SOLRAY

July 2012

DESIGN AND OPERATIONS REPORT

Marsh Hill Solar Farm

DILLON CONSULTING

EXECUTIVE SUMMARY

Solray Energy Corporation (Solray) proposes to develop a solar facility with a maximum name plate capacity of approximately 10 megawatts (MW) located in the Township of Scugog and Regional Municipality of Durham, Ontario. The renewable energy facility will be known as the Marsh Hill Solar Farm and will be rated as a Class 3 Solar Facility. The project will require approval under *Ontario Regulation 359/09 – Renewable Energy Approval* (REA) under Part V.0.1 of the *Ontario Environmental Protection Act*.

The *Design and Operations Report* discusses the potential for environmental effects as they relate to permanent facility components and their operations within 300 metres of the project location. The report provides a detailed site plan, facility design plan, facility operations plan and Environmental Effects Mitigation and Monitoring Plan (EEMMP). It also contains Emergency Response and Communications Plans (ERCP) that cover the life of the proposed project from construction through to decommissioning.

The layout of the project location has been designed to minimize its footprint and potential negative environmental effects. It is located entirely within ploughed lands. The project has been developed to retain the significance of all natural features identified and mitigates any indirect effects that will occur.

Based on the results of the Stormwater Management Report no permanent measures or equipment are necessary to manage runoff quality, quantity or flow. During the operations phase, only minor potential negative environmental effects to natural features are anticipated due to routine maintenance at the project location. These potential effects, and their corresponding mitigation measures and monitoring strategies, are outlined in greater detail in the EEMMP, which can be found in **Appendix D**. The implementation of acoustical louvers on inverter units will mitigate noise levels from the facility and ensure that it complies with Ministry of the Environment requirements.

The Marsh Hill Solar Farm will operate year round and generate electricity during daylight hours only. The facility will be continuously monitored and managed remotely using an online system that will identify any problems that may occur. Minimal on-site activity is required for daily operation and there will be no permanent on-site employees. The project will be scheduled for maintenance every 2 to 3 months. Additional maintenance or service may be required if there are issues such as equipment damage or malfunction; however, this is not anticipated to be a common occurrence. Site inspections for all project components will occur on a weekly basis. Security and minor maintenance are the only regular activities anticipated on-site, and full training will be provided by Solray for those carrying out these activities.

An Emergency Communications Plan will be included in the Emergency Response Plan and will provide key contact information for relevant responders, regulators, landowners and other stakeholders. It will contain a description of the chain of communications between Solray and relevant responders under emergency scenarios applicable to the project.

Public consultation and stakeholder engagement activities will continue throughout the life of the project. Relevant notices will be published in *The Scugog Standard* and posted on the project website (www.solray.ca/projects/epsom-solar-farm or www.solray.ca/projects/marsh-hill-solar-farm). The contact list will continue to be updated as necessary and will be used to distribute information about the project to landowners, municipalities, agencies, Aboriginal communities, stakeholders and other interested parties.

This *Design and Operations Report* has been completed to fulfill regulatory requirements as mandated by the provincial government for the development of the Marsh Hill Solar Farm. This report is consistent with the provisions of *Ontario Regulation 359/09* for a Class 3 Solar Facility as set out by the *Green Energy and Green Economy Act,* 2009.

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1.0 INTRODUCTION

Solray Energy Corporation (Solray) proposes to develop a solar facility with a maximum name plate capacity of approximately 10 megawatts (MW), located in the Township of Scugog and Regional Municipality of Durham, Ontario. The renewable energy facility will be known as the Marsh Hill Solar Farm and will be rated as a Class 3 Solar Facility. Solray has received a contract from the Ontario Power Authority (OPA) for the sale of electricity generated by this renewable facility through the province's Feed-in-Tariff (FIT) program (enabled by the *Green Energy and Green Economy Act*, 2009). The project will require a Renewable Energy Approval (REA) as per *Ontario Regulation 359/09* under Part V.0.1 of the Ontario *Environmental Protection Act*.

This *Design and Operations Report* is being submitted to the Ontario Ministry of the Environment (MOE) as per *Ontario Regulation 359/09* as part of a complete REA application. This report was made available in draft form for public review and comments prior to this final REA submission. Other reports included in the REA submission package include:

- *Project Description Report*
- *Construction Plan Report*
- *Decommissioning Plan Report*
- *Noise Study Report*
- *Natural Heritage Assessment (4 reports)*
- *Water Assessment (2 reports) and Water Body Report (1 report)*
- *Archaeological Assessments*
- *Cultural Heritage Screening/Self Assessment*
- *Consultation Report*
- *Supporting Documents*

The *Design and Operations Report* discusses the potential for environmental effects as they relate to permanent facility components and their operation, within 300 metres of the project location. The report provides a detailed site plan, facility design plan, facility operations plan and Environmental Effects Mitigation and Monitoring Plan (EEMMP). It also contains information on the Emergency Response and Communications Plans (ECRP) that will cover the life of the proposed project from construction through to and including decommissioning.

2.0 THE PROPONENT

Solray is a developer of utility-scale solar energy projects in Ontario, with two projects moving towards construction and nine projects in early-stage development. Solray endeavours to work closely with all interested stakeholders in their projects including landowners, Aboriginal communities, the general public, municipalities, government agencies and ministries. Solray's main objective is to design and construct projects that are both environmentally beneficial and financially viable.

Contact information for the proponent is as follows:

Full Name of Company:	*Solray Energy Corporation*	
Prime Contacts:	*Andy Keith,* *President*	*Michael Jordan Halbert,* *Chairman and CEO*
Address:	*2788 Bathurst St., Suite 305* *Toronto, Ontario, M6B 3A3*	*2788 Bathurst St., Suite 305* *Toronto, Ontario, M6B 3A3*
Telephone:	*(416) 910-6580*	*(416) 780-8000*
Fax:	*(416) 780-8001*	*(416) 780-8001*
Email:	*andy@solray.ca*	*mjh@solray.ca*

Dillon Consulting Limited (Dillon) is the consultant responsible for the preparation of REA-related reports and for consultation activities for the Marsh Hill Solar Farm. The contacts at Dillon are:

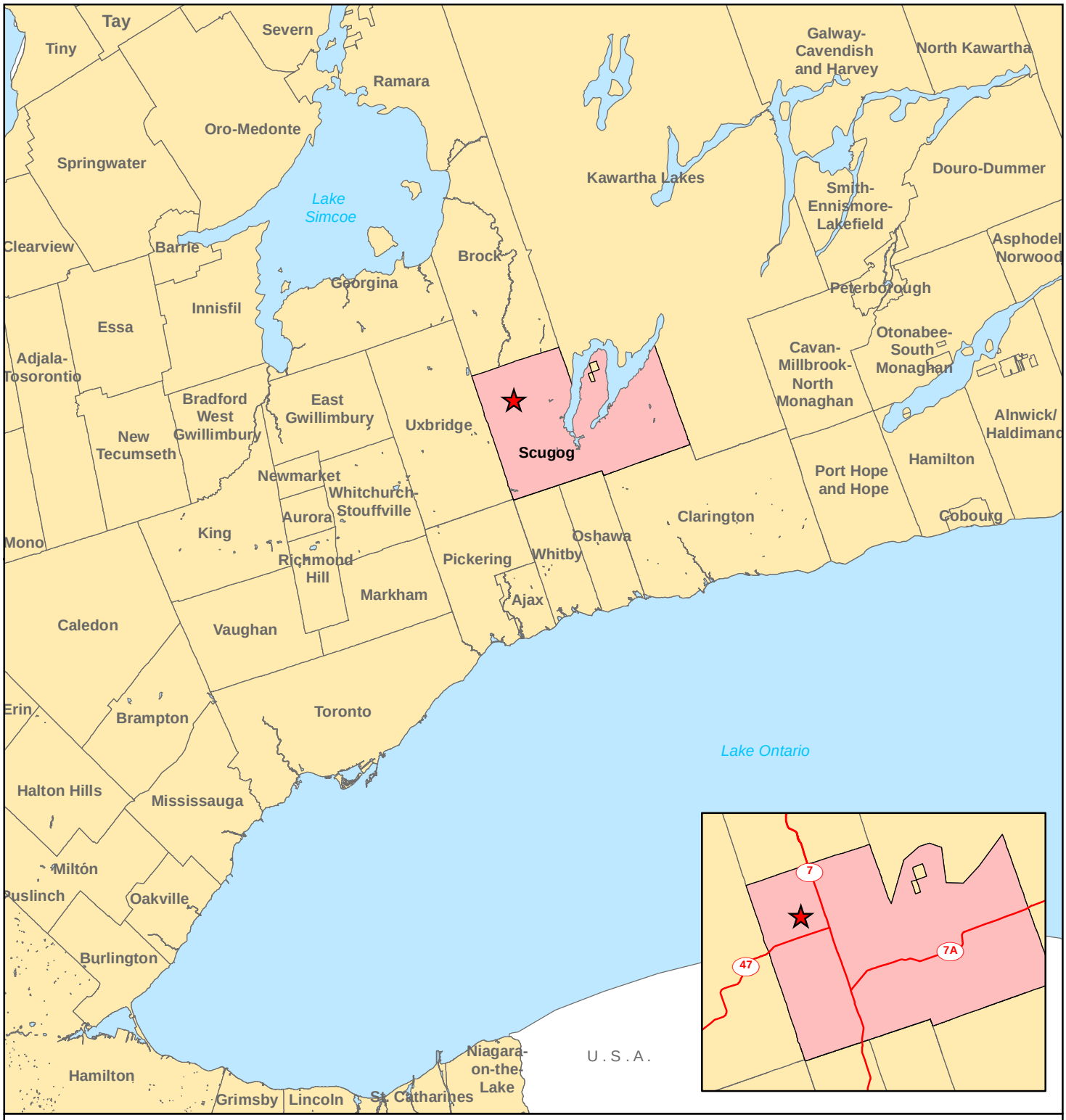
Full Name of Company:	*Dillon Consulting Limited*	
Prime Contact:	*Mario Buszynski,* *Project Manager*	*Katharine Myrans,* *REA Project Coordinator*
Address:	*235 Yorkland Blvd., Suite 800* *Toronto, Ontario, M2J 4Y8*	*235 Yorkland Blvd., Suite 800* *Toronto, Ontario, M2J 4Y8*
Telephone:	*(416) 229-4646 ext. 2365*	*(416) 229-4646 ext. 2381*
Fax:	*(416) 229-4692*	*(416) 229-4692*
Email:	*MBuszynski@Dillon.ca*	*KMyrans@Dillon.ca*

3.0 PROJECT LOCATION

The proposed Class 3 Solar Facility is located at 725 Cragg Road, Uxbridge, Ontario between Marsh Hill Road and Highway 7 within the Township of Scugog. **Figure 1** shows the general location of the project in Southern Ontario. The project location covers part of Lot 8, Concession 11 and consists of approximately 36.1 hectares of privately owned land (leased by the proponent); with geographic coordinates (centroids) as follows:

- Latitude: 44° 08' 59.78" N
- Longitude: 79° 02' 58.05" W

"Project location" is defined in *Ontario Regulation 359/09* to be "a part of land and all or part of any building or structure in, on or over which a person is engaging in or proposes to engage in the project". Facility components making up the project location are discussed in **Section 5** of this report and their locations have been mapped in the site plans provided in **Section 4**.



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Marsh Hill Solar Farm

Figure 1: General Location of the Marsh Hill Solar Farm in Southern Ontario

Legend

- Project Location
- Highway
- Township of Scugog
- Municipalities

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4.0 SITE PLANS

The following site plans (**Figures 2** to **4**) detail the location of facility components, natural features, noise receptors, land uses, setbacks and other features in accordance with Table 1 of *Ontario Regulation 359/09*. The following (and their associated infrastructure) are not shown in the site plans because they will not be collected, transmitted, treated, stored, handled, processed or disposed of in the construction, operation or decommissioning of the facility: groundwater, sewage, biomass or source separated organics. The facility will not discharge contaminants to air during its operation.

Figure 2 identifies the project location boundary and lands within 1000 metres. It provides the larger context for the facility components and natural features that will be shown in more detail in **Figures 3** and **4. Figure 2** shows the location of all potential noise receptors and the distance between the project location and closest noise receptors to the east, west, south and north (more information is provided in Section 4.1). **Figure 2** also identifies any: roads, utility corridor(s), rights-of-way, easements not directly associated with the project, municipal zoning and/or land use designations, on-ground land uses, property parcels, and lots/concessions.

Figure 3 provides the location of all proposed facility components. These components include: photovoltaic (PV) panels (and associated racking and supports), substation, inverter units (which contain step-up transformers), access roads, underground and overhead cabling, communication tower, permanent parking and the perimeter fence. Rights-of-way or easements associated with these components are also identified if applicable. Detailed information on facility components is provided in **Section 5** and **Appendix A**. UTM coordinates are provided for the substation and nearest noise receptors. The substation transformer is 44 kV and less than 1000 metres from the nearest noise receptor. The *Noise Study Report* concludes that the substation transformer is within acceptable noise limits and will not require any noise mitigation while a number of the inverter units will require noise mitigation in the form of acoustic louvres. The temporary construction laydown area is provided in **Figure 3** for context.

Figure 4 identifies the project location in relation to natural features and water bodies within the project location and surrounding 300 metres. Distances to the nearest features are provided, as well as the UTM coordinates of the nearest vertex of a natural feature to the project location. Setbacks apply only to those natural features evaluated as 'significant' or provincially significant by the *Evaluation of Significance Report*, which is included in the *Natural Heritage Assessment.* The project location is within 20.5 metres of Candidate Significant Amphibian Breeding Habitat (including Candidate Significant Habitat for Western Chorus Frog), Candidate Significant Amphibian Movement Corridor and Candidate Significant Bullfrog Concentration Area (all of which are associated with Wetland 2). The project location is also within 7.8 metres of a delineated woodland and Generalized Candidate Significant Wildlife Habitat, and within 33.5 metres of a watercourse. The location of the Marsh Hill Solar Farm has been the subject of field investigations and a thorough review of constraints to development was undertaken prior to delineating

the project location. Based on the natural environment information collected, the project location was refined to avoid impacts to significant and/or sensitive natural heritage features, where possible. Although the project location extends into the 120 metre setback of significant natural features, the layout of the solar project has been developed to minimize its footprint and prioritize the protection of natural features that provide habitat for sensitive species. The project has been developed to retain the significance of all natural features identified and mitigates any effects that will occur. Of the natural features evaluated to be significant, the layout of the project will allow for the persistence of all these natural features after this project is constructed and operational.

4.1 Transformers and Noise Receptors

The background ambient noise, exclusive of that generated by the project, can be characterized as having qualities of a Class 3 (Rural) Area, as described in the MOE Noise Pollution Control Publication *NPC-232 Sound Level Limits for Stationary Sources in Class 3 Areas.* The primary contributor to background sound during the daytime and nighttime in Class 3 areas are natural sounds and with occasional vehicle traffic on nearby roads. Marsh Hill is designed to operate 365 days per year. The solar panels are only able to generate electricity when the sun is shining. Similarly, the inverters only operate when the solar panels are generating electricity. The operating load for the inverters and transformers is dependent on the amount of electricity generated by the panels, which is at a maximum (100% load) when the sunlight is most intense. For the noise assessment the inverters and transformers were conservatively assumed to be operational at full power (i.e., maximum noise emission) during both daytime and night-time hours (note that nighttime power generation occurs after 7pm during the summer).

The chosen locations of inverter units (containing two inverters and one step-up transformer) and the substation transformer were based, in part, on the location of noise receptors. **Appendix B** provides a list of assessed noise receptors within 1 kilometre of the project location, their UTM coordinates and distance to the transformers. The closest potential[1] existing noise receptor (a participating receptor), as shown in **Figures 2 and 3**, is 58.51 metres from the project location and 182.47 metres from the nearest noise source (an inverter unit). As per *Ontario Regulation 369/09* and guidance documents from the MOE, possible future noise receptors must be identified on vacant lots. The locations of the noise receptors are subjective but have been chosen based on the typical building pattern in the area. The closest 'Assumed Future Noise Receptor', as shown in **Figures 2** and **3** is 227.85 metres from the project location and 415.45 metres from the nearest noise source (also an inverter unit). At present there are no known existing or planned solar facilities in the vicinity that must be considered for noise modelling.

[1] While it is possible that the assumed noise receptor may be a barn or outbuilding that does not meet the definition of a noise receptor as defined by *Ontario Regulation 359/09*, these structures are considered to be noise receptors in order to err on the side of caution with regard to noise.

Based on the results of the *Noise Study Report* acoustical louvers are required on Inverter Units 5 to 10 to ensure that noise levels meet MOE requirements. With the implementation of these mitigation measures, the proposed project complies with the daytime and nighttime applicable MOE environmental noise criteria. For more information refer to the *Noise Study Report*.

4.2 Archaeological and Cultural Heritage Resources

Based on the results of the Stage 1 and 2 *Archaeological Assessments* and the *Cultural Heritage Screening*, the project location does not fall within or adjacent to a protected property and no identified cultural heritage resources or significant archaeological resources fall within the project location (see the Stage 1 and Stage 2 *Archaeological Assessments* and *Cultural Heritage Screening*).

4.3 Land Uses and Land Use Plans

The project falls within lands zoned by the Township of Scugog as Rural. Surrounding lands are also zoned as Rural (*Township of Scugog Zoning By-law 75-80*, Schedule A1, 2010, see **Appendix C**). The project location lands are currently ploughed fields and the solar facility will temporarily alter the land use and remove approximately 36.1 hectares from agricultural production. **Figure 2** depicts the current land uses within the project location and surrounding 120 metres as identified by the Ecological Land Classification (conducted as part of the *Natural Heritage Assessment*) and the Zoning By-law.

Mitigation measures will be undertaken to ensure there are no impacts to surrounding land uses, which are primarily agricultural with a few residential dwellings. Landscaping with low-maintenance, low-growing native species will occur within the project location. This vegetation will be planted to maintain the nutrient quality of the soil and manage weed growth. The project location will be returned to its original or future anticipated land use after decommissioning.

A search and analysis of available records identified that the project location and surrounding 300 metres are located within the Greenbelt Protected Countryside as well as the Lake Simcoe Watershed (see **Figure 2**). No negative impacts are anticipated as a result of the project on these areas. Additional environmental studies, as stipulated by *Ontario Regulation 359/09* for project locations within Plan Areas will be conducted and will consider the full intent of the Lake Simcoe Protection Plan and *Greenbelt Act* when evaluating the potential negative environmental effects as a result of the proposed project. Potential environmental effects to these Land Use Plan Areas are discussed in the EEMMP, in **Appendix D**. The project does not lie within or adjacent to the Niagara Escarpment or the Oak Ridges Moraine.

4.4 Natural Heritage and Water Bodies

The project location of the Marsh Hill Solar Farm has been subject to numerous field investigations and a thorough review of development constraints was undertaken prior to delineating the project location.

Based on the natural environment information that was collected, the project location was refined to avoid impacts to significant and/or sensitive natural heritage features and water bodies. The layout of the solar facility has been developed to minimize its footprint and it occurs entirely within lands that are ploughed fields.

The project location is within 120 metres of two delineated woodlands, candidate significant amphibian breeding habitat, candidate significant amphibian movement corridor, candidate significant bullfrog concentration area and generalized candidate significant wildlife habitat. Of the natural features evaluated to be significant or assumed to be provincially significant, the layout of the project as shown on **Figure 3** will allow for the persistence of all these natural features after this project is constructed and operational. Based on the results of the *Environmental Impact Study Report* (EIS), consultation with the MNR, and in accordance with procedures established by the MNR - Subsection (1) of Section 38 (*Ontario Regulation 359/09*) - the project components may be constructed and installed within 120 metres of a significant or provincially significant natural feature. The EIS identifies any mitigation methods for indirect negative effects that may occur. For detailed information on natural heritage features at the project location refer to the *Natural Heritage Assessment* documents.

