Lehigh Hanson Materials Limited

Scott Property – Conceptual Level – Stormwater Management Report

Prepared by:

AECOM Canada Ltd.
300 – 48 Quarry Park Blvd. SE
Calgary, AB T2C 5P2
Canada

T: 403 254 3301
F: 403 270 0399
www.aecom.com

Prepared for:

Lehigh Hanson Materials Limited
885 – 42 Avenue SE
Calgary, AB T2G 1Y8

Date: July 2020

Project #: 60610856

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AECOM Canada Ltd.
300 – 48 Quarry Park Blvd. SE
Calgary, AB T2C 5P2
Canada

T: 403 254 3301
F: 403 270 0399
www.aecom.com

Ms. Valerie Haaf
Project Manager
Lehigh Hanson Materials Limited
885 – 42 Avenue SE
Calgary, AB T2G 1Y8

July 7, 2020

Project #
60610856

Dear Ms. Haaf:

Subject: Scott Property – Conceptual Level – Stormwater Management Report

AECOM Canada Ltd. is pleased to provide Lehigh Hanson Materials Limited with the following "Conceptual Level" Stormwater Management Report for the Scott Property Project in support of the re-zoning application. A Site-Specific Stormwater Management Report will be prepared in the detailed design stage to assist with gaining approval to work on natural water bodies in accordance with the *Environmental Protection and Enhancement Act* and *Water Act* by Alberta Environment and Parks. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,
AECOM Canada Ltd.

Jagadish Kayastha, P.Eng. PMP
Technical Lead – Water Resources
jagadish.kayastha@aecom.com

Robin Reese, M.E.Des., P.Biol, RPBio
Technical Lead – Permitting
robin.reese@aecom.com

JK:mm
Encl.
cc: GG

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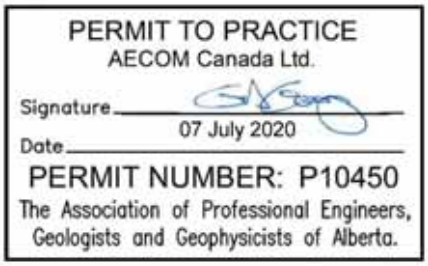
Authors

Report Prepared By:

July 07, 2020

Jagadish Kayastha, P.Eng. PMP
Technical Lead – Water Resources

Report Reviewed By:



Gordon Geoffrey, P. Eng.
Technical Manager – Water

Report Approved By:

Karina Andrus, B.A., M.Sc.
Lead Verifier with AECOM
Technical Leader
Environmental Assessment

Executive Summary

Lehigh Hanson Materials Limited (Lehigh) is proposing to construct and operate the Scott Property Project (the Project), which will be a Class I Aggregate Pit located in Rocky View County (RVC), in the rural community of Bearspaw, Alberta. The Project will occupy the majority of 05-26-02-W5M, with the exception of 33.9 acres (13.72 ha) located in the southwest corner (the Project Area). The Project Footprint refers to the proposed area of disturbance within the Project Area. The property totals an area of approximately 600 acres (243 hectares [ha]), of which 395 acres (160 ha) are proposed for development as a sand and gravel pit. The Project will be constructed and operated in six phases with an anticipated operational lifespan of 25 to 30 years; each phase will be approximately five years in duration. Project development is planned to commence in 2022, with material extraction starting in 2024.

This report describes the Project, outlines Project components and Project activities, summarizes regulatory requirements associated with stormwater, presents methods and results of Project Area investigation undertaken, and provides a conceptual strategy to mitigate peak flows, water quality and water balance impacts of the proposed development in line with County Servicing Standards (RVC 2013).

This Conceptual Level Stormwater Management Report (SWMR) was prepared for the Project as per the design standards and guidelines prescribed in the following documents:

- County Servicing Standards (RVC 2013)
- Nose Creek Watershed Water Management Plan (Palliser 2018)
- Bearspaw Master Drainage Plan (BMDP; MPE 2007)
- Bearspaw Meadow Drive Stormwater Management Plan (MPE 2018)
- The City of Calgary Stormwater Management Design Manual (City of Calgary 2011)
- Stormwater Management Guidelines for the Province of Alberta (AEP 1999)

The Project Area is comprised of undeveloped land situated within the West Nose Creek catchment VII as identified in the BMDP (MPE 2007). The total catchment area including off-site catchments for the Project is 360.147 ha.

A Stormwater Management Hydrologic Model (J.F. Sabourin and Associates Inc., 2005) analysis using the June 2005 extreme rainfall event was used to conceptualize stormwater management facilities required during operational stages using the Area Release Rate of 0.99 litres per second per hectare for West Nose Creek. The pond storage volume estimate, based on the June 2005 extreme rainfall event, is three (3) times larger than that of the 1:100 year, 24 hour duration storm event. Final mining pit storage options were designed as a dry pond or future constructed wetland option, based on the post-operation stormwater model.

Continuous Simulation Water Balance model (Westhoff 2011) results demonstrate that an annual average runoff volume control target of 17 mm was met at the post-operation condition.

This SWMR was prepared and submitted to Lehigh to support the conceptual stormwater management requirements for their upcoming re-zoning application to RVC.

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1. Introduction

AECOM Canada Ltd. (AECOM) was retained by Lehigh Hanson Materials Limited (Lehigh) to complete environmental studies and reporting for various technical disciplines, including a Conceptual Level Stormwater Management Report (SWMR) for the proposed Scott Property Project (the Project). This report describes the Project, outlines Project components and Project activities, summarizes regulatory requirements associated with stormwater, presents methods and results of the Project Area investigation undertaken, and provides a conceptual strategy to mitigate peak flows, water quality and water balance impacts of the proposed development in accordance with County Servicing Standards 2013 (RVC 2013).

1.1 Project Description

Lehigh is proposing to construct and operate the Project, which will be a Class I Aggregate Pit located in Rocky View County (RVC), in the rural community of Bearspaw, Alberta. The Project will occupy the majority of 05-26-02-W5M with the exception of 33.9 acres (14 hectares [ha]) located in the southwest corner (the Project Area). The Project is bound by 144 Avenue NW (also known as Burma Road) to the south, Range Road 24 to the East, and Range Road 25 (also known as Twelve Mile Coulee Road) to the west as shown in **Figure A1.** All figures are presented in **Appendix A**.

The property totals an area of approximately 600 acres (243 ha[1]), of which 395 acres (160 ha) are proposed for development as a sand and gravel pit, with a maximum open pit area of 60 acres (24 ha) at any given time. The Project Footprint refers to the proposed area of disturbance within the Project Area. The Project will be constructed and operated in six phases with an anticipated operational lifespan of 25 to 30 years; each phase will be approximately five years in duration.

The Project location was selected for development as the lands contain a significant quantity of high quality, close to market aggregate resources. The Project land use is currently pastureland with several wetlands and ephemeral water bodies throughout. Following operation, the Project lands will be reclaimed to an equivalent end land use.

1.2 Project Components

The Project will include the following key components:

- Crusher with in-pit conveyor
- Access roads
- Off-site conveyor system
- Operation & Maintenance Building
- Perimeter berms
- Site ponds for water management

Please refer to the Master Site Development Plan (MSDP) for additional details.

1. As per land title documents

1.2.1 Project Activities

Project activities are described in detail in the MSDP and include the following:

1.2.1.1 Site Preparation

- Initial topsoil, subsoil and overburden stripping and stockpiling for future reclamation.
- Berm construction.
- Establishing operating footprint (access roads, crusher, conveyors, buildings, stormwater ponds).

1.2.1.2 Operation

- Material excavation.
- Crushing and screening with use of in-pit conveyors to move material.
- Dust control.
- Conveying material to Inland's Spy Hill Property using off-site conveyor.
- Topsoil, subsoil and overburden stripping and stockpiling for future reclamation.
- Progressive reclamation.

In support of the Conceptual Stormwater Management Report, *post-operation* represents completion of mining phases, prior to final reclamation.

1.2.1.3 Final Reclamation

- Replacing and recontouring reclamation materials.
- De-compaction.
- Removing infrastructure.
- Seeding and weed control.

1.2.2 Project Schedule

Pending regulatory approval, Project development is planned to commence in 2022, with material extraction starting in 2024.

The anticipated schedule for each Project activity (as described in Section 1.1.2) is provided below in **Table 1-1**.

Table 1-1: Project Schedule

Project Activity	Period
Site Preparation	Commencing in 2022 for an estimated period of 2 years
Operation (including Progressive Reclamation)	Commencing in 2024 for an estimated period of 25 – 30 years.
Final Reclamation	Commencing following operational activities for an estimated period of 3 years

1.2.3 Project Area Descriptions

The Project Area consists of 243 ha of undeveloped land situated within the West Nose Creek catchment VII as identified in Bearspaw Master Drainage Plan (BMDP; MPE 2007). The Project Area contains a significant number of natural depression areas with no outlets. In extreme storm events or following multi-year wet cycles, these

depression areas can overspill to downstream catchment areas. All runoff generated from the Project Area drains (south to north) to a local drainage system flowing to West Nose Creek which is a tributary of Nose Creek.

1.3 Background Information

Previous background drainage reports related to the Project Area were reviewed to understand the opportunities and constraints of the proposed Project development. These documents were reviewed to provide an understanding of the current criteria and requirements established for areas adjacent to the Project Area and are discussed further in Section 2. Based on the County Servicing Standards (RVC 2013), Lehigh is responsible for ensuring all stormwater facilities and infrastructure are designed and constructed in accordance with Alberta Environment and Parks (AEP) regulations and guidelines.

In addition to the background review, AECOM civil engineers carried out a site visit on April 28, 2020. The site visit confirmed the presence of a 450 mm diameter corrugated steel pipe (CSP) crossing Range Road 24, a 450 mm diameter CSP culvert crossing Burma Road, and a 600 mm diameter CSP culvert crossing Range Road 25. Two of these culverts, the one crossing Burma Road and the one crossing Range Road 25, were not mentioned in the BMDP (MPE 2007). These two culverts are anticipated to effectively convey off-site runoff to the Project Area, as shown in Figure A5. Prior to Project detailed design, a culvert survey will be required for culvert inlet and outlet inverts, longitudinal slopes and their exact locations.

2. Stormwater Management Criteria

Stormwater management and drainage for the Project Area are subject to a number of design considerations and constraints. Relevant standards and design guidelines used in the SWMR include:

- County Servicing Standards (RVC 2013)
- Nose Creek Watershed Water Management Plan (NCWWMP; Palliser 2018)
- Bearspaw Master Drainage Plan (BMDP; MPE 2007)
- Bearspaw Meadow Drive Stormwater Management Plan (MPE 2018)
- The City of Calgary Stormwater Management Design Manual (SMDM; City of Calgary 2011)
- Stormwater Management Guidelines for the Province of Alberta (AEP 1999)

2.1 Design Standards and Guidelines

The following stormwater management design standards and guidelines are utilized in the model for the proposed development:

- Stormwater Quantity Control (Palliser 2018): Catchments draining to West Nose Creek have a maximum Allowable Release Rate (ARR) of 0.99 L/s/ha.
- Stormwater Quantity Control (MPE 2007):
  - Upstream offsite catchment areas must be included in analysis and design considerations (73 ha south of Burma Road, 32 ha northwest of Burma Road and Range Road 25).
  - June 2005 rainfall (282 mm rainfall) event governs minimum pond storage requirements at ARR of 0.99 L/s/ha, with a precipitation volume of 503 m^3/ha.
- Stormwater Quality Control (City of Calgary 2011): Target removal of 85% of suspended solids 50 microns or larger in size.
- Annual Runoff Volume Control (City of Calgary 2018): The current runoff volume control target of 26 mm was applied.
- SMDM (City of Calgary 2011):
  - Active storage depths to be 1.0 m to 2.0 m.
  - Permanent storage volume based on a minimum of 25 mm over the contributing catchment area with typical depths from 1.5 m to 2.0 m.
  - Modeling with locally accepted hydrological models such as SWMHYMO, QUALHYMO, WBSCC, PC SWMM, HYFRAN.
- Stormwater Management Guidelines for the Province of Alberta (AEP 1999): Overland flows, velocities and depths (Qvd) compliant.

3. Stormwater Design Considerations and Inputs

3.1 Computer Models

3.1.1 Single Event Stormwater Management Hydrologic Model

The Stormwater Management Hydrologic Model (SWMHYMO) computer model (Version 4.05), developed by J.F. Sabourin and Associates Inc. (2005), was used for the simulation and management of stormwater runoff for the Project. It is a complex hydrologic model which can undertake limited continuous rainfall simulations as well as single rainfall event simulations. The model was used for hydrologic and hydraulics analysis of the off-site and on-site major surface drainage system and to determine the required storage volumes of the proposed stormwater management facilities using the maximum ARR of 0.99 litres per second per hectare (L/s/ha) and Project Area of 241 ha.[2] Input parameters to the model are the June 2005 rainfall data and geotechnical and catchment characteristics as described throughout this Section. All SWMHYMO model data files and results are presented in **Appendix B**.

3.1.2 Continuous Simulation Water Balance Model

The Water Balance Spreadsheet for the City of Calgary (WBSCC; Westhoff 2011) (Version 1.2) is a Microsoft Excel Spreadsheet model developed by Westhoff Engineering Resources Inc. for the City of Calgary. The model was used to determine the annual runoff volumes discharged to West Nose Creek as a result of the Project's development. The model can perform continuous simulation of the rainfall-runoff process for an urbanized or rural catchment area by using climate data such as daily rainfall, mean daily temperature and monthly evaporation in the form of time series. For the current version of this model, the climate data has been taken from the Calgary International Airport Station for the period of 1960-2010. The WBSCC allows different source control practices such as absorbent landscaping for simulation of water balance of stormwater storage facilities receiving runoff produced by the catchment area. All WBSCC model data files and results are presented in **Appendix C**.

3.1.3 Other Models

HYFRAN-Plus hydro-statistical frequency distribution software (Bobee *et al. 2008*) (Version 1.2) was used to estimate storage volumes for different return periods based on annual maximum storage volumes obtained from the Water Balance model. The model consists of a Decision Support Systems (DSS) to help the users choose adequate distribution to fit a set of independent and identically distributed data.

3.2 Design Storm

The Project Area catchment lies within the West Nose Creek watershed and the ARR is 0.99 L/s/ha as per NCWWMP (Palliser 2018). Northwest Recreation Centre, Calgary Rain Gauge Station ID 3031093 is the nearest rainfall recording station in the vicinity of the Project Area and the June 2005 rainfall event provides 282 mm of rain for 30 days. **Figure A2** shows the June 2005 rainfall data recorded at Northwest Recreation Centre. Calibrated runoff parameters obtained from the BMDP (MPE 2007), combined with June 2005 rainfall data, were used as input

2. As per digital cadastral data

parameters into the SWMHYMO model simulation to determine the required storage volumes. **Table 3-1** shows the SWMHYMO model calibration parameters.

Table 3-1: Model Calibration Parameters for the June 2005 Rainfall Event

Parameters	Values	Remarks
Total Rainfall	282 mm	June 2005 Rainfall Event
Total Runoff	158 mm	Estimated Runoff at Site
Model Period	30 days	June 2005 Rainfall Event
Imperviousness Ratio	20%	Imperviousness Percentage including Wetlands
Impervious Initial Abstraction	1.5 mm	Estimated Depression Storage
Antecedent Moisture Condition	I	AMC I (assumed as dry prior to event)
Parameters Adjusted for Calibration		
CN Value	55	Estimated to match measured runoff
Initial Abstraction	15 mm	Estimated to match measured runoff

The adjusted Intensity-Duration-Frequency (IDF) parameters (a, b and c) used in the SWMHYMO model correspond to the rainfall data recorded at the Calgary International Airport, in order to create the 1:100-year, 24-hour 'Chicago' rainfall distribution and other model input parameters. The Chicago rainfall distribution is a standard hydrograph approach adopted for Calgary to create adjusted IDF curves. The IDF curve is a statistical description of the maximum potential rainfall intensity for a given duration and storm frequency. In Calgary, the IDF curve is based on Meteorological Service of Canada rainfall data collected from 1947 to 1998 and Gumbel frequency distribution was used for IDF curves. Not all of the points fit the best-fit curves in Gumbel distribution and thus, further analysis was undertaken to fine tune the curves for the different durations and these adjusted IDF parameters were used in the model. The model input parameters used are presented in **Table 3-2**.

Table 3-2: SWMHYMO Input Parameters

Adjusted Intensity-Duration-Frequency (IDF) Parameters for Chicago Storm	a		663.1
	b		1.87
	c		0.712
Design Storm Parameters	Duration		24 hrs.
	Time Step		5 min
	Time to Peak Ratio		0.3
	Modified CN Value		55
	Depression Storage	Pervious Areas	15.0 mm
		Impervious Areas	1.5 mm
Horton Infiltration Parameters	Initial Infiltration Rate		75 mm/hr
	Final Infiltration Rate		7.5 mm/hr
	Decay Rate		4.14 / hr
	CN Value		55

The 1:100 year, 24 hour duration design storm event and the June 2005 extreme rainfall event were evaluated to estimate post-operation storage volume requirements. Based the low unit release rate of 0.99 L/s/ha, the June 2005 event governs. For higher release rates above 3 L/s/ha, the 1:100 year, 24 hour duration would govern. **Figure A3** shows a design storm for the 1:100 year, 24 hour rainfall distribution for Calgary.

3.3 Geotechnical Information

A detailed Geotechnical Investigation Report has not been completed at this stage. However, boreholes drilled within the Project Area, for overburden and aggregate delineation, illustrate that on average there is more than 10 m of overburden material, mainly consisting of till, boulders, gravel, sand and silt deposits imbedded in clay

material. **Figure A4** shows borehole and monitoring well locations in the Project Area. For the existing condition Water Balance modelling, the topsoil characteristics for the Project Area are proposed based on the City of Calgary SMDM (City of Calgary 2011):

Pre-construction Soil Properties

- Sand 30%; Silt 35% and Clay 35%
- Porosity 46%
- Field capacity 27.1%
- Wilting Point 12.6%
- Saturated hydraulic conductivity of 5.0 x 10^{-6} m/s
- Sub-soil hydraulic conductivity of 1.0 x 10^{-8} m/s

Once the aggregate is removed during the different mining phases, the remaining substrate at the bottom of the pit (i.e., post-operation) is anticipated to have the following characteristics based on the City of Calgary SMDM (City of Calgary 2011):

Post-operation Soil Properties

- Sand 88%; Silt 7% and Clay 5%
- Porosity 43.7%
- Field capacity 10.5%
- Wilting Point 4.7%
- Saturated hydraulic conductivity of 5.0 x 10^{-6} m/s
- Sub-soil hydraulic conductivity of 1.0 x 10^{-4} m/s (gravel)

The existing topsoil layer ranges from 50 mm to 500 mm throughout the Project Area (AECOM 2020a). A 200 mm depth topsoil layer was used in the WBSCC model for both pre- and post-operation conditions.

As reclamation will be completed progressively, the post-operation mining surfaces consisting of topsoil will act as an absorptive landscaping which can be considered as Low Impact Development. Therefore, annual average runoff volumes will be reduced and improve stormwater quality due to loss of volumes through infiltration process.

3.4 Catchment Area

3.4.1 Existing Condition

The Project Area includes 241 ha of land within the property boundary as shown in **Figure A5**. In addition to the on-site catchment area, there are approximately 14 ha associated with a residential subdivision southwest of the Project Area. Additional runoff generated from an off-site catchment area of 73 ha located south of Burma Road is being conveyed to Project Area through a 450 mm diameter CSP culvert. The off-site catchment area has a detention capacity of 18,345 m^3 as per the BMDP (2007). Similarly, the off-site catchment area of 32 ha located at the northwest of the Burma Road and Range Road 25 intersection drains to the Project Area through a 600 mm diameter CSP culvert. These culverts were not in place at the time of the BMDP (MPE 2007) but were verified in the field. The Project Area is covered with grasses, bushes and trees and slopes south to north with four (4) defined ephemeral drainages discharging runoff north to a local drainage system that flows west to east, ultimately discharging into West Nose Creek. **Table 3-3** shows the existing condition sub-catchment characteristics (AE representing sub-catchments for existing conditions) as shown in **Figure A5**.

Table 3-3: Existing Sub-catchment Characteristics

Sub-catchment ID*	Area (ha)	Weighted Impervious	Length (m)	Slope (%)
AE1	38.206	22	1604	2.4
AE2	35.948	27	1756	2.6
AE3	43.368	24	1320	3.8
AE4	28.048	20	1188	5.3
AE5	109.538	23	1967	3.2
Off-site 1	32.379	25	428	1.4
Off-site 2	73.135	22	1200	1.1
Total Area	**360.622**	**23**		

*Note: Off-site 3 is comprised of portions of AE1, AE2 and AE5 totalling approximately 14 hectares (see **Figure A5**).*

3.4.2 Post-operation Condition

Post-operation sub-catchment delineation on the Property Area will be altered from the pre-development sub-catchment areas after construction of perimeter berms and ditches along the south and west side of the property as shown in **Figure A6**. Construction of berms, except one along the north side, will be completed prior to start of mining operation. The north berm will be constructed after Phase 3 mining is complete. There are 6 phases of mining operation and each phase runs for 5 to 7 years. **Table 3-4** shows sub-catchment characteristics for the 6 different phases of mining operation. Runoff generated from sub-catchment area within the berms drains at existing condition until it is disturbed for mining activities. **Table 3-5** shows the post-operation (AP representing sub-catchments for post-operation conditions) sub-catchment characteristics (**Figures A6** and **A7**).

Table 3-4: Post Sub-catchment Characteristics for Phases 1-6

Sub-catchment ID	Area (ha)	Weighted Impervious	Length (m)	Slope (%)
Phase 1	25.152	20	458	9.7
Phase 2	23.088	20	322	15.0
Phase 3	23.202	20	481	6.7
Phase 4	36.458	20	517	4.6
Phase 5	25.425	20	313	6.3
Phase 6	42.492	25	611	7.5

Table 3-5: Post Sub-catchment Characteristics

Sub-catchment ID	Area (ha)	Weighted Impervious	Length (m)	Slope (%)
AP1	58.945	20	637	7.5
AP2	48.970	20	717	4.7
AP3	7.380	20	261	2.8
AP4	23.967	20	312	5.3
AP5	36.555	20	364	3.2
AP6	6.906	20	301	10.3
AP7	4.189	20	261	7.7
AP8	5.012	20	373	4.8
AP9	6.585	20	353	9.1
AP10	23.077	26	555	0.5
AP11	18.942	29	680	1.2
AP12	6.747	20	823	3.5
AP13	0.572	20	226	0.5
AP14	7.253	20	380	3.7
Off-site 1	32.379	25	428	1.4
Off-site 2	73.135	22	1200	1.1
Total	**360.614**	**22**	**-**	**-**

*Note: Off-site 3 is comprised of portions of AP10 and AP11 totalling approximately 14 hectares (see **Figure A6**).*

3.5 Major – Minor System

There is no minor stormwater drainage system such as underground pipe networks for the Project. However, a major system will always exist as overland surface drainage at the site.

3.6 Soils Technical Assessment

Based on the Soils Technical Assessment completed for the Project (AECOM 2020a), there are no signs of soil contamination within the Project Area. The six phases of mining comprise 160 ha of catchment area, surrounded by the proposed perimeter berms, and wetlands outside the berm wall will be maintained at their existing conditions, if possible. Lehigh will be submitting a *Water Act* Application to permanently remove all existing wetlands within the berm boundary.

3.7 Groundwater Contamination and Site Operations

The impact on surface water quality is anticipated to be negligible since the extraction of the aggregate material is a clean activity. Potential contaminants, such as lubricants and fuel, will be subject to a Spill Prevention and Response Plan to eliminate or minimize the impact of spills. (AECOM 2020b). The groundwater elevation will be at least 1.0 m below a temporary storage pond bottom elevation so that no pond liner is required. Ponds will be depressed at the pit low point area so that mining operations are not impeded during high intensity storm events. As the seepage rate is 1.2 L/day, which is low, no seepage water from an escarpment will be accounted for in the stormwater volume calculation.

3.8 Stormwater Storage Options

3.8.1 Operations

A stormwater storage facility could include either a wet or dry pond to impound and store stormwater runoff both within the pit and outside of the pit. A wet pond captures surface runoff and stores water at permanent average depth. A dry pond utilizes infiltration into the ground or through a pipe to release captured and stored water at a defined ARR. All ponds need to be designed to attenuate storm event peak flows. The pond release rate criteria of 0.99 L/s/ha will help to reduce downstream flooding and erosion potential.

3.8.2 Post-Operation

The lowest Phase 6 pit excavation bottom is 1226.0 m elevation based on the Phase 6 mining completion plan as shown in **Figures A9** to **A11** and the pit will contain runoff volumes generated from a total catchment area of approximately 127 ha. Pit runoff volume can be handled either by a dry pond option or a future constructed wetland (i.e., a self contained evaporation pond with vegetation). Stormwater storage options mentioned below could also be used for post-operation or final reclamation of the completed mining operation.

3.8.2.1 Option 1: Dry Pond within Pit

Dry pond Option 1 can be constructed with a bottom elevation of 1226.5 m and an outlet pipe discharging into the local drainage based on Phase 6 mining operation design surface with pit bottom of 1226.0 m elevation. Since the pit bottom is lower than 1226.5 m elevation, it will need to be backfilled to match the designed pond bottom so that gravity flow can be maintained through the outflow pipe. Two dry ponds post-operation, connected with a surface ditch, are proposed (**Figure A7**). Combined pond stage area and volume characteristics are summarized in **Table 3-6**.

Table 3-6: Combined Pit Dry Pond Stage, Area, Volume and Outflow

Elevation (m)	Depth (m)	Area (m^2)	Incremental Volume (m^3)	Cumulative Volume (m^3)	Pond Outflow (L/s)	Remarks
1226.50	0.00	24430	0	0	0	Bottom
1227.00	0.50	31482	13978	13978	63	
1227.50	1.00	39644	17781	31759	89	
1228.00	1.50	60289	24983	56743	109	
1228.50	2.00	88983	37318	94061	126	HWL

Note: HWL = High Water Level

3.8.2.2 Option 2: Constructed Wetland

Post-operation pit runoff can also be self-contained without any outlet at the end of mining completion and be designed as a constructed wetland of 1.0 m depth, considering bottom elevation of 1226.0 m and high-water level (HWL) 1227.0 m as shown in **Figure A8**.

4. Results

4.1 Overland Flows

As there is no minor storm sewer system proposed for any phase of development, the whole drainage system was designed as overland surface flows with culverts, surface ditches and storages facilities such as wet and dry ponds. A grass ditch along the outside of the south and west berms is trapezoidal in section with a 1.5 m base width and 3:1 side slope. The ditch longitudinal slope varies from 0.5% to 2% and the design depth varies from 0.17 m to 0.24 m for the June 2005 rainfall event. Maximum design ditch flow was estimated at 945 L/s with 0.24 m water depth and 1.2 m/s velocity. There is a steep slope of 12.8% after Station 2+500 m and this section requires a 600 mm diameter CSP with flared end at inlet and outlet. **Figure A12** shows the ditch plan, section and longitudinal profile. **Table 4-1** shows estimated ditch flow, velocity and depth which meets AEPs Stormwater Management Guidelines for the Province of Alberta (1999) criteria as illustrated in **Figure A13**. No ditch is required from Station 0+000 m to 0+800 m.

Table 4-1: Ditch Discharge, Velocity and Depth

Descriptions	Discharge (L/s)	Velocity (m/s)	Flow Depth (m)	Meet AEP Criteria
Ditch 1 (0+800 to 0+950)	509	0.965	0.171	Yes
Ditch 2 (0+950 to 1+450)	886	1.158	0.235	Yes
Ditch 3 (1+450 to 2+500)	945	1.183	0.244	Yes

Pre-development conditions (i.e. existing conditions) for estimated overland flows obtained from the SWMHYMO model for the June 2005 rainfall event are shown in **Table 4-2**. The existing release rate was estimated at 7.1 L/s/ha (average) for the entire 361 ha catchment area.

Table 4-2: Existing Condition Overland Flow Assessment

Sub-catchment ID	Area (ha)	Peak Flow (L/s)	Release Rate (L/s/ha)
AE1	38.206	264	6.9
AE2	35.948	252	7.0
AE3	43.368	329	7.6
AE4	28.048	218	7.8
AE5	109.538	749	6.8
Off-site 1	32.379	266	8.2
Off-site 2	73.135	492	6.7
Total	**360.622**	**2570**	**7.1**

*Note: Off-site 3 is comprised of portions of AE1, AE2 and AE5 totalling approximately 14 hectares (see **Figure A5**).*

Table 4-3 shows post-operation overland flows after completion of Phase 6 mining.

Table 4-3: Post-operation Overland Flow Assessment

Sub-catchment ID	Area (ha)	Peak Flow (L/s)	Release Rate L/s/ha	Remarks
AP1	58.945	500	8.5	Figure A7
AP2	48.970	404	8.2	Figure A7
AP3	7.380	67	9.1	Figure A7
AP4	23.967	243	10.1	Figure A7
AP5	36.555	360	9.8	Figure A7
AP6	6.906	64	9.3	Figure A6
AP7	4.189	41	9.8	Figure A6
AP8	5.012	43	8.6	Figure A6
AP9	6.585	60	9.1	Figure A6
AP10	23.077	259	11.2	Figure A7
AP11	18.942	149	7.9	Figure A6
AP12	6.747	68	10.1	Figure A6
AP13	0.572	5	8.7	Figure A6
Off-site 1	32.379	266	8.2	Figure A6
Off-site 2	73.135	504	6.9	Figure A6
Total	**360.614**	**3095**	**8.58**	**-**

Note: Off-site 3 is comprised of portions of AP10 and AP11 totalling approximately 14 hectares (see Figure A6).

The overland flow assessments presented in **Table 4-2** and **Table 4-3** accounts for infiltration losses using the City of Calgary default values (City of Calgary 2011).. The overland flow assessment shows that the post-operation flow release rate is 8.58 L/s/ha to the proposed ponds and a controlled release rate from ponds is 0.99 L/s/ha as shown in **Table 4-3**.

4.2 Annual Runoff Volumes

The WBSCC model was used for estimating the annual average volume control target based on climate data recorded at Calgary International Airport. The WBSCC uses 51 years (1960 to 2010) of recorded rainfall, temperature and evaporation data. The historical data is recorded at one-hour time steps.

The sub-catchment areas used in the WBSCC model are based on pre-development sub-catchment areas as shown in **Figure A5**. Annual average pre-development volumes were estimated using WBSCC continuous simulation for the 51 years of historical climate data and the pre-development soil properties (Section 3.3) as shown in **Table 4-4**.

Table 4-4: Average Annual Runoff Volumes for Pre-development Condition

Sub-catchment ID	Area (ha)	Average Runoff (mm)
Sub-catchment 1 (AE1 and Offsite 1)	70.110	20.6
Sub-catchment 2 (AE2)	35.948	32.0
Sub-catchment 3 (AE3)	43.368	21.0
Sub-catchment 4 (AE4)	28.048	6.4
Sub-catchment 5 (AE5 & Offsite 2)	183.903	14.4

Similarly, the average annual volumes were estimated for the post-operation condition using WBSCC continuous simulation for the 51 years of historical climate data and the post-operation soil properties (Section 3.3) as shown in **Table 4-5**.

Table 4-5: Average Annual Runoff Volumes for Post-operation Condition

Sub-catchment ID	Area (ha)	Average Runoff (mm)
Sub-catchment 1 (AP1, AP3, AP4 & AP5)	126.847	9.7
Sub-catchment 2 (AP2)	48.970	2.2
Sub-catchment 3 (Contributing catchments to Northwest Wet Pond 1)	161.533	19.1

Sub-catchments 1 and 2 are referenced in **Figure A7**, and Sub-catchment 3 is referenced in **Figure A6**.

The post-operation catchment area (161.533 ha) is not the same as pre-operation values (183.903 ha) as the catchment areas north of the berm are not anticipated to be disturbed; therefore, are not included in the post-operation WBSCC model analysis.

Sub-surface hydraulic conductivity of $1.0x10^{-8}$ m/s as per the City of Calgary default value (City of Calgary 2011) was used for both pre- and post-operation conditions as there was no geotechnical investigation done to confirm sub-surface hydraulic conductivity for post-operation condition.

Based on WBSCC model results, the annual runoff volume control target is less than the 26.0 mm criteria for the post-operation condition. Thus, the runoff volume control target criteria fall within the NCWWMP criteria (City of Calgary 2018).

4.3 Inlet Restrictions

Inlet restrictions to the Project Area are not valid as there is no minor stormwater drainage system such as underground pipe networks and associated structures. However, two existing culverts: a 450 mm diameter CSP across Burma Road and a 600 mm diameter CSP culvert across Range Road 25 restrict flows to the site. Both culvert inlet inverts are approximately 0.45 m offset above from the existing ground level. A detailed culvert survey is required to determine culvert slope, inlet and outlet inverts and will be completed at the detailed design stage.

4.4 Stormwater Management Facility

Two permanent stormwater storage facilities in between the property line and north berm will be constructed. Northwest Pond 1 will be required after completion of the south and west berms. However, Northeast Pond 2 will be required after completion of Phases 1 to 3 mining operation as shown in **Figures A14** to **A16**. Culverts across the north berm will be required so that natural site drainage is not blocked. Water storage after reclamation will be required as the pit bottom is below the existing drainage level (**Figures A9** to **A11**). Based on the anticipated mining design surface after completion of Phase 6, two dry ponds or a constructed wetland will be required to manage pit surface flows. Any pond option for final reclamation must have a bottom elevation of at least 1.0 m above groundwater elevation to avoid groundwater – surface water interaction.

4.4.1 Northwest Wet Pond 1

The proposed Northwest Wet Pond 1 is a wet pond required to capture runoff generated mainly from the two (2) off-site catchment areas and berm areas as shown in **Figure A6**. Runoff generated from the off-site areas and berms will be conveyed into Northwest Wet Pond 1 via a trapezoidal ditch with a 1.5 m base width and 3:1 side slope. Northwest Wet Pond 1 is designed for attenuation of the June 2005 rainfall with a maximum release rate of 0.99 L/s/ha. It needs to capture at least 85% of suspended solids of 50 micron or larger particle size as per stormwater quality control design criteria requirements. Permanent storage volume is estimated based on 25 mm of contributing sub-catchment areas of 162 ha. Northwest Wet Pond 1 was designed with a permanent storage depth of 1.5 m and a live storage depth of 2.0 m with 5:1 side slopes and a freeboard of 0.3 m.

