and established prior to the removal of such control measure.

Temporary erosion and sediment control measures shall be removed and associated excavations backfilled and compacted when the measures are no longer required.

Temporary erosion and sediment control measures shall be removed in a manner that:

- a) Prevents entry of equipment, other than hand-held equipment or boats, to any waterbody.
- b) Prevents release of sediment and debris to any waterbody.

Prior to removal of the in-water control measures, the area enclosed by turbidity curtains and cofferdams shall be cleaned of all debris. For cofferdams, accumulated sediment shall be removed prior to removal of the sediment control measure.

Any seeding and mulching, temporary cover, sod, other surface application, or original turf cover disturbed by removal or backfilling of erosion and sedimentation control measures and removal of accumulated sediment, shall be brought to final grade and restored as specified in the Contract Documents.

577.07.15 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

Sediment removed from temporary erosion and sediment control measures shall be managed as excess earth material.

577.09 MEASUREMENT FOR PAYMENT

577.09.01 Actual Measurement

577.09.01.01 Light-Duty Sediment Barriers Light-Duty Straw Bale Barriers Light-Duty Silt Fence Barriers Heavy-Duty Sediment Barriers Heavy-Duty Silt Fence Barriers Berm Barriers Sandbag Barriers

Measurement shall be the length in lineal metres from end to end of the barrier constructed, maintained, and removed, following the contours of the ground.

577.09.01.02 **Flow Check Dams**
Straw Bale Flow Check Dams
Silt Fence Flow Check Dams
Sandbag Flow Check Dams
Rock Flow Check Dams

For measurement purposes, a count shall be made of the flow check dams constructed, maintained, and removed.

577.09.01.03 **Excavated Sediment Traps**
Chutes
Dewatering Traps

For measurement purposes, a count shall be made of the number of excavated sediment traps, chutes, and dewatering traps constructed, maintained, and removed. Component parts shall not be counted separately for payment.

577.09.01.04 **Turbidity Curtains**

Measurement of turbidity curtain shall be made in lineal metres along its length from end to end between tie-downs for each turbidity curtain installed, maintained, and removed.

577.09.01.05 **Cofferdams**

For measurement purposes, a count shall be made of the number of cofferdams constructed, maintained, and removed.

577.09.01.06 **Sediment Removal**

Measurement shall be as specified in the Contract Documents by the volume of sediment excavated in cubic meters or by the number of hours required for excavation of sediment.

577.09.02 **Plan Quantity Measurement**

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

577.10 **BASIS OF PAYMENT**

577.10.01 **Light-Duty Sediment Barriers - Item**
Light-Duty Straw Bale Barriers - Item
Light-Duty Silt Fence Barriers - Item
Heavy-Duty Sediment Barriers - Item
Heavy-Duty Silt Fence Barriers - Item
Berm Barriers - Item
Sandbag Barriers - Item
Flow Check Dams - Item
Straw Bale Flow Check Dams - Item
Silt Fence Flow Check Dams - Item
Sandbag Flow Check Dams - Item

Rock Flow Check Dams - Item
Excavated Sediment Traps - Item
Chutes - Item
Dewatering Traps - Item
Turbidity Curtains - Item
Cofferdams - Item

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material required to do the work.

Progress payments for the temporary erosion and sediment control measures shall be made as follows:

- a) 50% for initial construction.
- b) 30% for maintenance.
- c) 20% for removal.

577.10.02 Sediment Removal - Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Material to do the work.

When the Contract Documents do not have a separate item for sediment removal, payment at the Contract price for the appropriate tender item for the installation of the sediment control measures shall be full compensation for all labour, Material, and Equipment to do the work of sediment removal.

Appendix 577 A, Commentary for OPSS 577, November 2006

Note: This appendix does not form part of the standard specification. It is intended to provide information to the designer on the use of this specification in a Contract.

Designer Action/Considerations

The designer should specify the following in the Contract Documents:

- Installation and removal times for temporary erosion and sediment control measures (577.07.02.04)
- Grading requirements for control measure removal. (577.07.14)
- Sediment removal measurement for payment. (577.09.01.06)

The designer should determine the following and, if they are required, the requirements should be included in the Contract Documents:

- The need for a chute. (577.07.02.02)
- The need to specify a specific light-duty sediment barrier. (577.07.03)
- The need for double rows of straw bales. (577.07.03.01)
- The need for a specific heavy-duty sediment barrier. (577.07.04)
- The need for a specific flow check dam. (577.07.05)
- Whether sediment removal is to be measured by volume or time. (577.09.01.06)

The designer should ensure that the Ontario Provincial Standards General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

OPSD 219.100	Light-Duty Straw Bale Barrier
OPSD 219.110	Light-Duty Silt Fence Barrier
OPSD 219.130	Heavy-Duty Silt Fence Barrier
OPSD 219.150	Sandbag Barrier
OPSD 219.180	Straw Bale Flow Check Dam
OPSD 219.190	Silt Fence Flow Check Dam
OPSD 219.200	Sandbag Flow Check Dam
OPSD 219.210	Temporary Rock Flow Check Dam V-Ditch
OPSD 219.211	Temporary Rock Flow Check Dam Flat Bottom Ditch
OPSD 219.220	Excavated Sediment Trap In Ditch
OPSD 219.230	Chute For Excavated Sediment Trap
OPSD 219.231	Berm Barrier
OPSD 219.240	Dewatering Trap
OPSD 219.260	Turbidity Curtain
OPSD 219.261	Turbidity Curtain Seam Detail

Environmental Impact Statement Report

APPENDIX E
Operational Statement

April 10, 2007

DFO-OGLA Review of Water Crossing Projects under the *Fisheries Act*.

The following position statement is intended to provide greater consistency and clarity in Fisheries and Oceans - Ontario-Great Lakes Area review and approval of water crossing projects under the *Fisheries Act*. The advice outlined in this document is similar to the advice provided in the Environmental Guidelines for Fish and Fish Habitat (Appendix 7a) (which is a supporting document to the *MTO/DFO/OMNR Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings*). This advice applies to all water crossing types (e.g. bridges culverts, open and closed bottom structures) and all waterbodies (creeks, streams, rivers, bays, narrows, wetlands etc.) in Ontario. This advice is intended as guidance and should be used in conjunction with the DFOs Risk Management Framework and related Operational Statements (<http://www.dfo-mpo.gc.ca/oceans-habitat>).

Water crossings have the potential to impact fish habitat and fish passage. For each water crossing project whether it is a replacement or a new installation, we have outlined various habitat impacts that should be considered before a management decision is made on a file. In addition, when reviewing these same projects fish passage impacts need to be considered and any requirements for fish passage should be linked to the fisheries management objectives.

DFO-OGLA Position

Water Crossing Modifications - Extensions

An authorization for the harmful alteration, disruption or destruction of fish habitat will typically not be required in instances where existing water crossings requiring minor *water crossing extensions* will be extended with a similar design or better and all of the following criteria can be met:

- The extension does not require channel realignment.
- The extension does not result in an infill.
- The footprint of the project is not placed on important habitat or areas of groundwater upwelling.
- The extension does not impede fish passage (e.g. velocity barrier due to crossing length) as per fisheries management objectives
- The extension does not cause destabilization of the upstream or downstream channel.

Water Crossing Modifications – Liners

An authorization for the harmful alteration, disruption or destruction of fish habitat will not be required for *water crossing liners* if all of the following criteria can be met:

- The liner does not impede fish passage as per fisheries management objectives
- The design does not destabilize the upstream or downstream channel.

Water crossing replacements – like for like design:

An authorization for the harmful alteration, disruption or destruction of fish habitat will typically not be required for *water crossing replacements* when the project meets all of the following conditions:

- There are no fish passage concerns with the existing crossing (e.g. perched crossing, undersized water crossing, velocity barrier where fish movement is required) and
- The crossing will be replaced with a similar or better design (e.g. from crossing with no substrate in the barrel to crossing with substrate to provide roughness).

Water crossing replacements – upgrades:

An authorization for the harmful alteration, disruption or destruction of fish habitat will not be required where *water crossing upgrades* meet all of the following conditions:

- The water crossing design has been improved to alleviate fish passage concerns by:
 - Increasing the culvert diameter or bridge span width
 - Embedding the water crossing to ensure fish passage

April 10, 2007

- Create a low flow channel to assist fish passage during low flow periods as required;
- Incorporating plunge pools for energy dissipation (as appropriate), etc.
- Ensuring the stream dynamics are not destabilized by the crossing.

Water Crossing Removal or Decommissioning:

An authorization for the harmful alteration, disruption or destruction of fish habitat will not be required for *water crossing removal or decommissioning*. Mitigation measures and best management practices should be applied on a case by case basis including stabilization of approach slopes with rip-rap, erosion blankets, etc and restoring the site to pre-construction conditions or better, etc.

New Crossings – Indirect Fish Habitat

An authorization for the harmful alteration, disruption or destruction of fish habitat will not be required for new water crossing installations on indirect fish habitat. In this case channel destabilization and sediment deposition on downstream fish habitat are the main concerns. The crossing size and erosion protection should be sufficient to prevent soil erosion at the crossing.

New Crossings – Low Sensitivity

An authorization for the harmful alteration, disruption or destruction of fish habitat will not be required for new water crossing installations on marginal fish habitat if the following criteria can be met:

- the water crossing spans the bankfull width (no infill on the stream channel);
- no channel realignment is required
- by ensuring that stream dynamics are not destabilized by the crossing.

New Crossings – Moderately Sensitive

An authorization for the harmful alteration, disruption or destruction of fish habitat will not be required for new water crossing installations on important fish habitat if the following criteria can be met:

- no channel realignment is required
- no infilling on moderately important fish habitat (e.g. pike spawning habitat, floodplain fish passage use)
- water crossing spans bankfull width including the placement of abutments, footings or armouring
- stream dynamics are not destabilized by the crossing.
- fish passage is maintained during operation and life of the water crossing as per fisheries management objectives.

New Crossings – Highly Sensitive/Critical Fish Habitat

An authorization for the harmful alteration, disruption or destruction of fish habitat will not be required for new water crossing installations on highly sensitive or critical fish habitat if the following criteria can be met:

- no channel realignment is required
- no infilling on highly sensitive or critical fish habitat (see definitions below)
- water crossing spans bankfull width including the placement of abutments, footings or armouring
- stream dynamics are not destabilized by the crossing
- fish passage is maintained during operation and life of the water crossing as per fisheries management objectives.

Note: If your project is in an area with Species at Risk – refer to SARA Section next page

Additional Considerations:

- Water crossing risk may be elevated due to lengthy in-water work periods since this could be considered a "harmful" disruption
- Permanent fill in the bankfull channel (refer to definitions below) that impacts fish passage may be unacceptable and should be assessed against fisheries management objectives

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- Infilling moderately and highly sensitive fish habitat for abutments and approaches may require an Authorization.
- Cumulative effects should be considered where appropriate
- No fill/footprint should occur on important, highly sensitive (unique) or "critical" habitat.
- Avoid placing the crossing/fill footprint on groundwater upwellings that are used for spawning. Relocate the crossing to a more suitable area or redesign the crossing to an open-bottom structure of sufficient size to maintain spawning bed size material within the water crossing structure to mitigate the impacts.
- Changes in channel morphology may harmfully alter, disrupt, or destroy fish habitat (e.g. change in bankfull cross-section, loss of thalweg, loss of undercut banks, water depth, pools).

Species at Risk Act

- Ensure that any Letters of Advice (LOAs) and *Fisheries Act* Authorizations issued by DFO are in compliance with the *Species at Risk Act* (SARA):
 - For LOAs and *Fisheries Act* Authorizations: ensure compliance with Sections 32, 33 and 58 of SARA to ensure protection of Schedule 1 Species at Risk (mussels and fish) (Extirpated, Endangered, and Threatened species). For example closed bottom culverts may need to be redesigned to open bottom full spanning structures or the crossing may need to be relocated to another site.
 - For projects requiring a CEAA review: Ensure that all Schedule 1 SAR species (including Special Concern species) are protected under Section 79 of SARA. In addition, formal notification to other competent Ministers is required if there are potential impacts to non-aquatic SAR.
 - SARA permits may also be required for a water crossing project. Ensure that the appropriate SARA permits are obtained prior to any in-water works.
- Ensure that fish passage for Schedule 1 Species at Risk is maintained.

