

121-18125-00

May 15, 2012

Mr. Dana Cruikshank  
Surface Water Specialist  
Ministry of the Environment, Eastern Region  
1259 Gardiners Road, Unit 3  
Kingston, ON K7P3J6

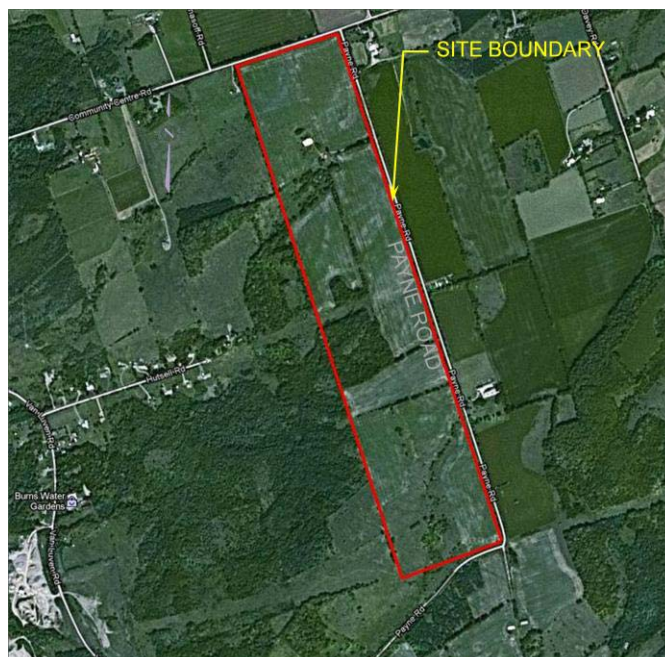
**Re: Penn Energy - Hamilton\_Port Hope 4 Solar Farm ("Solar Farm")  
Stormwater Management Letter Report**

Dear Mr. Cruikshank:

We are pleased to submit this Stormwater Management Letter Report ("Letter Report") for the Hamilton Port Hope 4 solar farm site. Based on discussions with Penn Energy ("Penn") on April 04, 2012 and our discussion with you on April 17th, 2012, the purpose of this Letter Report is to address the concerns which you have raised with respect to stormwater management for the above-captioned solar farm site. The concerns of the Ganaraska Region Conservation Authority (GRCA) have already been separately addressed.

## 1. INTRODUCTION

The proposed Penn Energy - Hamilton\_Port Hope 4 Solar Farm is proposed to be developed at 2700 Payne Road in Baltimore, Ontario. Specifically the subject lands are located in part of Lot 3 Concession 2 and Lots 3-5 Concession 1, Township of Hamilton, Northumberland County (Figure 1).



**Figure 1 Hamilton\_Port-Hope 4 Solar Farm Site**

The Solar Farm facility will consist of arrays of solar modules mounted on a series of steel framing elements that will be sloped (facing south) to optimize the capture of solar energy. These arrays of modules will be set at an approximate tilt angle of 30 degrees, with the lowest edge of the array approximately 1 meter (3.3') above the surface of the ground. In this configuration, the upper edge of the array will be approximately 3 meters (10') above the surface of the ground. As such, the array will be entirely above the ground, providing for a fully open structure. Due to this design, the arrays and their corresponding mounting systems pose virtually no obstruction to the flow of water underneath them and do not significantly impact the permeability of the underlying area. The rows will be spaced approximately 8 meters (25') apart on a north-to-south basis, in order to provide ample room for installation and maintenance. The posts that support the arrays will be spaced approximately 3-4 meters apart on an east-west basis. The post bases will be the only point of contact between the solar arrays and the ground. On this site, the posts will most likely be mounted on ground screws (or possibly piles) that can be installed with minimal disturbance to the surrounding area. The capacity of the Solar PV Renewable Energy Generation facility will be 10 MW (AC).

