Final Construction Plan Report – Belle River Wind Project

Report

Final Construction Plan Report – Belle River Wind Project

Prepared by:

AECOM
105 Commerce Valley Drive West, Floor 7 905 886 7022 tel
Markham, ON, Canada L3T 7W3 905 886 9494 fax
www.aecom.com

Project Number:

60321891

Date:

May, 2015

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Acronyms and Abbreviations

ANSI	Area of Natural and Scientific Interest
Belle River Wind	SP Belle River Wind LP
BMPs	Best management practices
dbh	Diameter at breast height
EEMP	Environmental Effects Monitoring Plan
EIS	Environmental Impact Study
ERCA	Essex Region Conservation Authority
GHGs	Greenhouse gases
Hydro One	Hydro One Networks Inc.
IESO	Independent Electricity System Operator
km	Kilometres
kV	Kilovolts
L/day	Litres per day
m	Metres
m^2	Metres squared
m^3	Metres cubed
mm	Millimetres
m/s	Metre per second
MNRF	Ontario Ministry of Natural Resources and Forestry
MOECC	Ontario Ministry of the Environment and Climate Change
MTCS	Ontario Ministry of Tourism, Culture and Sport
MW	Megawatts
NRSI	Natural Resource Solutions Inc.
O. Reg.	Ontario Regulation
OEB	Ontario Energy Board
Pattern Development	Pattern Renewable Holdings Canada ULC
PDR	Project Description Report
Project	Belle River Wind Project
PSA	Project Study Area
PTTW	Permit to Take Water
REA	Renewable Energy Approval
Samsung Renewable Energy	Samsung Renewable Energy Inc.
SCADA	Supervisory Control and Data Acquisition
SRP	Spill Response Plan
SWH	Significant Wildlife Habitat
TSS	Total Suspended Solids
ZOI	Zone of influence

1. Introduction

The Belle River Wind Project ("Project") is being proposed by SP Belle River Wind LP, by its general partner, SP Belle River Wind GP Inc. ("Belle River Wind"). Belle River Wind is a joint venture limited partnership owned by affiliates of Pattern Renewable Holdings Canada ULC ("Pattern Development") and Samsung Renewable Energy Inc. ("Samsung Renewable Energy").

This Construction Plan Report was prepared in accordance with the requirements of the Renewable Energy Approval ("REA") process outlined in Ontario Regulation ("O. Reg.") 359/09, as amended, and the *Technical Guide to Renewable Energy Approvals* (Ontario Ministry of the Environment and Climate Change ("MOECC"), 2013).

The following sections provide information on the construction and installation activities, potential negative environmental effects of construction and installation activities and mitigation measures for the identified negative effects.

1.1 Summary of Construction Plan Report Requirements

The requirements for the Construction Plan Report as defined under O. Reg. 359/09, as amended, and where those requirements are addressed in this report are provided in the following table (**Table 1-1**).

Table 1-1: Adherence to Construction Plan Report Requirements under O. Reg. 359/09, as Amended

Requirement	Completed	Corresponding Section
Details of construction or installation activities	Yes	**Section 3**
The location and timing of any construction or installation activities for the duration of the construction or installation	Yes	**Figure 2-1** and **Section 3.1**
Any negative environmental effects that may result from construction or installation activities	Yes	**Section 4**
Mitigation measures in respect of any negative environmental effects	Yes	**Section 4** and the Environmental Effects Monitoring Plan ("EEMP") in the Design and Operations Report

This Construction Plan Report was provided to the Town of Lakeshore and County of Essex 90 days in advance of the second public meeting. First Nation and Aboriginal Communities, government agencies and the public were able to review copies of the report 60 days in advance of the second public meeting. These timelines align with the distribution requirements outlined in O. Reg. 359/09, as amended, and the *Technical Guide to Renewable Energy Approvals* (MOECC, 2013).

1.2 The Proponent

Applicant:

As noted above, Belle River Wind is a joint venture limited partnership owned by affiliates of Pattern Development and Samsung Renewable Energy. The contacts for the Project are as follows:

Brian Edwards
Project Developer
Samsung Renewable Energy
2050 Derry Road West, 2nd floor
Mississauga, ON L5N 0B9
Phone: (905) 501-5667
Email: b.edwards@samsungrenewableenergy.ca

Jody Law
Project Developer
Pattern Development
355 Adelaide Street West, Suite 100
Toronto, ON M5V 1S2
Phone: (416) 263-8026
Email: jody.law@patternenergy.com

Consultant:

Marc Rose
Senior Environmental Planner
AECOM
105 Commerce Valley Drive West, 7th Floor
Markham, ON L3T 7W3
Phone: (905) 747-7793
Email: marc.rose@aecom.com

Project:

Project Email: *info@belleriverwind.com*
Project Website: *www.belleriverwind.com*

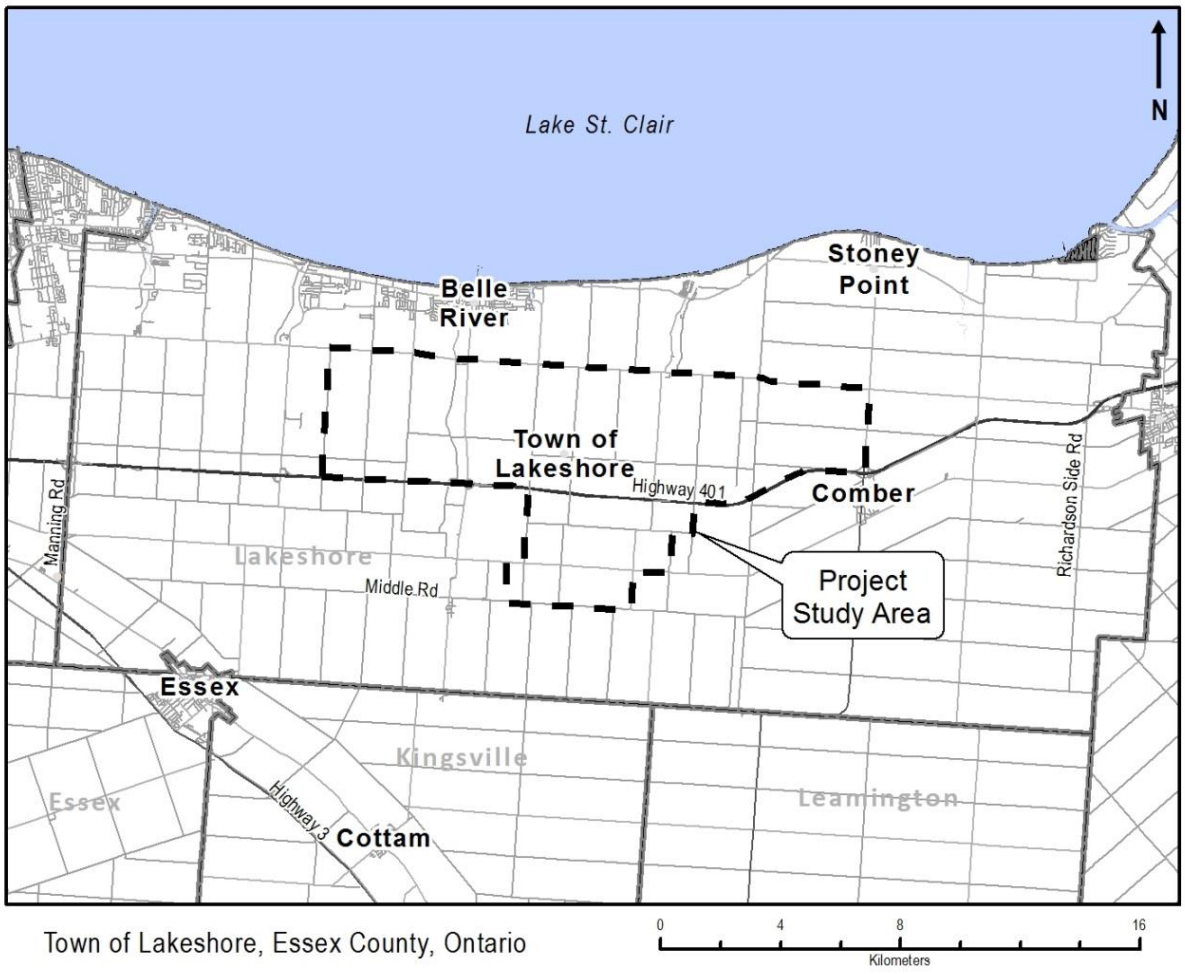
1.3 Project Location

Belle River Wind is proposing to develop a wind project in the Town of Lakeshore in the County of Essex, Ontario. The Project will be located on public and private lands south of the community of Belle River. The location of the Project was established based on interest expressed by local landowners, the availability of wind resources, and availability of existing infrastructure for connection to the electrical grid.

According to O. Reg. 359/09, as amended, the Project Location is “a part of land and all or part of any building or structure in, on, or over which a person is engaging in or proposes to engage in the project and any air space in which a person is engaging in or proposes to engage in the project”. As described therein, the Project Location boundary is the outer limit of where site preparation and construction activities will occur (i.e., disturbance areas described below) and where permanent infrastructure will be located, including the air space occupied by turbine blades.

The Project is generally bounded by County Road 42 to the north, Lakeshore Road 111 to the west, Highway 401 and South Middle Road to the south, and Comber Sideroad to the east. The area encompassed by these boundaries is referred to as the Project Study Area (“PSA”). **Figure 1-1**, below, shows a map of the PSA. To see the location of the Project within Ontario, please see **Figure 1-2**.

Figure 1-1: Project Study Area



The PSA covers approximately 22,200 acres[1] of land that the Town of Lakeshore's Official Plan (2010) and the Town of Lakeshore Zoning By-law (2014) identify as predominantly agricultural in use. The PSA also consists of fragmented areas of forest and riparian habitat associated with small creeks or farm drains. The Project is not situated on Crown land or within areas protected under provincial land use plans. The PSA represents the area being assessed as part of the REA process. The following co-ordinates define corners of the external boundaries of the PSA:

Longitude	Latitude
-82.769	42.277
-82.687	42.236
-82.645	42.2
-82.55	42.268

1. *Metric units are used throughout REA documentation when describing the size of Project infrastructure, except in instances describing areas of land. When describing land size, acres (imperial) will be used rather than hectares (metric) because it is the measuring unit most commonly used by the local community. It is assumed that 1 hectare of land is equal to 2.47 acres of land.*

Figure 1-2: Study Area in Ontario

1.4 Summary of Key Project Information

A summary of key Project information is presented in the table below.

Table 1-2: Summary of Key Project Information[2]

General	*Project Name:*	Belle River Wind Project
	Project Ownership and Operation:	SP Belle River Wind LP
	Project Lifespan (commercial operation):	20 Years
	Project Nameplate Capacity:	Up to 100 megawatts ("MW")
Project Area *(as shown in **Figure 1-1**)*	*Location of Project:*	Privately-owned land and public road allowances in the Town of Lakeshore, County of Essex
	Total Project Study Area:	22,200 acres
	Total Area of Project Location (total disturbance area):	1,760 acres
Wind Turbine Generators	*Make and Model:*	Siemens SWT-3.2-113
	Total Number Permitted:	49 turbines
	Approximate Number Constructed:	44 turbines
	Nominal Turbine Power:	2.257 to 3.2 MW
	Number of Blades:	3
	Blade Length:	55 metres ("m")
	Hub Height:	99.5 m
	Rotor Diameter:	113 m
	Cut-in Wind Speed:	3 to 5 metres per second ("m/s")
	Cut-out Wind Speed:	32 m/s
	Rated Wind Speed:	12 to 13 m/s
	Swept Area:	10,000 metres squared ("m^2")
	Foundation Dimensions:	25 m diameter
Access Roads	*Access Roads – Operations: (includes shoulder, travel width and ditch)*	49 kilometres ("km") x 8 to 12 m
	Access Roads – Construction (with shoulder):	49 km x 8 to 15 m
Collector Lines	*34.5 kilovolts ("kV") Collector Lines in Public Right-of-way: (total combined length of proposed underground and/or overhead)*	80 km x 2 to 6 m
	34.5 kV Collector Lines on Private Lands (underground):	49 km x 2 to 6 m
Transmission Line	*230 kV Transmission Line in Public Right-of-way or Private Lands*	5 to 10 km x 2 to 6 m
Other Project Structures and Facilities	*Collector Substation:*	10 acres
	Operations and Maintenance Building:	7 acres
	Interconnection Station:	10 acres
	Meteorological Towers:	Up to 2
	Microwave Tower:	Up to 2
Temporary Land Use *(Construction Phase)*	*Construction Staging Areas:*	10 to 15 acres
	Wind Turbine Laydown Area (each turbine):	1.5 acres
	Crane Pads:	0.2 acres

2. Dimensions are near approximations.

2. Summary of Project Components

The proposed Project Location is shown on **Figure 2-1** and includes the components of the Project listed in **Table 2-1** below.

A description and listing of Project components and temporary Project components are outlined below in **Table 2-1** and **Table 2-2**, respectively.

Table 2-1: Description of Project Components

Component	Description
Wind Turbine Generators	• The Project will include commercial wind turbines, namely the Siemens SWT-3.2-113 turbine, with a nominal power of 2.257 to 3.2 MW. The wind turbine nacelle includes the electric generator, gearbox, wind direction and speed sensors and auxiliary equipment. These components are located at the top of a supporting tower and are connected to three blades and a hub via a main shaft.
Wind Turbine Foundation	• Each turbine tower is anticipated to have a concrete foundation up to 25 m wide and 2.5 m deep. The land base of each turbine foundation will be dependent on subsurface conditions determined during geotechnical investigations. Following geotechnical investigations it may be determined that pile type foundations may be suitable for certain locations.
Pad-mounted Transformers	• A pad-mounted transformer will be located immediately adjacent to each wind turbine. This transformer 'steps-up' the electricity generated by the wind turbine to a common electrical collector line voltage (34.5 kV).
Wind Turbine Access Roads	• During construction and operation of the proposed Project, roads are required in order to access wind turbine locations. Access roads will be constructed of native materials or engineered fill and are expected to be up to 15 m wide during construction in order to accommodate cranes and transportation equipment used to deliver wind turbine components. Following the construction phase, roads may be reduced in size, which would allow access to turbines and associated infrastructure for maintenance and repairs.
Collector Lines	• Collector lines carry the electricity from the pad-mounted transformers to the Project substation (described below). The collector lines will be 34.5 kV standard utility generator lines buried on private property, where possible, from the turbines to the public road allowance. Within the public road allowance, the electrical collector lines will remain underground. Where possible, underground electrical collector lines will be installed within the access road disturbance area in order to minimize the area of disturbed land. Underground electrical collector lines will be buried at a minimum depth of approximately 1.2 m. Farming practices will not be affected by the underground cabling due to the depth of the cables and location of the cable beneath the access roads. • If aboveground electrical collector lines are required, they will be constructed on hydro pole structures that are similar to existing electrical distribution lines in the PSA. • Where two or more underground collector lines must be connected together, a junction box will be installed either below or aboveground on public and/or private land. Junction boxes may contain equipment related to splices, junctions, cable splices and disconnect switches.
Collector Substation	• A collector substation is required to bring together all of the underground and aboveground electrical collector lines. The collected power will be transformed from the electrical collector line voltage (34.5 kV) to a transmission voltage (230 kV). • The collector substation will be constructed within a disturbance area of approximately 10 acres on a raised pad or a prepared base of engineered fill to a depth of approximately 2 m. The substation will comply with the noise requirements specified in O. Reg. 359/09, as amended. • Collector substation equipment will include an isolation switch(es), circuit breaker(s), step-up power transformer(s), distribution switch-gear(s), instrument transformers, capacitor banks, communication equipment, Supervisory Control and Data Acquisition ("SCADA") equipment, protection and control equipment, grounding transformers, revenue metering (conforming to Independent Electricity System Operator ("IESO") market rules), substation grounding and a control building. Substation grounding will follow the Ontario Electrical Safety Code. An oil containment system will be installed at the site to prevent soil contamination in the event of a leak.
Microwave Tower	• A microwave tower used for communication purposes may be constructed within the substation construction disturbance area and/or the Interconnection Station location. If required, the microwave tower may be up to 100 m tall and will likely be installed by a single crane; soil conditions will determine whether the tower will be steel-lattice or guyed.
Meteorological Towers	• Up to two meteorological towers, each, up to 100 m in height are proposed to be constructed and will consist of either a monopole or lattice structure depending on soil conditions. These meteorological towers may be constructed on a concrete foundation or they may be guyed. • Permanent meteorological towers are an operational requirement of the IESO for all electricity market participants (this includes all generators of electricity) and allow the IESO to operate the system in a reliable and safe manner. The use of meteorological data is crucial to the safe and efficient operation of a wind project as they aid in operational decisions including the wind speed at which a turbine 'cuts-in' / 'cuts-out' and provide warning in extreme weather conditions (e.g., icing conditions) to ensure turbine shutdown occurs in advance of an extreme weather event at the turbine location.

Table 2-1: Description of Project Components

Component	Description
Transmission Line and Interconnection Station (Connection to Electrical Grid)	• A 230 kV electrical transmission line will be built from the transformer substation to a connection point on the Hydro One Networks Inc. ("Hydro One") transmission corridor. The transmission line will be buried and/or mounted on new poles or a combination thereof. The poles will be made of wood, concrete or steel. The line will be located on private property and/or within existing municipal road right-of-ways. The point of interconnection will require modifications to the existing transmission line and may include circuit breakers, isolation switches, transmission switchgear, instrumentation, grounding, metering equipment and other equipment typical of such systems. • The interconnection plan for any wind project is subject to study, design and engineering by the IESO which manages the province's electricity grid, Hydro One which owns the transmission lines, the local hydro distribution company and the Ontario Energy Board ("OEB"), which regulates the industry through the Transmission System Code and the Distribution System Code.
Operations and Maintenance Building	• An operations and maintenance building will be constructed to accommodate offices, mess facilities, control facilities, storage space, maintenance work area and a parking area. It will be located within the same disturbance area as either the collector substation or interconnection station. • The operations and maintenance building will be constructed on a concrete foundation. An access road to the operations and maintenance building from a municipal road will be constructed to accommodate construction equipment and on-site traffic during the operation of the Project. • The operations and maintenance building will be powered by the local distribution company, with an on-site backup power supply. The power will be delivered via overhead poles installed adjacent to the access road and will terminate on a transformer pole adjacent to the operations and maintenance building. An underground cable will then connect the transformer pole to the building electrical service.

To facilitate the construction of the proposed Project, a number of temporary construction components are required. These temporary components, described further in **Table 2-2** below, include crane pads, turbine laydown areas and a construction staging area.

