Natural Heritage Assessment

Environmental Impact Study

Report

Belleville TS Demorestville

Solar Energy Project

prepared for

AxioPower Canada Inc.

DRAFT

ECOLOGICAL SERVICES

Report Author Signature

Date
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1.0 INTRODUCTION

Axio Power Canada Inc. (Axio Power) is proposing to develop a 10 megawatt solar photovoltaic project titled Belleville TS Demorestville Solar Energy Project. The Project Location[1] is a 36 hectare (ha) parcel situated on Part of Lots 51 and 52, Concession 1, Sophiasburgh Township, within the County of Prince Edward (single tier municipality) and within Picton Ecodistrict 6E-15. The longitude and latitude are 44° 04' 30.86" and 77° 16' 15.71".

As stated in sections 37 and 38 of Ontario Regulation (O. Reg.) 359/09 *Renewable Energy Approvals Under Part V.0.1 of the Act*, (herein referred to as the "REA Regulation"), an environmental impact study is required for all significant natural heritage features determined to be within a specified distance of the Project Location[1]. The environmental impact study identifies the potential negative environmental effects of all Project phases on these significant natural features, documents the proposed mitigation measures to prevent/minimize adverse effects, and describes the environmental effects monitoring plan

1.1 Renewable Energy Approval Legislative Requirements

Ontario Regulation (O. Reg.) 359/09 – *Renewable Energy Approvals Under Part V.0.1 of the Act*, (herein referred to as the REA Regulation), came into force on September 24, 2009 and identifies the Renewable Energy Approval (REA) requirements for renewable energy generation facilities in Ontario. The REA Regulation has since been amended by O. Reg. 521/10, which came in effect as of January 1, 2011.

As per the REA Regulation (Part II, Section 4), ground mounted solar facilities with a name plate capacity greater than (>) 10 kilowatts (kW) are classified as Class 3 solar facilities and require an REA.

The REA process requires the preparation of several reports with respect to natural heritage features on and adjacent to the Project Location, including the natural heritage records review report (*NHARR*), natural heritage site investigation report (*SI*), natural heritage evaluation of significance report (*EOS*), and if necessary, an environmental impact study (*EIS*). The legislative requirements for these reports are summarized in the following sections.

1.1.1 Natural Heritage Records Review Report

Subsection 25 (3) of the REA Regulation requires the proponent to prepare a report "setting out a summary of the records searched and the results of the analysis" (O. Reg. 359/09) and to identify whether the Project is:

(a) in a natural feature

(b) within 50 m of an area of natural and scientific interest (ANSI) (earth science)

(c) within 120 m of a natural feature that is not an ANSI (earth science).

Natural features are defined in Section 1 (1) of the REA Regulation to be all or part of:

a) an ANSI (earth science)

b) an ANSI (life science)

c) a coastal wetland

d) a northern wetland

e) a southern wetland

f) a valleyland

g) wildlife habitat, or

h) a woodland.

The *NHARR* (Hatch Ltd., 2011a) was prepared to meet these requirements.

1.1.2 Natural Heritage Site Investigation Report

Section 26 of the REA Regulation requires proponents of Class 3 solar projects to undertake a natural heritage site investigation for the purpose of determining:

a) whether the results of the analysis summarized in the *NHARR* (Hatch Ltd., 2011a) prepared under subsection 25 (3) are correct or require correction, and identifying any required corrections

b) whether any additional natural features exist, other than those that were identified in the *NHARR* (Hatch Ltd., 2011a)

c) the boundaries of any natural feature that was identified in the *NHARR* (Hatch Ltd., 2011a) or the *SI* (Ecological Services 2011a) within 120 m of the Project Location, and

d) the distance from the Project Location to the boundaries determined under Clause (c).

The *SI* (Ecological Services, 2011a) was prepared to meet these requirements.

1.1.3 Natural Heritage Evaluation of Significance Report

Subsection 27 (1) of the REA Regulation requires proponents of Class 3 solar projects to prepare an *EOS* for natural features identified during the *NHARR* (Hatch Ltd., 2011a) and *SI* (Ecological Services, 2011) that sets out:

a) a determination of whether the natural feature is:

- provincially significant or not provincially significant (wetlands)
- significant or not significant (all other natural features)

b) a summary of the evaluation criteria or procedures used to make the determinations.

c) the name and qualifications of any person who applied the evaluation criteria or procedures.

The *EOS* (Ecological Services 2011b) for the natural features identified within 120 m of the Project Location was prepared to meet these requirements.

1.1.4 Environmental Impact Study Report

Subsection 38 (1) of the REA Regulation prohibits the construction, installation or expansion of any component of a solar Project is:

a) within a provincially significant northern wetland or within 120 m of a provincially significant northern wetland

b) within 120 m of a provincially significant southern wetland

c) within 120 m of a provincially significant coastal wetland

d) a provincially significant ANSI (earth science) or within 50 m of a provincially significant ANSI (earth science)

e) a provincially significant ANSI (life science) or within 120 m of a provincially significant ANSI (life science)

f) a significant valleyland or within 120 m of a significant valleyland

g) a significant woodland or within 120 m of a significant woodland

h) a significant wildlife habitat or within 120 m of a significant wildlife habitat

i) within 120 m of a provincial park

j) within 120 m of a conservation reserve.

However, pursuant to subsection 38 (2), construction within the locations noted above may be permitted, subject to the completion of an *EIS* to assess negative effects and evaluate appropriate mitigation and monitoring measures.

Subsection 38 (2) of the REA Regulation indicates that the *EIS* must:

a) identify and assess any negative environmental effects of the Project on a natural feature, provincial park or conservation reserve referred to in subsection 38 (1)

b) identify mitigation measures in respect of any negative environmental effects

c) describe how the environmental effects monitoring plan in the design and operations report (Hatch Ltd., 2011c) addresses any negative environmental effects

d) describe how the Construction Plan Report (Hatch Ltd., 2011b) addresses any negative environmental effects.

This ***EIS*** has been prepared to address these requirements for construction within 120 m of the significant natural features identified in Section 1.1.

1.2 Background Information on Natural Heritage Features

The *NHARR* (Hatch Ltd., 2010a) and *SI* (Ecological Services, 2011a) confirmed the Project will be constructed within 120 m of significant natural heritage features identified in the *EOS* (Ecological Services, 2011b).

The natural heritage features classified as significant include:

- **Significant Woodlands** – 4.5 ha of significant woodland (*Woodland 1*) extends east of the Project Location within 120 m adjacent lands. The presence of this woodland was confirmed during the ***SI*** (Ecological Services 2011a), and evaluated as significant in the ***EOS*** (Ecological Services 2011b).
- **Significant Wildlife Habitat** – The following wildlife habitat type occurring on and within 120 m of the Project Location has been evaluated as significant:
    - **Habitats of species of conservation concern** – *shrub/early successional bird breeding habitat*

1.3 Environmental Impact Study Format

Section 1 of this report has identified the legislative requirements for an *EIS* under the REA Regulation and identified the reasons why an *EIS* is required for the Project. Section 2 provides the methodology of the *EIS*. Section 3 summarizes the activities associated with Project construction, operation and decommissioning, as described in the Project Description Report (Hatch Ltd., 2010e). Section 4 identifies and assesses negative environmental effects and the proposed mitigation measures to prevent/minimize the potential effects. Section 5 describes the environmental effects monitoring plan from the Design and Operations Report (Hatch Ltd., 2010c). Section 6 describes how the Construction Plan Report (Hatch Ltd., 2010b) addresses the potential negative environmental effects. Section 7 summarizes the results of the *EIS*. References are included in Section 8.

2.0 METHODOLOGY

The following steps outline the methodology that was used to prepare this *EIS*:

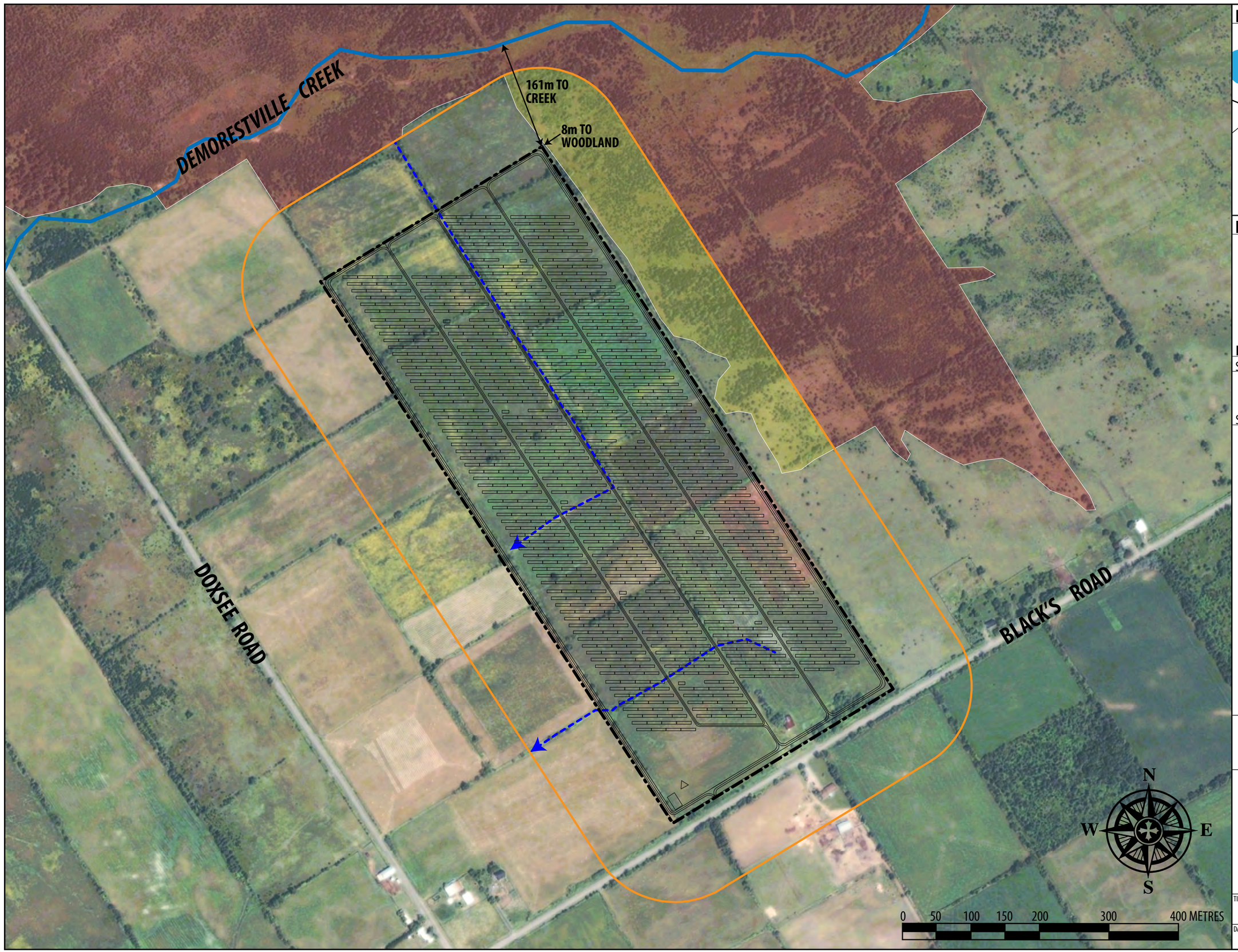
1. Documentation of Project components and activities during all Project phases, including construction, operations and decommissioning, including identification of temporal and spatial boundaries.

2. Background data collection on the natural features on and within 120 m of the Project location through the Records Review and Site Investigation processes.

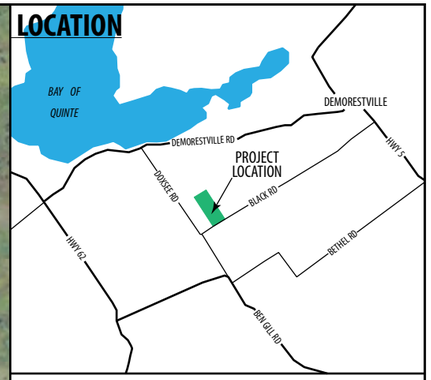
3. Identification of the effects likely to occur to identified environmental components as result of implementing, operating and decommissioning of the project.

4. Development of mitigation measures to eliminate, alleviate or avoid the identified negative effects.

5. Design of an environmental effects monitoring program to confirm the predicted effects and the effectiveness of mitigation measures.



LOCATION



LEGEND

- PROJECT LOCATION
- 120m BUFFER FROM PROJECT LOCATION
- WATERCOURSE
- AGRICULTURAL DRAINS
- SOLAR PROJECT

NATURAL HERITAGE FEATURES

SIGNIFICANT WOODLANDS

- WOODLAND
- LOCAL WOODLANDS

SIGNIFICANT WILDLIFE HABITAT

- SHRUB/EARLY SUCCESSIONAL BIRD BREEDING HABITAT

FIGURE 2.1

axiopower

Ecological Services

McINTOSH PERRY Consulting Engineers Ltd.

TITLE		
BELLEVILLE TS DEMORESTVILLE NATURAL HERITAGE FEATURES		
DATE	PROJECT No.	FIGURE
JULY 6, 2011	KP-11-626	

3.0 PROJECT COMPONENTS AND ACTIVITIES

The following sections briefly describe the construction, operation and decommissioning phases of the Project. The information is taken from the Construction Plan Report (Hatch, 2011b), Design and Operations Report (Hatch 2011c) and the Decommissioning Plan Report (Hatch, 2011d).

3.1 Construction

Information presented below is a reproduction from Section 2.1 of the Construction Plan Report (Hatch Ltd., 2010b).

3.1.1 Site Plan and Project Drawings

Figure 2.1 provides a conceptualized depiction of the site plan and the proposed Project facilities that are discussed throughout this report. Figure 2.1 also identifies the Project's property boundary, the Project Location, existing local roads, land uses, cultural and natural features and waterbodies on and within 120 m of the Project Location. In addition, Figure 2.1 depicts the proposed facility components including the construction staging/ laydown area, access roads, solar PV module arrays, inverters, the substation yard, and the proposed connecting distribution line. Setback distances from identified significant natural heritage features and waterbodies are also shown.

More detailed drawings of the site plan and the proposed Project facilities have been prepared as part of this REA application. The drawings are provided in Appendix B and listed in Table 3.1

Table 3.1 Project Drawing List

Drawing	Title	Information Depicted
G-001	Title Sheet	Project Location including existing land uses and roads.
ES-101	Existing Site Plan	Existing features including: topographic contours, Project Location boundaries, utilities, easements, roads, etc.
ES-102	Array Plan	Proposed facilities including: solar PV module layout, inverter locations, substation yard, construction laydown areas, site entrances, communications tower, interior roads, and perimeter fence.
EP-801	Single Line Diagram	Electrical wiring schematic.
S-101	Racking and Anchor Details	Solar PV module racking details, array spacing, foundation support and road subgrade construction details.
S-102	Racking and Anchor Options	Optional helical screw foundation support details.