## 2. STORMWATER MANAGEMENT ASSESSMENT

The purpose of this analysis is to assess the potential impacts of the solar farm development on the drainage conditions of the site. Some considerations regarding stormwater management assessment for this site are the following:

- Although some grading is anticipated to smooth contours of the site, the Solar Farm will generally follow the existing topography. There is no planned import or export of fill or other material to or from the site. The anticipated grading is not expected to significantly increase the rate and/or flow of stormwater discharge from the site and may, in fact, increase stormwater infiltration by slightly reducing the average pitch of the site. Furthermore, installation of the solar module arrays is anticipated to occur no closer than 46 meters (and, in some cases, up to 146 meters) from any confirmed water bodies. To minimize and/or mitigate any potential stormwater discharge impacts on area water bodies, the areas of anticipated grading and the array installations have been purposefully distanced from said water bodies and their associated drainage features.
- Although the solar panels are themselves impervious, the design and placement of the solar panels promotes the flow of rainwater to the ground surface beneath and surrounding the panels. Grasses and/or alternative species of groundcover will be planted in these areas. As a result, runoff from these solar panels will travel predominantly along the surface of the ground, maintaining the opportunity to infiltrate in a manner similar to pre-development conditions.
- Limited impervious surfaces (e.g., inverter, transformer and substation pads) will be constructed for this development. The site access lanes and a small parking area would be constructed of gravel and would, as a consequence, maintain some level of stormwater infiltration.

### 3. SCOPE OF WORK

The scope of work of this stormwater management assessment included the following:

- Collect and review relevant background material;
- Identification of drainage features on the site;
- Delineation of drainage patterns for the site; and,
- Preliminary assessment of the post-development drainage conditions.

In our telephone conversation of April 17, 2012, we discussed the most effective strategy for providing you with the information you have requested about this project's potential impact on stormwater in the surrounding area. As a result of our discussion, the following strategy is currently being pursued by GENIVAR:

First, GENIVAR will prepare a Preliminary SWM Assessment in the form of this Letter Report. In order to prepare this Letter Report, we began by collecting relevant background information. Accordingly, this Letter Report contains identification of drainage features and the site plans with directions of flow and drainage patterns for existing and proposed conditions including our preliminary assessment of pre- and post-development drainage conditions. This Letter Report is hereby being submitted to the MOE for your comments and approval.

Thereafter, we will contact you to determine if you are satisfied with the contents of this Letter Report, with respect to the information you have requested. If upon reviewing this Letter Report you find it insufficiently insightful, we look forward to discussing and mutually agreeing upon the appropriate next steps, including potentially, as per our conversation, the preparation of additional analyses as a part of the ongoing post-approval engineering process. Please note that Penn anticipates that as a part of the EPC (engineering, procurement and construction) process, the EPC firm will prepare additional stormwater management analyses of the proposed final engineering design together with results and recommendations related thereto.

### 4. COLLECTION AND REVIEW OF BACKGROUND INFORMATION

For the purpose of this assessment, we have collected and reviewed relevant background information. This includes a site plan concept with topographic mapping, various background reports and other relevant information provided by Penn. All of these documents have been made available on Penn's project website (<http://www.pennenergyrenewables.com>), should you wish to view these documents in detail.

The site plan concept with existing topography (1 meter contours) was provided by Penn in digital (AutoCAD) format. In addition, we have reviewed the following documentation:

- Project Description Report; Penn Energy Renewables Ltd., 2011;
- Water Assessment and Water Bodies Report, Bowfin Environmental Consulting, 2011;
- Environmental Impact Study Report, Bowfin Environmental Consulting, 2011;
- Natural Heritage Assessment Report (Site Investigation Report, Records Review, Evaluation of Significance), Bowfin Environmental Consulting, 2011.

