North Kent Wind 1 Project

Construction Plan Report

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Prepared for:

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Project Number:

60343599

Date:

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Acronyms and Abbreviations

ANSI	Area of Natural and Scientific Interest
BMPs	Best management practices
dbh	Diameter at breast height
EEMP	Environmental Effects Monitoring Plan
EIS	Environmental Impact Study
GHGs	Greenhouse Gases
Hydro One	Hydro One Networks Inc.
IESO	Independent Electricity System Operator
km	Kilometres
kV	Kilovolts
L/day	Litres per day
LTVCA	Lower Thames Valley Conservation Authority
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
North Kent Wind 1	North Kent Wind 1 LP, by its general partner, North Kent Wind 1 GP Inc.
NRSI	Natural Resource Solutions Inc.
O. Reg.	Ontario Regulation
OEB	Ontario Energy Board
Pattern Development	Pattern Renewable Holdings Canada ULC
PDR	Project Description Report
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
SCRCA	St. Clair Region Conservation Authority
SRP	Spill Response Plan
SWH	Significant Wildlife Habitat
TSS	Total Suspended Solids
ZOI	Zone of influence

1. Introduction

The North Kent Wind 1 Project (the Project) is being proposed by North Kent Wind 1 LP, by its general partner, North Kent Wind 1 GP Inc. (North Kent Wind 1). North Kent Wind 1 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 Project has been proposed in response to the Government of Ontario's plan to integrate more renewable energy into the province's power grid. 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), 2012; 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 environmental 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 any 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**

This Construction Plan Report was provided to Municipality of Chatham-Kent 90 days in advance of the second public meeting. It was also provided to Aboriginal communities, government agencies and the public for review 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, North Kent Wind 1 is a joint venture limited partnership owned by affiliates of Pattern Development and Samsung Renewable Energy. The contacts for the Project are as follows:

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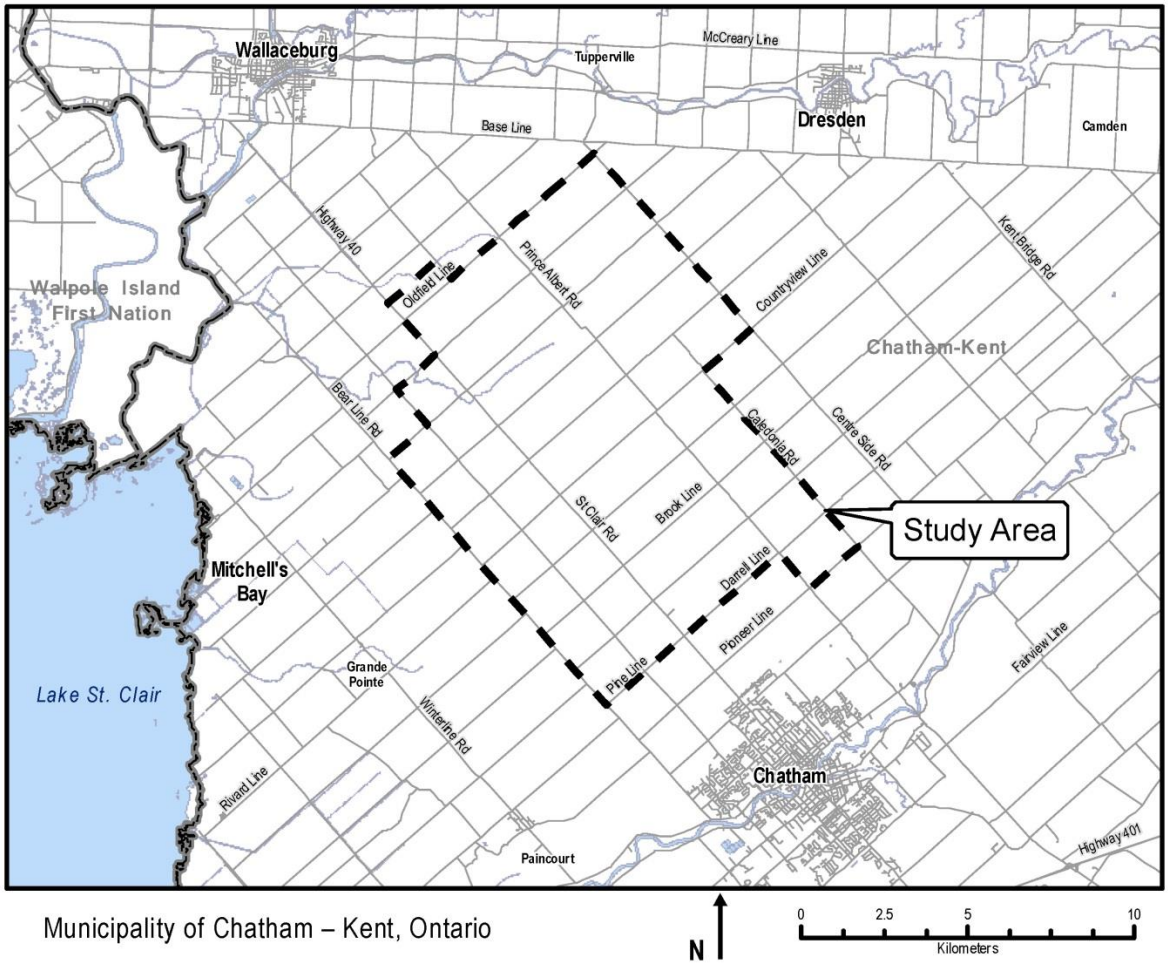
1.3 Project Location

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.

North Kent Wind 1 is proposing to develop a wind energy project located north of the City of Chatham in the Municipality of Chatham-Kent, Ontario. The Project will be located on both public and private lands. The location of the Project was developed based on interest expressed by local landowners, municipal support for the Project, the availability of wind resources, and the availability of existing infrastructure for connection to the electrical grid.

The Project is generally bounded by Oldfield Line to the north, Bear Line Road to the west, Pioneer Line and Pine Line / Darrell Line to the south and Centre Side road and Caledonia Road 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 30,400 acres[1] of land that is predominantly designated for agricultural use according to the Municipality of Chatham-Kent's Official Plan (2014). The PSA also consists of fragmented areas of forest and riparian habitat associated with small creeks or farm drains. 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:

Table 1-2: External Boundaries of the Project Study Area

Longitude	Latitude
-82.270	42.573
-82.343	42.490
-82.262	42.424
-82.171	42.468

The Project will be located primarily on privately owned land with some components (e.g., electrical collector lines) being placed along public right-of-ways. The Project is not located on Crown land. Legal descriptions of the land parcels to be used for the Project are provided in **Appendix A** of the Project Description Report (PDR).

1. *Metric units are used throughout REA reports 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 1-3: Summary of Key Project Information[2]

General	*Project Name:*	North Kent Wind 1 Project
	Project Ownership and Operation:	North Kent Wind 1 LP
	Project Lifespan (Commercial Operation):	20 Years
	Project Nameplate Capacity:	Up to 100 Megawatts (MW)
Project Area *(as shown in **Figure 2-1**)*	*Location of Project:*	Public and privately-owned land and public road allowances in the Municipality of Chatham-Kent
	Total Project Study Area:	30,400 acres
	Estimated Total Permanent Area of Project Location:	140 acres
Wind Turbine Generators	*Make and Model:*	Siemens SWT-3.2-113
	Total Number Permitted:	46 turbines
	Approximate Number Constructed:	36 turbines
	Nominal Turbine Power:	2.772 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):*	31 kilometres (km) x 8 to 12 m
	Access Roads – Construction (with shoulder):	31 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):*	160 km x 2 to 6 m
	34.5 kV Collector Lines on Private Lands (underground):	31 km x 2 to 6 m
Other Project Structures and Facilities	*Collector Substation:*	10 acres
	Operations and Maintenance Building:	7 acres
	Interconnection Station / Point of Interconnection:	10 acres
	Meteorological Towers:	Up to 2
	Microwave Tower:	1
Temporary Land Use *(Construction Phase)*	*Construction Staging Areas:*	10 to 15 acres
	Wind Turbine Laydown Area (each turbine):	Up to 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.

Table 2-1: Description of Project Components

Component	Description
Wind Turbine Generators	• The Project will include commercial wind turbines, which will be the Siemens SWT-3.2-113 turbine which has a nominal turbine power of 2.772 to 3.2 MW. The wind turbine nacelle includes the electric generator, 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 approximately 25 m wide and 3 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; otherwise a spread-footing type foundation will be constructed.
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 collector substation (described below). The collector lines will be 34.5 kV and buried on private property, where possible, from the turbines to the public road allowance. Within the public road allowance, where possible, 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 1.2 m. Farming practices will not be affected by the underground collector lines due to the depth of installation and location of the collector lines being adjacent to access roads. • If aboveground electrical collector lines are required, they will be constructed on either wood, steel or concrete hydro pole structures. • 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 is proposed to be located adjacent to the existing Hydro One Networks Inc. (Hydro One) transmission line on private property north of Eberts Line and east of Prince Albert Road. • 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 sound requirements specified in O. Reg. 359/09, as amended. • Collector substation equipment may include 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. A secondary containment system will be installed at the site to prevent soil contamination in the event of a leak. Containment around the transformer(s) at the substation will include an enclosure (conservator, tank, etc.) as well as a containment pit system.

Component	Description
Microwave Tower	• A microwave tower used for communication purposes may be constructed within the substation construction disturbance area and/or the interconnection station / point of interconnection location. If required, the microwave tower may be up to 100 m tall and may be steel-lattice or guyed.
Meteorological Towers	• Up to 2 permanent 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. During construction and operations of the proposed Project, access roads are required in order to access meteorological towers. The design of the roads will be consistent with the wind turbine access roads described above. • 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.
Interconnection Station / Point of Interconnection location (Connection to Electrical Grid)	• 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 Networks Inc. (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. • The interconnection station includes the point of interconnection, which 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.
Operations and Maintenance Building	• An operations and maintenance building will be constructed to accommodate offices, kitchen / dining facilities, washroom facilities, control facilities, storage space, maintenance work area and a parking area and will be located within the PSA. • 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 underground or via overhead poles installed adjacent to the access road and will terminate on a transformer adjacent to the operations and maintenance building.

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

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. • Portions of the crane pad will remain following construction for use during the operations phase for the Project for deliveries and maintenance activities. Areas not required for maintenance will be restored so that pre-existing land uses can continue. During decommissioning portions of the crane pads that are restored may be reconstructed, if required.
Wind Turbine Laydown Areas	• Laydown areas adjacent to wind turbine locations will be incorporated into the disturbance area for each turbine. Each wind turbine laydown area is approximately up to 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.

Component	Description
Construction Staging Area	• Temporary construction staging areas will be located within the PSA. Construction staging areas 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 areas will be approximately 10 to 15 acres in size and will primarily serve the following aspects of the Project construction: ▪ Construction equipment / tool 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 areas will be restored 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 Investigation Areas

Investigation Areas have been identified surrounding various Project components, which are depicted on **Figure 2-1** as the “Project Location / Investigation Area”. The Project Location figure identifies the location of permanent project components, including wind turbines, access roads, the electrical collector system, collector substation and interconnection station / point of interconnection location options. The figure also identifies areas where temporary disturbance may occur as a result of construction of Project components, including laydown and storage areas, crane pad construction, turnaround areas and construction access roads. Following construction activities, temporarily disturbed land will be reclaimed.

