CanadianSolar

Glenarm Solar Project

Renewable Energy Approval Application

Construction Plan Report

July 2012

GL Garrad Hassan

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GLENARM SOLAR PROJECT

RENEWABLE ENERGY APPROVAL (REA) APPLICATION

CONSTRUCTION PLAN REPORT

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REVISION HISTORY

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C	05 July 2012	Re-branding to Canadian Solar (electronic version only)

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1 PREAMBLE

SkyPower Glenarm LP is proposing to develop the Glenarm Solar Project which is subject to *Ontario Regulation 359/09* (Renewable Energy Approval (REA) [1] under Part V.0.1 of the *Ontario Environmental Protection Act* (EPA)) and *Regulation 521/10* [2]. SkyPower Glenarm LP has received a contract from the Ontario Power Authority (OPA) for the purchase of electricity generated by photovoltaic solar panels through the Province's Feed-in Tariff (FIT) Program. Canadian Solar Solutions Inc. is managing and coordinating the approvals process for SkyPower Glenarm LP. The Project is seeking a Renewable Energy Approval from the Ontario Ministry of the Environment (MOE).

This Construction Plan Report has been prepared in accordance with Table 1 of *Ontario Regulation 359/09* and the MOE's "Technical Guide to Renewable Energy Approvals" (July 2011) [3].

2 OVERVIEW OF CONSTRUCTION PLAN

SkyPower Glenarm LP is proposing the Glenarm Solar Project, a utility-scale solar energy facility located on Part Lot 11 and 12, Concessions 6, Eldon Township, City of Kawartha Lakes, approximately 25 km north of Lindsay, Ontario. More specifically, the Project is located on the northeast corner of the intersection of County Road 8 (Glenarm Road) and Sandringham Road. The Project Location is approximately 38 ha (93 acres) and the Projects components will be installed on one lot owned by the proponent. The Project layout is presented in Appendix A.

As requested under REA, all built and natural features within 300 m of the Project Location are described and addressed in the various REA reports, and construction effects (Section 4) on natural features are assessed in more detail within 120 m of the Project Location. If warranted construction effects on some features are also assessed within the 300 m radius area, generally defined as the "Study Area", or beyond, depending on the type of impact and the type of feature.

The Project Location is defined as per O. Reg. 359/09 as "*...a part of land and all or part of any building or structure in, on or over which a person is engaging in or proposes to engage in the project and any air space in which a person is engaging in or proposes to engage in the project*". As described therein, the Project Location boundary is the outer limit of where site preparation and construction activities will occur (including temporary construction areas if applicable) and where permanent infrastructure is proposed.

The timing of construction activities can be summarized as follows:

- Anticipated construction start date – Early 2013 (subject to change and permitting approvals);
- Duration of construction – Approximately 6 to 7 months; and
- Testing and commissioning will occur over the last few weeks of construction according to ESA and Hydro One requirements and under their supervision.

3 DESCRIPTION OF CONSTRUCTION AND INSTALLATION ACTIVITIES

This section includes all activities from initial work planning to testing of the Project before commissioning. The main activities during this phase include:

- Site preparation;
- Installation of the Project's components; and
- Transportation and construction equipment.

3.1 Site Preparation

Site preparation is required for construction and installation of the Project components and generally includes clearing, grubbing and grading as necessary and installation or improvement of access roads. Site preparation tasks are as follows:

- Install temporary erosion and sediment control measures;
- Clear and grub all areas for temporary road construction;
- Clear areas for arrays; and
- Strip and salvage topsoil, where necessary, to allow for re-use and re-spreading.

No significant grading is anticipated; however, if required, it will maintain the natural drainage pattern in the area. Typically, topsoil is left in place and is only removed where necessary. Gravel access roads will be approximately 3.7 m to 5 m wide.

All vehicles will be within the Ontario Ministry of Transportation (MTO) standards as for axle loads. All transportation routes will be discussed with the City of Kawartha Lakes if required. At time of write-up of the present report, it is expected that vehicles will travel on Glenarm Road and a small portion of Sandringham Road to access the site.

Transportation crews will be trained and equipped to respond to accidental spills. All Project vehicles will carry an emergency spill response kit.

3.2 Installation of the Project's Components

This activity includes installation of the foundations, racking system and PV panels, collector system and fences.

3.2.1 Foundations

The type of foundation will be determined based on subsurface conditions that were evaluated during a geotechnical assessment. Typically, this step will require the installation of ground screws or plate-pounded steel beams with possible pre-drilling. Excavated top soil and sub-soil will be salvaged for rehabilitation following project completion.

The foundation for the inverter stations and transformer will be made of concrete. Approximately 1000 m^3 of concrete will be required for the entire Project. The concrete may be prepared off-site and delivered by truck.

Figure 3-1: Construction of foundations

3.2.2 Racking and PV panels

The assembly consists of the PV panels made of glass, refined silicon and copper electrical leads, held in place by aluminum support structures mounted on the foundations. Approximately 30,000 – 100,000 PV panels (60 to 300 W each depending on panel model) are proposed to be installed for the Project, for a total installed capacity of 10 MW AC. Typically for a project of this size, panels are mounted on a racking system and aligned in approximately 80 m and approximately 4-10 m apart.

3.2.3 Collector System and Transformer

Each inverter station contains two 500 kW inverters that convert the direct current (DC) electricity produced by the panels to alternating current (AC) electricity suitable for distribution to the local grid. The inverter stations also contain a transformer to step up the output. Electricity will be collected and directed to a transformer to step up the output to 44 kV. This Project will use up to 11 inverter clusters, each comprising 2 inverters located in a metal structure, as well as one main step-up transformer.

Underground cables will be buried in trenches approximately 1 m deep and varying from 0.5 m to 1 m in width. As a cautionary measure, a tape will be layered 30 cm above the underground cabling system (i.e. buried 70 cm underground) to serve as markers. The trenched corridors will be restored with backfill to conform to the surrounding surface contours with appropriate materials for grounding.