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Marsh Hill Solar Farm

Figure 2:
Site Plan - Land Uses

LOT 6, CON 12
LOT 7, CON 12
LOT 8, CON 12
LOT 9, CON 12
LOT 10, CON 12
MARSH HILL ROAD
SCUGOG 12 LINE ROAD
LOT 6, CON 11
LOT 7, CON 11
LOT 8, CON 11
LOT 9, CON 11
LOT 10, CON 11
CRAGG ROAD
LOT 6, CON 10
LOT 7, CON 10
LOT 8, CON 10
LOT 9, CON 10
LOT 10, CON 10

10 (0.38 ha)
2 (0.05 ha)
10 (0.44 ha)
6 (3.41 ha)
4 (0.36 ha)
3 (2.18 ha)
7 (3.11 ha)
10 (0.97 ha)
1 (3.06 ha)
5 (46.38 ha)
7 (6.46 ha)
10 (1.29 ha)
8 (0.78 ha)
7 (2.51 ha)
9 (0.85 ha)
6 (2.15 ha)

656304.78, 4891203.17
402.40 m
227.85 m
58.51 m
228.99 m
655657.45, 4889737.28
656083.62, 4889948.10
656384.39, 4889979.29
311.92 m
656282.48, 488970.08

Legend

- Assumed Future Noise Receptor
- Potential Noise Receptor
- Watercourse
- Local Roads
- Project Location
- 120 m from Project Location
- 300 m from Project Location
- Vacant Parcel
- Occupied Parcel
- Lots/Concessions
- Lake Simcoe Protection Act Watershed Boundary
- Greenbelt Natural Heritage System

Ecological Land Classification

- 1) MAMM1-3: Reed Canary Grass Graminoid Mineral Meadow Marsh Type
- 2) SWM: Mixed Swamp
- 3) WOMM4-1: Fresh - Moist White Cedar - Hardwood Mixed Woodland Type
- 4) Open Aquatic
- 5) Ploughed Field
- 6) OAGM1: Annual Row Crops
- 7) OAGM2: Perennial Cover Crops
- 8) IAGM1: Agricultural Buildings
- 9) CVR_4: Rural Property
- 10) MEFM4: Fresh-Moist Forb Meadow Ecosite

Project falls within the Greenbelt Protected Countryside and is zoned as rural by the Township of Scugog

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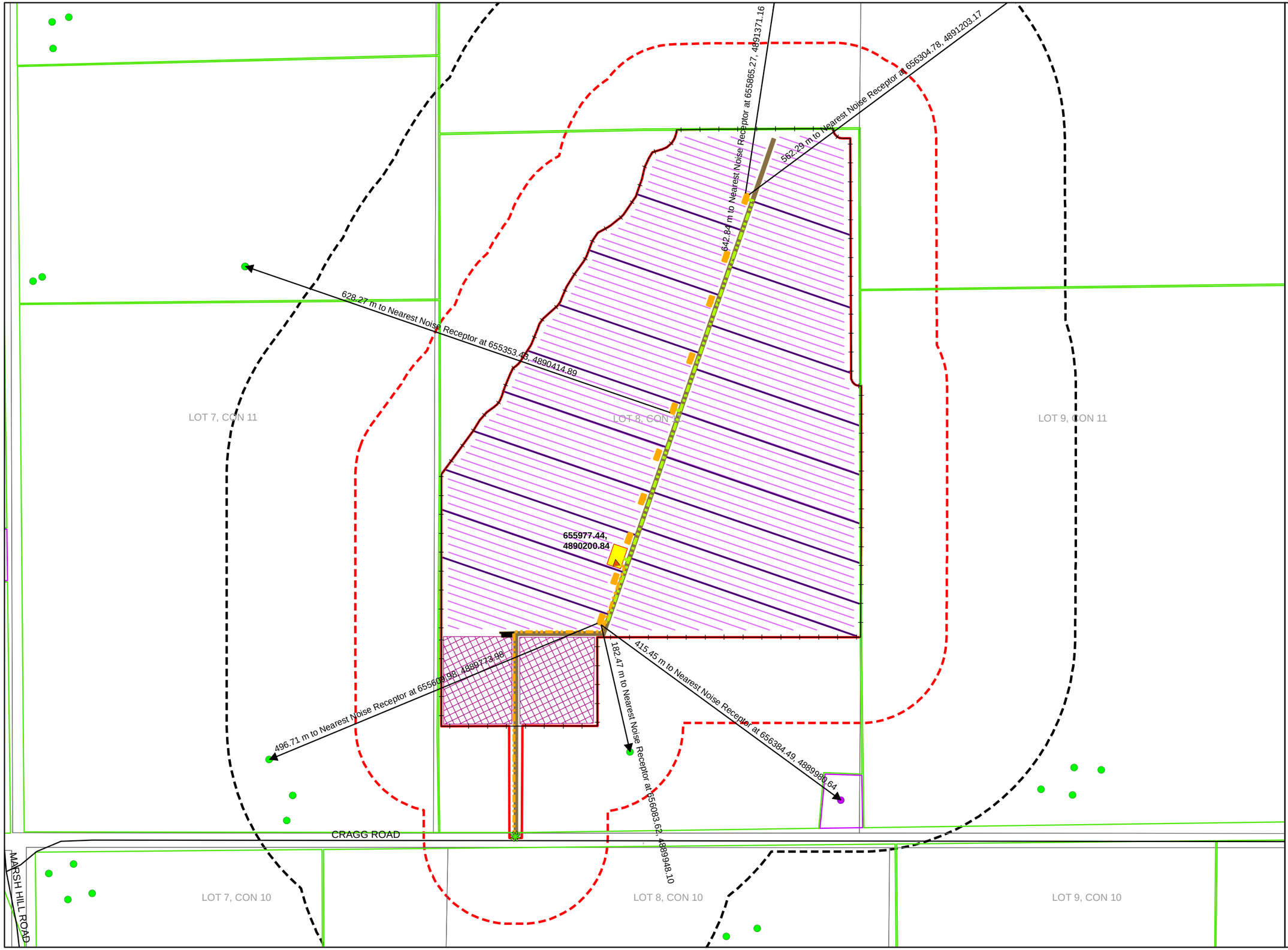
File Path: I:\GIS\114838 - Solray Park Property\Mapping\Design and Operations\Figure 2 Marsh Hill Site Plan-Land Uses.mxd



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Marsh Hill Solar Farm

Figure 3:
Site Plan - Component Layout

Legend

- Assumed Future Noise Receptor
- Potential Noise Receptor
- Local Roads
- Project Location
- 120 m from Project Location
- 300 m from Project Location
- Lots/Concessions
- Vacant Parcel
- Occupied Parcel

Project Components

- Communication Tower
- Site Entrance
- Fence
- Solar Panel
- 0.5 MW Boundaries Section
- Underground Cable
- Overhead Line
- Access Roads
- Laydown Area (Temporary)
- Inverter
- Substation Yard
- Permanent Parking

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Marsh Hill Solar Farm

Figure 4: Site Plan - Natural Heritage Features

B
ABH2
Stream 1
Stream 2
Open Water 1
ABH1
7.78 m
A
33.46 m
20.48 m
Open Water 2
Open Water 3
LOT 6, CON 11
LOT 7, CON 11
LOT 8, CON 11
LOT 9, CON 11
LOT 10, CON 11
LOT 6, CON 10
LOT 7, CON 10
LOT 8, CON 10
LOT 9, CON 10
LOT 10, CON 10

Legend

- Watercourse (Intermittent Stream)
- Watercourse (Permanent Stream)
- Local Roads
- 5 m Contours
- Project Location
- 120 m from Project Location
- 300 m from Project Location
- Lots/Concessions
- Undelineated Woodland
- Undelineated Wetlands

Significant Natural Features

- Generalized Candidate Significant Wildife Habitat
- ABH — Candidate Significant Amphibian Breeding Habitat (Habitat for Western Chorus Frog)
- Candidate Significant Amphibian Movement Corridor
- Candidate Significant Bullfrog Concentration Area
- A — Delineated Woodland
- Delineated Wetlands

An *Environmental Impact Study* has been submitted to the Ministry of Natural Resources for natural features deemed significant

A *Water Bodies Report* has been prepared

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File Path: I:\GIS\114838 - Solray Park Property\Mapping\Design and Operations\Figure 4 Marsh Hill Site Plan-Natural Heritage Features.mxd

5.0 FACILITY DESIGN PLAN

The following subsections describe the solar facility components that will be in place for the life of the project. The locations of the project components are shown in **Figure 3** and manufacturer technical specifications are provided in **Appendix A.** Temporary features related to construction and decommissioning activities are described in the *Construction Plan Report* and *Decommissioning Plan Report.* They are also shown in **Figure 3** for context.

The operation of the facility will not require the applicant to take groundwater or surface water. The solar facility will not generate air emissions or sewage or handle, store or process biomass, source separated organics, or farm materials. Therefore, no equipment or components are required for these activities. The project will require minimal stormwater management (see **Section 6.1.1**).

5.1 Existing Features

The Marsh Hill Solar Farm will not require the use of any existing features (e.g., buildings), as there are none within the project location; however, the facility will be connected to the existing electrical distribution grid and the project location will be accessed from Cragg Road.

5.2 Electricity Generation Process

PV panels will be the technology used to convert solar energy into electricity. With exposure to sunlight, the solar modules convert solar radiation into direct current (DC) electricity through a PV process. The PV process occurs when the energy from the sunlight is transferred to semiconductors contained in the modules. DC electricity generated from the panels will be collected and converted into alternating current (AC) electricity by inverters. From the inverters, the electricity voltage will be stepped up via a transformer in each inverter unit and then further stepped up to local distribution voltage through the transformer substation. It will then be metered and transferred into the local distribution system for regular use.

5.3 Solar Facility Components

The following sub-sections provide detail on the individual components that will be used over the lifetime of the project and may cause negative environmental effects.

5.3.1 Solar Modules and Mounting System

Approximately 40,000 to 50,000 PV panels of between 250 to 300 watts each will be installed for the Marsh Hill Solar Farm. It is anticipated that the following panels, or similar, will be used: Suntech Model STP275-24/Vdx panels of 280 watts. The panels will be mounted and aligned in rows facing due south (approximately 5 to 7 metres apart) and will be mounted on fixed-tilt, ground-mounted, modular racking systems. The foundation type used will be selected based on the array foundation type appropriate for the geotechnical conditions at the project location.

5.3.2 Inverters, Transformers and Electrical Collection System

DC electricity generated from the panels will be transmitted through underground cables connected to combiner boxes where a number of incoming wires from the racks will be combined into a single outgoing cable. From the combiner box, the DC current will be transmitted below ground to one of ten inverter units (enclosed) which will convert the DC electricity into AC electricity suitable for distribution to the local grid. A total of 10 inverter units will be spread across the project location. The inverter units (SMA's Sunny Central) will be rated for 1000 kVA of continuous output power and will contain two 500 kW inverters, an inverter step-up transformer (1000 kVA), and an internal cooling fan. Each inverter unit will handle 1 MW AC of power from its associated array of panels.

The step-up transformers located in the inverter units will increase the voltage of the electricity collected to 27.6 kV, which will then be distributed below ground (requires trenching) to a main step-up transformer located within the substation. The main transformer is expected to be a 10 MVA pad mount transformer (make/model to be determined) and will increase the voltage further to 44 kV for connection to the Hydro One transmission grid. A short overhead line mounted on poles will be constructed to the point of common coupling (at the project location boundary and Cragg Road municipal right-of-way). The distribution line along Cragg Road will either be upgraded or replaced by Hydro One and they will be responsible for any permits associated with this distribution line. Given that the line is located within the existing right-of-way, it is not expected that any natural features would be removed. Appropriate grounding systems will be installed for the project, where necessary.

The 'substation' consists of a gravel yard within which the substation transformer, switch gear, monitoring equipment and communications tower are located. Secondary containment for the substation transformer will be built to reduce potential negative environmental effects from an oil leak. The transformer will have appropriate spill containment that may consist of one of the following:

- Single-walled transformer resting in a concrete basin designed to hold the liquid contents of the transformer and stormwater equivalent to a 30-minute 100-year storm. Stormwater will be contained in the concrete basin with a rock base for infiltration and then drained through an oil/water separator, which will contain the oil and use gravity to release water back into the surrounding environment. Any oil discharge from the oil/water separator will be collected and disposed of at a registered facility;
- Single-walled transformer would be located in an enclosure with no exposure to rainwater. It would rest in a concrete basin with dimensions appropriate to contain 100% of the liquid contents of the transformer; or
- Double-walled transformer.

Step-up transformers in the inverter units are contained within the unit enclosure and do not require additional containment.

5.3.3 Noise Barriers

Based on the *Noise Study Report*, minimal noise reduction measures will be required to ensure that the noise levels (dBAs) meet MOE-regulated limits at both potential existing and assumed future noise receptors. For the Marsh Hill Solar Farm, a barrier will not be required for the substation transformer; however, acoustic louvers will be required for inverter units 5, 6, 7, 8, 9 and 10 as shown in **Figure 3**. These louvres are part of the all-weather enclosure constructed of steel and are not separate project components.

5.3.4 Access Roads

A main access road will be needed for the construction equipment and related vehicles to enter the project location off Cragg Road. Internal access roads may also be developed for construction purposes and to provide for long-term maintenance during operation. These will be packed dirt during construction and vegetated after construction. The main access road will be about 5 metres wide (with 2.5 metre vegetated shoulders) and will consist of granular material. A geotextile fabric underlay will be used to improve structural integrity and preserve the granular material. If necessary, culverts will be installed beneath the access road at locations where conveyance of surface water drainage is required.

5.3.5 Perimeter Fence, Communications Tower and Lighting

For the safety of the public and to prevent vandalism, a perimeter fence will be installed. This will be a chain link fence as required by the Electrical Safety Authority (approximately 2 metres in height) around the perimeter of the project location with gated entrance(s). A communications tower, approximately 35 metres in height will be installed to transmit data. It will be located inside the substation yard. Motion-sensored lighting will be installed as necessary.

5.3.6 Temporary Construction Area and Permanent Parking

During construction it will be necessary to designate/construct a temporary storage/laydown area for equipment and components as well as parking spaces for facility workers. This area has been provided in **Figure 3** for context. In addition, a small gravel area (approximately 122.9 square metres) will be constructed north of the temporary construction area and east of the main access road. It will be used during operations for permanent parking of maintenance vehicles and for storage of maintenance materials during the operational phase of the facility.

5.3.7 Water Crossings

As shown in **Figure 4**, permanent and intermittent streams are within 300 metres of the project location; however, no water crossings are anticipated for this project. For more information, please refer to the *Natural Heritage Assessment*.

5.3.8 Equipment Related to Stormwater Management

Once operational, the solar facility is not anticipated to have any significant negative impacts to existing stormwater runoff or drainage patterns. The Stormwater Management Plan (discussed below in **Section 6.1.1**) determined that no permanent stormwater features or equipment are required at the project location to minimize potential negative environmental effects from stormwater. Stormwater management measures and equipment related to construction activities are discussed in the *Construction Plan Report*.

5.3.9 Other Equipment

During the operation and maintenance phases, the solar energy facility will not engage in, nor will any equipment be required for, the following activities:

- the use or taking of groundwater or surface water;
- the generation, collection, transmission or treatment of sewage;
- the production, handling, storing or processing of any waste, biomass, source separated organics, farm material or biogas; or
- discharges of contaminants to air.

6.0 FACILITY OPERATIONS PLAN

6.1 Daily Operations, Staffing and Training

The Marsh Hill Solar Farm will operate year round and generate electricity during daylight hours only. The facility will be continuously monitored and managed remotely via the communications tower and using an online system that will track performance in real time and identify any problems that may occur. The solar facility can be accessed via this system and minor faults can be analyzed and corrected remotely, or crews dispatched to the site as required.

Minimal on-site activity is required for daily operation and there will be no permanent on-site employees. Maintenance and transportation crews will be made aware of the contents of the Emergency Response and Communications Plans, site-specific health and safety plan and procedures to follow in the instance of accidental spills. All project vehicles entering the site will carry an emergency spill response kit. Such a kit will also be made available on-site, likely in the substation.

During the operations phase, the only potential negative environmental effects to natural features would be due to routine maintenance at the project location, and would likely be minor. These are outlined in greater detail in the EEMMP, which can be found in **Appendix D**. No hazardous materials will be stored on-site with the exception of oil for transformers, which will be adequately contained and accompanied by a Spills Response Plan.

6.1.1 Stormwater Management

A preliminary Stormwater Management (SWM) Report has been prepared for the Marsh Hill Solar Farm (see **Appendix E**). The report contains a level of detail suitable to satisfy the requirements set forth within the MOE's *Technical Guide to Renewable Energy Approvals (2011).* Prior to construction a more comprehensive plan will be developed based on the detailed design of the facility and in consultation with the EPC Contractor.

It is assumed the existing topography will not be significantly altered; therefore, the drainage pattern will remain the same in post-development. Impervious surfaces considered in the study are concrete (for inverter unit, substation transformer and communication tower foundations) and gravel (access roads, substation yard and parking). Imperviousness of the proposed solar panels does not factor into the calculation of the post-development runoff coefficient due to the elevated nature of the racks; constructed above ground, mounted and tilted. Runoff is directed from the solar panels onto the ground in front of the solar panels (which is grass covered, below the fronting row of solar panels).

Based on the SWM Report the proposed runoff coefficients and peak flows after construction do not vary significantly from existing conditions. Accordingly, no quantity abatement measures are required.

Although the majority of the project location poses no increased loading of total suspended solids (TSS) or other pollutants such as oil, spill containment design features for the substation and inverter transformers have been considered.

6.2 Maintenance Activities

The project will be scheduled for maintenance every 2 to 3 months. Typically, maintenance includes checking the structures and connections. It is anticipated that the PV panels will be washed with water approximately three times annually. Additional maintenance or service may be required if there are issues such as equipment damage or malfunction; however, this is not anticipated to be a common occurrence. Site inspections for all project components will occur on a weekly basis. Security and minor maintenance are the only regular activities anticipated on-site, and full training will be provided by Solray for those carrying out these activities.

Activities associated with the operation and maintenance of the solar facility are detailed in **Table 1**. These activities will take place over the operational lifetime of the project.

Table 1: Operations and Maintenance Activities

Activity	Description
Monitoring and meter calibrations	The facility will be managed twenty-four hours a day off-site through remote monitoring (via internet) to ensure proper power output and to alert the operations staff to potential issues. Most issues can be remotely diagnosed so that the correct individual(s) can be dispatched to the facility to correct any problems.
Routine periodic maintenance and inspection of project components	Site visits by the operations manager will occur approximately every week to visually inspect the solar farm and project location and ensure that the facility is in proper working order. Activities that will occur during these visits may include data collection, regular maintenance (as described below) and any necessary minor repairs. Security visits may also occur periodically.
Transformers	Transformers will be visually inspected approximately once a month. The inspection will include the following : ▪ Checking the containment system to ensure the liner is attached and shows no signs of perforation or other damage; ▪ Checking of the concrete walls for cracks or signs of frost heaving; ▪ Checking of the sump for evidence of water or oil. There should be no oily sheen on the water in the oil separator sump; and ▪ Inspection of the transformer for signs of leaks. If noted, they will be immediately assessed and repaired as necessary.

Activity	Description
Lighting	For security and maintenance purposes, shielded, task-specific lighting will be installed at the temporary construction offices, construction staging areas, substation and possibly on or near each inverter unit. These lights will be turned on either by a local switch or by motion sensors that will be triggered by movement during maintenance or emergency activities. No lights are currently planned around the project perimeter to minimize the project's visual impact on surrounding development and roads. All exterior lights will be shielded to minimize their impact to the night sky and neighbours. Periodically, light bulbs may require replacement should they become inoperable.
Cleaning of panels	Cleaning of panels and equipment will take place approximately three times annually. It is anticipated that two crews will take approximately 4 to 5 days to wash the panels in the facility for each maintenance period. It is expected that between 15,000 and 35,000 litres of water will be required for each maintenance period. No water-taking will occur. All water required for panel washing will be trucked to the project location. Only water is used for cleaning. No cleaning solutions of any type will be used to wash the panels. Runoff from washing of panels will managed in the same way as stormwater.
Major maintenance	Unforeseen, large repairs are not anticipated but could potentially include broken modules, electrical equipment breakdowns or other component or systems failures. Should major maintenance be required it will be performed using existing roads and site access.
Periodic landscape maintenance	Short native vegetation will be planted once construction activities are complete. It will be necessary to maintain the land in such a way that vegetation does not shade or in other ways impact the solar panels; however, it is anticipated that the site will be planted with mostly low-growth native plant species, which will not only limit the need for regular maintenance, but will also maintain the nutrient quality of the soil and manage weed growth. Regular maintenance may include mowing of grass to ensure cleanliness and prevent shading of panels. We will hire local farmers to maintain the cover vegetation and will rely on their knowledge of best practices for weed control.
Inspections and testing	Activities will be carried out as required by the local utility and other governing bodies.
Traffic	Limited deliveries may be necessary for maintenance during operation of the facility. Traffic will not be significant on a daily basis.