3.1.2 Construction Schedule

The construction process of the Project consists of four phases:

- Phase 1 – Site Preparation
- Phase 2 – Construction and Installation
- Phase 3 – Testing and Commissioning
- Phase 4 – Site Restoration

Table 3.2 lists the timeline and duration of the main construction activities.

The site preparation activities, including vegetation removal, are anticipated to occur within a January 2012 to March 2012 window. If vegetation removal cannot be completed within this time frame, removal activities will cease and resume in August following the breeding season for most species of conservation concern. Other site activities may continue on lands that are clear, or have been cleared.

The Project is expected to achieve commercial operations the beginning of October 2012. Depending upon when the notice to proceed is obtain from the OPA, Axio may pursue winter construction which would result in an earlier 'in service' date. It is anticipated that the operation of the Project (Project life) will be at least 20 years.

Table 3.2 Project Timeline

Construction Phase and Activity	Approximate Timeline (2011-2012)	Duration
Site Preparation		
Vegetation Removal and Site Clearing	January 1 – January 31, 2012	30 days
Security Lighting & Entrance Fencing	March 1 – March 30, 2012	30 days
Laydown Area & Temporary Facilities	March 15 – March 30, 2012	15 days
Construction and Installation		
Foundation Construction	April 1 – May 15, 2012	45 days
Structural Support Installation	May 1 – June 15, 2012	45 days
Solar PV Modules Installation	June 15 – August 15, 2012	60 days
Electrical Collection System	August 1 – September 30, 2012	60 days
Testing and Commissioning		
Testing and Commissioning	September 1 – September 30, 2012	30 days
Site Restoration		
Landscaping and Vegetation	September 1 – September 30, 2012	30 days
In Service and Operating	October 10, 2012	

3.1.3 Construction Methodology

3.1.3.1 Safety Management

Safety is a primary objective for the Project. The goal is to maintain a safe working environment for workers and the public at all times. The Project will comply with all applicable Ontario Occupational Health and Safety Act (OHSA) requirements during the construction period.

The Contractor will prepare a site-specific health and safety plan and a safety and compliance officer will be assigned to the Project to implement and strictly enforce the plan. The Contractor will provide construction method statements and related Job Safety Assessments (JSA) for review by the Owner's Construction Manager, prior to commencement of work.

3.1.3.2 Workforce

The Project will employ a workforce recruited locally, to the greatest extent possible. The workforce will include construction supervision, general and skilled labour, equipment operators, technicians for electrical systems and commissioning, plant installation and operation, security and general maintenance. The construction workforce is estimated to be 50 workers on average for the 6-month construction period, with a peak of about 60 workers.

Construction hours will normally be from 7:00 am to 6:00 pm, Monday through Friday, in accordance with local municipal by-laws. Occasionally, the work may have to be continued after dusk and on weekends; however it will follow the local municipal requirements and minimize impacts to the local community.

3.1.3.3 Vehicle Access

The Project is situated on the north side of Black's Road and will be accessed via local municipal roads that include Doxsee Road about 600 m west of the Project Location and County Road 14 about 1.5 km north of the Project Location.

3.1.3.4 Temporary Facilities

Part of the Project Location will be used as a construction staging /laydown area (Figure 2.1). The staging area will include construction offices, a first aid station, worker parking, truck loading and unloading facilities, and waste disposal/pick-up area. Temporary construction trailers and portable facilities will be used for the offices and the first aid station. Temporary toilets and washing stations will be maintained to meet the daily sanitary needs of the workforce during the construction. The staging area will be decommissioned and removed when construction is completed.

3.1.3.5 Construction Materials

Table 3.3 lists the principal construction materials and estimated quantities that will be transported to the Project Location for construction and installation. In addition, estimates of the number of vehicle loads required and where the material will be used and/or temporarily stored is provided.

Table 3.1 Construction Materials

Construction Material	Delivery Vehicle	No. of Vehicle Loads	Usage	On-site Storage	[1]Quantity
Solar PV Modules	Semi-Trailer	189	Solar photovoltaic modules	Laydown Area	45,320
Solar PV Module Racks	Semi-Trailer	30	Racking supports for PV modules	Laydown Area	1,030
Steel Support Piles	Semi-Trailer	15	Foundation supports for PV modules racks	Laydown Area	5,150
Inverters, Transformers and Enclosures	Semi-Trailer	15	Electricity inversion and voltage transformation and equipment weather protection	No	10
DC and AC Cables, and Conduits	Semi-Trailer	192	Electrical cabling and conduits	Laydown Area	736,000 m
DC Disconnects, Combiner Boxes and Connectors	Semi-Trailer	2	Electrical disconnect switches, wire combining and cabling connections	Laydown Area	Misc.
Concrete	Semi-Trailer	11	Precast foundations for inverter building enclosures (including transformers) and switchgear pad (including underground vault)	No	250 m^3
Granular A and B	Dump Trucks	606	Access roads, laydown area and substation yard	No	10,000 m^3
Topsoil (if required)	Dump Trucks	5	Site restoration of disturbed areas (assumed allowance)	No	60 m^3
	Total	**1,065**	[1]Quantities estimated by Blue Oak Engineering Canada.		

3.1.3.6 Construction Equipment

Table 3.4 lists the mechanized vehicles and equipment that are expected to be used in the construction of the Project. The operation of this equipment has the potential to generate noise and air emissions (exhaust) as well as potential dust emissions resulting from earth excavation, site grading and vehicles travelling on temporary construction roads. These activities are not expected to result in significant negative effects to air quality, nearby noise receptors or wildlife.

Construction vehicles and some types of mechanical equipment use a variety of petroleum based or synthetic chemicals including: fuel (diesel and gasoline) for engine combustion; lubricants (motor oils) for engine cooling and lubrication of mechanical parts; hydraulic fluids (mineral oil) for hydraulic systems such as brakes, power steering, backhoes and excavators; and, coolants (methanol, glycol blends) used in vehicle radiators and windshield antifreeze. The potential effects of accidental spills or leakage of these fluids, along with mitigation measures to prevent and/or clean-up spills are discussed in the *Construction Plan Report*.

Construction equipment will be transported to and from the Project Location using public roads. Tracked vehicles such as bulldozers, excavators and large pieces of electrical equipment (e.g. inverters, transformers, building enclosures) will be transported on flatbed trailers. Wheeled vehicles such as dump trucks, concrete mixers and tractor trailers will be driven directly to and from the site.

Table 3.4 Construction Equipment

Equipment	Power & Weight	Usage	No.
Track-Type Tractor (D8)	179 kW 37.6 T	Land Clearing and Grubbing; Spreading granular material for access road	2
Wheel Tractor-Scraper (615C)	198 kW 25.6 T	Excavating and moving topsoil	1
Hydraulic Excavator (325B)	125 kW 25.9 T	Excavating topsoil and placing backfill	1-2
Backhoe Loader (446B)	82 kW 8.9 T	Excavating topsoil and placing backfill	1
Wheel Loader (966F)	164 kW 20.5 T	Moving soil and granular material	1
Dump Truck (D25D)	194 kW 19.5 T	Transport and placement of granular for access road.	2-4
Motor Grader (14H)	160 kW 18.8 T	Grading of access road during construction (as necessary)	1
Drum Vibratory Compactor (CS-563C)	108 kW 10.9 T	Granular compaction for access road	1-2
Crawler Crane (LS-118)	267 kW 49.9 T	Pile driving or installation of screw piles	1
Pile Driving Equipment (B-6505 HD)	300 kJ 19.5 T	Mounted on the crawler crane, used for driving piles	4
Rough Terrain Crane (RT500C)	90 kW 23.4 T	Unloading and moving material and equipment	1
Telescopic Handler (TH83)	81 kW 10.0 T	Unloading and moving material and equipment	1-2
Concrete Transit Mixers (6-8 m^3 Capacity)	250 kW Loaded: 20-25 T	Transportation and placement of concrete mix for foundations	1-4
Container Box and Flatbed Semi-Trailers (12 - 17 m long)	Empty: 7-16 T Loaded: 40-70 T	Transportation of tracked machines (bulldozers, excavators), large electric equipment (inverters, transformers, building enclosures) and materials (precast concrete pads, solar PV modules and support racks)	1-2
Pick-up Trucks (F150 Super Crew)	300 hp 2.6 T	General transportation of small equipment, materials, and personnel	5
Diesel Generators, Air Compressors	175 kW	Power supply for electrical equipment (hand tools, etc)	3
Hand Tools - drills, saws, wrenches, concrete vibrators, welders		General construction and assembly activities	15+

3.1.3.7 Fencing, Security Gate and Lighting

The perimeter of the Project Location will be fenced and the Project entrance from Black's Road will be gated with additional security measures installed as required. The fence will be galvanized steel chain link about 2.7 m high with barbed wire on top of the fence. Fence posts will typically be spaced every ±2.5 m. During construction, the site will be monitored by the supervising construction staff. In addition, 24-hr on-site security will be utilized. For security, safety and maintenance purposes, task-specific lights will be installed in the Project Location during construction. A set of lights will be installed near the entrance to the facility. Additional motion sensor security lighting may be installed.

3.1.3.8 Fire Control Plan

The Project is very unlikely to be a source of fire, or a contributor to the spreading of an existing fire. However, there are some rare potential fire hazards due to electrical faults at the PV modules and ancillary equipment. The Contractor will prepare a fire control plan for the construction activities. This will include establishing procedures for specific types of possible fires, training staff accordingly, and keeping fire protection equipment on-site.

3.1.3.9 Drainage

The Project does not propose any major alteration to the existing surface drainage patterns for construction. Currently, the Project Location is using undeveloped land that is predominately covered by woodland vegetation. The majority of the site drains westward via drainage channels towards Doxsee Road (Figure 2.1). The Water Body Site Investigation Report (Ecological Services, 2011a) indicates that there are no waterbodies on or within 120 m of the Project Location. The nearest watercourse is Demorestville Creek (seasonal) located about 130 m north of the Project Location and a series of farm drainage channels that cross the farm fields within the Project Location. These watercourse features are under the jurisdiction of Quinte Conservation.

3.1.3.10 Landscaping and Vegetation

The Project proposes the removal of woody vegetation from the landscape within the Project Location for construction purposes. Woody vegetation within a 50 m swath of woodland to the west of the solar array, but within project lands, will be managed for height in order to reduce shading on the solar arrays. After installation of the Project facility components, all disturbed areas, with the exception of roads and drains, will be covered with suitable, locally grown, low maintenance vegetation. This will aid in the prevention of soil erosion and the invasion of non-native plant species as well as present a natural appearance. Any temporary access roads built for construction purposes will be cleared, tilled, levelled and covered with vegetation.

3.1.3.11 Power and Communication

During construction, any electricity required for using heavy equipment such as welders and pumps will be provided from portable diesel generators supplied by the Contractor. A supply of electricity needed for construction offices, security lighting and other purposes will be obtained from the local electricity utility. Cellular phones and wireless connections will be used as means for communication, and therefore, telephone or internet cable line installation will not be necessary.

3.1.3.12 Water Usage

The Project will not require any surface water withdrawals or result in the installation of groundwater wells to supply water for construction. In order to meet the water demand during construction, the Contractor will have a temporary water storage facility on-site and bring the water from off-site sources using a tanker truck. The water will be used for construction, sanitary and dust control purposes.

3.1.3.13 Housekeeping and Waste Management

Construction wastes such as broken PV modules, electric wires, wood, scrap metal and material packaging as well domestic waste such as food and sanitary waste will be managed and disposed of in accordance with local, provincial, and federal regulations during the construction. All waste material will be sorted and temporarily stored on-site in defined areas and within proper bins or containers as appropriate. The recyclable wastes will be returned safely to the recycle-centre for further processing and reuse. Sanitary facilities on-site will include portable self-contained toilets provided and maintained by the Contractor.

3.1.4 Construction Phase 1 - Site Preparation

Site preparation refers to all necessary activities prior to the construction of foundations, substation, and installation of the PV modules. It includes surveying/staking, installation of erosion and sediment controls, site clearing and grubbing, surface grading, construction of access roads and drainage systems,

installation of security gate and fencing, and construction of a staging area.

3.1.4.1 Site Survey and Staking

A registered Ontario land surveyor will provide a site survey, and will stake the exact location of the site perimeter for fencing, access road layout, and all foundations and substation. As part of this work, any buried utilities, infrastructure and their associated easements as well as any designated environmental features (e.g. waterbodies, woodlands, etc.) and their associated setbacks will be demarcated and protected by means of staking, flagging, fencing and signage to prevent any intrusion into these areas by construction vehicles.

3.1.4.2 Sediment and Erosion Controls

Prior to any vegetation removal, clearing and/or grading activities, sediment and erosion control measures (e.g., silt fence barriers, rock flow check dams, etc.) will be installed where required throughout the site. Additional measures will be installed as required for specific Phase 2 construction activities, discussed in Section 3.1.5. All sediment and erosion control measures will remain in place throughout the construction period and will be routinely inspected and maintained by the Contractor.

3.1.4.3 Construction Staging / Laydown Area

Part of the Project Location will be graded and fenced for security and used as construction staging/laydown areas as shown on Figure 2.1. The laydown area will include construction offices, washrooms, first aid station, worker parking, construction equipment, material laydown and storage shed, truck unloading/loading area, and a waste disposal/pick-up area. Modular trailers will be used for the construction offices, washrooms and first aid station. Washrooms (portable toilets) will be maintained daily during construction.

Establishment of the laydown area will involve the removal of vegetation and the stripping and stockpiling of topsoil. A layer of granular material (possibly underlain by geogrid and/or geotextile) will be installed to provide an adequate road base for construction vehicles, heavy equipment and material laydown. The laydown area will be decommissioned and all temporary facilities removed when construction is completed, although portions of the area may be retained to provide vehicle parking for maintenance personnel and equipment storage.

3.1.4.4 Tree-Cutting and Vegetation Removal

To construct the Project, minor tree and vegetation removal will be required across the Project Location, mainly along vegetated hedgerows which include maple, oak, and ash. Timing constraints for these activities are provided in Table 3.2.

Tree cutting would be conducted using chainsaws. Stumps, roots and brush vegetation removed using an excavator or small bulldozer. During the clearing activities, merchantable timber, non-merchantable timber (e.g. firewood) and other cleared vegetation will be temporarily stockpiled adjacent to the access road(s). This material would be loaded on trucks and taken away by the buyer (i.e., merchantable timber), chipped for off-site composting or disposal, or used on-site as biodegradable erosion protection matting for exposed soil areas.

The Project will obtain all relevant tree-cutting permits as may be required by municipal by-laws passed under the Forestry Act (upper tier municipality) and/or the Municipal Act (lower tier municipality) as well as any other approvals that may be required by the Ministry of Natural Resources (MNR).