3.2.4 Security Fence

A minimum 2.7 m (9') tall chain link security fence will be installed around the perimeter of the solar facility for security purposes, or as required by the *Electrical Safety Act* (ESA).

3.2.5 Water Crossings

The design of the Glenarm Solar Project layout avoids any water crossings and the Project Location is greater than 120 m from any water body or water course feature. Information on water bodies located within the study area can be found in the Water Bodies Report appended to the Design and Operations Report.

3.2.6 Access Roads

The internal road system for the Project will consist of approximately 4,000 m of granular roadways that are approximately 3.7 m - 5 m wide. Two site entrances onto the Project Location have been proposed, both towards the southern end of the Project: One along Sandringham Road approximately 200 m north of the intersection of Sandringham Road and Glenarm Road and the other along Glenarm Road approximately 300 m east of the same intersection.

3.3 Transportation and Construction Equipment

The following table presents the construction equipment necessary for the Project, the approximate number of units, the anticipated usage frequency and the time on site per trip. The type of equipment will determine the length of time it stays on site and the number of trips made to and from the works site. Although cars will make daily round trips, some equipment will remain on site for longer periods.

Table 3-1: Construction equipment and vehicles used

Vehicle Type (approximate number of units)	Phase	Frequency	Estimated Time on Site per Trip
Scraper (1)	Site preparation	Once	1 month
Grader (1)	Site preparation	Once	1 month
Front-loader/Backhoe (2 - 4)	Site preparation Site reclamation	Once Once	1 month 1 week
Dump truck (12)	Site preparation Installation of Project components Site reclamation	Daily Weekly Weekly	8 hours 8 hours 8 hours
Roller/Packer (1)	Installation of Project components	0 (delivered)	1 week
Water truck (1)	Site preparation Installation of Project components Site reclamation	Weekly Weekly Weekly	8 hours 8 hours 8 hours
Concrete trucks (50) - depending if concrete is made on or off site	Installation of the foundations	Daily	2 days

Vehicle Type (approximate number of units)	Phase	Frequency	Estimated Time on Site per Trip
Delivery trucks (10)	Site preparation Installation of Project components Site reclamation	Once Daily Once	4 hours 4 hours 4 hours
Truck cranes (1)	Installation of Project components	Once	2/3 days
Boom lifts (2)	Installation of Project components	0 (delivered)	2 months
All-terrain vehicles (3 - 10)	Installation of Project components	0 (delivered)	Entire Project
Mobile fuelling truck (1)	Installation of foundations	Daily	2 hours
Plate pounders (1 - 4)	Installation of foundations	Once	2 weeks
Pick-up Trucks (20)	Site preparation Installation of Project components Site reclamation	Daily Daily Daily	8 hours 8 hours 8 hours
Car (20)	Site preparation Installation of Project components Site reclamation	Daily Daily Daily	8 hours 8 hours 8 hours

Potential environmental effects such as noise, dust and chemical usage are discussed in detail in Section 4.

3.4 Timing and Operational Plans of Proposed Construction and Installation Activities

Commencement of the Construction Phase is anticipated to occur in early 2013. In any scenario, construction is expected to be completed within 6 to 7 months and will lead to the commissioning of the Project.

Construction activities will commence once all necessary permits have been obtained and weather conditions are conducive for construction. Table 3-2 outlines the approximate duration of each activity.

Table 3-2: Duration of construction activities

Activity	Total Duration	Notes
Surveying	1 week	
Access roads	4 weeks	
Site clearing	4 weeks	Concurrent with access road construction
Foundations	6 weeks	
PV panels assembly and installation	8 weeks	Concurrent with foundation construction
Installation of electrical collector system	4 weeks	Concurrent with foundation construction and PV panels assembly installation
Transformer installation and connection to transmission grid	4 weeks	Concurrent with electrical collector system construction
Clean up and site reclamation	2 weeks	
Commissioning	3 weeks	

Table 3-3: Project schedule

Activity	Month 1	Month 2	Month 3	Month 4	Month 5	Months 6-7
Clearing of areas	●					
New access road construction and upgrades	●	●				
Foundations			●	●		
PV panel installation			●	●	●	
Substation			●	●	●	
Cabling			●	●	●	
Site reclamation					●	If appropriate
Testing					●	●
Commissioning						●

3.5 Temporary Uses of Land

It is not anticipated that any significant temporary changes to the land will be necessary. All of the changes with respect to the land surface or grading are essential to the permanent design of the renewable energy facility. The only temporary uses that are required during the Construction Phase are the temporary site trailers and associated parking spaces which will be located within the lay down area.

3.5.1 Temporary Office Trailers

Temporary office trailers as well as sufficient parking spaces and facilities for workers will be situated on site, within the lay down area, and will conform to all REA setbacks during the construction period. Once construction is completed, these temporary structures and facilities will be removed. The land used for the temporary office trailers, facilities, and parking spaces will be stabilized to minimize the potential for surface erosion and compaction, and restored.

3.5.2 Site Reclamation

The disturbed areas will be stabilized to minimize potential for soil movement through mass wasting or surface erosion. This will be achieved through the application of various re-vegetation strategies and techniques specific to the characteristics of each site. Generally, salvaged subsoil will be replaced and capped with topsoil and salvaged organic material. The area around the PV panel installations will be allowed to re-vegetate naturally or seeded with a low-growing species, such as clover, as necessary. If required, an erosion control seed mix, consisting of fast-growing species can be used in areas of erosion risk.

3.5.3 Storage of Waste Materials

It is not anticipated that any waste material will be stored on site therefore a Certificate of Approval for waste under Part V of the *Environmental Protection Act* will not be required. Waste material that is

generated during the construction of the solar energy facility will be transported off site for proper disposal. The licensed contractor for the installation activities will be responsible for disposing of the waste in accordance with provincial guidelines.

Waste materials will be created as part of this Project and will eventually need to be removed from the Project site and recycled or disposed of per provincial waste management regulations. The final decision on waste disposal or recycling will be trusted to the on-site contractor who will abide by the *Environmental Protection Act*.