Best Management Practices

- Avoid building on meander bends, braided streams or alluvial fans or other areas that are inherently unstable
- Adhere to standard "best management practices" for in-water work, and for sediment and erosion control.
- Fish passage is most easily maintained when the water crossing design maintains natural stream processes within or under the crossing. This is referred to as 'stream simulation design', which is based on the premise that the simulated channel inside the crossing presents no more of a challenge to movement of organisms than the adjacent natural channel. Water crossing length typically should not be a concern if the water crossing is sized appropriately for fish passage.
- Construction should be completed in the dry, when there is no flow in the channel, or by use of a by-pass channel, dam and pump or other construction techniques, unless it is determined that working in the wet is appropriate.
- Follow the in-water work timing guidelines determined by OMNR.

Key Mitigation Measures:

- Water crossings should be backfilled with substrate material that is consistent with the existing substrate size and texture found within the watercourse and will remain in/under the crossing. (Note that the water crossing needs to be sized sufficiently to prevent it from being scoured out).
- Embed water crossings as appropriate to ensure fish passage and channel crossing stability.
- If fish passage is required during low flows, ensure that a low flow channel is maintained through the crossing, even for bridges.
- Fish passage should be maintained through the water crossing at high and/or low flows, as dictated by the fisheries management objectives.
- The natural stream gradient should be maintained upstream, downstream and through the water crossing.

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- Water depth within the water crossing should be not less than 20 cm or the same depth as the natural channel especially during low flows.
- Fish passage will be maintained during operation and life of the water crossing as per fisheries management objectives;
- Work during low flow conditions and avoid work during large precipitation/runoff events.

Definitions

Sensitive fish species

Includes Species at Risk (as per Schedules 1 to 3 of *Species at Risk Act*) and other fishes that have specialized or limiting habitat requirements (e.g. brook trout, lake trout, lake sturgeon and muskellunge)

Indirect Fish Habitat

Areas that do not directly support fish and the main function of the watercourse is to convey flow, food and nutrients to downstream fish habitat.

Fish habitat – Low Sensitivity

Fish habitat areas with limited use by fish for feeding, growth, migration, and spawning. These habitat areas require less protection because they have a low productive capacity and contribute marginally to fish production. Changes to these areas will not result in a loss of productive capacity of fish habitat.

Fish habitat – Moderately Sensitive

Those habitat areas utilized by fish for feeding, growth and migration which, while important to the fish stock, are not considered critical. These can include spawning areas for species with non-stringent spawning requirements, such as yellow perch or gravel areas for smallmouth bass. Areas in this category usually contain a relatively large amount of similar habitat that is readily available to the stock (e.g. areas with aquatic vegetation in water bodies with an abundant supply of aquatic vegetation). Small scale changes to these areas will typically not result in a loss of productive capacity of fish habitat.

Fish habitat – Highly Sensitive/Critical

Those habitat areas which are needed to maintain the overall productive capacity of the fishery. These can include spawning areas for fish species with stringent spawning requirements, such as cobble areas for walleye and lake trout, ground water upwelling areas for brook trout; highly productive nursery and feeding areas such as wetlands; areas with Species at Risk, essential refuges areas such as winter refugium for brook trout in small streams; habitats that cannot be replaced or compensated for, such as ground water upwellings, and migration routes which provide access to spawning areas for fish species with stringent spawning requirements (e.g. brook trout). These include habitat types that are relatively rare or sensitive to disturbance (e.g. areas with aquatic vegetation in water bodies with a limited supply of aquatic vegetation). Alterations in these areas will result in a loss of productive capacity of fish habitat.

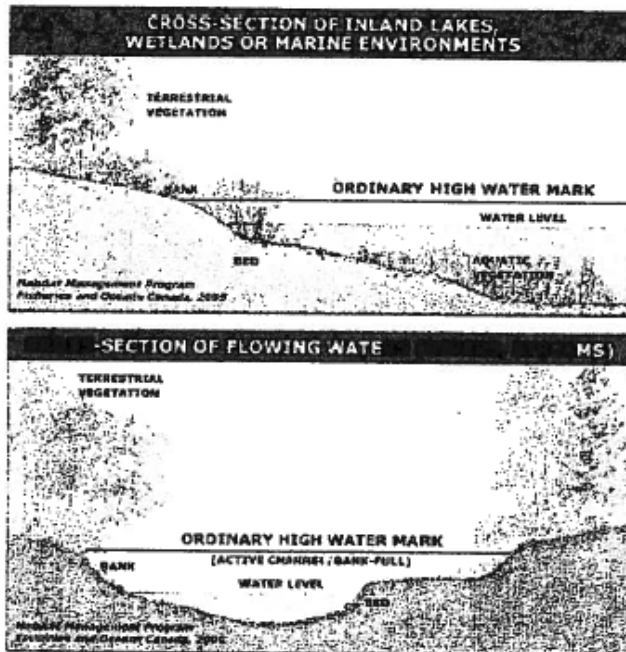
Critical Habitat: includes habitat for Species at Risk as defined under the Act. "Critical habitat means habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species "critical habitat" in the recovery strategy or in an action plan for the species". Critical habitat can also apply to other species if the habitats are limiting or sensitive to disturbance.

Bankfull (Ordinary High Water Mark)

In alluvial streams, bankfull stage (i.e., elevation on the bank) is associated with the flow that just fills the channel to the top of its banks and at a point where the water begins to overflow onto a floodplain (Rosgen 1996). In DFO's Operational Statements (http://www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/prov-terr/on/index_e.htm) we have also defined this level as the ordinary high water mark (refer to figure below). These are the flows during bankfull stage that are typically considered to be channel forming (i.e., this is when the most 'work' is performed on the

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channel with respect to erosion, deposition and sediment transport). In streams flowing through channels that are affected by bedrock, roots and woody material, large glacial deposits etc., an equivalent to the bankfull stage (that the trim line depth) is identified as the upper limit of a regularly scoured zone and a distinct change in vegetation. natural streams bankfull flow typically occurs with a return frequency of about 1:2 years. However, urban streams may exhibit bankfull flows more frequently.



Stream Simulation is a design process to create natural stream processes within a water crossing. It is based on the principal that if a fish can migrate through the natural channel, they can also migrate through a human-made channel that simulates the stream channel. As a result, sediment transport, fish passage, flood and debris conveyance within the water crossing are intended to function as they would in a natural channel. Taking this approach eliminates the need to consider such parameters as target species, timing of migration, and fish-passage hydrology because it simply mimics what already exists. As a result, fish passage is typically addressed.

Water crossings designed for stream simulation are sized wider than the channel width and the bed inside the water crossing is sloped at a similar or greater gradient than the adjacent stream reach. These culverts are lined at the bottom with boulder/cobble mix that resists erosion and is unlikely to change grade unless specifically designed to do so. This fill material is placed to mimic a stream channel and allowed to adjust in minor ways to changing conditions. Stream simulation design culverts are usually the preferred alternative for steep channels and long water crossings. (Washington Department of Fish and Wildlife. 2003. Design of Road Culverts for Fish Passage.)

Fisheries Management Objective – the fish species or community that OMNR is managing for below and above the water crossing. Sometimes a water crossing that is a barrier to upstream fish migration enables a fisheries management objective to be met such as maintaining a viable brook trout population upstream of the crossing by blocking upstream migration of species such as Pacific salmon or rainbow trout. Don't forget to comment OMNR.

Wainfleet Wind Energy Project: Study Area Map for Renewable Energy Approval (REA) Consultation Purposes

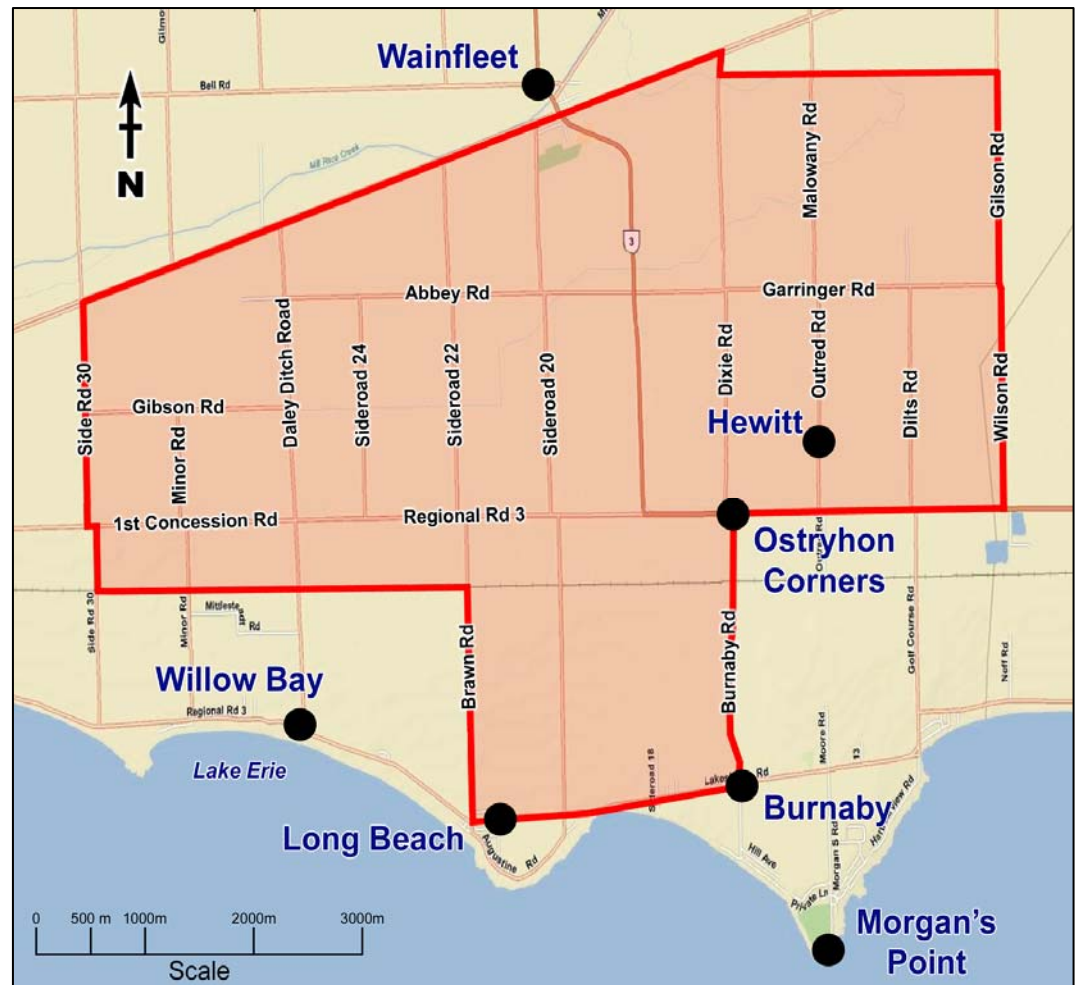
The proposed Wainfleet Wind Energy Project is located in south-western Ontario, in the Township of Wainfleet, in Niagara Region. The Study Area is located south of the community of Wainfleet, north of the communities of Burnaby and Long Beach, and the community of Ostryhon Corners is located within the Study Area.

More specifically, the Study Area is bound by:

- Side Road 30
- CNR Rail Line
- Brawn Line Road
- Lakeshore Road
- Burnaby Road
- Regional Road #3 (Corners Road)
- Wilson Road

The landscape of the Study Area consists of an area of approximately 3400ha and is generally agricultural in land use. Project components will be installed on privately-owned agricultural lots within the study area. The land inside the project area is mostly flat, with an elevation of 174 m to 182 m above mean sea level. Within the study area, streams are relatively small, some only seasonal. No major rivers are found in the study area.