Stormwater quality control will be confirmed in the detailed design stage. **Table 4-6** shows Northwest Wet Pond 1 characteristics based on SWMHYMO model results.

Table 4-6: Northwest Wet Pond 1

Descriptions	Unit	Value
Contributing Catchment Area	**ha**	**161.5**
June 2005 Rainfall	**mm**	**282**
Pond Inflow	**m^3/s**	**0.989**
Permanent Storage	**m^3**	**40,375**
Live Storage	**m^3**	**98,400**
Total Storage	**m^3**	**138,775**
Pond Outflow	**m^3/s**	**0.157**
Release Rate Criteria	**L/s/ha**	**0.99**

Pond 1 storage volumes were estimated at 138,775 m^3 and approximately 88,545 m^3 for the June 2005 rainfall and the 1:100 year, 24 hour duration storm event, respectively. Based on this volume comparison, the June 2005 storage volume is almost one and half (1.5) times larger than the 1:100 year, 24 hour duration storm event.

SWMHYMO Model data file and results are presented in **Appendix B**.

4.4.2 Northeast Dry Pond 2

The proposed Northeast Dry Pond 2 is a dry pond because the surface runoff captured from the post-operation mining areas will be clean water. The SWMHYMO model was used to simulate the June 2005 rainfall and pond size was based on the West Nose Creek release rate criteria of 0.99 L/s/ha. **Table 4-7** shows Northeast Dry Pond 2 characteristics. The mined surface will be reclaimed during progressive reclamation.

Figure A7 shows the design surface after completion of Phase 6 mining operation prior to final reclamation. Runoff generated from sub-catchment area AP2 of 49 ha can be drained to Northeast Dry Pond 2 through a 450 mm diameter CSP culvert.

Table 4-7: Northeast Dry Pond 2

Descriptions	Unit	Value
Contributing Catchment Area	ha	49
June 2005 Rainfall	mm	282
Pond Inflow	m^3/s	0.404
Total Storage	m^3	55,060
Pond Outflow	m^3/s	0.036
Release Rate Criteria	L/s/ha	0.99

Pond 2 storage volumes were estimated at 55,060 m^3 and 18,400 m^3 for the June 2005 rainfall and the 1:100 year, 24 hour duration storm event, respectively. Based on this volume comparison, the June 2005 storage volume is almost three (3) times larger than the 1:100 year, 24 hour duration storm event.

4.4.3 Post-Operation Option 1: In Pit Dry Ponds

Figure A7 shows a completed Phase 6 mining design surface and **Figures A9** to **A11** show mining cross-sections for all phases. Based on the design surface, runoff generated from catchment area A2 of 49 ha can be drained to Pond 2. However, runoff generated from the remaining pit catchment areas of 127 ha will be collected at the pit bottom with the proposed culvert outlet option as shown in **Figure A7**. **Table 4-8** shows combined pit dry pond characteristics.

Table 4-8: Combined Pit Dry Ponds

Descriptions	Unit	Value
Contributing Catchment Area	ha	127
June 2005 Rainfall	mm	282
Pond Inflow	m^3/s	1.17
Total Storage	m^3	78,340
Pond Outflow	m^3/s	0.119
Release Rate Criteria	L/s/ha	0.99

SWMHYMO Model data file and results are presented in **Appendix B**.

4.4.4 Post-Operation Option 2: Constructed Wetland

Pit storage facilities can be converted into a future constructed wetland (i.e., a self-containing evaporation pond with vegetation) with no outlet flows, if desired.

Based on 51 years of evaporation data, average monthly evaporation ranges from 3.0 mm (January) to 154.7 mm (July); therefore, an average monthly expected evaporation rate is 63.0 mm was selected for analysis. Based on information obtained from the hydrogeological assessment conducted for the Project, a shale caprock layer at an elevation of 1224.5 m was used for this analysis. An example of a possible future constructed wetland having a HWL at 1227.0 m elevation is shown in **Figure A8**.

Table 4-9 shows the 1:100 year wetland storage volume calculation based on 51 years of annual maximum storage volumes. The 1:100 year volume of 40,500 m^3 was obtained from Gumbel frequency distribution and can be considered for the constructed wetland design volume as the standard deviation was the smallest among the 5 distributions used in the HYFRAN-Plus frequency analysis software.

Table 4-9: 1:100 Year Wetland Storage Volumes for Different Distributions

Distributions	Volumes (m^3)	Standard Deviation
Gamma	42,100	6,320
Log Normal (3 Parameters)	46,900	23,800
Pearson Type 3	50,000	17,500
Gumbel	40,500	4,950
GEV	45,800	15,900

WBSCC model input data and results are provided in **Appendix C** and HYFRAN-Plus frequency analysis results are presented in **Appendix D**.

Based on the WBSCC model results, an annual maximum storage volume of 58,079 m^3 for the constructed wetland would be required. **Figure A17** shows annual maximum volumes estimated for 51 years of rainfall data simulation obtained from WBSCC.

4.5 Interim Stormwater Management Facility

Temporary detention storage is required during each phase of mining operation. The WBSCC model was used to simulate 51 years of rainfall data to estimate maximum annual runoff volumes for each mining phase. Each mining phase will have its own temporary detention pond to impound the estimated annual maximum volumes as shown in **Figures A14** to **A16** and **Figures A18** to **A20**. **Table 4-10** shows the estimated annual maximum runoff volumes for each phase based on WBSCC model results. **Table 4-11** illustrates different return period estimated runoff volumes based on frequency analysis on 51 years of annual maximum runoff volumes for mining phases 1 to 6.

Log Pearson Type 3 distribution was used in the analysis which shows a minimum standard deviation among other used distributions in HYFRAN-Plus frequency analysis (refer to **Appendix D**).

Table 4-10: Maximum Annual Runoff Volumes in 2005

Mining Phase	Catchment Area (ha)	Maximum Volumes (m^3)
Phase 1	25.152	8,148
Phase 2	23.088	7,479
Phase 3	23.202	8,180
Phase 4	36.458	12,853
Phase 5	25.425	8,258
Phase 6	42.492	13,765
Total	**175.817**	**58,683**

Table 4-11: Storage Volumes (m^3) for different Return Period Storms for each phase

Mining Phase	2-year	5-year	10-year	20-year	50-year	100-year
Phase 1	2,950	5,430	7,000	8,370	9,930	10,900
Phase 2	2,700	4,980	6,420	7,680	9,110	10,000
Phase 3	3,670	5,830	7,160	8,340	9,730	10,700
Phase 4	5,770	9,150	11,300	13,100	15,300	16,800
Phase 5	3,710	5,880	7,230	8,420	9,820	10,800
Phase 6	2,950	5,430	7,000	8,370	9,930	10,900

4.6 Emergency Escape Route

All ponds need an emergency escape route. The results of the WBSCC model indicate the controlled outflow from Northwest Wet Pond 1 and Northeast Dry Pond 2 are 157 L/s and 36 L/s respectively, which requires Inlet Control Devices (ICDs) of 30 mm radius and 70 mm radius orifices. There is a chance of ICDs becoming blocked; therefore, an emergency escape route is also required to control the potential for overflow from the pond. The overland emergency escape route is designed for 1 m^3/s or pond peak inflow, whichever is higher.

Escape route options for any future post-operation dry pond options can also be designed using a control structure with an overflow through a weir and large downstream pipe, in case the ICD is blocked. No escape route would be required for a future post-operation constructed wetland as the wetland design would be self-contained.

4.7 Best Management Practices and Mitigation Measures

Erosion and sediment control (ESC) measures will be implemented and maintained to prevent water quality degradation. ESC measures will be required on all stockpiles and newly stripped areas. Silt fences or vegetation cover will be required for stockpiles to prevent water quality or wind erosion/dust issues. Topsoil clearing, stripping and grading will be carried out in stages to minimize the area of exposed soil. Operations personnel will inspect ESC devices after heavy rainfalls of 25 mm or more within a 24 hour duration. A detailed ESC plan will be prepared during the detailed design stage. Controlled release flow from stormwater ponds will help to reduce downstream channel erosion and scouring.

5. Conclusions and Recommendations

The existing release rate was estimated at 7.1 L/s/ha (average) for the entire 361 ha catchment area based on SWMHYMO model analysis using the June 2005 extreme rainfall event. The ARR from the Project Area will not exceed 0.99 L/s/ha throughout the life of the development. This reduction of 6.11 L/s/ha (average) to the overall discharge will help reduce downstream erosion and local flooding issues during high storm events. Also, the existing downstream 450 mm diameter CSP culvert across Range Road 24 will have less flow pressure as the Project Area ARR is reduced from the existing 7.1 L/s/ha to 0.99 L/s/ha.

Based on WBSCC model results, the annual runoff volume control target is less than the 26.0 mm criteria for the post-operation condition as illustrated in **Table 4-5**. Thus, the runoff volume control target criteria fall within the NCWWMP criteria (City of Calgary 2018) . This indicates that there is a reduction of runoff volumes mainly through a reduction in drainage area due to the depressed mining area and resulting infiltration helping to recharge groundwater after completion of Phase 6 mining work. Estimated volumes for different return period storms during each mining phase were shown in **Table 4-11**. Detailed information about how the post-operation pits will operate on a year to year basis will be included once sub-surface hydraulic conductivity and hydrogeology information are confirmed.

Pit wetland storage volume was calculated based on hydraulic conductivity of 1.0×10^{-8} m/s for 51 years of rainfall data continuous simulation using WBSCC and it needs to be recalculated once the sub-surface hydraulic conductivity is confirmed in future.

Detailed design drawings and stormwater quality enhancement were not carried out at this ‘Conceptual Level’ study and they will be carried out in a future detailed design stage.

The following reports are to be completed prior to starting a detailed SSMR:

- Geotechnical Investigation Report
- Existing Culvert Survey

6. References

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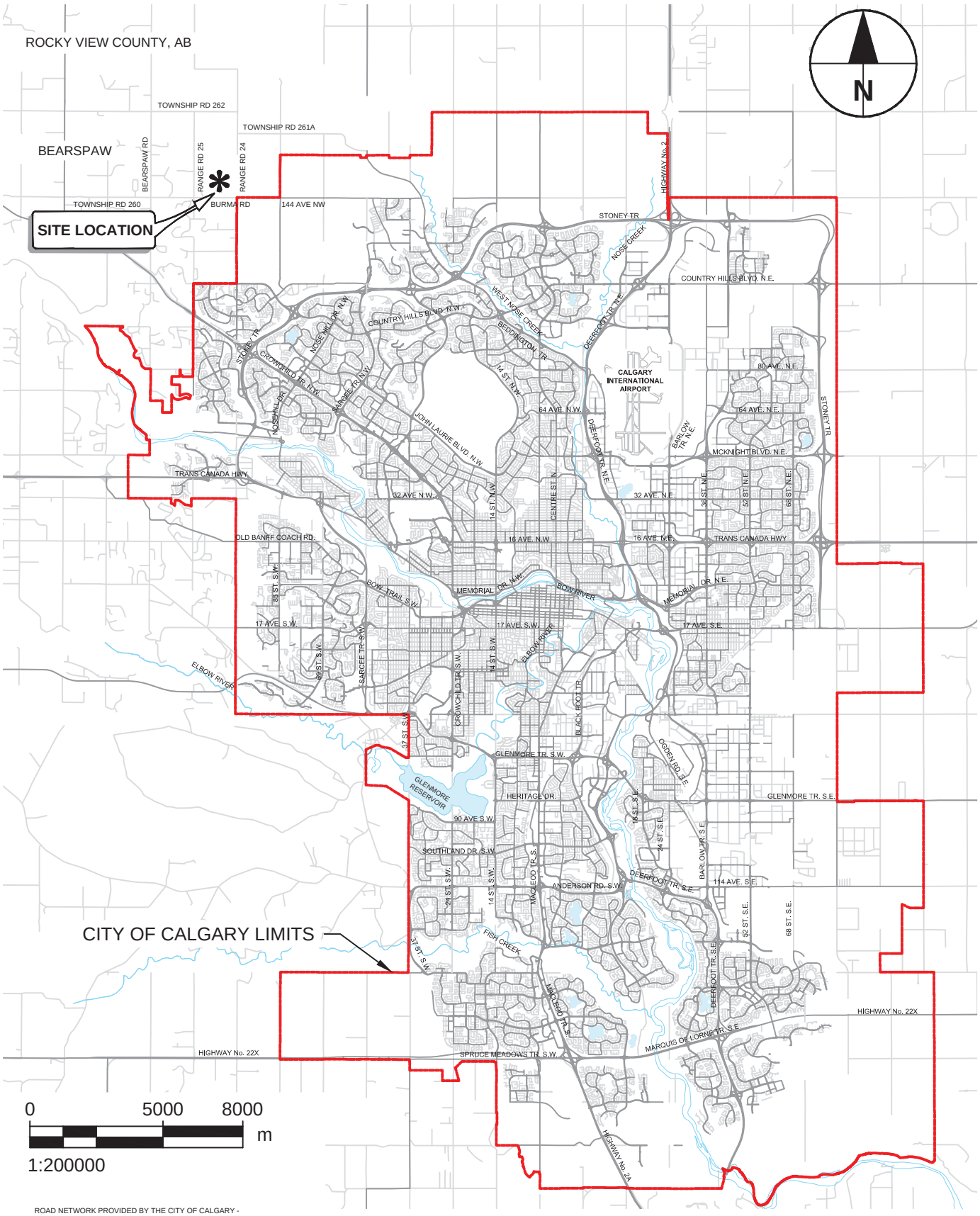
AECOM Imagine it. Delivered.

Appendix A

Figures



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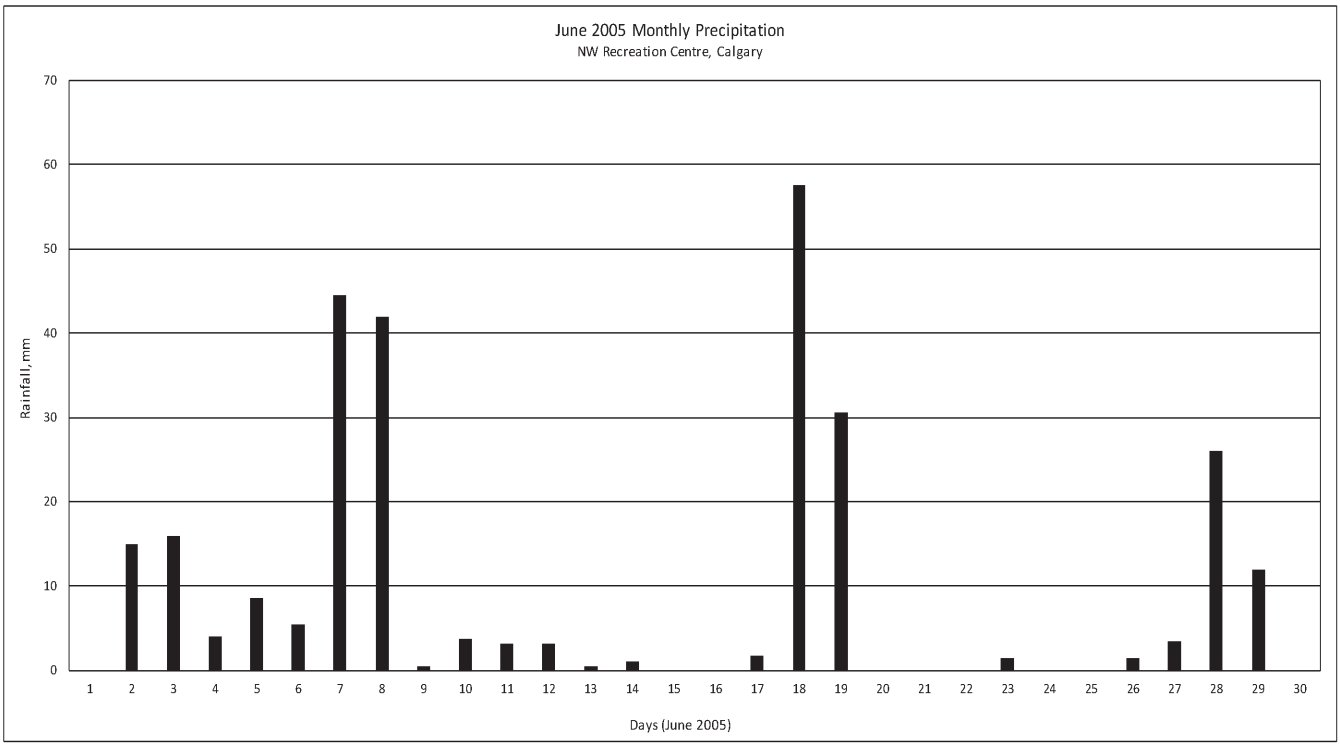
SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

LOCATION PLAN

AECOM

Figure: A1

ANSI A 215.9mm x 279.4mm



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SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

JUNE 2005 EXTREME RAINFALL EVENT

AECOM

Figure: A2

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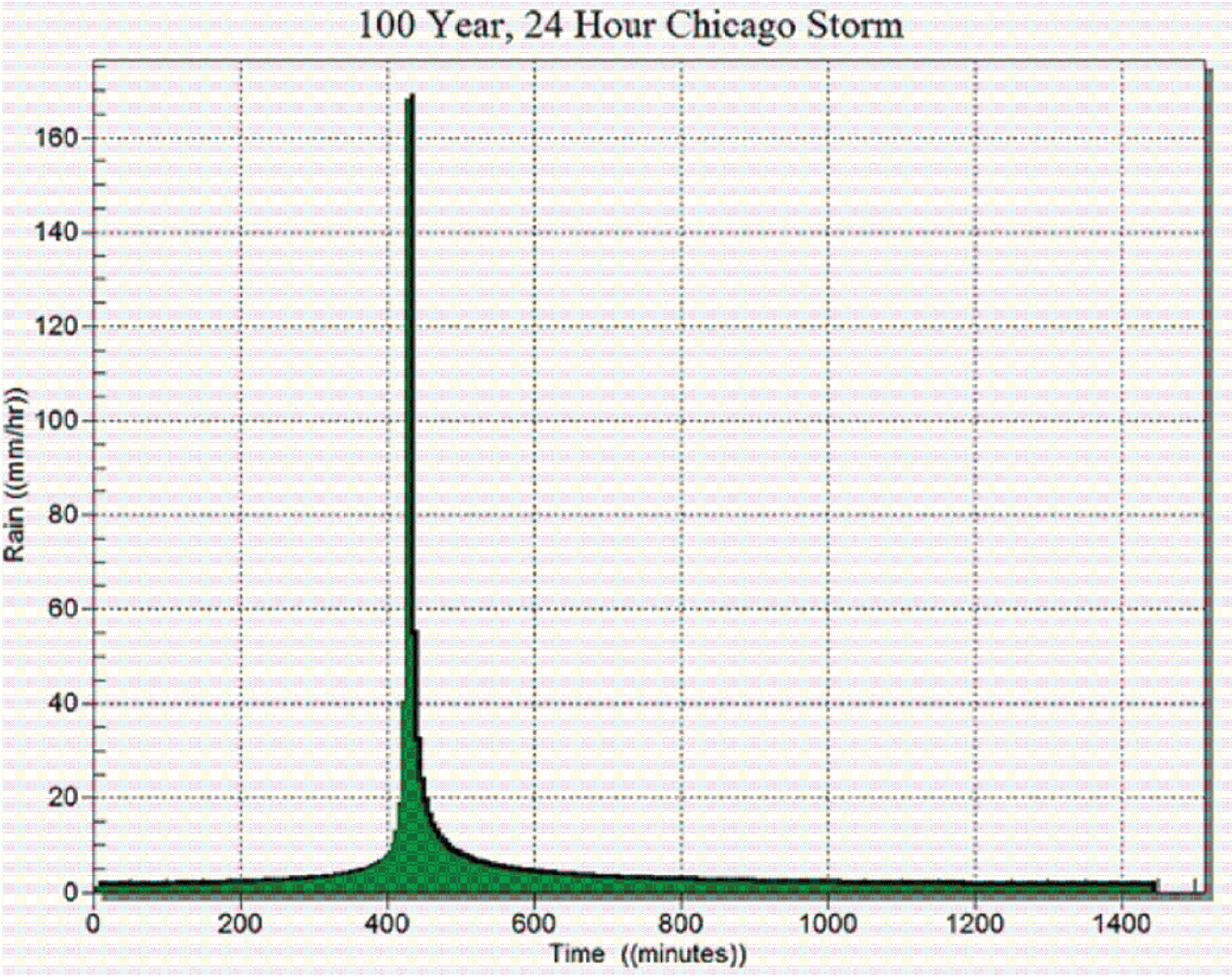

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SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

100 YEAR, 24 HOUR STORM EVENT

AECOM

Figure: A3

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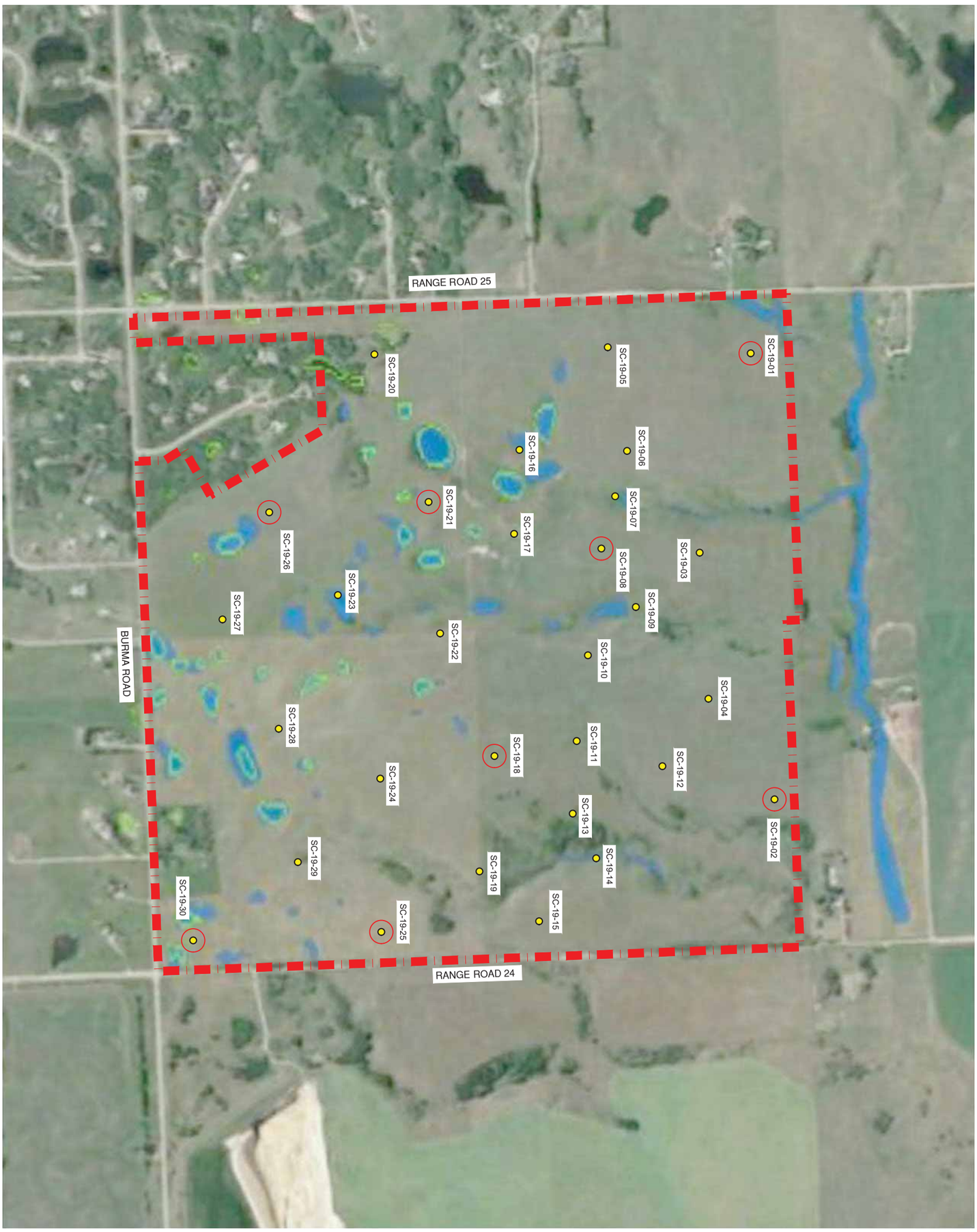


LEGEND

- BOREHOLE LOCATIONS
- PROPOSED MONITORING WELLS
- PROPERTY LINE

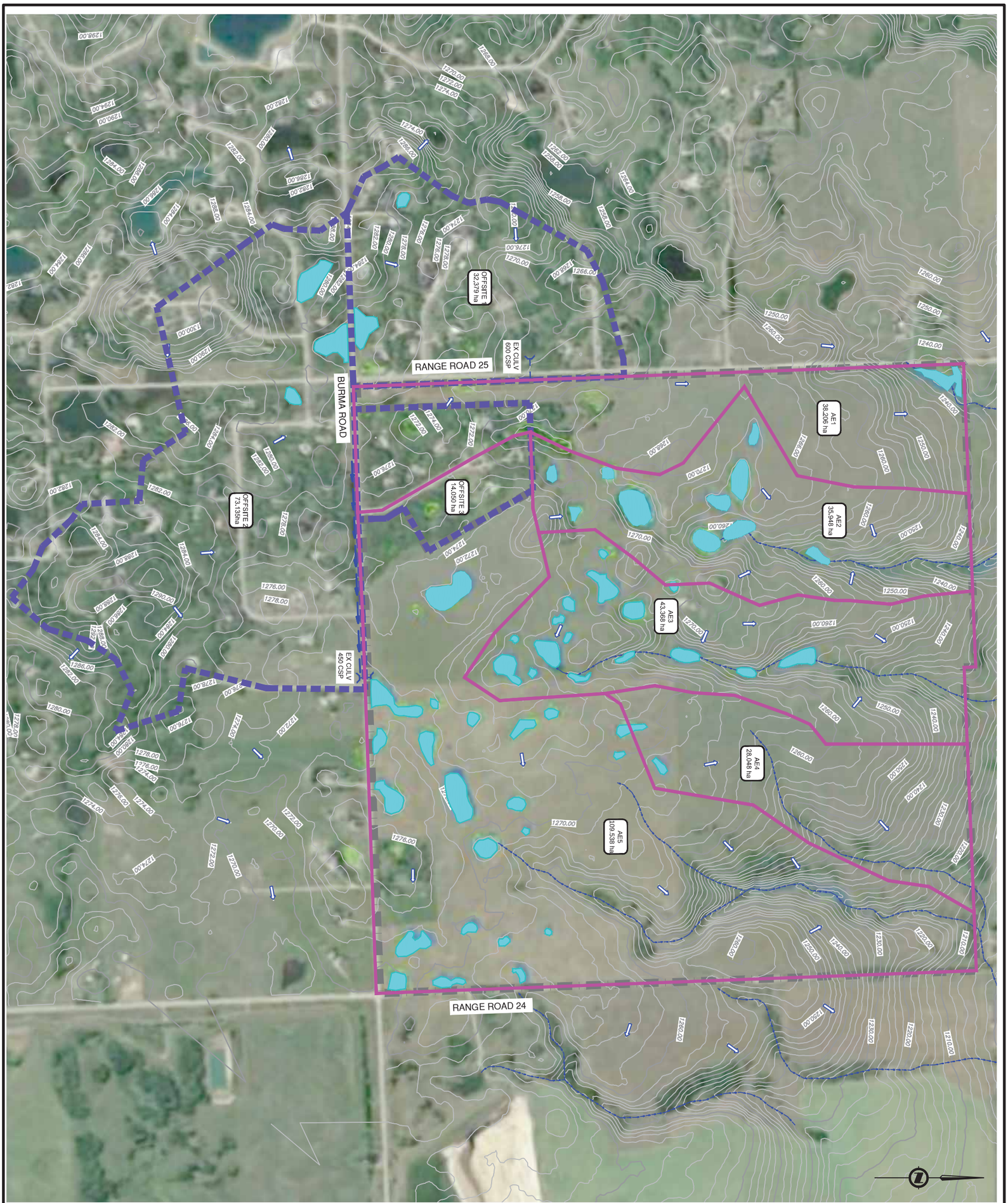
1:5000 0 100 200 m

SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-26

BOREHOLE LOCATION MAP

AECOM

Figure: A4



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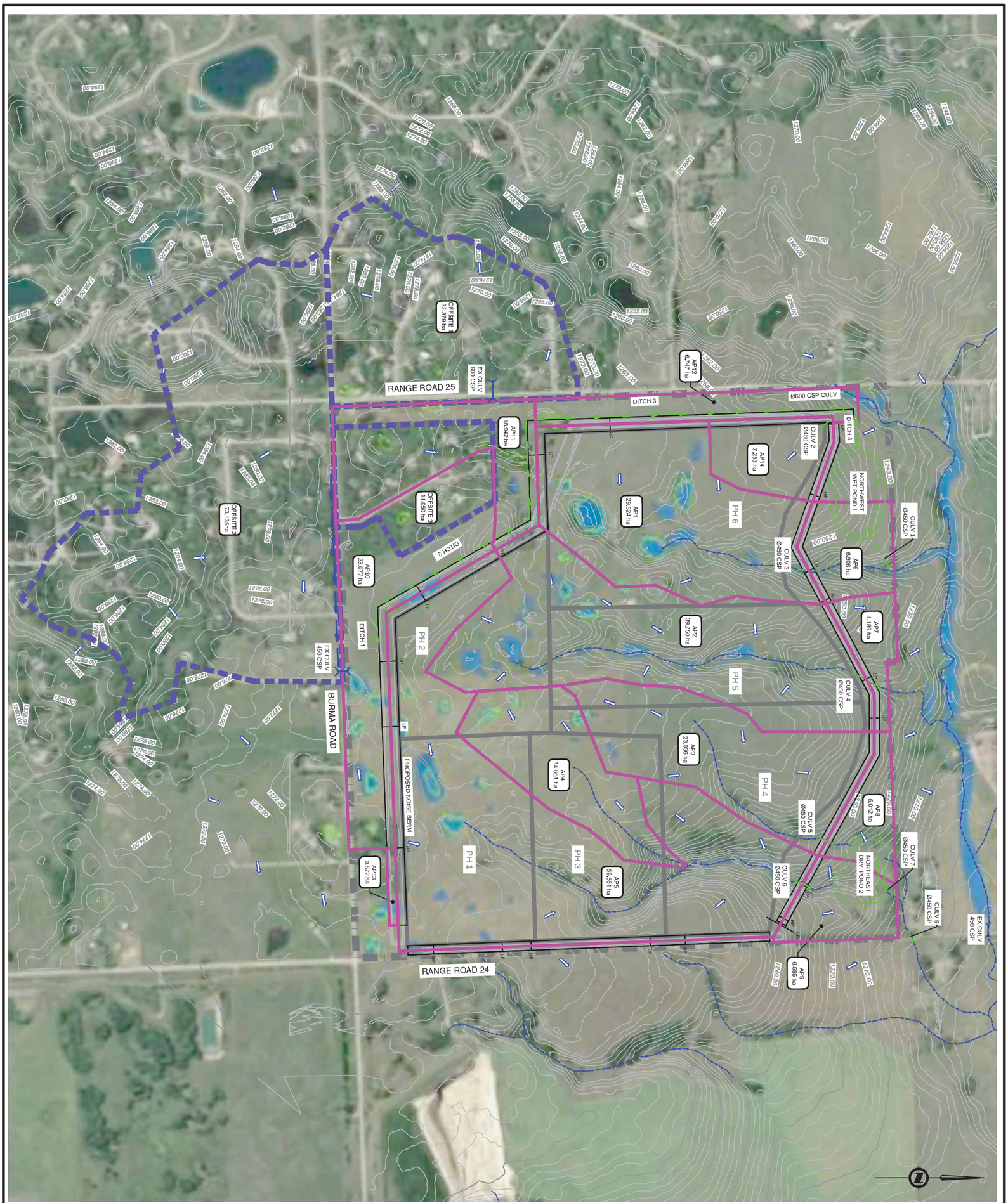
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