Activity	Description
Drainage and erosion control	Stormwater runoff at the project location is not expected to require ongoing management; however, a more detailed SWM Report at the detailed design stage will take into consideration pre-construction drainage patterns and any recommendations or limitations outlined in the *Natural Heritage Assessment, Water Assessment* or *Water Body Report*. Any implemented measures will be inspected during routine maintenance.
Waste	The operation of the system does not produce waste of any kind. All debris as a result of maintenance or cleaning will be removed from the site immediately by the contractor.

7.0 ENVIRONMENTAL EFFECTS MITIGATION AND MONITORING PLAN

The EEMMP outlines how potential negative environmental effects of the proposed project will be mitigated and how ongoing monitoring will occur to meet the requirements set out in *Ontario Regulation 359/09*. The EEMMP includes information on potential negative effects associated with all phases of the project from construction through decommissioning. The potential negative environmental effects associated specifically with the construction phase are also described in the *Construction Plan Report*. Given the nature of solar power generation, few (if any) effects are expected during the operations period.

The purpose of the EEMMP is to:

- ensure that commitments to minimize environmental effects in general, and specific regulatory requirements, will be met;
- provide clear and concise instructions regarding measures for protecting the environment and minimizing potential negative environmental effects;
- document environmental concerns and describe appropriate protection measures associated with all phases of the project;
- outline suggested monitoring activities;
- provide a reference document for planning and/or conducting specific activities that may have an effect on the environment;
- function as a training aid for environmental education and orientation; and to
- communicate changes in the program through a revision process.

Appendix D presents the EEMMP for the Marsh Hill Solar Farm, which includes identification of the potential negative environmental effects, performance objectives, mitigation strategies and the proposed monitoring plan for each environmental feature.

8.0 EMERGENCY RESPONSE AND COMMUNICATIONS PLANS

Emergency events associated with a solar facility are unlikely. The proponent will develop Emergency Response and Communications Plans that cover the entire life of the project including construction, operation and decommissioning phases. The plans will be in place prior to construction and will be reviewed and updated on an annual basis or when necessary due to changes in operation. Information dissemination to stakeholders on significant changes will follow the same procedures as described in **Section 8.3**.

8.1 Emergency Response Plan

The Regional Municipality of Durham has established an Emergency Response Plan (the *Durham Region Emergency Master Plan, 2007)*. The Township of Scugog has also established such a plan (*Scugog Emergency Plan, 2004)* based on hazard identification and risk assessment. The latter outlines the policies for emergency management, emergency plans structure, response strategies, concept of operations and the roles and responsibilities of emergency responders. The plan is reviewed on an annual basis by the Township and is updated as necessary.

Prior to construction, Solray will establish a detailed Emergency Response Plan (ERP) for Marsh Hill that is consistent with the Emergency Response Plans of the Municipality and Township. In preparing this Plan, Solray will invite the Fire Chief of the Port Perry Fire Department to the project location to review potential emergency scenarios that could arise during construction, operation, maintenance and decommissioning of the project. The ERP will then be submitted for review and comment to the Township Scugog, the Regional Municipality of Durham, and the Lake Simcoe Region Conservation Authority (if requested). Based on their feedback, a final version of the plan will be prepared and posted on the project website and provided to the MOE and MNR. At the time of construction this plan will be reviewed with the chosen contractor and may be further updated. Copies of the plan will be kept on-site and in relevant offices and updated versions will be provided on the website.

8.2 Emergency Communications Plan

An Emergency Communications Plan will be included in the ERP and will provide key contact information for relevant responders, regulators, landowners and other stakeholders. It will contain a description of the chain of communications between Solray and relevant responders under emergency scenarios applicable to the project. Emergency issues could potentially occur including fire, natural disasters, personal injury and spill incidents. A log book including key contacts and their information (names, emergency phone numbers) will be posted in the construction trailers as well as at the municipal clerk's office and Solray offices for easy access during an emergency.

In the event of an emergency, relevant responders will be immediately contacted by phone based on the outlined chain of communication. If required during a major emergency, Solray will provide information releases to the community. Technical staff will recommend action plans and assist with responses to the public, stakeholders, and first responders such as the local fire department and police services. The Emergency Communications Plan will be developed in coordination with the Fire Department, Region, Township, and Conservation Authority and will be made available on the project website and provided to the MNR and MOE.

8.3 Non-Emergency Communications Plan

This section provides information on the methods of communication and information dissemination in non-emergency situations.

8.3.1 Ongoing Stakeholder Engagement

Public consultation and stakeholder engagement activities will continue throughout the life of the project. Relevant notices will be published in *The Scugog Standard* and posted on the project website (www.solray.ca/projects/epsom-solar-farm or www.solray.ca/projects/marsh-hill-solar-farm). Information will be mailed to stakeholders as necessary. During construction and operations phases of the project, a sign will be erected at the gate of the facility, which will include the appropriate contact information, including telephone number, email and mailing address should the public have any questions, concerns or complaints. The contact list will continue to be updated as necessary and will be used to distribute information about the project in writing to landowners, municipalities, agencies, Aboriginal communities, stakeholders and other interested parties.

The following consultation activities are up-coming:

- notice announcing application to MOE and posting on EBR;
- final copies of REA documents posted on website;
- responses to communications received from the public throughout MOE technical review;
- announcement on project website when MOE review is complete and Notice to Proceed has been issued;
- notices announcing construction dates and any traffic disruptions; and
- ongoing liaison with public via a designated contact person.

Members of the public can contact Solray at any time with questions or comments about this project via phone or email. Contact information is provided in **Section 2** of this and other REA technical reports and is available on the website and in newspaper notices.

8.3.2 Communications Methods, Records and Complaints Resolution Process

Correspondence received by Solray will be recorded in an electronic file and/or log book. If received during the REA process and prior to REA submission to the MOE, this correspondence has been included in the *Consultation Report*. If received after the final REA submission to the MOE and before application approval it will be recorded, filed, and provided to the MOE as an addendum to the *Consultation Report*. In both cases, if the correspondence requires a response this will be provided in a timely fashion and the response will be recorded.

Complaints and other communications received during the construction, operations, maintenance and decommissioning phases will be recorded in an electronic file and/or log book and will include the following:

- time and date of communication;
- type of inquiry/comment/complaint;
- name and contact information of the person(s);
- response and date of response; and
- any follow-up issues.

A record will be kept of all complaints, including: the history of the complaint resolution process that was followed and all actions taken to remediate the cause of the complaint. Where appropriate, steps will be taken to prevent reoccurrence of similar complaints in the future and this information will also be recorded. Where relevant, the Ministry's Spills Action Centre will be notified of the complaint at 1-800-268-6060.

9.0 CONSIDERATIONS FOR PROJECTS SUBJECT TO LAND USE PLANS

The project location and surrounding 300 metres are located within the Greenbelt Protected Countryside as well as the Lake Simcoe Watershed (see **Figure 2**). Additional environmental studies, as stipulated by *Ontario Regulation 359/09* for project locations within Plan Areas will be conducted and will consider the full intent of the Lake Simcoe Protection Plan and *Greenbelt Act* when evaluating the potential negative environmental effects as a result of the proposed project. Potential environmental effects to these Land Use Plan Areas are discussed in the EEMMP, in **Appendix D**. The project does not lie within or adjacent to the Niagara Escarpment or the Oak Ridges Moraine. No negative impacts are anticipated as a result of the project on these areas.

10.0 CONCLUSIONS

This *Design and Operations Report* has been completed to fulfill regulatory requirements as mandated by the provincial government for the development of the Marsh Hill Solar Farm. This report is consistent with the provisions of *Ontario Regulation 359/09* for a Class 3 Solar Facility as set out by the *Green Energy and Green Economy Act, 2009*. Significant adverse effects from the operational activities to the environment have been avoided through careful facility layout planning, the application of appropriate mitigation measures, and adherence to all regulatory requirements.

There are no provincial parks or conservation reserves within 120 metres of the project location and the project has been developed to retain the significance of all natural features identified within 120 metres of the project location and mitigates any negative effects that may occur. Of the natural features evaluated to be significant, the layout of the project will allow for their persistence after the project is constructed and operational. No impacts are expected to the permanent and intermittent streams located within 120 metres of the project location after mitigation measures have been implemented.

No protected properties, or significant archaeological or cultural heritage resources, have been identified within or adjacent to the project location. The project does not impact any areas subject to land use plans. Based on a *Noise Study Report* the project will meet or exceed all MOE requirements. Based on the results of the Stormwater Management Report no permanent measures or equipment are necessary to manage runoff quality, quantity or flow. Further details of all potential impacts and proposed mitigation measures for the operational phase (as well as the construction and decommissioning phases) of the project are provided in **Appendix D.** The overall conclusion of this *Design and Operations Report* is that this project can be operated without any significant adverse residual effects to the environment.

The generation of power from solar energy will displace approximately 10 MW AC of electricity that otherwise may have been generated by fossil fuel burning or non-renewable power plants. As a result, the energy generated will not contribute to climate change or emissions-related health impacts. A further benefit is that local jobs will be created, including maintenance jobs during the operations phase. The project supports the goals of the Province's *Green Energy and Green Economy Act*, *2009*.

APPENDIX A

Manufacturer and Technical Specifications

Tranformer Noise Calculation

Transformer Maximum Rating (MVA) = **10** MVA

NEMA Calculation:

PWL1 = 55 + 12log (MVA)……..(dB)

Area factor Correction:

PWL2 = 14 + 2.5log (MVA)…… (dB)

Overall PWL

PWL(overall) = PWL1 + PWL2……..(dB)

	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Octave band Adjustments →	-3	3	5	0	0	-6	-11	-16	-23
Converstion from linear to A-weighted →	-39.4	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1

Resulting PWL Octave Band (A-weighted)...(dBA)	**41.1**	**60.3**	**72.4**	**74.9**	**80.3**	**77.5**	**73.7**	**68.5**	**59.4**
PWL + 5 dB tonal penalty……..…(dBA)	**46.1**	**65.3**	**77.4**	**79.9**	**85.3**	**82.5**	**78.7**	**73.5**	**64.4**
PWL + 5 dB tonal penalty……..…(dB)	**85.5**	**91.5**	**93.5**	**88.5**	**88.5**	**82.5**	**77.5**	**72.5**	**65.5**

SUNNY CENTRAL 800MV / 1000MV / 1250MV

SC 800MV-11 / SC 1000MV-11 / SC 1250MV-11

Efficient

- Without low-voltage transformer: greater plant efficiency due to direct connection to the medium-voltage grid

Turnkey Delivery

- With medium-voltage transformer and concrete substation for outdoor installation

Optional

- Medium-voltage switchgear systems for a flexible structure of large solar parks
- AC transfer station with measurement
- Medium-voltage transformers for other grid voltages (deviating from 20 kV)

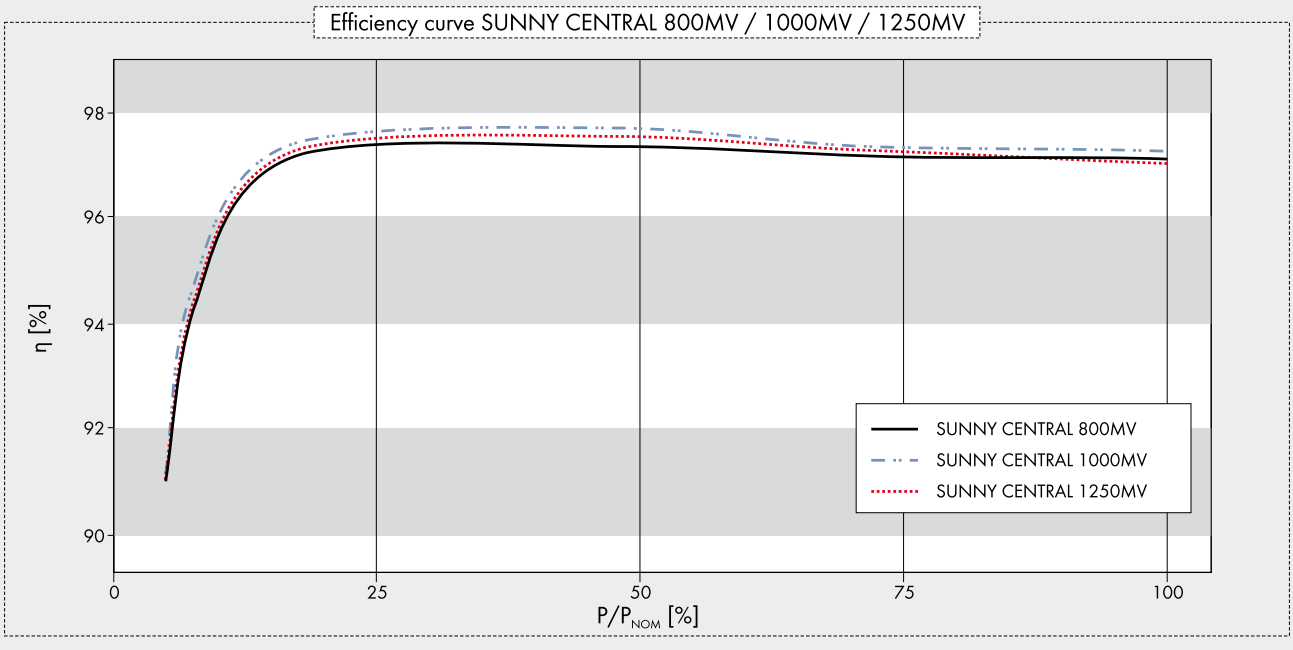
SUNNY CENTRAL for Direct medium-voltage feed-in 800MV / 1000MV / 1250MV

High-performance medium-voltage station

For even more power: Two powerful Sunny Central HE inverters are components of a medium-voltage station (MV) which feeds directly into a shared medium-voltage transformer. In this way, for example, two Sunny Central 630HE inverters are combined into a powerful Sunny Central 1250MV station. The advantage: By removing the need for the low-voltage transformer, the plant operator realizes greater yields and at the same time lower inverter costs. The Sunny Central MV is delivered as a "turnkey" concrete substation for outside installation. On top of that, the Sunny Central MV actively participates in grid management, and thereby fulfils all requirements of the Medium-Voltage Directive valid as of July 2010.

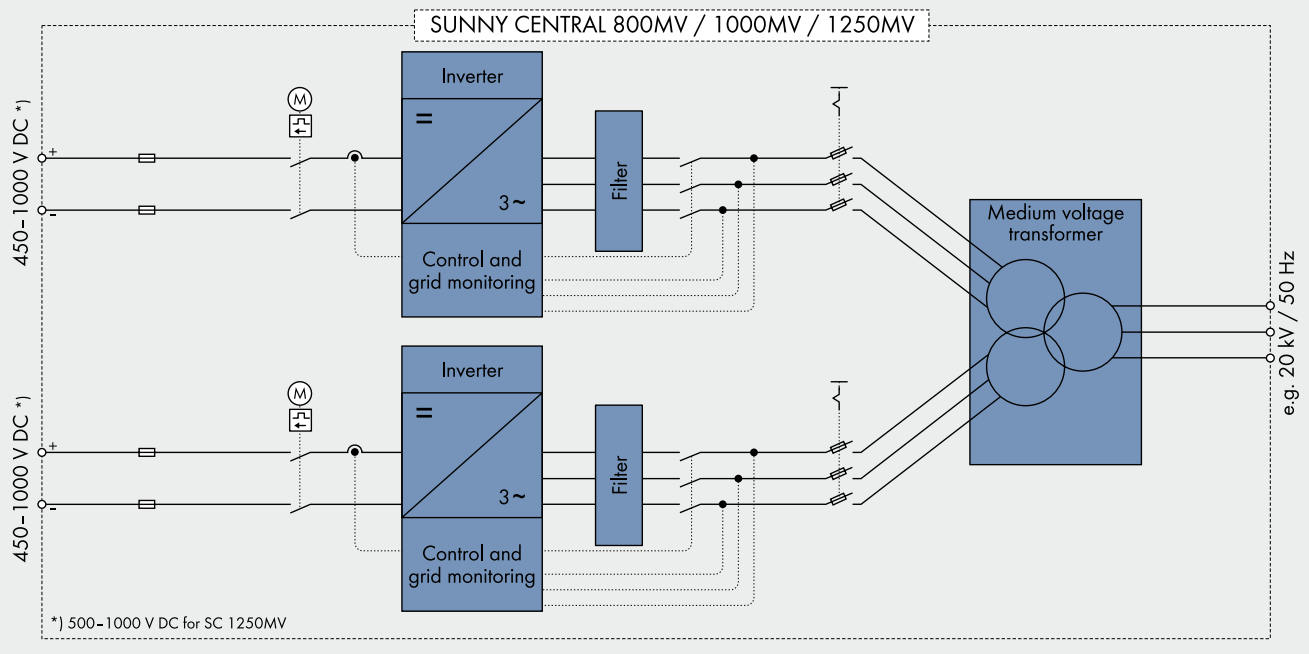
SUNNY CENTRAL 800MV / 1000MV / 1250MV

Technical data	Sunny Central 800MV	Sunny Central 1000MV	Sunny Central 1250MV
Input data			
Nominal DC power	816 kW	1018 kW	1284 kW
Max. DC power	900 kWp[1)]	1120 kWp[1)]	1410 kWp[1)]
MPP voltage range	450 V – 820 V [5)]	450 V – 820 V [5)]	500 V – 820 V [5) 7)]
Max. DC voltage	1000 V	1000 V	1000 V
Max. DC current	1986 A	2484 A	2844 A
Number of DC inputs	(16 + 16) + 4 DCHV	(16 + 16) + 4 DCHV	(16 + 16) + 4 DCHV
Output data			
Nominal AC power @ 45 °C	800 kVA	1000 kVA	1250 kVA
Continuous AC power @ 25 °C	880 kVA	1100 kVA	1400 kVA
Nominal AC voltage	20000 V	20000 V	20000 V
Nominal AC current	23.2 A	28.8 A	36.1 A
AC grid frequency 50 Hz	●	●	●
AC grid frequency 60 Hz	●	●	●
Power factor (cos φ)		0.9 leading ... 0.9 lagging	
Max. THD	< 3 %	< 3 %	< 3 %
Power consumption			
Internal consumption in operation	< 3000 W [4)]	< 3000 W [4)]	< 3000 W [4)]
Standby consumption	< 180 W + 1100 W	< 180 W + 1100 W	< 180 W + 1350 W
External auxiliary supply voltage	3 x 230 V, 50/60 Hz	3 x 230 V, 50/60 Hz	3 x 230 V, 50/60 Hz
External back-up fuse for auxiliary supply	B 20 A, 3-pole	B 20 A, 3-pole	B 20 A, 3-pole
Dimensions and weight			
Height	3620 mm	3620 mm	3620 mm
Width	5400 mm	5400 mm	5400 mm
Depth	3000 mm	3000 mm	3000 mm
Weight	35000 kg	35000 kg	35000 kg
Efficiency [2)]			
Max. efficiency	97.7 %	97.9 %	97.8 %
Euro-eta	97.3 %	97.5 %	97.4 %
Protection rating and ambient conditions			
Protection rating (as per EN 60529)	IP54	IP54	IP54
Operating temperature range	–20 °C ... +45 °C	–20 °C ... +45 °C	–20 °C ... +45 °C
Rel. humidity	15 % ... 95 %	15 % ... 95 %	15 % ... 95 %
Fresh air consumption	12400 m³/h	12400 m³/h	12400 m³/h
Max. altitude (above sea level)	1000 m	1000 m	1000 m

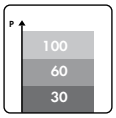


	Sunny Central 800MV	Sunny Central 1000MV	Sunny Central 1250MV
Features			
Display: text line / graphic	●/–	●/–	●/–
Ground fault monitoring	●	●	●
Heating	●	●	●
Emergency stop	●	●	●
Circuit breaker AC side	SI load disconnection switch	SI load disconnection switch	SI load disconnection switch
Circuit breaker DC side	Switch-disconnector with motor	Switch-disconnector with motor	Switch-disconnector with motor
Monitored overvoltage protectors AC / DC	●/●	●/●	●/●
Monitored overvoltage protectors for auxiliary supply	●	●	●
SCC (Sunny Central Control) interfaces			
Communication (NET Piggy-Back, optional)	analog, ISDN, Ethernet	analog, ISDN, Ethernet	analog, ISDN, Ethernet
Analog inputs	10 x A_{in} [3]	10 x A_{in} [3]	10 x A_{in} [3]
Overvoltage protection for analog inputs	O	O	O
Sunny String-Monitor connection (COM1)	RS485	RS485	RS485
PC connection (COM3)	RS232	RS232	RS232
Electrically separated relay (ext. alert signal)	2	2	2
Certificates / listings			
EMC	EN 61000-6-2 EN 61000-6-4		
CE conformity	●	●	●
BDEW-MSRL / FGW / TR8 [6]	●	●	●
RD 1633 / 2000	●	●	●
Arrêté du 23/04/08	●	●	●
● standard features O optional features – not available			
Type designation	SC 800MV-11	SC 1000MV-11	SC 1250MV-11

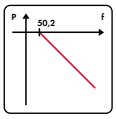
HE: High Efficiency, inverter without galvanic isolation for connection to a medium-voltage transformer (taking into account the SMA specification for the transformer)
1) Specifications apply to irradiation values below STC
2) Efficiency measured without an internal power supply at U_{DC} = 500 V
3) 2x inputs for the external nominal value specification for active power and reactive power, 1x external alarm input, 1x irradiation sensor, 1x pyranometer
4) Internal consumption at nominal power
5) At 1.05 $U_{AC, nom}$ and cos φ = 1
6) With limited dynamic grid support
7) At f_{grid} = 60 Hz: 510 V - 820 V
Please note: in certain countries the substations may differ from the substations shown in the images



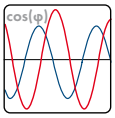
POWERFUL GRID MANAGEMENT FUNCTIONS



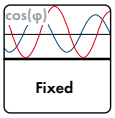
Remote controlled power reduction in case of grid overload
In order to avoid short-term grid overload, the grid operator presets a nominal active power value which the inverter will implement within 60 seconds. The nominal value is transmitted to the inverters via a ripple control receiver in combination with the SMA Power Reducer Box. Typical limit values are 100, 60, 30 or 0 per cent of the nominal power.



