Grand Bend Wind Farm

Construction Plan Report

Grand Bend Wind Limited Partnership

Northland Power Inc., as agent

NORTHLAND POWER

NEEGAN BURNSIDE

February 2013

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Construction Plan Report

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Record of Revisions

Revision	Date	Description
0	August 27, 2012	Initial Draft Submission to Municipal and Aboriginal Communities as well as Selected Government Agencies
1	February 15, 2013	Application for Renewable Energy Approval

Executive Summary

Grand Bend Wind Limited Partnership, with Northland Power Inc. ("Northland") as agent, are proposing to develop, construct and operate a 100 MW wind facility located north of Grand Bend, Ontario. An application for approval is being prepared under Ontario Regulation 359/09 of the *Environmental Protection Act*. The project is classified as a Class 4 Wind facility under the Regulation. The Grand Bend Wind Farm ("the Project") is located in Huron County, spanning the lower-tier municipalities of Bluewater and Huron South. Portions of the transmission line also traverse the municipality of Huron East and municipality of West Perth in Perth County.

This Construction Plan Report describes Project construction activities, timing, materials, traffic, and potential negative environmental effects with associated mitigation, monitoring and contingency measures.

Construction of the Project is estimated to take fifteen months, from September 2013 to December 2014. Within this timeframe, specific construction activities have been scheduled to protect natural resources and municipal infrastructure, in particular, the condition of local roads.

Construction-related activities of the Project generally involve:

- Survey for Layout;
- Geotechnical Investigation;
- Site Preparation and Clearing;
- Construction Compound;
- Watercourse Crossings;
- Agricultural Tile Drain Modifications;
- Turbine Foundations;
- Local Road Improvements;
- Access Roads;
- Underground Collector Lines (36 kV);
- Transformer Substation;
- Overhead Transmission Line (230 kV);
- Crane Delivery and Erection;
- Delivery of Turbine Components;
- Turbine Tower, Nacelle and Rotor Assembly;
- Parts and Storage Building;
- Switchyard & Interconnection;
- Meteorological Tower(s)
- Commissioning; and,

- Site Restoration.

The majority of construction activities will be completed using standard equipment, materials, and methods utilized in Ontario for electricity generation, distribution, transmission, and land development projects. Turbines will be delivered and installed using custom delivery trucks, cranes, and methods utilized for other wind projects in Ontario and worldwide.

Each potential negative environmental effect during construction has been analyzed with the following key considerations:

- the magnitude of the effect both in intensity and spatial scale;
- the proximity of the effect in relation to the Project;
- the likelihood of occurrence and reoccurrence of the effect;
- the timing and duration of the effect; and,
- the permanence or irreversibility of the effect.

For each potential negative effect, appropriate mitigation, monitoring, and contingency measures were developed. These typically involve setbacks from environmental features, modified construction procedures, timing restrictions, and rehabilitation measures.

During detailed design, the proposed mitigation, monitoring, and contingency measures described in this report will be translated into construction contract specifications as appropriate to fulfill the obligations of Renewable Energy Approval (REA).

This Construction Plan Report has been prepared in accordance with O.Reg. 359/09, and is one component of the REA application for the Project.

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1.0 Introduction

1.1 Project Overview

Grand Bend Wind Limited Partnership, with Northland Power Inc. ("Northland") as agent, are proposing to develop, construct and operate a 100 MW wind facility located north of Grand Bend, Ontario. An application for approval is being prepared under Ontario Regulation 359/09 of the *Environmental Protection Act*. The project is classified as a Class 4 Wind facility under the Regulation. The Grand Bend Wind Farm ("the Project") is located in Huron County, spanning the lower-tier municipalities of Bluewater and Huron South. Portions of the transmission line also traverse the municipality of Huron East and municipality of West Perth in Perth County.

The basic project components will include up to 48 turbines (Siemens SWT-2.3-113 direct drive wind turbine generators with a total name plate capacity of 100 MW), turbine access roads, a 36 kV electrical collection system, substation, a parts and storage (office/maintenance) building, a new transmission line within municipal road right-of ways ("ROWs") along Sararas Road, Rodgerville Road, and Road 183 with connection to the provincial power grid at the 230 kV transmission line south of the Seaforth Transformer Station. During construction temporary components will include access roads and work/storage areas at the turbine locations and transmission connections.

1.2 Report Requirements

Activities related to the construction of the Project as well as associated potential negative environmental effects are described within the Construction Plan Report.

This Construction Plan Report is one component of the REA Application for the Project, and has been prepared in accordance with Item 1, Table 1 of O.Reg. 359/09 which sets out specific content requirements as provided in **Table 1.1**.

O.Reg. 359/09 and its corresponding Table 1 requirements were amended on July 1, and November 2, 2012, with project transition provisions. Under provisions of the Regulation, Northland has elected to submit in accordance with the July 1 and November 2, 2012 provisions.

Table 1.1 Construction Plan Report Requirements

Requirements	Completed	Section Reference
Details of any construction or installation activities.	Yes	Section 2.0
The location and timing of any construction or installation activities for the duration of the construction or installation	Yes	Section 2.0
Any negative environmental effects that may result from construction or installation activities.	Yes	Section 3.0
Mitigation measures in respect of any negative environmental effects, as identified above	Yes	Section 3.0

2.0 Construction and Installation Activities

The construction methods, equipment, material types and quantities described in this report are provided as an estimate of project scope for the purpose of identifying and mitigating potential negative environmental effects. Approvals from authorities having jurisdiction will be required in addition to Renewable Energy Approval administered by the Ministry of the Environment. As such, the details described in the following sections are subject to change during the course of detailed design and permitting.

For context, an outline of the construction timing and methodology for each Project component is summarized below. Further detail on construction materials, equipment, traffic, and other considerations are then outlined in the remaining portions of this Section.

2.1 Timing and Operational Plan

Subject to the approval from all applicable regulatory agencies, construction of the Grand Bend Wind Farm is planned to commence in September 2013. Construction (excluding pre-construction activities) is estimated to take place over approximately a 15 month period according to the schedule outlined in **Table 2.1**. Some aspects of the work schedule (for example, the geotechnical investigation) will start prior to September 2013 in order to inform the development of contractual and construction design details.

The schedule provided in **Table 2.1** is intended for construction duration and phasing, and may be modified to accommodate the requirements of Northland and the applicable approval agencies.

Table 2.1 Construction Schedule

Activity	Duration	Start Date	End Date
Geotechnical Investigation	12 weeks	October 2012	January 2013
Survey for Layout	6 weeks	September 2013	October 2013
Site Preparation and Clearing	8 weeks	October 2013	November 2013
Construction Compound	2 weeks	October 2013	October 2013
Culvert Crossings	10 weeks	October 2013	December 2013
Agricultural Tile Drain Modifications	10 weeks	October 2013	December 2013
Underground Collector Line (36 kV)	10 weeks	October 2013	December 2013
Access Roads	12 weeks	October 2013	January 2014
Transmission Line (230 kV)	24 weeks	April 2014	September 2014
Local Road Improvements	8 weeks	May 2014	June 2014
Transformer Substation	16 weeks	May 2014	August 2014
Turbine Foundations	12 weeks	June 2014	August 2014
Delivery of Turbine Components	10 weeks	August 2014	October 2014
Erect Turbine Tower, Nacelle and Rotor	10 weeks	August 2014	October 2014
Switchyard and Interconnection	12 weeks	August 2014	October 2014
Parts and Storage Building	16 weeks	August 2014	November 2014
Commissioning	12 weeks	September 2014	November 2014
Site Restoration	8 weeks	April 2015	May 2015

2.1.1 Natural Heritage Timing Restrictions

As outlined in the Natural Heritage Assessment Environmental Impact Study under a separate cover, wildlife habitats are susceptible to potential negative effects during construction. As such, construction timing restrictions will be utilized to bolster mitigation techniques. Construction timing restrictions associated with specific habitats are described below.

Fish Habitat
Where access roads are required to traverse a watercourse, culverts will be installed according to the requirements of the authorities having jurisdiction. Where in-water work is involved, culvert installations will take place outside of the designated timing windows governed by Fisheries and Oceans Canada and the Ausable Bayfield Conservation Authority. For further information on fish habitat and timing windows, refer to the Water Assessment and Water Body Report.

Amphibian Habitat
Construction works within 120 m of amphibian breeding habitats will not occur after dusk during the breeding season (April to June).

Bird Habitat
Construction activities within 120 m of bird habitats will not occur in the early morning hours (between dawn and 1.5 hours after dawn) during the breeding season (May 15 to July 30).

Bat Habitat
Construction activities immediately adjacent to significant bat maternity colony habitats will not occur during the timing window of May 1 to July 30.

2.1.2 Local Road Timing Restrictions

The County of Huron may not issue oversize/overweight permits for travel during certain periods of the spring due to the susceptibility of the roads to damage. Also, heavy loads are not recommended on the local municipal roads during this time period, due to soft subgrade conditions and the reduced design standards of these roads.

2.1.3 Winter Construction

Depending on climate conditions, winter construction may affect the supply and placement of aggregates and concrete. It is assumed that local aggregate and concrete suppliers will remain operational during the winter months as required to supply construction materials for the Project. Due to additional concrete construction procedures during cold weather, additional crews may be required to satisfy Project requirements.

2.2 Pre-Construction Activities

Pre-construction activities for the Project generally involve investigative, design, and layout work that will be required prior to construction of Project infrastructure. These activities are described in further detail below.

2.2.1 Survey

Lands to be used during construction of the Project include access roads and work/storage areas at the turbine locations and collection/transmission connections. These areas will be surveyed and staked prior to any ground breaking works. Once staked, all construction and installation activities will be conducted within the defined area. For further detail on the location of Project components and construction areas, refer to the Site Plan in **Appendix A**.

2.2.2 Geotechnical Investigation

A geotechnical investigation will be performed to obtain subsurface information of the soils. This information will inform the design of project infrastructure such as the wind turbine foundations, access roads, and underground watercourse crossings.

The investigation will consist of a strategic layout of boreholes and test pits at various depths to determine the subsurface stratigraphy across the study area. Soil samples will be collected and laboratory tested to determine the physical and structural properties of the soil. In locations where creek crossings are proposed, boreholes will be taken on one or both sides of the creek, outside the ordinary high water level to avoid disturbance of the watercourse.

2.2.3 Erosion and Sediment Control

Erosion and sediment control measures will be designed to minimize displacement of soil and impacts on receiving watercourses during construction. A combination of Ontario Provincial Standard Specifications and Drawings (OPSS and OPSD), and industry best management practices will be utilized. Typical erosion and sediment control measures anticipated to be employed include the following:

- Silt Fence (OPSD 219.110);
- Straw Bale Barrier (OPSD 219.100);
- Rock Flow Check Dam (OPSD 219.210);
- Excavated Sediment Trap (OPSD 219.220);
- Dewatering Filter Bags;
- Erosion Control Blankets (i.e., Terrafix RECPs); and,
- Seeding/Hydroseeding/Terraseeding.

Additional Erosion and Sediment Control details will be required to satisfy the requirements of the Fisheries and Oceans Canada Operational Statements outlined in Section 2.3.6.

Once construction is complete in each area of the project, temporary construction areas will be restored to pre-development conditions to minimize the residual effects of erosion and sedimentation during construction.

2.2.4 Safety Measures

Construction site and traffic safety measures will be designed and included in the construction contract documents. Certain measures will require detailed design such as a Traffic Management Plan, whereas others will be standard prescriptive measures. The

construction contract documents will outline all details necessary to construct the project in accordance with the Ontario Occupational Health and Safety Act. Provincial, county, and municipal road and entrance permits will also be obtained, outlining further detail on safety measures and design requirements.

2.3 Construction Activities

Construction activities for the Project generally involve:

- site works to prepare the lands and facilitate access for construction;
- electrical works and equipment installation for electricity generation and transmission; and,
- restoration works to reinstate temporary construction areas to predevelopment conditions.

A more detailed description of these activities is outlined for each Project component below.

2.3.1 Site Preparation and Clearing

Prior to any other construction activity, lands designated for Project infrastructure will need to be prepared and cleared of obstructions and debris. Generally, site preparation will include the installation of construction fencing, safety features, and erosion and sediment control features as defined in the construction contract documents. Site clearing will include the removal of fences, trees, shrubs, foreign objects, and other debris that would interfere with the construction of the Project. The access roads and turbine sites have been designed to minimize the removal or relocation of trees where possible. Further details on tree displacement will be outlined in the road user agreements with the authorities having jurisdiction.

2.3.2 Construction Compound

A Construction Compound will be prepared at a central location of the Project to temporarily host construction trailers, equipment, materials, vehicles, communications infrastructure, and provide an area for on-site fabrication of Project infrastructure such as weld plate rings and cable modifications. Any hazardous materials such as fuels, oils, and lubricants required for construction equipment will be stored in proper storage containers with associated labels and MSDS documentation, and secured in a proper location identified by the Contractor. The Construction Compound area is approximately 5.4 hectares, and is shown in **Figure A8** of **Appendix A**.

To prepare the Construction Compound area, the area will be graded level, and a geotextile will be installed to define a boundary between the soil and the aggregate, which will be placed and compacted on the surface at an approximate depth of 0.2 m to 0.5 m.

2.3.3 Tile Drain Modifications

Tile drain modifications will be made to preserve agricultural drainage during and after construction. They will be completed by a licensed drainage Contractor, which will ensure proper equipment and methods are utilized. In general, water will be directed around excavations and under access roads such that agricultural drainage is preserved and construction areas are protected. A licensed drainage Contractor will ultimately be responsible for the design and construction of the tile modifications, but conceptual designs are detailed in **Figures B1** and **B2** of **Appendix B** for the purpose of identifying potential negative effects associated with the work.

The construction phasing of tile drain modifications will be sequenced to divert tile drainage around excavations during construction. This will protect the structural integrity of access roads and minimize the requirement of water taking in the form of dewatering during construction.

2.3.4 Local Road Improvements

Existing provincial, county, and municipal roads will be used for delivery of Project equipment. Due to the size and weight of the wind turbine delivery trucks, existing road geometry, condition, and strength must be considered. As such, an assessment of the existing roads anticipated to be used was performed to identify access and loading constraints. The Ministry of Transportation and the County of Huron were consulted and the Municipalities of Bluewater and South Huron attended field surveys of the roads. Each authority provided available input and considerations on the design and condition of their roads. This investigation provided the necessary detail to identify potential impacts on local roads and structures, and develop associated mitigation measures, as outlined in **Table 3.9**. Further discussion and analysis of the investigation will be required to develop road user agreements and obtain necessary permits from each authority.

The road assessment outlined above indicated that local road improvements will be required to accommodate the turning requirements of custom wind turbine delivery trucks. These improvements will typically involve temporary culvert extensions and placement and compaction of Granular ‘A’ and ‘B’ at intersections. Further details on local road improvements will be outlined in the road user agreement and/or applicable permit with each road authority.

2.3.5 Access Roads and Turbine Installation Areas

Access roads and turbine installation areas will be constructed to facilitate the delivery of Project equipment to the site. The access road layout illustrated in **Appendix A** incorporates wide turning radii required by wind turbine delivery trucks during construction. Construction access roads will vary from 5 to 11 m wide during construction, depending on the passing lane and crane movement requirements of the laneway. Permanent access laneways will be approximately 5 m wide, with the exception of entrances off local roads and all turning areas which require wider turning radii.

Truck turnaround areas have been designed to encircle the turbine installation areas, and will be designed to withstand the same loads as the access roads. In addition to a truck turnaround area, the turbine installation area has been designed to accommodate stockpiled topsoil and subsoil, turbine equipment staging, construction and rotor assembly areas, and a crane pad. A conceptual layout of the turbine installation area is detailed in **Figure B3** of **Appendix B**.

Crane pads will be approximately 18 m x 35 m, and will be designed to support the loading imparted by the crane during construction. Subject to the results of the geotechnical investigation, it is anticipated that an appropriate granular foundation design will be suitable to support the crane. Assembled cranes will be required to crawl between all turbine sites that can be accessed from the same site entrance off a local road. Access roads for these segments will be 11 m wide, and will be designed to support the loads imparted by the assembled crane. Access roads anticipated to support crane crawling are shown in **Appendix A**.

The construction phasing of access roads will be required to accommodate the construction of other Project infrastructure such as underground collector lines and fiber optic cable. It will also be scheduled in accordance with the conditions of the authorized trip permits and road user agreements to protect the condition of local roads used as haul routes.

In general, standard road construction techniques will be used to construct the access roads and turbine installation areas. Prior to grading works, tile drainage modifications will be made by a licensed drainage Contractor to preserve agricultural drainage during and after construction. Topsoil and subsoil will then be stripped and stockpiled separately, and the underground 36 kV collector line and fiber optic cable will be installed. Prior to the placement of aggregate, a geotextile material may be required to reinforce the subsurface soils. Granular ‘A’ and ‘B’ will then be placed and compacted to form the base and sub-base structure of the road, allowing surface water to drain freely

across the access road. The thickness of granular material will be approximately 0.3 m to 0.7 m to facilitate the movement of heavy construction equipment. Further accuracy of the access road granular composition will be developed during detailed design, after a geotechnical investigation of the subsurface soils has been performed.

2.3.6 Watercourse Crossings

Where access roads are required to traverse a watercourse, culverts will be required. Culverts will be installed according to the design and procedures approved by the authorities having jurisdiction. A preliminary culvert design has been developed and submitted to the Ausable Bayfield Conservation Authority (ABCA) for review. The preliminary design is detailed in **Figure B4** of **Appendix B**, and includes the use of rip-rap and geotextile materials to minimize erosion of the watercourse banks. Further development and approval of this design by the ABCA will be required prior to construction.

Where in-water work is required, culvert installations will have to take place outside of the designated timing windows governed by Fisheries and Oceans Canada and ABCA. For further information on fish habitat and timing windows, refer to the Water Assessment and Water Body Report.

Collector line and transmission line watercourse crossings will be installed according to the applicable Fisheries and Oceans Canada Operational Statements and procedures approved by the ABCA. It is anticipated that a combination of Punch & Bore, Horizontal Directional Drilling, Isolated or Dry Open-cut, and Overhead Line Construction will be employed for watercourse crossings. A brief summary of these operational statements is provided below. For further detail, refer to the Operational Statements available online at www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/provinces-territories-territoires/on/index-eng.htm.

Punch and Bore requires the design of a punch and bore path at an appropriate location and depth to prevent the cable from becoming exposed due to natural scouring of the stream bed. Erosion and Sediment Control measures will be designed to mitigate any potential negative environmental effects associated with the bell holes and work areas. A response plan will need to be developed by the Contractor to mitigate negative environmental effects in the event of a spill of sediment-laden water or other deleterious substances to the watercourse.

Horizontal Directional Drilling requires a geotechnical assessment of the soils to design a drill path at an appropriate location and depth to minimize the potential for a “frac-out” to occur. A “frac-out” is caused when excessive drilling pressure results in drilling mud propagating toward the surface. A frac-out response plan and a contingency crossing

plan will need to be developed by the Contractor to mitigate negative environmental effects in the event of a frac-out should this method of drilling be selected. Erosion and Sediment Control measures will also be designed to mitigate any potential negative environmental effects associated with the drilling and dugout work areas.

Isolated or Dry Open-cut crossings require sufficient erosion and sediment control measures in combination with timing restrictions and/or water diversion techniques to protect fish habitat during open cut trench work through the crossing. Isolated crossings refer to procedures that divert the natural flow of water around the site during construction while Dry Open-cut crossings refer to work that is carried out during a period when the stream width is seasonally dry or is frozen to the bottom. The operational statement includes detailed requirements with respect to the construction and restoration methods that will need to be employed as part of the work.

Overhead Line Construction requires the design of crossing approaches that minimize disturbance to riparian vegetation. Erosion and Sediment Control measures will be employed to mitigate any potential negative environmental effects associated with the disturbed areas during construction.

2.3.7 Turbine Assembly

Foundations

Turbine foundations will be designed based on the results of the geotechnical investigation. At this time, based on soils in the area and preliminary discussions with geotechnical engineers, the turbines will likely be supported by shallow spread footings. The footings will be constructed of reinforced concrete, and will be poured in-place on site. Approximate dimensions of the turbine footings are anticipated to be 3 m in depth and 18 to 22 m in diameter.

To prepare the turbine foundation sites, topsoil and subsoil will be stripped and stockpiled separately. Excavation of the foundation sites will be accomplished with a backhoe as bedrock and blasting is not anticipated. At the appropriate depth, a thin layer (approximately 0.05 to 0.15 m) of lean concrete will be poured to create a level and protected foundation pad. After setting of the lean concrete base, outer formwork, ground wiring, and rebar assembly for the foundation will then take place. With the formwork, rebar, and ground wiring in place, high-strength concrete will then be poured to form the foundation. After setting of the concrete, the formwork will be removed, and the foundation will cure for up to 28 days to achieve its design strength. Once sufficiently cured, the foundation will be backfilled and compacted.

Tower, Nacelle and Rotor
The turbine tower, nacelle and rotor will be delivered to the site in components. The 99.5 m high turbine tower will be delivered to the site in five sections: the base, three mid-sections, and the top section. The nacelle will be pre-assembled and delivered to the site in one component. The rotor will be delivered in four components: the three blades and the hub. After sufficient curing of the reinforced concrete foundation, the wind turbine will be erected with the use of cranes. The turbine tower and nacelle will first be installed, and the blades will be connected to the hub on the ground for rotor assembly. The assembled rotor will then be lifted into place and installed again with the use of cranes.

2.3.8 Electrical Lines

36 kV Collection System
Underground 36 kV collector lines will be installed to connect each turbine to the Project's transformer substation. On private land, the underground collector lines will be installed in a trench alongside access roads at an approximate depth of 0.5 m to 1.6 m with bedding, compacted backfill, and overlain with marker tape according to the authorities having jurisdiction. On public land, the underground collector lines will be installed in the gravel shoulder at an approximate depth of 0.5 m to 1.6 m with bedding, compacted backfill, and overlain with marker tape according to the authorities having jurisdiction.

In areas where the collector line intersects a watercourse, the line will be installed according to the Operational Statements outlined in Section 2.3.6.

230 kV Transmission Line
230 kV transmission lines will be installed to connect the Project's transformer substation to the existing 230 kV transmission line south of Seaforth Transformer Station. The transmission lines will be installed either above ground on utility poles or underground, complying with the requirements of the authorities having jurisdiction.

If the transmission line is to be installed above ground, it is anticipated that the utility poles will be approximately 25 m to 35 m high at a spacing of approximately 100 m, and will require proper clearance from property lines, trees, and other obstructions. Conceptual details of the utility poles are provided in **Figure B5** of **Appendix B**. The utility pole layout will be modified during detailed design as required to avoid sensitive areas such as wetlands, woodlots, an airstrip, and graveyards. Avoidance can be achieved by adjusting utility pole spacing, height, or relocation to the other side of the road.

If the transmission line is to be installed underground, it will be directly buried in a trench in the road shoulder at an approximate depth of 1.0 to 1.2 m and overlain with a concrete warning barrier.

A variety of equipment and service trucks outlined in Section 2.5.2 will be used to dig the required holes and install the utility poles and transmission lines. In areas where the transmission line intersects a watercourse, the line will be installed according to the Operational Statements outlined in Section 2.3.6.

2.3.9 Communication Lines

Fiber optic communication lines will be installed in conjunction with the electrical collector and transmission lines described in Section 2.3.8. For the underground segments, the fiber optic cable will be installed in a common trench with the electrical lines. For the overhead segments, the fiber optic cable will be installed on the utility poles. Fiber optic and electrical cable will be installed with proper spacing according to the requirements of the authorities having jurisdiction.

2.3.10 Transformer Substation

A transformer substation will be constructed to convert the voltage from the incoming 36 kV collector lines to the outgoing 230 kV transmission lines. The transformer substation is proposed to be located near the intersection of Sararas Road and Blackbush Line in the Municipality of Bluewater, and will be approximately 91 m x 54 m (4,914 m^2). Refer to **Figure A5** of **Appendix A** for the proposed location and **Figures B6 to B8** of **Appendix B** for conceptual drawings of the transformer substation.

To prepare the site, topsoil and subsoil will be stripped and stockpiled separately, followed by construction of the electrical connections and grounding, granular foundation, electrical equipment, and safety features. Access to the transformer substation will be secured by a properly grounded perimeter fence, a locked gate, and appropriate warning signage.

2.3.11 Switchyard

A Switchyard will be constructed to connect the Project's 230 kV transmission line to the provincial grid south of the Seaforth Transformer Station. Refer to **Figure A11** of **Appendix A** for the proposed location and **Figures B9 to B10** of **Appendix B** for conceptual drawings of the Switchyard.

To prepare the site, topsoil and subsoil will be stripped and stockpiled separately, followed by construction of the electrical connections and grounding, granular foundation, electrical equipment, and safety features. Access to the switchyard will be

secured by a properly grounded perimeter fence, a locked gate, and appropriate warning signage.

