Loyalist Solar Project – Block D Stormwater Management and Erosion and Sediment Control Report

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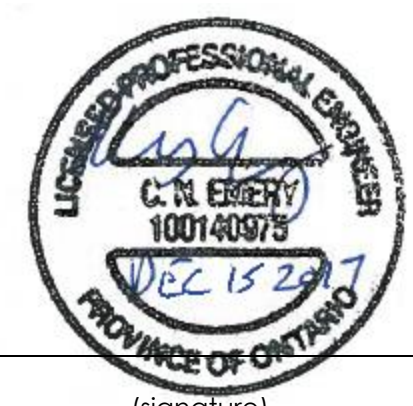

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Stantec

Table of Contents

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF DRAWINGS

1.0 INTRODUCTION

Stantec has been retained by PCL Constructors Canada Inc. (PCL) to assist with final design engineering services related to the proposed development of the 54-megwatt (MW) Loyalist Solar Project (Project) in the Township of Stone Mills, County of Lennox & Addington, Ontario.

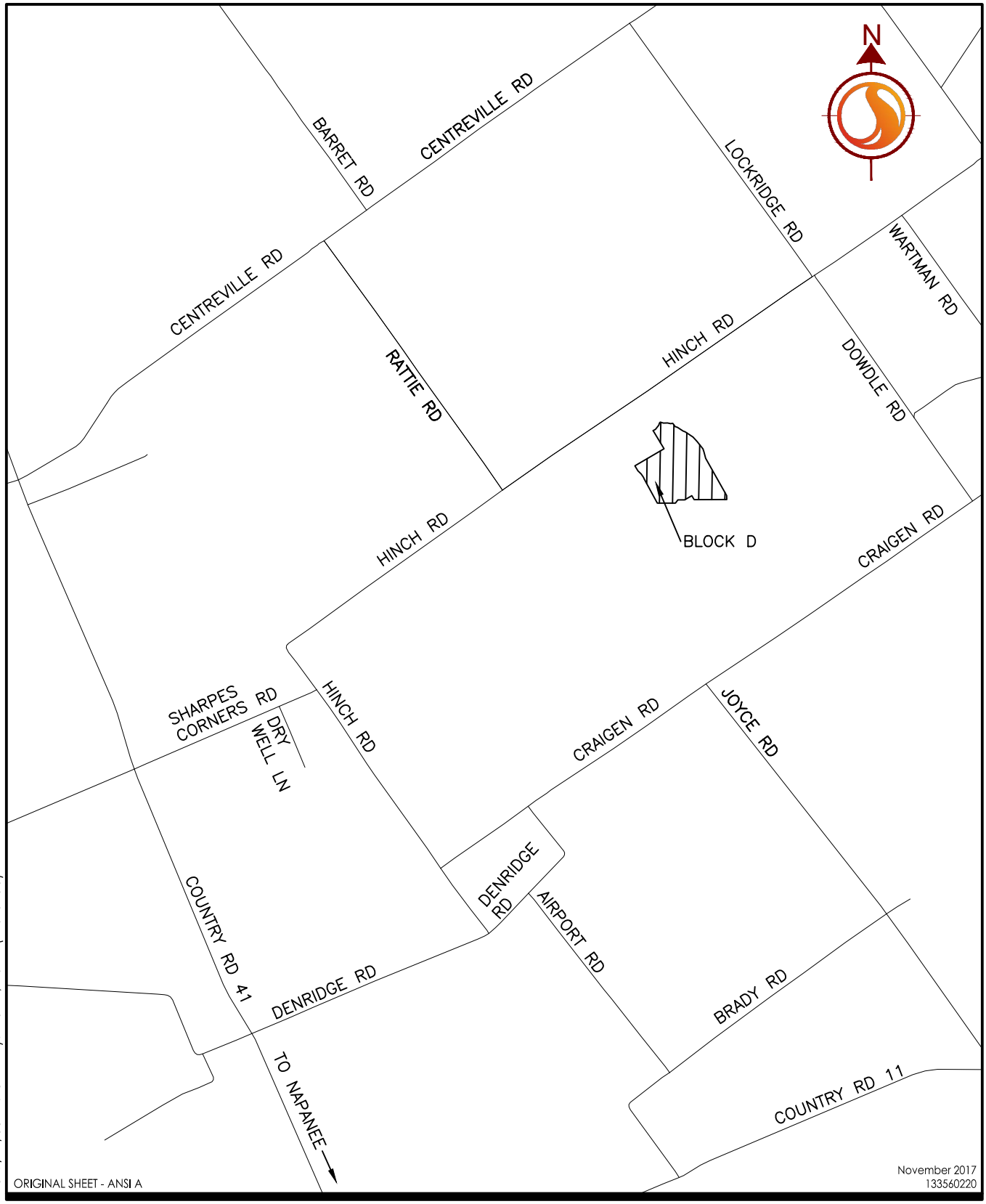
Generation Block D is located on the south side of Hinch Road approximately 1.5 km west of Dowdle Road, as shown on **Figure 1**. The site is generally bounded by Hinch Road to the north, existing agricultural lands to the east, and Hinch Swamp to the south and west.

This Stormwater Management (SWM) and Erosion and Sediment Control (ESC) Report summarizes the assessment of potential hydrologic impacts associated with the construction phase (i.e., ESC) and operational phase (i.e., SWM) of the Project. Potential hydrologic impacts assessed include changes to the runoff quality and/or quantity discharged to the surface receiving systems. The objective of the report is to demonstrate that the Project design and proposed mitigation measures associated with the construction and operation phases of the Project, as described in the REA Application, detailed engineering design, and herein, are sufficient to address any potential impacts to environmental features within the Project area and, further, to provide details on the mitigation measures and control measures that will be implemented.

1.1 STUDY APPROACH

The study approach involves the following components:

- A quantitative assessment of existing hydrologic conditions of the project area and receiving systems;
- A review of the proposed Project activities as described in the REA Application with an emphasis on assessing the potential for impacts associated with changes in hydrology;
- Completion of final design of SWM measures to control site runoff in a manner consistent with Ministry of Environment and Climate Change (MOECC) and Quinte Conservation (QC) requirements; and
- Development of an ESC strategy outlining the anticipated approach to minimize impacts related to construction.



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Client/Project
BLUEARTH RENEWABLES INC.
LOYALIST SOLAR PROJECT
County of Lennox and Addington, ON

Figure No.
FIG 1.0

Title
LOCATION PLAN
BLOCK 'D'

1.2 BACKGROUND INFORMATION

A variety of sources have been referenced during the preparation of this SWM and ESC report, including project-specific documentation, such as various reports submitted in support of the Renewable Energy Application (REA), and more general industry-standard design guidance documentation and/or literature references, as follows:

General Guidance Documentation / Literature

- *Hydrologic Response of Solar Farms article in the Journal of Hydrologic Engineering,* Cook and McCuen, May 2013
- *Quinte Conservation Stormwater Management Submission Guidelines*, Quinte Conservation, May 2012
- *Low Impact Development Stormwater Management Planning and Design Guide (LID Design Guide)*, Credit Valley Conservation Authority and Toronto Region Conservation, 2010
- *Erosion & Sediment Control Guideline for Urban Construction (ESC Guideline)*, Greater Golden Horseshoe Conservation Authorities (GGHCA), December 2006
- *Stormwater Management Planning and Design Manual (SWMPD Manual)*, Ontario Ministry of the Environment, March 2003
- *Control of Erosion – Fact Sheet,* Ontario Ministry of Food and Agriculture and Rural Affairs (OMAFRA), October 1986

Project-Specific Consultation / Documentation

- *Pre-consultation meeting with Quinte Conservation, Stantec, PCL and BlueEarth Renewables*, October 20, 2017
- *Draft Geotechnical Report – Loyalist Solar Project – 230 kV/34.5 kV Collector Station, Township of Stone Mills, ON*, Tulloch Engineering Inc., October 2017
- *Preliminary Stormwater Management and Erosion and Sediment Control Plan*, Tulloch Engineering Inc., March 2017
- *Hydrogeological Assessment – Loyalist Solar Project – Township of Stone Mills, Harden Environmental Services Ltd., May 2017*
- *Loyalist Solar Project – Project Description Report,* Dillon Consulting Ltd., February 2017
- *Loyalist Solar Project – Construction Plan Report,* Dillon Consulting Ltd., February 2017
- *Loyalist Solar Project – Design and Operations Report,* Dillon Consulting Ltd., February 2017

- *Loyalist Solar Project – Water Body Report,* Dillon Consulting Ltd., February 2017
- *Loyalist Solar Project – Water Assessment Report,* Dillon Consulting Ltd., February 2017

1.3 STORMWATER MANAGEMENT CRITERIA

Based on the background information and pre-consultation noted above, the following SWM design criteria have been established for the Loyalist Solar Project:

- Water Quantity Control
    - Control post-development runoff rates to pre-development levels for the 2-year to 100-year storm events
    - The designer must also check the 25 mm storm for erosion protection
    - Accommode future climate change scenarios by designing facilities with an additional 10% design storage capacity
- Water Quality Control
    - Provide MOECC Normal Protection Level (70% Total Suspended Solids (TSS) removal) water quality control
- Erosion and Sediment Control
    - Provide appropriate erosion and sediment control during construction/area grading to protect adjacent properties and downstream watercourses, wetlands and other sensitive receivers from potential siltation

2.0 EXISTING CONDITIONS

2.1 TOPOGRAPHY AND SURFACE DRAINAGE

The location of the proposed Generation Block D is currently vacant agricultural lands with moderate to scattered tree cover. Runoff from the site travels southwestward as shallow overland flow to the neighboring Hinch Swamp Provincially Significant Wetland. The average site slopes range from approximately 2.5% to 3.0% and elevations range from approximately 149 m on the eastern site boundary to approximately 139 m on the western and southern site boundaries. Drainage catchments were delineated using a combination of topographical survey, Light Detection and Radar (LiDAR) survey, aerial imagery and observations made during site visits completed by Stantec on September 26 and 27, 2017. The pre-development drainage catchments are shown on **Figure 2** and are described as follows:

Catchment EXT D-1 – This external drainage area is comprised of active agricultural land used for meadow and mown for hay and vacant agricultural land with scattered tree cover. Runoff from this area travels westward as shallow overland flow to Hinch Swamp.

Catchment D-100 – Vegetation on this vacant agricultural area is comprised of a mixture of weeds and grasses with scattered tree cover. Runoff from this catchment travels westward as shallow overland flow to Hinch Swamp.

Catchment D-101 – Vegetation on this vacant agricultural area is comprised of a mixture of weeds and grasses with scattered tree cover. Runoff from this catchment travels southward as shallow overland flow to Hinch Swamp.

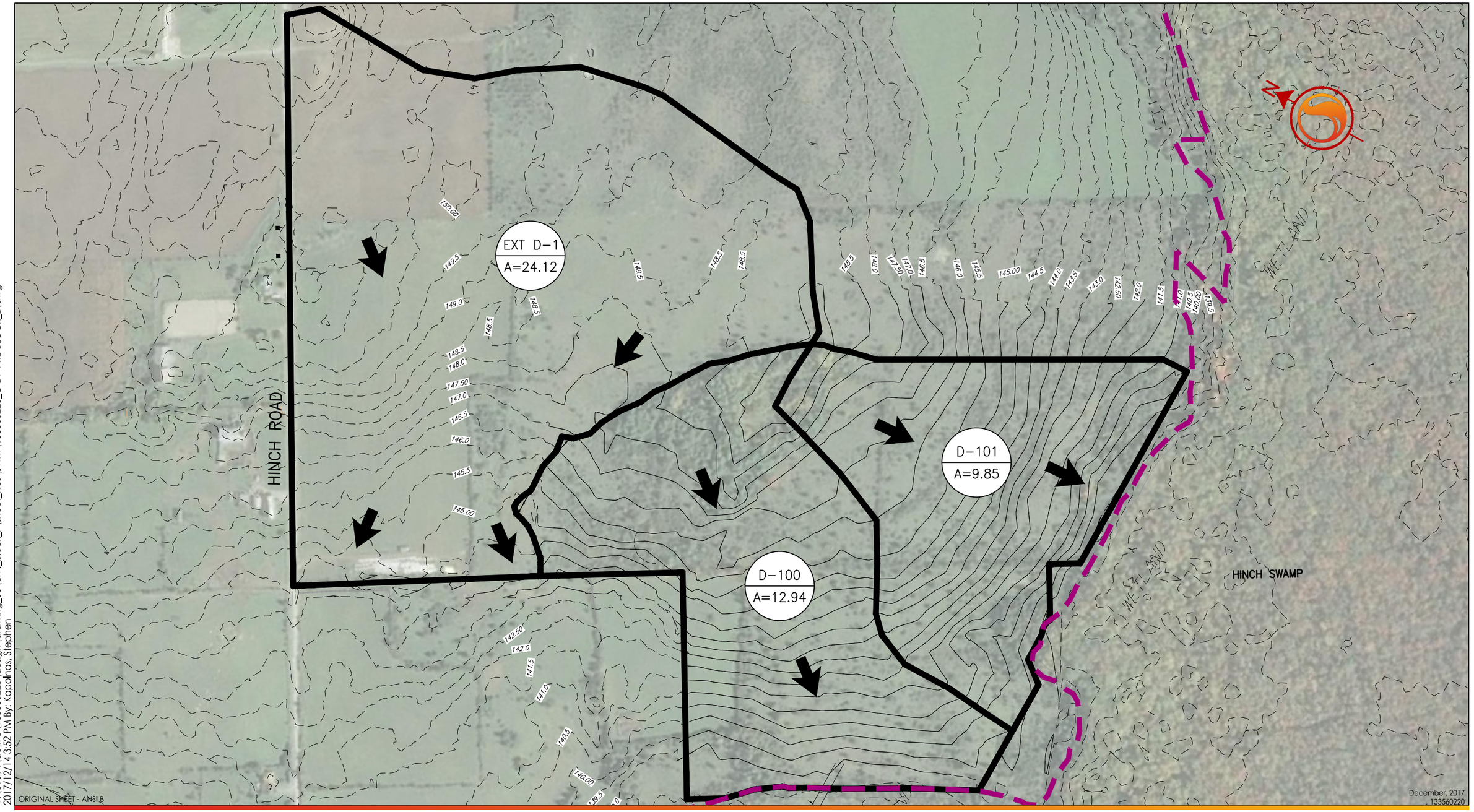
2.2 GEOTECHNICAL INFORMATION

The Soil Map of Lennox and Addington County suggests that the site soils are characterized as Farmington loam, which is described as shallow till overlying bedrock. A detailed geotechnical investigation was completed by Tulloch Engineering Inc. (Tulloch) in 2017. The investigation results are consistent with the soil description presented in the soil survey. Ten boreholes were completed within the Block D limits and the results show that the soil depth in this area ranges from 0 m to approximately 0.45 m above the bedrock. The soils are comprised of a mixture of topsoil and organics.

2.3 HYDROGEOLOGICAL INFORMATION

As part of a hydrogeological assessment completed by Harden Environmental Services Ltd. (Harden) in 2017, a monitoring well was installed within the Generation Block D limits and daily groundwater levels were recorded over a period of approximately five months. The measured groundwater levels were less than 0.5 m below the local ground surface for the duration of the monitoring period.

The hydrogeological assessment notes the presence of exposed surface fractures in the bedrock within the proposed work limits. However, the investigation notes that these fractures do not penetrate deeply into the bedrock and the report findings suggest that subsurface flow through the fractures is not significant. This conclusion is supported by surface water monitoring in Hinch Swamp, which showed a steady decrease in the summer 2016 water levels, suggesting that groundwater discharges to the wetland are not significant.



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December, 2017
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D-100
A=31.72 — AREA NUMBER, CONTRIBUTING AREA (ha)

OVERLAND FLOW DIRECTION

DRAINAGE BOUNDARY

WETLAND BOUNDARY

1:4000 0 40 120 200m

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT
54MW GROUND-MOUNT SOLAR FARM

Figure No.
FIG 2

Title
PRE-DEVELOPMENT CATCHMENTS
BLOCK 'D'

3.0 PROPOSED CONDITIONS

The Loyalist Solar Project employs a low-impact approach to site development. The grading plans presented on **Drawing C-404** show that the proposed grades will match existing grades wherever possible; existing drainage patterns are preserved wherever possible; roads will typically be constructed at grade to maintain existing drainage patterns; and site excavation will only occur to allow construction of the access road network and inverter stations.

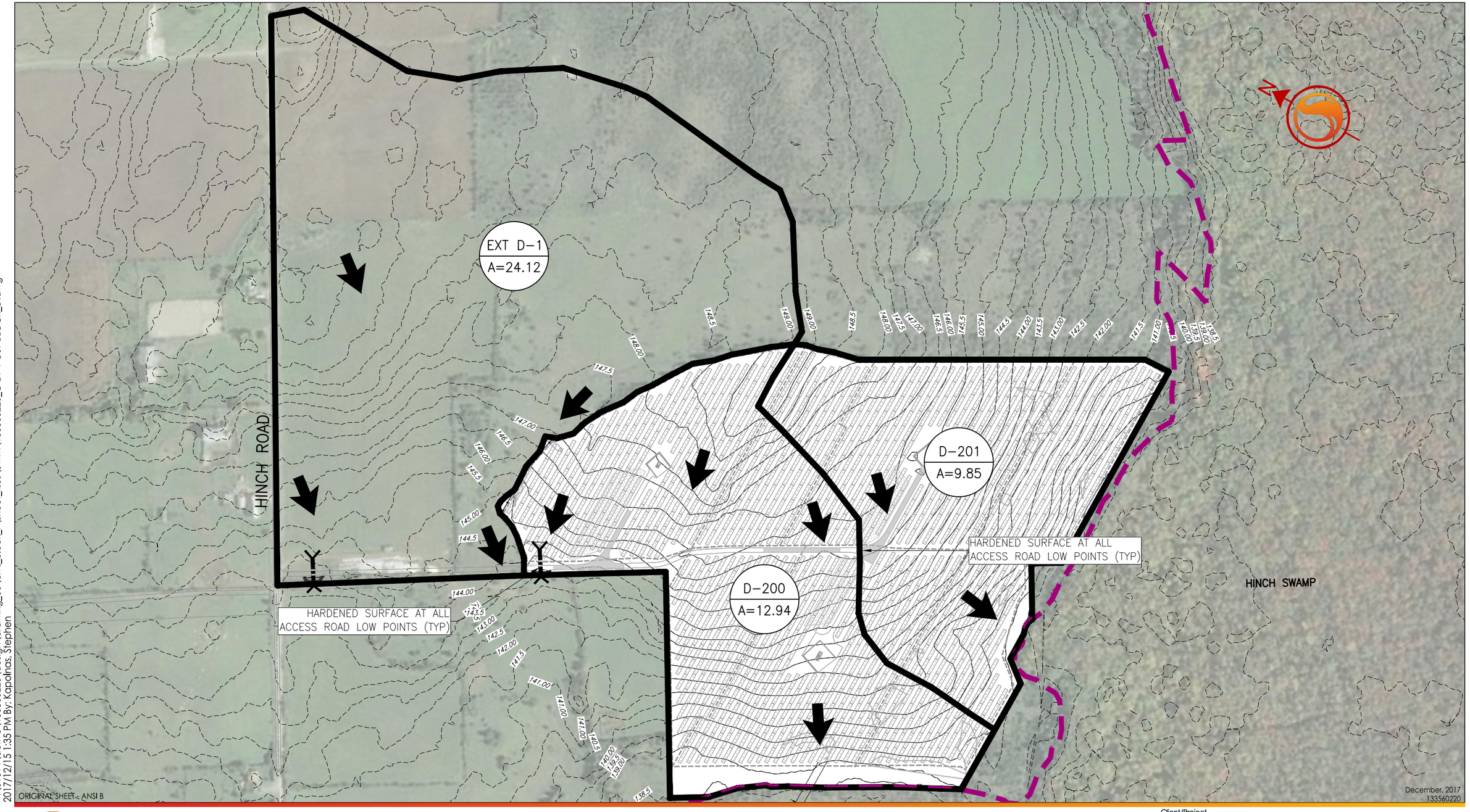
Once the panels and racking are in place, all accessible areas will be scarified to alleviate soil compaction prior to seeding. The post-development hydrology will mimic a permanent grassed meadow, similar to the existing vacant agricultural land use.

The Generation Block D includes approximately 980 m of 5 m wide access roads, three inverter stations located on granular pads and the ground mounted solar panels. Runoff from Block D travels as shallow overland flow to the neighboring Hinch Swamp Provincially Significant Wetland. The proposed drainage catchments are shown on **Figure 3** and are described below:

Catchment EXT D-1 – This external drainage area is comprised of active agricultural land used for meadow and mown for hay and vacant agricultural land with scattered tree cover. Runoff from this area travels westward as shallow overland and is conveyed across the proposed access road by two proposed culverts.

Catchment D-200 – The proposed development within this catchment includes ground mounted solar panels, access roads, and two inverter stations. Similar to existing conditions, runoff from this catchment travels westward as shallow overland flow to Hinch Swamp.

Catchment D-201 – The proposed development within this catchment includes ground mounted solar panels, access roads, and one inverter station. Similar to existing conditions, runoff from this catchment travels southward as shallow overland flow to Hinch Swamp.



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D-200
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OVERLAND FLOW DIRECTION

DRAINAGE BOUNDARY

PROPOSED CULVERT

WETLAND BOUNDARY

1:4000 0 40 120 200m

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT
54MW GROUND-MOUNT SOLAR FARM

Figure No.
FIG 3

Title
POST-DEVELOPMENT CATCHMENTS
BLOCK 'D'

4.0 STORMWATER MANAGEMENT DESIGN

In accordance with guidance provided by the MOECC, the Generation Block D stormwater management strategy was developed to treat the runoff from the site under the following conditions:

- During and immediately after construction, prior to establishment of the stabilization vegetation; and
- Following construction, after all stabilization vegetation is established.

The shallow depth to bedrock within the Generation Block D project limits presents a significant design constraint for conventional SWM design, as it prevents excavation of detention areas or channels. Consequently, the proposed SWM strategy relies on at-source controls to reduce runoff and meet the site stormwater management control criteria.

4.1 STORMWATER MANAGEMENT DURING CONSTRUCTION

Recent experience has shown that vegetation clearing and soil compaction caused by construction traffic during solar project site construction typically results in peak runoff discharges and volumes greater than those anticipated post-construction. Furthermore, several growing seasons may be required before the restoration vegetation becomes fully established and the site's hydrologic response meets the conditions anticipated in the proposed SWM strategy. Consequently, an interim SWM strategy was developed to manage the additional site runoff anticipated during construction. The interim SWM strategy includes the following measures to manage the site runoff during construction:

- Soil management practices to reduce runoff and augment infiltration;
- Stormwater detention to capture additional runoff and reduce peak flows and volumes from the site;
- Vegetated buffers to provide additional water quality treatment to the site runoff, and
- A grassed waterway to convey concentrated flows along an existing drainage path.

4.1.1 Soil Management

The following soil management measures are proposed for Generation Block D to promote infiltration and reduce the site runoff volumes:

- Minimizing topsoil stripping; and
- Ground surface scarification.

Preserving the quantity and quality of the site topsoil is critical to preserve the site infiltration capacity both during and after construction and to promote restoration vegetation establishment. Topsoil stripping will be limited to the areas necessary for access road and inverter station construction, and for the creation of temporary laydown areas (as required). The

proposed stripping limits are identified on **Drawing C-054.** Furthermore, all stripped topsoil must remain on the site and be reused for landscaping or slope interruption berms.

Contour plowing is an agricultural soil conservation practice where tillage is performed perpendicular to the slope. This results in furrows oriented perpendicular to overland flow that provide depression storage and increased surface roughness, which improves infiltration rates, reduces runoff peaks and volumes, and promotes sheet flow. Scarification will be performed on Generation Block D to achieve similar results.

Following clearing and grubbing, the Generation Block D work limits will be scarified to a minimum depth of 150 mm, where topsoil depth permits. In accordance with the guidance presented in the ESC Guideline (GGHCA, 2006), scarification will be performed with a chisel plow to retain as much vegetation residue on the soil surface as possible. Plowing will be performed perpendicular to the ground surface slopes to create furrows perpendicular to overland flow. Scarification will be performed again at the end of construction, immediately before restoration seeding, to mitigate soil compaction caused by construction traffic and to promote seed establishment.

4.1.2 Stormwater Detention

As shown on **Drawing C-404**, stormwater detention is provided by a series of slope interruption berms that intercept the Generation Block D surface runoff to reduce the peak discharges and volumes. Collected stormwater is released via infiltration and evaporation.

The proposed 300 mm high slope interruption berms are constructed of topsoil and are oriented perpendicular to the ground surface slopes. Each berm has a uniform crest elevation, and the proposed berms are spaced approximately 38 m apart to promote sheet flow, similar to the filter berm design guidance presented in the ESC Guideline (GGHCA, 2006). The proposed slope interruption berm stage/storage/discharge relationships are presented in **Appendix A**.

The proposed berms provide sufficient storage to capture all runoff from the 25 mm water quality design rainfall event. Since the captured stormwater is released via infiltration and evaporation, the proposed slope interruption berms provide all necessary water quality treatment to the site runoff.

The slope interruption berms will require periodic regrading during construction to repair ruts and compaction caused by construction traffic.

4.1.3 Vegetated Buffers

Vegetated buffers located along the western and southern site perimeter provide additional water quality control for shallow overland runoff from Generation Block D. The vegetated buffers are comprised of 5 m wide swaths of undisturbed native vegetation draining via shallow overland flow. Water quality benefits of the proposed vegetated buffers are achieved by the runoff / vegetation interaction which reduces the velocity of runoff, thereby promoting the

sedimentation of particulate matter. The vegetation also provides nutrient uptake benefits to help reduce biological pollutants such as nitrogen and phosphorous.

4.1.4 Grassed Waterway

Grassed waterways are a common agricultural surface water management practice used to mitigate erosion by conveying concentrated flows through well vegetated channels. In Generation Block D, a grassed waterway collects and conveys concentrated flows along an existing flow path to reduce the risk of erosion on site.

4.2 STORMWATER MANAGEMENT POST-CONSTRUCTION

The Loyalist Solar Project increases site impervious coverage to approximately 0.74 ha, or 3.2% of the total site area, mainly in the form of roadways and inverter platforms. As noted in *Hydrologic Response of Solar Farms* (Cook and McCuen; Journal of Hydrologic Engineering, May 2013), included in **Appendix E** for reference, solar panels suspended on racking above vegetated cover do not functionally contribute to site imperviousness and do not have "a significant effect on the runoff volumes, peaks or times to peak" of solar farm development sites. Thus, once the site restoration vegetation is fully established, the Generation Block D peak runoff rates and volumes will be similar to the existing conditions values.

However, recent solar project experience has shown that several growing seasons are necessary for the site restoration vegetation to become fully established. Consequently, the slope interruption berms and the vegetated buffers used to manage runoff during the site construction will remain as permanent features to mitigate the risk of downstream flooding or erosion caused by the site development, as shown on **Drawing C-404**. Erosion and sediment control measures implemented during project construction will remain in place until the site restoration vegetation has become sufficiently established to provide adequate stabilization.

4.2.1 Permanent Slope Interruption Berms

The proposed slope interruption berms used to control the site runoff during construction will be retained as a passive stormwater management measure during the operation phase of the Loyalist Solar Project. Similar to their role during site construction, the proposed berms will provide the following stormwater management functions:

- Intercepting and detaining site runoff;
- Promoting sheet flow; and
- Reducing runoff velocities.

The proposed permanent slope interruption berms will also serve to distribute runoff evenly across the site during the operation phase of the Loyalist Solar Project. In locations where the solar panel rows are oriented parallel to the ground surface slope, runoff may not travel into the dry areas beneath the panels, reducing the percentage of the site surface available for infiltration. However, this effect will be mitigated by the permanent slope interruption berms,

which will act similar to level spreaders, distributing runoff across the site slopes, including the areas under the solar panels.

At the end of construction, the slope interruption berms will be regraded to repair compaction and damage caused by construction vehicles. The berms will be seeded with restoration seed mix when the rest of the site is stabilized. The slope interruption berms will provide stormwater quantity and quality control while the stabilization vegetation becomes established.

4.2.2 Vegetated Buffers

The 5 m vegetated buffers located along the western and southern site perimeter will continue to provide additional water quality control for shallow overland runoff from Generation Block D following construction.

4.2.3 Grassed Waterway

The proposed grassed waterway will continue to convey concentrated flow through the existing drainage route to reduce the risk of erosion and frequent overtopping of the proposed slope interruption berms.

4.3 HYDROLOGIC ANALYSIS

A hydrologic analysis was performed to characterize the existing conditions peak flows and runoff volumes and to evaluate the interim and proposed condition SWM strategies. The hydrologic calculations were performed using the Stormwater Management Hydrologic Model (SWMHYMO).

4.3.1 Design Storms

In accordance with requirements provided by Quinte Conservation, existing and proposed development conditions were modelled for the 2-, 5- and 100-year rainfall events. The Atmospheric Environment Service (AES) 30% 1-hour and 12-hour synthetic storm distributions were used for each rain event. The AES distribution was selected since it was previously used in the *Preliminary Stormwater Management and Erosion and Sediment Control Plan* (Tulloch, 2017). A 25 mm, 4-hour Chicago design storm was used to assess erosion protection for the site. Rainfall Intensity-Duration-Frequency (IDF) data was obtained from the Environment Canada Belleville station.

4.3.2 Hydrologic Parameters

As per direction provided by Quinte Conservation, the hydrologic calculations were performed for both Antecedent Moisture Condition (AMC) II and III. Soil Conservation Service (SCS) curve numbers and hydrologic parameters were calculated for each catchment based on land use,

slopes, overland flow path lengths, and soil type and are provided in **Appendix A**, while detailed modeling files are included in **Appendices B, C, and D**.

While the MTC Drainage Manual classifies Farmington loams as Hydrologic Soils Group (HSG) B, NRCS guidance states that soils less than 50 cm deep should be treated as HSG D. Since the available borehole information shows that the average soil depth within the Generation Block D limits is less than 50 cm, the SCS curve numbers were selected based on HSG D.

4.3.3 Hydrologic Analysis Results

Hydrologic calculations were performed to estimate the peak stormwater discharges under existing, interim, and proposed conditions. The corresponding results are summarized in the following tables.

Table 1: Peak Flows and Runoff Volumes – AMC II

Discharge Location[1]	Condition[2]	Design Storm						
		25 mm	2-year		5-year		100-year	
		4-hr	1-hr	12-hr	1-hr	12-hr	1-hr	12-hr
Peak Discharge (m^3/s)								
Western Site Boundary	Existing	0.16	0.19	0.12	0.29	0.19	0.63	0.43
	Interim	0	0	0	0	0.14	0	0.49
	Proposed	0	0	0	0	0	0	0.39
Southern Site Boundary	Existing	0.13	0.15	0.09	0.23	0.15	0.50	0.33
	Interim	0	0	0	0	0.09	0	0.36
	Proposed	0	0	0	0	0	0	0.29
Runoff Volume (mm)								
Western Site Boundary	Existing	5.8	4.6	14.8	7.2	23.5	15.9	51.9
	Interim	0	0	0	0	4.5	0	37.4
	Proposed	0	0	0	0	0	0	28.5
Southern Site Boundary	Existing	5.8	4.6	14.8	7.2	23.5	15.9	51.9
	Interim	0	0	0	0	2.9	0	35.7
	Proposed	0	0	0	0	0	0	25.5

Notes:

[1] Discharges at the western site boundary represented by Catchments D-100 and D-200. Discharges at the southern site boundary represented by Catchments D-101 and D-201.

[2] The interim condition calculations were performed using SCS curve numbers consistent with contour farming and crop residue in poor hydrologic condition to represent the scarified site surfaces. Furthermore, the CALIB NASHYD command was used to define an initial abstraction consistent with plowed surfaces, selected based on the guidance presented in Effects of Tillage on Soil Microrelief, Surface Depression Storage and Soil Water Storage (Guzha, 2003).

The AMC II calculation results show that the interim condition peak flows are less than the existing conditions peak flows for all design storms except for the 100-year 12-hour event. While the peak calculated discharge for this event is greater than the target, no downstream negative impacts are anticipated since:

1. The total runoff volumes are reduced, compared to existing conditions,
2. The magnitude of the increases is small - only 60 L/s at the western site boundary and 30 L/s at the southern site boundary, which correspond to increases of approximately 14% and 9%, respectively,
3. The additional runoff is distributed as sheet flow along approximately 950 m of the site perimeter, and corresponds to an increase in unit flow of only 0.1 L/s/m, and

4. The downstream receiver is the Hinch Swamp, which occupies approximately 300 ha, and is unlikely to be affected by minor increases in peak discharges.

The AMC II proposed condition results suggest that the proposed site SWM strategy captures all of the site runoff for all of the evaluated storms, with the exception of the 100-year 12-hour design event, which is controlled to less than existing condition discharge rates.

Table 2: Peak Flows and Runoff Volumes – AMC III

Discharge Location[1]	Condition[2]	Design Storm						
		25 mm	2-year		5-year		100-year	
		4-hr	1-hr	12-hr	1-hr	12-hr	1-hr	12-hr
Peak Discharge (m^3/s)								
Western Site Boundary	Existing	0.31	0.35	0.20	0.51	0.30	1.01	0.60
	Interim	0	0	0.10	0	0.28	0.48	0.67
	Proposed	0	0	0	0	0.25	0.10	0.60
Southern Site Boundary	Existing	0.25	0.28	0.15	0.41	0.23	0.81	0.46
	Interim	0	0	0.04	0	0.21	0.26	0.51
	Proposed	0	0	0	0	0.19	0.04	0.47
Runoff Volume (mm)								
Western Site Boundary	Existing	10.7	8.7	24.1	12.8	35.9	25.6	70.6
	Interim	0	0	2.7	0	15.6	4.5	52.3
	Proposed	0	0	0	0	11.2	1.0	45.9
Southern Site Boundary	Existing	10.7	8.7	24.1	12.8	35.9	25.6	70.6
	Interim	0	0	1.1	0	14.1	2.8	50.7
	Proposed	0	0	0	0	11.0	0.5	46.0

Notes:

[1] Discharges at the western site boundary represented by Catchments D-100 and D-200. Discharges at the southern site boundary represented by Catchments D-101 and D-201.

[2] The interim condition calculations were performed using SCS curve numbers consistent with contour farming and crop residue in poor hydrologic condition to represent the scarified site surfaces. Furthermore, the CALIB NASHYD command was used to define an initial abstraction consistent with plowed surfaces, selected based on the guidance presented in Effects of Tillage on Soil Microrelief, Surface Depression Storage and Soil Water Storage (Guzha, 2003).

The AMC III interim condition calculation results are similar to the AMC II calculation results. While the 12-hour 100-year event calculated peak discharges are slightly higher than the existing condition magnitudes, no downstream negative impacts are anticipated, for the reasons noted above.

The AMC III proposed conditions results shows that the proposed site SWM strategy meets the discharge targets for all for all design storms except for the 100-year 12-hour event. However, the magnitude of the calculated increase in peak discharge is negligible and no downstream negative impacts are anticipated.

4.3.4 Access Road Culverts

The access road culverts are sized to convey the post-development peak discharges from both the 1-hour and 12-hour 2-year storm events. The proposed culvert hydrologic calculations are presented in **Appendix A**.

4.4 GROUNDWATER/SURFACE WATER INTERACTION

The hydrogeological assessment completed by Harden Environmental Services Ltd. (Harden) in 2017 identifies the presence of exposed surface fractures in the bedrock within the proposed work limits. However, the investigation notes that while these fractures likely play a significant role in capturing site runoff, they do not penetrate deeply into the bedrock and the report findings suggest that subsurface flow through the fractures is not significant.

The proposed slope interruption berms alignments will be modified in the field to prevent surface water from ponding on top of exposed fractures to mitigate the risk of increasing local subsurface flows.

4.5 STORMWATER MANAGEMENT MONITORING AND MAINTENANCE

The proposed permanent slope interruption berms are a passive and simple type of stormwater management practice, with operational and maintenance requirements to match. Given this, the site owner's inspection, operational, and maintenance activities can be generally limited to:

- Routine observations as to the presence of trash/debris and accumulated sediment upstream of the berms that could be conveyed downstream and/or affect the capacity of the system, and removal of same as needed.
- Semi-annual walking inspection should be completed during the spring and autumn to identify areas of bare soil and/or erosion. Remediation efforts would typically involve re-grading the affected berm and/or re-vegetating with sod or appropriate seed mix, with fertilizer and water applied as necessary to ensure germination and stabilization.
- Concurrent with the walking inspections, a visual assessment of any areas of persistent sediment build-up should be identified. Excessive sedimentation is an issue requiring attention if it remains in a non-vegetated condition and is, therefore, prone to re-suspension and transport downstream, or if it occurs to an extent that it affects the storage capacity of

the berms. If any such condition occurs, the sediment should be removed and the area re-stabilized.

- The walking inspections will also include a review of the ground surface conditions along the entire downstream site perimeter to identify any areas of erosion or concentrated stormwater flows. Downstream impacts will be identified and the Owner will develop a remediation plan to address them.
- The density and health of vegetation around the berms should be evaluated during the walking inspections. Deficiencies in this regard could be indicative of poor species selection and replanting should be undertaken to ensure sufficient vegetation densities.
- The height of the permanent slope interruption berms will likely decline over time due to soil bioturbation, erosion, and compaction by maintenance vehicles. The berm crests shall be restored to their design elevations once the berm heights are reduced to 200 mm or if downstream erosion or surface flow concerns are identified.
- Driving on the slope interruption berms should be avoided during wet periods to reduce the possibility of excessive rutting.

5.0 EROSION AND SEDIMENT CONTROL PLAN

5.1 SITE EROSION POTENTIAL

An assessment of the erosion potential of the construction area was completed following the methodology outlined in the *ESC Guideline (GGHCA, 2006)*. The erosion potential is based on an assessment of three primary factors, namely slope gradient, slope length and soil texture (erodibility), with the resultant designation of either "low", "medium" or "high" erosion potential. The relative level of erosion potential dictates, to some extent, the comprehensiveness of the resultant ESC system design, monitoring, and maintenance program.

The existing and proposed (post-construction) condition gradients on Generation Block D are classified as moderate (2-10%), with predominantly long slopes (greater than 30 m). Site soils are primarily loam, which has a high erosion potential (*Table A, ESC Guidelines*). Therefore, based on this classification, this site has a "high" erodibility potential (*Table A2, ESC Guidelines*)

Beyond the three-parameter approach described by the *ESC Guidelines*, it is also appropriate to account for additional factors that may result in potential sediment transport offsite during construction. In this particular case, construction is anticipated to commence in January 2018, which will prohibit in the establishment of vegetative stabilization measures until springtime. Furthermore, removal of the scattered trees during site clearing and grubbing will likely cause localized soil disturbance.

5.2 DURING CONSTRUCTION DEWATERING

No significant excavation is proposed within Generation Block D. While pile installation for the proposed solar panel racking is anticipated to intercept the groundwater table, significant dewatering is not anticipated due to the low bedrock permeability.

However, if necessary, any required dewatering operations will be completed such that discharge rates will not adversely impact flooding or erosion conditions upstream or downstream of Generation Block D. To mitigate the risk of sediment migration to downstream areas, dewatering discharges may be treated with a variety of measures including, but not limited to, filter socks, and sediment traps at the discretion of the contractor in consultation with the owner's engineer. Dewatering measures will be directed through the sediment control measures to a gently sloped, vegetated area (when possible) greater than 30 m from any watercourse or wetland feature. Although an exceedance isn't expected, should anticipated pumping rates exceed 50,000 L/day an Environmental Activity Sector Registration (EASR) application is required. Should anticipated pumping rates exceed 400,000 L/day a Permit to Take Water (PTTW) application is required.

5.3 EROSION AND SEDIMENT CONTROL MEASURES

The various construction activities required to construct Generation Block D include topsoil removal, clearing and grubbing, minor grading activities, and general construction traffic. If left unmitigated, these activities will result in impacts ranging from disturbance of at-surface soils and exposure of bedrock to potential erosion and sediment transport to offsite locations.

Erosion control will be achieved primarily by:

- managing disturbed soils using soil conservation practices to reduce runoff and sediment transport during construction;
- providing temporary runoff detention to reduce peak flows and promote settling; and
- constructing barriers to filter runoff.

Erosion and sediment control measures will be implemented prior to any grading or servicing works commencing as shown on the accompanying Plans (**Drawings C-604 and C-650**), and include, but are not necessarily be limited to, the following measures:

- A perimeter silt fence will be installed at the downstream side of the work limits concurrent with the construction of the site chain link fence. Since the shallow site topsoil depths will likely prevent installation of separate silt fence stakes, the perimeter silt fence will be fixed to the upstream side of the permanent chain link fence. Where shallow topsoil depths prevent trenching in the filter fabric, 150 mm of clear stone or pea gravel will be used to provide contact between the fabric and the ground surface;

- A 5 m wide vegetated buffer will be provided on the downstream side of all disturbed areas, as shown on **Drawing C-604**. The vegetated buffer will consist of undisturbed native vegetation and any areas of sparse vegetation will be seeded;

- Following all clearing and grubbing operations, contour plowing will be performed in all disturbed areas were the soil depth permits to scarify the soil surface. Contour plowing will be performed with a chisel plow to keep existing vegetation near the soil surface;

- Slope interruption berms will be constructed of stripped topsoil from road and inverter station locations to promote sheet flow and provide temporary stormwater detention.

- A construction entrance feature ("mud mat") will be provided at all site entrances to minimize the offsite transport of sediment via construction vehicles;

- Hinch Road will be cleaned daily of any sediment deposited by site construction traffic;

- Stabilize topsoil stockpiles expected to be left in place in excess of 30 days with vegetative cover (i.e., hydroseeding) or a rolled erosion control product in the event of unfavourable growing conditions (i.e., during the winter);

- Natural drainage routes will have rock check dams to help attenuate flows and encourage deposition of suspended sediment where appropriate;
- No equipment will be permitted to enter any area beyond the proposed work limits during construction;
- Temporarily stockpiled excavated native materials and imported materials with a D_{50} less than 4.75 mm (typical D_{50} of Granular A) will be covered with rolled erosion control products when the material is expected to be left in place in excess of 30 days, while imported materials with a D_{50} of 4.75 mm or greater can remain uncovered. Granular A and B (Type II) gradation requirements allow up to 55% percent passing a 4.75 mm sieve (#4 sieve), and may be stockpiled without covering with rolled erosion control products. Uncovered stockpiles will be surrounded with a double layer of light duty silt fence (1 m separation between layers) to provide a secondary layer of protection from sediment migration;
- Re-vegetate all disturbed areas where construction is not expected for 30 days with a minimum 50 mm of topsoil and hydro-seeding or other stabilizing vegetation / erosion protection measures (per OPSS 804). If vegetation establishment is not possible given seasonal restriction or other revegetation limiting factors, the disturbed area should be stabilized against erosion impacts by non-vegetated means such as erosion control blankets.
- All materials and equipment used for the purpose of site preparation and project construction should be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, silt, etc.) from migrating to offsite receivers:
    - Refueling and maintenance of construction equipment should occur in designated areas, a minimum of 30 m from a water body, wetland or other sensitive receiver;
    - All spills shall be reported to the Environmental Monitor for assessment and documentation, and to establish a remedial plan based on the contractor's project-specific spill response plan. Based on the assessment of the extent of the impact, The Environmental Monitor shall determine if the MOECC Spills Action Centre should be notified. Should the incident require that the Spills Action Centre be notified, this notification will be undertaken as quickly as possible by calling 1-800-268-6060.
- In the event of inclement weather or unfavourable terrain for construction, construction best practices, such as temporary rig-mats may be used to prevent disruption of surface soils and vegetative cover by construction vehicles and equipment.

The ESC measures shall be maintained in good repair during the entire construction period, and removed as contributing drainage areas are restored and stabilized. ESC measures shall not be removed until a qualified erosion and sediment control inspector determines that the measures are no longer required and the risk of surface water and environmental impacts from construction activities are negligible. In addition, the condition of erosion control works, their

overall performance, and any repairs, replacement, or modifications to the installed item shall be noted in logbooks to be kept on-site.

5.4 CONTINGENCY PLAN

The purpose of the contingency plan is to help minimize the risk or consequence of failure of the erosion and sediment control works. Failure could result from insufficient measures, lack of maintenance, or severe weather conditions. The contingency plan includes two areas of consideration: the procedures that will be followed where a failure has occurred; and the contingency measures that will be implemented where there is potential for failure.

The Contractor shall be responsible for following the contingency plan, and will prepare the following items:

- Workers shall be on call for emergency situations for all aspects of the emergency from design to construction of emergency sediment and erosion control measures. Any associated health and safety issues are the responsibility of the Contractor;
- Heavy duty silt fence, double-net straw matting erosion control blankets, straw bales and stakes, sandbags, appropriate sized rip-rap, and clean gravel fill shall be available on-site for emergency installation;
- Heavy equipment shall be on standby for emergency works;
- Fuel spill containment supplies and equipment shall be available on-site for emergency spills of deleterious substances; and
- A contact list for any further required equipment or materials shall be prepared and made available for emergency use.

5.4.1 Contingency Measures in Case of Failure

In the event of a failure, the Contractor will cease all construction related work and focus on erosion and sediment control as required to effectively stabilize the site where a failure has occurred or is imminent.

If significant long-term damage to downstream fish habitat or property is suspected, the Environmental Monitor will immediately assess and document the situation and report the incident to the MOECC Spills Action Centre. The Contractor will develop a restoration plan in consultation with MOECC. Development of the initial restoration plan will begin within 24 hours of the discovery of sediment discharge, and will be implemented as soon as possible, following consultation and approval from the MOECC, QC, DFO (if necessary) and the Township of Stone Mills. The plan will address:

- Removal and disposal of sediment from outside the work limits;

- Restoration of the affected area; and
- Restoration of any areas disturbed through deposition or removal.

5.4.2 Contingency Measures where there is a High Risk of Failure

Conditions that may potentially cause failures can be identified through two methods: monitoring of the erosion and sediment control measures, and weather forecasts that anticipate severe weather conditions.

5.4.2.1 High Risk Identified Through Monitoring

Where monitoring has identified a high potential for failure, steps shall be immediately taken to reduce the risk. These measures may include repair to existing measures, modification of existing measures, and the addition of new measures.

5.4.2.2 Severe Weather Anticipated

In cases where the weather forecast indicates that significant rainfall (>10 mm) is expected within a 24-hour period, the Contractor shall immediately complete the following:

- Verify that all erosion and sediment control measures are secure and that there is no exposed soil that could erode and be deposited downstream;
- Verify that all other measures are in good working order;
- Monitor all measures during the rainfall event, and where a potential for failure is identified, take corrective measures.

If unforeseen events cause the strategies set out in the contingency plan to be insufficient or inappropriate to meet the objective of containing sediment within the work limits, the Contractor will respond in a timely manner with all reasonable measures consistent with safety, to prevent, counteract or remedy any negative effects on the natural environment or adjacent properties.

5.5 EROSION AND SEDIMENT CONTROL MONITORING PROGRAM

To ensure the effectiveness of the various erosion and sediment control measures, a routine program should be implemented which includes the inspection of the erosion and sediment controls daily and after each significant rainfall event (10 mm), and immediate repair of any deficiencies. Non-urgent repairs (i.e., no immediate risk of sediment discharges to the downstream environment) will be completed within 48 hours of identifying the deficiency, or prior to the next anticipated rainfall event, whichever is less. This program will consist of the following activities:

- Visual inspection of the ESC measures to ensure discharged flows are generally free of sediment and turbidity;
- Inspection of vegetation protection, erosion control blankets and silt fencing to ensure that they are maintained in good repair;
- Removal of construction debris that may accumulate; and
- Implementation of remedial measures including erosion stabilization, repair of damaged measures and any other remediation where required.

If the monitoring program outlined above indicates a persistent problem, then the following steps should be undertaken to determine appropriate mitigative measures (if step 1 does not resolve the issue, proceed to step 2):

1. Analysis of the monitoring information and field visits as required, to determine the cause of the problem and develop a mitigation plan to address the issue in consultation with a qualified Environmental Monitor.
    a. Implement additional mitigation measures and monitor the results.
2. Convene a meeting with the appropriate review agencies (i.e., MOECC, QC and/or Stone Mills Township, etc.)
    a. Develop a consensus on a proposed plan of action to resolve the problem in consultation with agency staff.
    b. Implement additional mitigation measures and monitor the results.

5.6 LONG TERM EROSION AND SEDIMENT CONTROL

Approximately one (1) year after completion of construction, a site inspection will be completed to ensure that long-term erosion control measures have been effective. Seeded or replanted areas will be inspected to ensure that vegetation measures were successful and reseeding or replanting will occur where necessary.

If erosion control measures are found to be less than fully effective during this survey, reseeding or replanting of problem areas will take place. Should there be residual effects noted during post-construction monitoring, advice on contingency measures will be sought and applied.