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 investigations areas in relation to surrounding natural heritage and water body features such as: wetlands, wooded areas, waterbodies, and watercourses. This figure also illustrates topographical land contours and surface water drainage.
- **Figure 2-3 (a-d):** Location of Project components and associated disturbance areas in relation to surrounding socio-economic features such as: property boundaries, roads, highways, railways, existing transmission lines, built-up areas, sound receptors and other resources such as pipelines, petroleum well and water wells. This figure also illustrates required setback distances from road and rail, property boundaries and non-participating sound receptors. Note that sound compliance is assessed in the Noise Impact Assessment (refer to **Appendix B** of the Design and Operations Report).

The Stage 1 and 2 Archaeological Assessment Reports were submitted for review and approval by the Ontario Ministry of Tourism, Culture and Sport (MTCS). The precise location of archaeological resources is sensitive information and is not depicted on the figures described above.

The Heritage Impact Assessment was also submitted for review and approval by MTCS. The report provides maps depicting the location of built heritage resources and cultural heritage landscapes within the PSA. The Heritage Impact Assessment for the Project identified 14 potential built heritage resources and six cultural landscapes within the PSA. Of these, eight built heritage resources and one cultural heritage landscape were determined to have cultural heritage value or interest and are been included on **Figure 2.3a to Figure 2.3d**.