2.3.12 Parts and Storage Building

A permanent steel-framed parts and storage building with parking lot will be constructed to facilitate the long-term operations and maintenance of the wind farm. The building is proposed to be located near the intersection of Sararas Road and Blackbush Line in the Municipality of Bluewater, and will be approximately 15 m x 36 m (540 m^2). Refer to **Figure A5** in **Appendix A** for the proposed location and **Figures B11 to B16** of **Appendix B** for conceptual drawings of the building.

Standard building construction techniques will be employed, including stripping and stockpiling of topsoil and subsoil separately, placement and compaction of aggregate for the parking lot and building pad, construction of a reinforced concrete foundation, and erection of framing, siding, and roofing. The building will be serviced with well water and a septic system, and an electrical service from the distribution line on Blackbush Line. As outlined in the Design and Operations Report, if the well is found to have water quality or quantity issues, a storage and/or treatment system will be constructed at the building.

2.3.13 Site Restoration

Lands to be temporarily used during construction of the Project include temporary construction access roads, and staging/work areas on private land and within the public right-of-way.

Following construction activities, all disturbed areas adjacent to project components will be restored to pre-development conditions. Restoration work will start following installation of each wind turbine and removal of all construction materials and equipment from each turbine site. In general, restoration will consist of reclaiming agricultural use on private land, and re-vegetating public land. Specific restoration measures on private land are described below. Further details on restoration measures within the public right-of-way will be outlined in the road user agreements with each authority having jurisdiction.

Turbine Installation Sites

Turbine components will be delivered directly to the staging areas for each turbine. The components will be temporarily stored within these staging areas until assembled. Turbine staging areas will be designated during access road construction, and will form the central component of the turbine installation area. In addition, an area encircling the turbine staging area will be prepared to accommodate delivery truck turnarounds and

allow for a clear area to assemble the rotor. Crane pads will also be constructed at each turbine installation site, adjacent to the proposed turbine location. The applicable portions of turbine installation area will be constructed of a suitable granular makeup to withstand the delivery truck and crane loading conditions.

After construction, a small portion of the turbine installation area will become the permanent access road for turbine maintenance. The remaining areas will be ripped to restore compacted subsoil, and surfaced with topsoil to restore the agricultural use of the land. Tile drain modifications may also be made to maintain agricultural drainage.

Construction Access Roads
Construction access roads will be required to accommodate wind turbine delivery truck turning requirements and crane crawling. These roads will require larger entrances and laneway widths than the permanent access roads for maintenance. A staging area will also be required along the edges of the access roads to temporarily store materials such as excavated soil, collector cable, and geotextile. After construction, the access roads may be reduced in size to accommodate smaller maintenance vehicle turning requirements. This would be accomplished by removing a depth of approximately 0.2 m to 0.4 m of access road aggregate from temporary construction access road areas, ripping the compacted subsoil, and replacing with topsoil to restore the agricultural use of the land. Alternatively, geotextile may be placed under the access roads during construction to address soil compaction, rather than subsoil ripping. The method of restoration with respect to soil compaction on agricultural land will be coordinated with the appropriate landowners. Tile drain modifications may also be made to maintain agricultural drainage.

Construction Compound
The Construction Compound will only be required during the construction phase of the Project. After construction, the aggregate and geotextile will be removed and recycled or otherwise disposed of at an approved facility. The soils will be decompacted and readied for agricultural use. Tile drain modifications may also be made to maintain agricultural drainage.

2.4 Materials Brought On-Site

Standard building materials will be utilized for the construction of the Project. These generally include metal, aggregate, concrete, wood, geotextile, wiring, plastic, glass, and ceramic. Certain Project components will be pre-assembled prior to delivery to the site, while other components will require the raw materials to be delivered for construction on-site. The type and quantity of equipment used to deliver these materials to the site is described in Section 2.6.

2.4.1 Pre-Assembled Materials

Turbines
The turbines will be transported on-site in the following pre-assembled components: the hub, blades, nacelle, and tower sections. Each of these components have a unique material makeup, approximately 90% of which is steel by weight and approximately 6% of which is glass-fiber-reinforced plastic in the blades. The total weight of each turbine excluding the foundation is approximately 400 metric tonnes.

Electrical Equipment
With the exception of the collector and transmission lines, the majority of electrical equipment will be delivered to the site in pre-assembled components. These components generally include transformers, switches, capacitors, insulators, and meters. These pre-assembled components are predominantly comprised of composite metals and ceramics for their conductive, insulating, and structural properties.

2.4.2 Raw Materials

Raw materials will be delivered to the site's staging and construction areas according to the Contractor's detailed construction plan. Hazardous materials such as fuels, oils, and lubricants required for construction equipment will be kept in proper storage containers with associated labels and MSDS documentation, and secured in a proper location identified by the Contractor. Predominant raw material requirements for the Project are described in detail below.

Concrete
As described in Section 2.3.7, turbine foundations will require a thin layer of lean concrete under the high-strength concrete. The strength of the lean concrete will likely be 5 to 15 megapascals (MPa), and the high-strength concrete will likely be 25 to 35 MPa. It is estimated that each turbine foundation will require approximately 25 cubic metres (m^3) of lean concrete, and 450 m^3 of high-strength concrete. Concrete requirements for the entire Project will therefore be approximately 1,200 m^3 of lean concrete, and 21,600 m^3 of high-strength concrete. An additional 165 m^3 of high-strength concrete will also be required for the parts and storage building foundation. Concrete will be prepared off-site at a local commercial facility, and delivered in mixing trucks to reduce the need for water-taking activities on site during construction.

Steel
Each turbine foundation will require steel reinforcement (rebar) in the concrete to enhance tensile strength. It is estimated that each turbine foundation will require approximately 4.4 m^3, or 35 metric tonnes of rebar. Steel requirements for the turbine foundations across the entire Project will therefore be approximately 211 m^3, or 1,680 metric tonnes.

The material used for utility poles proposed along the transmission line will be determined during detailed design, but is assumed to be steel for the purposes of this report. Subject to the height and spacing requirements to be determined during detailed design, it is estimated that approximately 350 utility poles will be required.

Aggregate

Aggregate requirements for the access roads and turbine installation areas will depend on the depth of aggregate determined during detailed design. Assuming an average depth of 0.5 m, approximately 282,000 m^3 of aggregate would be required. Up to 16,150 m^3 of aggregate would be required for the Construction Compound, and approximately 1,000 m^3 of additional aggregate would be required for the foundations of the transformer substation, parts and storage building and switchyard.

Geotextile

Geotextile may be required to reinforce subsurface soils. If the geotechnical investigation recommends subsurface reinforcement for the access roads and turbine installation areas, up to 522,000 m^2 of geotextile could be required. Up to 54,000 m^2 of geotextile could also be required at the Construction Compound.

Fill

Based on the relatively flat topography of the site, it is anticipated that the excavated subsoil during access road and turbine foundation construction will be adequate for any required re-grading and backfilling. As such, apart from the aggregate described above, no fill from an external source is anticipated to be imported to the site.

Water

Water required for concrete mixing and dust control will be acquired off-site. The water component of concrete (prepared off-site at a commercial facility) required for each turbine foundation will be approximately 70 m^3. For dust control during the construction of access roads, approximately 0.6 L/m^2 will be used every 30 minutes, or as required to satisfy the requirements of the applicable approval agencies. Assuming there is no rain to assist with dust control, this application rate would require approximately 15,000 m^3 of water during access road construction. Dewatering requirements are discussed in Section 2.8, which indicates that less than 50,000 L/day of water will be pumped for open excavations. Water will also be supplied to the trailers in the Construction Compound area via a commercial service provider. It is estimated that 750 L of water will be supplied to the Construction Compound area each week during construction.

Wiring
Wiring/cabling will be required to construct the underground collector and transmission lines, as well as fiber optic communications lines. It is estimated that approximately 53 km of 36 kV, 31 km of 230 kV, and 84 km of fiber optic cabling will be required.

Culverts
Culverts will be plastic, steel, or concrete depending on their required structural and geometric requirements. Approximately 22 permanent culverts will be required in roadside ditches at site entrances, and six permanent culverts will be required to cross watercourses on private land. The Contractor may require additional culverts at site entrances and local road intersection improvements during construction to facilitate drainage around wide turning radii.

2.5 Construction Equipment

2.5.1 Typical Construction Equipment

The heavy construction equipment required will generally consist of earth moving and compacting equipment, cranes, and a variety of service and delivery trucks. The equipment will vary depending on the preferred techniques of the selected Contractor, but will typically include the equipment outlined in **Table 2.2**. Further specifications on each machine can be provided upon request, or found on the manufacturer's website.

Table 2.2 Typical Construction Equipment

Description	Example
Auger Drill	CME-55
Directional Drill	Vermeer D80X100
Harvester	CAT 511
Backhoe	CAT 450E
Scraper	CAT 621H
Excavator	CAT 320D L
Rotary Trencher	US Ditcher Drenag 75/100
Loader	CAT 950H
Bulldozer	CAT D6N
Vibratory Soil Compactor	CAT CP54B
Grader	CAT 12M2
Asphalt Paver	CAT AP1055E
Pneumatic Tire Compactor	CAT PS150C
Vibratory Asphalt Compactor	CAT CB54
Bundle Conductor Tensioner	Timberland PT150-4H/4
Water Truck	International 7400
Cable Reel Truck	Ground Force Cable Reel Truck

Description	Example
Concrete Truck (7 m^3 capacity)	Mack Granite Mixer
Tri-axle Dump Truck (15 m^3 capacity)	Mack Granite Dump
Standard Transport Truck	Volvo VN670
Wind Turbine Delivery Truck (Custom)	Temisko, Lenron, Mammoet
Lattice Boom Crawler Crane	Terex CC 2800-1
Truck Mounted Crane	Terex Roadmaster 5300

2.5.2 Construction Equipment by Activity

Each construction operation will require a variety of equipment as outlined in **Table 2.3**. The selected Contractor may elect to use a different combination or quantity of equipment depending on their preferred techniques.

Table 2.3 Construction Equipment by Activity

Activity	Equipment Required	Quantity
Geotechnical Investigation	Auger Drill	1
Site Preparation & Clearing	Harvester	1
	Bulldozer	1
	Excavator	1
	Loader	1
	Tri-axle Dump Truck	4
Construction Compound	Scraper	2
	Bulldozer	2
	Excavator	2
	Loader	2
	Tri-axle Dump Truck	14
	Vibratory Soil Compactor	2
	Grader	2
	Water Truck	1
Culvert Crossings	Backhoe	1
	Bulldozer	1
	Excavator	1
	Vibratory Soil Compactor	1
	Grader	1
Underground Collector Line (36 kV)	Excavator or Rotary Trencher	2
	Vibratory Soil Compactor	1
	Directional Drill	1
	Cable Reel Truck	2

Activity	Equipment Required	Quantity
Agricultural Tile Drain Modifications	Rotary Trencher	1
	Backhoe	1
	Drainage Tile Reel Truck	1
Turbine Foundations	Bulldozer	1
	Excavator	1
	Loader	1
	Concrete Truck	9
	Tri-axle Dump Truck	4
	Vibratory Soil Compactor	1
	Grader	1
Local Road Improvements	Loader	1
	Tri-axle Dump Truck	4
	Vibratory Soil Compactor	1
	Grader	1
Access Roads	Scraper	4
	Bulldozer	2
	Excavator	2
	Loader	2
	Tri-axle Dump Truck	38
	Vibratory Soil Compactor	2
	Grader	2
	Water Truck	3
Transformer Substation	Bulldozer	1
	Excavator	1
	Loader	1
	Tri-axle Dump Truck	4
	Vibratory Soil Compactor	1
	Grader	1
	Standard Transport Truck	2
Transmission Line (230 kV)	Directional Drill	1
	Auger Drill	1
	Standard Transport Truck	2
	Truck Mounted Crane	1
	Cable Reel Truck	1
	Bundle Conductor Tensioner	1
Delivery of Turbine Components	Wind Turbine Delivery Truck	11
	Standard Transport Truck	4
	Truck Mounted Crane	2

Activity	Equipment Required	Quantity
Turbine Tower, Nacelle and Rotor	Lattice Boom Crawler Crane	1
	Truck Mounted Crane	2
Parts and Storage Building	Bulldozer	1
	Excavator	1
	Loader	1
	Tri-axle Dump Truck	4
	Vibratory Soil Compactor	1
	Grader	1
Electrical Interconnection	Truck Mounted Crane	1
	Bundle Conductor Tensioner	1
Site Restoration	Backhoe	4
	Tri-axle Dump Truck	6
	Loader	2
	Vibratory Soil Compactor	1
	Grader	1
	Asphalt Paver	1
	Pneumatic Tire Compactor	1
	Vibratory Asphalt Compactor	1

2.6 Transportation and Traffic

Construction of the Project will require the delivery of construction equipment, pre-assembled materials, and raw materials to the site. A Traffic Management Plan will be prepared by the Contractor during detailed design to facilitate safe delivery, and to minimize local traffic impacts due to construction operations. The Traffic Management Plan will outline access routes to be used by delivery vehicles, signage to be implemented and maintained, temporary lane modifications, and timing restrictions that may be required. The Contractor will be responsible for obtaining all required permits for the use of existing roads, and the implementation of temporary traffic measures that may be required. For overweight/oversize loads, the Contractor will be required to employ the safety measures required by each road authority, such as flags, signs, lighting, and escort vehicles as required.

Construction traffic will be dispersed across the available haul routes and construction timeframe. While the area roads have sufficient capacities to accommodate the construction traffic, additional effort will be made to schedule slow-moving traffic (e.g., delivery of turbine components via oversize vehicles) outside of the peak traffic summer period.

A summary of construction traffic generated by construction activities is provided in **Table 2.4**, and described in detail below.

Table 2.4 Construction Traffic Summary

Material Delivered	Trucks Required	Frequency of Total Trips to Site	Duration of Trips to Site
Construction Equipment – Mobilization	4 Transport Trucks	6 trips/day	1 week
Construction Equipment – During Construction	1 Transport Truck	1 trip/day	56 weeks
Wind Turbines	5 Custom Trucks	9 trips/day	10 weeks
Wind Turbine Ancillary Equipment	2 Transport Trucks	3 trips/day	10 weeks
Transformer Substation and Switchyard	1 Transport Truck	2 trips/day	1 week
Concrete – Turbine Foundations	9 Concrete Trucks	68 trips/day	10 weeks
Concrete – Parts and Storage Building Foundation	3 Concrete Trucks	24 trips/day	1 day
Steel (Rebar)	1 Transport Truck	3 trips/day	3 weeks
Aggregate – Access Roads and Structure Foundations	38 Dump Trucks	305 trips/day	12 weeks
Aggregate – Construction Compound	14 Dump Trucks	108 trips/day	2 weeks
Geotextile	1 Transport Truck	1 trip/day	1 week
Water	3 Water Trucks	28 trips/day	12 weeks
Utility Poles	1 Transport Truck	2 trips/day	18 weeks
Wiring – Collector Line	2 Cable Reel Trucks	2 trips/day	10 weeks
Wiring – Transmission Line	1 Cable Reel Truck	1 trip/day	24 weeks
Pipes	1 Transport Truck	2 trips/day	1 week

2.6.1 Construction Equipment Delivery

With the exception of service and delivery trucks, the construction equipment outlined in Section 2.5 will be transported to the site on transport trucks. Approximately four transport trucks will be required, making a total of six trips per day to the site over one week. During construction, track-mounted equipment will need to be transported to the turbine sites through 22 access points, which will require one transport truck to make on average one trip per day on local roads over the duration of the project.

2.6.2 Turbine Delivery

Custom wind turbine delivery trucks up to 60 m in length and weighing up to 174 metric tonnes (under load) will be required to deliver the pre-assembled components of the turbine to the site. The maximum axle load would be 11 metric tonnes. It is estimated that five custom wind turbine delivery trucks will be required for transport of the nacelles, blades, and tower sections, making a total of nine trips per day to the site over 10 weeks. In addition, two transport trucks will be required for delivery of the base ring, hubs, and transformers, making a total of three trips per day to the site over 10 weeks.

2.6.3 Electrical Equipment Delivery

The majority of equipment for the transformer substation and switchyard will be delivered to the site with the use of transport trucks. Approximately one transport truck will be required to make two trips per day to the site area over one week.

2.6.4 Raw Material Delivery

Concrete will be prepared off-site and delivered with the use of tri-axle concrete trucks. For turbine foundations, approximately nine concrete trucks with a capacity of 7 cubic metres (7 m^3) will be required, making a total of 68 trips per day to the site over 10 weeks. For the parts and storage building foundation, approximately three concrete trucks will make 24 trips to the site area over one day.

Steel to be used as reinforcement in the concrete foundations of turbines and the parts and storage building and will be delivered to the site with the use of transport trucks. Approximately one transport truck will be required to make a total of three trips per day to the site area over three weeks.

Aggregate for the access roads and structure foundations will be delivered to the site with the use of tri-axle dump trucks. Approximately 38 trucks with a capacity of 15 m^3 will be required to make a total of 305 trips per day to the site area over 12 weeks. Aggregate for the Construction Compound will require approximately 14 tri-axle dump trucks to make a total of 108 trips per day to the site area over two weeks.

If required for subsoil reinforcement, geotextile may be delivered to the site with the use of transport trucks. Approximately one transport truck will be required to make a total of one trip per day over one week.

Water for dust control during access road construction will typically be supplied with the use of a 4,000 gallon (15,150 L) water truck. Approximately three water trucks will be required to make a total of 28 trips per day to the site area over 12 weeks.

If the transmission line is installed above ground, utility poles will be delivered to the site with the use of transport trucks. Approximately one transport truck will be required to make a total of two trips per day to the 230 kV transmission line site area over 18 weeks.

Wiring for electrical lines will be delivered with the use of cable reel trucks. For the collector lines and fiber optic cable, approximately two trucks will be required to make a total of two trips per day to the site over 10 weeks. For the transmission line, approximately one truck will be required to make one trip per day to the site area over 24 weeks.

Culverts will be delivered to the site with the use of a transport truck. Approximately one transport truck will be required to make two trips per day to the site area over one week.

2.7 Temporary Uses of Land

Temporary changes to land will be limited to the construction areas described in Section 2.3.13 of this report. Portions of these construction areas (i.e., access roads, turbine installation areas and the Construction Compound) are on private land for agricultural use. The remaining areas (i.e., site entrances and collector/transmission lines) are within the municipal right-of-way, which is used as a transportation corridor.

During construction, these areas will be used to install construction fencing, safety features, erosion and sediment control measures, and to temporarily store materials.

Any temporary structures used during construction will not be serviced with electrical or water connections, and will be placed within delineated construction work areas. The one exception might be the Construction Compound, which might be serviced by the use of a new temporary electrical connection from the local distribution system.

The lands proposed for temporary construction purposes are suitable for the implementation of required construction measures, and can be restored to pre-development conditions after construction, as described in Section 2.3.13.

Once construction is complete in each area, lands used for temporary construction activities will be restored. The land required for access roads and site entrances may be reduced in size to accommodate smaller maintenance vehicles. Restoration on private land will typically include the removal of aggregate and replacement of topsoil as required to restore the agricultural use of land. For areas within the municipal right-of-way, culverts installed during construction will be modified to suit permanent site

entrances, and the entire corridor will be restored to the pre-development composition of topsoil, vegetation, and drainage features.

2.8 Temporary Water Takings

2.8.1 Desktop Review

A desktop review was completed to assess potential water taking activities required to facilitate construction of the Project. The review included soils, bedrock and surficial geology maps, and well records.

The following observations were made during the desktop review:

- The majority of the turbine sites are underlain by St. Joseph Till, which is a fine grained, stiff clayey silt to silty clay till, with a hydraulic conductivity of approximately 10^{-8} m/s. Approximately seven to 10 of the turbine sites are underlain by finer grained glaciolacustrine deposits, and three to five are located near sandier beach deposits, which may have a hydraulic conductivity of approximately 10^{-5} m/s.
- Overburden thickness in the area generally exceeds 25 m and a search of well records within 150 m of each site location indicated bedrock no shallower than 14 m.
- Static water levels in the wells in the area are typically greater than 15 m deep, although higher perched water tables may exist in localized areas. A review of well records within 150 m of the sites shows only two of 84 wells with a static water level shallower than 5 m.
- The turbines are not located in wetlands, peat/muck, or swamps.

2.8.2 Dewatering Calculations

Using the desktop review as a basis, dewatering calculations for turbine foundation excavations were performed (refer to **Appendix C**). The typical size of excavation for the proposed wind turbine foundations was assumed to be 3 m deep x 19 m x 19 m. It was also assumed that tile drainage will be redirected around the excavated area through the use of a header around each turbine foundation.

The calculations indicate that the rate of pumping required for each proposed turbine foundation excavation is unlikely to exceed 50,000 L/day. Other subsurface excavations required for access roads and the parts and storage building are shallower, and are therefore not anticipated to exceed 50,000 L/day. Similarly to the turbine foundation excavations, other subsurface excavations will require proper tile drain modifications to be made to divert drainage around the excavated areas.

2.8.3 Dewatering Procedures

Where dewatering from Project excavations is required, water will be pumped through a filter bag to adjacent agricultural land for infiltration and settlement of suspended solids.

2.9 Materials/Waste Generated at, or Transported from, the Project Location

The general strategy for materials and waste generated at and transported from the Project during construction is as follows:

- supply construction materials without packaging;
- reuse materials and temporary structures where possible; and,
- dispose of excess materials at approved disposal facilities.

A detailed description of each waste material generated at and transported from the Project is provided below.

2.9.1 Construction Debris

The majority of materials brought on site are pre-assembled or raw materials having little or no packaging. Formwork can be reused, and a limited number of temporary structures are anticipated. It is therefore estimated that a minor amount of construction debris will be stored in bins and disposed of at an approved facility.

2.9.2 Sewage

Portable washrooms will be provided and maintained during construction by a commercial supplier. The supplier will be responsible for regular servicing of the washrooms, including removal and disposal of sewage at an approved facility. It is estimated that one sewage truck will be required to remove approximately 6,350 L of sewage from the Project location each week during construction.

2.9.3 Aggregate

As outlined in Section 2.4.2, no fill from an external source is anticipated to be imported to the site for grading works. However, the Construction Compound and temporary construction access roads will be restored to their pre-development agricultural use after construction. This will be achieved by removing the aggregate and restoring the topsoil. The amount of aggregate removed during site restoration is estimated to be approximately 66,000 m^3, and is anticipated to be either re-used on site if possible, or disposed of or recycled at an approved facility.

3.0 Potential Negative Environmental Effects, Mitigation and Monitoring

All potential negative environmental effects anticipated during construction, including associated mitigation and monitoring strategies, are detailed in **Tables 3.4 to 3.9**. The guiding principles that were used to identify and analyze each effect are summarized below.

3.1 Description of Potential Negative Environmental Effects

Any potential negative environmental effect that may result from Project construction has been identified in **Tables 3.4 to 3.9**. For a complete list of all potential negative environmental effects during construction, operation and decommissioning, refer to the Project Description Report. Effects described in **Tables 3.4 to 3.9** were identified from the construction and installation activities described in this report in conjunction with other investigations undertaken. For details relating to the natural heritage, water, archaeological, and cultural heritage features of the study area, refer to the Natural Heritage Assessment Environmental Impact Study, Water Assessment and Water Body Report, and The 2012 Heritage Assessment of the Proposed Grand Bend Wind Farm under separate covers as part of the application for Renewable Energy Approval.

A number of considerations for each potential negative environmental effect were considered to understand the extent of the effect and to develop appropriate mitigation and monitoring strategies. Key considerations included:

- the magnitude of the effect both in intensity and spatial scale;
- the proximity of the effect in relation to the Project;
- the likelihood of occurrence and reoccurrence of the effect;
- the timing and duration of the effect; and,
- the permanence or irreversibility of the effect.

3.2 Mitigation Strategies

Wherever possible, construction scheduling and procedures were developed to avoid occurrence of a potential effect. In cases where avoidance was not possible, an appropriate mitigation strategy was developed to minimize the magnitude, likelihood, duration and permanence of the potential effect. Mitigation strategies were typically developed according to the following approach:

- Design Project siting to avoid occurrence of the effect;
- develop construction scheduling and procedures to mitigate the effect; and,
- develop rehabilitation measures to restore affected features.

Mitigation will be implemented through a variety of mechanisms, including:

Contract Documents
Northland is committed to constructing the Project in an environmentally responsible manner and in compliance with all applicable environmental laws, regulations, and guidelines. All of Northland's contractors and subcontractors will be accountable for actions that have an adverse effect on the environment. As such, any contract documents executed by Northland will incorporate appropriate provisions from the Renewable Energy Approval documents. Additionally, all contractors, subcontractors, and other associates of the Project will follow the guiding principles of the monitoring program. These organizations will also comply with all relevant municipal, provincial, and federal legislation.

Management Structures
Northland, the turbine manufacturer, and the Contractor will take steps to ensure that they have appropriately skilled personnel to carry out the environmental responsibilities as defined in this Report. All organizations associated with Project development activities will develop responsive reporting systems that clearly assign responsibility and accountability for development actions. As appropriate, Northland will review these reporting documents.