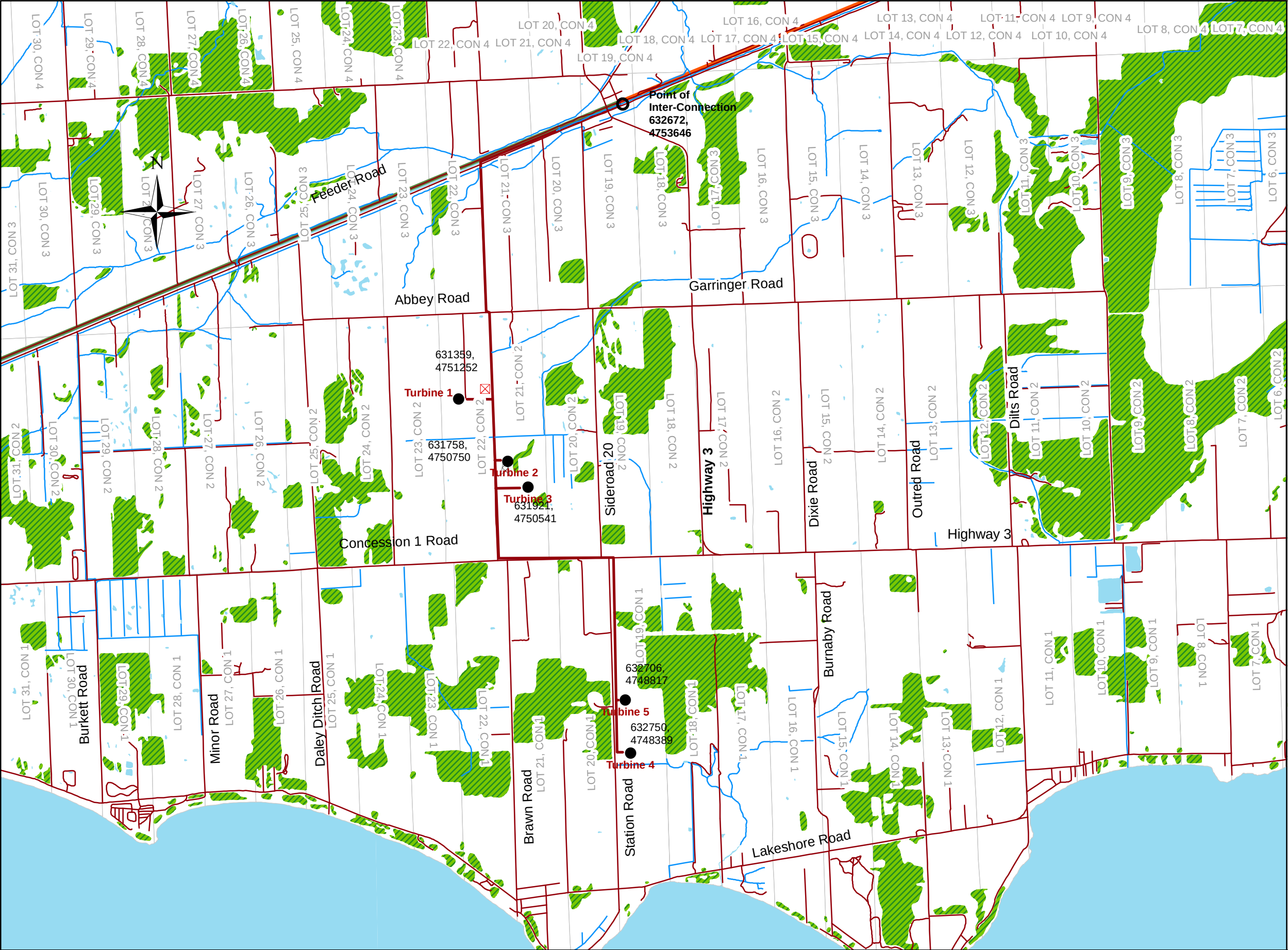
There are some large drains in which water remains year round. All wind turbines are to be placed in open agricultural fields within the required setbacks from residences, natural heritage, water, and other features required under the REA. Most of these fields are tilled and planted seasonally with crops such as corn, oats, and soybeans. Field sizes vary considerably. The landscape is fragmented with open fields, roads, fences, planted crops and vegetation, and settlement areas. There are few woodlots in and around the project location. The diversity of tree species is relatively low.



***Black dots on map indicate locations of communities not turbine locations.**

Wainfleet Wind Energy Project Area

Draft
26-Nov-10



Legend

- Roads
- Streams
- Switching Station
- Tap Line 27.6 kV
- Turbines
- MetTower
- Distribution 31M2 27.6kV
- Distribution 41M13 27.6kV
- Forests
- Lots
- Lakes

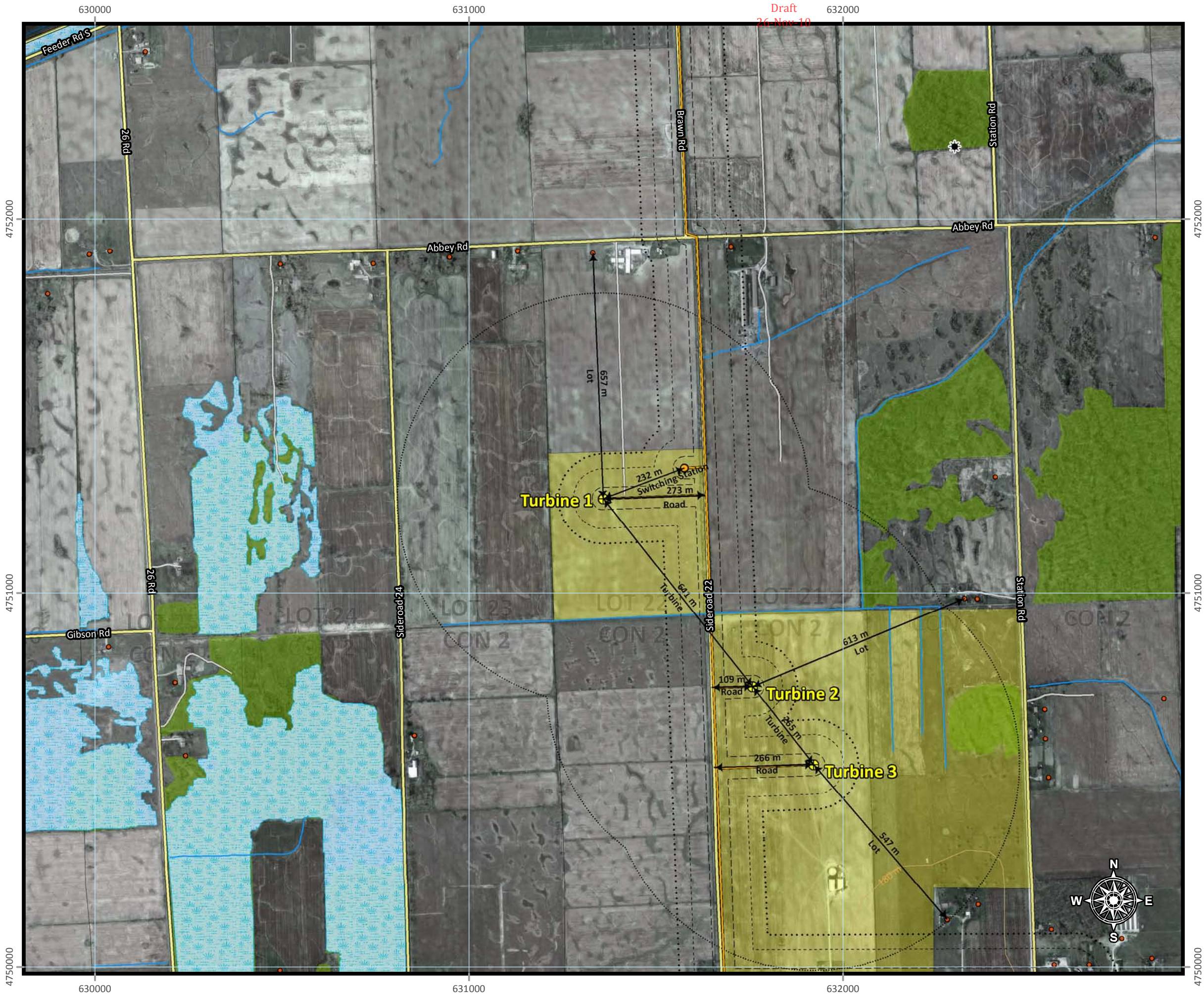


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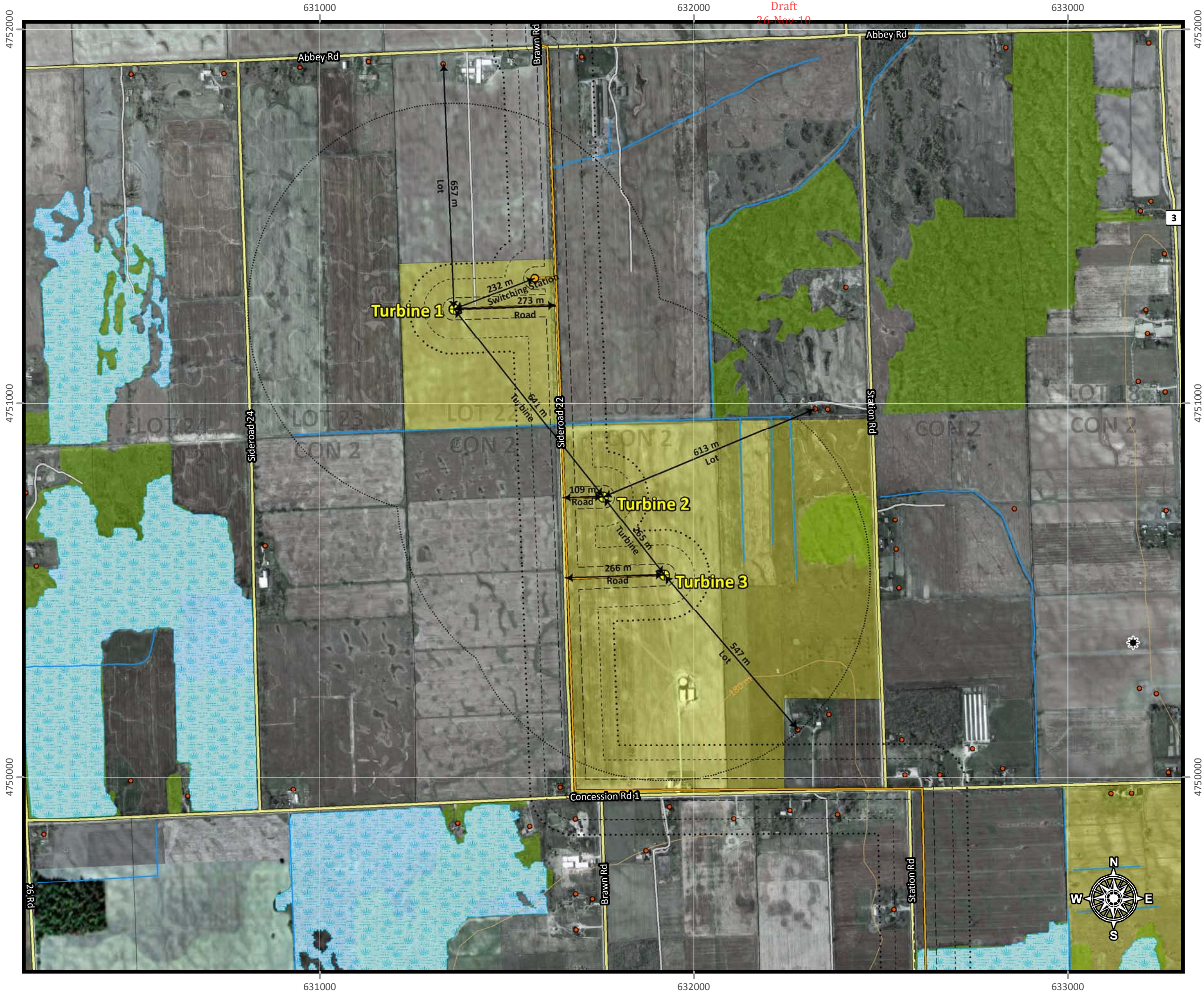
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Created by Geoff Bell, IPC Energy
Version 4
August 27, 2010