4 ENVIRONMENTAL EFFECTS, MITIGATION MEASURES AND MONITORING PLANS

This section presents a summary of potential effects, mitigation measures and residual effects associated with project-environment interactions during the construction phase of the Project. Design and operation effects are discussed and provided in the Design and Operations Report.

More detailed discussions relating to natural heritage impacts, archaeological and heritage impacts, noise impacts, and water body impacts are found in the Natural Heritage Assessment reports, Archaeological Assessment reports, Heritage report, Noise Impact Assessment, and Water Body report, part of the complete REA Application package.

The Project was designed to minimize environmental impacts both during construction and operation based on available biophysical and anthropogenic environmental data and the validation of the features in and adjacent to the Project Location.

As requested under REA, construction effects on natural features are assessed in more detail within 120 m of the Project Location. If warranted construction effects on some features are also assessed within the 300 m radius area, generally defined as the "Study Area", or beyond, depending on the type of impact and the type of feature. Effects on the following environmental components have been analysed in this Report:

- Archaeological and heritage resources;
- Emissions to air, including odour and dust;
- Terrain and soil;
- Aquatic resources;
- Vegetation;
- Avian fauna and wildlife habitat;
- Terrestrial fauna;
- Noise;
- Local interests, land use and infrastructure;
- Provincial interests;
- Other resources; and
- Public health and safety.

Potential environmental effects of the Project's construction activities and associated mitigation measures and monitoring plans are discussed in detail for each component.

4.1 Environmental Effects – Methodological Approach

As requested under REA, potential effects from the construction, installation and operation and of the solar facility have to be assessed while considering applicable mitigation and compensation measures. GL GH evaluated the significance of the residual effect, based on Table 4-1 below.

Table 4-1: Levels of residual effects

Residual Effect	Residual Effect Level	Significance
Potential impact could threaten sustainability of the resource and should be considered a management concern. Research, monitoring and/or recovery initiatives should be considered.	High	Significant
Potential impact could result in a decline in resource to lower-than-baseline but stable levels in the study area after Project closure and into the foreseeable future. Regional management actions such as research, monitoring and/or recovery initiatives may be required.	Medium	Significant
Potential impact may result in a slight decline in resource in study area during the life of the Project. Research, monitoring and/or recovery initiatives would not normally be required.	Low	Not Significant
Potential impact may result in a slight decline in resource in study area during Construction Phase, but the resource should return to baseline levels.	Minimal	Not Significant

Depending on the outcome of the effects assessment, follow-up and/or monitoring programs could be proposed in order to further investigate the potential effects, or to verify the significance of the effect following commissioning.

4.2 Archaeological and Heritage Resources

4.2.1 Potential Effects

A Stage 1 and 2 Archaeological Assessment and a Cultural Heritage Assessment were completed for the Project. Areas with archaeological and heritage potential were identified. The studies conclude that the Project Location does not contain any archaeological value or interest, and that the Study Area has two built heritage features that exhibit heritage value.

The potential effects to archaeology and cultural heritage resources include:

- Loss of Archaeological Resources; and
- Loss/Disruption to Heritage Resources.

4.2.2 Effect Assessment

Loss of Archaeological Resources

A Stage 1 Archeological Assessment was completed by Scarlett Janusas with Scarlett Janusas Archaeological and Heritage Consulting and Education in June 2010 [4]. Subsequently, a Stage 2 Archaeological Assessment was completed by Donna Morrison with Advance Archaeology in December 2011 [5]. Both of these assessments have been submitted to the Ministry of Tourism, Culture and Sport (MTCS)

The Stage 1 Archaeological Assessment determined that approximately two thirds of the area within the property boundary exhibits archaeological potential for the recovery of both prehistoric and historic cultural materials. Subsequently, a Stage 2 Archaeological Assessment was conducted which produced no artifacts, structural remains, or other cultural heritage resources from either the prehistoric or pre-contact time periods. Based on the lack of findings during the Stage 2, a Stage 3 was determined not to be necessary.

The Archaeology Review Officer, Jim Sherratt with the MTCS issued a confirmation letter for the Stage 1 Archaeological Assessment on July 14, 2010. Andrew Hinshelwood with the MTCS also issued a confirmation letter for the Stage 2 Archaeological Assessment on January 13, 2012. The confirmation letters state the Ministry is satisfied that concerns for archaeological sites have been met for the area of this Project.

The complete Stage 1 and 2 Archaeological Assessments that were submitted to the MTCS and the confirmations letters can be found appended to the Design and Operations Report.

Loss/Disruption to Heritage Resources

A Cultural Heritage Assessment was completed by Scarlett Janusas with Scarlett Janusas Archaeological and Heritage Consulting and Education in June 2010. The report was submitted to the MTCS and updated in October 2011 to reflect their comments [6]. Laura Hatcher (Heritage Planner) with the MTCS issued a confirmation letter on November 2011 based on the successful completion and review of the Heritage Assessment. The letter stated that based on the information contained in the assessment the MTCS is satisfied that concerns for heritage features have been appropriately addressed.

By applying the evaluation criteria in Ontario Regulation 9/06 under the Environmental Protection Act, it was determined that two buildings adjacent to the Project Location exhibit some heritage values. Subsequently, a visual simulation of the two buildings was completed to determine if either will be impacted by the Glenarm Solar Project. The simulations determined that one of the buildings (school house identified as BF#4) is currently surrounded by coniferous trees. The other building (log house identified as BF#3) will be impacted if no visual barriers are proposed. As a result, a berm was proposed between the log house and the solar panels to eliminate visual impacts. A letter of clearance from the MTCS determined that there will be no direct impacts to either of the two buildings that exhibited some heritage value.

The complete Cultural Heritage Assessment that was submitted to the MTCS and the confirmations letter can be found appended to the Design and Operations Report.