Change Management
During Project construction, changes may be required to address unforeseen or unexpected conditions or situations. Northland, the turbine manufacturer, and the Contractor will be responsible for ensuring environmental and safety issues are addressed. Northland will put into effect any significant changes to Project programs, procedures, and plans throughout the life of the Project.

Environmental Procedures
Northland, the turbine manufacturer, and the Contractor will be responsible for implementing all approved environmental procedures during construction. Individual personnel responsibilities will be assigned as necessary to support the full and effective implementation of the environmental procedures. Environmental procedures will address the following issues to prevent environmental contamination:

- Spills and releases: to identify the specific procedures for the prevention, response, and notification of spills. In addition it should establish the general procedures for spill clean-up, personnel training, and material handling and storage to prevent spills.
- Hazardous waste management: to outline the procedures for the proper identification of hazardous waste and its proper storage, handling, transport, and disposal. In

addition, the procedures should outline specific requirements for personnel training, emergency response, product review and approval, and record keeping.
- Solid waste management: to establish alternative procedures for the management and disposal of used lubricants, used drums, and general office waste.

These procedures will ensure internal and external risks are fully evaluated and the information communicated to personnel in advance of any accident or malfunction.

Training Program

As appropriate, Northland and/or the Contractor should develop a training program to ensure personnel receive appropriate training in relation to construction activities, environmental procedures, and the emergency preparedness and response plan. With respect to the environment and natural heritage, training may cover the following issues:

- Environmental Protection, including:
  - important/sensitive environmental features and areas;
  - incident reporting (spills, wildlife incidents); and,
  - materials disposal.

- Facility Safety, including:
  - accident reporting; and,
  - chemical and hazardous materials handling.

- Emergency Preparedness, including:
  - fire preparedness and response;
  - natural disasters (i.e., extreme weather events); and,
  - hazardous materials and spill response.

Training should begin as the initial staff complement is hired during the pre-construction mobilization period. There should also be on-going training for personnel as well as specific training sessions for new hires.

Emergency Response and Communications Plans

Northland and/or the Contractor will finalize a detailed Emergency Response Plan in collaboration with the local Emergency Service Departments. A Communications Plan will also be implemented that clearly outlines a process for two-way communication with all stakeholders during construction. For further details of the Emergency Response and Communications Plans, including the complaint response protocol to be followed during construction, refer to the Design and Operations Report under a separate cover.

3.3 Environmental Monitoring

Some mitigation strategies will require environmental monitoring to ensure proper implementation and confirmation that the effect is adequately mitigated. In some cases where the likelihood of a significant negative environmental effect is low, a monitoring approach has been proposed in lieu of a mitigation strategy. To prepare for an event where environmental monitoring may reveal a negative environmental effect, contingency measures have been developed to achieve the following:

- rehabilitate or correct a negative environmental effect;
- notify the applicable agencies if required; and,
- develop alternative mitigation strategies that could prevent the same negative environmental effect from occurring again.

The Project will employ an Environmental Inspector during construction, who will be responsible for continual inspection/monitoring for environmental compliance and adherence to proper procedures.

3.4 Potential Negative Environmental Effects, Mitigation and Monitoring

All potential negative environmental effects during construction are detailed in **Tables 3.1 to 3.4** as follows:

- **Tables 3.1 and 3.2** include all potential effects associated with the Natural Heritage Assessment Environmental Impact Study for the Project.
- **Table 3.3** includes all potential effects associated with the Water Assessment and Water Body Report for the Project.
- **Table 3.4** includes all potential effects associated with land use and socio-economic features. These effects are informed by all other investigations undertaken for the Project.

Each potential negative environmental effect is identified and assessed for performance objectives, mitigation strategies, monitoring, and contingency measures. For details relating to the natural heritage, water, archaeological, and cultural heritage features of the study area, refer to the Natural Heritage Assessment Environmental Impact Study, Water Assessment and Water Body Report, and The 2012 Heritage Assessment of the Proposed Grand Bend Wind Farm under separate covers as part of the application for Renewable Energy Approval.

Table 3.1 Environmental Effects Monitoring Plan – Environmental Impact Study General Features

Project Activity	Potential Effects (D=Direct) (I=Indirect)	Mitigation Strategy	Residual Effect (magnitude/frequency/duration)	Performance Objective	Monitoring Plan and Contingency Measures
Installation of 36kV collector lines, 230 kV transmission line, communication lines	• Sediment and erosion impacts associated with open cut trenching and directional drilling/punch and bore activities (I).	• All work zones should be clearly marked to indicate that no work should occur outside the work zone. • To ensure that work zones are not within significant natural features, the boundaries of significant natural features are to be delineated in the field by a qualified environmental technician based on the following definitions: – Wetlands: OWES methodology (50% wetland vegetation rule); – Woodlands: Edge of the drip line; and, – SWH: As per criteria detailed in the EOS report. • Implementation of the erosion and sediment control measures will conform to industry best management practices and recognized standard specifications such as Ontario Provincial Standards Specifications (OPSS). • Sediment and erosion control measures will be implemented prior to construction and maintained during the construction phase in accordance with the erosion and sediment control plan developed during detailed design. • All sediment and erosion control measures will be inspected prior to construction and maintained during the construction phase to prevent entry of sediment into natural features. • If the sediment and erosion control measures are not functioning properly, no further work in the affected areas will occur until the sediment and/or erosion problem is addressed. • All disturbed areas of the construction site will be stabilized and re-vegetated as soon as conditions allow. • Sediment and erosion control measures will be left in place until all areas of the construction site have been stabilized. • Trenching along straight sections will be within the disturbed portion of the municipal road ROW.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No erosion and sediment impacts on natural features including wildlife habitats.	• A plan for addressing impacts associated with “frac-out” during directional drilling will be prepared in accordance with the Operational Statement. • Erosion and sediment control measures will be regularly inspected to ensure they are functioning and are maintained as required. • If erosion and sediment control measures are not functioning properly, alternative measures will be implemented and prioritized above other construction activities.

Project Activity	Potential Effects (D=Direct) (I=Indirect)	Mitigation Strategy	Residual Effect (magnitude/frequency/duration)	Performance Objective	Monitoring Plan and Contingency Measures
		• Directional drilling and/or punch and bore options will be undertaken in accordance with the Department of Fisheries and Oceans' Operational Statement. • Horizontal directional drilling and/or punch and bore operations will be designed with launching and receiving pits that will minimize tree loss and disturbance of natural vegetation wherever possible. • Launch and receiving pits will be designed by the drilling contractor in accordance with the operational statement, and will not extend beyond the disturbed portion of the municipal road ROW. To the extent possible, pits will be located at least 30m from significant natural features as delineated by a qualified Environmental Inspector. In some instances, pits may need to be less than 30m (but no less than 5m) from a natural feature. This will be determined during detailed design and will be documented in the sediment and erosion control plan.			
All Construction Activities	• Accidental encroachment of equipment, stockpiles etc. into natural areas (I).	• All work zones (as detailed in Figures A1 – A19 in Appendix A) should be clearly marked to indicate that no work should occur outside the work zone. • Silt fencing will be installed in accordance with an erosion and sediment control plan which will be prepared during detailed design to further protect significant natural features adjacent to work areas. • To ensure that work zones are not within significant natural features, the boundaries of significant natural features are to be delineated in the field by a qualified environmental technician based on the following definitions: – Wetlands: OWES methodology (50% wetland vegetation rule); – Woodlands: Edge of the drip line; and, – SWH: As per criteria detailed in the EOS report.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No disturbance to natural areas.	• An Environmental Inspector will perform regular inspection to ensure that mitigation is implemented and all silt fencing is maintained and functioning properly. If they are not functional, they should be repaired immediately. • If accidental encroachment occurs the offending material or equipment will be immediately removed and restoration of the area conducted as needed.

Project Activity	Potential Effects (D=Direct) (I=Indirect)	Mitigation Strategy	Residual Effect (magnitude/frequency/duration)	Performance Objective	Monitoring Plan and Contingency Measures
All Construction Activities	• Potential soil compaction (D).	• Heavy equipment and material stockpiles will be limited to marked construction areas. • To ensure that work zones are not within significant natural features, the boundaries of significant natural features are to be delineated in the field by a qualified environmental technician based on the following definitions: – Wetlands: OWES methodology (50% wetland vegetation rule); – Woodlands: Edge of the drip line; and, – SWH: As per criteria detailed in the EOS report. • Temporary construction staging areas and construction roads which have been compacted will be rehabilitated upon completion of construction.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• Minimize the geographical extent of soil compaction to the extent possible. • Rehabilitate any compacted soils within temporary construction areas.	• An Environmental Inspector will perform regular inspection to ensure that equipment and stockpiles do not extend beyond construction areas. • Northland and the contractor will work with participating landowners to ensure that soils in construction areas are rehabilitated to restore agricultural uses.
All Construction Activities	• Mortality of wildlife inadvertently moving through construction zones (I).	• Silt fencing will be properly installed and maintained in accordance with the erosion and sediment control plan to keep wildlife out of work areas. • Speed limit signage will be posted along construction travel routes to ensure that construction vehicles respect appropriate speeds.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No wildlife mortality.	• An environmental inspector will regularly monitor fenced areas to ensure that fencing is properly keyed/toed in to the ground to ensure that wildlife cannot gain access under fenced area. • If wildlife inadvertently moves into a construction area, the Environmental Inspector will move the species outside of the work area, if possible, using gloves and a bucket or plastic tub, as appropriate. • If any species at risk are encountered that are not identified on relevant permits, all work will cease within the immediate work area and the Ministry of Natural Resources will be contacted.
Site Restoration	• Introduction of invasive species into natural areas (I).	• All disturbed areas of the construction site will be re-vegetated as soon as conditions allow. • Where re-vegetation is required in the municipal road allowance, as a result of transmission line installation, standard roadside seed mixes, which do not contain invasive species, will be used.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No introduction of invasive species.	• An Environmental Inspector will perform regular inspection to ensure that mitigation is implemented. • If extensive invasion of non-native species is identified as a result of the Project, contingency measures may include an applicable herbicide application. An herbicide application plan will be developed as required.
Turbine assembly	• Effects on groundwater levels/seepage areas and wetlands due to dewatering for construction of turbine foundations (I).	• Any discharge from dewatering will be outlet to a vegetated or agricultural area at least 30m from a significant natural feature or watercourse utilizing a sediment filter bag.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No effect on groundwater levels.	• An Environmental Inspector should be on-site during any dewatering within 120m of natural features. The Monitor should ensure that the filter bag is working appropriately and ensure that no sediment is entering significant natural features or watercourse. • In the event of sediment discharge, all operations should stop immediately until the problem can be

Project Activity	Potential Effects (D=Direct) (I=Indirect)	Mitigation Strategy	Residual Effect (magnitude/frequency/duration)	Performance Objective	Monitoring Plan and Contingency Measures
					resolved. • If significant changes in water levels/seepage areas are noted, operations should cease until water levels recover.
All Construction Activities	• Spills from equipment fueling, oiling, greasing of project components (I).	• All materials and equipment used for the purpose of site preparation and project construction shall be operated and stored in a manner that prevents any deleterious substances (petroleum products, silt, etc.) from entering natural features. • Any stockpiled materials will be stored away from the feature. • Refueling and maintenance of construction equipment should occur a minimum of 30 m from a natural feature. • Hazardous material transportation and application will occur in designated areas according to operational procedures. Proper spill containment equipment will be used and maintained on site.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• Minimize potential for indirect effects from accidental spills.	• As appropriate, spills will be reported to the MOE Spills Action Centre.
All Construction Activities	• Impacts of construction noise on wildlife (I).	• Environmental noise will be reduced through the standard operating practices. A traffic plan will be developed and implemented by the Construction Contractor. • Work within 120 m of Amphibian Breeding Habitats (GCSWH-ABH & GCSWH-ABH(WE)) will not occur after dusk during the breeding season (April, May and June). • Work within 120 m of bird habitats (GCSWH-WRN, GCSWH-WASBB, GCSWH-WNA, GCSWH-WSSA, GCSWH-SESBB, GCSWH-SCC) will not occur in the early morning hours (between dawn and 1.5 hours after dawn) during the breeding season (May 15 to July 30).	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• Minimize effects of noise.	• The Environmental Inspector will ensure that all operational plans and construction timing associated with noise reduction are being followed. • If work must occur in these areas during the noted time periods due to an emergency or critical phase of construction, work may be permitted if conditions for amphibian breeding are not ideal. Specifically, work may occur if temperatures are below 6^{o}C, there has been no rain in the previous 24 hours or wind speeds are higher than 3 on the Beaufort Scale. The Environmental Inspector will track weather conditions and determine if suitable amphibian breeding conditions are or are not present. • Similarly, emergency work may occur in the vicinity of bird habitats if conditions are not suitable for bird breeding (i.e. if temperatures are below 10^{o}C, if there is rain or fog or if winds are greater than 3 on the Beaufort Scale). The Environmental Inspector will track weather conditions and determine if suitable bird breeding conditions are or are not present.
All Construction Activities	• Dust effects on wildlife habitat (I).	• As appropriate, dust from the work areas will be controlled through suppressants (e.g., water).	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• Minimize effects from dust on wildlife habitats.	• Dust emissions will be monitored daily during construction to ensure dust control watering frequency and rates are adequate.

Table 3.2 Environmental Effects Monitoring Plan – Environmental Impact Study Significant Features

Affected Environmental Feature(s)	Project Activity	Potential Effects (D=Direct) (I=Indirect) Potential effect on the size, diversity, health, connectivity, functionality and resilience of the natural feature.	Mitigation Strategy	Residual Effect (magnitude/frequency/ duration)	Performance Objective	Monitoring Plan and Contingency Measures
All Significant Features	• All Construction Activities	• General construction and decommissioning effects. • Refer to effects listed under Generalized Significant Wildlife Habitat.	• Refer to mitigation listed under Generalized Significant Wildlife Habitat.	• Refer to Residual Effects listed under Generalized Significant Wildlife Habitat.	• Refer to Performance Objectives listed under Generalized Significant Wildlife Habitat.	• Refer to monitoring and contingency measures listed under Generalized Significant Wildlife Habitat.
Significant Woodlands, Provincially Significant Wetlands, Wetlands Assumed Significant, Deer Yarding Areas W-038, W-039, W-079, W-081, W-086, W-088, W-094,W-102, W-103, W-123, W-128 Wetland Complex B WE-013, WE-014, WE-015, WE-017, WE020, WE-026 Individual Wetlands WE-022, WE-027, WE-029, WE-030, WE-031, WE-033, WE-034, WE-038 DYA-001, DYA-002	• Installation of 36 kV and 230 kV transmission line and communication lines along straight road sections.	• Inadvertent loss of, or disturbance to, vegetation within the wetlands/deer yards through encroachment of equipment or stockpiles (I). • Movement of exposed sediment into the features (I). • The effects identified above could have minor effect on the size of woodlands and wetlands and on the function of the wetland as surface water storage.	• Cables will be installed using open trenching methods within the disturbed municipal road ROW. • Significant features will be clearly marked with sediment and/or tree protection fencing to ensure the equipment and material stockpiles do not encroach into any significant woodlands, wetlands or deer yards adjacent to the ROW. • The boundaries of the features are to be delineated in the field by a qualified environmental technician based on the following definitions: – Woodlands: Edge of the drip line – Wetlands: OWES methodology (50% wetland vegetation rule) • Silt and/or tree protection fencing will be installed along the boundaries of significant features.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No vegetation loss or disturbance associated with sediment and erosion on woodlands or wetlands.	• An Environmental Inspector will regularly monitor operations to ensure that activities do not encroach into significant natural features.
Significant Woodlands, Provincially Significant Wetlands, Wetlands Assumed Significant, Deer Yarding Areas W-038, W-039, W--079, W-081, W-086, W-088, W-094,W-102, W-103, W-123, W-128 Wetland Complex B WE-013, WE-014, WE-015, WE-017, WE-020, WE-026 Individual Wetlands WE-022, WE-027, WE-029, WE-030, WE-031, WE-033, WE-034, WE-038	• Installation of 230 kV transmission line and communication lines at watercourse and bridge crossings and road bends.	• Inadvertent loss of, or disturbance to, vegetation within the wetlands/deer yards through encroachment of launch or receiving pits into or adjacent to significant features D). • Movement of exposed sediment into the features (I). • The effects identified above could have minor effect on the size of woodlands and wetlands and on the function of the wetland as surface water storage.	• Lines will be installed using directional drilling, punch and bore, or open-cut techniques at watercourse, bridge, road, and utility crossings. • Significant woodlands and wetlands will be clearly demarcated with sediment and/or tree protection fencing to ensure the equipment and material stockpiles do not encroach into the features. • The boundaries of the features are to be delineated in the field by a qualified environmental technician based on the following definitions: – Wetlands: OWES methodology (50% wetland vegetation rule) – Woodlands: Edge of the drip line – SWH: As per criteria detailed in the EOS report • Silt and/or tree protection fencing will be installed along the boundaries of the natural features. • Vegetated buffers will be left in place to the extent possible.	• Duration is expected to be moderate (10 to 15 years until replacement trees have matured); however magnitude, frequency and geographic scope are very limited. • No residual effect anticipated. May also be residual effect associated with frac-out during directional drilling; likelihood is low, limited duration, frequency and	• No vegetation loss or disturbance associated with sediment and erosion on woodlands or wetlands.	• An Environmental Inspector will regularly monitor operations to ensure that activities do not encroach into wetland areas. • If directional drilling is used, an Environmental Inspector will be on-site during drilling activities. • Erosion and sediment control measures will be regularly inspected to ensure they are functioning and are maintained as required. • If erosion and sediment control measures are not functioning properly,

Affected Environmental Feature(s)	Project Activity	Potential Effects (D=Direct) (I=Indirect) Potential effect on the size, diversity, health, connectivity, functionality and resilience of the natural feature.	Mitigation Strategy	Residual Effect (magnitude/frequency/ duration)	Performance Objective	Monitoring Plan and Contingency Measures
DYA-001, DYA-002			• Any cleared areas adjacent to significant features will be re-vegetated using a native seed mix and/or native shrub and tree plantings • Trenching along straight sections will be within the disturbed portion of the municipal road ROW. • Directional drilling and/or punch and bore options will be undertaken in accordance with the Department of Fisheries and Oceans' Operational Statement. • Horizontal directional drilling and/or punch and bore operations will be designed with launching and receiving pits that will minimize tree loss and disturbance of natural vegetation wherever possible. • Launch and receiving pits will be designed by the drilling contractor in accordance with the operational statement, and will not extend beyond the disturbed portion of the municipal road ROW. To the extent possible, pits will be located at least 30 m from significant natural features as delineated by a qualified Environmental Inspector. In some instances, pits may need to be less than 30 m (but no less than 5 m) from a natural feature. This will be determined during detailed design and will be documented in the sediment and erosion control plan.	geographic extent.		alternative measures will be implemented and prioritized above other construction activities. • An emergency frac-out plan will be prepared and implemented by the Contractor. The Environmental Inspector will hold the Contractor accountable to implementation of the emergency frac-out plan. • Undertake monthly site inspections during the Site Preparation stage to ensure that trees are not damaged during construction activities.
Significant Wetlands Wetland Complex A WE-008, WE-009, WE-010, WE-011 Individual Wetlands WE-001, WE-002,	Turbine Assembly	• Localized effects on wetland water levels due to dewatering for construction of turbine foundations (I). • Water from the dewatering process could be outlet into a wetland causing scour within the wetland and deposition of sediment from the pumped water (I). • The effects identified above could affect habitat for aquatic species if standing water is drawn down. • Sedimentation could affect wetland functions associated with surface water storage and flood control.	• Dewatering will be minimized to the extent possible. • Any discharge from dewatering will be outlet to an agricultural or vegetated area at least 30m from a significant natural feature or watercourse utilizing a sediment filter bag. • Significant natural features boundaries are to be delineated in the field by a qualified environmental technician based on the following definitions: – Wetlands: OWES methodology (50% wetland vegetation rule) – Woodlands: Edge of the drip line – SWH: As per criteria detailed in the EOS report.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No effect on wetland water levels. • No sediment discharge into wetlands.	• An Environmental Monitor should be on-site during any dewatering within 120m of wetlands. The Monitor should ensure that the filter bag is working appropriately. • In the event of sediment discharge, all operations in the affected area should stop immediately until the problem can be resolved. • Although no effects on water levels is anticipated, the Environmental Monitor should also monitor water levels in the vicinity of dewatering activities during the dewatering process. If

Affected Environmental Feature(s)	Project Activity	Potential Effects (D=Direct) (I=Indirect) Potential effect on the size, diversity, health, connectivity, functionality and resilience of the natural feature.	Mitigation Strategy	Residual Effect (magnitude/frequency/ duration)	Performance Objective	Monitoring Plan and Contingency Measures
						significant changes in water levels are noted, operations should cease until water levels recover.
Significant Woodlands W-04, W-020, W-21, W-23, W-026, W-29, W-30, W-31, W-34, W-036, W-37, W-042, W-053,	• Construction and removal of access roads adjacent to the following woodlands: – W-053 (access road to T-16); – W-042 (access road to T-18); – W-036 (access road to T-25 and T-28); – W-026 (access road to T-31); and, – W-020 (access road to T-40). • Installation of 36 kV collector lines adjacent to the following woodlands: – W--04 and W-037 (collector line along Sararas Road); – W-029, W-030, W-034, W-031 (collector line along Shipka Road); – W-023 and W-026 along Schadeview Road; – W-020 along Turnbull's Road; and, – W-021 along the field edge	• Inadvertent loss of, or disturbance to, vegetation along the edge of woodlands during construction of adjacent access roads and below ground collector lines (I). • The effects identified above could have minor effect on the size of woodlands and their function in providing edge habitat for a variety of species including Red-headed woodpecker (Special Concern species).	• Construction areas are to correspond to those areas detailed on **Figures A1 – A19, Appendix A** • Access road and collector lines will be no closer than the dripline of each significant woodland edge. • The significant woodland edge should be demarcated by a silt fence and/or tree protection fencing. • Below ground collector lines will be located within the access road allowance and will not extend into wooded areas. • Additional, taller tree protection fencing (tree hoarding) should be installed in these areas to protect tree limbs from equipment in adjacent areas. • Any tree roots which extend into the construction area should be cut and re-packed into soil to avoid desiccation.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No disturbance to woodlots.	• Silt fencing and/or tree protection fencing will be installed as per the construction areas detailed in **Figures A1 – A19, Appendix A**. Further to this silt fencing and/or tree protection fencing will installed no closer than the dripline and monitored regularly by an Environmental Inspector to ensure they are functioning and are maintained as required. • If the silt fencing and tree hoarding are not functioning properly, alternative measures will be implemented and prioritized above other construction activities.