## 5. DRAINAGE CONDITIONS

### 5.1 Pre-Development Condition

The total drainage area of the site is approximately 64.3 hectares. The Project Area (within the Project Location boundaries) occupies approximately 39 hectares of the total drainage area. The site currently consists of cultivated agricultural land that is mostly clear of any significant vegetation and is planted with seasonal agricultural crops such as corn and soybeans. Drawing No. 2, attached hereto, shows the existing pre-development condition of the proposed facility site. Review of the topographic contour mapping confirms that the site is generally medium sloped. Four branches of headwater tributaries of the Brook Creek flowing from or through various points on this site are identified as Tributary 1, Tributary 2a, Tributary 2b and Tributary 3. All tributaries are outside of the Project Area boundary. Tributary 1 was identified as a permanent stream located a minimum of approximately 65 metres beyond the southern Project Area Boundary. Tributaries 2a and 2b were identified as intermittent streams. They are located on the west side of the property, outside of the Project Area Boundary. Tributary 3, confirmed as a swale in the Water Assessment Report prepared by Penn's biologist, is located on the northwest portion of the property and is also located outside of the Project Area boundary.

The site's drainage patterns are presented in terms of existing conditions on Drawing No. 2 attached hereto. As shown on Drawing No. 2, the overall surface runoff drains ultimately in four directions, each stemming from a separate sub-catchment. The surface runoff from sub-catchment B drains generally towards Tributary 3. Sub-catchment C drains generally towards both Tributaries 2a and 2b. At the north end of the site, sub-catchment A drains overland in a northwestern direction; at the south end, sub-catchment D drains overland in a southeasterly direction. The corresponding drainage areas contributing to each sub-catchment are summarized below in Table 1.

**Table 1 Drainage Areas**

Sub-catchment	Drainage Area (ha)
Area A	7.8
Area B	19.9
Area C	24.1
Area D	12.5
Total	64.3

### 5.2 Existing Site Geology Conditions

The proposed development site is characterized as agricultural land. A geotechnical investigation was conducted in March 2011 (GENIVAR Inc., 2011) and it was determined that sub-surface conditions consist primarily of sandy silt soil. The soil generally contains trace gravel, and it was moist to wet at the time of investigation.

### 5.3 Existing Site Geology Conditions

With regard to post-development conditions, the site's primary slope and overall drainage patterns, as noted above, will be generally maintained. This conclusion can be drawn from Penn's anticipated plans for no import or export of fill to or from the site and intend to grade only as necessary to smooth existing contours to a somewhat more level condition. Overall, Penn

anticipates that the construction will generally follow the current overall grades of the site. Surface runoff will continue naturally towards the existing watercourses or as overland flow (Section 1.), the configuration of the module arrays promotes the dispersal of rainfall to the ground surface beneath the panels, where it will either infiltrate or runoff generally in accordance with its current course. The ground under the panels is currently disturbed crop land. Post-development, it will be stabilized with grass or other groundcover species, which should reduce erosion and sediment runoff, as well as aid in maintaining pre-development hydrologic conditions . The Project Area boundaries as depicted on Drawing No. 3 were defined as per Penn's site plan concept posted to the Project website and filed with their REA application at the MOE. A perimeter fence is planned to encompass the Project; additionally, an evergreen hedge and a grass apron is proposed for separate areas along the north and east sides of the Project Area. A grass apron is also proposed along the south and west sides of the Project Area. Notably, these landscaped, apron and hedge areas will provide additional quality control for the runoff from the site.

The installation of the inverter, transformer pads and substation will create additional impervious surfaces on the site; however, their cumulative area will reflect only a very minor increase in the overall imperviousness of the site. More specifically, these land uses will be extremely limited in scope, covering an estimated 0.07 hectares (651 m<sup>2</sup>) and corresponding to only 0.2% of the Project Area.

The use of gravel for the design of the proposed access lanes and parking area is intended to maintain some level of perviousness in these areas. Gravel, unlike a traditional impervious surface such as asphalt or concrete, should allow some stormwater infiltration to occur on the lanes and parking area. Notably, these gravel areas will cover only about 5% of the property.

As a critical step in this Project's development, Bowfin Environmental Consulting ("Bowfin") has conducted environmental site investigations, an Environmental Impact Assessment, a Water Assessment Report together with associated Water Bodies Report and a Natural Heritage Assessment. In concluding this extensive process of research, reviews, studies and reports, Bowfin determined that this Project's development will not result in any watercourse alterations nor have any potential to impact aquatic populations or habitats in the immediate and surrounding areas.