Table 2-2: Description of Temporary Project Components

Component	Description
Crane Pads	• Crane pads will be constructed in tandem with wind turbine access roads. Crane pads will be located directly adjacent to wind turbine locations and within the associated construction disturbance area. The crane pad area will be approximately 0.2 acres, and will consist of a mixture of heavier granular material, native materials and engineered fill, as appropriate. • Crane pad areas will be restored following construction so that existing land uses can continue. As required for maintenance and decommissioning activities, crane pads may be reconstructed in the future.
Wind Turbine Laydown Areas	• Laydown areas adjacent to wind turbine locations will be incorporated into the disturbance area for each turbine. Each disturbance area is approximately 1.5 acres and will allow for temporary turbine component storage during construction. Temporary wind turbine laydown areas will be restored following construction activities so that agricultural activities can continue.
Construction Staging Area	• A temporary construction staging area will be located within the PSA. The construction staging area will consist of compacted surface material suitable for vehicular traffic. The depth of the material required will vary and will be dependent upon conditions encountered during the time of construction. The construction staging area will be approximately 10 to 15 acres in size and will primarily serve the following aspects of the Project construction: ▪ Construction equipment / toll storage and maintenance; ▪ Laydown areas for Project components; ▪ Location of Project construction offices; ▪ Parking areas for Project staff; ▪ Portable generators; ▪ Waste disposal containers; ▪ Self-contained temporary toilet facilities; and ▪ Water and rinsing facilities. • Following Project construction, the temporary construction staging area will be restored to pre-existing conditions so that previous land use can continue. Construction offices and temporary storage of Project equipment may also occur in pre-existing areas used for commercial and industrial purposes.

2.1 Disturbance Areas

Disturbance Areas have been identified surrounding various Project components, which are depicted on **Figure 2-1** as the "Project Location". The Project Location denotes the location of wind turbines, access roads, the electrical collector system, 230 kV transmission line route options, collector substation options and temporary laydown / storage areas. The figure also outlines areas where temporary disturbance may occur as a result of construction of Project component laydown and storage areas, crane pad construction, turnaround areas, and access roads and electrical collector system. With the exception of the Project components described above, no permanent infrastructure is proposed within these areas. Following construction activities, the land will be returned to pre-existing land uses, unless otherwise agreed to with landowners.

In addition to **Figure 2-1** which depicts the Project Location, the following figures also provide visual illustration of the following:

- **Figure 2-2:** Location of Project components and associated disturbance areas in relation to surrounding natural heritage and water body features such as: wetlands, woodlands, and streams, in addition to water wells identified in the MOECC's database. This figure also illustrates compliance with the 120 m setback distance for natural heritage features, measured from the boundary of the Project Location, as well as topographical land contours and surface water drainage for all lands within 120 m of the Project Location.
- **Figure 2-3a** and **Figure 2-3b:** Location of Project components and associated disturbance areas in relation to surrounding socio-economic features such as: property boundaries, roads and railways, petroleum resources, landfills, aggregate resources and noise receptors. This figure also identifies the setback distances between these features and the Project components. Note that noise compliance is assessed in the Noise Impact Assessment (refer to **Appendix C** of the Design and Operations Report).

The precise location of archaeological resources is sensitive information and is not depicted on the figures described above to prevent these resources from being located; however, the Heritage Assessment Report and Stage 1 and 2 Archaeological Assessment Reports were submitted for review and approval by the Ontario Ministry of Tourism, Culture and Sport ("MTCS"). The Heritage Impact Assessment for the Project concluded that no protected properties or heritage resources are located within the PSA and, therefore, are not depicted on the figures described above.

The following sections outline the activities anticipated for the construction phase of the Project and provide details on the timing of the activities, materials brought on site, construction equipment used and temporary uses of the land.

Additional details regarding Project activities are provided in the following reports. These reports will form part of the Project's REA Application:

- Project Description Report ("PDR");
- Design and Operations Report; and
- Decommissioning Plan Report.

Figure 2-1: Project Location

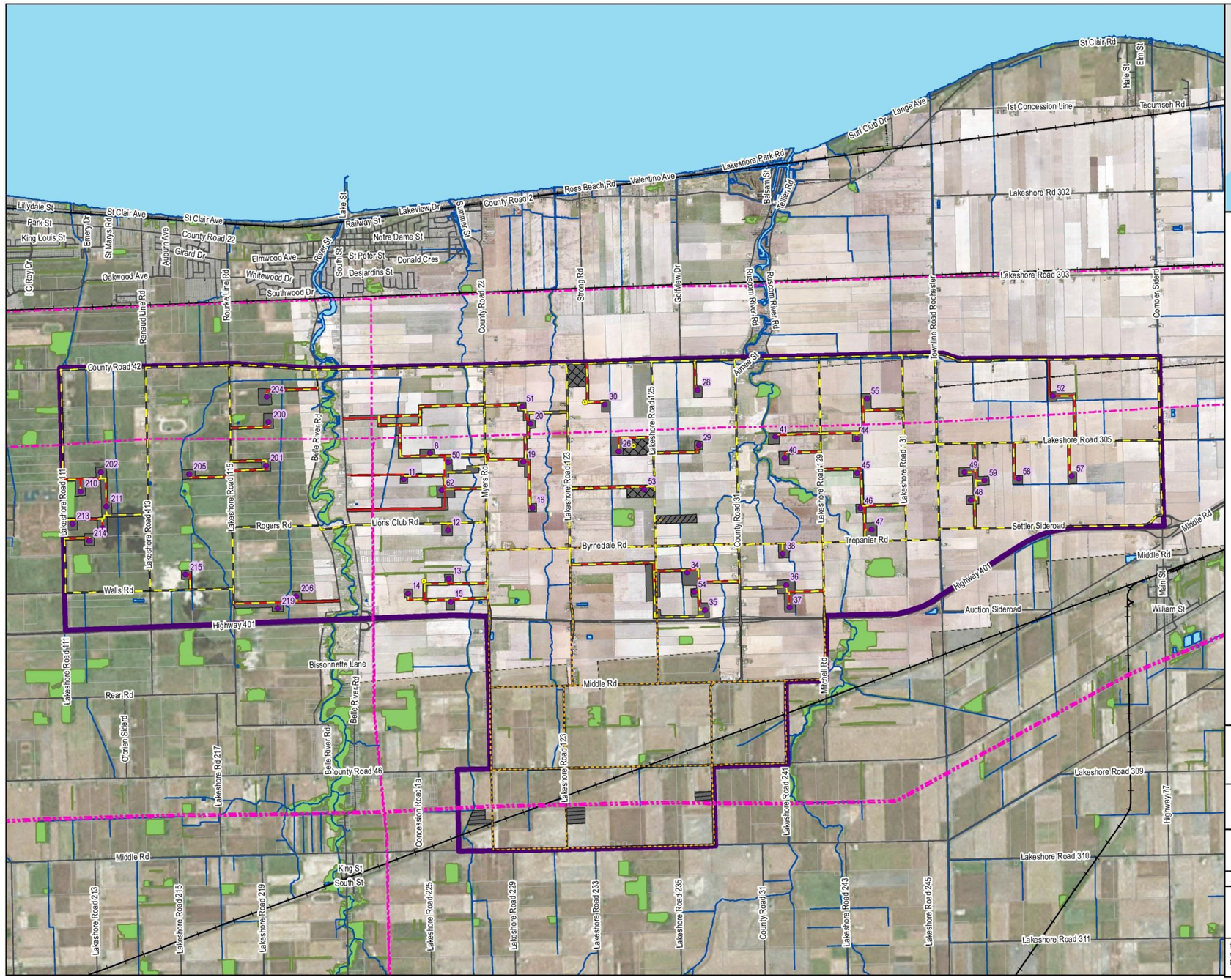


Figure 2-2: Project Location and Natural Heritage Features

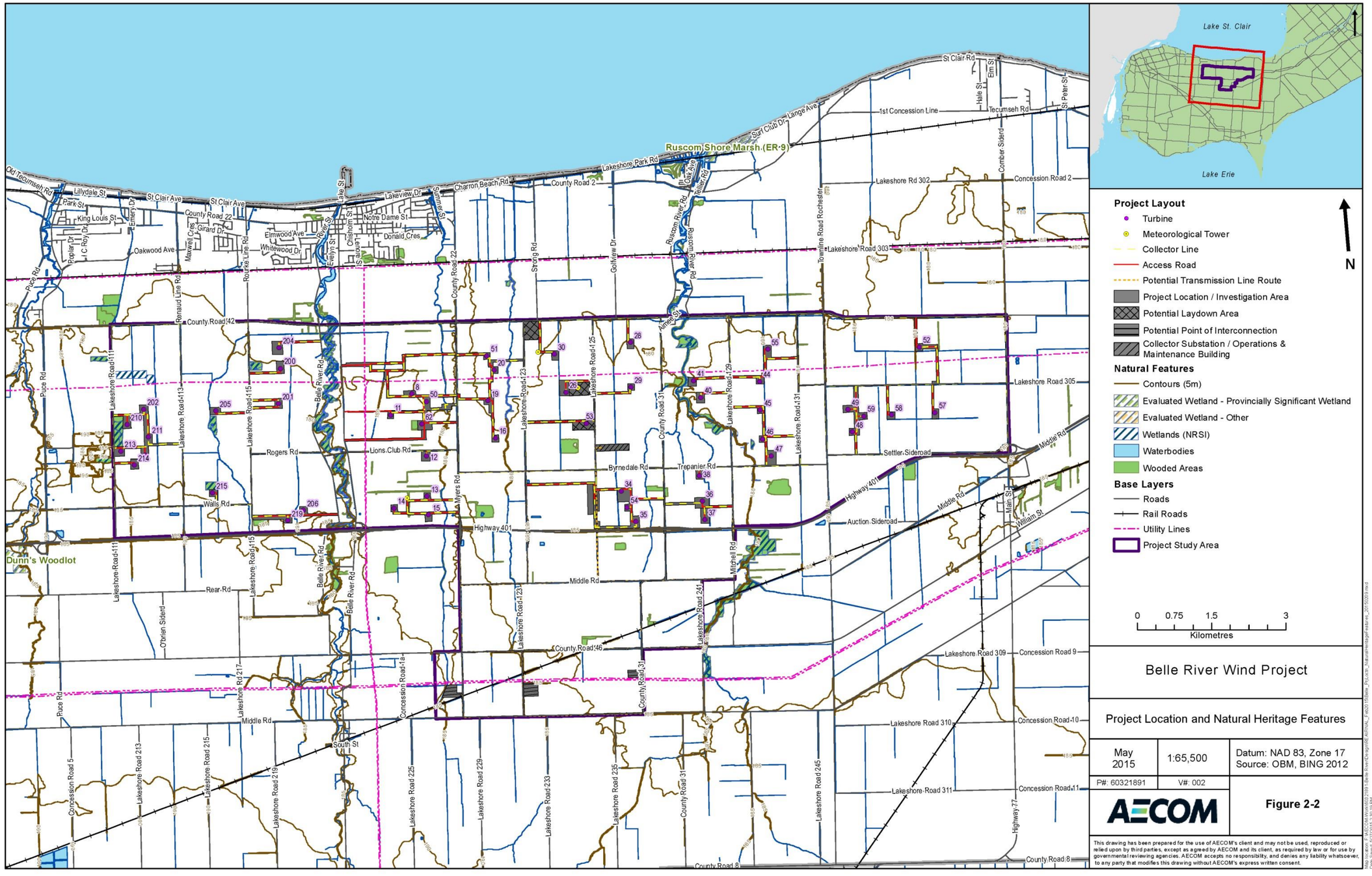
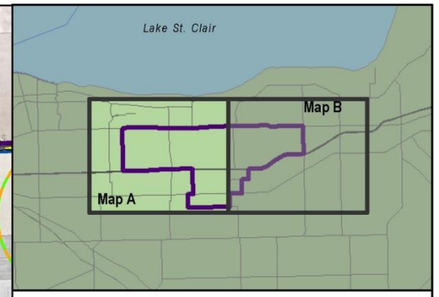


Figure 2-3a: Project Location and Socio-economic Features



Noise Receptors within 2km of Turbines

Existing Receptors
- Non-Participating
- Participating

Vacant Lot Receptors
- Non-Participating
- Participating

Other Resources
- Active Petroleum Wells (2013)
- Abandoned Petroleum Wells (2013)
- Water Wells

Setback Distances
- Road & Rail Setback (60m)
- Property Boundary Setback (80m)
- Noise Receptor Setback (550m)

Project Layout
- Turbine
- Meteorological Tower
- Collector Line
- Access Road
- Potential Transmission Line Route
- Project Location / Investigation Area
- Potential Laydown Areas
- Potential Point of Interconnection
- Collector Substation / Operations & Maintenance Building

Base Layers
- Roads
- Rail Roads
- Waterbodies
- Urban Areas
- Property Boundaries
- Project Study Area
- Pipelines
- Existing Transmission Lines

N

0 0.45 0.9 1.8
Kilometres

Belle River Wind Project

Project Location and Socio-Economic Features - A

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Figure 2-3a

Map location: P:\AECOM Work\60321891\Belle River\Design\REAP\Fig_Fig2015\Belle_PlyLocEn_SocioEcon_20150209.mxd
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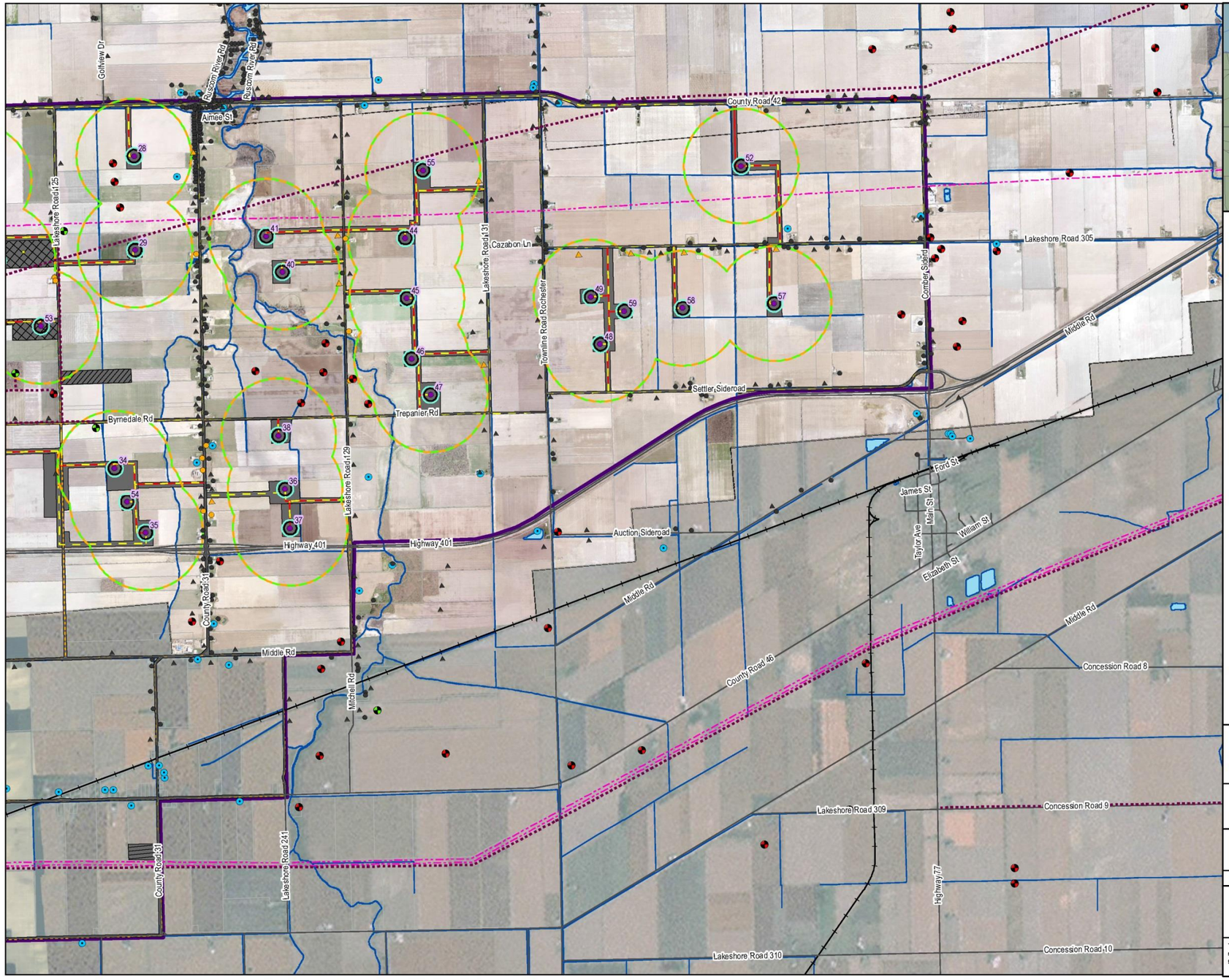
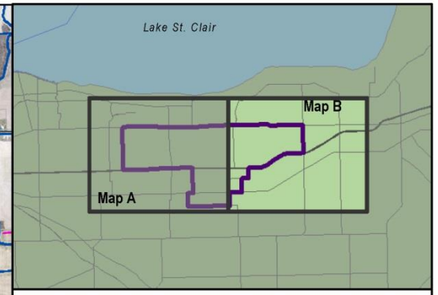
Figure 2-3b: Project Location and Socio-economic Features





Noise Receptors within 2km of Turbines

Existing Receptors
- Non-Participating
- Participating

Vacant Lot Receptors
- Non-Participating
- Participating

Other Resources
- Active Petroleum Wells (2013)
- Abandoned Petroleum Wells (2013)
- Water Wells

Setback Distances
- Road & Rail Setback (60m)
- Property Boundary Setback (80m)
- Noise Receptor Setback (550m)

Project Layout
- Turbine
- Meteorological Tower
- Collector Line
- Access Road
- Potential Transmission Line Route
- Project Location / Investigation Area
- Potential Laydown Areas
- Potential Point of Interconnection
- Collector Substation / Operations & Maintenance Building

Base Layers
- Roads
- Rail Roads
- Waterbodies
- Urban Areas
- Property Boundaries
- Project Study Area
- Pipelines
- Existing Transmission Lines

N

0 0.45 0.9 1.8
Kilometres

Belle River Wind Project

Project Location and Socio-Economic Features - B

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Figure 2-3b

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3. Description of Construction and Installation Activities

The following sections provide the following information for construction and installation activities:

- Project timing;
- Materials brought on-site;
- Construction equipment used; and
- Explanation of how the components will be constructed.