Affected Environmental Feature(s)	Project Activity	Potential Effects (D=Direct) (I=Indirect) Potential effect on the size, diversity, health, connectivity, functionality and resilience of the natural feature.	Mitigation Strategy	Residual Effect (magnitude/frequency/ duration)	Performance Objective	Monitoring Plan and Contingency Measures
	between T-37 and T-39.					
Turtle Nesting Area, Turtle Overwintering Habitat* and Amphibian Breeding Habitat ABH-001 TNA-002 TWA-003*	All Construction Activities	• Accidental mortality due to wildlife moving through the construction zone (I). • The effect identified above may affect individual animals but unlikely to affect population health or resiliency. No effect on habitat functionality.	• During construction wildlife fencing (sediment fencing) will be installed around all work areas within 120m of these habitats prior to any earth movement, stockpiling or other activities on the site. Fencing must be keyed in correctly and monitored for proper installation and maintenance by the contractor. • The boundary of the construction compound will be fenced to limit the ability for wildlife to enter the area. • Construction areas are to correspond to those areas detailed on **Figures A1 – A19, Appendix A**. • Work within 120 m of Amphibian Breeding Habitats (ABH-001) will not occur after dusk during the breeding season (April, May and June).	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No accidental mortality. • No reduced amphibian breeding due to noise impacts.	• The contractor will be responsible for ensuring fencing is maintained and inspected regularly for signs of wildlife in the work zone while work is occurring these areas. • The Environmental Inspector will be on-site as required to ensure proper maintenance of wildlife fencing. • If any turtles are found within the TNA-002 and TWA-003 adjacent work zones, the Environmental Inspector should relocate them to the nearest habitat area outside of the work zone. When relocating snapping turtles, care should be taken to avoid injury by wearing gloves and placing turtles into a bucket or large plastic tub for relocation. • Sediment/wildlife fencing within 120 m of Amphibian Breeding Habitat (ABH-001) should also be inspected by the Environmental Inspector at least once a week during the breeding season April, May and June) to ensure they are functioning and are maintained as required. • If the sediment/wildlife fencing is not functioning properly, alternative measures will be implemented and prioritized above other construction

Affected Environmental Feature(s)	Project Activity	Potential Effects (D=Direct) (I=Indirect) Potential effect on the size, diversity, health, connectivity, functionality and resilience of the natural feature.	Mitigation Strategy	Residual Effect (magnitude/frequency/ duration)	Performance Objective	Monitoring Plan and Contingency Measures
						activities. • Contractor and Environmental Inspector to monitor work schedules to ensure that no work occurs within the restricted timing window.
Amphibian Breeding Habitat ABH-001	Construction of turbines T-21, T-22, T-23, T-24 and T-25, their access roads and all associated components	• Inhibition of amphibian breeding patterns and reproductive success due to disruptions of breeding calling patterns from turbine construction noise (I). • The effect identified above could affect the size and diversity of the amphibian population in this pond.	• Construction of turbines T-21, T-22, T-23, T-24 and T-25, their access roads and all associated components should not occur after dusk during the breeding season (April, May and June).	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No significant decrease in amphibian populations.	• Contractor and Environmental Inspector to monitor work schedules to ensure that no work occurs within the restricted timing window. • If work must occur in these areas during the noted time periods due to an emergency or critical phase of construction, work may be permitted if conditions for amphibian breeding are not ideal. Specifically, work may occur if temperatures are below 6^{o}C, there has been no rain in the previous 24 hours or wind speeds are higher than 3 on the Beaufort Scale. The Environmental Inspector will track weather conditions and determine if suitable amphibian breeding conditions are or are not present.
Species of Conservation Concern* SCC-001, SCC-002, SCC-003, SCC-004, SCC-005, SCC-006, SCC-007, SCC-008, SCC-009, SCC-010, SCC-011, SCC-012, SCC-013, SCC-014, SCC-015, SCC-016, SCC-017	Site Preparation	• Inadvertent loss of, or disturbance to, vegetation within significant habitat areas as a result of unauthorized encroachment into the habitat (I). • Movement of exposed sediment into the habitat (I). • The effects identified above could have minor effect on the size of habitat and could affect individuals if sediment washes out or buries	• Significant habitats will be clearly demarcated with sediment and/or tree protection fencing to ensure the equipment and material stockpiles do not encroach into any features. • Significant habitats to be demarcated by a qualified Environmental Inspector based on the boundary of the finest applicable ELC unit. • Construction areas are to correspond to those areas detailed on **Figures A1 – A19, Appendix A**.	• Limited duration, frequency, geographic extent. • No residual effect anticipated.	• No disturbance to significant habitat areas.	• An Environmental Inspector will perform regular inspection to ensure that mitigation is implemented and all silt fencing and/or tree protection fencing is maintained and functioning properly. If they are not functional, they should be repaired immediately. • If accidental encroachment

Affected Environmental Feature(s)	Project Activity	Potential Effects (D=Direct) (I=Indirect) Potential effect on the size, diversity, health, connectivity, functionality and resilience of the natural feature.	Mitigation Strategy	Residual Effect (magnitude/frequency/ duration)	Performance Objective	Monitoring Plan and Contingency Measures
		vegetation.				occurs the offending material or equipment will be immediately removed and restoration of the area conducted as needed.
Bat Maternity Colonies* BMC-001, BMC-002, BMC-003, BMC-004, BMC-005, BMC-006, BMC-007, BMC-008, BMC-009, BMC-010, BMC-011, BMC-012,	All Construction Activities	• Disturbance due to construction activity and noise could result in bats avoiding habitat (I). • Inadvertent loss of, or disturbance to, vegetation within significant habitat areas as a result of unauthorized encroachment into the habitat (I). • The effect could impact the use of the habitat by bats.	• No construction will occur immediately adjacent to significant bat maternity colony habitats within the timing window of May 1 to July 30. • Significant habitats will be clearly demarcated with sediment and/or tree protection fencing to ensure the equipment and material stockpiles do not encroach into any features. • Significant habitats to be demarcated by a qualified Environmental Inspector based on the boundary of the finest applicable ELC unit. • Construction areas are to correspond to those areas detailed on **Figures A1 – A19, Appendix A**.	• Limited duration and magnitude. • No residual effect anticipated.	• No disturbance to significant bat maternity colonies.	• An Environmental Inspector will perform regular inspection to ensure that work does not occur within specified timing windows. • An Environmental Inspector will perform regular inspection to ensure that mitigation is implemented and all silt fencing and/or tree protection fencing is maintained and functioning properly. If they are not functional, they should be repaired immediately. • If accidental encroachment occurs the offending material or equipment will be immediately removed and restoration of the area conducted as needed.

* Wildlife habitat treated as significant. These are features which may be significant and which are being treated as such until habitat use study can confirm the relative use of each habitat. If it is found that wildlife are not using the habitat in significant numbers, then the mitigation identified will not be required.

Table 3.3 Environmental Effects Monitoring Plan – Water Assessment and Water Body Features

Affected Environmental Feature(s)	Project Activity	Potential Effects	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Aquatic Species and Aquatic Habitat Watercourse Crossings: CR-013, CR-018, CR-023, CR-031, CR-032, CR-041	All Construction Activities	• Potential direct effects to aquatic habitat quality from sedimentation during construction activities (i.e., culverts for access roads). • Effects to riparian vegetation during construction. • Effects to fish during in-water works • Potential failure of slopes – impacts to bed/banks of stream during culvert construction.	• Minimize indirect effects from dust, sedimentation and erosion. • Minimize direct effects to fish and fish habitat during construction.	• Erosion and sediment control measures (i.e., silt fence, straw bales, wooden stakes, sand bags, filters, pumps, snow fencing) will be installed and will be maintained during the construction work phase and until the site has been stabilized. Implementation of the erosion and sediment control measures will conform to industry best management practices and recognized standard specifications such as Ontario Provincial Standards Specifications (OPSS). • Minimize footprint for culvert crossings at access roads. • Culvert construction will take place outside fish and fish habitat timing windows, and will be designed and installed according to the requirements of the Ausable Bayfield Conservation Authority. • Directional drilling and/or punch and bore operations will be designed with launching and receiving pits with appropriate setbacks from watercourses wherever possible. • Dewatering from open excavations will take place on tile-drained agricultural land to promote infiltration and settling of suspended solids prior to entering a watercourse. • Fish salvage will be conducted by a qualified biologist under a Scientific Collection Permit from MNR and all fish captured within the work area will be released downstream unharmed. • Operational Statements (OS) provided by DFO will be used where appropriate to ensure that no impact to fish and fish habitat will occur during construction (i.e., punch and bore, directional drilling, open-cut watercourse crossings and isolated dam and pump).	• Regular weekly site inspection will occur by designated Environmental Monitor for sediment and erosion control measures. Severe weather conditions may require additional site visits depending on the proximity of the watercourse. • The level of monitoring and reporting would be based on the severity of the spill and may be discussed with the MOE Spills Action Center and MNR. **Contingency Measures** • Environmental Monitor will be responsible for “stop works” if mitigation measures are not incorporated into the construction activities or performance objectives are not achieved. • Changes to the mitigation measures to best suit the current conditions will be adopted to achieve overall performance objective.
Aquatic Species and Aquatic Habitat	All Construction Activities	• Potential contamination from accidental spills.	• Minimize potential for indirect effects from accidental spills.	• Hazardous material transportation and application will occur in designated areas according to operational procedures. Proper spill containment equipment will be used and maintained on site. • No fuelling within 30 m of any watercourse. • No fuel storage within 30 m of any watercourse. • A spill containment kit will be available during construction for every location that heavy equipment is operated.	• Regular site inspections will occur by designated Environmental Monitors for in-water works and work adjacent to sensitive areas. • The level of monitoring and reporting would be based on the severity of the spill and may be discussed with the MOE Spills Action Center and MNR. **Contingency Measures** • Additional sediment and erosion control measure (silt fence, erosion control blankets, etc.) will be on site a ready for use if original measures are not suitable. • Refer to Spill Contingency Plan. • Contaminated soil will be removed and disposed of at an approved facility.
Surface Water/Soils	All Construction Activities	• Short-term degradation of soil/water quality and fisheries habitat due to accidental spills or releases.	• Minimize indirect effects from dust, sedimentation and erosion. • Minimize potential for indirect effects from accidental spills.	• Erosion and sediment control measures (i.e., silt fence, straw bales, wooden stakes, sand bags, filters, pumps, snow fencing) will be installed and will be maintained during the construction work phase and until the site has been stabilized. Implementation of the erosion and sediment control measures will conform to industry best management practices and recognized standard specifications such as Ontario Provincial Standards Specifications (OPSS). • Culvert construction will take place outside fish and fish habitat timing windows, and will be designed and installed according to the requirements of the Ausable Bayfield Conservation Authority.	• Regular site inspection will occur by designated Environmental Monitors. The level of monitoring and reporting would be based on the severity of the occurrence and may be discussed with the MOE Spills Action Center and MNR. **Contingency Measures** • Contaminated soil will be removed and disposed of at an approved facility.

Affected Environmental Feature(s)	Project Activity	Potential Effects	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
				• Directional drilling and/or punch and bore operations will be designed with launching and receiving pits with appropriate setbacks from watercourses wherever possible. • Dewatering from open excavations will take place on tile-drained agricultural land to promote infiltration and settling of suspended solids prior to entering a watercourse. • Hazardous material transportation and application will occur in designated areas according to operational procedures. Proper spill containment equipment will be used and maintained on site.	
Groundwater	All Construction Activities	• Potential direct impacts to groundwater quality and quantity due to water taking at Parts and Storage Building. • Water quality impacts due to potential fuel and oil spills. • Dewatering operations during construction are not expected to impact groundwater quantity or quality. Refer to the Construction Plan Report for further details.	• Minimize impacts to groundwater quality and quantity. • No spills.	• Confirmation of water supply needs and capacity for the Part and Storage Building will be verified at the detailed design phase. If required, detailed design and implementation plans will include measures for water storage and/or water treatment. • An Emergency Response and Communications Plan will be developed during detailed design to ensure proper mitigation and notification procedures are in place regarding groundwater quality during Project operation.	• Regular site inspection will occur by designated Environmental Monitors. The level of monitoring and reporting would be based on the severity of the occurrence and may be discussed with the MOE Spills Action Center and MNR. **Contingency Measures** • All spills that could potentially have an adverse environmental effect, are outside the normal course of events, or are in excess of the prescribed regulatory levels would be reported to the MOE's Spills Action Centre.

Table 3.4 Environmental Effects Monitoring Plan – Land Use and Socio-Economic Features

Affected Environmental Feature(s)	Project Phase	Potential Effects	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Petroleum, Oil and Gas Resources	Construction	• Fires and explosions from disturbance of existing oil and gas resources. • Methane and sour gas releases from disturbance of existing oil and gas resources.	• No fires or explosions from existing oil and gas resources as a result of Project activities. • No methane and sour gas releases from existing oil and gas resources as a result of Project activities.	• Project infrastructure has been sited with a clearance of over 75 m from existing active wells. • For Project infrastructure located within 75 m of abandoned wells, a visual search will be conducted to confirm the condition of the abandoned well. If required, the abandoned well will be properly decommissioned prior to construction within 75 m of the abandoned well. • An engineer's report will be prepared outlining risks, mitigation, and emergency response procedures for wells within 75 m of Project activities.	• Contingency Measures • Existing well records indicate 2 abandoned wells are located within 75 m of an access road and the collector line. The wells have been decommissioned and are not likely to be affected by Project activities. If a fire, explosion, or release of sour gas occurs during Project activities, the Emergency Response Plan will be implemented.
Existing Land Uses - Agriculture and Rural Resources	Construction	• Loss of lands required for the lease period and farming practices. • Potential impacts to drainage systems. • Potential impact from soil compaction. • Potential impact to crop production and yields.	• Minimize disturbance to agricultural lands, drainage systems, soil compaction and crop production.	• Siting of Project components in discussion with landowners. • Compensation provided to the landowners who have Land Lease Agreements. • Construction methods have been included that will avoid impacts to drainage systems and soil compaction thereby minimizing impacts to normal crop production and yields.	• During construction the environmental inspector will monitor the drainage and soil remediation measures to be implemented. • A landowner complaint procedure will be established. • Following construction all site areas will be monitored by qualified professionals for a two year period to ensure that drainage systems are functioning properly and normal crop production is not reduced. **Contingency Measures** • Additional drainage system repairs as required. • Additional soil compaction relief measures as required. • Crop compensation, if necessary, to landowners.
Game and Fisheries Resources	Construction	• Disturbance to game species from noise and maintenance activities.	• Minimize disturbance.	• Keep equipment in good working condition and regularly maintained to minimize noise. • Minimize impacts to aquatic resources see protection and mitigation measures under water bodies and natural heritage. • Schedule construction periods to avoid impacts.	• Complaint response protocol will be followed.
Provincial and Local Infrastructure and Local Traffic	Construction	• Negligible increase in traffic during operational phases. • Traffic impacts during construction phases. • Impacts to structures (i.e., culverts, bridges, watermain, gas, sewers) due to construction traffic loading.	• Minimize traffic disturbance. • Prevent damage to structures.	• The Contractor will implement a traffic management plan. • Road user agreement anticipated with local municipalities. • Permits will be obtained for applicable oversize / overweight loads. • Public notification of non-conventional load movements (if required). Escort vehicles will be used as appropriate. • Roads will be maintained and any additional repairs necessary will be completed immediately following construction to pre-development conditions or better.	• Complaint response protocol will be followed. • Monitor road conditions weekly during construction and decommissioning. **Contingency Measures** • Road maintenance, repair crews and materials to be on standby for repairs as required.
Telecommunication Networks	Construction	• Potential interference to communication systems, including radar, cellular and broadcasting systems.	• Minimize disturbance.	• Possible adjustment of turbine locations • Curtailment of operations during selected periods • Possible location adjustment of turbines, transmission or telecommunication systems or radar installation. • During construction, position crane on north side of T-21 to avoid interference with nearby microwave tower. • During construction, position crane on east or south side of T-04 to avoid interference with microwave tower.	• Additional studies to confirm non interference. • Ongoing communication with impacted agencies to resolve any outstanding issues.

Affected Environmental Feature(s)	Project Phase	Potential Effects	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Aeronautical Systems	Construction	• Aeronautical obstruction.	• Minimize hazards.	• Turbine lighting must conform to Transport Canada standards. Lights would be selected with the minimal allowable flash duration, narrow bean and would be synchronized • Nav Canada would be responsible for updating all aeronautical charts with the turbine locations. • Consideration of radar detection system to eliminate night lights except when aircraft are in the vicinity of the wind farm. Radar detection system would likely require 2 radar stations in the vicinity of the Project location.	• Routine maintenance and repair.
Viewscape / Aesthetics	Construction	• Change in viewscape as a result of Project infrastructure.	• Minimize disturbance to viewscape.	• Northland will consider a tree planting program in selected locations to assist local residents who wish to block views and shadow flicker effects of the wind farm from their properties. • Many views of the wind farm cannot be mitigated and changes to the local viewscape cannot be avoided.	• A formal complaints procedure will be established. Communication links to service will be provided. Follow-up action and investigation as required.
Air, Odour, Dust	Construction	• Air and dust emissions from operation and maintenance vehicles. No odour effects anticipated.	• Minimize emissions.	• The Contractor would implement good site practices with regard to air which may include: – multi-passenger vehicles would be utilized to the extent practical; – company and contractor personnel would avoid idling of vehicles when not necessary; – equipment and vehicles would be turned off when not in use unless required for activities and/or effective operation of the equipment or vehicle; – equipment and vehicles would be maintained in good working order with functioning mufflers and emission control systems as available; and – all vehicles would be fitted with catalytic converters as required. • The Contractor would implement good site practices with regard to dust which may include: – protecting stockpiles of friable material with a barrier; – dust suppression (e.g., water) of source areas; and, – covering loads of friable materials during transport.	• Complaint Response Protocol will be followed.
Environmental Noise	Construction	• Noise associated with the operation of turbines and transformer station (all turbines are expected to meet the 40 dBA limit for non-participating noise receptors). • Noise emitted from operation/maintenance vehicles.	• Minimize noise impacts to meet MOE standards.	• Noise levels have been extensively modeled with performance standards established to meet MOE requirements at all facilities • Turbines can be adjusted for noise, power levels and operational schedules. • Sound limitations have been developed for equipment to be used at the transformer substation to satisfy the 40 dBA limit at all non-participating noise receptors. • Construction equipment to be maintained with normal noise attenuation. • Schedule construction work to minimize noise impacts.	• Noise levels will be monitored in the field as required • Complaints protocol will be established with follow-up investigations and action, as required. **Contingency Measures** • Adjustments to turbine noise levels and scheduled operations as required.
Public Safety – Turbine Blade and Structure Failure	Construction	• Collapse of turbine tower and/or blade detachment.	• No failure of components.	• Adherence to setbacks from receptors. • Design, install, operate and maintain turbines according to applicable industry standards. • Use of lightening protection system.	• Regular maintenance and monitoring activities. • Emergency Response Plan will be followed.

Affected Environmental Feature(s)	Project Phase	Potential Effects	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Public Safety – Extreme Weather Events	Construction	• Potential damage to Project infrastructure.	• No damage or structural failure.	• Project components have been designed to withstand the effects from extreme events. • Design, install, operate and maintain turbines according to applicable industry standards. • Failsafe devices are capable of shutting down the turbine blades in the event of excessive wind conditions, imbalance or malfunction of other turbine components.	• Regular maintenance and monitoring activities. • Emergency procedures and protocols to be established.
Contaminated Lands – Disposal of wastes	Construction	• Nuisance refuse dispersed to adjacent properties. • Potential contamination to soil, groundwater and/ or surface water resources on or off the Project site.	• Proper disposal of waste materials.	The Contractor would implement a site-specific waste collection and disposal management plan which may include site practices such as: • systematic collection of waste and on-site storage in weather protected areas; • all waste materials and recycling will be transported off site by private waste material collection contractors licensed with a Certificate of Approval – Waste Management System; • contractors will be required to remove excess materials from the site (such as extra cable, scrap metals, pallets, etc.); • appropriate handling and disposal of all wastes classes according to current provincial standards and guidelines; • disposal of contaminated material (if encountered) to a registered waste facility according to current regulatory standards; • labelling and proper storage of liquid wastes (e.g., used oil, drained hydraulic fluid, and used solvents) in a secure area that will ensure containment of the material in the event of a spill; • any spill that does occur, which could potentially cause an adverse environmental effect, should be reported to the MOE's Spills Action Centre (SAC); • prohibition of dumping or burying wastes within the Project areas; • should contaminated soil be encountered during the course of excavations the contaminated material will be disposed of in accordance with the current appropriate provincial legislation, specifically Ontario Regulation 153/04; • disposal of non-hazardous waste at a registered facility; • disposal of sanitary wastes will be the responsibility of the contracted third party and they will ensure disposal in accordance with appropriate legislation, standards and policies; and, • implementation of an on-going waste management program consisting of reduction, reuse and recycling of material.	• Monitoring by the Environmental Inspector to ensure compliance during construction and decommissioning phases. • Routine staff waste management procedures and inspection during operational phases.

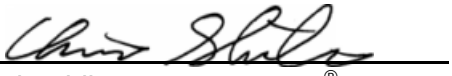
4.0 Conclusion

The Grand Bend Wind Farm can be constructed without causing significant adverse environmental effects. This will be achieved through proper implementation of the mitigation, monitoring, and contingency measures outlined in this report.

Burnside has prepared the Grand Bend Wind Farm Construction Plan Report for Northland in accordance with O.Reg. 359/09. This report has been prepared by Burnside for the sole benefit of Northland, and may not be re-produced by any third party without the express written consent of Northland.

Respectfully submitted,

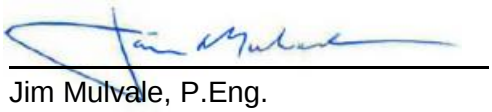
Neegan Burnside Ltd.

Signature  Date February 2013
Chris Shilton, P.Eng, LEED® AP
Project Engineer

Reviewed by:

Signature  Date February 2013
Lyle Parsons, BES
Project Manager

Approved by:

Signature  Date February 2013
Jim Mulvale, P.Eng.
Manager, Environmental, Health and Safety
Northland Power Inc.

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Appendix A
Site Plan

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Appendix A
Figure 1 Key Map

Grand Bend Wind Farm

Construction Plan Report

Turbine Location: Northland Power Grand Bend Wind Farm

Turbine Location: NextEra Bluewater Wind Energy Centre

Turbine Location: Existing Magnum Wind Energy Corp. Zurich Wind Farm

Transformer Sub-Station | Switchyard

Project Area

Central Huron

Huron East

Mitchell

West Perth

Hensall

Zurich

Bluewater

Hay

Exeter

South Huron

Grand Bend

Lake Huron

A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19

Switchyard

Transformer Sub-Station

21 4 8 84 83 23 81

500kv 230kv / 115kv 230kv 115kv 115kv 500kv

NOTES:

1. Reference Figures A1 - A11 for site detail and A12 - A19 for collector and transmission line network.

DATA SOURCES:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada

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Date: 24 January 2013
Project Number: PIA019991

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Checked By: C. Shilton

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Appendix A
Figure A1

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Permanent Access Road & Collector Line
- Permanent Access Road (No Collector Line)
- Permanent Access Road Supporting Crane Crawling & Collector Line
- Temporary Access Road (Removed After Construction)
- Transmission Line
- Area of Construction on Private Land
- Collector Line
- Participating Property
- Existing Transmission Line: Overhead
- Building / Transformer Sub-Station / Switching Yard
- Contour (5m Interval)

Siemens SWT-2.3-113 Turbine:

Base Diameter 4.2m | Hub Height 99.5m | Blade Length 55m

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
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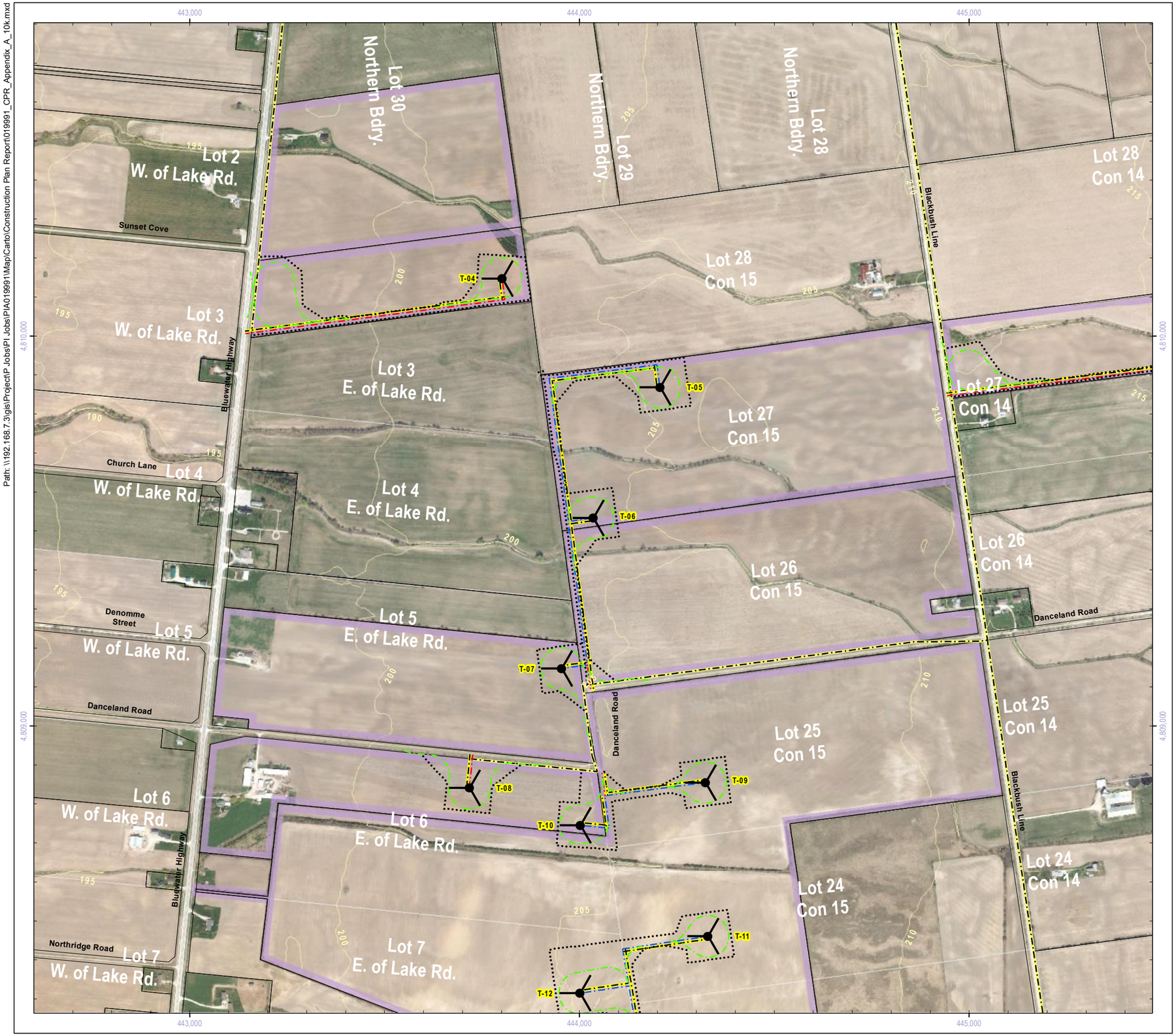