Table 4-2: Effects assessment summary – Archaeology and heritage resources

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Construction			
Loss of archaeological resources	• Stage 1 and 2 archaeological resource assessments have been conducted at specific locations prior to construction. It was determined that no further archaeological assessments are necessary. Furthermore, complete clearance of archaeological condition on the subject property has been recommended by the MTCS. • If archaeological resources are discovered, alteration of the site will cease immediately, proper officials will be contacted and a licensed archaeologist will be hired to carry out archaeological fieldwork.	Minimal	Not significant
Loss of heritage resources	• A Cultural Heritage Assessment has been completed for the subject property. Two buildings that exhibit cultural value were identified. • One of the buildings has an existing vegetation screen and therefore no visual impacts are expected. • The construction of a berm as identified in the Cultural Heritage Assessment will prevent any direct impact to the other building that exhibits cultural heritage value.	Minimal	Not Significant

Follow-up and Monitoring

Considering the minimal residual effects that the Project is expected to have on the archaeology and heritage of the site, no follow-up or monitoring programs have been proposed or are considered necessary. However, if archaeological resources are discovered, alteration of the site will cease immediately, proper officials will be contacted and a licensed archaeologist will be hired to carry out archaeological fieldwork.

4.3 Emissions to Air, including Odour and Dust

4.3.1 Potential Effects

Construction activities can affect air quality due to machinery use and transportation, which can produce dust and fugitive emissions (i.e., tailpipe exhaust emitting CO_2 and nitrous and sulphur oxides). The potential of a decrease in air quality associated with the following types of construction-related emissions were assessed:

- Dust emissions;

- Criteria Air Contaminant (CAC) emissions;
- Greenhouse Gas (GHG) emissions; and
- Odour emissions.

4.3.2 Effects Assessment

Dust Emissions

Construction-related activities, including stripping of topsoil, road construction and upgrading, installation of infrastructure and electrical lines, as well as, restoration of the Project Location, may create or stir up dust and temporarily increase particulate matter concentrations. Transportation of the Project equipment, as well as, traffic generated by workers, may also create dust, particularly on the unpaved municipal roads and access roads.

However, no significant concentrations of dust emissions that could affect air quality for an extended period are anticipated.

The effect of these activities is limited to the Project Location, located in primarily rural area with low population density. Though dust could theoretically affect temporary users within the Study Area such as local residents, they are unlikely to be frequenting the surroundings during construction.

Dust may cause annoyance, reduce visibility, and create the potential for accidents.

To reduce the effect of dust emissions, the following mitigation measure are recommended:

- Limit vehicle speeds to 40 km/h on unpaved roads; and
- Apply water or a water-based dust suppressant to control dust, as required on unpaved roads in summer months.

The effect of dust emissions on air quality is of minimal concern and considered not significant.

Fugitive Emissions – Criteria Air Contaminant (CAC) Emissions

The main contributors to criteria air contaminant (CAC) emissions of the Project will be machinery and truck transportation during the Construction Phase. Machinery and vehicles will run for the most part on diesel fuel. Emissions generated during construction are considered to be similar to those produced for similar small-scale construction projects.

Assuming displacement of an equivalent amount of power produced from a natural gas or coal plant, the Project would offset significant amounts of CAC emissions. Under these assumptions, it can be stated that the Project will have a positive effect on air quality. Given that the actual displaced energy source is not known, however, it can be concluded that the Project will have no effect on CAC concentrations.

To reduce CAC emissions, the following mitigation measures are recommended:

- All Project and contractor vehicles and machinery will comply with current emission standards; and

- During construction, the Proponent will ensure efficient use of vehicles that will minimize distance travelled and periods of machinery use.
- The adverse effect on air quality of the Project's CAC emissions is of minimal concern and considered not significant. Depending on the type of energy displaced, the overall effect could be considered positive given the potential for solar energy to displace the use of fossil fuels.

Fugitive Emissions – Greenhouse Gases

Polluting emissions associated with construction, operations and decommissioning of a solar energy project are largely offset by the avoided emissions from producing electricity from the sun rather than from fossil fuels. Given that the actual displaced energy source is not known, however, it can only be concluded that the Project will have no effect on GHGs emitted in the atmosphere.

To reduce GHG emissions, the following mitigation measures are recommended:

- All Project and contractor vehicles and machinery will comply with current emission standards; and
- During construction, the Proponent will ensure efficient use of vehicles, minimizing distances traveled and periods of machinery use.

The adverse effect on air quality of the Project greenhouse emissions is of minimal concern and considered not significant. Depending on the type of energy displaced, the overall effect could be considered positive given the potential for solar energy to displace the use of fossil fuels.

Odour Emissions

Due to the nature of the proposed renewable energy facility, no odour emissions are anticipated.

Table 4-3: Effects assessment summary – Emissions to air, including odour and dust

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Construction			
Dust	As part of the Construction and Traffic Management Plan: • Limit vehicle speeds to 40 km/h on unpaved roads • Dust suppression – Occasional spraying of water or a water-based suppressant on unpaved roads	Minimal	Not significant
Fugitive emissions (CaCs and CO_2)	As part of the Construction and Traffic Management Plan: • Vehicle emission compliance – Inspection of trucks for compliance with emission standards • Efficient transportation during construction and decommissioning	Minimal	Not significant
Odour emissions	No mitigations measures are proposed for odour emissions	Minimal	Not Significant

Follow-Up and Monitoring

Considering the minimal residual effects that the Project is expected to have regarding odour, dust and fugitive emissions, no follow-up or monitoring programs have been proposed or are considered necessary. However, a construction supervisor will be present on site, during construction, to ensure that all measures are applied to limit any potential effects.

4.4 Terrain and Soils

4.4.1 Potential Effects

Construction activities – including road building, soil stripping and grubbing and vegetation clearing at the Project site – have the potential to interact with the terrain and soil resources both within and beyond the immediate footprint of the Project.

No soil is planned to be removed from the site during the Construction Phase. In the event that any material needs to be removed from site, all required permits for removing material from site will be obtained.

In the event that waste materials are created as part of this Project and these waste fluids will eventually need to be removed from the Project site and recycled or disposed of in accordance with provincial waste management regulations. The final decision on waste disposal or recycling will be trusted to the on-site contractor who will abide by the *Environmental Protection Act*.