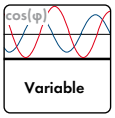
Frequency-dependent control of active power
As of a grid frequency of 50.2 Hz, the inverter automatically reduces the fed-in of active power according to a definable characteristic curve which thereby contributes to the stabilization of the grid frequency.



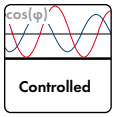
Static voltage support based on reactive power
To stabilize the grid voltage, SMA inverters feed reactive power (leading or lagging) into the grid. Three different modes are available:



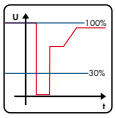
a) Fixed definition of the reactive power by the grid operator
The grid operator defines a fixed reactive power value or a fixed displacement factor between $\cos(\varphi)_{leading}$= 0.90 and $\cos(\varphi)_{lagging}$= 0.90.



b) Definition of a dynamic setpoint of the reactive power by the utility operator
The grid operator defines a dynamic displacement factor - any value between $\cos(\varphi)_{leading}$= 0.90 und $\cos(\varphi)_{lagging}$= 0.90. It is transmitted either through a communication unit the evaluation can e.g. be evaluated and processed by the SMA Power Reducer Box.



c) Control of the reactive power over a characteristic curve
The reactive power or the phase shift is controlled by a pre-defined characteristic curve – depending on the active power fed into the grid or the grid voltage.

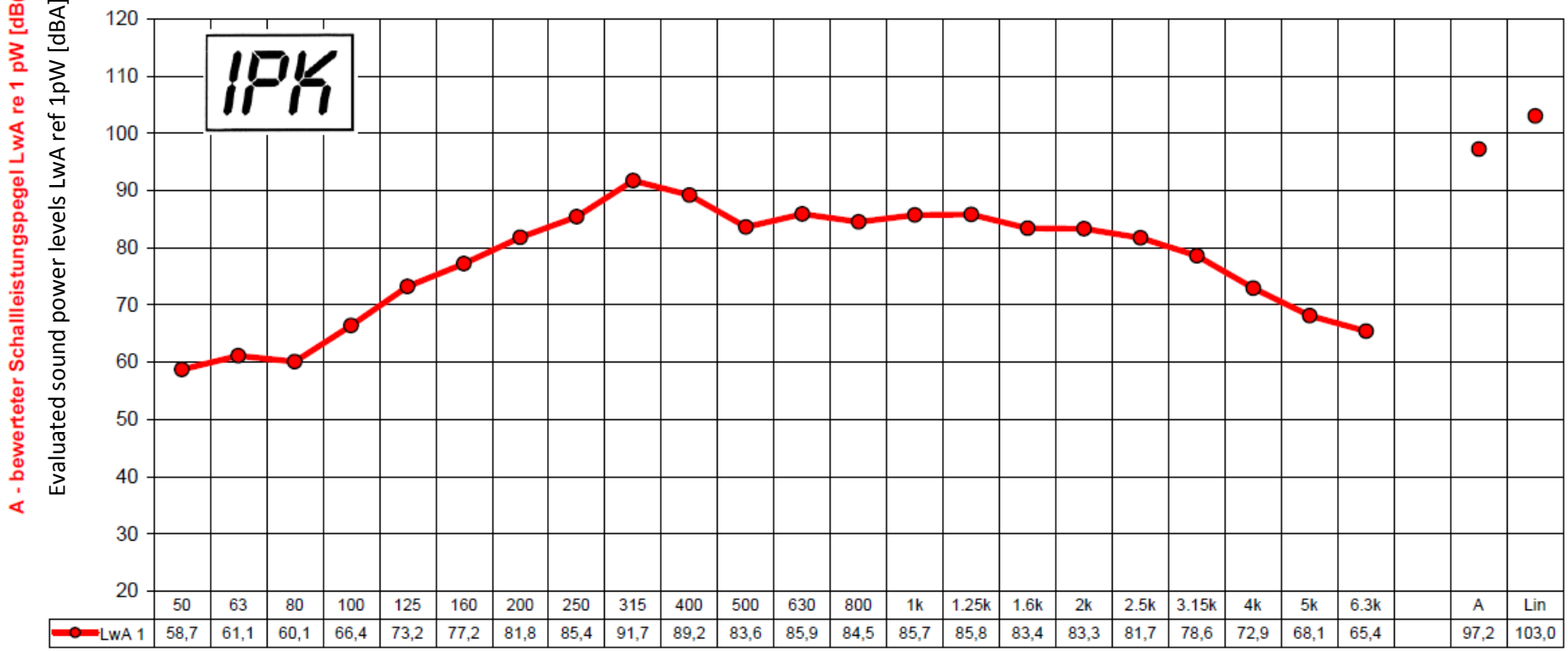


Limited Dynamic Grid Support
The inverter continues to feed to the grid after short term voltage drops – as long as the grid voltage is within a defined voltage window.

SMA Solar Technologie Umrichteranlage Sunny Central SC 1000MV
Betrieb bei Nennleistung und 50 Hz; 1000 KW

SMA Solar Technologies Inverter Unit Sunny Central SC 1000MV

Name Plate Capacity 1000 kW at 50 Hz



	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k		A	Lin
LwA 1	58,7	61,1	60,1	66,4	73,2	77,2	81,8	85,4	91,7	89,2	83,6	85,9	84,5	85,7	85,8	83,4	83,3	81,7	78,6	72,9	68,1	65,4		97,2	103,0

Third octave band frequency [Hz]

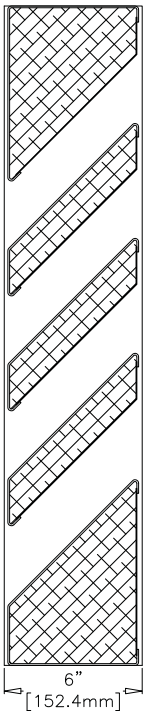
Terz - Mittenfrequenz [Hz]

GREENHECK AFJ-601

Acoustical Louver
J Blade

Application and Design

AFJ-601 is an acoustical weather louver designed to protect air intake and exhaust openings in building exterior walls. Design incorporates J style insulated acoustical blades and high free area to provide maximum resistance to sound transmission, rain and weather while providing minimum resistance to airflow. The AFJ-601 is an extremely efficient louver with **AMCA LICENSED PERFORMANCE DATA** enabling designers to select and apply with confidence.



amca CERTIFIED RATINGS
WATER PENETRATION
SOUND AND AIR PERFORMANCE
AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

Standard Construction

Frame . . . . . . Heavy gauge formed aluminum, 6 in. x 0.080 in. nominal wall thickness

Blades. . . . . . J style, heavy gauge formed aluminum, 0.080 in. nominal wall thickness, positioned at 45° on approximately 5 in. centers

Construction . . . Mechanically fastened

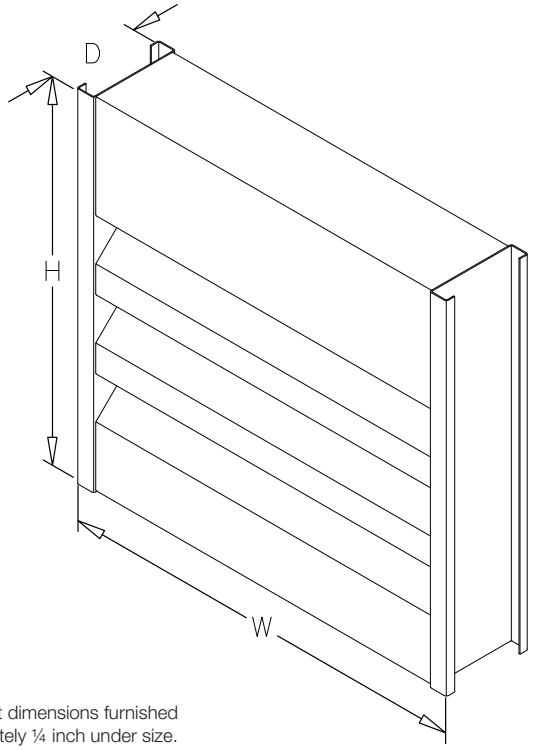
Acoustical Insulation . . . . . Fiberglass Insulation

Birdscreen. . . . . 3/4 in. x 0.051 flattened expanded aluminum in removable frame, inside mount (rear)

Finish. . . . . . Mill

Minimum Size . . 12 in. W x 15 in. H

Maximum Single Section Size . . . 60 in. W x 120 in. H



*Width and height dimensions furnished approximately ¼ inch under size.

Options *(at additional cost)*

- A variety of bird and insect screens
- Blank off panels
- Clip angles
- Extended sill
- Filter racks
- Flanged frame
- Galvanized steel frame and blade
- Security bars
- A variety of architectural finishes including:
  - Clear anodize
  - Integral color anodize
  - Baked enamel paint
  - Kynar paint

PERFORMANCE DATA

AFJ-601

J Blade Acoustical Louver
Formed Aluminum

Free Area Chart (Sq. ft.)

Louver Height Inches	Louver Width Inches								
	12	18	24	30	36	42	**48**	54	60
15	0.12	0.21	0.29	0.37	0.45	0.53	0.61	0.69	0.77
18	0.25	0.41	0.57	0.74	0.90	1.06	1.22	1.38	1.55
24	0.37	0.62	0.86	1.10	1.35	1.59	1.83	2.08	2.32
30	0.50	0.82	1.15	1.47	1.80	2.12	2.44	2.77	3.09
36	0.62	1.03	1.43	1.84	2.24	2.65	3.05	3.46	3.86
42	0.75	1.24	1.72	2.21	2.69	3.18	3.67	4.15	4.64
48	1.00	1.65	2.30	2.94	3.59	4.24	**4.89**	5.54	6.18
54	1.12	1.85	2.58	3.31	4.04	4.77	5.50	6.23	6.96
60	1.25	2.06	2.87	3.68	4.49	5.30	6.11	6.92	7.73
66	1.37	2.26	3.16	4.05	4.94	5.83	6.72	7.61	8.50
72	1.50	2.47	3.44	4.41	5.39	6.36	7.33	8.30	9.27
78	1.75	2.88	4.02	5.15	6.28	7.42	8.55	9.69	10.82
84	1.87	3.09	4.30	5.52	6.73	7.95	9.16	10.38	11.59
90	2.00	3.29	4.59	5.89	7.18	8.48	9.77	11.07	12.37
96	2.12	3.50	4.88	6.25	7.63	9.01	10.38	11.76	13.14
102	2.25	3.71	5.16	6.62	8.08	9.54	11.00	12.45	13.91
108	2.50	4.12	5.74	7.36	8.98	10.60	12.22	13.84	15.46
114	2.62	4.32	6.02	7.73	9.43	11.13	12.83	14.53	16.23
120	2.75	4.53	6.31	8.09	9.88	11.66	13.44	15.22	17.00

Greenheck Fan Corporation certifies that the AFJ-601 louvers shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to water penetration, air performance and sound ratings.

Sound Transmission Class

The Sound Transmission Class (STC) is a rating of the effectiveness of an assembly in isolating or reducing airborne sound transmission. STC is a single number that summarizes airborne sound transmission loss data. Assemblies with higher STC ratings are more efficient at reducing sound transmission. STC is determined in accordance with ASTM E413-04.

Transmission Loss

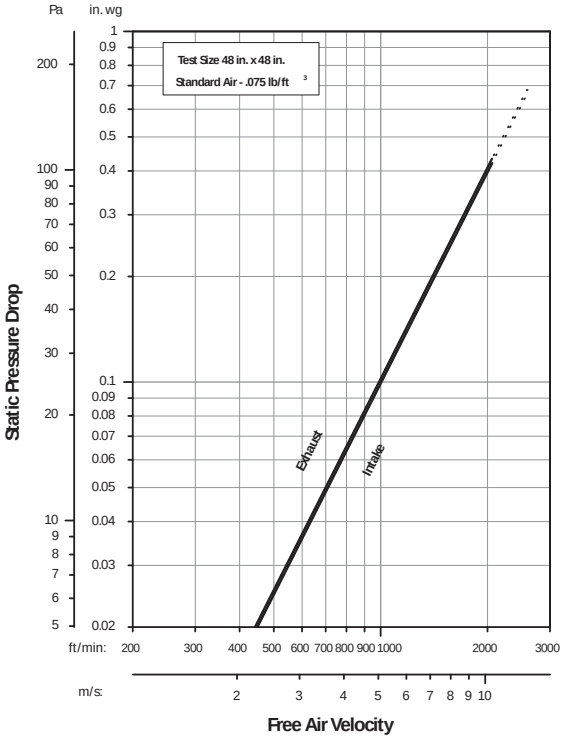
Transmission loss (TL) is a measurement of the reduction of sound power transmission (dB) through an assembly at a given frequency. The more sound power that is reduced, the greater the TL. TL is tested in accordance with ASTM E90-04.

Free Field Noise Reduction in Decibels

Free Field Noise Reduction is determined by adding 6 dB to the Transmission Loss.

Octave Band	2	3	4	5	6	7	STC
Frequency (Hz)	63	125	250	500	1000	2000	
Transmission Loss (dB)	4	4	6	10	17	12	10
Free Field Noise Reduction (dB)	10	10	12	16	23	18	

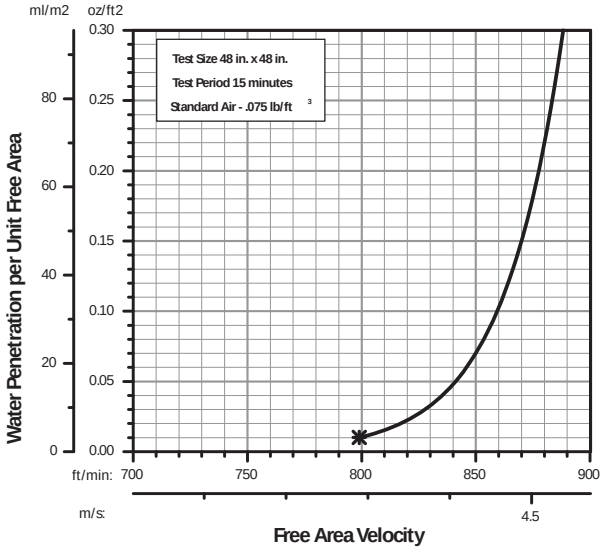
Airflow Resistance (Standard Air - .075 lb/ft³)



Model AFJ-601 resistance to airflow (pressure drop) varies depending on louver application (air intake or air exhaust). Free area velocities (shown) are higher than average velocity through the overall louver size. See louver selection information.

Water Penetration (Standard Air - .075 lb/ft³)

Test size 48 in. x 48 in. Test duration of 15 min.



The AMCA Water Penetration Test provides a method for comparing various louver models and designs as to their efficiency in resisting the penetration of rainfall under specific laboratory test conditions. The beginning point of water penetration is defined as that velocity where the water penetration curve projects through .01 oz. of water (penetration) per sq. ft. of louver free area. ***The beginning point of water penetration for Model AFJ-601 is 799 fpm free area velocity.** These performance ratings do not guarantee a louver to be weatherproof or stormproof and should be used in combination with other factors including good engineering judgement in selecting louvers.

INSTALLATION DETAILS

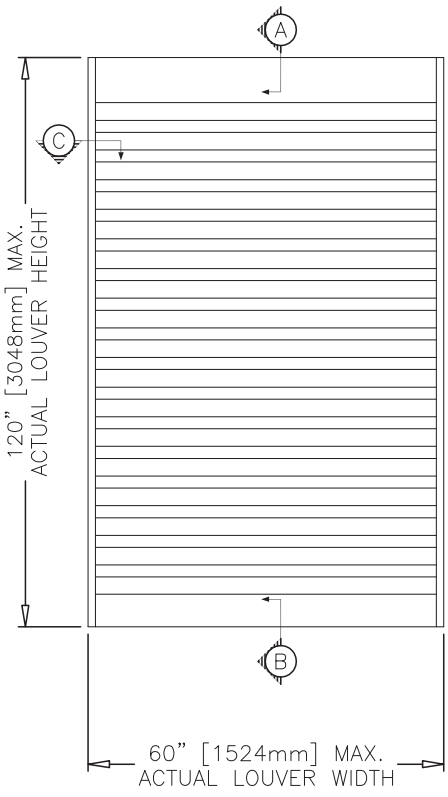
AFJ-601

J Blade Acoustical Louver
Formed Aluminum

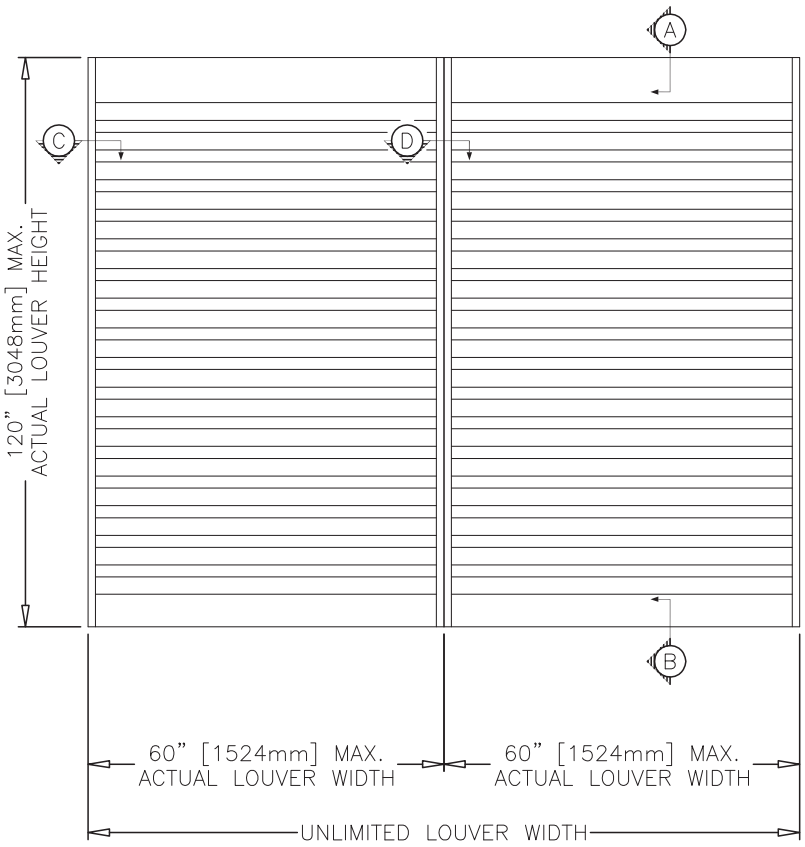
Maximum Size and Installation Information

Maximum single section size for model AFJ-601 is 60 in. W x 120 in. H. Larger openings require field assembly of multiple louver panels to make up the overall opening size. Individual louver panels are designed to withstand a 25 PSF wind-load (please consult Greenheck if the louvers must withstand higher wind-loads). Structural reinforcing members may be required to adequately support and install multiple louver panels within a large opening. Structural reinforcing members along with any associated installation hardware is not provided by Greenheck unless indicated otherwise by Greenheck. Additional information on louver installation may be found in AMCA Publication #501, Louver Application Manual.