Figure 2-1: Project Location

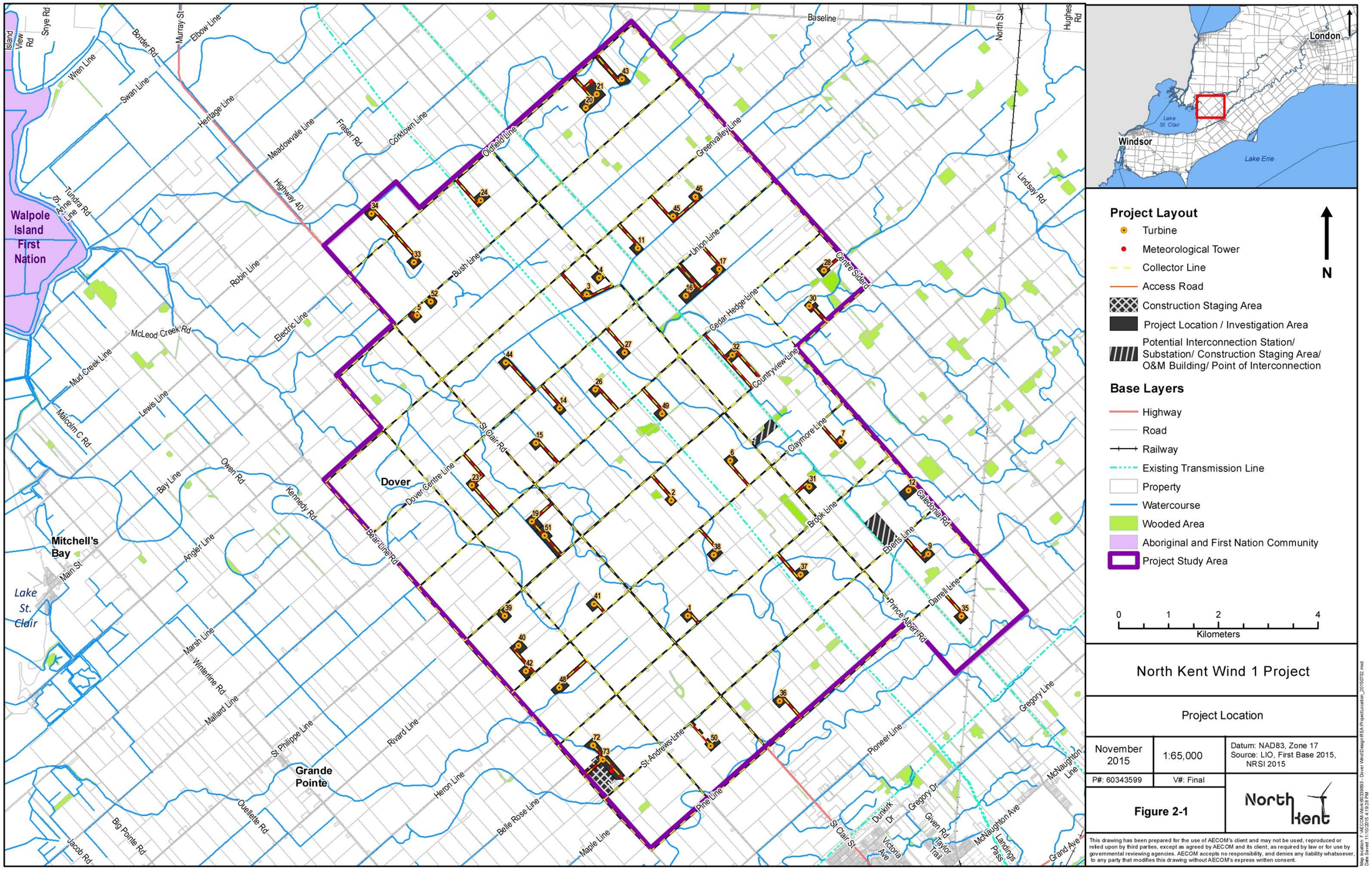


Figure 2-2: Project Location and Natural Heritage Features

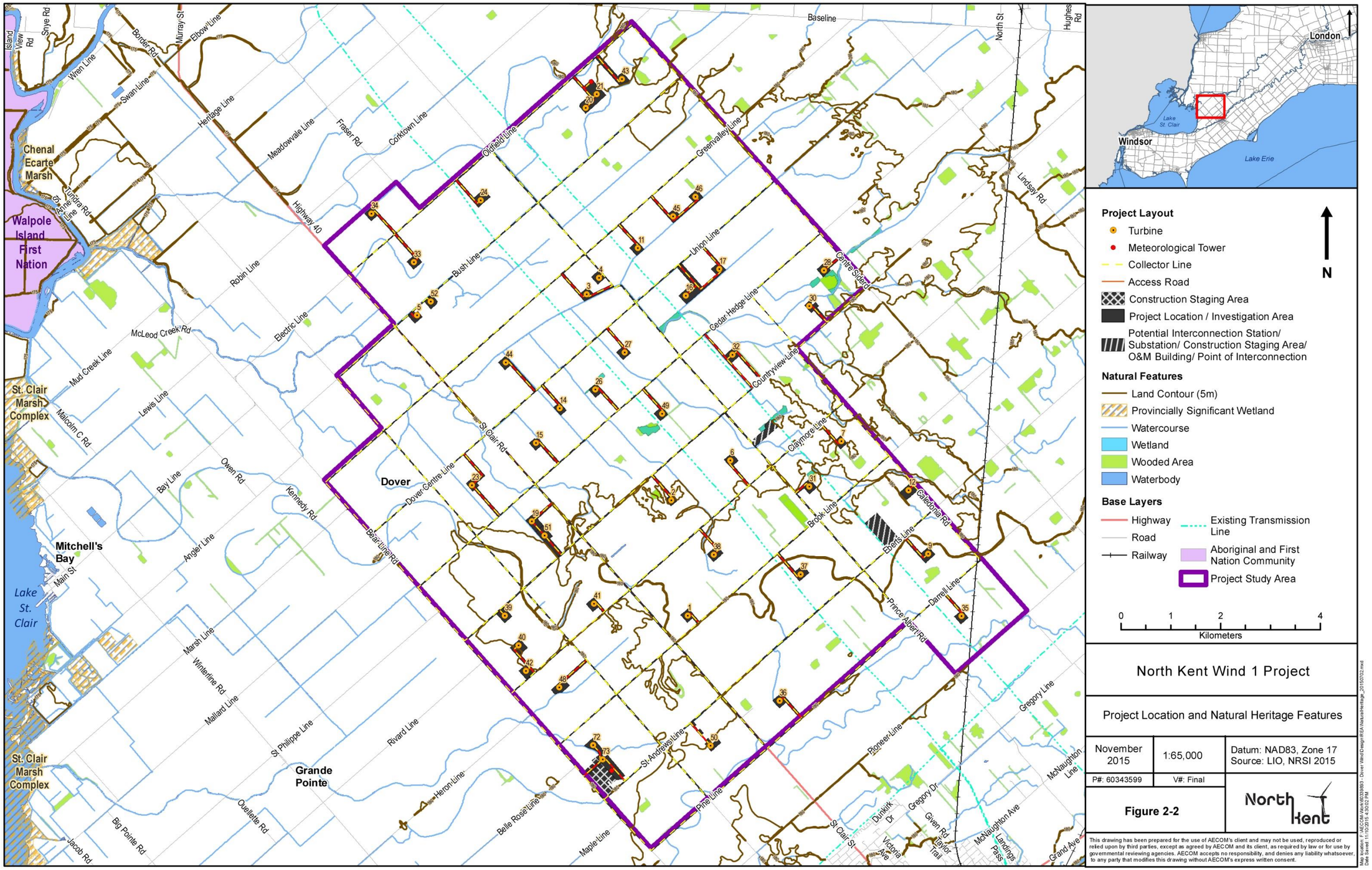


Figure 2-3a: Project Location and Socio-economic Features

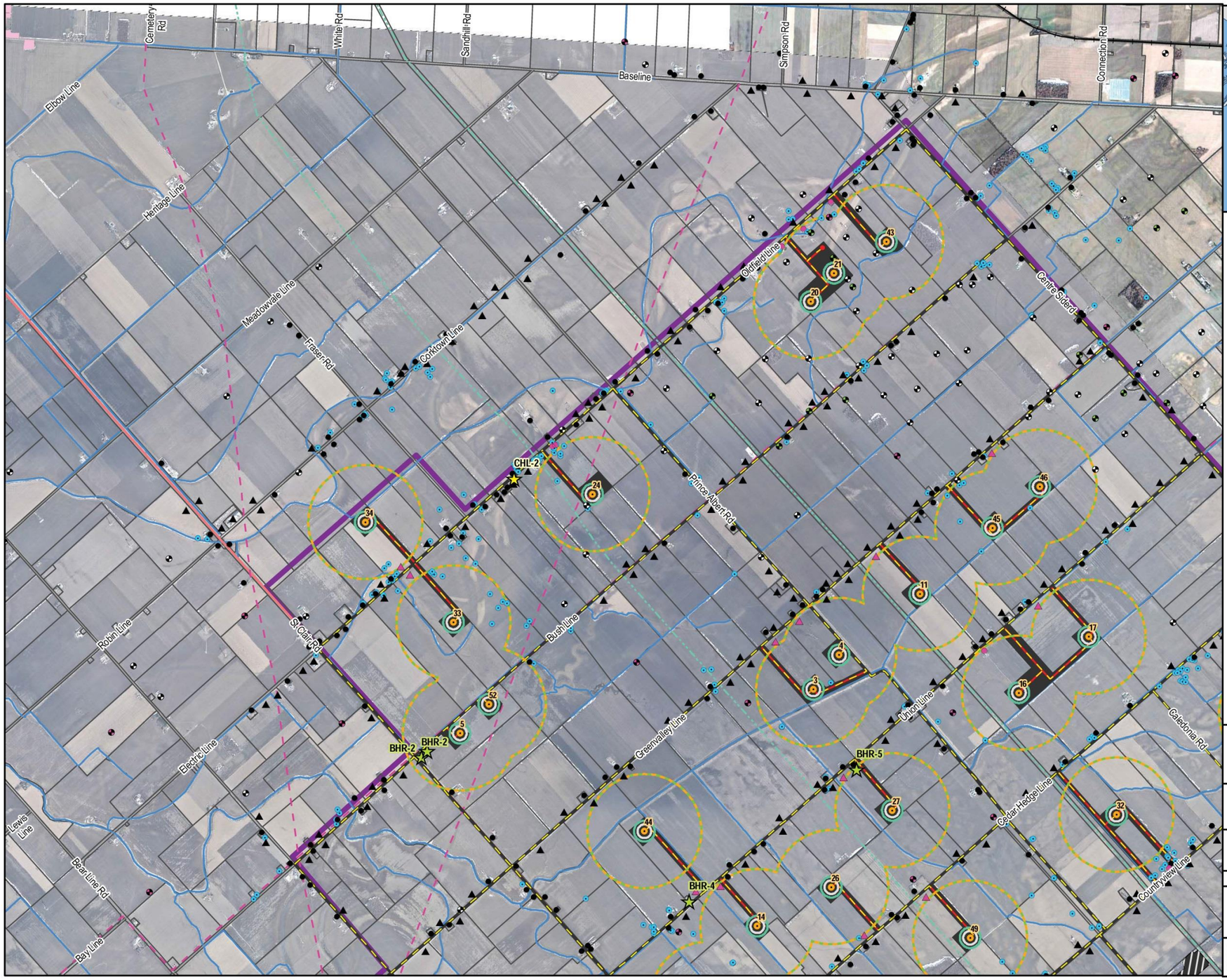


Figure 2-3b: Project Location and Socio-economic Features

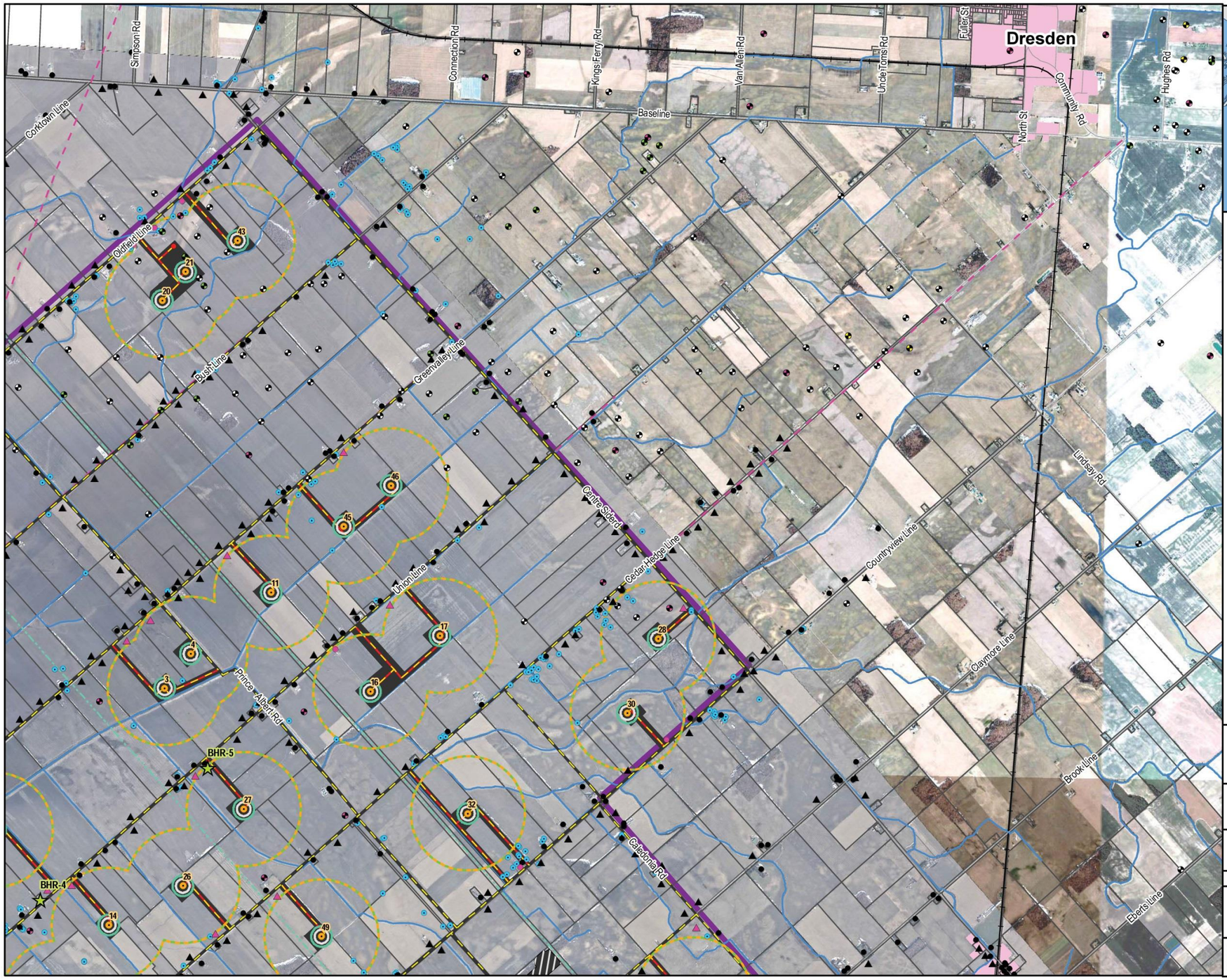
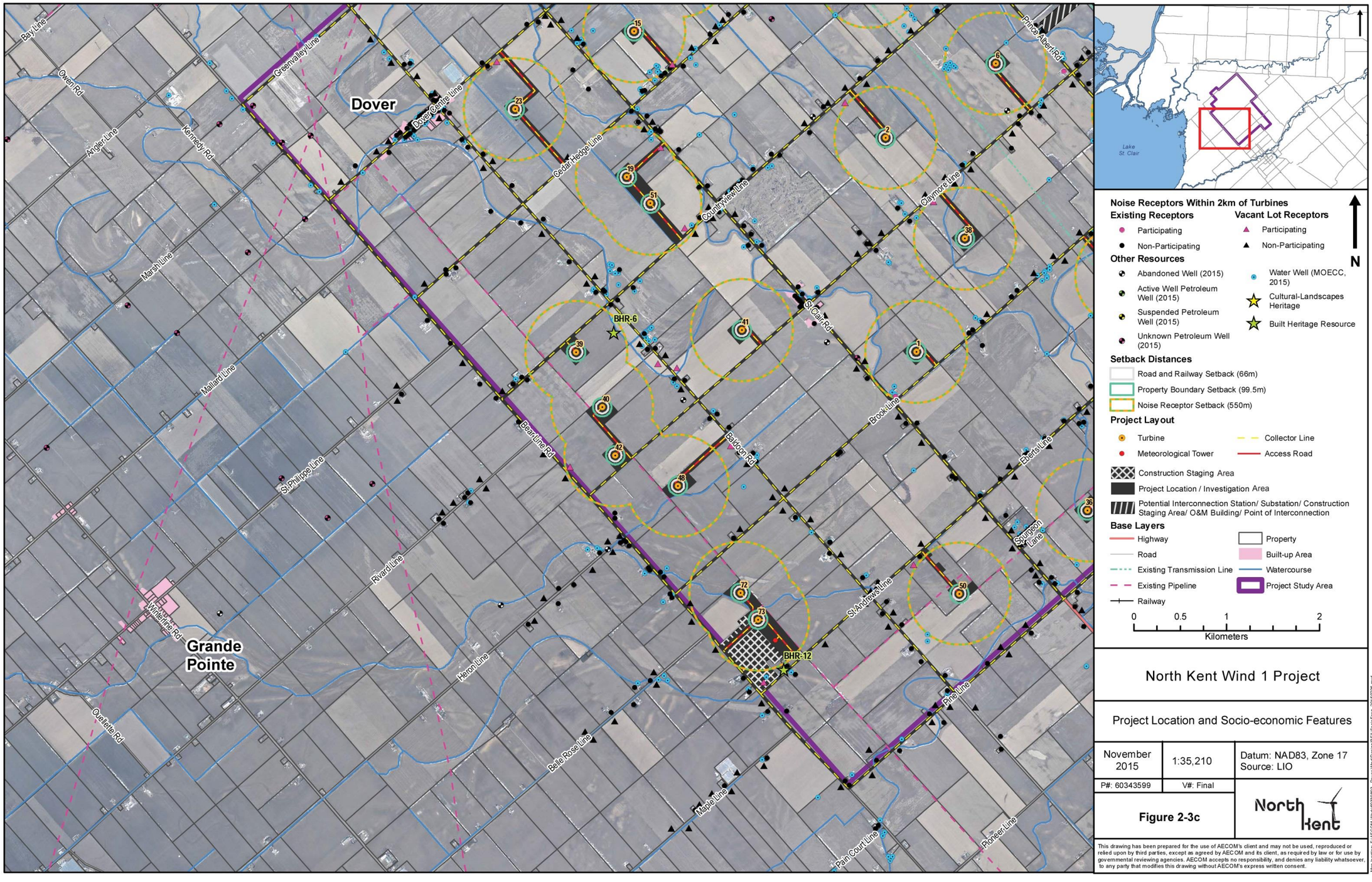


Figure 2-3c: Project Location and Socio-economic Features



North Kent Wind 1 Project

Project Location and Socio-economic Features

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P#: 60343599	V#: Final	

Figure 2-3c

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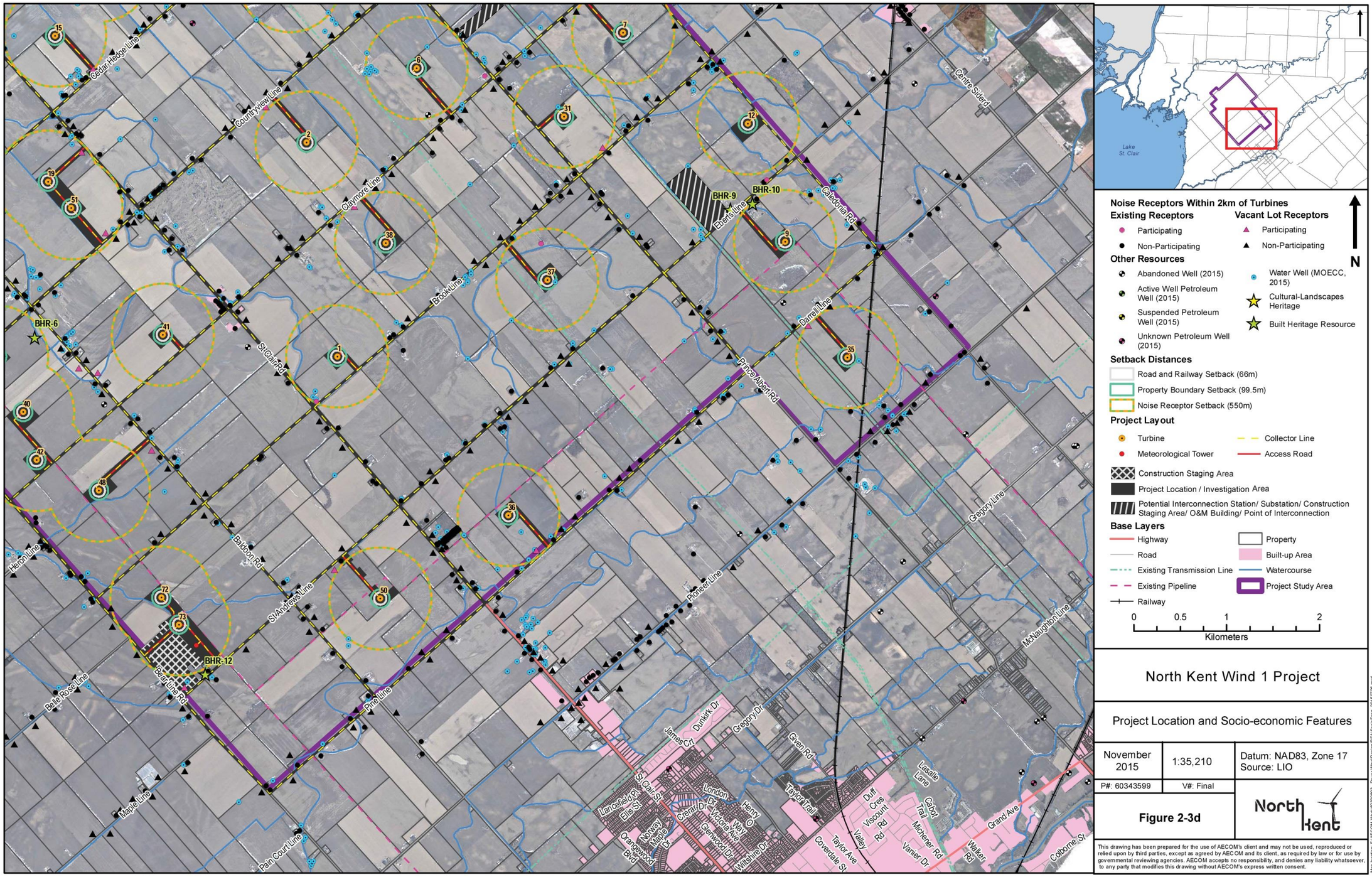
Figure 2-3d: Project Location and Socio-economic Features