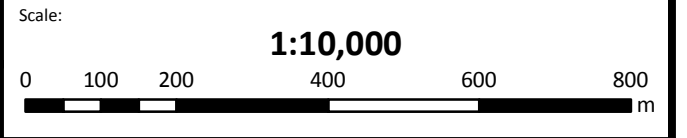


- Wind Turbines - Switching Station - Tap Line 30 m setback 80 m setback 120 m setback 550 m setback - Optioned Properties - Lots	- Noise Receptors - Airports - Meteorological Tower - Oil, Gas, Salt Resource - Paved Road - Unpaved Road - Watercourses - Elevation Contours - Provincially Significant Wetlands - Significant Woodlots
Produced by Morrison Hershfield September 2010. All frames: North American Datum 1983, Universal Transverse Mercator Projection, Zone 17N.	
1:400,000	
mh MORRISON HERSHFIELD	
Scale: 1:10,000	
Project: WAINFLEET WIND ENERGY PROJECT	
Title: Proposed Wind Turbines Site Plan Landuse in Proximity to Turbine 1	
Project No.: 1104036	Drawing No.: Figure No. 2
Date: September 9, 2010	



Wind Turbines	Noise Receptors
Switching Station	Airports
Tap Line	Meteorological Tower
30 m setback	Oil, Gas, Salt Resource
80 m setback	Paved Road
120 m setback	Unpaved Road
550 m setback	Watercourses
Optioned Properties	Elevation Contours
Lots	Provincially Significant Wetlands
	Significant Woodlots

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Universal Transverse Mercator Projection, Zone 17N.



Project:
WAINFLEET WIND ENERGY PROJECT

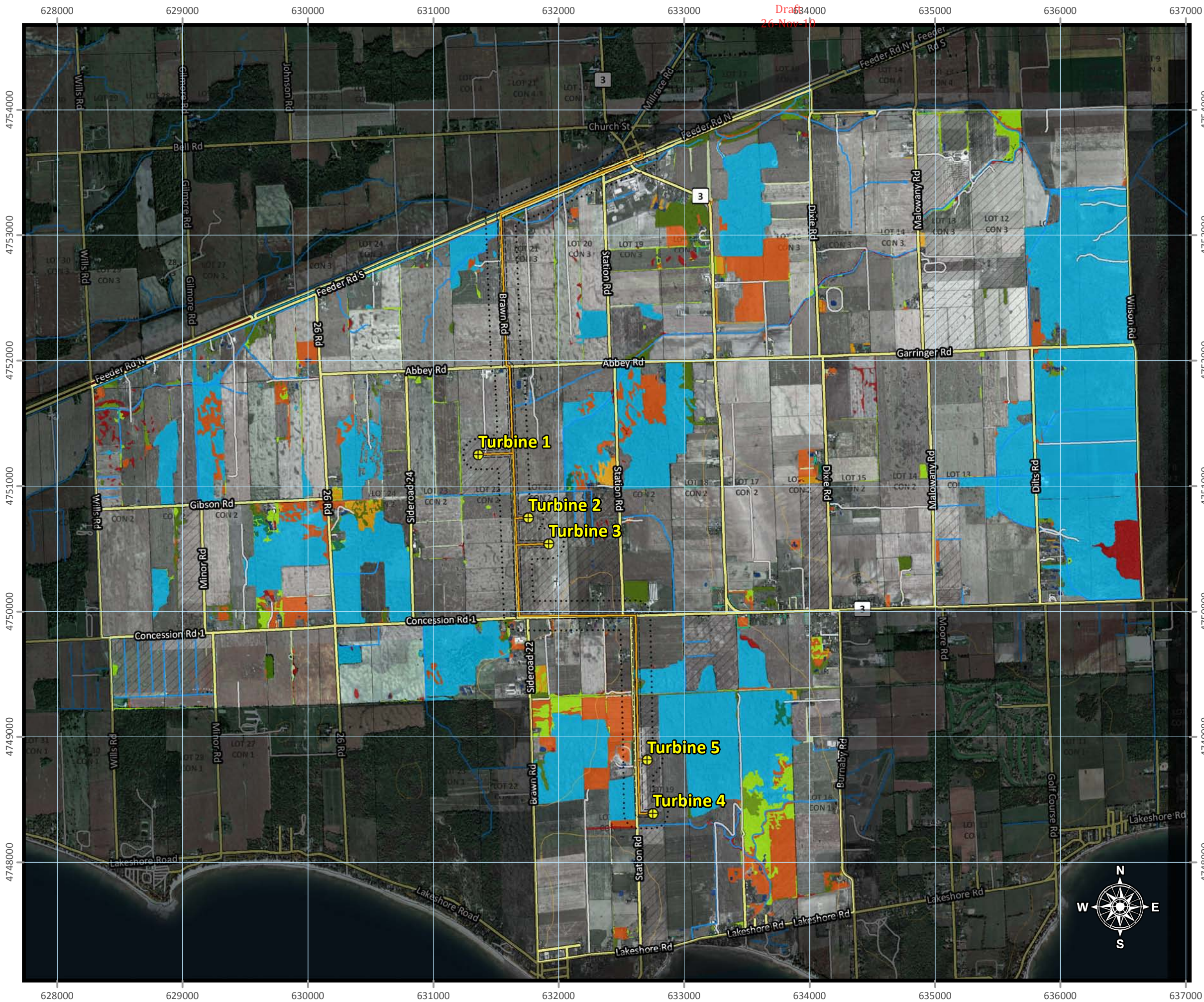
Title:
**Proposed Wind Turbines Site Plan
Landuse in Proximity to Turbine 2**

Project No.:
1104036

Drawing No.:
Figure No. 3

Date:
September 9, 2010

Date:
September 9, 2010

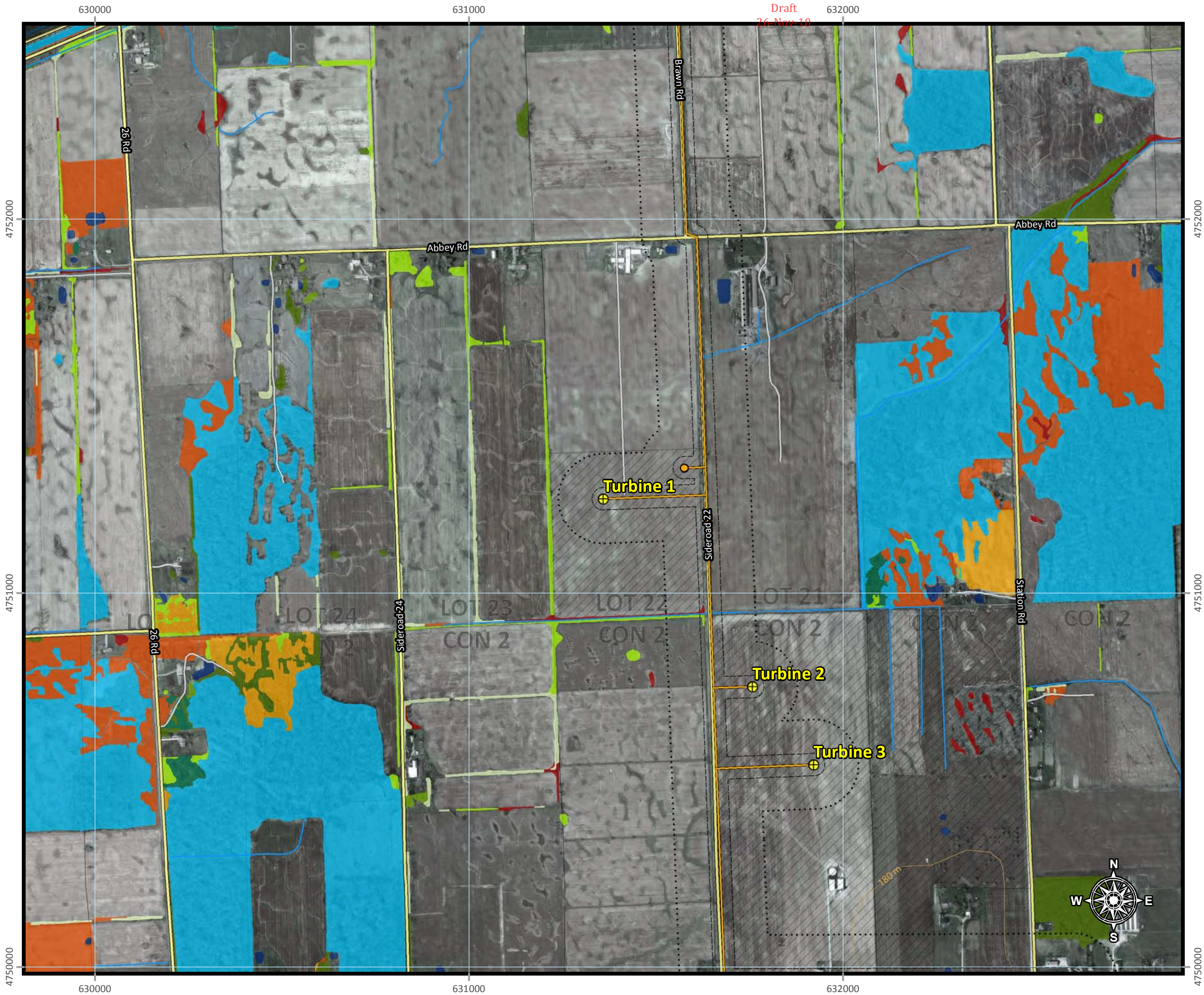


Wind Turbines	Ecological Communities
Switching Station	Coniferous Forest
Tap Line	Coniferous Hedgerow
30 m setback	Deciduous Forest
120 m setback	Deciduous Woodland
Paved Road	Deciduous Thicket
Unpaved Road	Deciduous Hedgerow
Elevation Contours	Meadow (Community Complex)
Watercourses	Mixed Meadow
Optioned Properties	Treed Agriculture
Lots	Open Aquatic
	Wetland (System)
	Swamp (Community Class)