3.1.4.5 Excavations, Fill Placement and Surface Grading

The Project does not propose any major excavation works, fill placement or significant alteration of the existing landscape. The primary excavation work will be limited to soil removal for building foundation construction, access road construction and digging of trenches to run electrical cables. The utilization of driven pipe piles to support the solar PV modules does not require soil excavation. No excavations, fill placement or grading activities will take place within 30 m of a watercourse since no watercourses are

present on or within 120 m of the Project Location. Sediment and erosion control measures will be implemented for areas with exposed soils to control soil erosion caused by wind or runoff.

Once completed, foundation excavations and cable trenches will be backfilled and levelled to match the existing grade. Any excess subsoil will be used to infill low lying areas followed by general surface grading, including redistribution of topsoil; overall, the Project is not expected to result in any excess fill material. Following this, the entire Project area, with the exception of new access roads, parking lots and the substation yard will be covered with low maintenance vegetation. Native plant species from local sources will be used if available.

3.1.4.6 Access Roads

A new site access road, about 5 m wide, will be constructed of asphalt from Black's Road into the Project Location to support construction activities and provide vehicle access into the site during the Project's operation (Figure 2.1). In addition, several smaller gravel roads, about 3.7 m wide each, will be constructed to allow transport of equipment and materials into interior areas of the Project Location to facilitate the installation of the foundations, supports and solar modules. Following completion of the construction, the majority of these roads will remain as permanent roads to provide maintenance access during Project operation. Construction access roads that are not required will be removed and the areas restored by replacing the topsoil and seeding the area.

Road construction will involve vegetation clearing (if necessary) and topsoil removal prior to the placement of a granular base. Placement of soil maybe required to fill depressions in low lying areas followed by mechanical compaction to ensure a stable road bed. Geo-grid and geotextile fabric will be used where necessary. The roads will then be constructed with a granular 'B' base and a finished surface of granular 'A' material to a recommended total thickness of 350 mm (GENIVAR, 2011). The use of gravel will reduce water use for dust control during construction.

Culverts will be installed beneath the access roads at locations where conveyance of surface drainage is required. As part of the site drainage plan, parallel side ditches maybe constructed along the access roads to collect and convey runoff. Design of roads, culverts, swales, and ditches will be in accordance with Ontario Provincial Standard Specifications (OPSS) and local municipal engineering guidelines. Sediment and erosion control measures (e.g., silt fence barriers, rock flow check dams) will be installed where required.

3.1.4.7 Surface Drainage

Preliminary site grading plans and a Conceptual Stormwater Management Report (McIntosh Perry, 2011a) have been prepared for the Project. The proposed site drainage is expected to consist of (i) overland runoff (i.e., sheet flow) on grassed and vegetated areas; (ii) existing and constructed shallow triangular shaped grassed swales 0.3 to 0.5 m deep; and (iii) constructed ditches in the form of flat bottomed, trapezoid shaped, grassed swales 0.5 to 1.0 m deep by 0.5 to 1.0 m wide situated along the access roads and if required, around the perimeter of the site to intercept and convey external drainage to maintain riparian drainage conditions.

Construction of surface drainage features (e.g. grassed swales, ditches) would typically involve a small bulldozer to remove topsoil and form the shape of the swale and a hydraulic excavator equipped with a bucket attachment to form the shape of any ditches, followed by hydro-seeding to establish a grassed lining to protect against erosion. Rip rap would be placed at locations in the ditches (e.g. culvert outfalls) to provide additional erosion protection. Overall, major alteration to the existing surface drainage patterns is not expected as part of the Project's construction and operation.

3.1.5 Construction Phase 2 - Construction and Installation

Construction and installation of the facility consists of building foundations, trenches for electrical cabling, structural supports for the solar PV module racks, installation of the solar PV modules on the

racks, and installation of the inverters and transformers and associated electrical equipment. This includes the underground and above ground cabling installations within the Project Location and the overhead electrical distribution line from the Project substation to the local distribution line.

3.1.5.1 Inverter Building and Electrical Equipment Foundations

Support foundations for the inverter buildings, pad-mounted transformers and the substation transformer and switching equipment will be precast or cast-in-place concrete pads. If precast concrete foundations are used they will be transported to the site by truck and unloaded and set into position by crane.

If cast-in-place concrete foundations are used, they will be constructed on-site by means of excavation and removal of in-situ material using a backhoe or excavator, placement of granular material using a front-end loader, formwork construction, installation of reinforcing steel (rebar), installation of electrical grounding grid, and placement of concrete into the forms. Ready-mix concrete will be delivered to the Project Location by transit mixer truck from a local supplier. Foundations will require a minimum of 28 days to cure to allow for concrete to reach its specified compressive strength prior to erection of structural support and equipment installation. No wash station will be provided on-site for pressure washing concrete trucks and/or heavy construction equipment. All equipment will be cleaned off-site and is the responsibility of the Contractor.

Subject to the completion of detailed design, it is expected that the Project will consist of:

- 10 – 6.4 m by 4.0 m precast concrete pad foundations for the building enclosures that will house the inverters and transformers.
- 1 – 9.0 m by 5.0 m precast concrete pad foundation for the substation electrical building.
- 1 – 7.0 m by 7.0 m precast concrete pad foundation for the substation transformer pad.

Based on these quantities, the total amount of impervious area associated with concrete foundations will be approximately 350 m^2 corresponding to less than 0.10% of the 36 ha Project Location area.

3.1.5.2 PV Module Mounting System, Supports and Foundations

The solar PV modules will be mounted on a fixed tilt, ground mounted racking system comprised of a steel and/or aluminum lattice structure. Each lattice structure will be assembled on-site and will typically hold 44 individual PV modules. An estimated 1030 racks will be required for the Project. The racking system will be supported by five steel uprights mounted on driven steel pipe piles depending on the soil conditions within the site. An estimated 5,000 piles will be installed within the Project Location. Based on an assumed pile diameter of 300 mm, the total area occupied by the piles will represent less than 0.09% of the 34 ha Project Location area.

Driven pipe piles, if used, will be installed using mechanical, hydraulic or vibratory pile hammer equipment mounted on a specialized rig, excavator or boom truck. The steel support piles will be driven to a design depth up to 3 m below grade to support the racking structure and PV modules. Compared to traditional cast-in-drilled-hole (CIDH) foundation methods, driven piles do not require earth excavation, soil disposal or the use of concrete.

3.1.5.3 Solar PV Modules

The Project will have a total of approximately 45,000 PV modules (270 watt), each weighing approximately 27 kg, with dimensions of 1954 mm long by 982 mm wide by 40 mm thick. The modules will be mounted on the racking system (Section 2.3.2.2) by installers with the help of a small mobile crane.

3.1.5.4 Inverters and Pad-Mounted Transformers Installation

The Project will have a total of twenty (20) 500 kW AC inverters and ten (10) intermediate 1 MVA pad-mounted transformers. The inverters will convert the DC power collected by the solar PV modules into

AC power and this voltage will be stepped up by the pad-mounted transformers to a voltage of 27.6 kV. Each inverter/transformer cluster installation will consist of two 500 kW inverters and a single 1MVA pad-mounted transformer installed together in one of ten (10) prefabricated buildings to protect the equipment from the weather and to reduce noise emissions. The inverters, transformers and prefabricated building enclosures will be trucked to the site and installed on either a precast or cast-in-place concrete pad by means of a crane.

3.1.5.5 Electrical Cable Installation

Electrical cabling, including DC cables from the solar PV modules to the inverters and AC cables from the inverters to the substation yard, will be run underground in trenches excavated for this purpose. Trenches will typically be 1 m deep by 0.5 m wide and will be excavated using a 'ditch-witch' plough, backhoe or similar equipment. The cabling will be buried to a minimum depth of 915 mm and caution tape will be buried in the trench above the cables to warn of the presence of the underground cables. Once the cabling is laid, the trenches will be backfilled and levelled to match the existing grade. Where necessary, high density polyethylene (HDPE) conduits will be installed beneath road crossings and in areas of shallow bedrock to house and protect the cables.

3.1.5.6 Substation Yard, Transformer and Electrical Building

The substation yard will be located in the southeast corner of the Project Location (Figure 2.1) and will include a 10 MVA transformer and the electrical building. Construction will include excavation of topsoil, installation of ground grid, foundation construction, covering of surface area with crushed stone, and installation of electrical equipment, including a main transformer to step up the voltage to 44 kV. Switchgear and protection and control equipment will be housed in a prefabricated, weatherproof building. The electrical building will be trucked to the site and installed on either a precast or cast-in-place concrete pad. Any outdoor electrical cabinets, not housed in the electrical building, will be NEMA 4X rated weatherproof cabinets.

The electrical cabling from the inverters will be run underground to the substation yard, where the main transformer will step power up to the local distribution voltage of 44 kV. Power will then be run overhead from the substation about 60 m and connect to the existing HONI distribution line situated along Highway 2.

Conductors at this voltage will run underground from the inverter enclosures to the Project substation yard, where one main transformer will step power up to the local distribution voltage of 44 kV. Power will then be run overhead from the substation to a new Hydro One Networks Inc. (HONI) 44 kV distribution line situated along Black's and Doxsee Roads.

3.1.5.7 Electrical Distribution Line and Interconnection Point

Connecting to a HONI 44 kV distribution line along Black's Road will require about 60 m long overhead 44 kV transmission line be constructed between the Project substation yard and the point of interconnection (POI) with the HONI distribution line (Figure 2.1). The Proponent will construct the overhead distribution line from the substation yard to the Project property line in accordance with the Ontario Electrical Safety Code. HONI will construct the section of the line from the Proponent property line to the POI.

3.1.6 Construction Phase 3 – Testing and Commissioning

Testing and commissioning will be performed on the installation prior to start up and connection to the power grid. The solar modules, inverters, transformers and electrical cables will be checked for system continuity, reliability, and performance tested. If problems or issues are identified, modifications will be made prior to start up.

3.1.7 Construction Phase 4 – Site Restoration

Site restoration will be applicable for the entire Project Location. The main objective will be to re-instate the area to the original pre-construction condition to the extent possible. All construction material, equipment, temporary facilities, and waste will be removed from the site. Topsoil will be redistributed where required, followed by finished grading and landscaping to achieve proper drainage. Re-vegetation will include planting of native plants and hydro-seeding where required.

3.2 Operations

Information presented below is a reproduction from Section 4 of the Design and Operations Report (Hatch, 2010d)

3.2.1 Operations Plan

The Project will operate year round and generate electricity during daylight hours. The amount of power generated will depend on daily weather conditions and sufficient solar irradiation. The Project will be operated remotely and does not require a permanent on-site operator. Any damage or faults with the PV modules and electrical systems will be alerted to staff remotely and repaired (or replaced) by facility staff or qualified professionals. To ensure the safety and integrity of the Project facilities, access to the site will be limited to Project personnel and unauthorized public access to the site will be prevented by fences, gates and security procedures.

A Project Facility Manager, appointed by the Proponent will be responsible for the day-to-day management of all Project facilities, including supervising site activities, site inspections, facility maintenance and repair. The Project Facility Manager, or his/her designate and/or other Proponent staff will be responsible for staff training, health and safety training and compliance, environmental regulatory compliance and public/municipal communications. For general monitoring and site maintenance purposes, two part time or full-time local personnel will be hired and would be dispatched from a central operations office as needed. Proper health and safety procedures for on-site maintenance personnel will be implemented as per provincial and federal regulations.

Operationally, there are no significant hazards involved in the operation of the Project, nor are hazardous materials used in, stored on the site or created by the Project during its operation. The Project will not generate significant quantities of waste from its operation nor will the Project generate any wastewater (sewage) or discharge any liquid effluent from its operation.

Project operation will not result in the discharge of contaminates or pollutants to the air. The only noise emissions associated with the Project operation will be from the inverters, pad-mounted transformers and the main substation transformers, which will only operate during daylight hours. A Noise Study Report (Hatch Ltd, 2011) involving computer modeling simulations of the Project inverters and transformers has confirmed that the applicable Ministry of Environment (MOE) noise level limits will not be exceeded at the locations of the nearest noise receptors. Sound level monitoring, if required by MOE, as a condition in the REA for the Project will be implemented and annual compliance reports submitted to the MOE. In addition, the Proponent will use feedback obtained from nearby noise receptors to confirm that noise emissions are within reasonable levels.

3.2.2 Site Inspection and Maintenance

The Project solar PV modules, inverters and transformers and other electrical equipment, wiring and electrical connections will be routinely inspected, typically on a monthly basis. Any broken or malfunctioning PV modules, electrical cabling or components will be repaired or replaced by qualified facility staff. Trash, debris and equipment parts replaced during maintenance and repair activities will be

collected and properly stored in a small waste disposal bin(s) provided on the site. All waste collected during operation of the Project will be removed from the site and managed according to provincial and municipal requirements.

The Project site grounds including vegetation coverage, drainage systems and trees will be monitored and maintained regularly. Since suitable ground cover will be established under the PV modules, some form of vegetation abatement such as grass cutting may be required several times throughout the summer months. No hazardous chemicals would be used for this vegetation control.

The site, including any constructed drainage features (e.g. grassed swales, culverts) and any erosion and sediment control measures (e.g. rip rap protection, rock flow checks) will be visually inspected for any signs of erosion or sedimentation and recorded in a log book. Regular maintenance such as the cleanout of accumulated sediment and/or the removal of any debris blockage would be conducted at that time. If required, remedial works (e.g. stabilizing and/or reseeding of identified erosion areas) and repairs to any drainage features or sediment and erosion control measures will be implemented to prevent environmental impacts.

The need to clean the solar PV modules will be determined according to local weather conditions, such as the quantity and frequency of rain and snow at the Project Location. At the very most, it is expected that the modules will require cleaning quarterly, but it is possible that cleaning the modules will not be necessary at all. If required, water trucks will bring water to the site to supply the water required. No chemicals will be used for the cleaning of the modules.

The transformers will be visually inspected on a monthly basis and their status recorded in a log book. Any faulty equipment that could result in an oil leak will be repaired and any observed leaks will be cleaned up immediately by maintenance personnel. Spill response equipment will be left on-site or in the maintenance trucks should leaks be observed.

During winter, Project access roads will be ploughed to clear snow to maintain access of personnel to Project facilities within the site. Under most winter conditions, snow is expected to melt due to the module heating and the 30° tilt. Under some conditions, manual snow removal may be performed by maintenance personnel who will clear the snow using a brush attached to a long pole.

3.3 Decommissioning

Information presented below is a reproduction from Sections 2 and 4 of the Decommissioning Plan Report (Hatch, 2011d).

It is anticipated that the Project equipment will have a useful lifetime of at least 20 years, which can be extended up to 30 years or more with proper maintenance, component replacement and repowering. For this section of the Report, it is assumed that the Project will be decommissioned after the 20-yr power purchase agreement with the Ontario Power Authority concludes. Axio, the owner of the Project lands, will ensure that the entire Project Location is restored back to its pre-construction condition (agricultural crop land use or as may be appropriate at that time) and that the decommissioning is conducted in accordance with the applicable local, provincial and federal requirements.