6.0 CONCLUSION AND RECOMMENDATIONS

A site stormwater management strategy was developed for proposed Generation Block D to control runoff both during the construction phase and for the project operation phase. The proposed stormwater management strategy focusses on retaining the site runoff at source to better mimic the existing conditions hydrology. The on-site detention is provided by a series of slope interruption berms that will remain until the solar project is decommissioned. Hydrologic calculation results suggest that the proposed site SWM strategy mitigates the risk of downstream flooding, erosion or water quality impacts caused by the site development.

Based on the findings of the report, the following recommendations are provided:

- The proposed SWM measures provided in this report shall be constructed as designed;
- The ESC measures documented herein shall be implemented during construction; and
- The Stormwater Monitoring and Maintenance Program shall be carried out during and following construction.

APPENDIX A – DESIGN CALCULATIONS

SWMHYMO Parameters
Slope Interruption Berm Storage – Catchment D-200
Slope Interruption Berm Storage – Catchment D-201
HY-8 Culvert Analysis Report

Subject: SWMHYMO Parameters
Project: Loyalist Solar Project
Site: Block D
Project No.: 1335-60220
Client: Loyalist Solar LP
Date: November 23, 2017

Existing Conditions

Catchment Number	SWMHYMO Command	Area	CN (AMC II)	CN (AMC III)	Runoff Coefficient	Length	Catchment Slope	Tc	Tp
		(ha)				(m)	(%)	(hrs)	(hrs)
EXT D-1	DESIGN NASHYD	24.12	74	88	0.28	630	1.2	1.05	0.63
D-100	DESIGN NASHYD	12.94	78	90	0.28	400	2.7	0.64	0.39
D-101	DESIGN NASHYD	9.85	78	90	0.28	360	2.9	0.59	0.36
		46.91							

Interim Conditions

Catchment Number	SWMHYMO Command	Area	CN (AMC II)	CN (AMC III)	Runoff Coefficient	Length	Catchment Slope	Tc	Tp
		(ha)				(m)	(%)	(hrs)	(hrs)
EXT D-1	DESIGN NASHYD	24.12	74	88	0.28	630	1.2	1.05	0.63
D-200	CALIB NASHYD	12.94	87	95	0.35	400	2.7	0.59	0.35
D-201	CALIB NASHYD	9.85	87	95	0.35	360	2.9	0.54	0.33
		46.91							

Proposed Conditions

Catchment Number	SWMHYMO Command	Area	CN (AMC II)	CN (AMC III)	Runoff Coefficient	Length	Catchment Slope	Tc	Tp
		(ha)				(m)	(%)	(hrs)	(hrs)
EXT D-1	DESIGN NASHYD	24.12	74	88	0.28	630	1.2	1.05	0.63
D-200	DESIGN NASHYD	12.94	79	90	0.28	400	2.7	0.64	0.39
D-201	DESIGN NASHYD	9.85	78	91	0.28	360	2.9	0.59	0.36
		46.91							

Notes:

Time of Concentration calculated using the Airport Methc $Tc = [3.26 (1.1-C) L^{0.5}] / S^{0.33}$ [min]
(For areas less than 100 ha) Where: C = Runoff Coefficient
L = Length of Overland Flow (m)
S = Slope (%)

Time to Peak $Tp = 0.6Tc$

CN is a weighted average for DESIGN NASHYD
Runoff Coefficients from MTO Drainage Management Manual Design Chart 1.07

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Subject: Slope Interruption Berm Storage
Project: Loyalist Solar Project
Site: Block D
Project No.: 1335-60220
Client: Loyalist Solar LP
Date: November 23, 2017

Catchment ID:	D-200
Berm Height (mm):	300
Total Berm Length (m):	2000
Surface Slope:	3%
Infiltration Rate (mm/hr):	7
Weir Discharge Coefficient:	1.5

Ponding Depth (m)	Ponding Width (m)	Cross Sectional Area (m^2)	Ponding Volume (m^3)	Head (m)	Discharge (m^3/s)	Incremental Drawdown Time (h)	Cumulative Drawdown Time (h)
0	0	0	0			0	0
0.01	0.4	0.00	4			1.4	1.4
0.02	0.7	0.01	15			1.4	2.9
0.03	1.1	0.02	33			1.4	4.3
0.04	1.5	0.03	58			1.4	5.7
0.05	1.8	0.05	91			1.4	7.1
0.06	2.2	0.07	131			1.4	8.6
0.07	2.5	0.09	178			1.4	10.0
0.08	2.9	0.12	233			1.4	11.4
0.09	3.3	0.15	294			1.4	12.9
0.1	3.6	0.18	363			1.4	14.3
0.11	4.0	0.22	440			1.4	15.7
0.12	4.4	0.26	523			1.4	17.1
0.13	4.7	0.31	614			1.4	18.6
0.14	5.1	0.36	712			1.4	20.0
0.15	5.5	0.41	818			1.4	21.4
0.16	5.8	0.47	930			1.4	22.9
0.17	6.2	0.53	1050			1.4	24.3
0.18	6.5	0.59	1177			1.4	25.7
0.19	6.9	0.66	1312			1.4	27.1
0.2	7.3	0.73	1453			1.4	28.6
0.21	7.6	0.80	1602			1.4	30.0
0.22	8.0	0.88	1759			1.4	31.4
0.23	8.4	0.96	1922			1.4	32.9
0.24	8.7	1.05	2093			1.4	34.3
0.25	9.1	1.14	2271			1.4	35.7
0.26	9.4	1.23	2456			1.4	37.1
0.27	9.8	1.32	2649			1.4	38.6
0.28	10.2	1.42	2849			1.4	40.0
0.29	10.5	1.53	3056			1.4	41.4
0.3	10.9	1.64	3270	0	0	1.4	42.9
0.31	11.3	1.75	3492	0.01	3	0.0	42.9
0.32	11.6	1.86	3721	0.02	8	0.0	42.9
0.33	12.0	1.98	3957	0.03	16	0.0	42.9
0.34	12.4	2.10	4200	0.04	24	0.0	42.9
0.35	12.7	2.23	4451	0.05	34	0.0	42.9

Subject: Slope Interruption Berm Storage
Project: Loyalist Solar Project
Site: Block D
Project No.: 1335-60220
Client: Loyalist Solar LP
Date: November 23, 2017

Catchment ID:	D-201
Berm Height (mm):	300
Total Berm Length (m):	1600
Surface Slope:	3%
Infiltration Rate (mm/hr):	7
Weir Discharge Coefficient:	1.5

Ponding Depth (m)	Ponding Width (m)	Cross Sectional Area (m^2)	Ponding Volume (m^3)	Head (m)	Discharge (m^3/s)	Incremental Drawdown Time (h)	Cumulative Drawdown Time (h)
0	0	0	0			0	0
0.01	0.4	0.00	3			1.4	1.4
0.02	0.7	0.01	12			1.4	2.9
0.03	1.1	0.02	26			1.4	4.3
0.04	1.5	0.03	47			1.4	5.7
0.05	1.8	0.05	73			1.4	7.1
0.06	2.2	0.07	105			1.4	8.6
0.07	2.5	0.09	142			1.4	10.0
0.08	2.9	0.12	186			1.4	11.4
0.09	3.3	0.15	235			1.4	12.9
0.1	3.6	0.18	291			1.4	14.3
0.11	4.0	0.22	352			1.4	15.7
0.12	4.4	0.26	419			1.4	17.1
0.13	4.7	0.31	491			1.4	18.6
0.14	5.1	0.36	570			1.4	20.0
0.15	5.5	0.41	654			1.4	21.4
0.16	5.8	0.47	744			1.4	22.9
0.17	6.2	0.53	840			1.4	24.3
0.18	6.5	0.59	942			1.4	25.7
0.19	6.9	0.66	1049			1.4	27.1
0.2	7.3	0.73	1163			1.4	28.6
0.21	7.6	0.80	1282			1.4	30.0
0.22	8.0	0.88	1407			1.4	31.4
0.23	8.4	0.96	1538			1.4	32.9
0.24	8.7	1.05	1674			1.4	34.3
0.25	9.1	1.14	1817			1.4	35.7
0.26	9.4	1.23	1965			1.4	37.1
0.27	9.8	1.32	2119			1.4	38.6
0.28	10.2	1.42	2279			1.4	40.0
0.29	10.5	1.53	2445			1.4	41.4
0.3	10.9	1.64	2616	0	0	1.4	42.9
0.31	11.3	1.75	2793	0.01	2	0.0	42.9
0.32	11.6	1.86	2976	0.02	7	0.0	42.9
0.33	12.0	1.98	3165	0.03	12	0.0	42.9
0.34	12.4	2.10	3360	0.04	19	0.0	42.9
0.35	12.7	2.23	3561	0.05	27	0.0	42.9

HY-8 Culvert Analysis Report

Table 1 - Culvert Summary Table: Culvert 2

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
Minimum	0.02	0.02	143.77	0.065	0.100	3-M1t	0.056	0.049	0.150	0.150	0.233	0.000
2-Year	0.15	0.15	144.04	0.252	0.371	2-M2c	0.198	0.193	0.193	0.150	1.335	0.000

****

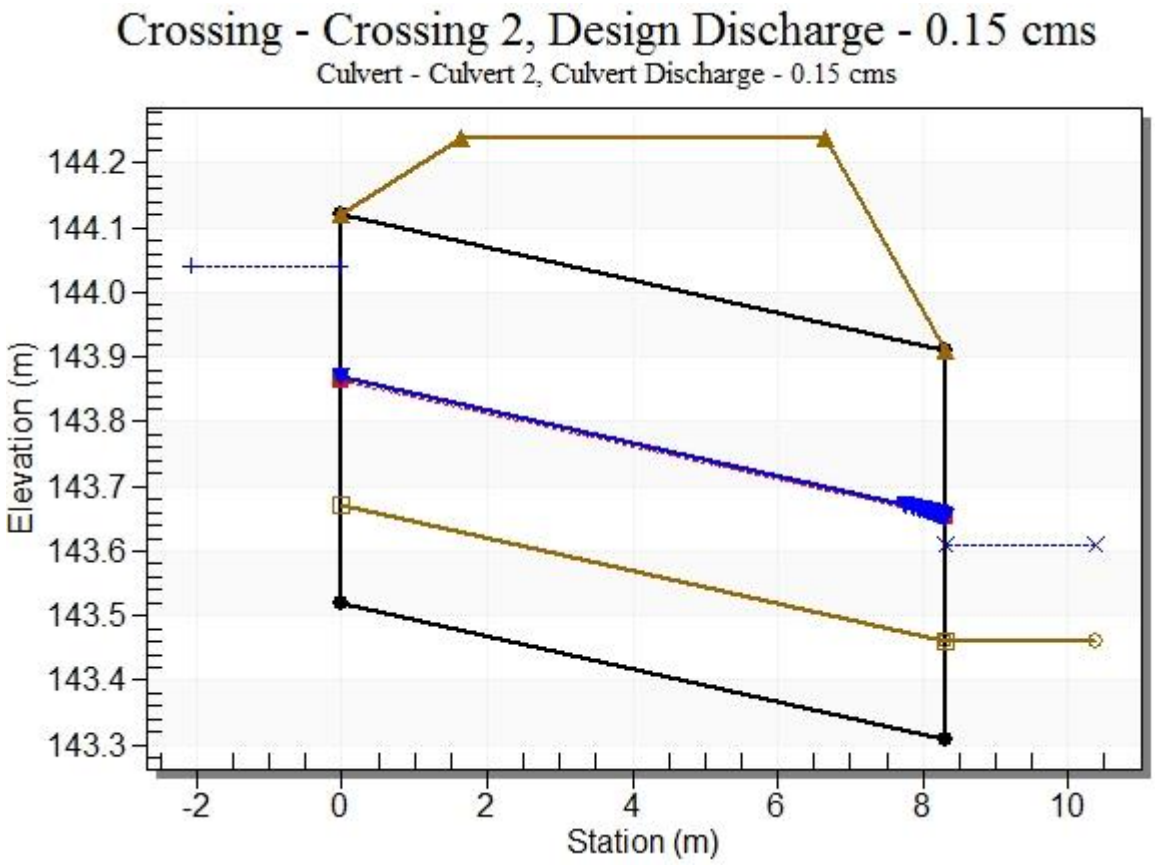
Straight Culvert

Inlet Elevation (invert): 143.67 m, Outlet Elevation (invert): 143.46 m

Culvert Length: 8.30 m, Culvert Slope: 0.0253

****

Water Surface Profile Plot for Culvert: Culvert 2



Site Data - Culvert 2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 143.52 m

Outlet Station: 8.30 m

Outlet Elevation: 143.31 m

Number of Barrels: 1

Culvert Data Summary - Culvert 2

Barrel Shape: Circular

Barrel Diameter: 600.00 mm

Barrel Material: Corrugated Steel

Embedment: 150.00 mm

Barrel Manning's n: 0.0240 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 2 - Downstream Channel Rating Curve (Crossing: Crossing 2)

Flow (cms)	Water Surface Elev (m)	Depth (m)
0.71	143.61	0.15
5.30	143.61	0.15

Tailwater Channel Data - Crossing 2

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 143.61 m

Roadway Data for Crossing: Crossing 2

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (m)	Elevation (m)
0	263.90	144.24
1	286.00	144.32
2	322.30	144.04
3	339.90	144.06
4	437.20	146.01

Roadway Surface: Gravel

Roadway Top Width: 5.00 m

Table 3 - Culvert Summary Table: Culvert 1

Discharge Names	Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
Minimum	0.01	0.01	144.38	0.052	0.118	3-M1t	0.068	0.034	0.150	0.150	0.137	0.000
2-Year	0.04	0.04	144.45	0.122	0.188	3-M2t	0.169	0.091	0.150	0.150	0.547	0.000

****

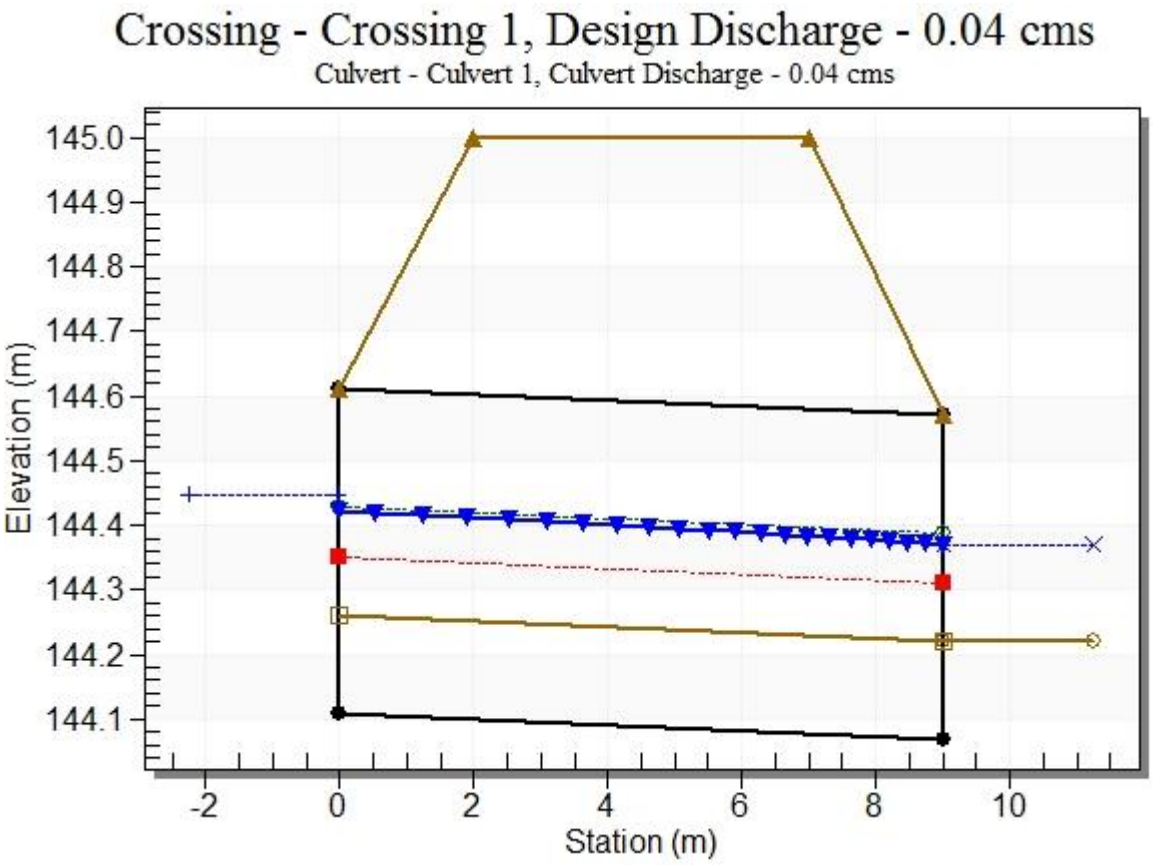
Straight Culvert

Inlet Elevation (invert): 144.26 m, Outlet Elevation (invert): 144.22 m

Culvert Length: 9.00 m, Culvert Slope: 0.0044

****

Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 144.11 m

Outlet Station: 9.00 m

Outlet Elevation: 144.07 m

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 500.00 mm

Barrel Material: Corrugated Steel

Embedment: 150.00 mm

Barrel Manning's n: 0.0240 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 4 - Downstream Channel Rating Curve (Crossing: Crossing 1)

Flow (cms)	Water Surface Elev (m)	Depth (m)
0.35	144.37	0.15
1.41	144.37	0.15

Tailwater Channel Data - Crossing 1

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 144.37 m

Roadway Data for Crossing: Crossing 1

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (m)	Elevation (m)
0	0.00	145.00
1	21.10	144.80
2	41.90	144.90
3	64.20	144.82
4	133.20	145.16

Roadway Surface: Gravel

Roadway Top Width: 5.00 m

APPENDIX B – EXISTING CONDITIONS

NRCS (SCS) Curve Number Determination – Existing Conditions
Existing Conditions SWMHYMO Output – AMC II
Existing Conditions SWMHYMO Output – AMC III

Subject: **NRCS (SCS) Curve Number Determination - Existing Conditions**
Project: **Loyalist Solar Project**
Site: **Block D**
Project No.: **1335-60220**
Client: **Loyalist Solar LP**
Date: **November 23, 2017**

TABLE OF CURVE NUMBERS (CN's)								
Land Use		Hydrologic Soil Type							Source
		A	AB	B	BC	C	CD	D	
Meadow	"Good"	30	44	58	65	71	75	78	USDA
Woodlot	"Fair"	36	48	60	67	73	76	79	USDA
Lawns	"Good"	39	50	61	68	74	77	80	USDA
Pasture/Range	"Fair"	49	55	60	70	79	82	84	USDA
Crop - SR + CR	"Good"	64	70	75	79	82	84	85	USDA
Gravel		76	81	85	87	89	90	91	USDA
Bare Soil (Fallow)		77	82	86	89	91	93	94	USDA
Wetland/Lake		100	100	100	100	100	100	100	USDA
Impervious		98	98	98	98	98	98	98	USDA

USDA - United States Department of Agriculture (2004), National Engineering Handbook, Part 630 Hydrology, Chapter 9 Hydrologic Soil Cover Compexes

HYDROLOGIC SOIL TYPE (%) - Existing Conditions								
Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
EXT D-1			50				50	100
D-100							100	100
D-101							100	100

LAND USE (%) - Existing Conditions										
Catchment	Meadow	Woodlot	Lawns	Pasture Range	Crop	Gravel	Bare Soil	Wetland	Impervious	Total
EXT D-1	50				50					100
D-100	100									100
D-101	100									100

CURVE NUMBER (CN) - Existing Conditions											
Catchment	Meadow	Woodlot	Lawns	Pasture Range	Crop	Gravel	Bare Soil	Wetland/ Lakes	Impervious	Weighted CN (AMC II)	Weighted CN (AMC III)
EXT D-1	34				40					74	88
D-100	78									78	90
D-101	78									78	90

Notes: AMC II assumed - AMC III Conversion Per Soil Conservation Service Curve Number (SCS-CN) Methodology (Mishra, Surendra and Vijay P. Sing (2003))
Hydrological Soil Groups identified based on USDA guidance and MTC Drainage Manual

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9    =========
                                                        9   9  9   9   # 4730904
         StormWater Management HYdrologic Model          999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                  OTTHYMO-83 and OTTHYMO-89.                  *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                   Ottawa,  Ontario: (613) 836-3884          *********
 *********                   Gatineau, Quebec: (819) 243-6858          *********
 *********                   E-Mail: swmhymo@jfsa.Com                  *********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)          +++++++++
 +++++++++                Kitchener              SERIAL#:4730904       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10           *********
 *********           Max. number of rainfall points: 105408           *********
 *********           Max. number of flow points    : 105408           *********
 ********************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2017-11-20     TIME: 21:01:41     RUN COUNTER: 000655         *
 ********************************************************************************
 * Input   filename: Z:\Temp\Loyalist\DEX2-1.dat                                *
 * Output  filename: Z:\Temp\Loyalist\DEX2-1.out                                *
 * Summary filename: Z:\Temp\Loyalist\DEX2-1.sum                                *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
-
001:0001--------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC II Conditions
*#
*#*****************************************************************************

--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=LYA2.1hr
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 2 Year)
| Ptotal=  22.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 2 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  23.868 |    .33  29.172 |    .58  26.520 |    .83   7.956
               .17  37.128 |    .42  34.476 |    .67  13.260 |    .92   2.652
               .25  55.692 |    .50  23.868 |    .75  10.608 |   1.00    .000

--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .189 (i)
     TIME TO PEAK    (hrs)=    1.183
     RUNOFF VOLUME    (mm)=    3.863
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .175

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=78.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .185 (i)
     TIME TO PEAK    (hrs)=     .900
     RUNOFF VOLUME    (mm)=    4.601
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .208

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
```

```
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .147 (i)
     TIME TO PEAK    (hrs)=     .867
     RUNOFF VOLUME    (mm)=    4.601
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .208

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0006--------------------------------------------------------------------------
-
  ** END OF RUN :   1

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=LYA2.12h
-------------------------------------------------------------------------------
-
002:0002--------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC II Conditions
*#
*#*****************************************************************************
-------------------------------------------------------------------------------
-
002:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 2 Year)
| Ptotal=  42.24 mm|    Comments: Belleville IDF (12-hr 30% AES - 2 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              1.00   3.960 |   4.00   6.600 |   7.00   1.320 |  10.00    .000
              2.00  11.440 |   5.00   6.160 |   8.00    .440 |  11.00    .000
              3.00   8.800 |   6.00   3.520 |   9.00    .000 |  12.00    .000

-------------------------------------------------------------------------------
-
002:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .186 (i)
     TIME TO PEAK    (hrs)=    5.133
     RUNOFF VOLUME    (mm)=   12.769
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .302

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0004--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=78.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .118 (i)
     TIME TO PEAK    (hrs)=    3.200
     RUNOFF VOLUME    (mm)=   14.769
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .350

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0005--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .090 (i)
     TIME TO PEAK    (hrs)=    3.167
     RUNOFF VOLUME    (mm)=   14.769
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .350

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0006--------------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
002:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   2

********************************************************************************
```

```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 003
    NSTORM=   1
           #  1=LYA5.1hr
-------------------------------------------------------------------------------
-
003:0002-----------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC II Conditions
*#
*#**************************************************************************
-------------------------------------------------------------------------------
-
003:0002-----------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 5 Year)
| Ptotal=  28.00 mm|    Comments: Belleville IDF (1-hr 30% AES - 5 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  30.240 |    .33  36.960 |    .58  33.600 |    .83  10.080
               .17  47.040 |    .42  43.680 |    .67  16.800 |    .92   3.360
               .25  70.560 |    .50  30.240 |    .75  13.440 |   1.00    .000

-------------------------------------------------------------------------------
-
003:0003-----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .296 (i)
     TIME TO PEAK    (hrs)=    1.183
     RUNOFF VOLUME    (mm)=    6.067
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .217

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
003:0004-----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   12.94   Curve Number   (CN)=78.00
| 01:D-100  DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .286 (i)
     TIME TO PEAK    (hrs)=     .900
     RUNOFF VOLUME    (mm)=    7.156
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .256

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
003:0005-----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=    9.85   Curve Number   (CN)=78.00
| 01:D-101  DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .228 (i)
     TIME TO PEAK    (hrs)=     .867
     RUNOFF VOLUME    (mm)=    7.156
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .256

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
003:0006-----------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
003:0002-----------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
003:0002-----------------------------------------------------------------------
-
  ** END OF RUN :   3

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 004
    NSTORM=   1
           #  1=LYA5.12h
-------------------------------------------------------------------------------
-
```

```
004:0002--------------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC II Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 5 Year)
| Ptotal=  55.97 mm|    Comments: Belleville IDF (12-hr 30% AES - 5 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              1.00   5.247 |   4.00   8.745 |   7.00   1.749 |  10.00    .000
              2.00  15.158 |   5.00   8.162 |   8.00    .583 |  11.00    .000
              3.00  11.660 |   6.00   4.664 |   9.00    .000 |  12.00    .000

--------------------------------------------------------------------------------
-
004:0003--------------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .295 (i)
     TIME TO PEAK    (hrs)=    5.100
     RUNOFF VOLUME    (mm)=   20.644
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .369

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0004--------------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=78.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .190 (i)
     TIME TO PEAK    (hrs)=    3.167
     RUNOFF VOLUME    (mm)=   23.525
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .420

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0005--------------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .146 (i)
     TIME TO PEAK    (hrs)=    3.150
     RUNOFF VOLUME    (mm)=   23.526
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .420

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0006--------------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------------
-
  ** END OF RUN :   4

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
           #  1=LYA100.1hr
--------------------------------------------------------------------------------
-
005:0002--------------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
```

```
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC II Conditions
*#
*#*************************************************************************
--------------------------------------------------------------------------------
-
005:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 100 Year)
| Ptotal=  44.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 100 Year)
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .08  47.628 |    .33  58.212 |    .58  52.920 |    .83  15.876
                .17  74.088 |    .42  68.796 |    .67  26.460 |    .92   5.292
                .25 111.132 |    .50  47.628 |    .75  21.168 |   1.00    .000

--------------------------------------------------------------------------------
-
005:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .671 (i)
     TIME TO PEAK    (hrs)=    1.167
     RUNOFF VOLUME    (mm)=   13.765
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .312

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
005:0004--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=78.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .631 (i)
     TIME TO PEAK    (hrs)=     .883
     RUNOFF VOLUME    (mm)=   15.885
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .360

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
005:0005--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .504 (i)
     TIME TO PEAK    (hrs)=     .850
     RUNOFF VOLUME    (mm)=   15.885
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .360

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
005:0006--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
005:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
005:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
005:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
005:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   5

*************************************************************************



--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 006
    NSTORM=   1
          #  1=LYA100.12h
--------------------------------------------------------------------------------
-
006:0002--------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC II Conditions
*#
*#*************************************************************************
--------------------------------------------------------------------------------
-
```

```
006:0002----------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 100 Year
| Ptotal=  93.70 mm|    Comments: Belleville IDF (12-hr 30% AES - 100 Year
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              1.00   8.784 |   4.00  14.640 |   7.00   2.928 |  10.00    .000
              2.00  25.376 |   5.00  13.664 |   8.00    .976 |  11.00    .000
              3.00  19.520 |   6.00   7.808 |   9.00    .000 |  12.00    .000

-------------------------------------------------------------------------------
-
006:0003----------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .665 (i)
     TIME TO PEAK    (hrs)=    3.550
     RUNOFF VOLUME    (mm)=   46.848
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .500

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
006:0004----------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=78.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .429 (i)
     TIME TO PEAK    (hrs)=    3.133
     RUNOFF VOLUME    (mm)=   51.882
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .554

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
006:0005----------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .328 (i)
     TIME TO PEAK    (hrs)=    3.117
     RUNOFF VOLUME    (mm)=   51.882
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .554

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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006:0006----------------------------------------------------------------------------
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006:0002----------------------------------------------------------------------------
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006:0002----------------------------------------------------------------------------
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006:0002----------------------------------------------------------------------------
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-
006:0002----------------------------------------------------------------------------
-
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-
006:0002----------------------------------------------------------------------------
-
  ** END OF RUN :   6

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 007
    NSTORM=   1
           #  1=25mm.4hr
-------------------------------------------------------------------------------
-
007:0002----------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC II Conditions
*#
*#*****************************************************************************
-------------------------------------------------------------------------------
-
007:0002----------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: 25 mm, 4hr Chicago Storm
```

```
| Ptotal=  25.00 mm|    Comments: 25 mm, 4hr Chicago Storm
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .08   1.465 |   1.08   4.024 |   2.08   5.764 |   3.08   2.074
                .17   1.540 |   1.17   4.814 |   2.17   4.969 |   3.17   1.977
                .25   1.625 |   1.25   6.025 |   2.25   4.374 |   3.25   1.889
                .33   1.720 |   1.33   8.114 |   2.33   3.913 |   3.33   1.810
                .42   1.829 |   1.42  12.526 |   2.42   3.545 |   3.42   1.737
                .50   1.955 |   1.50  27.198 |   2.50   3.245 |   3.50   1.671
                .58   2.101 |   1.58  74.855 |   2.58   2.994 |   3.58   1.610
                .67   2.274 |   1.67  31.410 |   2.67   2.782 |   3.67   1.553
                .75   2.482 |   1.75  16.819 |   2.75   2.601 |   3.75   1.501
                .83   2.736 |   1.83  11.357 |   2.83   2.443 |   3.83   1.453
                .92   3.055 |   1.92   8.563 |   2.92   2.305 |   3.92   1.408
               1.00   3.468 |   2.00   6.882 |   3.00   2.183 |   4.00   1.366

-------------------------------------------------------------------------------
-
007:0003---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .171 (i)
     TIME TO PEAK    (hrs)=    2.467
     RUNOFF VOLUME    (mm)=    4.898
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .196

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
007:0004---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=78.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .162 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=    5.805
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .232

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
007:0005---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .130 (i)
     TIME TO PEAK    (hrs)=    2.033
     RUNOFF VOLUME    (mm)=    5.805
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .232

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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007:0006---------------------------------------------------------------------
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007:0002---------------------------------------------------------------------
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007:0002---------------------------------------------------------------------
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007:0002---------------------------------------------------------------------
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007:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
007:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
007:0002---------------------------------------------------------------------
-
      FINISH
-------------------------------------------------------------------------------
-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2017-11-20     at 21:01:43
===============================================================================
=
```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                        9   9  9   9   # 4730904
         StormWater Management HYdrologic Model          999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                  OTTHYMO-83 and OTTHYMO-89.                  *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                   Ottawa,  Ontario: (613) 836-3884          *********
 *********                   Gatineau, Quebec: (819) 243-6858          *********
 *********                   E-Mail: swmhymo@jfsa.Com                  *********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)           +++++++++
 +++++++++                Kitchener              SERIAL#:4730904       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ********************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2017-11-20     TIME: 20:57:59     RUN COUNTER: 000654          *
 ********************************************************************************
 * Input   filename: Z:\Temp\Loyalist\DEX3-1.dat                                *
 * Output  filename: Z:\Temp\Loyalist\DEX3-1.out                                *
 * Summary filename: Z:\Temp\Loyalist\DEX3-1.sum                                *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
-
001:0001--------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC III Conditions
*#
*#*****************************************************************************

--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=LYA2.1hr
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 2 Year)
| Ptotal=  22.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 2 Year)
--------------------

              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  23.868 |    .33  29.172 |    .58  26.520 |    .83   7.956
               .17  37.128 |    .42  34.476 |    .67  13.260 |    .92   2.652
               .25  55.692 |    .50  23.868 |    .75  10.608 |   1.00    .000

--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .189 (i)
     TIME TO PEAK    (hrs)=    1.183
     RUNOFF VOLUME    (mm)=    3.863
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .175

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .347 (i)
     TIME TO PEAK    (hrs)=     .883
     RUNOFF VOLUME    (mm)=    8.692
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .393

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=90.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
```

```
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .277 (i)
     TIME TO PEAK    (hrs)=     .850
     RUNOFF VOLUME    (mm)=    8.692
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .393

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
-
001:0006---------------------------------------------------------------------------------
-
  ** END OF RUN :   1

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=LYA2.12h
------------------------------------------------------------------------------------------
-
002:0002---------------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC III Conditions
*#
*#*****************************************************************************
------------------------------------------------------------------------------------------
-
002:0002---------------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 2 Year)
| Ptotal=  42.24 mm|    Comments: Belleville IDF (12-hr 30% AES - 2 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              1.00   3.960 |   4.00   6.600 |   7.00   1.320 |  10.00    .000
              2.00  11.440 |   5.00   6.160 |   8.00    .440 |  11.00    .000
              3.00   8.800 |   6.00   3.520 |   9.00    .000 |  12.00    .000

------------------------------------------------------------------------------------------
-
002:0003---------------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .186 (i)
     TIME TO PEAK    (hrs)=    5.133
     RUNOFF VOLUME    (mm)=   12.769
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .302

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
-
002:0004---------------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .202 (i)
     TIME TO PEAK    (hrs)=    3.133
     RUNOFF VOLUME    (mm)=   24.068
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .570

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------
-
002:0005---------------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=90.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .154 (i)
     TIME TO PEAK    (hrs)=    3.117
     RUNOFF VOLUME    (mm)=   24.068
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .570

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
002:0006---------------------------------------------------------------------------------
-
------------------------------------------------------------------------------------------
-
002:0002---------------------------------------------------------------------------------
-
  ** END OF RUN :   2

********************************************************************************
```

```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 003
    NSTORM=   1
           #  1=LYA5.1hr
-------------------------------------------------------------------------------
-
003:0002-----------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC III Conditions
*#
*#**************************************************************************
-------------------------------------------------------------------------------
-
003:0002-----------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 5 Year)
| Ptotal=  28.00 mm|    Comments: Belleville IDF (1-hr 30% AES - 5 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  30.240 |    .33  36.960 |    .58  33.600 |    .83  10.080
               .17  47.040 |    .42  43.680 |    .67  16.800 |    .92   3.360
               .25  70.560 |    .50  30.240 |    .75  13.440 |   1.00    .000

-------------------------------------------------------------------------------
-
003:0003-----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .296 (i)
     TIME TO PEAK    (hrs)=    1.183
     RUNOFF VOLUME    (mm)=    6.067
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .217

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
003:0004-----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   12.94   Curve Number   (CN)=90.00
| 01:D-100  DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .511 (i)
     TIME TO PEAK    (hrs)=     .867
     RUNOFF VOLUME    (mm)=   12.833
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .458

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
003:0005-----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=    9.85   Curve Number   (CN)=90.00
| 01:D-101  DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .408 (i)
     TIME TO PEAK    (hrs)=     .833
     RUNOFF VOLUME    (mm)=   12.833
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .458

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
003:0006-----------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
003:0002-----------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
003:0002-----------------------------------------------------------------------
-
  ** END OF RUN :   3

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 004
    NSTORM=   1
           #  1=LYA5.12h
-------------------------------------------------------------------------------
-
```

```
004:0002--------------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC III Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 5 Year)
| Ptotal=  55.97 mm|    Comments: Belleville IDF (12-hr 30% AES - 5 Year)
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               1.00   5.247 |   4.00   8.745 |   7.00   1.749 |  10.00    .000
               2.00  15.158 |   5.00   8.162 |   8.00    .583 |  11.00    .000
               3.00  11.660 |   6.00   4.664 |   9.00    .000 |  12.00    .000

--------------------------------------------------------------------------------
-
004:0003--------------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .295 (i)
     TIME TO PEAK    (hrs)=    5.100
     RUNOFF VOLUME    (mm)=   20.644
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .369

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0004--------------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .303 (i)
     TIME TO PEAK    (hrs)=    3.100
     RUNOFF VOLUME    (mm)=   35.878
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .641

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0005--------------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=90.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .231 (i)
     TIME TO PEAK    (hrs)=    3.083
     RUNOFF VOLUME    (mm)=   35.878
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .641

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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004:0006--------------------------------------------------------------------------------
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004:0002--------------------------------------------------------------------------------
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004:0002--------------------------------------------------------------------------------
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004:0002--------------------------------------------------------------------------------
-
  ** END OF RUN :   4

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
           #  1=LYA100.1hr
--------------------------------------------------------------------------------
-
005:0002--------------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
```

```
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC III Conditions
*#
*#*************************************************************************
--------------------------------------------------------------------------------
-
005:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 100 Year)
| Ptotal=  44.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 100 Year)
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .08  47.628 |    .33  58.212 |    .58  52.920 |    .83  15.876
                .17  74.088 |    .42  68.796 |    .67  26.460 |    .92   5.292
                .25 111.132 |    .50  47.628 |    .75  21.168 |   1.00    .000

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-
005:0003--------------------------------------------------------------------------
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----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .671 (i)
     TIME TO PEAK    (hrs)=    1.167
     RUNOFF VOLUME    (mm)=   13.765
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .312

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
005:0004--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=    1.013 (i)
     TIME TO PEAK    (hrs)=     .850
     RUNOFF VOLUME    (mm)=   25.624
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .581

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
005:0005--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=90.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .809 (i)
     TIME TO PEAK    (hrs)=     .817
     RUNOFF VOLUME    (mm)=   25.624
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .581

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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005:0006--------------------------------------------------------------------------
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005:0002--------------------------------------------------------------------------
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005:0002--------------------------------------------------------------------------
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-
005:0002--------------------------------------------------------------------------
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-
005:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   5

*************************************************************************



--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 006
    NSTORM=   1
          #  1=LYA100.12h
--------------------------------------------------------------------------------
-
006:0002--------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC III Conditions
*#
*#*************************************************************************
--------------------------------------------------------------------------------
-
```

```
006:0002----------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 100 Year
| Ptotal=  93.70 mm|    Comments: Belleville IDF (12-hr 30% AES - 100 Year
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              1.00   8.784 |   4.00  14.640 |   7.00   2.928 |  10.00    .000
              2.00  25.376 |   5.00  13.664 |   8.00    .976 |  11.00    .000
              3.00  19.520 |   6.00   7.808 |   9.00    .000 |  12.00    .000

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006:0003----------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .665 (i)
     TIME TO PEAK    (hrs)=    3.550
     RUNOFF VOLUME    (mm)=   46.848
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .500

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------
-
006:0004----------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .601 (i)
     TIME TO PEAK    (hrs)=    2.383
     RUNOFF VOLUME    (mm)=   70.588
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .753

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------
-
006:0005----------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=90.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .464 (i)
     TIME TO PEAK    (hrs)=    2.300
     RUNOFF VOLUME    (mm)=   70.588
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .753

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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006:0006----------------------------------------------------------------------------
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006:0002----------------------------------------------------------------------------
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006:0002----------------------------------------------------------------------------
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006:0002----------------------------------------------------------------------------
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006:0002----------------------------------------------------------------------------
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-
006:0002----------------------------------------------------------------------------
-
  ** END OF RUN :   6

********************************************************************************



--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 007
    NSTORM=   1
           #  1=25mm.4hr
----------------------------------------------------------------------------------
-
007:0002----------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - EXISTING CONDITIONS
*#
*# - Hydrologic conditions represent site prior to construction
*# - AMC III Conditions
*#
*#*****************************************************************************
----------------------------------------------------------------------------------
-
007:0002----------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: 25 mm, 4hr Chicago Storm
```

```
| Ptotal=  25.00 mm|    Comments: 25 mm, 4hr Chicago Storm
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .08   1.465 |   1.08   4.024 |   2.08   5.764 |   3.08   2.074
                .17   1.540 |   1.17   4.814 |   2.17   4.969 |   3.17   1.977
                .25   1.625 |   1.25   6.025 |   2.25   4.374 |   3.25   1.889
                .33   1.720 |   1.33   8.114 |   2.33   3.913 |   3.33   1.810
                .42   1.829 |   1.42  12.526 |   2.42   3.545 |   3.42   1.737
                .50   1.955 |   1.50  27.198 |   2.50   3.245 |   3.50   1.671
                .58   2.101 |   1.58  74.855 |   2.58   2.994 |   3.58   1.610
                .67   2.274 |   1.67  31.410 |   2.67   2.782 |   3.67   1.553
                .75   2.482 |   1.75  16.819 |   2.75   2.601 |   3.75   1.501
                .83   2.736 |   1.83  11.357 |   2.83   2.443 |   3.83   1.453
                .92   3.055 |   1.92   8.563 |   2.92   2.305 |   3.92   1.408
               1.00   3.468 |   2.00   6.882 |   3.00   2.183 |   4.00   1.366

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007:0003-----------------------------------------------------------------------
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----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .690

     Unit Hyd Qpeak  (cms)=    1.335

     PEAK FLOW       (cms)=     .171 (i)
     TIME TO PEAK    (hrs)=    2.467
     RUNOFF VOLUME    (mm)=    4.898
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .196

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
007:0004-----------------------------------------------------------------------
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----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 01:D-100  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .312 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   10.677
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .427

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
007:0005-----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=90.00
| 01:D-101  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .251 (i)
     TIME TO PEAK    (hrs)=    2.017
     RUNOFF VOLUME    (mm)=   10.677
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .427

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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007:0006-----------------------------------------------------------------------
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007:0002-----------------------------------------------------------------------
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007:0002-----------------------------------------------------------------------
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007:0002-----------------------------------------------------------------------
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007:0002-----------------------------------------------------------------------
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-
007:0002-----------------------------------------------------------------------
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-
007:0002-----------------------------------------------------------------------
-
      FINISH
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-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2017-11-20     at 20:58:01
===============================================================================
=
```

APPENDIX C – INTERIM CONDITIONS

NRCS (SCS) Curve Number Determination – Interim Conditions
Interim Conditions SWMHYMO Output – AMC II
Interim Conditions SWMHYMO Output – AMC III

Subject: **NRCS (SCS) Curve Number Determination - During Construction**
Project: **Loyalist Solar Project**
Site: **Substation**
Project No.: **1335-60220**
Client: **Loyalist Solar LP**
Date: **November 23, 2017**

TABLE OF CURVE NUMBERS (CN's)								
Land Use		Hydrologic Soil Type							Source
		A	AB	B	BC	C	CD	D	
Meadow	"Good"	30	44	58	65	71	75	78	USDA
Woodlot	"Fair"	36	48	60	67	73	76	79	USDA
Lawns	"Good"	39	50	61	68	74	77	80	USDA
Pasture/Range	"Fair"	49	55	60	70	79	82	84	USDA
Crop - SR + CR	"Good"	64	70	75	79	82	84	85	USDA
Gravel		76	81	85	87	89	90	91	USDA
Scarified Soil		69	74	78	81	83	85	87	USDA
Wetland/Lake		100	100	100	100	100	100	100	USDA
Impervious		98	98	98	98	98	98	98	USDA

USDA - United States Department of Agriculture (2004), National Engineering Handbook, Part 630 Hydrology, Chapter 9 Hydrologic Soil Cover Compexes
Scarified Soil CNs based on contour plowing & crop residue in poor hydrologic condition

HYDROLOGIC SOIL TYPE (%) - Interim Conditions								
	Hydrologic Soil Type							
Catchment	A	AB	B	BC	C	CD	D	TOTAL
EXT D-1			50				50	100
D-200							100	100
D-201							100	100

LAND USE (%) - Interim Conditions										
Catchment	Meadow	Woodlot	Lawns	Pasture Range	Crop	Gravel	Scarified Soil	Wetland	Impervious	Total
EXT D-1	49				50				1	100
D-200							96		4	100
D-201							98		2	100

CURVE NUMBER (CN) - Interim Conditions											
Catchment	Meadow	Woodlot	Lawns	Pasture Range	Crop	Gravel	Scarified Soil	Wetland/ Lakes	Impervious	Weighted CN (AMC II)	Weighted CN (AMC III)
EXT D-1	33				40				1	74	88
D-200							84		4	87	95
D-201							85		2	87	95

Notes: AMC II assumed - AMC III Conversion Per Soil Conservation Service Curve Number (SCS-CN) Methodology (Mishra, Surendra and Vijay P. Sing (2003))
Hydrological Soil Groups based on guidance presented in National Engineering Handbook

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                         9   9  9   9   # 4730904
        StormWater Management HYdrologic Model            999    999   =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                    OTTHYMO-83 and OTTHYMO-89.                *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                   Ottawa,  Ontario: (613) 836-3884          *********
 *********                   Gatineau, Quebec: (819) 243-6858          *********
 *********                   E-Mail: swmhymo@jfsa.Com                  *********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)          +++++++++
 +++++++++                Kitchener              SERIAL#:4730904       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10           *********
 *********           Max. number of rainfall points: 105408           *********
 *********           Max. number of flow points    : 105408           *********
 ********************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2017-11-22     TIME: 20:29:56     RUN COUNTER: 000666         *
 ********************************************************************************
 * Input   filename: Z:\Temp\Loyalist\DINT2-2.dat                               *
 * Output  filename: Z:\Temp\Loyalist\DINT2-2.out                               *
 * Summary filename: Z:\Temp\Loyalist\DINT2-2.sum                               *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
-
001:0001----------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#*****************************************************************************
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
          #  1=LYA2.1hr
--------------------------------------------------------------------------------
-
001:0002----------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 2 Year)
| Ptotal=  22.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 2 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  23.868 |    .33  29.172 |    .58  26.520 |    .83   7.956
               .17  37.128 |    .42  34.476 |    .67  13.260 |    .92   2.652
               .25  55.692 |    .50  23.868 |    .75  10.608 |   1.00    .000

--------------------------------------------------------------------------------
-
001:0003----------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .204 (i)
     TIME TO PEAK    (hrs)=    1.133
     RUNOFF VOLUME    (mm)=    3.863
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .175

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0004----------------------------------------------------------------------------
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----------------------
| CALIB NASHYD       |   Area    (ha)=   12.94   Curve Number   (CN)=87.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .235 (i)
     TIME TO PEAK    (hrs)=     .883
     RUNOFF VOLUME    (mm)=    5.311
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .240