Appendix A
Figure A2

Grand Bend Wind Farm

Construction Plan Report

- T-02 — Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Permanent Access Road & Collector Line
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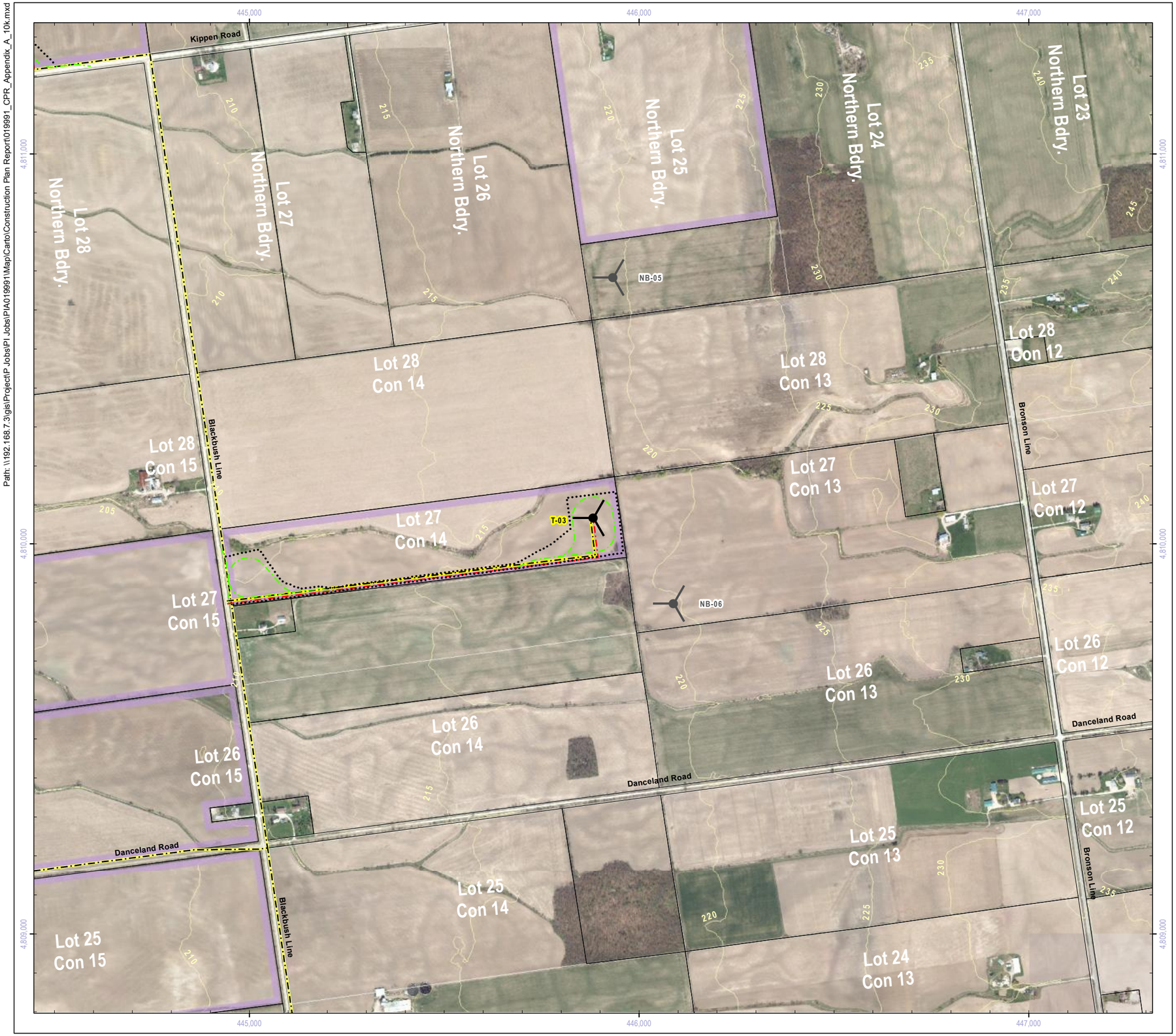

Appendix A
Figure A3

Grand Bend Wind Farm

Construction Plan Report

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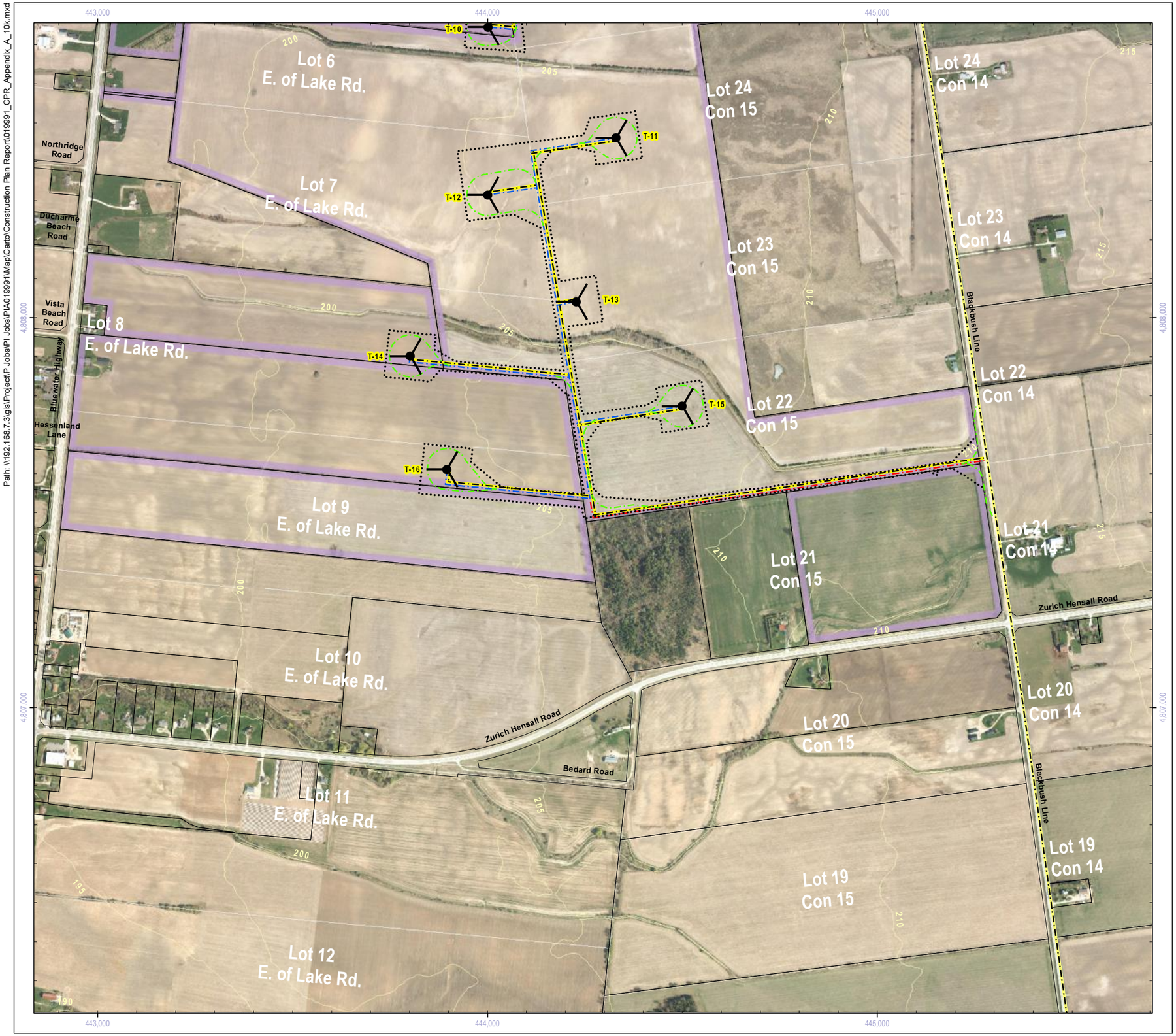

Appendix A
Figure A4

Grand Bend Wind Farm

Construction Plan Report

- T-02 — Proposed Project Wind Turbine (Grand Bend Wind Farm)
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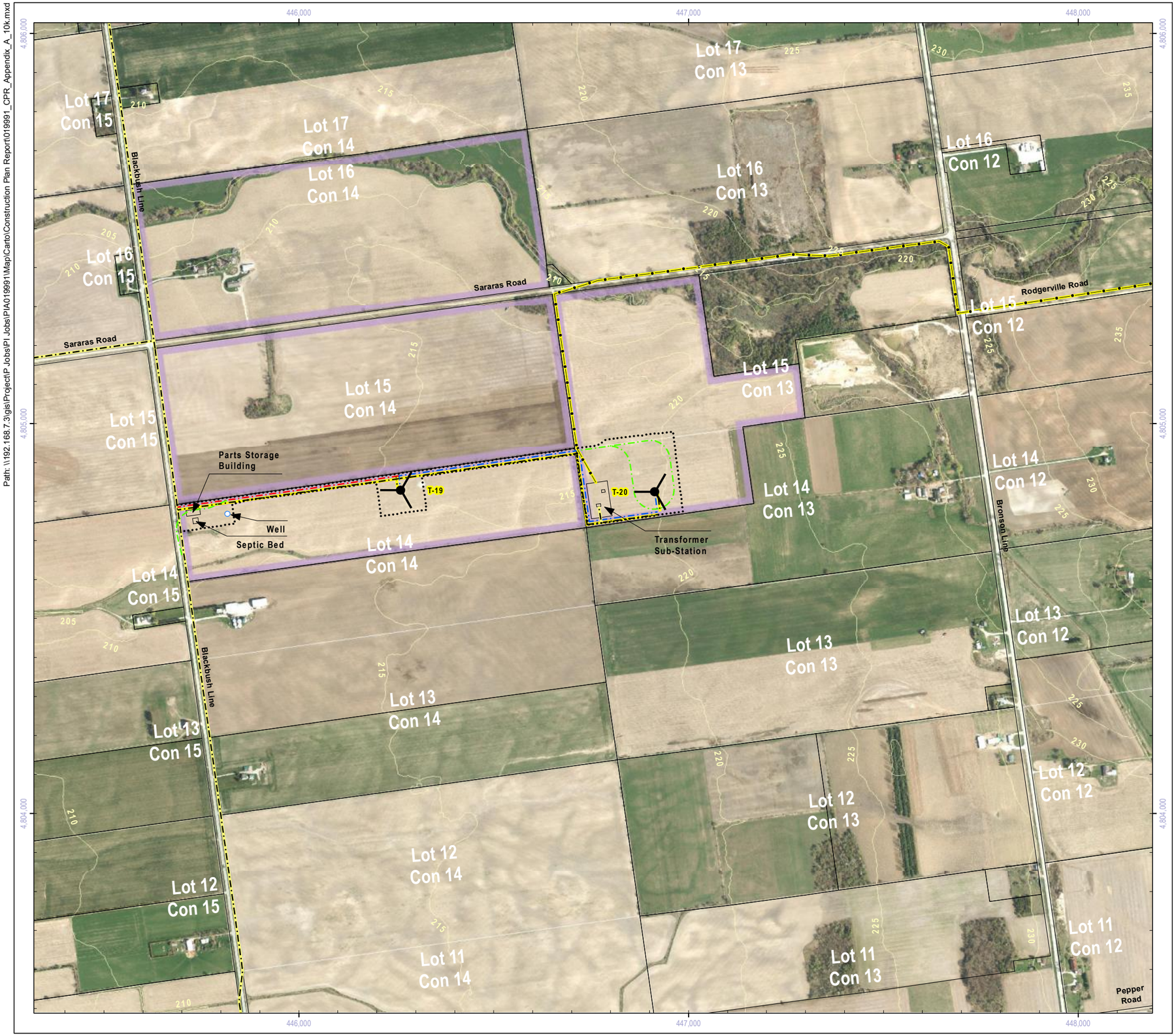

Appendix A
Figure A5

Grand Bend Wind Farm

Construction Plan Report

- T-02 — Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Permanent Access Road & Collector Line
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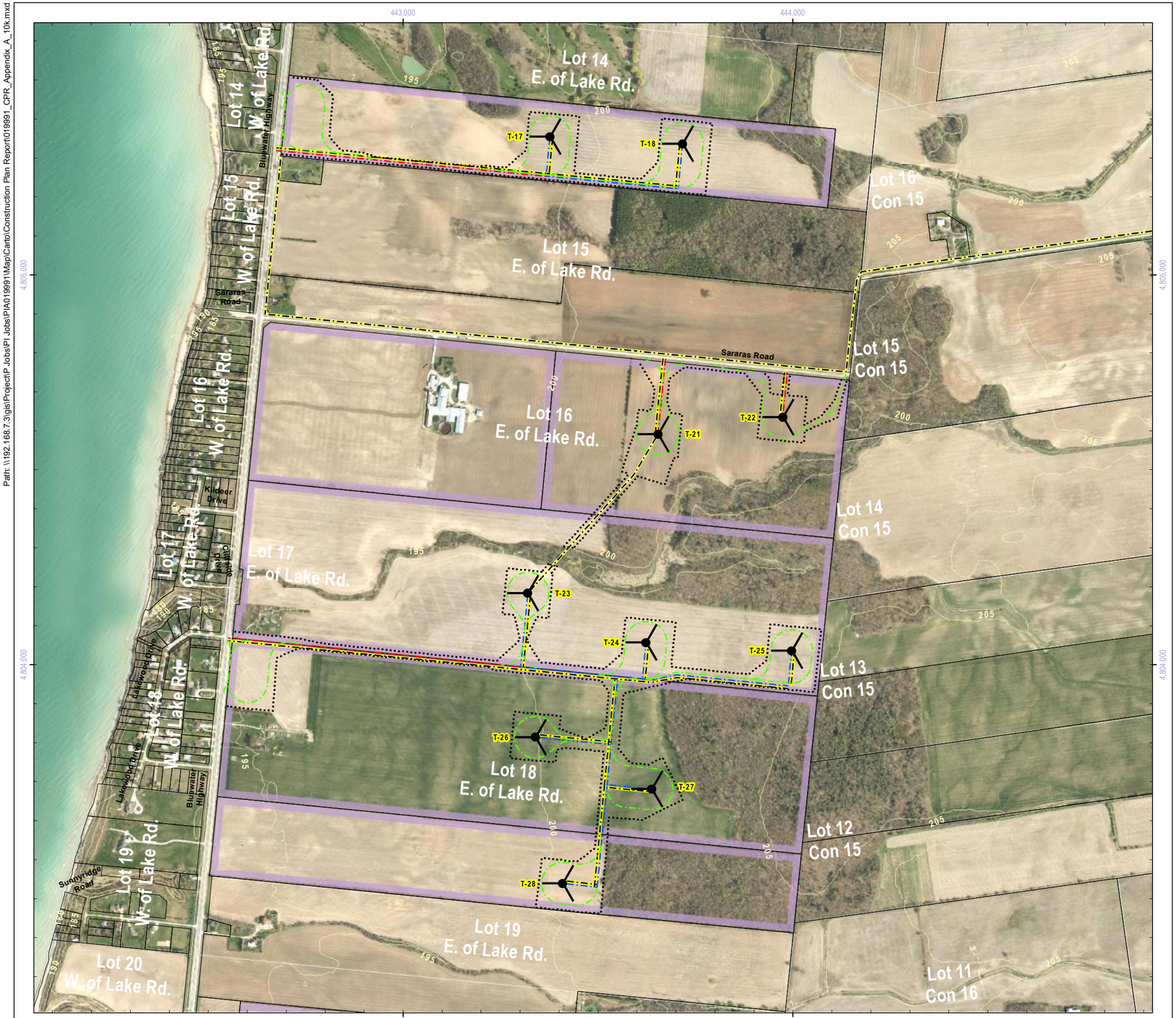

Appendix A
Figure A6

Grand Bend Wind Farm

Construction Plan Report

- T-02 — Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Permanent Access Road & Collector Line
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Siemens SWT-2.3-113 Turbine:

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Appendix A
Figure A7

Grand Bend Wind Farm

Construction Plan Report

- T-02 — Proposed Project Wind Turbine (Grand Bend Wind Farm)
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Siemens SWT-2.3-113 Turbine:

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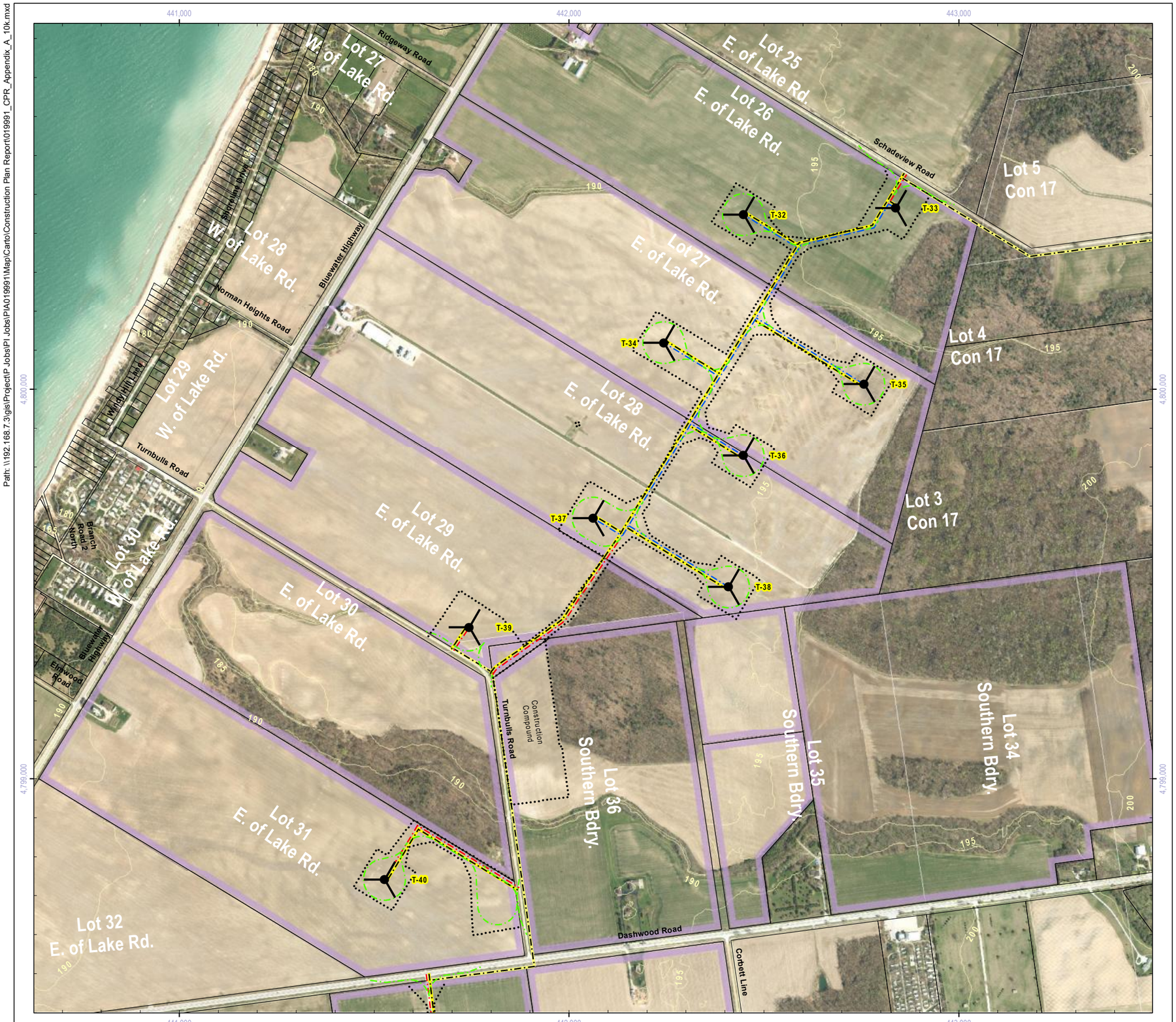

Appendix A
Figure A8

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
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- Participating Property
- Existing Transmission Line: Overhead
- Building / Transformer Sub-Station / Switching Yard
- Contour (5m Interval)

Siemens SWT-2.3-113 Turbine:

Base Diameter 4.2m | Hub Height 99.5m | Blade Length 55m

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
2. Ministry of Natural Resources, © Queen's Printer for Ontario
3. Natural Resources Canada © Her Majesty the Queen in Right of Canada

Scale: 1:10,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

0 100 200 300 400 500 600 700 800

Meters

NEEGAN BURNSIDE

Path: \\192.168.7.3\gis\Project\P Jobs\P I Jobs\PIA\019991\Map\Carto\Construction Plan Report\019991_CPR_Appendix_A_10k.mxd

Appendix A
Figure A9

Grand Bend Wind Farm

Construction Plan Report

- T-02 — Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Permanent Access Road & Collector Line
- Permanent Access Road (No Collector Line)
- Permanent Access Road Supporting Crane Crawling & Collector Line
- Temporary Access Road (Removed After Construction)
- Transmission Line
- Area of Construction on Private Land
- Collector Line
- Participating Property
- Existing Transmission Line: Overhead
- Building / Transformer Sub-Station / Switching Yard
- 200 — Contour (5m Interval)

Siemens SWT-2.3-113 Turbine:

Base Diameter 4.2m | Hub Height 99.5m | Blade Length 55m

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
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Scale: 1:10,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

0 100 200 300 400 500 600 700 800

Meters

NEEGAN BURNSIDE

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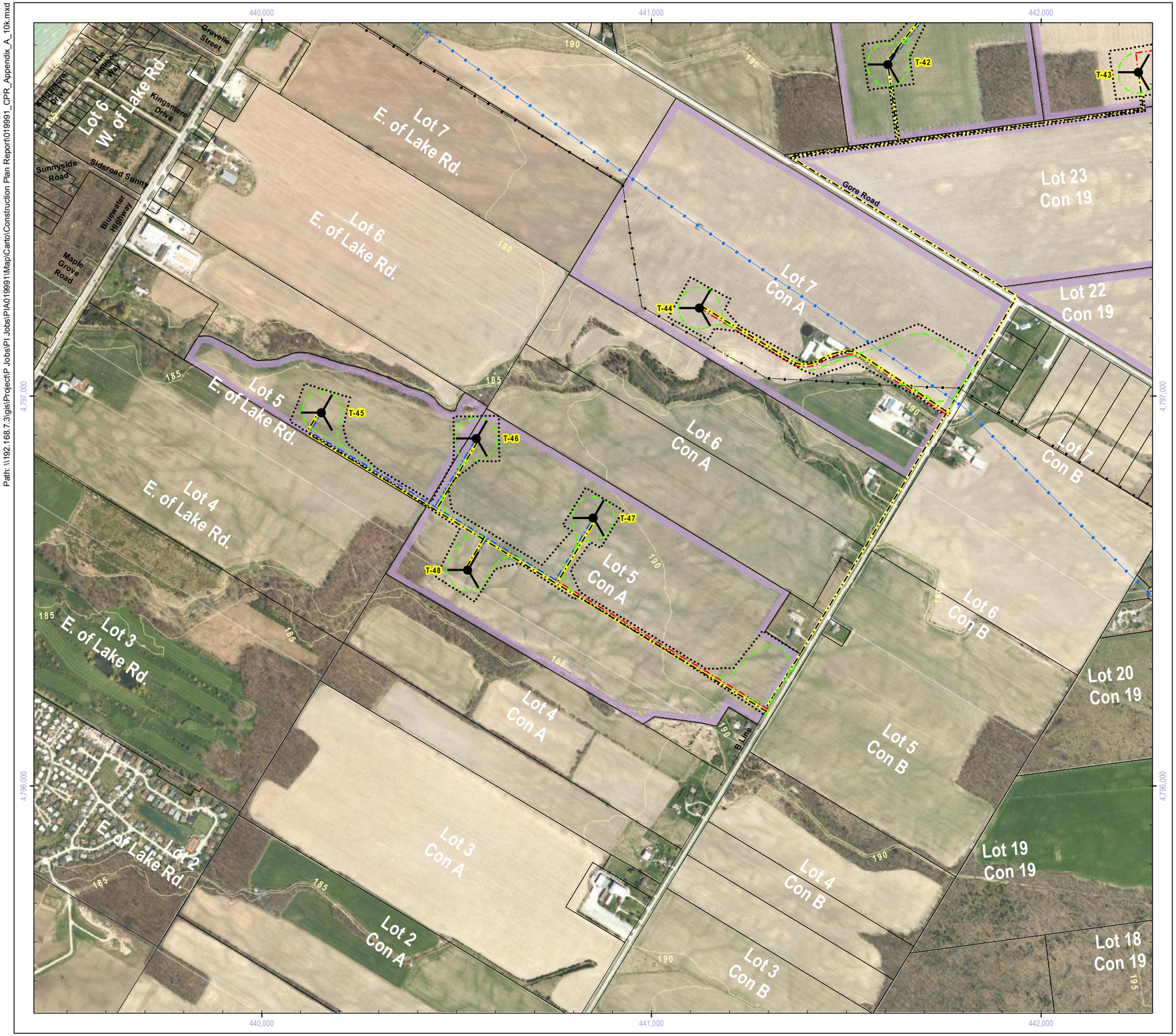