North Kent Wind 1 Project

Project Location and Socio-economic Features

November 2015	1:35,210	Datum: NAD83, Zone 17 Source: LIO
P#: 60343599	V#: Final	

Figure 2-3d

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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;
- Temporary uses of land;
- 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 North Kent Wind 1 Project is expected to begin in 2016 and last for approximately 16 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 Summer / Fall 2015	2 to 3 months
Geotechnical Sampling		Prior to Construction Summer / Fall 2015	3 to 4 months
Delivery of Equipment		Fall / Winter 2016	12 to 14 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
Substation and Interconnect Station Construction		Fall / Winter 2016	12 months
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 months
Turbine Testing and Commissioning		Winter / Spring 2017	4 months
Clean-up and Site Reclamation		Spring / Summer 2017	8 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 the location of turbines and property lines. 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 about soil compaction, grain size, resistivity, and soil pH. 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. Limited 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 road will typically require clearing and grubbing of any vegetation, excavation of the topsoil layer and addition of a layer of compacted material. Prior to access road construction, soil from the access road footprint will be stripped and stockpiled for re-use following construction to reclaim the site. A 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. Access roads will be constructed of native materials or engineered fill. A geotextile or cement stabilized soil may also be used where necessary. The construction of the access roads will result in disturbance areas approximately 15 m wide. The access road 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 be 8 to 12 m in width and require two to four days of construction time. Approximated 31 km of access roads are included in the design of the Project. Depending on the length of the access road as well as road and site conditions, construction of each road 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		Estimated Quantity Required
Roadbed Depth	Granular Base Material[1]	200,000 metres cubed (m^3)
	Crushed Gravel[2]	50,000 m^3
	Total	275,000 m^3

Notes: 1. A geotextile or cement-stabilized soil may be used 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, to be finalized during detailed design.

New culverts may be required to maintain drainage in ditches at junctions with roadways where roads are constructed to allow access for construction equipment and delivery trucks. Early consultation with the St. Clair Region Conservation Authority (SCRCA) and the Lower Thames Valley Conservation Authority (LTVCA) was conducted to confirm permitting requirements for construction. Further conversations will be held in winter 2016 as part of the ongoing permitting process for the Project.

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, as required.

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 Wind Turbine Laydown Areas

A site of approximately up to 5 acres will be constructed for the temporary storage of construction material. 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. Following the construction phase, the gravel will be removed from the site or re-used, at the discretion of landowners. 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 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**.

3.3.4 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 will be used to stabilize cranes during their operation. The crane pad dimensions will be approximately 0.2 acres. Once the turbine erection is complete, portions of the crane pad not required during the operations phase will be restored to a state similar to pre-existing conditions by removing the granular base materials and crushed gravel as well as replacing native topsoil.

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 assessment, 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 concrete curing time.

After construction the foundation will be backfilled and the surface will be graded for drainage so that land can be cultivated to within a few metres of the turbine. Wood-waste generated will be removed from the site and recycled, unless the landowner requests otherwise. 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. 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 and Traffic Management Plan will be developed in consultation with the Municipality of Chatham-Kent. 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 constructed 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, where possible, 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 construction, the temporary construction staging 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 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 used 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 or disposed of at an appropriate waste / recycling facility.

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, pad-mounted disconnect switches, fiber optic cables, fiber optic junction boxes and underground collector lines installed along turbine access roads on private property and a buried or above ground collection system running along municipal and provincial 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 the installation of collector lines 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

Collector Lines 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 will 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 a minimum of 1.2 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, if required, along public road allowances will require installation of wood, steel or concrete monopoles to a depth of approximately 5 to 6 m and will be spaced approximately 45 to 60 m apart. 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 collector lines may need to be installed using horizontal directional drilling to minimize effects to woodlots, watercourses or private property. 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 area 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, or other suitable materials, 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 collector lines will then be installed through the hole.

If required, equipment used during directional drilling will include a 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 and Interconnection Station

The collector substation, including an acoustic barrier, and interconnection station 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. The collector substation is proposed to be located adjacent to the existing Hydro One Networks Inc. (Hydro One) transmission line on private property north of Eberts Line and east of Prince Albert Road.

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 for land reclamation and landscaping, which may include the construction of an aesthetic berm,

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

The collector substation will be connected to the Hydro One line by a single circuit overhead line, supported by 3 to 4 interconnection structures. 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.

Equipment required for the construction and installation of the collector substation and interconnection station 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 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**.

3.3.12 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 to 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.

3.3.13 Construction of Microwave Tower

A microwave tower used for communication purposes may be constructed within the substation construction disturbance area. 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. An access road may be constructed to access the microwave tower 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 the microwave 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 and/or 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 and temporary entrances will also be reduced to 8 to 12 m. High voltage warning signs will be installed at the collector substation and elsewhere, as appropriate.

3.4 Turbine Commissioning

Testing and commissioning will be performed prior to Project connection to the existing 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. If these generators exceed 700 kW an Environmental Compliance Approval will be obtained prior to their use. Following the commissioning phase, temporary 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, portable generators and the turbine components. 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 areas 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 (e.g. agricultural) 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 a state similar 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

Water 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 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 water taking needs of the Project during construction and operation, outlined potential effects of the Project on water 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 North Kent Wind 1 Project. For further details please refer to the Hydrogeological Assessment and Effects Assessment Report in **Appendix C** 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 Litres per day (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 for the Project, found in **Appendix C** of the Design and Operations Report, the proposed source of water for general construction use is a groundwater supply well located at the Operations and Maintenance (O&M) building.

A review of existing secondary source information provided by Ontario Geological Survey and from local MOECC water well records indicates surficial soils within the PSA typically are composed of sand and/or sand and gravel glaciolacustrine and alluvial deposits overlying predominantly clay soils (OGS, 2010). The granular surface materials have the potential to readily transmit groundwater and turbine foundations excavated within these materials may require significant dewatering during construction. For the purpose of maintaining dry work conditions for each turbine foundation construction temporary water taking may exceed 400,000 L/day, but is dependent on the surficial material being excavated, the depth to groundwater, and other hydrogeological characteristics that may be determined during geotechnical analysis. Prior to construction a site-specific geotechnical investigation will be completed to confirm soil and groundwater conditions at each turbine foundation location. For the purposes of this investigation, anticipated dewatering rates and potential zone of influence (ZOI) have been calculated for a typical turbine foundation excavation in coarse-textured glaciolacustrine surficial sediments and are detailed in the Hydrogeological Assessment and Effects Assessment Report (**Appendix C** of the Design and Operations Report).

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 oil and hazardous waste disposal methods.

In addition, concrete wash out of empty cement trucks will adhere to applicable regulations. As a note, the washing out of cement trucks is expected to occur at various locations within the construction disturbance area. The water used for the cleaning of cement construction materials will be deposited in a concrete washout container to allow for evaporation and hardening. The water will then be disposed of at a licensed waste facility or recovered and recycled back into the cement truck. During site preparation and construction, portable toilets will be used and a licensed contractor responsible for waste removal will be engaged. 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 managed 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 during 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 4.5** of this Report outlines potentially negative effects to air quality relating to the Project and identifies mitigation measures proposed.

Project sound emissions will adhere to the requirements of O. Reg. 359/09, as amended. Project activities are not anticipated to generate significant 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 impact to the health and safety of local residents or the environment.

3.10 Health and Safety Plan

North Kent Wind 1 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 and will follow the applicable health and safety legislation. North Kent Wind 1 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 46 turbines and associated infrastructure shown on the Project Location figures. However, note that only approximately 36 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, 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, 2015a and Golder Associates, 2015b) 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 there was archaeological potential for both pre-contact Aboriginal and historic Euro-Canadian sites in the PSA.

The Stage 2 archaeological assessment of the Project Location was conducted between the spring and fall of 2015 (Golder Associates, 2015b). The assessment was conducted in accordance with the 2011 *Standards and Guidelines for Consultant Archaeologists* (MTCS, 2011). This assessment involved a combination of the pedestrian survey and test pit survey methods across portions of the study area that are proposed to be impacted by the project, including turbine locations, access roads, substation, collector lines, operations and maintenance buildings, meteorological and microwave towers, and temporary staging areas. In some cases, entire parcels of land under option were also assessed. The areas assessed cumulatively represented approximately 675 hectares of land.

The Stage 2 archaeological assessment resulted in the identification of 58 locations producing cultural material. Twenty-four of the 58 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. While twenty-four locations were documented during the archaeological field work conducted within the North Kent Wind 1 Project only one of the twenty-four sites recommended for Stage 3 archaeological assessment will be impacted by construction activities and therefore will be subjected to Stage 3 and if required Stage 4 archaeological assessments. During Stage 3 and 4 assessments, archaeological resources will be assessed and protected and potentially removed from the site. The remainder of the sites avoided by all soil disturbance activities related to the wind facility construction will not be subjected to Stage 3 archaeological assessment at this time. 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, 2015c) 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 14 structures 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*, eight of these structures were determined to have some 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 eight 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 Study Area represented a single vernacular rural landscape that also contained six potential cultural heritage landscapes. Evaluation according to O. Reg. 9/06 concluded that the vernacular rural landscape did not contain cultural heritage value or interest. One cemetery was determined to have some cultural heritage value or interest as a cultural heritage landscape. Although this one property was determined to be demonstrating cultural heritage value or interest, no direct or indirect impacts are anticipated. As no cultural heritage value or interest was determined, there are no adverse impacts anticipated to the cultural heritage landscapes.

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 24 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 on-site 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, if required, 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 1990a). • 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, 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 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 and treated as 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	**5 wetlands were determined to be significant and therefore carried forward to the EIS. These include the following wetlands**: WET-001, WET-002, WET-004, WET-005, WET-006.
Woodlands	**13 woodlands were determined to be significant and therefore carried forward to the EIS. These include the following woodlands:** WOD-001, WOD-002, WOD-003, WOD-004, WOD-005, WOD-006, WOD-007, WOD-008, WOD-009, WOD-011, WOD-012, WOD-016, WOD-017.
Significant Wildlife Habitat (SWH)	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): • Bat Maternity Colony • Colonially-Nesting Breeding Bird Habitat (Trees/Shrubs) • Old Growth Forest • Other Rare Vegetation Communities Habitat • Waterfowl Nesting Area • Amphibian Breeding Habitat (Woodland) • Marsh 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 ▪ Rigid Sedge Habitat ▪ Round-Fruited Panic Grass Habitat ▪ Blue Ash Habitat ▪ Swamp Rose-mallow Habitat ▪ Black Gum Habitat ▪ Northern Fogfruit Habitat ▪ Shumard Oak Habitat ▪ Gray-headed Prairie Coneflower Habitat ▪ Climbing Prairie Rose Habitat ▪ Lizard's Tail Habitat ▪ Wild Senna Habitat ▪ Cup-Plant Habitat ▪ Riddell's Goldenrod Habitat ▪ Southern Slender Ladies' Tresses Habitat ▪ Wing-stem Habitat ▪ Giant Ironweed Habitat ▪ Virginia Culver's-root Habitat ▪ Cream Violet Habitat The following features were carried forward to the EIS as Generalized SWH[3]: • Waterfowl Stopover and Staging Areas (Terrestrial) • Bat Maternity Colonies • Turtle Wintering Areas • Snake Hibernaculum

3. Generalized Candidate SWH are determined based on the criteria outlined in Appendix D of the Natural Heritage Assessment Guide for Renewable Energy Projects (MNRF, 2012). Therein, candidate SWH 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.