In general, all work crews will drive automobiles (typically light trucks) to reach the PSA. Flatbed trucks will be used to transport specialized equipment (e.g., tracked bulldozers, excavators, loaders, dump trucks, compactors and graders) to the PSA. Construction equipment, fuel and lubricants will be delivered to temporary storage / laydown areas by large truck and trailer combinations.

3.1 Timing of Construction and Installation Activities

Subject to the receipt of the necessary permits and approvals, site work for the Belle River Wind Project is expected to begin in 2016 and last for approximately 12 months. Construction and installation activities will generally occur at times of day when agricultural machinery would normally be in operation, unless circumstances require otherwise. **Table 3-1** presents the anticipated construction schedule and approximate order of construction activities for the proposed Project.

Table 3-1: Construction Schedule

Activity		Estimated Start Date	Estimated Duration
Surveying		"Prior to Construction" Spring / Summer 2015	2 to 3 months
Geotechnical Sampling		"Prior to Construction" Spring / Summer 2015	3 to 4 months
Site Preparations and Land Clearing		Summer / Fall 2016	2 to 3 months
Access Road Construction		Summer / Fall 2016	5 to 6 months
Construction of Laydown Area		Summer / Fall 2016	6 months
Turbine Site and Crane Pad Construction		Summer / Fall 2016	6 months
Turbine Foundations Construction		Summer / Fall 2016	8 months
Collector Substation Construction		Summer / Fall 2016	12 months
Transmission Line and Interconnection Station Construction		Summer / Fall 2016	12 months
Delivery of Equipment		Fall / Winter 2016	As needed throughout construction phase
Wind Turbine Assembly and Installation		Fall / Winter 2016	8 months
Electrical Collector System Construction	*Pad-Mounted Transformers*	Fall / Winter 2016	8 months
	Collector Lines	Fall / Winter 2016	8 months
Operations and Maintenance Building Construction		Fall / Winter 2016	8 months
Meteorological Towers and Microwave Tower Installation		Fall / Winter 2016	6 month
Turbine Testing and Commissioning		Summer 2017	4 months
Clean-up and Site Reclamation		Summer / Fall 2017	3 months

3.2 Pre-construction Activities

3.2.1 Surveying and Geotechnical Sampling Activities

Prior to construction, a registered Ontario Land Surveyor (or equivalent) will survey all access roads, collector lines, turbine locations, and all other foundations and work locations, as appropriate. Equipment used for surveying will likely include a small number of light duty trucks and all-terrain vehicles.

Existing buried infrastructure located on public property will be identified using the Ontario One Call service and buried infrastructure located on private property will be identified by private contractors prior to construction and updated throughout construction, as required.

Geotechnical sampling will be required for turbine foundation locations. Typically, a truck-mounted drill rig visits the sampling locations, drills the borehole and collects geotechnical information for laboratory testing and analysis. Information collected will include details of soil compaction, grain size, resistivity, soil pH, and depth to the collector substation and along collector lines. This operation typically uses two operators and requires three to four hours per turbine location.

Equipment will include, at a minimum, trucks, a truck mounted drill rig, and possibly a track-mounted drill rig. The trucks will be driven to the site via existing municipal roads. No materials will be brought on-site for these activities and any waste generated would be comprised of drill cuttings which will be scattered in the vicinity of the boreholes. The chemicals required for this phase will include oils, gasoline and grease used to operate construction equipment.

3.3 Construction Activities

3.3.1 Site Preparation and Land Clearing

The construction of the access roads will typically require clearing and grubbing of any vegetation, excavation of the topsoil layer and adding a layer of compacted material. Prior to access road construction, soil from the access road footprint will be stripped, stockpiled and re-used during construction to reclaim the site. A woven geotextile or cement-stabilized soil will be used where necessary.

3.3.2 Construction of Access Roads

Access roads will be constructed to transport equipment to the construction sites. The construction of the access roads will result in disturbance areas approximately 15 m wide. The access roads will be sited within this area of disturbance in consultation with the landowner and taking into consideration potential environmental effects. Where possible, access will follow property boundaries and will be located to minimize the loss of arable land, disturbance to agricultural operations and limit the number of watercourse crossings. As necessary, ditches and culverts will be constructed to maintain existing site drainage.

The access road to each turbine will typically require two to four days of construction time. Depending on the length of the access roads as well as road and site conditions, construction may require up to 30 trucks of gravel. **Table 3-2** provides details on the dimensions and materials required for access road construction.

Table 3-2: Description of Access Road Dimensions and Materials Required for Construction

Access Road Description		Measurement	Estimated Quantity Required (up to)
Roadbed Depth	*Granular Base Material*[1]	0.50 to 0.75 m	300,000 metres cubed ("m^3")
	Crushed Gravel[2]	0.10 to 0.20 m	80,000 m^3
	Total	0.60 to 0.95 m	440,000 m^3
Permanent Road Width[3]		8 to 12 m	--
Road Length[3]		50 km	--

Notes:
1. *A woven geotextile or cement-stabilized soil may be utilized which would reduce the amount of granular base material required. Approximately 50,000 m^2 of geotextile material may be required for access road construction.*
2. *This width includes shoulder, travel width and ditch.*
3. *Approximate Dimensions*

New culverts may be required to maintain drainage in ditches at junctions with roadways and these will be constructed to support the construction equipment and delivery trucks. The details of culverts and their installation in addition to erosion control measures will be determined in conjunction with the Essex Region Conservation Authority ("ERCA") and Town of Lakeshore as part of their permitting processes. Once the construction activities have been completed, the width of the access roads will be reduced and the granular base of the access roads will be removed and distributed to the landowners, if desired, or removed from the site and disposed of in an approved and appropriate manner. The disturbed area will have the topsoil replaced from stockpiled material and will be reseeded at the discretion of the landowner.

The construction crew is anticipated to require approximately six people and the timeline for constructing an access road to a turbine is expected to take between two and four days to complete, depending on the length of the road and site conditions. Equipment will include, at a minimum, trucks, graders and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The chemicals required for this phase will include oils, gasoline and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.3 Construction of Turbine Laydown Areas

A site of approximately 1.5 acres will be constructed for the temporary storage of construction material (i.e., no turbine components) and as a site for the construction office trailers. Following clearing and grubbing of any vegetation, the topsoil at the temporary laydown area will be removed and a layer of clean compacted crushed gravel will be imported as needed. The excavated topsoil will be re-used on-site, where feasible. A temporary electrical service line will be connected to the existing distribution line for the purpose of providing power to the construction office trailers. Following the construction phase, the gravel will be removed from the site or re-used, at the discretion of landowners. The temporary electrical service line and poles will be removed. The stockpiled topsoil will then be redistributed throughout the temporary laydown area.

The construction crew is anticipated to require approximately six people and construction activities are expected to last for approximately four to six days. Equipment will include, at a minimum, trucks, graders and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The chemicals required for this phase will include oils, gasoline and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.4 Construction of Crane Pads

Temporary crane pads will be constructed at the same time as the access roads and will be located adjacent to the turbine locations. Bulldozers will remove topsoil and subsoil, and crane pad locations will be filled with a varying mixture of granular base material and crushed gravel depending on site specific conditions. Geotextile will be used as required to meet crane bearing capacity requirements. Crane mats (large pieces of wood) will be used to stabilize cranes during their operation. The crane pad dimensions will be approximately 0.2 acres. The excavated topsoil will be re-used on-site as feasible. Once the turbine erection is complete, the crane pad, granular base materials and crushed gravel will be removed, native topsoil replaced, and crane pads returned to their pre-construction condition, at the discretion of the landowners.

The construction crew is anticipated to require approximately six people and construction activities are expected to last for approximately two to four days. Equipment will include, at a minimum, trucks, graders and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The chemicals required for this phase will include oils, gasoline and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.5 Construction of Wind Turbine Foundations

A determination of a final turbine foundation design will be based on results of site-specific geotechnical assessments. Based on site specific conditions that will be determined from geotechnical assessments, blasting may be required during wind turbine foundation excavation. Following the assessments, it may be determined that pile type foundations are more suitable for specific locations.

For typical foundations, the expected dimensions of the wind turbine foundation excavation are 0.2 acres with an excavated depth of up to 3 m. Stockpiled material will have topsoil and subsoil separated out and surplus excavated material may be removed from the site for disposal in an approved manner. The foundation will be constructed of poured concrete and reinforced with steel rebar to provide strength. The construction timeframe for turbine foundations is approximately four to seven days, excluding curing time.

After construction the foundation will be backfilled and the surface will be landscaped for drainage. The only surface evidence of the foundation will be a small protrusion of concrete to which the tower is attached; as such, land can be cultivated to within a few metres of the turbine. Any wood-waste generated will be removed from the site and recycled unless the landowner otherwise directs. Spent welding rods will be disposed of as hazardous waste by a licensed contractor.

Equipment required for the construction and installation of wind turbine foundations will include light-duty trucks, tracked bulldozers, excavators, loaders, dump trucks, compactors, graders, concrete trucks, concrete pump trucks, boom truck or crane and water trucks. An estimated 50 concrete truck loads will be required for each wind turbine foundation. The trucks, crane and graders will be driven to the site and the bulldozers will be transported via trailers. The chemicals required for this phase will include oils, gasoline and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.6 Delivery of Equipment

Equipment will be delivered by truck and trailer throughout the construction phase and stored at the temporary laydown areas surrounding each turbine. Each turbine site will include required infrastructure to accommodate delivery of oversized loads (e.g., turbine components). A Road Use Agreement will be developed in consultation with the Town of Lakeshore and Essex County. Alternative traffic routes will be prepared to address traffic congestion, as needed.

3.3.7 Construction Staging Areas

Up to three potential temporary construction staging areas may be located within the PSA. The temporary construction staging areas will each be approximately 10 to 15 acres.

Topsoil and subsoil will be stripped and stockpiled on-site and the construction staging areas will be constructed of compacted surface material suitable for vehicular traffic and equipment / component storage. The depth of the graveled areas will vary and will be dependent on conditions encountered during the time of construction. Following Project construction, the temporary construction laydown area will be restored to pre-existing conditions to allow agricultural or prior activities to resume, at the discretion of landowners.

Equipment required to prepare the construction staging areas will include trucks, excavators, bulldozers, graders and compaction equipment. The construction staging areas will take approximately four to six weeks to prepare. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.8 Wind Turbine Assembly and Installation

Turbine components will arrive on-site using flatbed and other trucks and will be temporarily stored on-site in the immediate vicinity of the base prior to assembly. Wind turbines will be assembled on-site by qualified installers. Typically two cranes will be used to install the turbines. The larger crane is usually a crawler type with a capacity of 600 tonnes or larger, and is used for the higher lifts.

Cranes and crew will erect the wind turbines once the foundations are completed and the concrete has cured. This will typically be in seven to ten lifts (five for the tower sections, one for the nacelle and one to three for the rotor) over a period of three to five days depending on environmental conditions (i.e., high wind conditions would delay installation). The lower tower sections may be installed several days before the upper tower sections and the turbine to optimize installation sequence. The lower tower section will also include electrical and communications equipment.

Following the erection of the wind turbine tower, the nacelle (which will be assembled prior to the delivery) will be lifted into place by the heavy-lift crane. The wind turbine rotor, which consists of three blades and the hub, will be lifted into place by a combination of two cranes. One smaller crane will stabilize the rotor as the larger crane does the heavy lifting. In some circumstances, a single blade and hub lifting technique may be utilized where space or high wind constraints prevent the rotor from being lifted in one piece. Installation may require 15 to 20 people at the site. Upon completion, packing frames for the turbine components will be returned to the turbine vendor.

Equipment will include, at a minimum, trucks, two cranes, graders and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The larger track mounted crane can move from turbine site to turbine site; however, it may need to be disassembled to move it along roadways and from the Project site. Alternatively, cranes may be moved between turbine sites without disassembly along access roads. In such instances, no additional infrastructure is required to support the crane movement. The chemicals required for this phase will include oils, gasoline and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.9 Construction of the Electrical Collector System

The electrical collector system will consist of pad-mounted transformers, underground cabling for use on private property along turbine access roads and a buried or above ground collector system running along municipal road right-of-ways. These components are described below.

3.3.9.1 Pad-Mounted Transformers

A concrete transformer pad, approximately 6 m^2 in size, will be installed adjacent to each turbine at the same time as the turbine base installation. The construction will consist of excavation, soil storage, installation of the buried electrical grounding grid, installation of the concrete pad, installation of the transformer and electrical connections.

Transformer installation and cabling between the turbine and transformer is expected to take three days per turbine. Equipment will include flatbed trucks to transport the equipment to site, and a truck-mounted crane for the installation. These activities will likely require up to six trucks, and a work force of approximately two people per vehicle per day. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.9.2 Collector Lines

Cables will carry electricity from each turbine to the collector substation. Similarly, fibre optics lines will be installed to allow for communications between the turbines and the substation. The collector lines may be a combination of underground lines on private lands and overhead and/or underground lines on public road allowances.

All underground collector lines will be installed in a trench approximately 1.5 m deep and/or in conduits installed by directional drilling. Where two or more underground collector lines must be connected together, a junction box will be installed either below or aboveground on public and/or private land. Junction boxes may contain equipment related to splices, junctions, cable splices and disconnect switches.

Overhead collector lines along public road allowances will require installation of wood, steel or concrete monopoles to a depth of approximately 5 to 6 m. Conductors will be strung from pole to pole in a manner similar to local electrical distribution circuits, and will be spaced approximately 45 to 60 m apart. The overhead collector lines will converge at the collector substation.

Equipment required for underground collector line installation will include excavators, dozers, dump trucks, directional drilling equipment and compaction equipment. Equipment required for overhead collector line installation will include utility bucket trucks, auguring trucks (or excavators), pole trailers, reel stand vehicles, an excavator, conductor puller vehicles and tensioner vehicles. Installation of the collector lines may require crews of approximately six people. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.9.3 Horizontal Directional Drilling

Electrical cables may need to be installed using horizontal directional drilling to minimize effects to woodlots or watercourses. Erosion control devices will be installed at the drill location and drill cuttings will be collected and removed from the site for disposal in an approved and appropriate manner. An entrance and exit pit will be excavated on either side of the feature to be bored under. The directional drilling equipment will be set up at the entrance pit and a drill bit attached to rod segments will be advanced until it reaches the exit pit. A slurry of bentonite and/or polymer mixed with water will be injected into the hole while drilling to help stabilize the bore hole and reduce friction. Once the drill bit has reached the exit pit the drill bit will be removed and a “reamer” attached and pulled back through the hole to enlarge the bore. The electrical cable will then be installed through the hole.

If required, equipment will include a directional drilling rig and two to three support trucks to carry drilling rods, drilling supplies and cable. The chemicals required for the drilling will include oils, gasoline and grease used to operate construction equipment, and the polymer used for directional drilling. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.10 Construction of the Collector Substation

The collector substation will be constructed on an area of approximately 10 acres within a larger construction disturbance area that may include the operations and maintenance building. Topsoil and subsoil will be removed to create an even work surface and the collector substation will be constructed on a raised pad or a prepared base on engineered fill or native soil to a depth of approximately 2 m.

Existing vegetation will be stripped with the topsoil, which will be stockpiled separately from stripped subsoil in a temporary (i.e., during construction) workspace adjacent to the collector substation. Stockpiled soil will be used during site restoration after construction activities are completed.

Following soil removal, a ground grid will be installed, a foundation will be poured, a grounding system and electrical equipment will be installed, and a crushed stone cover applied. Switchgear and protection and control equipment will be housed in an enclosed building.

The substation will comply with the noise requirements of O. Reg. 359/09, as amended. The collector substation will follow the Canadian Electrical Code for grounding, which will consist of a below grade grid of copper cable that will be interconnected to collector substation equipment and a fence for controlling access. The transformer foundation will be approximately 50 m^2 and have a depth of approximately 2 m. A secondary concrete containment system will be installed around the collector substation transformer(s) and connected to the drainage system through an oil water separator that will be buried below grade.

Equipment required for the construction and installation of the collector substation will include flatbed trucks, tracked bulldozers, dump trucks, excavators, compaction equipment, concrete trucks, concrete pump trucks, water trucks and a crane. Construction of the collector substation facilities may take up to 12 months. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.11 Installation of the Transmission Line

Transmission line poles may be installed by augur or mounted on concrete pier foundations. Where auguring is required, a truck or track mounted auger device will be used. The poles will then be inserted using special cranes to a typical depth of 2 to 3 m below grade. The poles are typically “dressed” (made ready to accept conductors) on the ground prior to installation. If required, guy wires may be used to anchor a pole in place. At times when guy wires cannot be used, steel poles may be mounted on concrete pier foundations. Approximately six construction vehicles (including trucks and a pole loader) and a crew of approximately 12 to 15 people are anticipated for construction of the transmission lines. Once the poles are in place and dressed, cables will be strung in place using boom trucks and special cable reel trucks. Finally, any pre-existing poles that are no longer in use will be removed.

Some packing-material waste may be generated from construction. All recyclable materials will be separated from non-recyclable materials and both streams will be removed from the site and disposed of at an approved and licenced facility.

Equipment will include, at a minimum, a truck mounted crane, a drill rig, flatbed trailers and a truck mounted auger. The only chemicals required for this phase are oils, gasoline and grease used to operate construction equipment. A lubricant is likely to be used when the cables are pulled in through the conduit. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.12 Construction of the Operations and Maintenance Building

The operations and maintenance building will be a structure constructed on a concrete foundation with a footprint of approximately 0.5 acres. A gravelled vehicle and parts storage area will be located around the perimeter of the operations and maintenance building that will be contained by a chain link fence. An access road to the building will be constructed to accommodate construction equipment and on-site traffic during the operation of the proposed Project.

The operations and maintenance building will be powered by a local distribution company and will terminate on a transformer adjacent to the building.

Construction of an operations and maintenance building may take up to six months to complete and will require a crew of approximately 15 people. Equipment will include, at a minimum, forklifts, concrete trucks and smaller crew trucks. The chemicals required for this phase will include oils, gasoline and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.3.13 Construction of Permanent Meteorological Towers

Permanent meteorological towers will be erected using cranes and secured with guy wires tied off to anchors or a monopole foundation. Access roads may be constructed to access meteorological tower locations and the site may be surrounded by a chain link fence. The towers will be connected to the Project power and communication infrastructure. Construction of each meteorological tower will take approximately two days and require a crew of approximately six people.