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005----------------------------------------------------------------------------
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```

```
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .235      .883      5.311
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -53.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.6873E-01

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
001:0006-----------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=    9.85   Curve Number   (CN)=87.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .185 (i)
     TIME TO PEAK    (hrs)=     .867
     RUNOFF VOLUME    (mm)=    5.311
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .240

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0007-----------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .185      .867      5.311
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -52.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.5232E-01

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
001:0008-----------------------------------------------------------------------
-
*#**************************************************************************
*#                              AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 01:EXTD-1      24.12     .204    1.13   3.86    .000
                       +ID2 03:      3000  12.94     .000     .00    .00    .000
                       +ID3 04:      3010   9.85     .000     .00    .00    .000
                        ==========================================================
                        SUM 02:      3020  46.91     .204    1.13   1.99    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
001:0009-----------------------------------------------------------------------
-
  ** END OF RUN :   1

*******************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=LYA2.12h
-------------------------------------------------------------------------------
-
002:0002-----------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#**************************************************************************
-------------------------------------------------------------------------------
-
002:0002-----------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 2 Year)
| Ptotal=  42.24 mm|    Comments: Belleville IDF (12-hr 30% AES - 2 Year)
```

```
--------------------
              TIME     RAIN |   TIME     RAIN |   TIME     RAIN |   TIME     RAIN
               hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr
              1.00    3.960 |   4.00    6.600 |   7.00    1.320 |  10.00     .000
              2.00   11.440 |   5.00    6.160 |   8.00     .440 |  11.00     .000
              3.00    8.800 |   6.00    3.520 |   9.00     .000 |  12.00     .000

--------------------------------------------------------------------------------
-
002:0003----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .187 (i)
     TIME TO PEAK    (hrs)=    5.117
     RUNOFF VOLUME    (mm)=   12.769
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .302

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
002:0004----------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=   12.94   Curve Number   (CN)=87.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .157 (i)
     TIME TO PEAK    (hrs)=    3.167
     RUNOFF VOLUME    (mm)=   18.443
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .437

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
002:0005----------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .157     3.167     18.443
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -190.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2387E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
002:0006----------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=    9.85   Curve Number   (CN)=87.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .120 (i)
     TIME TO PEAK    (hrs)=    3.150
     RUNOFF VOLUME    (mm)=   18.443
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .437

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
002:0007----------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .120     3.150     18.443
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -189.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1817E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
002:0008----------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                         ID1 01:EXTD-1       24.12     .187    5.12  12.77    .000
                        +ID2 03:      3000   12.94     .000     .00    .00    .000
                        +ID3 04:      3010    9.85     .000     .00    .00    .000
                         ==========================================================
                         SUM 02:      3020   46.91     .187    5.12   6.57    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------------------------------------------------------------------
-
002:0009--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
002:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   2

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 003
    NSTORM=   1
           #  1=LYA5.1hr
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date         : 11-20-2017
*#  Modeller     : [N. Emery]
*#  Company      : Stantec Consulting Ltd. (London)
*#  License #    :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 5 Year)
| Ptotal=  28.00 mm|    Comments: Belleville IDF (1-hr 30% AES - 5 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  30.240 |    .33  36.960 |    .58  33.600 |    .83  10.080
               .17  47.040 |    .42  43.680 |    .67  16.800 |    .92   3.360
               .25  70.560 |    .50  30.240 |    .75  13.440 |   1.00    .000

--------------------------------------------------------------------------------
-
003:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .320 (i)
     TIME TO PEAK    (hrs)=    1.117
     RUNOFF VOLUME    (mm)=    6.067
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .217

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
003:0004--------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=   12.94   Curve Number   (CN)=87.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .379 (i)
     TIME TO PEAK    (hrs)=     .867
     RUNOFF VOLUME    (mm)=    8.679
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .310

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
003:0005--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )    |
| OUT<03:(003000)    |    =========  OUTLFOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |    (cms)     (ha.m.)
                             .000  .0000E+00    |    3.000  .3400E+00
                             .000  .3200E+00    |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .379      .867      8.679
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -52.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1123E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
003:0006--------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=    9.85   Curve Number   (CN)=87.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140
```

```
     PEAK FLOW       (cms)=     .298 (i)
     TIME TO PEAK    (hrs)=     .850
     RUNOFF VOLUME    (mm)=    8.679
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .310

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
003:0007--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >02: (D-201 )       9.85      .298      .850       8.679
     OUTFLOW<04: (003010)       9.85      .000      .000        .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -51.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.8549E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
003:0008--------------------------------------------------------------------------
-
*#**************************************************************************
*#                              AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:EXTD-1       24.12     .320    1.12   6.07    .000
                     +ID2 03:      3000    12.94     .000     .00    .00    .000
                     +ID3 04:      3010     9.85     .000     .00    .00    .000
                      ==========================================================
                      SUM 02:      3020    46.91     .320    1.12   3.12    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
003:0009--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   3

********************************************************************************




--------------------
| START             |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 004
    NSTORM=   1
             #  1=LYA5.12h
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date         : 11-20-2017
*#  Modeller     : [N. Emery]
*#  Company      : Stantec Consulting Ltd. (London)
*#  License #    :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 5 Year)
| Ptotal=  55.97 mm|    Comments: Belleville IDF (12-hr 30% AES - 5 Year)
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             1.00   5.247 |   4.00   8.745 |   7.00   1.749 |  10.00    .000
             2.00  15.158 |   5.00   8.162 |   8.00    .583 |  11.00    .000
             3.00  11.660 |   6.00   4.664 |   9.00    .000 |  12.00    .000

--------------------------------------------------------------------------------
-
004:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .295 (i)
     TIME TO PEAK    (hrs)=    5.083
     RUNOFF VOLUME    (mm)=   20.644
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .369
```

```
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0004--------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=   12.94   Curve Number   (CN)=87.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .251 (i)
     TIME TO PEAK    (hrs)=    3.133
     RUNOFF VOLUME    (mm)=   29.214
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .522

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0005--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )    |
| OUT<03:(003000)    |    =========  OUTLFOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)    |    (cms)    (ha.m.)
                             .000  .0000E+00    |    3.000  .3400E+00
                             .000  .3200E+00    |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )       12.94      .251     3.133     29.214
     OUTFLOW<03: (003000)       12.94      .142     5.933      4.526

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   56.634
                  TIME SHIFT OF PEAK FLOW         (min)=   168.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3209E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
004:0006--------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=    9.85   Curve Number   (CN)=87.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .192 (i)
     TIME TO PEAK    (hrs)=    3.117
     RUNOFF VOLUME    (mm)=   29.214
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .522

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0007--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )    |
| OUT<04:(003010)    |    =========  OUTLFOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)    |    (cms)    (ha.m.)
                             .000  .0000E+00    |    2.000  .2700E+00
                             .000  .2600E+00    |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )        9.85      .192     3.117     29.214
     OUTFLOW<04: (003010)        9.85      .085     6.300      2.901

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   44.034
                  TIME SHIFT OF PEAK FLOW         (min)=   191.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2604E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
004:0008--------------------------------------------------------------------------
-
*#**************************************************************************
*#                              AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 01:EXTD-1      24.12     .295    5.08  20.64    .000
                       +ID2 03:      3000  12.94     .142    5.93   4.53    .000
                       +ID3 04:      3010   9.85     .085    6.30   2.90    .000
                        ==========================================================
                        SUM 02:      3020  46.91     .403    6.28  12.44    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
004:0009--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   4

********************************************************************************
```

```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
           #  1=LYA100.1hr
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#*************************************************************************
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 100 Year)
| Ptotal=  44.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 100 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  47.628 |    .33  58.212 |    .58  52.920 |    .83  15.876
               .17  74.088 |    .42  68.796 |    .67  26.460 |    .92   5.292
               .25 111.132 |    .50  47.628 |    .75  21.168 |   1.00    .000

-------------------------------------------------------------------------------
-
005:0003---------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .724 (i)
     TIME TO PEAK    (hrs)=    1.117
     RUNOFF VOLUME    (mm)=   13.765
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .312

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
005:0004---------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area     (ha)=   12.94   Curve Number   (CN)=87.00
| 02:D-200  DT= 1.00 |   Ia       (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .852 (i)
     TIME TO PEAK    (hrs)=     .833
     RUNOFF VOLUME    (mm)=   19.841
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .450

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
005:0005---------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )    |
| OUT<03:(003000)    |    =========  OUTLFOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
                             .000  .0000E+00    |    3.000  .3400E+00
                             .000  .3200E+00    |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .852      .833     19.841
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -50.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2567E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
005:0006---------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area     (ha)=    9.85   Curve Number   (CN)=87.00
| 02:D-201  DT= 1.00 |   Ia       (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .670 (i)
     TIME TO PEAK    (hrs)=     .817
     RUNOFF VOLUME    (mm)=   19.841
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .450

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
005:0007---------------------------------------------------------------------------
-
*#*************************************************************************
```

```
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00   |    2.000  .2700E+00
                          .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .670      .817     19.841
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -49.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1954E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
005:0008---------------------------------------------------------------------
-
*#**************************************************************************
*#                              AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                     ID1 01:EXTD-1        24.12     .724    1.12  13.76    .000
                    +ID2 03:      3000    12.94     .000     .00    .00    .000
                    +ID3 04:      3010     9.85     .000     .00    .00    .000
                     ==========================================================
                     SUM 02:      3020    46.91     .724    1.12   7.08    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
005:0009---------------------------------------------------------------------
-
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005:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------
-
  ** END OF RUN :   5

**************************************************************************
--------------------
| START             |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 006
    NSTORM=   1
             #  1=LYA100.12h
-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#**************************************************************************
-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 100 Year
| Ptotal=  93.70 mm|    Comments: Belleville IDF (12-hr 30% AES - 100 Year
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             1.00   8.784 |   4.00  14.640 |   7.00   2.928 |  10.00    .000
             2.00  25.376 |   5.00  13.664 |   8.00    .976 |  11.00    .000
             3.00  19.520 |   6.00   7.808 |   9.00    .000 |  12.00    .000

-------------------------------------------------------------------------------
-
006:0003---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .675 (i)
     TIME TO PEAK    (hrs)=    3.417
     RUNOFF VOLUME    (mm)=   46.848
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .500

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
006:0004---------------------------------------------------------------------
-
```

```
---------------------
| CALIB NASHYD       |   Area     (ha)=   12.94   Curve Number   (CN)=87.00
| 02:D-200  DT= 1.00 |   Ia       (mm)=   5.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .537 (i)
     TIME TO PEAK    (hrs)=    3.083
     RUNOFF VOLUME    (mm)=   62.116
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .663

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
006:0005---------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .537     3.083     62.116
     OUTFLOW<03: (003000)      12.94      .492     3.450     37.387

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   91.639
                  TIME SHIFT OF PEAK FLOW         (min)=    22.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3233E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
006:0006---------------------------------------------------------------------
-
---------------------
| CALIB NASHYD       |   Area     (ha)=    9.85   Curve Number   (CN)=87.00
| 02:D-201  DT= 1.00 |   Ia       (mm)=   5.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .410 (i)
     TIME TO PEAK    (hrs)=    3.067
     RUNOFF VOLUME    (mm)=   62.116
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .663

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
006:0007---------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .410     3.067     62.116
     OUTFLOW<04: (003010)       9.85      .364     3.517     35.720

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   88.811
                  TIME SHIFT OF PEAK FLOW         (min)=    27.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2618E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
006:0008---------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 01:EXTD-1        24.12     .675    3.42  46.85    .000
                       +ID2 03:      3000    12.94     .492    3.45  37.39    .000
                       +ID3 04:      3010     9.85     .364    3.52  35.72    .000
                        ==========================================================
                        SUM 02:      3020    46.91    1.523    3.50  41.90    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
006:0009---------------------------------------------------------------------
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-------------------------------------------------------------------------------
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006:0002---------------------------------------------------------------------
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-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
  ** END OF RUN :   6

*******************************************************************************
```

```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 007
    NSTORM=   1
           #  1=25mm.4hr
--------------------------------------------------------------------------------
-
007:0002-----------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
007:0002-----------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: 25 mm, 4hr Chicago Storm
| Ptotal=  25.00 mm|    Comments: 25 mm, 4hr Chicago Storm
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   1.465 |   1.08   4.024 |   2.08   5.764 |   3.08   2.074
               .17   1.540 |   1.17   4.814 |   2.17   4.969 |   3.17   1.977
               .25   1.625 |   1.25   6.025 |   2.25   4.374 |   3.25   1.889
               .33   1.720 |   1.33   8.114 |   2.33   3.913 |   3.33   1.810
               .42   1.829 |   1.42  12.526 |   2.42   3.545 |   3.42   1.737
               .50   1.955 |   1.50  27.198 |   2.50   3.245 |   3.50   1.671
               .58   2.101 |   1.58  74.855 |   2.58   2.994 |   3.58   1.610
               .67   2.274 |   1.67  31.410 |   2.67   2.782 |   3.67   1.553
               .75   2.482 |   1.75  16.819 |   2.75   2.601 |   3.75   1.501
               .83   2.736 |   1.83  11.357 |   2.83   2.443 |   3.83   1.453
               .92   3.055 |   1.92   8.563 |   2.92   2.305 |   3.92   1.408
              1.00   3.468 |   2.00   6.882 |   3.00   2.183 |   4.00   1.366

--------------------------------------------------------------------------------
-
007:0003-----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .182 (i)
     TIME TO PEAK    (hrs)=    2.400
     RUNOFF VOLUME    (mm)=    4.898
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .196

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
007:0004-----------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=   12.94   Curve Number   (CN)=87.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .200 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=    6.902
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .276

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
007:0005-----------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .200     2.050      6.902
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -123.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.8932E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
007:0006-----------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=    9.85   Curve Number   (CN)=87.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .158 (i)
     TIME TO PEAK    (hrs)=    2.033
     RUNOFF VOLUME    (mm)=    6.902
     TOTAL RAINFALL   (mm)=   25.000
```

```
     RUNOFF COEFFICIENT   =     .276

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
-
007:0007----------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .158     2.033      6.902
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -122.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.6799E-01

      *** WARNING: Outflow volume is less than inflow volume.
------------------------------------------------------------------------------
-
007:0008----------------------------------------------------------------------
-
*#**************************************************************************
*#                          AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                    ID1 01:EXTD-1        24.12     .182    2.40   4.90    .000
                   +ID2 03:      3000    12.94     .000     .00    .00    .000
                   +ID3 04:      3010     9.85     .000     .00    .00    .000
                    ==========================================================
                    SUM 02:      3020    46.91     .182    2.40   2.52    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
-
007:0009----------------------------------------------------------------------
-
------------------------------------------------------------------------------
-
007:0002----------------------------------------------------------------------
-
------------------------------------------------------------------------------
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007:0002----------------------------------------------------------------------
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-
007:0002----------------------------------------------------------------------
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-

007:0002----------------------------------------------------------------------
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------------------------------------------------------------------------------
-
007:0002----------------------------------------------------------------------
-
------------------------------------------------------------------------------
-
007:0002----------------------------------------------------------------------
-
      FINISH
------------------------------------------------------------------------------
-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 001:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 002:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 002:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 003:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 003:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 004:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 004:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 005:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 005:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 006:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 006:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 007:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 007:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-11-22     at 20:29:59
==============================================================================
=
```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9    =========
                                                        9   9  9   9   # 4730904
        StormWater Management HYdrologic Model           999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                    OTTHYMO-83 and OTTHYMO-89.                *********
 ********************************************************************************
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 *********                   Gatineau, Quebec: (819) 243-6858          *********
 *********                   E-Mail: swmhymo@jfsa.Com                  *********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)          +++++++++
 +++++++++                Kitchener              SERIAL#:4730904       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10           *********
 *********           Max. number of rainfall points: 105408           *********
 *********           Max. number of flow points    : 105408           *********
 ********************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2017-11-22     TIME: 20:30:18     RUN COUNTER: 000667         *
 ********************************************************************************
 * Input   filename: Z:\Temp\Loyalist\DINT3-2.dat                               *
 * Output  filename: Z:\Temp\Loyalist\DINT3-2.out                               *
 * Summary filename: Z:\Temp\Loyalist\DINT3-2.sum                               *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
-
001:0001--------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC III Conditions
*#
*#*****************************************************************************
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
          #  1=LYA2.1hr
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 2 Year)
| Ptotal=  22.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 2 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  23.868 |    .33  29.172 |    .58  26.520 |    .83   7.956
               .17  37.128 |    .42  34.476 |    .67  13.260 |    .92   2.652
               .25  55.692 |    .50  23.868 |    .75  10.608 |   1.00    .000

--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .204 (i)
     TIME TO PEAK    (hrs)=    1.133
     RUNOFF VOLUME    (mm)=    3.863
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .175

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=   12.94   Curve Number   (CN)=95.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .422 (i)
     TIME TO PEAK    (hrs)=     .867
     RUNOFF VOLUME    (mm)=    9.597
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .434

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
```

```
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .422      .867      9.597
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -52.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1242E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
001:0006-----------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=    9.85   Curve Number   (CN)=95.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .332 (i)
     TIME TO PEAK    (hrs)=     .833
     RUNOFF VOLUME    (mm)=    9.597
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .434

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0007-----------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .332      .833      9.597
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -50.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.9453E-01

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
001:0008-----------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 01:EXTD-1      24.12     .204    1.13   3.86    .000
                       +ID2 03:      3000  12.94     .000     .00    .00    .000
                       +ID3 04:      3010   9.85     .000     .00    .00    .000
                        ==========================================================
                        SUM 02:      3020  46.91     .204    1.13   1.99    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
001:0009-----------------------------------------------------------------------
-
  ** END OF RUN :   1

*************************************************************************



--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=LYA2.12h
-------------------------------------------------------------------------------
-
002:0002-----------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC III Conditions
*#
*#*************************************************************************
-------------------------------------------------------------------------------
-
002:0002-----------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 2 Year)
| Ptotal=  42.24 mm|    Comments: Belleville IDF (12-hr 30% AES - 2 Year)
```

```
--------------------
              TIME     RAIN |   TIME     RAIN |   TIME     RAIN |   TIME     RAIN
               hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr
              1.00    3.960 |   4.00    6.600 |   7.00    1.320 |  10.00     .000
              2.00   11.440 |   5.00    6.160 |   8.00     .440 |  11.00     .000
              3.00    8.800 |   6.00    3.520 |   9.00     .000 |  12.00     .000

-------------------------------------------------------------------------------
-
002:0003---------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .187 (i)
     TIME TO PEAK    (hrs)=    5.117
     RUNOFF VOLUME    (mm)=   12.769
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .302

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0004---------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=   12.94   Curve Number   (CN)=95.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .247 (i)
     TIME TO PEAK    (hrs)=    3.083
     RUNOFF VOLUME    (mm)=   27.403
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .649

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0005---------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .247     3.083     27.403
     OUTFLOW<03: (003000)      12.94      .102     6.283      2.737

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   41.367
                  TIME SHIFT OF PEAK FLOW         (min)=   192.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3207E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
002:0006---------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=    9.85   Curve Number   (CN)=95.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .189 (i)
     TIME TO PEAK    (hrs)=    3.083
     RUNOFF VOLUME    (mm)=   27.403
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .649

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0007---------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .189     3.083     27.403
     OUTFLOW<04: (003010)       9.85      .035     7.083      1.090

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   18.717
                  TIME SHIFT OF PEAK FLOW         (min)=   240.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2602E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
002:0008---------------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                         ID1 01:EXTD-1       24.12     .187    5.12  12.77    .000
                        +ID2 03:      3000   12.94     .102    6.28   2.74    .000
                        +ID3 04:      3010    9.85     .035    7.08   1.09    .000
                         ==========================================================
                         SUM 02:      3020   46.91     .234    6.27   7.51    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------------------------------------------------------------------
-
002:0009--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
002:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   2

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 003
    NSTORM=   1
           #  1=LYA5.1hr
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date         : 11-20-2017
*#  Modeller     : [N. Emery]
*#  Company      : Stantec Consulting Ltd. (London)
*#  License #    :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC III Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 5 Year)
| Ptotal=  28.00 mm|    Comments: Belleville IDF (1-hr 30% AES - 5 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  30.240 |    .33  36.960 |    .58  33.600 |    .83  10.080
               .17  47.040 |    .42  43.680 |    .67  16.800 |    .92   3.360
               .25  70.560 |    .50  30.240 |    .75  13.440 |   1.00    .000

--------------------------------------------------------------------------------
-
003:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .320 (i)
     TIME TO PEAK    (hrs)=    1.117
     RUNOFF VOLUME    (mm)=    6.067
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .217

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
003:0004--------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=   12.94   Curve Number   (CN)=95.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .631 (i)
     TIME TO PEAK    (hrs)=     .833
     RUNOFF VOLUME    (mm)=   14.546
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .519

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
003:0005--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )    |
| OUT<03:(003000)    |    =========  OUTLFOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |    (cms)     (ha.m.)
                             .000  .0000E+00    |    3.000  .3400E+00
                             .000  .3200E+00    |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .631      .833     14.546
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -50.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1882E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
003:0006--------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=    9.85   Curve Number   (CN)=95.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140
```

```
     PEAK FLOW       (cms)=     .497 (i)
     TIME TO PEAK    (hrs)=     .817
     RUNOFF VOLUME    (mm)=   14.546
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .519

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
003:0007--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .497      .817     14.546
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -49.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1433E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
003:0008--------------------------------------------------------------------------
-
*#**************************************************************************
*#                              AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:EXTD-1       24.12     .320    1.12   6.07    .000
                     +ID2 03:      3000    12.94     .000     .00    .00    .000
                     +ID3 04:      3010     9.85     .000     .00    .00    .000
                      ==========================================================
                      SUM 02:      3020    46.91     .320    1.12   3.12    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
003:0009--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   3

********************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 004
    NSTORM=   1
             #  1=LYA5.12h
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC III Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 5 Year)
| Ptotal=  55.97 mm|    Comments: Belleville IDF (12-hr 30% AES - 5 Year)
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             1.00   5.247 |   4.00   8.745 |   7.00   1.749 |  10.00    .000
             2.00  15.158 |   5.00   8.162 |   8.00    .583 |  11.00    .000
             3.00  11.660 |   6.00   4.664 |   9.00    .000 |  12.00    .000

--------------------------------------------------------------------------------
-
004:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .295 (i)
     TIME TO PEAK    (hrs)=    5.083
     RUNOFF VOLUME    (mm)=   20.644
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .369
```

```
     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0004--------------------------------------------------------------------------
-
---------------------
| CALIB NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=95.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .360 (i)
     TIME TO PEAK    (hrs)=    3.050
     RUNOFF VOLUME    (mm)=   40.377
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .721

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0005--------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    3.000  .3400E+00
                            .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )       12.94      .360     3.050     40.377
     OUTFLOW<03: (003000)       12.94      .281     4.467     15.648

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   78.155
                  TIME SHIFT OF PEAK FLOW         (min)=    85.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3219E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
004:0006--------------------------------------------------------------------------
-
---------------------
| CALIB NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=95.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .274 (i)
     TIME TO PEAK    (hrs)=    3.050
     RUNOFF VOLUME    (mm)=   40.377
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .721

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0007--------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    2.000  .2700E+00
                            .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )        9.85      .274     3.050     40.377
     OUTFLOW<04: (003010)        9.85      .211     4.617     14.092

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   77.045
                  TIME SHIFT OF PEAK FLOW         (min)=    94.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2611E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
004:0008--------------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 01:EXTD-1      24.12     .295    5.08  20.64    .000
                       +ID2 03:      3000   12.94     .281    4.47  15.65    .000
                       +ID3 04:      3010    9.85     .211    4.62  14.09    .000
                        ============================================================
                        SUM 02:      3020   46.91     .781    4.62  17.87    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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004:0009--------------------------------------------------------------------------
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004:0002--------------------------------------------------------------------------
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004:0002--------------------------------------------------------------------------
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--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   4

********************************************************************************
```

```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
           #  1=LYA100.1hr
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC III Conditions
*#
*#*************************************************************************
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 100 Year)
| Ptotal=  44.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 100 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .08  47.628 |    .33  58.212 |    .58  52.920 |    .83  15.876
              .17  74.088 |    .42  68.796 |    .67  26.460 |    .92   5.292
              .25 111.132 |    .50  47.628 |    .75  21.168 |   1.00    .000

-------------------------------------------------------------------------------
-
005:0003---------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .724 (i)
     TIME TO PEAK    (hrs)=    1.117
     RUNOFF VOLUME    (mm)=   13.765
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .312

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
005:0004---------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area     (ha)=   12.94   Curve Number   (CN)=95.00
| 02:D-200  DT= 1.00 |   Ia       (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=    1.244 (i)
     TIME TO PEAK    (hrs)=     .800
     RUNOFF VOLUME    (mm)=   29.138
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .661

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
005:0005---------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )    |
| OUT<03:(003000)    |    =========  OUTLFOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
                             .000  .0000E+00   |    3.000  .3400E+00
                             .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94     1.244      .800     29.138
     OUTFLOW<03: (003000)      12.94      .480     1.333      4.451

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.554
                  TIME SHIFT OF PEAK FLOW         (min)=    32.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3232E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
005:0006---------------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area     (ha)=    9.85   Curve Number   (CN)=95.00
| 02:D-201  DT= 1.00 |   Ia       (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .980 (i)
     TIME TO PEAK    (hrs)=     .783
     RUNOFF VOLUME    (mm)=   29.138
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .661

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
005:0007---------------------------------------------------------------------------
-
*#*************************************************************************
```

```
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00   |    2.000  .2700E+00
                          .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .980      .783     29.138
     OUTFLOW<04: (003010)       9.85      .263     1.400      2.825

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   26.801
                  TIME SHIFT OF PEAK FLOW         (min)=    37.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2613E+00

      *** WARNING: Outflow volume is less than inflow volume.
------------------------------------------------------------------------------------
-
005:0008--------------------------------------------------------------------------
-
*#**************************************************************************
*#                              AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                     ID1 01:EXTD-1        24.12     .724    1.12  13.76    .000
                    +ID2 03:      3000    12.94     .480    1.33   4.45    .000
                    +ID3 04:      3010     9.85     .263    1.40   2.83    .000
                     ========================================================
                     SUM 02:      3020    46.91    1.303    1.40   8.87    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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005:0009--------------------------------------------------------------------------
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005:0002--------------------------------------------------------------------------
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005:0002--------------------------------------------------------------------------
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005:0002--------------------------------------------------------------------------
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-
005:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   5

**************************************************************************
```

```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 006
    NSTORM=   1
             #  1=LYA100.12h
------------------------------------------------------------------------------------
-
006:0002--------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC III Conditions
*#
*#**************************************************************************
------------------------------------------------------------------------------------
-
006:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 100 Year
| Ptotal=  93.70 mm|    Comments: Belleville IDF (12-hr 30% AES - 100 Year
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             1.00   8.784 |   4.00  14.640 |   7.00   2.928 |  10.00    .000
             2.00  25.376 |   5.00  13.664 |   8.00    .976 |  11.00    .000
             3.00  19.520 |   6.00   7.808 |   9.00    .000 |  12.00    .000

------------------------------------------------------------------------------------
-
006:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .675 (i)
     TIME TO PEAK    (hrs)=    3.417
     RUNOFF VOLUME    (mm)=   46.848
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .500

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------
-
006:0004--------------------------------------------------------------------------
-
```

```
---------------------
| CALIB NASHYD       |   Area     (ha)=   12.94   Curve Number   (CN)=95.00
| 02:D-200  DT= 1.00 |   Ia       (mm)=   5.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .719 (i)
     TIME TO PEAK    (hrs)=    2.233
     RUNOFF VOLUME    (mm)=   77.079
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .823

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
006:0005----------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .719     2.233     77.079
     OUTFLOW<03: (003000)      12.94      .667     2.917     52.349

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   92.727
                  TIME SHIFT OF PEAK FLOW         (min)=    41.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3244E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
006:0006----------------------------------------------------------------------
-
---------------------
| CALIB NASHYD       |   Area     (ha)=    9.85   Curve Number   (CN)=95.00
| 02:D-201  DT= 1.00 |   Ia       (mm)=   5.000   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .554 (i)
     TIME TO PEAK    (hrs)=    2.200
     RUNOFF VOLUME    (mm)=   77.079
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .823

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
006:0007----------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .554     2.200     77.079
     OUTFLOW<04: (003010)       9.85      .506     2.950     50.683

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   91.399
                  TIME SHIFT OF PEAK FLOW         (min)=    45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2625E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
006:0008----------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 01:EXTD-1        24.12     .675    3.42  46.85    .000
                       +ID2 03:      3000    12.94     .667    2.92  52.35    .000
                       +ID3 04:      3010     9.85     .506    2.95  50.68    .000
                        ==========================================================
                        SUM 02:      3020    46.91    1.819    3.10  49.17    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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006:0009----------------------------------------------------------------------
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006:0002----------------------------------------------------------------------
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--------------------------------------------------------------------------------
-
006:0002----------------------------------------------------------------------
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-
006:0002----------------------------------------------------------------------
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006:0002----------------------------------------------------------------------
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--------------------------------------------------------------------------------
-
006:0002----------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
006:0002----------------------------------------------------------------------
-
  ** END OF RUN :   6

********************************************************************************
```

```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 007
    NSTORM=   1
           #  1=25mm.4hr
-------------------------------------------------------------------------------
-
007:0002---------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - INTERIM CONDITIONS
*#
*# - Hydrologic conditions represent site during construction, prior to
*#   establishment of stabilization vegetation
*# - Assumes contour plowing performed to provide surface scarification
*# - ESC/SWM control provided by slope interruption berms
*# - AMC III Conditions
*#
*#*************************************************************************
-------------------------------------------------------------------------------
-
007:0002---------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: 25 mm, 4hr Chicago Storm
| Ptotal=  25.00 mm|    Comments: 25 mm, 4hr Chicago Storm
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   1.465 |   1.08   4.024 |   2.08   5.764 |   3.08   2.074
               .17   1.540 |   1.17   4.814 |   2.17   4.969 |   3.17   1.977
               .25   1.625 |   1.25   6.025 |   2.25   4.374 |   3.25   1.889
               .33   1.720 |   1.33   8.114 |   2.33   3.913 |   3.33   1.810
               .42   1.829 |   1.42  12.526 |   2.42   3.545 |   3.42   1.737
               .50   1.955 |   1.50  27.198 |   2.50   3.245 |   3.50   1.671
               .58   2.101 |   1.58  74.855 |   2.58   2.994 |   3.58   1.610
               .67   2.274 |   1.67  31.410 |   2.67   2.782 |   3.67   1.553
               .75   2.482 |   1.75  16.819 |   2.75   2.601 |   3.75   1.501
               .83   2.736 |   1.83  11.357 |   2.83   2.443 |   3.83   1.453
               .92   3.055 |   1.92   8.563 |   2.92   2.305 |   3.92   1.408
              1.00   3.468 |   2.00   6.882 |   3.00   2.183 |   4.00   1.366

-------------------------------------------------------------------------------
-
007:0003---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .182 (i)
     TIME TO PEAK    (hrs)=    2.400
     RUNOFF VOLUME    (mm)=    4.898
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .196

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
007:0004---------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=   12.94   Curve Number   (CN)=95.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .350

     Unit Hyd Qpeak  (cms)=    1.412

     PEAK FLOW       (cms)=     .374 (i)
     TIME TO PEAK    (hrs)=    2.033
     RUNOFF VOLUME    (mm)=   11.988
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .479

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
007:0005---------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .374     2.033     11.988
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -122.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1551E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
007:0006---------------------------------------------------------------------
-
----------------------
| CALIB NASHYD       |   Area    (ha)=    9.85   Curve Number   (CN)=95.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   5.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .330

     Unit Hyd Qpeak  (cms)=    1.140

     PEAK FLOW       (cms)=     .296 (i)
     TIME TO PEAK    (hrs)=    2.000
     RUNOFF VOLUME    (mm)=   11.988
     TOTAL RAINFALL   (mm)=   25.000
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```
     RUNOFF COEFFICIENT   =     .479

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
007:0007----------------------------------------------------------------------
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*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .296     2.000     11.988
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -120.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1181E+00

      *** WARNING: Outflow volume is less than inflow volume.
------------------------------------------------------------------------------
-
007:0008----------------------------------------------------------------------
-
*#**************************************************************************
*#                          AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                    ID1 01:EXTD-1        24.12     .182    2.40   4.90    .000
                   +ID2 03:      3000    12.94     .000     .00    .00    .000
                   +ID3 04:      3010     9.85     .000     .00    .00    .000
                    ==========================================================
                    SUM 02:      3020    46.91     .182    2.40   2.52    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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007:0009----------------------------------------------------------------------
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007:0002----------------------------------------------------------------------
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007:0002----------------------------------------------------------------------
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007:0002----------------------------------------------------------------------
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007:0002----------------------------------------------------------------------
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------------------------------------------------------------------------------
-
007:0002----------------------------------------------------------------------
-
------------------------------------------------------------------------------
-
007:0002----------------------------------------------------------------------
-
      FINISH
------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 001:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 002:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 002:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 003:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 003:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 004:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 004:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 005:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 005:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 006:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 006:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 007:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 007:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-11-22     at 20:30:21
================================================================================
=
```

APPENDIX D – PROPOSED CONDITIONS

NRCS (SCS) Curve Number Determination – Proposed Conditions
Proposed Conditions SWMHYMO Output – AMC II
Proposed Conditions SWMHYMO Output – AMC III

Subject: **NRCS (SCS) Curve Number Determination - Proposed Conditions**
Project: **Loyalist Solar Project**
Site: **Substation**
Project No.: **1335-60220**
Client: **Loyalist Solar LP**
Date: **November 23, 2017**

TABLE OF CURVE NUMBERS (CN's)								
Land Use	Hydrologic Soil Type							Source
	A	AB	B	BC	C	CD	D	
Meadow "Good"	30	44	58	65	71	75	78	USDA
Woodlot "Fair"	36	48	60	67	73	76	79	USDA
Lawns "Good"	39	50	61	68	74	77	80	USDA
Pasture/Range "Fair"	49	55	60	70	79	82	84	USDA
Crop - SR + CR "Good"	64	70	75	79	82	84	85	USDA
Gravel	76	81	85	87	89	90	91	USDA
Scarified Soil	69	74	78	81	83	85	87	USDA
Wetland/Lake	100	100	100	100	100	100	100	USDA
Impervious	98	98	98	98	98	98	98	USDA

USDA - United States Department of Agriculture (2004), National Engineering Handbook, Part 630 Hydrology, Chapter 9 Hydrologic Soil Cover Compexes
Scarified Soil CNs based on contour plowing & crop residue in poor hydrologic condition

HYDROLOGIC SOIL TYPE (%) - Proposed Conditions								
	Hydrologic Soil Type							
Catchment	A	AB	B	BC	C	CD	D	TOTAL
EXT D-1			50				50	100
D-200							100	100
D-201							100	100

LAND USE (%) - Proposed Conditions										
Catchment	Meadow	Woodlot	Lawns	Pasture Range	Crop	Gravel	Scarified Soil	Wetland	Impervious	Total
EXT D-1	49				50				1	100
D-200	96								4	100
D-201	98								2	100

CURVE NUMBER (CN) - Proposed Conditions											
Catchment	Meadow	Woodlot	Lawns	Pasture Range	Crop	Gravel	Scarified Soil	Wetland/ Lakes	Impervious	Weighted CN (AMC II)	Weighted CN (AMC III)
EXT D-1	33				40				1	74	88
D-200	75								4	79	91
D-201	76								2	78	90

Notes: AMC II assumed - AMC III Conversion Per Soil Conservation Service Curve Number (SCS-CN) Methodology (Mishra, Surendra and Vijay P. Sing (2003))
Hydrological Soil Groups based on guidance presented in National Engineering Handbook

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9    =========
                                                        9   9  9   9   # 4730904
         StormWater Management HYdrologic Model          999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                  OTTHYMO-83 and OTTHYMO-89.                  *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                   Ottawa,  Ontario: (613) 836-3884          *********
 *********                   Gatineau, Quebec: (819) 243-6858          *********
 *********                   E-Mail: swmhymo@jfsa.Com                  *********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)          +++++++++
 +++++++++                Kitchener            SERIAL#:4730904        +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ********************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2017-11-23     TIME: 14:37:40     RUN COUNTER: 000668          *
 ********************************************************************************
 * Input   filename: Z:\Temp\Loyalist\DPR2-4.dat                                *
 * Output  filename: Z:\Temp\Loyalist\DPR2-4.out                                *
 * Summary filename: Z:\Temp\Loyalist\DPR2-4.sum                                *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
-
001:0001--------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#*****************************************************************************
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=LYA2.1hr
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 2 Year)
| Ptotal=  22.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 2 Year)
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .08  23.868 |    .33  29.172 |    .58  26.520 |    .83   7.956
              .17  37.128 |    .42  34.476 |    .67  13.260 |    .92   2.652
              .25  55.692 |    .50  23.868 |    .75  10.608 |   1.00    .000

--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .204 (i)
     TIME TO PEAK    (hrs)=    1.133
     RUNOFF VOLUME    (mm)=    3.863
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .175

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=79.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .193 (i)
     TIME TO PEAK    (hrs)=     .900
     RUNOFF VOLUME    (mm)=    4.816
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .218

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
*#*****************************************************************************
```

```
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    3.000  .3400E+00
                            .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .193      .900      4.816
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -54.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.6232E-01

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
001:0006-------------------------------------------------------------------------
-
---------------------
| DESIGN NASHYD     |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .147 (i)
     TIME TO PEAK    (hrs)=     .867
     RUNOFF VOLUME    (mm)=    4.601
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .208

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0007-------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    2.000  .2700E+00
                            .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .147      .867      4.601
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -52.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.4532E-01

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
001:0008-------------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 01:EXTD-1      24.12     .204    1.13   3.86    .000
                       +ID2 03:      3000  12.94     .000     .00    .00    .000
                       +ID3 04:      3010   9.85     .000     .00    .00    .000
                        ==========================================================
                        SUM 02:      3020  46.91     .204    1.13   1.99    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
001:0009-------------------------------------------------------------------------
-
  ** END OF RUN :   1

*******************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=LYA2.12h
-------------------------------------------------------------------------------
-
002:0002-------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#*************************************************************************
-------------------------------------------------------------------------------
-
002:0002-------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 2 Year)
| Ptotal=  42.24 mm|    Comments: Belleville IDF (12-hr 30% AES - 2 Year)
--------------------
```

```
             TIME     RAIN |   TIME     RAIN |   TIME     RAIN |   TIME     RAIN
              hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr
             1.00    3.960 |   4.00    6.600 |   7.00    1.320 |  10.00     .000
             2.00   11.440 |   5.00    6.160 |   8.00     .440 |  11.00     .000
             3.00    8.800 |   6.00    3.520 |   9.00     .000 |  12.00     .000

-------------------------------------------------------------------------------
-
002:0003---------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .187 (i)
     TIME TO PEAK    (hrs)=    5.117
     RUNOFF VOLUME    (mm)=   12.769
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .302

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0004---------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=79.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .123 (i)
     TIME TO PEAK    (hrs)=    3.183
     RUNOFF VOLUME    (mm)=   15.331
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .363

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0005---------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    3.000  .3400E+00
                            .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .123     3.183     15.331
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -191.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1984E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
002:0006---------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .090 (i)
     TIME TO PEAK    (hrs)=    3.167
     RUNOFF VOLUME    (mm)=   14.769
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .350

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0007---------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    2.000  .2700E+00
                            .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .090     3.167     14.769
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -190.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1455E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
002:0008---------------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                     ID1 01:EXTD-1        24.12     .187    5.12  12.77    .000
                    +ID2 03:      3000    12.94     .000     .00    .00    .000
                    +ID3 04:      3010     9.85     .000     .00    .00    .000
                     ========================================================
                     SUM 02:      3020    46.91     .187    5.12   6.57    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
-------------------------------------------------------------------------------
-
002:0009---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
002:0002---------------------------------------------------------------------
-
  ** END OF RUN :   2

*******************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 003
    NSTORM=   1
           #  1=LYA5.1hr
-------------------------------------------------------------------------------
-
003:0002---------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date         : 11-20-2017
*#  Modeller     : [N. Emery]
*#  Company      : Stantec Consulting Ltd. (London)
*#  License #    :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#**************************************************************************
-------------------------------------------------------------------------------
-
003:0002---------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 5 Year)
| Ptotal=  28.00 mm|    Comments: Belleville IDF (1-hr 30% AES - 5 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  30.240 |    .33  36.960 |    .58  33.600 |    .83  10.080
               .17  47.040 |    .42  43.680 |    .67  16.800 |    .92   3.360
               .25  70.560 |    .50  30.240 |    .75  13.440 |   1.00    .000

-------------------------------------------------------------------------------
-
003:0003---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .320 (i)
     TIME TO PEAK    (hrs)=    1.117
     RUNOFF VOLUME    (mm)=    6.067
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .217

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
003:0004---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   12.94   Curve Number   (CN)=79.00
| 02:D-200  DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .298 (i)
     TIME TO PEAK    (hrs)=     .900
     RUNOFF VOLUME    (mm)=    7.469
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .267

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
003:0005---------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )    |
| OUT<03:(003000)    |    =========  OUTFLOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    3.000  .3400E+00
                            .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .298      .900      7.469
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -54.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.9665E-01

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
003:0006---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=    9.85   Curve Number   (CN)=78.00
| 02:D-201  DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045
```

```
     PEAK FLOW       (cms)=     .228 (i)
     TIME TO PEAK    (hrs)=     .867
     RUNOFF VOLUME    (mm)=    7.156
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .256

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
003:0007--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .228      .867      7.156
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -52.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.7048E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
003:0008--------------------------------------------------------------------------
-
*#**************************************************************************
*#                              AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                     ID1 01:EXTD-1        24.12     .320    1.12   6.07    .000
                    +ID2 03:      3000    12.94     .000     .00    .00    .000
                    +ID3 04:      3010     9.85     .000     .00    .00    .000
                     ==========================================================
                     SUM 02:      3020    46.91     .320    1.12   3.12    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
003:0009--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   3

********************************************************************************
```

```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 004
    NSTORM=   1
           #  1=LYA5.12h
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 5 Year)
| Ptotal=  55.97 mm|    Comments: Belleville IDF (12-hr 30% AES - 5 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              1.00   5.247 |   4.00   8.745 |   7.00   1.749 |  10.00    .000
              2.00  15.158 |   5.00   8.162 |   8.00    .583 |  11.00    .000
              3.00  11.660 |   6.00   4.664 |   9.00    .000 |  12.00    .000

--------------------------------------------------------------------------------
-
004:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .295 (i)
     TIME TO PEAK    (hrs)=    5.083
     RUNOFF VOLUME    (mm)=   20.644
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .369

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
-
004:0004--------------------------------------------------------------------------
-
---------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=79.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .197 (i)
     TIME TO PEAK    (hrs)=    3.167
     RUNOFF VOLUME    (mm)=   24.320
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .435

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0005--------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00   |    3.000  .3400E+00
                          .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .197     3.167     24.320
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -190.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3147E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
004:0006--------------------------------------------------------------------------
-
---------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .146 (i)
     TIME TO PEAK    (hrs)=    3.150
     RUNOFF VOLUME    (mm)=   23.526
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .420

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
004:0007--------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00   |    2.000  .2700E+00
                          .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .146     3.150     23.526
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -189.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2317E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
004:0008--------------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 01:EXTD-1       24.12     .295    5.08  20.64    .000
                       +ID2 03:      3000   12.94     .000     .00    .00    .000
                       +ID3 04:      3010    9.85     .000     .00    .00    .000
                        ==========================================================
                        SUM 02:      3020   46.91     .295    5.08  10.61    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
004:0009--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
004:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   4

********************************************************************************



--------------------
```

```
| START            |  Project  dir.: Z:\Temp\Loyalist\
-------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
           #  1=LYA100.1hr
--------------------------------------------------------------------------------
-
005:0002----------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
005:0002----------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 100 Year)
| Ptotal=  44.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 100 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  47.628 |    .33  58.212 |    .58  52.920 |    .83  15.876
               .17  74.088 |    .42  68.796 |    .67  26.460 |    .92   5.292
               .25 111.132 |    .50  47.628 |    .75  21.168 |   1.00    .000

--------------------------------------------------------------------------------
-
005:0003----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .724 (i)
     TIME TO PEAK    (hrs)=    1.117
     RUNOFF VOLUME    (mm)=   13.765
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .312

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
005:0004----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=79.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .655 (i)
     TIME TO PEAK    (hrs)=     .883
     RUNOFF VOLUME    (mm)=   16.480
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .374

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
005:0005----------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .655      .883     16.480
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -53.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2133E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
005:0006----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .504 (i)
     TIME TO PEAK    (hrs)=     .850
     RUNOFF VOLUME    (mm)=   15.885
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .360

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
005:0007----------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
```

```
|  IN>02:(D-201 )    |
| OUT<04:(003010)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)    |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .504      .850     15.885
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -51.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1565E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
005:0008---------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                    ID1 01:EXTD-1        24.12     .724    1.12  13.76    .000
                   +ID2 03:      3000    12.94     .000     .00    .00    .000
                   +ID3 04:      3010     9.85     .000     .00    .00    .000
                    ==========================================================
                    SUM 02:      3020    46.91     .724    1.12   7.08    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-
005:0009---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------
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-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------
-
  ** END OF RUN :   5

*******************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 006
    NSTORM=   1
           #  1=LYA100.12h
-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#*************************************************************************
-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 100 Year
| Ptotal=  93.70 mm|    Comments: Belleville IDF (12-hr 30% AES - 100 Year
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             1.00   8.784 |   4.00  14.640 |   7.00   2.928 |  10.00    .000
             2.00  25.376 |   5.00  13.664 |   8.00    .976 |  11.00    .000
             3.00  19.520 |   6.00   7.808 |   9.00    .000 |  12.00    .000

-------------------------------------------------------------------------------
-
006:0003---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .675 (i)
     TIME TO PEAK    (hrs)=    3.417
     RUNOFF VOLUME    (mm)=   46.848
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .500

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
006:0004---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=79.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390
```

```
     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .441 (i)
     TIME TO PEAK    (hrs)=    3.117
     RUNOFF VOLUME    (mm)=   53.221
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .568

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
-
006:0005----------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .441     3.117     53.221
     OUTFLOW<03: (003000)      12.94      .388     3.900     28.491

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=   87.950
                 TIME SHIFT OF PEAK FLOW         (min)=    47.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=.3226E+00

      *** WARNING: Outflow volume is less than inflow volume.
------------------------------------------------------------------------------
-
006:0006----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .328 (i)
     TIME TO PEAK    (hrs)=    3.117
     RUNOFF VOLUME    (mm)=   51.882
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .554

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
-
006:0007----------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .328     3.117     51.882
     OUTFLOW<04: (003010)       9.85      .286     4.100     25.486

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=   87.305
                 TIME SHIFT OF PEAK FLOW         (min)=    59.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=.2614E+00

      *** WARNING: Outflow volume is less than inflow volume.
------------------------------------------------------------------------------
-
006:0008----------------------------------------------------------------------
-
*#**************************************************************************
*#                              AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                    ID1 01:EXTD-1        24.12      .675    3.42  46.85    .000
                   +ID2 03:      3000    12.94      .388    3.90  28.49    .000
                   +ID3 04:      3010     9.85      .286    4.10  25.49    .000
                    ==========================================================
                    SUM 02:      3020    46.91    1.327    4.05  37.30    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
-
006:0009----------------------------------------------------------------------
-
------------------------------------------------------------------------------
-
006:0002----------------------------------------------------------------------
-
------------------------------------------------------------------------------
-
006:0002----------------------------------------------------------------------
-
------------------------------------------------------------------------------
-
006:0002----------------------------------------------------------------------
-
------------------------------------------------------------------------------
-
006:0002----------------------------------------------------------------------
-
------------------------------------------------------------------------------
-
006:0002----------------------------------------------------------------------
-
  ** END OF RUN :   6

******************************************************************************



--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
```

```
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 007
    NSTORM=   1
           #  1=25mm.4hr
--------------------------------------------------------------------------------
-
007:0002--------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by slope interruption berms
*# - AMC II Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
007:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: 25 mm, 4hr Chicago Storm
| Ptotal=  25.00 mm|    Comments: 25 mm, 4hr Chicago Storm
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   1.465 |   1.08   4.024 |   2.08   5.764 |   3.08   2.074
               .17   1.540 |   1.17   4.814 |   2.17   4.969 |   3.17   1.977
               .25   1.625 |   1.25   6.025 |   2.25   4.374 |   3.25   1.889
               .33   1.720 |   1.33   8.114 |   2.33   3.913 |   3.33   1.810
               .42   1.829 |   1.42  12.526 |   2.42   3.545 |   3.42   1.737
               .50   1.955 |   1.50  27.198 |   2.50   3.245 |   3.50   1.671
               .58   2.101 |   1.58  74.855 |   2.58   2.994 |   3.58   1.610
               .67   2.274 |   1.67  31.410 |   2.67   2.782 |   3.67   1.553
               .75   2.482 |   1.75  16.819 |   2.75   2.601 |   3.75   1.501
               .83   2.736 |   1.83  11.357 |   2.83   2.443 |   3.83   1.453
               .92   3.055 |   1.92   8.563 |   2.92   2.305 |   3.92   1.408
              1.00   3.468 |   2.00   6.882 |   3.00   2.183 |   4.00   1.366

--------------------------------------------------------------------------------
-
007:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .182 (i)
     TIME TO PEAK    (hrs)=    2.400
     RUNOFF VOLUME    (mm)=    4.898
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .196

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
007:0004--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=79.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .170 (i)
     TIME TO PEAK    (hrs)=    2.067
     RUNOFF VOLUME    (mm)=    6.068
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .243

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
007:0005--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR  |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )  |
| OUT<03:(003000)  |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .170     2.067      6.068
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -124.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.7851E-01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
007:0006--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=78.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .130 (i)
     TIME TO PEAK    (hrs)=    2.033
     RUNOFF VOLUME    (mm)=    5.805
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .232

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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007:0007-------------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .130     2.033      5.805
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -122.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.5718E-01

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
007:0008-------------------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 01:EXTD-1        24.12     .182    2.40   4.90    .000
                    +ID2 03:      3000    12.94     .000     .00    .00    .000
                    +ID3 04:      3010     9.85     .000     .00    .00    .000
                     ==========================================================
                     SUM 02:      3020    46.91     .182    2.40   2.52    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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007:0009-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
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-
007:0002-------------------------------------------------------------------------------
-
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-
007:0002-------------------------------------------------------------------------------
-
      FINISH
-------------------------------------------------------------------------------
-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 001:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 002:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 002:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 003:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 003:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 004:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 004:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 005:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 005:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 006:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 006:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 007:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 007:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-11-23     at 14:37:43
===============================================================================
=
```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                        9   9  9   9   # 4730904
         StormWater Management HYdrologic Model          999    999    =========

 ********************************************************************************
 **************************** SWMHYMO Ver/4.05  *****************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                    OTTHYMO-83 and OTTHYMO-89.                *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                   Ottawa,  Ontario: (613) 836-3884          *********
 *********                   Gatineau, Quebec: (819) 243-6858          *********
 *********                   E-Mail: swmhymo@jfsa.Com                  *********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)          +++++++++
 +++++++++                Kitchener             SERIAL#:4730904       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
 *********           Maximum value for ID numbers  :     10            *********
 *********           Max. number of rainfall points: 105408            *********
 *********           Max. number of flow points    : 105408            *********
 ********************************************************************************


 **********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2017-11-23     TIME: 14:39:43     RUN COUNTER: 000669         *
 ********************************************************************************
 * Input   filename: Z:\Temp\Loyalist\DPR3-4.dat                                *
 * Output  filename: Z:\Temp\Loyalist\DPR3-4.out                                *
 * Summary filename: Z:\Temp\Loyalist\DPR3-4.sum                                *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

--------------------------------------------------------------------------------
-
001:0001--------------------------------------------------------------------------
-
*#*****************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*****************************************************************************
*#*****************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by 200 mm high slope interruption berms
*# - AMC III Conditions
*#
*#*****************************************************************************
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=LYA2.1hr
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 2 Year)
| Ptotal=  22.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 2 Year)
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .08  23.868 |    .33  29.172 |    .58  26.520 |    .83   7.956
              .17  37.128 |    .42  34.476 |    .67  13.260 |    .92   2.652
              .25  55.692 |    .50  23.868 |    .75  10.608 |   1.00    .000

--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .204 (i)
     TIME TO PEAK    (hrs)=    1.133
     RUNOFF VOLUME    (mm)=    3.863
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .175