#### 5.4 Sediment and Erosion Control Measures

Temporary sediment and erosion control measures will be installed in conjunction with any grading of the site and are anticipated to be maintained while the site becomes stabilized. An erosion and sediment control plan will be prepared for the construction phase of the development. It is anticipated that this plan will employ a number of measures which may include, but not be limited to, silt fencing, mud mats and straw bale flow check dams to be utilized in temporary swales. The combination of these temporary measures should minimize the potential for sediment to be transported off the site during construction.

### 6. RESULTS OF ASSESSMENT

The proposed solar farm installation would occur within the Project Area and generally follow the existing topography. Penn anticipates it will neither import nor export fill material to or from the site, and intends to grade only as necessary to smooth the existing contours of the site to a somewhat more level condition. Overall, the application of such site grading to the pre-development condition will have minimal impact on existing average grades. While the Project's development will create additional impervious surfaces on-site due to installations

such as the inverter, transformer and substation pads, for example, it is estimated that this will reflect only a slight increase to the overall imperviousness of the site and thus a very minor variation in drainage conditions post-development. The establishment of natural vegetative installation of a grassed apron along its perimeter will collectively function to attenuate the flow of stormwater both on and leaving the site. Notably, these practices will serve as filters to manage sediment on the site and at its borders. In addition, the permeability of the existing sandy-silt soil conditions should permit significant infiltration of runoff throughout the site.

## 7. CLOSURE

We hope that this Letter Report meets with your requirements. I will contact you to follow-up, but if in the meantime should you have any questions or require further clarification on our report, please contact the undersigned at (905) 475-7270, ext. 18229.