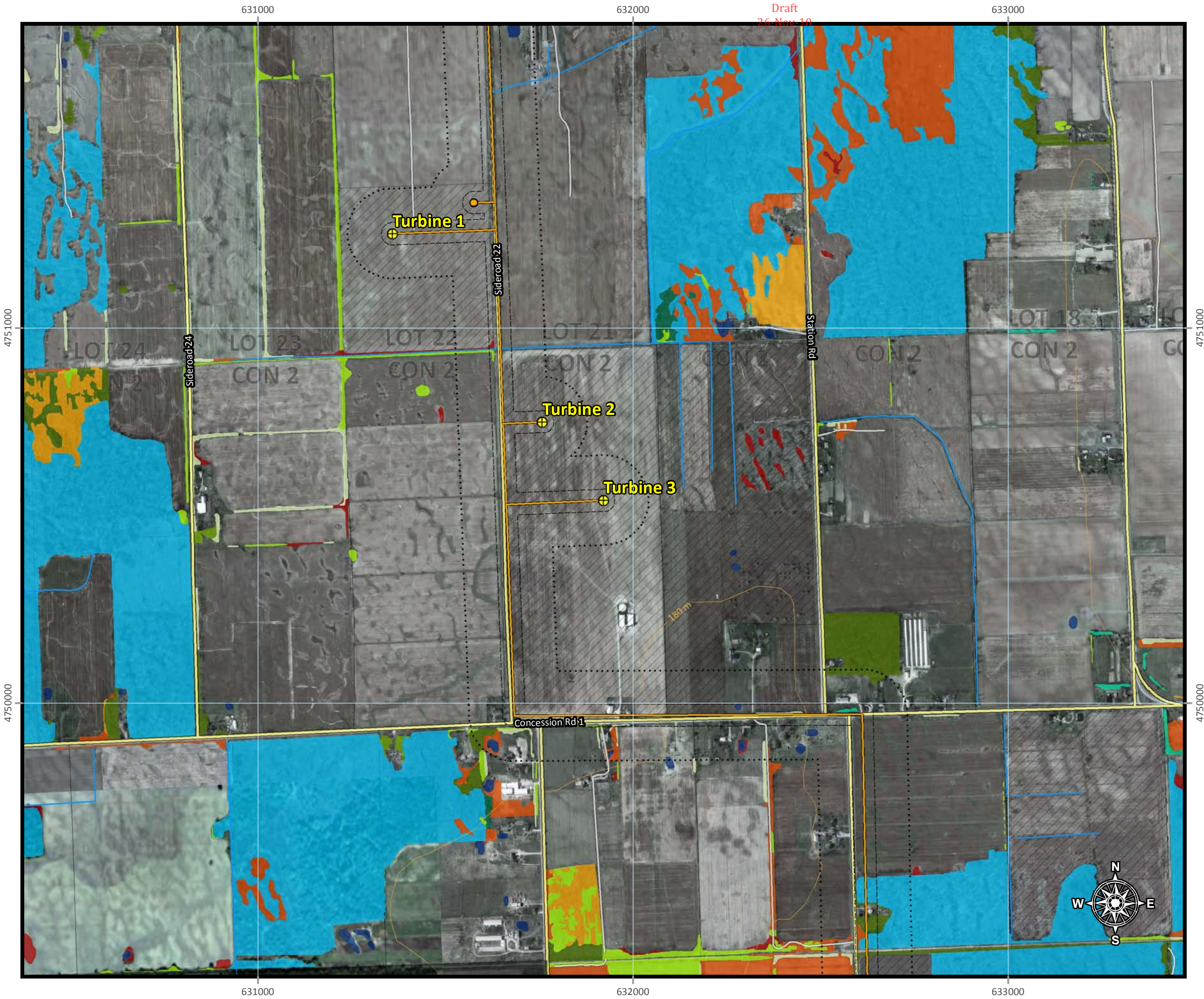
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All frames: North American Datum 1983,
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Project: WAINFLEET WIND ENERGY PROJECT	
Title: Proposed Wind Turbines Site Plan Ecological Land Classification (NPCA)	
Project No.: 1104036	Drawing No.: Figure No. 13
	Date: September 9, 2010

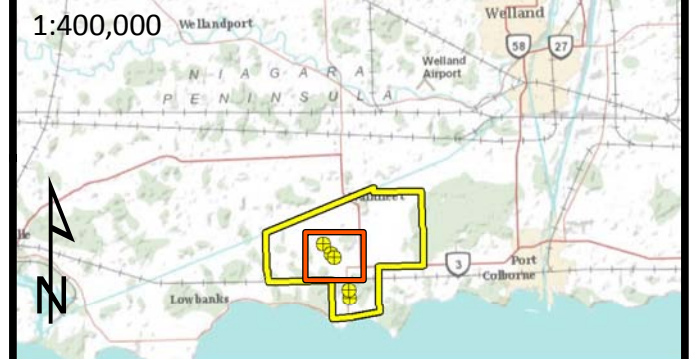


- Wind Turbines - Switching Station - Tap Line 30 m setback 120 m setback - Paved Road - Unpaved Road - Elevation Contours - Watercourses - Optioned Properties - Lots	Ecological Communities - Coniferous Forest - Coniferous Hedgerow - Deciduous Forest - Deciduous Woodland - Deciduous Thicket - Deciduous Hedgerow - Meadow (Community Complex) - Mixed Meadow - Treed Agriculture - Open Aquatic - Wetland (System) - Swamp (Community Class)
Produced by Morrison Hershfield August 2010. All frames: North American Datum 1983, Universal Transverse Mercator Projection, Zone 17N.	
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Project: WAINFLEET WIND ENERGY PROJECT	
Title: Proposed Wind Turbines Site Plan ELC in Proximity to Turbine 1	
Project No.: 1104036	Drawing No.: Figure No. 14
	Date: September 9, 2010



Wind Turbines	Ecological Communities
Switching Station	Coniferous Forest
Tap Line	Coniferous Hedgerow
30 m setback	Deciduous Forest
120 m setback	Deciduous Woodland
Paved Road	Deciduous Thicket
Unpaved Road	Deciduous Hedgerow
Elevation Contours	Meadow (Community Complex)
Watercourses	Mixed Meadow
Optioned Properties	Treed Agriculture
Lots	Open Aquatic
	Wetland (System)
	Swamp (Community Class)

Produced by Morrison Hershfield August 2010.
All frames: North American Datum 1983,
Universal Transverse Mercator Projection, Zone 17N.



Project:

WAINFLEET WIND ENERGY PROJECT

Title:

**Proposed Wind Turbines Site Plan
ELC in Proximity to Turbine 3**

Project No.:

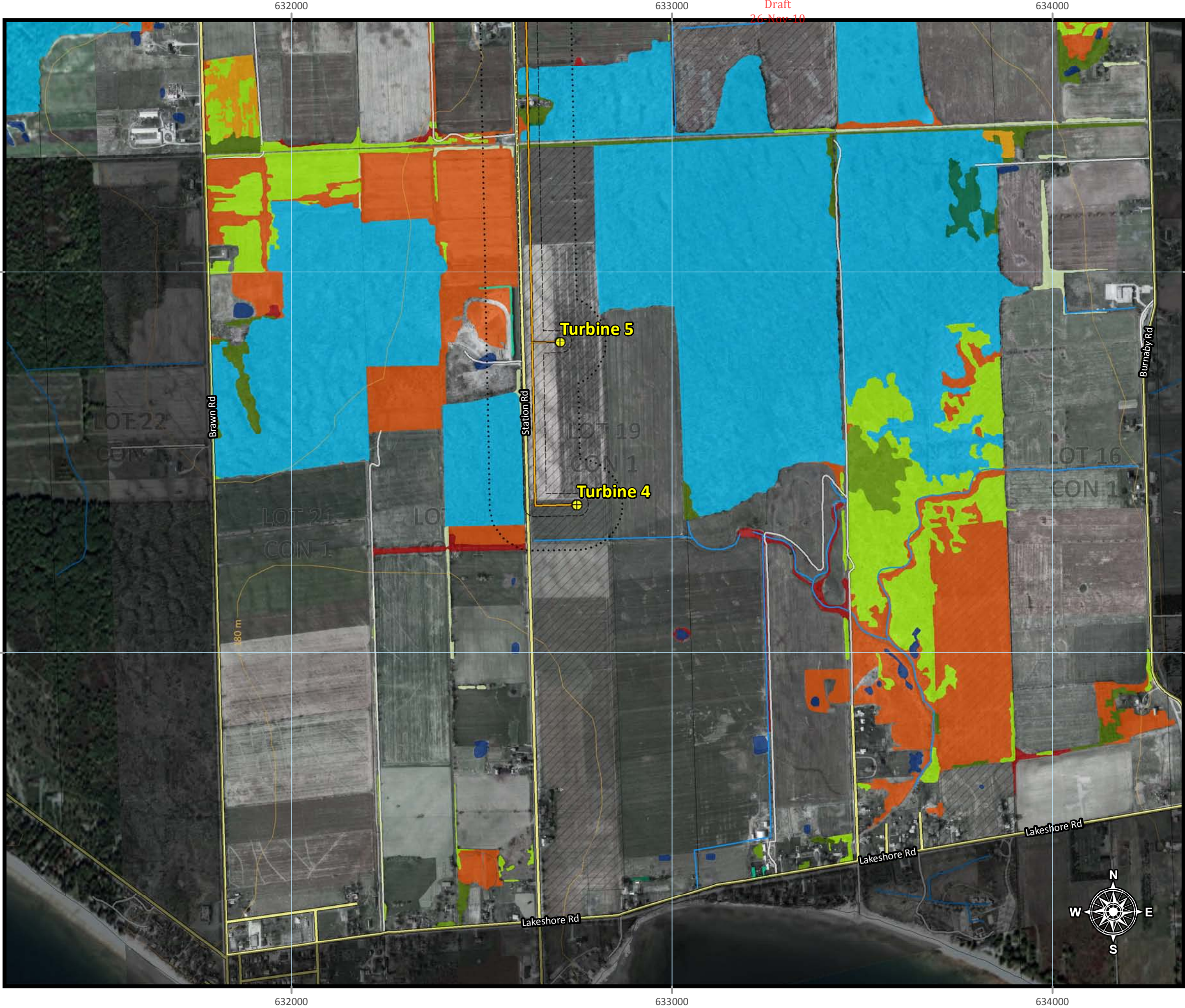
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Drawing No.:

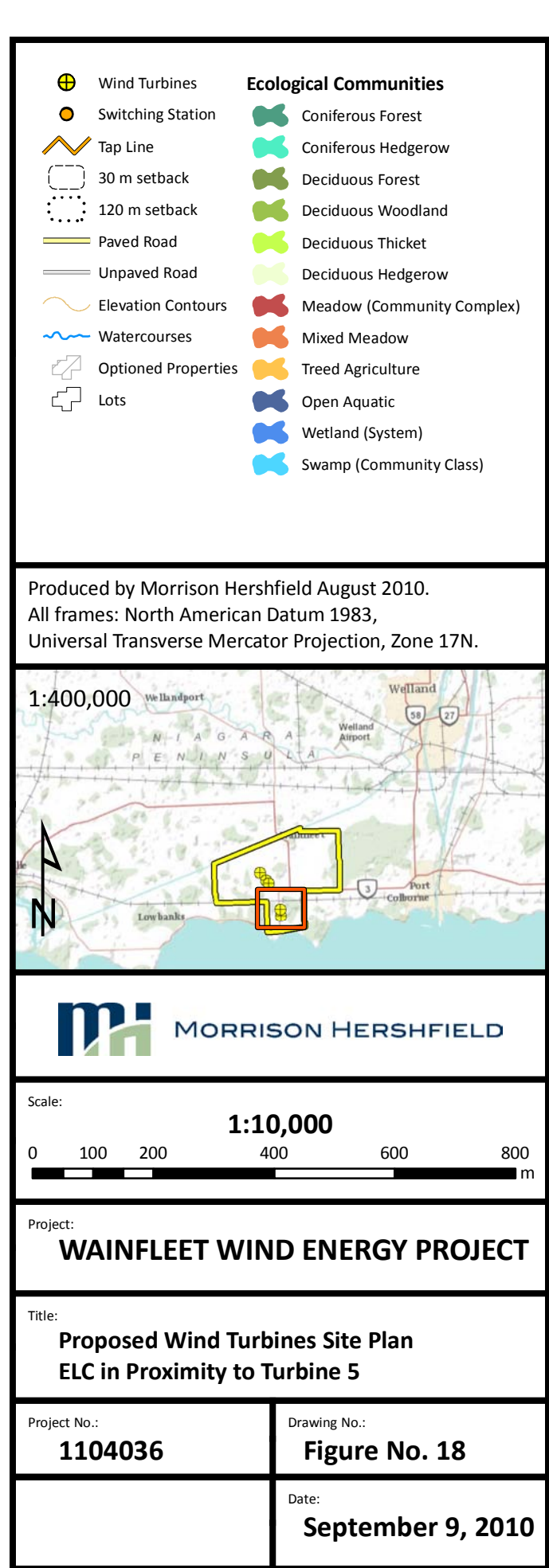
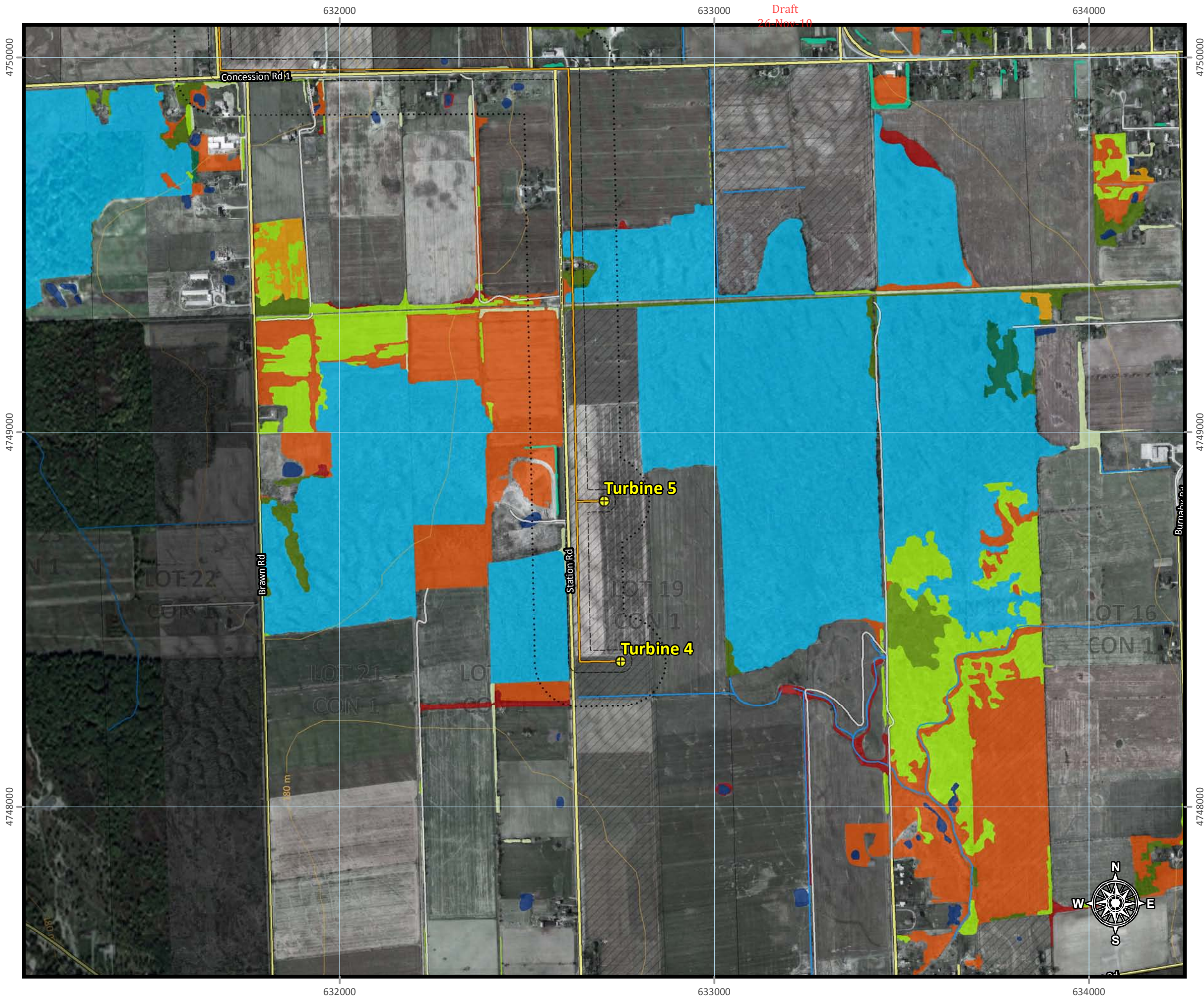
Figure No. 16