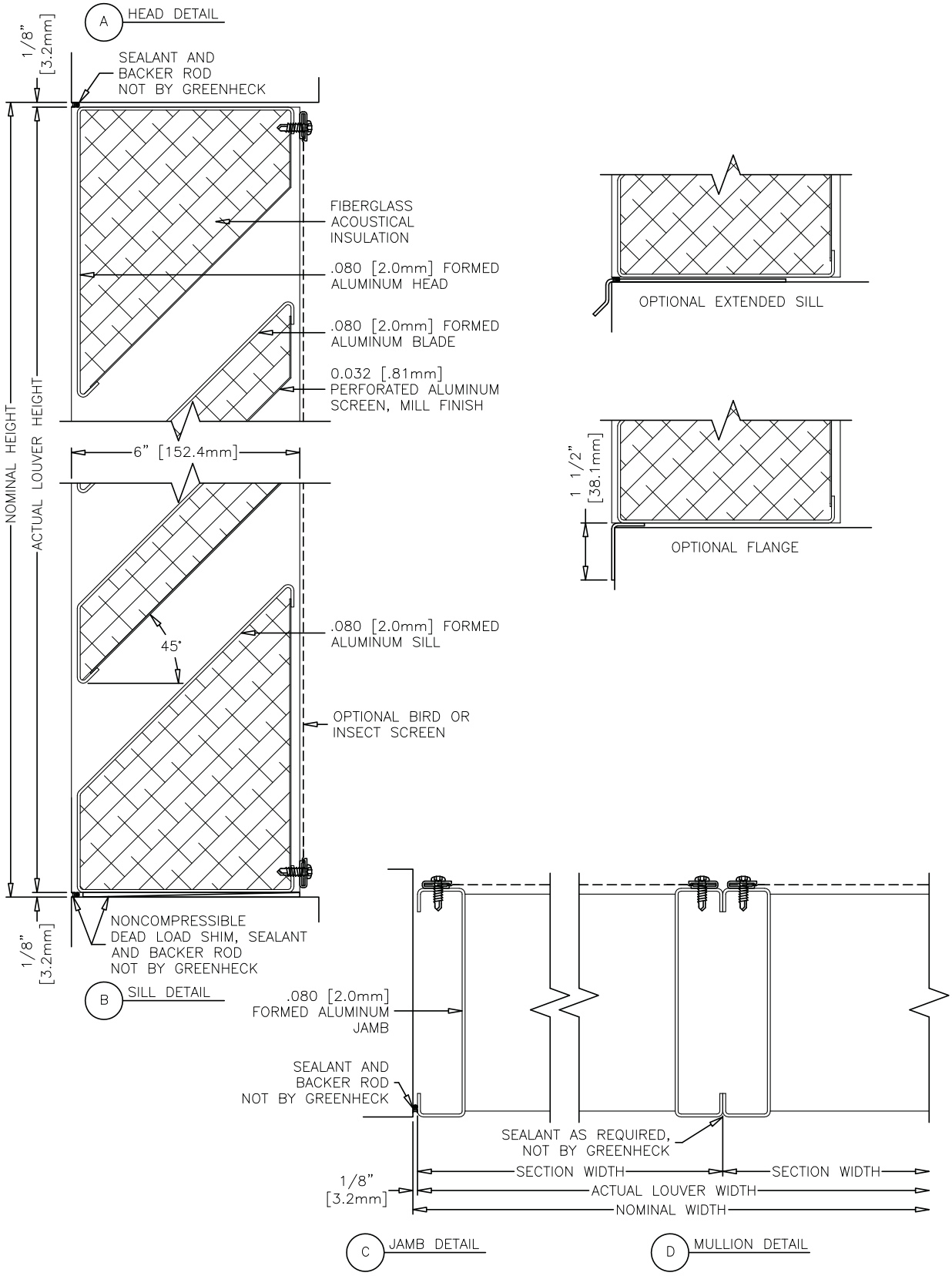
SINGLE SECTION



MULTIPLE SECTION W/ MULLION



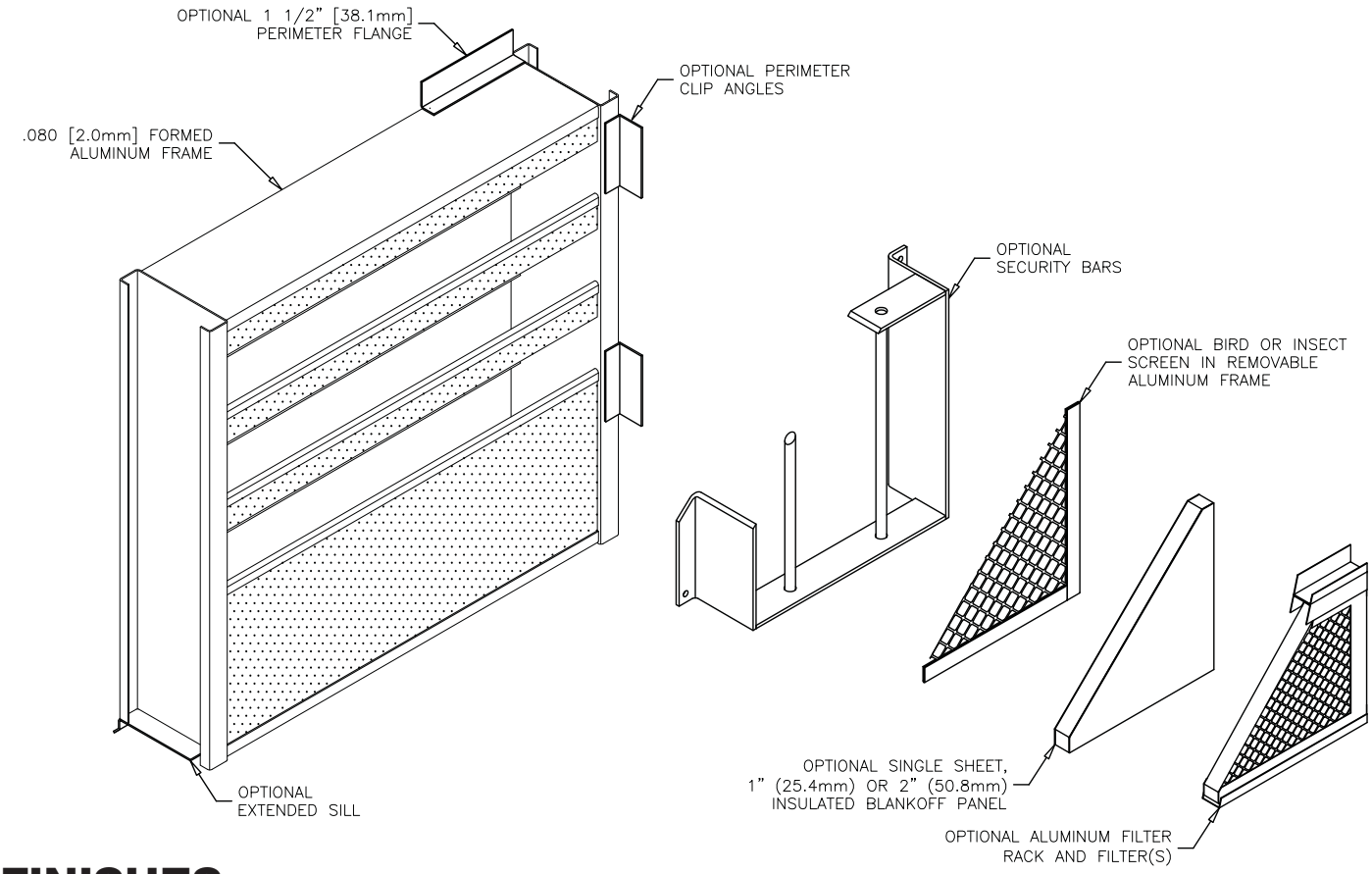
Minimum Single Section Size	Maximum Single Section Size
12 in. W x 15 in. H	60 in. W x 120 in. H


A
HEAD DETAIL
1/8" [3.2mm]
SEALANT AND BACKER ROD NOT BY GREENHECK
FIBERGLASS ACOUSTICAL INSULATION
.080 [2.0mm] FORMED ALUMINUM HEAD
.080 [2.0mm] FORMED ALUMINUM BLADE
0.032 [.81mm] PERFORATED ALUMINUM SCREEN, MILL FINISH
NOMINAL HEIGHT
ACTUAL LOUVER HEIGHT
6" [152.4mm]
45°
.080 [2.0mm] FORMED ALUMINUM SILL
OPTIONAL BIRD OR INSECT SCREEN
1/8" [3.2mm]
NONCOMPRESSIBLE DEAD LOAD SHIM, SEALANT AND BACKER ROD NOT BY GREENHECK
B
SILL DETAIL
OPTIONAL EXTENDED SILL
1 1/2" [38.1mm]
OPTIONAL FLANGE
.080 [2.0mm] FORMED ALUMINUM JAMB
SEALANT AND BACKER ROD NOT BY GREENHECK
SEALANT AS REQUIRED, NOT BY GREENHECK
SECTION WIDTH
SECTION WIDTH
1/8" [3.2mm]
ACTUAL LOUVER WIDTH
NOMINAL WIDTH
C
JAMB DETAIL
D
MULLION DETAIL

OPTION DRAWINGS

AFJ-601

J Blade Acoustical Louver
Formed Aluminum



FINISHES

Finish Type	Description/Application	Color Selection	Standard Warranty (Aluminum)
2-coat 70% KYNAR 500®/HYLAR 5000® AAMA 2605 – Dry film thickness 1.2 mil. (AKA: Duranar®, Fluoropon®, Trinar®, Flouropolymer, Polyvinylidene Fluoride, PVDF2)	***"Best."*** The premier finish for extruded aluminum. Tough, long-lasting coating has superior color retention and abrasive properties. Resists chalking, fading, chemical abrasion and weathering.	**Standard Colors:** Any of the 24 standard colors shown can be furnished in 70% or 50% KYNAR 500®/HYLAR 5000® or Baked Enamel. **2-Coat Mica:** Greenheck offers 9 standard 2-coat Mica colors. Other colors are available. Consult Greenheck for possible extra cost when selecting non-standard colors or special finishes.	10 Years (Consult Greenheck for availability of extended warranty)
2-coat 50% KYNAR 500®/HYLAR 5000® AAMA 2604 – Dry film thickness 1.2 mil. (AKA: Acroflur®, Acrynar®)	***"Better."*** Tough, long-lasting coating has excellent color retention and abrasive properties. Resists chalking, fading, chemical abrasion and weathering.		5 Years
Baked Enamel AAMA 2603 – Dry film thickness 0.8 mil. (AKA: Acrabond Plus®, Duracron®)	***"Good."*** Provides good adhesion and resistance to weathering, corrosion and chemical stain.		1 Year
Integral Color Anodize AA-M10C22A42 (>0.7 mil)	"Two-step" anodizing is produced by following the normal anodizing step with a second, colorfast process.	Light, Medium or Dark Bronze; Champagne; Black	5 years
Clear Anodize 215 R-1 AA-M10C22A41 (>0.7 mil)	Clear, colorless and hard oxide aluminum coating that resists weathering and chemical attack.	Clear	5 years
Clear Anodize 204 R-1 AA-M10C22A31 (0.4-0.7 mil)	Clear, colorless and hard oxide aluminum coating that resists weathering and chemical attack.	Clear	1 Year
Industrial coatings	Greenheck offers a number of industrial coatings such as Hi-Pro Polyester, Epoxy, and Permatector®. Consult a Greenheck Product Specialist for complete color and application information.		Consult Greenheck
Mill	Materials may be supplied in natural aluminum or galvanized steel finish when normal weathering is acceptable and there is no concern for color or color change.		n/a

Finishes meet or exceed AAMA 2605, AAMA 2604, and AAMA 2603 requirements. Please consult www.greenheck.com for complete information on standard and extended paint warranties. Paint finish warranties are not applicable to steel products.

GREENHECK®

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AFJ-601
August 2010 Rev. 1

wind loading that was determined for all of the proposed installation sites and is shown in table 2. These numbers are based on a 1 in 50 year snow load and a 1 in 50 year Hourly wind pressure.

Table 2: Wind and Snow Loads for Locations

Location	1/50 Year Snow (kPa)	1/50 Wind Pressure (kPa)
Example Site 1	2.2	0.43
Example Site 2	1.3	0.40
Example Site 3	2.2	0.44
Example Site 4	2.2	0.41
Example Site 5	2.1	0.47
Example Site 6	2.4	0.41

A dead load of 4 psf was calculated based on self-weight of the Flexrack. A ULS load of ***43.34 psf*** was calculated based on dead and snow loads. The controlling design load of 1.25*(Dead Load) + 1.5*(Snow Load) was used.

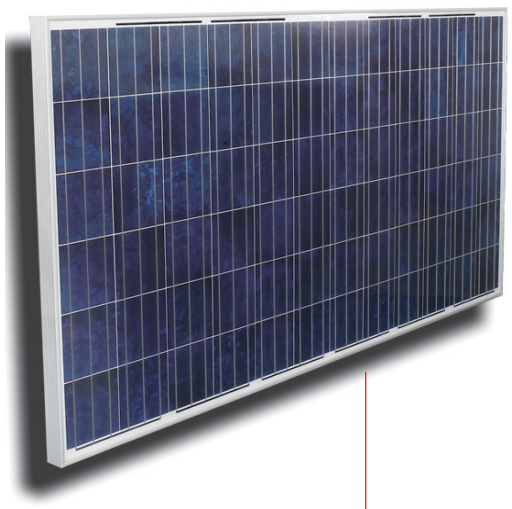
The horizontal and vertical rails were analyzed in Algor Finite Element Analysis (FEA) to determine if design is structurally efficient. A model of the Solar Flexrack was generated in Solid Works and inserted into FEA to run the analysis.

The Z-purlin design was also verified using “AISI Manual Standard for North American Specification for the Design of Cold-Formed Steel Structural Members 2007 Edition”. Bending, bi-axial bending, shear, combined bending and shear, web crippling, and combined bending and web crippling were calculated and confirmed. Results on the horizontal rail show a maximum deflection of 0.7 inches at the end, with a deflection ratio of L/96, which is within standard design limits of L/60. Maximum stress of 47,000 psi was found in the horizontal rail, which is less than the yield strength of material used. The vertical aluminum member had a maximum deflection of 0.106”, and a maximum stress of 13,500 psi. The stresses in each member as well as the bolted connections of the FlexRack are summarized below in tables 3 and 4.

STP275 - 24/Vdx

SUNTECH

275 Watt
POLYCRYSTALLINE SOLAR MODULE



Features

High module conversion efficiency
Up to 14.3%, through superior cell technology and leading manufacturing capability

Double junction boxes
Double junction boxes with unique design improve the module stability

100% Ontario silicon
Modules are made with 100% Ontario silicon

Excellent weak light performance
Excellent performance under low light environments mornings, evenings, and cloudy days

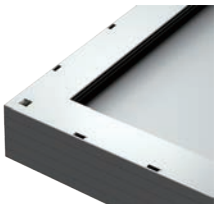
Extended wind and snow load tests
Entire module certified to withstand extreme wind (3800 Pascal) and snow loads (5400 Pascal) *

Suntech current sorting process
Suntech modules sorted and packaged by amperage, maximizing system output by reducing mismatch losses by up to 2%

Certifications and standards:
UL 1703, IEC 61215, IEC 61730, conformity to CE

Trust Suntech to Deliver Reliable Performance Over Time

- World's No.1 manufacturer of crystalline silicon photovoltaic modules
- Unrivaled manufacturing capacity and world-class technology
- Rigorous quality control meeting the highest international standards: ISO 9001: 2008, ISO 14001: 2004 and ISO17025: 2005
- Tested for harsh environment (salt mist and ammonia corrosion testing: IEC 61701, DIN 50916: 1985 T2)**
- Industry-leading warranty. Please contact Suntech sales team for details



Superior Frame Design
Specially designed drainage holes and rigid construction prevent frames from deforming. Screwless frame design for a long term durability.

Suntech modules are trusted and proven, powering over 3 GW of solar installations all over the world

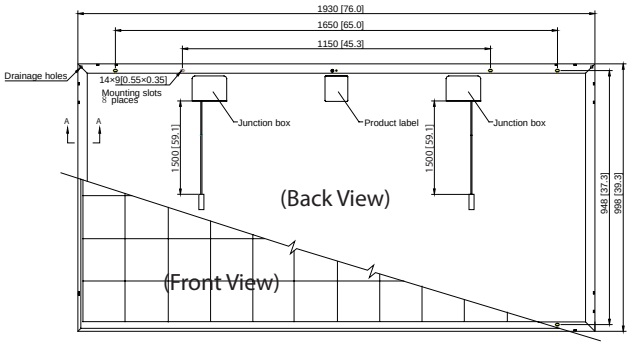
Most Modern IP67 Rated Junction Box
Supports any orientation installation. High performance low resistance connectors ensure maximum module power output for highest energy production.

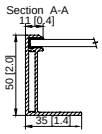
* Please refer to Suntech Standard Module Installation Manual for details.