The Project-related effects on these environmental components include the following:

- Change in terrain stability;
- Change in soil compaction; and
- Soil contamination from oil or fuel spills.

4.4.2 Effects Assessment

Change in Terrain Stability

Parameters used to assess terrain stability are thickness and quality of surface deposits, bedrock quality and surface water and groundwater conditions. The assessment of these parameters is based on surface observations and a preliminary geotechnical assessment.

Mitigation measures for terrain stability and surface erosion also include:

- Conducting geotechnical investigations prior to any soil excavation. In the event that the geotechnical assessment determines that one or more locations for the installation of racking systems or underground electrical infrastructure are not suitable, consideration will be given to alternate locations. All alternate locations will be within the Project Location, and will comply with all constraints per this layout scenario (setbacks, noise levels, avoiding woodlots, etc.).
- Confirm information about soil quality, drainage and groundwater conditions at photovoltaic arrays, racking systems and road locations through subsurface investigations;
- Best practice, such as abiding by the Erosion & Sediment Control Guideline (Greater Golden Horseshoe Area Conservation Authorities, 2006) [7].

Change in Soil Compaction

Soil compaction occurs when soil particles are pressed together, reducing pore space between them. As the pore space is decreased within a soil, the bulk density is increased. The repetitive passing of construction machinery and trucks on the land may have effects on soil compaction. This effect will be limited to the areas used for access roads, which represent a very small portion of the affected lands within the Project Locations during operations.

The majority of the Project Location was previously used for agriculture but the lands have been idle for several years. Depending on the future use of the Project Location soil compaction may need to be addressed.

Contamination of Soils from Oil and Fuel Spills

Spills may occur due to an accident or malfunction during construction activities. Mitigation measures include:

- Training of the construction and maintenance crews to respond to accidental spills;
- Equipping all Project vehicles with an emergency spill response kit;
- Inspecting truck and machinery on a regular basis; and
- Providing refuelling and maintenance areas.

In accordance with the Environmental Management and Emergency Response Plans, should spills occur, they will be reported to the MOE's Spills Action Centre immediately upon their discovery. Through the aforementioned Plans, the Proponent commits to routinely train and update applicable staff during all phases of the Project's life on spill reporting, containment, and proper spill clean-up and disposal procedures.

Given the small quantities possibly involved and the planned mitigation measures proposed, the adverse effects on soil due to accidental oil or fuel spills is of minimal concern and not significant.

Table 4-4: Effects assessment summary – Terrain and soils

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Construction			
Change in terrain stability, soil compaction	Prepare and implement a Post construction Site Reclamation Plan including: • Confirm information about soil/rock quality, drainage and groundwater conditions at site and road locations through subsurface investigations prior to any soil/rock excavation.	Minimal	Not significant
Accidents			
Contamination of soil from oil and fuel spills	• Hazardous material will not be stored on site. • Designated refueling/ maintenance areas to be located away from vegetated areas. • Construction equipment to be well maintained throughout the construction period to minimize the potential for accidental releases of toxic fluids (hydraulic fluids, coolant, etc.). • Contractor to have Emergency Response Plan (ERP) in place in accordance with EMP. • All construction staff to be trained on proper implementation of the ERP. • Adhere to operational control procedure for storage and handling of hazardous materials. All construction staff to be trained on proper implementation of this procedure. • Contractor to have spill clean-up materials on hand at all times.	Minimal	Not significant

Follow-Up and Monitoring

Considering the minimal residual effects that the Project is expected to have on terrain stability and soil compaction or contamination, no follow-up or monitoring programs have been proposed or are considered necessary. However, a supervisor will be present on site, during construction, to ensure that all measures are applied to limit any potential effects.

4.5 Aquatic Resources

4.5.1 Potential Effects

Construction-related activities, including road construction and upgrading, installation of infrastructure and electrical lines, as well as restoration of the Project Location, may have limited interactions with surrounding aquatic resources including wetlands, surface water features, and storm water. Minimal grading is expected to occur during the construction and exiting drainage patterns of the Project Location are expected to remain unaltered.

No wetlands, water bodies, or surface water features were identified on or within 120 of the Project Location. Two wetlands were identified outside of 120 m from the Project Location. No lake trout lakes were identified within 300 m of the Project Location.

Five unnamed watercourses were identified within 300 m of the Project Location [8]. Three unnamed tributaries of the Staples River (Tributaries A, B, and C) are located east of the Project Location, and two tributaries (Tributaries D and E) are located west of the Project Location. Additional information on these features can be found in the Water Report appended to the Design and Operations Report.

The potential Project-related effects on this environmental component are the following:

- Alteration of local drainage patterns;
- Aquatic habitat alteration/loss;
- Sedimentation; and
- Surface water and storm water contamination; and

4.5.2 Effects Assessment

Alteration of Local Drainage Patterns

The preliminary layout for the Glenarm Solar Project was designed to minimize alteration of the surficial drainage patterns and functions within the Project Location. Significant alterations to surficial drainage patterns are not anticipated, however, the following mitigation measures are provided:

- The detailed engineering design should incorporate drainage swales to convey overland flow to pre-construction outlets; and
- The use of permeable surfaces should be used to the maximum extent possible

Aquatic Habitat Alteration/Loss

The design of the Glenarm Solar Project has respected a setback of 120 m from natural heritage features. Construction activities are not expected to have an impact on aquatic habitat features.

A mitigation measure to further reduce the potential for impact includes:

- Installation of erosion control measures (such as silt fences) placed at an appropriate distance from aquatic features.

Sedimentation

Bare soils will be exposed during site preparation, construction of access roads, preparation of concrete foundations and the installation of the electrical network. Rainfall and surface water runoff may result in the potential erosion of soils and sediment-laden runoff potentially entering aquatic features. Other drilling by-products such as extracted soil cores may also result in sedimentation.

Minimal grading or earth displacement will be required during the construction of the Project; however, sediment control measures will be implemented during construction activities. This is to ensure that sediment does not enter into aquatic resources that are located more than 120 m from the Project Location.