EXISTING SUB-CATCHMENT AREAS

AECOM

Figure: A5



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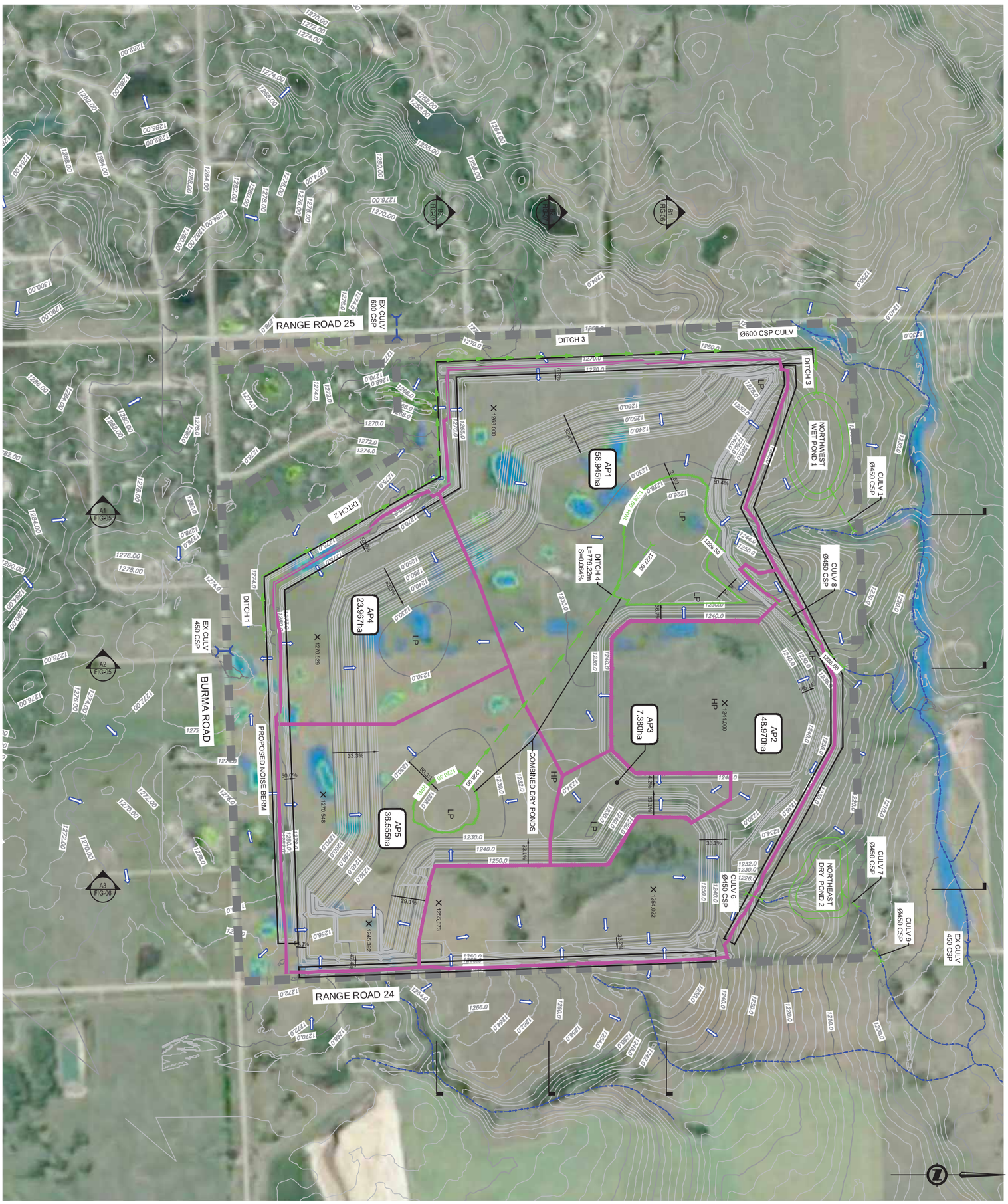
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

EXISTING SUB-CATCHMENT AREAS
WITH PROPOSED BERMS

AECOM

Figure: A6



LEGEND

- ON-SITE CATCHMENT BOUNDARY
- PROPOSED DITCH
- EXISTING DITCH
- PROPOSED CATCHMENT ID (AP3, 43.368 ha)
- FLOW DIRECTION
- PROPOSED CULVERT
- EXISTING CULVERT
- PROPERTY LINE
- POND OUTLINE

1:5000 0 100 200 m

SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

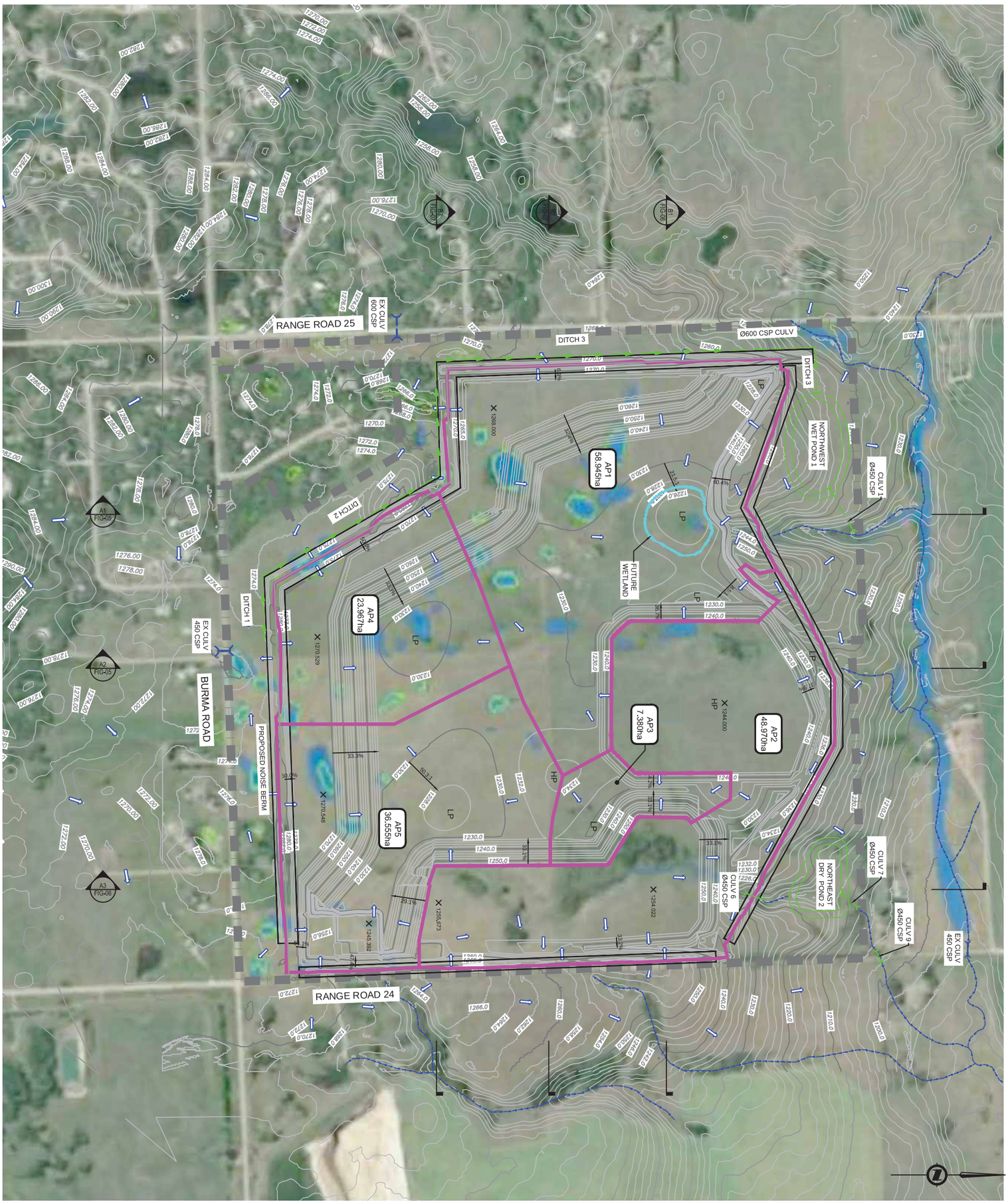
POST-OPERATION
STORMWATER MANAGEMENT PLAN
OPTION 1: COMBINED DRY PONDS

AECOM

Figure: A7

Last saved by: ZHANGD1(2020-06-23) Last Plotted: 2020-06-23
Filename: P:\60610856\900-CAD_GIS\910-CAD\21-FIGURES\CW\60610856-FIG-00-0000-CW-08.DWG

Project Management Initials: Designer: _____ Checked: _____ Approved: _____ ANSI D 558.8mm x 863.6mm



LEGEND

- ON-SITE CATCHMENT BOUNDARY
- PROPOSED DITCH
- EXISTING DITCH
- PROPOSED CATCHMENT ID (AP3 43.368 ha)
- FLOW DIRECTION
- PROPOSED CULVERT
- EXISTING CULVERT
- PROPERTY LINE
- POND OUTLINE
- WETLAND OUTLINE

1:5000 0 100 200 m

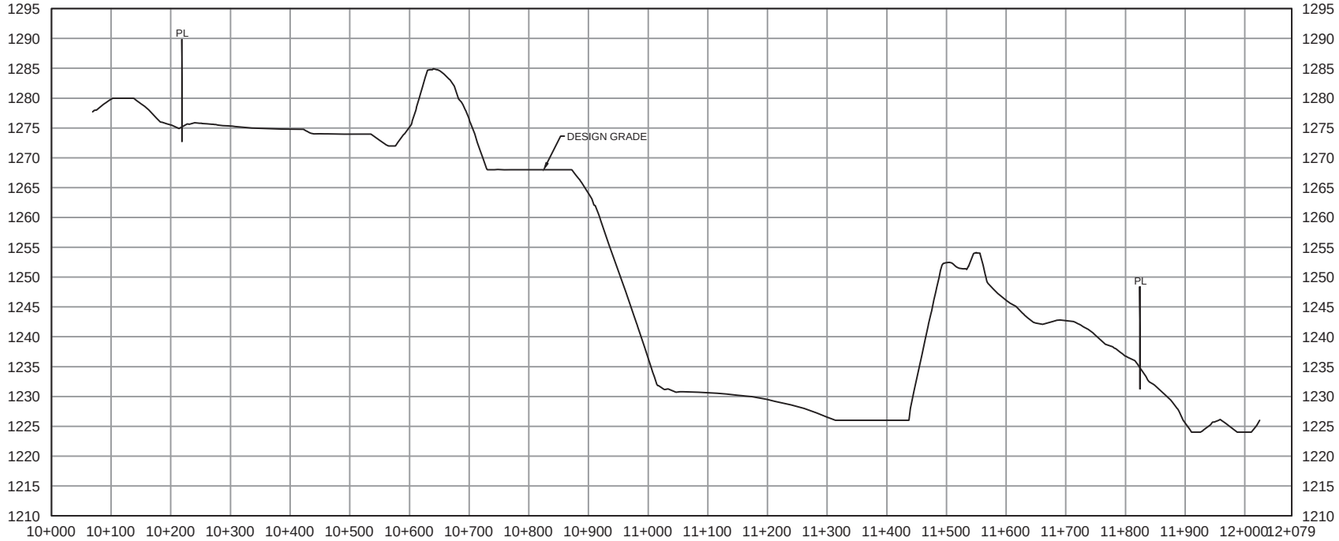
SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

POST-OPERATION
STORMWATER MANAGEMENT PLAN
OPTION 2: FUTURE WETLAND

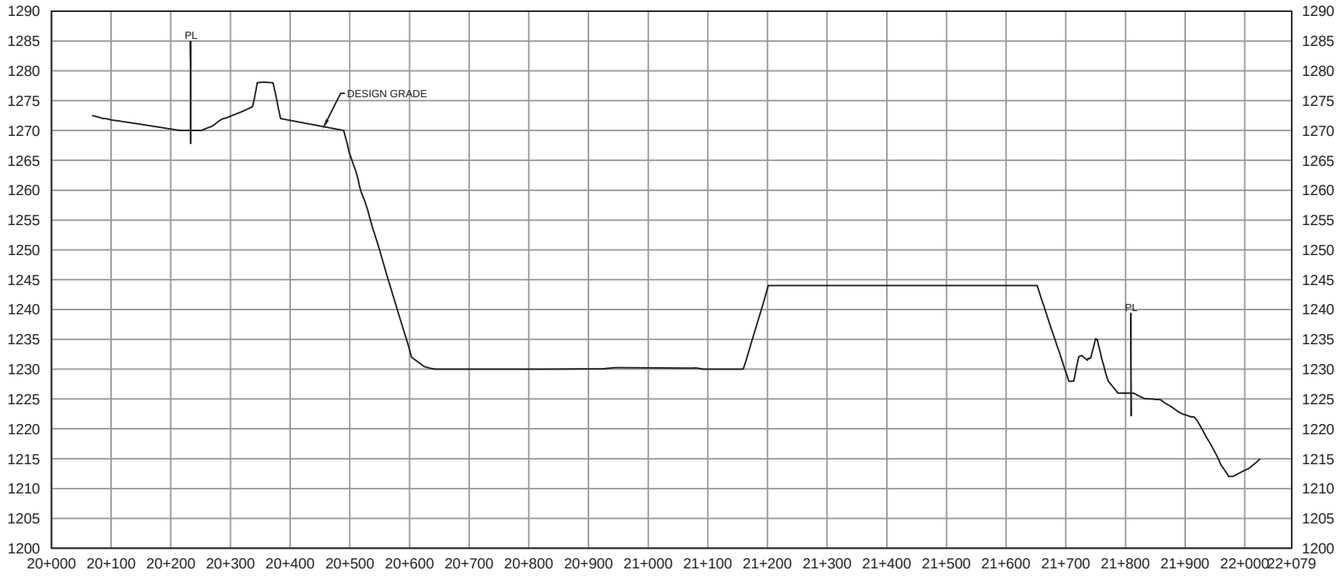
AECOM

Figure: A8

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI D 558.8mm x 863.6mm



A1 SECTION
SCALE: H=1:5000 V=1:500



A2 SECTION
SCALE: H=1:5000 V=1:500

1:5000 (HORZ) 0 100 200 m
1:500 (VERT) 0 10 20 m

AECOM

Figure: A9

POST-OPERATION
SECTIONS

SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

Last saved by: ZHANGD1(2020-06-04) Last Plotted: 2020-06-23
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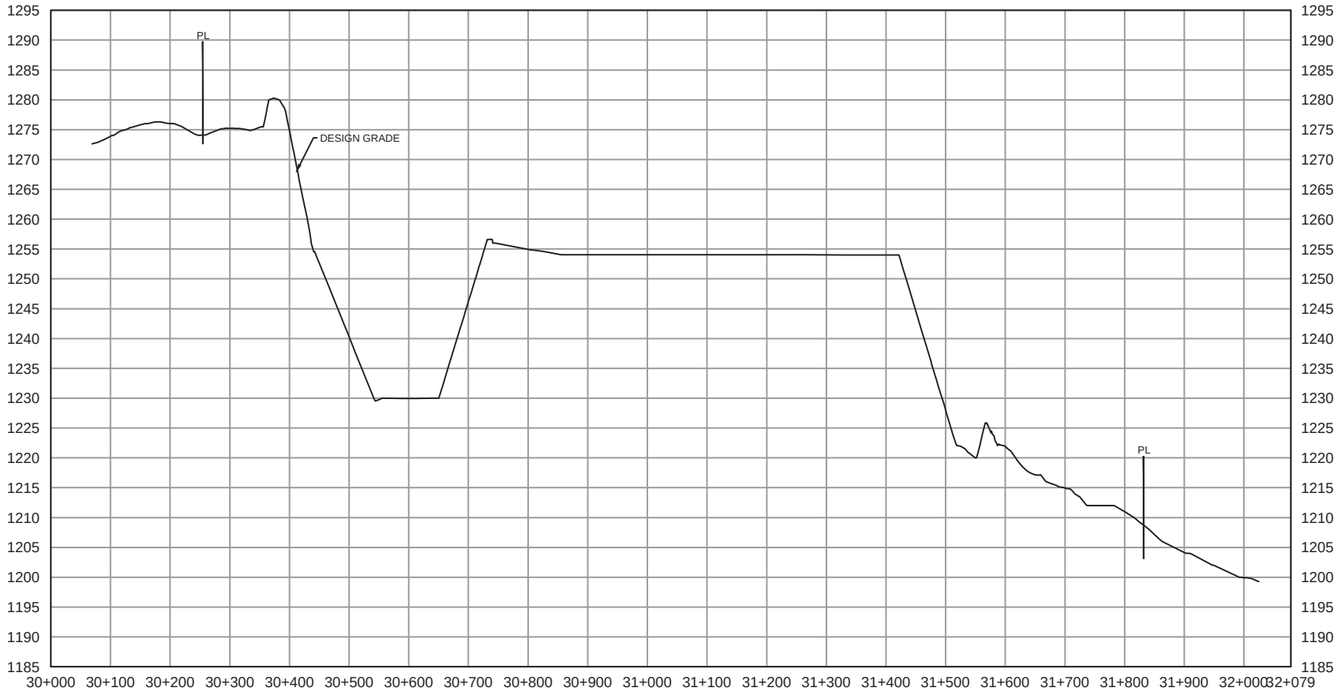
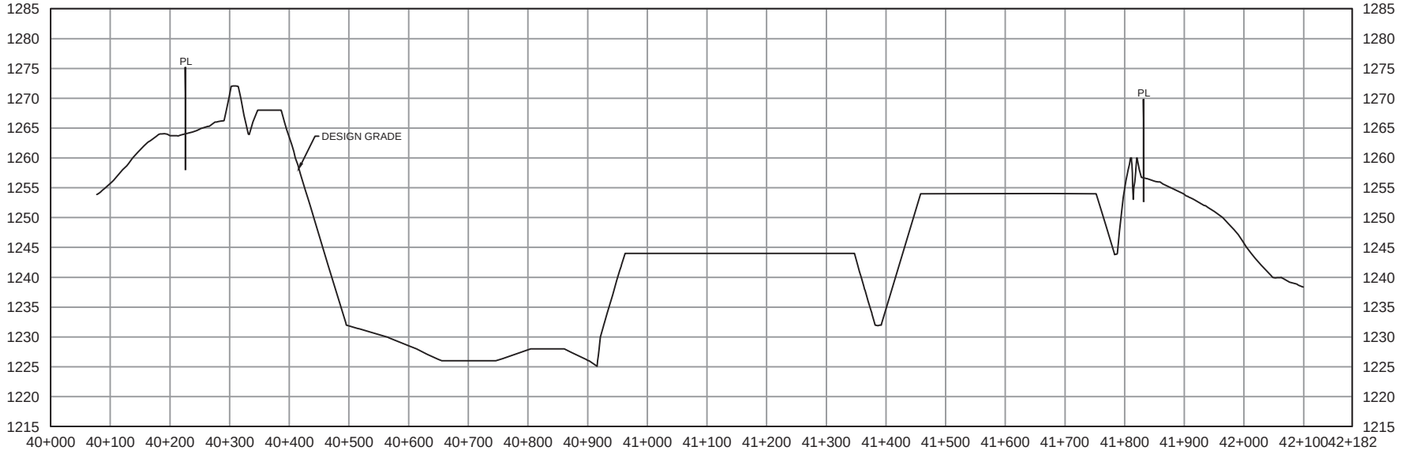
Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI D 558.8mm x 863.6mm



A3 SECTION
SCALE: H=1:5000 V=1:500



B1 SECTION
SCALE: H=1:5000 V=1:500

1:5000 (HORZ) 0 100 200 m
1:500 (VERT) 0 10 20 m

AECOM

Figure: A10

POST-OPERATION
SECTIONS

SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

Last saved by: ZHANGD1(2020-06-04) Last Plotted: 2020-06-23
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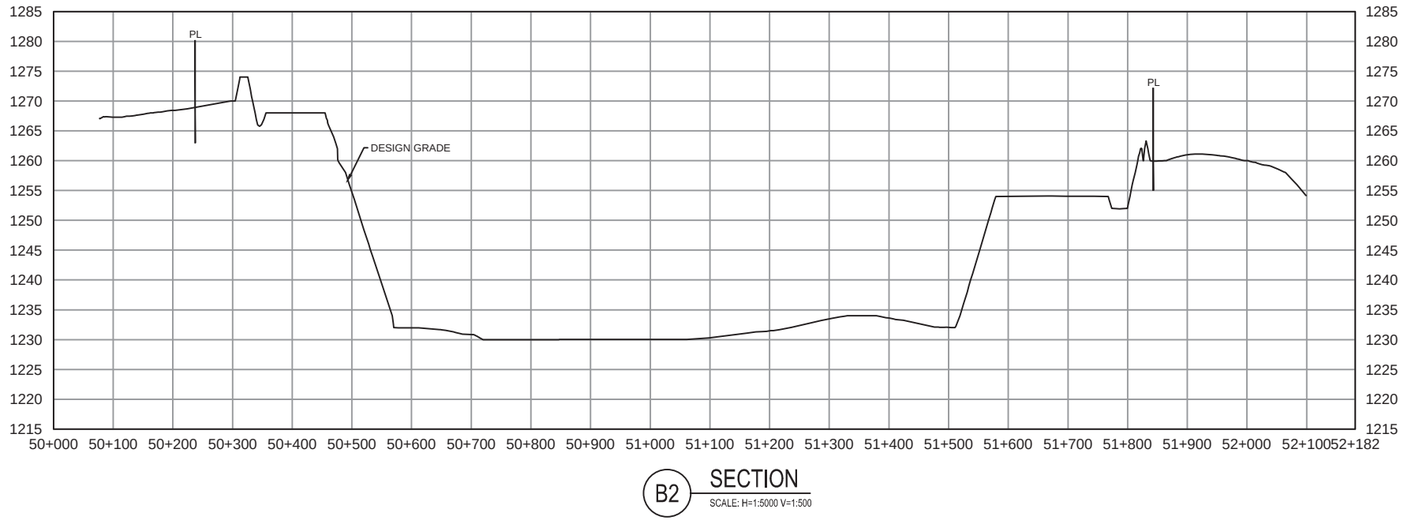
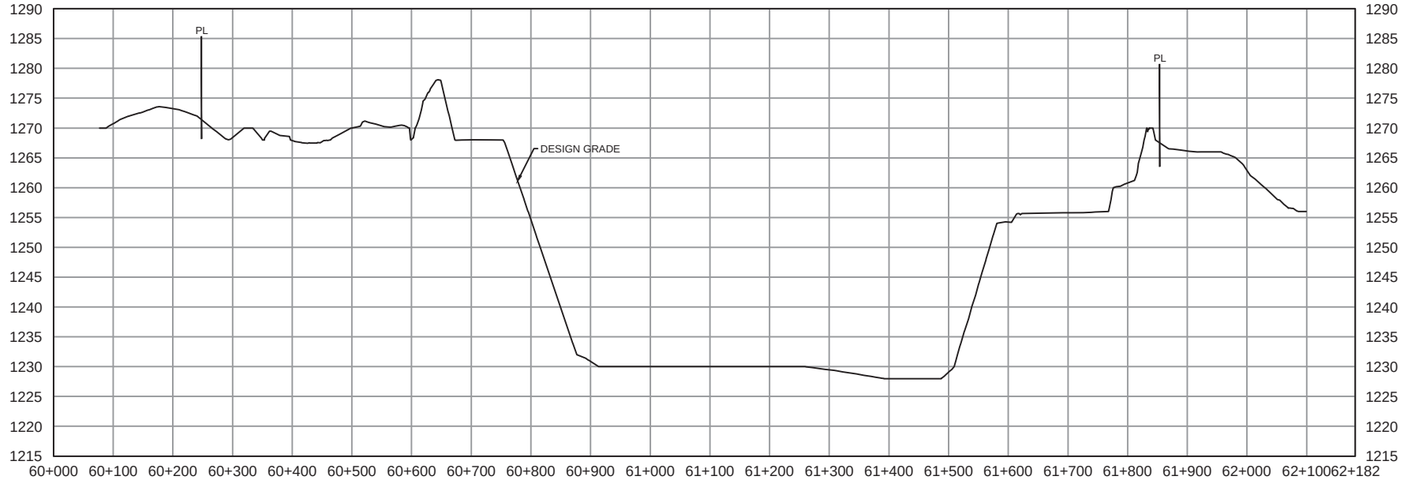


B2 SECTION
SCALE: H=1:5000 V=1:500



B3 SECTION
SCALE: H=1:5000 V=1:500

1:5000 (HORZ) 0 100 200 m
1:500 (VERT) 0 10 20 m

AECOM

Figure: A11

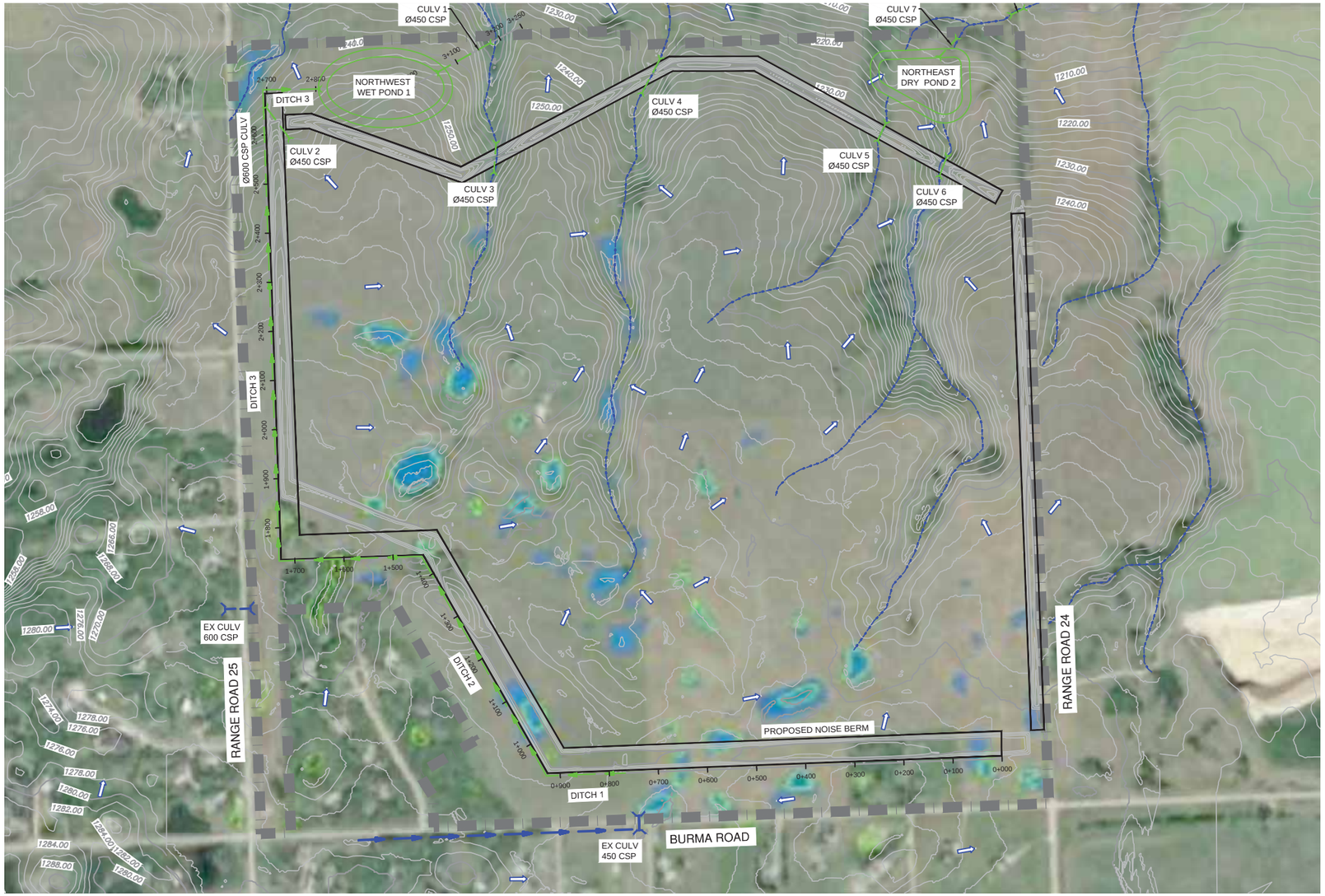
POST-OPERATION
SECTIONS

SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI D 558.8mm x 863.6mm

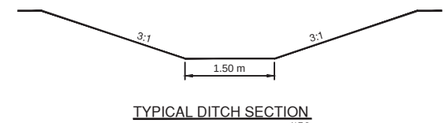
Last saved by: ZHANGD1(2020-06-04) Last Plotted: 2020-06-23
Filename: P:\60610856\900-CAD_GIS\10-CAD\21-FIGURES\CW\60610856-FIG-00-0000-CW-11.DWG

Project Management Initials: Designer: Checked: Approved: ANSI D 558.8mm x 863.6mm

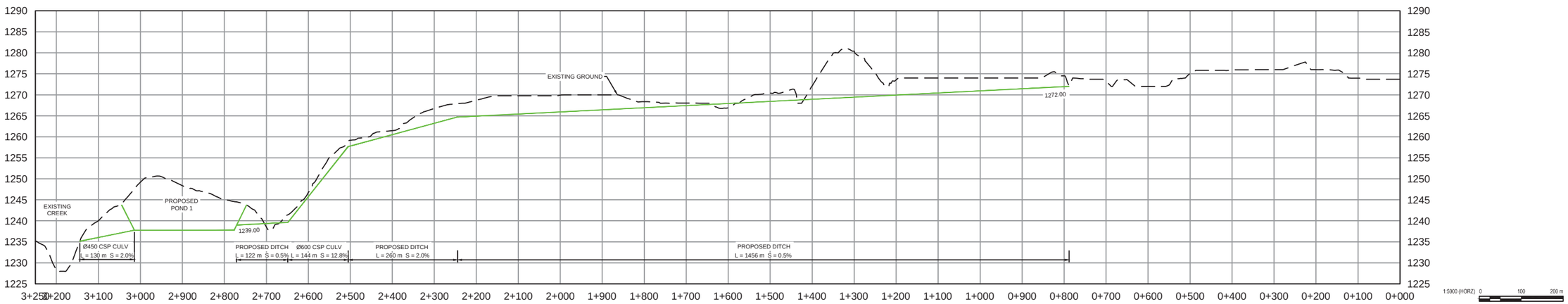


LEGEND

- PROPOSED DITCH
- EXISTING DITCH
- FLOW DIRECTION
- PROPOSED CULVERT
- EXISTING CULVERT
- PROPERTY LINE



TYPICAL DITCH SECTION
N.T.S.



1:5000 (HORZ) 0 100 200 m
1:500 (VERT) 0 10 20 m

PROPOSED DITCH PLAN / PROFILE

AECOM

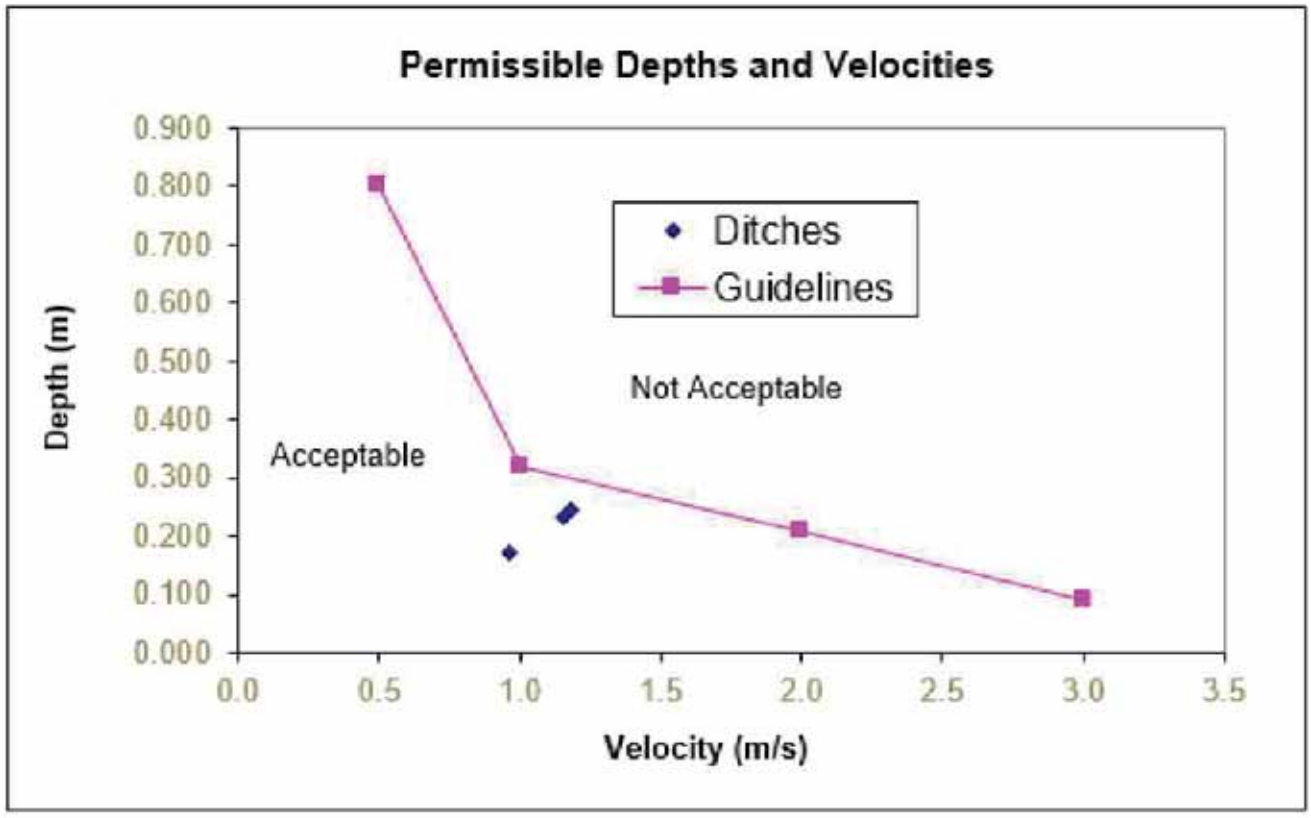
Figure: A12

SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

Last saved by: ZHANGD1(2020-06-04) Last Plotted: 2020-06-23
Filename: P:\60610856\900-CAD_GIS\10-CAD\21-FIGURES\CW\60610856-FIG-00-0000-CW-12.DWG

ANSI A 215.9mm x 279.4mm

JUNE 2005 EXTREME RAINFALL EVENT DITCH FLOWS				
	Total Flow (Q)	Velocity (V)	Depth (D)	Meets AEP Criteria?
ID	m^3/s	m/s	m	
Ditch 1	0.509	0.965	0.171	Yes
Ditch 2	0.886	1.158	0.235	Yes
Ditch 3	0.945	1.183	0.244	Yes



Last saved by: ZHANGD1(2020-06-04) Last Plotted: 2020-06-04
Filename: P:\60610856\900-CAD_GIS\910-CAD\21-FIGURES\CW\60610856-FIG-00-0000-CW-13.DWG

SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

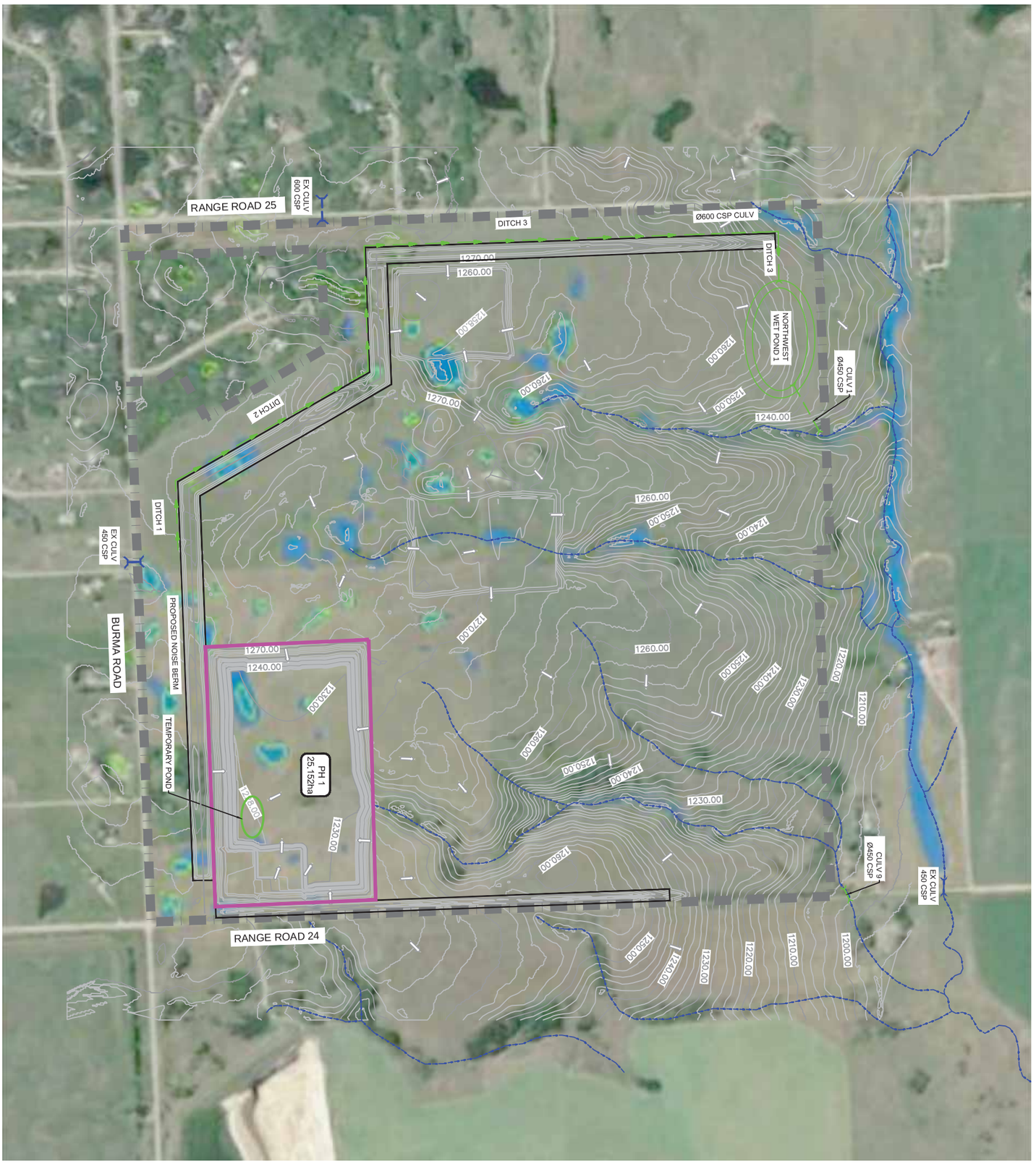
FLOW DEPTHS AND VELOCITIES

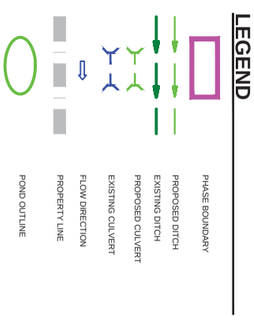
AECOM

Figure: A13

Last saved by: ZHANGD1(2020-06-27) Last Plotted: 2020-06-27
Filename: P:\60610856\900-CAD_GIS\910-CAD\21-FIGURES\CW\60610856-FIG-00-0000-CW-14.DWG

Project Management Initials: Designer: _____ Checked: _____ Approved: _____ ANSI D 558.8mm x 863.6mm



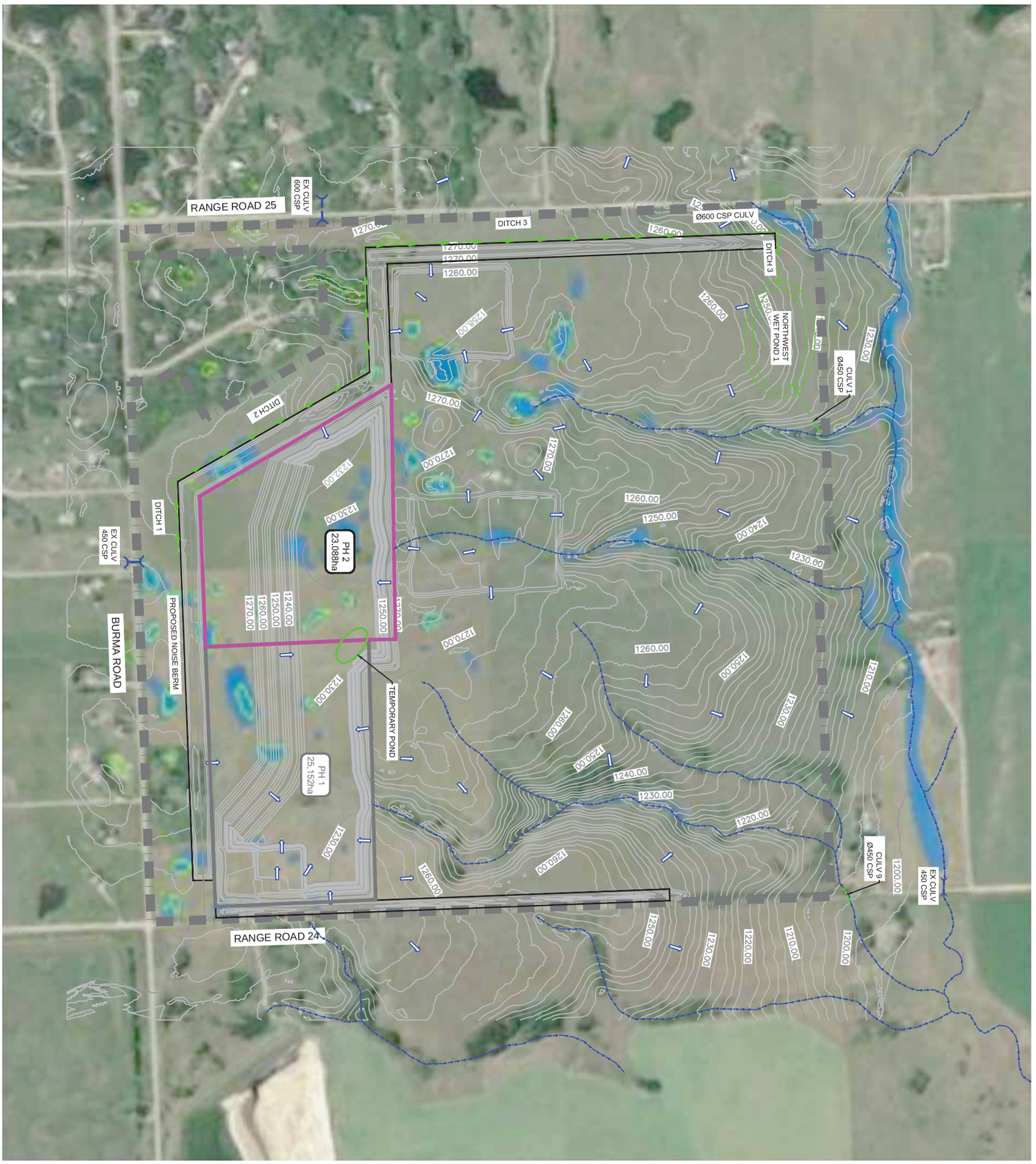


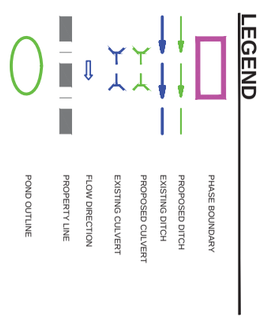
SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

PHASE 1 MINING PLAN

AECOM

Figure: A14





SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

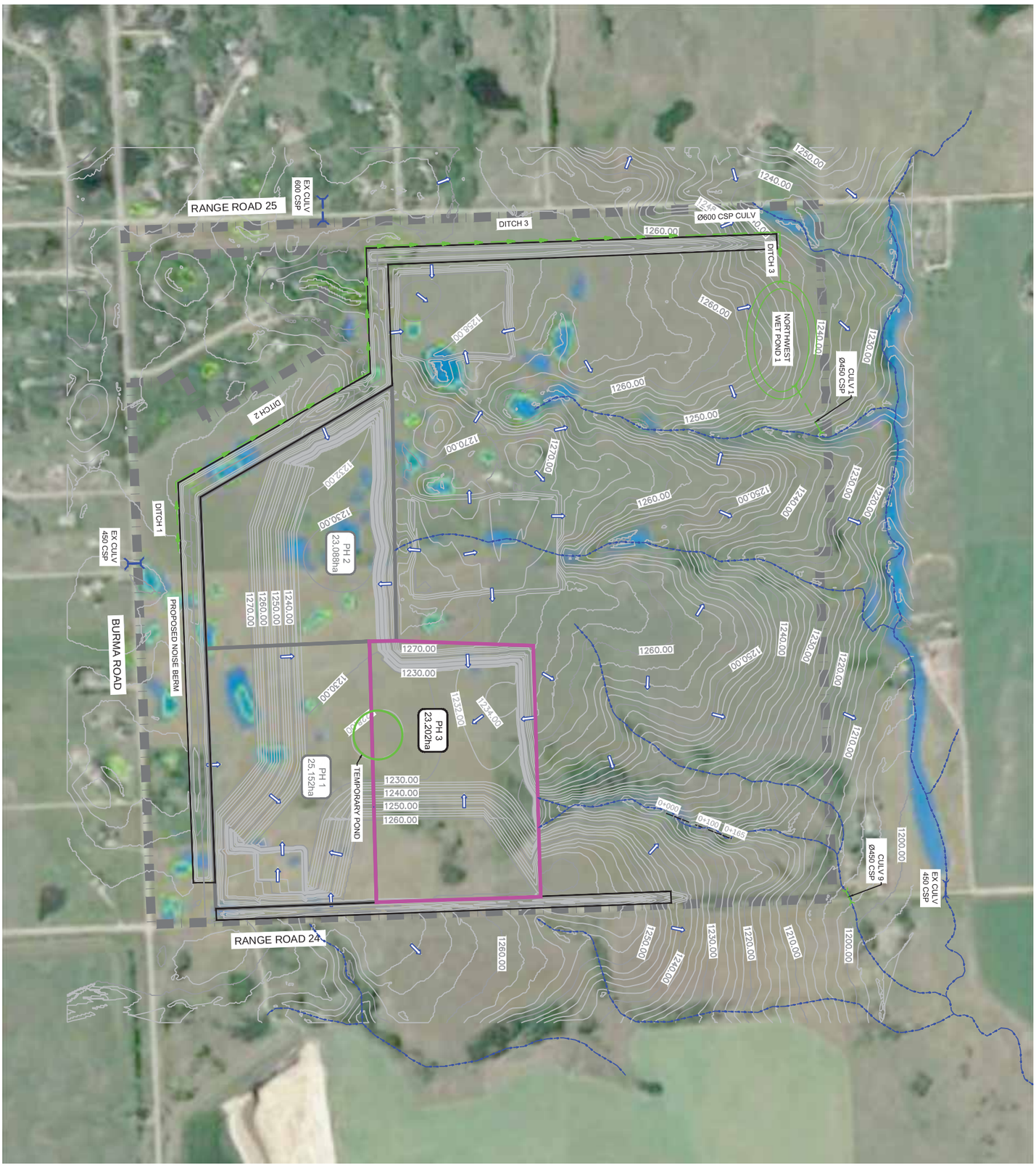
PHASE 2 MINING PLAN

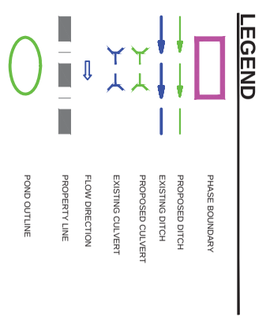
AECOM

Figure: A15

Last saved by: ZHANGD1(2020-06-23) Last Plotted: 2020-06-27
Filename: P:\60610856\900-CAD_GIS\910-CAD\21-FIGURES\CW\60610856-FIG-00-0000-CW-16.DWG

Project Management Initials: Designer: _____ Checked: _____ Approved: _____ ANSI D 558.8mm x 863.6mm





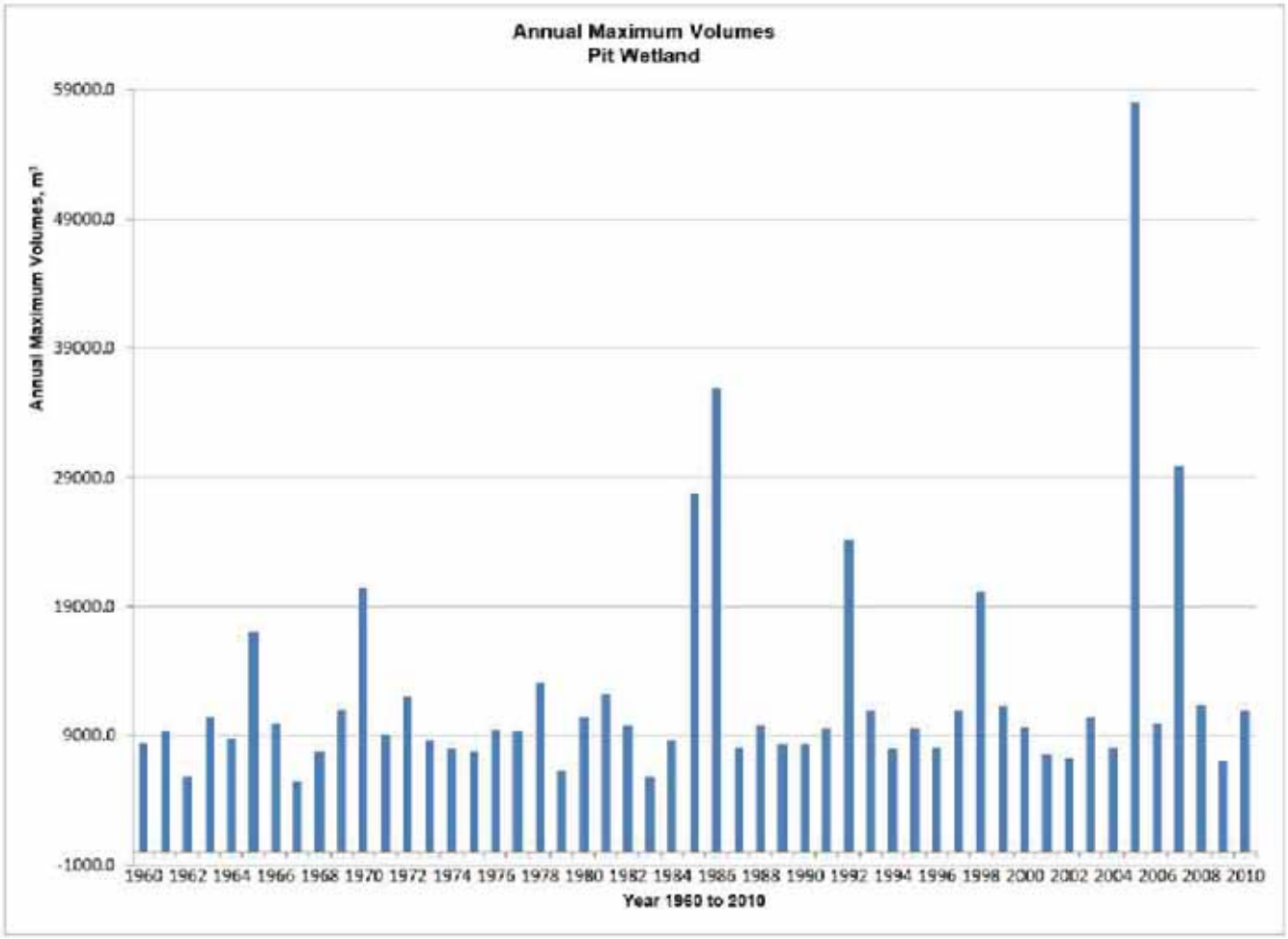
SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

PHASE 3 MINING PLAN

AECOM

Figure: A16

ANSI A 215.9mm x 279.4mm



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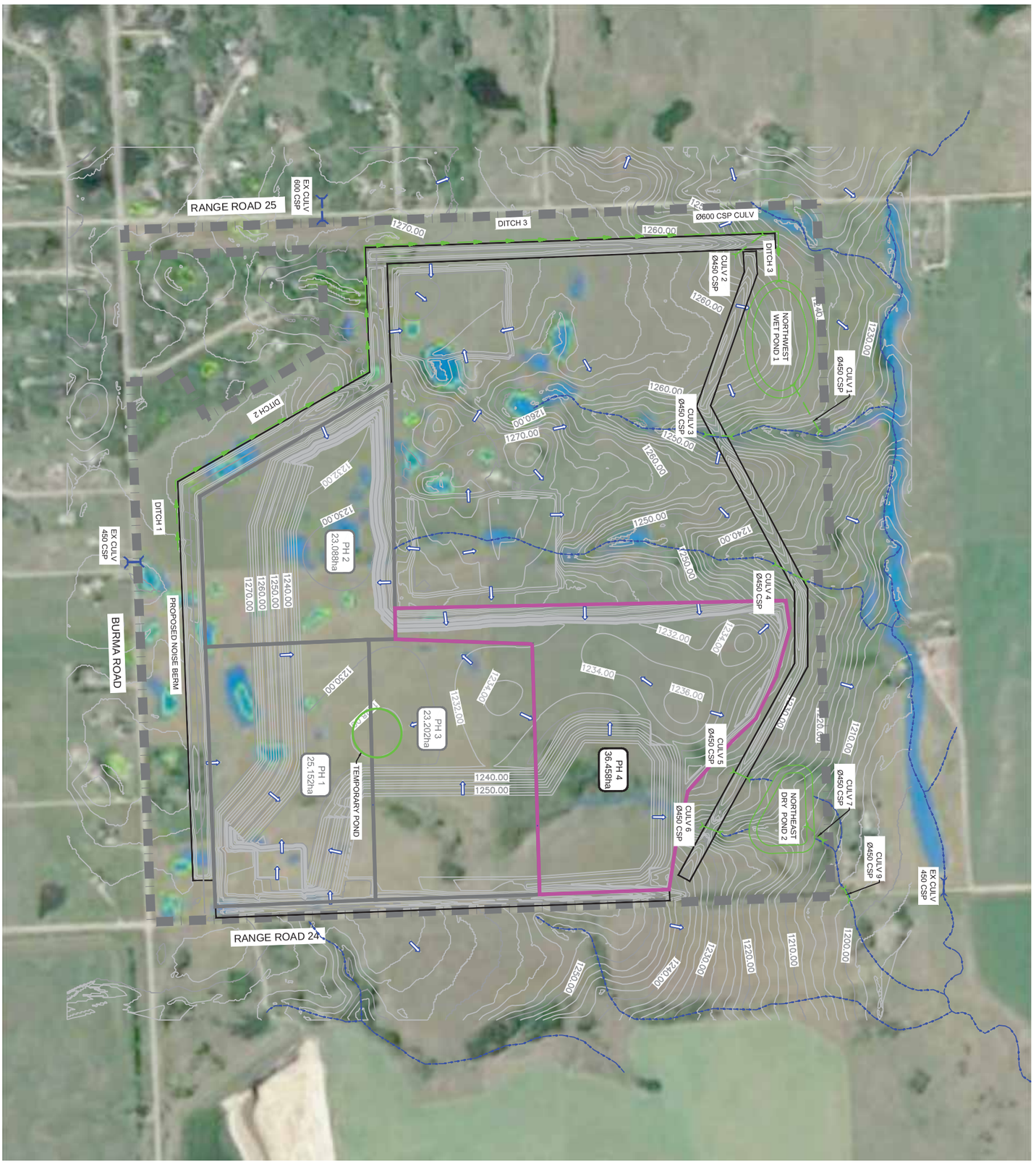
Filename: P:\60610856\900-CAD_GIS\910-CAD\21-FIGURES\CW\60610856-FIG-00-0000-CW-17.DWG

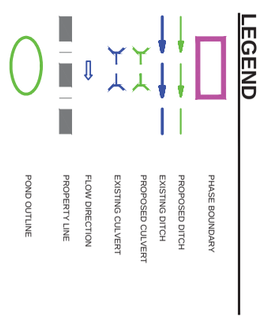
SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

ANNUAL MAXIMUM VOLUME

AECOM

Figure: A17



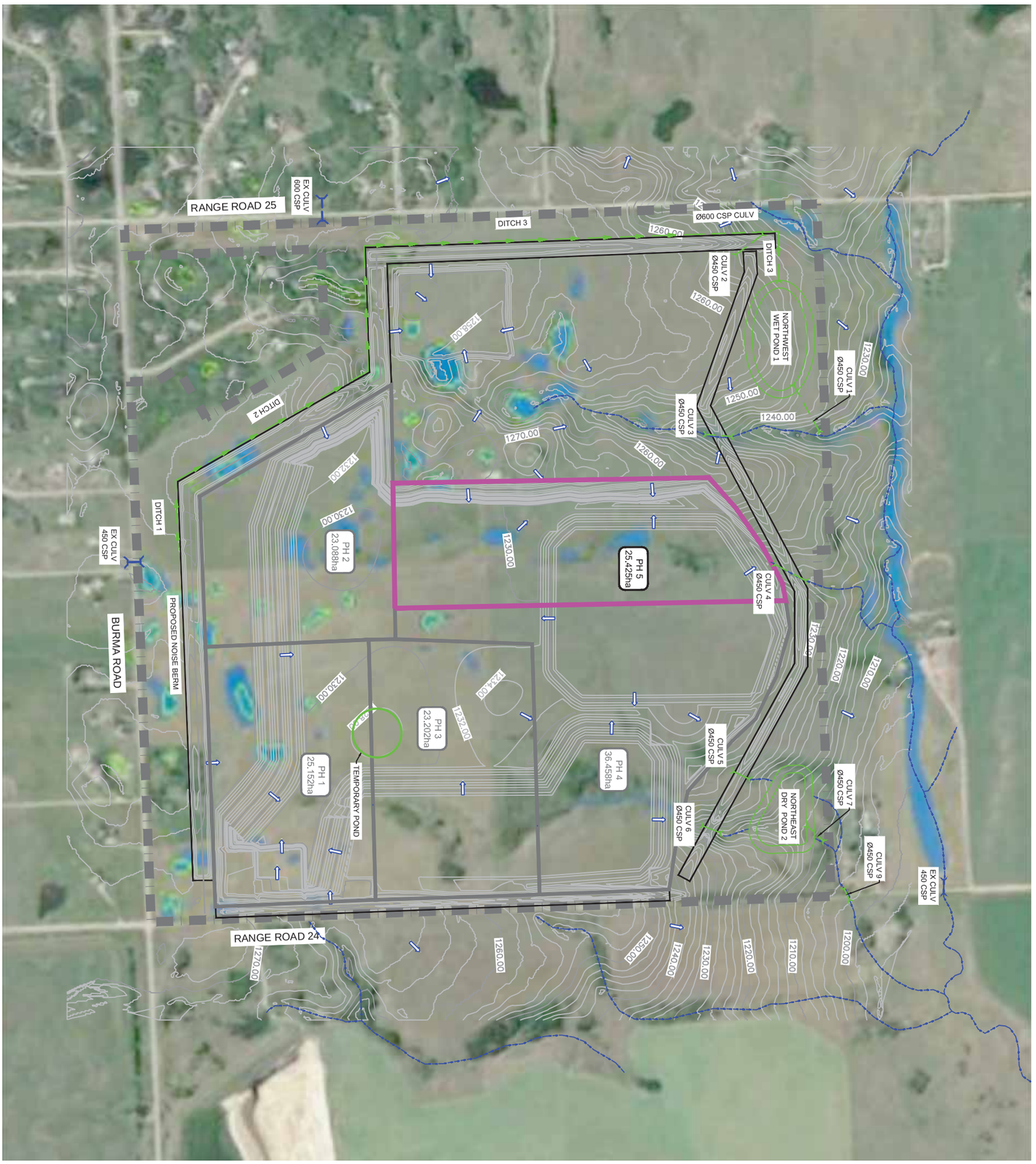


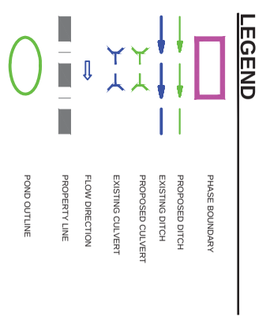
SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

PHASE 4 MINING PLAN

AECOM

Figure: A18



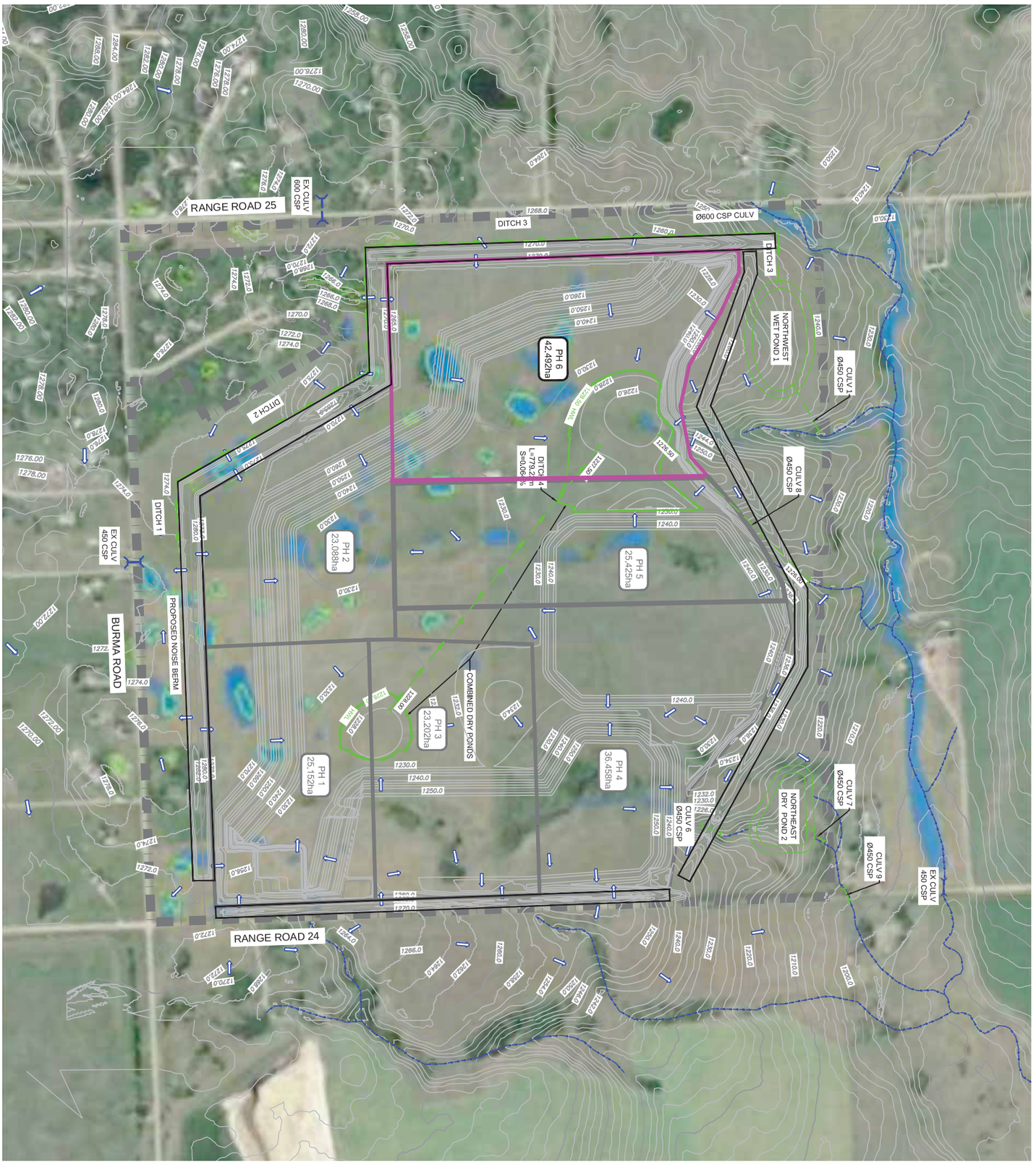


SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

PHASE 5 MINING PLAN

AECOM

Figure: A19



LEGEND

- PHASE BOUNDARY
- PROPOSED DITCH
- EXISTING DITCH
- PROPOSED CULVERT
- EXISTING CULVERT
- FLOW DIRECTION
- PROPERTY LINE
- POND OUTLINE

SCOTT PROPERTY
STORMWATER MANAGEMENT
LEHIGH HANSON MATERIALS LIMITED
Project No.: 60610856 Date: 2020-06-05

PHASE 6 MINING PLAN

AECOM

Figure: A20

AECOM Imagine it. Delivered.