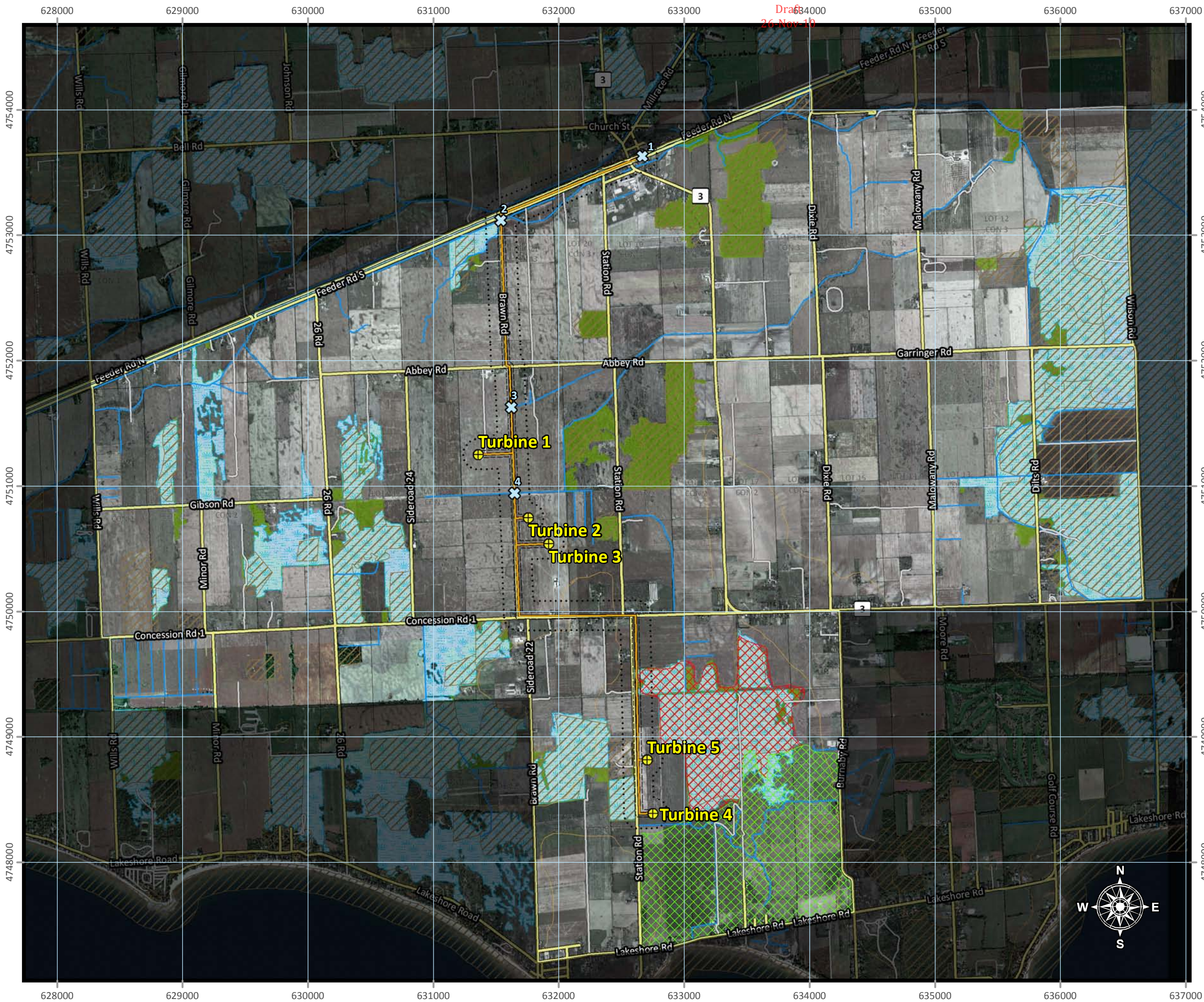
Date:

September 9, 2010



- Wind Turbines - Switching Station - Tap Line 30 m setback 120 m setback - Paved Road - Unpaved Road - Elevation Contours - Watercourses - Optioned Properties - Lots	Ecological Communities - Coniferous Forest - Coniferous Hedgerow - Deciduous Forest - Deciduous Woodland - Deciduous Thicket - Deciduous Hedgerow - Meadow (Community Complex) - Mixed Meadow - Treed Agriculture - Open Aquatic - Wetland (System) - Swamp (Community Class)
Produced by Morrison Hershfield August 2010. All frames: North American Datum 1983, Universal Transverse Mercator Projection, Zone 17N.	
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Project: WAINFLEET WIND ENERGY PROJECT	
Title: Proposed Wind Turbines Site Plan ELC in Proximity to Turbine 4	
Project No.: 1104036	Drawing No.: Figure No. 17
Date: September 9, 2010	





	Wind Turbines		Elevation Contours
	Switching Station		Watercourses
	Tap Line		Wildlife Habitat: Waterfowl Stop Over and Staging Area
	30 m setback		Wildlife Habitat: Wild Turkey Range
	120 m setback		Wildlife Habitat: Deer Wintering Area
	Paved Road		Provincially Significant Wetlands
	Unpaved Road		Significant Woodlots
	Water Crossings		
	Lots		

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Universal Transverse Mercator Projection, Zone 17N.

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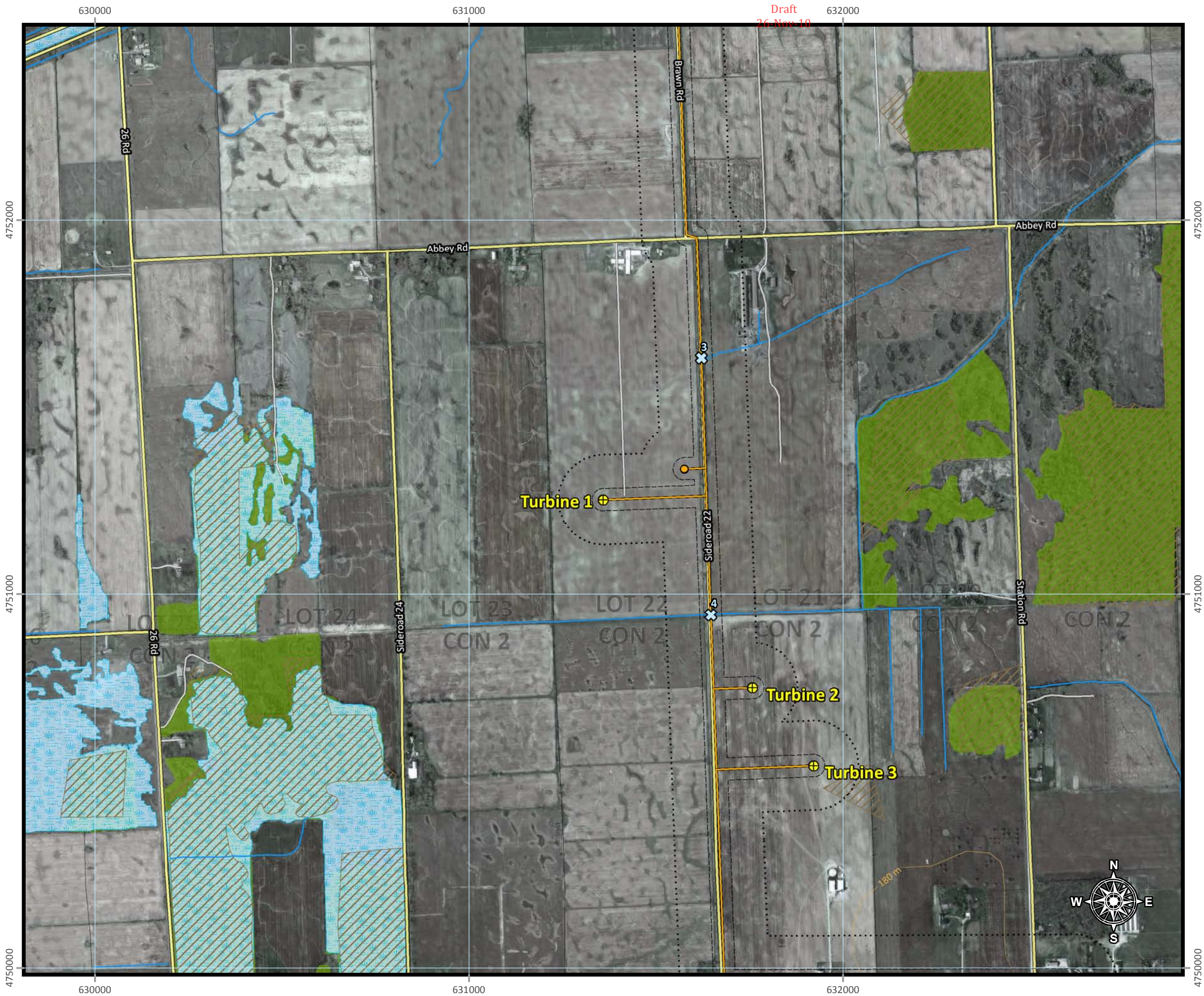
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Project: **WAINFLEET WIND ENERGY PROJECT**

Title: **Proposed Wind Turbines Site Plan
Natural Heritage Features**

Project No.: 1104036	Drawing No.: Figure No. 7
	Date: September 9, 2010



Wind Turbines	Elevation Contours
Switching Station	Watercourses
Tap Line	Wildlife Habitat: Waterfowl Stop Over and Staging Area
30 m setback	Wildlife Habitat: Wild Turkey Range
120 m setback	Wildlife Habitat: Deer Wintering Area
Paved Road	Provincially Significant Wetlands
Unpaved Road	Significant Woodlots
Water Crossings	
Lots	

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All frames: North American Datum 1983,
Universal Transverse Mercator Projection, Zone 17N.