** Please refer to Suntech Product Near-coast Installation Manual for details.

STP275 - 24/Vdx

SUNTECH





Note: mm [inch]

Electrical Characteristics

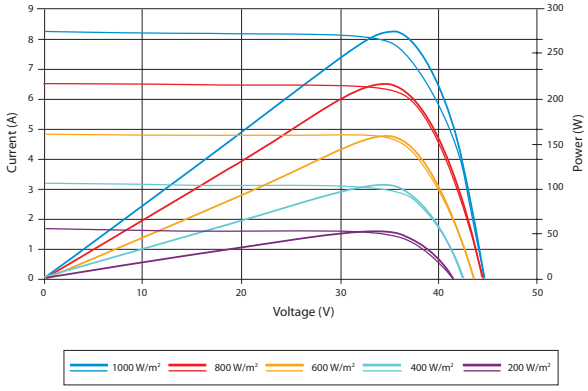
STC	STP275-24/Vdx
Optimum Operating Voltage (Vmp)	35.1 V
Optimum Operating Current (Imp)	7.84 A
Open Circuit Voltage (Voc)	44.7 V
Short Circuit Current (Isc)	8.26 A
Maximum Power at STC (Pmax)	275 W
Module Efficiency	14.3%
Operating Module Temperature	-40 °C to +85 °C
Maximum System Voltage	1000 V DC (IEC) / 600 V DC (UL)
Maximum Series Fuse Rating	20 A
Power Tolerance	±3 %

STC: Irradiance 1000 W/m2, module temperature 25 °C, AM=1.5;
Best in Class AAA solar simulator (IEC 60904-9) used, power measurement uncertainty is within +/- 3%

NOCT	STP275-24/Vdx
Maximum Power at NOCT (Pmax)	201 W
Optimum Operating Voltage (Vmp)	31.9 V
Optimum Operating Current (Imp)	6.29 A
Open Circuit Voltage (Voc)	40.7 V
Short Circuit Current (Isc)	6.68 A

NOCT: Irradiance 800 W/m2, ambient temperature 20 °C, AM=1.5, wind speed 1 m/s;
Best in Class AAA solar simulator (IEC 60904-9) used, power measurement uncertainty is within +/- 3%

Current-Voltage & Power-Voltage Curve (275-24)



Excellent performance under weak light conditions: at an irradiation intensity of 200 W/m² (AM 1.5, 25 °C), 95.5% or higher of the STC efficiency (1000 W/m²) is achieved

Temperature Characteristics

Nominal Operating Cell Temperature (**NOCT**)	45±2°C
Temperature Coefficient of Pmax	-0.39 %/°C
Temperature Coefficient of Voc	-0.31 %/°C
Temperature Coefficient of Isc	0.067 %/°C

Mechanical Characteristics

Solar Cell	Polycrystalline silicon 156 × 156 mm (6 inches)
No. of Cells	72 (6 × 12)
Dimensions	1930 × 998 × 50mm (76.0 × 39.3 × 2.0 inches)
Weight	27.0 kgs (59.5 lbs.)
Front Glass	4.0 mm (0.16 inches) tempered glass
Frame	Anodized aluminium alloy
Junction Box	IP67 rated (6 bypass diodes)
Output Cables	TUV (2Pfg1169:2007), UL 4703
	4.0 mm² (0.006 inches²), symmetrical lengths (-) 1500 mm (59 inches) and (+) 1500 mm (59 inches)
Connectors	H4 connectors (MC4 connectable)

Dealer information

Specifications are subject to change without further notification

Packing Configuration

Container	20' GP	40' GP	40' HC
Pieces per pallet	20	20	20
Pallets per container	5	11	22
Pieces per container	100	220	440

APPENDIX B

Noise Receptor Coordinates

Noise Receptor ID	UTM Coordinates[1] Easting	Northing	Distance to Nearest Transformer (m)	Distance to Substation (m)
Potential Existing Noise Receptors				
R 1	655007.27	4890664.10	978	1124
R 2	655094.55	4890946.00	915	1221
R 3	655476.37	4891293.33	757	1288
R 4	655865.27	4891371.16	650	1267
R 5	656304.78	4891203.17	569	1139
R 6	656541.39	4891462.51	918	1463
R 7	656692.91	4891525.23	1063	1583
R 8	657211.54	4890917.79	1241	1469
R 9	657119.94	4890282.16	1135	1148
R 10	656677.87	4890129.93	694	693
R 12	656331.99	4889773.20	484	484
R 13	656083.99	4889948.47	190	190
R 14	655609.98	4889773.98	503	503
R 15	655128.97	4889907.45	879	879
R 16	655353.77	4890414.88	631	701
Assumed Future Noise Receptors				
R 11	656384.38	4889980.50	420	420

[1] All UTM coordinates are in Zone 18 NAD 83.

APPENDIX C

Zoning By-Law: Land Use Zoning

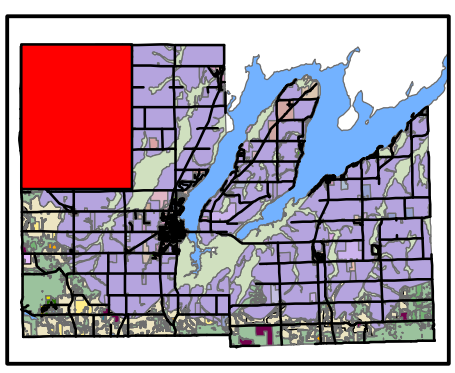
TOWNSHIP OF SCUGOG
ZONING BY-LAW 75-80
SCHEDULE 'A1' Map 1 of 4

LOTS: 1 2 3 4 5 6 7 8 9 10 11 12 13

CONCESSIONS: XIV XIII XII XI X IX VIII

Victoria Corners
Brock Concession Rd 1
Lake Ridge
Scugog Line 14
Jacobsville
7 & 12
Scugog Line 12
Lake Ridge
Cragg
Cragg
REFER TO SCHEDULE 'A6'
Pearl
Ganton
Regional Highway 47
Scugog Line 9
Marsh Hill
Strattonville
Reach
Ward
Scugog Line 8

HR
RU
RU-9
M3-11
C1
C1
RU-7
Blue Mountain
EP-2
EP
EP
EP
M4
RU-57
RU
OS-P
RU-7
M3-17
RU
RU-51
M4
RU
RU
RU-50
H
HR-17
C1
HR
RU
M4
M4-2
C4-49
C4-15
M3-9
RU-7
M3-21
C4-11
EP
EP
EP C4-4
EP-4
EP
RC
RU
RU-35
RU-70
RU-7
EP
ORM-EP2
ORM-EP1
RU-18
CF-7
C4-13
C4-12



0 500 1,000 2,000 3,000 4,000
Meters

N W E S

MAP BOUNDARY

OAK RIDGES MORAINE BOUNDARY

NOTE:
THE SCHEDULE 'A1' Map 1 HAS BEEN PREPARED FOR OFFICE CONSOLIDATION PURPOSES ONLY. IT INCORPORATES THOSE AMENDMENTS TO SCHEDULE 'A1' Map 1 AS OF JUNE 2010. FOR ACCURATE REFERENCE, THE ORIGINAL BY-LAW SHOULD BE CONSULTED. PROVISIONS AFFECTING THE USE OF LANDS ZONED WITHIN A ZONE CATEGORY ARE SPECIFIED UNDER SECTION 4- ZONE PROVISIONS.

TOWNSHIP OF Scugog

JUNE, 2010

APPENDIX D

Environmental Effects Mitigation and Monitoring Plan

Environmental Effects Mitigation and Monitoring Plan[1]

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
CONSTRUCTION PHASE								
Cultural Heritage and Archaeological Resources								
Disruption or destruction of cultural or archaeological materials	Cultural heritage resources Archaeological resources	Low	Low	N/A	N/A	N/A	N/A	Should a previously undocumented cultural or archaeological resource be discovered, alteration of the site will immediately cease, and additional fieldwork will be undertaken by a licensed archaeologist in accordance with Section 48(1) of the *Ontario Heritage Act*. Should human remains be found, the police or regional coroner's office and the Registrar of Cemeteries will be contacted in accordance with the *Cemeteries Act*. Contact Curve Lake First Nation and Alderville First Nation immediately of any archaeological findings or burial sites.
Natural Heritage Features								
There are no direct effects on significant or non-significant natural features within 120 metres of the project location. Potential indirect effects relate to site preparation and electrical cable trenching: ▪ Potential for increased sedimentation and erosion on adjacent lands. ▪ Change in water quality	Wetland 2 (assumed provincially significant) Candidate Significant Amphibian Breeding Habitat 1 & 2 Candidate Significant Bullfrog Concentration Area Candidate	Low	Low	No erosion or sedimentation on adjacent lands and maintain surface water quality of wetlands and streams.	**<u>Erosion and Sediment Control (ESC)</u>** ▪ Minimize soil exposure ▪ Minimize the removal/disturbance to vegetation adjacent to natural features ▪ Install ESC measures prior to grading to prevent mobilization of sediment from the project location into the surrounding landscape ▪ Project location will be seeded with low-growing, native vegetation post-construction ▪ Consideration will be given to minimize or avoid construction activities adjacent to amphibian habitats between sunset	Monitor ESC measures regularly during site preparation and construction. Monitor around the perimeter of the project location where ESC measures are implemented. Monitor	Monitor ESC measures regularly during site preparation and construction Post-construction ESC monitoring to occur monthly or after rain events 10 mm or greater until vegetation is re-established	Repair deficiencies in ESC structures as soon as possible upon notification of breach in ESC structure or buffer fencing Appropriate restoration of wetland vegetation if a high degree of sedimentation occurs or excessive (more than 50%) vegetation mortality is observed

[1] This table provides an overview of potential effects, proposed mitigation measures and monitoring. Individual reports (e.g.., *Environmental Impact Study*, *Water Bodies Report*) contain additional mitigation and monitoring requirements.

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
and/or water levels. ▪ Obstacle to wildlife movement.	Significant Amphibian Movement Corridor Woodland A Woodland B (sig.) Generalized Significant Wildlife Habitat Mixed Meadow Stream 1 Stream 2 Open Water Area 1				and midnight during the amphibian breeding season (April – June) **<u>Stormwater Management</u>** ▪ Develop and implement a stormwater management plan to ensure drainage patterns are not significantly altered from existing conditions due to road drainage, reduction in surface permeability, etc. ▪ Changes in overland drainage can be addressed via scheduling of grading to avoid times of high runoff volumes where possible (i.e. spring and fall), minimizing changes in land contours and maintain natural drainage patterns, where possible. Additional considerations will also be given to the following: ▪ Changes to land contours will be minimized; any physical land alterations (i.e., cut and fill) required will be designed to remain consistent with pre-existing drainage patterns. ▪ Silt fencing will be installed in areas where there is potential for run-off to the receiving water bodies (i.e., perimeter of the project location). ▪ Access roads have been designed to promote infiltration; the roadways within the project location will be gravel. **<u>Open Trenches and Pile Installation</u>** ▪ Maintain effective ESC measures ▪ Minimize duration of times trenches remain excavated ▪ Avoid excavation of trenches during periods of expected heavy rainfall ▪ Consideration will be given to minimize or avoid construction activities adjacent to amphibian habitats between sunset and midnight during the amphibian breeding season (April – June)	effectiveness of stormwater management measures; ensure flow is free of sedimentation. Monitor for surface water run-off flow and evidence of erosion to the features.		

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
					Obstacles to Wildlife ▪ Maximize the distance of all construction equipment used from the edges of natural features ▪ Operate machinery in the project location only ▪ Ensure no wildlife are trapped within the project location prior to construction of the fence ▪ Consideration will be given to minimize or avoid construction noise and activities adjacent to the wetland between sunset and midnight during the amphibian breeding season (April – June).			
Waterbodies								
There are no direct effects on waterbodies in the study area. Potential indirect effects relate to site preparation and electrical cable trenching: ▪ Potential for soil mobilization and erosion resulting in increased sedimentation and turbidity after site clearing. ▪ Increased sedimentation and turbidity may affect fish habitat (e.g., spawning areas, food sources, benthic composition). ▪ Decreased site permeability has potential to increase amount of surface runoff.	Stream 1 Stream 2 Open Water 1	Low	Low	Appropriate ESC measures are implemented prior to and during construction. All ESC controls are maintained during the construction phase.	**Erosion and Sediment Control (ESC)** ▪ Limit the amount of time that bare soils are exposed ▪ Minimize the removal/disturbance to vegetation adjacent to natural features ▪ Install ESC measures prior to grading to prevent mobilization of sediment from the project location into the surrounding landscape ▪ Project location will be seeded with low-growing, native vegetation post-construction ▪ Consideration will be given to minimize or avoid construction activities adjacent to amphibian habitats between sunset and midnight during the amphibian breeding season (April – June) Additional considerations will also be given to the following: ▪ Changes to land contours will be minimized; any physical land alterations (i.e., cut and fill) required will be designed to remain consistent with pre-existing drainage patterns. ▪ Silt fencing will be installed in areas where there is potential for run-off to the receiving water bodies (i.e.,	At all areas where ESC controls are constructed.	Monitor ESC measures regularly during site preparation and construction. Post-construction ESC monitoring to occur monthly or after rain events 10 mm or greater until vegetation is re-established.	Repair deficiencies in ESC structures as soon as possible upon notification of breach in ESC structure and buffer fencing.

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
					perimeter of the project location). ▪ Access roads have been designed to promote infiltration; the roadways within the project location will be gravel. **<u>Stormwater Management</u>** ▪ Develop and implement a stormwater management plan to ensure drainage patterns are not significantly altered from existing conditions due to road drainage, reduction in surface permeability, etc. ▪ Changes in overland drainage can be addressed via scheduling of grading to avoid times of high runoff volumes where possible (i.e. spring and fall), minimizing changes in land contours and maintain natural drainage patterns, where possible. **<u>Open Trenches and Pile Installation</u>** ▪ Maintain effective ESC measures ▪ Minimize duration of times trenches remain excavated ▪ Avoid excavation of trenches during periods of expected heavy rainfall ▪ If dewatering of trenches is necessary, direct all discharged water away from the wetland ▪ Control the rate and timing of water pumping. Pump water onto vegetated surfaces if possible or into a temporary retention basin. If possible, restrict groundwater taking to low flow time periods. ▪ Consideration will be given to minimize or avoid construction activities adjacent to amphibian habitats between sunset and midnight during the amphibian breeding season (April – June).			
Air, Odour and Dust								
Deposition of dust on agricultural crops, sensitive	Neighbouring land uses	Low	Low	N/A	Vehicle idling will be restricted where possible.	N/A	N/A	N/A

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
natural features and adjacent properties from construction activities such as clearing, grubbing, grading and levelling.					Equipment will be maintained in good working order. Vehicular traffic will be minimized in areas of exposed soils. Dust-producing activities will be limited on windy days, where possible, to reduce dust deposition on neighbouring properties. Gravel roads will be watered down during construction as needed to reduce dust.			
Health related impacts from the release of emissions related to construction activities, such as CO, NOx, SO_2 and Volatile Organic Compounds (VOCs) from machinery	Construction workers Project staff Neighbouring landowners	High	Low	N/A		N/A	N/A	N/A
Odour nuisance from the operation of diesel-fuelled machinery during construction activities.	Neighbouring landowners	Low	Low	N/A		N/A	N/A	N/A
Noise								
Increased noise disturbance due to construction activities such as compacting and grading, and driving of foundation piles for solar panel supports.	Neighbouring landowners	Moderate	Low	N/A	Vehicle idling will be restricted, where possible. Construction activities resulting in noise emissions will take place as stipulated by the Township (Monday through Friday from 7:00 am until 7:00 pm and 8:00 am to 3:00 pm on Saturdays) or in accordance with local By-laws. Should work need to be conducted on weekends, this work will be done in accordance with local regulations and policies to minimize disturbance to the surrounding community. All equipment will be maintained in good working order, with muffler devices, where appropriate. Any noise complaints will be investigated as discussed in the Communications Plan (see the *Design and Operations Report*).	N/A	N/A	N/A

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
Land Use and Resources								
Temporary removal of land from agricultural production	36 hectares of project location lands	High	Low	N/A	Soil nutrient contents will be maintained through planting of a low-growing species such as clover.	N/A	N/A	Lands will be restored to their original or future anticipated land use at the time of decommissioning.
Visual impact	Neighbouring landowners	Low	Low	N/A	Landscaping as required to minimize view of project location.	N/A	N/A	Visual impact studies will be undertaken, as required.
Provincial and Local Infrastructure								
Periodic traffic disruption during the delivery of project components	Cragg Road, Marsh Hill Road and/or Highway 7/12	Moderate	Low	Limit traffic flow disruption	Construction signage will be implemented to warn travelers of possible traffic disruption.	N/A	N/A	N/A
Damage to local roads	Cragg Road, Marsh Hill Road and/or Highway 7/12	Moderate	Low	N/A	A survey of existing road conditions would be undertaken prior to construction. This would serve as a benchmark for repair and/or rehabilitation after decommissioning of the facility, should it be required.	N/A	N/A	Solray will work with the municipality to create a Road User's Agreement, which will dictate how infrastructure will be repaired, or how the municipality will be compensated should damage occur.
Temporary power outages to local customers during commissioning of the facility	Neighbouring landowners and local community	Low	Moderate	N/A	To be undertaken by Hydro One.	N/A	N/A	N/A
Public Health and Safety								
Risks of injury of death from transport of materials on public roads	Construction workers Neighbouring landowners and other members of the community	Low	High	No injuries or deaths	A traffic management plan will be developed with the municipality prior to construction Reduced speed limits on local roads Special care will be taken with regard to school buses, pedestrians and the blind entrance to the cemetery Flag person as required	N/A	N/A	Implementation of Emergency Response and Communications Plans
Fires (electrical, wildfire) at the project location during construction	Construction workers Neighbouring landowners and other members of the community Municipal	Low Low Low	Low Low Moderate	Minimize fire potential at project location	Solray will work with the local fire department to develop a fire prevention plan for the project location that includes the construction phase. This plan will be outlined in the Emergency Response and Communications Plans. (See the *Design and Operations Report*). The Emergency Response and	N/A	N/A	Implementation of Emergency Response and Communications Plans.

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
	firefighters				Communications Plans will outline key contact information for emergency responders, landowners, contractors and stakeholders.			
Areas Protected Under Provincial Plans and Policies								
No potential negative effects are anticipated to the Greenbelt Protected Countryside or Lake Simcoe Watershed. Additional natural environment studies, as stipulated by *Ontario Regulation 359/09* for project locations within Plan Areas will be conducted and will consider the full intent of the *Greenbelt Act* and Lake Simcoe Watershed Protection Plan.								
OPERATIONS PHASE								
Natural Heritage Features								
In addition to the effects listed below, unanticipated major maintenance activities have the potential to cause negative environmental effects as described for the construction phase and the same mitigation and monitoring activities would apply.								
Light and Noise Disturbance	Candidate Significant Amphibian Breeding Habitat 1 & 2 Candidate Significant Bullfrog Concentration Area Generalized Significant Wildlife Habitat	Low	Low	Amphibian breeding activity continues at or above observations recorded pre-construction	Limit use of lighting where possible. Avoid light effects entering the wetland (eliminate light trespass). If lighting is required around the project location, use of motion sensors may be implemented as necessary.	N/A	N/A	N/A
Leakage / Spill of Transformer Oil	Wetland 2 (assumed provincially significant) Candidate Significant Amphibian Breeding Habitat 1 & 2 Candidate Significant Bullfrog Concentration Area Candidate Significant Amphibian Movement Corridor	Low	Low	No discharge of oil to the environment.	Development of a Spills Response Plan prior to construction and operation. Transformers will have secondary spill containment. Equipment will be maintained in good working order. Spill kits will be located in strategic locations at the project location.	N/A	N/A	Implementation of Spills and Response Plan.

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
	Woodland A Woodland B (sig.) Generalized Significant Wildlife Habitat Mixed Meadow							
Waterbodies								
There are no potential negative effects anticipated to waterbodies during the operations phase of the project. Unanticipated major maintenance activities have the potential to cause negative environmental effects as described for the construction phase and the same mitigation and monitoring activities would apply.								
Air, Odour and Dust								
Operation of the facility will have no impact on air, odour or dust with the exception of unanticipated major maintenance activities, which have the potential to cause negative environmental effects as described for the construction phase. The same mitigation and monitoring activities would apply.								
Noise								
In addition to the effect listed below, unanticipated major maintenance activities have the potential to cause noise as described for the construction phase and the same mitigation and monitoring activities would apply.								
Increased noise disturbance due to operations activities of the solar farm (inverter units and transformers)	Neighbouring Landowners	Low	Low	Minimize noise effects on surrounding area and landowners.	The project will include the installation of acoustic louvers on inverter units.	N/A	N/A	Following implementation of mitigation measures, the project will comply with the daytime / night-time noise criteria as defined in the Ontario Ministry of the Environment Noise Pollution Control Publication NPC-232 "*Sound Level Limits for Stationary Sources in Class 3 areas*".
Land Use and Resources								
There are no potential negative effects anticipated to land use and resources during the operations phase of the project. Unanticipated major maintenance activities have the potential to cause negative environmental effects as described for the construction phase. The same mitigation and monitoring activities would apply.								
Provincial and Local Infrastructure								
There are no potential negative effects anticipated to provincial and local infrastructure during the operations phase of the project. Unanticipated major maintenance activities have the potential to cause negative environmental effects as described for the construction phase. The same mitigation and monitoring activities would apply.								
Public Health and Safety								
In addition to the effects listed below, unanticipated major maintenance activities have the potential to cause negative environmental effects as described for the construction phase and the same mitigation and monitoring activities would apply.								
Fire (e.g., electrical or wildfires) at the project location during operation	Neighbouring landowners and other members of the community	Low	Low	N/A	Solray will work with the local fire department to develop a fire prevention plan for the project location. This plan will be outlined in the Emergency Response and	Project location	Ongoing (remotely)	Implementation of Emergency Response and Communications Plans.