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .347 (i)
     TIME TO PEAK    (hrs)=     .883
     RUNOFF VOLUME    (mm)=    8.692
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .393

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
*#*****************************************************************************
```

```
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .347      .883      8.692
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -53.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1125E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
001:0006-------------------------------------------------------------------------
-
---------------------
| DESIGN NASHYD     |   Area    (ha)=    9.85   Curve Number   (CN)=91.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
---------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .296 (i)
     TIME TO PEAK    (hrs)=     .850
     RUNOFF VOLUME    (mm)=    9.282
     TOTAL RAINFALL   (mm)=   22.100
     RUNOFF COEFFICIENT   =     .420

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0007-------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .296      .850      9.282
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -51.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.9142E-01

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
001:0008-------------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 01:EXTD-1      24.12     .204    1.13   3.86    .000
                       +ID2 03:      3000  12.94     .000     .00    .00    .000
                       +ID3 04:      3010   9.85     .000     .00    .00    .000
                        ==========================================================
                        SUM 02:      3020  46.91     .204    1.13   1.99    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
-
001:0009-------------------------------------------------------------------------
-
  ** END OF RUN :   1

*******************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=LYA2.12h
-------------------------------------------------------------------------------
-
002:0002-------------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by 200 mm high slope interruption berms
*# - AMC III Conditions
*#
*#*************************************************************************
-------------------------------------------------------------------------------
-
002:0002-------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 2 Year)
| Ptotal=  42.24 mm|    Comments: Belleville IDF (12-hr 30% AES - 2 Year)
--------------------
```

```
             TIME     RAIN |   TIME     RAIN |   TIME     RAIN |   TIME     RAIN
              hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr |    hrs    mm/hr
             1.00    3.960 |   4.00    6.600 |   7.00    1.320 |  10.00     .000
             2.00   11.440 |   5.00    6.160 |   8.00     .440 |  11.00     .000
             3.00    8.800 |   6.00    3.520 |   9.00     .000 |  12.00     .000

-------------------------------------------------------------------------------
-
002:0003---------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .187 (i)
     TIME TO PEAK    (hrs)=    5.117
     RUNOFF VOLUME    (mm)=   12.769
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .302

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0004---------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .202 (i)
     TIME TO PEAK    (hrs)=    3.133
     RUNOFF VOLUME    (mm)=   24.068
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .570

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0005---------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR  |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )  |
| OUT<03:(003000)  |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .202     3.133     24.068
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -188.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3114E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
002:0006---------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=91.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .162 (i)
     TIME TO PEAK    (hrs)=    3.100
     RUNOFF VOLUME    (mm)=   25.201
     TOTAL RAINFALL   (mm)=   42.240
     RUNOFF COEFFICIENT   =     .597

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
002:0007---------------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR  |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )  |
| OUT<04:(003010)  |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .162     3.100     25.201
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -186.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2482E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
002:0008---------------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                     ID1 01:EXTD-1        24.12     .187    5.12  12.77    .000
                    +ID2 03:      3000    12.94     .000     .00    .00    .000
                    +ID3 04:      3010     9.85     .000     .00    .00    .000
                     ========================================================
                     SUM 02:      3020    46.91     .187    5.12   6.57    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------------------------------------------------------------------
-
002:0009--------------------------------------------------------------------------
-
--------------------------------------------------------------------------------
-
002:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   2

*******************************************************************************




--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 003
    NSTORM=   1
           #  1=LYA5.1hr
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by 200 mm high slope interruption berms
*# - AMC III Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
003:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 5 Year)
| Ptotal=  28.00 mm|    Comments: Belleville IDF (1-hr 30% AES - 5 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  30.240 |    .33  36.960 |    .58  33.600 |    .83  10.080
               .17  47.040 |    .42  43.680 |    .67  16.800 |    .92   3.360
               .25  70.560 |    .50  30.240 |    .75  13.440 |   1.00    .000

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003:0003--------------------------------------------------------------------------
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----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .320 (i)
     TIME TO PEAK    (hrs)=    1.117
     RUNOFF VOLUME    (mm)=    6.067
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .217

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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003:0004--------------------------------------------------------------------------
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----------------------
| DESIGN NASHYD      |   Area     (ha)=   12.94   Curve Number   (CN)=90.00
| 02:D-200  DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .511 (i)
     TIME TO PEAK    (hrs)=     .867
     RUNOFF VOLUME    (mm)=   12.833
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .458

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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003:0005--------------------------------------------------------------------------
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*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )    |
| OUT<03:(003000)    |    =========  OUTFLOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
                             .000  .0000E+00   |    3.000  .3400E+00
                             .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .511      .867     12.833
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -52.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1661E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
003:0006--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=    9.85   Curve Number   (CN)=91.00
| 02:D-201  DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045
```

```
     PEAK FLOW       (cms)=     .432 (i)
     TIME TO PEAK    (hrs)=     .833
     RUNOFF VOLUME    (mm)=   13.604
     TOTAL RAINFALL   (mm)=   28.000
     RUNOFF COEFFICIENT   =     .486

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
003:0007---------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                            .000  .0000E+00   |    2.000  .2700E+00
                            .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .432      .833     13.604
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=   -50.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1340E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
003:0008---------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:EXTD-1        24.12     .320    1.12   6.07    .000
                     +ID2 03:      3000    12.94     .000     .00    .00    .000
                     +ID3 04:      3010     9.85     .000     .00    .00    .000
                      ==========================================================
                      SUM 02:      3020    46.91     .320    1.12   3.12    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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003:0009---------------------------------------------------------------------
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-
003:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
003:0002---------------------------------------------------------------------
-
  ** END OF RUN :   3

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```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 004
    NSTORM=   1
           #  1=LYA5.12h
-------------------------------------------------------------------------------
-
004:0002---------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by 200 mm high slope interruption berms
*# - AMC III Conditions
*#
*#*************************************************************************
-------------------------------------------------------------------------------
-
004:0002---------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 5 Year)
| Ptotal=  55.97 mm|    Comments: Belleville IDF (12-hr 30% AES - 5 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              1.00   5.247 |   4.00   8.745 |   7.00   1.749 |  10.00    .000
              2.00  15.158 |   5.00   8.162 |   8.00    .583 |  11.00    .000
              3.00  11.660 |   6.00   4.664 |   9.00    .000 |  12.00    .000

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-
004:0003---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area     (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .295 (i)
     TIME TO PEAK    (hrs)=    5.083
     RUNOFF VOLUME    (mm)=   20.644
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .369

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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-------------------------------------------------------------------------------
-
004:0004---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .303 (i)
     TIME TO PEAK    (hrs)=    3.100
     RUNOFF VOLUME    (mm)=   35.878
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .641

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
004:0005---------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00   |    3.000  .3400E+00
                          .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .303     3.100     35.878
     OUTFLOW<03: (003000)      12.94      .249     5.033     11.233

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   82.202
                  TIME SHIFT OF PEAK FLOW         (min)=   116.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3217E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
004:0006---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=91.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .241 (i)
     TIME TO PEAK    (hrs)=    3.083
     RUNOFF VOLUME    (mm)=   37.276
     TOTAL RAINFALL   (mm)=   55.968
     RUNOFF COEFFICIENT   =     .666

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
004:0007---------------------------------------------------------------------
-
*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00   |    2.000  .2700E+00
                          .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .241     3.083     37.276
     OUTFLOW<04: (003010)       9.85      .194     5.017     10.991

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   80.575
                  TIME SHIFT OF PEAK FLOW         (min)=   116.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2610E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
004:0008---------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                         ID1 01:EXTD-1      24.12     .295    5.08  20.64    .000
                        +ID2 03:      3000  12.94     .249    5.03  11.23    .000
                        +ID3 04:      3010   9.85     .194    5.02  10.99    .000
                         ============================================================
                         SUM 02:      3020  46.91     .738    5.05  15.97    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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004:0009---------------------------------------------------------------------
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-------------------------------------------------------------------------------
-
004:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
004:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
004:0002---------------------------------------------------------------------
-
  ** END OF RUN :   4

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--------------------
```

```
| START            |  Project  dir.: Z:\Temp\Loyalist\
-------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
           #  1=LYA100.1hr
--------------------------------------------------------------------------------
-
005:0002----------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by 200 mm high slope interruption berms
*# - AMC III Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
005:0002----------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (1-hr 30% AES - 100 Year)
| Ptotal=  44.10 mm|    Comments: Belleville IDF (1-hr 30% AES - 100 Year)
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08  47.628 |    .33  58.212 |    .58  52.920 |    .83  15.876
               .17  74.088 |    .42  68.796 |    .67  26.460 |    .92   5.292
               .25 111.132 |    .50  47.628 |    .75  21.168 |   1.00    .000

--------------------------------------------------------------------------------
-
005:0003----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .724 (i)
     TIME TO PEAK    (hrs)=    1.117
     RUNOFF VOLUME    (mm)=   13.765
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .312

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
005:0004----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=    1.013 (i)
     TIME TO PEAK    (hrs)=     .850
     RUNOFF VOLUME    (mm)=   25.624
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .581

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
005:0005----------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00   |    3.000  .3400E+00
                          .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94     1.013      .850     25.624
     OUTFLOW<03: (003000)      12.94      .104     1.833       .958

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   10.301
                  TIME SHIFT OF PEAK FLOW         (min)=    59.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3207E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
005:0006----------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=91.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .845 (i)
     TIME TO PEAK    (hrs)=     .817
     RUNOFF VOLUME    (mm)=   26.798
     TOTAL RAINFALL   (mm)=   44.100
     RUNOFF COEFFICIENT   =     .608

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
005:0007----------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
```

```
|  IN>02:(D-201 )    |
| OUT<04:(003010)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)    |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .845      .817     26.798
     OUTFLOW<04: (003010)       9.85      .043     1.917       .482

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    5.090
                  TIME SHIFT OF PEAK FLOW         (min)=    66.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2602E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
005:0008---------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                    ID1 01:EXTD-1        24.12     .724    1.12  13.76    .000
                   +ID2 03:      3000    12.94     .104    1.83    .96    .000
                   +ID3 04:      3010     9.85     .043    1.92    .48    .000
                    ==========================================================
                    SUM 02:      3020    46.91     .724    1.12   7.42    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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005:0009---------------------------------------------------------------------
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005:0002---------------------------------------------------------------------
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-
005:0002---------------------------------------------------------------------
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-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
005:0002---------------------------------------------------------------------
-
  ** END OF RUN :   5

*************************************************************************
```

```
--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 006
    NSTORM=   1
            #  1=LYA100.12h
-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
*#*************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#*************************************************************************
*#*************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by 200 mm high slope interruption berms
*# - AMC III Conditions
*#
*#*************************************************************************
-------------------------------------------------------------------------------
-
006:0002---------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: Belleville IDF (12-hr 30% AES - 100 Year
| Ptotal=  93.70 mm|    Comments: Belleville IDF (12-hr 30% AES - 100 Year
--------------------
             TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
              hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             1.00   8.784 |   4.00  14.640 |   7.00   2.928 |  10.00    .000
             2.00  25.376 |   5.00  13.664 |   8.00    .976 |  11.00    .000
             3.00  19.520 |   6.00   7.808 |   9.00    .000 |  12.00    .000

-------------------------------------------------------------------------------
-
006:0003---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .675 (i)
     TIME TO PEAK    (hrs)=    3.417
     RUNOFF VOLUME    (mm)=   46.848
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .500

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
006:0004---------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390
```

```
     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .601 (i)
     TIME TO PEAK    (hrs)=    2.383
     RUNOFF VOLUME    (mm)=   70.588
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .753

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
006:0005--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    3.000  .3400E+00
                           .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .601     2.383     70.588
     OUTFLOW<03: (003000)      12.94      .593     3.133     45.859

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   98.686
                  TIME SHIFT OF PEAK FLOW         (min)=    45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.3240E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
006:0006--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=91.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .482 (i)
     TIME TO PEAK    (hrs)=    2.283
     RUNOFF VOLUME    (mm)=   72.454
     TOTAL RAINFALL   (mm)=   93.696
     RUNOFF COEFFICIENT   =     .773

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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006:0007--------------------------------------------------------------------------
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*#**************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#**************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .482     2.283     72.454
     OUTFLOW<04: (003010)       9.85      .465     3.100     46.059

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   96.351
                  TIME SHIFT OF PEAK FLOW         (min)=    49.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2623E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
006:0008--------------------------------------------------------------------------
-
*#**************************************************************************
*#                              AREA CHECK
*#**************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
                    ID1 01:EXTD-1        24.12      .675    3.42  46.85    .000
                   +ID2 03:      3000    12.94      .593    3.13  45.86    .000
                   +ID3 04:      3010     9.85      .465    3.10  46.06    .000
                    ==========================================================
                    SUM 02:      3020    46.91    1.716    3.15  46.41    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-
006:0009--------------------------------------------------------------------------
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006:0002--------------------------------------------------------------------------
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006:0002--------------------------------------------------------------------------
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006:0002--------------------------------------------------------------------------
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006:0002--------------------------------------------------------------------------
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-
006:0002--------------------------------------------------------------------------
-
  ** END OF RUN :   6

********************************************************************************



--------------------
| START            |  Project  dir.: Z:\Temp\Loyalist\
--------------------  Rainfall dir.: Z:\Temp\Loyalist\
```

```
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 007
    NSTORM=   1
           #  1=25mm.4hr
--------------------------------------------------------------------------------
-
007:0002--------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: [Loyalist Solar]    Project Number: [133560220]
*#  Date        : 11-20-2017
*#  Modeller    : [N. Emery]
*#  Company     : Stantec Consulting Ltd. (London)
*#  License #   :  4730904
*#**************************************************************************
*#**************************************************************************
*#
*#                     BLOCK D - PROPOSED CONDITIONS
*#
*# - Hydrologic conditions represent site after stabilization vegetation is
*#   fully established
*# - SWM control provided by 200 mm high slope interruption berms
*# - AMC III Conditions
*#
*#**************************************************************************
--------------------------------------------------------------------------------
-
007:0002--------------------------------------------------------------------------
-
--------------------
| READ STORM       |    Filename: 25 mm, 4hr Chicago Storm
| Ptotal=  25.00 mm|    Comments: 25 mm, 4hr Chicago Storm
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .08   1.465 |   1.08   4.024 |   2.08   5.764 |   3.08   2.074
               .17   1.540 |   1.17   4.814 |   2.17   4.969 |   3.17   1.977
               .25   1.625 |   1.25   6.025 |   2.25   4.374 |   3.25   1.889
               .33   1.720 |   1.33   8.114 |   2.33   3.913 |   3.33   1.810
               .42   1.829 |   1.42  12.526 |   2.42   3.545 |   3.42   1.737
               .50   1.955 |   1.50  27.198 |   2.50   3.245 |   3.50   1.671
               .58   2.101 |   1.58  74.855 |   2.58   2.994 |   3.58   1.610
               .67   2.274 |   1.67  31.410 |   2.67   2.782 |   3.67   1.553
               .75   2.482 |   1.75  16.819 |   2.75   2.601 |   3.75   1.501
               .83   2.736 |   1.83  11.357 |   2.83   2.443 |   3.83   1.453
               .92   3.055 |   1.92   8.563 |   2.92   2.305 |   3.92   1.408
              1.00   3.468 |   2.00   6.882 |   3.00   2.183 |   4.00   1.366

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007:0003--------------------------------------------------------------------------
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----------------------
| DESIGN NASHYD      |   Area    (ha)=   24.12   Curve Number   (CN)=74.00
| 01:EXTD-1 DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .630

     Unit Hyd Qpeak  (cms)=    1.462

     PEAK FLOW       (cms)=     .182 (i)
     TIME TO PEAK    (hrs)=    2.400
     RUNOFF VOLUME    (mm)=    4.898
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .196

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
007:0004--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=   12.94   Curve Number   (CN)=90.00
| 02:D-200  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .390

     Unit Hyd Qpeak  (cms)=    1.267

     PEAK FLOW       (cms)=     .312 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   10.677
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .427

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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007:0005--------------------------------------------------------------------------
-
*#**************************************************************************
*# Route Catchment D-200 flows through slope interruption berms
*#**************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-200 )   |
| OUT<03:(003000)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |    3.000  .3400E+00
                            .000  .3200E+00   |    8.000  .3700E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-200 )      12.94      .312     2.050     10.677
     OUTFLOW<03: (003000)      12.94      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -123.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1382E+00

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
007:0006--------------------------------------------------------------------------
-
----------------------
| DESIGN NASHYD      |   Area    (ha)=    9.85   Curve Number   (CN)=91.00
| 02:D-201  DT= 1.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .360

     Unit Hyd Qpeak  (cms)=    1.045

     PEAK FLOW       (cms)=     .268 (i)
     TIME TO PEAK    (hrs)=    2.017
     RUNOFF VOLUME    (mm)=   11.358
     TOTAL RAINFALL   (mm)=   25.000
     RUNOFF COEFFICIENT   =     .454

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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007:0007-------------------------------------------------------------------------------
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*#*************************************************************************
*# Route Catchment D-201 flows through slope interruption berms
*#*************************************************************************
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>02:(D-201 )   |
| OUT<04:(003010)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000  .0000E+00   |    2.000  .2700E+00
                           .000  .2600E+00   |    7.000  .2900E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >02: (D-201 )       9.85      .268     2.017     11.358
     OUTFLOW<04: (003010)       9.85      .000      .000       .000

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -121.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1119E+00

      *** WARNING: Outflow volume is less than inflow volume.
-------------------------------------------------------------------------------
-
007:0008-------------------------------------------------------------------------------
-
*#*************************************************************************
*#                              AREA CHECK
*#*************************************************************************
------------------------
| ADD HYD (      3020) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                     ID1 01:EXTD-1        24.12     .182    2.40   4.90    .000
                    +ID2 03:      3000    12.94     .000     .00    .00    .000
                    +ID3 04:      3010     9.85     .000     .00    .00    .000
                     ============================================================
                     SUM 02:      3020    46.91     .182    2.40   2.52    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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007:0009-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
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007:0002-------------------------------------------------------------------------------
-
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007:0002-------------------------------------------------------------------------------
-
-------------------------------------------------------------------------------
-
007:0002-------------------------------------------------------------------------------
-
      FINISH
-------------------------------------------------------------------------------
-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 001:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 002:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 002:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 003:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 003:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 004:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 004:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 005:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 005:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 006:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 006:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 007:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 007:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2017-11-23     at 14:39:46
===============================================================================
=
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APPENDIX E – PUBLICATIONS

Hydrologic Response of Solar Farms
Effects of Tillage on soil Microrelief, Surface Depression Storage and Soil Water Storage

Hydrologic Response of Solar Farms

Lauren M. Cook, S.M.ASCE[1]; and Richard H. McCuen, M.ASCE[2]

Abstract: Because of the benefits of solar energy, the number of solar farms is increasing; however, their hydrologic impacts have not been studied. The goal of this study was to determine the hydrologic effects of solar farms and examine whether or not storm-water management is needed to control runoff volumes and rates. A model of a solar farm was used to simulate runoff for two conditions: the pre- and postpaneled conditions. Using sensitivity analyses, modeling showed that the solar panels themselves did not have a significant effect on the runoff volumes, peaks, or times to peak. However, if the ground cover under the panels is gravel or bare ground, owing to design decisions or lack of maintenance, the peak discharge may increase significantly with storm-water management needed. In addition, the kinetic energy of the flow that drains from the panels was found to be greater than that of the rainfall, which could cause erosion at the base of the panels. Thus, it is recommended that the grass beneath the panels be well maintained or that a buffer strip be placed after the most downgradient row of panels. This study, along with design recommendations, can be used as a guide for the future design of solar farms. **DOI: 10.1061/(ASCE)HE.1943-5584.0000530.**

CE Database subject headings: Hydrology; Land use; Solar power; Floods; Surface water; Runoff; Stormwater management.

Author keywords: Hydrology; Land use change; Solar energy; Flooding; Surface water runoff; Storm-water management.

Introduction

Storm-water management practices are generally implemented to reverse the effects of land-cover changes that cause increases in volumes and rates of runoff. This is a concern posed for new types of land-cover change such as the solar farm. Solar energy is a renewable energy source that is expected to increase in importance in the near future. Because solar farms require considerable land, it is necessary to understand the design of solar farms and their potential effect on erosion rates and storm runoff, especially the impact on offsite properties and receiving streams. These farms can vary in size from 8 ha (20 acres) in residential areas to 250 ha (600 acres) in areas where land is abundant.

The solar panels are impervious to rain water; however, they are mounted on metal rods and placed over pervious land. In some cases, the area below the panel is paved or covered with gravel. Service roads are generally located between rows of panels. Although some panels are stationary, others are designed to move so that the angle of the panel varies with the angle of the sun. The angle can range, depending on the latitude, from 22° during the summer months to 74° during the winter months. In addition, the angle and direction can also change throughout the day. The issue posed is whether or not these rows of impervious panels will change the runoff characteristics of the site, specifically increase runoff volumes or peak discharge rates. If the increases are hydrologically significant, storm-water management facilities may be needed. Additionally, it is possible that the velocity of water draining from the edge of the panels is sufficient to cause erosion of the soil below the panels, especially where the maintenance roadways are bare ground.

The outcome of this study provides guidance for assessing the hydrologic effects of solar farms, which is important to those who plan, design, and install arrays of solar panels. Those who design solar farms may need to provide for storm-water management. This study investigated the hydrologic effects of solar farms, assessed whether or not storm-water management might be needed, and if the velocity of the runoff from the panels could be sufficient to cause erosion of the soil below the panels.

Model Development

Solar farms are generally designed to maximize the amount of energy produced per unit of land area, while still allowing space for maintenance. The hydrologic response of solar farms is not usually considered in design. Typically, the panels will be arrayed in long rows with separations between the rows to allow for maintenance vehicles. To model a typical layout, a unit width of one panel was assumed, with the length of the downgradient strip depending on the size of the farm. For example, a solar farm with 30 rows of 200 panels each could be modeled as a strip of 30 panels with space between the panels for maintenance vehicles. Rainwater that drains from the upper panel onto the ground will flow over the land under the 29 panels on the downgradient strip. Depending on the land cover, infiltration losses would be expected as the runoff flows to the bottom of the slope.

To determine the effects that the solar panels have on runoff characteristics, a model of a solar farm was developed. Runoff in the form of sheet flow without the addition of the solar panels served as the prepaneled condition. The paneled condition assumed a downgradient series of cells with one solar panel per ground cell. Each cell was separated into three sections: wet, dry, and spacer.

The dry section is that portion directly underneath the solar panel, unexposed directly to the rainfall. As the angle of the panel from the horizontal increases, more of the rain will fall directly onto

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Note. This manuscript was submitted on August 12, 2010; approved on October 20, 2011; published online on October 24, 2011. Discussion period open until October 1, 2013; separate discussions must be submitted for individual papers. This paper is part of the ***Journal of Hydrologic Engineering***, Vol. 18, No. 5, May 1, 2013. © ASCE, ISSN 1084-0699/2013/5-536-541/$25.00.

the ground; this section of the cell is referred to as the wet section. The spacer section is the area between the rows of panels used by maintenance vehicles. Fig. 1 is an image of two solar panels and the spacer section allotted for maintenance vehicles. Fig. 2 is a schematic of the wet, dry, and spacer sections with their respective dimensions. In Fig. 1, tracks from the vehicles are visible on what is modeled within as the spacer section. When the solar panel is horizontal, then the length longitudinal to the direction that runoff will occur is the length of the dry and wet sections combined. Runoff from a dry section drains onto the downgradient spacer section. Runoff from the spacer section flows to the wet section of the next downgradient cell. Water that drains from a solar panel falls directly onto the spacer section of that cell.

The length of the spacer section is constant. During a storm event, the loss rate was assumed constant for the 24-h storm because a wet antecedent condition was assumed. The lengths of the wet and dry sections changed depending on the angle of the solar panel. The total length of the wet and dry sections was set equal to the length of one horizontal solar panel, which was assumed to be 3.5 m. When a solar panel is horizontal, the dry section length would equal 3.5 m and the wet section length would be zero. In the paneled condition, the dry section does not receive direct rainfall because the rain first falls onto the solar panel then drains onto the spacer section. However, the dry section does infiltrate some of the runoff that comes from the upgradient wet section. The wet section was modeled similar to the spacer section with rain falling directly onto the section and assuming a constant loss rate.

For the presolar panel condition, the spacer and wet sections are modeled the same as in the paneled condition; however, the cell does not include a dry section. In the prepaneled condition, rain falls directly onto the entire cell. When modeling the prepaneled condition, all cells receive rainfall at the same rate and are subject to losses. All other conditions were assumed to remain the same such that the prepaneled and paneled conditions can be compared.

Rainfall was modeled after an natural resources conservation service (NRCS) Type II Storm (McCuen 2005) because it is an accurate representation of actual storms of varying characteristics that are imbedded in intensity-duration-frequency (IDF) curves. For each duration of interest, a dimensionless hyetograph was developed using a time increment of 12 s over the duration of the storm (see Fig. 3). The depth of rainfall that corresponds to each storm magnitude was then multiplied by the dimensionless hyetograph. For a 2-h storm duration, depths of 40.6, 76.2, and 101.6 mm were used for the 2-, 25-, and 100-year events. The 2- and 6-h duration hyetographs were developed using the center portion of the 24-h storm, with the rainfall depths established with the Baltimore IDF curve. The corresponding depths for a 6-h duration were 53.3, 106.7, and 132.1 mm, respectively. These magnitudes were chosen to give a range of storm conditions.

During each time increment, the depth of rain is multiplied by the cell area to determine the volume of rain added to each section of each cell. This volume becomes the storage in each cell. Depending on the soil group, a constant volume of losses was subtracted from the storage. The runoff velocity from a solar panel was calculated using Manning's equation, with the hydraulic radius for sheet flow assumed to equal the depth of the storage on the panel (Bedient and Huber 2002). Similar assumptions were made to compute the velocities in each section of the surface sections.

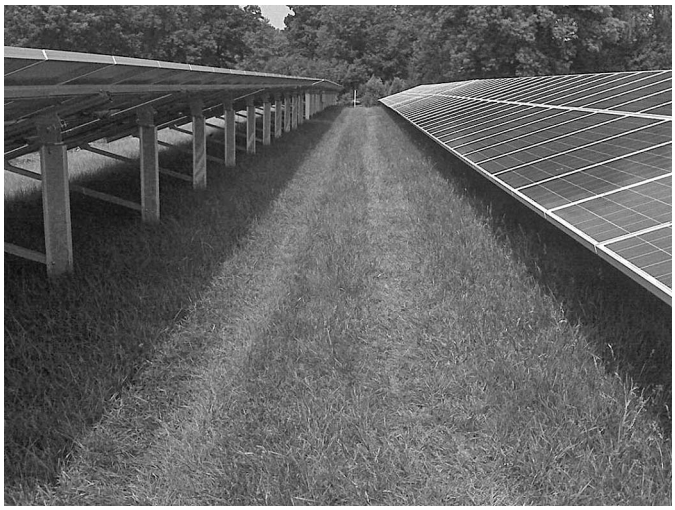

Fig. 1. Maintenance or "spacer" section between two rows of solar panels (photo by John E. Showler, reprinted with permission)

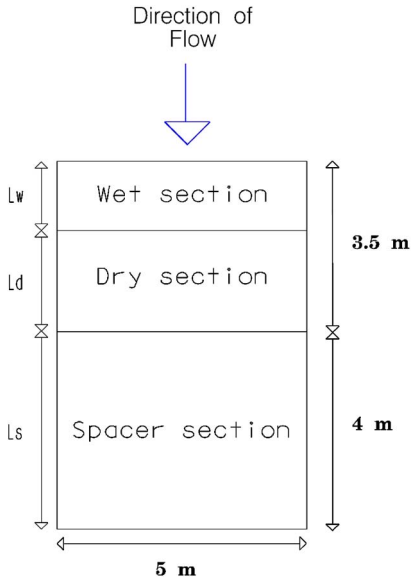

Fig. 2. Wet, dry, and spacer sections of a single cell with lengths *Lw*, *Ls*, and *Ld* with the solar panel covering the dry section

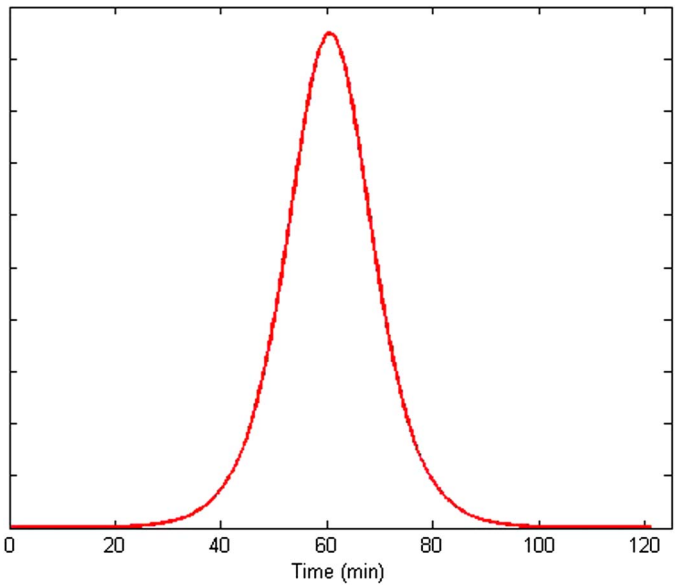

Fig. 3. Dimensionless hyetograph of 2-h Type II storm

Runoff from one section to the next and then to the next downgradient cell was routed using the continuity of mass. The routing coefficient depended on the depth of flow in storage and the velocity of runoff. Flow was routed from the wet section to the dry section to the spacer section, with flow from the spacer section draining to the wet section of the next cell. Flow from the most downgradient cell was assumed to be the outflow. Discharge rates and volumes from the most downgradient cell were used for comparisons between the prepaneled and paneled conditions.

Alternative Model Scenarios

To assess the effects of the different variables, a section of 30 cells, each with a solar panel, was assumed for the base model. Each cell was separated individually into wet, dry, and spacer sections. The area had a total ground length of 225 m with a ground slope of 1% and width of 5 m, which was the width of an average solar panel. The roughness coefficient (Engman 1986) for the silicon solar panel was assumed to be that of glass, 0.01. Roughness coefficients of 0.15 for grass and 0.02 for bare ground were also assumed. Loss rates of 0.5715 cm/h (0.225 in./h) and 0.254 cm/h (0.1 in./h) for B and C soils, respectively, were assumed.

The prepaneled condition using the 2-h, 25-year rainfall was assumed for the base condition, with each cell assumed to have a good grass cover condition. All other analyses were made assuming a paneled condition. For most scenarios, the runoff volumes and peak discharge rates from the paneled model were not significantly greater than those for the prepaneled condition. Over a total length of 225 m with 30 solar panels, the runoff increased by 0.26 m^3, which was a difference of only 0.35%. The slight increase in runoff volume reflects the slightly higher velocities for the paneled condition. The peak discharge increased by 0.0013 m^3, a change of only 0.31%. The time to peak was delayed by one time increment, i.e., 12 s. Inclusion of the panels did not have a significant hydrologic impact.

Storm Magnitude

The effect of storm magnitude was investigated by changing the magnitude from a 25-year storm to a 2-year storm. For the 2-year storm, the rainfall and runoff volumes decreased by approximately 50%. However, the runoff from the paneled watershed condition increased compared to the prepaneled condition by approximately the same volume as for the 25-year analysis, 0.26 m^3. This increase represents only a 0.78% increase in volume. The peak discharge and the time to peak did not change significantly. These results reflect runoff from a good grass cover condition and indicated that the general conclusion of very minimal impacts was the same for different storm magnitudes.

Ground Slope

The effect of the downgradient ground slope of the solar farm was also examined. The angle of the solar panels would influence the velocity of flows from the panels. As the ground slope was increased, the velocity of flow over the ground surface would be closer to that on the panels. This could cause an overall increase in discharge rates. The ground slope was changed from 1 to 5%, with all other conditions remaining the same as the base conditions.

With the steeper incline, the volume of losses decreased from that for the 1% slope, which is to be expected because the faster velocity of the runoff would provide less opportunity for infiltration. However, between the prepaneled and paneled conditions, the increase in runoff volume was less than 1%. The peak discharge and the time to peak did not change. Therefore, the greater ground slope did not significantly influence the response of the solar farm.

Soil Type

The effect of soil type on the runoff was also examined. The soil group was changed from B soil to C soil by varying the loss rate. As expected, owing to the higher loss rate for the C soil, the depths of runoff increased by approximately 7.5% with the C soil when compared with the volume for B soils. However, the runoff volume for the C soil condition only increased by 0.17% from the prepaneled condition to the paneled condition. In comparison with the B soil, a difference of 0.35% in volume resulted between the two conditions. Therefore, the soil group influenced the actual volumes and rates, but not the relative effect of the paneled condition when compared to the prepaneled condition.

Panel Angle

Because runoff velocities increase with slope, the effect of the angle of the solar panel on the hydrologic response was examined. Analyses were made for angles of 30° and 70° to test an average range from winter to summer. The hydrologic response for these angles was compared to that of the base condition angle of 45°. The other site conditions remained the same. The analyses showed that the angle of the panel had only a slight effect on runoff volumes and discharge rates. The lower angle of 30° was associated with an increased runoff volume, whereas the runoff volume decreased for the steeper angle of 70° when compared with the base condition of 45°. However, the differences (~0.5%) were very slight. Nevertheless, these results indicate that, when the solar panel was closer to horizontal, i.e., at a lower angle, a larger difference in runoff volume occurred between the prepaneled and paneled conditions. These differences in the response result are from differences in loss rates.

The peak discharge was also lower at the lower angle. At an angle of 30°, the peak discharge was slightly lower than at the higher angle of 70°. For the 2-h storm duration, the time to peak of the 30° angle was 2 min delayed from the time to peak of when the panel was positioned at a 70° angle, which reflects the longer travel times across the solar panels.

Storm Duration

To assess the effect of storm duration, analyses were made for 6-h storms, testing magnitudes for 2-, 25-, and 100-year return periods, with the results compared with those for the 2-h rainfall events. The longer storm duration was tested to determine whether a longer duration storm would produce a different ratio of increase in runoff between the prepaneled and paneled conditions. When compared to runoff volumes from the 2-h storm, those for the 6-h storm were 34% greater in both the paneled and prepaneled cases. However, when comparing the prepaneled to the paneled condition, the increase in the runoff volume with the 6-h storm was less than 1% regardless of the return period. The peak discharge and the time-to-peak did not differ significantly between the two conditions. The trends in the hydrologic response of the solar farm did not vary with storm duration.

Ground Cover

The ground cover under the panels was assumed to be a native grass that received little maintenance. For some solar farms, the area beneath the panel is covered in gravel or partially paved because the panels prevent the grass from receiving sunlight. Depending on the

volume of traffic, the spacer cell could be grass, patches of grass, or bare ground. Thus, it was necessary to determine whether or not these alternative ground-cover conditions would affect the runoff characteristics. This was accomplished by changing the Manning's n for the ground beneath the panels. The value of n under the panels, i.e., the dry section, was set to 0.015 for gravel, with the value for the spacer or maintenance section set to 0.02, i.e., bare ground. These can be compared to the base condition of a native grass ($n = 0.15$). A good cover should promote losses and delay the runoff.

For the smoother surfaces, the velocity of the runoff increased and the losses decreased, which resulted in increasing runoff volumes. This occurred both when the ground cover under the panels was changed to gravel and when the cover in the spacer section was changed to bare ground. Owing to the higher velocities of the flow, runoff rates from the cells increased significantly such that it was necessary to reduce the computational time increment. Fig. 4(a) shows the hydrograph from a 30-panel area with a time increment of 12 s. With a time increment of 12 s, the water in each cell is discharged at the end of every time increment, which results in no attenuation of the flow; thus, the undulations shown in Fig. 4(a) result. The time increment was reduced to 3 s for the 2-h storm, which resulted in watershed smoothing and a rational hydrograph shape [Fig. 4(b)]. The results showed that the storm runoff

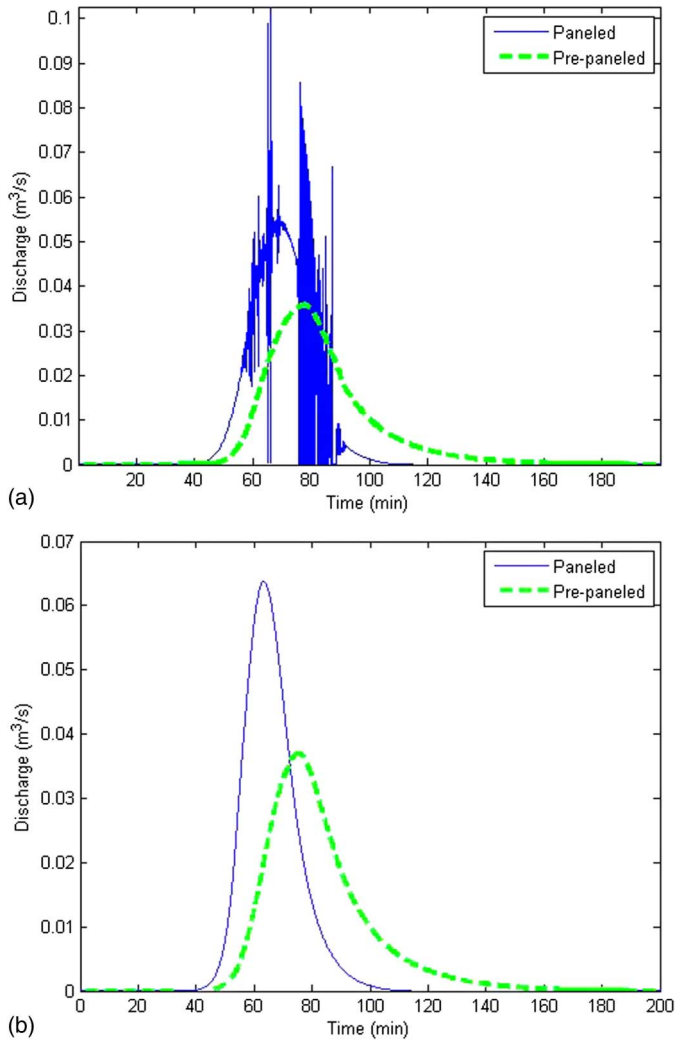

Fig. 4. Hydrograph with time increment of (a) 12 s; (b) 3 s with Manning's n for bare ground

increased by 7% from the grass-covered scenario to the scenario with gravel under the panel. The peak discharge increased by 73% for the gravel ground cover when compared with the grass cover without the panels. The time to peak was 10 min less with the gravel than with the grass, which reflects the effect of differences in surface roughness and the resulting velocities.

If maintenance vehicles used the spacer section regularly and the grass cover was not adequately maintained, the soil in the spacer section would be compacted and potentially the runoff volumes and rates would increase. Grass that is not maintained has the potential to become patchy and turn to bare ground. The grass under the panel may not get enough sunlight and die. Fig. 1 shows the result of the maintenance trucks frequently driving in the spacer section, which diminished the grass cover.

The effect of the lack of solar farm maintenance on runoff characteristics was modeled by changing the Manning's n to a value of 0.02 for bare ground. In this scenario, the roughness coefficient for the ground under the panels, i.e., the dry section, as well as in the spacer cell was changed from grass covered to bare ground ($n = 0.02$).The effects were nearly identical to that of the gravel. The runoff volume increased by 7% from the grass-covered to the bare-ground condition. The peak discharge increased by 72% when compared with the grass-covered condition. The runoff for the bare-ground condition also resulted in an earlier time to peak by approximately 10 min. Two other conditions were also modeled, showing similar results. In the first scenario, gravel was placed directly under the panel, and healthy grass was placed in the spacer section, which mimics a possible design decision. Under these conditions, the peak discharge increased by 42%, and the volume of runoff increased by 4%, which suggests that storm-water management would be necessary if gravel is placed anywhere.

Fig. 5 shows two solar panels from a solar farm in New Jersey. The bare ground between the panels can cause increased runoff rates and reductions in time of concentration, both of which could necessitate storm-water management. The final condition modeled involved the assumption of healthy grass beneath the panels and bare ground in the spacer section, which would simulate the condition of unmaintained grass resulting from vehicles that drive over the spacer section. Because the spacer section is 53% of the cell, the change in land cover to bare ground would reduce losses and decrease runoff travel times, which would cause runoff to amass as it

Fig. 5. Site showing the initiation of bare ground below the panels, which increases the potential for erosion (photo by John Showler, reprinted with permission)

moves downgradient. With the spacer section as bare ground, the peak discharge increased by 100%, which reflected the increases in volume and decrease in timing. These results illustrate the need for maintenance of the grass below and between the panels.

Design Suggestions

With well-maintained grass underneath the panels, the solar panels themselves do not have much effect on total volumes of the runoff or peak discharge rates. Although the panels are impervious, the rainwater that drains from the panels appears as runoff over the downgradient cells. Some of the runoff infiltrates. If the grass cover of a solar farm is not maintained, it can deteriorate either because of a lack of sunlight or maintenance vehicle traffic. In this case, the runoff characteristics can change significantly with both runoff rates and volumes increasing by significant amounts. In addition, if gravel or pavement is placed underneath the panels, this can also contribute to a significant increase in the hydrologic response.

If bare ground is foreseen to be a problem or gravel is to be placed under the panels to prevent erosion, it is necessary to counteract the excess runoff using some form of storm-water management. A simple practice that can be implemented is a buffer strip (Dabney et al. 2006) at the downgradient end of the solar farm. The buffer strip length must be sufficient to return the runoff characteristics with the panels to those of runoff experienced before the gravel and panels were installed. Alternatively, a detention basin can be installed.

A buffer strip was modeled along with the panels. For approximately every 200 m of panels, or 29 cells, the buffer must be 5 cells long (or 35 m) to reduce the runoff volume to that which occurred before the panels were added. Even if a gravel base is not placed under the panels, the inclusion of a buffer strip may be a good practice when grass maintenance is not a top funding priority. Fig. 6 shows the peak discharge from the graveled surface versus the length of the buffer needed to keep the discharge to prepaneled peak rate.

Water draining from a solar panel can increase the potential for erosion of the spacer section. If the spacer section is bare ground, the high kinetic energy of water draining from the panel can cause soil detachment and transport (Garde and Raju 1977; Beuselinck et al. 2002). The amount and risk of erosion was modeled using the velocity of water coming off a solar panel compared with the velocity and intensity of the rainwater. The velocity of panel runoff was calculated using Manning's equation, and the velocity of falling rainwater was calculated using the following:

$$V_t = 120\, d_r^{0.35} \tag{1}$$

where d_r = diameter of a raindrop, assumed to be 1 mm. The relationship between kinetic energy and rainfall intensity is

$$K_e = 916 + 330 \log_{10} i \tag{2}$$

where i = rainfall intensity (in./h) and K_e = kinetic energy (ft-tons per ac-in. of rain) of rain falling onto the wet section and the panel, as well as the water flowing off of the end of the panel (Wischmeier and Smith 1978). The kinetic energy (Salles et al. 2002) of the rainfall was greater than that coming off the panel, but the area under the panel (i.e., the product of the length, width, and cosine of the panel angle) is greater than the area under the edge of the panel where the water drains from the panel onto the ground. Thus, dividing the kinetic energy by the respective areas gives a more accurate representation of the kinetic energy experienced by the soil. The energy of the water draining from the panel onto the ground can be nearly 10 times greater than the rain itself falling onto the ground area. If the solar panel runoff falls onto an unsealed soil, considerable detachment can result (Motha et al. 2004). Thus, because of the increased kinetic energy, it is possible that the soil is much more prone to erosion with the panels than without. Where panels are installed, methods of erosion control should be included in the design.

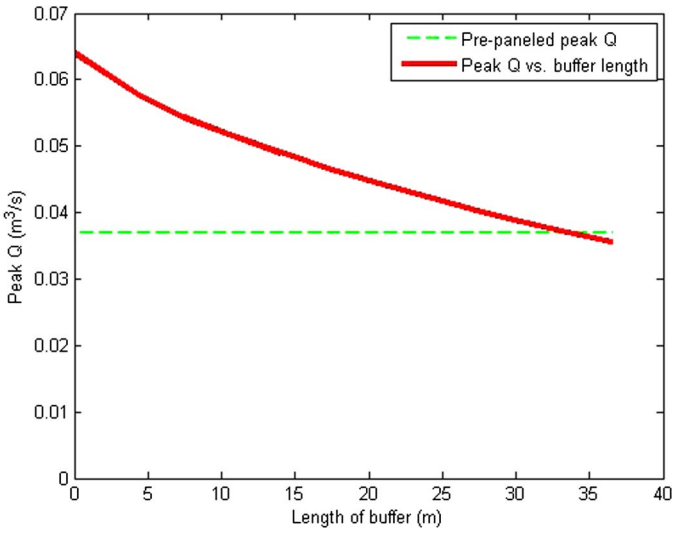

Fig. 6. Peak discharge over gravel compared with buffer length

Conclusions

Solar farms are the energy generators of the future; thus, it is important to determine the environmental and hydrologic effects of these farms, both existing and proposed. A model was created to simulate storm-water runoff over a land surface without panels and then with solar panels added. Various sensitivity analyses were conducted including changing the storm duration and volume, soil type, ground slope, panel angle, and ground cover to determine the effect that each of these factors would have on the volumes and peak discharge rates of the runoff.

The addition of solar panels over a grassy field does not have much of an effect on the volume of runoff, the peak discharge, nor the time to peak. With each analysis, the runoff volume increased slightly but not enough to require storm-water management facilities. However, when the land-cover type was changed under the panels, the hydrologic response changed significantly. When gravel or pavement was placed under the panels, with the spacer section left as patchy grass or bare ground, the volume of the runoff increased significantly and the peak discharge increased by approximately 100%. This was also the result when the entire cell was assumed to be bare ground.

The potential for erosion of the soil at the base of the solar panels was also studied. It was determined that the kinetic energy of the water draining from the solar panel could be as much as 10 times greater than that of rainfall. Thus, because the energy of the water draining from the panels is much higher, it is very possible that soil below the base of the solar panel could erode owing to the concentrated flow of water off the panel, especially if there is bare ground in the spacer section of the cell. If necessary, erosion control methods should be used.

Bare ground beneath the panels and in the spacer section is a realistic possibility (see Figs. 1 and 5). Thus, a good, well-maintained grass cover beneath the panels and in the spacer section is highly recommended. If gravel, pavement, or bare ground is

deemed unavoidable below the panels or in the spacer section, it may necessary to add a buffer section to control the excess runoff volume and ensure adequate losses. If these simple measures are taken, solar farms will not have an adverse hydrologic impact from excess runoff or contribute eroded soil particles to receiving streams and waterways.

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Effects of tillage on soil microrelief, surface depression storage and soil water storage

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Abstract

Conservation of soil water is an important management objective for crop production in the semi-arid tropics where droughts are persistent. Identification of the best tillage methods to achieve this objective is thus imperative. The integrated effects of conservation tillage on soil micro topography and soil moisture on a sandy loam soil were evaluated. The field experiment consisted of five tillage treatments, namely tied ridging (TR), no till (NT), disc plough (DP), strip catchment tillage (SCT) and hand hoe (HH). Data measured in the field included soil moisture content, surface roughness, infiltration and sorghum grain yield. A depth storage model was used to estimate depression storage TR treatment and the higher the surface roughness, the greater the depression storage volume. Regression analysis showed that random roughness decreased exponentially with increase in cumulative rainfall. Higher moisture contents were associated with treatments having higher depressional storage. Infiltration rate was significantly higher in the tilled soils than the untilled soils. The DP treatment had the highest cumulative infiltration while NT had the lowest. The Infiltration model which was fitted to the infiltration data gave good fit. Grain yield was highest in TR and least in NT, whereas DP and HH had similar yields.

Keywords: Depression storage; Soil water storage; Soil microrelief; Sorghum yield; Cumulative infiltration

1. Introduction

1.1. Background to tillage research

Tillage research has proceeded along two distinctly separate but complimentary directions. One direction referred to as the engineering approach (Hillel, 1980) has concentrated on the tillage operations (the forces involved and the soil conditions produced and described). The other referred to as the agronomic approach direction involves investigating the effects of the tillage induced conditions on crop production. A lot of work has been done to investigate the effects of various tillage techniques on crop yields (Nyakatawa et al., 1994; Thomlow and Bruneau, 1999; Li et al., 2001). Henderson (1979) remarked that most of the literature deal with studies on the effect of a tillage procedure on crop yield without providing an insight into how the procedure influenced crop growth and, therefore yield. Due to these general objectives, the results obtained were often site and year specific. In recent years, research on tillage has narrowed down to a few parameters and how they influence crop growth. It was observed, for example, that tillage could have an impact on crop production if physical properties of the soil hindering crop growth such as hard pans were

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removed. As a result many subsequent studies narrowed down their objectives to specific factors, such as tillage effects on bulk density and water infiltration. However, with this later approach, results have been contradictory and inconclusive due to variability in soils different researchers worked on. Therefore further research work on different types of soil is still being carried out. The new approach in tillage research moved away from associating crop yield with the type of implement used to associate it with the soil conditions produced by tillage implement. Research has also moved away from using crop yields as an indicator of the suitability for the soil conditions produced by tillage. The new dimension is to use soil physical properties such as soil water storage, soil temperature and mechanical impendence as indicators.