Appendix B

Pre- and Post-development SWMHYMO Model Data Files and Results

PRE-DEVELOPMENT CONDITION

```
2     Metric units
*#*************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : May 30 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#*************************************************************************
*%
*% CONTINUOUS STANDHYD command using 30 Days of June 2005 rainfall data
*% AES Data file is read, where peak flows can
*% be analysed.
*%
*%*************************************************************************
START               TZERO=[2005.0601],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%-----------------|-------------------------------------------------------|
*%
*# STATION 3031093: NW Rec Centre Calgary(2005.0601 to 2005.0630)
*%
READ AES DATA       AES_FILENAME=["2005-06.123"],
                    IELEM=[123],
                    START_DATE=[0], END_DATE=[-30]
*%-----------------|-------------------------------------------------------|
*%
*% This command is necessary to compute the the depression storage recovery.
*% It must follow the READ AES DATA command, and precede the CONTINUOUS STANDHYD
*% command.
*%*************************************************************************
COMPUTE API         APII=[20], APIK=[0.9]/day
*%-----------------|-------------------------------------------------------|
*% Off-site 2 south of Burma Road
*%*************************************************************************
CONTINUOUS STANDHYD ID=[1], NHYD=["Off_2"], DT=[5](min), AREA=[73.135](ha),
                    XIMP=[0.22], TIMP=[0.22], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[1.1](%),
                            LGP=[1200](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[1.1](%),
                            LGI=[1200](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[1],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Off_2"]
*%-----------------|-------------------------------------------------------|
COMPUTE DUALHYD     IDin=[ 1 ], CINLET=[ 0.250  ](cms), NINLET=[ 1 ],
                    MAJID=[ 2 ], MajNHYD=["Spill"],
```

```
                  MINID=[ 3 ], MinNHYD=["Minor"],
                  TMJSTO=[ 15036 ](cu-m)
*%-----------------|-------------------------------------------------------------|
*% 450 CSP Culvert across Burma Road
*%-----------------|-------------------------------------------------------------|
ROUTE PIPE        PTYPE=[1]circ, IDout=[  2   ], NHYD=["450mm"], RNUMBER=[ 1 ],
                  PDIAM=[ 450 ](mm), PLNGTH=[ 30  ](m),
                  PROUGH=[ 0.027  ], PSLOPE=[ 0.05  ](m/m), IDin=[  3  ],
                  RDT=[ 5 ](min)
*%-----------------|-------------------------------------------------------------|
*% North of Burma Road, Area A5
*%*****************************************************************************
CONTINUOUS STANDHYD ID=[4], NHYD=["A5"], DT=[5](min), AREA=[109.538](ha),
                  XIMP=[0.23], TIMP=[0.23], DWF=[0](cms), LOSS=[2],
                  SCS curve number CN=[55],
                  Pervious   surfaces: IAper=[15](mm), SLPP=[3.2](%),
                          LGP=[1967](m), MNP=[0.250], SCP=[0](hrs),
                  Impervious surfaces: IAimp=[1.5](mm), SLPI=[3.2](%),
                          LGI=[1967](m), MNI=[0.015], SCI=[0](hrs),
                  Continuous simulation parameters:
                  IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                  SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                  InterEventTime=[48](hrs),   END=-1

*%
*%
SAVE HYD          ID=[4],   # OF PCYCLES=[-1],  ICASEsh=[1]
                  HYD_COMMENT=["Runoff from Catchment A5"]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
ADD HYD           IDsum=[ 5 ], NHYD=["A5"], IDs to add=[2+4]
*%-----------------|-------------------------------------------------------------|
*$ Area A4
*****************************************************************************
CONTINUOUS STANDHYD ID=[6], NHYD=["A4"], DT=[5](min), AREA=[28.048](ha),
                  XIMP=[0.2], TIMP=[0.2], DWF=[0](cms), LOSS=[2],
                  SCS curve number CN=[55],
                  Pervious   surfaces: IAper=[15](mm), SLPP=[5.3](%),
                          LGP=[1188](m), MNP=[0.250], SCP=[0](hrs),
                  Impervious surfaces: IAimp=[1.5](mm), SLPI=[5.3](%),
                          LGI=[1188](m), MNI=[0.015], SCI=[0](hrs),
                  Continuous simulation parameters:
                  IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                  SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                  InterEventTime=[48](hrs),   END=-1

*%
*%
SAVE HYD          ID=[6],   # OF PCYCLES=[-1],  ICASEsh=[1]
                  HYD_COMMENT=["Runoff from Catchment A4"]
```

```
*%-----------------|---------------------------------------------------------|
*% Offsite 1 west of RR25
*%-----------------|---------------------------------------------------------|
*%
CONTINUOUS STANDHYD ID=[7], NHYD=["Off_1"], DT=[5](min), AREA=[32.379](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[1.4](%),
                            LGP=[428](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[1.4](%),
                            LGI=[226](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[428](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[7],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Offsite 1"]
*%
*%-----------------|---------------------------------------------------------|
*% 600 CSP Culvert across Range Road 25
*%-----------------|---------------------------------------------------------|
ROUTE PIPE          PTYPE=[1]circ, IDout=[  8   ], NHYD=["450mm"], RNUMBER=[ 1 ],
                    PDIAM=[ 600 ](mm), PLNGTH=[ 30  ](m),
                    PROUGH=[ 0.027  ], PSLOPE=[ 0.05  ](m/m), IDin=[  7  ],
                    RDT=[ 5 ](min)
*%-----------------|---------------------------------------------------------|
*% Area A1
*************************************************************************
CONTINUOUS STANDHYD ID=[9], NHYD=["A1"], DT=[5](min), AREA=[38.206](ha),
                    XIMP=[0.22], TIMP=[0.22], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[2.4](%),
                            LGP=[1604](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[2.4](%),
                            LGI=[1604](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[9],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A1"]
*%
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
ADD HYD             IDsum=[ 10 ], NHYD=["A1_Off"], IDs to add=[8+9]
*%-----------------|---------------------------------------------------------|
```

```
*% Area A2
*%-----------------|-------------------------------------------------------------|
CONTINUOUS STANDHYD ID=[1], NHYD=["Area 2"], DT=[5](min), AREA=[35.948](ha),
                    XIMP=[0.27], TIMP=[0.27], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[2.6](%),
                            LGP=[1756](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[2.6](%),
                            LGI=[1756](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
*%
SAVE HYD            ID=[1],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A2"]
*%-----------------|-------------------------------------------------------------|
*% Area A3
*%-----------------|-------------------------------------------------------------|
CONTINUOUS STANDHYD ID=[2], NHYD=["A3"], DT=[5](min), AREA=[43.368](ha),
                    XIMP=[0.24], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[3.8](%),
                            LGP=[1320](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[3.8](%),
                            LGI=[1320](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
*%
SAVE HYD            ID=[2],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A3"]
*******************************************************************************
FINISH
```

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

   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   # 3920701
         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: Reid Crowther _Partners Ltd                 +++++++++
 +++++++++                Edmonton             SERIAL#:3920701       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ***************************************************************************
 *********           ++++++ 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: 2020-05-29     TIME: 09:57:32     RUN COUNTER: 000371         *
 ***************************************************************************
 * Input   filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\Exist.dat              *
 * Output  filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\Exist.out              *
 * Summary filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\Exist.sum              *
 * User comments:                                                             *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ***************************************************************************

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

```
001:0001--------------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : May 30 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#**************************************************************************
--------------------
| START            |  Project  dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

--------------------  Rainfall dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

    TZERO =   .00 hrs on 20050601
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
--------------------------------------------------------------------------------
-
001:0002--------------------------------------------------------------------------------
-
*# STATION 3031093: NW Rec Centre Calgary(2005.0601 to 2005.0630)
--------------------
| READ AES DATA    |   AES filename = E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\2005-06.123

--------------------   Data type    = 123 (hourly rainfall)
                       Start date   = 2005.0601
                       End date     = 2005.0701
                       Time span    =   30 days
                       Station ID   = 3031093

      *** WARNING: Specified end date is beyond the end
                   date in file.
                    (ie. 20050701 > 20050630 )
      RAINFALL RECORD STATISTICS:
      Data read from 20050601 @  0hrs to the end of 20050630
      Number of rainfall increments read=    720 (   30.0 days)
      Total precipitation read=    282.0 mm
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs
         9.0      7.5      6.7      4.4      3.4      2.4    mm/hr
      20050628 20050628 20050628 20050628 20050618 20050618  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs
          37       32       28       23       15        6
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs
          36       27       20        8        3        1
```

```
--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
--------------------
| COMPUTE API      |   Initial API  =  20.00 mm
--------------------   APIk factor  =    .90 /day

          ANTECEDENT PRECIPITATION INDEX (API) STATISTICS:
               Initial  API value =   20.00 mm
               End date API value =   71.12 mm
               Maximum  API value =  126.20 mm
               Minimum  API value =   17.53 mm
               Average  API value =   73.17 mm
               Total precipitation=  282.00 mm
--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   73.14
| 01:Off_2  DT= 5.00 |   Total Imp(%)=   22.00   Dir. Conn.(%)=   22.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      16.09        57.05
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       1.10         1.10
     Length            (m)=    1200.00      1200.00
     Mannings n             =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.09
                over (min)       30.00       290.00
     Storage Coeff.  (min)=      31.48 (ii)  292.44 (ii)
     Unit Hyd. Tpeak (min)=      30.00       290.00
     Unit Hyd. peak  (cms)=        .04          .00
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .35          .36          .492 (iii)
     TIME TO PEAK    (hrs)=     652.17       182.83       180.083
                                                     or on 2005.0608_12:05
     RUNOFF VOLUME    (mm)=     243.07       136.24       159.891
     TOTAL RAINFALL   (mm)=     282.00       282.00       281.999
     RUNOFF COEFFICIENT   =        .86          .48          .567
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=   73.135
| ID=01 (Off_2 )   |   QPEAK     (cms)=     .492 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.083
--------------------   VOLUME     (mm)=  159.891
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Off_2.001
  Comments: Runoff from Catchment Off_2

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0006--------------------------------------------------------------------------
-
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .250  (cms)
| TotalHyd 01:Off_2  |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .250  (cms)
                         Total major system storage [TMJSTO] =   15036.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   01:Off_2       73.14      .492   180.083  159.891     .000
     ================================================================================
     MAJOR SYST   02:Spill         .00      .000      .000     .000     .000
     MINOR SYST   03:Minor       73.14      .250   151.000  160.012     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

     Maximum MAJOR SYSTEM storage used =    7847.(cu.m.)

--------------------------------------------------------------------------------
-
001:0007--------------------------------------------------------------------------
-
--------------------
| ROUTE PIPE 450mm |     PIPE Number     =    1.00
| IN= 3---> OUT= 2 |     Diameter    (mm)=  450.00
| DT=  5.0 min     |     Length       (m)=   30.00
--------------------     Slope      (m/m)= .05000
```

Manning n = .027

<-------------------- TRAVEL TIME TABLE ------------------->

DEPTH (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME min
.024	.962E-01	.002	.513	.97
.047	.268E+00	.007	.800	.62
.071	.483E+00	.017	1.030	.49
.095	.731E+00	.030	1.225	.41
.118	.100E+01	.047	1.393	.36
.142	.129E+01	.066	1.541	.32
.166	.160E+01	.089	1.672	.30
.189	.191E+01	.114	1.786	.28
.213	.223E+01	.140	1.887	.27
.237	.255E+01	.167	1.973	.25
.261	.286E+01	.195	2.046	.24
.284	.318E+01	.223	2.105	.24
.308	.348E+01	.250	2.152	.23
.332	.377E+01	.274	2.184	.23
.355	.404E+01	.296	2.200	.23
.379	.429E+01	.314	2.199	.23
.403	.450E+01	.327	2.175	.23
.426	.468E+01	.330	2.119	.24
.450	.477E+01	.307	1.932	.26

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 3:Minor	73.14	.250	151.00	160.012	.308	2.152
OUTFLOW: ID= 2:450mm	73.14	.250	651.50	160.012	.309	2.153

001:0008---

| CONTINUOUS STANDHYD | 04:A5 DT= 5.00 |

Area (ha)= 109.54
Total Imp(%)= 23.00 Dir. Conn.(%)= 23.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	25.19	84.34
Dep. Storage	(mm)=	1.50	15.00
Average Slope	(%)=	3.20	3.20
Length	(m)=	1967.00	1967.00
Mannings n	=	.015	.250

CONTINUOUS SIMULATION INPUT PARAMETERS:
IaRECimp (hrs)= 2.00, IaRECper (hrs)=720.00,
SMIN (mm)= 83.24, SMAX (mm)=554.96, SK= .200
InterEventTime (hrs)= 48.00

```
              STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
              S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.10
               over (min)       30.00       285.00
     Storage Coeff.  (min)=      30.74 (ii)  285.53 (ii)
     Unit Hyd. Tpeak (min)=      30.00       285.00
     Unit Hyd. peak  (cms)=        .04          .00
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .55          .54           .749 (iii)
     TIME TO PEAK    (hrs)=     652.17       182.75        180.083
                                                   or on 2005.0608_12:05
     RUNOFF VOLUME    (mm)=     243.07       136.27        160.958
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .571

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0009--------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=  109.538
| ID=04 (A5    )   |   QPEAK     (cms)=     .749 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.083
--------------------   VOLUME     (mm)=  160.958
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A5.001
  Comments: Runoff from Catchment A5

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0010--------------------------------------------------------------------------
-
------------------------
| ADD HYD (A5        ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 02:450mm         73.14     .250  651.50 160.01    .000

                    +ID2 04:A5           109.54     .749  180.08 160.96    .000

                     ============================================================
                     SUM 05:A5           182.67     .999  180.08 160.58    .000
```

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

--------------------------------------------------------------------------------
-
001:0011--------------------------------------------------------------------------
-
*$ Area A4
********************************************************************************
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   28.05
| 06:A4     DT= 5.00 |   Total Imp(%)=   20.00   Dir. Conn.(%)=   20.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.61         22.44
     Dep. Storage     (mm)=       1.50         15.00
     Average Slope     (%)=       5.30          5.30
     Length            (m)=    1188.00       1188.00
     Mannings n           =       .015          .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=      9.00          3.35
               over (min)       20.00        175.00
     Storage Coeff.  (min)=     19.52 (ii)   176.24 (ii)
     Unit Hyd. Tpeak (min)=     20.00        175.00
     Unit Hyd. peak  (cms)=       .06           .01
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .13           .16           .218 (iii)
     TIME TO PEAK    (hrs)=    652.00        181.08        180.000
                                                     or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=    243.09        136.33        157.757
     TOTAL RAINFALL   (mm)=    282.00        282.00        281.999
     RUNOFF COEFFICIENT   =       .86           .48           .559

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0012--------------------------------------------------------------------------
```

```
-
--------------------
| SAVE HYD         |   AREA       (ha)=   28.048
| ID=06 (A4    )   |   QPEAK     (cms)=     .218 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.000
--------------------   VOLUME     (mm)=  157.757
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A4.001
  Comments: Runoff from Catchment A4

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-------------------------------------------------------------------------------
-
001:0013----------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   32.38
| 07:Off_1  DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       8.09        24.28
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       1.40         1.40
     Length            (m)=     226.00       428.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=428.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.47
               over (min)        10.00       135.00
     Storage Coeff.  (min)=      10.75 (ii)  135.68 (ii)
     Unit Hyd. Tpeak (min)=      10.00       135.00
     Unit Hyd. peak  (cms)=        .11          .01
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .20          .19           .266 (iii)
     TIME TO PEAK    (hrs)=     652.00       180.58        180.000
                                                      or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=     243.09       131.52        159.463
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .47           .565

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

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

-
001:0014---
-

| SAVE HYD | AREA (ha)= 32.379
| ID=07 (Off_1) | QPEAK (cms)= .266 (i)
| DT= 5.00 PCYC=-1 | TPEAK (hrs)= 180.000
--- VOLUME (mm)= 159.463
Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Off_1.001
Comments: Runoff from Catchment Offsite 1

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

-
001:0015---
-

| ROUTE PIPE 450mm | PIPE Number = 1.00
| IN= 7---> OUT= 8 | Diameter (mm)= 600.00
| DT= 5.0 min | Length (m)= 30.00
--- Slope (m/m)= .05000
Manning n = .027

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME min
.032	.171E+00	.004	.621	.80
.063	.476E+00	.015	.969	.52
.095	.859E+00	.036	1.248	.40
.126	.130E+01	.064	1.483	.34
.158	.178E+01	.100	1.688	.30
.189	.230E+01	.143	1.867	.27
.221	.284E+01	.192	2.025	.25
.253	.339E+01	.245	2.164	.23
.284	.396E+01	.301	2.285	.22
.316	.453E+01	.361	2.390	.21
.347	.509E+01	.421	2.478	.20
.379	.565E+01	.480	2.551	.20
.411	.618E+01	.537	2.606	.19
.442	.670E+01	.591	2.645	.19
.474	.718E+01	.638	2.665	.19
.505	.762E+01	.677	2.664	.19
.537	.801E+01	.703	2.635	.19
.568	.831E+01	.711	2.567	.19
.600	.848E+01	.662	2.340	.21

<---- hydrograph ----> <-pipe / channel->

	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL

```
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 7:Off_1      32.38     .266  180.00159.463      .264     2.208
   OUTFLOW: ID= 8:450mm      32.38     .266  180.00159.462      .263     2.204


--------------------------------------------------------------------------------
-
001:0016--------------------------------------------------------------------------
-
********************************************************************************
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   38.21
| 09:A1     DT= 5.00 |   Total Imp(%)=   22.00   Dir. Conn.(%)=   22.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       8.41        29.80
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       2.40         2.40
     Length            (m)=    1604.00      1604.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=      9.00         3.10
               over (min)       30.00       275.00
     Storage Coeff.  (min)=     29.65 (ii)  275.36 (ii)
     Unit Hyd. Tpeak (min)=     30.00       275.00
     Unit Hyd. peak  (cms)=       .04          .00
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .19          .19           .264 (iii)
     TIME TO PEAK    (hrs)=    652.17       182.58        180.083
                                                    or on 2005.0608_12:05
     RUNOFF VOLUME    (mm)=    243.07       136.26        159.891
     TOTAL RAINFALL   (mm)=    282.00       282.00        281.999
     RUNOFF COEFFICIENT   =       .86          .48           .567

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

```
001:0017--------------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=   38.206
| ID=09 (A1    )   |   QPEAK     (cms)=     .264 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.083
--------------------   VOLUME     (mm)=  159.891
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A1.001
  Comments: Runoff from Catchment A1

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0018--------------------------------------------------------------------------------
-
------------------------
| ADD HYD (A1_Off    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 08:450mm         32.38     .266  180.00 159.46    .000

                     +ID2 09:A1            38.21     .264  180.08 159.89    .000

                      ============================================================
                      SUM 10:A1_Off        70.59     .529  180.00 159.69    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0019--------------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   35.95
| 01:Area 2 DT= 5.00 |   Total Imp(%)=   27.00   Dir. Conn.(%)=   27.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.71        26.24
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       2.60         2.60
     Length            (m)=    1756.00      1756.00
     Mannings n             =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19
```

```
     Max.eff.Inten.(mm/hr)=       9.00         3.10
               over (min)       30.00       285.00
     Storage Coeff.  (min)=      30.56 (ii)  283.88 (ii)
     Unit Hyd. Tpeak (min)=      30.00       285.00
     Unit Hyd. peak  (cms)=        .04          .00
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .21          .17          .252 (iii)
     TIME TO PEAK    (hrs)=     652.17       182.75       180.083
                                                   or on 2005.0608_12:05
     RUNOFF VOLUME    (mm)=     243.07       136.26       165.225
     TOTAL RAINFALL   (mm)=     282.00       282.00       281.999
     RUNOFF COEFFICIENT   =        .86          .48          .586

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0020--------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=   35.948
| ID=01 (Area 2)   |   QPEAK     (cms)=     .252 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.083
--------------------   VOLUME     (mm)=  165.225
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area 2.001
  Comments: Runoff from Catchment A2

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0021--------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   43.37
| 02:A3     DT= 5.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=   24.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.41        32.96
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       3.80         3.80
     Length            (m)=    1320.00      1320.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
```

```
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.21
                over (min)       25.00       210.00
     Storage Coeff.  (min)=      22.98 (ii)  210.82 (ii)
     Unit Hyd. Tpeak (min)=      25.00       210.00
     Unit Hyd. peak  (cms)=        .05          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .24          .23          .329 (iii)
     TIME TO PEAK    (hrs)=     652.08       181.58       180.000
                                                     or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=     243.08       136.30       162.025
     TOTAL RAINFALL   (mm)=     282.00       282.00       281.999
     RUNOFF COEFFICIENT   =        .86          .48          .575

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0022---------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=   43.368
| ID=02 (A3    )   |   QPEAK     (cms)=     .329 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.000
--------------------   VOLUME     (mm)=  162.025
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A3.001
  Comments: Runoff from Catchment A3

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0023---------------------------------------------------------------------------
-
********************************************************************************
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
```

```
 001:0002 READ AES DATA
      *** WARNING: Specified end date is beyond the end
                   date in file.
   Simulation ended on 2020-05-29     at 09:57:34
================================================================================
=
```

Post-development Conditions

Northwest Pond 1

```
2     Metric units
*#*************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : May 26 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#*************************************************************************
*%
*% CONTINUOUS STANDHYD command using 30 Days of June 2005 rainfall data
*% AES Data file is read, where peak flows can
*% be analysed.
*%
*%*************************************************************************
START               TZERO=[2005.0601],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%-----------------|-------------------------------------------------------|
*%
*# STATION 3031093: NW Rec Centre Calgary(2005.0601 to 2005.0630)
*%
READ AES DATA       AES_FILENAME=["2005-06.123"],
                    IELEM=[123],
                    START_DATE=[0], END_DATE=[-30]
*%-----------------|-------------------------------------------------------|
*%
*% This command is necessary to compute the the depression storage recovery.
*% It must follow the READ AES DATA command, and precede the CONTINUOUS STANDHYD
*% command.
*%
COMPUTE API         APII=[20], APIK=[0.9]/day
*%-----------------|-------------------------------------------------------|
*%
*% Off-site south of Burma Road
*%
CONTINUOUS STANDHYD ID=[1], NHYD=["Off_2"], DT=[5](min), AREA=[73.135](ha),
                    XIMP=[0.254], TIMP=[0.254], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[1.1](%),
                            LGP=[1200](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[1.1](%),
                            LGI=[1200](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[1],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Off_2"]
*%-----------------|-------------------------------------------------------|
COMPUTE DUALHYD     IDin=[ 1 ], CINLET=[ 0.250  ](cms), NINLET=[ 1 ],
```

```
                  MAJID=[ 2 ], MajNHYD=["Spill"],
                  MINID=[ 3 ], MinNHYD=["Minor"],
                  TMJSTO=[ 18345 ](cu-m)
*%----------------|-------------------------------------------------------------|
*% 450 CSP Culvert across Burma Road
*%----------------|-------------------------------------------------------------|
ROUTE PIPE        PTYPE=[1]circ, IDout=[  4   ], NHYD=["Culv_6"], RNUMBER=[ 1 ],
                  PDIAM=[ 450 ](mm), PLNGTH=[ 30  ](m),
                  PROUGH=[ 0.027  ], PSLOPE=[ 0.05  ](m/m), IDin=[  3  ],
                  RDT=[ 5 ](min)
*%----------------|-------------------------------------------------------------|
*% North of Burma Road
*%
CONTINUOUS STANDHYD ID=[5], NHYD=["A10"], DT=[5](min), AREA=[23.077](ha),
                  XIMP=[0.48], TIMP=[0.48], DWF=[0](cms), LOSS=[2],
                  SCS curve number CN=[55],
                  Pervious   surfaces: IAper=[15](mm), SLPP=[0.4](%),
                          LGP=[543](m), MNP=[0.250], SCP=[0](hrs),
                  Impervious surfaces: IAimp=[1.5](mm), SLPI=[0.4](%),
                          LGI=[543](m), MNI=[0.015], SCI=[0](hrs),
                  Continuous simulation parameters:
                  IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                  SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                  InterEventTime=[48](hrs),   END=-1

*%
*%
SAVE HYD          ID=[5],   # OF PCYCLES=[-1],  ICASEsh=[1]
                  HYD_COMMENT=["Runoff from Catchment A10"]
*%----------------|-------------------------------------------------------------|
ADD HYD           IDsum=[ 6 ], NHYD=["A10"], IDs to add=[4+5]
*%----------------|-------------------------------------------------------------|
*%----------------|-------------------------------------------------------------|
*% Route ditch #1
*%----------------|-------------------------------------------------------------|
ROUTE CHANNEL     IDout=[7], NHYD=["Ditch 1"], IDin=[6],
                  RDT=[5](min),
                  CHLGTH=[550](m),  CHSLOPE=[0.5](%),
                                      FPSLOPE=[0.5](%),
                  SECNUM=[1.0],       NSEG=[1]
                  ( SEGROUGH, SEGDIST (m))=[-0.02,7.0] NSEG times
                  ( DISTANCE (m), ELEVATION (m))=[0,      1.00]
                                                [3.0,    0.00]
                                                [4.0,    0.00]
                                                [7.0,    1.00]
*%----------------|-------------------------------------------------------------|
*% Offsite 1
*%----------------|-------------------------------------------------------------|
CONTINUOUS STANDHYD ID=[1], NHYD=["Off_1"], DT=[5](min), AREA=[32.379](ha),
                  XIMP=[0.26], TIMP=[0.26], DWF=[0](cms), LOSS=[2],
```

```
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[1.4](%),
                            LGP=[428](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[1.4](%),
                            LGI=[428](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[8],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Offsite 1"]
*%-----------------|-------------------------------------------------------------|
*% 600 CSP Culvert across Range Road 25
*%-----------------|-------------------------------------------------------------|
ROUTE PIPE          PTYPE=[1]circ, IDout=[ 8 ], NHYD=["Culv_6"], RNUMBER=[ 1 ],
                    PDIAM=[ 600 ](mm), PLNGTH=[ 30  ](m),
                    PROUGH=[ 0.027  ], PSLOPE=[ 0.05  ](m/m), IDin=[  1  ],
                    RDT=[ 5 ](min)
*%-----------------|-------------------------------------------------------------|

*****************************************************************************
*% Sub-catchment A11
*****************************************************************************
CONTINUOUS STANDHYD ID=[9], NHYD=["A11"], DT=[15](min), AREA=[18.942](ha),
                    XIMP=[0.29], TIMP=[0.29], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[1.2](%),
                            LGP=[680](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[1.2](%),
                            LGI=[680](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
*%
SAVE HYD            ID=[9],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A11"]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[ 10 ], NHYD=["Offsite"], IDs to add=[7+8+9]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
*% Route ditch #2
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL       IDout=[1], NHYD=["Ditch 2"], IDin=[10],
                    RDT=[5](min),
```

```
                    CHLGTH=[350](m),  CHSLOPE=[0.5](%),
                                        FPSLOPE=[0.5](%),
                    SECNUM=[1.0],       NSEG=[1]
                    ( SEGROUGH, SEGDIST (m))=[-0.02,7.0] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[0,      1.00]
                                                  [3.0,    0.00]
                                                  [4.0,    0.00]
                                                  [7.0,    1.00]
*%-----------------|-------------------------------------------------------------|
*% Catchment west of Berm = A12
*%-----------------|-------------------------------------------------------------|
*%
CONTINUOUS STANDHYD ID=[2], NHYD=["A12"], DT=[15](min), AREA=[6.747](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[5.5](%),
                            LGP=[226](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[5.5](%),
                            LGI=[226](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[2],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A12"]
*%
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[ 3 ], NHYD=["A11"], IDs to add=[1+2]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
*% Route ditch #3
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL       IDout=[4], NHYD=["Ditch 3"], IDin=[3],
                    RDT=[5](min),
                    CHLGTH=[750](m),  CHSLOPE=[0.5](%),
                                        FPSLOPE=[0.5](%),
                    SECNUM=[1.0],       NSEG=[1]
                    ( SEGROUGH, SEGDIST (m))=[-0.02,7.0] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[0,      1.00]
                                                  [3.0,    0.00]
                                                  [4.0,    0.00]
                                                  [7.0,    1.00]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
*% Catchment west of Berm = A14
*%-----------------|-------------------------------------------------------------|
*%
CONTINUOUS STANDHYD ID=[5], NHYD=["A14"], DT=[15](min), AREA=[7.253](ha),
```

```
                    XIMP=[0.2], TIMP=[0.2], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[3.7](%),
                            LGP=[380](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[3.7](%),
                            LGI=[380](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[5],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A14"]
*%
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[ 6 ], NHYD=["A11"], IDs to add=[4+5]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
*% Routing through Pond 1 with no inflitration
*******************************************************************************
ROUTE RESERVOIR     IDout=[7], NHYD=["Pond 1"], IDin=[6],
                    RDT=[5](min),
                    TABLE of ( OUTFLOW-STORAGE ) values
                    (cms) - (ha-m)
                    (cms) - (ha-m)
                    [ 0.0 ,    0.0]
                    [ 0.080,   2.4]
                    [ 0.113,   4.9]
                    [ 0.138,   7.5]
                    [ 0.160,  10.2]
                    [ -1 , -1 ]
                    IDovf=[1], NHYDovf=[2000]
*******************************************************************************
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
*% Routing through Pond 1 with inflitration rate = 3.0 x 10^-5 m/s
*******************************************************************************
ROUTE RESERVOIR     IDout=[8], NHYD=["Pond NW"], IDin=[6],
                    RDT=[5](min),
                    TABLE of ( OUTFLOW-STORAGE ) values
                    (cms) - (ha-m)
                    (cms) - (ha-m)
                    [ 0.0 ,    0.0]
                    [ 0.759,   1.45]
                    [ 0.793,   3.0]
                    [ 0.818,   4.6]
                    [ 0.840,   6.4]
                    [ -1 , -1 ]
                    IDovf=[1], NHYDovf=[2000]
```

```
*******************************************************************************
*******************************************************************************
*******************************************************************************
*******************************************************************************
*******************************************************************************
*******************************************************************************
*% On-site area A1
*%-----------------|---------------------------------------------------------|
*%
CONTINUOUS STANDHYD ID=[1], NHYD=["A1"], DT=[15](min), AREA=[36.877](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[3.5](%),
                            LGP=[746](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[3.5](%),
                            LGI=[746](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[1],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A1"]
*%
*%-----------------|---------------------------------------------------------|
*% On-site Catchment A2
*%-----------------|---------------------------------------------------------|
*%
CONTINUOUS STANDHYD ID=[2], NHYD=["A2"], DT=[15](min), AREA=[44.135](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[3.1](%),
                            LGP=[1367](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[3.1](%),
                            LGI=[1367](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[2],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A2"]
*%
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
ADD HYD             IDsum=[ 3 ], NHYD=["A12A1"], IDs to add=[1+2]
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
```

```
*%-----------------|---------------------------------------------------------|
*% Catchment A5
*%
CONTINUOUS STANDHYD ID=[1], NHYD=["A5"], DT=[5](min), AREA=[59.561](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[4.5](%),
                            LGP=[1264](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[4.5](%),
                            LGI=[1264](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[1],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A5"]
*%
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
*% Catchment A4
*%
CONTINUOUS STANDHYD ID=[2], NHYD=["A4"], DT=[5](min), AREA=[14.661](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[5.3](%),
                            LGP=[751](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[5.3](%),
                            LGI=[751](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[2],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A4"]
*%
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
ADD HYD             IDsum=[ 3 ], NHYD=["A4A5"], IDs to add=[1+2]
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
*% Catchment A3
*%
CONTINUOUS STANDHYD ID=[3], NHYD=["A3"], DT=[15](min), AREA=[23.036](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[5.1](%),
```

```
                        LGP=[865](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[5.1](%),
                        LGI=[865](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1

*%
SAVE HYD            ID=[3],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment A3"]
*%
*%-----------------|---------------------------------------------------------------|
*********************************************************************************
FINISH
```

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

   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   # 3920701
         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: Reid Crowther _Partners Ltd                 +++++++++
 +++++++++                Edmonton              SERIAL#:3920701       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ***************************************************************************
 *********           ++++++ 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: 2020-05-27     TIME: 18:46:26     RUN COUNTER: 000367         *
 ***************************************************************************
 * Input   filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\Off_Pst.dat            *
 * Output  filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\Off_Pst.out            *
 * Summary filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\Off_Pst.sum            *
 * User comments:                                                             *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ***************************************************************************

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

```
001:0001----------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : May 26 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#**************************************************************************
--------------------
| START            |  Project  dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

--------------------  Rainfall dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

    TZERO =   .00 hrs on 20050601
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
----------------------------------------------------------------------------------
-
001:0002----------------------------------------------------------------------------
-
*# STATION 3031093: NW Rec Centre Calgary(2005.0601 to 2005.0630)
--------------------
| READ AES DATA    |   AES filename = E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\2005-06.123

--------------------   Data type    = 123 (hourly rainfall)
                       Start date   = 2005.0601
                       End date     = 2005.0701
                       Time span    =   30 days
                       Station ID   = 3031093

      *** WARNING: Specified end date is beyond the end
                   date in file.
                    (ie. 20050701 > 20050630 )
      RAINFALL RECORD STATISTICS:
      Data read from 20050601 @  0hrs to the end of 20050630
      Number of rainfall increments read=    720 (   30.0 days)
      Total precipitation read=    282.0 mm
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs
         9.0      7.5      6.7      4.4      3.4      2.4    mm/hr
      20050628 20050628 20050628 20050628 20050618 20050618  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs
          37       32       28       23       15        6
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs
          36       27       20        8        3        1
```

```
--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
--------------------
| COMPUTE API      |   Initial API  =  20.00 mm
--------------------   APIk factor  =    .90 /day

          ANTECEDENT PRECIPITATION INDEX (API) STATISTICS:
               Initial  API value =   20.00 mm
               End date API value =   71.12 mm
               Maximum  API value =  126.20 mm
               Minimum  API value =   17.53 mm
               Average  API value =   73.17 mm
               Total precipitation=  282.00 mm
--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   73.14
| 01:Off_2  DT= 5.00 |   Total Imp(%)=   25.40   Dir. Conn.(%)=   25.40
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      18.58        54.56
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       1.10         1.10
     Length            (m)=    1200.00      1200.00
     Mannings n             =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.09
               over (min)        30.00       290.00
     Storage Coeff.  (min)=      31.48 (ii)  292.44 (ii)
     Unit Hyd. Tpeak (min)=      30.00       290.00
     Unit Hyd. peak  (cms)=        .04          .00
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .41          .34          .504 (iii)
     TIME TO PEAK    (hrs)=     652.17       182.83       180.083
                                                     or on 2005.0608_12:05
     RUNOFF VOLUME    (mm)=     243.08       136.25       163.518
     TOTAL RAINFALL   (mm)=     282.00       282.00       281.999
     RUNOFF COEFFICIENT   =        .86          .48          .580
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=   73.135
| ID=01 (Off_2 )   |   QPEAK     (cms)=     .504 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.083
--------------------   VOLUME     (mm)=  163.518
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Off_2.001
  Comments: Runoff from Catchment Off_2

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0006--------------------------------------------------------------------------
-
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .250  (cms)
| TotalHyd 01:Off_2  |   Number of inlets in system [NINLET] =      1
----------------------   Total minor system capacity         =    .250  (cms)
                         Total major system storage [TMJSTO] =   18345.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                  (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   01:Off_2       73.14      .504   180.083  163.518     .000
     ================================================================================
     MAJOR SYST   02:Spill         .00      .000      .000     .000     .000
     MINOR SYST   03:Minor       73.14      .250   150.583  163.612     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

     Maximum MAJOR SYSTEM storage used =    8379.(cu.m.)