3.3.14 Site Clean-up and Reclamation

Site clean-up will occur throughout the construction phase and site reclamation will occur after construction has been completed. Waste and debris generated during the construction activities will be collected by a licensed operator and disposed of at an approved facility. All reasonable efforts will be made to minimize waste generated and to recycle materials including returning packaging material to suppliers for re-use / recycling, where possible.

Temporary disturbance areas (crane pads, laydown and construction staging areas) will be restored by replacing and re-contouring stripped soil to return the land to previous conditions, at the discretion of the landowner. Erosion control equipment will be removed once inspections have determined that the threat of erosion has diminished to the original land use level or lower. Access road widths will also be reduced to 8 to 12 m. High voltage warning signs will be installed at the transformer substation and elsewhere, as appropriate. At the conclusion of construction, vehicles and construction equipment will be removed from the site.

3.4 Turbine Commissioning

Testing and commissioning will be performed prior to Project connection to the Hydro One transmission line. The commissioning activities will consist of testing and inspection of electrical, mechanical and communications systems for system continuity, reliability and performance. Some packing-material waste may be generated. Recyclable materials will be separated from non-recyclable materials and both streams will be removed from the site and disposed of at an approved and licenced facility.

Temporary portable generator sets may be used to electrically commission the turbines prior to connection to the grid. Following the commissioning phase, the portable generators will be removed from the site.

Equipment will include support trucks which will be driven to the construction site. The only chemicals required for this phase are oils, gasoline, lubricants and grease used to operate construction equipment and portable generators and the turbine gearboxes. Fuel-handling will be conducted in compliance with the mitigation measures outlined in **Section 4**.

3.5 Temporary Uses of Land

Construction and installation activities will utilize temporary storage and laydown area adjacent to access roads, wind turbines, the collector substation, and the operations and maintenance building. Lands used for temporary storage and laydown areas will be converted from their current state to one appropriate for their use prior to construction. Since the lands proposed for the temporary storage and laydown areas are already actively worked by heavy agricultural equipment, the impacts from construction will be less than if undisturbed areas were used. Soil management will be incorporated into the creation and use of these areas to facilitate site reclamation, and all temporary work spaces will be converted back to their previous land use after the completion of the construction and installation phase. Temporarily-used areas will be reclaimed approximately two years from initial construction disturbance or sooner. An assessment of potential environmental effects as a result of temporary uses of land is provided in **Section 4**.

3.6 Temporary Water Takings

Groundwater takings for the purposes of providing dry working conditions during turbine foundation construction, collection line installation, road construction, dust suppression and general maintenance activities may be required during construction of the Project. Any water taking conducted during the construction phase or the operations phase of the Project is subject to the REA application and as such does not require a separate Permit to Take Water (“PTTW”).

A desktop hydrogeological assessment was completed for the purpose of providing a high level review of existing hydrogeological conditions within the PSA. The assessment identified potential groundwater taking needs of the Project during construction and operation, outlined potential effects of the Project on groundwater resources, and provided a mitigation strategy and contingency measures to negate any adverse effects. The following section provides an overview of the Hydrogeological Assessment and Effects Assessment Report for the Project. For further details please refer to the Hydrogeological Assessment and Effects Assessment Report in **Appendix B** of the Design and Operations Report.

During the construction phase of the Project, water may be required to support turbine infrastructure construction (i.e., dust suppression and directional drilling fluids). Water demands for these purposes are expected to have peak volumes up to 40,000 L/day. Actual daily demands will vary and will typically be lower in volume than the estimated peak volume. As described in the Groundwater Supply Feasibility and Effects Desktop Assessment, found in **Appendix B** of the Design and Operations Report, the proposed source of water for general construction use is a groundwater supply well located at the site of the future operations and maintenance building.

A review of existing secondary source information provided by the Ontario Geological Survey and from local MOECC water well records indicates that groundwater takings for the purpose of turbine foundation construction is expected to be of relatively low volume, if any. The majority of the PSA is underlain by fine-textured glacial till and glaciolacustrine deposits that do not readily transmit groundwater. Therefore, turbine foundations excavated in this material are not anticipated to require significant dewatering during construction.

In the central portion of the PSA, in proximity to where the coarse-textured lacustrine beach sand is exposed at surface, higher groundwater taking requirements for turbine foundation construction is anticipated. Thus, there is limited potential for groundwater takings to exceed 50,000 L/day at a turbine site, but is dependent on the surficial material being excavated, the depth to groundwater, and other hydrogeological characteristics that may be determined during geotechnical analysis.

3.7 Materials / Waste Generation and Transportation

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

Waste will also be generated as a result of construction and installation activities. Concrete wash out of empty cement trucks will adhere to applicable regulations. Sanitary sewage collected in portable toilets and wash stations will be transported to an off-site facility by a licensed hauler. Small amounts of spoil material from borehole drilling during geotechnical surveys may be redistributed on disturbed areas at respective drill sites. Topsoil and/or subsoil stripped from access roads and temporary storage / laydown areas may be re-used on-site, where feasible, or otherwise removed to an appropriate location.

If any grubbing of the site is required prior to construction activities, the grubbing materials (e.g., vegetation, branches and tree stumps) will be removed or remain on-site and buried within disturbance areas. As required, stockpiles will be covered with plastic sheeting, tarps or following best management practices (“BMPs”) to prevent erosion and propagation of noxious weeds. During construction of the wind turbine foundation, collector substation and other infrastructure, excavated subsoil and topsoil will be stored in piles on-site at each temporary storage / laydown area until they are replaced during clean-up and reclamation activities. Any excess subsoil will be distributed with landowner input, and excess clean topsoil will be redistributed to adjacent lands, as appropriate. If contaminated soil is encountered during the course of excavations, this soil will be disposed of in accordance with the current appropriate provincial legislation.

Disposal and recycling of materials and waste generated will require the use of flatbed and large dump trucks that are capable of transporting heavy loads. The type and number of truck trips necessary will be determined by the licensed construction contractor prior to the construction and installation of the Project. Disposal and recycling of waste will occur throughout the construction and installation of the Project since there are no plans for long-term storage of waste in the PSA.

3.8 Air Emissions

During each phase of the Project, activities requiring the use of motorized vehicles (e.g., transportation of maintenance personnel to turbine sites) will have infrequent and short-term emissions of low levels of greenhouse gases (“GHGs”) and other compounds. These emissions will be negligible compared to normal operation of motorized vehicles in the PSA. **Section 4.4** of this Report outlines potentially negative effects to air quality relating to the Project and identifies mitigation measures proposed.

Project noise emissions will adhere to the requirements of O. Reg. 359/09, as amended.

Project activities are not anticipated to generate any odour emissions.

3.9 Emergency Action Plan

The Emergency Action Plan is described in **Section 5.1** of the Design and Operations Report. The Emergency Action Plan is to be used in the event of an emergency and includes contact information for regulators, the local municipality, landowners and other stakeholders. All identified stakeholders will be notified should the emergency include any potential major impact to the health and safety of local residents or the environment.

3.10 Health and Safety Plan

Belle River Wind and its construction contractor will institute a Health and Safety Plan during the construction period. A detailed plan will be developed and the construction workforce will be made aware of the plan. Belle River Wind and its construction contractor will maintain an Incident Report. The Incident Report will document all activities resulting in incapacity to work for at least one full workday beyond the day on which the incident occurred. Records will also be maintained noting the total number of days of absence from work as a direct result of the incident.

4. Description of Environmental Effects and Mitigation Measures

The following section describes potential effects associated with the construction and installation of the Project. The potential effects described below are also presented in **Section 4** of the PDR.

For each potential effect, performance objectives were developed to describe a desired outcome of mitigation. Next, mitigation measures were proposed to achieve the performance objectives. Net effects, which are those effects that remain following the application of mitigation measures and monitoring commitments, were then assessed based on professional judgment as well as previous project experience. Where possible, the significance of adverse net effects has been described based on the following:

Magnitude ..... the size or degree of the effect compared against baseline conditions; and
Likelihood ..... the probability that the effect will occur.

Finally, where monitoring commitments have been identified, they are intended to verify that the mitigation measures achieve performance objectives. Should the monitoring during the construction of the Project reveal that the mitigation measures are not achieving the intended results, the identified contingency measures will then be implemented.

This description of effects was completed for all 49 turbines and associated infrastructure shown on the Project Location figures. However, note that only approximately 44 turbines will be constructed resulting in a conservative assessment of effects.

Baseline information on the existing natural environment can be found in the Natural Heritage Assessment (NHA) Report, Water Body Assessment and Water Body Reports, Stage 1 and Stage 2 Archaeological Assessment Reports, and the Heritage Assessment Report. All of these reports accompany the REA Application for the Project.

The following sections describe construction-specific potential effects and mitigation measures that may result from construction / installation activities within 300 m from the boundary of the Project Location.

4.1 Impacts on Cultural Heritage (Archaeological and Heritage Resources, Protected Properties)

Stage 1 and 2 Archaeological Assessments (Golder Associates, 2014a and Golder Associates, 2015) were conducted to identify the presence of archaeological resources within the PSA and within the Project Location. The Stage 1 Archaeological Assessment consists of an initial desktop archaeological study within 1 km of the Project Location. The study determined that there are known archaeological resources within the PSA, in addition to properties with the potential to contain archaeological resources.

The Stage 2 archaeological assessment of the Project Location was conducted over 37 days from the spring to winter of 2014 (Golder Associates, 2015). The assessment was conducted in accordance with the 2011 Standards and Guidelines for Consultant Archaeologists (Ontario Ministry of Tourism, Culture and Sport (MTCS), 2011). This assessment involved a combination of the pedestrian survey and test pit survey methods across portions of the PSA that are proposed for the Project Location, including turbine locations, access roads, substations, collector and transmission lines, operations and maintenance building, meteorological and microwave towers, temporary staging areas, and ancillary equipment. In some cases, entire parcels of land under option were also assessed.

The Stage 2 archaeological assessment resulted in the identification of cultural material in 29 locations. Ten of the 29 archaeological locations identified within the PSA were determined to exhibit cultural heritage value or interest and, as such, have been recommended for Stage 3 site-specific archaeological assessment. Details on the recommendations for each archaeological site, as well as the rationale for the recommendation pertaining to each site, are contained in Section 5.0 of the Stage 2 Archaeological Assessment Report.

A Heritage Impact Assessment (Golder Associates, 2014b) was also completed to identify heritage resources including cultural heritage features and cultural heritage landscapes of cultural heritage value or interest. All work was carried out in accordance with O. Reg. 359/09, as amended, and included assessing Project Location as well as adjacent lots to the Project Location. The report identified 19 structures (14 houses, and five barns) greater than 40 years of age located on parcels within the Project Location. When applying the criteria set out in O. Reg. 9/06 of the *Ontario Heritage Act*, nine of these structures (four houses and five barns) were determined to have cultural heritage value or interest. Following the evaluation of anticipated direct and indirect impacts, according to MTCS' *Ontario Heritage Toolkit: Heritage Resources in the Land Use Planning Process,* no anticipated impacts to these nine structures were identified. Therefore, no further work is recommended with regard to cultural heritage features.

In relation to cultural heritage landscapes, Golder Associates concluded that the Project Location was determined to represent a single vernacular rural landscape (2014b). Evaluation according to O. Reg. 9/06 concluded that the vernacular rural landscape was not of cultural heritage interest or significance. Therefore, there are no cultural landscapes located at the Project Location that have been determined to have cultural heritage value or interest. As no cultural heritage value or interest was determined, there are no adverse impacts anticipated to the cultural heritage landscape and no further work is recommended.

Table 4-1 provides mitigation measures, net effects and the monitoring plan for potential effects related to cultural heritage.

Table 4-1: Mitigation Measures, Net Effects and Monitoring Plan: Archaeological Resources and Cultural Heritage

Potential Effects	Performance Objectives	Mitigation Measures	Net Effects	Monitoring Plan and Contingency Measures
Disturbance or Displacement of Archaeological Resources Identified at Ten Locations through Stage 2 Assessment Due to Construction of Project Infrastructure.	• Avoid disturbance / loss of archaeological sites	• Avoid site: ▪ To avoid the sites, install a 20 m protective buffer zone (snow fence) for those sites located within the Project Location to clearly delineate their boundaries. If required, a licensed archaeologist must confirm and document the proper placing of the fencing. ▪ No ground alteration activities will take place inside of the 20 m protective zone. "No-go" instructions will be issued to all on-site personnel involved in day-to-day activities during construction. ▪ If construction activities are required within 70 m of a site, a 50 m construction monitoring buffering zone must be established surrounding the protective zone and a licensed archaeologist must be brought in to monitor construction activities within the monitoring area. • Where sites cannot be avoided, undertake a Stage 3 archaeological assessment (and Stage 4 where required) and submit the archaeological assessment report(s) to the MTCS for review and approval. • Following a Stage 4 assessment report, construction can proceed without any further documentation or monitoring.	• By implementing appropriate mitigation measure, no significant adverse effects on archaeological resources are anticipated during the construction and installation of the project. ▪ *Low likelihood and limited magnitude of effect as a result.*	**Monitoring:** • Archaeological monitoring by a licensed archaeologist is proposed during construction and installation activities should construction activities intrude into the 50 m construction monitoring zone. • Monitoring is intended to help avoid any potential effects resulting from construction, and installation on any archaeological locations that have been recommended for a Stage 3 or 4 assessment. **Contingency Measures:** • Should previously undocumented archaeological resources be discovered, the licensed archaeologist that discovered the archaeological resources can cease alteration of the site immediately and engage a licensed consultant archaeologist in compliance with Section 48(1) of the *Ontario Heritage Act* (Government of Ontario 1990b). • Any person discovering or having knowledge of a burial site will immediately notify the police or coroner as noted in the *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33. • As deemed appropriate, First Nation and Aboriginal Communities will be contacted with regards to undocumented resources or knowledge relating to burial sites.

4.2 Impacts on Vegetation and Natural Heritage (Including from Spills)

The potential effects, mitigation measures, residual effects and monitoring commitments regarding Significant Natural Heritage Features (including significant wetlands, woodlands, and wildlife habitat and Life Science Areas of Natural and Scientific Interest) were identified and evaluated in the NHA and Environmental Impact Study ("EIS") Report (Natural Resource Solutions Inc. ("NRSI"), 2015a) prepared based on the *Natural Heritage Assessment Guide for Renewable Energy Projects* (Ontario Ministry of Natural Resources and Forestry ("MNRF")), 2012) and submitted to the MNRF for review and sign-off.

Following the completion of the Records Review and Site Investigation for all natural heritage features located within 120 m of the Project Location, an Evaluation of Significance was conducted to identify any features that required an EIS.

Table 4-2 documents the significant natural heritage features located within 120 m of the Project Location for which an EIS was conducted.

Table 4-2: Summary of Natural Features Carried Forward to the Environmental Impact Study

Feature	Natural Features Carried Forward to the EIS
Wetlands	**12 wetlands were determined to be significant and therefore carried forward to the EIS. These include the following wetlands**: WET-001, WET-002, WET-003, WET-005, WET-006, WET-007, WET-008, WET-009, WET-013, WET-014, WET-015 and WET-016.
Woodlands	**25 woodlands were determined to be significant and therefore carried forward to the EIS. These include the following woodlands:** WOD-002, WOD-006, WOD-008, WOD-009, WOD-010, WOD-011, WOD-012, WOD-013, WOD-014, WOD-015, WOD-016, WOD-017, WOD-018, WOD-019, WOD-020, WOD-021, WOD-023, WOD-024, WOD-026, WOD-027, WOD-029, WOD-030, WOD-031, WOD-032 and WOD-034.
Significant Wildlife Habitat ("SWH")	**The following SWH features were confirmed to be significant within the 120 m Area of Investigation and within 120 m of Project infrastructure, and were therefore carried forward to the EIS:** • Shumard Oak Habitat (SHU-001 and SHU-002) • Climbing Prairie Rose Habitat (CPR-002) • Upright Carrion Flower Habitat (UCF-004) • Shellbark Hickory Habitat (SHH-001, SHH-002, SHH-003, SHH-004 and SHH-005) • Pignut Hickory Habitat (PGH-001) • Missouri Ironweed Habitat (MIW-003) The following features were treated as SWH and carried forward to the EIS with a commitment to complete pre-construction surveys (mitigation measures described in the EIS will be applied to these features if they are confirmed as significant based on the results of the pre-construction surveys): • Raptor Wintering Area • Bat Maternity Colony • Amphibian Breeding Habitat (Woodland) • Marsh Bird Breeding Habitat • Open Country Bird Breeding Habitat • Eastern Wood-Pewee Habitat • Wood Thrush Habitat • Numerous Plant Special Concern and Rare Wildlife Species Habitats, including: ▪ Prairie Milkweed Habitat ▪ Pawpaw Habitat ▪ Muskingum Sedge Habitat ▪ Field Dodder Habitat ▪ Schweinitz's Flatsedge Habitat ▪ Deer-tongue Panicgrass Habitat ▪ White-haired Panicgrass Habitat ▪ Burning Bush Habitat ▪ Many-fruit Primrose-willow Habitat ▪ Winged Loosestrife Habitat ▪ Biennial Gaura Habitat ▪ Climbing Prairie Rose Habitat ▪ Upright Carrion Flower Habitat ▪ Illinois Carrion Flower Habitat ▪ Giant Ironweed Habitat ▪ Lizard's Tail Habitat ▪ Missouri Ironweed Habitat • Numerous Insect Special Concern and Rare Wildlife Habitats, including: ▪ Dion Skipper Habitat ▪ Duke's Skipper Habitat ▪ Giant Swallowtail Habitat

Feature	Natural Features Carried Forward to the EIS
	▪ Common Sootywing Habitat ▪ Hickory Hairstreak Habitat ▪ Hayhurst's Scallopwing Habitat ▪ Southern Cloudywing Habitat The following features were carried forward to the EIS as Generalized SWH[3]: • Waterfowl Stopover and Staging Areas (Terrestrial) • Waterfowl Stopover and Staging Areas (Aquatic) • Shorebird Migratory Stopover Area • Bat Maternity Colonies • Turtle Wintering Areas • Snake Hibernaculum • Colonially – Nesting Bird Breeding Habitat (Tree/Shrubs) • Colonially – Nesting Bird Breeding Habitat (Ground) • Savannah • Waterfowl Nesting Area • Turtle Nesting Area • Amphibian Breeding Habitat (Woodland) • Marsh Bird Breeding Habitat • Shrub/Early Successional Bird Breeding Habitat • Terrestrial Crayfish • Eastern Wood-Pewee • Wood Thrush • Red-headed Woodpecker • Numerous Plant Special Concern and Rare Wildlife Species Habitats, including: ▪ Prairie Milkweed ▪ Coast Barnyard Grass ▪ Climbing Prairie Rose ▪ Pawpaw ▪ Burning Bush ▪ Upright Carrion Flower ▪ Trumpet Creeper ▪ Swamp Rose-mallow ▪ Illinois Carrion Flower ▪ Muskingum Sedge ▪ Many-fruit Primrose-willow ▪ Giant Ironweed ▪ Field Dodder ▪ Winged Loosestrife ▪ Shellbark Hickory ▪ Schweinitz's Flatsedge ▪ Biennial Gaura ▪ Lizard's Tail ▪ Deer-tongue Panicgrass ▪ Shumard Oak ▪ Missouri Ironweed ▪ White-haired Panicgrass ▪ Pignut Hickory • Numerous Insect Special Concern and Rare Wildlife Habitats, including: ▪ Mottled Darner ▪ Duke's Skipper ▪ Hickory Hairstreak ▪ Hackberry Emperor ▪ Giant Swallowtail ▪ Hayhurst's Scallopwing ▪ Tawny Emperor ▪ Common Sootywing ▪ Southern Cloudywing ▪ Dion Skipper
Provincially Significant Life Science Areas of Natural and Scientific Interest ("ANSIs")	There are no Provincially Significant Life or Earth Science ANSIs identified within 120 m of the Project Location.