Appendix A
Figure A10

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Permanent Access Road & Collector Line
- Permanent Access Road (No Collector Line)
- Permanent Access Road Supporting Crane Crawling & Collector Line
- Temporary Access Road (Removed After Construction)
- Transmission Line
- Area of Construction on Private Land
- Collector Line
- Participating Property
- Existing Transmission Line: Overhead
- Building / Transformer Sub-Station / Switching Yard
- 200 — Contour (5m Interval)

Siemens SWT-2.3-113 Turbine:

Base Diameter 4.2m | Hub Height 99.5m | Blade Length 55m

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
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Scale: 1:10,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

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Meters

NEEGAN BURNSIDE

Path: \\192.168.7.3\gis\Project\P Jobs\P I Jobs\PIA019991\Map\Carto\Construction Plan Report\019991_CPR_Appendix_A_10k.mxd

Appendix A
Figure A11

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm) (T-02)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Permanent Access Road & Collector Line
- Permanent Access Road (No Collector Line)
- Permanent Access Road Supporting Crane Crawling & Collector Line
- Temporary Access Road (Removed After Construction)
- Transmission Line
- Area of Construction on Private Land
- Collector Line
- Participating Property
- Existing Transmission Line: Overhead
- Building / Transformer Sub-Station / Switching Yard
- 200 — Contour (5m Interval)

Siemens SWT-2.3-113 Turbine:

Base Diameter 4.2m | Hub Height 99.5m | Blade Length 55m

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
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Scale: 1:10,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

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Meters

NEEGAN BURNSIDE

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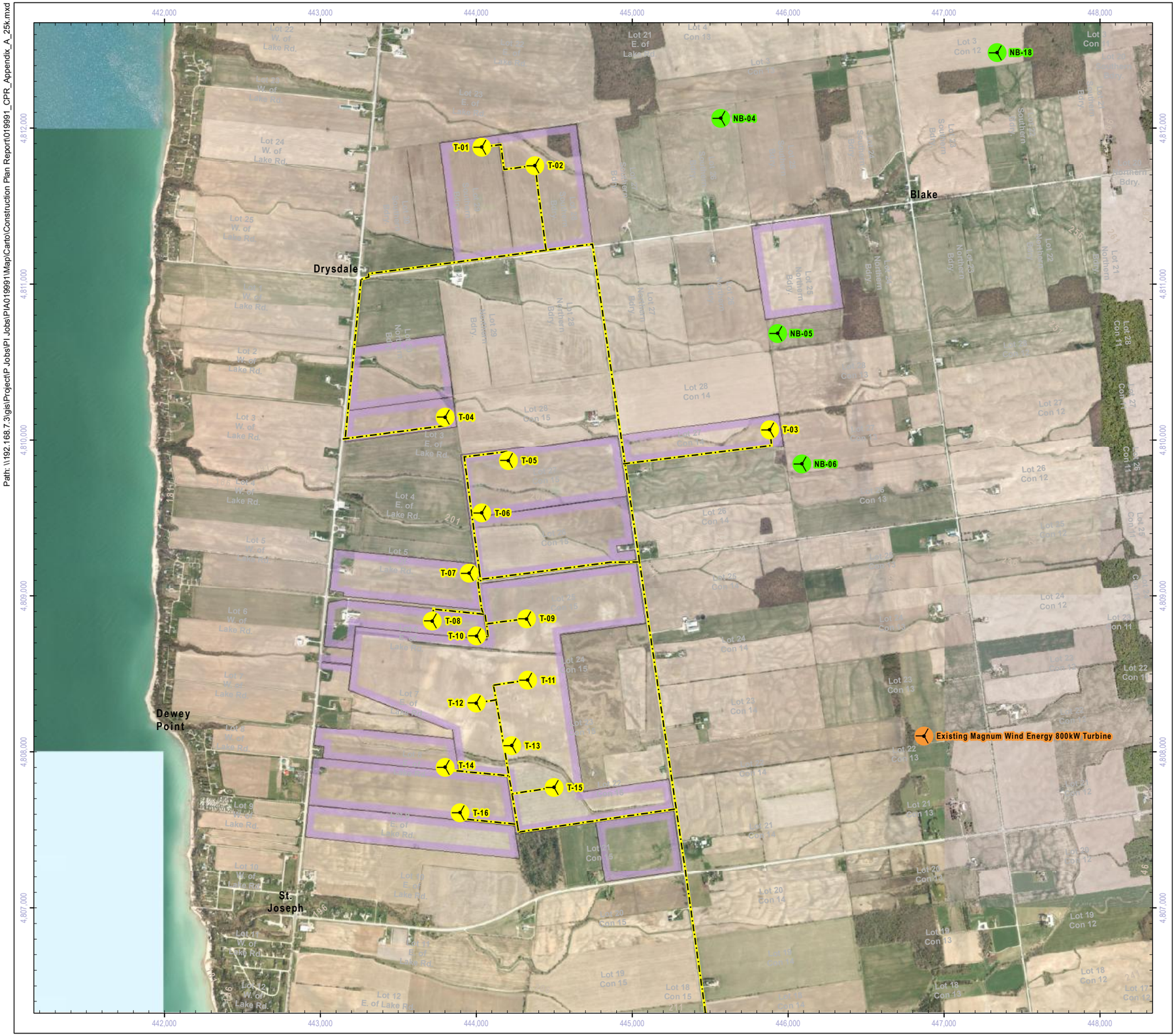

Appendix A
Figure A12

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Existing Wind Turbine (Magnum Wind Energy Corp.)
- Collector Line
- Transmission Line
- Existing Transmission Line: Overhead
- Transformer Sub-Station or Switchyard
- Participating Property

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
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Scale: 1:25,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

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Meters

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Appendix A
Figure A13

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Existing Wind Turbine (Magnum Wind Energy Corp.)
- Collector Line
- Transmission Line
- Existing Transmission Line: Overhead
- Transformer Sub-Station or Switchyard
- Participating Property

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
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Scale: 1:25,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

0 1,000 2,000

Meters

NEEGAN BURNSIDE

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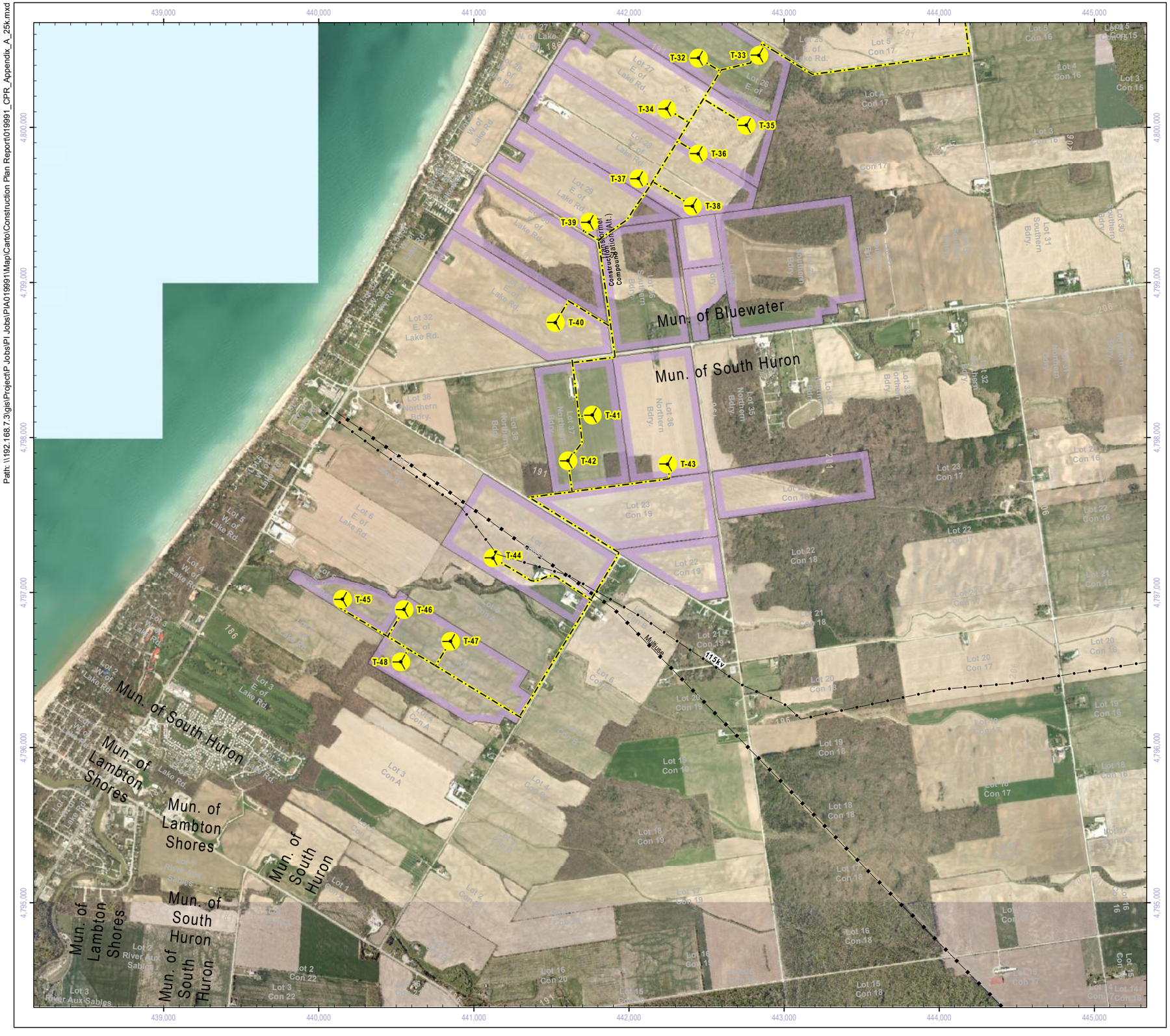

Appendix A
Figure A14

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Existing Wind Turbine (Magnum Wind Energy Corp.)
- Collector Line
- Transmission Line
- Existing Transmission Line: Overhead
- Transformer Sub-Station or Switchyard
- Participating Property

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
2. Ministry of Natural Resources, © Queen's Printer for Ontario
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Scale: 1:25,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

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Meters

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Appendix A
Figure A15

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Existing Wind Turbine (Magnum Wind Energy Corp.)
- Collector Line
- Transmission Line
- Existing Transmission Line: Overhead
- Transformer Sub-Station or Switchyard
- Participating Property

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
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Date: 24 January 2013
Project Number: PIA019991

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Prepared: P. Stubbert

Checked By: C. Shilton

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Meters

NEEGAN BURNSIDE

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Appendix A
Figure A16

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Existing Wind Turbine (Magnum Wind Energy Corp.)
- Collector Line
- Transmission Line
- Existing Transmission Line: Overhead
- Transformer Sub-Station or Switchyard
- Participating Property

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
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Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

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Meters

NEEGAN BURNSIDE

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Appendix A
Figure A17

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Existing Wind Turbine (Magnum Wind Energy Corp.)
- Collector Line
- Transmission Line
- Existing Transmission Line: Overhead
- Transformer Sub-Station or Switchyard
- Participating Property

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
2. Ministry of Natural Resources, © Queen's Printer for Ontario
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Scale: 1:25,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

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Meters

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Appendix A
Figure A18

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Existing Wind Turbine (Magnum Wind Energy Corp.)
- Collector Line
- Transmission Line
- Existing Transmission Line: Overhead
- Transformer Sub-Station or Switchyard
- Participating Property

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
2. Ministry of Natural Resources, © Queen's Printer for Ontario
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Scale: 1:25,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

0 1,000 2,000

Meters

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Appendix A
Figure A19

Grand Bend Wind Farm

Construction Plan Report

- Proposed Project Wind Turbine (Grand Bend Wind Farm)
- Proposed Other Wind Turbine (NextEra Bluewater Wind Engery Centre)
- Existing Wind Turbine (Magnum Wind Energy Corp.)
- Collector Line
- Transmission Line
- Existing Transmission Line: Overhead
- Transformer Sub-Station or Switchyard
- Participating Property

NOTES:

1. Reference the Figure 1 Key Map for location in the overall project area.
2. NextEra Turbine Locations taken from the document DRAFT Site Plan - Bluewater Wind Engery Centre, December 2011.

DATA SOURCES:

1. County of Huron (including Imagery: 2010)
2. Ministry of Natural Resources, © Queen's Printer for Ontario
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Scale: 1:25,000
Date: 24 January 2013
Project Number: PIA019991

N

Prepared: P. Stubbert

Checked By: C. Shilton

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Meters

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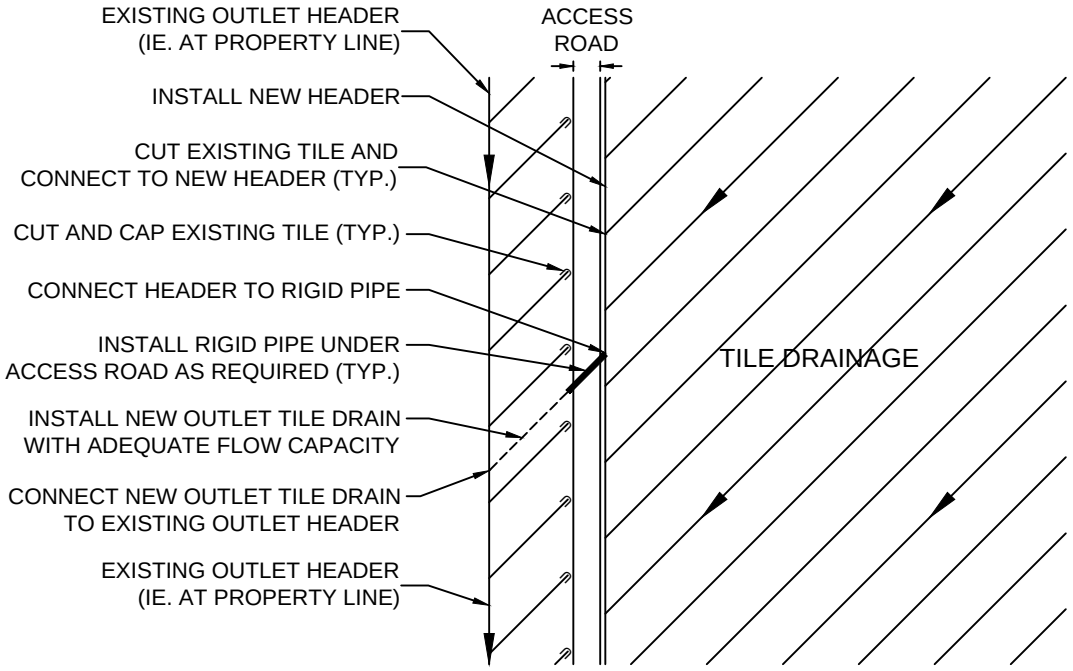
Appendix B
Conceptual Plans / Specifications



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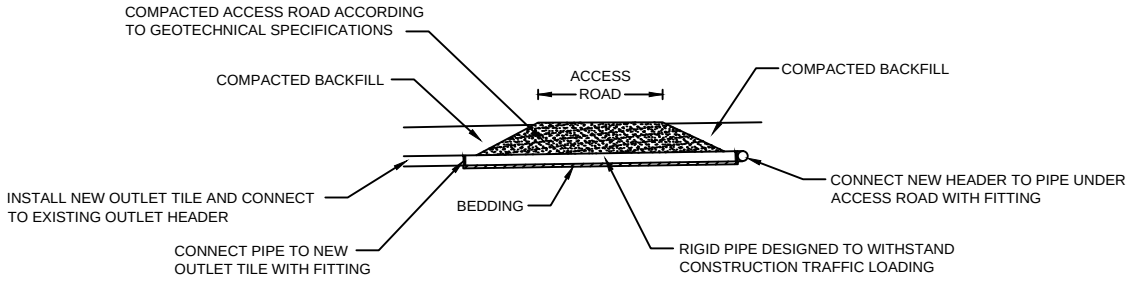

REPRESENTATIVE HEADER
CONNECTION UNDER ACCESS ROAD

Client

NORTHLAND POWER INC.
30 ST. CLAIR AVENUE WEST, 12TH FLOOR
TORONTO, ON
M4A 3A1

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6990 Creditview Road, Unit 2
Mississauga, Ontario, L5N 8R9
telephone (905) 821-1800 **fax** (905) 821-1809
web www.neeganburnside.com

Drawing Title

TILE DRAIN MODIFICATIONS
FOR ACCESS ROADS

Drawn By	Checked By	Drawing No.
CS	LP	B1
Scale	Project No.	
N.T.S.	PIA019991	

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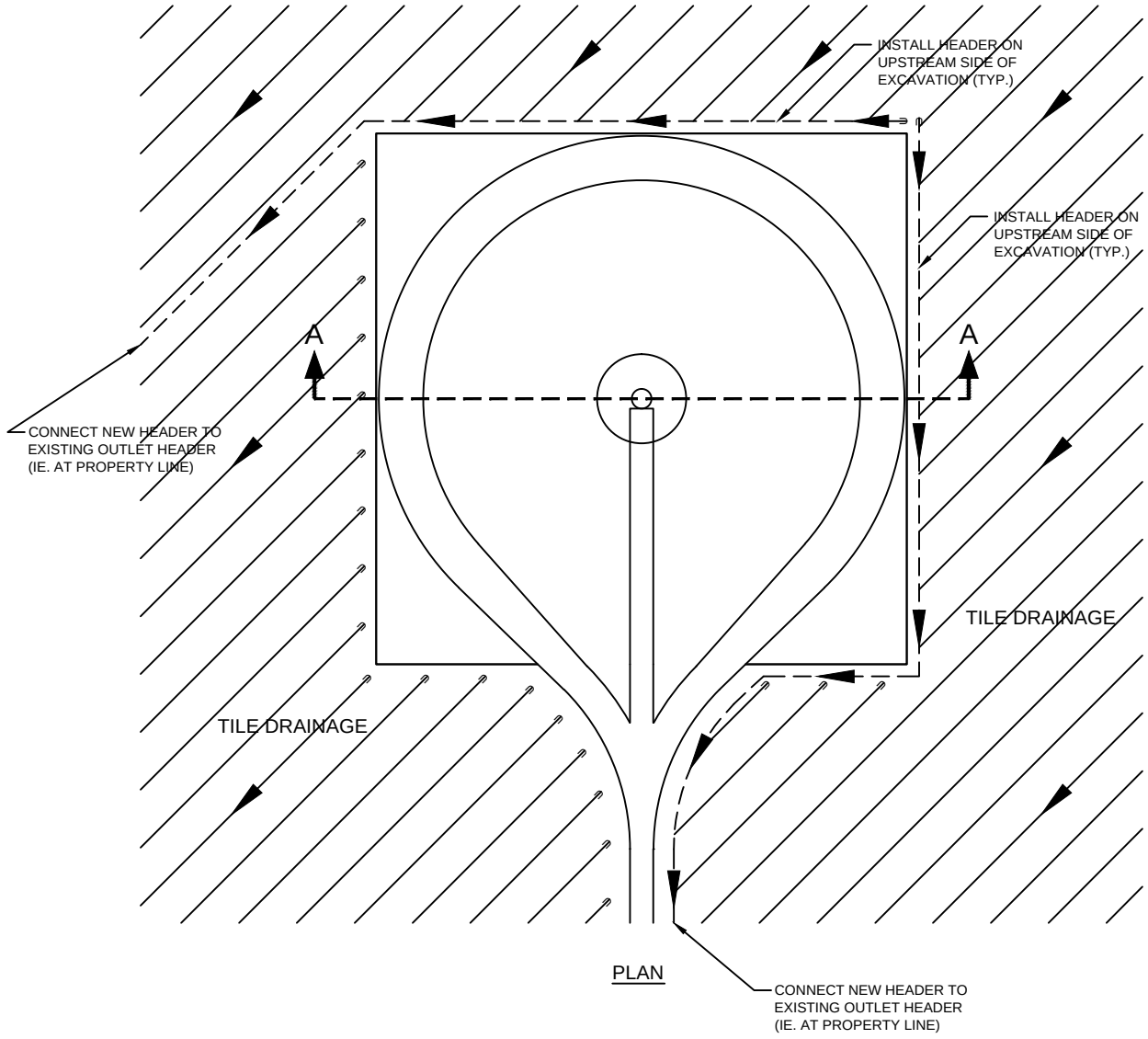

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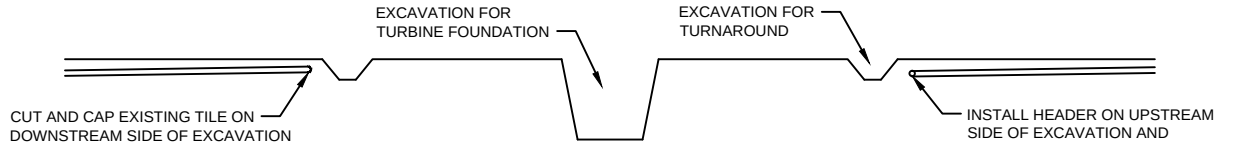

SECTION A-A

Client

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TILE DRAIN MODIFICATIONS FOR TURBINE INSTALLATION AREAS

Drawn By	Checked By	Drawing No.
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Scale	Project No.	
N.T.S.	PIA019991	

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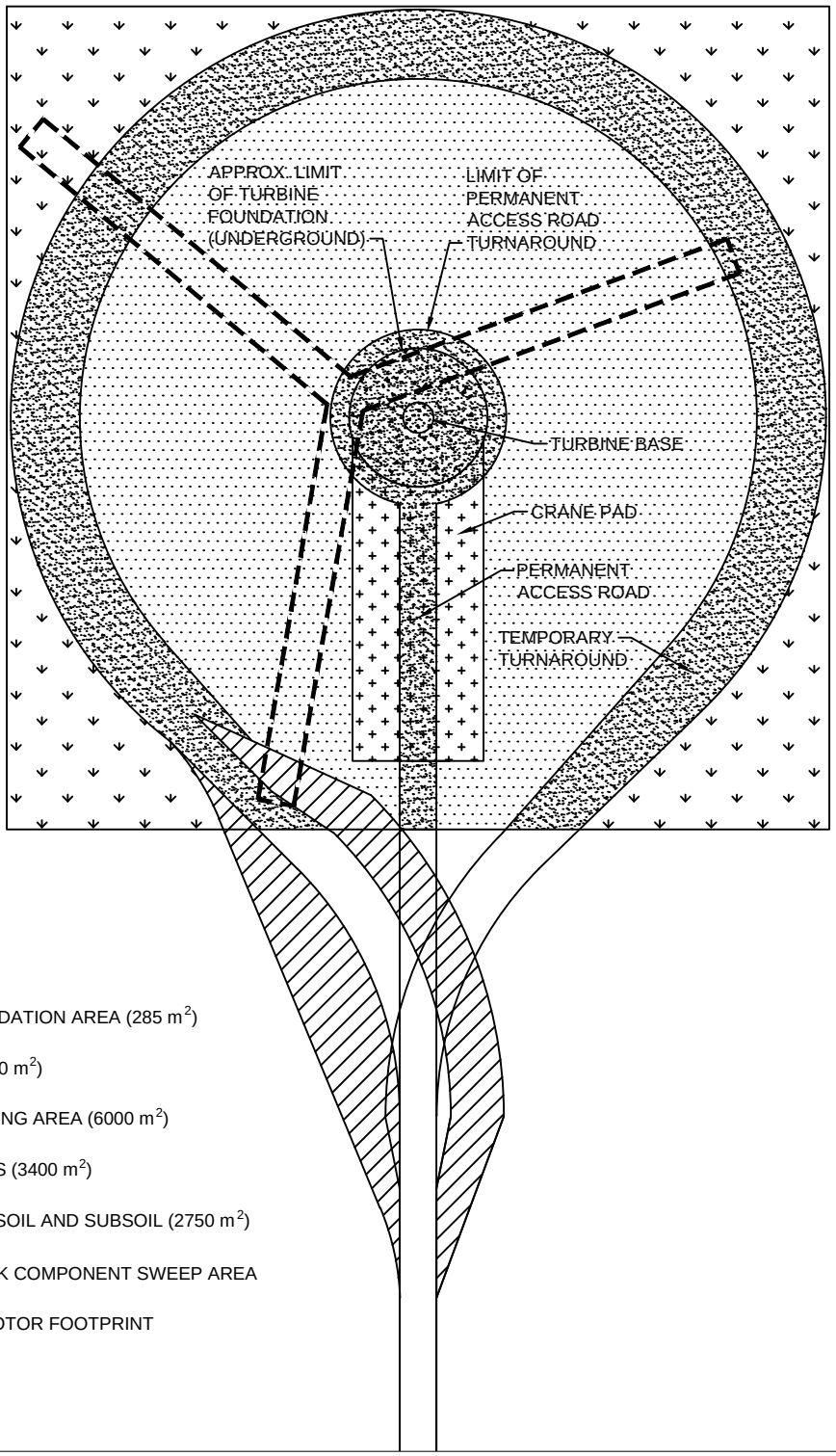