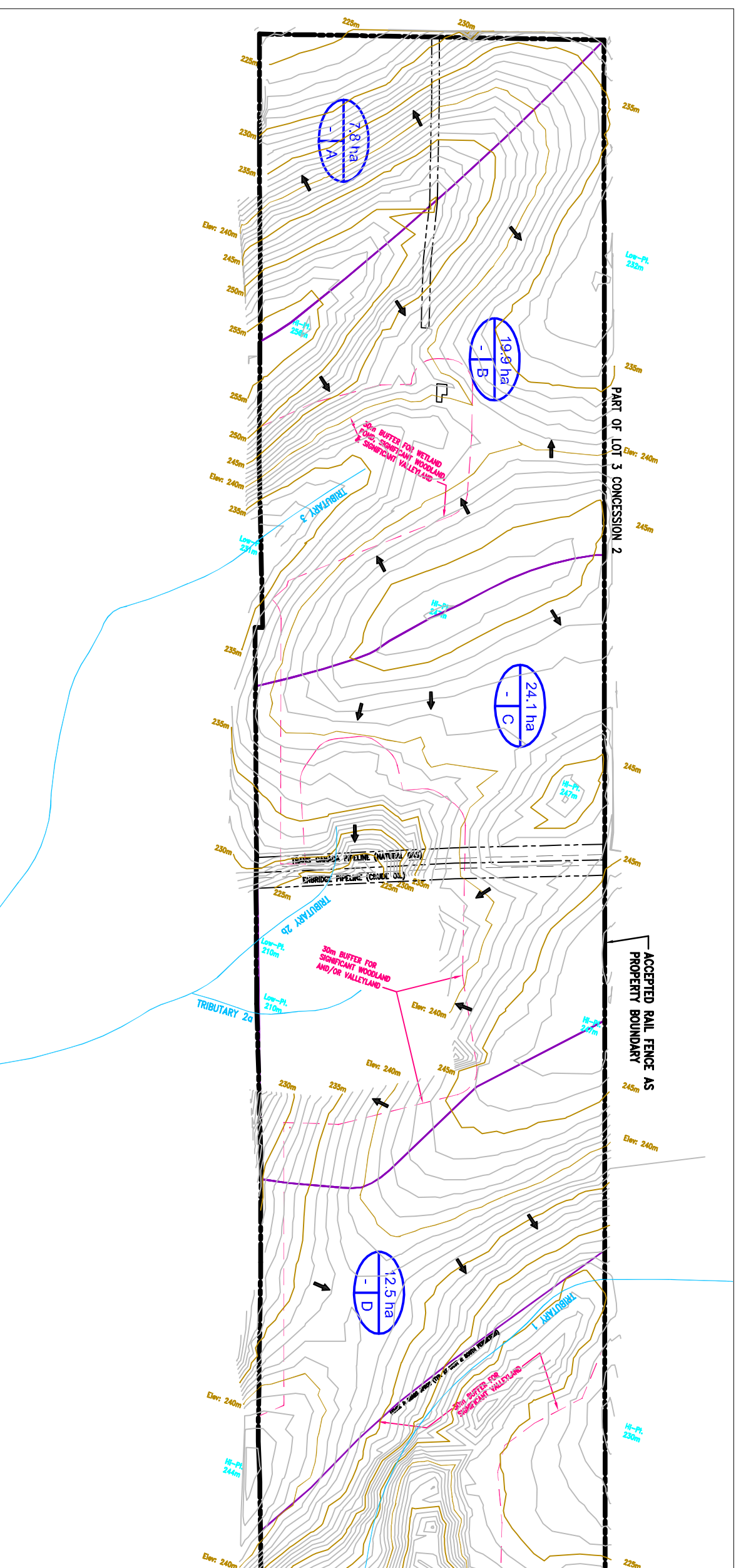
Yours truly,

**GENIVAR Inc.**

A handwritten signature in purple ink that reads "Mario D. Conetta". The signature is written in a cursive style with a long horizontal stroke at the end.

Mario Conetta, P. Eng.  
Practice Leader  
Water Resources Engineering

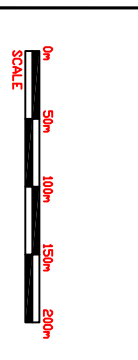
# PROJECT SITE WITH EXISTING TOPOGRAPHY, SUB-CATCHMENT DELINEATION AND DRAINAGE PATTERNS FOR EXISTING AND PROPOSED CONDITIONS