Feature	Natural Features Carried Forward to the EIS
	• Colonially – Nesting Bird Breeding Habitat (Tree/Shrubs) • Amphibian Breeding Habitat (Woodland) • Marsh Bird Breeding Habitat • Terrestrial Crayfish • Grasshopper Sparrow • Common Nighthawk • Eastern Wood-Pewee • Wood Thrush • Red-headed Woodpecker • Numerous Plant Special Concern and Rare Wildlife Species Habitats, including: ▪ Pawpaw ▪ Black Gum ▪ Cup-Plant ▪ Muskingum Sedge ▪ Northern Fogfruit ▪ Southern Slender Ladies' Tresses ▪ Rigid Sedge ▪ Shumard Oak ▪ Hoary Tick-trefoil ▪ Gray-headed Prairie Coneflower ▪ Wing-stem ▪ Round-Fruited Panic Grass ▪ Climbing Prairie Rose ▪ Giant Ironweed ▪ Blue Ash ▪ Lizard's Tail ▪ Virginia Culver's-root ▪ Swamp Rose-mallow ▪ Wild Senna ▪ Cream Violet ▪ American Lotus • Numerous Insect Special Concern and Rare Wildlife Habitats, including: ▪ Blue-ringed Dancer ▪ Blue-tipped Dancer ▪ Variegated Meadowhawk
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 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 Woodlands, Wetlands as well as Treated as Significant Wildlife Habitat.

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
Sedimentation and Erosion. **Fugitive Dust Emission.** **Changes in Soil Moisture and Compaction.**	• Minimize direct impacts on vegetation communities and protect rare/sensitive habitats. • Maintain vegetated buffers, particularly within riparian zones. • Minimize the impacts of sedimentation and fugitive dust on nearby natural features. • Limit disturbances to surface water drainage patterns.	• Develop and implement a sediment and erosion control plan. • Utilize erosion control measures, such as erosion blankets, silt fencing, straw bales, etc., for construction activities within 30 m of a wetland, woodland, or water body. • 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. • Maintain erosion control measures for the duration of construction or decommissioning activities as identified within the sediment and erosion 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. • The environmental monitor will be an independent contractor with experience providing environmental recommendations on a large-scale construction site. • On site speed limits will be clearly posted, applied, and followed by construction staff. • 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 after construction activities are complete. • 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 during site clearing, grubbing, grading and top soil removal. • 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. • Maintain vegetative buffers around water bodies. • Control quantity and quality of stormwater discharge using best management practices. • Minimize grading activities to maintain existing drainage patterns as much as possible. • 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).
Disturbance and/or Mortality to Local Wildlife.	• Minimize impacts to migratory birds and their nests. • Limit potential wildlife road mortalities.	• Schedule all construction and decommissioning activities within 30 m of generalized 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. If an active bird nest is identified in the location where natural vegetation clearing is proposed, the area will be protected and no construction activities will occur until the young have fledged or until the nest is no longer active, as confirmed by a qualified biologist. • Schedule construction and decommissioning activities within 30 m of woodlands or wetlands to occur during daylight hours, wherever possible. • If construction and decommissioning activities within 30 m of woodlands or wetlands must occur outside of daylight hours, any spotlights will be directed downward and/or away from the woodland or wetland to limit potential light disturbance to breeding birds. • On site speed limits will be clearly posted, applied, and followed by construction staff.	• 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.	• 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. • Depending on site-specific conditions, 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 instances where the natural features are at a higher elevation than the occurring construction activity when appropriate. • Document all trees (>10 cm dbh) to be removed and retained within the disturbance area limit, prior to construction. • Prune any tree limbs or roots that are accidentally damaged by construction activities using proper arboricultural techniques. • Re-vegetate cleared areas as soon as reasonably possible after construction activities are complete.	• 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 natural features or water bodies.	• Develop a spill response plan and train staff on appropriate procedures. • Keep emergency spill kits on site. • Keep contact information for the MOECC Spills Action Centre in a designated area on the construction site. • Locate all maintenance activities, vehicle refueling or washing, as well as the storage of chemical and construction equipment more than 30 m from natural features or water bodies. • Dispose of waste material by authorized and approved off-site vendors. • Store hazardous materials in designated areas. • Develop a 'frac-out' (i.e. the escape of drilling mud and/or fluids into the environment as a result of a spill, drilling tunnel collapse or rupture of mud to the surface due to excessive pressure from an obstruction within the borehole) contingency plan and train staff on appropriate procedures during the construction phase. • 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 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.	• 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 4-3: Mitigation Measures and Net Effects: Generalized Candidate Significant Wildlife Habitat and Natural Heritage Features

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.	• Monitor rate of water pumping and timing to meet requirement of less than 50,000 L per day, and contact the MOECC if a situation arises where this cannot be met. • Control quantity and quality of water discharge using best management practices, and avoid direct discharge into wetlands or watercourses. • Restrict taking of groundwater and surface water during extreme low flow time periods.	• 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.	• 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. • Maintain vegetative buffers around water bodies. • Control quantity and quality of stormwater discharge using best management practices. • 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 Wetlands and Woodlands and Treated as Significant 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.	• No use of herbicides (Project related activities only) within significant woodlands during the construction and decommissioning phases. • Clearly delineate work area using erosion fencing or other barrier to avoid accidental damage to retained species. • Where construction is within 10 m of a significant woodland, erect erosion fencing, or other barrier, to correspond to the disturbance area limits. • Place the erosion fencing, or other barrier, as far away as possible from the significant woodland and no closer to the significant woodland than the dripline. • Depending on site-specific conditions, the environmental monitor may consider substituting other demarcating types for fencing, such as staking and flagging, where it is determined that there is no apparent risk to significant woodlands. This could include instances where the significant woodland is at higher elevation than the occurring construction activity. The environmental monitor will be a contractor with experience providing environmental recommendations on a large-scale construction site.	• 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 dripline 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 dripline to ensure the work area is clearly delineated and dripline 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, depending on the extent of damage incurred.
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.	Common Mitigation • Avoid construction activities during the breeding bird period (May 1st – July 31st), wherever possible, to limit 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. If an active bird nest is identified in the location where natural vegetation clearing is proposed, the area will be protected and no construction activities will occur until the young have fledged or until the nest is no longer active, as confirmed by a qualified biologist. • Schedule construction activities within 30 m of significant woodlands to occur during daylight hours to avoid excessive sound and/or light disturbances to wildlife, wherever possible. • 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. • On site speed limits will be clearly posted, applied, and followed by construction staff. Significant Wetlands • No use of herbicides (Project related activities only) within significant wetlands during the construction and decommissioning phases.	• 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).	**No monitoring or contingency plan required.**
Sedimentation and Erosion.	• Minimize impacts to natural features and associated wildlife habitats. • Minimize impacts to woodland/wetland integrity and diversity. • Maintain vegetated buffers, including riparian zones. • Minimize impacts to bat maternity colony habitats. • Avoid contamination of bat maternity colony habitat. • Minimize impacts to colonially-nesting breeding bird habitats. • Avoid contamination of colonially-nesting breeding bird habitat	Common Mitigation • Implement a sediment and erosion control plan. • Install, monitor, and maintain erosion and sediment control measures (i.e. erosion fencing) around the construction area for the duration of the construction or decommissioning activities, as identified within the sediment and erosion control plan. • Erect erosion fencing, or other barrier, to correspond to the construction disturbance area limits. • Place the erosion fencing, or other barrier, as far away as possible from the significant woodland and no closer to the significant woodland than the dripline. • 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.	• 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 erosion fencing, 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 when active directional drilling is occurring.

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

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
	• Minimize impacts to significant waterfowl nesting habitat. • Avoid contamination of waterfowl nesting area habitat. • Minimize impacts to amphibian breeding habitat and minimize amphibian mortality. • Avoid contamination of amphibian breeding habitat. • Minimize impacts to marsh bird breeding habitats. • Avoid contamination of marsh bird breeding habitat. • Minimize impacts to bird species of conservation concern habitats. • Avoid contamination of bird species of conservation concern habitat. • Minimize impacts to plant species of conservation concern. • Protect plant species of conservation concern habitat. • Avoid contamination of plant species of conservation concern habitat. • Minimize impacts to significant old growth forest.	• Utilize erosion blankets, silt fencing, straw bales, etc. for construction activities within 30 m of significant woodlands. • Store any stockpiled material more than 30 m from significant woodlands and wetlands throughout the construction and decommissioning phases. • 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 the significant woodlands 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. • Re-vegetate areas adjacent to the natural feature as soon as possible after construction activities are complete. <u>Significant Wetlands</u> • Where the temporary construction area is proposed to be within 5 m of, but not overlapping by a method other than directional drilling, 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 as soon as reasonably possible after construction.		<u>Plant Species of Conservation Concern Monitoring</u> • Conduct post-construction monitoring in years 1, 3, and 5 of operation at a time of year when the species can be identified (refer to Table 10 of the EIS (NRSI, 2015a) for specific survey timing). Following pre-construction survey methods, one standardized area search will be conducted throughout each significant habitat. The UTM location of any individuals or clusters will be recorded and a stem count will be conducted. Specific locations of plant species of conservation concern identified during pre-construction surveys will also be monitored post-construction. The results of the surveys will be compared to the results of the pre-construction surveys to assess any potential changes in species populations or distribution. **Contingency Measures:** <u>Common Contingency Measures</u> • 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 sedimentation and erosion control measures fail and degradation of the natural feature or habitat occurs, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas, depending on the extent of degradation incurred. <u>Plant Species of Conservation Concern Measures</u> • If any potential changes in species populations or distribution are noted during post-construction surveys as a result of construction, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of changes to species population or distribution.
Fugitive Dust Emission.	• Minimize impacts to natural features and associated wildlife habitats. • Maintain vegetated buffers, including riparian zones. • Minimize impacts to bat maternity colony habitats. • Avoid contamination of bat maternity colony habitat. • Minimize impacts to colonially-nesting breeding bird habitats. • Avoid contamination of colonially-nesting breeding bird habitat. • Minimize impacts to significant waterfowl nesting habitat. • Avoid contamination of waterfowl nesting area 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 habitats. • Avoid contamination of marsh bird breeding habitat. • Minimize impacts to bird species of conservation concern habitats. • Avoid contamination of bird species of conservation concern habitat. • Minimize impacts to plant species of conservation concern. • Protect plant species of conservation concern habitat. • Avoid contamination of plant species of conservation concern habitat. • Minimize impacts to significant old growth forest.	<u>Common Mitigation</u> • On site speed limits will be clearly posted, applied, and followed by construction staff. • 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 after construction activities are complete. • 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. <u>Significant Wetlands</u> • Where the temporary construction area is proposed to be within 5 m of, but not overlapping by a method other than directional drilling, a wetland (excluding along existing municipal roads), any permanent infrastructure (i.e. access roads) will be placed 5 m from the wetland edge and native vegetation will be planted 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:** <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 erosion fencing, check dams, and dust control measures daily in areas where work is taking place and prior to and after any storm events. <u>Plant Species of Conservation Concern Monitoring</u> • Conduct post-construction monitoring in years 1, 3, and 5 of operation at a time of year when the species can be identified (refer to Table 10 of the EIS (NRSI, 2015a) for specific survey timing). Following pre-construction survey methods, one standardized area search will be conducted throughout each significant habitat. The UTM location of any individuals or clusters will be recorded and a stem count will be conducted. Specific locations of plant species of conservation concern identified during pre-construction surveys will also be monitoring post-construction. The results of the surveys will be compared to the results of the pre-construction surveys to assess any potential changes in species populations or distribution. **Contingency Measures:** <u>Common Contingency Measures</u> • If fugitive dust control measures fail and degradation of the natural feature occurs, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of degradation incurred. <u>Plant Species of Conservation Concern Measures</u> • If any potential changes in species populations or distribution are noted during post-construction surveys as a result of construction, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of changes to species population or distribution.