--------------------------------------------------------------------------------
-
001:0007--------------------------------------------------------------------------
-
--------------------
| ROUTE PIPE Culv_6|     PIPE Number     =    1.00
| IN= 3---> OUT= 4 |     Diameter    (mm)=  450.00
| DT=  5.0 min     |     Length       (m)=   30.00
--------------------     Slope      (m/m)= .05000
```

Manning n = .027

<-------------------- TRAVEL TIME TABLE ------------------->

DEPTH (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME min
.024	.962E-01	.002	.513	.97
.047	.268E+00	.007	.800	.62
.071	.483E+00	.017	1.030	.49
.095	.731E+00	.030	1.225	.41
.118	.100E+01	.047	1.393	.36
.142	.129E+01	.066	1.541	.32
.166	.160E+01	.089	1.672	.30
.189	.191E+01	.114	1.786	.28
.213	.223E+01	.140	1.887	.27
.237	.255E+01	.167	1.973	.25
.261	.286E+01	.195	2.046	.24
.284	.318E+01	.223	2.105	.24
.308	.348E+01	.250	2.152	.23
.332	.377E+01	.274	2.184	.23
.355	.404E+01	.296	2.200	.23
.379	.429E+01	.314	2.199	.23
.403	.450E+01	.327	2.175	.23
.426	.468E+01	.330	2.119	.24
.450	.477E+01	.307	1.932	.26

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 3:Minor	73.14	.250	150.58	163.612	.308	2.152
OUTFLOW: ID= 4:Culv_6	73.14	.251	650.00	163.612	.308	2.152

001:0008---

CONTINUOUS STANDHYD	05:A10 DT= 5.00

Area (ha)= 23.08
Total Imp(%)= 48.00 Dir. Conn.(%)= 48.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	11.08	12.00
Dep. Storage	(mm)=	1.50	15.00
Average Slope	(%)=	.40	.40
Length	(m)=	543.00	543.00
Mannings n	=	.015	.250

CONTINUOUS SIMULATION INPUT PARAMETERS:
IaRECimp (hrs)= 2.00, IaRECper (hrs)=720.00,
SMIN (mm)= 83.24, SMAX (mm)=554.96, SK= .200
InterEventTime (hrs)= 48.00

```
              STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
              S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.10
               over (min)       25.00       245.00
     Storage Coeff.  (min)=      26.50 (ii)  245.93 (ii)
     Unit Hyd. Tpeak (min)=      25.00       245.00
     Unit Hyd. peak  (cms)=        .04          .00
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .25          .08          .259 (iii)
     TIME TO PEAK    (hrs)=     652.08       182.17       652.083
                                                   or on 2005.0628_ 4:05
     RUNOFF VOLUME    (mm)=     243.08       136.29       187.627
     TOTAL RAINFALL   (mm)=     282.00       282.00       281.999
     RUNOFF COEFFICIENT   =        .86          .48          .665

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0009---------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=   23.077
| ID=05 (A10   )   |   QPEAK     (cms)=     .259 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  652.083
--------------------   VOLUME     (mm)=  187.627
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A10.001
  Comments: Runoff from Catchment A10

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0010---------------------------------------------------------------------
-
------------------------
| ADD HYD (A10       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 04:Culv_6        73.14     .251  650.00 163.61    .000

                     +ID2 05:A10           23.08     .259  652.08 187.63    .000

                      ============================================================
                      SUM 06:A10           96.21     .509  652.08 169.37    .000
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

001:0011

ROUTE CHANNEL	Routing time step (min) = 5.00
IN> 06:A10	Number of SEGMENTS = 1
OUT< 07:Ditch	Slopes (%), CHANNEL= .50 FLOODPLAIN= .50
	LENGTH = 550.00 (m)

<------ DATA FOR SECTION (1.0) ------>

Distance	Elevation	Manning	
.00	1.00	.0200	Main Channel
3.00	.00	.0200	Main Channel
4.00	.00	.0200	Main Channel
7.00	1.00	.0200	Main Channel

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	X-VOLUME (cu.m.)	S-VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)	D x V (m2/s)
.053	.053	.335E+02	.321E+00	.028	.452	20.28	.024
.105	.105	.762E+02	.146E+01	.093	.674	13.61	.071
.158	.158	.128E+03	.367E+01	.196	.843	10.87	.133
.211	.211	.189E+03	.723E+01	.339	.986	9.29	.208
.263	.263	.259E+03	.124E+02	.524	1.114	8.23	.293
.316	.316	.338E+03	.194E+02	.756	1.230	7.45	.388
.368	.368	.427E+03	.286E+02	1.038	1.338	6.85	.493
.421	.421	.524E+03	.401E+02	1.373	1.441	6.36	.607
.474	.474	.631E+03	.543E+02	1.764	1.538	5.96	.729
.526	.526	.747E+03	.714E+02	2.215	1.632	5.62	.859
.579	.579	.871E+03	.917E+02	2.729	1.722	5.32	.997
.632	.632	.101E+04	.115E+03	3.308	1.809	5.07	1.143
.684	.684	.115E+04	.143E+03	3.956	1.894	4.84	1.296
.737	.737	.130E+04	.174E+03	4.676	1.976	4.64	1.456
.789	.789	.146E+04	.210E+03	5.470	2.057	4.46	1.624
.842	.842	.163E+04	.250E+03	6.342	2.136	4.29	1.798
.895	.895	.181E+04	.295E+03	7.294	2.213	4.14	1.980
.947	.947	.200E+04	.345E+03	8.329	2.288	4.01	2.168
1.000	1.000	.220E+04	.400E+03	9.449	2.362	3.88	2.362

X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 6:A10	96.21	.509	652.08	169.374	.259	1.102

```
   OUTFLOW: ID= 7:Ditch      96.21     .506  652.17169.374      .257     1.097


--------------------------------------------------------------------------------
-
001:0012--------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   32.38
| 01:Off_1  DT= 5.00 |   Total Imp(%)=   26.00   Dir. Conn.(%)=   26.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       8.42        23.96
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       1.40         1.40
     Length            (m)=     428.00       428.00
     Mannings n             =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=      9.00         3.46
               over (min)       15.00       140.00
     Storage Coeff.  (min)=     15.77 (ii)  140.81 (ii)
     Unit Hyd. Tpeak (min)=     15.00       140.00
     Unit Hyd. peak  (cms)=       .07          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=       .21          .18           .266 (iii)
     TIME TO PEAK    (hrs)=    652.00       180.67        180.000
                                                   or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=    243.09       136.34        164.158
     TOTAL RAINFALL   (mm)=    282.00       282.00        281.999
     RUNOFF COEFFICIENT   =       .86          .48           .582

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0013--------------------------------------------------------------------------
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```
| SAVE HYD          |   AREA       (ha)=     .000
| ID=08 (      )    |   QPEAK     (cms)=     .000 (i)
| DT=  .00 PCYC=-1 |   TPEAK     (hrs)=     .000
--------------------   VOLUME     (mm)=     .000
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-.001
  Comments: Runoff from Catchment Offsite 1

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
      *** WARNING: This hydrograph is dry.
-------------------------------------------------------------------------------
-
001:0014-------------------------------------------------------------------------
-
--------------------
| ROUTE PIPE Culv_6|     PIPE Number     =    1.00
| IN= 1---> OUT= 8 |     Diameter    (mm)=  600.00
| DT=  5.0 min     |     Length       (m)=   30.00
--------------------     Slope      (m/m)= .05000
                         Manning n       =   .027

     <------------------- TRAVEL TIME TABLE ------------------->
       DEPTH      VOLUME    FLOW RATE    VELOCITY    TRAV.TIME
        (m)      (cu.m.)      (cms)        (m/s)        min
       .032     .171E+00      .004         .621          .80
       .063     .476E+00      .015         .969          .52
       .095     .859E+00      .036        1.248          .40
       .126     .130E+01      .064        1.483          .34
       .158     .178E+01      .100        1.688          .30
       .189     .230E+01      .143        1.867          .27
       .221     .284E+01      .192        2.025          .25
       .253     .339E+01      .245        2.164          .23
       .284     .396E+01      .301        2.285          .22
       .316     .453E+01      .361        2.390          .21
       .347     .509E+01      .421        2.478          .20
       .379     .565E+01      .480        2.551          .20
       .411     .618E+01      .537        2.606          .19
       .442     .670E+01      .591        2.645          .19
       .474     .718E+01      .638        2.665          .19
       .505     .762E+01      .677        2.664          .19
       .537     .801E+01      .703        2.635          .19
       .568     .831E+01      .711        2.567          .19
       .600     .848E+01      .662        2.340          .21
                                    <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:Off_1      32.38     .266  180.00164.158      .265     2.208
   OUTFLOW: ID= 8:Culv_6     32.38     .266  180.00164.158      .264     2.207


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

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-
001:0015-------------------------------------------------------------------------------
-
*******************************************************************************
*******************************************************************************
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   18.94
| 09:A11    DT=15.00 |   Total Imp(%)=   29.00   Dir. Conn.(%)=   29.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.49         13.45
     Dep. Storage     (mm)=       1.50         15.00
     Average Slope     (%)=       1.20          1.20
     Length            (m)=     680.00        680.00
     Mannings n             =       .015          .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00          3.27
               over (min)        15.00        195.00
     Storage Coeff.  (min)=      21.81 (ii)   198.72 (ii)
     Unit Hyd. Tpeak (min)=      15.00        195.00
     Unit Hyd. peak  (cms)=        .06          .01
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .13          .10           .149 (iii)
     TIME TO PEAK    (hrs)=     652.00        181.25        180.000
                                                      or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=     243.10        136.41        167.359
     TOTAL RAINFALL   (mm)=     282.00        282.00        282.000
     RUNOFF COEFFICIENT   =        .86           .48           .593

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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-
001:0016-------------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=   18.942
| ID=09 (A11   )   |   QPEAK     (cms)=     .149 (i)
```

```
| DT=15.00 PCYC=-1 |   TPEAK     (hrs)=  180.000
--------------------   VOLUME     (mm)=  167.359
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A11.001
  Comments: Runoff from Catchment A11

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-------------------------------------------------------------------------------
-
001:0017-------------------------------------------------------------------------
-
------------------------
| ADD HYD (Offsite   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 07:Ditch 1       96.21     .506  652.17 169.37    .000

                     +ID2 08:Culv_6        32.38     .266  180.00 164.16    .000

                     +ID3 09:A11           18.94     .149  180.00 167.36    .000

                      ============================================================
                      SUM 10:Offsite      147.53     .888  652.00 167.97    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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001:0018-------------------------------------------------------------------------
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--------------------
| ROUTE CHANNEL    |     Routing time step (min) =  5.00
|  IN> 10:Offsit   |     Number of SEGMENTS =  1
| OUT< 01:Ditch    |     Slopes (%), CHANNEL= .50   FLOODPLAIN= .50
--------------------                  LENGTH =  350.00    (m)

               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00          1.00         .0200      Main Channel
                   3.00           .00         .0200      Main Channel
                   4.00           .00         .0200      Main Channel
                   7.00          1.00         .0200      Main Channel

   <---------------------------- TRAVEL TIME TABLE ---------------------------->
    DEPTH    ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
      (m)     (m)   (cu.m.)   (cu.m.)      (cms)     (m/s)     (min)   (m2/s)
     .053    .053  .213E+02  .321E+00       .028      .452     12.90     .024
     .105    .105  .485E+02  .146E+01       .093      .674      8.66     .071
     .158    .158  .814E+02  .367E+01       .196      .843      6.92     .133
     .211    .211  .120E+03  .723E+01       .339      .986      5.91     .208
     .263    .263  .165E+03  .124E+02       .524     1.114      5.24     .293
```

.316	.316	.215E+03	.194E+02	.756	1.230	4.74	.388
.368	.368	.271E+03	.286E+02	1.038	1.338	4.36	.493
.421	.421	.334E+03	.401E+02	1.373	1.441	4.05	.607
.474	.474	.401E+03	.543E+02	1.764	1.538	3.79	.729
.526	.526	.475E+03	.714E+02	2.215	1.632	3.57	.859
.579	.579	.555E+03	.917E+02	2.729	1.722	3.39	.997
.632	.632	.640E+03	.115E+03	3.308	1.809	3.22	1.143
.684	.684	.731E+03	.143E+03	3.956	1.894	3.08	1.296
.737	.737	.828E+03	.174E+03	4.676	1.976	2.95	1.456
.789	.789	.931E+03	.210E+03	5.470	2.057	2.84	1.624
.842	.842	.104E+04	.250E+03	6.342	2.136	2.73	1.798
.895	.895	.115E+04	.295E+03	7.294	2.213	2.64	1.980
.947	.947	.127E+04	.345E+03	8.329	2.288	2.55	2.168
1.000	1.000	.140E+04	.400E+03	9.449	2.362	2.47	2.362

X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID=10:Offsit	147.53	.888	652.00	167.970	.340	1.278
OUTFLOW: ID= 1:Ditch	147.53	.886	652.08	167.970	.340	1.278

001:0019---

CONTINUOUS STANDHYD	Area (ha)= 6.75
02:A12 DT=15.00	Total Imp(%)= 25.00 Dir. Conn.(%)= 25.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.69	5.06
Dep. Storage	(mm)=	1.50	15.00
Average Slope	(%)=	5.50	5.50
Length	(m)=	226.00	226.00
Mannings n	=	.015	.250

CONTINUOUS SIMULATION INPUT PARAMETERS:
IaRECimp (hrs)= 2.00, IaRECper (hrs)=720.00,
SMIN (mm)= 83.24, SMAX (mm)=554.96, SK= .200
InterEventTime (hrs)= 48.00

STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
S*max= 97.40, S*min= 83.24, S*avg= 83.82, CNavg= 75.19

Max.eff.Inten.(mm/hr)=		9.00	3.97
over (min)		15.00	60.00

```
     Storage Coeff.  (min)=       7.13 (ii)   60.67 (ii)
     Unit Hyd. Tpeak (min)=      15.00        60.00
     Unit Hyd. peak  (cms)=        .10          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .04          .05           .068 (iii)
     TIME TO PEAK    (hrs)=     652.00       176.75        422.000
                                                   or on 2005.0618_14:00
     RUNOFF VOLUME    (mm)=     243.10       136.42        163.092
     TOTAL RAINFALL   (mm)=     282.00       282.00        282.000
     RUNOFF COEFFICIENT   =        .86          .48           .578
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0020--------------------------------------------------------------------------
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| SAVE HYD         |   AREA       (ha)=    6.747
| ID=02 (A12   )   |   QPEAK     (cms)=     .068 (i)
| DT=15.00 PCYC=-1 |   TPEAK     (hrs)=  422.000
--------------------   VOLUME     (mm)=  163.092
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A12.001
  Comments: Runoff from Catchment A12

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0021--------------------------------------------------------------------------
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------------------------
| ADD HYD (A11       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:Ditch 2      147.53     .886  652.08 167.97    .000

                     +ID2 02:A12            6.75     .068  422.00 163.09    .000

                      ============================================================
                      SUM 03:A11          154.28     .948  652.08 167.76    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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001:0022--------------------------------------------------------------------------------
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| ROUTE CHANNEL    |     Routing time step (min) =  5.00
|  IN> 03:A11      |     Number of SEGMENTS =  1
| OUT< 04:Ditch    |     Slopes (%), CHANNEL= .50   FLOODPLAIN= .50
--------------------                  LENGTH =  750.00    (m)

               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00          1.00          .0200      Main Channel
                   3.00           .00          .0200      Main Channel
                   4.00           .00          .0200      Main Channel
                   7.00          1.00          .0200      Main Channel

   <---------------------------- TRAVEL TIME TABLE ---------------------------->
    DEPTH    ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
      (m)     (m)   (cu.m.)   (cu.m.)      (cms)     (m/s)     (min)   (m2/s)
     .053    .053  .457E+02  .321E+00       .028      .452     27.65     .024
     .105    .105  .104E+03  .146E+01       .093      .674     18.56     .071
     .158    .158  .175E+03  .367E+01       .196      .843     14.83     .133
     .211    .211  .258E+03  .723E+01       .339      .986     12.67     .208
     .263    .263  .353E+03  .124E+02       .524     1.114     11.23     .293
     .316    .316  .461E+03  .194E+02       .756     1.230     10.16     .388
     .368    .368  .582E+03  .286E+02      1.038     1.338      9.34     .493
     .421    .421  .715E+03  .401E+02      1.373     1.441      8.68     .607
     .474    .474  .860E+03  .543E+02      1.764     1.538      8.13     .729
     .526    .526  .102E+04  .714E+02      2.215     1.632      7.66     .859
     .579    .579  .119E+04  .917E+02      2.729     1.722      7.26     .997
     .632    .632  .137E+04  .115E+03      3.308     1.809      6.91    1.143
     .684    .684  .157E+04  .143E+03      3.956     1.894      6.60    1.296
     .737    .737  .177E+04  .174E+03      4.676     1.976      6.32    1.456
     .789    .789  .199E+04  .210E+03      5.470     2.057      6.08    1.624
     .842    .842  .223E+04  .250E+03      6.342     2.136      5.85    1.798
     .895    .895  .247E+04  .295E+03      7.294     2.213      5.65    1.980
     .947    .947  .273E+04  .345E+03      8.329     2.288      5.46    2.168
    1.000   1.000  .300E+04  .400E+03      9.449     2.362      5.29    2.362

 X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
 S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
  INFLOW : ID= 3:A11       154.28     .948  652.08167.757      .352     1.302
  OUTFLOW: ID= 4:Ditch     154.28     .935  652.17167.757      .348     1.293


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001:0023------------------------------------------------------------------------
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| CONTINUOUS STANDHYD|   Area    (ha)=    7.25
| 05:A14    DT=15.00 |   Total Imp(%)=   20.00   Dir. Conn.(%)=   20.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.45         5.80
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       3.70         3.70
     Length            (m)=     380.00       380.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.70
                over (min)       15.00        90.00
     Storage Coeff.  (min)=      10.97 (ii)   95.71 (ii)
     Unit Hyd. Tpeak (min)=      15.00        90.00
     Unit Hyd. peak  (cms)=        .08          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .04          .05           .062 (iii)
     TIME TO PEAK    (hrs)=     652.00       177.25        177.000
                                                   or on 2005.0608_ 9:00
     RUNOFF VOLUME    (mm)=     243.10       136.42        157.758
     TOTAL RAINFALL   (mm)=     282.00       282.00        282.000
     RUNOFF COEFFICIENT   =        .86          .48           .559
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0024------------------------------------------------------------------------
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| SAVE HYD         |   AREA       (ha)=    7.253
| ID=05 (A14   )   |   QPEAK     (cms)=     .062 (i)
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| DT=15.00 PCYC=-1 |   TPEAK     (hrs)=  177.000
--------------------   VOLUME     (mm)=  157.758
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A14.001
  Comments: Runoff from Catchment A14

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0025-------------------------------------------------------------------------
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------------------------
| ADD HYD (A11       ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 04:Ditch 3      154.28     .935  652.17 167.76    .000

                     +ID2 05:A14            7.25     .062  177.00 157.76    .000

                      ============================================================
                      SUM 06:A11          161.53     .989  422.08 167.31    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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001:0026-------------------------------------------------------------------------
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*******************************************************************************
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| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>06:(A11   )   |
| OUT<07:(Pond 1)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .138  .7500E+01
                            .080  .2400E+01   |     .160  .1020E+02
                            .113  .4900E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >06: (A11   )     161.53      .989   422.083    167.308
     OUTFLOW<07: (Pond 1)     161.53      .157   202.333    167.304
    OVERFLOW<01: (002000)        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   15.850
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                    TIME SHIFT OF PEAK FLOW         (min)=-13185.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.9804E+01

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001:0027--------------------------------------------------------------------------
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| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>06:(A11   )   |
| OUT<08:(Pond N)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .818  .4600E+01
                            .759  .1450E+01   |     .840  .6400E+01
                            .793  .3000E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >06: (A11   )     161.53      .989   422.083    167.308
     OUTFLOW<08: (Pond N)     161.53      .761   182.833    167.308
    OVERFLOW<01: (002000)        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   76.948
                    TIME SHIFT OF PEAK FLOW         (min)=-14355.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1546E+01

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001:0028--------------------------------------------------------------------------
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| CONTINUOUS STANDHYD|   Area    (ha)=   36.88
| 01:A1     DT=15.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.22        27.66
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     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       3.50         3.50
     Length            (m)=     746.00       746.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=      9.00         3.43
                over (min)      15.00       150.00
     Storage Coeff.  (min)=     16.72 (ii)  149.85 (ii)
     Unit Hyd. Tpeak (min)=     15.00       150.00
     Unit Hyd. peak  (cms)=       .07          .01
                                                      *TOTALS*
     PEAK FLOW       (cms)=       .23          .21          .300 (iii)
     TIME TO PEAK    (hrs)=    652.00       180.75       180.000
                                                  or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=    243.10       136.41       163.092
     TOTAL RAINFALL   (mm)=    282.00       282.00       282.000
     RUNOFF COEFFICIENT   =       .86          .48          .578

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0029---------------------------------------------------------------------------
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| SAVE HYD         |   AREA       (ha)=   36.877
| ID=01 (A1    )   |   QPEAK     (cms)=     .300 (i)
| DT=15.00 PCYC=-1 |   TPEAK     (hrs)=  180.000
--------------------   VOLUME     (mm)=  163.092
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A1.001
  Comments: Runoff from Catchment A1

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0030---------------------------------------------------------------------------
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| CONTINUOUS STANDHYD|   Area    (ha)=   44.13
| 02:A2     DT=15.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.03        33.10
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       3.10         3.10
     Length            (m)=    1367.00      1367.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.15
                over (min)       30.00       225.00
     Storage Coeff.  (min)=      24.95 (ii)  230.25 (ii)
     Unit Hyd. Tpeak (min)=      30.00       225.00
     Unit Hyd. peak  (cms)=        .04          .00
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .25          .23          .330 (iii)
     TIME TO PEAK    (hrs)=     652.00       181.75        180.000
                                                   or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=     243.10       136.41        163.092
     TOTAL RAINFALL   (mm)=     282.00       282.00        282.000
     RUNOFF COEFFICIENT   =        .86          .48           .578

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0031----------------------------------------------------------------------
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| SAVE HYD         |   AREA       (ha)=   44.135
| ID=02 (A2    )   |   QPEAK     (cms)=     .330 (i)
| DT=15.00 PCYC=-1 |   TPEAK      (hrs)=  180.000
--------------------   VOLUME     (mm)=  163.092
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A2.001
  Comments: Runoff from Catchment A2

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0032--------------------------------------------------------------------------
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| ADD HYD (A12A1     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:A1           36.88     .300  180.00 163.09    .000

                     +ID2 02:A2           44.13     .330  180.00 163.09    .000

                      ============================================================
                      SUM 03:A12A1        81.01     .630  180.00 163.09    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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001:0033--------------------------------------------------------------------------
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| CONTINUOUS STANDHYD|   Area    (ha)=   59.56
| 01:A5     DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.89        44.67
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       4.50         4.50
     Length            (m)=    1264.00      1264.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.27
                over (min)       20.00       195.00
     Storage Coeff.  (min)=      21.28 (ii)  193.90 (ii)
     Unit Hyd. Tpeak (min)=      20.00       195.00
     Unit Hyd. peak  (cms)=        .05          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .35          .32          .463 (iii)
     TIME TO PEAK    (hrs)=     652.00       181.33        180.000
                                                    or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=     243.08       136.32        163.091
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```
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .578

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0034---------------------------------------------------------------------------
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| SAVE HYD         |   AREA       (ha)=   59.561
| ID=01 (A5    )   |   QPEAK     (cms)=     .463 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.000
--------------------   VOLUME     (mm)=  163.091
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A5.001
  Comments: Runoff from Catchment A5

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0035---------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   14.66
| 02:A4     DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.67         11.00
     Dep. Storage     (mm)=       1.50         15.00
     Average Slope     (%)=       5.30          5.30
     Length            (m)=     751.00       751.00
     Mannings n           =       .015          .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00          3.50
                over (min)       15.00        130.00
     Storage Coeff.  (min)=      14.83 (ii)   131.77 (ii)
     Unit Hyd. Tpeak (min)=      15.00        130.00
     Unit Hyd. peak  (cms)=        .08           .01
```

```
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .09          .08           .121 (iii)
     TIME TO PEAK    (hrs)=     652.00       180.50        180.000
                                                  or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=     243.09       136.35        163.091
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .578

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0036--------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=   14.661
| ID=02 (A4    )   |   QPEAK     (cms)=     .121 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.000
--------------------   VOLUME     (mm)=  163.091
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A4.001
  Comments: Runoff from Catchment A4

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0037--------------------------------------------------------------------------
-
------------------------
| ADD HYD (A4A5      ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:A5           59.56     .463  180.00 163.09    .000

                     +ID2 02:A4           14.66     .121  180.00 163.09    .000

                      ============================================================
                      SUM 03:A4A5         74.22     .584  180.00 163.09    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
-
001:0038--------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   23.04
```

```
| 03:A3     DT=15.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.76        17.28
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       5.10         5.10
     Length            (m)=     865.00       865.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.43
               over (min)        15.00       150.00
     Storage Coeff.  (min)=      16.33 (ii)  146.28 (ii)
     Unit Hyd. Tpeak (min)=      15.00       150.00
     Unit Hyd. peak  (cms)=        .07          .01
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .14          .13          .188 (iii)
     TIME TO PEAK    (hrs)=     652.00       180.75       180.000
                                                   or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=     243.10       136.41       163.092
     TOTAL RAINFALL   (mm)=     282.00       282.00       282.000
     RUNOFF COEFFICIENT   =        .86          .48          .578

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0039--------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=   23.036
| ID=03 (A3    )   |   QPEAK     (cms)=     .188 (i)
| DT=15.00 PCYC=-1 |   TPEAK      (hrs)=  180.000
--------------------   VOLUME      (mm)=  163.092
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-A3.001
  Comments: Runoff from Catchment A3

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

```
-
001:0040-------------------------------------------------------------------------
-
*************************************************************************
      FINISH
-------------------------------------------------------------------------------
-
*******************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0002 READ AES DATA
      *** WARNING: Specified end date is beyond the end
                   date in file.
 001:0013 SAVE HYD
      *** WARNING: This hydrograph is dry.
 001:0019 CONTINUOUS STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0023 CONTINUOUS STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
   Simulation ended on 2020-05-27     at 18:46:28
===============================================================================
=
```

Post-development Condition

Northeast Pond 2

```
2     Metric units
*#*****************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : May 29 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#*****************************************************************************
*%
*% CONTINUOUS STANDHYD command using 30 Days of June 2005 rainfall data
*% AES Data file is read, where peak flows can
*% be analysed.
*%
*%*****************************************************************************
START               TZERO=[2005.0601],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%-----------------|-------------------------------------------------------------|
*%
*# STATION 3031093: NW Rec Centre Calgary(2005.0601 to 2005.0630)
*%
READ AES DATA       AES_FILENAME=["2005-06.123"],
                    IELEM=[123],
                    START_DATE=[0], END_DATE=[-30]
*%-----------------|-------------------------------------------------------------|
*%
*% This command is necessary to compute the the depression storage recovery.
*% It must follow the READ AES DATA command, and precede the CONTINUOUS STANDHYD
*% command.
*%
COMPUTE API         APII=[20], APIK=[0.9]/day
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
*% On-site Area A3
*%
CONTINUOUS STANDHYD ID=[1], NHYD=["Area_3"], DT=[5](min), AREA=[7.380](ha),
                    XIMP=[0.254], TIMP=[0.254], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[2.8](%),
                            LGP=[261](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[2.8](%),
                            LGI=[261](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[1],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_3"]
*%-----------------|-------------------------------------------------------------|
*% On-site Area A4
```

```
*%
CONTINUOUS STANDHYD ID=[2], NHYD=["Area_4"], DT=[5](min), AREA=[23.967](ha),
                    XIMP=[0.25], TIMP=[0.254], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[15.4](%),
                            LGP=[312](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[15.4](%),
                            LGI=[312](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[2],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_4"]
*%-----------------|-------------------------------------------------------------|
*% On-site Area A5
*%
CONTINUOUS STANDHYD ID=[3], NHYD=["Area_5"], DT=[5](min), AREA=[36.555](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[14.8](%),
                            LGP=[364](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[14.8](%),
                            LGI=[364](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[3],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_5"]
*%-----------------|-------------------------------------------------------------|
*% On-site Area A1
*%
CONTINUOUS STANDHYD ID=[4], NHYD=["Area_1"], DT=[5](min), AREA=[58.945](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[7.5](%),
                            LGP=[637](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[7.5](%),
                            LGI=[637](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
```

```
SAVE HYD            ID=[4],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_1"]
*%-----------------|-------------------------------------------------------------|

*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[ 5 ], NHYD=["A1A3A4A5"], IDs to add=[1+2+3+4]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
*% Routing through combined pit Pond
*%-----------------|-------------------------------------------------------------|
COMPUTE VOLUME      ID=[ 5 ], STRATE=[ 0 ](cms), RELRATE=[ 0.126 ](cms)
*%-----------------|-------------------------------------------------------------|
COMPUTE DUALHYD     IDin=[ 5 ], CINLET=[ 0.126  ](cms), NINLET=[ 1 ],
                    MAJID=[ 9 ], MajNHYD=["Spill"],
                    MINID=[ 8 ], MinNHYD=["Pipe"],
                    TMJSTO=[ 200000  ](cu-m)
*%-----------------|-------------------------------------------------------------|
*************************************************************************
ROUTE RESERVOIR     IDout=[10], NHYD=["Pond 1"], IDin=[5],
                    RDT=[5](min),
                    TABLE of ( OUTFLOW-STORAGE ) values
                    (cms) - (ha-m)
                    [ 0.0 ,     0.00]
                    [ 0.063,   1.398]
                    [ 0.089,   3.176]
                    [ 0.109,   5.674]
                    [ 0.126,   9.406]
                    [ -1 , -1 ]
                    IDovf=[1], NHYDovf=[2000]
*************************************************************************
*%-----------------|-------------------------------------------------------------|
*% On-site Area A2
*%
CONTINUOUS STANDHYD ID=[6], NHYD=["Area_2"], DT=[5](min), AREA=[48.970](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[4.7](%),
                            LGP=[717](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[4.7](%),
                            LGI=[717](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[6],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_2"]
*%-----------------|-------------------------------------------------------------|
```

```
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
*%-----------------|---------------------------------------------------------|
*% Routing through northeast Pond 2
*%-----------------|---------------------------------------------------------|
COMPUTE VOLUME      ID=[ 6 ], STRATE=[ 0 ](cms), RELRATE=[ 0.048 ](cms)
*%-----------------|---------------------------------------------------------|
COMPUTE DUALHYD     IDin=[ 6 ], CINLET=[ 0.048  ](cms), NINLET=[ 1 ],
                    MAJID=[ 9 ], MajNHYD=["Spill"],
                    MINID=[ 8 ], MinNHYD=["Pipe"],
                    TMJSTO=[ 200000  ](cu-m)
*%-----------------|---------------------------------------------------------|
**************************************************************************
ROUTE RESERVOIR     IDout=[10], NHYD=["Pond NE"], IDin=[6],
                    RDT=[5](min),
                    TABLE of ( OUTFLOW-STORAGE ) values
                    (cms) - (ha-m)
                    [ 0.0 ,    2.892]
                    [ 0.024,   4.008]
                    [ 0.034,   5.203]
                    [ 0.042,   6.481]
                    [ 0.048,   7.844]
                    [ -1 , -1 ]
                    IDovf=[1], NHYDovf=[2000]
**************************************************************************
*% Catchment areas outside berms as existing condition
**************************************************************************
*% On-site Area A6
*%
CONTINUOUS STANDHYD ID=[1], NHYD=["Area_6"], DT=[5](min), AREA=[6.906](ha),
                    XIMP=[0.2], TIMP=[0.2], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[10.3](%),
                            LGP=[301](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[10.3](%),
                            LGI=[301](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[1],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_6"]
*%-----------------|---------------------------------------------------------|
*% On-site Area A7
*%
CONTINUOUS STANDHYD ID=[2], NHYD=["Area_7"], DT=[5](min), AREA=[4.189](ha),
                    XIMP=[0.25], TIMP=[0.25], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
```

```
                    Pervious   surfaces: IAper=[15](mm), SLPP=[7.7](%),
                            LGP=[261](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[7.7](%),
                            LGI=[261](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[2],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_7"]
*%-----------------|-------------------------------------------------------------|
*% On-site Area A8
*%
CONTINUOUS STANDHYD ID=[3], NHYD=["Area_8"], DT=[5](min), AREA=[5.012](ha),
                    XIMP=[0.2], TIMP=[0.2], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[4.8](%),
                            LGP=[373](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[4.8](%),
                            LGI=[373](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[3],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_8"]
*%-----------------|-------------------------------------------------------------|
*% On-site Area A9
*%
CONTINUOUS STANDHYD ID=[4], NHYD=["Area_9"], DT=[5](min), AREA=[6.585](ha),
                    XIMP=[0.2], TIMP=[0.2], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[9.1](%),
                            LGP=[353](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[9.1](%),
                            LGI=[353](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[4],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_9]
*%-----------------|-------------------------------------------------------------|
*% On-site Area A13
```

```
*%
CONTINUOUS STANDHYD ID=[5], NHYD=["Area13"], DT=[5](min), AREA=[0.572](ha),
                    XIMP=[0.2], TIMP=[0.2], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[55],
                    Pervious   surfaces: IAper=[15](mm), SLPP=[0.5](%),
                            LGP=[226](m), MNP=[0.250], SCP=[0](hrs),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[0.5](%),
                            LGI=[226](m), MNI=[0.015], SCI=[0](hrs),
                    Continuous simulation parameters:
                    IaRECper=[720](hrs),  IaRECimp=[2](hrs),
                    SMIN=[-1](mm),  SMAX=[-1](mm), SK=[0.2]/(mm),
                    InterEventTime=[48](hrs),   END=-1
*%
*%
SAVE HYD            ID=[5],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_13"]
*%-----------------|-------------------------------------------------------------|
*%-----------------|-------------------------------------------------------------|
FINISH
```

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

   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   # 3920701
        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: Reid Crowther _Partners Ltd                 +++++++++
 +++++++++                Edmonton              SERIAL#:3920701       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ***************************************************************************
 *********           ++++++ 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: 2020-05-29     TIME: 12:15:49     RUN COUNTER: 000374         *
 ***************************************************************************
 * Input   filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\Scot_pst.dat           *
 * Output  filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\Scot_pst.out           *
 * Summary filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\Scot_pst.sum           *
 * User comments:                                                             *
 * 1:_____________________________________________________________________*
 * 2:_____________________________________________________________________*
 * 3:_____________________________________________________________________*
 ***************************************************************************

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

```
001:0001----------------------------------------------------------------------------
-
*#**************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : May 29 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#**************************************************************************
--------------------
| START            |  Project  dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

--------------------  Rainfall dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

    TZERO =   .00 hrs on 20050601
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
----------------------------------------------------------------------------------
-
001:0002----------------------------------------------------------------------------
-
*# STATION 3031093: NW Rec Centre Calgary(2005.0601 to 2005.0630)
--------------------
| READ AES DATA    |   AES filename = E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\2005-06.123

--------------------   Data type    = 123 (hourly rainfall)
                       Start date   = 2005.0601
                       End date     = 2005.0701
                       Time span    =   30 days
                       Station ID   = 3031093

      *** WARNING: Specified end date is beyond the end
                   date in file.
                    (ie. 20050701 > 20050630 )
      RAINFALL RECORD STATISTICS:
      Data read from 20050601 @  0hrs to the end of 20050630
      Number of rainfall increments read=    720 (   30.0 days)
      Total precipitation read=    282.0 mm
      Maximum average rainfall intensities over
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs
         9.0      7.5      6.7      4.4      3.4      2.4    mm/hr
      20050628 20050628 20050628 20050628 20050618 20050618  date
      Number of rainfall events per following interevent time
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs
          37       32       28       23       15        6
      Number of events with at least the following durations
        1 hr    2 hrs    3 hrs    6 hrs   12 hrs   24 hrs
          36       27       20        8        3        1
```

```
--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
--------------------
| COMPUTE API      |   Initial API  =  20.00 mm
--------------------   APIk factor  =    .90 /day

          ANTECEDENT PRECIPITATION INDEX (API) STATISTICS:
               Initial  API value =   20.00 mm
               End date API value =   71.12 mm
               Maximum  API value =  126.20 mm
               Minimum  API value =   17.53 mm
               Average  API value =   73.17 mm
               Total precipitation=  282.00 mm
--------------------------------------------------------------------------------
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001:0004--------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=    7.38
| 01:Area_3 DT= 5.00 |   Total Imp(%)=   25.40   Dir. Conn.(%)=   25.40
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.87         5.51
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       2.80         2.80
     Length            (m)=     261.00       261.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.73
                over (min)       10.00        85.00
     Storage Coeff.  (min)=       9.52 (ii)   82.80 (ii)
     Unit Hyd. Tpeak (min)=      10.00        85.00
     Unit Hyd. peak  (cms)=        .12          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .05          .05          .067 (iii)
     TIME TO PEAK    (hrs)=     652.00       177.17        422.000
                                                    or on 2005.0618_14:00
     RUNOFF VOLUME    (mm)=     243.09       136.38        163.518
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .580
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0005--------------------------------------------------------------------------
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| SAVE HYD         |   AREA       (ha)=    7.380
| ID=01 (Area_3)   |   QPEAK     (cms)=     .067 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  422.000
--------------------   VOLUME     (mm)=  163.518
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_3.001
  Comments: Runoff from Catchment Area_3