Mitigation measures include:

- Installation of erosion control measures (such as silt fences) placed at an appropriate distance from an aquatic feature.

Installation of these erosion control measures will protect the aquatic features from run-off during precipitation and the fences will clearly delineate the buffers in the field to ensure that no construction activities occur within these buffers. Therefore, negative impacts from erosion and sedimentation are not anticipated to occur after implementation of this mitigation measure.

Surface Water and Storm Water Contamination

Spills may occur due to an accident or malfunction during construction activities. The potential interaction between the Project activities with this environmental component is similar to the interactions that the Project might have with the terrain and soil. Therefore, the mitigation measures for surface water and storm water impacts are similar.

Mitigation measures include:

- Use of Industry Best Practices to manage storm water;
- Installation of erosion control measures placed at an appropriate distance from an aquatic feature;
- Training of the construction and maintenance crews to respond to accidental spills;
- Maintaining an emergency spill response kit onsite;
- Inspecting truck and machinery on a regular basis; and
- Providing designated refuelling and maintenance areas.

In accordance with the Environmental Management and Emergency Response Plans, should spills occur, they will be reported to the MOE's Spills Action Centre immediately upon their discovery. Through the aforementioned Plans, the Proponent commits to routinely train and update applicable staff during all phases of the Project's lifecycle on spill reporting, containment, and proper spill clean-up and disposal procedures.

Given the limited quantities involved and the planned mitigation measures proposed, the adverse effects on aquatic habitat are of minimal concern and not significant. The storm water impacts are mitigated by applying watercourse setbacks in accordance with Ontario Regulation 359/09. Other mitigation measures may include minimizing earth disturbances and maintaining native soils and vegetation to the extent feasible.

Table 4-5: Effects assessment summary – Aquatic resources

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Construction			
Alteration of local drainage patterns	• The detailed engineering design should incorporate drainage swales to convey overland flow to pre-construction outlets; and • The use of permeable surfaces should be used to the maximum extent possible	Low	Not significant
Aquatic habitat alteration/loss	• Installation of erosion control measures	Minimal	Not significant
Sedimentation	• Installation of erosion control measures; • Standard sediment and erosion controls to be implemented and maintained for the duration of the disturbance; • An Environmental Management Plan (EMP) is recommended as guidance for the contractor to minimize environmental impacts, including impacts on water resources; • Train all site staff on implementation of plans and procedures contained within the EMP; • Contractor to develop a sediment and erosion control plan for the entire site;	Minimal	Not significant

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Surface water and storm water contamination	• Installation of erosion control measures placed at an appropriate distance from an aquatic feature; • Apply spill control measures including prevention and emergency response; • Training of the construction and maintenance crews to respond to accidental spills; • Maintaining an emergency spill response kit onsite; • Inspecting truck and machinery on a regular basis; • Providing designated refuelling and maintenance areas.	Minimal	Not significant

Follow-Up and Monitoring

- One pre-construction monitoring event to document existing conditions; and
- Weekly monitoring during construction; and

The Glenarm Solar Project is not expected to have a significant effect on aquatic resources during construction activities. If the mitigation measure provided and follow-up monitoring is completed the level of concern is minimal and not significant. A supervisor will be present on site, during construction and decommissioning, to ensure that all measures are applied to limit any potential effects.

4.6 Vegetation

4.6.1 Potential Effects

Construction activities – including road building, soil stripping and grubbing are expected to effect the vegetation within the Project Location.

The majority of the Project Location is idle agricultural lands that have not been used for agriculture for several years. The lands are dominated by agricultural grasses, invasive species, and small woody vegetation.

No significant woodlands have been identified within 120 m of the Project Location.

The following potential effects will be encountered during the construction phase of this project:

- Vegetation clearing; removal of native and non-native vegetation (shrubs and grass).

4.6.2 Effects Assessment

Vegetation Clearing

No terrestrial species of concern were observed within the Project Location. The residual level of concern for vegetation clearing is classified as minimal and not significant.

Table 4-6: Effects assessment summary – Vegetation

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Construction			
Vegetation clearing	• Avoid vegetation removal during the breeding bird season (May 1- July 15), where possible	Minimal	Not significant

Follow-up and Monitoring

No monitoring is considered necessary for the removal of vegetation to accommodate the Glenarm Solar Project.

4.7 Avian Fauna and Wildlife Habitat

4.7.1 Potential Effects

Construction activities – including road building, soil stripping and grubbing, and vegetation clearing on the Project Location have the potential to interact with the avian fauna within the Study Area. Three species of conservation concern (Black Tern, Common Nighthawk, and the Red-headed Woodpecker) were identified in the Records Review section of the NHA [9]. The NHA's site investigation determined that there is no suitable habitat for either of these species within the Project location. Regardless, common species are known to inhabit the area.

Four categories of significant wildlife habitat were assessed: seasonal concentration areas, rare vegetation communities and specialized wildlife habitat, habitats of species of conservation concern, and animal movement corridors.

Table 4.7 below summarizes the findings and recommendations.

Table 4-7: Significant wildlife habitat

Category	Findings
Seasonal concentration areas	No seasonal concentration areas have been identified within 120 m of the Project Location
Rare vegetation communities and specialized wildlife habitat	No rare vegetation communities and/or specialized wildlife habitat have been identified within 120 m of the Project Location
Habitats of species of conservation concern	Three habitats of species of conservation concern associated with open country breeding bird habitat have been presumed significant within 120 m of the Project Location. One of these habitats overlaps the Project Location. The other habitats are located 35m and 40 m from the Project Location.
Animal movement corridors	No candidate significant animal movement corridors are present within 120m of the Project Location.

The potential effects on avian fauna and wildlife habitat during construction include:

- Disruption of bird nest; and
- Wildlife Habitat loss.

4.7.2 Effects Assessment

Disruption of Bird Nests

The disruption of bird nests is only an issue for a relatively short period of time, i.e. within the potential time overlap of the nesting period of local avifauna and the various construction or decommissioning activities. Vegetation clearing and construction should be avoided, if possible, during the period of breeding bird and nesting activity, occurring from approximately May 1 through July 15. If construction or decommissioning occurs during this time period, a biologist should be present to identify any bird nests that may be present prior to any vegetation removal.