1.2. Surface roughness

Surface roughness is the configuration of the soil caused by the randomly oriented arrangement of soil clods. Tillage implements can produce two types of roughness; oriented roughness and random roughness (Allmaras et al., 1966). The second type of roughness is caused by the random occurrence of peaks and depressions resulting from soil clods and organization of aggregates which cannot be attributed to oriented roughness resulting from tillage tool marks or general slope effects. Random roughness is a very important property of tilled soils in terms of soil water storage. Infiltration, evaporation and runoff retardation are closely associated with random roughness. Burwell and Larson (1969) have shown highly significant correlation of infiltration capacities prior to the start of runoff with a roughness index and that differences can only occur due to the nature of the sealed or crusted layer formed at the soil surface. Allmaras et al. (1972) observed higher evaporation rates from rough surfaces, as well as increased porosity, which increased infiltration. The water stored in the surface depressions on the soil surface is termed depressional storage. It has been found that there is a positive correlation between the surface roughness and the depressional storage. Work has been done on how to measure depressional storage and predict storage values using different models that consider roughness (Linden, 1979; Onstad, 1984). Seginer (1971) developed a model to predict both drainage pattern and surface storage capacity of the cultivated surfaces taking into account the slope of the field, direction of the furrows and roughness of the field. Mitchell and Jones (1976) developed models that use geometric models of the surface configuration. However most of these models are complex and very laborious. Their empirical nature often limits their use in estimating depression storage. Mitchell and Jones (1976) also developed another simpler depth storage model that can be expressed as

$$W = aD^b \tag{1}$$

where W is the water storage on the surface (cm), D the depth above the lowest point on the surface (cm), and a and b the fitted equation parameters.

The selection of appropriate methods for use needs careful consideration and the selection of any one single model depends on the purpose of the calculation and the objectives of the investigation (Makungu, 1991).

2. Dynamic nature of tillage induced soil physical conditions

Initially, tillage induced soil conditions have been found to decline as time progresses (Zoebeck and Onstad, 1987). The major cause of the decline is normally cumulative rainfall. A rough cloddy surface will gradually slake and be smoothed by raindrop energy. Dexter (1977) measured the random roughness of the soil and related it to cumulative natural rainfall. Johnson et al. (1979) and Zoebeck and Onstad (1987) also observed a similar exponential decay of the form shown in Eq. (2):

$$\mathrm{RR} = \alpha \mathrm{RR}_0 \, \mathrm{e}^{-\beta P} \tag{2}$$

where RR is the random roughness on any day, RR_0 the initial random roughness, P the cumulative rainfall, e the exponential factor, and α and β the regression coefficients representing rate of decline in random roughness and the shape of the exponential curve, respectively.

Burwell and Larson (1969) observed that much of the random roughness and total pore space created by tillage decreased significantly by the time runoff begins. Similarly, porosity decreases in freshly tilled soils with cumulative rainfall. They found bulk density

increase to be very rapid at the beginning and gradually declines at later stages of water application.

The variations of the results obtained in previous studies prompted this study. This study was carried out in the semi-arid region of Dodoma, in Tanzania with a view to investigate the effect of tillage method on soil surface micro topography and how this influences the soil's ability to store and transmit water.

3. Materials and methods

3.1. Study area

The research work was conducted at Hombolo agricultural research institute (ARI) in Dodoma, central region of Tanzania. The institute is located 58 km northeast of the Dodoma town, 5°53′S latitude and 35°55′S longitude. The altitude is 1097 m a.s.l.

The soils are classified as Typic Untorthent in the US Soil Taxonomy and as Dystric Regosols in the FAO classification. The profile is fairly deep with texture ranging from sandy to sandy clay on the surface and loam subsoil. The structure is weakly developed. It is characterised by an ochric epipedon and no other diagnostic horizon is recognized. The sand fraction is dominated by quartz. The moisture and temperature regimes of the soil are ustic and thermic, respectively.

The general rainfall pattern in the study area is influenced by the movements of the inter-tropical convergence zone (ITCZ) between the northern and the southern hemispheres. The year is divided into two distinct seasons: a dry season between May and November and a rainy season from December to March. The average monthly rainfall amounts at Hombolo Meteorological Station from 1974 to 1992 are compared with the monthly totals during the experimental period are shown in Table 1.

The average annual rainfall is 589 mm but the distribution is highly variable with high intensities.

The mean temperature shows seasonal variation although the transition is not sharply marked. In July–August, it is relatively cooler than the rest of the year and July is the coolest month with an average temperature of 19.6 °C. November is the hottest month when temperatures soar up to as high as 35 °C. The average annual temperature is 22.7 °C. Average annual potential evaporation of 2123 mm (Christianson, 1981). The actual evaporation is 650 mm and on very few occasions the rainfall meets the evapotranspiration demand.

3.2. Tillage treatments

The five tillage treatments used in the experiments are described in Table 2.

3.3. Experimental design and layout

The experiment was laid out in a completely randomised design. The five tillage treatments were replicated three times thus a total of 15 field plots measuring 20 m long and 5 m wide were used. The lengths of all the plots were parallel to the direction of the slope and the general slope average was 4%. Plots were separated by pathways of 1 m wide each. Each plot was bordered with iron sheets on all the sides. This was done to prevent loss of water from the plots. The iron sheets were placed immediately after the tillage operations. Tillage was performed after the first rains in November and platting was done immediately. Drainage channels were cut at the top and bottom of the plots in order to drain away runoff from outside the plots as well as for emptying water from the surface runoff measurement drums.

Sorghum (*Sorghum bicolor* var. *Tegemeo*) was planted at a spacing of 0.75 m between rows and 0.3 m within rows to achieve a plant population of about 45 000–46 000 plants per hectare.

Table 1
Monthly averages of rainfall (mm) at Hombolo during the experiment period compared with the long-term (1974–1992) monthly averages

	Month											
	August	September	October	November	December	January	February	March	April	May	June	July
1974–1992	0	0	7	37	14	118	107	63	8	9	1	0
Period of study	0	9	0	34	55	120	45	67	32	0	0	0

Table 2
Tillage methods

Treatment	Description
NT	Soil remained undisturbed throughout the season. The only disturbance was during planting when the hand hoe was used to dig the holes for the seeds
HH	Flat cultivation with a hand hoe which involved digging across the slope to a depth of 10 cm. It produced uniform sized clods (8–15 cm diameter) and a relatively rough surface configuration
DP	Involved a three-furrow disc plough, pulled by a 50 HP tractor ploughing at a depth of 15 cm. It resulted in partial soil inversion of the soil with reduced pulverisation and a very rough surface
SCT	SCT is a reduced tillage method that creates minimal disturbance of the soil structure. Involved digging to 10 cm depth with a hand hoe a strip (5–10 cm width) in which planting of the seed was done and minimal disturbance of the soil occurred and surface roughness was relatively low
TR	Topsoil was heaped in bunds forming micro basins. Ridges were 0.75 m apart and tied at 1.5 m intervals with dimensions of 450 mm by 450 mm and 250 mm deep

3.4. Instrumentation and measurements

A microrelief meter was used to measure surface roughness. The microrelief meter used in this study was similar to the one used by Kuipers (1957). The instrument consists of a 130 cm × 90 cm mainframe of aluminium bars. Across the middle of the frame is a needle locking string. The string is designed to hold 23 needles that slide up and down. Each needle is fitted with a small foot to prevent it from penetrating the soil.

For height measurement, the whole device was placed horizontally with the needles locked up. The instrument was levelled by means of a spirit level and adjusting the support pins. The needles were then allowed to slide down until their feet touched the soil surface and were then locked in position. The height of each of the needles above the top of the frame was measured with a ruler. The needles were pulled up again, locked and the instrument moved to the next measuring position. The surface roughness was determined as the standard deviation of the pin height measurement. There were six measurement positions for each plot on each measurement day. These positions were selected randomly and spaced at least 3 m apart. Analysis of variance (ANOVA) was used to compare the differences in random roughness caused by different tillage treatments. The data for random roughness was fitted to the Zoebeck and Onstad (1987) equation. There was no consideration of the TR treatment because making the tied ridges created oriented roughness while all the other treatments had random roughness.

The Mitchell and Jones (1978) method represented by Eq. (1) was used in this study to determine depression storage. Microrelief meter data was processed to obtain depth storage values on the assumption that each point measurement was the centre of a 2.5 cm square level surface.

The values of actual elevations (measured) and line of best fit (LOBF) obtained by simple regression analysis were plotted against distance from measuring points. All points below the LOBF were taken as depressional storage. For the TR, covering a pond with a plastic sheet and measuring the volume of water required to fill the pond determined plots depression storage. This was done at the same time when surface roughness was determined for each treatment. Depressional storage was determined each time the random roughness was determined during the season to observe the influence of cumulative rainfall on the depressional storage produced by each tillage treatment.

Measurement of soil moisture was done using core samplers of diameter 6 cm and a length of 12 cm. Samples were collected randomly each week from each plot at three different depths: 0–15, 15–30 and 30–45 cm. The standard gravimetric method where soil samples were dried in an oven at 105 °C for 24 h was used. The gravimetric moisture content was then converted to volumetric moisture contents by multiplying with the bulk density of the soil. Each of the three values was assumed to represent an average value in a section of the profile of thickness 15 cm and the volume (in units of depth) contained within the soil profile of depth 45 cm was determined.

3.5. Determination of soil water infiltration

Infiltration was measured using a double ring infiltrometer (falling head) with the diameters of the inner ring and an outer ring 27.9 and 54.5 cm, respectively. The infiltration measurements were carried out at the beginning of the season after the tillage operations and before planting. The procedure was repeated midway through the season and after harvesting the sorghum crop. The experiments were conducted in the middle of the each plot. Infiltration data was also fitted to the Phillip's model (1957) which is described by the following equation

$$I = St^{0.5} + At \quad (3)$$

where I is the cumulative infiltration (cm), S the soil water sorptivity, A the parameter close to saturated hydraulic conductivity, and t the time (min).

Weather data (rainfall, temperature, wind speed, evaporation) was collected from the Hombolo Meteorological station situated about 100 m from the experimental plots. Data was collected for one full season. A computer package, SAS was used to carry out the statistical analysis. ANOVA was carried out on the data. Depression storage, profile moisture content, random roughness and crop yield were the dependent variable while tillage method and sampling time were the independent variables.

4. Results and discussion

4.1. Effects of tillage on surface random roughness

Generally random roughness values were significantly higher in tilled plots than untilled plots as shown in Table 3. The DP treatments had the highest values of random roughness while the NT had the least. Random roughness however declined sharply with time in the DP due to the crumbling of the soil clods as a result of the raindrop effect. Random roughness declined rapidly with small amounts of rainfall and approached a steady rate of decline with additional rainfall. The initially high rate of decrease could probably be due to sloughing and breaking of soil clods as a result of wetting. Subsequent rate of reduction is checked by deposition into the depression and the shear resistance of the individual soil clods.

Table 3
Mean values of field measured random roughness of the four tillage treatments[a]

Cumulative rainfall (mm)	Surface roughness (cm)			
	NT	SCT	DP	HH
0	0.69 a	3.34 b	8.33 c	4.80 d
142.4	0.60 a	2.87 b	6.33 c	1.85 d
315.4	0.59 a	1.66 b	5.28 c	1.54 b
407.6	0.54 a	1.15 b	4.77 c	1.91 d
637.4	0.54 a	0.56 a	1.63 b	0.61 a

[a] Means with the same letter for each cumulative rainfall are not significantly different at the 5% level of the Duncan's multiple range test.

The derived regression equations for the tillage treatments used in this experiment are given in Table 4. The high α value for the DP indicates a more rapid decline in the DP than the other treatments. The rates of decline in the SCT and HH were almost the same. The reduction in random roughness has a great significance in the soil water storage capacity. The slow and steady decline in the SCT and HH treatments would mean that more water would be held in the depressions at any time than in the DP were the roughness declined more rapidly. This may partly explain the greater amount of soil moisture in the SCT and HH treatments at times than in the DP. The high R^2 values for the tilled soils show that the Zoebeck equation was able to fully explain the observed variations.

The relatively low regression coefficient and negative value of α for the NT suggest that the variation of random roughness as described by the above equation does not truly characterise the changes in actual physical conditions on the NT surface. A number of rills developed on the NT surface with increase in cumulative precipitation and this created some oriented roughness which gave a picture of increase in random roughness and its residual value depends to a greater extent on the initial surface conditions, which is

Table 4
Fitted Zoebeck and Onstad (1987) equations for random roughness decline

Tillage treatment	Equation	R^2 ($n = 8$)
DP	$RR = 9.39RR_0\, e^{-0.00265P}$	0.96
HH	$RR = 3.72RR_0\, e^{-0.00277P}$	0.95
SCT	$RR = 3.47RR_0\, e^{-0.00205P}$	0.96
NT	$RR = -3.37RR_0\, e^{-0.00104P}$	0.91

contrary to what Dexter (1977) observed. He observed that random roughness reduction due to rainfall was independent of the initial random roughness and the surface conditions. The reduction in random roughness that occurs with pulverisation increases susceptibility of the soil to wind erosion because a smoother surface is less effective in reducing wind velocity. A smoother surface does reduce wind turbulence, but the effect of the decreasing turbulence in reducing wind erosion usually does not compensate entirely for the increased surface wind velocity (Chepil and Milne, 1941). The considerable turbulence that would occur over a rougher surface at higher wind velocities might be expected to enhance water vapour loss from the soil surface. The susceptibility of the smoother surfaces to crust formation would be greater, than for rougher surfaces. At the end of the season, random roughness for SCT, HH, and NT was not significantly different (Table 3).

4.2. Influence of tillage on depressional storage

The TR treatment had the highest values of depressional storage at all measurement times while the NT treatment had the least as shown in Fig. 1. The pulverisation of the soil clods caused by the HH resulted in lower depressional storage for the HH than the SCT treatment. Soil tilt with larger clods would always give higher depressional storage values. It was observed that the volume of tied ridges was eroded after intense storms as well as silting of the ponds. As a result the depressional storage was reduced significantly with time. The effect of the raindrop impact on the soil clods in the HH and DP plots resulted in a sharp decline in depressional storage. Such an observation would be expected since the random roughness in these treatments also declined rapidly with cumulative rainfall. The decline in depressional storage had a significant impact on soil water storage. The decline in depressional storage would result in an increase in surface runoff that is undesirable in semi-arid regions where rainfall is low and unreliable.

4.3. Influence of tillage on soil water storage

The influences of tillage method on the soil water storage were highly significant. Fig. 2 shows the results obtained in this experiment. The TR treatment had the highest values throughout the season for profile moisture content. The depressions kept water for longer periods and allowed it to infiltrate into the soils. The results agree very well with the results obtained by Makungu (1991) and Kayombo and Lal (1992). They noted that compared to either open ridging or flat cultivation, tied ridging increased soil water content, soil water retention and available water capacity. It also decreases runoff.

The SCT and DP treatments had high values of depressional storage but these were significantly lower than that for the TR treatment. Early in the season the NT treatment had significantly higher levels of soil water storage than the HH, SCT and DP treatment. This is contrary to what was expected. However, results showing relatively high soil water storage un-

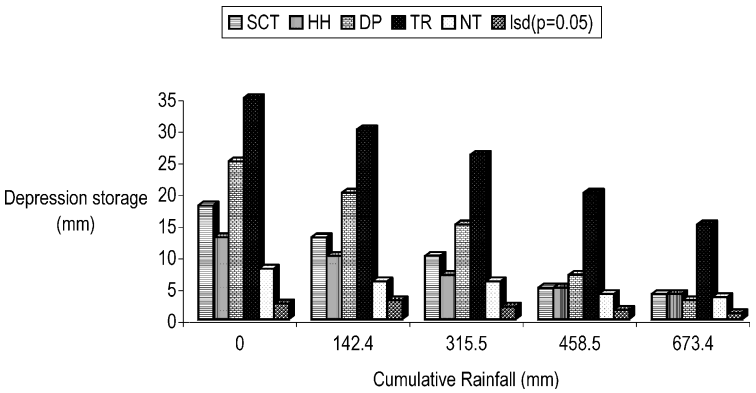

Fig. 1. The influence of rainfall on depressional storage for the five tillage methods.

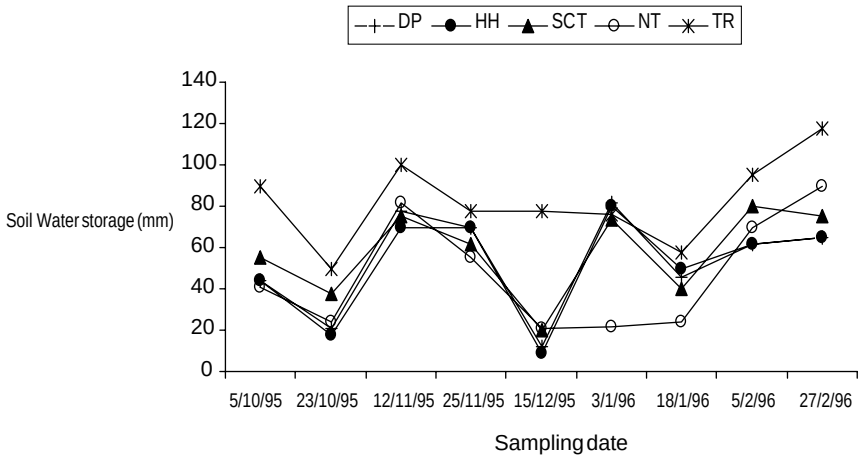

Fig. 2. Soil water content at different sampling times for the five tillage methods.

der NT in comparison to other tillage treatments have been noted in other studies (Kayombo et al., 1991; McFarland et al., 1991). The high moisture content in the NT treatment was attributed to improved infiltration rates under NT as a result of a more stable structure and existence of a more continuous pore system from dead roots and worm activity which are often lacking in the conventionally tilled soils. The merits of NT systems including soil moisture retention, in bio-structurally active soils have been documented in some tropical regions (Lal, 1985).

4.4. Influence of tillage on infiltration

Results obtained indicate that tilling the soils enhanced infiltration rates. Infiltration rates were significantly higher in the DP than the SCT treatment. This is probably due to the higher random roughness in the DP than the SCT treatment. The tilled plots had very high values of the initial infiltration rates, but these rates rapidly declined with time. This is probably due to rapid structural deterioration caused by slacking and dispersion. The large proportion of medium sized clods, which easily broke down and accelerated crust formation, might be the major cause for this behaviour.

Infiltration rates were significantly lower in the TR treatment than in the tilled soils. This is probably due to the fact that the infiltration studies were done in the furrows where the soils were scooped to form the ridges thus exposing less the porous subsoil. However, the advantage of the TR treatment is that the ponds created in the field will capture most of the rainwater and allow it to infiltrate into the soil over time (Fig. 3).

4.5. Phillip (1957) model fitting to infiltration data

Infiltration data was analysed by fitting straight lines to the plots of infiltration rate (I) against the square root of cumulative time ($t^{0.5}$) in seconds. I (cm) was divided by a corresponding value of $t^{0.5}$ (s) in the entire infiltration run. The values obtained were then regressed against $t^{0.5}$ and S was the regression coefficient and A the slope of the regression line. The mean values of parameters S and A were determined together with their correlation coefficients and significance tests as shown in Table 5.

Parameter S indicates the capacity of a soil to absorb water and theoretically it is supposed to decrease with the increase of the initial soil moisture. It controls the initial infiltration rate. In contrast, equilibrium infiltration rate is governed by the transmissivity parameter, A, which indicates the ability of a soil to transmit water. The data showed significant differences in S for most of the treatments. However the average S in the TR treatment was similar to that for NT. The high sorptivity values for the tilled plots imply that tillage

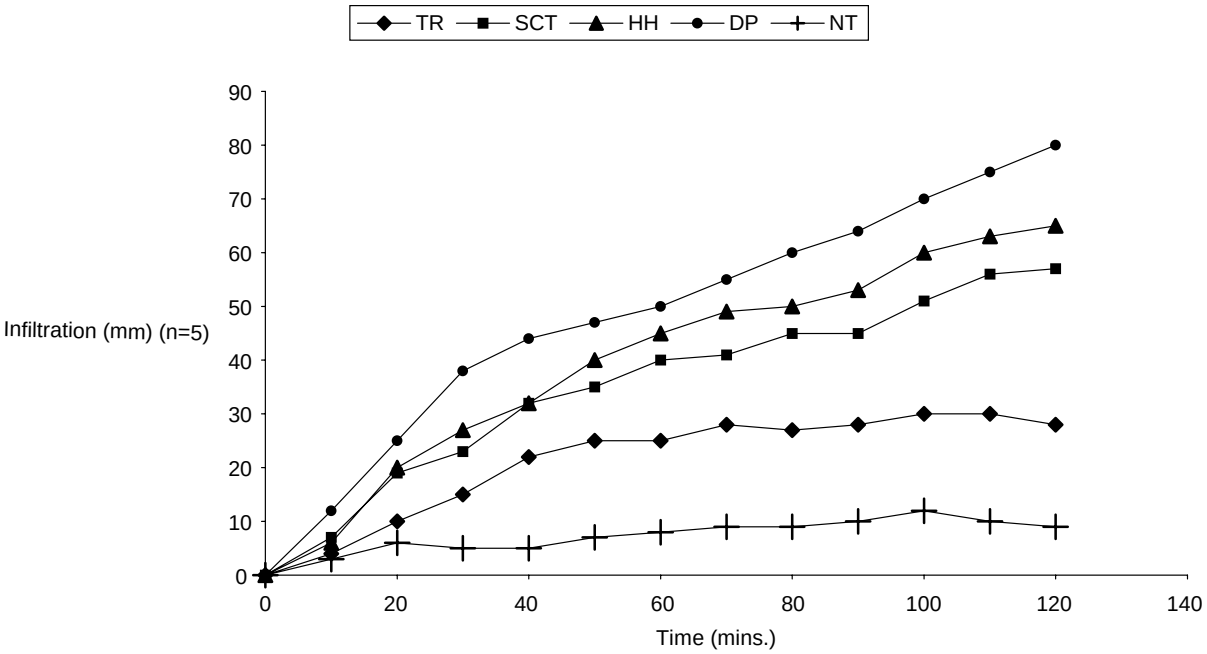

Fig. 3. Cumulative infiltration for the five tillage treatments after the tillage operations.

improves the soil's initial water intake ability. Parameter *A* had the same trend as *S*. The *A* values increased in the order TR, NT, SCT, HH and DP indicating that the soil transmissivity increased with the level of soil disturbance. Again the DP treatment had the highest significant values of parameter *A*. Similar results were obtained by Mwendera (1992) working on silty loam soils. Lal et al. (1989) however obtained negative values for the transmissivity parameter on the plough till treatments. Taylor and Ashcroft (1972) attributed the negative values of *A* to the heavy texture of the soils.

Table 5
Phillips model parameters and correlation coefficients for the five tillage treatments and their significance tests[a]

Tillage method	Phillips parameters		
	S (mm h$^{-0.5}$)	A (mm h^{-1})	R^2 ($n = 8$)
TR	10.73 a	2.08 a	0.95
NT	12.27 a	2.60 a	0.95
DP	50.74 b	14.17 b	0.90
SCT	23.24 c	5.86 c	0.92
HH	37.43 d	9.37 h	0.90

[a] Means with the same letter in column are not significantly different at the 5% level of Duncan's multiple range test.

4.6. Effect of tillage methods on sorghum grain yield

The TR treatment had the highest grain yield as shown in Table 6. This would be probably due to the high water retention that was associated with this treatment. The SCT treatment also produced relatively higher yields. Hatibu (1995) also obtained similar results in the same area. In Ohio, Dick et al. (1991) obtained higher maize yields under NT than conventionally tilled soils in a 25 year experiment. However they observed that such an advantage of the NT system was only pronounced as the experiment

Table 6
Mean sorghum yields for the five tillage methods[a]

Tillage method	Yield (kg ha^{-1})
HH	2143 a
SCT	2262 b
TR	2406 c
DP	2162 a
NT	2038 d

[a] Means with the same letter are not significantly different at the 5% level of Duncan's multiple range test.

proceeded. In the initial years there were no significant advantages of the NT system. This could be the reason why in this work the NT system had lower yields than the yield from conventionally tilled soils.

5. Conclusion and recommendations

Within the confines of the obtained results, it can be concluded that treatments associated with high values of depressional storage had higher soil moisture contents throughout the season. The results therefore suggest that depressional storage is a suitable index for characterising effects of tillage that have a bearing on soil moisture conservation. Random roughness and depressional storage followed this order: TR > DP > SCT > HH > NT. TR had the highest values of depressional storage because of the oriented roughness associated with tied ridging. With cumulative rainfall, random roughness deteriorated drastically, and at the end of the season the values were almost the same for all tillage methods.

The obtained results also show that tilling soils resulted in increased ability of soil to hold and transmit water. This was evident from the infiltration tests done. The good precision of the Phillip equation also shows the validity of the equation under the given conditions. However the fit was relatively poor on tilled soils (DP, SCT, and HH). This could be because of the equation's inability to account for the instability of the soil porous system as a result of tillage.

There were significant yield differences among the tillage treatments indicating that tillage induced soil conditions influenced the yields. A higher soil moisture regime in the TR treatment resulted in higher yields.

It can also be concluded that the high degree of surface roughness and associated total porosity created by tillage increased infiltration into the soils. However, the susceptibility of the soils to structural degradation is a very important factor in soil water infiltration in tilled soils.

Acknowledgements

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DRAWINGS

Drawing No. C-054 Block D Existing Conditions, Clearing, Grubbing and Fencing Plan
Drawing No. C-404 Block D Grading Plan
Drawing No. C-500 General Notes and Details
Drawing No. C-604 Block D Sedimentation and Erosion Control Plan
Drawing No. C-650 Sedimentation and Erosion Control Notes and Details

(SEE DRAWING C052)
BLOCK B
HINCH ROAD
R10.0m
ROCK CHECK SPREADER SEE SHEET C-500 FOR DETAILS
EXISTING RAIL FENCE TO BE REMOVED AND DISPOSED OF OFF SITE
EXISTING RAIL FENCE
SEE DETAIL 1
EXISTING RAIL FENCE TO BE REMOVED AND DISPOSED OF OFF SITE
POTENTIAL EXPOSED ROCK LOCATION
POTENTIAL EXPOSED ROCK LOCATION
EXISTING TREED AREA TO REMAIN
TEMPORARY LAYDOWN AREA TOPSOIL REMOVAL AS REQUIRED
R15.0m
R10.0m
R42.0m
EXISTING TREED AREA TO BE CLEARED, GRUBBED AND REMOVED OFF SITE AS PER OPSS 201
EXISTING TREED AREA TO REMAIN
10.0m SETBACK LIMIT NO TOUCH ZONE
POTENTIAL EXPOSED ROCK LOCATION
POTENTIAL EXPOSED ROCK LOCATION
EXISTING WETLANDS
EXISTING TREED AREA TO BE CLEARED, GRUBBED AND REMOVED OFF SITE AS PER OPSS 201
TEMPORARY LAYDOWN AREA TOPSOIL REMOVAL AS REQUIRED
TEMPORARY LAYDOWN AREA TOPSOIL REMOVAL AS REQUIRED
R10.0m
R15.0m
R54.0m
10.0m SETBACK LIMIT NO TOUCH ZONE
POTENTIAL EXPOSED ROCK LOCATION
POTENTIAL EXPOSED ROCK LOCATION
EXISTING WETLANDS
POTENTIAL EXPOSED ROCK LOCATION
EXISTING TREED AREA TO REMAIN
EXISTING WETLANDS
10.0m SETBACK LIMIT NO TOUCH ZONE
EXISTING TREED AREA TO REMAIN
POTENTIAL EXPOSED ROCK LOCATION
POTENTIAL EXPOSED ROCK LOCATION
EXISTING TREED AREA TO REMAIN
EXISTING TREED AREA TO BE CLEARED, GRUBBED AND REMOVED OFF SITE AS PER OPSS 201
POTENTIAL EXPOSED ROCK LOCATION
EXISTING RAIL FENCE TO BE REMOVED AND DISPOSED OF OFF SITE

N

CENTREVILLE RD
LOCKRIDGE RD
WARTMAN RD
RATTIE RD
HINCH RD
DONDLE RD
BLOCK D
HINCH RD
CRAIGEN RD
CRAIGEN RD
JOYCE RD

KEY MAP
N.T.S.

NOTE:
LIDAR HAS BEEN USED TO SUPPLEMENT THE TOPOGRAPHICAL AND ILLUSTRATE EXTERNAL SITE DRAINAGE PATTERNS. CONTRACTOR IS RESPONSIBLE TO REVIEW ONSITE ELEVATIONS PRIOR TO COMMENCEMENT OF ANY WORK AND ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER OF RECORD.

DETAIL 1
(FENCE REMOVAL)
SCALE= 1:750

Stantec
Stantec Consulting Ltd.
300 Hagey Boulevard
Waterloo ON Canada
Tel. 519.579.4410
www.stantec.com

PCL
CONSTRUCTION LEADERS

Notes
1. TOPOGRAPHIC INFORMATION CONDUCTED BY LESLIE M. HIGGINSON AND RECEIVED OCTOBER 20, 2017. TOPOGRAPHIC SURVEY IS UTM 18. LIDAR INFORMATION CONDUCTED BY TULLOCH ENGINEERING ON JUNE 27, 2016. LIDAR SURVEY IS UTM 18. BEDROCK SURVEY INFORMATION PROVIDED BY PCL CONSTRUCTORS LTD. RECEIVED ON OCTOBER 31, 2017. EXISTING VEGETATION INFORMATION IS APPROXIMATE, PROVIDED FROM AERIAL IMAGERY. CONTRACTOR TO CONFIRM ALL TREE & SHRUB LOCATION ON SITE.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THIS SET PREPARED BY STANTEC CONSULTING LTD.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
4. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
5. IF, FOR UNFORESEEN REASONS, THE OWNER AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE OWNER AND CONTRACTOR AND A COPY IS TO BE KEPT ON FILE ON SITE PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT THE PROPERTY OWNERS OWN RISK.
6. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY.
7. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER. THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED EVERYWHERE PRIOR TO THE INSTALLATION OF SOLAR PANELS.
8. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
9. CULVERTS ARE TO BE INSTALLED AS PER OPSD 802.010. SOIL TYPE TO BE CONFIRMED ON SITE FOR DETERMINATION OF TRENCH WIDTH.
10. ALL AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE-VEGETATED USING NATIVE TOPSOIL AND SEED. MIX AND APPLICATION RATE/METHOD TO BE SUBMITTED AND APPROVED BY OWNER PRIOR TO IMPLEMENTATION.
11. CLEARING AND GRUBBING AND REMOVALS TO BE COMPLETED IN ACCORDANCE WITH OPSS 201. TEMPORARY EROSION CONTROL TO BE COMPLETED IN ACCORDANCE WITH OPSS 577.
12. GRADING TO BE COMPLETED IN ACCORDANCE WITH OPSS 206. GRANULAR MATERIAL TO BE USED IN ACCORDANCE WITH OPSS 1010.
13. CULVERT TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421. HEIGHT OF FILL TABLE FOR CSP CULVERTS TO COMPLY WITH OPSD 805.010.
14. RIPRAP AT CULVERT OUTLETS SHALL BE IN ACCORDANCE WITH OPSD 810.010 SECTION B-B.
15. ALL SEEDING TO BE COMPLETED IN ACCORDANCE WITH OPSS 804.
16. ROCK SPOIL FROM INSTALLATION TO BE REMOVED FROM GROUND SURFACE PRIOR TO GROUND PREPARATION FOR RESTORATION SEEDING.

Legend

PROPOSED	EXISTING
FENCE	
TOPOGRAPHIC SURVEY CONTOUR	295.5
LIDAR CONTOUR	295.5
EXISTING TREES TO BE CLEARED	
POTENTIAL EXPOSED ROCK LOCATION	
LIMIT OF TOPSOIL REMOVAL	
OVERLAND FLOW DIRECTION	
TREE LINE	
REMOVALS	

D	RE-ISSUED FOR TENDER	DRR	DS	17.12.18
C	RE-ISSUED FOR TENDER	DRR	DS	17.12.15
B	ISSUED FOR TENDER	DRR	DS	17.11.23
A	ISSUED FOR CLIENT REVIEW	DRR	DS	17.11.10
Revision		By	Appd.	YY.MM.DD

File Name: 133560220_C-DP-BLOCK_F.dwg	DRR	DS	DRR	17.10.25
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT
54MW GROUND-MOUNT SOLAR FARM
County of Lennox and Addington, Ontario

Title
BLOCK D
EXISTING CONDITIONS, CLEARING, GRUBBING AND FENCING PLAN

Project No.	Scale	Sheet	Revision
133560220	1:1500 (0, 15, 45, 75m)		
Drawing No.		1 of 1	
C-054			D

\\CD1004701\WORK_GROUP\101614\active\133560220\design\drawings_06\civil_block_F\sheet_files\133560220_C-DP-BLOCK_F.dwg
2017/12/18 4:28 PM By: Ricki Dietrick

ORIGINAL SHEET - ARCH D

(SEE DRAWING C402)
BLOCK B
HINCH ROAD

9.0m-500mmø CSP @ 0.50% PIPE EMBEDDED 150mm

EMBEDDED INV=144.11m F/G INV=144.26

ROCK CHECK SPREADER TOP ELEVATION=144.37 SEE SHEET C-500 FOR DETAILS

EMBEDDED INV=144.07m F/G INV=144.22

266m OF ACCESS ROAD FROM HINCH ROAD TO PERIMETER SITE FENCE TO BE CONSTRUCTED WITH HARDENING COMPOUND (ie. CALCIUM CHLORIDE). COMPOUND TO BE REVIEWED PRIOR TO PLACEMENT.

5.0m ACCESS ROAD

BLOCK D-ACCESS ROAD ONE

5.0m WIDE VEGETATED BUFFER TO BE SEEDED WITH NATIVE UPLAD FORAGE AND MEADOW MIX SEE DETAILS ON SHEET C-604.

144.43(SW)
144.24(SW)
144.06(SW)
143.88(SW)
143.68(SW)
143.25

POTENTIAL EXPOSED ROCK LOCATION

S.I. BERM #1

5.0m WIDE VEGETATED BUFFER TO BE SEEDED WITH NATIVE UPLAD FORAGE AND MEADOW MIX SEE DETAILS ON SHEET C-604.

EMBEDDED INV=143.52m F/G INV=143.67

8.3m-600mmø CSP @ 2.54% PIPE EMBEDDED 150mm

EMBEDDED INV=143.31m F/G INV=143.46

ROCK CHECK SPREADER TOP ELEVATION=143.61 SEE SHEET C-500 FOR DETAILS

POTENTIAL EXPOSED ROCK LOCATION

S.I. BERM #2

S.I. BERM #3

S.I. BERM #4

S.I. BERM #5

S.I. BERM #6

S.I. BERM #7

TREED AREA TO REMAIN

BLOCK D-ACCESS ROAD TWO

147.28
147.55
147.14
147.60
SCI
ISDTB

2.3mX50.0m (115m³) RIP RAP (R-50) SPILLWAY AS PER OPSS MUNI 1004 AND OPSS 511 (TYP.)

(SEE DRAWING C-404-SHEET 2)

(SEE DRAWING C-404-SHEET 2)

SLOPE INTERRUPTION BERM SCHEDULE			
BERM No.	LENGTH OF BERM (m)	TOP OF BERM ELEVATION (m)	KEY IN ELEVATION (m)
1	91	144.5	144.5
2	94	146.5	146.5
3	78	147.6	147.6
4	138	148.2	148.2
5	74	146.0	146.0
6	89	147.2	147.2
7	97	148.8	148.8
8	55	144.3	144.3
9	155	148.8	148.8
10	111	147.1	147.1
11	92	147.3	147.3
12	38	147.8	147.8
13	57	146.5	146.5
14	49	146.4	146.0
15	114	146.2	146.2
16	59	145.6	145.6
17	133	144.4	144.4
18	158	142.3	142.3
19	131	140.3	140.3
20	114	146.2	146.2
21	119	144.4	144.4
22	54	144.4	144.4
23	133	145.5	145.5
24	204	143.8	143.8
25	67	142.3	142.3
26	318	138.9	138.9
27	271	140.6	140.6
28	118	139.8	139.8
29	236	141.8	141.8
30	123	141.6	141.6
31	190	139.5	139.5

KEY MAP
N.T.S.

BLOCK D SITE MAP

KEY MAP
N.T.S.

CENTREVILLE RD
GOODRIDGE RD
WARTMAN RD
RATTIE RD
HINCH RD
DOWDLE RD
BLOCK D
CRAIGEN RD
HINCH RD
CRAIGEN RD
JOYCE RD

EAST FACING TABLE — 2.0% — WEST FACING TABLE (2.0%)
TABLE SLOPING DETAIL
NTS

NOTE:
LIDAR HAS BEEN USED TO SUPPLEMENT THE TOPOGRAPHICAL AND ILLUSTRATE EXTERNAL SITE DRAINAGE PATTERNS. CONTRACTOR IS RESPONSIBLE TO REVIEW ONSITE ELEVATIONS PRIOR TO COMMENCEMENT OF ANY WORK AND ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER OF RECORD.

THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE STORM WATER MANAGEMENT PLAN DATED DECEMBER 15, 2017.

GRADING NOTE:
FOR SLOPE INTERRUPTION BERMS SEE GRADING TABLE ON THIS PAGE AND DETAILS ON SHEET C-500 FOR GRADING & CONSTRUCTION DETAILS

NOISE WALL TO BE REMOVED TO ACCESS INVERTER STATIONS POST CONSTRUCTION

FOR ACCESS ROAD TYPICAL CROSS SECTION PLEASE REFER TO DRAWING C-500

REFER TO ELECTRICAL DRAWING E241-SHEET 1 FOR FINAL LOCATIONS OF TRNECHING

EXISTING EXPOSED BEDROCK FRACTURE INFILLNG TO BE MINIMIZED. IF REQUIRED, FILL TO BE OF COARSE GRANULAR MATERIAL. REFER TO HYDROLOGICAL ASSESSMENT (2017, HARDEN ENVIRONMENTAL SERVICES LTD.).

Stantec
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PCL CONSTRUCTION LEADERS

Notes

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6. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY.
7. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER, THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED EVERYWHERE PRIOR TO THE INSTALLATION OF SOLAR PANELS.
8. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
9. CULVERTS ARE TO BE INSTALLED AS PER OPSD 802.010. SOIL TYPE TO BE CONFIRMED ON SITE FOR DETERMINATION OF TRENCH WIDTH.
10. ALL AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE-VEGETATED USING NATIVE TOPSOIL AND SEED, MIX AND APPLICATION RATE/METHOD TO BE SUBMITTED AND APPROVED BY OWNER PRIOR TO IMPLEMENTATION.
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15. RIPRAP AT CULVERT OUTLETS SHALL BE IN ACCORDANCE WITH OPSD 810.010 SECTION B-B.
16. ALL SEEDING TO BE COMPLETED IN ACCORDANCE WITH OPSS 804.
17. ROCK SPOIL FROM INSTALLATION TO BE REMOVED FROM GROUND SURFACE PRIOR TO GROUND PREPARATION FOR RESTORATION SEEDING.

Legend

PROPOSED	EXISTING
185.19 ELEVATION	185.19(EX)
SWALE	
TOPOGRAPHIC SURVEY CONTOUR	184.5
LIDAR CONTOUR	184.5
FENCE	
OVERLAND FLOW DIRECTION	
2.0% GRADE	
SLOPE (3:1 UNLESS NOTED OTHERWISE)	
HARDENED SURFACE	
CULVERT	
PROPOSED FILL AREA	
AC CABLE TRENCH	
DC CABLE TRENCH	
POTENTIAL EXPOSED ROCK LOCATIONS	
SLOPE INTERRUPTION BERM (S.I. BERM) (SEE DETAIL ON SHEET C-500)	
TEMPORARY LAYDOWN AREA (MATERIAL TO BE DETERMINED ON SITE)	
10m SETBACK LIMIT NO TOUCH ZONE	
GRASSED WATERWAY (SEE SHEET C-500 FOR DETAILS)	

Revision	By	Appd.	YY.MM.DD
C REISSUED FOR TENDER	DRR	DS	17.12.15
B ISSUED FOR TENDER	DRR	DS	17.11.23
A ISSUED FOR CLIENT REVIEW	DRR	DS	17.11.10

File Name: 133560220_C-GP-BLOCK_F.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	DRR	DS	DRR	17.10.24

Permit-Seal

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT

54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
BLOCK D
GRADING PLAN

Project No. 133560220

Scale 1:750 (0, 7.5, 22.5, 37.5m)

Drawing No. C-404

Sheet 1 of 4

Revision C

\\CD1004-F01\WORK_GROUP\01614\active\133560220\design\drawing_DA\civil_block_F\sheet_files\133560220_C-GP-BLOCK_F.dwg
2017/12/18 4:34 PM By: Reis, Derrick

ORIGINAL SHEET - ARCH D

(SEE DRAWING C-404-1)

(SEE DRAWING C-404-SHEET 3)

(SEE DRAWING C-404-SHEET 4)

BLOCK D-ACCESS ROAD TWO

BLOCK D-ACCESS ROAD THREE

BLOCK D-ACCESS ROAD TWO

POTENTIAL EXPOSED ROCK LOCATION

POTENTIAL EXPOSED ROCK

S.I. BERM #1

S.I. BERM #2

S.I. BERM #3

S.I. BERM #4

S.I. BERM #5

S.I. BERM #6

S.I. BERM #7

S.I. BERM #8

S.I. BERM #9

S.I. BERM #10

S.I. BERM #11

S.I. BERM #12

S.I. BERM #13

S.I. BERM #14

S.I. BERM #15

S.I. BERM #16

S.I. BERM #17

S.I. BERM #18

S.I. BERM #19

S.I. BERM #20

S.I. BERM #23

TREED AREA TO REMAIN

5.0m WIDE VEGETATED BUFFER TO BE SEEDED WITH NATIVE UPLAD FORAGE AND MEADOW MIX SEE DETAILS ON SHEET C-604

EMBEDDED INV=143.52m
F/G INV=143.67

8.3m-600mmø CSP @ 2.54% PIPE EMBEDDED 150mm

EMBEDDED INV=143.31m
F/G INV=143.46

ROCK CHECK SPREADER TOP ELEVATION=143.61
SEE SHEET C-500 FOR DETAILS

2.3mX50.0m (115m³ OF 450mm THK OPSS RIP RAP (R-50) SPILLWAY AS PER OPSD MUNI 1004 AND OPSS 511 (TYP.)

PROPOSED FILL AREA

ISO17 & 18

ISO19

ISO20 & 21

POTENTIAL EXPOSED ROCK

N

KEY MAP
N.T.S.

BLOCK D SITE MAP

KEY MAP
N.T.S.

CENTREVILLE RD
LOCKRIDGE RD
WARTMAN RD
RATTE RD
HINCH RD
DONDLE RD
BLOCK D
HINCH RD
CRAIGEN RD
HINCH RD
CRAIGEN RD
JOYCE RD

NOTE:
LIDAR HAS BEEN USED TO SUPPLEMENT THE TOPOGRAPHICAL AND ILLUSTRATE EXTERNAL SITE DRAINAGE PATTERNS. CONTRACTOR IS RESPONSIBLE TO REVIEW ONSITE ELEVATIONS PRIOR TO COMMENCEMENT OF ANY WORK AND ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER OF RECORD.

THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE STORM WATER MANAGEMENT PLAN DATED DECEMBER 15, 2017.

GRADING NOTE:
FOR SLOPE INTERRUPTION BERMS SEE GRADING TABLE ON THIS PAGE AND DETAILS ON SHEET C-500 FOR GRADING & CONSTRUCTION DETAILS

NOISE WALL TO BE REMOVED TO ACCESS INVERTER STATIONS POST CONSTRUCTION

FOR ACCESS ROAD TYPICAL CROSS SECTION PLEASE REFER TO DRAWING C-500

REFER TO ELECTRICAL DRAWING E241-SHEET 1 FOR FINAL LOCATIONS OF TRNECHING

EXISTING EXPOSED BEDROCK FRACTURE INFILLING TO BE MINIMIZED. IF REQUIRED, FILL TO BE OF COARSE GRANULAR MATERIAL. REFER TO HYDROLOGICAL ASSESSMENT (2017, HARDEN ENVIRONMENTAL SERVICES LTD.).

SLOPE INTERRUPTION BERM SCHEDULE

BERM No.	LENGTH OF BERM (m)	TOP OF BERM ELEVATION (m)	KEY IN ELEVATION (m)
1	91	144.5	144.5
2	94	146.5	146.5
3	78	147.6	147.6
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6	89	147.2	147.2
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Stantec

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PCL
CONSTRUCTION LEADERS

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Legend

PROPOSED	EXISTING
185.19 ELEVATION	185.19(EX)
SWALE	
TOPOGRAPHIC SURVEY CONTOUR	184.5
LIDAR CONTOUR	184.5
FENCE	
OVERLAND FLOW DIRECTION	
2.0% GRADE	
SLOPE (3:1 UNLESS NOTED OTHERWISE)	
HARDENED SURFACE	
CULVERT	
PROPOSED FILL AREA	
AC CABLE TRENCH	
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Permit-Seal

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT

54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
BLOCK D
GRADING PLAN

Project No.	Scale	Drawing No.	Sheet	Revision
133560220	1:750 (0 7.5 22.5 37.5m)	C-404	2 of 4	C

\\CD1004-F01\WORK_GROUP\01614\active\133560220\design\drawing_04\civil_block_F\sheet_files\133560220_C-GP-BLOCK_F.dwg
2017/12/18 4:34 PM By: Ricis, Danica

ORIGINAL SHEET - ARCH D

(SEE DRAWING C-404-SHEET 2)

(SEE DRAWING C-404-SHEET 4)

KEY MAP
N.T.S.

BLOCK D SITE MAP

KEY MAP
N.T.S.

CENTREVILLE RD
COCKBURGE RD
WARTMAN RD
RATTIE RD
HINCH RD
DOWDLE RD
BLOCK D
HINCH RD
CRAIGEN RD
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PROPOSED FILL AREA

S.I. BERM #8
S.I. BERM #18
S.I. BERM #17
S.I. BERM #19
S.I. BERM #16
S.I. BERM #15
S.I. BERM #14
S.I. BERM #13
S.I. BERM #23
S.I. BERM #22
S.I. BERM #24
S.I. BERM #25
S.I. BERM #26
S.I. BERM #27
S.I. BERM #28
S.I. BERM #29

POTENTIAL EXPOSED ROCK
POTENTIAL EXPOSED ROCK LOCATION

5.0m WIDE VEGETATED BUFFER, TO BE SEEDED WITH NATIVE UPLAD FORAGE AND MEADOW MIX SEE DETAILS ON SHEET C-604

BLOCK D-ACCESS ROAD THREE

ISD17 & 18
ISD20 & 21

GRASSED WATERWAY SEE SHEET C-500 FOR DETAILS

EXISTING WETLANDS

10m SETBACK LIMIT NO TOUCH ZONE

NOISE WALL TO BE REMOVED TO ACCESS INVERTER STATIONS POST CONSTRUCTION

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	DRR	DS	DRR
			17.10.24
			YY.MM.DD

Permit-Seal

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT

54MW GROUND-MOUNT SOLAR FARM

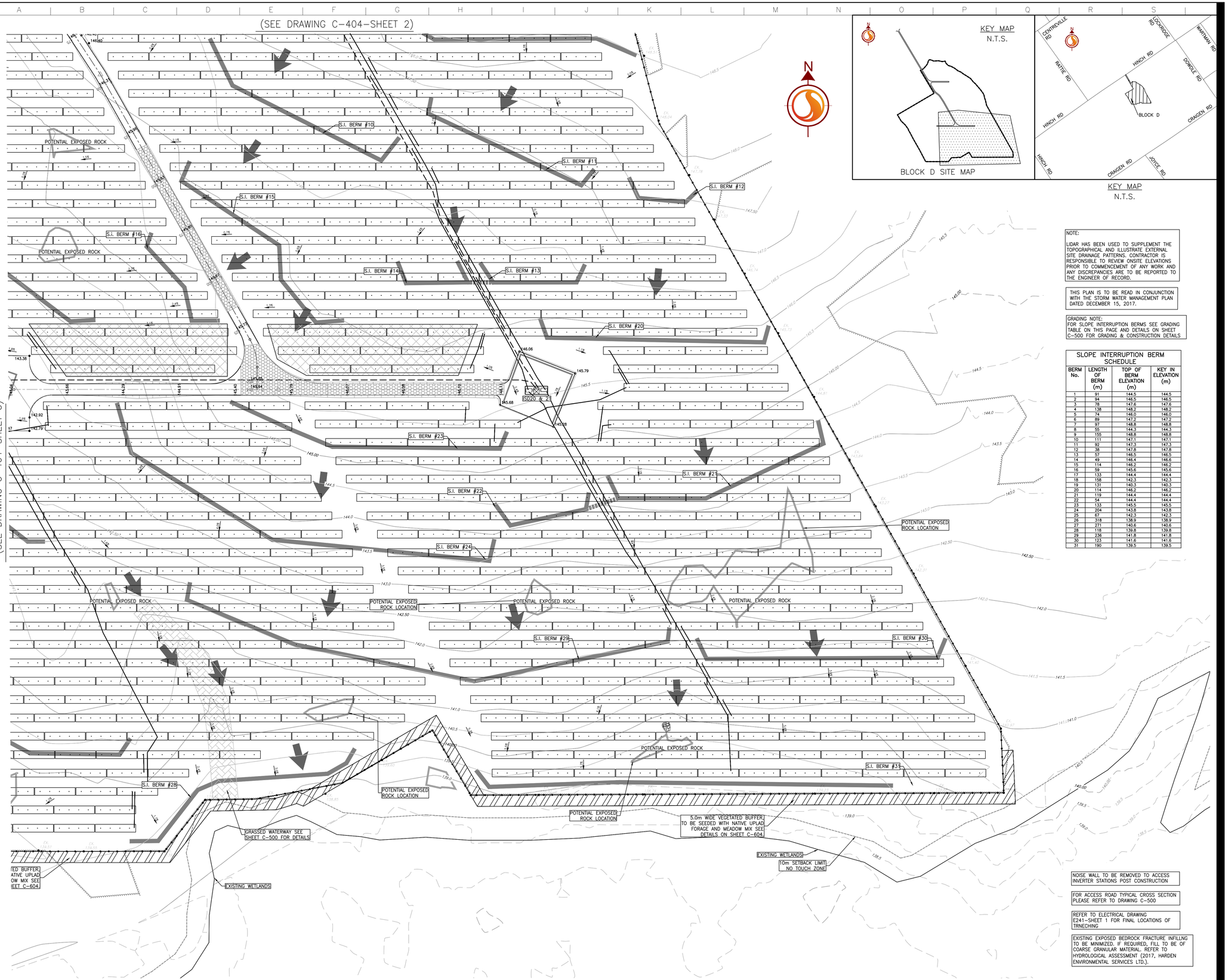
County of Lennox and Addington, Ontario

Title
BLOCK D
GRADING PLAN

Project No.	Scale	Drawing No.	Sheet	Revision
133560220	1:750 (0, 7.5, 22.5, 37.5m)	C-404	3 of 4	C

(SEE DRAWING C-404-SHEET 2)

(SEE DRAWING C-404-SHEET 3)



KEY MAP
N.T.S.