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

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Spills *(i.e., oil, gasoline, grease, and/or drilling frac-out, etc.).*	• Minimize impacts to natural features and associated wildlife habitats. • Maintain vegetated buffers, including riparian zones. • Minimize impacts to bat maternity colony habitats. • Avoid contamination of bat maternity colony habitat. • Minimize impacts to colonially-nesting breeding bird habitats. • Avoid contamination of colonially-nesting breeding bird habitat. • Minimize impacts to significant waterfowl nesting habitat. • Avoid contamination of waterfowl nesting area 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 habitats. • Avoid contamination of marsh bird breeding habitat. • Minimize impacts to bird species of conservation concern habitats. • Avoid contamination of bird species of conservation concern habitat. • Minimize impacts to plant species of conservation concern. • Protect plant species of conservation concern habitat. • Avoid contamination of plant species of conservation concern habitat. • Minimize impacts to significant old growth forest. • Minimize impacts to rare vegetation communities. • Protect rare vegetation communities habitat. • Avoid contamination of rare vegetation communities habitat.	• Develop a spill response plan and train staff on appropriate procedures. • Develop a 'frac-out' contingency plan and train staff on appropriate procedures during the construction phase. • Keep emergency spill kits on site. • Keep contact information for the MOECC Spills Action Centre 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.	• 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> • An environmental monitor will be present when active directional drilling is occurring. <u>Plant Species of Conservation Concern Monitoring</u> • Conduct post-construction monitoring in years 1, 3, and 5 of operation at a time of year when the species can be identified (refer to Table 10 of the EIS (NRSI, 2015a) for specific survey timing). Following pre-construction survey methods, one standardized area search will be conducted throughout each significant habitat. The UTM location of any individuals or clusters will be recorded and a stem count will be conducted. Specific locations of plant species of conservation concern identified during pre-construction surveys will also be monitored post-construction. The results of the surveys will be compared to the results of the pre-construction surveys to assess any potential changes in species populations or distribution. **Contingency Measures:** <u>Common Contingency Measures</u> • If 'frac-out' occurs, immediately implement 'frac-out' contingency plan. • 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. • If degradation of the natural feature occurs as a result of the spill, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of degradation incurred. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. <u>Plant Species of Conservation Concern Measures</u> • If any potential changes in species populations or distribution are noted during post-construction surveys as a result of construction, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of changes to species population or distribution.
Changes in Soil Moisture and Compaction.	• Minimize impact to soil moisture regime and vegetation species composition.	• 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. • Minimize vehicle traffic on exposed soils during site clearing, grubbing, grading and topsoil removal. • Clearly delineate the dripline and root zone of all trees within 10 m of construction activities with erosion fencing or other 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).	**No monitoring or contingency plan required.**
Reduced Water Quality in Significant Wetlands (i.e. increased turbidity).	• 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. • On site speed limits will be clearly posted, applied, and followed by construction staff. • 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 after construction activities are complete. • 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. • No use of herbicides (Project related activities only) within significant wetlands during the construction and decommissioning phases. • Where the temporary construction area is proposed to be within 5m of, but not overlapping by a method other than directional drilling, a wetland (excluding along existing municipal roads), design any permanent infrastructure (i.e. access roads) to be 5m from the wetland edge and plant native vegetation in the 5m buffer between the infrastructure and wetland edge as soon as reasonably 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).	**Monitoring:** • Undertake regular monitoring of the wetland to ensure the work area is clearly delineated 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 the work area is clearly delineated and respected 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, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of degradation incurred. • If negative impacts such as reduced water quality (i.e. increased turbidity), infiltration and/or groundwater discharge, as a result of construction activities, are observed, consult the MNRF to determine appropriate contingency measures.

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

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
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, the environmental monitor may consider substituting other styles of fencing for erosion fencing, when appropriate. • Where the temporary construction area is proposed to be within 5 m of, but not overlapping by a method other than directional drilling, 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 as soon as reasonably possible after construction. • Re-vegetate cleared areas as soon as reasonably possible after construction activities are complete.	• 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 wetland to ensure the work area is clearly delineated 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 the work area is clearly delineated and respected 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, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of degradation incurred. • If negative impacts such as reduced water quality (i.e. increased turbidity), infiltration and/or groundwater discharge, as a result of construction activities, are observed, consult the MNRF to determine appropriate 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. <u>For groundwater taking (if necessary):</u> • Monitor rate of water pumping and timing to meet requirement of less than 50,000 L per day, and contact the MOECC if a situation arises where this cannot be met. • 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 wetland to ensure the work area is clearly delineated 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 the work area is clearly delineated and respected 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, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of degradation incurred. • If negative impacts such as reduced water quality (i.e. increased turbidity), infiltration and/or groundwater discharge, as a result of construction activities, are observed, consult the MNRF to determine appropriate contingency measures.
Changes in Surface Hydrology in Significant Waterfowl Nesting Areas.	• Minimize impacts to hydrological functions associated with permanent open water. • Maintain existing surface water flow patterns.	• Clearly delineate work area using erosion fencing, or other barrier, to avoid impacting hydrological functions associated with permanent open water. • Limit grading activities and changes in land contours, wherever possible. • Minimize paved surfaces and design roads to promote infiltration. • 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.	• 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 habitat when grading activities are located within 30 m of waterfowl nesting area habitat at a minimum frequency of once per week. • Conduct post-construction behaviour surveys of this habitat for 3 years following pre-construction methods to assess the potential Project disturbance on the habitat if deemed significant. Full details of this monitoring will be provided in the Bird and Bat EEMP. **Contingency Measures:** • If changes in surface hydrology are noted as a result of construction, appropriate mitigation measures will implemented, which may include modifications to previous grading and/or constructed ditches depending on the extent of changes incurred.
Sound Disturbance / Avoidance Behaviour.	• Protection of bat maternity colony habitat. • Protection of colonially-nesting breeding bird habitat (tree/shrub). • Minimize disturbance to waterfowl species. • 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. • Minimize disturbance to marsh breeding birds. • Minimize sound disturbance/avoidance behavior of bird species of conservation concern.	<u>Common Mitigation</u> • On site speed limits will be clearly posted, applied, and followed by construction staff throughout the construction and decommissioning phases. <u>Bat Maternity Colony</u> • Schedule construction activities to occur outside of the critical roosting period (June), unless specifically required in accordance with manufacturer specifications. <u>Colonially Nesting Breeding Bird Habitat (Trees/Shrubs)</u> • Avoid scheduling construction activities during the peak breeding season (April-August), wherever possible. • If construction must occur during peak breeding season, a biologist will be present to	• 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>Bat Maternity Colony Monitoring</u> • Conduct post-construction disturbance 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 Bird and Bat EEMP. <u>Colonially Nesting Breeding Bird Habitat (Trees/Shrubs) Monitoring</u> • Conduct post-construction behaviour surveys for three years following pre-construction survey methods to assess any potential changes to breeding habitats deemed significant. Full details of this monitoring will be provided within the Bird and Bat EEMP.

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

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
		confirm nesting birds will not be impacted by construction activities. Waterfowl Nesting Area • Avoid scheduling construction activities during the peak waterfowl nesting season (April-June), if possible. • If construction must occur during peak breeding season, a biologist will be present to confirm birds will not be impacted by construction activities. Amphibian Breeding Habitat (Woodland) • Schedule construction activities to occur outside of the peak frog breeding season (April 15th-June 15th). • If construction activities must occur during the peak frog breeding season, install temporary drift fencing (erosion fencing) to help control amphibian movements around construction activity. • Schedule construction activities within 30m during daylight hours, wherever possible, to limit potential impacts from light, sound, or vehicle interactions. • If construction activities within 30 m of significant amphibian breeding habitats must occur outside of daylight hours, spotlights will be directed downwards and/or away from the woodland to limit potential impacts to breeding amphibians. Marsh Bird Breeding Habitat • Schedule construction activities to occur outside of the peak marsh bird breeding season (mid-May to early July), wherever possible. • If construction must occur during this peak breeding season (mid-May to early July), have a biologist confirm birds will not be impacted by construction activities. Bird Species of Conservation Concern Habitat • Schedule construction 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 must occur during the breeding bird period (May 1st – July 31st), have a biologist confirm birds will not be impacted by construction activities.		Waterfowl Nesting Area 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 Bird and Bat EEMP. Amphibian Breeding Habitat (Woodland) Monitoring • Conduct post-construction amphibian call surveys for 1 year following pre-construction survey methods to assess any potential changes in amphibian breeding populations or species distribution for all habitats deemed significant. Marsh Bird Breeding Habitat 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 Bird and Bat EEMP. Bird Species of Conservation Concern Habitat Monitoring • 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 in the Bird and Bat EEMP. **Contingency Measures:** Bat Maternity Colony Measures • An annual report, which documents the results of disturbance monitoring, will be prepared following each year that disturbance monitoring occurs. The report will be submitted to MNRF and the results presented in these annual reports will be used to determine if any additional mitigation measures should be implemented during the operational phase of this Project to further protect this habitat. Colonially Nesting Breeding Bird Habitat (Trees/Shrubs) Measures • An annual report, which documents the results of disturbance monitoring, will be prepared following each year that disturbance monitoring occurs. The report will be submitted to MNRF and the results presented in these annual reports will be used to determine if any additional mitigation measures should be implemented during the operational phase of this Project to further protect this habitat. Waterfowl Nesting Area Measures • An annual report, which documents the results of disturbance monitoring, will be prepared following each year that disturbance monitoring occurs. The report will be submitted to MNRF and the results presented in these annual reports will be used to determine if any additional mitigation measures should be implemented during the operational phase of this Project to further protect this habitat. Amphibian Breeding Habitat (Woodland) Measures • 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. • Given the short-term and temporary nature of increased traffic and the restriction of construction activities to daylight hours, wherever possible, the timing restriction during breeding period, the risk of increased mortality during construction is considered low. Marsh Bird Breeding Habitat Measures • An annual report, which documents the results of disturbance monitoring, will be prepared following each year that disturbance monitoring occurs. The report will be submitted to MNRF and the results presented in these annual reports will be used to determine if any additional mitigation measures should be implemented during the operational phase of this Project to further protect this habitat. Bird Species of Conservation Concern Measures • An annual report, which documents the results of disturbance monitoring, will be prepared following each year that disturbance monitoring occurs. The report will be submitted to MNRF and the results presented in these annual reports will be used to determine if any additional mitigation measures should be implemented during the operational phase of this Project to further protect this habitat.