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Drawing Title

CONCEPTUAL TURBINE INSTALLATION AREA

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Scale	Project No.	
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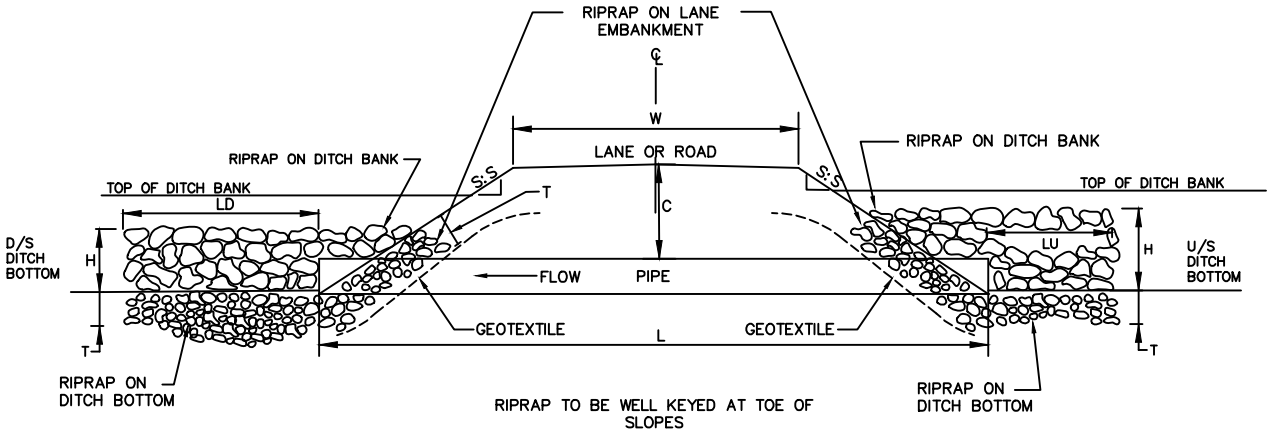

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Drawing Title

TYPICAL CULVERT INSTALLATION WITH RIPRAP

Drawn By	Checked By	Drawing No.
CS	JD	B4
Scale	Project No.	
N.T.S.	PIA019991	

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Plotted By: cshilton

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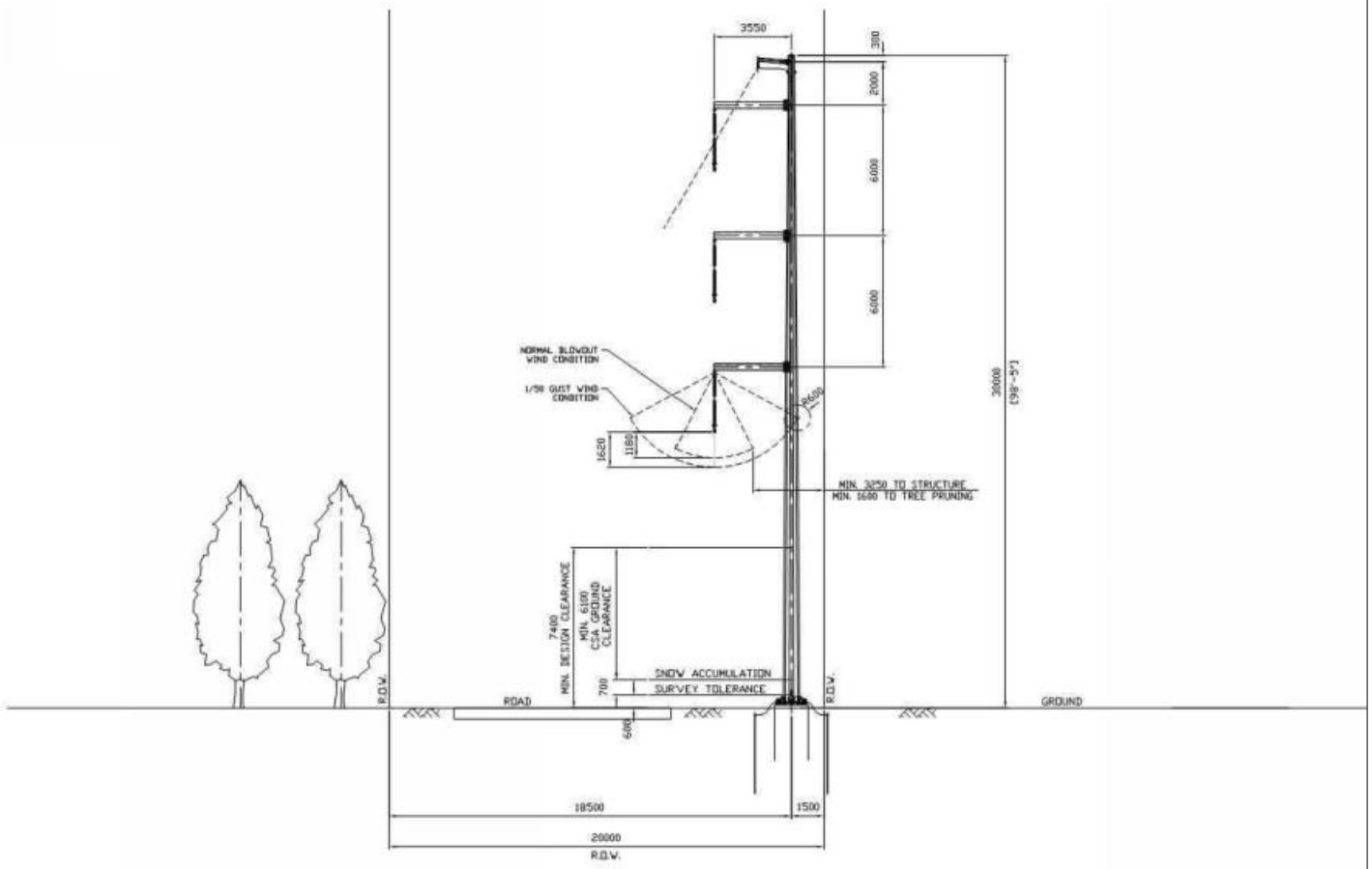

230kV TRANSMISSION LINE
TANGENT STRUCTURES
CONCEPTUAL RIGHT OF WAY DESIGN

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Drawing Title

CONCEPTUAL TRANSMISSION LINE
UTILITY POLE

Drawn By	Checked By	Drawing No.
OTHERS	NORTHLAND	B5
Scale: N.T.S.	Project No.: PIA019991	

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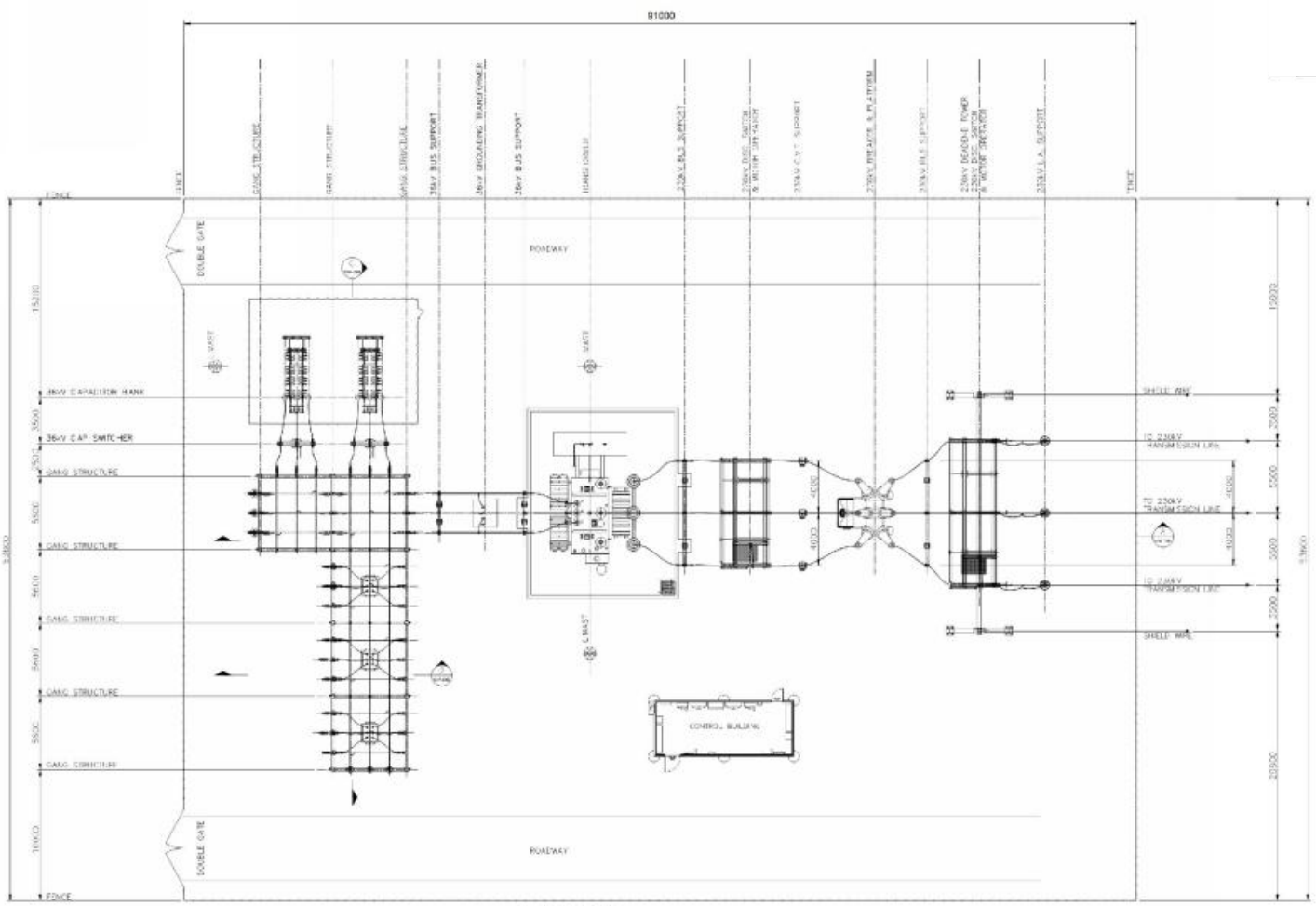

PLAN VIEW

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Drawing Title

CONCEPTUAL TRANSFORMER SUBSTATION - LAYOUT

Drawn By	Checked By	Drawing No.
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Scale: N.T.S.	Project No.: PIA019991	

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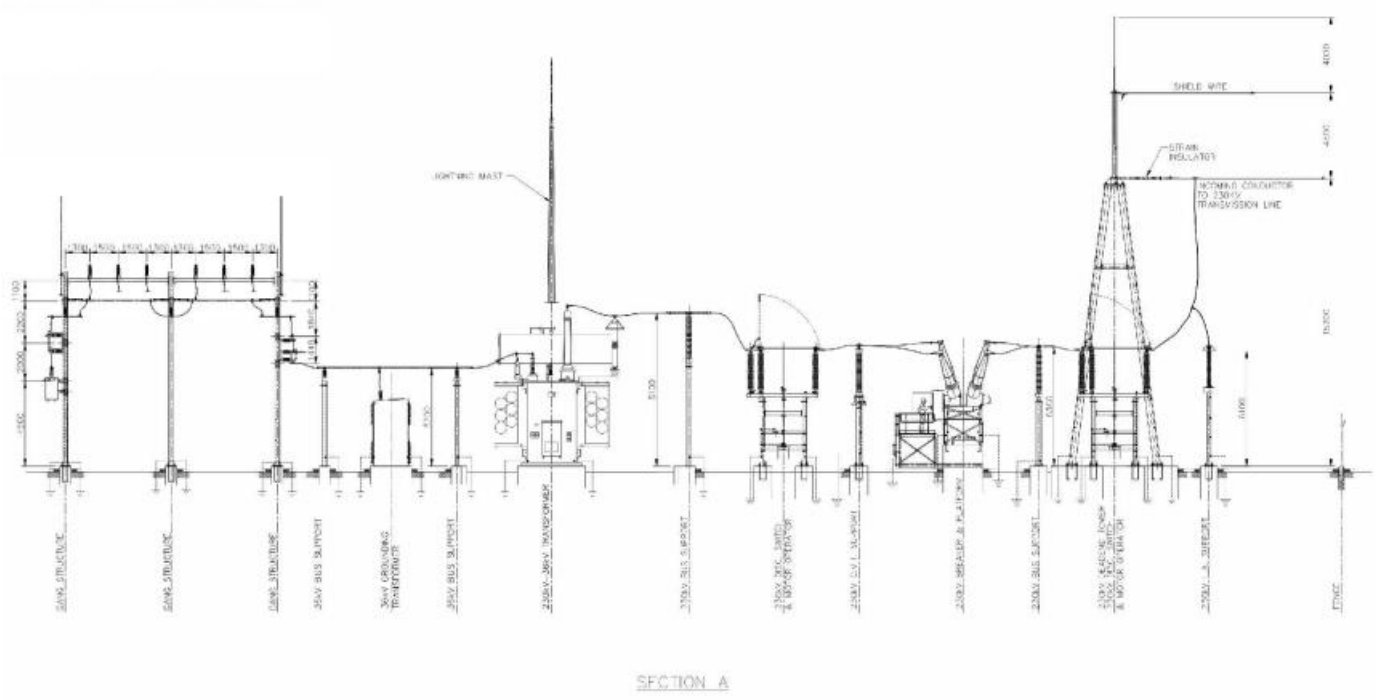

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Drawing Title

CONCEPTUAL TRANSFORMER SUBSTATION - SECTION A

Drawn By	Checked By	Drawing No.
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Scale: N.T.S.	Project No.: PIA019991	

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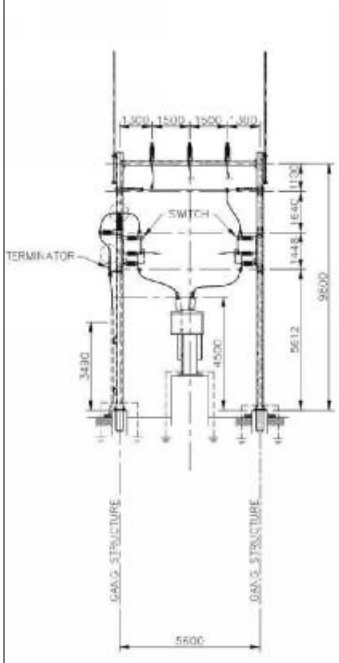

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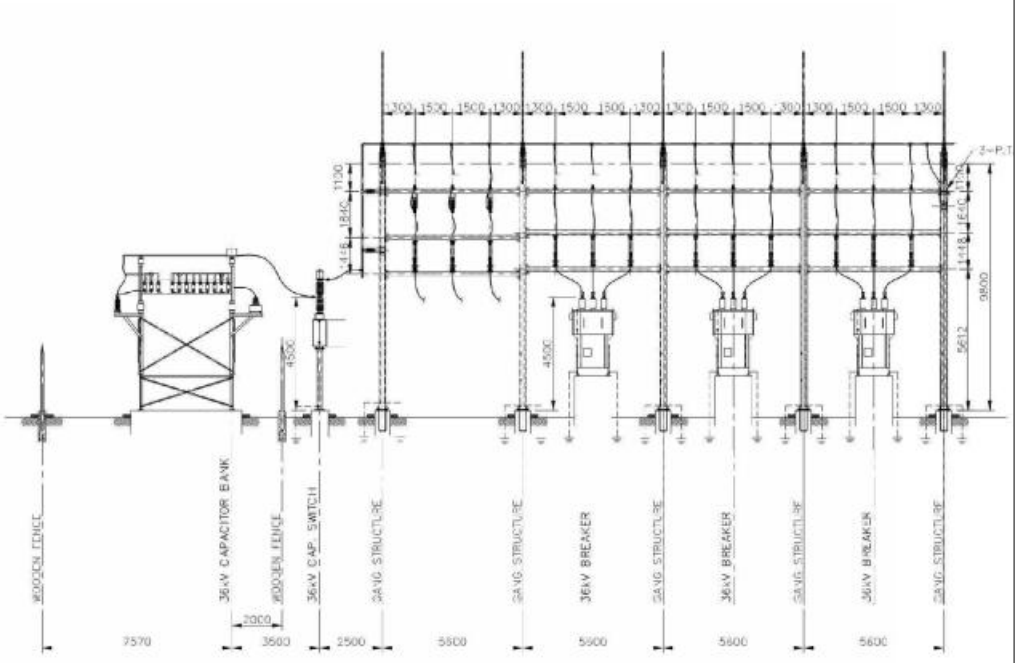

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Client

NORTHLAND POWER INC.
30 ST. CLAIR AVENUE WEST, 12TH FLOOR
TORONTO, ON
M4A 3A1

NEEGAN BURNSIDE

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Drawing Title

CONCEPTUAL TRANSFORMER SUBSTATION - SECTIONS B AND C

Drawn By	Checked By	Drawing No.
OTHERS	NORTHLAND	B8
Scale	Project No.	
N.T.S.	PIA019991	

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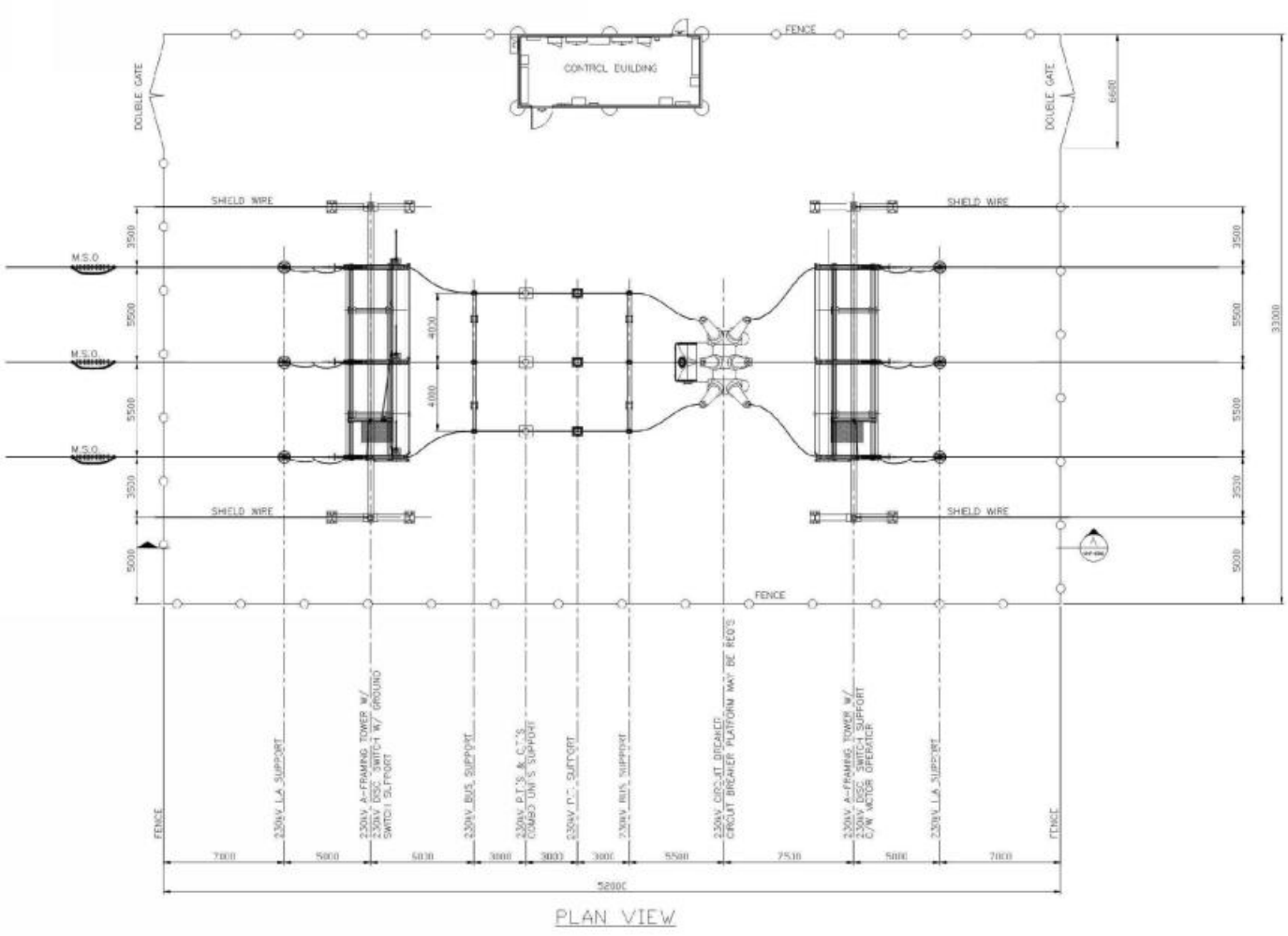

PLAN VIEW

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Drawing Title

CONCEPTUAL SWITCHYARD - LAYOUT

Drawn By	Checked By	Drawing No.
OTHERS	NORTHLAND	B9
Scale: N.T.S.	Project No.: PIA019991	

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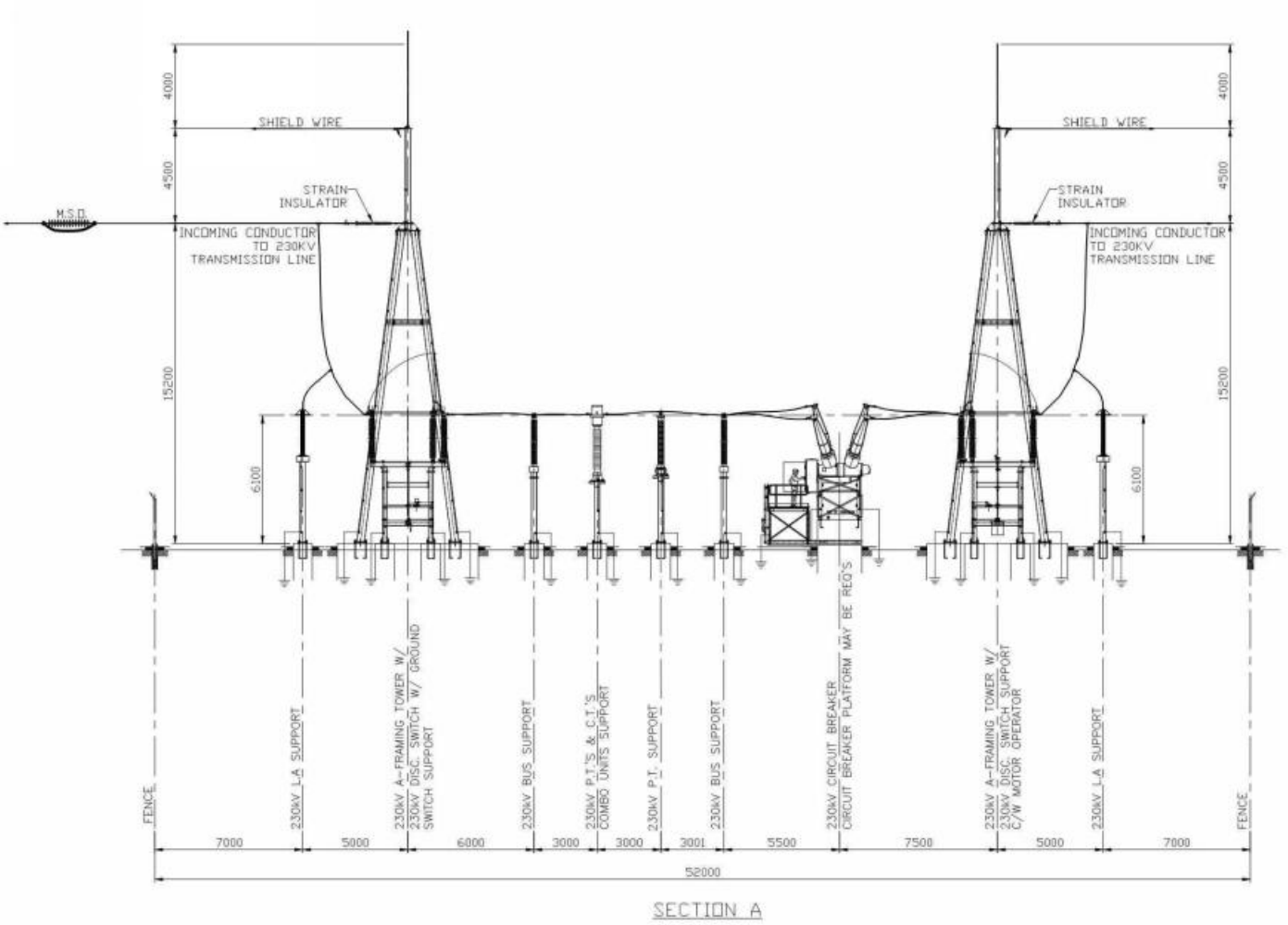

SECTION A

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Drawing Title

CONCEPTUAL SWITCHYARD - SECTION A

Drawn By	Checked By	Drawing No.
OTHERS	NORTHLAND	B10
Scale: N.T.S.	Project No.: PIA019991	