3.3.1 Equipment Dismantling and Removal

All decommissioning of electrical devices, equipment, and wiring/cabling will be conducted in accordance with local, municipal, provincial and federal standards and guidelines. Any electrical decommissioning will include obtaining the required permits and following lockout/tag out procedures before de-energizing, isolating, and disconnecting electrical devices, equipment and wiring/cabling.

3.3.1.1 PV Modules, Racks and Supports

All modules will be disconnected, removed from the racks, packaged and transported to a designated location for resale, recycling or disposal. If the modules are not to be reused in a different location, the glass and silicon will be reclaimed and the aluminum frames will be recycled. Any disposal or recycling will be done in accordance with local by-laws and requirements. The connecting underground cables and the junction boxes will be de-energized, disconnected and removed.

The steel lattice racks supporting the modules will be unbolted and disassembled by labourers using standard hand tools, possibly assisted by a small portable crane. The vertical steel posts supporting the racks and all steel support piles will be completely removed by mechanical equipment and transported off-site for salvage. Any demolition debris that is not salvageable will be transported by truck to an approved disposal area. Other salvageable equipment and/or material will be removed from the site for resale, scrap value or disposal depending on market conditions.

3.3.1.2 Electrical Equipment, Buildings and Foundations

All decommissioning of electrical devices, equipment, and wiring/cabling will be in accordance with local, municipal, provincial and federal agencies standards and guidelines. Any electrical decommissioning will include obtaining the required permits, and following lockout/tag out procedures before de-energizing, isolating, and disconnecting of electrical devices, equipment and wiring/cabling.

Decommissioning will require dismantling and removal of the electrical equipment, including inverters, transformers, underground cables and overhead lines, the prefabricated inverter enclosures and switch house electrical building. The equipment will be disconnected and transported off-site by truck. The larger slab-on-grade concrete foundations and support pads will be broken up by mechanical equipment (backhoe-hydraulic hammer/shovel, jackhammer), loaded onto dump trucks and removed from the site. Smaller pre-cast concrete support pads will be removed intact by cranes and loaded onto trucks for reuse or be broken up and hauled away by dump trucks.

3.3.1.3 Roads, Parking Area and Substation Yard

Unless retained for other purposes, all access roads, the parking area and the substation yard will be removed to allow for the complete restoration of these areas. Typically, the granular base covering these areas would be removed using a wheel loader to strip off the material and dump trucks to haul the aggregate to a recycling facility or approved disposal facility. The underlying subsoil, if exhibiting significant compaction (more likely for the site entrance road than the interior access roads) will then be disced using a tractor and disc attachment to restore the soil structure and to aerate the soil. Clean topsoil would be imported on-site by dump truck, replaced over the area and levelled to match the existing grade. Depending upon the time of year and the planned use of the land, the area will either be seeded with native grass/forb species or with winter wheat (to be determined) for the purpose of erosion control or agricultural crop cultivation.

3.3.1.4 Other Components

Unless retained for other purposes, removal of all other facility components from the site will be completed, including but not limited to surface drains, culverts, and fencing. Anything deemed usable shall be recovered and reused. All other remaining components will be considered as waste and managed according to federal, provincial and municipal requirements. For safety and security, the security fence will be the final component dismantled and removed from the site.

3.3.2 Site Restoration

At the discretion of regulatory authorities (MNR, Greater Town of Napanee), the site will be redeveloped as cultural meadow and/or forested.

Generally the process will involve the following steps:

- Site cleanup, and, if necessary, restoration of surface drainage swales and ditches. Any damage to tile drains (if present) will be repaired and /or restored.
- The roads, parking areas and substation yard will be removed completely, filled with suitable sub-grade material and leveled.
- Any compacted ground will be tilled, mixed with suitable sub-grade materials and leveled.
- Prepared soil, with all the nutrients required for the crop to grow will be spread as necessary.
- Legumes, grasses, and/or other native vegetation including native tree species will be planted as directed to provide a rapid return of nutrients and soil structure, protect against erosion, and restore wildlife habitat.

4.0 POTENTIAL NEGATIVE ENVIRONMENTAL EFFECTS AND PROPOSED MITIGATION MEASURES

This section describes the anticipated negative environmental effects on the identified significant natural features that could occur as a result of construction, operation and decommissioning phases of the Project (as described in Section 3).

Mitigation measures are proposed to minimize, eliminate or alleviate any negative effects. Potential negative effects are discussed by environmental component, where affects on the land could negatively affect the significant natural features.

These effects are discussed below by significant natural feature.

4.1 Significant Woodland

A 5 ha portion of woodland (*Woodland* 1) to the east of the Project Location and within the 120 m adjacent land area was identified as significant based on assessment criteria including size and ecological functions (proximity to other woodlands and other habitats, and linkages) (Figure 2.1). It is also located within the Napanee Plains Important Bird Area (IBA). This woodland was identified as providing significant wildlife habitat for species of conservation concern (*shrub/early successional bird breeding habitat*) aspects that will be discussed in subsequent sections of this report. Potential impacts to this woodland as a result of construction, operations, and decommissioning are addressed below by project phase.

4.1.1 Vegetation Removal (Construction)

There will no encroachment onto any portion of identified significant woodland by the Project and no requirement for vegetation removal within this feature (Appendix A).

Construction activities within the Project Location may result in indirect impacts on adjacent woodlands remaining around the perimeter as a result of root compaction, changes to local hydrology, light exposure on shade-sensitive tree species and accidental encroachment. These impacts however, will be reduced or eliminated through appropriate mitigation measures including clear demarcation of work boundaries and incorporation of a site drainage plan that will not alter existing hydrology within adjacent lands. It is noted that significant woodlands are a minimum of 8 m from the nearest Project component (access road).

4.1.2 Site Grading (Construction)

Adjacent woodland and associated wildlife habitat features may be impacted by alterations to surface water runoff as a result of site grading. Activities that could occur during the construction phase that would have the potential to affect surface water runoff patterns and rates include:

- soil grading and ditching associated with access roads
- soil compaction due to heavy equipment or stockpiling
- vegetation removal.

The potential negative effects and proposed mitigation measures associated with these activities are discussed in the Waterbodies Site Investigation Report (Ecological Services, 2011) and in the Stormwater Management Report (McIntosh Perry, 2011). In general, it was concluded that through the use of effective mitigation measures, there will be no measurable change in surface water runoff as a result of soil compaction and vegetation removal. Further, land will be graded and reseeded to meadow such that

surface water runoff flows in the same general direction as present; therefore no alterations in moisture regime are anticipated. This will ensure that there is no impact to local and regional water quality.

4.1.3 Dust Generation (Construction)

Further to the direct impacts of encroachment, indirect impacts may occur on adjacent woodland features in the form of dust generation. Dust may be mobilized due to vehicular traffic and heavy machinery use, drilling (if necessary for solar panel installation) and soil moving activities (e.g., excavation, trenching). However, it is anticipated that the potential impacts can be substantially mitigated through the use of standard construction site best management practices and mitigation measures. In this regard, the document entitled "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" (Cheminfo Services Inc., 2005) will be used as a guideline for contractors.
Mitigation measures to be used, as required, to control dust include:

- use of approved dust suppression (i.e., water or non-chloride based materials) on exposed areas including access roads, stockpiles and works/laydown areas as necessary
- hard surfacing (addition of coarse granular A material, free of fine soil particles) of access roads or other high-traffic working areas
- phased construction, where possible, to limit the amount of time soils are exposed
- avoid earth moving works during excessively windy weather. Stockpiles to be worked (e.g., loaded/unloaded) from the downwind side to minimize wind erosion stockpiles and other disturbed areas to be stabilized as necessary (e.g., tarped, mulched, graded, revegetated or watered to create a hard surface crust) to reduce/prevent erosion and escape of fugitive dust.

Visual monitoring of dust generation will occur during site grading activities and if dust is observed to be of concern, additional mitigation will be implemented. Given the mitigation and monitoring proposed, it is anticipated that dust generation will be relatively low in magnitude and limited in duration and geographical area, such that no negative effects on vegetation communities will occur as a result of dust.

4.1.4 Road Construction (Construction)

A network of access roads (Section 3.1.4.6) will be constructed to provide access to the solar arrays. These roads will be within and around the perimeter of the arrays and their construction has the potential to affect site hydrology. Accordingly, road construction is addressed in the Stormwater Management Plan and standard BMP measures for road construction will be followed to ensure that there are no adjacent effects.

4.1.5 Facility Operations (Operations)

The operation of the solar array facility is not expected to affect any of the identified habitat functions or features associated with adjacent woodland. There are no cleaning agents required that could affect surficial or groundwater quality, and there is only an occasional requirement for staff (1- 3) to be present.

4.1.6 Vegetation Management (Operations)

Vegetation management actions within the Project Location consist of occasional mowing of the meadow areas around the panels. Such actions will have no impact on adjacent woodlands or associated wildlife habitat features.

4.1.7 Component Removal and Site Restoration (Decommissioning)

Disturbances affecting areas on and adjacent to the Project Location during site deconstruction will be similar to those described for initial site grading as described in Section 4.1.1.2, and mitigation measures employed during construction will be used during decommissioning. As a result, there will be no impact on the form or function of adjacent woodland during decommissioning. Site restoration following the removal of all components will take the form of reseeding to create cultural meadow or, at the discretion of the municipality or other regulatory agency (MNR), reforestation.

4.2 Shrub/Early Successional Habitat for Breeding Birds

Shrub thicket and patchy woodland communities associated with the Project Location were evaluated in the *EOS* (Ecological Services, 2011a) as providing significant wildlife habitat for shrub/early successional breeding birds. During the breeding bird survey in June, 2010, shrub/early successional indicator species (Brown Thrasher, Clay-coloured Sparrow, Eastern Towhee and Field Sparrow) were encountered within both the fallow fields on the Project Location and within adjacent open woodlands to the east.

4.2.1 Vegetation Removal (Construction)

There will be no encroachment into the woodlands and associated patches of thicket and meadow habitat to the east of the Project Location, where several shrub/early successional breeding birds were reported in 2010. The open farm fields that represent the majority of the Project Location were also found to be supportive of shrub/early successional breeding birds in 2010 when these areas were in fallow condition. However, in 2011, the fields were ploughed and rotated back into crop production rendering them unavailable as habitat. Breeding habitat supportive of this particular guild of songbirds is anticipated to remain available for the life of the Project within adjacent lands and several hundred hectares of contiguous early successional thicket and meadow habitat remain across the local landscape (Appendix A). Accordingly, there will be no significant loss of habitat or a reduction in local populations of shrub/early successional songbirds, including identified species of conservation concern as a result of this project.

In the unlikely event of incidental take of species of conservation interest including birds listed in the regulations of the Migratory Bird Convention Act, work within the Project area will cease immediately, and the MNR and/or Environment Canada will be contacted to make them aware of the occurrence. Work in the area will remain stopped until a survey is conducted by a trained biologist to ensure that there are no species of conservation concern remaining in the area. All occurrences will be documented in the monthly environmental report.

To ensure that there is minimal disturbance to wildlife species found within remaining habitat areas adjacent to the Project Location, work areas will be well marked and workers will be advised to remain within the bounds of the demarcated work areas. Further, workers will be advised not to enter natural areas beyond the boundaries of the work area.

4.2.2 Site Grading (Construction)

Any required site grading following the clearing of vegetation from across former areas of cultural thicket is not anticipated to result in impacts to shrub/early successional breeding birds, as no habitat occurs within the Project Location. Indirect impacts to adjacent habitats supportive of this guild are also expected to be minor following the implementation of a Stormwater Management Plan that will retain the existing site hydrology.

The restoration of the Project Location to cultural meadow following site grading and panel installation may create a unique habitat type of potential use to shrub/early successional breeding birds. Thus, the installation of the facility may represent a potential gain in habitat for this species guild. In order to determine the extent of use, breeding bird point counts will be conducted across the Project Location twice during the breeding season in the year following project installation. This information will be made available to MNR for evaluation.

4.2.3 Dust Generation (Construction)

As discussed for significant woodlands, dust generation across the Project Location will be managed through appropriate dust control measures. Impacts on adjacent shrub habitats will be minimal during site construction, and absent once site vegetation is restored.

4.2.4 Road Construction (Construction)

Impacts and mitigation measures as described for significant woodlands.

4.2.5 Facility Operations (Operations)

It is anticipated that songbirds that might otherwise breed or forage within the cultural meadow across the Project Location may be deterred by the presence of solar panels, thus limiting the suitability of this cultural habitat. Accordingly, in order to determine the extent of use, breeding bird point counts will be conducted across the Project Location and 120 m adjacent lands twice during the breeding season in the year following project installation. This information will be made available to MNR for evaluation.

Other aspects of facility operation (occasional cleaning and maintenance) and ambient noise associated with the presence of panel inverters and transformer substation are not expected to result in any additional impacts to shrub/early successional habitat contained within or adjacent to the Project.

4.2.6 Vegetation Management (Operations)

There is a requirement to maintain vegetation cover across the Project Location as a cultural meadow. Thus, successional shrub and tree growth around the solar panels will be removed if they are found to impair facility operations (i.e., shading). The long term maintenance of the project area as a cultural meadow may prove beneficial to some songbird species found within this and other habitat guilds.

Mowing operations across the Project Location during the breeding season for grassland species and shrub/early successional species may lead to mortality of nestlings. If the wildlife surveys of the Project Location determine that the facility supports species of conservation concern, it is recommended that mowing be delayed if possible until at least mid-July following the peak of the breeding season. The potential impact to bird species populations will be better understood following the breeding bird point count monitoring of the Project area.

No impact to the form and function of shrub/early successional habitat adjacent to the Project Location is anticipated as a result of operations activities.

4.2.7 Component Removal and Site Restoration (Decommissioning)

Decommissioning impacts across the Project Location and adjacent natural areas will be similar to those described in Section 4.1.3, and mitigation measures employed during construction will be used during decommissioning.

Following decommissioning, the Project Location will be revegetated using native forbs and grasses (as determined through consultation with MNR), such that the site will be left as cultural meadow. If left undisturbed, the site is expected to be re-invaded by native shrubs and trees, potentially returning it to a state supportive of early successional songbirds.

Table 4.1. Potential negative environmental effects and associated mitigation measures for identified natural features.