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0006--------------------------------------------------------------------------
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----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   23.97
| 02:Area_4 DT= 5.00 |   Total Imp(%)=   25.40   Dir. Conn.(%)=   25.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.09        17.88
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=      15.40        15.40
     Length            (m)=     312.00       312.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         4.00
               over (min)         5.00        55.00
     Storage Coeff.  (min)=       6.36 (ii)   53.91 (ii)
     Unit Hyd. Tpeak (min)=       5.00        55.00
     Unit Hyd. peak  (cms)=        .19          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .15          .17           .243 (iii)
```

```
     TIME TO PEAK    (hrs)=     652.00       176.58        422.000
                                                      or on 2005.0618_14:00
     RUNOFF VOLUME    (mm)=     243.10       136.83        163.417
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .49           .579

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0007---------------------------------------------------------------------------
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| SAVE HYD         |   AREA       (ha)=   23.967
| ID=02 (Area_4)   |   QPEAK     (cms)=     .243 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  422.000
--------------------   VOLUME     (mm)=  163.417
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_4.001
  Comments: Runoff from Catchment Area_4

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0008---------------------------------------------------------------------------
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----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   36.56
| 03:Area_5 DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.14         27.42
     Dep. Storage     (mm)=       1.50         15.00
     Average Slope     (%)=      14.80         14.80
     Length            (m)=     364.00        364.00
     Mannings n           =       .015          .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00          3.97
                over (min)        5.00         60.00
```

```
     Storage Coeff.  (min)=       7.06 (ii)   60.01 (ii)
     Unit Hyd. Tpeak (min)=       5.00        60.00
     Unit Hyd. peak  (cms)=        .17          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .23          .25           .360 (iii)
     TIME TO PEAK    (hrs)=     652.00       176.67        422.000
                                                   or on 2005.0618_14:00
     RUNOFF VOLUME    (mm)=     243.10       136.39        163.091
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .578

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0009---------------------------------------------------------------------------
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--------------------
| SAVE HYD         |   AREA       (ha)=   36.555
| ID=03 (Area_5)   |   QPEAK     (cms)=     .360 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  422.000
--------------------   VOLUME     (mm)=  163.091
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_5.001
  Comments: Runoff from Catchment Area_5

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0010---------------------------------------------------------------------------
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----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   58.94
| 04:Area_1 DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      14.74        44.21
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       7.50         7.50
     Length            (m)=     637.00       637.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00
```

```
              STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
              S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.62
               over (min)        10.00       105.00
     Storage Coeff.  (min)=      12.10 (ii)  106.38 (ii)
     Unit Hyd. Tpeak (min)=      10.00       105.00
     Unit Hyd. peak  (cms)=        .10          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .37          .35          .500 (iii)
     TIME TO PEAK    (hrs)=     652.00       180.33        422.000
                                                    or on 2005.0618_14:00
     RUNOFF VOLUME    (mm)=     243.09       136.37        163.091
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .578

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0011---------------------------------------------------------------------------
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--------------------
| SAVE HYD         |   AREA       (ha)=   58.945
| ID=04 (Area_1)   |   QPEAK     (cms)=     .500 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  422.000
--------------------   VOLUME     (mm)=  163.091
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_1.001
  Comments: Runoff from Catchment Area_1

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0012---------------------------------------------------------------------------
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------------------------
| ADD HYD (A1A3A4A5  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 01:Area_3         7.38     .067  422.00 163.52    .000

                     +ID2 02:Area_4        23.97     .243  422.00 163.42    .000

                     +ID3 03:Area_5        36.56     .360  422.00 163.09    .000

                     +ID4 04:Area_1        58.94     .500  422.00 163.09    .000
```

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                    ============================================================
                    SUM 05:A1A3A4A5     126.85    1.170  422.00 163.18    .000


   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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001:0013--------------------------------------------------------------------------
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--------------------
| COMPUTE VOLUME   |
| ID:05  (A1A3A4)  |             DISCHARGE      TIME
--------------------               (cms)       (hrs)
           START CONTROLLING AT     .000     401.417
           INFLOW HYD. PEAKS AT    1.170     422.000
           STOP  CONTROLLING AT     .126     432.936

           REQUIRED STORAGE VOLUME (ha.m.)=   3.2853
           TOTAL HYDROGRAPH VOLUME (ha.m.)=  20.6988
           % OF HYDROGRAPH TO STORE       =  15.8718

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .126  (cms).

      *** WARNING: Calculated volume may not be the maximum.

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001:0014--------------------------------------------------------------------------
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| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .126  (cms)
| TotalHyd 05:A1A3A4 |   Number of inlets in system [NINLET] =      1
----------------------   Total minor system capacity         =    .126  (cms)
                         Total major system storage [TMJSTO] =  200000.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                   (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   05:A1A3A4     126.85     1.170   422.000  163.177     .000
     ============================================================================
     MAJOR SYST   09:Spill         .00      .000      .000     .000     .000
     MINOR SYST   08:Pipe       126.85      .126    31.333  163.302     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

     Maximum MAJOR SYSTEM storage used =   64669.(cu.m.)

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001:0015-------------------------------------------------------------------------
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| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>05:(A1A3A4)   |
| OUT<10:(Pond 1)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .109  .5674E+01
                           .063  .1398E+01   |     .126  .9406E+01
                           .089  .3176E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >05: (A1A3A4)     126.85     1.170   422.000    163.177
     OUTFLOW<10: (Pond 1)     126.85      .119   187.250    163.174
    OVERFLOW<01: (002000)        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   10.160
                    TIME SHIFT OF PEAK FLOW        (min)=-14085.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.7834E+01

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001:0016-------------------------------------------------------------------------
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*************************************************************************
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=   48.97
| 06:Area_2 DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.24        36.73
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       4.70         4.70
     Length            (m)=     717.00       717.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
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```
              S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.48
               over (min)       15.00       135.00
     Storage Coeff.  (min)=     14.95 (ii)  133.16 (ii)
     Unit Hyd. Tpeak (min)=     15.00       135.00
     Unit Hyd. peak  (cms)=       .08          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=       .30          .28          .404 (iii)
     TIME TO PEAK    (hrs)=    652.00       180.58       180.000
                                                    or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=    243.08       136.35       163.091
     TOTAL RAINFALL   (mm)=    282.00       282.00       281.999
     RUNOFF COEFFICIENT   =       .86          .48          .578

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0017---------------------------------------------------------------------
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--------------------
| SAVE HYD         |   AREA       (ha)=   48.970
| ID=06 (Area_2)   |   QPEAK     (cms)=     .404 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.000
--------------------   VOLUME     (mm)=  163.091
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_2.001
  Comments: Runoff from Catchment Area_2

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0018---------------------------------------------------------------------
-
--------------------
| COMPUTE VOLUME   |
| ID:06  (Area_2)  |             DISCHARGE      TIME
--------------------               (cms)       (hrs)
           START CONTROLLING AT     .000      53.250
           INFLOW HYD. PEAKS AT     .404     180.000
           STOP  CONTROLLING AT     .048     188.881

           REQUIRED STORAGE VOLUME (ha.m.)=   3.0276
           TOTAL HYDROGRAPH VOLUME (ha.m.)=   7.9867
           % OF HYDROGRAPH TO STORE       =  37.9077
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           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .048  (cms).

      *** WARNING: Calculated volume may not be the maximum.

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001:0019--------------------------------------------------------------------------
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| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .048  (cms)
| TotalHyd 06:Area_2 |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .048  (cms)
                         Total major system storage [TMJSTO] =  200000.(cu.m.)

                  ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                   (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   06:Area_2      48.97      .404   180.000  163.091     .000
     ============================================================================
     MAJOR SYST   09:Spill         .00      .000      .000     .000     .000
     MINOR SYST   08:Pipe        48.97      .048    35.750  163.184     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

     Maximum MAJOR SYSTEM storage used =   24724.(cu.m.)

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001:0020--------------------------------------------------------------------------
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| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>06:(Area_2)   |
| OUT<10:(Pond N)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .2892E+01   |     .042  .6481E+01
                            .024  .4008E+01   |     .048  .7844E+01
                            .034  .5203E+01   |     .000  .0000E+00

     ROUTING RESULTS           AREA     QPEAK     TPEAK       R.V.
     --------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW >06: (Area_2)     48.97      .404   180.000    163.091
     OUTFLOW<10: (Pond N)     48.97      .036   450.417    104.032
    OVERFLOW<01: (002000)       .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
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                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    8.891
                  TIME SHIFT OF PEAK FLOW         (min)= 16225.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.5506E+01

      *** WARNING: Outflow volume is less than inflow volume.
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001:0021----------------------------------------------------------------------
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| CONTINUOUS STANDHYD|   Area    (ha)=    6.91
| 01:Area_6 DT= 5.00 |   Total Imp(%)=   20.00   Dir. Conn.(%)=   20.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.38         5.52
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=      10.30        10.30
     Length            (m)=     301.00       301.00
     Mannings n             =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.97
                over (min)        5.00        60.00
     Storage Coeff.  (min)=       7.02 (ii)   59.69 (ii)
     Unit Hyd. Tpeak (min)=       5.00        60.00
     Unit Hyd. peak  (cms)=        .17          .02
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .03          .05           .064 (iii)
     TIME TO PEAK    (hrs)=     652.00       176.67        176.000
                                                     or on 2005.0608_ 8:00
     RUNOFF VOLUME    (mm)=     243.09       136.39        157.757
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .559

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0022--------------------------------------------------------------------------
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| SAVE HYD         |   AREA       (ha)=    6.906
| ID=01 (Area_6)   |   QPEAK     (cms)=     .064 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  176.000
--------------------   VOLUME     (mm)=  157.757
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_6.001
  Comments: Runoff from Catchment Area_6

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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001:0023--------------------------------------------------------------------------
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| CONTINUOUS STANDHYD|   Area    (ha)=    4.19
| 02:Area_7 DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.05         3.14
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       7.70         7.70
     Length            (m)=     261.00       261.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.97
               over (min)         5.00        60.00
     Storage Coeff.  (min)=       7.03 (ii)   59.80 (ii)
     Unit Hyd. Tpeak (min)=       5.00        60.00
     Unit Hyd. peak  (cms)=        .17          .02
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .03          .03           .041 (iii)
     TIME TO PEAK    (hrs)=     652.00       176.67        422.000
                                                     or on 2005.0618_14:00
     RUNOFF VOLUME    (mm)=     243.09       136.39        163.091
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .578
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0024--------------------------------------------------------------------------
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| SAVE HYD         |   AREA       (ha)=    4.189
| ID=02 (Area_7)   |   QPEAK     (cms)=     .041 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  422.000
--------------------   VOLUME      (mm)=  163.091
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_7.001
  Comments: Runoff from Catchment Area_7

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0025--------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=    5.01
| 03:Area_8 DT= 5.00 |   Total Imp(%)=   20.00   Dir. Conn.(%)=   20.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.00         4.01
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       4.80         4.80
     Length            (m)=     373.00       373.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.73
               over (min)        10.00        85.00
     Storage Coeff.  (min)=      10.04 (ii)   87.26 (ii)
     Unit Hyd. Tpeak (min)=      10.00        85.00
     Unit Hyd. peak  (cms)=        .11          .01
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .03          .03          .043 (iii)
     TIME TO PEAK    (hrs)=     652.00       177.25       177.000
```

```
                                                    or on 2005.0608_ 9:00
     RUNOFF VOLUME    (mm)=     243.09       136.37        157.757
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .559

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0026--------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=    5.012
| ID=03 (Area_8)   |   QPEAK     (cms)=     .043 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  177.000
--------------------   VOLUME     (mm)=  157.757
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_8.001
  Comments: Runoff from Catchment Area_8

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0027--------------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=    6.58
| 04:Area_9 DT= 5.00 |   Total Imp(%)=   20.00   Dir. Conn.(%)=   20.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.32         5.27
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       9.10         9.10
     Length            (m)=     353.00       353.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
               S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.85
               over (min)        10.00        70.00
     Storage Coeff.  (min)=       8.01 (ii)   68.88 (ii)
```

```
     Unit Hyd. Tpeak (min)=      10.00        70.00
     Unit Hyd. peak  (cms)=        .13          .02
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .03          .05          .060 (iii)
     TIME TO PEAK    (hrs)=     652.00       176.92       176.917
                                                    or on 2005.0608_ 8:55
     RUNOFF VOLUME    (mm)=     243.09       136.39       157.757
     TOTAL RAINFALL   (mm)=     282.00       282.00       281.999
     RUNOFF COEFFICIENT   =        .86          .48          .559

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
-
001:0028---------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=    6.585
| ID=04 (Area_9)   |   QPEAK     (cms)=     .060 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  176.917
--------------------   VOLUME     (mm)=  157.757
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_9.001
  Comments: HYD_COMMENT=["Runoff from Catchment Area_9]

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-------------------------------------------------------------------------------
-
001:0029---------------------------------------------------------------------
-
----------------------
| CONTINUOUS STANDHYD|   Area    (ha)=     .57
| 05:Area_1 DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .14          .43
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=        .50          .50
     Length            (m)=     226.00       226.00
     Mannings n           =       .015         .250

               CONTINUOUS SIMULATION INPUT PARAMETERS:
               IaRECimp (hrs)=  2.00, IaRECper (hrs)=720.00,
               SMIN      (mm)= 83.24, SMAX      (mm)=554.96, SK= .200
               InterEventTime  (hrs)= 48.00

               STATISTICS OF CONTINUOUSLY COMPUTED S-VALUE:
```

```
              S*max= 97.40, S*min= 83.24, S*avg= 83.82,  CNavg= 75.19

     Max.eff.Inten.(mm/hr)=       9.00         3.50
               over (min)       15.00       130.00
     Storage Coeff.  (min)=      14.65 (ii)  130.17 (ii)
     Unit Hyd. Tpeak (min)=      15.00       130.00
     Unit Hyd. peak  (cms)=        .08          .01
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .00          .00           .005 (iii)
     TIME TO PEAK    (hrs)=     652.00       180.50        180.000
                                                      or on 2005.0608_12:00
     RUNOFF VOLUME    (mm)=     243.09       136.35        163.092
     TOTAL RAINFALL   (mm)=     282.00       282.00        281.999
     RUNOFF COEFFICIENT   =        .86          .48           .578

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0030--------------------------------------------------------------------------
-
--------------------
| SAVE HYD         |   AREA       (ha)=     .572
| ID=05 (Area_1)   |   QPEAK     (cms)=     .005 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=  180.000
--------------------   VOLUME     (mm)=  163.092
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area_1.001
  Comments: Runoff from Catchment Area_13

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0031--------------------------------------------------------------------------
-
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0002 READ AES DATA
      *** WARNING: Specified end date is beyond the end
                   date in file.
 001:0013 COMPUTE VOLUME
      *** WARNING: Calculated volume may not be the maximum.
```

```
 001:0018 COMPUTE VOLUME
      *** WARNING: Calculated volume may not be the maximum.
 001:0020 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2020-05-29     at 12:15:50
================================================================================
=
```

SWMHYMO 100 year 24 hours Duration

Pond 2 Post-construction

Input and Output

```
2     Metric units
*#************************************************************************
*#************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : May 29 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#************************************************************************
*%
*%
*% 1:100 year storm (Chicago storm) generates an runoff hydrograph using the
*% CALIB STANDHYD commands.
*%
*%
*%
*%************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|------------------------------------------------------|
CHICAGO STORM       IUNITS=[2],  TD=[ 24  ](hrs), TPRAT=[ 0.30  ],  CSDT=[ 5 ](min),
                    ICASEcs=[1],
                     A=[  663.1 ],  B=[ 1.870  ], and C=[  0.712  ],
*%************************************************************************
*%-----------------|------------------------------------------------------|
*% On-site Area A2
*%
CALIB STANDHYD      ID=[1], NHYD=["Area 2"], DT=[ 5  ](min), AREA=[48.97](ha),
                    XIMP=[ 0.25  ], TIMP=[ 0.25  ], DWF=[ 0 ](cms), LOSS=[1],
                    Horton: Fo=[ 75  ](mm/hr), Fc=[ 7.5  ](mm/hr),
                            DCAY=[ 4.14  ](/hr), F=[ 0 ](mm),
                    Pervious   surfaces: IAper=[ 15  ](mm), SLPP=[ 4.7 ](%),
                                         LGP=[717](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[4.7 ](%),
                                         LGI=[717](m), MNI=[0.015], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|------------------------------------------------------|
SAVE HYD            ID=[1],   # OF PCYCLES=[-1],  ICASEsh=[1]
                    HYD_COMMENT=["Runoff from Catchment Area_2"]
*%-----------------|------------------------------------------------------|
*%-----------------|------------------------------------------------------|
*%-----------------|------------------------------------------------------|
*%-----------------|------------------------------------------------------|
*%-----------------|------------------------------------------------------|
*% Routing through northeast Pond 2
*%-----------------|------------------------------------------------------|
************************************************************************
ROUTE RESERVOIR     IDout=[2], NHYD=["Pond NE"], IDin=[1],
                    RDT=[5](min),
                    TABLE of ( OUTFLOW-STORAGE ) values
```

```
                    (cms) - (ha-m)
                    [ 0.0 ,    2.892]
                    [ 0.024,   4.008]
                    [ 0.034,   5.203]
                    [ 0.042,   6.481]
                    [ 0.048,   7.844]
                    [ -1 , -1 ]
                    IDovf=[5], NHYDovf=[2000]
*******************************************************************************
CALIB STANDHYD      ID=[1], NHYD=["Area 2 "], DT=[ 5  ](min), AREA=[ 48.97   ](ha),
                    XIMP=[ 0.25  ], TIMP=[0.25   ], DWF=[ 0  ](cms), LOSS=[2],
                    SCS curve number CN=[ 55  ],
                    Pervious   surfaces: IAper=[ 15  ](mm), SLPP=[ 4.7 ](%),
                                         LGP=[717](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[4.7 ](%),
                                         LGI=[717](m), MNI=[0.015], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------------|
*% Routing through northeast Pond 2
*%-----------------|-------------------------------------------------------------|
*******************************************************************************
ROUTE RESERVOIR     IDout=[2], NHYD=["Pond NE"], IDin=[1],
                    RDT=[5](min),
                    TABLE of ( OUTFLOW-STORAGE ) values
                    (cms) - (ha-m)
                    [ 0.0 ,    2.892]
                    [ 0.024,   4.008]
                    [ 0.034,   5.203]
                    [ 0.042,   6.481]
                    [ 0.048,   7.844]
                    [ -1 , -1 ]
                    IDovf=[5], NHYDovf=[2000]
*******************************************************************************

*%-----------------|-------------------------------------------------------------|
FINISH
```

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

   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   # 3920701
         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: Reid Crowther _Partners Ltd                 +++++++++
 +++++++++                Edmonton              SERIAL#:3920701       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ***************************************************************************
 *********           ++++++ 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: 2020-05-30     TIME: 11:23:21     RUN COUNTER: 000381         *
 ***************************************************************************
 * Input   filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\POND2~1.DAT             *
 * Output  filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\POND2~1.out             *
 * Summary filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\POND2~1.sum             *
 * User comments:                                                              *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ***************************************************************************

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

```
001:0001----------------------------------------------------------------------------
-
*#**************************************************************************
*#**************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : May 29 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#**************************************************************************
--------------------
| START            |  Project  dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

--------------------  Rainfall dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------------
-
001:0002----------------------------------------------------------------------------
-
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 663.100
| Ptotal= 89.67 mm |                          B=   1.870
--------------------                          C=    .712
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =   .30

               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .08   1.094 |   6.08   4.259 |  12.08   2.597 |  18.08   1.467
                .17   1.103 |   6.17   4.519 |  12.17   2.566 |  18.17   1.460
                .25   1.113 |   6.25   4.821 |  12.25   2.536 |  18.25   1.452
                .33   1.122 |   6.33   5.176 |  12.33   2.506 |  18.33   1.444
                .42   1.132 |   6.42   5.601 |  12.42   2.478 |  18.42   1.436
                .50   1.143 |   6.50   6.120 |  12.50   2.450 |  18.50   1.429
                .58   1.153 |   6.58   6.773 |  12.58   2.423 |  18.58   1.421
                .67   1.163 |   6.67   7.624 |  12.67   2.396 |  18.67   1.414
                .75   1.174 |   6.75   8.785 |  12.75   2.371 |  18.75   1.407
                .83   1.185 |   6.83  10.488 |  12.83   2.346 |  18.83   1.399
                .92   1.197 |   6.92  13.283 |  12.92   2.321 |  18.92   1.392
               1.00   1.208 |   7.00  18.961 |  13.00   2.297 |  19.00   1.385
               1.08   1.220 |   7.08  40.516 |  13.08   2.274 |  19.08   1.378
               1.17   1.232 |   7.17 168.138 |  13.17   2.252 |  19.17   1.372
               1.25   1.245 |   7.25  54.372 |  13.25   2.229 |  19.25   1.365
```

1.33	1.257	7.33	31.748	13.33	2.208	19.33	1.358
1.42	1.270	7.42	23.236	13.42	2.187	19.42	1.352
1.50	1.284	7.50	18.660	13.50	2.166	19.50	1.345
1.58	1.297	7.58	15.763	13.58	2.146	19.58	1.339
1.67	1.311	7.67	13.746	13.67	2.126	19.67	1.332
1.75	1.326	7.75	12.251	13.75	2.107	19.75	1.326
1.83	1.341	7.83	11.093	13.83	2.088	19.83	1.320
1.92	1.356	7.92	10.166	13.92	2.069	19.92	1.313
2.00	1.372	8.00	9.405	14.00	2.051	20.00	1.307
2.08	1.388	8.08	8.768	14.08	2.034	20.08	1.301
2.17	1.404	8.17	8.225	14.17	2.016	20.17	1.295
2.25	1.421	8.25	7.756	14.25	1.999	20.25	1.289
2.33	1.439	8.33	7.346	14.33	1.983	20.33	1.284
2.42	1.457	8.42	6.985	14.42	1.966	20.42	1.278
2.50	1.476	8.50	6.664	14.50	1.950	20.50	1.272
2.58	1.495	8.58	6.376	14.58	1.935	20.58	1.266
2.67	1.515	8.67	6.116	14.67	1.919	20.67	1.261
2.75	1.535	8.75	5.880	14.75	1.904	20.75	1.255
2.83	1.556	8.83	5.665	14.83	1.889	20.83	1.250
2.92	1.578	8.92	5.468	14.92	1.875	20.92	1.244
3.00	1.601	9.00	5.287	15.00	1.860	21.00	1.239
3.08	1.624	9.08	5.119	15.08	1.846	21.08	1.234
3.17	1.648	9.17	4.964	15.17	1.833	21.17	1.229
3.25	1.674	9.25	4.819	15.25	1.819	21.25	1.223
3.33	1.700	9.33	4.684	15.33	1.806	21.33	1.218
3.42	1.727	9.42	4.558	15.42	1.793	21.42	1.213
3.50	1.755	9.50	4.440	15.50	1.780	21.50	1.208
3.58	1.784	9.58	4.329	15.58	1.767	21.58	1.203
3.67	1.815	9.67	4.224	15.67	1.755	21.67	1.198
3.75	1.846	9.75	4.125	15.75	1.743	21.75	1.193
3.83	1.880	9.83	4.032	15.83	1.731	21.83	1.188
3.92	1.914	9.92	3.943	15.92	1.719	21.92	1.184
4.00	1.950	10.00	3.859	16.00	1.707	22.00	1.179
4.08	1.988	10.08	3.780	16.08	1.696	22.08	1.174
4.17	2.028	10.17	3.704	16.17	1.685	22.17	1.170
4.25	2.070	10.25	3.631	16.25	1.673	22.25	1.165
4.33	2.113	10.33	3.562	16.33	1.663	22.33	1.160
4.42	2.159	10.42	3.496	16.42	1.652	22.42	1.156
4.50	2.208	10.50	3.433	16.50	1.641	22.50	1.151
4.58	2.259	10.58	3.373	16.58	1.631	22.58	1.147
4.67	2.313	10.67	3.315	16.67	1.621	22.67	1.143
4.75	2.371	10.75	3.259	16.75	1.611	22.75	1.138
4.83	2.432	10.83	3.206	16.83	1.601	22.83	1.134
4.92	2.497	10.92	3.154	16.92	1.591	22.92	1.130
5.00	2.566	11.00	3.105	17.00	1.581	23.00	1.125
5.08	2.640	11.08	3.057	17.08	1.572	23.08	1.121
5.17	2.719	11.17	3.011	17.17	1.562	23.17	1.117
5.25	2.805	11.25	2.967	17.25	1.553	23.25	1.113
5.33	2.897	11.33	2.924	17.33	1.544	23.33	1.109
5.42	2.997	11.42	2.883	17.42	1.535	23.42	1.105

```
              5.50   3.105 |  11.50   2.843 |  17.50   1.526 |  23.50   1.101
              5.58   3.224 |  11.58   2.805 |  17.58   1.517 |  23.58   1.097
              5.67   3.354 |  11.67   2.767 |  17.67   1.509 |  23.67   1.093
              5.75   3.497 |  11.75   2.731 |  17.75   1.500 |  23.75   1.089
              5.83   3.656 |  11.83   2.696 |  17.83   1.492 |  23.83   1.085
              5.92   3.833 |  11.92   2.662 |  17.92   1.484 |  23.92   1.081
              6.00   4.033 |  12.00   2.629 |  18.00   1.476 |  24.00   1.077

--------------------------------------------------------------------------------
-
001:0003--------------------------------------------------------------------------
-
----------------------
| CALIB STANDHYD     |   Area    (ha)=   48.97
| 01:Area 2 DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.24         36.73
     Dep. Storage     (mm)=       1.50         15.00
     Average Slope     (%)=       4.70          4.70
     Length            (m)=     717.00        717.00
     Mannings n           =       .015          .250

     Max.eff.Inten.(mm/hr)=     168.14        126.75
               over (min)         5.00         35.00
     Storage Coeff.  (min)=       4.63 (ii)    32.70 (ii)
     Unit Hyd. Tpeak (min)=       5.00         35.00
     Unit Hyd. peak  (cms)=        .22           .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=       4.15          1.58          4.332 (iii)
     TIME TO PEAK    (hrs)=       7.17          7.67          7.167
     RUNOFF VOLUME    (mm)=      88.17         14.44         32.869
     TOTAL RAINFALL   (mm)=      89.67         89.67         89.667
     RUNOFF COEFFICIENT   =        .98           .16           .367
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)=  7.50     Cum.Inf.   (mm)=   .00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-
001:0004--------------------------------------------------------------------------
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--------------------
| SAVE HYD         |   AREA       (ha)=   48.970
```

```
| ID=01 (Area 2)   |   QPEAK     (cms)=    4.332 (i)
| DT= 5.00 PCYC=-1 |   TPEAK     (hrs)=    7.167
--------------------   VOLUME     (mm)=   32.869
  Filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\H-Area 2.001
  Comments: Runoff from Catchment Area_2

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------
-
001:0005--------------------------------------------------------------------------
-
********************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(Area 2)   |
| OUT<02:(Pond N)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .2892E+01   |     .042  .6481E+01
                            .024  .4008E+01   |     .048  .7844E+01
                            .034  .5203E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (Area 2)      48.97     4.332     7.167     32.869
     OUTFLOW<02: (Pond N)      48.97      .000      .000       .000
    OVERFLOW<05: (002000)        .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW        (min)=  -430.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1610E+01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
001:0006--------------------------------------------------------------------------
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********************************************************************************
----------------------
| CALIB STANDHYD     |   Area    (ha)=   48.97
| 01:Area 2 DT= 5.00 |   Total Imp(%)=   25.00   Dir. Conn.(%)=   25.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.24        36.73
     Dep. Storage     (mm)=       1.50        15.00
```

```
     Average Slope     (%)=       4.70         4.70
     Length            (m)=     717.00       717.00
     Mannings n             =       .015         .250

     Max.eff.Inten.(mm/hr)=     168.14        21.21
               over (min)         5.00        60.00
     Storage Coeff.  (min)=       4.63 (ii)   62.02 (ii)
     Unit Hyd. Tpeak (min)=       5.00        60.00
     Unit Hyd. peak  (cms)=        .22          .02
                                                          *TOTALS*
     PEAK FLOW       (cms)=       4.15          .32          4.162 (iii)
     TIME TO PEAK    (hrs)=       7.17         8.33          7.167
     RUNOFF VOLUME    (mm)=      88.17        19.74         36.844
     TOTAL RAINFALL   (mm)=      89.67        89.67         89.667
     RUNOFF COEFFICIENT   =        .98          .22           .411
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0007--------------------------------------------------------------------------
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********************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(Area 2)   |
| OUT<02:(Pond N)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .2892E+01   |     .042  .6481E+01
                            .024  .4008E+01   |     .048  .7844E+01
                            .034  .5203E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (Area 2)      48.97     4.162     7.167     36.844
     OUTFLOW<02: (Pond N)      48.97      .000      .000       .000
    OVERFLOW<05: (002000)        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
```

```
                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=     .000
                  TIME SHIFT OF PEAK FLOW         (min)=  -430.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1804E+01

      *** WARNING: Outflow volume is less than inflow volume.
--------------------------------------------------------------------------------
-
001:0008----------------------------------------------------------------------
-
********************************************************************************
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0003 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0005 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
 001:0006 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0007 ROUTE RESERVOIR
      *** WARNING: Outflow volume is less than inflow volume.
   Simulation ended on 2020-05-30     at 11:23:22
================================================================================
=
```

```
2     Metric units
*#*************************************************************************
*#*************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : July 06 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#*************************************************************************
*%
*%
*% 1:100 year storm (Chicago storm) generates an runoff hydrograph using the
*% CALIB STANDHYD commands.
*%
*%
*%
*%*************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[0],  NRUN=[0]
*%                   [  ] <--storm filename, one per line for NSTORM time
*%-----------------|-------------------------------------------------------|
CHICAGO STORM       IUNITS=[2],  TD=[ 24  ](hrs), TPRAT=[ 0.30  ],  CSDT=[ 5 ](min),
                    ICASEcs=[1],
                     A=[  663.1 ],  B=[ 1.870  ], and C=[  0.712  ],
*%*************************************************************************
*%-----------------|-------------------------------------------------------|
*************************************************************************
*% On-site and offsite Areas
*************************************************************************
CALIB STANDHYD      ID=[1], NHYD=["Pond 1 "], DT=[ 5  ](min), AREA=[ 161.533
](ha),
                    XIMP=[ 0.218  ], TIMP=[0.218   ], DWF=[ 0  ](cms), LOSS=[2],
                    SCS curve number CN=[ 55  ],
                    Pervious   surfaces: IAper=[ 15  ](mm), SLPP=[ 2.5 ](%),
                                         LGP=[2000](m), MNP=[0.25], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.5](mm), SLPI=[2.5 ](%),
                                         LGI=[2000](m), MNI=[0.015], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------|
*% Routing through northeast Pond 1
*%-----------------|-------------------------------------------------------|
*************************************************************************
ROUTE RESERVOIR     IDout=[2], NHYD=["Pond NE"], IDin=[1],
                    RDT=[5](min),
                    TABLE of ( OUTFLOW-STORAGE ) values
                    (cms) - (ha-m)
                    [ 0.0 ,    0.000]
                    [ 0.080,   2.383]
                    [ 0.113,   4.876]
                    [ 0.138,   7.484]
                    [ 0.16,   10.208]
                    [ -1 , -1 ]
```

```
                    IDovf=[5], NHYDovf=[2000]
*********************************************************************************

*%-----------------|---------------------------------------------------------------|
FINISH
```

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

   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   # 3920701
        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: Reid Crowther _Partners Ltd                  +++++++++
 +++++++++                Edmonton              SERIAL#:3920701       +++++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********           ++++++ 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: 2020-07-06     TIME: 12:57:05     RUN COUNTER: 000400         *
 ********************************************************************************
 * Input   filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\POND1~1.DAT              *
 * Output  filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\POND1~1.out              *
 * Summary filename: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\POND1~1.sum              *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************

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-
001:0001---------------------------------------------------------------------------
```

```
-
*#*************************************************************************
*#*************************************************************************
*#  Project Name: Lehigh Scott Property          Project Number: [60610856]
*#  Date        : July 06 2020
*#  Modeller    : Jagadish Kayastha
*#  Company     : J.F. Sabourin and Associates Inc.
*#  License #   : 5826103
*#*************************************************************************
--------------------
| START            |  Project  dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

--------------------  Rainfall dir.: E:\AECOM\LEHIGH~1\STORMW~1\SWMHYMO\

    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   0
-------------------------------------------------------------------------------
-
001:0002----------------------------------------------------------------------
-
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 663.100
| Ptotal= 89.67 mm |                          B=   1.870
--------------------                          C=    .712
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  = 24.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =   .30