Table 4-3 provides mitigation measures and net effects for potential effects related to Generalized Candidate SWH and Natural Heritage Features.

Table 4-4 provides mitigation measures and net effects for potential effects related to Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat.

The Belle River Wind Project Species At Risk Report was submitted to MNRF on May 4, 2015. The report identifies the potential impacts and associated mitigation measures related to the following species: Barn Swallow, Eastern Foxsnake, Little Brown Myotis and Northern Myotis. A Notice of Activity is being prepared for wind turbine operations and a draft Operational Mitigation Plan will be circulated to MNRF following the REA submission.

3. *Generalized Candidate SWHs are determined based on the criteria outlined in Appendix D of the Natural Heritage Assessment Guide for Renewable Energy Projects (MNRF, 2012a). Therein, candidate SWHs that are located within 120 m of Project Location but do not require to be individually identified due to their proximity to specific types of Project infrastructure as specified in Appendix D and are also not overlapped by other Project infrastructure are treated as Generalized Candidate SWH.*

Table 4-3: Mitigation Measures and Net Effects: Generalized Candidate Significant Wildlife Habitat and Natural Heritage Features

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects
Increased Erosion and Sedimentation into Woodlands, Wetlands and Other Natural Features. **Soil Compaction.**	• Minimize direct impacts on vegetation communities and protect rare/ sensitive habitats. • Maintain vegetated buffers, particularly within riparian zones. • Minimize the impacts of sedimentation on nearby natural features.	• Develop and implement an Erosion and Sediment Control Plan. • Utilize erosion blankets, silt fencing, straw bales, etc. for construction activities within 30 m of a wetland, woodland, or water body. • Maintain erosion control measures for the duration of construction activities. • Suspend work if high runoff volume is noted or excessive sediment discharge occurs, as determined by an Environmental Monitor. • Implement and enforce speed limits for construction equipment and trucks. • Apply dust suppressants to unpaved areas when necessary to suppress dust, as determined by the Environmental Monitor. Application frequency will vary, but will be determined by site specific weather conditions, including recent precipitation, temperatures, and wind speed. Input from the construction team may also warrant an increased frequency of dust suppression. • Re-vegetate cleared areas as soon as reasonably possible. • Install wind fences, as required, where determined to be necessary by the on-site Environmental Monitor. Installation of these fences will depend on site-specific conditions, including wind speeds, topography, land cover, and the extent of surrounding natural wind breaks. • Store any stockpiled material more than 30 m from a wetland, woodland, or water body. • Minimize vehicle traffic on exposed soils during site clearing, grubbing, grading and top soil removal. • For roadside collector routes, keep vegetation removal (if any) to a minimum and limited to the road right-of-way. • Locate all entry and exit pits (directional drilling) a sufficient distance from the edge of natural features (i.e., woodlands, wetlands) to maintain a vertical depth of at least 1.5 m at all times below the natural feature to protect the critical root zone. • Collect directional drill cuttings as they are generated and placed in a soil bin or bag for off-site disposal. • Restore and re-vegetate directional drill entry/exit pits to pre-construction conditions as soon as possible after construction. • Implement fugitive dust suppression techniques, such as water application to all inactive disturbed surface areas, unpaved roads, open storage piles, and work areas.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).
Disturbance and/or Mortality to Local Wildlife.	• Minimize impacts to migratory birds and their nests. • Limit potential wildlife road mortalities.	• Schedule all construction activities within 30 m of generalized significant wildlife habitats outside of the core breeding period for migratory birds (May 1st – July 31st), wherever possible, to limit disturbance to migratory birds, or their nests. • If construction and decommissioning activities within 30 m of generalized wildlife habitats will occur during the breeding bird season (May 1st- July 31st), a biologist will conduct nest searches, where natural vegetation will be removed, to ensure there will be no impact to breeding birds. • Schedule construction activities within 30 m of woodlands or wetlands to occur during daylight hours, wherever possible. • Clearly post construction speed limits. • Restore and re-vegetate entry and exit pits to pre-construction conditions as soon as possible after construction.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).
Damage or Removal of Vegetation Adjacent to the Project Location.	• Minimize impacts to natural vegetation. • Re-vegetate areas as soon as possible.	• Where construction activity occurs within 30 m of a naturally vegetated feature (i.e., woodland, wetland, etc.), clearly delineate the construction area with protective fencing, such as silt fencing or other barrier, to avoid accidental damage to species to be retained. The Environmental Monitor may also consider substituting other demarcating types for fencing, such as staking and flagging, where it is determined that there is no apparent risk to nearby natural features. This could include situations where the natural feature is at a higher elevation than construction activity. • Document all trees (>10 cm diameter at breast height (“dbh”)) to be removed and retained within the disturbance area limit, prior to construction. • Prune damaged trees through implementation of proper arboricultural techniques.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).
Soil or Water Contamination.	• Minimize impacts to natural features and wildlife habitats. • Avoid contamination of water or wetland features.	• Develop a Spill Response Plan (“SRP”) and train staff on appropriate procedures. • Keep emergency spill kits on site. • Develop a ‘frac-out’ contingency plan and train staff on appropriate procedures. • Keep contact information for the MOECC Spills Action Centre in a designated area on the construction site. • Locate vehicle washing, refueling stations, and chemical storage more than 30 m from natural features or water bodies. • Dispose of waste material by authorized and approved off-site vendors. • Use best practices to ensure directional drill depth is at an appropriate level below natural features (i.e., woodlands, wetlands, etc.) or water bodies to prevent ‘frac-out’. • Locate any directional drill entry and exit pits a sufficient distance from the edge of natural features (i.e., woodlands, wetlands, etc.) to maintain a vertical depth of at least 1.5 m at all times below the natural features to protect the critical root zone.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).
Removal of Vegetation Within the Road Right-of-way.	• Minimize direct impacts on vegetation communities and protect rare/sensitive habitats. • Maintain vegetated buffers, particularly within riparian zones. • Minimize the impacts of sedimentation on nearby natural features.	• Develop and implement an Erosion and Sediment Control Plan. • Utilize erosion blankets, silt fencing, straw bales, etc. to delineate construction activities within 30 m of a wetland, woodland, or water body. • Depending on site-specific conditions, such as topography and surface water flow patterns, the Environmental Monitor may consider substituting other styles of fencing for silt fencing, when appropriate. • Maintain erosion control measures for the duration of construction activities. • Implement and enforce speed limits for construction equipment and trucks. • Apply dust suppressants to unpaved areas when necessary to suppress dust, as determined by the Environmental Monitor. Application frequency will vary, but will be determined by site-specific weather conditions, including recent precipitation, temperatures, and wind speeds. Input from the construction team may also warrant an increased frequency of dust suppression. • Re-vegetate cleared areas as soon as reasonably possible. • Install wind fences, where determined to be necessary by the on-site Environmental Monitor. Installation of these fences will depend on site-specific conditions, including wind speeds, topography, land cover, and the extent of surrounding natural wind breaks. • Store any stockpiled material more than 30 m from a wetland, woodland, or water body. • Minimize vehicle traffic on exposed soils, and limit heavy machinery traffic on sensitive slopes. • For roadside collector routes, keep vegetation removal (if any) to a minimum and limited to the road right-of-way. • Locate all entry and exit pits (directional drilling) a sufficient distance from the edge of natural features (i.e., woodlands, wetlands) to maintain a vertical depth of at least 1.5 m at all times below the natural features to protect the critical root zone. • Collect directional drill cuttings as they are generated and placed in a soil bin or bag for off-site disposal. • Restore and re-vegetate directional drill entry/exit pits to pre-construction conditions as soon as possible after construction.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects
Reduced Stream Flow Rate. **Increased Water Temperature.**	• Maintain ground and surface water conditions with those near pre-construction conditions.	• Control rate and timing of water pumping. • Control quantity and quality of stormwater discharge using BMPs. • Avoid direct discharge into wetlands or watercourses. • Restrict taking of water during periods of extreme low flow.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).
Increase Surface Runoff. **Changes in Surface Water Drainage.**	• Limit disturbances to surface water drainage patterns.	• Maintain vegetative buffers around water bodies. • Control quantity and quality of stormwater discharge using BMPs. • Minimize grading activities to maintain existing drainage patterns as much as possible.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Accidental Vegetation Removal.	• Minimize direct impacts on vegetation communities and protect rare / sensitive habitats. • Minimize direct impacts to plant species of conservation concern. • Protect plant species of conservation concern habitat. • Minimize impacts on current species composition. • Reduce the potential spread of non-native or invasive species.	Common Mitigation • Clearly delineate work area using erosion fencing, or other barrier, to avoid accidental damage to species to be retained and habitat. • Depending on site-specific conditions, such as steep topography and the presence of direct, or regular, surface water flow, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. The Environmental Monitor(s) will be an independent contractor with experience providing environmental recommendations on a large-scale construction site. Significant Woodlands • Where construction is within 10 m of a significant woodland, erect erosion fencing to correspond to the disturbance area limits. • Place the erosion fencing as far away as possible from the significant woodland and no closer to the significant woodland than the drip-line. • No use of herbicides (project related activities only) within significant features or wildlife habitats. Plant species of Conservation Concern • Locate directional drilling entry and exit pits a sufficient distance from the edge of this habitat to maintain a vertical depth of at least 1.5 m at all times below the habitat to protect the critical root zone. • Directional drilling will be a minimum of 1.5 m below the surface of this habitat. • Document all trees (>10 cm dbh) to be removed and retained within 5 m of construction activities, prior to construction, for all habitats containing tree species of conservation concern. • Prune damaged trees through implementation of proper arboricultural techniques.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** Significant Woodlands • Undertake weekly monitoring of the drip-line of significant woodlands within 10 m of construction activities for the duration of the construction and decommissioning phases of this Project. • Undertake monthly monitoring of the drip-line to ensure the work area is clearly delineated and drip-line boundaries are respected when construction is anticipated to occur within 10 to 30 m of significant woodlands. Plant species of Conservation Concern • Conduct post-construction monitoring in years 1, 3, and 5 of operation. Surveys will be conducted at a time of year when the species can be identified to assess any potential changes in species populations or distribution. Full details of this monitoring will be provided in the EEMP. **Contingency Measures:** Significant Woodlands • Prune any tree limbs or roots that are accidentally damaged by construction activities using proper arboricultural techniques. • Accidental damage to trees, or unexpected vegetation removal, may require re-planting of similar, native species. If re-planting is required, consult the MNRF to determine appropriate contingency measures, which may include a re-planting strategy. Plant species of Conservation Concern • Replace any plant species of conservation concern which are damaged or destroyed at a 1:1 ratio with plantings in the habitat. The success of any planted specimens will be monitored for two years after planting. • If any potential changes in species populations or distribution are noted during post-construction surveys, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas.
Disturbance of Local Wildlife.	• Avoid direct impacts on breeding birds and their habitats. • Minimize impacts on species that are relatively inactive at night and not accustomed to nighttime disturbances. • Minimize impacts to amphibian breeding habitat and minimize amphibian mortality. • Minimize impacts to woodland/wetland integrity and diversity.	Common Mitigation • Avoid construction activities during the breeding bird period (May 1st – July 31st), wherever possible, to limit the disturbance of local wildlife. • If construction activities must occur during the breeding bird period (May 1st – July 31st), a biologist will conduct nest searches, in areas where natural vegetation will be removed, to ensure there will be no impact to breeding birds. • Schedule construction activities within 30 m of significant woodlands to occur during daylight hours, wherever possible, to avoid excessive noise and/or light disturbances to wildlife. • If construction activities within 30 m of significant woodlands must occur outside of daylight hours, spotlights will be directed downward and/or away from the woodland to limit potential light disturbance to breeding birds. • Implement and enforce on-site speed limits. Significant Wetlands • No use of herbicides (project related activities only) within significant features or wildlife habitats. Amphibian Woodland Breeding Habitat • Avoid construction activities located within 30 m of significant amphibian woodland breeding habitats during the peak frog breeding season (April 15th – June 15th),	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a). • Given the short-term and temporary nature of increased traffic and the restriction of construction activities to daylight hours, risk of increased mortality during construction is considered low.	**Monitoring:** Significant Woodlands/Wetlands • No monitoring plan required. Amphibian Woodland Breeding Habitat • Conduct post-construction amphibian call surveys for one year following pre-construction survey methods to assess any potential changes in amphibian breeding populations or species distribution if deemed significant. Full details of this monitoring will be provided in the EEMP. • Undertake regular construction monitoring and routine inspections to ensure proper installation of erosion control measures and that proper fugitive dust control measures are in place. • Monitor sediment and erosion control measures, such as silt fence, check dams, and dust control measures daily in areas where work is taking place and prior to and after any storm events. • Monitor sediment and erosion control measures weekly in areas where active construction is not occurring until the construction phase is complete. • Correct silt fencing, or other applicable sediment and erosion control measures, that is not working properly. • Ensure an Environmental Monitor is present, as required, when active directional drilling is occurring.

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
		wherever possible, or install drift fencing (erosion fencing) to help control amphibian movements around construction activity. • Schedule construction activities to occur during daylight hours, wherever possible, to limit potential impacts from light, noise or vehicle interactions.		**Contingency Measures:** <u>Significant Woodlands/Wetlands</u> • No contingency plan required. <u>Amphibian Woodland Breeding Habitat</u> • If deficiencies in sediment and erosion control measures are noted, the Environmental Monitor will notify the contract administrator and recommend remedial actions, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. • If sedimentation and erosion control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If fugitive dust control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • In the event of a spill, notify the MOECC Spills Action Centre, immediately stop work and ensure all efforts are made to completely remediate affected areas, especially prior to rain events. • Given the short-term and temporary nature of increased traffic and the restriction of construction activities to daylight hours, wherever possible, risk of increased mortality during construction is considered low. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. • If the results of the monitoring indicate a feature is no longer significant, the MNRF will be consulted to discuss the need (if any) for additional post-construction surveys.
Sedimentation and Erosion. **Habitat Degradation Caused by Sedimentation and Erosion.**	• Minimize impacts to natural features and associated wildlife habitats. • Minimize impacts to plant species of conservation concern. • Protect plant species of conservation concern habitat. • Maintain vegetated buffers, including riparian zones. • Avoid contamination of plant species of conservation concern habitat. • Minimize impacts to butterfly species of conservation concern habitat. • Minimize impacts to amphibian breeding habitat and minimize amphibian mortality. • Minimize impacts to woodland/wetland integrity and diversity. • Minimize impacts to raptor wintering areas • Avoid contamination of raptor wintering area habitat. • Minimize impacts to bat maternity colony habitats • Avoid contamination of bat maternity colony habitat. • Minimize impacts to marsh bird breeding habitat • Avoid contamination of marsh bird breeding habitat. • Minimize impacts to open country bird breeding habitat. • Avoid contamination of open country bird breeding habitat. • Minimize impacts to bird species of conservation concern habitat. • Avoid contamination of bird species of conservation concern habitat.	<u>Common Mitigation</u> • Implement an Erosion and Sediment Control Plan. • Install, monitor, and maintain erosion and sediment control measures (i.e., silt fences) around the construction area, as identified within the Erosion and Sediment Control Plan. • Schedule grading to avoid times of high runoff volumes, wherever possible and suspend work if an excessive sediment discharge occurs, as determined by an Environmental Monitor, until mitigation measures have been established. • Locate all directional drill entry and exit pits a sufficient distance from the edge of these natural features to maintain a vertical depth of at least 1.5 m at all times below the natural features to protect the critical root zone. • Collect directional drill cuttings as they are generated and placed in a soil bin or bag for off-site disposal. • Restore and re-vegetate directional drill entry/exit pits to pre-construction conditions as soon as possible after construction. • Depending on site-specific conditions, such as steep topography and the presence of direct, or regular, surface water flow, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. <u>Significant Wetlands</u> • Erect erosion fencing to correspond to the construction disturbance area limits. • Place the erosion fencing as far away as possible from the significant wetland and no closer to the significant wetland than the drip-line. • Where the temporary construction area is proposed to be within 5 m of, but not overlapping, a significant wetland (excluding along existing municipal roads), design any permanent infrastructure (i.e., access roads) to be 5 m from the wetland edge and plant native vegetation in the 5 m buffer between the infrastructure and wetland edge. • Re-vegetate areas adjacent to the significant wetland as soon as possible. <u>Amphibian Breeding Habitat</u> • Schedule grading to avoid times of high runoff volumes, wherever possible and suspend work if an excessive sediment discharge occurs until mitigation measures have been established. • Locate all directional drilling entry and exit pits a sufficient distance from the edge of this natural feature to maintain a vertical depth of at least 1.5 m at all times below the natural feature to protect the critical root zone. • Collect directional drill cuttings as they are generated and placed in a soil bin or bag for	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** <u>Common Monitoring</u> • Undertake regular construction monitoring and routine inspections to ensure proper installation of erosion control measures and that proper fugitive dust control measures are in place. • Monitor sediment and erosion control measures, such as silt fence, check dams, and dust control measures daily in areas where work is taking place and prior to and after any storm events. • Monitor sediment and erosion control measures weekly in areas where active construction is not occurring until the construction phase is complete. • Correct silt fencing, or other applicable sediment and erosion control measures, that is not working properly. • An Environmental Monitor will be present, as required, when active directional drilling is occurring. <u>Plant Species of Conservation Concern</u> • Conduct post-construction monitoring in years 1, 3, and 5 of operation following pre-construction survey methods. Surveys will be conducted at a time of year when the species can be identified to assess any potential changes in species populations or distribution. Full details of this monitoring will be provided in the EEMP. <u>Amphibian Breeding Habitat</u> • Conduct post-construction amphibian call surveys for one year following pre-construction survey methods to assess any potential changes in amphibian breeding populations or species distribution if deemed significant. Full details of this monitoring will be provided in the EEMP. • Ensure that an Environmental Monitor will be present at all times when active directional drilling is occurring. **Contingency Measures:** <u>Common Contingency</u> • If any potential changes in species population or distribution are noted during post-construction surveys, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. If deficiencies in sediment and erosion control measures are noted, the Environmental Monitor will notify the contract administrator and recommend remedial actions.