KEY MAP
N.T.S.

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15	114	146.2	146.2
16	59	145.6	145.6
17	133	144.4	144.4
18	158	142.3	142.3
19	131	140.3	140.3
20	114	146.2	146.2
21	119	144.4	144.4
22	54	144.4	144.4
23	133	145.5	145.5
24	204	143.8	143.8
25	67	142.3	142.3
26	318	138.9	138.9
27	271	140.6	140.6
28	118	139.8	139.8
29	236	141.8	141.8
30	123	141.6	141.6
31	190	139.5	139.5

NOISE WALL TO BE REMOVED TO ACCESS INVERTER STATIONS POST CONSTRUCTION

FOR ACCESS ROAD TYPICAL CROSS SECTION PLEASE REFER TO DRAWING C-500

REFER TO ELECTRICAL DRAWING E241-SHEET 1 FOR FINAL LOCATIONS OF TRNECHING

EXISTING EXPOSED BEDROCK FRACTURE INFILLNG TO BE MINIMIZED. IF REQUIRED, FILL TO BE OF COARSE GRANULAR MATERIAL. REFER TO HYDROLOGICAL ASSESSMENT (2017, HARDEN ENVIRONMENTAL SERVICES LTD.).

Stantec

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CONSTRUCTION LEADERS

Notes

1. TOPOGRAPHIC INFORMATION CONDUCTED BY LESLIE M. HIGGINSON AND RECEIVED OCTOBER 20, 2017. TOPOGRAPHIC SURVEY IS UTM 18. LIDAR INFORMATION CONDUCTED BY TULLOCH ENGINEERING ON JUNE 27, 2016. LIDAR SURVEY IS UTM 18. BEDROCK SURVEY INFORMATION PROVIDED BY PCL CONSTRUCTORS LTD. RECEIVED ON OCTOBER 31, 2017. EXISTING VEGETATION INFORMATION IS APPROXIMATE, PROVIDED FROM AERIAL IMAGERY. CONTRACTOR TO CONFIRM ALL TREE & SHRUB LOCATION ON SITE.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THIS SET PREPARED BY STANTEC CONSULTING LTD.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
4. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
5. IF, FOR UNFORESEEN REASONS, THE OWNER AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE OWNER AND CONTRACTOR AND A COPY IS TO BE KEPT ON FILE ON SITE PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT THE PROPERTY OWNERS OWN RISK.
6. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY.
7. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER, THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED EVERYWHERE PRIOR TO THE INSTALLATION OF SOLAR PANELS.
8. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
9. CULVERTS ARE TO BE INSTALLED AS PER OPSD 802.010. SOIL TYPE TO BE CONFIRMED ON SITE FOR DETERMINATION OF TRENCH WIDTH.
10. ALL AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE-VEGETATED USING NATIVE TOPSOIL AND SEED, MIX AND APPLICATION RATE/METHOD TO BE SUBMITTED AND APPROVED BY OWNER PRIOR TO IMPLEMENTATION.
11. CLEARING AND GRUBBING AND REMOVALS TO BE COMPLETED IN ACCORDANCE WITH OPSS 201. TEMPORARY EROSION CONTROL TO BE COMPLETED IN ACCORDANCE WITH OPSS 577.
12. GRADING TO BE COMPLETED IN ACCORDANCE WITH OPSS 206. GRANULAR MATERIAL TO BE USED IN ACCORDANCE WITH OPSS 1010.
13. CULVERT TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421. HEIGHT OF FILL TABLE FOR CSP CULVERTS TO COMPLY WITH OPSD 805.010.
14. RIPRAP AT CULVERT OUTLETS SHALL BE IN ACCORDANCE WITH OPSD 810.010 SECTION B-B.
15. ALL SEEDING TO BE COMPLETED IN ACCORDANCE WITH OPSS 804.
16. ROCK SPOIL FROM INSTALLATION TO BE REMOVED FROM GROUND SURFACE PRIOR TO GROUND PREPARATION FOR RESTORATION SEEDING.

Legend

PROPOSED		EXISTING
185.19	ELEVATION	185.19(EX)
	SWALE	
	TOPOGRAPHIC SURVEY CONTOUR	184.5
	LIDAR CONTOUR	184.5
	FENCE	
	OVERLAND FLOW DIRECTION	
2.0%	GRADE	
	SLOPE (3:1 UNLESS NOTED OTHERWISE)	
	HARDENED SURFACE	
	CULVERT	
	PROPOSED FILL AREA	
	AC CABLE TRENCH	
	DC CABLE TRENCH	
	POTENTIAL EXPOSED ROCK LOCATIONS	
	SLOPE INTERRUPTION BERM (S.I. BERM) (SEE DETAIL ON SHEET C-500)	
	TEMPORARY LAYDOWN AREA (MATERIAL TO BE DETERMINED ON SITE)	
	10m SETBACK LIMIT NO TOUCH ZONE	
	GRASSED WATERWAY (SEE SHEET C-500 FOR DETAILS)	

Revision	By	Appd.	YY.MM.DD
C REISSUED FOR TENDER	DRR	DS	17.12.15
B ISSUED FOR TENDER	DRR	DS	17.11.23
A ISSUED FOR CLIENT REVIEW	DRR	DS	17.11.10

File Name: 133560220_C-GP-BLOCK_F.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	DRR	DS	DRR	17.10.24

Permit-Seal

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT

54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
BLOCK D
GRADING PLAN

Project No. 133560220

Scale 1:750 (0, 7.5, 22.5, 37.5m)

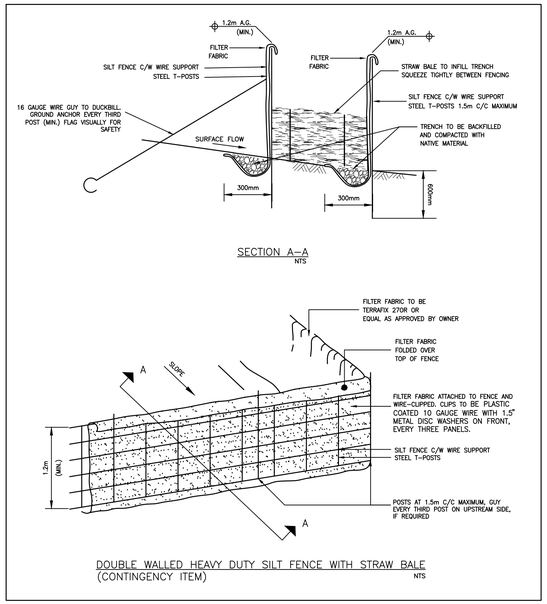
Drawing No. C-404

Sheet 4 of 4

Revision C

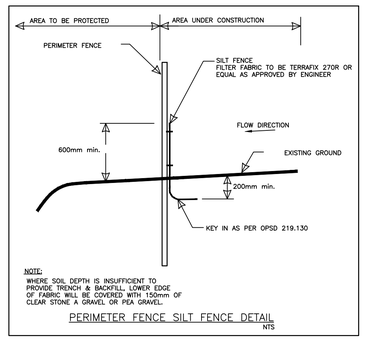
\\CD1004-F01\WORK_GROUP\0161\active\133560220\design\drawing_DA\civil_block_F\sheet_files\133560220_C-GP-BLOCK_F.dwg
2017/12/18 4:53 PM By: Ricis Derrick

ORIGINAL SHEET - ARCH D



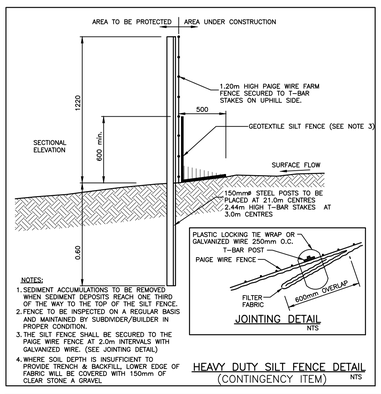
SECTION A–A
NTS

DOUBLE WALLED HEAVY DUTY SILT FENCE WITH STRAW BALE
(CONTINGENCY ITEM)
NTS



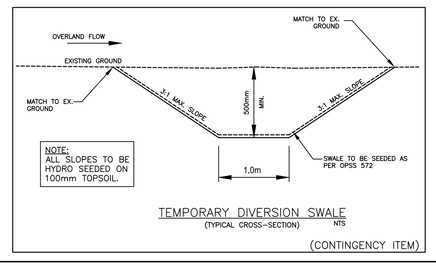
NOTE:
WHERE SOIL DEPTH IS INSUFFICIENT TO PROVIDE TRENCH & BACKFILL, LOWER EDGE OF FABRIC WILL BE COVERED WITH 150mm OF CLEAR STONE A GRAVEL OR PEA GRAVEL.

PERIMETER FENCE SILT FENCE DETAIL
NTS



NOTES:
1. SEDIMENT ACCUMULATIONS TO BE REMOVED WHEN SEDIMENT DEPOSITS REACH ONE THIRD OF THE WAY TO THE TOP OF THE SILT FENCE.
2. FENCE TO BE INSPECTED ON A REGULAR BASIS AND MAINTAINED BY SUBDIVIDER/BUILDER IN PROPER CONDITION.
3. THE SILT FENCE SHALL BE SECURED TO THE PAGE WIRE FENCE AT 2.0m INTERVALS WITH GALVANIZED WIRE. (SEE JOINTING DETAIL)
4. WHERE SOIL DEPTH IS INSUFFICIENT TO PROVIDE TRENCH & BACKFILL, LOWER EDGE OF FABRIC WILL BE COVERED WITH 150mm OF CLEAR STONE A GRAVEL.

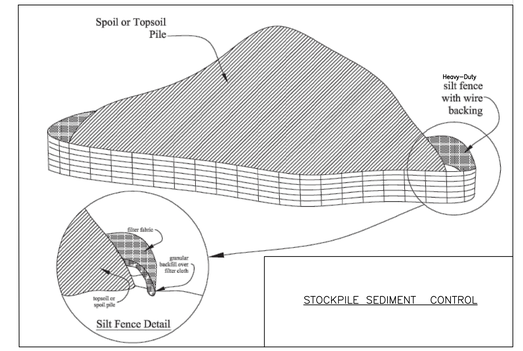
HEAVY DUTY SILT FENCE DETAIL
(CONTINGENCY ITEM)
NTS



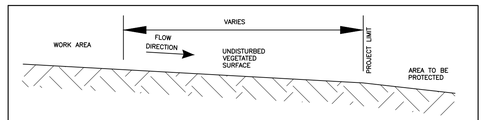
NOTE:
ALL SLOPES TO BE HYDRO SEEDED ON 100mm TOPSOIL.

TEMPORARY DIVERSION SWALE
(TYPICAL CROSS-SECTION)
NTS

(CONTINGENCY ITEM)

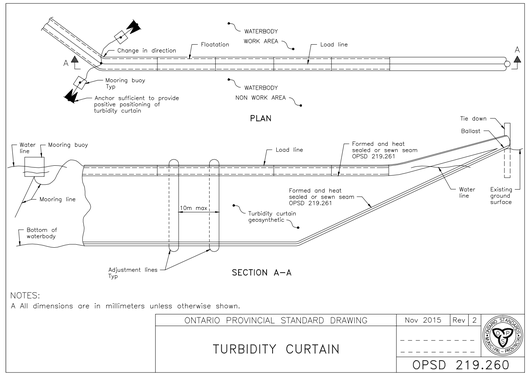


STOCKPILE SEDIMENT CONTROL



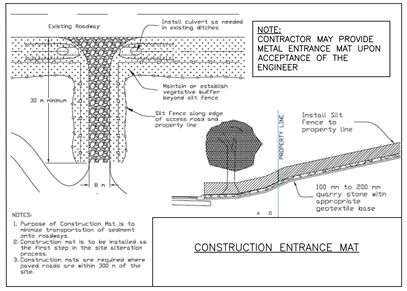
NOTE: –ANY AREAS OF BARE SOIL OR SPARSE VEGETATION TO BE SCARIFIED TO A DEPTH OF 100mm AND HYDROSEEDED
–LIMITS OF VEGETATED FILTER STRIP TO BE DELINEATED WITH STAKES, FLAGGING OR CONSTRUCTION FENCE

VEGETATED FILTER STRIP DETAIL
NTS



NOTES:
A All dimensions are in millimeters unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
TURBIDITY CURTAIN		OPSD 219.260



NOTES:
1. Purpose of Construction Mat is to minimize transportation of sediment onto roadways.
2. Construction mat is to be installed as the first step in the site alteration process.
3. Construction mats are required where paved roads are within 300 m of the site.

CONSTRUCTION ENTRANCE MAT

EROSION AND SEDIMENT CONTROL NOTES: (SEE DETAILS THIS SHEET)

1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM DURING CONSTRUCTION ACTIVITIES. THIS INCLUDES LIMITING THE AMOUNT AND DURATION OF EXPOSED SOIL AND INSTALLING SILT FENCES AND OTHER SEDIMENT TRAPS/FILTERS SIMILAR TO THOSE ILLUSTRATED HEREIN.
2. EROSION AND SEDIMENT CONTROL WORKS SHALL BE INSTALLED AND IN WORKING CONDITION PRIOR TO COMMENCEMENT OF CONSTRUCTION RELATED ACITVITIES.
3. SEDIMENT CONTROL MEASURES ADJACENT TO CONSTRUCTION AREAS MAY REQUIRE REMOVAL / RELOCATION IN ORDER TO COMPLETE SPECIFIC CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL ENSURE THAT ADEQUATE SEDIMENT CONTROL MEASURES ARE IN PLACE AT ALL TIMES.
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN AND BOLSTER EROSION AND SEDIMENT CONTROL MEASURES AS NECESSARY TO KEEP THEM EFFECTIVE AND MINIMIZE THE POTENTIAL FOR EROSION AND MIGRATION OF SEDIMENT TO THE DOWNSTREAM NATURAL ENVIRONMENT
5. AT THE DISCRETION OF THE OWNER OR OWNER'S CONSULTANT, ADDITIONAL SILT CONTROL DEVICES SHALL BE INSTALLED AT DESIGNATED LOCATIONS.
6. STOCKPILED MATERIAL IS TO BE STORED AWAY FROM WATER BODIES, WETLANDS AND OTHER SENSITIVE RECEIVERS IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCE FROM ENTERING THAT FEATURE AND BE SURROUNDED BY EROSION CONTROL MEASURE WHERE MATERIAL IS TO BE LEFT IN PLACE IN EXCESS OF 10 DAYS OR PRIOR TO A RAIN EVENT, WHICHEVER OCCURS SOONER.
7. SEDIMENT THAT IS ACCUMULATED BY THE TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES SHALL BE REMOVED IN A MANNER THAT AVOIDS ESCAPE OF THE SEDIMENT TO THE DOWNSTREAM SIDE OF THE CONTROL MEASURE AND AVOIDS DAMAGE TO THE CONTROL MEASURE. ALL SEDIMENT SHALL BE REMOVED AND TOPSOIL WITH SEED TO BE ADDED IF NECESSARY.
8. ACCUMULATED SEDIMENT IS TO BE REMOVED AND DISPOSED OF AS PER OPSS 180, PRIOR TO THE REMOVAL OF ANY CONTROL MEASURE.
9. SILT FENCE AND EROSION CONTROL STRUCTURES TO BE CHECKED DAILY AND AFTER EACH RAINFALL (>10mm) BY A QUALIFIED INSPECTOR FOR DEFICIENCIES. SEDIMENT SHALL BE REMOVED WHEN THE LEVEL OF SEDIMENT DEPOSITION REACHES ONE THIRD OF THE WAY TO THE TOP OF THE BARRIER.
10. STOCKPILED MATERIAL IS TO BE STORED A SUFFICIENT DISTANCE FROM WATERCOURSES, TO PRECLUDE SEDIMENT INPUTS DUE TO EROSION OF STORED SOIL MATERIALS. WHERE STOCKPILED EXCAVATED NATIVE MATERIALS AND IMPORTED MATERIALS WITH A D50 LESS THAN 4.75mm ARE TO BE LEFT IN PLACE UNDISTURBED IN EXCESS OF 30 DAYS, STOCKPILES ARE TO BE COVERED WITH A ROLLED EROSION CONTROL PRODUCT (RECP) SUCH AS A TARP, SINGLE NET STRAW MAT OR DOUBLE NET STRAW MAT. IMPORTED MATERIALS WITH A D50 OF 4.75mm OR GREATER CAN REMAIN UNCOVERED. GRANULAR A AND B (TYPE II) GRADATION REQUIREMENTS ALLOW UP TO 55% PERCENT PASSING A 4.75mm SIEVE (#4 SIEVE), AND MAY BE STOCKPILED WITHOUT COVERING WITH AN RECP.
11. EROSION AND SEDIMENT CONTROL MONITORING RECORDS SHALL BE KEPT AND MADE AVAILABLE TO THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE AND QUINTE CONSERVATION UPON REQUEST.
12. IN THE EVENT OF INCLEMENT WEATHER OR UNFAVOURABLE TERRAIN FOR CONSTRUCTION, CONSTRUCTION BEST PRACTICES, SUCH AS TEMPORARY RIG–MATS MAY BE USED TO PREVENT DISRUPTION OF SURFACE SOILS AND VEGETATIVE COVER BY CONSTRUCTION VEHICLES AND EQUIPMENT.
13. EQUIPMENT AND CONSTRUCTION MATERIAL SHALL BE STORED AWAY FROM WATER BODIES IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCE FROM ENTERING THE WATER, REFUELLING OF MACHINERY AND GENERATORS SHALL NOT BE CONDUCTED WITHIN 30m OF A WATER BODY OR WETLAND AND SHALL BE COMPLETED IN A CONTROLLED MANNER WITH ADEQUATE SPILL PROTECTION ON SITE
14. ADDITIONAL CONTROLS MAY BE REQUIRED DUE TO UNFORESEEN CIRCUMSTANCES, CHANGING SITE CONDITIONS OR IF THE PROPOSED CONTROLS DO NOT ACHIEVE THEIR ANTICIPATED RESULT. IN THESE CIRCUMSTANCES, ADDITIONAL CONTROLS WILL BE INSTALLED CONSISTENT WITH THE EROSION AND SEDIMENT CONTROL GUIDELINE FOR URBAN CONSTRUCTION (GREATER GOLDEN HORSESHOE CONSERVATION AUTHORITIES, DECEMBER, 2006). THE LOCATIONS AND APPLICATION OF THE CONTROLS WILL BE APPROVED BY THE INSPECTOR PRIOR TO THEIR INSTALLATION.
15. PUBLIC ROADS TO BE CLEANED DAILY OF ACCUMULATED SEDIMENT CAUSED BY CONSTRUCTION.
16. IN ADDITION TO BEING RESPONSIBLE FOR ENSURING THAT THE PRESCRIBED MEASURES ARE INSTITUTED AND FUNCTIONING AS INTENDED, THE CONTRACTOR IS ALSO RESPONSIBLE FOR IMPLEMENTING ANY INTERIM OR EMERGENCY MEASURES REQUIRED, TO ENSURE THAT NO SEDIMENT IS DISCHARGED TO THE NATURAL ENVIRONMENT. THE FOLLOWING EXTRA EQUIPMENT/MATERIALS ARE TO BE KEPT ON SITE AS A CONTINGENCY, IN CASE THE PROPOSED CONTROL MEASURES ARE BREACHED.
    - SILT FENCE
    - FILTER CLOTH
    - PUMPS
    - CLEAN RIP–RAP (FREE OF FINES) FOR ROCK CHECK DAMS
    - SAND BAGS
    - ANY ADDITIONAL MATERIAL DEEMED NECESSARY TO REPAIR/ CONSTRUCT PROPOSED MEASURES OR TO ADEQUATELY DEAL WITH UNEXPECTED HIGH FLOWS

DURING AREA GRADING :

1. TOPSOIL IS TO BE STRIPPED ONLY IN AREAS REQUIRING EARTHWORKS AND PLACED IN STOCKPILES AT THE LOCATIONS SHOWN ON THE PLANS OR AS APPROVED BY THE QUALIFIED ENVIRONMENTAL SITE INSPECTOR.
2. ROADWAYS AND LAY DOWN YARDS ARE TO BE PLACED ON NATIVE GROUND AFTER TOPSOIL HAS BEEN STRIPPED
3. ALL TOPSOIL IS TO BE RE–SPREAD ON CONSTRUCTION IMPACTED AREAS TO A MINIMUM DEPTH OF 150mm AFTER FINAL GRADING IS COMPLETION.
4. NO TOPSOIL MAY BE EXPORTED FROM THE SITE.
5. INFILLING OF BEDROCK FRACTURES SHALL BE MINIMIZED AND IF NECESSARY, COARSE GRANULAR FILL SHALL BE USED.

SEEDING MAINTENANCE NOTES:

1. CONTRACTOR SHALL REPAIR AND RESEED DEAD OR BARE SPOTS PRIOR TO SUBSTANTIAL COMPLETION.
2. SEEDING SHALL BE WATERED AS REQUIRED TO ESTABLISH WEED–FREE, HEALTHY ESTABLISHMENT OF SEED MIX.
3. CONTROL NOXIOUS AND INVASIVE WEED GROWTH DURING (2) YEAR MAINTENANCE PERIOD. NATIVE SPECIES THAT HAVE GERMINATED NATURALLY SHALL BE RETAINED (i.e. GOLDENRODS, ASTERS etc.) REFER TO OMAFRA's NOXIOUS WEEDS IN ONTARIO FOR A LIST OF SPECIES TO BE REMOVED http://www.omafra.gov.on.ca/english/crops/facts/noxious_weeds.htm
4. SEEDED AREAS SHALL BE UNIFORM, FREE OF RUTS EROSION AND/OR BARE AND DEAD SPOTS, FREE OF WEEDS, AND HAVE, MINIMUM 80% COVER OF GERMINATED PERENNIAL SEED FOR FINAL ACCEPTANCE.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DAMAGE TO SEEDED AREAS AND SHALL RESTORE IT TO ORIGINAL CONDITION TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR.
6. THE CONTRACTOR SHALL REPAIR ANY RILLS FORMED BELOW THE LOWER EDGE OF THE SOLAR PANELS PRIOR TO SEEDING.

AFTER AREA GRADING :

1. ALL AREAS WHERE ACTIVE CONSTRUCTION IS NOT EXPECTED FOR 30 DAYS SHALL BE RE–SEEDED WITH NATIVE PLANT SPECIES PER LANDSCAPE PLAN
2. REMOVAL OF SEDIMENT CONTROL MEASURES AND COLLECTION OF ACCUMULATED SEDIMENT SHALL OCCUR FOLLOWING SUBSTANTIAL COMPLETION OF CONSTRUCTION (90%–100%) AND SITE STABILIZATION TO 90%

SILT FENCE NOTES (AS PER OPSD):

1. STAKES/POSTS ARE TO BE INSTALLED ON THE DOWNSTREAM SIDE OF THE BARRIER.
2. SILT FENCE FABRIC TO BE TERRAFIX 270R OR EQUIVALENT.
3. CONTRACTOR TO MONITOR SILT FENCE FOR UV DEGRADATION AND UNDERMINING
4. PAIGE WIRE TO BE 16 GAUGE OR HEAVIER

ROLLED EROSION CONTROL PRODUCT (RECP) NOTES:

1. EITHER ROLLED EROSION CONTROL PRODUCTS (RECP) OR MULCHMAX ULTRA AT 500KG/HA ARE TO BE USED ON 3:1 SLOPES OR GREATER.
2. RECP SHALL BE BIODEGRADABLE AND CONSIST OF STRAW, STRAW–COCONUT, OR COCONUT FIBER WHICH ARE HELD IN PLACE BY NETTING SEWN ON BOTH SIDES OF THE MATERIAL.
3. RECP MUST BE SECURED ON STOCKPILE BY STAPLING AT THE BOTTOM OF THE SLOPE AND UPHILL TRENCHES ON THE STOCKPILE/SLOPED SURFACE.
4. RECP PRODUCTS ARE TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS. INSTALLATION TO BE INSPECTED AND REPAIRED AS NEEDED.
5. RECP ARE TO BE APPLIED AS SOON AS POSSIBLE FOLLOWING GRADING AND SEEDING OF SUBJECT AREAS.
6. SUBSOILS ARE TO BE SMOOTH AND FREE OF STONES AND DEBRIS OR OTHER WEED CLUMPS PRIOR TO RECP BEING INSTALLED.
7. CONTRACTOR TO ENSURE THAT RECP IS SECURED AT THE TOP OF THE SLOPE IN A TRENCH AND OVERLAP (SIDE TO SIDE AND BOTTOM TO TOP)
8. CONTRACTOR TO INSPECT THE SITE DAILY AND AFTER EVERY SIGNIFICANT RAINFALL EVENT (>10mm) AND IDENTIFY AREAS OF EROSION OR POTENTIAL EROSION. BEST MANAGEMENT PRACTICES ARE TO BE USED TO CONTROL THE EROSION. METHODS OF CONTROL MAY INCLUDE THE USE OF EROSION CONTROL BLANKETS C/W SEEDING, HYDRAULIC MULCH OR STRAW MULCH, OR SOIL BINDER. SOILS ARE TO BE STABILIZED AS SOON AS AREAS ARE IDENTIFIED TO PREVENT FURTHER EROSION.
9. CONTRACTORS TO ENSURE THAT RILLING/GULLYING RECTIFIED PRIOR TO RECP OR MULCHMAX ULTRA INSTALLATION OR CONTRACTOR TO MONITOR RUNOFF UNDER THE RECP FOLLOWING INSTALLATION.

HYDRAULIC MULCH NOTES:

1. COORDINATE/CONSULT WITH OWNER PRIOR TO UTILIZING ANY HYDRAULIC MULCH. TIMELINES AND SEEDING METHODS NEED TO BE CAREFULLY CONSIDERED PRIOR TO IMPLEMENTATION.
2. ENSURE THAT A TACKIFIER IS USED TO KEEP PRODUCT IN PLACE.
3. APPLY SEED MIX PRIOR TO MULCH WITH TACKIFIER.
4. HYDRAULIC MULCH IS TO BE APPLIED AS SOON AS GRADING AND SEEDING WORK IS COMPLETE TO ENSURE STABILIZATION OF SOILS.
5. RE–APPLY HYDRAULIC MULCH IF THE SUBJECT AREA IS DAMAGED OR ERODED BY WIND OR WATER, SURFACE COVERAGE MUST BE AT LEAST 80% AT ALL TIMES.

CULVERT NOTES:

1. CULVERT SLOPE TO MATCH EXISTING DITCH GRADE UNLESS OTHERWISE NOTED.
2. CULVERT TO BE EMBEDDED 10% OF PIPE DIAMETER BELOW DITCH INVERT OR AS NOTED.
3. CULVERTS TO BE CORRUGATED STEEL PIPE (CSP). PIPE MATERIAL TO BE GALVANIZED STEEL AND HAVE A 68mm x 13mm CORRUGATION WITH 1.6mm METAL THICKNESS.
4. CULVERT TO BE INSTALLED IN ACCORDANCE WITH OPSD 802.010.
5. CULVERT ELEVATIONS ARE APPROXIMATE AND ARE TO BE FINALIZED IN THE FIELD.

SCARIFICATION NOTES:

1. ENTIRE WORK AREA TO BE SCARIFIED FOLLOWING COMPLETION OF CLEARING AND GRUBBING.
2. SCARIFICATION TO BE PERFORMED USING A CHISEL PLOW TO RETAIN AS MUCH RESIDUE AT THE SOIL SURFACE AS POSSIBLE.
3. SOIL TO BE SCARIFIED TO A MINIMUM DEPTH OF 150mm, OR AS DEPTH TO BEDROCK PERMITS.
4. SCARIFICATION TO BE PERFORMED PARALLEL TO GROUND SURFACE CONTOURS.

CONTINGENCY MEASURES WHERE FAILURE RISK IS HIGH:

1. WHERE MONITORING HAS IDENTIFIED A HIGH POTENTIAL FOR FAILURE, THE CONTRACTOR SHALL IMMEDIATELY TAKE STEPS TO REDUCE THE RISK. STEPS MAY INCLUDE REPAIRS TO EXISTING MEASURES, MODIFICATIONS TO EXISTING MEASURES, AND THE ADDITION OF NEW MEASURES.
2. WHEN THE LOCAL WEATHER FORECAST INDICATES THAT SIGNIFICANT (I.E >10mm) RAINFALL IS EXPECTED WITHIN 24 HOURS, THE CONTRACTOR SHALL VERIFY ALL EROSION AND SEDIMENT CONTROL MEASURES ARE SECURE.

CONTINGENCY MEASURES IN CASE OF FAILURE:

1. THE CONTRACTOR WILL CEASE CONSTRUCTION RELATED WORK AND FOCUS ON EROSION AND SEDIMENT CONTROL REPAIRS TO EFFECTIVELY STABILIZE THE SITE WHERE A FAILURE HAS OCCURRED OR IS IMMINENT.
2. ALL SPILLS SHALL BE REPORTED TO THE ENVIRONMENTAL MONITOR FOR ASSESSMENT AND DOCUMENTATION, AND TO ESTABLISH A REMEDIAL PLAN BASED ON THE PROJECT–SPECIFIC SPILL RESPONSE PLAN. BASED ON THE ASSESSMENT OF THE EXTENT OF THE IMPACT, THE ENVIRONMENTAL MONITOR SHALL DETERMINE IF THE MOECC SPILLS ACTION CENTRE SHOULD BE NOTIFIED. SHOULD THE INCIDENT REQUIRE THAT THE SPILLS ACTION CENTRE BE NOTIFIED, THIS NOTIFICATION WILL BE UNDERTAKEN AS QUICKLY AS POSSIBLE BY CALLING 1–800–268–6060.
3. IF SIGNIFICANT LONG–TERM DAMAGE TO DOWNSTREAM FISH HABITAT OR PROPERTY IS SUSPECTED, THE ENVIRONMENTAL MONITOR WILL IMMEDIATELY ASSESS AND DOCUMENT THE SITUATION AND REPORT THE INCIDENT TO THE MOECC SPILLS ACTION CENTRE. THE CONTRACTOR WILL DEVELOP A RESTORATION PLAN IN CONSULTATION WITH MOECC. DEVELOPMENT OF THE INITIAL RESTORATION PLAN WILL BEGIN WITHIN 24 HOURS OF THE DISCOVERY OF SEDIMENT DISCHARGE, AND WILL BE IMPLEMENTED AS SOON AS POSSIBLE, FOLLOWING CONSULTATION AND APPROVAL FROM THE MOECC, QC, DFO (IF NECESSARY) AND THE TOWNSHIP OF STONE MILLS
4. THE RESTORATION PLAN WILL ADDRESS:
    - REMOVAL AND DISPOSAL OF SEDIMENT FROM OUTSIDE THE WORK LIMITS,
    - RESTORATION OF THE AFFECTED AREA, AND
    - RESTORATION OF ANY AREAS DISTURBED THROUGH DEPOSITION OR REMOVAL.

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PCL CONSTRUCTION LEADERS

Notes

1. LIDAR INFORMATION CONDUCTED BY TULLOCH ENGINEERING ON JUNE 27, 2016. LIDAR SURVEY IS UTM 18.
2. LEGAL PLAN OF SURVEY BY CALLON DIETZ INC. MARCH 6, 2017. EPTCON, (REV. A) SEPTEMBER 20, 2017.
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THIS SET PREPARED BY STANTEC CONSULTING LTD.
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5. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
6. IF, FOR UNFORESEEN REASONS, THE OWNER AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE OWNER AND CONTRACTOR, AND A COPY IS TO BE KEPT ON FILE ON SITE, PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT THE PROPERTY OWNERS OWN RISK.
7. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT–OF–WAY.
8. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER. THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED EVERYWHERE PRIOR TO THE INSTALLATION OF SOLAR PANELS.
9. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
10. CULVERTS ARE TO BE INSTALLED AS PER OPSD 802.010. SOIL TYPE TO BE CONFIRMED ON SITE FOR DETERMINATION OF TRENCH WIDTH.
11. ALL AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE–VEGETATED USING NATIVE TOPSOIL AND SEED MIX AND APPLICATION RATE/METHOD TO BE SUBMITTED AND APPROVED BY OWNER PRIOR TO IMPLEMENTATION.
12. CLEARING AND GRUBBING AND REMOVALS TO BE COMPLETED IN ACCORDANCE WITH OPSS 201. TEMPORARY EROSION CONTROL TO BE COMPLETED IN ACCORDANCE WITH OPSS 577.
13. GRADING TO BE COMPLETED IN ACCORDANCE WITH OPSS 206. GRANULAR MATERIAL TO BE USED IN ACCORDANCE WITH OPSS 1010.
14. CULVERT TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421. HEIGHT OF FILL TABLE FOR CSP CULVERTS TO COMPLY WITH OPSD 805.010.
15. RIPRAP SHALL BE IN ACCORDANCE WITH OPSD 810.010 SECTION B–B.

Revision	By	Appd.	YY.MM.DD
E. UPDATED DETAILS	MALM	DS	17.12.15
D. UPDATED ESC NOTES	DRR	DS	17.11.30
C. UPDATED ESC NOTES	DRR	DS	17.11.23
B. ISSUED FOR TENDER	DRR	DS	17.11.21
A. ISSUED FOR CLIENT REVIEW	DRR	DS	17.10.30

File Name: 133560220_C-01-EC.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	DRR	DS	DRR	17.10.18

Permit-Seal

PRELIMINARY
NOT FOR CONSTRUCTION

Client/Project
BLUEARTH RENEWABLES INC.
LOYALIST SOLAR PROJECT

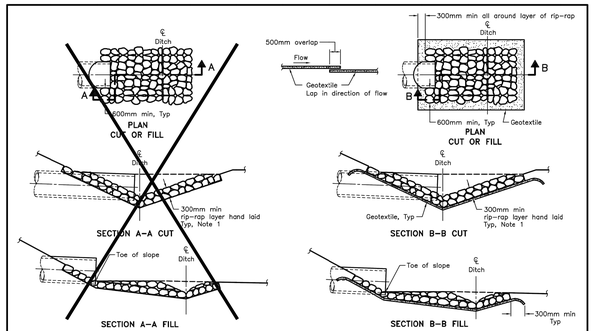
54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
SEDIMENTATION AND EROSION CONTROLS DETAILS

Project No.	Scale	
133560220	AS NOTED	
Drawing No.	Sheet	Revision
C-650	1 of 1	E

ORIGINAL SHEET - ARCH D



TYPE A – WITHOUT GEOTEXTILE

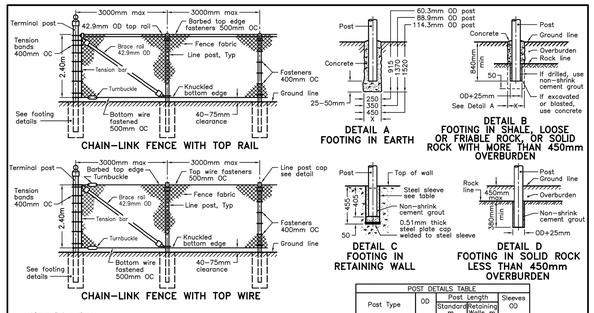
TYPE B – WITH GEOTEXTILE

NOTES:
1 The thickness of the rip–rap layer shall be at least 1.5 times the rip–rap mean diameter.

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev 2
GENERAL RIP–RAP LAYOUT FOR SEWER AND CULVERT OUTLETS		
		OPSD 810.010

RIP–RAP TO BE PLACED:
–3 x THE CULVERT DIAMETER WIDE
–4 x THE CULVERT DIAMETER LONG
–FOR MULTIPLE CULVERTS THE WIDTH AND LENGTH ARE TO BE MULTIPLIED BY THE NUMBER OF CULVERTS. FOR THE WIDTH 0.5m BETWEEN CULVERTS IS TO BE ADDED

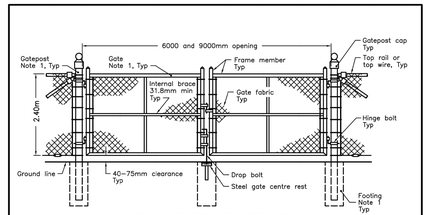


POST DETAILS TABLE				
Post Type	OD	Post Length Standard m	Post Length Retaining Walls m	Sleeves OD
Line post	60.3	2.6	2.0	88.9
Terminal post	88.9	2.9	2.3	114.3

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2005	Rev 1
FENCE, CHAIN–LINK INSTALLATION – ROADWAY		
		OPSD – 972.130

NOTE:
A Fence as viewed from the roadway.
B All dimensions are in millimetres unless otherwise shown.

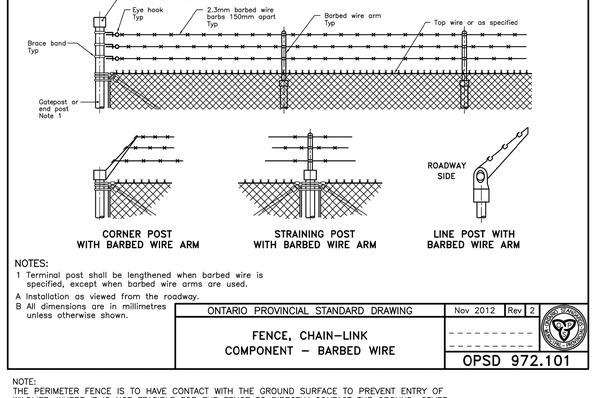
* NOTE: PERIMETER FENCE FABRIC IS TO BE BURIED A MINIMUM OF 100mm–200mm IN THE GROUND, WHERE SOIL DEPTHS ALLOW, TO PREVENT WILDLIFE FROM BURROWING UNDER AND ENTERING THE FACILITY. WHERE THE FENCE FABRIC IS INSTALLED OVER BEDROCK, THE BOTTOM OF THE FENCE FABRIC IS TO BE FLUSH WITH GROUND SURFACE AND ADDITIONAL MEASURES ARE TO BE INSTALLED TO PREVENT WILDLIFE ACCESS UNDER THE FENCE FABRIC. ADDITIONAL MEASURES CAN BE FOUND ON PERIMETER SILT FENCE DETAIL ON DRAWING C–650



NOTES:
1 For footing details and Gate and Gatepost Details Table refer to OPSD 972.132.

A Gates as viewed from the roadway.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
FENCE, CHAIN–LINK COMPONENT – GATE		
		OPSD 972.102

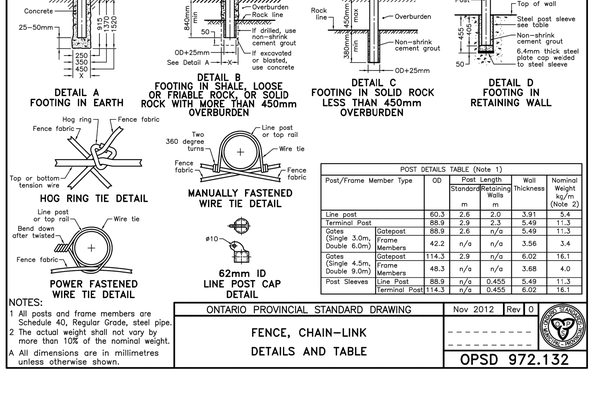


NOTES:
1 Terminal post shall be lengthened when barbed wire is specified, except when barbed wire arms are used.

A Installation as viewed from the roadway.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
FENCE, CHAIN–LINK COMPONENT – BARBED WIRE		
		OPSD 972.101

NOTE:
THE PERIMETER FENCE IS TO HAVE CONTACT WITH THE GROUND SURFACE TO PREVENT ENTRY OF WILDLIFE. WHERE IT IS NOT FEASIBLE FOR THE FENCE TO DIRECTLY CONTACT THE GROUND, OTHER MEASURES WILL BE INSTALLED TO PREVENT WILDLIFE ACCESS UNDER THE FENCE. REFER TO PERIMETER SILT FENCE DETAIL ON DRAWING C–650 FOR SILT FENCE KEY–IN DEPTH TO PRVENT WILDLIFE ACCESS.

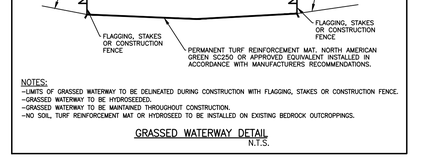


POST DETAILS TABLE (Note 1)						
Post/Frame Member Type		OD	Post Length Standard m	Post Length Retaining Walls m	Wall Thickness	Nominal Weight kg/m (Note 2)
Line post		60.3	2.6	2.0	3.91	5.4
Terminal Post		88.9	2.9	2.3	5.49	11.3
Gates (Single 3.0m, Double 6.0m)	Gatepost	88.9	2.6	n/a	5.49	11.3
	Frame Members	42.2	n/a	n/a	3.56	3.4
Gates (Single 4.5m, Double 9.0m)	Gatepost	114.3	2.9	n/a	6.02	16.1
	Frame Members	48.3	n/a	n/a	3.68	4.0
Post Sleeves	Line Post	88.9	n/a	0.455	5.49	11.3
	Terminal Post	114.3	n/a	0.455	6.02	16.1

NOTES:
1 All posts and frame members are Schedule 40, Regular Grade, steel pipe.
2 The actual weight shall not vary by more than 10% of the nominal weight.

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 0
FENCE, CHAIN–LINK DETAILS AND TABLE		
		OPSD 972.132



NOTES:
–LIMITS OF GRASSED WATERWAY TO BE DELINEATED DURING CONSTRUCTION WITH FLAGGING, STAKES OR CONSTRUCTION FENCE.
–GRASSED WATERWAY TO BE HYDROSEEDED.
–GRASSED WATERWAY TO BE MAINTAINED THROUGHOUT CONSTRUCTION.
–NO SOIL, TURF REINFORCEMENT MAT OR HYDROSEED TO BE INSTALLED ON EXISTING BEDROCK OUTCROPPINGS.

GRASSED WATERWAY DETAIL
N.T.S.

Stantec

Stantec Consulting Ltd.
300 Hagey Boulevard
Waterloo ON Canada
Tel. 519.579.4410
www.stantec.com

PCL
CONSTRUCTION LEADERS

Notes

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E.	REVISED NOTES AND DETAILS	MALM	DS	17.12.15
D.	REVISED NOTES AND DETAILS	DRR	DS	17.11.30
C.	REVISED NOTES AND DETAILS	KDB	DS	17.11.23
B.	ISSUED FOR TENDER	DRR	DS	17.11.23
A.	ISSUED FOR CLIENT REVIEW	MALM	DS	17.10.31
Revision		By	Appd.	YY.MM.DD

File Name: 133560220_C-DT.dwg	DRR	DS	DRR	17.10.18
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

PRELIMINARY
NOT FOR CONSTRUCTION

Client/Project
BLUEARTH RENEWABLES INC.
LOYALIST SOLAR PROJECT

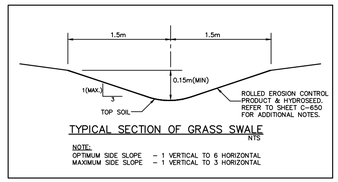
54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
GENERAL DETAILS AND NOTES

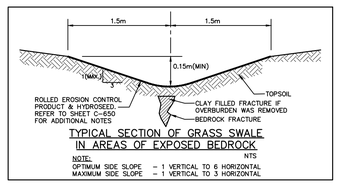
Project No.	Scale	
133560220	AS NOTED	
Drawing No.	Sheet	Revision
C-500	1 of 2	E

ORIGINAL SHEET - ARCH D



TYPICAL SECTION OF GRASS SWALE
NTS

NOTE:
OPTIMUM SIDE SLOPE – 1 VERTICAL TO 6 HORIZONTAL
MAXIMUM SIDE SLOPE – 1 VERTICAL TO 3 HORIZONTAL



TYPICAL SECTION OF GRASS SWALE IN AREAS OF EXPOSED BEDROCK
NTS

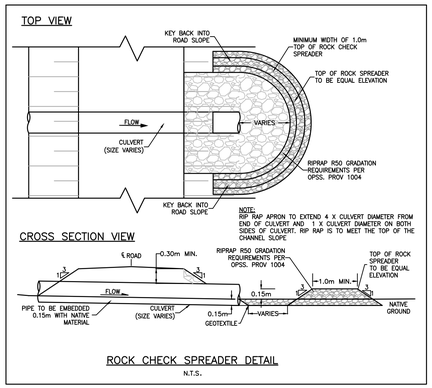
NOTE:
OPTIMUM SIDE SLOPE – 1 VERTICAL TO 6 HORIZONTAL
MAXIMUM SIDE SLOPE – 1 VERTICAL TO 3 HORIZONTAL

ROAD CONSTRUCTION NOTES

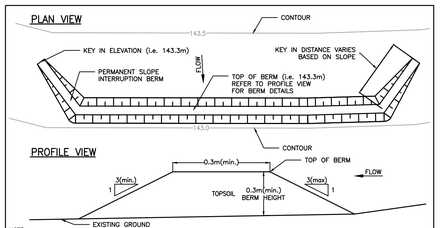
1. THE FOREGOING DESIGN ASSUMES THAT CONSTRUCTION IS CARRIED OUT DURING DRY PERIODS AND THE SUB-GRADE IS STABLE UNDER THE LOAD OF CONSTRUCTION EQUIPMENT. IF CONSTRUCTION IS CARRIED OUT DURING WET WEATHER AND HEAVING OR ROLLING OF THE SUB-GRADE IS EXPERIENCED, ADDITIONAL THICKNESS OF GRANULAR ROAD BASE MAY BE REQUIRED AND INSPECTED BY A QUALIFIED GEOTECHNICAL ENGINEER.
2. THE LONG-TERM PERFORMANCE OF THE ROAD BASE STRUCTURE IS HIGHLY DEPENDENT UPON THE SUB-GRADE SUPPORT CONDITIONS. STRINGENT CONSTRUCTION CONTROL PROCEDURES SHALL BE MAINTAINED TO ENSURE THAT UNIFORM SUB-GRADE MOISTURE AND DENSITY CONDITIONS ARE ACHIEVED. IF, DURING THE EXCAVATION PROCESS, NATIVE MATERIAL APPEARS SUITABLE TO BE USED AS ROAD SUB-BASE A GRAIN SIZE ANALYSIS MUST BE COMPLETED TO DETERMINE IF THE MATERIAL CAN BE LEFT IN PLACE AND WHETHER A REDUCTION IN DEPTH OF THE GRANULAR ROAD STRUCTURE IS WARRANTED. THE UNDERLYING SUB-GRADE SHALL BE FREE OF DEPRESSIONS AND IS TO BE SLOPED TO PROVIDE POSITIVE SURFACE DRAINAGE. SURFACE WATER SHALL NOT BE PERMITTED TO POND ADJACENT TO THE OUTSIDE EDGES.
3. AS PART OF THE SUB-GRADE PREPARATION, PROPOSED ROADWAYS SHALL BE STRIPPED OF TOPSOIL AND OBVIOUSLY UNSUITABLE MATERIAL. FILL REQUIRED TO RAISE THE SUB-GRADE TO DESIGN ELEVATIONS SHALL BE ORGANIC-FREE AND SHALL HAVE A MOISTURE CONTENT WHICH WILL PERMIT COMPACTION TO THE DENSITIES INDICATED. THE SUB-GRADE SHALL BE SHAPED, CROWNED AND THEN PROOF-ROLLED IN THE PRESENCE OF A GEOTECHNICAL CONSULTANT. SOFT OR SPONGY SUB-GRADE AREAS SHALL BE SUB-EXCAVATED AND REPLACED WITH SUITABLE APPROVED BACKFILL COMPACTED TO 98 PERCENT SPMDD.
4. ACCESS ROAD CONSTRUCTION FROM MUNICIPAL ROAD TO SITE PERIMETER FENCING TO BE CONSTRUCTED WITH HARDENING COMPOUND (i.e. CALCIUM CHLORIDE) TO DISCOURAGE TURTLE NESTING. HARDENING COMPOUND USED MUST HAVE NO POTENTIAL TO CONTAMINATE GROUNDWATER OR DOMESTIC WELLS.