Natural Feature(s)	Characteristics and Functions	Potential Negative Environmental Effect		Mitigation Measures	Residual Effects on Natural Feature
		Direct	***Indirect***		
Significant Woodland ***Shrub/Early Successional Breeding Bird Habitat***	*Characteristics* • Size – 5 ha within 120 m adjacent lands only • Proximity to other significant natural features: woodland contiguous with regional forest identified as significant • Linkages: woodland contiguous with regional forest cover identified as significant • Community types: *Red Cedar Cultural Woodland* • Disturbance – cattle pasture • Located within Napanee Plains IBA • Several indicator species noted (Brown Thrasher, Clay-coloured Sparrow, Field Sparrow, Eastern Towhee) *Functions* • extent of landscape cover – <5% of local woodland • significant wildlife habitat- shrub/early successional breeding bird habitat • Part of larger regional communities of similar type and function	*i. Vegetation Removal (Construction Phase)*			
		• No encroachment onto feature	• Potential disturbance of wildlife using adjacent habitat during operation	• Daily visual monitoring of work area to ensure compliance • Remaining wildlife will be directed away from areas of impact through established protocols.	• No residual effect on woodlands anticipated • No anticipated reduction in population size of local breeding birds
		ii. Site Grading (Construction Phase)			
		• No encroachment onto feature	• Potential changes in soil moisture and hydrology of adjacent woodlands and habitats	• Soil grading will not disrupt or significantly alter current site hydrology including surficial flow patterns • Soil grading will occur only within demarcated areas within Project Location • Site will be revegetated as open meadow	• No change to hydrological features and/or functions associated with adjacent woodlands • Creation of persistent cultural meadow within Project Location may increase availability of habitat for early successional species
		iii. Road Construction (Construction Phase)			
		• No encroachment onto feature	• Potential changes in soil moisture and hydrology of adjacent woodlands and habitats	• Standard BMP measures for road construction	• No change to hydrological features and/or functions associated with adjacent woodlands
		iv. Dust Generation (Construction Phase)			
		• No encroachment onto feature	• Temporary disruption in growth of adjacent woodland vegetation	• Standard construction BMP measures taken for dust control measures • Site will be revegetated as open meadow	• No residual effects on woodland features and/or functions expected
		v. Facility Operations (Operation Phase)			
		• No encroachment onto feature	• Potential disturbance to wildlife using adjacent woodland habitat from presence of solar panels • Noise from transformer substation and panel inverters	• No mitigation possible for solar array • Transformer will not be situated near adjacent woodland • Wildlife monitoring required to determine which bird species are breeding on and within 120 m of the Project location • Initiate breeding bird monitoring across Project Location in Year 1-3 of operation	• No residual effects on adjacent woodland habitat features and/or functions expected • Noise habituation by local wildlife anticipated
		vi. Vegetation Management (Operation Phase)			
		• Mowing operation has potential to cause mortality of nesting birds within Project Location	• No indirect effects	• Bird mortality related to mowing operations will be documented	• Breeding habitat for some shrub/early successional species may be provided by Project Location (determination of use from breeding bird monitoring report
		vii. Component removal and site restoration (Decommissioning Phase)			
		• No encroachment onto feature	• Potential changes in soil moisture and hydrology of adjacent woodlands and habitats	• Maintain existing hydrology and prevent erosion • Site will be revegetated as open meadow or reforested at discretion of Municipality or resource authority (MNR)	• No impact to adjacent woodland features and/or functions expected from site decommissioning • Site restoration may provide additional habitat for shrub/early successional species if allowed to succeed to shrubland

5.0 ENVIRONMENTAL EFFECTS MONITORING PLAN – DESIGN AND OPERATIONS REPORT

As discussed in the Design and Operations Report (Hatch Ltd., 2010c) environmental effects monitoring is proposed in respect of any negative environmental effects that may result from engaging in the Project. As per the REA Regulation, the monitoring plan identifies

- performance objectives in respect of the negative environmental effects
- mitigation measures to assist in achieving the performance objectives
- a program for monitoring negative environmental effects for the duration of the time the Project is engaged in, including a contingency plan to be implemented if any mitigation measures fail.

For the purposes of this ***EIS*** report, the effects monitoring measures with respect to negative effects on the significant natural features have been reproduced here, in Table 5.1.

The monitoring proposed in Table 5.1 will serve to verify that mitigation measures are functioning as designed to meet performance objectives. If monitoring shows that performance objectives are not being met, the contingency measures documented in Table 5.1 will be used to ensure that remedial action is undertaken as necessary to meet the performance objectives.

Table 5.1 Summary of Environmental Effects Monitoring Requirements with Respect to Significant Natural Features

Mitigation Measures by Stage	Monitoring Plan					
	Performance Objective	Methodology	Monitoring Locations	Frequency	Reporting Requirements	Contingency Measures
Vegetation Removal (Construction Phase)						
• Daily visual monitoring of work area to ensure compliance (i.e., no encroachment onto adjacent natural features) • Remaining wildlife will be directed away from areas of impact through established protocols.	• Maintain features and associated functions of adjacent natural areas including significant woodland and cultural thicket	• Standard marking and flagging to demarcate off-limit areas • Visual monitoring of work area to ensure compliance • Wildlife relocation will follow established protocols with trained staff	• Throughout construction site.	• Ongoing during construction.	Reported in monthly construction monitoring report during construction	• Loss of woodland outside of demarcated area will require remediation to restore impacted area including but not limited to reforestation with native species appropriate to the site • Wildlife species mortality will be reviewed immediately following the event, and construction protocols will be revised to ensure wildlife protection
Site Grading (Construction Phase)						
• Soil grading will not disrupt or significantly alter current site hydrology including surficial flow patterns • Soil grading will occur only within demarcated areas within Project Location • Site will be revegetated as open meadow immediately following erection of solar array panel	• Maintain site hydrology similar to pre-development state such that impacts to adjacent natural features and functions is minimal	• Preparation of a CRCA approved Stormwater Management Plan to maintain existing hydrology and prevent erosion • Areas requiring grading clearly demarcated • Site seeded with native or approved agricultural seed mix including grasses and forbs • Monitoring conducted over growing season to ensure meadow vegetation established	• Monitoring of water quality within adjacent drainage channels (constructed or otherwise) • Site revegetation monitored across Project Location	• Periodically during all site grading activities and following storm events • Twice during growing season (May-Sept) to ensure meadow establishment and once in following year	Reported in monthly construction monitoring report during construction.	• Evidence of offsite sediment transport will be dealt with through standard BMP measures including immediate erection of a silt fence followed by evaluation of source of problem and consultation with Quinte CA as to remedial actions required • Failure to establish vegetation within any portion of the Project Location in or after the first year will be dealt with through reseeding and additional monitoring
Road Construction(Construction Phase)						
• Standard BMP measures for road construction	• Construct road system such that site hydrology is not affected and adjacent natural areas are not impacted	• Visual monitoring of work area to ensure compliance • Speeds limited on road network within Project Location	• Throughout construction site.	• Ongoing during construction.	Reported in monthly construction monitoring report during construction	• See contingency measures for site grading and vegetation removal
Dust Generation (Construction Phase)						
• Standard construction BMP measures taken for dust control measures • Site will be revegetated as open meadow	• Limit dust related impacts to adjacent vegetation function and growth	• Visual monitoring of work area to ensure compliance	• Throughout construction site.	• Ongoing during construction.	Reported in monthly construction monitoring report during construction	• Dust control measures implemented as necessary to prevent/minimize dust generation. • See contingency measures for site grading
Facility Operations (Operation Phase)						
• No mitigation possible for solar array • Transformer will be situated near Blacks Road and not near adjacent woodland • Wildlife monitoring required to determine which bird species are breeding on and within 120 m of the Project location	• Ensure no impact to wildlife using adjacent habitats	• Noise Report prepared • Breeding Bird Survey consisting of point counts and area searches completed in accordance with standard protocols	• Across construction site at established point count stations	• Breeding bird point counts twice during breeding season in Years 1-3 of operation	Reported annually following final monitoring session in memorandum to MNR Peterborough District	• If substantial reduction in use of adjacent habitats by previously identified wildlife species, consultation with MNR to determine probable cause and revise mitigation approach as necessary
Vegetation Management (Operation Phase)						
• Visual monitoring of work area to ensure compliance • Wildlife will be directed away from work areas using established protocols.	• Ensure no impact to wildlife using any habitat present on and within 120 m of Project	• Visual monitoring of work area to ensure compliance • Wildlife relocation will follow established protocols and by trained staff	• Throughout construction site.	• Ongoing during vegetation control operations	Reported in monthly construction monitoring report during construction	• If substantial reduction in use of adjacent habitats by previously identified wildlife species, consultation with MNR to determine probable cause and revise mitigation approach as necessary
Component removal and site restoration (Decommissioning Phase)						
• Maintain existing hydrology and prevent erosion • Site will be revegetated as open meadow or reforested at discretion of regulatory authority	• Maintain site hydrology similar to pre-development state minimal	• Preparation of approved Stormwater Management Plan if necessary • See site grading methodology	• Throughout decommissioning stage	• Ongoing during decommissioning.	Reported in monthly construction monitoring report during decommissioning.	• See contingency measures for site grading

6.0 CONSTRUCTION PLAN REPORT

The REA Regulation requires proponents of Class 3 solar projects to prepare a Construction Plan Report (*CPR*) (Hatch Ltd., 2010b). The CPR details the location and timing of construction and installation activities, any negative environmental effects that result from construction activities within 300 m of the Project Location and mitigation measures for the identified negative environmental effects. The *CPR* addresses all potential effects of construction on natural features as well as socio-economic considerations such as air quality, noise and traffic within 300 m of the Project Location in a general manner.

The mitigation proposed in the *CPR* with respect to preventing or minimizing negative effects on significant natural features is the same as discussed in this *EIS*. Additional mitigation is proposed in the *CPR* to address negative effects to socio-economic considerations and other non-significant natural features that are not discussed in this Report. Therefore, the *CPR* and this *EIS* should be read in conjunction with each other.

7.0 SUMMARY AND CONCLUSIONS

As discussed in the *NHARR* (Hatch Ltd. 2010a), the *SI* (Ecological Services, 2011a) and the *EOS* (Ecological Services, 2011b) there is significant woodland and significant wildlife habitat present on and within 120 m of the Project location.

This *EIS* has been prepared to identify potential negative environmental effects that all phases of the Project may have on these significant natural features. Mitigation measures have been proposed to prevent these effects from occurring or minimize the magnitude, extent, duration and frequency in the event that they do occur to an acceptable level. Monitoring measures have been proposed to confirm that mitigation measures are having the intended effect and that performance objectives are being met.

A summary table is provided below which documents both significant and non-significant natural features identified in the ***SI*** and the associated mitigation measures and monitoring requirements.

Table 7.1 Natural Features on and within 120 m of the Project Location

Feature	Attributes/Composition	Function	Significant?	Mitigation Strategy (C=Construction, O=Operation, D=Decommissioning)
Woodlands				
Woodland	*Red Cedar Cultural Woodland* (CUW1-1)	Provision of habitat for shrub/early successional breeding birds	Significant	To be addressed in the CPR (Hatch, 2010b) C – Demarcation of work areas; Dust control measures; Surface water runoff protection O – None required D – same as construction
Treed Hedgerow	*Mix of mature deciduous and shrub*	None noted	Non-significant	To be addressed in the CPR (Hatch, 2010b)
Wildlife Habitat				
Songbird migratory stopover habitat	Through Project Location and 120 m adjacent lands	Provision of foraging and roosting habitat	Non-significant	To be addressed in the CPR (Hatch, 2010b)
Shrub/early successional bird breeding habitat	Shrub thicket and meadow patches on and within 120 m of Project Location contiguous with several hundred ha on adjacent lands	Identified foraging and breeding habitat for several shrub thicket songbird species	Significant	To be addressed in the CPR (Hatch, 2010b) C –Demarcation of work area setbacks O – Monitoring of use D – None required
Open country bird breeding habitat	- extensive, meadows and shrub thickets across local region (agricultural lands)	Provision of nesting and foraging habitat	Non-significant	To be addressed in the CPR (Hatch, 2010b)

8.0 REFERENCES

Blue Oak Energy Canada. 2011. Belleville TS Demorestville Solar Energy Project. Schematic layouts (draft). Prepared for Axio Power Canada Inc.

Ecological Services. 2011a. Natural Heritage Assessment Site Investigation Report for Belleville TS Demorestville Solar Energy Project.

Ecological Services. 2011b. Natural Heritage Assessment Evaluation of Significance Report for Belleville TS Demorestville olar Energy Project.

Ecological Services. 2011c. Belleville TS Demorestville Solar Energy Project – Waterbodies Environmental Impact Study. Prepared for Axio Power Inc. and Canadian Solar Solutions Inc.

Hatch Limited. 2011a. Belleville TS Demorestville Solar Energy Project Natural Heritage Assessment Records Review. Axio Power Canada Inc. and Canadian Solar Solutions Inc.

Hatch. 2011b. Belleville TS Demorestville Solar Energy Project– *Construction Plan Report*. Prepared for Axio Power Canada Inc.

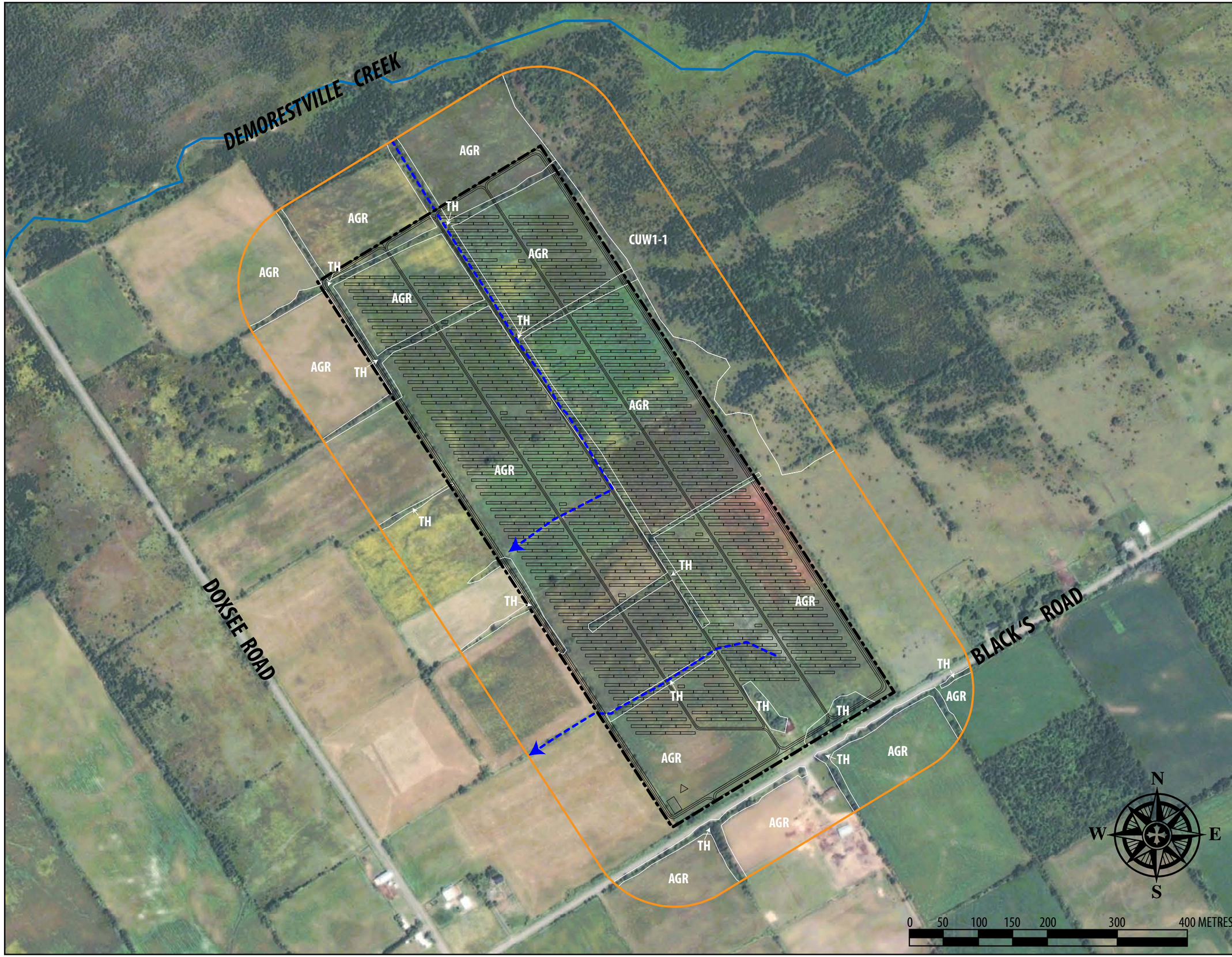
Hatch. 2011c. Belleville TS Demorestville Solar Energy Project – Decommissioning Plan Report. Prepared for Axio Power Canada Inc.