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
	Maintenance workers Municipal firefighters	Low Low	Low Moderate		Communications Plans. (See the *Design and Operations Report*). This plan will include measures such as regular maintenance of vegetation and electrical equipment. (See the *Design and Operations Report*). The Emergency Response and Communications Plans will outline key contact information for emergency responders, landowners, contractors and stakeholders.			
Provincial Plans and Policies								
No potential negative effects are anticipated to the Greenbelt Protected Countryside or Lake Simcoe Watershed. Additional natural environment studies, as stipulated by *Ontario Regulation 359/09* for project locations within Plan Areas will be conducted and will consider the full intent of the *Greenbelt Act* and Lake Simcoe Watershed Protection Plan.								
DECOMMISSIONING PHASE								
Natural Heritage Features								
Decommissioning activities have the potential to cause negative environmental effects as described for the construction phase and the same mitigation and monitoring activities would apply with the exception that the final site restoration activities will return the project location to its original condition or future anticipated use, as most appropriate.								
Waterbodies								
Decommissioning activities have the potential to cause negative environmental effects as described for the construction phase and the same mitigation and monitoring activities would apply with the exception that the final site restoration activities will return the project location to its original condition or future anticipated use, as most appropriate.								
Air, Odour and Dust								
Decommissioning activities have the potential to cause negative environmental effects similar to those described for the construction phase and the same mitigation and monitoring activities would apply.								
Noise								
Decommissioning activities have the potential to cause negative environmental effects similar to those described for the construction phase and the same mitigation and monitoring activities would apply.								
Land Use and Resources								
There are no anticipated negative environmental effects to land uses and resources during the decommissioning phase of the project. At the time of decommissioning, the land will be restored to its pre-construction use or future anticipated land use. All project components will be removed (with the exception of broken metal piles below 1.2 m) and the project location lands will be restored through the spreading of topsoil, re-vegetation and seeding. Materials will be reused and recycled where available. See the *Decommissioning Plan Report*.								
Public Health and Safety								
In addition to the effect listed below, decommissioning activities have the potential to cause negative environmental effects similar to those described for the construction phase and the same mitigation and monitoring activities would apply.								
Hazards and health impacts from debris left on site	Project location lands Neighbouring lands Persons encountering	Low	Low	N/A	The site will be cleared of debris and hazards and returned to its original condition or future anticipated land use. A Record of Site Condition may be required by the MOE.	N/A	N/A	N/A

Potential Effect	Affected Feature(s) / Environmental Components	Likelihood	Magnitude	Performance Objective	Mitigation Measures	Monitoring Locations	Frequency & Duration	Contingency Measures
	hazards							
Provincial Plans and Policies								
No potential negative effects are anticipated to the Greenbelt Protected Countryside or Lake Simcoe Watershed. Additional natural environment studies, as stipulated by *Ontario Regulation 359/09* for project locations within Plan Areas will be conducted and will consider the full intent of the *Greenbelt Act* and Lake Simcoe Watershed Protection Plan.								
(Sig.) – Indicates a natural heritage species that has been deemed either significant or provincially significant based on criteria from the Ministry of Natural Resources and the *Evaluation of Significance Report* as part of the *Natural Heritage Assessment*.								
N/A – Not Applicable								
"Assumed Provincially Significant" Applicants proposing to develop a renewable energy project within 120 metres of an unevaluated wetland can assume the wetland is provincially significant and can do a rapid assessment of the wetland in the *Natural Heritage Assessment Evaluation of Significance Report*. Mitigation measures to protect the wetland from negative environmental effects associated within development are outlined in the *Natural Heritage Assessment Environmental Impact Study*.								
"Candidate Significant" – Wildlife habitat can be treated as significant in the *Natural Heritage Assessment Evaluation of Significance Report* if targeted field studies have not yet occurred (due to seasonality). Targeted wildlife habitat studies will be done prior to the start of construction, as committed to in the *Natural Heritage Assessment Environmental Impact Study Report*, and the habitats will then be evaluated for significance.								

APPENDIX E

Stormwater Management Report

SOLRAY

July 2012

STORMWATER MANAGEMENT REPORT

Marsh Hill Solar Farm

DILLON CONSULTING

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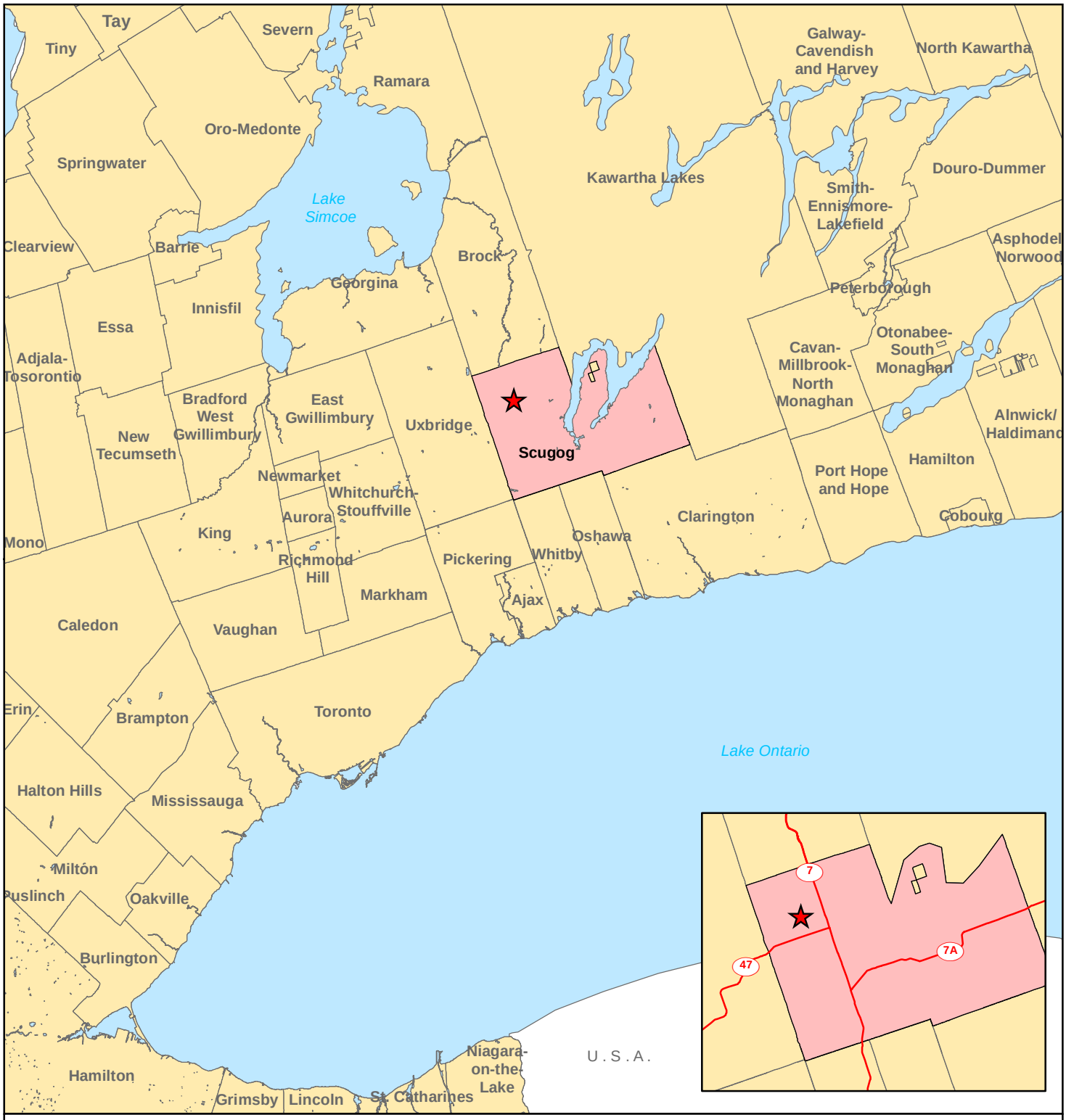
1.0 INTRODUCTION

Solray Energy Corporation (Solray) proposes to develop a solar facility with a maximum name plate capacity of 10 MW, located near Uxbridge in the Township of Scugog and Regional Municipality of Durham, Ontario (**Figure 1**). The renewable energy facility will be known as the Marsh Hill Solar Farm, (hereinafter referred to as the "project") and will be rated as a Class 3 Solar Facility. Solray has received a contract from the Ontario Power Authority (OPA) for the sale of electricity generated by this renewable facility through the province's Feed-in-Tariff (FIT) program (enabled by the *Green Energy and Green Economy Act, 2009*). The project will require a Renewable Energy Approval (REA) as per *Ontario Regulation 359/09* under Part V.0.1 of the *Ontario Environmental Protection Act*.

Ontario Regulation 359/09 requires that a proponent consider the potential negative environmental effects related to stormwater at the project location and impacts within 300 metres. This Stormwater Management Report has been prepared to address concerns over potential impacts to water quality and water quantity. This report investigates the proposed changes to the project location in order to facilitate the construction, design and operation of the Marsh Hill Solar Farm.



SOLRAY

Marsh Hill Solar Farm

Figure 1: General Location of the Marsh Hill Solar Farm in Southern Ontario

Legend

- Project Location
- Highway
- Township of Scugog
- Municipalities

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DILLON CONSULTING

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2.0 THE PROPONENT

Solray is a developer of utility-scale solar energy projects in Ontario, with two projects moving towards construction and nine projects in early-stage development. Solray endeavours to work closely with all interested stakeholders in their projects including landowners, Aboriginal communities, the general public, municipalities, government agencies and ministries. Solray's main objective is to design and construct projects that are both environmentally beneficial and financially viable.

Contact information for the proponent is as follows:

Full Name of Company:	*Solray Energy Corporation*	
Prime Contacts:	*Andy Keith,* *President*	*Michael Jordan Halbert,* *Chairman and CEO*
Address:	*2788 Bathurst St., Suite 305* *Toronto, Ontario, M6B 3A3*	*2788 Bathurst St., Suite 305* *Toronto, Ontario, M6B 3A3*
Telephone:	*(416) 910-6580*	*(416) 780-8000*
Fax:	*(416) 780-8001*	*(416) 780-8001*
Email:	*andy@solray.ca*	*mjh@solray.ca*

Dillon Consulting Limited (Dillon) is the consultant responsible for the preparation of this Stormwater Management Report and for consultation activities for the Marsh Hill Solar Farm. The contacts at Dillon are:

Full Name of Company:	*Solray Energy Corporation*	
Prime Contacts:	*Andy Keith,* *President*	*Michael Jordan Halbert,* *Chairman and CEO*
Address:	*2788 Bathurst St., Suite 305* *Toronto, Ontario, M6B 3A3*	*2788 Bathurst St., Suite 305* *Toronto, Ontario, M6B 3A3*
Telephone:	*(416) 910-6580*	*(416) 780-8000*
Fax:	*(416) 780-8001*	*(416) 780-8001*
Email:	*andy@solray.ca*	*mjh@solray.ca*

3.0 PROJECT LOCATION

The proposed Class 3 solar facility is located at 725 Cragg Road, Uxbridge, Ontario between Marsh Hill Road and Highway 7 within the Township of Scugog. The project location covers part of Lot 8, Concession 11, and consists of approximately 36.1 hectares of privately owned land (leased by the proponent) with geographic coordinates (centroids) as follows:

- Latitude: 44° 8’ 59.78” N
- Longitude: 79° 2’ 58.05” W

“Project location” is defined in *Ontario Regulation 359/09* to be “a part of land and all or part of any building or structure in, on or over which a person is engaging in or proposes to engage in the project”. **Figure 2** shows the relative location of the water course features adjacent to the project site.

The project location is situated on land zoned as rural by the Township of Scugog and designated as agricultural by the Region of Durham. The project location falls entirely within the Greenbelt Area Protected Countryside and almost entirely within the Lake Simcoe Watershed.

SOLRAY

Marsh Hill Solar Farm

Figure 2:
Watercourse Features

LOT 6, CON 12
LOT 7, CON 12
LOT 8, CON 12
LOT 9, CON 12
LOT 10, CON 12
SCUGOG LINE 12
Stream 1
Stream 2
Open water 1
Lake Simcoe Region Conservation Authority
LOT 6, CON 11
LOT 7, CON 11
LOT 8, CON 11
LOT 9, CON 11
LOT 10, CON 11
MARSH HILL ROAD
CRAGG ROAD
LOT 6, CON 10
LOT 7, CON 10
LOT 8, CON 10
LOT 9, CON 10
LOT 10, CON 10
Kawartha Region Conservation Authority

Legend

- Roads
- Watercourse
- Conservation Authority Boundary Line
- Project Location
- 120 m Project Location Setback
- 300 m Project Location Setback
- Lots/Concessions
- LSRCA Regulation Boundary

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File Path: I:\GIS\114838 - Solray Park Property\Mapping\Figure 2: Watercourse Features.mxd

3.1 Natural Resources

A *Natural Heritage Assessment* (NHA) was completed consistent with Section 25 of *Ontario Regulation 359/09* for the project location and lands within 120 metres. The NHA consisted of a *Records Review*, *Site Investigation*, *Evaluation of Significance* and *Environmental Impact Study*.

Adjacent to the project location, a wetland feature (treated as significant as per the Natural Heritage Assessment Guide, MNR 2011) was identified within 120 metres of the project location. Other significant natural features indentified within the 120 metres of the project location include a significant woodland, generalized candidate significant wildlife habitat, candidate significant amphibian movement corridor, candidate significant Bullfrog concentration area, and candidate significant amphibian breeding habitat (including candidate significant habitat for Western Chorus Frog). Additionally, a non-significant woodland was identified adjacent to the project location within the 120 metres setback.

No significant water features were identified within the boundary of the project location. However, within the 120 metre setback a single body of open water and two watercourses were inventoried. Neither field investigations nor aerial images could identify an outflow location of the body of open water inventoried. It likely provides some offline use to agricultural practices in the area. Both watercourses flow northerly toward Lake Simcoe and are part of the Beaver River Watershed Under existing conditions, the project location is utilized as an agricultural field.

3.2 Soil Conditions

A geotechnical investigation of the project location was completed by Genivar Inc. The investigation consisted of nineteen (19) exploratory boreholes, particle size distribution analysis for two borehole sites, chemical laboratory testing, and soil resistivity soundings.

Generally the soil profiles consisted of silty sands and sandy silts at a depth of 0.1 metre to 1.4 metres below the ground surface. A layer of sand was encountered at five (5) of the boreholes and ranged between 0.3 metre to 1.6 metre thick. At eighteen (18) borehole locations glacial till was encountered beneath a layer of sandy silt, silty sand, or sand. The brown to grey glacial till predominantly had a texture of sandy silt with a trace to some clay, a trace to some gravel, and occasional cobbles. At the time of the investigation the glacial till was moist to wet.

The depths of the nineteen (19) boreholes ranged from 6.2 to 6.6 metres below the ground surface. Bedrock was not encountered in any of the exploratory boreholes. Three (3) soil electrical resistivity sounding measurements were performed at the project location. Electrical resistivity sounding measurements provide a reasonable indication of soil and rock subsurface composition. An estimate of subsurface composition is determined by measuring the electrical resistance between measurement probes. The results of the sounding measurements indicated that the presence of bedrock was unlikely.

Groundwater was encountered in six (6) of the borehole locations at depths ranging from 2.7 metres to 6.0 metres below the existing ground surface.

3.3 Drainage

Topographic information indicates a ridge bisecting the project location and splitting surface water flow in two directions. **Exhibit 1.0** (located in Appendix A) illustrates the project location under existing drainage conditions including all inventoried drainage features. Catchment 101 drains north-westerly toward the watercourse to the north west of the project location. Catchment 102 drains north-easterly and connects with the watercourse to the north east of the project location.

3.4 Proposed Physical Land Alterations

In general, the proposed development will not alter the existing site grades significantly. Approximately 40,000 to 50,000 photovoltaic (PV) panels will be installed. In the preliminary design phase it is assumed that between 1,800 and 3,000 racks will be installed to support the PV panels. To conservatively estimate the impact of the development, the analysis considers the installation of the 3,000 racks. It is assumed that each rack will be mounted onto two piles (each approximately 300 millimetres in diameter); therefore an estimated 6,000 piles are required onsite. It is anticipated that this area will not significantly affect the overall imperviousness of the project location, as the area of the piles relative to the area of the project location is small.

A gravel access road will be constructed to allow for the transportation of equipment and materials into the project location, as well as for ongoing maintenance. Roads will be constructed to a width of 5.0 metres with granular 'B' base and a finished surface of granular 'A' material to a total thickness of approximately 300 millimetres. Culverts and parallel side ditches may be required to maintain existing overland flow routes. This will be determined at the detailed design stage of the project prior to construction.

In order to account for the worst case scenario, the following permanent components have been assumed for this report:

- Ten (10) inverter units (on concrete pad, 16 square metres each);
- Substation and Communication Tower (on concrete pads, 101 square metres);
- Substation yard (gravel, 499 square metres); and
- Gravel parking lot (124 square metres).

See **Exhibit 2.0** (located in **Appendix A**) for the proposed layout of the project location. Although the solar panels themselves are impervious, rain will land on the solar panels, which are tilted, and

runoff directly onto the ground surface below the individual panels. The overall effect of the runoff generated from the solar panels will be minimal as the proposed ground cover, in the form of grasses, will promote infiltration. Minimal erosion is anticipated beneath each solar panel.

4.0 STORMWATER ASSESSMENT

4.1 Proposed Location Characteristics

The features contributing to the increased imperviousness of the project location are presented in **Table 1**.

Table 1: Project Location Characteristics

Feature	Total for Site	Catchment 101	Catchment 102
Number of Solar Panel Rack Piles	6000	4000	2000
Length of Gravel Access Roads (m)	1135	1135	0
Area of Piles Supporting Racks (m^2) [(π $(d/2)^2$) x No. of Piles]	424	283	141
Area of Inverters Stations (m^2) [Area x No. of Inverter Units]	162	162	0
Area of Substation and Communication Tower (m^2)	101	101	0
Area of Gravel Substation Yard (m^2)	499	499	0
Area of Gravel Access Roads (m^2) [(Length of Road) x (Width of Road - 5.0 metres)]	5675	5675	0
Area for Gravel Parking (m^2)	124	124	0
Summary of Imperviousness	Total for Site	Catchment 101	Catchment 102
Total Paved or Concrete Area (ha)	0.07	0.05	0.01
Total Gravel Area (ha)	0.63	0.63	0.00
Existing Land Cover Remaining (ha)	35.40	23.42	11.99
Total Site Area (ha)	**36.10**	**24.10**	**12.00**

4.2 Assessment of Impacts

Increases to imperviousness and their impacts to stormwater runoff rates were assessed using the Rational Method for both existing and proposed conditions. Comparisons of peak flow runoff were made to determine any impacts due to the revised imperviousness at the project location.

Under existing conditions the land cover is entirely plowed agricultural fields with mild slopes ranging between 2 and 5 %. Using the Ministry of Transportation Drainage Design Manual (MTO, 1997), the runoff coefficients for both Catchment 101 and 102 is 0.35. **Table 2** presents the land use breakdown of the project location under proposed conditions.

Table 2: Post Development Land Use and Runoff Coefficient

Catchment 101			
Drainage Feature	Area (ha)	Runoff Coefficient	Area x Coefficient
Concrete Area	0.05	0.95	0.05
Gravel Area	0.63	0.60	0.38
Native Area	23.42	0.35	8.20
Total Area	24.10	0.36	8.63
Catchment 102			
Drainage Feature	Area (ha)	Runoff Coefficient	Area x Coefficient
Concrete Area	0.01	0.95	0.01
Gravel Area	0.00	0.60	0.00
Native Area	11.99	0.35	4.20
Total Area	12.00	0.35	4.21

The area weighted runoff coefficient for proposed conditions was calculated as per the example for Catchment 101 below:

$$C = \frac{(0.05)*(0.95)+(0.63)*(0.6)+(23.42)*(0.35)}{24.10} = 0.36$$

A summary of the parameters used in the existing and proposed conditions Rational Method analysis are outlined in **Table 3**. For detailed time of concentration calculations see **Appendix B**

Table 3: Rational Method Input Parameters

	Time of Concentration (minutes)	Pre-development Runoff Coefficient	Post-development Runoff Coefficient
Catchment 101	15	0.35	0.36
Catchment 102	24	0.35	0.35

The rainfall intensity was determined with intensity duration frequency (IDF) curves from the MTO. Peak flow calculations under existing and proposed conditions are summarized in **Table 4**. For detailed peak flow calculations, see **Appendix C**.