AREA GRADING NOTES

1. TOPSOIL IS TO BE STRIPPED ONLY IN AREAS REQUIRING EARTHWORKS AND PLACED IN TEMPORARY STOCKPILES, REFER TO ADDITIONAL NOTES ON C-650 REGARDING TOPSOIL STOCK PILING.
2. ALL TEMPORARY TOPSOIL STOCKPILES TO BE LOCATED IN CONSTRUCTION LAY DOWN AREAS AS SHOWN ON PLANS. SHOULD NO STOCKPILES LOCATIONS BE PROVIDED ON THE GRADING PLANS, LOCATIONS TO BE CONFIRMED WITH CONTRACT ADMINISTRATOR.
3. ROADWAYS AND STONE BASE LAY DOWN AREAS ARE TO BE PLACED ON NATIVE GROUND AFTER TOPSOIL HAS BEEN STRIPPED.
4. ALL ADDITIONAL TOPSOIL IS TO BE SPREAD IN DESIGNATED FILL AREAS IDENTIFIED ON THE GRADING PLANS (INCREASE IF ADDITIONAL TOPSOIL IS AVAILABLE).
5. INFILLING OF BEDROCK SURFACE FRACTURES SHALL BE MINIMIZED AND WHERE FILLING IS REQUIRED, COARSE GRANULAR FILL SHALL BE USED.

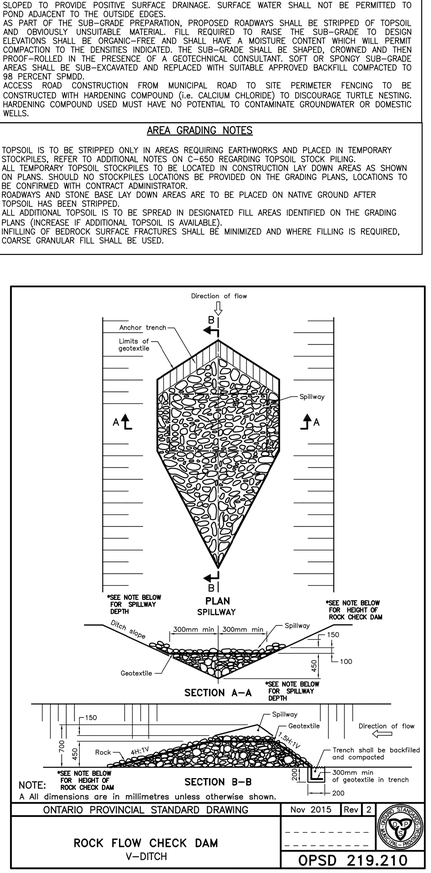


ROCK CHECK SPREADER DETAIL
N.T.S.



NOTE:
1. SLOPE INTERRUPTION BERMS TO BE CONSTRUCTED WITH CONSTANT TOP OF BERM ELEVATION.
2. SLOPE INTERRUPTION BERMS TO BE REPAIRED FROM RUTS AND LOWERED AREAS. MINIMUM BERM HEIGHT AT ANY POINT OF CONSTRUCTION SHALL NOT BE LESS THAN 0.15m. CONTRACTOR TO REVIEW BERM HEIGHTS ON A WEEKLY BASIS ON A DRY SEASON AND DAILY DURING A WET SEASON. WHEN LOCAL WEATHER FORECAST INDICATES THAT A SIGNIFICANT RAINFALL IS EXPECTED WITHIN 24 HOURS (i.e. GREATER THAN 10mm OF RAINFALL), CONTRACTOR TO VERIFY ALL BERMS ARE A MINIMUM OF 0.30m IN HEIGHT AND STABILIZED.
3. PRIOR TO SITE STABILIZATION, SLOPE INTERRUPTION BERMS TO BE REGRADED AND FORMED.
4. ALL SLOPE INTERRUPTION BERMS TO BE RESTORATION SEEDED.
5. CONTRACTOR IS TO MAINTAIN A LOCAL EMERGENCY TOPSOIL PILE STOCKPILE FOR ONGOING BERM MAINTAINANCE.
6. CONTRACTOR TO REVIEW THE SITE CONDITIONS IN RELATION TO THE PROPOSED LOCATIONS OF THE INTERCEPTION BERMS. IF ON SITE CONDITIONS, FRACTURED BEDROCK IS LOCATED NEAR AREAS OF PROPOSED BERMS. CONTRACTOR TO REVIEW THE FOLLOWING ALTERNATIVES:
   - IN AREAS WHERE BERM APPEARS TO BE DISCHARGING DIRECTLY OVER OR WITHIN 1.0m OF FRACTURE, CONTRACTOR TO MOVE ENTIRE LOCATION OF BERM UPSTREAM A MINIMUM OF 5.0m TO MITIGATE OVERCHARGING FRACTURE WITH STORMWATER MOVEMENT TO ALLOW STORM WATER TO DISPERSE TO PRE-DEVELOPMENT CONDITIONS.
   - IN AREAS WHERE BERM APPEARS TO HAVE THE KEY IN ELEVATION AT THE SAME ELEVATION OR HIGHER THAN A FRACTURE, ENTIRE LOCATION OF BERM TO BE MOVED DOWNSTREAM A MINIMUM OF 5.0m SO THE KEY IN ELEVATION IS LOWER THAN THE FRACTURE TO MITIGATE WATER DISPLACEMENT OF ENTIRE BERM CATCHMENT INTO THE FRACTURE.
7. BERM LOCATIONS TO FOLLOW CONTOURS AND FIT FIELD CONDITIONS. SHOULD PROPOSED LOCATIONS OF BERM INTERFERE WITH PILE/RACKING INSTALLATION, BERMS TO BE REALIGNED UP STREAM MAINTAINING THE TOP OF BERM ELEVATION. ALTERNATIVELY, USE THE KEY IN METHOD AND SPLIT BERMS AT PILE INTERFERENCE LOCATIONS.
8. BERMS SHALL NOT BE CONSTRUCTED ON EXPOSED BEDROCK.

PERMANENT SLOPE INTERRUPTION BERM DETAIL
NTS



NOTE:
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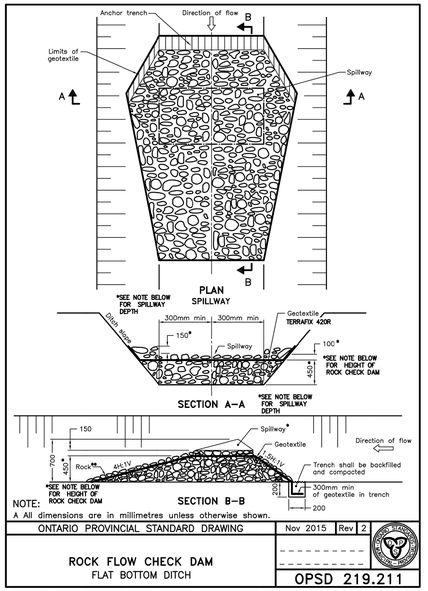
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
ROCK FLOW CHECK DAM V-DITCH			OPSD 219.210

*THE 550mm HEIGHT OF ROCK CHECK DAM TO VARY PER SITE AND TO SUIT LOCAL CONDITIONS. THIS VARIANCE IS NOTED ON ENGINEER DRAWINGS AS HEIGHT OF DAM. SPILLWAY DEPTH ALSO NOTED ON THE ENGINEER DRAWINGS.
*RIP RAP TO BE IN ACCORDANCE WITH OPSS 1004
RIP RAP R50 GRADATION



NOTE:
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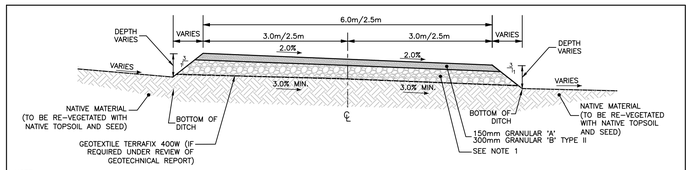
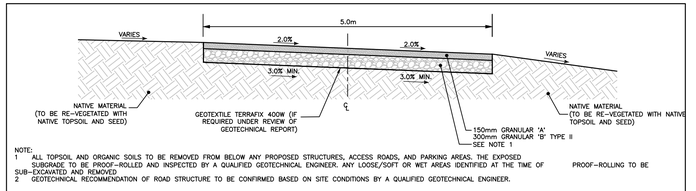
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
ROCK FLOW CHECK DAM FLAT BOTTOM DITCH			OPSD 219.211

*THE 550mm HEIGHT OF ROCK CHECK DAM TO VARY PER SITE AND TO SUIT LOCAL CONDITIONS. THIS VARIANCE IS NOTED ON ENGINEER DRAWINGS AS HEIGHT OF DAM. SPILLWAY DEPTH ALSO NOTED ON THE ENGINEER DRAWINGS.
*RIP RAP TO BE IN ACCORDANCE WITH OPSS 1004
RIP RAP R50 GRADATION



NOTE:
1 ALL TOPSOIL AND ORGANIC SOILS TO BE REMOVED FROM BELOW ANY PROPOSED STRUCTURES, ACCESS ROADS, AND PARKING AREAS. THE EXPOSED SUBGRADE TO BE PROOF-ROLLED AND INSPECTED BY A QUALIFIED GEOTECHNICAL ENGINEER. ANY LOOSE/SOFT OR WET AREAS IDENTIFIED AT THE TIME OF PROOF-ROLLING TO BE SUB-EXCAVATED AND REMOVED.
2 GEOTECHNICAL RECOMMENDATION OF ROAD STRUCTURE TO BE CONFIRMED BASED ON SITE CONDITIONS BY A QUALIFIED GEOTECHNICAL ENGINEER.

TYPICAL SUPER-ELEVATED CROSS-SECTION
6.0m/5.0m WIDE ACCESS ROAD
DETAIL(FILL)
NTS



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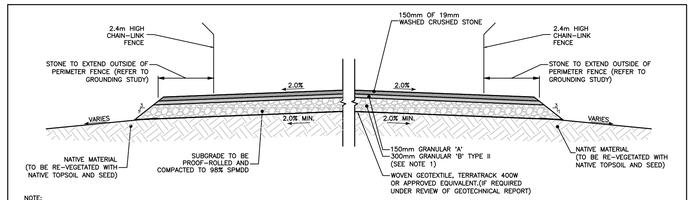
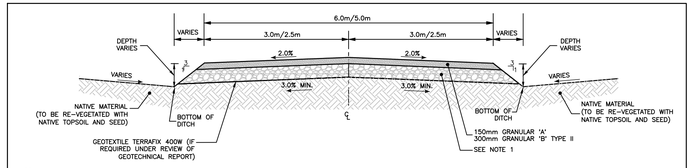
2 GEOTECHNICAL RECOMMENDATION OF ROAD STRUCTURE TO BE CONFIRMED BASED ON SITE CONDITIONS BY A QUALIFIED GEOTECHNICAL ENGINEER.

TYPICAL SUPERELEVATED CROSS-SECTION
5.0m WIDE ACCESS ROAD DETAIL (CUT)
NTS



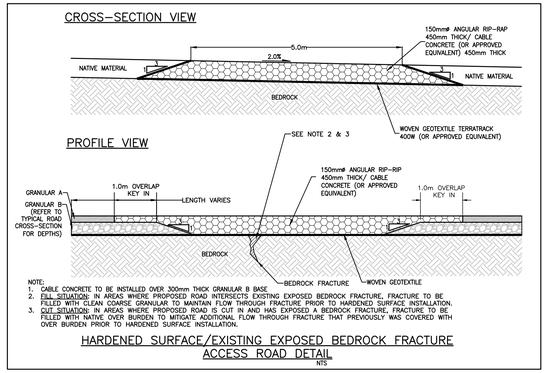
NOTE:
1. ALL TOPSOIL AND ORGANIC SOILS TO BE REMOVED FROM BELOW ANY PROPOSED STRUCTURES, ACCESS ROADS, AND PARKING AREAS. THE EXPOSED SUBGRADE TO BE PROOF-ROLLED, COMPACTED TO 98% SPMDD, AND INSPECTED BY A QUALIFIED GEOTECHNICAL ENGINEER. ANY LOOSE/SOFT OR WET AREAS IDENTIFIED AT THE TIME OF PROOF-ROLLING TO BE SUB-EXCAVATED AND REMOVED.

COLLECTOR SUBSTATION TYPICAL
CROSS-SECTION
NTS



NOTE:
1 ALL TOPSOIL AND ORGANIC SOILS TO BE REMOVED FROM BELOW ANY PROPOSED STRUCTURES, ACCESS ROADS, AND PARKING AREAS. THE EXPOSED SUBGRADE TO BE PROOF-ROLLED AND INSPECTED BY A QUALIFIED GEOTECHNICAL ENGINEER. ANY LOOSE/SOFT OR WET AREAS IDENTIFIED AT THE TIME OF PROOF-ROLLING TO BE SUB-EXCAVATED AND REMOVED
2 GEOTECHNICAL RECOMMENDATION OF ROAD STRUCTURE TO BE CONFIRMED BASED ON SITE CONDITIONS BY A QUALIFIED GEOTECHNICAL ENGINEER.

TYPICAL CROSS-SECTION 6.0m/5.0m WIDE
ACCESS ROAD DETAIL (FILL)
NTS



NOTE:
1. CABLE CONCRETE TO BE INSTALLED OVER 300mm THICK GRANULAR B BASE.
2. FILL SITUATION: IN AREAS WHERE PROPOSED ROAD INTERSECTS EXISTING EXPOSED BEDROCK FRACTURE, FRACTURE TO BE FILLED WITH CLEAN COARSE GRANULAR TO MAINTAIN FLOW THROUGH FRACTURE PRIOR TO HARDENED SURFACE INSTALLATION.
3. CUT SITUATION: IN AREAS WHERE PROPOSED ROAD IS CUT IN AND HAS EXPOSED A BEDROCK FRACTURE, FRACTURE TO BE FILLED WITH NATIVE OVER BURDEN TO MITIGATE ADDITIONAL FLOW THROUGH FRACTURE THAT PREVIOUSLY WAS COVERED WITH OVER BURDEN PRIOR TO HARDENED SURFACE INSTALLATION.

HARDENED SURFACE/EXISTING EXPOSED BEDROCK FRACTURE
ACCESS ROAD DETAIL
NTS

Stantec

Stantec Consulting Ltd.
300 Hagey Boulevard
Waterloo ON Canada
Tel. 519.579.4410
www.stantec.com

PCL
CONSTRUCTION LEADERS

Notes

1. LIDAR INFORMATION CONDUCTED BY TULLOCH ENGINEERING ON JUNE 27, 2016. LIDAR SURVEY IS UTM 18.
2. LEGAL PLAN OF SURVEY BY CALLON DIETZ INC. MARCH 6, 2017. EPTCON, (REV. A) SEPTEMBER 20, 2017.
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THIS SET PREPARED BY STANTEC CONSULTING LTD.
4. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
5. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
6. IF, FOR UNFORESEEN REASONS, THE OWNER AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE OWNER AND CONTRACTOR, AND A COPY IS TO BE KEPT ON FILE ON SITE, PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT THE PROPERTY OWNERS OWN RISK.
7. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY.
8. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER. THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED EVERYWHERE PRIOR TO THE INSTALLATION OF SOLAR PANELS.
9. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
10. CULVERTS ARE TO BE INSTALLED AS PER OPSD 802.010. SOIL TYPE TO BE CONFIRMED ON SITE FOR DETERMINATION OF TRENCH WIDTH.
11. ALL AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE-VEGETATED USING NATIVE TOPSOIL AND SEED. MIX AND APPLICATION RATE/METHOD TO BE SUBMITTED AND APPROVED BY OWNER PRIOR TO IMPLEMENTATION.
12. CLEARING AND GRUBBING AND REMOVALS TO BE COMPLETED IN ACCORDANCE WITH OPSS 201.
13. TEMPORARY EROSION CONTROL TO BE COMPLETED IN ACCORDANCE WITH OPSS 577.
14. GRADING TO BE COMPLETED IN ACCORDANCE WITH OPSS 206. GRANULAR MATERIAL TO BE USED IN ACCORDANCE WITH OPSS 1010.
15. CULVERT TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421. HEIGHT OF FILL TABLE FOR CSP CULVERTS TO COMPLY WITH OPSD 805.010.
16. RIPRAP SHALL BE IN ACCORDANCE WITH OPSD 810.010 SECTION B-B.

		By	Appd.	YY.MM.DD
E.	REVISED NOTES AND DETAILS	MALM	DS	17.12.15
D.	REVISED NOTES AND DETAILS	DRR	DS	17.11.30
C.	REVISED NOTES AND DETAILS	KDB	DS	17.11.23
B.	ISSUED FOR TENDER	DRR	DS	17.11.23
A.	ISSUED FOR CLIENT REVIEW	MALM	DS	17.10.31

Revision

File Name: 133560220_C-DT.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	DRR	DS	DRR	17.10.18

Permit-Seal

PRELIMINARY
NOT FOR CONSTRUCTION

Client/Project
BLUEARTH RENEWABLES INC.
LOYALIST SOLAR PROJECT

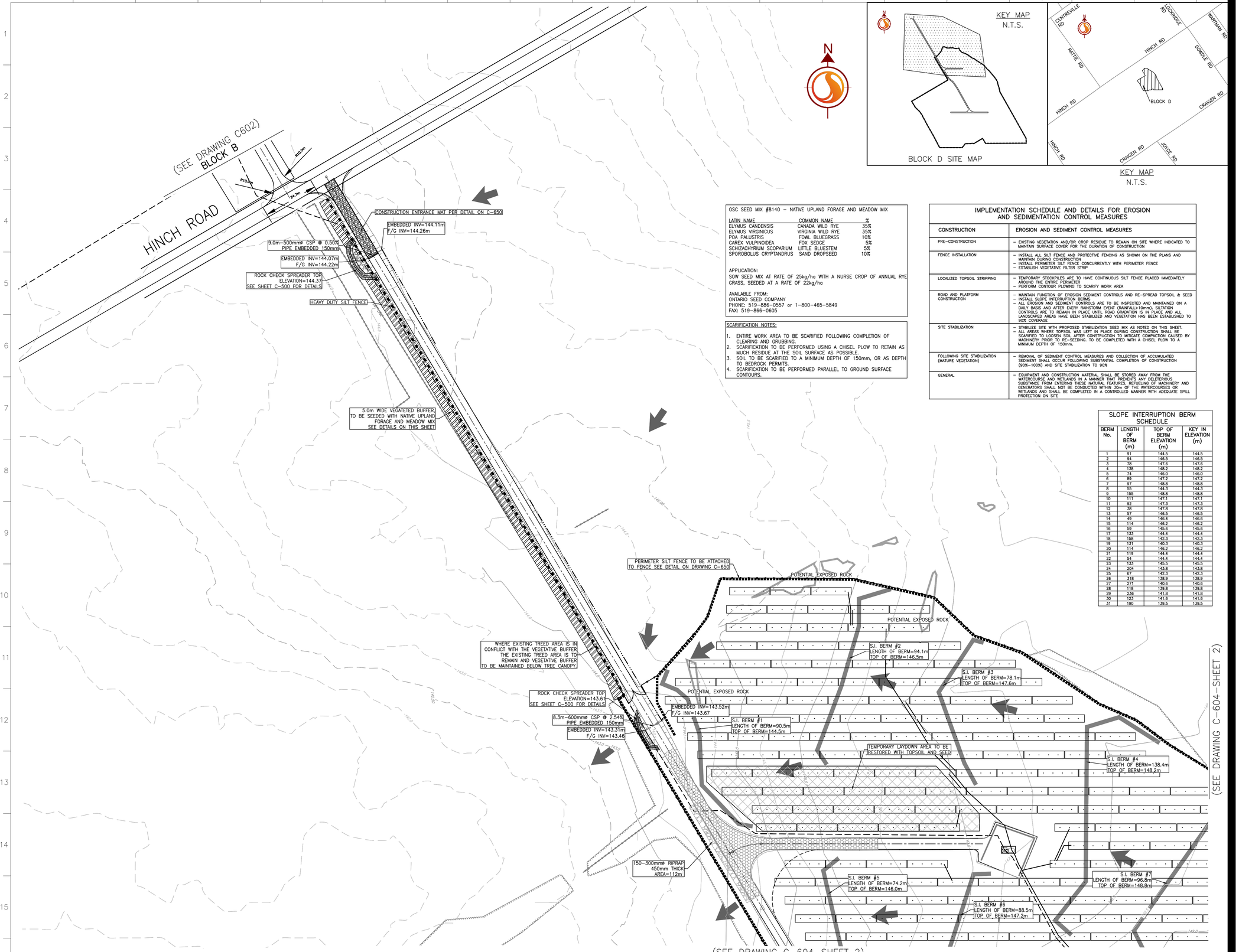
54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
GENERAL DETAILS
AND NOTES

Project No.	Scale	
133560220	AS NOTED	
Drawing No.	Sheet	Revision
C-500	2 of 2	E

ORIGINAL SHEET - ARCH D



KEY MAP
N.T.S.

BLOCK D SITE MAP

KEY MAP
N.T.S.

OSC SEED MIX #8140 – NATIVE UPLAND FORAGE AND MEADOW MIX

LATIN NAME	COMMON NAME	%
ELYMUS CANDENSIS	CANADA WILD RYE	35%
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	35%
POA PALUSTRIS	FOWL BLUEGRASS	10%
CAREX VULPINOIDEA	FOX SEDGE	5%
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	5%
SPOROBOLUS CRYPTANDRUS	SAND DROPSEED	10%

APPLICATION:
SOW SEED MIX AT RATE OF 25kg/ha WITH A NURSE CROP OF ANNUAL RYE GRASS, SEEDED AT A RATE OF 22kg/ha

AVAILABLE FROM:
ONTARIO SEED COMPANY
PHONE: 519-886-0557 or 1-800-465-5849
FAX: 519-886-0605

SCARIFICATION NOTES:

1. ENTIRE WORK AREA TO BE SCARIFIED FOLLOWING COMPLETION OF CLEARING AND GRUBBING.
2. SCARIFICATION TO BE PERFORMED USING A CHISEL PLOW TO RETAIN AS MUCH RESIDUE AT THE SOIL SURFACE AS POSSIBLE.
3. SOIL TO BE SCARIFIED TO A MINIMUM DEPTH OF 150mm, OR AS DEPTH TO BEDROCK PERMITS.
4. SCARIFICATION TO BE PERFORMED PARALLEL TO GROUND SURFACE CONTOURS.

IMPLEMENTATION SCHEDULE AND DETAILS FOR EROSION AND SEDIMENTATION CONTROL MEASURES

CONSTRUCTION	EROSION AND SEDIMENT CONTROL MEASURES
PRE-CONSTRUCTION	– EXISTING VEGETATION AND/OR CROP RESIDUE TO REMAIN ON SITE WHERE INDICATED TO MAINTAIN SURFACE COVER FOR THE DURATION OF CONSTRUCTION
FENCE INSTALLATION	– INSTALL ALL SILT FENCE AND PROTECTIVE FENCING AS SHOWN ON THE PLANS AND MAINTAIN DURING CONSTRUCTION – INSTALL PERIMETER SILT FENCE CONCURRENTLY WITH PERIMETER FENCE – ESTABLISH VEGETATIVE FILTER STRIP
LOCALIZED TOPSOIL STRIPPING	– TEMPORARY STOCKPILES ARE TO HAVE CONTINUOUS SILT FENCE PLACED IMMEDIATELY AROUND THE ENTIRE PERIMETER – PERFORM CONTOUR PLOWING TO SCARIFY WORK AREA
ROAD AND PLATFORM CONSTRUCTION	– MAINTAIN FUNCTION OF EROSION SEDIMENT CONTROLS AND RE-SPREAD TOPSOIL & SEED – INSTALL SLOPE INTERRUPTION BERMS – ALL EROSION AND SEDIMENT CONTROLS ARE TO BE INSPECTED AND MAINTAINED ON A DAILY BASIS, AND AFTER EVERY RAINSTORM EVENT (RAINFALL>10mm). SILTATION CONTROLS ARE TO REMAIN IN PLACE UNTIL ROAD GRADATION IS IN PLACE AND ALL LANDSCAPED AREAS HAVE BEEN STABILIZED AND VEGETATION HAS BEEN ESTABLISHED TO 90% COVERAGE
SITE STABILIZATION	– STABILIZE SITE WITH PROPOSED STABILIZATION SEED MIX AS NOTED ON THIS SHEET. – ALL AREAS WHERE TOPSOIL WAS LEFT IN PLACE DURING CONSTRUCTION SHALL BE SCARIFIED TO LOOSEN SOIL AFTER CONSTRUCTION TO MITIGATE COMPACTION CAUSED BY MACHINERY PRIOR TO RE-SEEDING. TO BE COMPLETED WITH A CHISEL PLOW TO A MINIMUM DEPTH OF 150mm.
FOLLOWING SITE STABILIZATION (MATURE VEGETATION)	– REMOVAL OF SEDIMENT CONTROL MEASURES AND COLLECTION OF ACCUMULATED SEDIMENT SHALL OCCUR FOLLOWING SUBSTANTIAL COMPLETION OF CONSTRUCTION (90%-100%) AND SITE STABILIZATION TO 90%
GENERAL	– EQUIPMENT AND CONSTRUCTION MATERIAL SHALL BE STORED AWAY FROM THE WATERCOURSE AND WETLANDS IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCE FROM ENTERING THESE NATURAL FEATURES. REFUELING OF MACHINERY AND GENERATORS SHALL NOT BE CONDUCTED WITHIN 30m OF THE WATERCOURSES OR WETLANDS AND SHALL BE COMPLETED IN A CONTROLLED MANNER WITH ADEQUATE SPILL PROTECTION ON SITE

SLOPE INTERRUPTION BERM SCHEDULE

BERM No.	LENGTH OF BERM (m)	TOP OF BERM ELEVATION (m)	KEY IN ELEVATION (m)
1	91	144.5	144.5
2	94	146.5	146.5
3	78	147.6	147.6
4	138	148.2	148.2
5	74	146.0	146.0
6	89	147.2	147.2
7	97	148.8	148.8
8	55	144.3	144.3
9	155	148.8	148.8
10	111	147.1	147.1
11	92	147.3	147.3
12	38	147.8	147.8
13	57	146.5	146.5
14	49	146.4	146.6
15	114	146.2	146.2
16	59	145.6	145.6
17	133	144.4	144.4
18	158	142.3	142.3
19	131	140.3	140.3
20	114	146.2	146.2
21	119	144.4	144.4
22	54	144.4	144.4
23	133	145.5	145.5
24	204	143.8	143.8
25	67	142.3	142.3
26	318	138.9	138.9
27	271	140.6	140.6
28	118	139.8	139.8
29	236	141.8	141.8
30	123	141.6	141.6
31	190	139.5	139.5

Stantec
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Waterloo ON Canada
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www.stantec.com

PCL
CONSTRUCTION LEADERS

Notes

1. TOPOGRAPHIC INFORMATION CONDUCTED BY LESLIE M. HIGGINSON AND RECEIVED OCTOBER 20, 2017. TOPOGRAPHIC SURVEY IS UTM 18. LIDAR INFORMATION CONDUCTED BY TULLOCH ENGINEERING ON JUNE 27, 2016. LIDAR SURVEY IS UTM 18. BEDROCK SURVEY INFORMATION PROVIDED BY PCL CONSTRUCTORS LTD. RECEIVED ON OCTOBER 31, 2017. EXISTING VEGETATION INFORMATION IS APPROXIMATE, PROVIDED FROM AERIAL IMAGERY. CONTRACTOR TO CONFIRM ALL TREE & SHRUB LOCATION ON SITE.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THIS SET PREPARED BY STANTEC CONSULTING LTD.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
4. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
5. IF, FOR UNFORESEEN REASONS, THE OWNER AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE OWNER AND CONTRACTOR AND A COPY IS TO BE KEPT ON FILE ON SITE PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT THE PROPERTY OWNERS OWN RISK.
6. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY.
7. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER. THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED EVERYWHERE PRIOR TO THE INSTALLATION OF SOLAR PANELS.
8. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
9. CULVERTS ARE TO BE INSTALLED AS PER OPSD 802.010. SOIL TYPE TO BE CONFIRMED ON SITE FOR DETERMINATION OF TRENCH WIDTH.
10. ALL AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE-VEGETATED USING NATIVE TOPSOIL AND SEED. MIX AND APPLICATION RATE/METHOD TO BE SUBMITTED AND APPROVED BY OWNER PRIOR TO IMPLEMENTATION.
11. CLEARING AND GRUBBING AND REMOVALS TO BE COMPLETED IN ACCORDANCE WITH OPSS 201. TEMPORARY EROSION CONTROL TO BE COMPLETED IN ACCORDANCE WITH OPSS 577.
12. GRADING TO BE COMPLETED IN ACCORDANCE WITH OPSS 206. GRANULAR MATERIAL TO BE USED IN ACCORDANCE WITH OPSS 1010.
13. CULVERT TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421. HEIGHT OF FILL TABLE FOR CSP CULVERTS TO COMPLY WITH OPSD 805.010.
14. RIPRAP AT CULVERT OUTLETS SHALL BE IN ACCORDANCE WITH OPSD 810.010 SECTION B-B.
15. ALL SEEDING TO BE COMPLETED IN ACCORDANCE WITH OPSS 804.
16. ROCK SPOIL FROM INSTALLATION TO BE REMOVED FROM GROUND SURFACE PRIOR TO GROUND PREPARATION FOR RESTORATION SEEDING.

Legend

PROPOSED	EXISTING
PROPERTY LINE	
FENCE	
TOPOGRAPHIC SURVEY CONTOUR	295.5
LIDAR CONTOUR	295.5
PERIMETER SILT FENCE (SEE DETAILS ON SHEET C-650)	
HEAVY DUTY SILT FENCE (SEE DETAILS ON SHEET C-650)	
CULVERT	
ROCK CHECK DAMS (SEE DETAILS ON SHEET C-650)	
OVERLAND FLOW DIRECTION	
SLOPE INTERRUPTION BERM (S.I. BERMS) (SEE DETAIL ON SHEET C-500)	
5.0M WIDE VEGETATIVE BUFFER NO TOUCH ZONE	
AC CABLE TRENCH	
DC CABLE TRENCH	
POTENTIAL EXPOSED ROCK LOCATIONS	
ROCK CHECK SPREADER (SEE DETAIL ON SHEET C-500)	
PROPOSED FILL AREA	
10m SETBACK LIMIT NO TOUCH ZONE	
HARDENED SURFACE	
GRASSED WATERWAY (SEESHEET C-500 FOR DETAILS)	

D	RE-ISSUED FOR TENDER	DRR	DS	17.12.18
C	RE-ISSUED FOR TENDER	DRR	DS	17.12.15
B	ISSUED FOR TENDER	DRR	DS	17.11.23
A	ISSUED FOR CLIENT REVIEW	DRR	DS	17.11.10
Revision		By	Appd.	YY.MM.DD

File Name: 133560220_C-EC-BLOCK_F.dwg	DRR	DS	DRR	17.10.24
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT

54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
BLOCK D
EROSION AND SEDIMENT CONTROL PLAN

Project No.	Scale				
133560220	1:750	0	7.5	22.5	37.5m
Drawing No.	Sheet		Revision		
C-604	1 of 4		D		

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2017/12/18 4:37 PM By: Rice, Derrick

ORIGINAL SHEET - ARCH D

PERIMETER SILT FENCE TO BE ATTACHED TO FENCE SEE DETAIL ON DRAWING C-650

POTENTIAL EXPOSED ROCK

POTENTIAL EXPOSED ROCK

WHERE EXISTING TREED AREA IS IN CONFLICT WITH THE VEGETATIVE BUFFER THE EXISTING TREED AREA IS TO REMAIN AND VEGETATIVE BUFFER TO BE MAINTAINED BELOW TREE CANOPY.

ROCK CHECK SPREADER TOP ELEVATION=143.61 SEE SHEET C-500 FOR DETAILS

POTENTIAL EXPOSED ROCK

EMBEDDED INV=143.52m F/G INV=143.67

8.3m-600mm⌀ CSP @ 2.54% PIPE EMBEDDED 150mm EMBEDDED INV=143.31m F/G INV=143.46

S.I. BERM #1 LENGTH OF BERM=90.5m TOP OF BERM=144.5m

S.I. BERM #2 LENGTH OF BERM=94.1m TOP OF BERM=146.5m

S.I. BERM #3 LENGTH OF BERM=78.1m TOP OF BERM=147.6m

TEMPORARY LAYDOWN AREA TO BE RESTORED WITH TOPSOIL AND SEED

S.I. BERM #4 LENGTH OF BERM=138.4m TOP OF BERM=148.2m

150-300mm⌀ RIPRAP 450mm THICK AREA=112m

S.I. BERM #5 LENGTH OF BERM=74.2m TOP OF BERM=146.0m

S.I. BERM #6 LENGTH OF BERM=88.5m TOP OF BERM=147.2m

S.I. BERM #7 LENGTH OF BERM=96.8m TOP OF BERM=148.8m

PERIMETER SILT FENCE TO BE ATTACHED TO FENCE SEE DETAIL ON DRAWING C-650

S.I. BERM #8 LENGTH OF BERM=55.2m TOP OF BERM=144.3m

S.I. BERM #9 LENGTH OF BERM=154.5m TOP OF BERM=148.8m

TEMPORARY REMOVAL OF S.I. BERM FOR TRENCH INSTALLATION. TRENCHES TO BE LINED WITH CLAY COLLARS OR FILLED WITH CONCRETE IF INSTALLED IN BEDROCK. BERMS TO BE REINSTALLED POST TRENCH INSTALLATION

S.I. BERM #10 LENGTH OF BERM=110.6m TOP OF BERM=147.1m

S.I. BERM #11 LENGTH OF BERM=91.8m TOP OF BERM=147.3m

POTENTIAL EXPOSED ROCK

S.I. BERM #12 LENGTH OF BERM=38.0m TOP OF BERM=147.8m

S.I. BERM #19 LENGTH OF BERM=131.1m TOP OF BERM=140.3m

S.I. BERM #17 LENGTH OF BERM=133.3m TOP OF BERM=144.4m

S.I. BERM #18 LENGTH OF BERM=157.8m TOP OF BERM=142.3m

POTENTIAL EXPOSED ROCK

S.I. BERM #16 LENGTH OF BERM=59.1m TOP OF BERM=145.6m

S.I. BERM #15 LENGTH OF BERM=114.4m TOP OF BERM=146.2m

S.I. BERM #14 LENGTH OF BERM=48.6m TOP OF BERM=146.4m

TEMPORARY REMOVAL OF S.I. BERM FOR TRENCH INSTALLATION. TRENCHES TO BE LINED WITH CLAY COLLARS OR FILLED WITH CONCRETE IF INSTALLED IN BEDROCK. BERMS TO BE REINSTALLED POST TRENCH INSTALLATION

S.I. BERM #13 LENGTH OF BERM=56.6m TOP OF BERM=146.5m

TEMPORARY LAYDOWN AREA TO BE RESTORED WITH TOPSOIL AND SEED

TEMPORARY LAYDOWN AREA TO BE RESTORED WITH TOPSOIL AND SEED

S.I. BERM #20 LENGTH OF BERM=113.8m TOP OF BERM=146.2m

S.I. BERM #23 LENGTH OF BERM=132.7m TOP OF BERM=145.5m

(SEE DRAWING C-604-SHEET 3)

(SEE DRAWING C-604-SHEET 4)

N

KEY MAP
N.T.S.

BLOCK D SITE MAP

KEY MAP
N.T.S.

CENTREVILLE RD, COCKBURGE RD, WARTMAN RD, RATTIE RD, HINCH RD, DONDLE RD, BLOCK D, HINCH RD, CRAIGEN RD, HINCH RD, CRAIGEN RD, JOYCE RD

OSC SEED MIX #8140 – NATIVE UPLAND FORAGE AND MEADOW MIX

LATIN NAME	COMMON NAME	%
ELYMUS CANDENSIS	CANADA WILD RYE	35%
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	35%
POA PALUSTRIS	FOWL BLUEGRASS	10%
CAREX VULPINOIDEA	FOX SEDGE	5%
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	5%
SPOROBOLUS CRYPTANDRUS	SAND DROPSEED	10%

APPLICATION:
SOW SEED MIX AT RATE OF 25kg/ha WITH A NURSE CROP OF ANNUAL RYE GRASS, SEEDED AT A RATE OF 22kg/ha

AVAILABLE FROM:
ONTARIO SEED COMPANY
PHONE: 519-886-0557 or 1-800-465-5849
FAX: 519-866-0605

SCARIFICATION NOTES:
1. ENTIRE WORK AREA TO BE SCARIFIED FOLLOWING COMPLETION OF CLEARING AND GRUBBING.
2. SCARIFICATION TO BE PERFORMED USING A CHISEL PLOW TO RETAIN AS MUCH RESIDUE AT THE SOIL SURFACE AS POSSIBLE.
3. SOIL TO BE SCARIFIED TO A MINIMUM DEPTH OF 150mm, OR AS DEPTH TO BEDROCK PERMITS.
4. SCARIFICATION TO BE PERFORMED PARALLEL TO GROUND SURFACE CONTOURS.

SLOPE INTERRUPTION BERM SCHEDULE

BERM No.	LENGTH OF BERM (m)	TOP OF BERM ELEVATION (m)	KEY IN ELEVATION (m)
1	91	144.5	144.5
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8	55	144.3	144.3
9	155	148.8	148.8
10	111	147.1	147.1
11	92	147.3	147.3
12	38	147.8	147.8
13	57	146.5	146.5
14	49	146.4	146.6
15	114	146.2	146.2
16	59	145.6	145.6
17	133	144.4	144.4
18	158	142.3	142.3
19	131	140.3	140.3
20	114	146.2	146.2
21	119	144.4	144.4
22	54	144.4	144.4
23	133	145.5	145.5
24	204	143.8	143.8
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27	271	140.6	140.6
28	118	139.8	139.8
29	236	141.8	141.8
30	123	141.6	141.6
31	190	139.5	139.5

IMPLEMENTATION SCHEDULE AND DETAILS FOR EROSION AND SEDIMENTATION CONTROL MEASURES

CONSTRUCTION	EROSION AND SEDIMENT CONTROL MEASURES
PRE-CONSTRUCTION	– EXISTING VEGETATION AND/OR CROP RESIDUE TO REMAIN ON SITE WHERE INDICATED TO MAINTAIN SURFACE COVER FOR THE DURATION OF CONSTRUCTION
FENCE INSTALLATION	– INSTALL ALL SILT FENCE AND PROTECTIVE FENCING AS SHOWN ON THE PLANS AND MAINTAIN DURING CONSTRUCTION – INSTALL PERIMETER SILT FENCE CONCURRENTLY WITH PERIMETER FENCE – ESTABLISH VEGETATIVE FILTER STRIP
LOCALIZED TOPSOIL STRIPPING	– TEMPORARY STOCKPILES ARE TO HAVE CONTINUOUS SILT FENCE PLACED IMMEDIATELY AROUND THE ENTIRE PERIMETER – PERFORM CONTOUR PLOWING TO SCARIFY WORK AREA
ROAD AND PLATFORM CONSTRUCTION	– MAINTAIN FUNCTION OF EROSION SEDIMENT CONTROLS AND RE-SPREAD TOPSOIL & SEED – INSTALL SLOPE INTERRUPTION BERMS – ALL EROSION AND SEDIMENT CONTROLS ARE TO BE INSPECTED AND MAINTAINED ON A DAILY BASIS AND AFTER EVERY RAINSTORM EVENT (RAINFALL>10mm). SILTATION CONTROLS ARE TO REMAIN IN PLACE UNTIL ROAD GRADATION IS IN PLACE AND ALL LANDSCAPED AREAS HAVE BEEN STABILIZED AND VEGETATION HAS BEEN ESTABLISHED TO 90% COVERAGE
SITE STABILIZATION	– STABILIZE SITE WITH PROPOSED STABILIZATION SEED MIX AS NOTED ON THIS SHEET. – ALL AREAS WHERE TOPSOIL WAS LEFT IN PLACE DURING CONSTRUCTION SHALL BE SCARIFIED TO LOOSEN SOIL AFTER CONSTRUCTION TO MITIGATE COMPACTION CAUSED BY MACHINERY PRIOR TO RE-SEEDING. TO BE COMPLETED WITH A CHISEL PLOW TO A MINIMUM DEPTH OF 150mm.
FOLLOWING SITE STABILIZATION (MATURE VEGETATION)	– REMOVAL OF SEDIMENT CONTROL MEASURES AND COLLECTION OF ACCUMULATED SEDIMENT SHALL OCCUR FOLLOWING SUBSTANTIAL COMPLETION OF CONSTRUCTION (90%-100%) AND SITE STABILIZATION TO 90%
GENERAL	– EQUIPMENT AND CONSTRUCTION MATERIAL SHALL BE STORED AWAY FROM THE WATERCOURSE AND WETLANDS IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCE FROM ENTERING THESE NATURAL FEATURES. REFUELING OF MACHINERY AND GENERATORS SHALL NOT BE CONDUCTED WITHIN 30m OF THE WATERCOURSES OR WETLANDS AND SHALL BE COMPLETED IN A CONTROLLED MANNER WITH ADEQUATE SPILL PROTECTION ON SITE

Legend

PROPOSED	EXISTING
PROPERTY LINE	
FENCE	
TOPOGRAPHIC SURVEY CONTOUR	295.5
LIDAR CONTOUR	295.5
PERIMETER SILT FENCE (SEE DETAILS ON SHEET C-650)	
HEAVY DUTY SILT FENCE (SEE DETAILS ON SHEET C-650)	
CULVERT	
ROCK CHECK DAMS (SEE DETAILS ON SHEET C-650)	
OVERLAND FLOW DIRECTION	
SLOPE INTERRUPTION BERM (S.I. BERMS) (SEE DETAIL ON SHEET C-500)	
5.0M WIDE VEGETATIVE BUFFER NO TOUCH ZONE	
AC CABLE TRENCH	
DC CABLE TRENCH	
POTENTIAL EXPOSED ROCK LOCATIONS	
ROCK CHECK SPREADER (SEE DETAIL ON SHEET C-500)	
PROPOSED FILL AREA	
10m SETBACK LIMIT NO TOUCH ZONE	
HARDENED SURFACE	
GRASSED WATERWAY (SEESHEET C-500 FOR DETAILS)	

Stantec
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www.stantec.com

PCL CONSTRUCTION LEADERS

Notes

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2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THIS SET PREPARED BY STANTEC CONSULTING LTD.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
4. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
5. IF, FOR UNFORESEEN REASONS, THE OWNER AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE OWNER AND CONTRACTOR AND A COPY IS TO BE KEPT ON FILE ON SITE PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT THE PROPERTY OWNERS OWN RISK.
6. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY.
7. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER. THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED EVERYWHERE PRIOR TO THE INSTALLATION OF SOLAR PANELS.
8. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
9. CULVERTS ARE TO BE INSTALLED AS PER OPSD 802.010. SOIL TYPE TO BE CONFIRMED ON SITE FOR DETERMINATION OF TRENCH WIDTH.
10. ALL AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE-VEGETATED USING NATIVE TOPSOIL AND SEED. MIX AND APPLICATION RATE/METHOD TO BE SUBMITTED AND APPROVED BY OWNER PRIOR TO IMPLEMENTATION.
11. CLEARING AND GRUBBING AND REMOVALS TO BE COMPLETED IN ACCORDANCE WITH OPSS 201. TEMPORARY EROSION CONTROL TO BE COMPLETED IN ACCORDANCE WITH OPSS 577.
12. GRADING TO BE COMPLETED IN ACCORDANCE WITH OPSS 206. GRANULAR MATERIAL TO BE USED IN ACCORDANCE WITH OPSS 1010.
13. CULVERT TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421. HEIGHT OF FILL TABLE FOR CSP CULVERTS TO COMPLY WITH OPSD 805.010.
14. RIPRAP AT CULVERT OUTLETS SHALL BE IN ACCORDANCE WITH OPSD 810.010 SECTION B-B.
15. ALL SEEDING TO BE COMPLETED IN ACCORDANCE WITH OPSS 804.
16. ROCK SPOIL FROM INSTALLATION TO BE REMOVED FROM GROUND SURFACE PRIOR TO GROUND PREPARATION FOR RESTORATION SEEDING.

D	RE-ISSUED FORTENDER	DRR	DS	17.12.18
C	RE-ISSUED FOR TENDER	DRR	DS	17.12.15
B	ISSUED FOR TENDER	DRR	DS	17.11.23
A	ISSUED FOR CLIENT REVIEW	DRR	DS	17.11.10
Revision		By	Appd.	YY.MM.DD

File Name: 133560220_C-EC-BLOCK_F.dwg		DRR	DS	DRR	17.10.24
		Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT

54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
BLOCK D
EROSION AND SEDIMENT CONTROL PLAN

Project No.	Scale				
133560220	1:750	0	7.5	22.5	37.5m
Drawing No.	Sheet		Revision		
C-604	2 of 4		D		

(SEE DRAWING C-604-SHEET 2)

(SEE DRAWING C-604-SHEET 4)

KEY MAP
N.T.S.

BLOCK D SITE MAP

KEY MAP
N.T.S.

CENTREVILLE RD
COCKBURGE RD
WARTMAN RD
RATTIE RD
HINCH RD
DOWDLE RD
BLOCK D
HINCH RD
CRAIGEN RD
CRAIGEN RD
JOYCE RD

TEMPORARY REMOVAL OF S.I. BERM FOR TRENCH INSTALLATION. TRENCHES TO BE LINED WITH CLAY COLLARS OR FILLED WITH CONCRETE IF INSTALLED IN BEDROCK. BERMS TO BE REINSTALLED POST TRENCH INSTALLATION

S.I. BERM #10
LENGTH OF BERM=110.6m
TOP OF BERM=147.1m

POTENTIAL EXPOSED ROCK

S.I. BERM #19
LENGTH OF BERM=131.1m
TOP OF BERM=140.3m

S.I. BERM #17
LENGTH OF BERM=133.3m
TOP OF BERM=144.4m

S.I. BERM #18
LENGTH OF BERM=157.8m
TOP OF BERM=142.3m

POTENTIAL EXPOSED ROCK

S.I. BERM #16
LENGTH OF BERM=59.1m
TOP OF BERM=145.6m

S.I. BERM #15
LENGTH OF BERM=114.4m
TOP OF BERM=146.2m

S.I. BERM #14
LENGTH OF BERM=48.6m
TOP OF BERM=146.4m

TEMPORARY REMOVAL OF S.I. BERM FOR TRENCH INSTALLATION. TRENCHES TO BE LINED WITH CLAY COLLARS OR FILLED WITH CONCRETE IF INSTALLED IN BEDROCK. BERMS TO BE REINSTALLED POST TRENCH INSTALLATION

TEMPORARY LAYDOWN AREA TO BE RESTORED WITH TOPSOIL AND SEED

TEMPORARY LAYDOWN AREA TO BE RESTORED WITH TOPSOIL AND SEED

S.I. BERM #13
LENGTH OF BERM=56.6m
TOP OF BERM=146.5m

WHERE EXISTING TREED AREA IS IN CONFLICT WITH THE VEGETATIVE BUFFER THE EXISTING TREED AREA IS TO REMAIN AND VEGETATIVE BUFFER TO BE MAINTAINED BELOW TREE CANOPY.