Project:

WAINFLEET WIND ENERGY PROJECT

Title:

**Proposed Wind Turbines Site Plan
Natural Features in Proximity to Turbine 1**

Project No.:

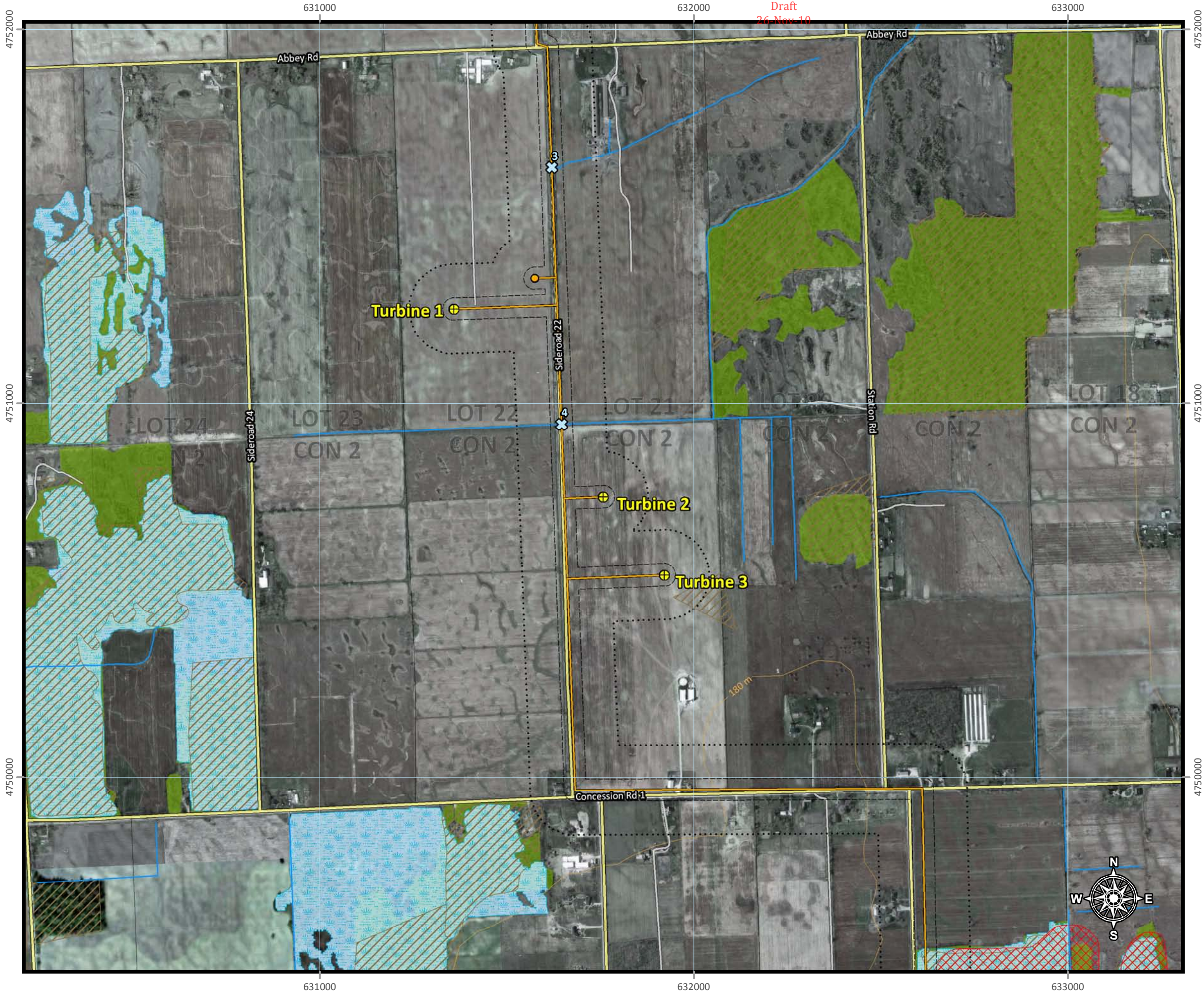
1104036

Drawing No.:

Figure No. 8

Date:

September 9, 2010



Draft
26-Nov-10

Wind Turbines	Elevation Contours
Switching Station	Watercourses
Tap Line	Wildlife Habitat: Waterfowl Stop Over and Staging Area
30 m setback	Wildlife Habitat: Wild Turkey Range
120 m setback	Wildlife Habitat: Deer Wintering Area
Paved Road	Provincially Significant Wetlands
Unpaved Road	Significant Woodlots
Water Crossings	
Lots	

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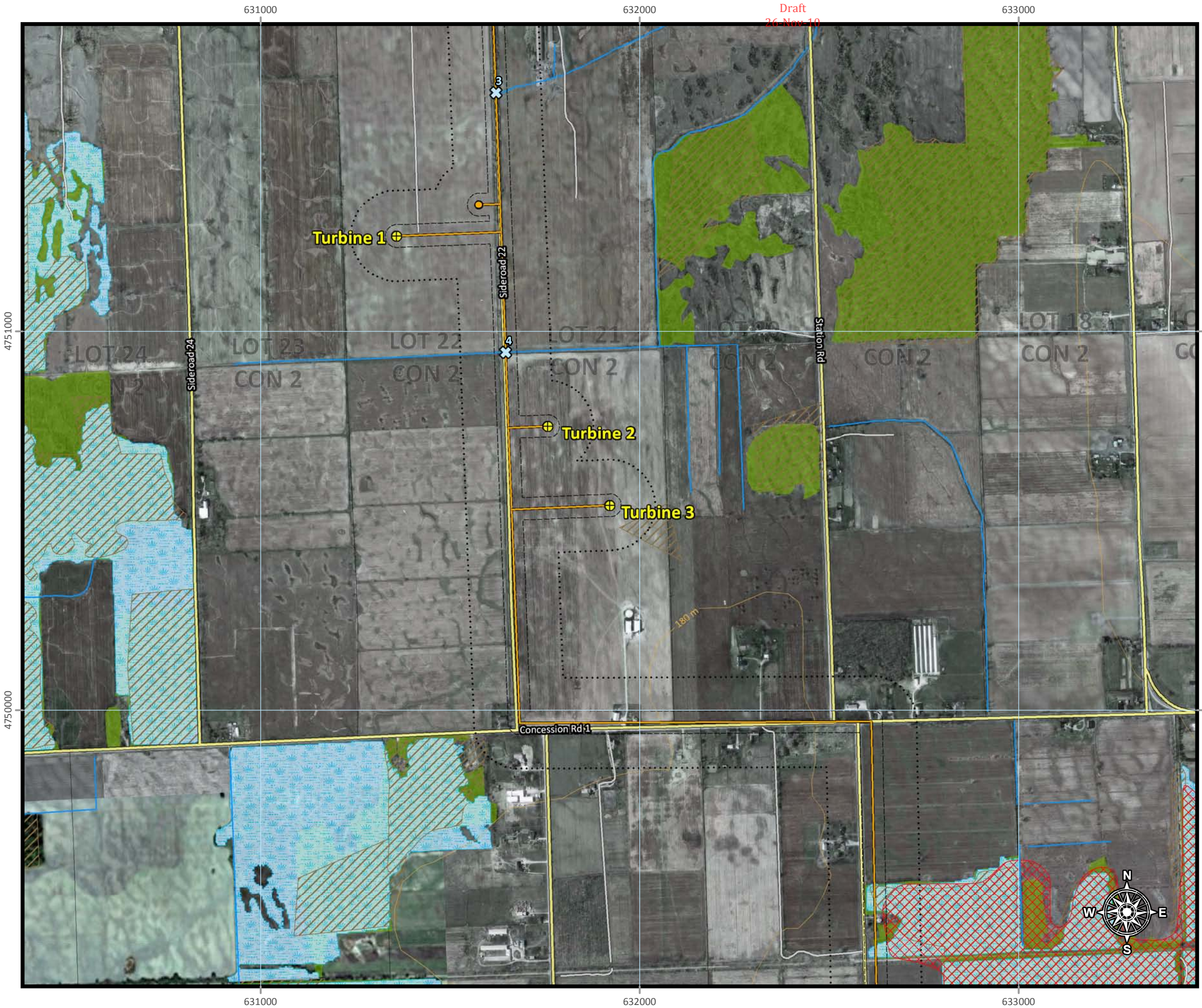
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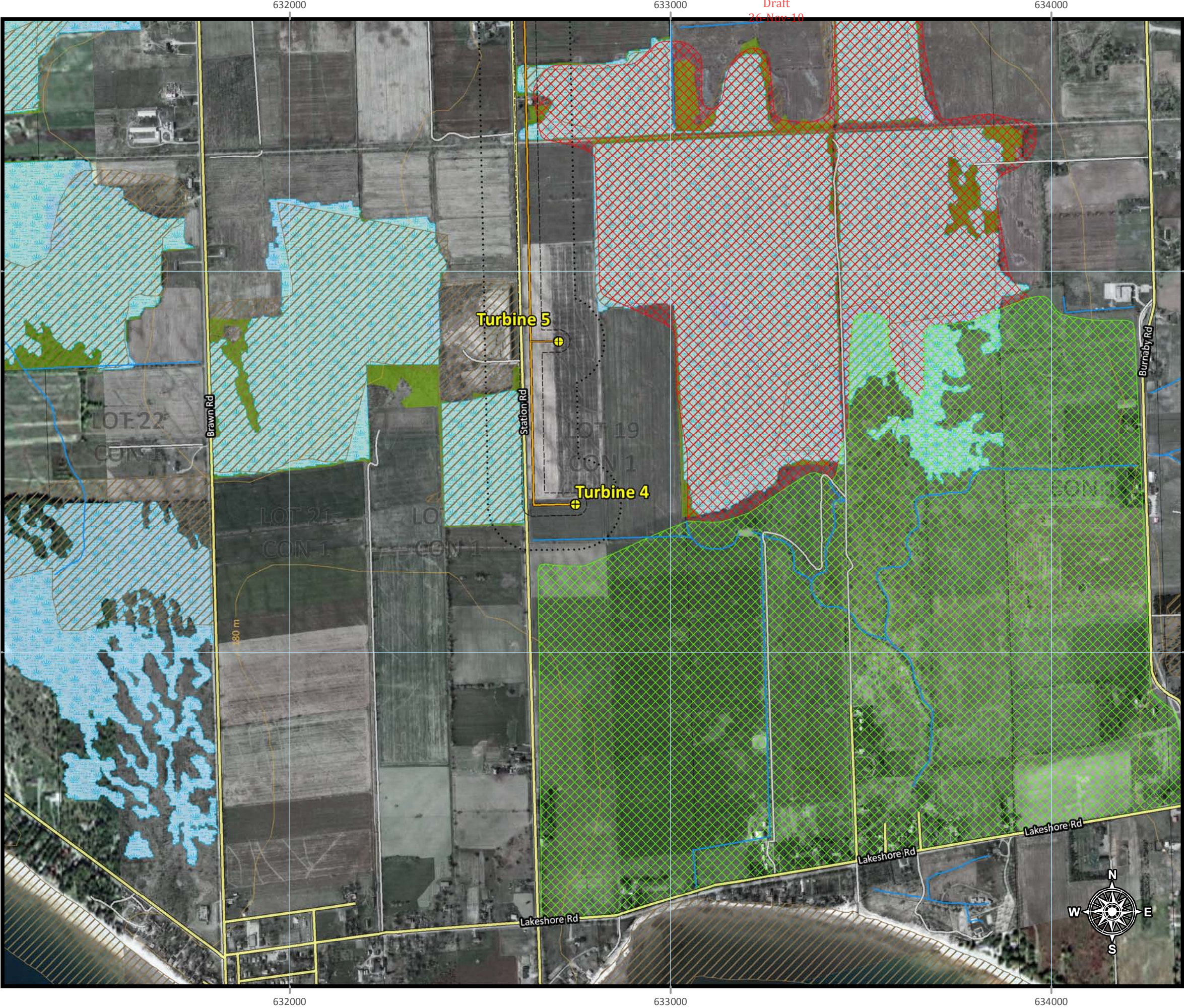
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Natural Features in Proximity to Turbine 2**