Wildlife Habitat Loss

Many small animals, including birds are known to use idle agricultural lands for habitat. The idle agriculture lands within the Project Location have been presumed to be significant open country breeding

bird habitat. Additional information is found in the NHA and EIS appended to the Design and Operations Report.

Table 4-8: Effects assessment summary – Avian fauna

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Construction			
Disruption of bird nests	Implement site-specific recommendations from the NHA, such as: • Timing of work, near natural areas, is recommended to occur outside the core bird nesting period if possible (1 May to 15 July). The alternative is to retain a trained biologist be present during those nesting periods to identify any bird nests that may be present prior to any vegetation removal. • *Migratory Birds Convention Act* prohibition periods may be required.	Low	Not Significant
Wildlife habitat loss	• Pre-construction surveys will be completed in accordance with MNR requirements to determine if open country habitat is indeed significant. • If it is determined to be significant, post-constructions point counts will be completed for two years after construction. • To compensate for the removal of habitat the proponent commits to managing an equivalent area adjacent to the Project Location (within the same property) for open country breeding bird habitat for the duration of the Project.	Low	Not Significant

Follow-up and Monitoring

If work must occur within the nesting period in or adjacent to idle agricultural lands, a trained biologist should inspect the proposed work area for nesting birds, identify and delineate the proposed work zone prior to undertaking work, and regularly inspect the extent of the work to ensure that the spatial extent of the work is minimized. This inspection should be completed prior to any proposed clearing.

The proponent has committed to pre-construction monitoring and if required post construction monitoring for two years after construction. In addition, an equivalent area of open country habitat adjacent to the

Project Location will be managed accordingly for the duration of the Project if pre-construction monitoring determines the open country breeding bird habitat is significant.

Based on the mitigation measures provided including pre- and post-construction monitoring and a commitment to compensate for the removal of open country breeding bird habitat, the residual level of concern is classified as low and not significant.

4.8 Terrestrial Fauna

4.8.1 Potential Effects

Construction activities – including road building, soil stripping and grubbing, and vegetation clearing at the Project site – have the potential to interact with terrestrial fauna within and beyond the immediate footprint of the Project.

There is a potential to encounter mammal and herpetofauna species during construction of this Project, including species of conservation concern that may be present within the general vicinity of the Project Location. Though the presence of such species was not confirmed within the Study Area during several site visits, they may be occasionally present within any of the suitable habitats. In other words, terrestrial fauna species that have not been identified within the Study Area but which are known to inhabit the general vicinity may be encountered during construction activities.

Typically, the largest anticipated effects on local populations of terrestrial mammals are habitat loss and direct mortality during the Construction Phase of development.

The potential effects to terrestrial fauna and wildlife habitat during construction include:

- Disturbance to wildlife from noise;
- Wildlife mortality due to traffic; and
- Habitat loss.

4.8.2 Effects Assessment

Disturbance to Wildlife from Noise

Some noise will be produced during Construction Phase activities such as vehicle traffic, construction of the access roads, preparation of foundations, and installation of the electrical network and solar panels. It is expected that wildlife will avoid the areas under construction during the construction period.

For the most part, the impacts will be of short duration during construction and very local in proximity to the activity; the residual level of concern is therefore considered to be minimal and not significant.

Wildlife Mortality Due to Traffic

Traffic is a consideration during project activities that require site access such as site prospecting, transport, construction of the access roads, preparation of foundations, and installation of electrical network. Traffic will be restricted in terms of volume and daylight access and will be very low. The residual level of concern is therefore considered to be minimal and not significant.

Wildlife Habitat Loss

Small animals, including reptiles, amphibians, and mammals, are known to use the types of habitats identified within 120 m of the Project Location. Proposed layouts indicate that existing areas will need to be cleared to accommodate the proposed development. These habitats are considered to provide limited habitat for potential and confirmed species within these areas. Clearing required to accommodate the proposed solar developments is considered to be low and not significant.

Table 4-9: Effects assessment summary – Terrestrial fauna and wildlife habitat

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Construction			
Noise impacts on wildlife	Implement site-specific recommendations from the NHA, such as: • Noise associated with construction activities will mostly occur during daylight hours and will be limited in terms of duration.	Minimal	Not significant
Wildlife mortality due to traffic	• Travel speeds on site will be restricted to minimize potential impacts on wildlife. • Where required, sight-line considerations will be used to maximize reaction time for vehicle drivers and wildlife. • Access will mostly occur during daylight hours and will be limited in terms of duration	Minimal	Not significant
Habitat loss	• Vegetation clearing will be minimized to within the Project Location	Low	Not significant

4.9 Noise

4.9.1 Potential Effects

Construction activities associated with the Project can increase ambient noise levels, which in turn can constitute a disturbance to wildlife and humans. Noise is common to any medium-scale project during

construction due to the use of machinery and vehicles. The area surrounding the Project Location is characterized as a rural agricultural area.

Potential effects to the acoustic environment during construction include:

- Increase in ambient noise levels.

4.9.2 Effect Assessment

Increase in Ambient Noise Levels during Construction

Construction activities will generate noise from the use of machinery and vehicles. The contribution to noise levels is only expected on site and on adjacent areas, and during a short period, i.e. the few months of planned work during the construction period. Increased truck transport is not expected to significantly increase ambient noise levels on existing roadways, due to the small amount of vehicle use for this Project compared to the existing truck traffic volumes on Glenarm Road. Increased noise levels will be of medium magnitude on the municipal access roads, but of short duration, intermittent and local. Overall, the effect of construction on ambient noise levels is of low concern and considered not significant.

In order to minimize any effects during construction, The Proponent will limit major construction activities to daytime and early evening hours, and implement a construction and traffic management plan. Nearby residents will also be advised of significant truck transportation passing through, and all internal combustion engines will be fitted with appropriate muffler systems.