PRELIMINARY - NOT FOR CONSTRUCTION

**LEGEND:**

- PROPERTY BOUNDARY
- FLOW DIRECTION
- SUBCATCHMENT AREA BOUNDARIES
- DRAINAGE AREA ha
- CATCHMENT ID



No.	Revision/Amend	Date

**Client:**  
**PENN ENERGY RENEWABLES LTD.**

**Orientation:**

**Seal:**

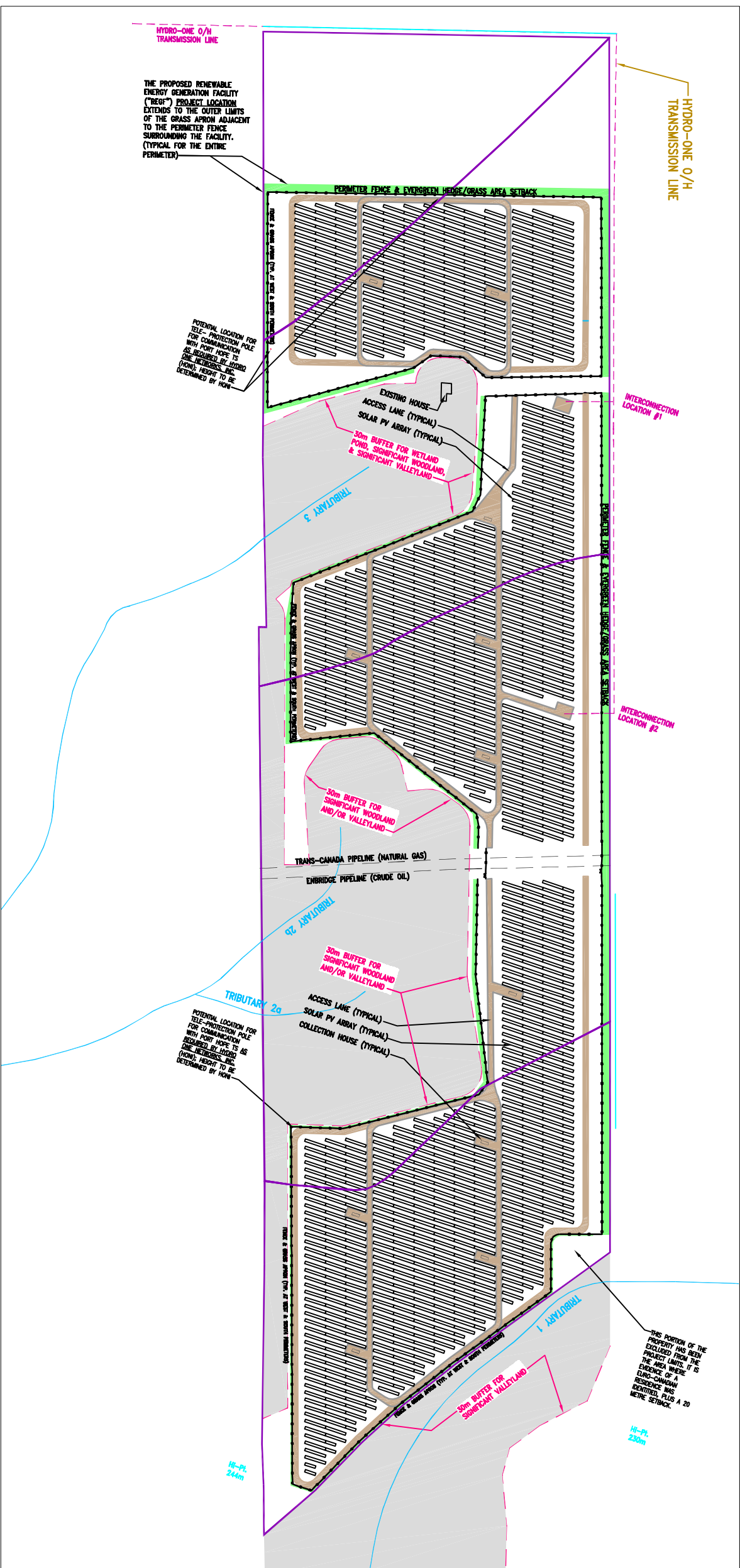
**Engineer:**  
 **GENIVAR**

**Contractor:**

**Project:**  
**HAMILTON PORT-HOPE-4  
10MW SOLAR  
GENERATING FACILITY**

**Drawing Title:**  
**PROJECT SITE WITH  
EXISTING TOPOGRAPHY,  
SUB-CATCHMENT  
DELINEATION AND DRAINAGE  
PATTERNS FOR EXISTING  
AND PROPOSED CONDITIONS**

<b>Drawn By:</b> BG/BC	<b>Date:</b> May 01, 2012
<b>Designed By:</b> BG/BJ	<b>Proj. No:</b> P12-11182-00
<b>Checked By:</b> BJ	<b>File No:</b>
<b>Approved By:</b> MC	<b>Scale:</b> AS SHOWN
<b>Drawing No:</b> 2	<b>Sheet No:</b> 0

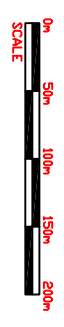


CONCEPT SITE PLAN

PRELIMINARY - NOT FOR CONSTRUCTION

LEGEND:

	PROPERTY BOUNDARY
	SUBCATCHMENT AREA BOUNDARIES



No.	Revisions/Amendments	Date:

Client:  
**PENN ENERGY RENEWABLES LTD.**

Orientation

Seal

Engineer:

Contractor

Project:  
**HAMILTON PORT-HOPE-4  
10MW SOLAR  
GENERATING FACILITY**

Drawing Title:  
**CONCEPT  
SITE PLAN**

Drawn By:	BG/RC	Date:	May 01, 2012
Designed By:	BG/BJ	Proj. No:	P12-11182-00
Checked By:	BJ	Title No:	
Approved By:	MC	Scale:	AS SHOWN
Drawing No:	3	Sheet No.:	0