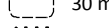
Project No.: 1104036	Drawing No.: Figure No. 9
	Date: September 9, 2010



Draft
26-Nov-10

- Wind Turbines - Switching Station - Tap Line 30 m setback 120 m setback - Paved Road - Unpaved Road - Water Crossings - Lots	- Elevation Contours - Watercourses - Wildlife Habitat: Waterfowl Stop Over and Staging Area - Wildlife Habitat: Wild Turkey Range - Wildlife Habitat: Deer Wintering Area - Provincially Significant Wetlands - Significant Woodlots
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Scale: 1:10,000 0 100 200 400 600 800 m	
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Title: Proposed Wind Turbines Site Plan Natural Features in Proximity to Turbine 3	
Project No.: 1104036	Drawing No.: Figure No. 10
Date: September 9, 2010	



 Wind Turbines	 Elevation Contours
 Switching Station	 Watercourses
 Tap Line	 Wildlife Habitat: Waterfowl Stop Over and Staging Area
 30 m setback	 Wildlife Habitat: Wild Turkey Range
 120 m setback	 Wildlife Habitat: Deer Wintering Area
 Paved Road	 Provincially Significant Wetlands
 Unpaved Road	 Significant Woodlots
 Water Crossings	
 Lots	

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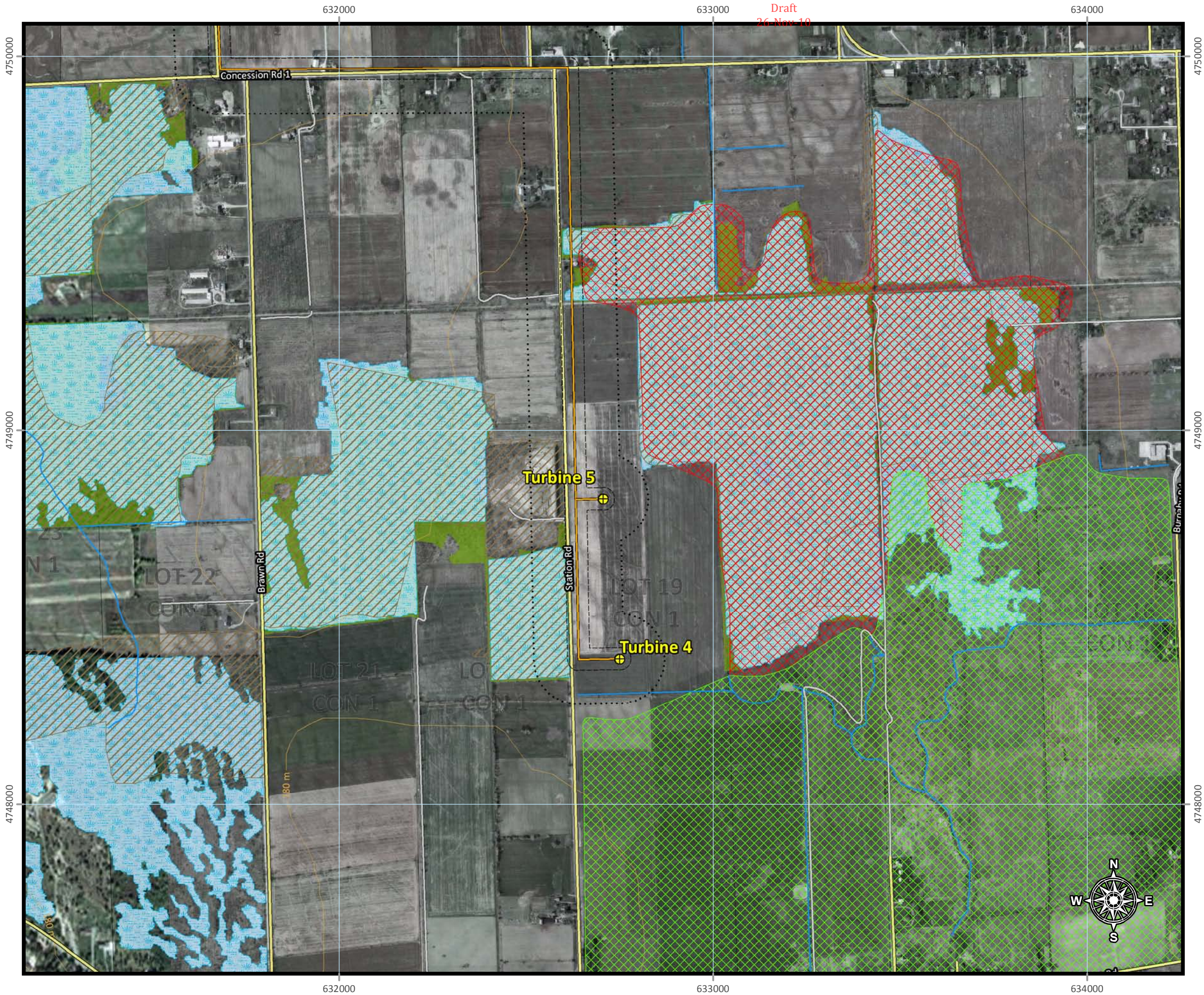
Project:

WAINFLEET WIND ENERGY PROJECT

Title:

**Proposed Wind Turbines Site Plan
Natural Features in Proximity to Turbine 4**

Project No.:	Drawing No.:
1104036	Figure No. 11
Date:	
September 9, 2010	



Draft
26-Nov-10

⊕ Wind Turbines	~ Elevation Contours
● Switching Station	~ Watercourses
~ Tap Line	~ Wildlife Habitat: Waterfowl Stop Over and Staging Area
⋯ 30 m setback	~ Wildlife Habitat: Wild Turkey Range
⋯ 120 m setback	~ Wildlife Habitat: Deer Wintering Area
— Paved Road	~ Provincially Significant Wetlands
— Unpaved Road	~ Significant Woodlots
✕ Water Crossings	
⊞ Lots	

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Project:
WAINFLEET WIND ENERGY PROJECT

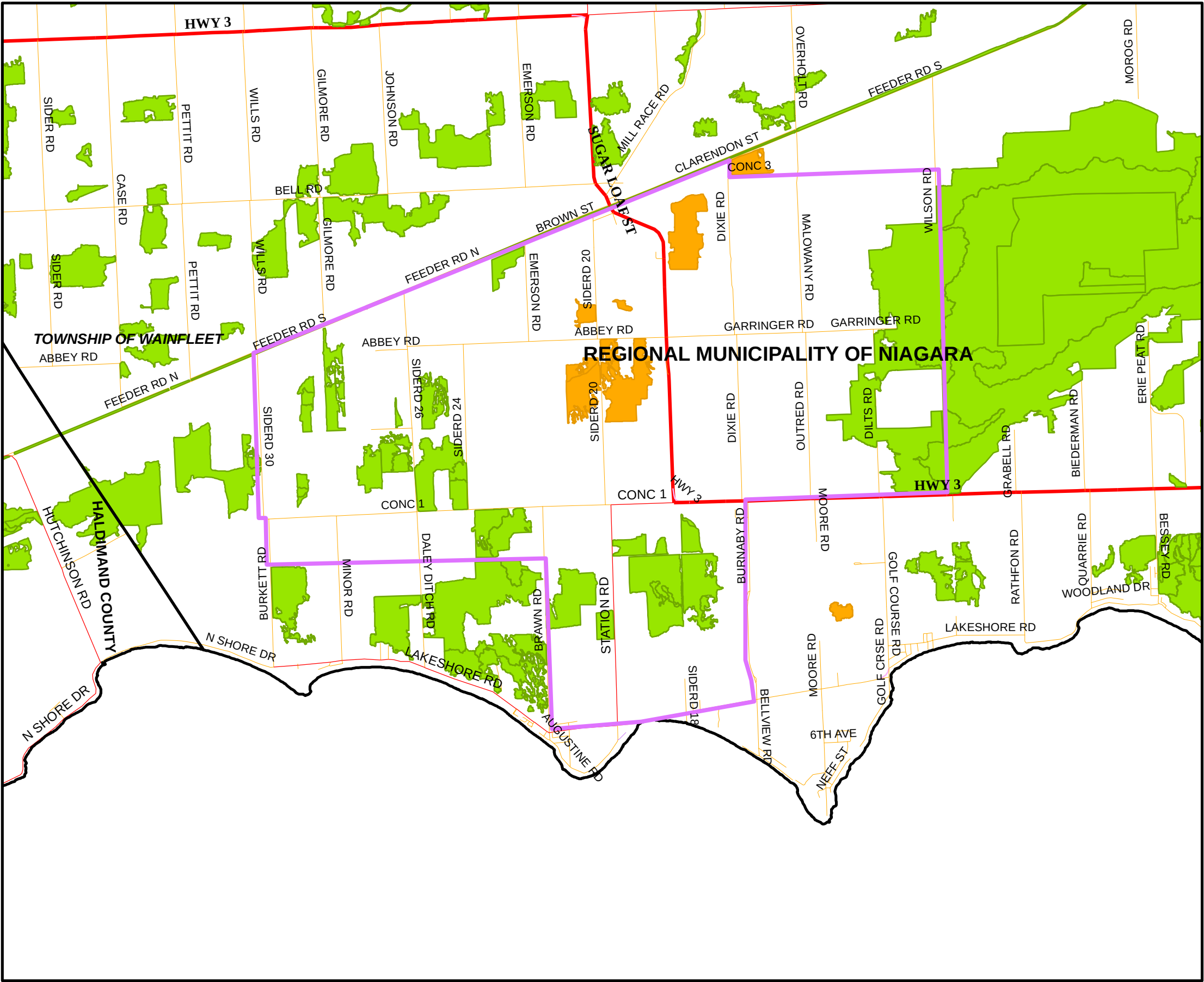
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**Proposed Wind Turbines Site Plan
Natural Features in Proximity to Turbine 5**

Project No.:
1104036

Drawing No.:
Figure No. 12

Date:
September 9, 2010

Evaluated Wetlands South of Wainfleet



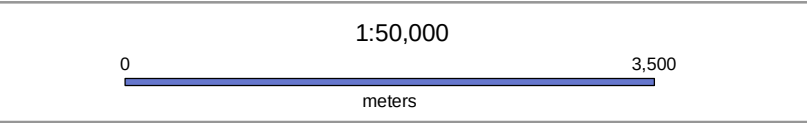
Legend

Study Area

MNR Evaluated Wetlands

SIGNIFICANCE

- PSW
- Non-PSW
- <not recorded>



Produced by:
laurenceje,
Guelph District Office,
Ontario Ministry of Natural Resources,
1 Stone Rd. W, Guelph, ON N1G 4Y2

Produced on: September 01, 2010

Projection: UTM Zone 17N
Datum: NAD 1983 (spheroid: GRS_1980)
Filename: WainfleetWetlands_2010_09_01.mxd

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