Hatch. 2011d. Belleville TS Demorestville Solar Energy Project – Design and Operations Report. Prepared for Axio Power Canada Inc.

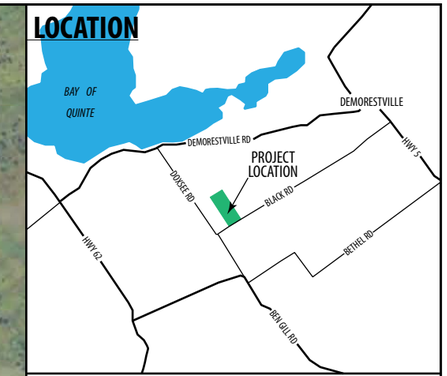
Henson, B.L. and K.E. Brodribb *2005. Great Lakes Conservation Blueprint for Terrestrial Biodiversity, Volume 2: Ecodistrict Summaries*. Nature Conservancy of Canada.

McIntosh-Perry Consulting Engineers Ltd. 2011. Conceptual Stormwater Management Report Proposed Photovoltaic Project (Demorestville Site) Demorestville, Ontario. Prepared for Axio Power Canada Inc.

Appendix A. Project Location and ELC vegetation community overlay.



LOCATION



LEGEND

PROJECT LOCATION

120m BUFFER FROM PROJECT LOCATION

SOLAR PROJECT

WATERCOURSE

AGRICULTURAL DRAINS

ELC VEGETATION COMMUNITIES

TH
TREED HEDGEROW

CUW1-1
RED CEDAR CULTURAL WOODLAND

AGR
AGRICULTURAL

axiopower

Ecological Services

McINTOSH PERRY Consulting Engineers Ltd.

TITLE		
BELLEVILLE TS DEMORESTVILLE ELC VEGETATION COMMUNITITIES: PROJECT OVERLAY		
DATE JULY 5, 2011	PROJECT No. KP-11-626	FIGURE

Appendix B. Draft site layout plan (Blue Oak Energy 2011).

BELLEVILLE TS DEMORESTVILLE SOLAR PROJECT

PART OF LOTS 51 & 52 CONCESSION 1, SOPHIASBURGH TOWNSHIP, ON

SOLAR ELECTRIC SYSTEM PROJECT - 10 MW AC

VICINITY MAP:

PROJECT SCOPE:

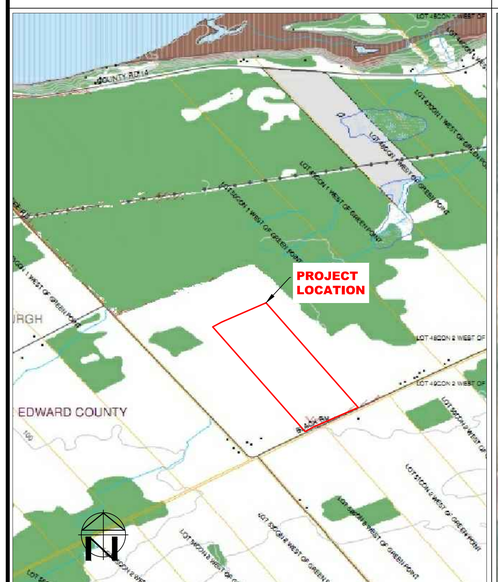
SOLAR ELECTRIC SYSTEM

THE PROPOSED PROJECT IS A RENEWABLE ENERGY GENERATION FACILITY WHICH WILL USE SOLAR PHOTOVOLTAIC TECHNOLOGY TO GENERATE ELECTRICITY. ELECTRICITY GENERATED BY SOLAR PHOTOVOLTAIC PANELS WILL BE CONVERTED FROM DIRECT CURRENT (DC) TO ALTERNATING CURRENT (AC) BY INVERTERS, WHICH WILL ALSO STEP-UP THE VOLTAGE TO 44 kV PRIOR TO BEING CONNECTED TO THE EXISTING LOCAL DISTRIBUTION LINE. TO MEET ONTARIO POWER AUTHORITY'S (OPA) FEED-IN-TARIFF (FIT) PROGRAM REQUIREMENTS, A SPECIFIC PERCENTAGE OF EQUIPMENT WILL BE MANUFACTURED IN ONTARIO. THIS PROJECT IS CLASSIFIED AS A CLASS 3 SOLAR FACILITY AND THEREFORE REQUIRES A RENEWABLE ENERGY APPROVAL (REA).

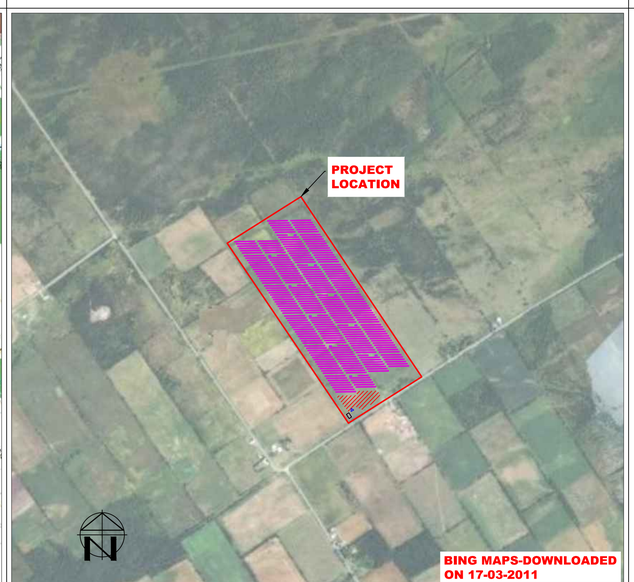
THE SYSTEM WILL BE INTERCONNECTED AND WILL BE OPERATED IN PARALLEL WITH THE ENERGY PROVIDER'S ELECTRIC GRID AS PER THE REQUIREMENTS OF THE ONTARIO ELECTRICAL SAFETY CODE (OESC).

DRAWING INDEX:

STREET MAP:



AERIAL VIEW:



PROJECT TEAM:

PROJECT CONTACT:

PROJECT: BELLEVILLE TS DEMORESTVILLE SOLAR PROJECT
AXIO POWER CANADA INC.
945 PRINCESS STREET, SUITE 252
KINGSTON, ON, K7L 3N6
CONTACT: ROBERT BARKLEY
TEL: (613) 545.0215
FAX: (613) 545.0692
EMAIL: rbarkley@axiopower.com

DESIGN ENGINEERING FIRM:

BLUE OAK ENERGY CANADA CORP.
200 VINYL COURT, UNIT D
VAUGHAN, ON L4L 4A3
CONTACT: VINCE GREEN, PE
TEL: (905) 850-3200
EMAIL: vince@blueoakenergy.com

ELECTRICAL ENGINEER:

PRELIMINARY DRAWING
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BLUE OAK ENERGY CANADA

200 VINYL COURT, UNIT D, VAUGHAN ON L4L 4A3 PHONE:(905) 850-3200

AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON ON K7L 3N6

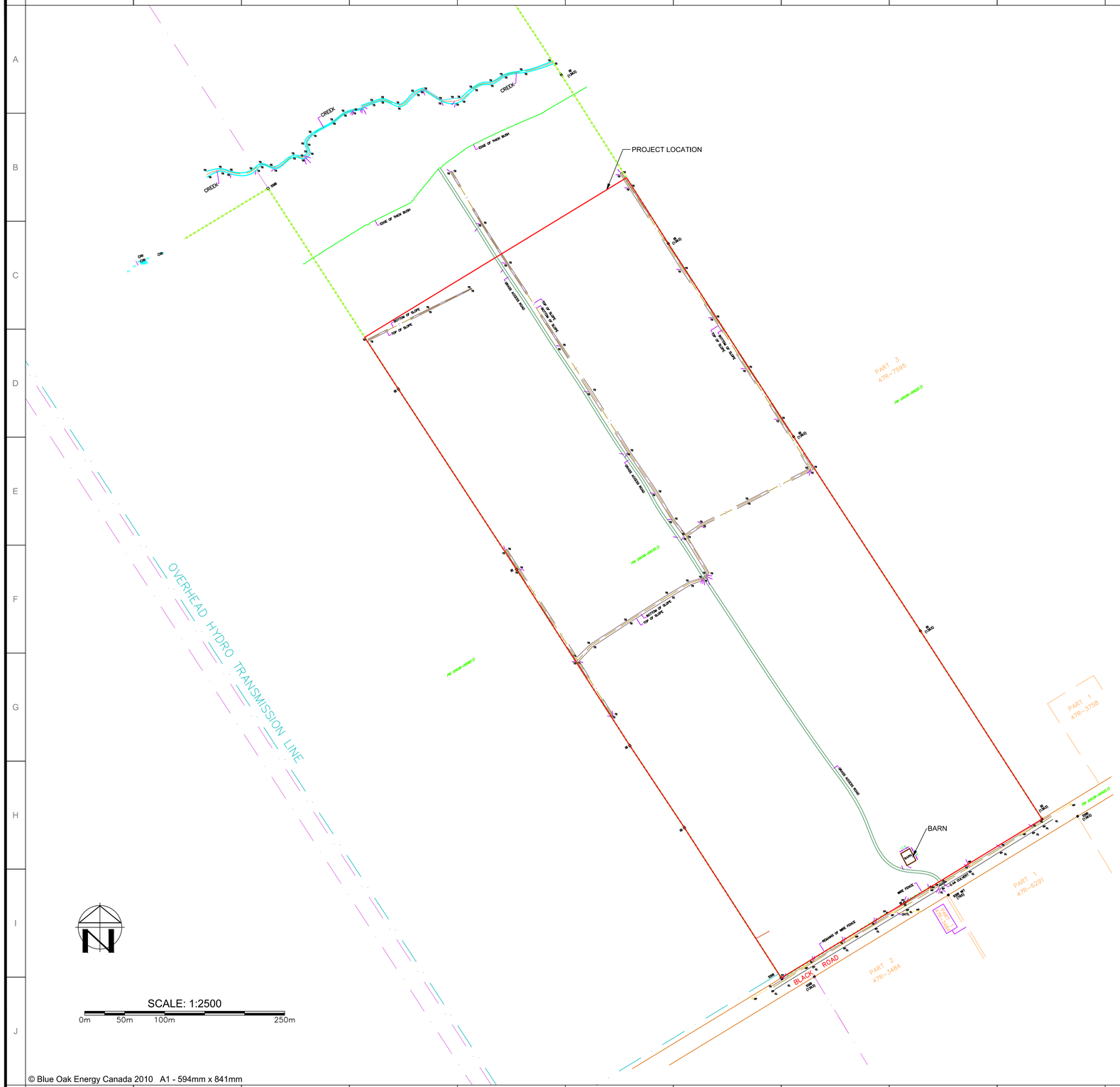
PROJECT SITE:

BELLEVILLE TS DEMORESTVILLE SOLAR PROJECT
PART OF LOTS 51 AND 52 CONCESSION 1
SOPHIASBURGH TOWNSHIP, ON

DRAWING: TITLE SHEET

DRAWING NO. G-001

 A1 - 594mm x 841mm



NOTES:

1. SEE PROJECT CIVIL DRAWINGS FOR OFFICIAL LANDMARKS, SITE INFORMATION AND SURVEYING. SHOWN HERE AS REFERENCE ONLY.

LEGEND

□	SURVEY MONUMENT PLANTED
■	SURVEY MONUMENT FOUND
SSIB	SHORT STANDARD IRON BAR
SIB	STANDARD IRON BAR
IB	IRON BAR
WIT	WITNESS
CALC	CALCULATED
S	SET
M	MEASURED
G	GROUND
TS	TOP OF SLOPE
BS	BOTTOM OF SLOPE
CUL INV	CULVERT INVERT
FP	FENCE POST
CL	CENTRE LINE OF PATH
EP	EDGE OF PAVEMENT
HP	HYDRO POLE
OHTL	OVERHEAD TRANSMISSION LINE
Ø	DIAMETER
	GRASS ACCESS ROAD
	EDGE OF THICK BUSH
	CREEK
	PROJECT LOCATION
	SITE BOUNDARY

ELECTRICAL ENGINEER:

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AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON ON K7L 3N6

PROJECT SITE:

BELLEVILLE TS DEMORESTVILLE SOLAR PROJECT

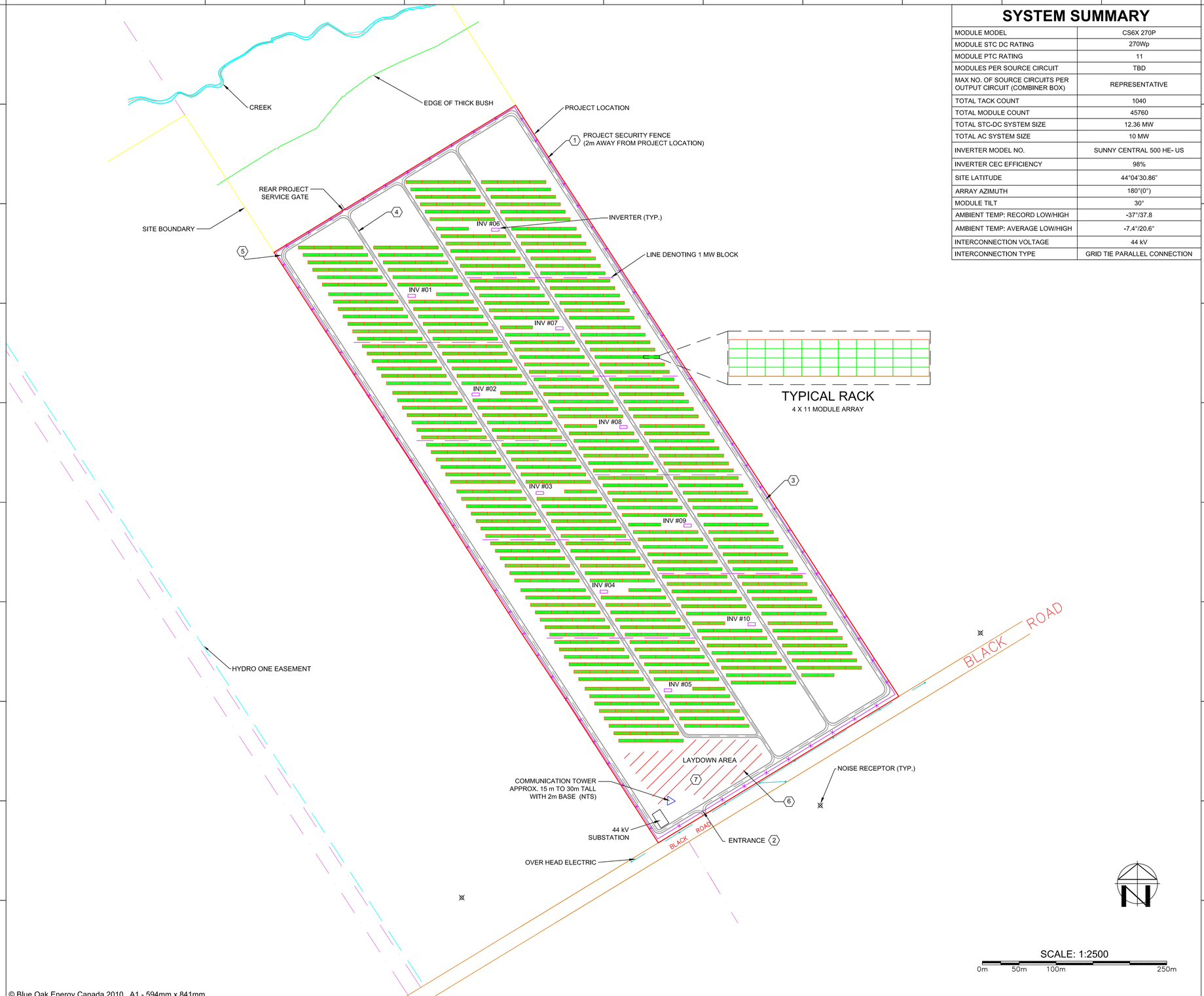
PART OF LOTS 51 AND 52 CONCESSION 1
SOPHIASBURGH TOWNSHIP, ON

DRAWING:

EXISTING SITE PLAN

DRAWING NO.

ES-101



SYSTEM SUMMARY

MODULE MODEL	CS6X 270P
MODULE STC DC RATING	270Wp
MODULE PTC RATING	11
MODULES PER SOURCE CIRCUIT	TBD
MAX NO. OF SOURCE CIRCUITS PER OUTPUT CIRCUIT (COMBINER BOX)	REPRESENTATIVE
TOTAL TACK COUNT	1040
TOTAL MODULE COUNT	45760
TOTAL STC-DC SYSTEM SIZE	12.36 MW
TOTAL AC SYSTEM SIZE	10 MW
INVERTER MODEL NO.	SUNNY CENTRAL 500 HE- US
INVERTER CEC EFFICIENCY	98%
SITE LATITUDE	44°04'30.86"
ARRAY AZIMUTH	180°(0°)
MODULE TILT	30°
AMBIENT TEMP: RECORD LOW/HIGH	-37°/37.8
AMBIENT TEMP: AVERAGE LOW/HIGH	-7.4°/20.6°
INTERCONNECTION VOLTAGE	44 kV
INTERCONNECTION TYPE	GRID TIE PARALLEL CONNECTION

NOTES:

1. PV RACKS SUPPORTING FIXED TILTED PV MODULES WITH DC WIRING AND COMBINER BOXES ABOVE GROUND. DC CABLING FROM COMBINER BOXES TO ROUTE UNDERGROUND TO INVERTER / POWER ENCLOSURES.
2. INVERTER / POWER ENCLOSURES TO BE LOCATED WITHIN ARRAY AREA TO COLLECT DC POWER, CONVERT AND OUTPUT MEDIUM VOLTAGE AC POWER.
3. DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
4. SEE RACK DETAIL DRAWINGS IN S-101 FOR RACK ELEVATION AND TOLERANCES.
5. CONTACT, COORDINATE AND ATTAIN APPROVAL FROM AGENCIES HAVING EASEMENTS AND ROW SPACING IN PROJECT AREA.
6. PV MODULES TO BE CANADIAN SOLAR MODEL CS6X 270P OR EQUIVALENT.

KEYED NOTES:

1. PROJECT SECURITY FENCE. 2.7m (9 FT) TALL, SET APPROXIMATELY 2m INSIDE PROJECT LOCATION LINE.
2. DOUBLE SWING GATES, 2.5m EACH SECTION.
3. PERIMETER SERVICE ROAD, 5m WIDTH . SEE SECTION DETAILS IN S-101.
4. INTERIOR SERVICE ROADS, 3.7m WIDTH SEE SECTION DETAILS IN S-101.
5. 9m TURNING RADII AT ROAD CENTER LINES ON PERIMETER SERVICE ROAD AND ON TRANSITIONS TO INTERIOR SERVICE ROADS TO MEET TYPICAL SAFETY AGENCY REQUIREMENTS.
6. AREA AROUND GATES AND SWITCH HOUSE COMPACTED, SLOPED FOR DRAINAGE AND TOPPED WITH 'ROAD BASE' ROCK AND SAND MIXTURE. PROVIDES PARKING FOR APPROX. 10 VEHICLES.
7. LAYDOWN AREA TO BE COMPACTED NATIVE SOIL ALLOWING TEMPORARY PARKING, STORAGE, ETC. DURING CONSTRUCTION. TO BE FINISH GRADED AND SEEDED AT END OF CONSTRUCTION.

ELECTRICAL ENGINEER:

PRELIMINARY DRAWING
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BLUE OAK ENERGY CANADA

200 VINYL COURT, UNIT D, VAUGHAN ON L4L 4A3 PHONE-(905) 850-3200

AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON ON K7L 3N6

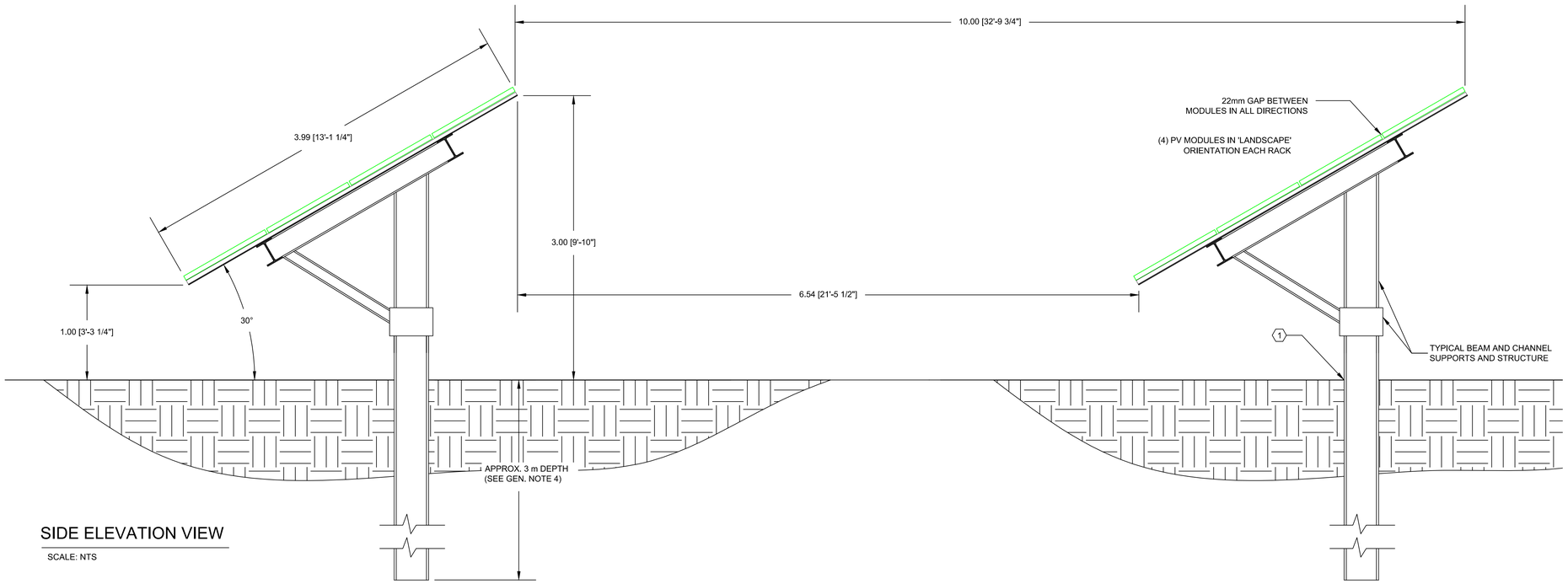
PROJECT SITE:

BELLEVILLE TS DEMORESTVILLE SOLAR PROJECT

PART OF LOTS 51 AND 52 CONCESSION 1
SOPHIASBURGH TOWNSHIP, ON

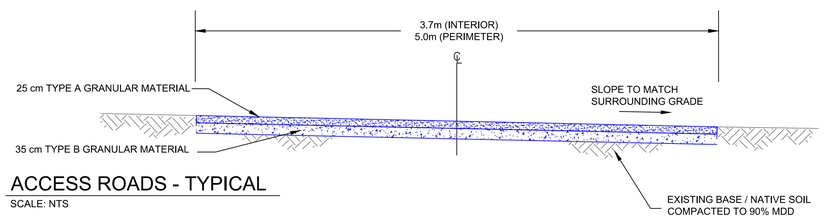
DRAWING: ARRAY PLAN

DRAWING NO. ES-102



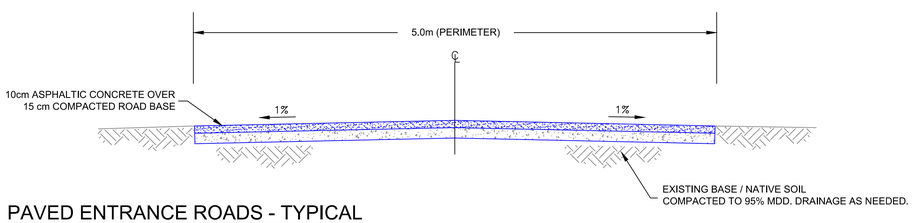
SIDE ELEVATION VIEW

SCALE: NTS



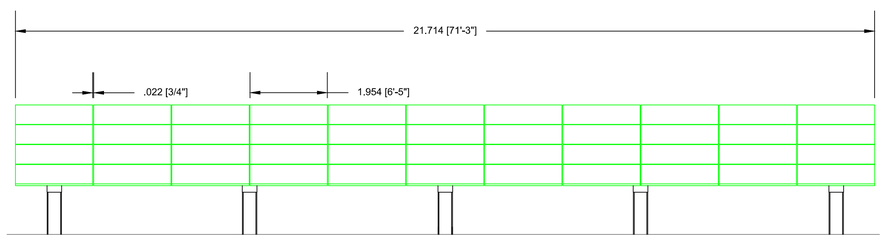
ACCESS ROADS - TYPICAL

SCALE: NTS



PAVED ENTRANCE ROADS - TYPICAL

SCALE: NTS



FRONT VIEW

SCALE: NTS

GENERAL NOTES:

1. EACH RACK INCORPORATES 44 CANADIAN SOLAR; CS6X 270P MODULES.
2. PV MODULES WIRED IN SERIES-PARALLEL COMBINATIONS ABOVE GROUND ALONG RACK STRUCTURES TO CREATE PV STRING CIRCUITS, 600V DC MAX. STRINGS TERMINATE IN PV COMBINER BOXES.
3. COMBINER BOX OUTPUT (50-150A DC EACH) IS ROUTED UNDERGROUND IN RIGID NON-METALIC CONDUIT OR DIRECT BURIAL 2-CONDUCTOR CABLE TO PV INVERTER STATIONS.
4. DEPTHS ARE APPROXIMATE, PENDING FINAL RACK AND STRUCTURAL ENGINEERING.
5. FOUNDATIONS AND DEPTH OF PILES/POST ARE REPRESENTATIVE ONLY. ACTUAL SPECIFICATION WILL BE DETERMINED BY A LICENSED STRUCTURAL ENGINEER BASED ON THE GEOTECHNICAL STUDY.
6. DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
7. APPROXIMATELY 5 PILES PER 44 MODULES

KEYED NOTES:

1. FOUNDATION OPTIONS INCLUDE DRIVEN PILE, HELICAL GROUND ANCHOR, DRILLED PILE WITH CONCRETE REINFORCEMENT. DEPENDS ON SOIL TYPE AND PROPERTIES.

ELECTRICAL ENGINEER:

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AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON ON K7L 3N6

PROJECT SITE:

BELLEVILLE TS DEMORESTVILLE SOLAR PROJECT

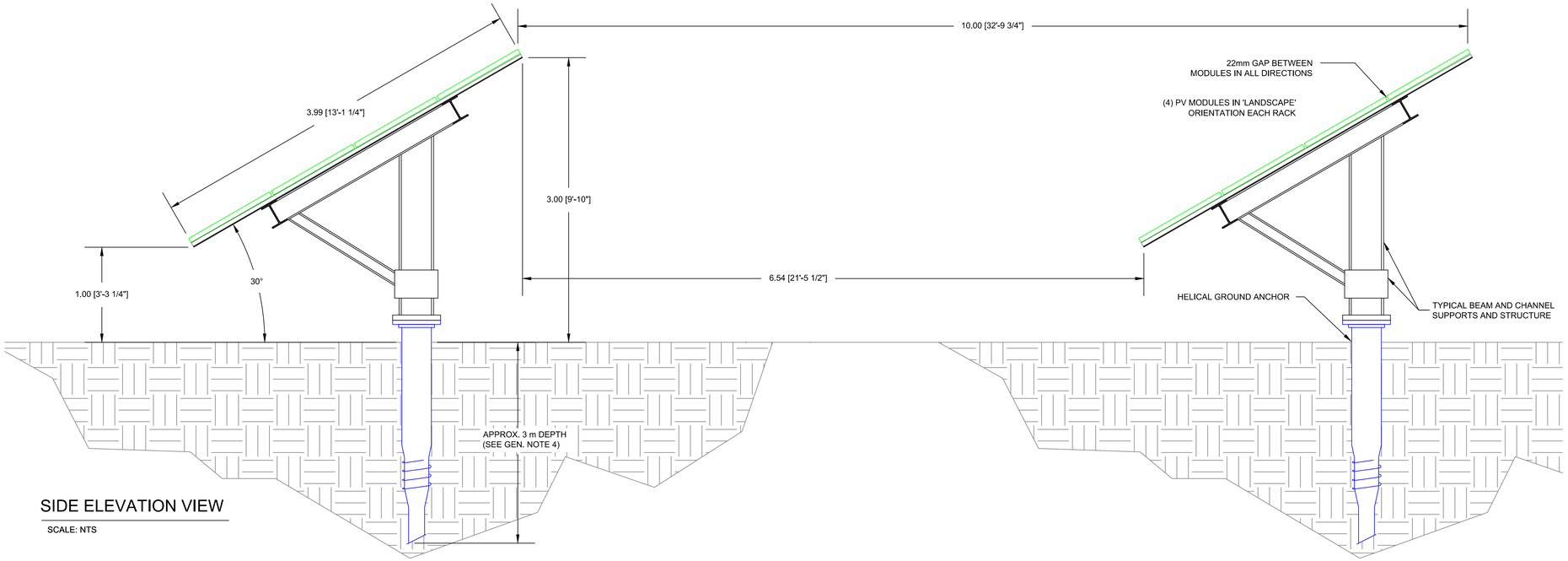
PART OF LOTS 51 AND 52 CONCESSION 1
SOPHIASBURGH TOWNSHIP, ON