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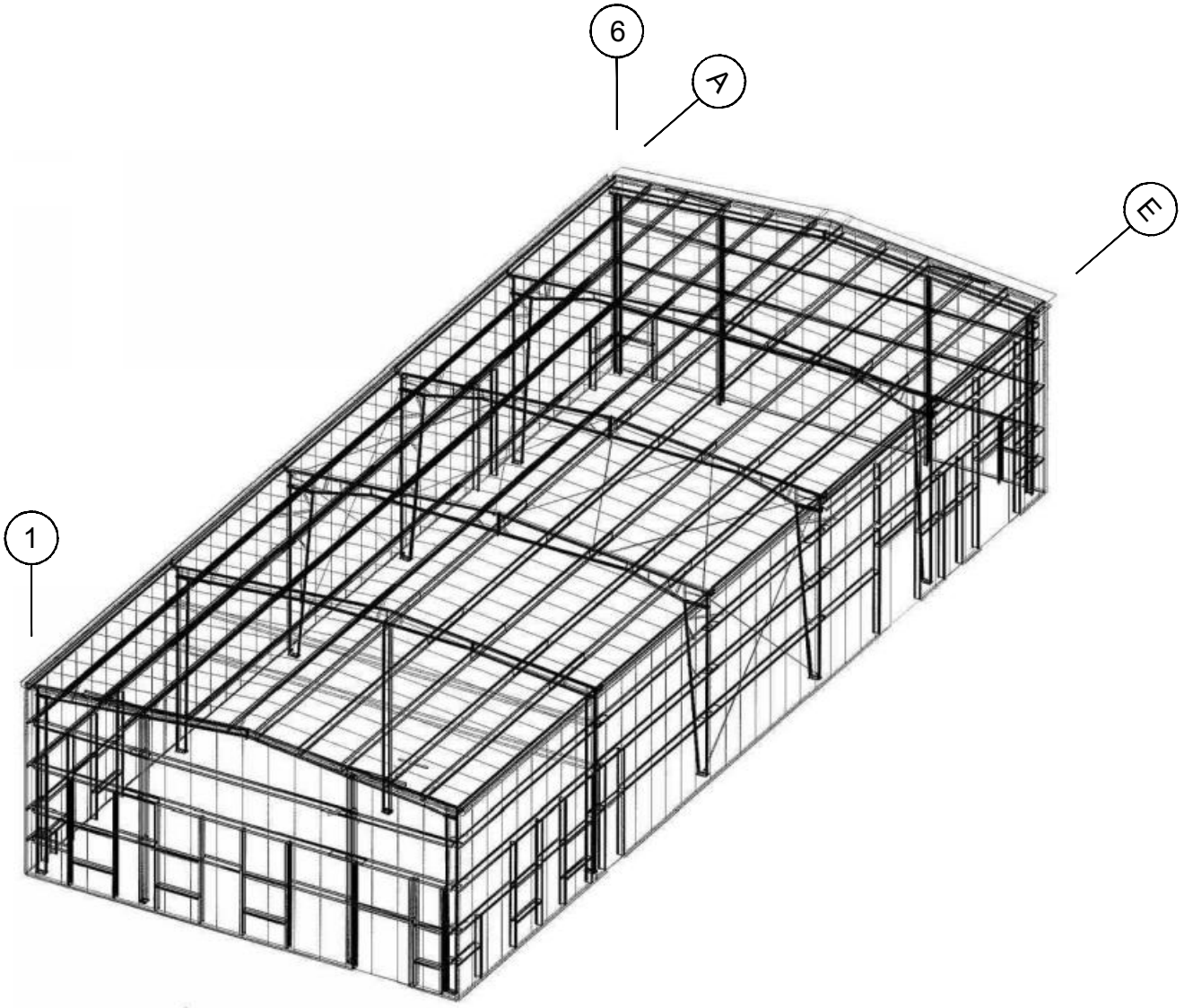

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Drawing Title

CONCEPTUAL PARTS AND STORAGE BUILDING - ISOMETRIC

Drawn By	Checked By	Drawing No.
		B11
Scale: NTS	Project No.: PIA019991	

W:\Northland Grand Bend Wind Farm\Reports\Design and Operations\Report Figures\Individual\019991_FIG_B11-B16.dwg
Date Plotted: Aug 10, 2012 - 12:40pm
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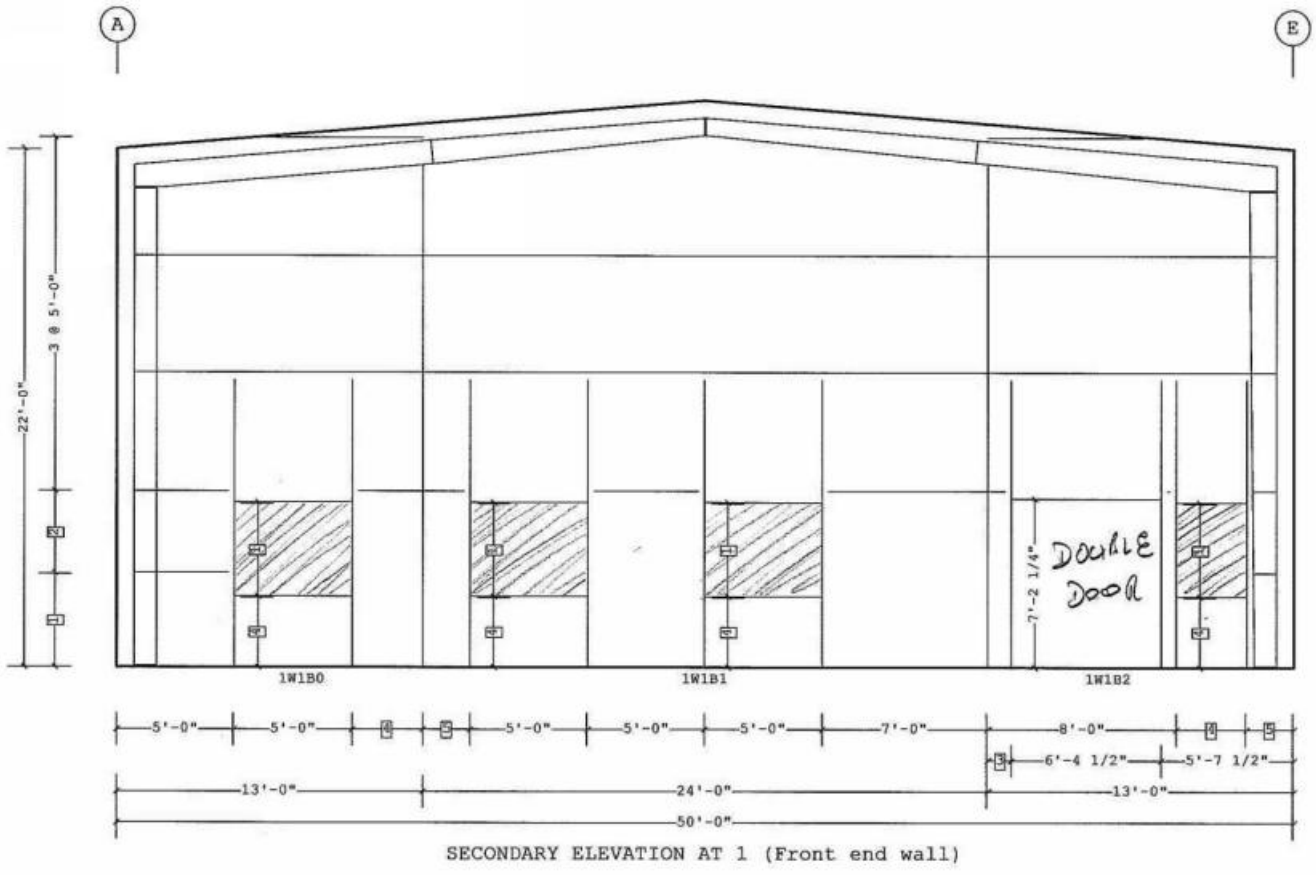

SECONDARY ELEVATION AT 1 (Front end wall)

5 2'-0"
4 3'-0"
3 1'-0"
2 3'-6"
1 4'-0"
Dimension Key

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Drawing Title

CONCEPTUAL PARTS AND STORAGE BUILDING - ELEVATION AT 1

Drawn By	Checked By	Drawing No.
		B12
Scale: NTS	Project No.: PIA019991	

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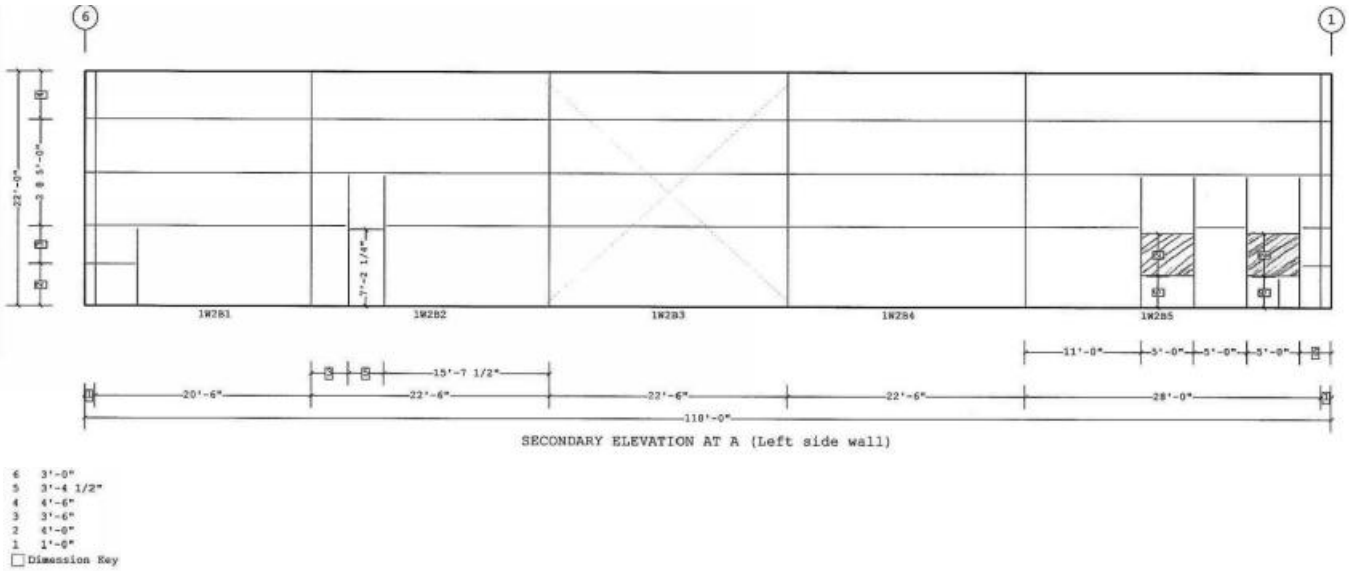

SECONDARY ELEVATION AT A (Left side wall)

6 3'-0"
5 3'-4 1/2"
4 4'-6"
3 3'-6"
2 4'-0"
1 1'-0"
Dimension Key

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Drawing Title

CONCEPTUAL PARTS AND STORAGE BUILDING - ELEVATION AT A

Drawn By	Checked By	Drawing No.
		B13
Scale: NTS	Project No.: PIA019991	

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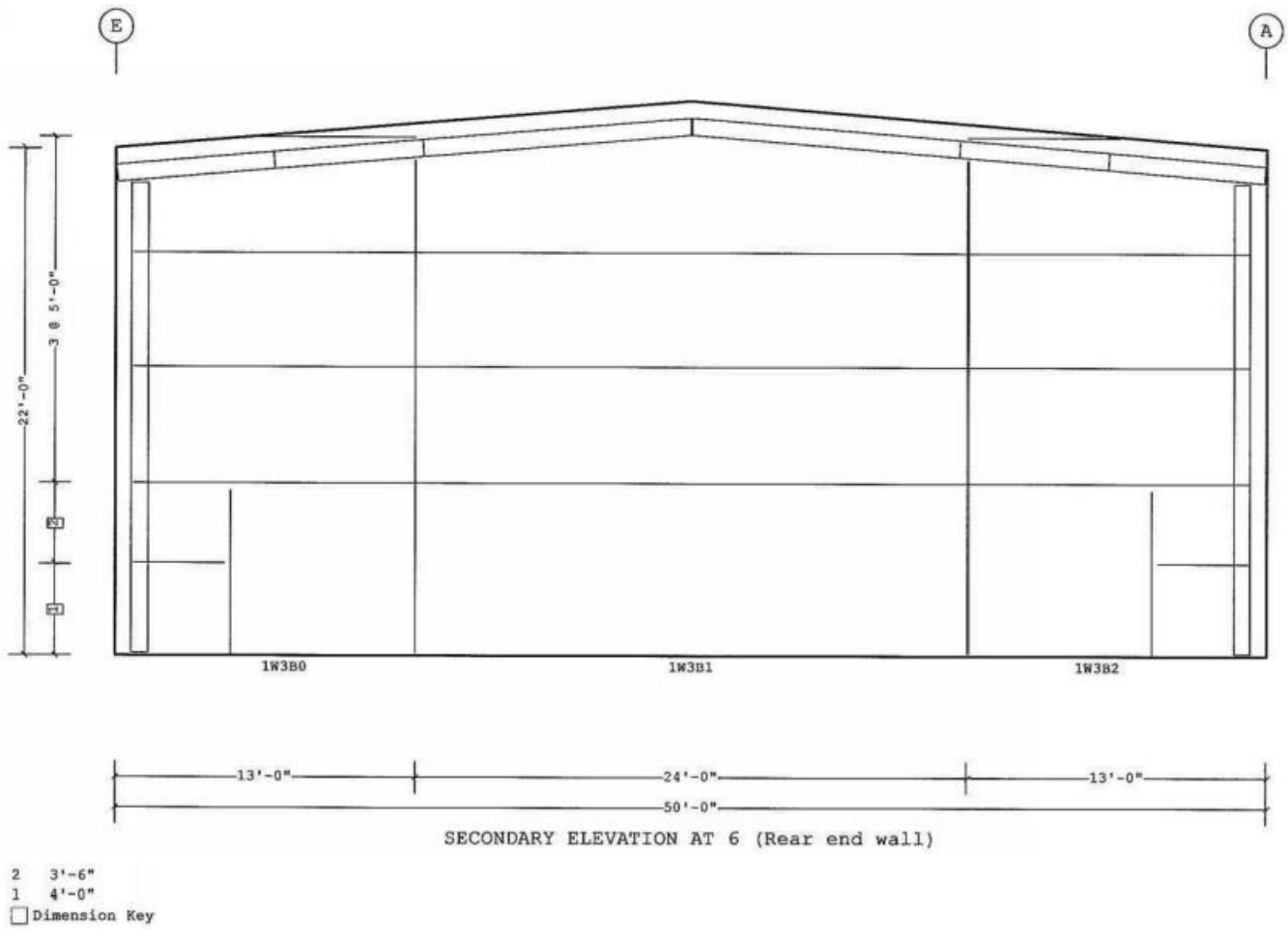

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Drawing Title

CONCEPTUAL PARTS AND STORAGE BUILDING - ELEVATION AT 6

Drawn By	Checked By	Drawing No.
		B14
Scale: NTS	Project No.: PIA019991	

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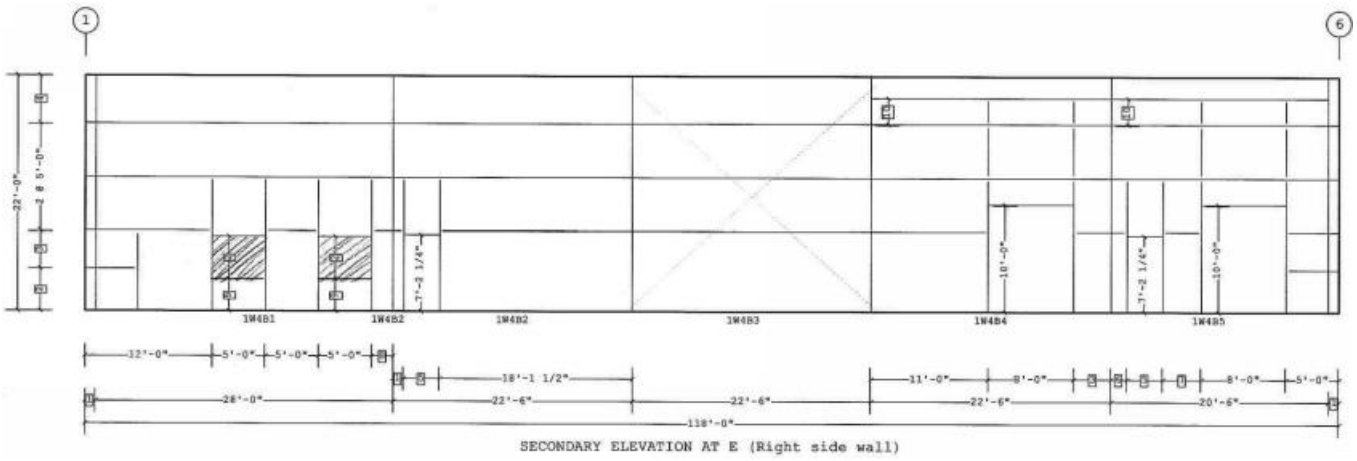

SECONDARY ELEVATION AT E (Right side wall)

10 2'-6"
9 3'-0"
8 2'-0"
7 3'-7 1/2"
6 1'-6"
5 3'-4 1/2"
4 4'-6"
3 3'-6"
2 4'-0"
1 1'-0"
Dimension Key

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Drawing Title

CONCEPTUAL PARTS AND STORAGE BUILDING - ELEVATION AT E

Drawn By	Checked By	Drawing No.
		B15
Scale: NTS	Project No.: PIA019991	

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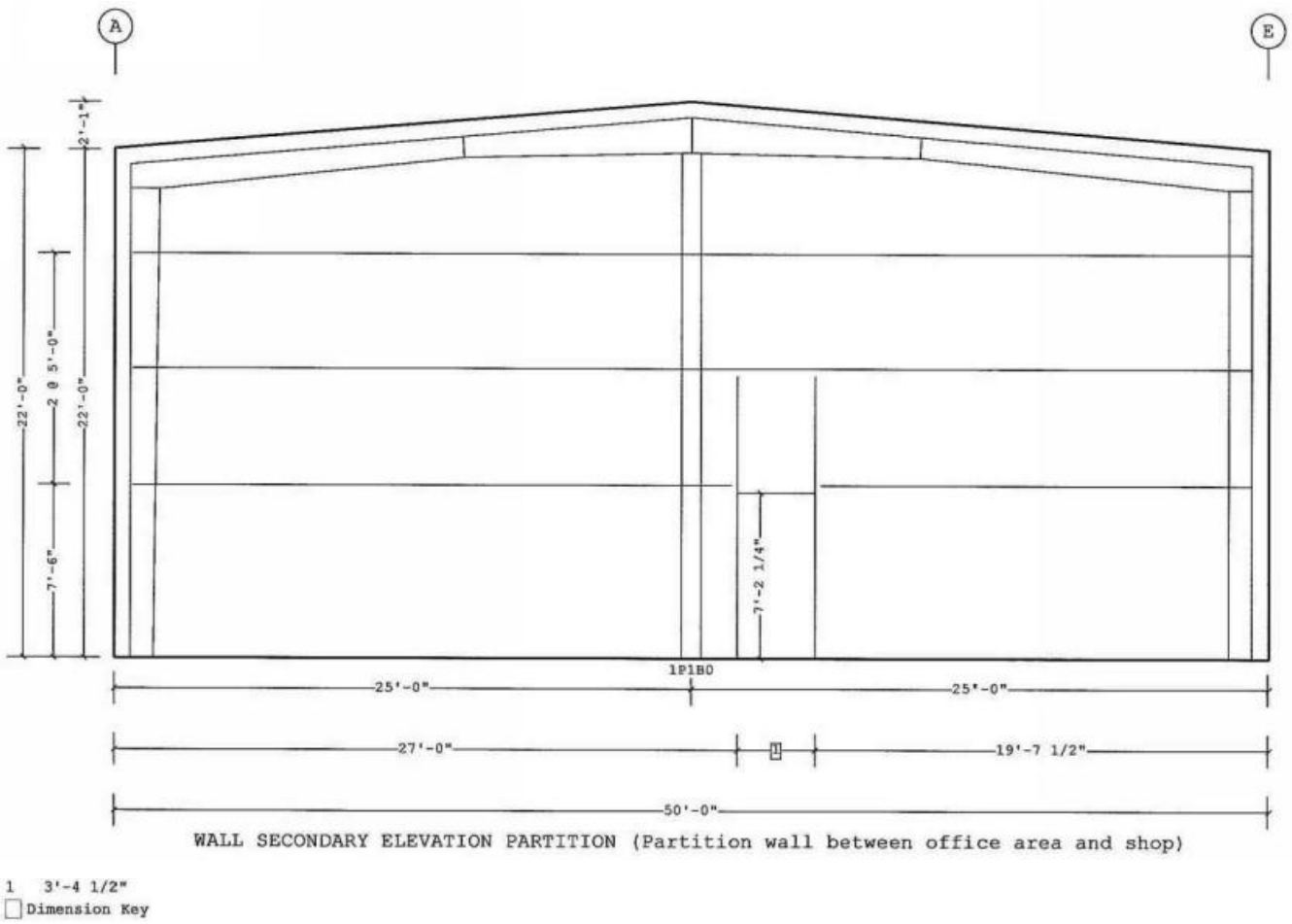

WALL SECONDARY ELEVATION PARTITION (Partition wall between office area and shop)

1 3'-4 1/2"
Dimension Key

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Drawing Title

CONCEPTUAL PARTS AND STORAGE BUILDING - PARTITION ELEVATION

Drawn By	Checked By	Drawing No.
		B16
Scale: NTS	Project No.: PIA019991	

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Appendix C
Water Taking Calculations

Dewatering Calculations
Grand Bend Wind Farm

Groundwater Inflow Rate Calculations - see notes section below for explanation of scenarios

*Using Q = (((Kx(H^2 - h^2))/2L)*n

where
Q = inflow rate m3/s
K = hydraulic conductivity m/s
x = length of trench (m)
H = saturated thickness before dewatering (m)
h = saturated thickness after dewatering (m)
L = distance to line source (m)
n = number of sides of excavation

Scenarios for TILL

Input	1	2	3	4	5	6	7
K	1.00E-08	1.00E-08	1.00E-08	1.00E-08	1.00E-08	1.00E-08	1.00E-08
H	3	3	3	25	25	50	50
h	0	0	0	22	22	47	47
x	19	19	19	19	19	19	19
n	4	4	4	4	4	4	4
L	200	50	10	10	50	10	50
Output							
Q m3/s	1.71E-08	6.84E-08	3.42E-07	5.36E-06	1.07E-06	1.11E-05	2.21E-06
Q l/day	1	6	30	463	93	955	191

Scenarios for SAND/ALLUVIAL

Input	1	2	3	4	5	6	7
K	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
H	3	3	3	3	10	10	13
h	0	0	0	0	7	7	10
x	19	19	19	19	19	19	19
n	4	4	4	4	4	4	4
L	200	100	50	30	100	50	50
Output							
Q m3/s	1.71E-05	3.42E-05	6.84E-05	1.14E-04	1.94E-04	3.88E-04	5.24E-04
Q l/day	1,477	2,955	5,910	9,850	16,744	33,489	45,308

note: assumes steady state conditions, initial pumping rate will be higher

*"Construction Dewatering and Groundwater Control", Third Edition, 2007, Powers et al.

NOTES

Assumptions
The L value in the calculations represents distance to line source from the excavation. The line source in this scenario is most likely a stream. It is assumed that the L value realistically will not be less than 50 m, but other values are shown for comparison purposes. In all calculations the excavation is assumed to be a square with sides of 19m excavated to a depth of 3m.

Scenarios for TILL
Scenarios 1 - 3 for TILL show pumping rate calculations using L values of 200, 50 and 10m and a saturated layer extending from surface to a depth of 3m. Scenarios 4 through 7 show calculations assuming saturated layers to depths of 25m and 50m using L values of 10m and 50m. In all till scenarios the pumping requirements are well below PTTW.

Scenarios for SAND/ALLUVIAL
Higher pumping rates will be required in those areas where coarser grained material such as sand is excavated (due to higher hydraulic conductivity value). Scenarios 1 through 4 show pumping rate calculations for a saturated layer to 3m depth and L values of 200, 100, 50 and 30m. Scenarios 5 to 7 show calculations assuming a saturated layer to depths of 10 and 13m with L values of 100 and 50m.

The pumping rate shown in Scenario 7 is near the 50,000 l/day which is the PTTW threshold. In this case we have assumed a saturated sand layer to 13 m depth with a line source 50m away. Although sand is likely to be found at some of the WTG sites, our desktop study indicates that it is typically < 3 m thick and is unlikely to be saturated to surface. Therefore there is a low probability that these conditions will be encountered during excavation work.