Table 4-10 below summarizes the effects of the Project on the acoustic environment.

Table 4-10: Effects assessment summary – Acoustic environment

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Construction			
Increase in ambient noise levels	• Limit construction activity between the hours of 07:00 and 22:00 to reduce the potential impact of construction noise. • Ensure all internal combustion engines are fitted with appropriate muffler systems.	Low	Not significant

Follow-up and Monitoring

Considering the minimal adverse residual effects that the Project is expected to have on noise, no follow-up or monitoring programs have been proposed or are considered necessary. The Proponent will implement a complaint reporting and registry process.

4.10 Local Interest, Land Use, and Infrastructure

The landscape within the Project Location is dominated by relatively flat, idle agricultural lands. These lands have been idle for several years. There are three residences and one retired agricultural operation within 120 m of the Project Location. No infrastructure is proposed to be removed to accommodate the proposed development.

The surrounding land use is characterized as low density rural residential. The Township of Eldon`s Road Department has a large depot located on the southwest corner of Sandringham and Glenarm Road.

4.10.1 Potential Effects

The potential effects of construction on local interests, land use, and infrastructure during construction are summarized as follows and are described in the subsequent paragraphs:

- Increased traffic on local roads;
- Damage to local infrastructure;
- Temporary increase in noise due to construction activities

4.10.2 Effect Assessment

During the Construction Phase, there will be increased traffic leading to the Project Location. In addition to the vehicles that will bring the solar facility components for assembly and installation, there will be trucks using public and private access roads.

Potential effects will be minimized by applying the following mitigation measures:

- Respecting, as much as possible, the construction schedule;
- Raising awareness of all workers to remain within the Project's footprint boundaries;
- Respecting boundaries of the natural environment, as much as possible.
- Respecting boundaries of private lands;
- Ensure proper operation and maintenance of vehicles and machinery to limit noise; and
- Implement a communications plan if required

Table 4-11: Effects Assessment Summary – Local interests, land use, and infrastructure

Effect	Mitigation Measure	Level of Concern	Significance of Effect
Construction			
Increased truck traffic on private access roads	• Raising awareness of all workers to remain within the Project's footprint boundaries; • Respecting boundaries, as much as possible, of private land; • Whenever possible and when preferred by lot owners, securing existing gates at the entrance of access roads with different locks.	Minimal	Not significant
Increase in noise due to construction activities	• Ensure proper operation and maintenance of vehicles and machinery to limit noise • Implement a communications plan	Minimal	Not significant

Follow-up and Monitoring

Considering the minimal residual effects that the Project is expected to have on local interests, land use, and infrastructure, no follow-up or monitoring programs have been proposed or are considered necessary.

4.11 Provincial Interests

The Glenarm Solar Project is not located within the following provincial plans: the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan Area, or the Niagara Escarpment Plan Area. The northwest corner of the Project Location is located within the Lake Simcoe Protection Plan [10]. The MOE will be consulted to determine if there are any requirements that apply to the Project.

4.12 Other Resources

No potential negative environmental effects related to other resources including but not limited to aggregate resources, landfill sites, petroleum wells, and forest resources are expected as a result of the Project.

4.13 Public Health and Safety

Effects on public health and safety during construction have been described above under Emissions to air, including odour and dust, Noise, and Local interests, land use and infrastructure.

An emergency response and communications plan is provided in the Design and Operations Report.

5 SUMMARY

This Construction Plan Report has been prepared in accordance with regulatory requirements subject to *Ontario Regulation 359/09* (Renewable Energy Approval (REA) under Part V.0.1 of the *Ontario Environmental Protection Act* (EPA)).

Numerous field studies including Natural Heritage, Archaeological, Cultural Heritage, and Noise have been completed for the proposed Glenarm Solar Project. These reports have been used to determine the potential construction effects on environmental features and social components. When necessary, mitigation measures to minimize or eliminate impacts have been provided. The Project layout was prepared by considering all environmental and social factors including proposed mitigation measures and all regulatory requirements. All studies supporting this renewable energy approval application are provided in the Design and Operations Report.

Careful planning and consideration for all environmental features and social components will enable construction without adverse effects to the natural of social environment.

6 REFERENCES

[1] *Ontario Regulation 359/09*, made under the *Environmental Protection Act*, Renewable Energy Approvals under Part 1.0 of the Act.

[2] *Ontario Regulation 521/10*, made under the *Environmental Protection Act,* Renewable Energy Approvals under Part 1.0 of the Act.

[3] Technical Guide to Renewable Energy Approvals, Ontario Ministry of the Environment, July 2011.

[4] Scarlett Janusas, Scarlett Janusas Archaeological and Heritage Consulting and Education. 2010. Stage 1 Archaeological Assessment - Proposed Glenarm Solar Farm – Lots 11 and 12, Concessions 6 – Geographic Township of Eldon, Victoria County, Municipality of Kawartha Lakes, Ontario.

[5] Donna Morrison, Advance Archaeology. December 5, 2011. Stage 2 Archaeological Assessment of the Proposed Glenarm Solar Energy Facility, Part of Lots 11 and 12, Concession 6, Geographic Township of Eldon, (Now in the City of Kawartha Lakes), County of Victoria, Ontario.

[6] Scarlett Janusas, Scarlett Janusas Archaeological and Heritage Consulting and Education. October 24, 2011. Cultural Heritage Assessment, Proposed Glenarm Solar Farm, Lot 11 and 12, Concessions 6, Township of Eldon, Former County of Victoria, City of Kawartha Lakes, Ontario.

[7] Greater Golden Horseshoe Conservation Authorities, Erosion and Sedimentation Control Guidelines, 2006

[8] Natural Resource Solutions Inc. February 2012. Water Report and Environmental Impact Study.

[9] Natural Resource Solutions Inc. January 2012. Glenarm Solar Park Natural Heritage Assessment & Environmental Impact Study.

[10] Ministry of the Environment. July 2009. Lake Simcoe Protection Plan.

APPENDIX A PROJECT LAYOUT