DRAWING:

RACKING & ANCHOR DETAILS

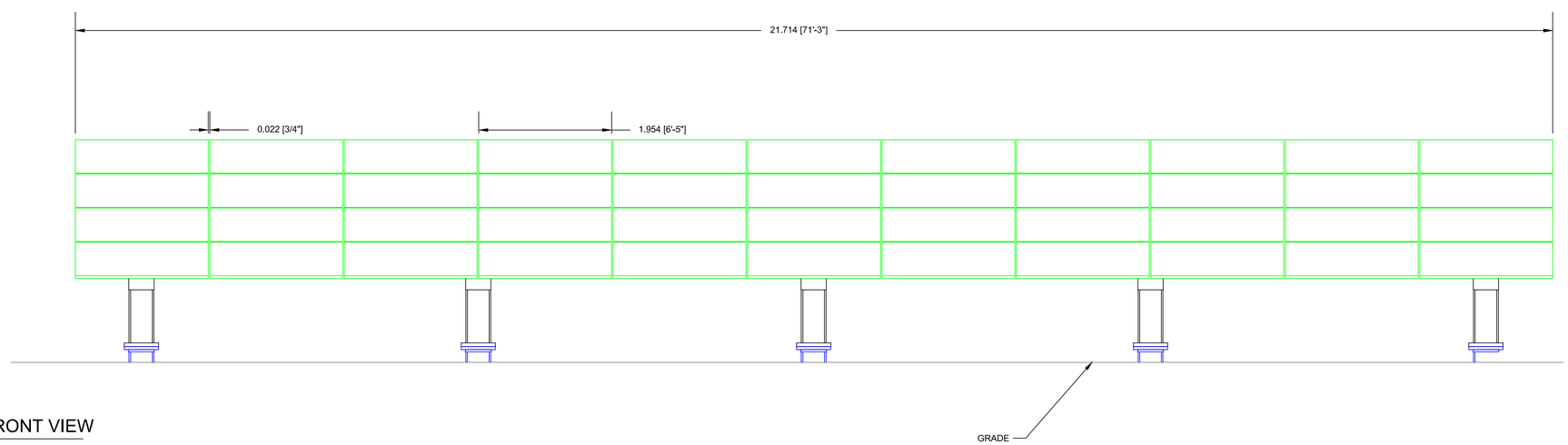
DRAWING NO.

S-101



SIDE ELEVATION VIEW

SCALE: NTS



FRONT VIEW

SCALE: NTS

GENERAL NOTES:

1. EACH RACK INCORPORATES 44 CANADIAN SOLAR; CS6X 270P MODULES.
2. PV MODULES WIRED IN SERIES-PARALLEL COMBINATIONS ABOVE GROUND ALONG RACK STRUCTURES TO CREATE PV STRING CIRCUITS, 600V DC MAX. STRINGS TERMINATE IN PV COMBINER BOXES.
3. COMBINER BOX OUTPUT (50-150A DC EACH) IS ROUTED UNDERGROUND IN RIGID NON-METALIC CONDUIT OR DIRECT BURIAL 2-CONDUCTOR CABLE TO PV INVERTER STATIONS.
4. DEPTHS ARE APPROXIMATE, PENDING FINAL RACK AND STRUCTURAL ENGINEERING.
5. DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED.
6. APPROXIMATELY 5 GROUND ANCHORS PER 44 MODULES.

ELECTRICAL ENGINEER:

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DATE: X-XX-XXXX

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BLUE OAK ENERGY CANADA

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AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON ON K7L 3N6

PROJECT SITE:

BELLEVILLE TS DEMORESTVILLE SOLAR PROJECT

PART OF LOTS 51 AND 52 CONCESSION 1
SOPHIASBURGH TOWNSHIP, ON

DRAWING:

RACKING & ANCHOR OPTIONS

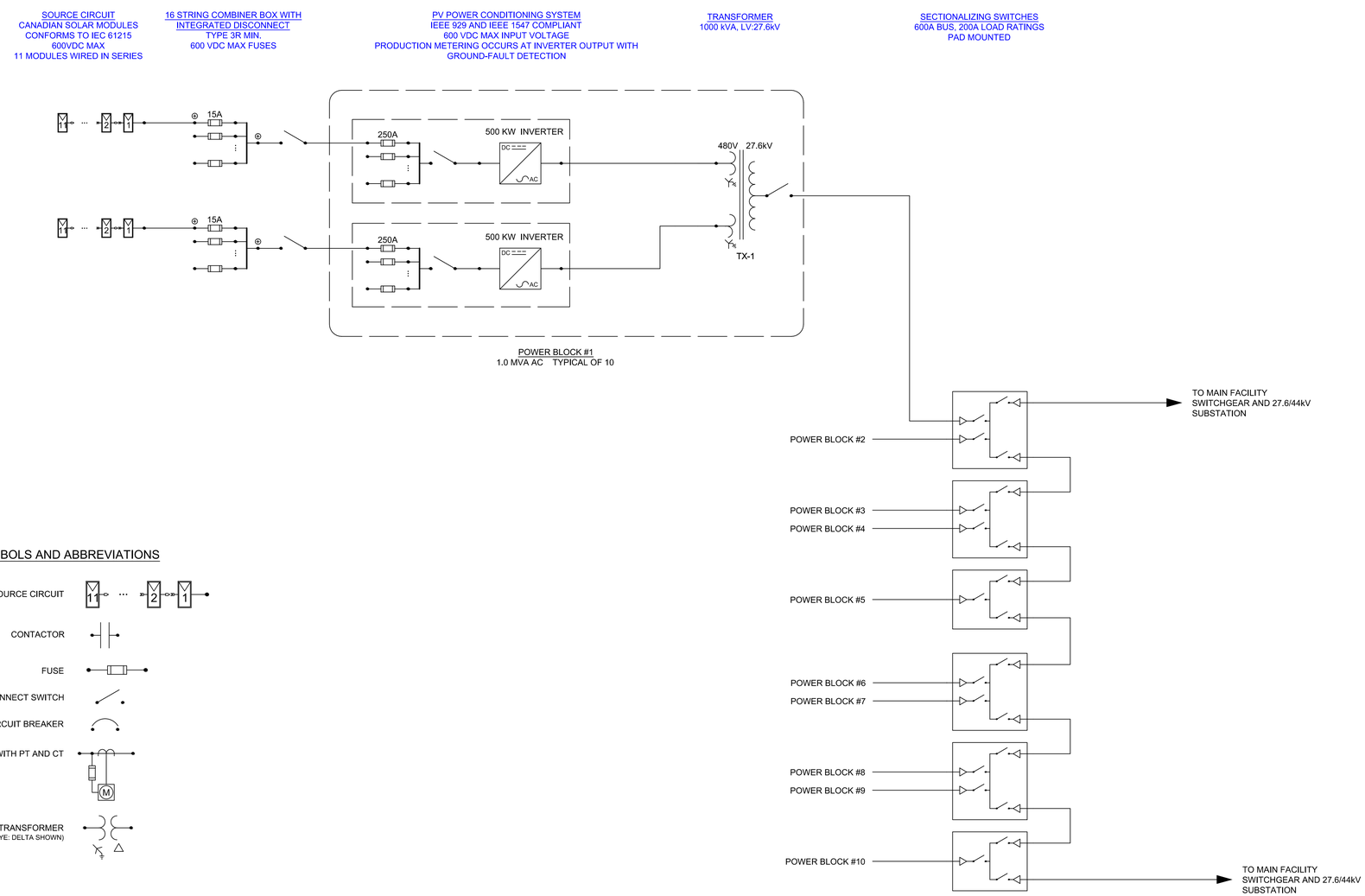
DRAWING NO.

S-102

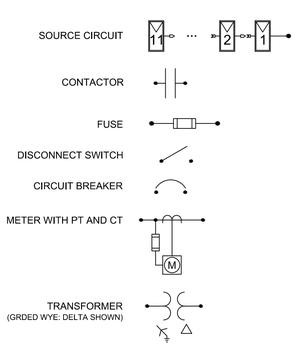
PV SYSTEM GENERATOR CALCULATIONS

MODULE	CANADIAN SOLAR CS6X-270 (TYPICAL)
MODULE STC POWER	270Wp
MODULE TILT	30°
ARRAY AZIMUTH	180°

	GENERATOR, TYPICAL OF 10	SITE TOTAL
GENERATOR MANUFACTURER	SMA	SMA
GENERATOR MODEL	SUNNY CENTRAL 500HE	SUNNY CENTRAL 500HE
NUMBER OF MODULES PER GENERATOR	4576	45760
DC RATING	1.236 MW	12.36 MW
AC NAMEPLATE RATING	1.0 MW	10 MW
NUMBER OF SOURCE CIRCUITS	416	4,160
SOURCE CIRCUIT COMBINERS	26	260



SYMBOLS AND ABBREVIATIONS



GENERAL NOTES:

1. THIS DRAWING IS FOR PRELIMINARY DESIGN PURPOSES ONLY. THE DESIGN SHOWN HERE IS NOT FOR CONSTRUCTION.

ELECTRICAL ENGINEER:

PRELIMINARY DRAWING
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	ISSUED	06/03/11	R.M.

BLUE OAK ENERGY CANADA

200 VINYL COURT, UNIT D, VAUGHAN ON L4L 4A3 PHONE-(905) 850-3200

AXIO POWER CANADA INC

945 PRINCESS STREET, SUITE 252
KINGSTON ON K7L 3N6

PROJECT SITE:

BELLEVILLE TS DEMORESTVILLE SOLAR PROJECT

PART OF LOTS 51 AND 52 CONCESSION 1
SOPHIASBURGH TOWNSHIP, ON

DRAWING:

SINGLE LINE DIAGRAM

DRAWING NO.

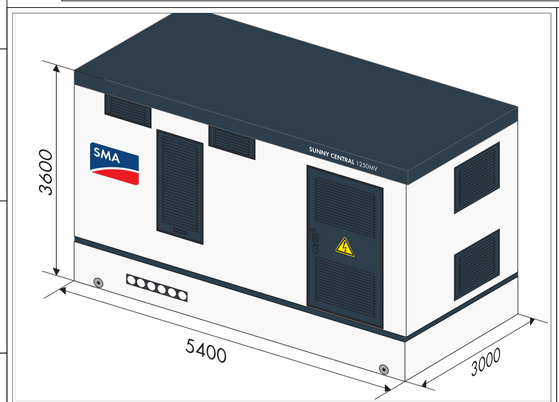
EP-801

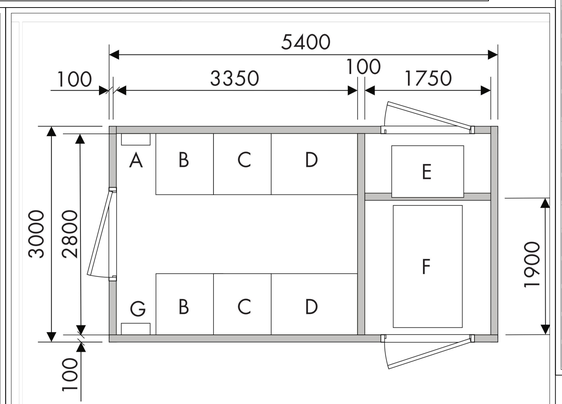
High Yields
- 98% CEC efficiency
- Suitable for ambient temperatures of up to 60 °C (140 °F)
- OptiCool™ intelligent temperature management

Low System Costs
- Outdoor-rated enclosure
- Couples to medium-voltage external transformer
- Available as integrated solution

Strong Peripherals
- Optional DC & AC disconnects
- Optional combiner boxes with string monitoring
- Sunny WebBox, Modbus® & OPC compatible

UL Certified
- UL 1741 / IEEE-1547 compliant





All figures in mm.

A COM-B, optional
C Sunny Central, inverter cabinet
E Medium-voltage switchgear
G Station sub-distribution

B Sunny Central, DC cabinet
D Sunny Central, AC cabinet
F Transformer

Technical data	Sunny Central 500HE-US
Input data	
Max. DC power	565 kWp [1)]
MPP voltage range	330 V – 600 V
Max. DC voltage	600 V
Feed starting at [U] / [P]	380 V / 5000 W
Max. DC current	1600 A
Number of DC inputs	6 – 9
Output data	
Nominal AC power	500 kVA @ 45 °C (113 °F)
Max. AC current	1470 A @ 200 V
AC grid frequency	60 Hz
AC voltage range	180 V – 220 V
AC voltage range, full active power	196 V – 210 V
Power factor (cos φ)	> 0.99
Max. THD	< 5%
Efficiency [2)]	
Max. efficiency	98.6%
CEC efficiency	98.0%
Euro-eta	97.9%
Ambient conditions	
Operating temperature range	-25 °C ... +60 °C (-13 °F ... +140 °F)
Max. temperature for nominal conditions	+45 °C (+113 °F)
Protection rating	NEMA 3R
Installation indoors / outdoors	●/●
Rel. humidity	15% ... 95%
Fresh air consumption	3000 m^3/h
Internal consumption at nominal power	< 1600 W
Standby consumption (P_{night})	< 110 W
Dimensions and weight	
Height	2277 mm (90 in)
Width	2562 mm (101 in)
Depth	956 mm (38 in)
Weight	< 1800 kg (3970 lb)
Certificates / listings	
Certificates	UL 1741, UL 1998, IEEE 1547
EMC conformity	FCC, Part 15, Class A
Interfaces	
RS485 / Ethernet / analog	O/O/O
Display: text line / graphic	–/●
Communication protocols	Modbus / TCP
SSM-US connection	RS485
Plant monitoring	Sunny Portal

NOTES:
1. NONE.

KEYED NOTES:
1. NONE.

ELECTRICAL ENGINEER:
PRELIMINARY DRAWING
FOR REVIEW ONLY
NOT FOR CONSTRUCTION
DATE: X-XX-XXXX

REV. NO.	DESCRIPTION	DATE	BY
	ISSUED	06/03/11	R.M.

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DRAWING: EQUIPMENT SPECIFICATIONS

DRAWING NO. EP-701

EQUIPMENT SPECIFICATIONS
SCALE: NTS