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
		off-site disposal. Restore and re-vegetate directional drill entry/exit pits to pre-construction conditions as soon as possible after construction.		• If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. • If sedimentation and erosion control measures and degradation of the natural feature occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • In the event of a spill, notify the MOECC Spills Action Centre, immediately stop work, and ensure all efforts are made to completely remediate affected areas, especially prior to rain events. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. Amphibian Breeding Habitat • If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. • If sedimentation and erosion control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If fugitive dust control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • Given the short-term and temporary nature of increased traffic and the restriction of construction activities to daylight hours, risk of increased mortality during construction is considered low. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. • If the results of the monitoring indicate a feature is no longer significant, consult the MNRF to discuss the need (if any) for additional post-construction surveys.
Fugitive Dust Emission. **Habitat Degradation Caused by Fugitive Dust Emission.**	• Minimize impacts to natural features and associated wildlife habitats. • Minimize impacts to plant species of conservation concern. • Protect plant species of conservation concern habitat. • Maintain vegetated buffers, including riparian zones. • Avoid contamination of plant species of conservation concern habitat. • Minimize impacts to amphibian breeding habitat and minimize amphibian mortality. • Minimize impacts to woodland/wetland integrity and diversity. • Minimize impacts to raptor wintering areas. • Avoid contamination of raptor wintering area habitat. • Minimize impacts to bat maternity colony habitats • Avoid contamination of bat maternity colony habitat. • Minimize impacts to marsh bird breeding habitat. • Avoid contamination of marsh bird breeding habitat. • Minimize impacts to open country bird breeding habitat. • Avoid contamination of open country bird breeding habitat. • Minimize impacts to bird species of conservation concern habitat. • Avoid contamination of bird species of conservation concern habitat. • Minimize impacts to butterfly species of conservation concern habitat. • Avoid contamination of butterfly species of conservation concern habitat.	Common Mitigation • Implement and enforce speed limits for construction equipment and trucks. • Apply dust suppressants to unpaved areas when necessary to suppress dust, as determined by the Environmental Monitor. Application frequency will vary, but will be determined by site-specific weather conditions, including recent precipitation, temperatures, and wind speeds. Input from the construction team may also warrant an increased frequency of dust suppression. • Re-vegetate cleared areas as soon as reasonably possible. Significant Wetlands • Install wind fences, where determined to be necessary by the on-site Environmental Monitor. Installation of these fences will depend on site-specific conditions, including wind speeds, topography, land cover, and the extent of surrounding natural wind breaks. Where the temporary construction area is proposed to be within 5 m of, but not overlapping, a wetland (excluding along existing municipal roads), place any permanent infrastructure (i.e., access roads) 5 m from the wetland edge and plant native vegetation in the 5 m buffer between the infrastructure and wetland edge. • Re-vegetate areas adjacent to the wetland as soon as possible.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** Common Monitoring • Undertake regular construction monitoring and routine inspections to ensure proper installation of erosion control measures and that proper fugitive dust control measures are in place. • Monitor sediment and erosion control measures, such as silt fences, check dams, and dust control measures daily in areas where work is taking place and prior to and after any storm events. • Monitor sediment and erosion control measures twice weekly in areas where active construction is not occurring until the construction phase is complete. • Correct silt fencing, or other applicable sediment and erosion control measures, that is not working properly. • Ensure an Environmental Monitor is present at all times when active directional drilling is occurring. • If fugitive dust control measures fail or negative impacts are observed, consult the MNRF on the appropriate action(s) to be taken. Plant Species of Conservation Concern • Conduct post-construction monitoring in years 1, 3, and 5 of operation following pre-construction survey methods. Surveys will be conducted at a time of year when the species can be identified to assess any potential changes in species populations or distribution. Full details of this monitoring will be provided in the EEMP. Amphibian Breeding Habitat • Conduct post-construction amphibian call surveys for one year following pre-construction survey methods to assess any potential changes in amphibian breeding populations or species distribution if deemed significant. Full details of this monitoring will be provided in the EEMP. • An Environmental Monitor will be present at all times when active directional drilling is occurring. **Contingency Measures:** Common Contingency Measures • If deficiencies in sediment and erosion control measures are noted, the Environmental Monitor will notify the contract administrator and recommend remedial actions. • If sedimentation and erosion control measures fail and degradation of the natural feature occurs, consult the MNRF to determine appropriate contingency measures, which may

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
				include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. • If fugitive dust control measures fail and degradation of the natural feature occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • In the event of a spill, notify the MOECC Spills Action Centre, immediately stop work, and ensure all efforts are made to completely remediate affected areas, especially prior to rain events. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. <u>Plant Species of Conservation Concern</u> • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. <u>Amphibian Breeding Habitat</u> • If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. • If sedimentation and erosion control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If fugitive dust control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • Given the short-term and temporary nature of increased traffic and the restriction of construction activities to daylight hours, risk of increased mortality during construction is considered low. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. • If the results of the monitoring indicate a feature is no longer significant, the MNRF will be consulted to discuss the need (if any) for additional post-construction surveys.
Spills *(i.e., oil, gasoline, grease, etc.).* **Habitat Degradation Caused by Spills** *(i.e., oil, gasoline, grease, etc.).*	• Minimize impacts to natural features and associated wildlife habitats. • Maintain vegetated buffers, including riparian zones. • Minimize impacts to plant species of conservation concern. • Protect plant species of conservation concern habitat. • Maintain vegetated buffers, including riparian zones. • Avoid contamination of plant species of conservation concern habitat. • Minimize impacts to raptor wintering areas. • Avoid contamination of raptor wintering area habitat. • Minimize impacts to bat maternity colony habitats • Avoid contamination of bat maternity colony habitat. • Minimize impacts to amphibian breeding habitat and minimize amphibian mortality. • Minimize impacts to woodland/wetland integrity and diversity. • Minimize impacts to marsh bird breeding habitat. • Avoid contamination of marsh bird breeding habitat. • Minimize impacts to open country bird breeding habitat. • Avoid contamination of open country bird breeding habitat. • Minimize impacts to bird species of conservation concern habitat. • Avoid contamination of bird species of conservation concern habitat.	<u>Common Mitigation</u> • Develop a SRP and train staff on appropriate procedures. • Develop a 'frac-out' contingency plan and train staff on appropriate procedures. • Keep emergency spill kits on site. • Keep contact information for the MOECC Spills Action Centre in all vehicles as well as posted in a designated area on the construction site. • Dispose of waste material by authorized and approved off-site vendors. • Store hazardous materials in designated areas. • Locate all maintenance activities, vehicle refueling or washing, as well as the storage of chemical and construction equipment more than 30 m from significant features. <u>Amphibian Breeding Habitat</u> • Develop a 'frac-out' contingency plan and train staff on appropriate procedures.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** <u>Common Monitoring</u> • Undertake regular construction monitoring and routine inspections to ensure proper installation of erosion control measures and that proper fugitive dust control measures are in place. • Monitor sediment and erosion control measures, such as silt fence, check dams, and dust control measures daily in areas where work is taking place and prior to and after any storm events. • Monitor sediment and erosion control measures weekly in areas where active construction is not occurring until the construction phase is complete. • Correct silt fencing, or other applicable sediment and erosion control measures, that is not working properly. • Conduct post-construction behaviour surveys of the habitat for three years following pre-construction survey methods to assess the potential project disturbance on all habitats deemed significant. Full details of this monitoring will be provided in the EEMP. • An Environmental Monitor will be present at all times when active directional drilling is occurring. <u>Butterfly Species of Conservation Concern</u> • Conduct one year of post-construction surveys of the habitat to assess the potential project disturbance on this habitat. Full details of this monitoring will be provided in the EEMP. <u>Plant Species of Conservation Concern</u> • Conduct post-construction monitoring in years 1, 3, and 5 of operation following pre-construction survey methods. Surveys will be conducted at a time of year when the species can be identified to assess any potential changes in species populations or distribution. Full details of this monitoring will be provided in the EEMP. <u>Amphibian Breeding Habitat</u> • Conduct post-construction amphibian call surveys for one year following pre-construction survey methods to assess any potential changes in amphibian breeding populations or

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
	• Minimize impacts to woodland/wetland integrity and diversity. • Minimize impacts to butterfly species of conservation concern habitat. • Avoid contamination of butterfly species of conservation concern habitat.			species distribution if deemed significant. Full details of this monitoring will be provided in the EEMP. • An Environmental Monitor will be present at all times when active directional drilling is occurring. **Contingency Measures:** <u>Common Contingency</u> • If deficiencies in sediment and erosion control measures are noted, the Environmental Monitor will notify the contract administrator and recommend remedial actions. • If sedimentation and erosion control measures fail and degradation of the natural feature occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If fugitive dust control measures fail or and degradation of the natural feature occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas • In the event of a spill, notify the MOECC Spills Action Centre, immediately stop work, and ensure all efforts are made to completely remediate affected areas, especially prior to rain events. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. • If any potential changes in species population or distribution are noted during post-construction surveys, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. <u>Amphibian Breeding Habitat</u> • If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. • If sedimentation and erosion control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If fugitive dust control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • Given the short-term and temporary nature of increased traffic and the restriction of construction activities to daylight hours, risk of increased mortality during construction is considered low. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. • If the results of the monitoring indicate a feature is no longer significant, the MNRF will be consulted to discuss the need (if any) for additional post-construction surveys.
Changes in Soil Moisture and Compaction.	• Minimize impact to soil moisture regime and vegetation species composition.	<u>Common Mitigation</u> • Minimize the use of impervious surfaces where possible, such as utilizing and contouring permeable surface material (i.e., gravel) to increase infiltration, and reduce surface water runoff. • Minimize paved surfaces and design roads to promote infiltration. <u>Significant Woodlands</u> • Clearly delineate the drip-line and root zone of all trees within 10 m of construction activities with erosion fencing or similar barrier.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWH (NRSI, 2015a).	**Monitoring and Contingency Measures:** • No monitoring or contingency plan required.

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Accidental Vegetation Removal from Significant Woodlands *(Project Location is sited outside of Significant Woodlands – impact to vegetation is not anticipated).*	• Minimize direct impacts on vegetation communities and protect rare / sensitive habitats.	• Clearly delineate work area using erosion fencing, or other barriers, to avoid accidental damage to retained species. • Where construction is within 10 m of a significant woodland, erect erosion fencing to correspond to the disturbance area limits. • Place the erosion fencing as far away as possible from the significant woodland and no closer to the significant woodland than the drip-line. • Depending on site-specific conditions, such as steep topography and the presence of direct, or regular, surface water flow, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. The Environmental Monitor may also consider substituting other demarcating types for fencing, such as staking and flagging, where it is determined that there is no apparent risk to nearby natural features. This could include situations where the natural feature is at higher elevation than construction activity. • No use of herbicides (project related activities only) within significant features or wildlife habitats.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** • Undertake regular monitoring of the drip-line to ensure the work area is clearly delineated within 10 m of construction activities for the duration of the construction and decommissioning phases of this project. This monitoring will be conducted at a minimum frequency of once per week when construction is anticipated within 10 m of a significant woodland. • Undertake regular monitoring of the drip-line to ensure the work area is clearly delineated and drip-line boundaries are respected when construction is anticipated to occur within 10 to 30 m of significant woodlands, at a minimum frequency of once per month. **Contingency Measures:** • Prune any tree limbs or roots that are accidentally damaged by construction activities using proper arboricultural techniques. • Accidental damage to trees, or unexpected vegetation removal, may require re-planting of similar, native species. If re-planting is required , a re-planting strategy will be provided to the MNRF.
Reduced Flood Attenuation in Significant Wetlands.	• Minimize direct impacts on vegetation communities and protect rare/sensitive habitats. • Minimize impacts to hydrological connectivity. • Minimize impacts to water quality.	• Clearly delineate work area using erosion fencing, or other barrier, to avoid accidental damage to retained wetland vegetation and to avoid impacting hydrological connectivity. • Depending on site-specific conditions, such as steep topography and the presence of direct, or regular, surface water flow patterns, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. • Re-vegetate cleared areas as soon as reasonably possible. • Where the temporary construction area is proposed to be within 5 m of, but not overlapping, a Significant Wetland (excluding along existing municipal roads), design any permanent infrastructure (i.e., access roads) to be 5 m from the wetland edge and plant native vegetation in the 5 m buffer between the infrastructure and wetland edge.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** • Undertake regular monitoring of the Significant Wetland to ensure proper erosion and sediment control measures, including fencing, are in place within 10 m of construction activities for the duration of the construction and decommissioning phases of the project. This monitoring will be conducted at a minimum frequency of once per week when construction is anticipated within 10 m of a significant wetland. • Undertake regular monitoring of the wetland to ensure proper erosion and sediment control measures, including fencing, are in place when construction is anticipated to occur within 10 to 30 m of significant wetlands, at a minimum frequency of once per month. Depending on the season and site-specific conditions, such as topography, surface water flow patterns, and the presence or absence of vegetative buffers, monitoring frequency will be increased at the discretion of the Environmental Monitor. **Contingency Measures**: • If sedimentation and erosion or fugitive dust control measures fail and degradation of the natural feature occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If negative impacts such as reduced water quality, infiltration and/or groundwater discharge are observed, consult the MNRF to determine appropriate contingency measures.
Reduced Water Quality in Significant Wetlands.	• Minimize direct impacts on vegetation communities and protect rare/sensitive habitats. • Minimize impacts to hydrological connectivity. • Minimize impacts to water quality.	• Clearly delineate work area using erosion fencing, or other barrier, to avoid accidental damage to retained wetland vegetation and to avoid impacting water quality. • Depending on site-specific conditions, such as steep topography and the presence of direct, or regular, surface water flow, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. • Implement and enforce speed limits for construction equipment and trucks. • Apply dust suppressants to unpaved areas when necessary to suppress dust, as determined by the Environmental Monitor. Application frequency will vary, but will be determined by site-specific weather conditions, including recent precipitation, temperatures, and wind speeds. Input from the construction team may also warrant an increased frequency of dust suppression. Re-vegetate areas adjacent to the wetland as soon as possible. • Install wind fences, where determined to be necessary by the on-site Environmental Monitor. Installation of these fences will depend on site-specific conditions, including wind speeds, topography, land cover, and the extent of surrounding natural wind breaks. Where the temporary construction area is proposed to be within 5 m of, but not overlapping, a wetland (excluding along existing municipal roads), design any permanent infrastructure (i.e., access roads) to be 5 m from the wetland edge and plant native vegetation in the 5 m buffer between the infrastructure and wetland edge.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** • Undertake regular monitoring of the Significant Wetland to ensure proper erosion and sediment control measures, including fencing, are in place within 10 m of construction activities for the duration of the construction and decommissioning phases of the project. This monitoring will be conducted at a minimum frequency of once per week when construction is anticipated within 10 m of a significant wetland. • Undertake regular monitoring of the wetland to ensure proper erosion and sediment control measures, including fencing, are in place when construction is anticipated to occur within 10 to 30 m of a Significant Wetland, at a minimum frequency of once per month. Depending on the season and site-specific conditions, such as topography, surface water flow patterns, and the presence or absence of vegetative buffers, monitoring frequency will be increased at the discretion of the Environmental Monitor. **Contingency Measures:** • If sedimentation and erosion or fugitive dust control measures fail and degradation of the natural feature occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If negative impacts such as reduced water quality, infiltration and/or groundwater discharge are observed, consult the MNRF to determine appropriate contingency measures.