Table 4-4: Mitigation Measures, Net Effects and Monitoring Plan: Significant Wetlands and Woodlands and Treated as Significant 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. • Minimize impacts to rare vegetation communities. • Protect rare vegetation communities habitat. • Avoid contamination of rare vegetation communities habitat.	• Clearly delineate work area using erosion fencing, or other barrier, to minimize seed transfer into suitable habitat. 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 significant rare vegetation communities. This could include instances where the significant rare vegetation communities are at a higher elevation than the occurring construction activity. • 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. • 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 at a time of year when the species can be identified (refer to Table 10 of the EIS (NRSI, 2015a) for specific survey timing). Following pre-construction survey methods, one standardized area search will be conducted throughout each significant habitat. The UTM location of any individuals or clusters will be recorded and a stem count will be conducted. Specific locations of plant species of conservation concern identified during pre-construction surveys will also be monitored post-construction. The results of the surveys will be compared to the results of the pre-construction surveys to assess any potential changes in species populations or distribution. • Undertake regular construction monitoring and routine inspections to ensure proper installation of erosion control and that proper fugitive dust control measures are in place. • Monitor sediment and erosion control measures, such as erosion fencing, 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 when active directional drilling is occurring. **Contingency Measures:** • 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 sedimentation and erosion control measures fail and degradation of the habitat(s) occurs, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of degradation incurred. • If any potential changes in species populations or distribution are noted during post-construction surveys as a result of construction, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of changes to species population or distribution.
Accidental Damage to Habitat, Including Tree Limbs (the Project Location is sited outside of SWH – vegetation removal is not anticipated).	• Protection of bat maternity colony habitat. • Protection of colonially-nesting breeding bird habitat (tree/shrub). • Minimize impacts to waterfowl nesting 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. • Minimize disturbance to marsh breeding birds. • Minimize impacts to bird species of conservation concern habitat. • 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. • Minimize direct impacts on vegetation communities and protect rare/sensitive habitats.	<u>Common Mitigation</u> • Clearly delineate work area using erosion fencing, or other barrier, to avoid accidental damage to potentially significant habitat trees and vegetation. • Depending on site-specific conditions, the environmental monitor may 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 instances where the natural feature is at a higher elevation than the occurring construction activity. • No use of herbicides (Project related activities only) within significant features or wildlife habitats. <u>Amphibian Breeding Habitat (Woodland)</u> • Avoid direct impacts to specific breeding habitat (i.e. vernal pools or other aquatic habitat), or immediately surrounding woodland habitat. <u>Plant Species Of Conservation Concern Habitat</u> • Where construction is within 10m of a significant plant species of conservation concern habitat, erect erosion fencing, or other barrier, to correspond to the disturbance area limits. • Place the erosion fencing, or other barrier, as far away as possible from the significant plant species of conservation concern habitat, and no closer to the significant habitat than the dripline. <u>Old Growth Forest</u> • Where construction is within 10m of the old growth forest, erect erosion fencing, or other barrier, to correspond to the disturbance area limits. • Place the erosion fencing, or other barrier, as far away as possible from the old growth forest and no closer to the feature than the dripline.	• 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>Bat Maternity Colony Monitoring</u> • Conduct post-construction disturbance monitoring of this feature for 3 years after construction, following pre-construction methods, for all features deemed significant. Full details of this monitoring will be provided in the Bird and Bat EEMP. <u>Colonially- Nesting Breeding Bird Habitat (Trees/ Shrubs) Monitoring</u> • Conduct post-construction disturbance monitoring of this feature for 3 years after construction, following pre-construction methods, for all features deemed significant. Full details of this monitoring will be provided in the Bird and Bat EEMP. <u>Waterfowl Nesting Area Habitat Monitoring</u> • Conduct post-construction disturbance monitoring of this feature for 3 years after construction, following pre-construction methods, for all features deemed significant. Full details of this monitoring will be provided in the Bird and Bat EEMP. <u>Amphibian Breeding Habitat (Woodland) Monitoring</u> • Conduct post-construction amphibian call surveys for 1 year following pre-construction survey methods to assess any potential changes in amphibian breeding populations or species distribution for all habitats deemed significant. <u>Marsh Bird Breeding Habitat Monitoring</u> • Conduct post-construction monitoring of this feature for 3 years after construction, following pre-construction methods, for all features deemed significant. Full details of this monitoring will be provided in the Bird and Bat EEMP.

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

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
				Plant Species Of Conservation Concern Habitat Monitoring • Undertake regular monitoring of the dripline 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 tree species of conservation concern habitat. • Undertake regular monitoring of the dripline to ensure the work area is clearly delineated and dripline boundaries are respected when construction is anticipated to occur within 10 to 30 m of significant tree species of conservation concern habitat. • Conduct post-construction monitoring in years 1, 3, and 5 of operation at a time of year when the species can be identified (refer to Table 10 of the EIS (NRSI, 2015a) for specific survey timing). Following pre-construction survey methods, one standardized area search will be conducted throughout each significant habitat. The UTM location of any individuals or clusters will be recorded and a stem count will be conducted. Specific locations of plant species of conservation concern identified during pre-construction surveys will also be monitored post-construction. The results of the surveys will be compared to the results of the pre-construction surveys to assess any potential changes in species populations or distribution. Bird Species of Conservation Concern Habitat Monitoring • Conduct post-construction behaviour surveys of this habitat for 3 years following pre-construction survey methods to assess the potential Project disturbance on this habitat. Full details of this monitoring will be provided in the Bird and Bat EEMP. Old Growth Forest Monitoring • Undertake regular monitoring of the dripline 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 the old growth forest. • Undertake regular monitoring of the dripline to ensure the work area is clearly delineated and dripline boundaries are respected when construction is anticipated to occur within 10 to 30 m of the old growth forest, at a minimum frequency of once per month. **Contingency Measures:** Common Contingency Measures • Prune damaged trees through implementation of proper arboricultural techniques. • Accidental damage to trees, or unexpected vegetation removal, may require re-planting of similar, native species depending on the extent of damage incurred. • An annual report, which documents the results of disturbance monitoring, will be prepared following each year that disturbance monitoring occurs. The report will be submitted to MNRF and the results presented in these annual reports will be used to determine if any additional mitigation measures should be implemented during the operational phase of this Project to further protect this habitat. • Restore vegetated buffers, including riparian zones, if accidentally damaged, as soon as possible. Amphibian Breeding Habitat (Woodland) Measures • 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. Plant Species Of Conservation Concern Habitat 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 2 years after planting. • If degradation of the habitat(s) occurs as a result of construction, appropriate contingency measures will be implemented, which may include re-establishing mitigation measures, habitat remediation, and/or seeding of permanently damaged areas depending on the extent of degradation incurred.

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 C** 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, 62 water bodies were identified within 120 m of the Project Location. Of the 62 water bodies identified, 53 are overlapping with the 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 fisheries or intermittent drainage features (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
Increased Erosion, Sedimentation, and Turbidity Resulting from Removal of Upland and Riparian Vegetation. **Excess Sediment Suspended Carried Downstream by Stream Flow during the Installation and Removal of Temporary Structures.** **Increased Sedimentation Resulting from Dust and Debris Settling in Water Bodies, if Blasting Occurs**	• 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, as determined by the Environmental Construction Monitor and significant snow melt/thaw events, where possible, and resume once soils have been stabilized or mitigation measures have been installed (i.e. heavy-duty silt fences, coir logs, or straw mats around any soil stockpiles) to avoid risk of erosion, soil compaction or the potential for sediment release into nearby water bodies. • Implement riparian planting after construction, as soon as weather permits, to stabilize water body banks and encourage rapid re-vegetation of disturbed soils. This will aid in preventing potential bank 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, fiber matting, rock (i.e. large, clean angular rocks) reinforcement/armoring or equivalent to contain the site over the winter period. Plant vegetative cover as soon as is feasible in the next growing season, followed by maintenance and inspection. • Monitor erosion and sediment control systems frequently for effectiveness, repairing deficient controls in a timely manner and using an adaptive management approach when deemed appropriate. • Avoid seasonally wet periods when conducting clearing, grubbing, and grading activities, where possible. • Develop a Flood Response Plan to deal with on-site flooding in order 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. • Where possible, locate blasting sites away from water bodies, use blasting mats to contain debris, and spray the surface of the blast site with water to keep dust down.	• The application of the ESC Plan and maintenance of erosion and sediment control systems will prevent impacts to water bodies from increased erosion, sedimentation, and turbidity due to the removal of upland riparian vegetation. In addition, the removal of vegetation will be localized. • The release of excess suspended sediment downstream is unlikely and may occur only during in water work. Using directional drilling methods will eliminate this impact. Performing in water work in the dry and isolating the work area will prevent increases in suspended sediment if in water work is required. • Blasting activities are highly unlikely and will be highly localized. Locating blasting sites as far away from water bodies as possible, using blasting mats to contain debris and dampening the surface to keep dust down will mitigate the effects that blasting activities may have on local water bodies.	**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 surface water quality for general parameters (i.e. Total Suspended Solids (TSS)). • Monitor water levels within water bodies during groundwater dewatering
Increase in Impervious Surfaces and Increased Surface Runoff Resulting from Clearing of Vegetation and Re-grading of Land. **Soil Compaction as a Result of Heavy Machinery and the Stockpiling of Heavy Materials (i.e., Soils) in the PSA.** **Decreased Infiltration to Key Areas (e.g. Areas of Recharge) Due to Newly Impervious Cover Leading to Interruptions to the Natural Water Cycle.**	• Minimize the increase of impervious surfaces and surface runoff. • Minimize soil compaction.	• Avoid seasonally wet periods when conducting clearing, grubbing, and grading activities, where possible. • Operate construction equipment (i.e., cranes, back hoes etc.), in a manner that minimizes disturbance to the water body banks and stays outside of the water body and bank area. • Restrict construction equipment to designated, controlled vehicle access routes to minimize the potential for soil compaction, • Avoid construction during high volume rain events, as determined by the Environmental Construction Monitor and significant snow melt/thaw events, where possible, and resume once soils have been stabilized (i.e. heavy-duty silt fences, coir logs, or straw mats around any soil stockpiles) to avoid risk of erosion, soil compaction or the potential for sediment release into nearby water bodies.	• The increase in impervious surfaces and grading activities is minimal and highly localized. The application of the ESC Plan and maintenance of erosion and sediment control systems will mitigate the increased potential for erosion and downstream sedimentation. • The reduction of soil permeability and infiltration capacity as a result of heavy machinery and stockpiling of heavy materials is minimal, localized, and temporary in nature. Stockpiling of material and the use of heavy machinery is expected to be localized and temporary in nature. • The reduction in infiltration to key areas due to newly impervious surfaces is minimal. The use of permeable materials on access roads, parking lots, etc. will reduce the impact of decreased infiltration.	
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.	• Monitor water levels immediately before and during dewatering activities, to determine if dewatering activities are resulting in alteration of water levels within the water body. • Dewatering discharge rated should be evaluated as to not result in erosion and sedimentation to receiving water body • If discharge to a municipal storm sewer, ensure that groundwater quality meets the objectives of the municipal storm sewer by-law prior to discharge. To mitigate potential effects associated with the discharge, sample for TSS prior to discharge to ensure the water is suitable for discharge and will not result in an impact to the receiving water body. If the groundwater is not suitable for discharge, identify alternate disposal locations or carry out adequate treatment.	• The extent of dewatering will be localized and minimal. Impacts to water levels due to dewatering activities are highly unlikely. Monitoring water levels immediately before, during and after dewatering activities will help to mitigate any impacts.	