S.I. BERM #23
LENGTH OF BERM=132.7m
TOP OF BERM=145.5m

5.0m WIDE VEGETATED BUFFER, TO BE SEEDED WITH NATIVE UPLAND FORAGE AND MEADOW MIX SEE DETAILS ON THIS SHEET

S.I. BERM #22
LENGTH OF BERM=54.2m
TOP OF BERM=144.4m

S.I. BERM #25
LENGTH OF BERM=67.3m
TOP OF BERM=142.3m

S.I. BERM #24
LENGTH OF BERM=204.3m
TOP OF BERM=143.8m

EXISTING WETLANDS

TEMPORARY REMOVAL OF S.I. BERM FOR TRENCH INSTALLATION. TRENCHES TO BE LINED WITH CLAY COLLARS OR FILLED WITH CONCRETE IF INSTALLED IN BEDROCK. BERMS TO BE REINSTALLED POST TRENCH INSTALLATION

POTENTIAL EXPOSED ROCK

POTENTIAL EXPOSED ROCK

POTENTIAL EXPOSED ROCK

S.I. BERM #21
LENGTH OF BERM=236.1m
TOP OF BERM=141.8m

GRASSED WATERWAY SEE SHEET C-500 FOR DETAILS

S.I. BERM #27
LENGTH OF BERM=271.3m
TOP OF BERM=140.5m

S.I. BERM #26
LENGTH OF BERM=317.3m
TOP OF BERM=138.9m

S.I. BERM #28
LENGTH OF BERM=117.5m
TOP OF BERM=139.8m

POTENTIAL EXPOSED ROCK

10m SETBACK LIMIT NO TOUCH ZONE

EXISTING WETLANDS

PERIMETER SILT FENCE TO BE ATTACHED TO FENCE SEE DETAIL ON DRAWING C-650

10m SETBACK LIMIT NO TOUCH ZONE

WETLAND

SLOPE INTERRUPTION BERM SCHEDULE

BERM No.	LENGTH OF BERM (m)	TOP OF BERM ELEVATION (m)	KEY IN ELEVATION (m)
1	91	144.5	144.5
2	94	145.5	146.5
3	78	147.6	147.6
4	138	148.2	148.2
5	74	146.0	146.0
6	89	147.2	147.2
7	97	148.8	148.8
8	55	144.3	144.3
9	155	148.8	148.8
10	111	147.1	147.1
11	92	147.3	147.3
12	38	147.8	147.8
13	57	146.5	146.5
14	49	146.4	146.6
15	114	145.2	146.2
16	59	145.6	145.6
17	133	144.4	144.4
18	158	142.3	142.3
19	131	140.3	140.3
20	114	146.2	146.2
21	119	144.4	144.4
22	54	144.4	144.4
23	133	145.5	145.5
24	204	143.8	143.8
25	67	142.3	142.3
26	318	138.9	138.9
27	271	140.6	140.6
28	118	139.8	139.8
29	236	141.8	141.8
30	123	141.6	141.6
31	190	139.5	139.5

OSC SEED MIX #8140 – NATIVE UPLAND FORAGE AND MEADOW MIX

LATIN NAME	COMMON NAME	%
ELYMUS CANDENSIS	CANADA WILD RYE	35%
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	35%
POA PALUSTRIS	FOWL BLUEGRASS	10%
CAREX VULPINOIDEA	FOX SEDGE	5%
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	5%
SPOROBOLUS CRYPTANDRUS	SAND DROPSEED	10%

APPLICATION:
SOW SEED MIX AT RATE OF 25kg/ha WITH A NURSE CROP OF ANNUAL RYE GRASS, SEEDED AT A RATE OF 22kg/ha

AVAILABLE FROM:
ONTARIO SEED COMPANY
PHONE: 519-886-0557 or 1-800-465-5849
FAX: 519-886-0605

IMPLEMENTATION SCHEDULE AND DETAILS FOR EROSION AND SEDIMENTATION CONTROL MEASURES

CONSTRUCTION	EROSION AND SEDIMENT CONTROL MEASURES
PRE-CONSTRUCTION	– EXISTING VEGETATION AND/OR CROP RESIDUE TO REMAIN ON SITE WHERE INDICATED TO MAINTAIN SURFACE COVER FOR THE DURATION OF CONSTRUCTION
FENCE INSTALLATION	– INSTALL ALL SILT FENCE AND PROTECTIVE FENCING AS SHOWN ON THE PLANS AND MAINTAIN DURING CONSTRUCTION – INSTALL PERIMETER SILT FENCE CONCURRENTLY WITH PERIMETER FENCE – ESTABLISH VEGETATIVE FILTER STRIP
LOCALIZED TOPSOIL STRIPPING	– TEMPORARY STOCKPILES ARE TO HAVE CONTINUOUS SILT FENCE PLACED IMMEDIATELY AROUND THE ENTIRE PERIMETER – PERFORM CONTOUR PLOWING TO SCARIFY WORK AREA
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FOLLOWING SITE STABILIZATION (MATURE VEGETATION)	– REMOVAL OF SEDIMENT CONTROL MEASURES AND COLLECTION OF ACCUMULATED SEDIMENT SHALL OCCUR FOLLOWING SUBSTANTIAL COMPLETION OF CONSTRUCTION (90%-100%) AND SITE STABILIZATION TO 90%
GENERAL	– EQUIPMENT AND CONSTRUCTION MATERIAL SHALL BE STORED AWAY FROM THE WATERCOURSE AND WETLANDS IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCE FROM ENTERING THESE NATURAL FEATURES. REFUELING OF MACHINERY AND GENERATORS SHALL NOT BE CONDUCTED WITHIN 30m OF THE WATERCOURSES OR WETLANDS AND SHALL BE COMPLETED IN A CONTROLLED MANNER WITH ADEQUATE SPILL PROTECTION ON SITE

SCARIFICATION NOTES:

1. ENTIRE WORK AREA TO BE SCARIFIED FOLLOWING COMPLETION OF CLEARING AND GRUBBING.
2. SCARIFICATION TO BE PERFORMED USING A CHISEL PLOW TO RETAIN AS MUCH RESIDUE AT THE SOIL SURFACE AS POSSIBLE.
3. SOIL TO BE SCARIFIED TO A MINIMUM DEPTH OF 150mm, OR AS DEPTH TO BEDROCK PERMITS.
4. SCARIFICATION TO BE PERFORMED PARALLEL TO GROUND SURFACE CONTOURS.

Stantec

Stantec Consulting Ltd.
300 Hagey Boulevard
Waterloo ON Canada
Tel. 519.579.4410
www.stantec.com

PCL CONSTRUCTION LEADERS

Notes

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15. ALL SEEDING TO BE COMPLETED IN ACCORDANCE WITH OPSS 804.
16. ROCK SPOIL FROM INSTALLATION TO BE REMOVED FROM GROUND SURFACE PRIOR TO GROUND PREPARATION FOR RESTORATION SEEDING.

Legend

PROPOSED	EXISTING
PROPERTY LINE	
FENCE	
TOPOGRAPHIC SURVEY CONTOUR	295.5
LIDAR CONTOUR	295.5
PERIMETER SILT FENCE (SEE DETAILS ON SHEET C-650)	
HEAVY DUTY SILT FENCE (SEE DETAILS ON SHEET C-650)	
CULVERT	
ROCK CHECK DAMS (SEE DETAILS ON SHEET C-650)	
OVERLAND FLOW DIRECTION	
SLOPE INTERRUPTION BERM (S.I. BERMS) (SEE DETAIL ON SHEET C-500)	
5.0M WIDE VEGETATIVE BUFFER NO TOUCH ZONE	
AC CABLE TRENCH	
DC CABLE TRENCH	
POTENTIAL EXPOSED ROCK LOCATIONS	
ROCK CHECK SPREADER (SEE DETAIL ON SHEET C-500)	
PROPOSED FILL AREA	
10m SETBACK LIMIT NO TOUCH ZONE	
HARDENED SURFACE	
GRASSED WATERWAY (SEESHEET C-500 FOR DETAILS)	

D	RE-ISSUED FOR TENDER	DRR	DS	17.12.18
C	RE-ISSUED FOR TENDER	DRR	DS	17.12.15
B	ISSUED FOR TENDER	DRR	DS	17.11.23
A	ISSUED FOR CLIENT REVIEW	DRR	DS	17.11.10
Revision		By	Appd.	YY.MM.DD

File Name: 133560220_C-EC-BLOCK_F.dwg		DRR	DS	17.10.24
		Dwn.	Chkd.	Dsgn. YY.MM.DD

Permit-Seal

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT

54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
BLOCK D
EROSION AND SEDIMENT CONTROL PLAN

Project No.	Scale	Sheet	Revision
133560220	1:500 (0, 5, 15, 25m)		
Drawing No.			
C-604		3 of 4	D

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2017/12/18 4:38 PM By: Ricki Dietrick

ORIGINAL SHEET - ARCH D

IMPLEMENTATION SCHEDULE AND DETAILS FOR EROSION AND SEDIMENTATION CONTROL MEASURES

CONSTRUCTION	EROSION AND SEDIMENT CONTROL MEASURES
PRE-CONSTRUCTION	– EXISTING VEGETATION AND/OR CROP RESIDUE TO REMAIN ON SITE WHERE INDICATED TO MAINTAIN SURFACE COVER FOR THE DURATION OF CONSTRUCTION
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LOCALIZED TOPSOIL STRIPPING	– TEMPORARY STOCKPILES ARE TO HAVE CONTINUOUS SILT FENCE PLACED IMMEDIATELY AROUND THE ENTIRE PERIMETER – PERFORM CONTOUR PLOWING TO SCARIFY WORK AREA
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FOLLOWING SITE STABILIZATION (MATURE VEGETATION)	– REMOVAL OF SEDIMENT CONTROL MEASURES AND COLLECTION OF ACCUMULATED SEDIMENT SHALL OCCUR FOLLOWING SUBSTANTIAL COMPLETION OF CONSTRUCTION (80%–100%) AND SITE STABILIZATION TO 90%
GENERAL	– EQUIPMENT AND CONSTRUCTION MATERIAL SHALL BE STORED AWAY FROM THE WATERCOURSE AND WETLANDS IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCE FROM ENTERING THE NATURAL FEATURES. REFUELING OF MACHINERY AND GENERATORS SHALL NOT BE CONDUCTED WITHIN 30m OF THE WATERCOURSES OR WETLANDS AND SHALL BE COMPLETED IN A CONTROLLED MANNER WITH ADEQUATE SPILL PROTECTION ON SITE

(SEE DRAWING C-604-SHEET 2)

(SEE DRAWING C-604-SHEET 3)

N

S.I. BERM #11
LENGTH OF BERM=91.8m
TOP OF BERM=147.3m

S.I. BERM #12
LENGTH OF BERM=38.0m
TOP OF BERM=147.8m

S.I. BERM #15
LENGTH OF BERM=114.4m
TOP OF BERM=146.2m

POTENTIAL EXPOSED ROCK

S.I. BERM #16
LENGTH OF BERM=59.1m
TOP OF BERM=145.6m

S.I. BERM #14
LENGTH OF BERM=48.6m
TOP OF BERM=146.4m

TEMPORARY REMOVAL OF S.I. BERM FOR TRENCH INSTALLATION. TRENCHES TO BE LINED WITH CLAY COLLARS OR FILLED WITH CONCRETE IF INSTALLED IN BEDROCK. BERMS TO BE REINSTALLED POST TRENCH INSTALLATION

TEMPORARY LAYDOWN AREA TO BE RESTORED WITH TOPSOIL AND SEED

S.I. BERM #13
LENGTH OF BERM=56.6m
TOP OF BERM=146.5m

TEMPORARY LAYDOWN AREA TO BE RESTORED WITH TOPSOIL AND SEED

S.I. BERM #20
LENGTH OF BERM=113.8m
TOP OF BERM=146.2m

S.I. BERM #23
LENGTH OF BERM=132.7m
TOP OF BERM=145.5m

S.I. BERM #21
LENGTH OF BERM=118.9m
TOP OF BERM=144.4m

S.I. BERM #22
LENGTH OF BERM=54.2m
TOP OF BERM=144.4m

S.I. BERM #25
LENGTH OF BERM=67.3m
TOP OF BERM=142.3m

S.I. BERM #24
LENGTH OF BERM=204.3m
TOP OF BERM=143.8m

TEMPORARY REMOVAL OF S.I. BERM FOR TRENCH INSTALLATION. TRENCHES TO BE LINED WITH CLAY COLLARS OR FILLED WITH CONCRETE IF INSTALLED IN BEDROCK. BERMS TO BE REINSTALLED POST TRENCH INSTALLATION

POTENTIAL EXPOSED ROCK

POTENTIAL EXPOSED ROCK

S.I. BERM #29
LENGTH OF BERM=236.1m
TOP OF BERM=141.8m

S.I. BERM #30
LENGTH OF BERM=122.6m
TOP OF BERM=141.6m

WHERE EXISTING TREED AREA IS IN CONFLICT WITH THE VEGETATIVE BUFFER THE EXISTING TREED AREA IS TO REMAIN AND VEGETATIVE BUFFER TO BE MAINTAINED BELOW TREE CANOPY

S.I. BERM #27
LENGTH OF BERM=271.3m
TOP OF BERM=140.6m

GRASSED WATERWAY SEE SHEET C-500 FOR DETAILS

POTENTIAL EXPOSED ROCK

S.I. BERM #31
LENGTH OF BERM=189.7m
TOP OF BERM=139.5m

S.I. BERM #28
LENGTH OF BERM=117.5m
TOP OF BERM=139.8m

PERIMETER SILT FENCE TO BE ATTACHED TO FENCE SEE DETAIL ON DRAWING C-650

5.0m WIDE VEGETATED BUFFER TO BE SEEDED WITH NATIVE UPLAND FORAGE AND MEADOW MIX SEE DETAILS ON THIS SHEET

10m SETBACK LIMIT NO TOUCH ZONE

EXISTING WETLANDS

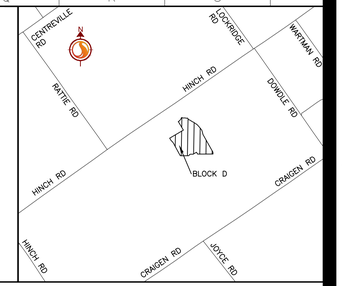
10m SETBACK LIMIT NO TOUCH ZONE

PERIMETER SILT FENCE TO BE ATTACHED TO FENCE SEE DETAIL ON DRAWING C-650

WETLAND

KEY MAP
N.T.S.

BLOCK D SITE MAP



KEY MAP
N.T.S.

OSC SEED MIX #8140 – NATIVE UPLAND FORAGE AND MEADOW MIX

LATIN NAME	COMMON NAME	%
ELYMUS CANDENSIS	CANADA WILD RYE	35%
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	35%
POA PALUSTRIS	FOWL BLUEGRASS	10%
CAREX VULPINOIDEA	FOX SEDGE	5%
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	5%
SPOROBOLUS CRYPTANDRUS	SAND DROPSEED	10%

APPLICATION:
SOW SEED MIX AT RATE OF 25kg/ha WITH A NURSE CROP OF ANNUAL RYE GRASS, SEEDED AT A RATE OF 22kg/ha

AVAILABLE FROM:
ONTARIO SEED COMPANY
PHONE: 519–886–0557 or 1–800–465–5849
FAX: 519–866–0605

SCARIFICATION NOTES:

1. ENTIRE WORK AREA TO BE SCARIFIED FOLLOWING COMPLETION OF CLEARING AND GRUBBING.
2. SCARIFICATION TO BE PERFORMED USING A CHISEL PLOW TO RETAIN AS MUCH RESIDUE AT THE SOIL SURFACE AS POSSIBLE.
3. SOIL TO BE SCARIFIED TO A MINIMUM DEPTH OF 150mm, OR AS DEPTH TO BEDROCK PERMITS.
4. SCARIFICATION TO BE PERFORMED PARALLEL TO GROUND SURFACE CONTOURS.

SLOPE INTERRUPTION BERM SCHEDULE

BERM No.	LENGTH OF BERM (m)	TOP OF BERM ELEVATION (m)	KEY IN ELEVATION (m)
1	91	144.5	144.5
2	94	146.5	146.5
3	78	147.6	147.6
4	138	148.2	148.2
5	74	146.0	146.0
6	89	147.2	147.2
7	97	148.8	148.8
8	55	144.3	144.3
9	155	148.8	148.8
10	111	147.1	147.1
11	92	147.3	147.3
12	38	147.8	147.8
13	57	146.5	146.5
14	49	146.4	146.5
15	114	146.2	146.2
16	59	145.6	145.6
17	133	144.4	144.4
18	158	142.3	142.3
19	131	140.3	140.3
20	114	146.2	146.2
21	119	144.4	144.4
22	54	144.4	144.4
23	133	145.5	145.5
24	204	143.8	143.8
25	67	142.3	142.3
26	318	138.9	138.9
27	271	140.6	140.6
28	118	139.8	139.8
29	236	141.8	141.8
30	123	141.6	141.6
31	190	139.5	139.5

Stantec

Stantec Consulting Ltd.
300 Hagey Boulevard
Waterloo ON Canada
Tel. 519.579.4410
www.stantec.com

PCL
CONSTRUCTION LEADERS

Notes

1. TOPOGRAPHIC INFORMATION CONDUCTED BY LESLIE M. HIGGINSON AND RECEIVED OCTOBER 20, 2017. TOPOGRAPHIC SURVEY IS UTM 18. LIDAR INFORMATION CONDUCTED BY TULLOCH ENGINEERING ON JUNE 27, 2016. LIDAR SURVEY IS UTM 18. BEDROCK SURVEY INFORMATION PROVIDED BY PCL CONSTRUCTORS LTD. RECEIVED ON OCTOBER 31, 2017. EXISTING VEGETATION INFORMATION IS APPROXIMATE, PROVIDED FROM AERIAL IMAGERY. CONTRACTOR TO CONFIRM ALL TREE & SHRUB LOCATION ON SITE.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THIS SET PREPARED BY STANTEC CONSULTING LTD.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
4. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
5. IF, FOR UNFORESEEN REASONS, THE OWNER AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE OWNER AND CONTRACTOR AND A COPY IS TO BE KEPT ON FILE ON SITE PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT THE PROPERTY OWNERS OWN RISK.
6. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY.
7. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER. THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED EVERYWHERE PRIOR TO THE INSTALLATION OF SOLAR PANELS.
8. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
9. CULVERTS ARE TO BE INSTALLED AS PER OPSD 802.010. SOIL TYPE TO BE CONFIRMED ON SITE FOR DETERMINATION OF TRENCH WIDTH.
10. ALL AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE-VEGETATED USING NATIVE TOPSOIL AND SEED. MIX AND APPLICATION RATE/METHOD TO BE SUBMITTED AND APPROVED BY OWNER PRIOR TO IMPLEMENTATION.
11. CLEARING AND GRUBBING AND REMOVALS TO BE COMPLETED IN ACCORDANCE WITH OPSS 201. TEMPORARY EROSION CONTROL TO BE COMPLETED IN ACCORDANCE WITH OPSS 577.
12. GRADING TO BE COMPLETED IN ACCORDANCE WITH OPSS 206. GRANULAR MATERIAL TO BE USED IN ACCORDANCE WITH OPSS 1010.
13. CULVERT TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421. HEIGHT OF FILL TABLE FOR CSP CULVERTS TO COMPLY WITH OPSD 805.010.
14. RIPRAP AT CULVERT OUTLETS SHALL BE IN ACCORDANCE WITH OPSD 810.010 SECTION B–B.
15. ALL SEEDING TO BE COMPLETED IN ACCORDANCE WITH OPSS 804.
16. ROCK SPOIL FROM INSTALLATION TO BE REMOVED FROM GROUND SURFACE PRIOR TO GROUND PREPARATION FOR RESTORATION SEEDING.

Legend

PROPOSED	EXISTING
PROPERTY LINE	
FENCE	
TOPOGRAPHIC SURVEY CONTOUR	295.5
LIDAR CONTOUR	295.5
PERIMETER SILT FENCE (SEE DETAILS ON SHEET C–650)	
HEAVY DUTY SILT FENCE (SEE DETAILS ON SHEET C–650)	
CULVERT	
ROCK CHECK DAMS (SEE DETAILS ON SHEET C–650)	
OVERLAND FLOW DIRECTION	
SLOPE INTERRUPTION BERM (S.I. BERMS) (SEE DETAIL ON SHEET C–500)	
5.0M WIDE VEGETATIVE BUFFER NO TOUCH ZONE	
AC CABLE TRENCH	
DC CABLE TRENCH	
POTENTIAL EXPOSED ROCK LOCATIONS	
ROCK CHECK SPREADER (SEE DETAIL ON SHEET C–500)	
PROPOSED FILL AREA	
10m SETBACK LIMIT NO TOUCH ZONE	
HARDENED SURFACE	
GRASSED WATERWAY (SEESHEET C–500 FOR DETAILS)	

Revision	By	Appd.	YY.MM.DD
D RE-ISSUED FOR TENDER	DRR	DS	17.12.18
C RE-ISSUED FOR TENDER	DRR	DS	17.12.15
B ISSUED FOR TENDER	DRR	DS	17.11.23
A ISSUED FOR CLIENT REVIEW	DRR	DS	17.11.10

File Name: 133560220_C-EC-BLOCK_F.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	DRR	DS	DRR	17.10.24

Permit-Seal

Client/Project
LOYALIST SOLAR LP
LOYALIST SOLAR PROJECT

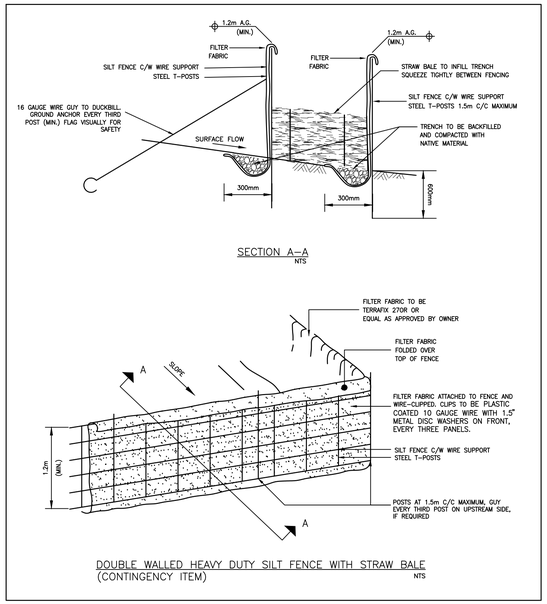
54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
BLOCK D
EROSION AND SEDIMENT CONTROL PLAN

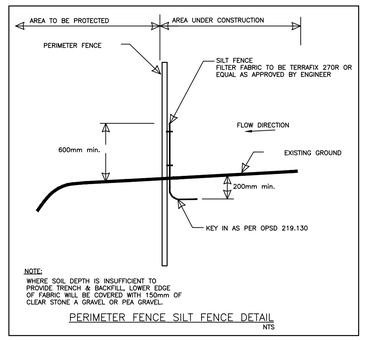
Project No. 133560220
Scale 1:500 (0, 5, 15, 25m)
Drawing No. C-604
Sheet 4 of 4
Revision D

ORIGINAL SHEET - ARCH D



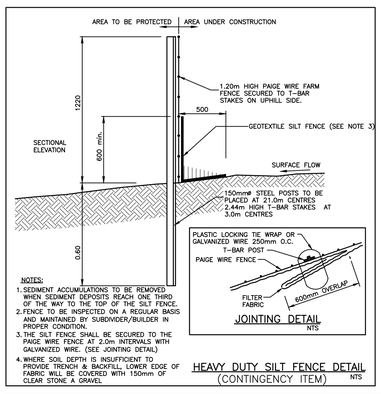
SECTION A–A
NTS

DOUBLE WALLED HEAVY DUTY SILT FENCE WITH STRAW BALE
(CONTINGENCY ITEM)
NTS



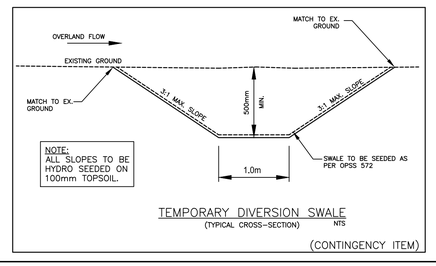
NOTE:
WHERE SOIL DEPTH IS INSUFFICIENT TO PROVIDE TRENCH & BACKFILL, LOWER EDGE OF FABRIC WILL BE COVERED WITH 150mm OF CLEAR STONE A GRAVEL OR PEA GRAVEL.

PERIMETER FENCE SILT FENCE DETAIL
NTS



NOTES:
1. SEDIMENT ACCUMULATIONS TO BE REMOVED WHEN SEDIMENT DEPOSITS REACH ONE THIRD OF THE WAY TO THE TOP OF THE SILT FENCE.
2. FENCE TO BE INSPECTED ON A REGULAR BASIS AND MAINTAINED BY SUBDIVIDER/BUILDER IN PROPER CONDITION.
3. THE SILT FENCE SHALL BE SECURED TO THE PAGE WIRE FENCE AT 2.0m INTERVALS WITH GALVANIZED WIRE. (SEE JOINTING DETAIL)
4. WHERE SOIL DEPTH IS INSUFFICIENT TO PROVIDE TRENCH & BACKFILL, LOWER EDGE OF FABRIC WILL BE COVERED WITH 150mm OF CLEAR STONE A GRAVEL.

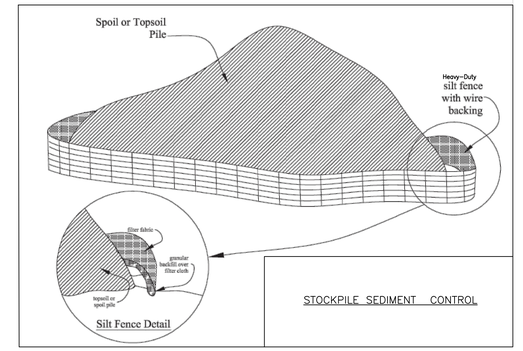
HEAVY DUTY SILT FENCE DETAIL
(CONTINGENCY ITEM)
NTS



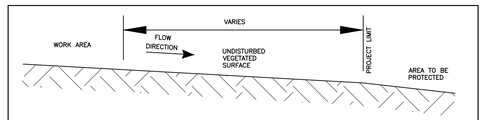
NOTE:
ALL SLOPES TO BE HYDRO SEEDED ON 100mm TOPSOIL.

TEMPORARY DIVERSION SWALE
(TYPICAL CROSS-SECTION)
NTS

(CONTINGENCY ITEM)

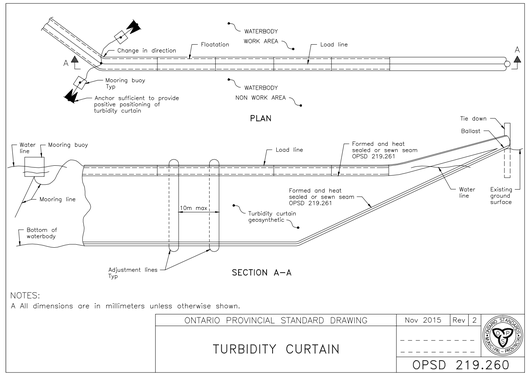


STOCKPILE SEDIMENT CONTROL



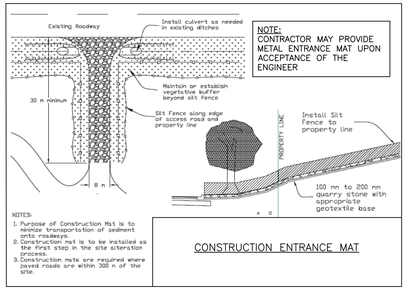
NOTE: –ANY AREAS OF BARE SOIL OR SPARSE VEGETATION TO BE SCARIFIED TO A DEPTH OF 100mm AND HYDROSEEDED
–LIMITS OF VEGETATED FILTER STRIP TO BE DELINEATED WITH STAKES, FLAGGING OR CONSTRUCTION FENCE

VEGETATED FILTER STRIP DETAIL
NTS



NOTES:
A All dimensions are in millimeters unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
TURBIDITY CURTAIN		OPSD 219.260



NOTES:
1. Purpose of Construction Mat is to minimize transportation of sediment onto roadways.
2. Construction mat is to be installed as the first step in the site alteration process.
3. Construction mats are required where paved roads are within 300 m of the site.

CONSTRUCTION ENTRANCE MAT

EROSION AND SEDIMENT CONTROL NOTES: (SEE DETAILS THIS SHEET)

1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM DURING CONSTRUCTION ACTIVITIES. THIS INCLUDES LIMITING THE AMOUNT AND DURATION OF EXPOSED SOIL AND INSTALLING SILT FENCES AND OTHER SEDIMENT TRAPS/FILTERS SIMILAR TO THOSE ILLUSTRATED HEREIN.
2. EROSION AND SEDIMENT CONTROL WORKS SHALL BE INSTALLED AND IN WORKING CONDITION PRIOR TO COMMENCEMENT OF CONSTRUCTION RELATED ACITVITIES.
3. SEDIMENT CONTROL MEASURES ADJACENT TO CONSTRUCTION AREAS MAY REQUIRE REMOVAL / RELOCATION IN ORDER TO COMPLETE SPECIFIC CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL ENSURE THAT ADEQUATE SEDIMENT CONTROL MEASURES ARE IN PLACE AT ALL TIMES.
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN AND BOLSTER EROSION AND SEDIMENT CONTROL MEASURES AS NECESSARY TO KEEP THEM EFFECTIVE AND MINIMIZE THE POTENTIAL FOR EROSION AND MIGRATION OF SEDIMENT TO THE DOWNSTREAM NATURAL ENVIRONMENT
5. AT THE DISCRETION OF THE OWNER OR OWNER'S CONSULTANT, ADDITIONAL SILT CONTROL DEVICES SHALL BE INSTALLED AT DESIGNATED LOCATIONS.
6. STOCKPILED MATERIAL IS TO BE STORED AWAY FROM WATER BODIES, WETLANDS AND OTHER SENSITIVE RECEIVERS IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCE FROM ENTERING THAT FEATURE AND BE SURROUNDED BY EROSION CONTROL MEASURE WHERE MATERIAL IS TO BE LEFT IN PLACE IN EXCESS OF 10 DAYS OR PRIOR TO A RAIN EVENT, WHICHEVER OCCURS SOONER.
7. SEDIMENT THAT IS ACCUMULATED BY THE TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES SHALL BE REMOVED IN A MANNER THAT AVOIDS ESCAPE OF THE SEDIMENT TO THE DOWNSTREAM SIDE OF THE CONTROL MEASURE AND AVOIDS DAMAGE TO THE CONTROL MEASURE. ALL SEDIMENT SHALL BE REMOVED AND TOPSOIL WITH SEED TO BE ADDED IF NECESSARY.
8. ACCUMULATED SEDIMENT IS TO BE REMOVED AND DISPOSED OF AS PER OPSS 180, PRIOR TO THE REMOVAL OF ANY CONTROL MEASURE.
9. SILT FENCE AND EROSION CONTROL STRUCTURES TO BE CHECKED DAILY AND AFTER EACH RAINFALL (>10mm) BY A QUALIFIED INSPECTOR FOR DEFICIENCIES. SEDIMENT SHALL BE REMOVED WHEN THE LEVEL OF SEDIMENT DEPOSITION REACHES ONE THIRD OF THE WAY TO THE TOP OF THE BARRIER.
10. STOCKPILED MATERIAL IS TO BE STORED A SUFFICIENT DISTANCE FROM WATERCOURSES, TO PRECLUDE SEDIMENT INPUTS DUE TO EROSION OF STORED SOIL MATERIALS. WHERE STOCKPILED EXCAVATED NATIVE MATERIALS AND IMPORTED MATERIALS WITH A D50 LESS THAN 4.75mm ARE TO BE LEFT IN PLACE UNDISTURBED IN EXCESS OF 30 DAYS, STOCKPILES ARE TO BE COVERED WITH A ROLLED EROSION CONTROL PRODUCT (RECP) SUCH AS A TARP, SINGLE NET STRAW MAT OR DOUBLE NET STRAW MAT. IMPORTED MATERIALS WITH A D50 OF 4.75mm OR GREATER CAN REMAIN UNCOVERED. GRANULAR A AND B (TYPE II) GRADATION REQUIREMENTS ALLOW UP TO 55% PERCENT PASSING A 4.75mm SIEVE (#4 SIEVE), AND MAY BE STOCKPILED WITHOUT COVERING WITH AN RECP.
11. EROSION AND SEDIMENT CONTROL MONITORING RECORDS SHALL BE KEPT AND MADE AVAILABLE TO THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE AND QUINTE CONSERVATION UPON REQUEST.
12. IN THE EVENT OF INCLEMENT WEATHER OR UNFAVOURABLE TERRAIN FOR CONSTRUCTION, CONSTRUCTION BEST PRACTICES, SUCH AS TEMPORARY RIG–MATS MAY BE USED TO PREVENT DISRUPTION OF SURFACE SOILS AND VEGETATIVE COVER BY CONSTRUCTION VEHICLES AND EQUIPMENT.
13. EQUIPMENT AND CONSTRUCTION MATERIAL SHALL BE STORED AWAY FROM WATER BODIES IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCE FROM ENTERING THE WATER, REFUELLING OF MACHINERY AND GENERATORS SHALL NOT BE CONDUCTED WITHIN 30m OF A WATER BODY OR WETLAND AND SHALL BE COMPLETED IN A CONTROLLED MANNER WITH ADEQUATE SPILL PROTECTION ON SITE
14. ADDITIONAL CONTROLS MAY BE REQUIRED DUE TO UNFORESEEN CIRCUMSTANCES, CHANGING SITE CONDITIONS OR IF THE PROPOSED CONTROLS DO NOT ACHIEVE THEIR ANTICIPATED RESULT. IN THESE CIRCUMSTANCES, ADDITIONAL CONTROLS WILL BE INSTALLED CONSISTENT WITH THE EROSION AND SEDIMENT CONTROL GUIDELINE FOR URBAN CONSTRUCTION (GREATER GOLDEN HORSESHOE CONSERVATION AUTHORITIES, DECEMBER, 2006). THE LOCATIONS AND APPLICATION OF THE CONTROLS WILL BE APPROVED BY THE INSPECTOR PRIOR TO THEIR INSTALLATION.
15. PUBLIC ROADS TO BE CLEANED DAILY OF ACCUMULATED SEDIMENT CAUSED BY CONSTRUCTION.
16. IN ADDITION TO BEING RESPONSIBLE FOR ENSURING THAT THE PRESCRIBED MEASURES ARE INSTITUTED AND FUNCTIONING AS INTENDED, THE CONTRACTOR IS ALSO RESPONSIBLE FOR IMPLEMENTING ANY INTERIM OR EMERGENCY MEASURES REQUIRED, TO ENSURE THAT NO SEDIMENT IS DISCHARGED TO THE NATURAL ENVIRONMENT. THE FOLLOWING EXTRA EQUIPMENT/MATERIALS ARE TO BE KEPT ON SITE AS A CONTINGENCY, IN CASE THE PROPOSED CONTROL MEASURES ARE BREACHED.
    - SILT FENCE
    - FILTER CLOTH
    - PUMPS
    - CLEAN RIP–RAP (FREE OF FINES) FOR ROCK CHECK DAMS
    - SAND BAGS
    - ANY ADDITIONAL MATERIAL DEEMED NECESSARY TO REPAIR/ CONSTRUCT PROPOSED MEASURES OR TO ADEQUATELY DEAL WITH UNEXPECTED HIGH FLOWS

DURING AREA GRADING :

1. TOPSOIL IS TO BE STRIPPED ONLY IN AREAS REQUIRING EARTHWORKS AND PLACED IN STOCKPILES AT THE LOCATIONS SHOWN ON THE PLANS OR AS APPROVED BY THE QUALIFIED ENVIRONMENTAL SITE INSPECTOR.
2. ROADWAYS AND LAY DOWN YARDS ARE TO BE PLACED ON NATIVE GROUND AFTER TOPSOIL HAS BEEN STRIPPED
3. ALL TOPSOIL IS TO BE RE–SPREAD ON CONSTRUCTION IMPACTED AREAS TO A MINIMUM DEPTH OF 150mm AFTER FINAL GRADING IS COMPLETION.
4. NO TOPSOIL MAY BE EXPORTED FROM THE SITE.
5. INFILLING OF BEDROCK FRACTURES SHALL BE MINIMIZED AND IF NECESSARY, COARSE GRANULAR FILL SHALL BE USED.

SEEDING MAINTENANCE NOTES:

1. CONTRACTOR SHALL REPAIR AND RESEED DEAD OR BARE SPOTS PRIOR TO SUBSTANTIAL COMPLETION.
2. SEEDING SHALL BE WATERED AS REQUIRED TO ESTABLISH WEED–FREE, HEALTHY ESTABLISHMENT OF SEED MIX.
3. CONTROL NOXIOUS AND INVASIVE WEED GROWTH DURING (2) YEAR MAINTENANCE PERIOD. NATIVE SPECIES THAT HAVE GERMINATED NATURALLY SHALL BE RETAINED (i.e. GOLDENRODS, ASTERS etc.) REFER TO OMAFRA's NOXIOUS WEEDS IN ONTARIO FOR A LIST OF SPECIES TO BE REMOVED http://www.omafra.gov.on.ca/english/crops/facts/noxious_weeds.htm
4. SEEDED AREAS SHALL BE UNIFORM, FREE OF RUTS EROSION AND/OR BARE AND DEAD SPOTS, FREE OF WEEDS, AND HAVE, MINIMUM 80% COVER OF GERMINATED PERENNIAL SEED FOR FINAL ACCEPTANCE.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DAMAGE TO SEEDED AREAS AND SHALL RESTORE IT TO ORIGINAL CONDITION TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR.
6. THE CONTRACTOR SHALL REPAIR ANY RILLS FORMED BELOW THE LOWER EDGE OF THE SOLAR PANELS PRIOR TO SEEDING.

AFTER AREA GRADING :

1. ALL AREAS WHERE ACTIVE CONSTRUCTION IS NOT EXPECTED FOR 30 DAYS SHALL BE RE–SEEDED WITH NATIVE PLANT SPECIES PER LANDSCAPE PLAN
2. REMOVAL OF SEDIMENT CONTROL MEASURES AND COLLECTION OF ACCUMULATED SEDIMENT SHALL OCCUR FOLLOWING SUBSTANTIAL COMPLETION OF CONSTRUCTION (90%–100%) AND SITE STABILIZATION TO 90%

SILT FENCE NOTES (AS PER OPSD):

1. STAKES/POSTS ARE TO BE INSTALLED ON THE DOWNSTREAM SIDE OF THE BARRIER.
2. SILT FENCE FABRIC TO BE TERRAFIX 270R OR EQUIVALENT.
3. CONTRACTOR TO MONITOR SILT FENCE FOR UV DEGRADATION AND UNDERMINING
4. PAIGE WIRE TO BE 16 GAUGE OR HEAVIER

ROLLED EROSION CONTROL PRODUCT (RECP) NOTES:

1. EITHER ROLLED EROSION CONTROL PRODUCTS (RECP) OR MULCHMAX ULTRA AT 500KG/HA ARE TO BE USED ON 3:1 SLOPES OR GREATER.
2. RECP SHALL BE BIODEGRADABLE AND CONSIST OF STRAW, STRAW–COCONUT, OR COCONUT FIBER WHICH ARE HELD IN PLACE BY NETTING SEWN ON BOTH SIDES OF THE MATERIAL.
3. RECP MUST BE SECURED ON STOCKPILE BY STAPLING AT THE BOTTOM OF THE SLOPE AND UPHILL TRENCHES ON THE STOCKPILE/SLOPED SURFACE.
4. RECP PRODUCTS ARE TO BE INSTALLED PER MANUFACTURER SPECIFICATIONS. INSTALLATION TO BE INSPECTED AND REPAIRED AS NEEDED.
5. RECP ARE TO BE APPLIED AS SOON AS POSSIBLE FOLLOWING GRADING AND SEEDING OF SUBJECT AREAS.
6. SUBSOILS ARE TO BE SMOOTH AND FREE OF STONES AND DEBRIS OR OTHER WEED CLUMPS PRIOR TO RECP BEING INSTALLED.
7. CONTRACTOR TO ENSURE THAT RECP IS SECURED AT THE TOP OF THE SLOPE IN A TRENCH AND OVERLAP (SIDE TO SIDE AND BOTTOM TO TOP)
8. CONTRACTOR TO INSPECT THE SITE DAILY AND AFTER EVERY SIGNIFICANT RAINFALL EVENT (>10mm) AND IDENTIFY AREAS OF EROSION OR POTENTIAL EROSION. BEST MANAGEMENT PRACTICES ARE TO BE USED TO CONTROL THE EROSION. METHODS OF CONTROL MAY INCLUDE THE USE OF EROSION CONTROL BLANKETS C/W SEEDING, HYDRAULIC MULCH OR STRAW MULCH, OR SOIL BINDER. SOILS ARE TO BE STABILIZED AS SOON AS AREAS ARE IDENTIFIED TO PREVENT FURTHER EROSION.
9. CONTRACTORS TO ENSURE THAT RILLING/GULLYING RECTIFIED PRIOR TO RECP OR MULCHMAX ULTRA INSTALLATION OR CONTRACTOR TO MONITOR RUNOFF UNDER THE RECP FOLLOWING INSTALLATION.

HYDRAULIC MULCH NOTES:

1. COORDINATE/CONSULT WITH OWNER PRIOR TO UTILIZING ANY HYDRAULIC MULCH. TIMELINES AND SEEDING METHODS NEED TO BE CAREFULLY CONSIDERED PRIOR TO IMPLEMENTATION.
2. ENSURE THAT A TACKIFIER IS USED TO KEEP PRODUCT IN PLACE.
3. APPLY SEED MIX PRIOR TO MULCH WITH TACKIFIER.
4. HYDRAULIC MULCH IS TO BE APPLIED AS SOON AS GRADING AND SEEDING WORK IS COMPLETE TO ENSURE STABILIZATION OF SOILS.
5. RE–APPLY HYDRAULIC MULCH IF THE SUBJECT AREA IS DAMAGED OR ERODED BY WIND OR WATER, SURFACE COVERAGE MUST BE AT LEAST 80% AT ALL TIMES.

CULVERT NOTES:

1. CULVERT SLOPE TO MATCH EXISTING DITCH GRADE UNLESS OTHERWISE NOTED.
2. CULVERT TO BE EMBEDDED 10% OF PIPE DIAMETER BELOW DITCH INVERT OR AS NOTED.
3. CULVERTS TO BE CORRUGATED STEEL PIPE (CSP). PIPE MATERIAL TO BE GALVANIZED STEEL AND HAVE A 68mm x 13mm CORRUGATION WITH 1.6mm METAL THICKNESS.
4. CULVERT TO BE INSTALLED IN ACCORDANCE WITH OPSD 802.010.
5. CULVERT ELEVATIONS ARE APPROXIMATE AND ARE TO BE FINALIZED IN THE FIELD.

SCARIFICATION NOTES:

1. ENTIRE WORK AREA TO BE SCARIFIED FOLLOWING COMPLETION OF CLEARING AND GRUBBING.
2. SCARIFICATION TO BE PERFORMED USING A CHISEL PLOW TO RETAIN AS MUCH RESIDUE AT THE SOIL SURFACE AS POSSIBLE.
3. SOIL TO BE SCARIFIED TO A MINIMUM DEPTH OF 150mm, OR AS DEPTH TO BEDROCK PERMITS.
4. SCARIFICATION TO BE PERFORMED PARALLEL TO GROUND SURFACE CONTOURS.

CONTINGENCY MEASURES WHERE FAILURE RISK IS HIGH:

1. WHERE MONITORING HAS IDENTIFIED A HIGH POTENTIAL FOR FAILURE, THE CONTRACTOR SHALL IMMEDIATELY TAKE STEPS TO REDUCE THE RISK. STEPS MAY INCLUDE REPAIRS TO EXISTING MEASURES, MODIFICATIONS TO EXISTING MEASURES, AND THE ADDITION OF NEW MEASURES.
2. WHEN THE LOCAL WEATHER FORECAST INDICATES THAT SIGNIFICANT (I.E >10mm) RAINFALL IS EXPECTED WITHIN 24 HOURS, THE CONTRACTOR SHALL VERIFY ALL EROSION AND SEDIMENT CONTROL MEASURES ARE SECURE.

CONTINGENCY MEASURES IN CASE OF FAILURE:

1. THE CONTRACTOR WILL CEASE CONSTRUCTION RELATED WORK AND FOCUS ON EROSION AND SEDIMENT CONTROL REPAIRS TO EFFECTIVELY STABILIZE THE SITE WHERE A FAILURE HAS OCCURRED OR IS IMMINENT.
2. ALL SPILLS SHALL BE REPORTED TO THE ENVIRONMENTAL MONITOR FOR ASSESSMENT AND DOCUMENTATION, AND TO ESTABLISH A REMEDIAL PLAN BASED ON THE PROJECT–SPECIFIC SPILL RESPONSE PLAN. BASED ON THE ASSESSMENT OF THE EXTENT OF THE IMPACT, THE ENVIRONMENTAL MONITOR SHALL DETERMINE IF THE MOECC SPILLS ACTION CENTRE SHOULD BE NOTIFIED. SHOULD THE INCIDENT REQUIRE THAT THE SPILLS ACTION CENTRE BE NOTIFIED, THIS NOTIFICATION WILL BE UNDERTAKEN AS QUICKLY AS POSSIBLE BY CALLING 1–800–268–6060.
3. IF SIGNIFICANT LONG–TERM DAMAGE TO DOWNSTREAM FISH HABITAT OR PROPERTY IS SUSPECTED, THE ENVIRONMENTAL MONITOR WILL IMMEDIATELY ASSESS AND DOCUMENT THE SITUATION AND REPORT THE INCIDENT TO THE MOECC SPILLS ACTION CENTRE. THE CONTRACTOR WILL DEVELOP A RESTORATION PLAN IN CONSULTATION WITH MOECC. DEVELOPMENT OF THE INITIAL RESTORATION PLAN WILL BEGIN WITHIN 24 HOURS OF THE DISCOVERY OF SEDIMENT DISCHARGE, AND WILL BE IMPLEMENTED AS SOON AS POSSIBLE, FOLLOWING CONSULTATION AND APPROVAL FROM THE MOECC, QC, DFO (IF NECESSARY) AND THE TOWNSHIP OF STONE MILLS
4. THE RESTORATION PLAN WILL ADDRESS:
    - REMOVAL AND DISPOSAL OF SEDIMENT FROM OUTSIDE THE WORK LIMITS,
    - RESTORATION OF THE AFFECTED AREA, AND
    - RESTORATION OF ANY AREAS DISTURBED THROUGH DEPOSITION OR REMOVAL.

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Notes

1. LIDAR INFORMATION CONDUCTED BY TULLOCH ENGINEERING ON JUNE 27, 2016. LIDAR SURVEY IS UTM 18.
2. LEGAL PLAN OF SURVEY BY CALLON DIETZ INC. MARCH 6, 2017. EPTCON, (REV. A) SEPTEMBER 20, 2017.
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THIS SET PREPARED BY STANTEC CONSULTING LTD.
4. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
5. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
6. IF, FOR UNFORESEEN REASONS, THE OWNER AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO THE OWNER AND CONTRACTOR, AND A COPY IS TO BE KEPT ON FILE ON SITE, PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT THE PROPERTY OWNERS OWN RISK.
7. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT–OF–WAY.
8. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER. THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED EVERYWHERE PRIOR TO THE INSTALLATION OF SOLAR PANELS.
9. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
10. CULVERTS ARE TO BE INSTALLED AS PER OPSD 802.010. SOIL TYPE TO BE CONFIRMED ON SITE FOR DETERMINATION OF TRENCH WIDTH.
11. ALL AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE–VEGETATED USING NATIVE TOPSOIL AND SEED MIX AND APPLICATION RATE/METHOD TO BE SUBMITTED AND APPROVED BY OWNER PRIOR TO IMPLEMENTATION.
12. CLEARING AND GRUBBING AND REMOVALS TO BE COMPLETED IN ACCORDANCE WITH OPSS 201. TEMPORARY EROSION CONTROL TO BE COMPLETED IN ACCORDANCE WITH OPSS 577.
13. GRADING TO BE COMPLETED IN ACCORDANCE WITH OPSS 206. GRANULAR MATERIAL TO BE USED IN ACCORDANCE WITH OPSS 1010.
14. CULVERT TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421. HEIGHT OF FILL TABLE FOR CSP CULVERTS TO COMPLY WITH OPSD 805.010.
15. RIPRAP SHALL BE IN ACCORDANCE WITH OPSD 810.010 SECTION B–B.

Revision	By	Appd.	YY.MM.DD
E. UPDATED DETAILS	MALM	DS	17.12.15
D. UPDATED ESC NOTES	DRR	DS	17.11.30
C. UPDATED ESC NOTES	DRR	DS	17.11.23
B. ISSUED FOR TENDER	DRR	DS	17.11.21
A. ISSUED FOR CLIENT REVIEW	DRR	DS	17.10.30

File Name: 133560220_C-01-EC.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	DRR	DS	DRR	17.10.18

Permit-Seal

PRELIMINARY
NOT FOR CONSTRUCTION

Client/Project
BLUEARTH RENEWABLES INC.
LOYALIST SOLAR PROJECT

54MW GROUND-MOUNT SOLAR FARM

County of Lennox and Addington, Ontario

Title
SEDIMENTATION AND EROSION CONTROLS DETAILS

Project No.	Scale	
133560220	AS NOTED	
Drawing No.	Sheet	Revision
C-650	1 of 1	E

ORIGINAL SHEET - ARCH D