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Reduced Infiltration and Groundwater Discharge in Significant Wetlands.	• Minimize direct impacts on vegetation communities and protect rare / sensitive habitats. • Minimize impacts to hydrological connectivity. • Minimize impacts to water quality.	• Minimize the use of impervious surfaces where possible, such as utilizing and contouring permeable surface material (i.e., gravel) to increase infiltration and reduce surface water runoff. For groundwater taking (if necessary): • Control rate and timing of water pumping. • Restrict taking of groundwater and surface water during extreme low flow time periods. • Control quantity and quality of stormwater discharge using BMPs, and avoid direct discharge into wetlands or watercourses.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWH (NRSI, 2015a).	**Monitoring:** • Undertake regular monitoring of the Significant Wetland to ensure proper erosion and sediment control measures, including fencing, are in place within 10 m of construction activities for the duration of the construction and decommissioning phases of the project. This monitoring will be conducted at a minimum frequency of once per week when construction is anticipated within 10 m of a Significant Wetland. • Undertake regular monitoring of the Significant Wetland to ensure proper erosion and sediment control measures, including fencing, are in place when construction is anticipated to occur within 10 to 30 m of a Significant Wetland, at a minimum frequency of once per month. Depending on the season and site-specific conditions, such as topography, surface water flow patterns, and the presence or absence of vegetative buffers, monitoring frequency will be increased at the discretion of the Environmental Monitor. **Contingency Measures:** • If sedimentation and erosion or fugitive dust control measures fail and degradation of the natural feature occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If negative impacts such as reduced water quality, infiltration and/or groundwater discharge are observed, consult the MNRF to determine appropriate contingency measures.
Noise Disturbance / Avoidance Behaviour.	• Minimize disturbance / avoidance behavior of butterfly species of conservation concern. • Protect bat maternity colony habitat. • Minimize impacts to marsh bird breeding habitat and minimize marsh bird mortality. • Minimize impacts to wetland integrity and diversity. • Protect open country bird breeding habitat. • Minimize noise disturbance/avoidance behavior of bird species of conservation concern.	<u>Bat Maternity Colony</u> • Impacts are expected to be minimal, and temporary, in nature, and no specific mitigation measures have been determined necessary. • <u>Schedule construction and regular (non-critical) maintenance activities to occur outside of the critical roosting period (June), unless specifically required in accordance with manufacturer specifications.</u> <u>Marsh Bird Breeding habitat</u> • Schedule construction and regular (non-critical) maintenance activities to occur outside of the peak marsh bird breeding season (April – June), wherever possible. • If construction must occur during this peak breeding season, have a biologist present to confirm birds will not be affected by construction activities. <u>Open Country Breeding Bird Habitat</u> • Clearly delineate work area using erosion fencing, or other barrier, to avoid accidental damage to breeding habitat. • Depending on site-specific conditions, such as steep topography and the presence of direct, or regular, surface water flow, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. • Restore temporary construction areas, including crane paths and turbine pads, to pre-construction conditions as soon as possible. • Schedule construction activities to occur outside of the peak breeding bird season (May 1st – July 31st), wherever possible. • If construction must occur during the breeding bird period (May 1st – July 31st), have a biologist present to confirm no nests will be affected by construction. <u>Bird Species of Conservation Concern</u> • Schedule construction and regular (non-critical) maintenance activities located within 30 m of significant bird species of conservation concern habitat to occur outside of the peak breeding bird season (May 1st – July 31st), whenever possible. • If construction and maintenance must occur during the breeding bird period (May 1st – July 31st), have a biologist present to confirm birds will not be affected by construction or maintenance activities. <u>Butterfly Species of Conservation Concern</u> • Schedule construction and regular (non-critical) maintenance activities located within 30 m of significant butterfly species of conservation concern habitat to occur outside of the flight period for when this species is likely to be encountered (late June to early August), whenever possible. • If construction and maintenance must occur during the peak flight period, have a biologist present to confirm that this species will not be affected by construction or maintenance activities.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** <u>Marsh Bird Breeding habitat/Open Country Breeding Bird Habitat/Bird Species of Conservation Concern</u> • Conduct post-construction behaviour surveys of the habitat for three years following pre-construction survey methods to assess the potential project disturbance on all habitats deemed significant. Full details of this monitoring will be provided in the EEMP. <u>Bat Maternity Colony</u> • Conduct post-construction monitoring of this feature for three years after construction, following pre-construction methods, for all features deemed significant. Full details of this monitoring will be provided in the EEMP. • Conduct post-construction mortality monitoring at this facility for at least three years following MNRF guidelines (MNRF, 2011b). The turbine closest to this habitat (T19) will be included with the subsample of turbines monitored during post-construction mortality monitoring, if this habitat is confirmed to be significant. Full details of this monitoring will be provided within the EEMP. <u>Butterfly Species of Conservation Concern</u> • Conduct one year of post-construction surveys of the habitat to assess the potential project disturbance on this habitat. Full details of this monitoring will be provided in the EEMP. **Contingency Measures:** <u>Bat Maternity Colony</u> • If a permanent disturbance has been noted within this wildlife habitat, the MNRF will be contacted to determine whether additional mitigation measures will be needed. • If high bat mortality is observed at T19, discuss appropriate mitigation measures with the MNRF. <u>Marsh Bird Breeding habitat/ Open Country Breeding Bird Habitat</u> • If a permanent disturbance has been noted within this wildlife habitat, consult the MNRF to determine whether additional mitigation measures will be needed. <u>Bird Species of Conservation Concern</u> • If considerable, and consistent, disturbance impacts are noted, discuss appropriate mitigation measures directly with the MNRF. <u>Butterfly Species of Conservation Concern</u> • If the results of the monitoring indicate a feature is no longer significant, consult the MNRF to discuss the need (if any) for additional post-construction surveys.

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Accidental Loss of Habitat *(damage to vegetation, including root zones).*	• Minimize impacts to amphibian breeding habitat and minimize amphibian mortality. • Minimize impacts to woodland / wetland integrity and diversity. • Minimize impacts to bird species of conservation concern habitat. • Minimize direct impacts to butterfly species of conservation concern habitat. • Minimize impacts to marsh bird breeding habitat and minimize marsh bird mortality. • Minimize impacts to wetland integrity and diversity. • Protection of open country bird breeding habitat.	Common Mitigation • Clearly delineate work area using erosion fencing, or other barrier, to avoid accidental vegetation damage within amphibian breeding habitat. • Depending on site-specific conditions, such as topography and surface water flow patterns, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. • No use of herbicides (project related activities only) within significant features or wildlife habitats. • Directional drilling entry and exit pits will be located at a sufficient distance from the edge of the natural feature to maintain a vertical depth of at least 1.5 m at all times below the natural feature to protect the critical root zone. • Directional drilling will be a minimum of 1.5 m below the surface of this habitat. Amphibian Woodland Breeding • Avoid direct impacts to specific breeding habitat (i.e., vernal pools or other aquatic habitat), or to the immediately surrounding woodland habitat. Bird Species of Conservation Concern • Restore temporary construction areas to pre-construction conditions as soon as possible. Butterfly Species of Conservation Concern • Clearly delineate work area using erosion fencing, or other barrier, to avoid accidental damage to butterfly species of conservation concern habitat. • Restore temporary construction areas to pre-construction conditions as soon as possible.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a). • Given the short-term and temporary nature of increased traffic and the restriction of construction activities to daylight hours, risk of increased mortality during construction is considered low.	**Monitoring:** Amphibian Woodland Breeding • Conduct post-construction amphibian call surveys for one year following pre-construction survey methods to assess any potential changes in amphibian breeding populations or species distribution if deemed significant. Full details of this monitoring will be provided in the EEMP. • Undertake regular construction monitoring and routine inspections to ensure proper installation of erosion control measures and that proper fugitive dust control measures are in place. • Monitor sediment and erosion control measures, such as silt fence, check dams, and dust control measures daily in areas where work is taking place and prior to and after any storm events. • Monitor sediment and erosion control measures weekly in areas where active construction is not occurring until the construction phase is complete. • Correct silt fencing, or other applicable sediment and erosion control measures, that is not working properly. • An Environmental Monitor will be present, as required, when active directional drilling is occurring. Bird Species of Conservation Concern • Conduct post-construction behaviour surveys of this habitat for three years following pre-construction survey methods to assess the potential project disturbance on this habitat. Full details of this monitoring will be provided within the EEMP. Butterfly Species of Conservation Concern • Conduct one year of post-construction surveys of the habitat to assess the potential project disturbance on this habitat. Full details of this monitoring will be provided in the EEMP. Marsh Bird Breeding Habitat/Open Country Breeding Birds • Conduct post-construction monitoring of this feature for three years after construction, following pre-construction methods, for all features deemed significant. Full details of this monitoring will be provided within the EEMP. **Contingency Measures:** Amphibian Woodland Breeding • If deficiencies in sediment and erosion control measures are noted, the Environmental Monitor will notify the contract administrator and recommend remedial actions, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. • If sedimentation and erosion control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If fugitive dust control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • In the event of a spill, notify the MOECC Spills Action Centre, immediately stop work and ensure all efforts are made to completely remediate affected areas, especially prior to rain events. • Given the short-term and temporary nature of increased traffic and the restriction of construction activities to daylight hours, wherever possible, risk of increased mortality during construction is considered low. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. • If the results of the monitoring indicate a feature is no longer significant, the MNRF will be consulted to discuss the need (if any) for additional post-construction surveys. Bird Species of Conservation Concern • Maintain bird species of conservation concern habitat quality and quantity within the project area, using baseline conditions as a minimum standard. Butterfly Species of Conservation Concern • Maintain butterfly species of conservation concern habitat within the project area in consultation with the MNFR, which may include restoring habitats with suitable host plants for butterfly species of conservation concern. Marsh Bird Breeding Habitat/Open Country Breeding Birds • If a permanent disturbance has been noted within this wildlife habitat, consult the MNRF to determine whether additional mitigation measures will be needed.

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Increased Species Competition to Plant Species of Conservation Concern through Introduction of Invasive Species.	• Minimize impacts to plant species of conservation concern. • Protect plant species of conservation concern habitat. • Maintain vegetated buffers, including riparian zones. • Avoid contamination of plant species of conservation concern habitat.	• Clearly delineate work area using erosion fencing, or other barrier, to minimize seed transfer into suitable habitat. • Depending on site-specific conditions, such as steep topography and presence of direct, or regular, surface water flow, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. • Regularly clean vehicles and equipment. • Vehicle use will occur primarily on access roads and in agricultural habitats, where invasive and non-native vegetation species are less likely to be concentrated.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** • Conduct post-construction monitoring in years 1, 3, and 5 of operation following pre-construction survey methods. Surveys will be conducted at a time of year when the species can be identified to assess any potential changes in species populations or distribution. Full details of this monitoring will be provided in the EEMP. • Undertake regular construction monitoring and routine inspections to ensure proper installation of erosion control measures and that proper fugitive dust control measures are in place. • Monitor sediment and erosion control measures, such as silt fence, check dams, and dust control measures daily in areas where work is taking place and prior to and after any storm events. • Monitor sediment and erosion control measures weekly in areas where active construction is not occurring until the construction phase is complete. • Correct silt fencing, or other applicable sediment and erosion control measures, that is not working properly. • An Environmental Monitor will be present at all times when active directional drilling is occurring. **Contingency Measures:** • If any potential changes in species population or distribution are noted during post-construction surveys, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. • If deficiencies in sediment and erosion control measures are noted, the Environmental Monitor will notify the contract administrator and recommend remedial actions, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. • If sedimentation and erosion control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • If fugitive dust control measures fail and degradation of the habitat(s) occurs, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas. • In the event of a spill, notify the MOECC Spills Action Centre, immediately stop work and ensure all efforts are made to completely remediate affected areas, especially prior to rain events.
Accidental Damage to Raptor Wintering Area Habitat, Including Tree Limbs.	• Protect raptor wintering area habitat. • Limit disturbance to raptors overwintering within the project area.	• Clearly delineate work area using erosion fencing, or other barrier, to avoid accidental vegetation damage within significant raptor wintering areas. • No use of herbicides (project related activities only) within significant features or wildlife habitats.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** • Conduct post-construction surveys of this wildlife habitat for one year after construction, following pre-construction methods if the habitats are deemed significant. Full details of this monitoring will be provided in the EEMP. • If surveys indicate that there is an avoidance effect, consult with MNRF to determine the need for an additional two years of post-construction monitoring following pre-construction methods. **Contingency Measures:** • Consult MNRF to determine contingency measures.
Accidental Damage to Bat Maternity Colony Habitat, Including Tree Limbs *(Project locations are sited outside of habitats – vegetation removal is not anticipated).*	• Protection of bat maternity colony habitat.	• Clearly delineate work area using erosion fencing, or other barrier, to avoid accidental damage to potentially significant bat roosting trees. • Depending on site-specific conditions, such as topography and surface water flow patterns, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. • No use of herbicides (project related activities only) within significant features or wildlife habitats.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** • Conduct post-construction monitoring of this feature for three years after construction, following pre-construction methods, for all features deemed significant. Full details of this monitoring will be provided in the EEMP. • Conduct post-construction mortality monitoring at this facility for at least three years following MNRF guidelines (MNRF, 2011b). The turbine closest to this habitat (T19) will be included with the subsample of turbines monitored during post-construction mortality monitoring, if this habitat is confirmed to be significant. Full details of this monitoring will be provided within the EEMP. **Contingency Measures:** • If a permanent disturbance has been noted within this wildlife habitat, contact the MNRF to determine whether additional mitigation measures will be needed. • If high bat mortality is observed at T19, discuss appropriate mitigation measures with the MNRF.

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant and Treated as Significant Wetlands, Woodlands and Wildlife Habitat

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Accidental Damage to Plant Species of Conservation Concern.	• Minimize direct impacts to plant species of conservation concern. • Protect plant species of conservation concern habitat. • Minimize impacts on current species composition. • Reduce the potential spread of non-native or invasive species.	• Clearly delineate work area using erosion fencing, or similar barrier, to avoid accidental damage to species to be retained and habitat. • Depending on site-specific conditions, such as steep topography and the presence of direct, or regular, surface water flow, the Environmental Monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. • Directional drilling entry and exit pits will be located a sufficient distance from the edge of the natural feature to maintain a vertical depth of at least 1.5 m at all times below the natural feature to protect the critical root zone. • Directional drilling will be a minimum of 1.5 m below the surface of this habitat. • No use of herbicides (project related activities only) within significant features or wildlife habitats. • Re-vegetate cleared areas as soon as reasonably possible.	• Assuming the implementation of the planned mitigation measures, monitoring programs, and contingency plans (if necessary), there is unlikely to be any significant impacts to natural heritage features, including woodlands, wetlands, or SWHs (NRSI, 2015a).	**Monitoring:** • Conduct post-construction monitoring in years 1, 3, and 5 of operation following pre-construction survey methods. Surveys will be conducted at a time of year when the species can be identified to assess any potential changes in species populations or distribution. Full details of this monitoring will be provided within the EEMP. **Contingency Measures:** • Replace any plant species of conservation concern which are damaged or destroyed at a 1:1 ratio with plantings in the habitat. The success of any planted specimens will be monitored for two years after planting. • If any potential changes in species populations or distribution are noted during post-construction surveys, consult the MNRF to determine appropriate contingency measures, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas.

4.3 Impacts to Water Resources (Including from Spills)

Potential effects to surface water, resulting from locating a Project component within the prescribed setbacks to water bodies, are evaluated in the Water Body Assessment and Water Body Report (NRSI, 2015b) and are described below. Similarly, the potential effects to groundwater are evaluated in the Hydrological Assessment and Effects Assessment Report (refer to **Appendix B** of the Design and Operations Report).

4.3.1 Surface Water and Runoff and Impacts to Water Bodies

According to Section 1.1 of the O. Reg. 359/09, as amended, a water body is defined as: a:

> *"A lake, permanent stream, intermittent stream and a seepage area but does not include:*
>
> *a) grassed waterways;*
> *b) temporary channels for surface drainage, such as furrows or shallow channels that can be tilled and driven through;*
> *c) rock chutes and spillways;*
> *d) roadside ditches that do not contain a permanent or intermittent stream;*
> *e) temporary ponded areas that are normally farmed;*
> *f) dugout ponds; and*
> *g) artificial bodies of water intended for storage, treatment or recirculation of runoff from animal yards, manure storage facilities and sites and outdoor confinement areas."*

Following the Records Review and Site Investigation, 38 water bodies were identified within 120 m of the Project Location. Of the 38 water bodies identified, 33 are overlapping with Project Location while the remaining water bodies are located within 120 m of the Project Location. All of these water bodies are either permanent or intermittent watercourses, and are designated as warmwater and/or coolwater fisheries and contain warmwater and/or coolwater baitfish species (NRSI, 2015b).

Table 4-5 provides mitigation measures, net effects and the monitoring plan for each potential effect relating to surface water.

Table 4-5: Mitigation Measures, Net Effects and Monitoring Plan: Surface Water

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Increased Erosion, Sedimentation, and Turbidity Resulting from Removal of Upland and Riparian Vegetation. **Excess Sediment Suspended and Carried Downstream by Stream Flow during the Installation and Removal of Temporary Structures.**	• Minimize erosion, sedimentation and turbidity. • Minimize transfer of sediment downstream via stream flow.	• Remove construction debris from the site and stabilize it to prevent it from entering the nearby water bodies. • Avoid construction during high volume rain events (20 millimetres (“mm”) in 24 hours) and significant snow melts/thaws, where possible, and resume once soils have stabilized to avoid risk of erosion, soil compaction or the potential for sediment release into nearby watercourses. • Avoid seasonally wet periods (i.e., spring) when conducting clearing, grubbing, and grading activities, where possible. Avoid construction during high volume rain events (20 mm in 24 hours) and significant snow melts / thaws where possible and resume once soils have stabilized to avoid risk of erosion, soil compaction or the potential for sediment release into nearby watercourses. • Develop a Flood Response Plan to deal with on-site flooding as to mitigate any possible effects to the aquatic environment. • Develop an Erosion and Sediment Control Plan to minimize the potential for construction related sediment release into nearby watercourses (Erosion and Sediment Control Plan Guideline), and prepare Erosion and Sediment Control Plan condition reports as part of the monitoring and maintenance plan. • Horizontal directional drilling should be executed at a minimum depth established by geotechnical studies to limit the potential impacts associated with the possibility of a frac-out. • Locate drilling entry/exit shafts at least 3 m from riparian vegetation or top of bank, whichever is greater, or at a distance otherwise agreed upon with regulatory agencies. • Develop and implement an emergency frac-out response plan including steps to contain, monitor and clean-up in response to the event.	• Increased flows to watercourses and associated streambed and / or bank erosion minimized through application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects as there will only be short term dewatering (if required).* • Increased transfer of sediments downstream minimized through application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects as a result.*	**Monitoring:** • Monitor on-site conditions (i.e., erosion and sediment control measures, spills, flooding). • Monitor meteorological conditions from Environment Canada during construction phase. • Monitor end point of dewatering discharge for water quality and erosion (if dewatering). • Monitor by-pass channel (if applicable). • Monitor aquatic habitat at drilling locations (if drilling). • Monitor surface water quality for general parameters (i.e., temperature, pH, dissolved oxygen, conductivity, Total Suspended Solids (“TSS”), turbidity). • Monitor water levels within water bodies during groundwater dewatering. • Monitor water levels of the water body to determine if dewatering activities are resulting in alteration of water levels within the water body. • Verify the success of all mitigation though groundwater quality sampling.
Increase in Impervious Surfaces and Increased Surface Runoff Resulting from Clearing of Forested Areas and Re-grading of Land. **Soil Compaction as a Result of Heavy Machinery and the Stockpiling of Heavy Materials (i.e., Soils) in the Project Study Area.**	• Minimize the increase of impervious surfaces and surface runoff. • Minimize soil compaction.	• Operate construction equipment (i.e., cranes, back hoes etc.), in a manner that minimizes disturbance to the banks of the watercourse and stays outside of the watercourse and bank area. • Restrict construction equipment to designated controlled vehicle access routes to minimize the potential for soil compaction.	• Increase in impervious surfaces and increased surface runoff minimized through application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects as a result.* • Soil compaction and associated increase in runoff into watercourses minimized though application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects as a result.*	
Serious Harm to Fish or Fish Habitat from Physical Changes to the Stream Channel, Streambed and Riparian Vegetation.	• Minimize alteration to the stream channel, streambed and riparian vegetation. • Minimize the alteration or removal of key aquatic habitat features. • Minimize the time of restricted fish passage.	• Implement riparian planting after construction as soon as weather permits, following reconstruction to stabilize watercourse channel banks and encourage rapid re-vegetation of disturbed soils to prevent collapse and erosion which, in turn, will minimize sedimentation, support fish habitat, and protect sensitive ecological functions that occur in water bodies. • If insufficient time is available in the growing season to establish vegetative cover, apply overwintering treatments such as erosion control blankets, fibre matting, rock (large, clean angular rocks) reinforcement/armoring or equivalent to contain the site over the winter period, and plant vegetative cover in the next growing season, followed by maintenance and inspection. • Develop fish habitat compensation measures, as required, should serious harm to fish habitat be anticipated. During surface water dewatering, collect and relocate fish to a suitable location, preferably downstream and away from the construction area prior to surface water dewatering. This should be executed by a qualified fisheries biologist.	• Harm to fish or fish habitat as a result of physical changes to stream channel and riparian vegetation minimized through application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects riparian cover and adjacent watercourse.* • Alteration or removal of key aquatic habitat features minimized through application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects as a result.* • Disruption of migration patterns minimized through application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects as a result.*	
Minor, Isolated, Short Term Dewatering of Shallow Groundwater from Excavation Areas Required when Excavation Intercepts an Area of Shallow Groundwater Table Conditions.	• Minimize short term dewatering activities when possible.	• Prior to groundwater dewatering, evaluate anticipated discharge rates and estimated zone of influence (“ZOI”) in relation to the associated water bodies to ensure the volumes will not impact water body hydrologic function. • Where a water body is located within a groundwater dewatering ZOI, develop appropriate strategies for dewatering in consultation with regulatory agencies during the detailed design phase of the project.	• Effects related to short term dewatering minimized through application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects as a result.*	
Temporary Disruption of Substrates / Habitat at Locations Where In-water Work is Required. **Completion of In-water Work Requiring In-stream Dewatering and the Construction of Temporary Dykes or Cofferdams.**	• Minimize disruption due to in-water works.	• Schedule construction activities near water to take place within the low flow period in the late summer months where possible to avoid or minimize impacts. • If in-water work is required (for culvert installation and or cabling installation), adhere to required timing windows confirmed through consultation with regulatory agencies, including the MNRF. In the event that this timing window cannot be met, consultation with MNRF will be undertaken. • Perform in-water work (if required) in the dry where possible. If this is not possible, short-term isolated dewatering will be required. Prior to dewatering, isolate the work area with the installation of a temporary water containment structure. The structure should form an impermeable enclosure, which also prevent escape of debris and sediment to the exterior water body. Construct a by-pass channel to maintain flow quantity through the watercourse and prevent from back flooding and ultimately overtopping the water containment structure.	• Temporary disruption of habitat associated with in-water works minimized through application of mitigation measures. ▪ *Moderate likelihood and magnitude of effect occurring due to number of watercourse crossings.*	