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

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan
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 (within 30 m) to occur within the low flow period of the late summer months, where possible, to avoid or minimize impacts. • If in-water work is required (e.g. for culvert installation and or collector line installation), adhere to required timing windows confirmed through consultation with regulatory agencies, including the MNRF. • If required, perform in-water work in the dry conditions, 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 that will prevent, which also prevent escape of debris and sediment from escaping into the surrounding to the exterior water body. Construct a by-pass channel to maintain flow quantity through the waterbody course and prevent from back flooding, which could and ultimately overtopping the water containment structure. Additional permits may be required for in-water work. • Install an in-stream sediment filter (e.g. Siltsoxx or Filtersoxx) downstream of water containment structure, dewatering discharge should be dissipated (i.e. splash pads, sand bags, hay bales etc.) and may require splitting discharge to more than one location. • Dewatering discharge rates should be evaluated as to not result in erosion and sedimentation to receiving water body. • Prior to surface water dewatering, collect and relocate fish to a suitable location, preferably downstream and away from the construction area. This should be executed through the development of a Fish Salvage Plan and by a qualified fisheries biologist.	• The extent of dewatering will be localized and minimal. Impacts to water levels due to dewatering activities are highly unlikely. Monitoring water levels immediately before, during and after dewatering activities will help to mitigate any impacts.	
Degradation of Water Quality from Contamination by Oils, Gasoline, Grease and Other Materials (e.g. 'frac-out') Due to Accidental Spills, as a Result of the Proximity of Construction Vehicles and Machinery to Water Bodies.	• Minimize water contamination • Minimize soil contamination.	• Machinery should arrive on site in clean condition. Frequent checks and maintenance should ensure that no fluid leaks occur. Machinery must be refueled, washed, and serviced a minimum of 30 m away from all water bodies and other drainage features to prevent any deleterious substances from entering a water body • 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 proper use of this kit and to be fully aware of the SRP. • Remove and dispose of any waste generated from the site appropriately off site according to provincial standards including but not limited to O.Reg 102/94, O.Reg 103/94, R.R.O. 1990, Regulation 347. • Horizontal directional drilling should be executed at a depth that limits the potential impacts associated with the possibility of a 'frac-out'. A minimum depth will be provided on design drawings and will be included in discussions with the conservation authorities. • Locate drilling entry/exit shafts beyond the top of bank, at a distance that allows the minimum depth, as identified on design drawings, to be reached while below the water body. This distance should be 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.	• Spills are highly unlikely and the application of a SRP will mitigate any potential impact to water bodies due to accidental spills. • Changes in water quality are highly unlikely and related only to spills or frac-out events. Following the SRP and locating machine fueling and maintenance activities away from water bodies will prevent contamination of water bodies.	**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 aquatic habitat at drilling locations (if drilling) (i.e. potential 'frac-out').
Disturbance of Flow Patterns, Increased Risk of Flooding, Erosion and Sedimentation, and Water Quality Impairment Due to Improper Containment of Stockpiles	• Minimize disturbance to local drainage patterns and flooding • Minimize erosion and sedimentation, and water quality impairment	• Schedule construction activities near water (within 30 m) to occur within the low flow period of the late summer months, where possible, to avoid or minimize impacts. • Remove construction debris from the site and stabilize it to prevent debris from entering the nearby water bodies • Avoid construction during high volume rain events, as determined by the Environmental Construction Monitor and significant snow melt/thaw events, where possible, and resume once soils have been stabilized (i.e. heavy-duty silt fences, coir logs, or straw mats around any soil stockpiles) to avoid risk of erosion, soil compaction or the potential for sediment release into nearby water bodies. • Develop a Flood Response Plan (FRP) to deal with on-site flooding in order to mitigate any possible effects to the aquatic environment	• Stockpiles of debris will be removed from the site and stabilized according to the ESC Plan. Change in flow patterns, flooding, erosion and sedimentation are highly unlikely following the application of the ESC Plan.	**Monitoring:** • Monitor on-site conditions (i.e., location of stockpiles, erosion and sediment control measures, flooding). • Monitor meteorological conditions from Environment Canada during construction phase. • Monitor surface water quality for general parameters (i.e. Total Suspended Solids (TSS)). • .

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 North Kent Wind 1 Project. For further details please refer to the Hydrogeological Assessment and Effects Assessment in **Appendix C** of the Design and Operations Report.

4.3.2.1 Existing Conditions

The PSA is located within 2 distinct physiographic regions. The western, northwestern and southeastern portions of the PSA lie within the Chatham Flats, a sub-region of the St. Clair Clay Plains physiographic region, whereas the northeastern portion of the PSA is located within the Bothwell Sand Plains physiographic region (Chapman and Putnam, 1984). The Chatham Flats is described as a low relief extensive clay plain that slopes gently to the west toward Lake St. Clair. In the Municipality of Chatham-Kent, encompassing the eastern portion of the PSA, a shallow sand layer is found to overlie the predominantly clay soils (Chapman and Putnam, 1984). According to MOECC water wells records, the sand layer can be up to 5 m thick in some places.

Currently, land use across the PSA is dominated by mixture of crop cultivation and livestock agriculture, which has been made possible by the installation of dredged ditches and tile under-drains to provide satisfactory moisture conditions within the imperfectly drained soils. Chapman and Putnam (1984) classify the soils of the Bothwell Sand Plains as low-grade, with the majority of the farmland cultivated with corn and soybeans. In contrast, the soils of the Chatham flats are considered highly fertile, producing cash crops in addition to corn and soybeans. Ground surface topography within the PSA is characterized as having low relief, with minor undulations associated with local surface water features.

Bedrock Geology

Across the PSA, thick successions of Upper Devonian aged Paleozoic sedimentary rocks subcrop beneath the overburden soils. The PSA is underlain by bedrock of the Kettle Point Formation, which can be described generally as a brown to black, laminated, organic-rich shale and siltstone (Armstrong, D.K., and Dodge, J.E.P., 2007).

Depth to bedrock across the PSA was assessed through a review of Drift Thickness mapping published by the OGS, as well as MOECC water well record information. Based on this review, overburden thickness within the PSA has been shown to range between approximately 10 m and 32 m, with an average thickness of about 18 m.

Overburden Geology

Thick overburden deposits consisting of both fine and coarse textured glacial sediments and fluvial deposits occur across the PSA. The PSA is situated within an abandoned lacustrine plain that consists of numerous alluvial features which were deposited in high level post-glacial and non-glacial lakes which historically occupied the Lake St. Clair basin (Kelly, 1991). Where the Thames River entered the glacial lakes, deltaic sediments of sand and gravel were deposited.

Groundwater Resources

Within the Municipality of Chatham-Kent, water for municipal supply is provided from 4 surface water facilities and 2 groundwater facilities (Chatham-Kent, 2015). There are no municipal surface water intakes and/or groundwater supply wells within the PSA. Approximately 97% of the population within the community is served by municipal

water. However, the remaining 3% depend on groundwater as the primary water supply for properties outside the municipally serviced areas (Chatham-Kent, 2015). See **Table 4-6** for a brief summary of recorded water wells within the PSA, as obtained from the current publically available MOECC data.

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	11	11.9 to 28.7	2 Overburden, 8 Bedrock, 1 unknown
Domestic	225	4.6 to 34.7	58 overburden, 154 bedrock, 13 unknown
Irrigation/Livestock	116	10.4 to 38.1	37 overburden, 79 bedrock
Monitoring/Test Hole	6	2.4 to 18.2	6 unknown
Public/Municipal	6	22.0 to 114.0	2 overburden, 3 bedrock, 1 unknown
Not Used	64	3.4 to 37.2	15 overburden, 36 bedrock, 13 unknown
Unknown	253	7.6 to 38.1	25 overburden, 193 bedrock, 35 unknown

The location and depth of MOECC water well records gives some indication of the presence of viable groundwater resources within the PSA. Approximately 77% of the wells within the PSA obtain their source water from the bedrock aquifer. In contrast, only 23% of the MOECC water well records within the PSA were completed in overburden sediments. This differential provides further evidence that the overburden is a marginal groundwater resource locally.

Results of this desktop investigation indicate that surficial soils within the PSA typically are composed of sand and/or sand and gravel glaciolacustrine and alluvial deposits overlying predominantly clay soils. The granular surface materials have the potential to readily transmit groundwater and turbine foundations excavated within these materials may require significant dewatering during construction. Prior to construction, a site-specific geotechnical investigation will be completed to confirm soil and groundwater conditions at each turbine foundation location. Should turbines be excavated in coarser-grained materials (e.g., sand and/or gravel) below the water table, dewatering requirements may exceed 400,000 L/day.

In conclusion, there is potential for groundwater takings to exceed 400,000 L/day at certain turbine foundation locations. This potential will be 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 a future geotechnical investigation. Should groundwater dewatering rates be expected to exceed 50,000 L/day from a turbine foundation excavation, implementation of mitigation measures to minimize the potential impact to groundwater resources are recommended, as detailed in the Hydrogeological Assessment and Effects Assessment report (**Appendix C** of the Design and Operations Report).

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.

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 exceed 50,000 L/day, the following will be implemented: ▪ Inlet pump head shall be surrounded with clear stone and filter fabric. ▪ The company shall regulate the discharge at such a rate that there is no flooding in the receiving water body or dissipate the discharge so 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. • Where construction dewatering is anticipated to exceed 50,000 L/day all water wells within 120 m of construction will be subject to a water well assessment.	• 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 in the unlikely event that a private water well becomes temporarily dry due to construction dewatering 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.

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 Sound Emissions

The operation of heavy construction vehicles, potential blasting and temporary generators could also result in nuisance sound at nearby residents or businesses and disturbance to local wildlife. Like air emissions, sound 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 sound.

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 a state similar to pre-existing land use after construction and installation activities are completed, unless otherwise agreed upon with the landowner. During the construction of access roads and crane pads, as well as the installation of collector lines, there is the potential to disturb existing agricultural drainage tiles. In the event that a drain would be severed or damaged, the affected drain will be capped and repaired as soon as reasonably possible to avoid negative impacts to existing drainage patterns.

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 4-11 provides mitigation measures, net effects and the monitoring plan for each potential effect relating to local interests, land use and infrastructure.

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. • In the unlikely event that blasting activities are required during excavation of wind turbine foundations, blasting mats will be used to contain debris and the surface of the blast site will be sprayed with water to keep dust down.	• 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). • Monitor dust and debris control systems at blasting sites, in the unlikely event that they are required, to ensure their proper installation. **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: Sound

Potential Effect	Performance Objectives	Mitigation Strategy	Net Effects	Monitoring Plan and Contingency Measures
Increased Sound Due to Construction Activity.	• Adherence to Municipality of Chatham-Kent noise by-law no. 41-2004 and amendment 43-2005.	• Ensure that construction equipment is frequently maintained and kept in good working condition. • Ensure that sound emissions from construction equipment not exceed guidelines specified in MOECC publication NPC-115 and manufacturer recommendations. • Schedule activities to comply with noise by-laws, where possible. • Implement construction speed limit on unpaved roads. • In the unlikely event that blasting activities are required during excavation of wind turbine foundation s, the following mitigation measures are proposed: ▪ Notify the municipality and local emergency services departments of blasting prior to occurring; ▪ Adhere to the Municipality of Chatham-Kent's noise by-law and avoid blasting outside of regular working hours (7:00 am – 11:00 p.m.).	• High likelihood of increased sound 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 sound complaints are received, conduct an investigation to determine the source of the problem.

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. • In the event that a drain would be severed or damaged, the drain will be capped and repaired as soon as reasonably possible to avoid negative impacts to existing drainage patterns.	• 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 Municipality of Chatham-Kent 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:** • Implementation of the traffic management plan will be monitored. **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 socio-economic 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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