Table 4: Peak Flows

Catchment 101						
	Return Period					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Existing Flow	1.28	1.68	1.96	2.42	2.93	3.36
Proposed Flow	1.32	1.73	2.02	2.48	3.01	3.46
% Change	2.9%	2.9%	2.9%	2.9%	2.9%	2.9%
Catchment 102						
	Return Period					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Existing Flow	0.46	0.58	0.70	0.87	1.06	1.22
Proposed Flow	0.46	0.58	0.70	0.87	1.06	1.22
% Change	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

4.3 Discussion

The proposed runoff coefficients and peak flows do not vary significantly from existing conditions. Based on the results of this study, a minimal change to the imperviousness of the project location does not significantly impact the peak flow rates. It is assumed the existing topography will not be significantly altered therefore the drainage pattern will remain the same in post-development.

As noted in the previous section, the imperviousness of the proposed solar panels does not factor into the calculation of the runoff coefficient due to the elevated nature of the racks; constructed above ground, mounted and tilted. Runoff is directed from the solar panels onto the ground in front of the solar panels (which is grass covered, below the fronting row of solar panels). Thus, the impervious surfaces do not ultimately impact the characteristics of the drainage. Accordingly, no quantity abatement measures are required.

5.0 STORMWATER POLLUTION

The extensive use of vegetative surface drainage allows for runoff peak flow attenuation and allows removal of suspended solids during flow over grassed areas. Although the majority of the project location poses no increased loading of total suspended solids (TSS) or other pollutants such as oil, spill containment design features for the substation and inverter transformers have been considered.

Within the substation yard, the substation will contain a single-walled transformer (with oil), switch gear and monitoring equipment. The secondary containment for the substation transformer will be built to reduce potential negative environmental effects from an oil leak. The secondary containment will be confirmed in the detailed design stage. Based on preliminary design estimates, the substation will rest in a concrete basin with an area of 100 square metres designed to hold the liquid contents of the transformer and stormwater equivalent to that of a 30-minute 100-year storm. Stormwater will be contained in the concrete basin with a gravel infill and then drained through an oil/water separator, which will contain the oil and use gravity to release the water back into the surrounding environment. Any oil separated from the oil/water separator will be collected and disposed of at a registered facility. Spill containment may also be provided for the transformers located in the inverter units, which contain organic oil that acts as a coolant. Additional details of the spill containment units and plans will be established during the detailed design stage.

6.0 CONSTRUCTION PERIOD MEASURES

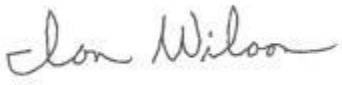
To minimize the potential for impairment of the quality of receiving waters during construction, an erosion abatement control plan will be implemented during construction. The plan should include, but not be limited to, the following:

- Installing straw bale barriers and/or filter cloth barriers including silt fences, in existing swales, drains, or at critical downstream flow points to intercept suspended solids carried by overland flow and to prevent the runoff from directly entering existing watercourses;
- Minimizing the need for topsoil stripping ; and
- Using appropriate grading techniques to prevent increased run-off potential and maintain positive drainage.
- Planting of grasses on disturbed areas after construction activities have ceased (e.g. construction laydown area).

7.0 SUMMARY

The overall changes to the imperviousness of the project location following the development of the Marsh Hill Solar Farm are minimal. However, based on the mildly sloped topography, it is expected that there will be some cut/fill and grading of the project location to accommodate the solar farm development. Once the project location has been restored and the ground cover has been re-established, it is anticipated that the total runoff from the project location will be similar to existing conditions, as the estimated changes in peak flows are approximately 2.9% and 0.0%, in Catchments 101 and 102, respectively. In the interim, it is proposed that qualitative protection measures be implemented for the project location to minimize both erosion and increases in runoff during construction until the vegetative ground cover has been re-established.

Respectfully submitted:



Ian Wilson, MASc., E.I.T

Roy Johnson, MASc., P.Eng.
Water Resources Engineer

8.0 REFERENCES

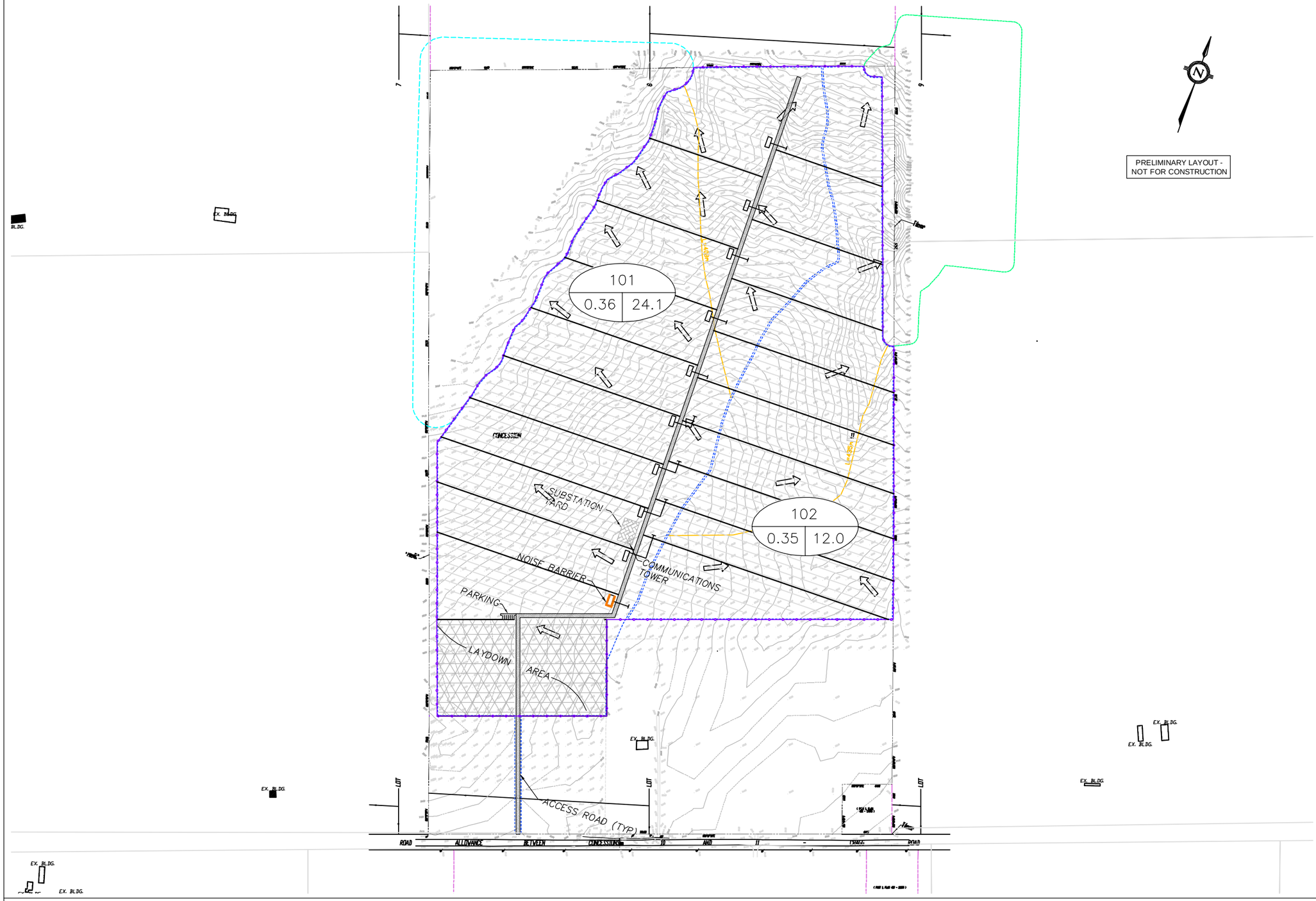
Ministry of the Environment – Ontario (MOE). 2003. Stormwater Management Planning and Design Manual

Ministry of Natural Resources – Ontario. July 2011. Natural Heritage Assessment Guide for Renewable Energy Projects. Queen's Printer for Ontario.

Ministry of Transportation – Ontario (MTO). 1997. MTO Drainage Management Manual

APPENDIX A

Exhibits



Project Size
10MW AC

Location
44-08'59.402"N
79-02'58.084"W

Legend

- Property Line
- Adjacent Parcel Line
- Fence Line
- 30m Top of Bank Setback
- 12m Edge of Forest Setback
- Flow Path
- Existing Building
- 101 / 0.32 | 40.53 — CATCHMENT ID, AREA (HA), RUNOFF COEFF.
- Area of Development / Drainage Boundary
- Overland Drainage Route
- Access Roads
- Temporary Construction Laydown Area (to be restored post-construction)
- Substation
- Solar Rack
- Inverter

NOTES:

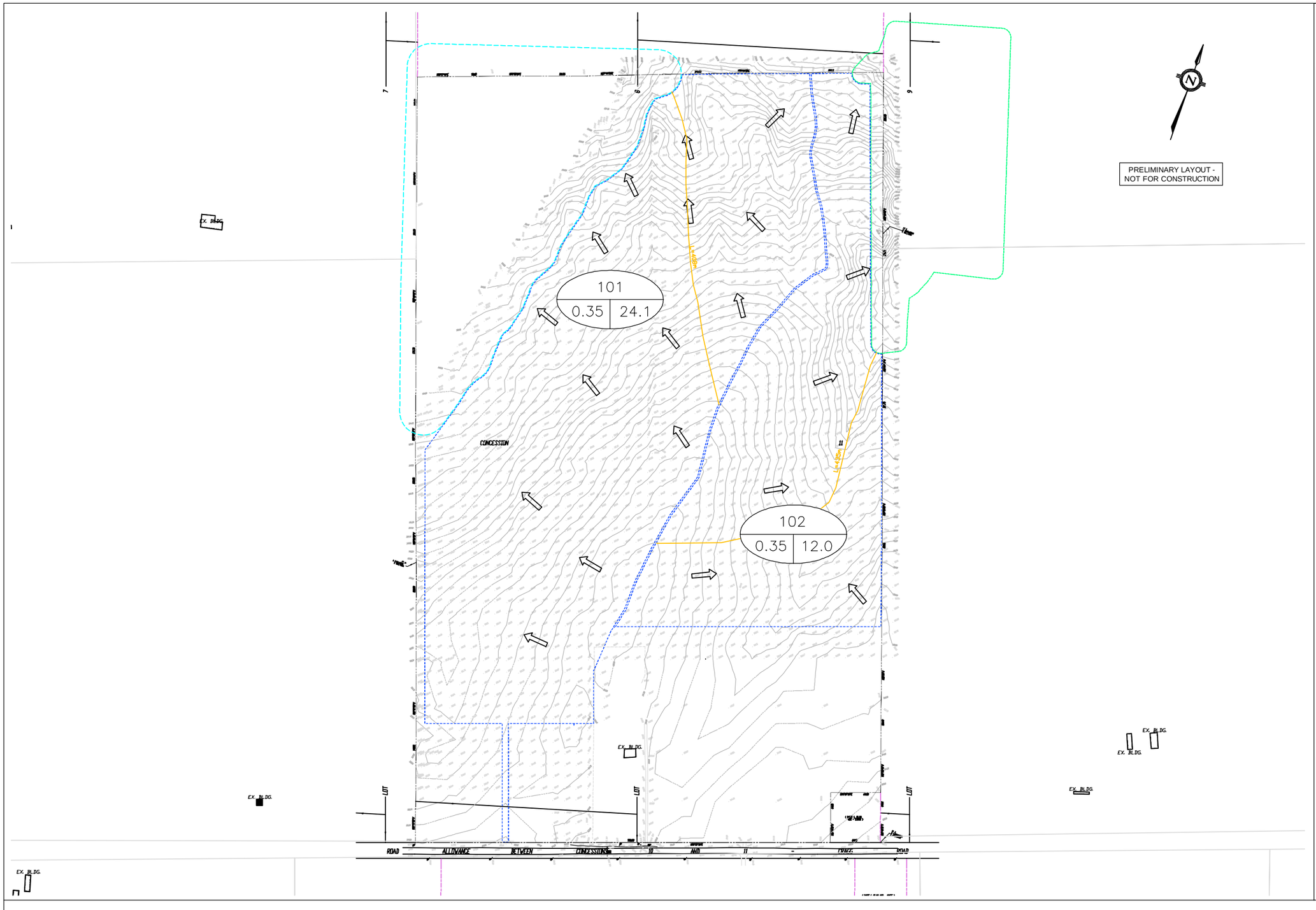
1. CONTRACTOR SHALL PERFORM MINOR GRADING AS REQUIRED TO PROVIDE POSITIVE DRAINAGE.
2. THE PERIMETER OF THE SOLAR PANELS AND GRAVEL ROADS WILL MATCH EXISTING GRADES.

DILLON CONSULTING

Rev #	Date	Description

SOLRAY - MARSH HILL SOLAR FARM
PROPOSED DRAINAGE PLAN

Date: January 12th, 2012	Designed By: Jason Jenkins	Project #: 11-4838	
Dwg Size: 24x36	Address: 725 Cragg Road Uxbridge, ON.	Legal: Parts of Concession 11, Lot 8 Former Township of Marbourough City of Ottawa	REV. No. 0
Scale: NTS		Solray Marsh Hill Solar Farm	Exhibit: 2.0



Project Size
10MW AC

Location
44-08'59.78"N
79-02'58.05"W

Legend

- Property Line
- Adjacent Parcel Line
- 30m Top of Bank Setback
- 12m Edge of Forest Setback
- Existing Building
- 101 / 0.32 / 24.1 — CATCHMENT ID, AREA (HA), RUNOFF COEFF.
- Area of Development / Drainage Boundary
- Overland Drainage Route

NOTES:

1. CONTRACTOR SHALL PERFORM MINOR GRADING AS REQUIRED TO PROVIDE POSITIVE DRAINAGE.
2. THE PERIMETER OF THE SOLAR PANELS AND GRAVEL ROADS WILL MATCH EXISTING GRADES.

DILLON CONSULTING

Rev #	Date	Description

SOLRAY - MARSH HILL SOLAR FARM
EXISTING DRAINAGE PLAN

Date: February 10th, 2012	Designed By: Jason Jenkins	Project #: 11-4838	
Dwg Size: 11x17	Address: 725 Cragg Road Uxbridge, ON.	Legal: Parts of Concession 11, Lot 8 Former Township of Marbourough City of Ottawa	REV. No. 1
Scale: NTS		Solray Marsh Hill Solar Farm	Figure: 1.0

APPENDIX B

Time of Concentration Calculations

Appendix B - Time of Concentration Calculations

SCS Velocity (Uplands) Method (1975,1986)

t_c = (L/v)/60

	* $v/S^{0.5}$ (m/s)
Forest with heavy ground litter, hay meadow	0.6
Trash fallow or min tillage cultivation, contour, strip cropped woodland	1.5
Short grass pasture	2.3
Cultivated straight row	2.7
Nearly bare and untilled or alluvial fans in Western mountain regions	3.0
Grassed waterway	4.6
Paved area	6.1

DATA ENTRY

	Slope (m/m)	Length (m)	Land Cover	$v/S^{0.5}$	v (m/s)	t_c (min)
Solray - Marsh Hill Catchment 101	0.039	408	Short grass pasture	2.3	0.4570	14.9
					Total t_c (min) =	**14.9**

SCS Velocity (Uplands) Method (1975,1986)

t_c = (L/v)/60

	* $v/S^{0.5}$ (m/s)
Forest with heavy ground litter, hay meadow	0.6
Trash fallow or min tillage cultivation, contour, strip cropped woodland	1.5
Short grass pasture	2.3
Cultivated straight row	2.7
Nearly bare and untilled or alluvial fans in Western mountain regions	3.0
Grassed waterway	4.6
Paved area	6.1

DATA ENTRY

	Slope (m/m)	Length (m)	Land Cover	$v/S^{0.5}$	v (m/s)	t_c (min)
Solray - Marsh Hill Catchment 102	0.017	435	Short grass pasture	2.3	0.3020	24.0
					Total t_c (min) =	**24.0**

* The velocity coefficient for the uplands method is average velocity charts developed by SCS (1975,1986). Refer to L. Mays and CSPI for chart details

** The chart from which these values are based on consider a minimum slope of 0.5% and 0.1 ft/s (i.e. 0.03048 m/s)

APPENDIX C

Peak Flow Calculations

Appendix C - Rational Method Peak Flow Calculations

Existing - Catchment 102						
Rainfall Intensity (I = A(T)^B						
	2 yr	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**
A	20.7	25.2	32.1	37	41.2	45.5
B	-0.697	-0.749	-0.687	-0.666	-0.664	-0.663
Time of Concentration = T (min)	24.0	24.0	24.0	24.0	24.0	24.0
Intensity = I (mm/hr)	39.2	50.0	60.2	68.1	75.7	83.5
Peak Flow using Rational Method (Q = 0.00278*C*I*A)						
Area = A (ha)	12.00					
Runoff Coefficient = C	0.35	0.35	0.35	0.39	0.420	0.438
Peak Flow = Q (m^3/s)	**0.458**	**0.584**	**0.703**	**0.875**	**1.061**	**1.219**
Proposed - Catchment 102						
Rainfall Intensity (I = A(T)^B						
	2 yr	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**
A	20.7	25.2	32.1	37	41.2	45.5
B	-0.697	-0.749	-0.687	-0.666	-0.664	-0.663
Time of Concentration = T (min)	24.0	24.0	24.0	24.0	24.0	24.0
Intensity = I (mm/hr)	39.2	50.0	60.2	68.1	75.7	83.5
Peak Flow using Rational Method (Q = 0.00278*C*I*A)						
Area = A (ha)	12.00					
Runoff Coefficient = C	0.35	0.35	0.35	0.385	0.420	0.438
Peak Flow = Q (m^3/s)	**0.458**	**0.584**	**0.703**	**0.875**	**1.061**	**1.219**
% Change	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

* Runoff coefficients for higher return period storms are increased as per MTO Criteria

Appendix C - Rational Method Peak Flow Calculations

Existing - Catchment 101						
Rainfall Intensity (I = A(T)^B						
	2 yr	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**
A	20.7	25.2	32.1	37	41.2	45.5
B	-0.697	-0.749	-0.687	-0.666	-0.664	-0.663
Time of Concentration = T (min)	14.9	14.9	14.9	14.9	14.9	14.9
Intensity = I (mm/hr)	54.7	71.6	83.7	93.7	104.0	114.7
Peak Flow using Rational Method (Q = 0.00278*C*I*A)						
Area = A (ha)	24.10					
Runoff Coefficient = C	0.35	0.35	0.35	0.39	0.420	0.438
Peak Flow = Q (m^3/s)	**1.283**	**1.679**	**1.962**	**2.416**	**2.926**	**3.362**
Proposed - Catchment 101						
Rainfall Intensity (I = A(T)^B						
	2 yr	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**
A	20.7	25.2	32.1	37	41.2	45.5
B	-0.697	-0.749	-0.687	-0.666	-0.664	-0.663
Time of Concentration = T (min)	14.9	14.9	14.9	14.9	14.9	14.9
Intensity = I (mm/hr)	54.7	71.6	83.7	93.7	104.0	114.7
Peak Flow using Rational Method (Q = 0.00278*C*I*A)						
Area = A (ha)	24.10					
Runoff Coefficient = C	0.36	0.36	0.36	0.396	0.432	0.450
Peak Flow = Q (m^3/s)	**1.320**	**1.727**	**2.018**	**2.485**	**3.010**	**3.458**
% Change	**2.9%**	**2.9%**	**2.9%**	**2.9%**	**2.9%**	**2.9%**

* Runoff coefficients for higher return period storms are increased as per MTO Criteria