Table 4-5: Mitigation Measures, Net Effects and Monitoring Plan: Surface Water

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Water Contamination by Oils, Gasoline, Grease and Other Materials. **Contaminant Spills Due to the Proximity of Construction Vehicles and Machinery to Water Bodies.**	• Minimize soil contamination.	• Ensure machinery arrives on site in clean condition and is checked and maintained free of fluid leaks. Refuel, wash and service machinery a minimum of 30 m away from all water bodies and other drainage features to prevent any deleterious substances from entering a watercourse. • Store fuel and other construction related materials securely away from any drainage features and locate construction staging areas 30 m away from any water body. • Develop a SRP prior to commencement of construction to provide a detailed response system to deal with events such as the release of petroleum, oils and lubricants or other hazardous liquids and chemicals. Keep a spill kit on site at all times and train on-site workers in the use of this kit and the SRP. • Remove and dispose of any waste generated from the site appropriately off site according to municipal standards. • If discharging to a municipal storm sewer system, ensure that groundwater quality meets the objectives of the municipal storm sewer by-law prior to discharge. Obtain water quality samples prior to discharge to ensure the quality is suitable for discharge and will not result in an impact to the receiving watercourse.	• Soil / water contamination minimized through application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects on surface water and groundwater as a result.*	**Monitoring:** • Monitor on-site conditions (i.e., erosion and sediment control measures, spills, flooding). • Monitor meteorological conditions from Environment Canada during Construction phase. • Identify changes to existing aquatic habitat during the pre-construction (to establish a baseline) and Construction Phases. • Monitor end point of dewatering discharge for water quality and erosion (if dewatering). • Monitor by-pass channel (if applicable). • Monitor aquatic habitat at drilling locations (if drilling). • Monitor surface water quality for general parameters (i.e., temperature, pH, dissolved oxygen, conductivity, TSS, turbidity). • Monitor water levels within water bodies during groundwater dewatering. • Monitor water levels of the water body to determine if dewatering activities are resulting in alteration of water levels within the water body. • Verify the success of all mitigation though groundwater quality sampling.

4.3.2 Impacts to Groundwater (including impacts related to Water Taking)

As described in the *Technical Guide to Renewable Energy Approvals* (MOECC, 2013), an important environmental effect to consider is the potential for the Project to interfere with existing uses of a water resource. The following section provides an overview of the Hydrogeological Assessment and Effects Assessment Report for the Belle River Wind Project. For further details please refer to the Groundwater Supply Feasibility and Effects Desktop Assessment in **Appendix B** of the Design and Operations Report.

4.3.2.1 Existing Conditions

The PSA is located within the Essex Clay Plain physiographic region, a sub-region of the St. Clair Clay Plains physiographic region (Chapman and Putnam, 1984). The region is described as a low relief extensive clay plain that slopes gently to the north, toward Lake St. Clair. The prominent soil type within the region is Brookston clay loam, a dark-surfaced gleysolic soil that was developed under a swamp forest (Chapman and Putnam, 1984).

Currently, land use is dominated by general crop and livestock farming, which has been made possible by the installation of dredged ditches and tile underdrains to provide satisfactory moisture conditions within the imperfectly drained soils. Peat and muck accumulation, within areas of poorly drained soils, are also common within the region. Ground surface topography within the PSA is characterized as having low relief, with minor undulations near river valleys and the shoreline of Lake St. Clair.

Bedrock Geology

Thick successions of Middle Devonian aged Paleozoic sedimentary rocks subcrop beneath glacial cover across the PSA. The PSA is primarily underlain by limestone of the Dundee Formation. The Dundee Formation can be described as a brown and tan microcrystalline limestone with occasional sand grains and brown chert (Telford and Russell, 1981). The average thickness of the Dundee Formation is 35 to 40 m (Strynatka, S., *et al.*, 2007).

Overburden Geology

Bedrock within the PSA is overlain by thick overburden deposits consisting primarily of fine-textured glacial sediments. Published geological mapping obtained from the Geological Survey of Canada, indicates that the PSA is underlain by approximately 28 to 44 m of overburden sediments consisting primarily of fine-textured glacial and proglacial deposits (Morris *and* Cousineau*,* 1994).

Groundwater Resources

Within the County of Essex, water for municipal supply is provided from surface water sources in the Great Lakes system. There are no municipal supply wells currently providing water to the region (ERCA, 2014). Approximately 95 percent of the population within the County of Essex is served by municipal water. However, the remaining 5 percent depend on groundwater as the primary water supply for properties outside the municipally serviced areas (ERCA, 2012). See **Table 4-6** for a brief summary of recorded water well information in the PSA.

Table 4-6: Summary of MOECC Water Well Record Information

Primary Water Use	Number of Well Records	Well Depth (m)	Primary Well Type
Commercial/Industrial	4	31.1 to 47.9	2 overburden, 2 bedrock
Domestic	26	25.9 to 44.2	4 overburden, 22 bedrock
Irrigation/Livestock	33	19.5 to 64.6	8 overburden, 25 bedrock
Monitoring/Test Hole	13	5.2 to 7.6	13 unknown
Public	3	29.6 to 39.6	0 overburden, 3 bedrock
Not Used	7	30.2 to 65.2	0 overburden, 4 bedrock, 3 unknown
Unknown	19	3.2 to 61.6	3 overburden, 8 bedrock, 8 unknown

The location and depth of MOECC water well records gives some indication of the presence of viable groundwater resources within the PSA. Approximately 61 percent of the wells within the PSA obtain their source water from the bedrock aquifer. Only 16 percent of the MOECC water well records within the PSA were completed in overburden sediments. This gives further evidence that the overburden is considered a poor groundwater resource.

Results of this desktop investigation indicate that the dominant soil type within the PSA is a clayey silt to silty clay till and/or a fine-textured glaciolacustrine deposits, and that these materials do not readily transmit groundwater. Therefore, turbine foundations excavated within these materials are not anticipated to require significant dewatering during construction. Site specific geotechnical work has not yet been completed to confirm soil conditions at each turbine site. Should turbines be excavated in coarser-grained materials (e.g., sand and/or gravel), below the water table, dewatering requirements may exceed 50,000 L/day.

In conclusion, there is limited potential for groundwater takings to exceed 50,000 L/day at a turbine site, but is dependent on the surficial material being excavated, the depth to groundwater (relative to the excavation extent), and other hydrogeological characteristics that will be determined during geotechnical analysis. Should groundwater dewatering rates be expected to exceed 50,000 L/day from a turbine foundation excavation, mitigation measures to minimize the potential impact to groundwater resources will be applied.

Potential environmental impacts, mitigation measures, residual effects, and a monitoring plan associated with potential effects to groundwater are described in **Table 4-7**. Once a final groundwater taking assessment is complete based on geotechnical information, site specific effects may be assessed based on calculated groundwater dewatering rates and ZOI.

4.4 Air, Odour and Dust Emissions

Excavation activities, construction vehicle traffic, temporary generator operation, and temporary exposure of soil stockpiles have the potential to generate short-term localized dust emissions that could result in nuisance effects.

Operation of construction equipment as described in **Section 3**, in particular vehicles using diesel fuel, will result in emissions including particulate, sulphur dioxide, nitrous oxides, volatile organic compounds, polyaromatic hydrocarbons, and carbon dioxide. Furthermore, traffic delays caused by construction could result in increased vehicle emissions in the PSA as vehicles travel slowly through construction zones. Air emissions will be highest during land clearing and other activities that involve significant levels of material handling (e.g., aggregate laydown for access road construction and preparation for the installation of underground collector lines).

No emissions of odours are anticipated.

Table 4-8 provides mitigation measures, net effects and the monitoring plan for each potential effect relating to emissions to air.

4.5 Noise Emissions

The operation of heavy construction vehicles, potential blasting and temporary generators could also result in nuisance noise at nearby residents or businesses and disturbance to local wildlife. Like air emissions, noise levels will be highest during land clearing and other activities that involve significant levels of material handling (e.g., aggregate laydown for access road construction and preparation for the installation of underground collector lines).

Table 4-9 provides mitigation measures, net effects and the monitoring plan for each potential effect relating to noise.

Table 4-7: Mitigation Measures, Net Effects and Monitoring Plan: Groundwater

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Temporary Reduction in Groundwater Flow to Natural Features (Water Bodies, Watercourses and Wetlands) during Groundwater Dewatering Activities Associated with Turbine Foundation Construction.	• Minimize reduction of groundwater contribution to near-by natural features.	• Direct dewatering discharge to the downgradient watercourse (following sediment and erosion control practices) to negate the potential that groundwater drawdown will decrease baseflow into streams and groundwater discharge into wetlands. • Limit duration of dewatering to as short a time frame as possible. • Implement groundwater cut-offs, where practical, to limit groundwater taking quantities.	• Reduction in groundwater quantity and quality minimized through application of mitigation measures. ▪ *Low likelihood and negligible magnitude of long term effects based on the amount of dewatering required and the duration of expected dewatering activities.*	**Monitoring and Contingency Measures:** • Should groundwater dewatering activities be expected to exceed 50,000 L/day, the following measures will be implemented: ▪ Inlet pump head shall be surrounded with clear stone and filter fabric. ▪ The discharge shall be regulated at such a rate that there is no flooding in the receiving water body and that no soil erosion is caused that impacts the receiving water body.
Temporary Reduction in Groundwater Quantity and Quality to Existing Groundwater Users (Private Water Wells) during Groundwater Dewatering Activities Associated with Turbine Foundation Construction.	• Minimize reduction of groundwater quantity and quality to existing groundwater users.	• Limit duration of dewatering to as short a time frame as possible. • Implement groundwater cut-offs, where practical, to limit groundwater taking quantities. • Maintain a setback of 120 m from known active residential groundwater supply wells (private water wells), where possible.	• Reduction in groundwater quantity and quality minimized through application of mitigation measures. ▪ *Low likelihood and negligible magnitude of long term effects based on the amount of dewatering required and the duration of expected dewatering activities.*	**Monitoring and Contingency Measures:** • Should groundwater dewatering activities exceed 50,000 L/day and a private water well becomes dry as a result of such activities, a temporary potable water supply will be provided to the property owner.
Contamination of Groundwater Resources Due to Accidental Spills or Releases of Contaminants (i.e., Fuel, Lubricating Oils and Other Fluids) During the Refuelling, Operation or Maintenance of Construction Equipment.	• Prevent contaminant discharge to the environment.	• Develop a SRP and train staff on procedures and protocols. • Refuel Project equipment and vehicles on spill collection pads and/or in designated areas. • Dispose of any waste material from construction activities by authorized and approved off-site vendors.	• Groundwater contamination minimized through application of mitigation measures. ▪ *Low likelihood and limited magnitude of effects on groundwater.*	**Monitoring:** • Routine inspections performed by the contractor of construction equipment for leaks and spills. **Contingency Measures:** • In the event of a spill all work will stop until the spill is cleaned up. • Notify MOECC's Spill Action Centre of any leaks or spills.

Table 4-8: Mitigation Measures, Net Effects and Monitoring Plan: Air, Odour and Dust

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Fugitive Dust and Vehicle Emissions *(including GHGs).*	• No persistent dust films (observable build-up) on nearby properties or vegetation. • Limited release of air emissions.	• Implement a speed limit for construction equipment and trucks on access roads. • Apply dust suppressants (e.g., water or environmental friendly dust suppressants) to unpaved areas at an environmental acceptable rate to minimize the release of dust. • Re-vegetate cleared areas as soon as possible. • Install wind fences, as required. • Limit unnecessary idling of vehicles.	• Increased dust and air emissions minimized through application of mitigation measures. ▪ *High likelihood of effects occurring; however, any dust and air emissions are short-term and localized so the magnitude of such effects will be limited.*	**Monitoring:** • Monitor complaints through the Project operations staff contact number according to the Emergency Response and Communications Plan (see Design and Operations Report). **Contingency Measures:** • Review of proposed mitigation measures. • Review of speed limit on access roads.
Reduction in Surface Water Quality as a Result of Dust Emissions.	• No persistent dust films on adjacent water bodies; no measurable change in TSS.			

Table 4-9: Mitigation Measures, Net Effects and Monitoring Plan: Noise

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Increased Noise Due to Construction Activity.	• Adherence to Town of Lakeshore noise by-law no. 106-2007.	• Schedule activities to comply with noise by-laws, where possible. • Ensure that construction equipment is frequently maintained and kept in good working condition. • Ensure that noise emissions from construction equipment not exceed guidelines specified in MOECC publication NPC-115 and manufacturer recommendations. • Implement construction speed limit on unpaved roads.	• High likelihood of increased noise during construction; however, the effect will be short-term, localized, and limited in magnitude.	**Monitoring:** • Monitor complaints through the Project operations staff contact number according to the Emergency Response and Communications Plan (see Design and Operations Report). **Contingency Measures:** • Repair equipment that is unable to meet noise standards. • If noise complaints are received, conduct an investigation to determine the source of the problem.

4.6 Impacts on Land Use and Infrastructure

There will be a temporary loss of agricultural land during construction and installation activities as a result of temporary Project components, including crane pads, turbine laydown areas and the construction staging areas. However, these areas will be small relative to the total land area within the PSA, and these lands will be returned to pre-existing land use after construction and installation activities are completed, unless otherwise agreed upon with the landowner. The construction of the Project will not result in the creation of access to previously inaccessible areas as the Project is located in areas already cleared for agricultural uses.

The road capacity and local traffic may also be affected during construction related activities. The delivery of construction equipment and Project infrastructure, and construction of new turbine access roads could result in a temporary increase in slower moving traffic volume on local roads. Construction related activities next to or in road easements could also result in temporary disruptions to the flow of traffic on some local roads. The changes in traffic volume are expected to be minimal and no appreciable change to traffic flow is anticipated as a result of the Project.

Table 4-10 provides mitigation measures, net effects and the monitoring plan for each potential effect relating to local interests, land use and infrastructure.

Table 4-10: Mitigation Measures, Net Effects and Monitoring Plan: Land Use and Infrastructure

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Reduction in Agricultural Land.	• No significant economic reduction in agricultural yields on lots containing Project Infrastructure.	• Minimize length of access roads where possible. • Consult with landowners to design access roads to minimize impacts to existing land use. • Compensate landowners on Project Location as per land lease agreement.	• Minor reduction in usable agricultural land. ▪ *High likelihood of effect, however limited magnitude due to size of overall footprint within the entire PSA.*	**Monitoring and Contingency Measures:** • No monitoring or contingency measures required.
Damage to Local Infrastructure.	• Minimize damage to local infrastructure.	• Adhere to best practices regarding the operation of construction equipment and delivery of construction materials. • Undertake roads condition survey prior to construction and post-construction.	• Damage to local infrastructure minimized through application of mitigation measures. ▪ *Moderate likelihood and magnitude of effects occurring due to presence oversize loads during delivery of turbine components.*	**Monitoring:** • Monitor complaints through the Project operations staff contact number according to the Emergency Response and Communications Plan (see Design and Operations Report). **Contingency Measures:** • Return damaged infrastructure to original condition (or better) where appropriate.
Increased Congestion Due to Increase in Truck Traffic and Short-term Lane Closures on Local Roads during Delivery of Project Components.	• Minimize disturbances to local traffic patterns.	• Develop a traffic management plan for the construction phase and submit to the municipalities prior to construction. • Conduct a survey in conjunction with the Town of Lakeshore and County of Essex to determine if the roads and travel routes within the PSA are capable of accommodating the oversized vehicles and heavy loads prior to the delivery of Project components and equipment. • Notify the community in advance of construction delivery schedules and install signage to notify road users of construction activity, where appropriate.	• No significant adverse effects to local roads and traffic are anticipated during construction and installation activities following the implementation of a traffic management plan.	**Monitoring:** • The construction contractor will regularly monitor and report to Belle River Wind on the implementation of the traffic management plan. **Contingency Measures:** • To the extent possible, use alternate component delivery routes.

5. Summary and Conclusions

Desktop analysis and field work were undertaken to determine the potential effects to the various environmental and social features during the construction and installation phase of the Project. Mitigation measures to manage these potential effects have been identified and monitoring and contingency plans proposed to ensure effects are minimized as outlined above.

The overall conclusion of this Construction Plan Report is that this Project can be constructed and installed without any significant adverse net effects.

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