               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .08   1.094 |   6.08   4.259 |  12.08   2.597 |  18.08   1.467
                .17   1.103 |   6.17   4.519 |  12.17   2.566 |  18.17   1.460
                .25   1.113 |   6.25   4.821 |  12.25   2.536 |  18.25   1.452
                .33   1.122 |   6.33   5.176 |  12.33   2.506 |  18.33   1.444
                .42   1.132 |   6.42   5.601 |  12.42   2.478 |  18.42   1.436
                .50   1.143 |   6.50   6.120 |  12.50   2.450 |  18.50   1.429
                .58   1.153 |   6.58   6.773 |  12.58   2.423 |  18.58   1.421
                .67   1.163 |   6.67   7.624 |  12.67   2.396 |  18.67   1.414
                .75   1.174 |   6.75   8.785 |  12.75   2.371 |  18.75   1.407
                .83   1.185 |   6.83  10.488 |  12.83   2.346 |  18.83   1.399
                .92   1.197 |   6.92  13.283 |  12.92   2.321 |  18.92   1.392
               1.00   1.208 |   7.00  18.961 |  13.00   2.297 |  19.00   1.385
               1.08   1.220 |   7.08  40.516 |  13.08   2.274 |  19.08   1.378
               1.17   1.232 |   7.17 168.138 |  13.17   2.252 |  19.17   1.372
               1.25   1.245 |   7.25  54.372 |  13.25   2.229 |  19.25   1.365
               1.33   1.257 |   7.33  31.748 |  13.33   2.208 |  19.33   1.358
               1.42   1.270 |   7.42  23.236 |  13.42   2.187 |  19.42   1.352
```

1.50	1.284	7.50	18.660	13.50	2.166	19.50	1.345
1.58	1.297	7.58	15.763	13.58	2.146	19.58	1.339
1.67	1.311	7.67	13.746	13.67	2.126	19.67	1.332
1.75	1.326	7.75	12.251	13.75	2.107	19.75	1.326
1.83	1.341	7.83	11.093	13.83	2.088	19.83	1.320
1.92	1.356	7.92	10.166	13.92	2.069	19.92	1.313
2.00	1.372	8.00	9.405	14.00	2.051	20.00	1.307
2.08	1.388	8.08	8.768	14.08	2.034	20.08	1.301
2.17	1.404	8.17	8.225	14.17	2.016	20.17	1.295
2.25	1.421	8.25	7.756	14.25	1.999	20.25	1.289
2.33	1.439	8.33	7.346	14.33	1.983	20.33	1.284
2.42	1.457	8.42	6.985	14.42	1.966	20.42	1.278
2.50	1.476	8.50	6.664	14.50	1.950	20.50	1.272
2.58	1.495	8.58	6.376	14.58	1.935	20.58	1.266
2.67	1.515	8.67	6.116	14.67	1.919	20.67	1.261
2.75	1.535	8.75	5.880	14.75	1.904	20.75	1.255
2.83	1.556	8.83	5.665	14.83	1.889	20.83	1.250
2.92	1.578	8.92	5.468	14.92	1.875	20.92	1.244
3.00	1.601	9.00	5.287	15.00	1.860	21.00	1.239
3.08	1.624	9.08	5.119	15.08	1.846	21.08	1.234
3.17	1.648	9.17	4.964	15.17	1.833	21.17	1.229
3.25	1.674	9.25	4.819	15.25	1.819	21.25	1.223
3.33	1.700	9.33	4.684	15.33	1.806	21.33	1.218
3.42	1.727	9.42	4.558	15.42	1.793	21.42	1.213
3.50	1.755	9.50	4.440	15.50	1.780	21.50	1.208
3.58	1.784	9.58	4.329	15.58	1.767	21.58	1.203
3.67	1.815	9.67	4.224	15.67	1.755	21.67	1.198
3.75	1.846	9.75	4.125	15.75	1.743	21.75	1.193
3.83	1.880	9.83	4.032	15.83	1.731	21.83	1.188
3.92	1.914	9.92	3.943	15.92	1.719	21.92	1.184
4.00	1.950	10.00	3.859	16.00	1.707	22.00	1.179
4.08	1.988	10.08	3.780	16.08	1.696	22.08	1.174
4.17	2.028	10.17	3.704	16.17	1.685	22.17	1.170
4.25	2.070	10.25	3.631	16.25	1.673	22.25	1.165
4.33	2.113	10.33	3.562	16.33	1.663	22.33	1.160
4.42	2.159	10.42	3.496	16.42	1.652	22.42	1.156
4.50	2.208	10.50	3.433	16.50	1.641	22.50	1.151
4.58	2.259	10.58	3.373	16.58	1.631	22.58	1.147
4.67	2.313	10.67	3.315	16.67	1.621	22.67	1.143
4.75	2.371	10.75	3.259	16.75	1.611	22.75	1.138
4.83	2.432	10.83	3.206	16.83	1.601	22.83	1.134
4.92	2.497	10.92	3.154	16.92	1.591	22.92	1.130
5.00	2.566	11.00	3.105	17.00	1.581	23.00	1.125
5.08	2.640	11.08	3.057	17.08	1.572	23.08	1.121
5.17	2.719	11.17	3.011	17.17	1.562	23.17	1.117
5.25	2.805	11.25	2.967	17.25	1.553	23.25	1.113
5.33	2.897	11.33	2.924	17.33	1.544	23.33	1.109
5.42	2.997	11.42	2.883	17.42	1.535	23.42	1.105
5.50	3.105	11.50	2.843	17.50	1.526	23.50	1.101
5.58	3.224	11.58	2.805	17.58	1.517	23.58	1.097
5.67	3.354	11.67	2.767	17.67	1.509	23.67	1.093

```
             5.75   3.497 |  11.75   2.731 |  17.75   1.500 |  23.75   1.089
             5.83   3.656 |  11.83   2.696 |  17.83   1.492 |  23.83   1.085
             5.92   3.833 |  11.92   2.662 |  17.92   1.484 |  23.92   1.081
             6.00   4.033 |  12.00   2.629 |  18.00   1.476 |  24.00   1.077

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001:0003--------------------------------------------------------------------------
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********************************************************************************
********************************************************************************
----------------------
| CALIB STANDHYD     |   Area    (ha)=  161.53
| 01:Pond 1 DT= 5.00 |   Total Imp(%)=   21.80   Dir. Conn.(%)=   21.80
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      35.21       126.32
     Dep. Storage     (mm)=       1.50        15.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=    2000.00      2000.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=      87.68        21.21
               over (min)        15.00       140.00
     Storage Coeff.  (min)=      13.45 (ii)  141.79 (ii)
     Unit Hyd. Tpeak (min)=      15.00       140.00
     Unit Hyd. peak  (cms)=        .08          .01
                                                      *TOTALS*
     PEAK FLOW       (cms)=       6.08          .68         6.108 (iii)
     TIME TO PEAK    (hrs)=       7.33        10.08         7.333
     RUNOFF VOLUME    (mm)=      88.17        19.73        34.654
     TOTAL RAINFALL   (mm)=      89.67        89.67        89.667
     RUNOFF COEFFICIENT   =        .98          .22          .386

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0004--------------------------------------------------------------------------
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********************************************************************************
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(Pond 1)   |
| OUT<02:(Pond N)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
```

```
                          .000  .0000E+00   |     .138  .7484E+01
                          .080  .2383E+01   |     .160  .1021E+02
                          .113  .4876E+01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (Pond 1)     161.53     6.108     7.333     34.654
     OUTFLOW<02: (Pond N)     161.53      .112    26.583     34.653
    OVERFLOW<05: (002000)        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    1.837
                   TIME SHIFT OF PEAK FLOW         (min)=  1155.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.4817E+01

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-
001:0005--------------------------------------------------------------------------
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********************************************************************************
      FINISH
--------------------------------------------------------------------------------
-
********************************************************************************
*
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-07-06     at 12:57:05
================================================================================
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AECOM Imagine it. Delivered.

Appendix C

Pre-and Post-development WBSCC Model Data Files and Results

PRE-DEVELOPMENT CONDITION

WBSCC

Water Balance Spreadsheet for the City of Calgary
Version 1.2

PROJECT SUMMARY SHEET

Project Name:	Lehigh Scott Property
Project Description:	Pre-construction offsite and catchment areas
Location:	Calgary
Date:	May 27, 2020
Designed by:	Daisy Zhang, P. Eng.
Company Name:	AECOM
Reviewed by:	Jagadish Kayastha, P. Eng.

WBSCC - PROJECT DATA SHEET - Environmental Information

Minimum Temperature to Trigger Runoff (^{o}C)	0
Sublimation Losses (%)	10
Precipitation Multiplication Factor (% Decrease)	0

Month	Is Winter or Summer?	Crop Water Requirement (mm/month)			
		KENTUCKY BLUE GRAS	SAGE BRUSH	Unnamed 1	Unnamed 2
January	Winter	0	0	0	0
February	Winter	0	0	0	0
March	Winter	0	0	0	0
April	Summer	0	0	0	0
May	Summer	110	50	0	0
June	Summer	110	50	0	0
July	Summer	110	60	0	0
August	Summer	110	50	0	0
September	Summer	110	50	0	0
October	Summer	0	20	0	0
November	Winter	0	0	0	0
December	Winter	0	0	0	0

Catchment Area Data

Sub-Catchment	Description of Sub-catchment Use	Area (ha)
Sub-Catchment 1	Offsite 1 and Sub-catchment area A1	70.11
Sub-Catchment 2	Sub-catchment Area A2	35.948
Sub-Catchment 3	Sub-catchment Area A3	43.368
Sub-Catchment 4	Sub-catchment Area A4	28.048
Sub-Catchment 5	Offsite 2 and subcatchment A5	183.903
Total		361.377

Pond Area Data

Pond	Description of Pond	Pond Area (m^2)
Pond 1	Pond	0
Pond 2		0

WBSCC - PROJECT DATA SHEET - Sub-Catchment 1: Parameters, Runoff Allocation

Usage: Offsite 1 and Sub-catchment area A1

Sub-catchment Parameters		Cover Type					
		Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Medium	Unassigned Area
Area (Total: 70.11)	(ha)	3.672	66.438	0	0	0	0
Depression Loss	(mm)	1.6					
Soil Type: Sand			30		100	90	
Silt			35	100	0	10	
Clay			35				
Custom							
Unassigned			0	0	0	0	
Soil or Media Depth	(mm)		200	300	200	600	
Porosity			0.46	0.46	0.512	0.469	
Field Capacity			0.271	0.271	0.132	0.092	
Wilting Point			0.126	0.126	0.057	0.038	
Saturated Hydraulic Conductivity	(m/s)		5.00E-06	5.00E-06	2.50E-05	3.50E-05	
Sub-soil Hydraulic Conductivity	(m/s)		1.00E-08	1.00E-08		5.00E-08	
Ponding Depth	(mm)		0	0	0	300	
Inv. Slope of Log. Tension Moisture Curve			4.98	4.98	4.55	4.32	
Subdrain Invert (above bottom of media)	(mm)					0	
Subdrain Capacity	(m^3/s)					0	

% of Runoff Allocated To:	Runoff Allocated from Cover Type/ Facility:						
	Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Media	Storage/ Reuse Tank	Discharge
Pervious Surface	0			0			
Absorbent Landscaping	0	0		0			
Green Roof Media	0						
Storage/ Reuse Tank	0	0	0	0			
Bioretention/Bioswale Media	0	0	0	0			
Discharge	100	100	100	100	100	100	
Pond 1/Pond 2							POND #1

WBSCC - PROJECT DATA SHEET - Sub-Catchment 2: Parameters, Runoff Allocation

Usage: Sub-catchment Area A2

Sub-catchment Parameters		Cover Type					
		Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Medium	Unassigned Area
Area (Total: 35.948)	(ha)	3.255	32.693	0	0	0	0
Depression Loss	(mm)	1.6					
Soil Type: Sand			30		100	90	
Silt			35	100	0	10	
Clay			35				
Custom							
Unassigned			0	0	0	0	
Soil or Media Depth	(mm)		200	300	200	600	
Porosity			0.46	0.46	0.512	0.469	
Field Capacity			0.271	0.271	0.132	0.092	
Wilting Point			0.126	0.126	0.057	0.038	
Saturated Hydraulic Conductivity	(m/s)		5.00E-06	5.00E-06	2.50E-05	3.50E-05	
Sub-soil Hydraulic Conductivity	(m/s)		1.00E-08	1.00E-08		5.00E-08	
Ponding Depth	(mm)		0	0	0	300	
Inv. Slope of Log. Tension Moisture Curve			4.98	4.98	4.55	4.32	
Subdrain Invert (above bottom of media)	(mm)					0	
Subdrain Capacity	(m^3/s)					0	

% of Runoff Allocated To:	Runoff Allocated from Cover Type/ Facility:						
	Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Media	Storage/ Reuse Tank	Discharge
Pervious Surface	0			0			
Absorbent Landscaping	0	0		0			
Green Roof Media	0						
Storage/ Reuse Tank	0	0	0	0			
Bioretention/Bioswale Media	0	0	0	0			
Discharge	100	100	100	100	100	100	
Pond 1/Pond 2							POND #2

WBSCC - PROJECT DATA SHEET - Sub-Catchment 3: Parameters, Runoff Allocation

Usage: Sub-catchment Area A3

Sub-catchment Parameters		Cover Type					
		Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Medium	Unassigned Area
Area (Total: 43.368)	(ha)	2.331	41.037	0	0	0	0
Depression Loss	(mm)	1.6					
Soil Type: Sand			30		100	90	
Silt			35	100	0	10	
Clay			35				
Custom							
Unassigned			0	0	0	0	
Soil or Media Depth	(mm)		200	300	200	600	
Porosity			0.46	0.46	0.512	0.469	
Field Capacity			0.271	0.271	0.132	0.092	
Wilting Point			0.126	0.126	0.057	0.038	
Saturated Hydraulic Conductivity	(m/s)		5.00E-06	5.00E-06	2.50E-05	3.50E-05	
Sub-soil Hydraulic Conductivity	(m/s)		1.00E-08	1.00E-08		5.00E-08	
Ponding Depth	(mm)		0	0	0	300	
Inv. Slope of Log. Tension Moisture Curve			4.98	4.98	4.55	4.32	
Subdrain Invert (above bottom of media)	(mm)					0	
Subdrain Capacity	(m^3/s)					0	

% of Runoff Allocated To:	Runoff Allocated from Cover Type/ Facility:						
	Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Media	Storage/ Reuse Tank	Discharge
Pervious Surface	0			0			
Absorbent Landscaping	0	0		0			
Green Roof Media	0						
Storage/ Reuse Tank	0	0	0	0			
Bioretention/Bioswale Media	0	0	0	0			
Discharge	100	100	100	100	100	100	
Pond 1/Pond 2							POND #2

WBSCC - PROJECT DATA SHEET - Sub-Catchment 4: Parameters, Runoff Allocation

Usage: Sub-catchment Area A4

Sub-catchment Parameters		Cover Type					
		Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Medium	Unassigned Area
Area (Total:)	(ha)	0.143	27.905	0	0	0	0
Depression Loss	(mm)	1.6					
Soil Type: Sand			30		100	90	
Silt			35	100	0	10	
Clay			35				
Customized Media							
Unassigned			0	0	0	0	
Soil or Media Depth	(mm)		200	50	200	600	
Porosity			0.46	0.46	0.512	0.469	
Field Capacity			0.271	0.271	0.132	0.092	
Wilting Point			0.126	0.126	0.057	0.038	
Saturated Hydraulic Conductivity	(m/s)		5.00E-06	5.00E-06	2.50E-05	3.50E-05	
Sub-soil Hydraulic Conductivity	(m/s)		1.00E-08	1.00E-08		5.00E-08	
Ponding Depth	(mm)		0	0	0	300	
Inv. Slope of Log. Tension Moisture Curve			4.98	4.98	4.55	4.32	
Subdrain Invert (above bottom of media)	(mm)					0	
Subdrain Capacity	(m^3/s)					0	

% of Runoff Allocated To:	Runoff Allocated from Cover Type/ Facility:						
	Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Media	Storage/ Reuse Tank	Discharge
Pervious Surface	0			0			
Absorbent Landscaping	0	0		0			
Green Roof Media	0						
Storage/ Reuse Tank	0	0	0	0			
Bioretention/Bioswale Media	0	0	0	0			
Discharge	100	100	100	100	100	100	
Pond 1/Pond 2							POND #2

WBSCC - PROJECT DATA SHEET - Sub-Catchment 5: Parameters, Runoff Allocation

Usage: Offsite 2 and subcatchment A5

Sub-catchment Parameters		Cover Type					
		Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Medium	Unassigned Area
Area (Total:)	(ha)	5.817	178.086	0	0	0	0
Depression Loss	(mm)	1.6					
Soil Type: Sand			30		100	90	
Silt			35	100	0	10	
Clay			35				
Custom			0				
Unassigned			0	0	0	0	
Soil or Media Depth	(mm)		200	50	200	600	
Porosity			0.46	0.46	0.512	0.469	
Field Capacity			0.271	0.271	0.132	0.092	
Wilting Point			0.126	0.126	0.057	0.038	
Saturated Hydraulic Conductivity	(m/s)		5.00E-06	5.00E-06	2.50E-05	3.50E-05	
Sub-soil Hydraulic Conductivity	(m/s)		1.00E-08	1.00E-08		5.00E-08	
Ponding Depth	(mm)		0	0	0	300	
Inv. Slope of Log. Tension Moisture Curve			4.98	4.98	4.55	4.32	
Subdrain Invert (above bottom of media)	(mm)					0	
Subdrain Capacity	(m^3/s)					0	

% of Runoff Allocated To:	Runoff Allocated from Cover Type/ Facility:						
	Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Media	Storage/ Reuse Tank	Discharge
Pervious Surface	0			0			
Absorbent Landscaping	0	0		0			
Green Roof Media	0						
Storage/ Reuse Tank	0	0	0	0			
Bioretention/Bioswale Media	0	0	0	0			
Discharge	100	100	100	100	100	100	
Pond 1/Pond 2							POND #1

SUBCATCHMENT 1	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	14650886.7
AVERAGE PRECIPITATION	409.7	
MEDIAN PRECIPITATION	404.7	
TOTAL RUNOFF (INCLUDING SUBDRAIN)	1049.1	735552.5
% OF RAINFALL AS RUNOFF	5.0	
AVERAGE RUNOFF (INCLUDING SUBDRAIN)	20.6	14422.6
MEDIAN RUNOFF (INCLUDING SUBDRAIN)	16.0	11218.8
TOTAL IRRIGATION DEMAND	0.0	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	39.6	27782.3
AVERAGE EVAPORATION	366.8	257147.3
AVERAGE PERCOLATION	10.1	7055.2
TOTAL RUNOFF + EVAP + PERCOLATION	397.4	278625.1

SC1: IMPERVIOUS AREA	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	767337.8
TOTAL RUNOFF	15516.1	569751.2
% OF RAINFALL AS RUNOFF	74.3	
AVERAGE RUNOFF	304.2	11171.6
MEDIAN RUNOFF	299.3	10988.8
MAXIMUM RUNOFF (ANY TIMESTEP)	91.0	3341.5
TOTAL RUNON	0.0	0.0
TOTAL DEP STORAGE (EVAPORATION LOSS)	5018.5	184280.4
TOTAL SUBLIMATION LOSS	356.4	13088.1
SNOW PACK AT THE END OF SIMULATION	5.9	218.1
WATER BALANCE (OVER PERIOD OF RECORD)	0.0	0.0

SUBCATCHMENT 2	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	7512053.6
AVERAGE PRECIPITATION	409.7	
MEDIAN PRECIPITATION	404.7	
TOTAL RUNOFF (INCLUDING SUBDRAIN)	1631.9	586637.0
% OF RAINFALL AS RUNOFF	7.8	
AVERAGE RUNOFF (INCLUDING SUBDRAIN)	32.0	11502.7
MEDIAN RUNOFF (INCLUDING SUBDRAIN)	27.4	9847.7
TOTAL IRRIGATION DEMAND	0.0	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	39.8	14317.0
AVERAGE EVAPORATION	352.0	126537.8
AVERAGE PERCOLATION	9.7	3471.8
TOTAL RUNOFF + EVAP + PERCOLATION	393.7	141512.2

SC2: IMPERVIOUS AREA	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	680197.4
TOTAL RUNOFF	15516.1	505049.1
% OF RAINFALL AS RUNOFF	74.3	
AVERAGE RUNOFF	304.2	9902.9
MEDIAN RUNOFF	299.3	9740.9
MAXIMUM RUNOFF (ANY TIMESTEP)	91.0	2962.1
TOTAL RUNON	0.0	0.0
TOTAL DEP STORAGE (EVAPORATION LOSS)	5018.5	163353.2
TOTAL SUBLIMATION LOSS	356.4	11601.8
SNOW PACK AT THE END OF SIMULATION	5.9	193.3
WATER BALANCE (OVER PERIOD OF RECORD)	0.0	0.0

SUBCATCHMENT 3	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	9062611.0
AVERAGE PRECIPITATION	409.7	
MEDIAN PRECIPITATION	404.7	
TOTAL RUNOFF (INCLUDING SUBDRAIN)	1070.1	464091.4
% OF RAINFALL AS RUNOFF	5.1	
AVERAGE RUNOFF (INCLUDING SUBDRAIN)	21.0	9099.8
MEDIAN RUNOFF (INCLUDING SUBDRAIN)	16.4	7117.2
TOTAL IRRIGATION DEMAND	0.0	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	39.6	17188.5
AVERAGE EVAPORATION	366.2	158833.1
AVERAGE PERCOLATION	10.0	4357.8
TOTAL RUNOFF + EVAP + PERCOLATION	397.3	172290.7

SC3: IMPERVIOUS AREA	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	487109.1
TOTAL RUNOFF	15516.1	361680.3
% OF RAINFALL AS RUNOFF	74.3	
AVERAGE RUNOFF	304.2	7091.8
MEDIAN RUNOFF	299.3	6975.8
MAXIMUM RUNOFF (ANY TIMESTEP)	91.0	2121.2
TOTAL RUNON	0.0	0.0
TOTAL DEP STORAGE (EVAPORATION LOSS)	5018.5	116981.9
TOTAL SUBLIMATION LOSS	356.4	8308.4
SNOW PACK AT THE END OF SIMULATION	5.9	138.5
WATER BALANCE (OVER PERIOD OF RECORD)	0.0	0.0

SUBCATCHMENT 4	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	5861190.6
AVERAGE PRECIPITATION	409.7	
MEDIAN PRECIPITATION	404.7	
TOTAL RUNOFF (INCLUDING SUBDRAIN)	327.4	91827.2
% OF RAINFALL AS RUNOFF	1.6	
AVERAGE RUNOFF (INCLUDING SUBDRAIN)	6.4	1800.5
MEDIAN RUNOFF (INCLUDING SUBDRAIN)	1.6	446.9
TOTAL IRRIGATION DEMAND	0.0	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	39.4	11044.9
AVERAGE EVAPORATION	385.1	108005.9
AVERAGE PERCOLATION	10.6	2963.3
TOTAL RUNOFF + EVAP + PERCOLATION	402.1	112769.7

SC4: IMPERVIOUS AREA	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	29882.7
TOTAL RUNOFF	15516.1	22188.0
% OF RAINFALL AS RUNOFF	74.3	
AVERAGE RUNOFF	304.2	435.1
MEDIAN RUNOFF	299.3	427.9
MAXIMUM RUNOFF (ANY TIMESTEP)	91.0	130.1
TOTAL RUNON	0.0	0.0
TOTAL DEP STORAGE (EVAPORATION LOSS)	5018.5	7176.5
TOTAL SUBLIMATION LOSS	356.4	509.7
SNOW PACK AT THE END OF SIMULATION	5.9	8.5
WATER BALANCE (OVER PERIOD OF RECORD)	0.0	0.0

SUBCATCHMENT 5	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	38430209.9
AVERAGE PRECIPITATION	409.7	
MEDIAN PRECIPITATION	404.7	
TOTAL RUNOFF (INCLUDING SUBDRAIN)	732.5	1346999.3
% OF RAINFALL AS RUNOFF	3.5	
AVERAGE RUNOFF (INCLUDING SUBDRAIN)	14.4	26411.8
MEDIAN RUNOFF (INCLUDING SUBDRAIN)	9.8	18061.4
TOTAL IRRIGATION DEMAND	0.0	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	39.5	72674.6
AVERAGE EVAPORATION	374.8	689279.2
AVERAGE PERCOLATION	10.3	18911.4
TOTAL RUNOFF + EVAP + PERCOLATION	399.5	734602.3

SC5: IMPERVIOUS AREA	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	1215578.5
TOTAL RUNOFF	15516.1	902571.5
% OF RAINFALL AS RUNOFF	74.3	
AVERAGE RUNOFF	304.2	17697.5
MEDIAN RUNOFF	299.3	17408.0
MAXIMUM RUNOFF (ANY TIMESTEP)	91.0	5293.5
TOTAL RUNON	0.0	0.0
TOTAL DEP STORAGE (EVAPORATION LOSS)	5018.5	291927.9
TOTAL SUBLIMATION LOSS	356.4	20733.5
SNOW PACK AT THE END OF SIMULATION	5.9	345.5
WATER BALANCE (OVER PERIOD OF RECORD)	0.0	0.0

POST-CONSTRUCTION STAGE

WBSCC

Water Balance Spreadsheet for the City of Calgary
Version 1.2

PROJECT SUMMARY SHEET

Project Name:	Lehigh Scott Property
Project Description:	Post-construction catchment area after Phase 6 mining completion
Location:	Calgary
Date:	May 26, 2020
Designed by:	Daisy Zhang, P. Eng.
Company Name:	AECOM
Reviewed by:	Jagadish Kayastha, P. Eng.

WBSCC - PROJECT DATA SHEET - Environmental Information

Minimum Temperature to Trigger Runoff (^{o}C)	0
Sublimation Losses (%)	10
Precipitation Multiplication Factor (% Decrease)	0

Month	Is Winter or Summer?	Crop Water Requirement (mm/month)			
		KENTUCKY BLUE GRAS	SAGE BRUSH	Unnamed 1	Unnamed 2
January	Winter	0	0	0	0
February	Winter	0	0	0	0
March	Winter	0	0	0	0
April	Summer	0	0	0	0
May	Summer	110	50	0	0
June	Summer	110	50	0	0
July	Summer	110	60	0	0
August	Summer	110	50	0	0
September	Summer	110	50	0	0
October	Summer	0	20	0	0
November	Winter	0	0	0	0
December	Winter	0	0	0	0

Catchment Area Data

Sub-Catchment	Description of Sub-catchment Use	Area (ha)
Sub-Catchment 1	A1, A3, A4 and A5	126.847
Sub-Catchment 2	A2	48.97
Sub-Catchment 3		
Sub-Catchment 4		
Sub-Catchment 5		
Total		175.817

Pond Area Data

Pond	Description of Pond	Pond Area (m^2)
Pond 1	Pond	0.15
Pond 2		31481

WBSCC - PROJECT DATA SHEET - Sub-Catchment 1: Parameters, Runoff Allocation

Usage: A1, A3, A4 and A5

Sub-catchment Parameters		Cover Type					
		Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Medium	Unassigned Area
Area (Total: 126.847)	(ha)	3.148	123.699	0	0	0	0
Depression Loss	(mm)	1.6					
Soil Type: Sand			88		100	90	
Silt			7	100	0	10	
Clay			5				
Custom							
Unassigned			0	0	0	0	
Soil or Media Depth	(mm)		200	300	200	600	
Porosity			0.437	0.46	0.512	0.469	
Field Capacity			0.105	0.271	0.132	0.092	
Wilting Point			0.047	0.126	0.057	0.038	
Saturated Hydraulic Conductivity	(m/s)		5.00E-06	5.00E-06	2.50E-05	3.50E-05	
Sub-soil Hydraulic Conductivity	(m/s)		1.00E-08	1.00E-08		5.00E-08	
Ponding Depth	(mm)		0	0	0	300	
Inv. Slope of Log. Tension Moisture Curve			4.75	4.98	4.55	4.32	
Subdrain Invert (above bottom of media)	(mm)					0	
Subdrain Capacity	(m^3/s)					0	

% of Runoff Allocated To:	Runoff Allocated from Cover Type/ Facility:						
	Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Media	Storage/ Reuse Tank	Discharge
Pervious Surface	0			0			
Absorbent Landscaping	0	0		0			
Green Roof Media	0						
Storage/ Reuse Tank	0	0	0	0			
Bioretention/Bioswale Media	0	0	0	0			
Discharge	100	100	100	100	100	100	
Pond 1/Pond 2							POND #2

WBSCC - PROJECT DATA SHEET - Sub-Catchment 2: Parameters, Runoff Allocation

Usage: A2

Sub-catchment Parameters		Cover Type					
		Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Medium	Unassigned Area
Area (Total: 48.97)	(ha)		48.97		0	0	0
Depression Loss	(mm)	1.6					
Soil Type: Sand			88	88	100	90	
Silt			7	7	0	10	
Clay			5	5			
Custom							
Unassigned			0	0	0	0	
Soil or Media Depth	(mm)		200	300	200	600	
Porosity			0.437	0.46	0.512	0.469	
Field Capacity			0.105	0.1	0.132	0.092	
Wilting Point			0.047	0.05	0.057	0.038	
Saturated Hydraulic Conductivity	(m/s)		5.00E-06	5.00E-06	2.50E-05	3.50E-05	
Sub-soil Hydraulic Conductivity	(m/s)		1.00E-08	1.00E-08		5.00E-08	
Ponding Depth	(mm)		0	0	0	300	
Inv. Slope of Log. Tension Moisture Curve			4.75	5.51	4.55	4.32	
Subdrain Invert (above bottom of media)	(mm)					0	
Subdrain Capacity	(m^3/s)					0	

% of Runoff Allocated To:	Runoff Allocated from Cover Type/ Facility:						
	Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Media	Storage/ Reuse Tank	Discharge
Pervious Surface	0			0			
Absorbent Landscaping	0	0		0			
Green Roof Media	0						
Storage/ Reuse Tank	0	0	0	0			
Bioretention/Bioswale Media	0	0	0	0			
Discharge	100	100	100	100	100	100	
Pond 1/Pond 2							POND #1

WBSCC - PROJECT DATA SHEET - Environmental Information

Minimum Temperature to Trigger Runoff (^{o}C)	0
Sublimation Losses (%)	10
Precipitation Multiplication Factor (% Decrease)	0

Month	Is Winter or Summer?	Crop Water Requirement (mm/month)			
		KENTUCKY BLUE GRAS	SAGE BRUSH	Unnamed 1	Unnamed 2
January	Winter	0	0	0	0
February	Winter	0	0	0	0
March	Winter	0	0	0	0
April	Summer	0	0	0	0
May	Summer	110	50	0	0
June	Summer	110	50	0	0
July	Summer	110	60	0	0
August	Summer	110	50	0	0
September	Summer	110	50	0	0
October	Summer	0	20	0	0
November	Winter	0	0	0	0
December	Winter	0	0	0	0

Catchment Area Data

Sub-Catchment	Description of Sub-catchment Use	Area (ha)
Sub-Catchment 1		
Sub-Catchment 2		
Sub-Catchment 3	Catchment contributing to Pond 1	161.533
Sub-Catchment 4		
Sub-Catchment 5		
Total		161.533

Pond Area Data

Pond	Description of Pond	Pond Area (m^2)
Pond 1	Pond	40250
Pond 2		31481

WBSCC - PROJECT DATA SHEET - Sub-Catchment 3: Parameters, Runoff Allocation

Usage: Catchment contributing to Pond 1

Sub-catchment Parameters		Cover Type					
		Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Medium	Unassigned Area
Area (Total: 161.533)	(ha)	7.432	154.101	0	0	0	0
Depression Loss	(mm)	1.6					
Soil Type: Sand					100	90	
Silt			100	100	0	10	
Clay							
Custom							
Unassigned			0	0	0	0	
Soil or Media Depth	(mm)		200	300	200	600	
Porosity			0.46	0.46	0.512	0.469	
Field Capacity			0.271	0.271	0.132	0.092	
Wilting Point			0.126	0.126	0.057	0.038	
Saturated Hydraulic Conductivity	(m/s)		5.00E-06	5.00E-06	2.50E-05	3.50E-05	
Sub-soil Hydraulic Conductivity	(m/s)		1.00E-08	1.00E-08		5.00E-08	
Ponding Depth	(mm)		0	0	0	300	
Inv. Slope of Log. Tension Moisture Curve			4.98	4.98	4.55	4.32	
Subdrain Invert (above bottom of media)	(mm)					0	
Subdrain Capacity	(m^3/s)					0	

% of Runoff Allocated To:	Runoff Allocated from Cover Type/ Facility:						
	Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Media	Storage/ Reuse Tank	Discharge
Pervious Surface	0			0			
Absorbent Landscaping	0	0		0			
Green Roof Media	0						
Storage/ Reuse Tank	0	0	0	0			
Bioretention/Bioswale Media	0	0	0	0			
Discharge	100	100	100	100	100	100	
Pond 1/Pond 2							POND #1

SUBCATCHMENT 1	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	26507217.6
AVERAGE PRECIPITATION	409.7	
MEDIAN PRECIPITATION	404.7	
TOTAL RUNOFF (INCLUDING SUBDRAIN)	493.6	626087.9
% OF RAINFALL AS RUNOFF	2.4	
AVERAGE RUNOFF (INCLUDING SUBDRAIN)	9.7	12276.2
MEDIAN RUNOFF (INCLUDING SUBDRAIN)	7.5	9524.0
TOTAL IRRIGATION DEMAND	0.0	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	32.7	41476.6
AVERAGE EVAPORATION	385.0	488307.8
AVERAGE PERCOLATION	5.4	6834.8
TOTAL RUNOFF + EVAP + PERCOLATION	400.0	507418.8

SC1: IMPERVIOUS AREA	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	657837.6
TOTAL RUNOFF	15516.1	488446.8
% OF RAINFALL AS RUNOFF	74.3	
AVERAGE RUNOFF	304.2	9577.4
MEDIAN RUNOFF	299.3	9420.7
MAXIMUM RUNOFF (ANY TIMESTEP)	91.0	2864.7
TOTAL RUNON	0.0	0.0
TOTAL DEP STORAGE (EVAPORATION LOSS)	5018.5	157983.3
TOTAL SUBLIMATION LOSS	356.4	11220.4
SNOW PACK AT THE END OF SIMULATION	5.9	187.0
WATER BALANCE (OVER PERIOD OF RECORD)	0.0	0.0

SUBCATCHMENT 2	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	10233260.9
AVERAGE PRECIPITATION	409.7	
MEDIAN PRECIPITATION	404.7	
TOTAL RUNOFF (INCLUDING SUBDRAIN)	111.3	54489.4
% OF RAINFALL AS RUNOFF	0.5	
AVERAGE RUNOFF (INCLUDING SUBDRAIN)	2.2	1068.4
MEDIAN RUNOFF (INCLUDING SUBDRAIN)	0.0	0.0
TOTAL IRRIGATION DEMAND	0.0	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	32.4	15864.0
AVERAGE EVAPORATION	394.8	193311.5
AVERAGE PERCOLATION	5.5	2705.7
TOTAL RUNOFF + EVAP + PERCOLATION	402.5	197085.6

SC2: IMPERVIOUS AREA	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	0.0
TOTAL RUNOFF	15516.1	0.0
% OF RAINFALL AS RUNOFF	74.3	
AVERAGE RUNOFF	304.2	0.0
MEDIAN RUNOFF	299.3	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	91.0	0.0
TOTAL RUNON	0.0	0.0
TOTAL DEP STORAGE (EVAPORATION LOSS)	5018.5	0.0
TOTAL SUBLIMATION LOSS	356.4	0.0
SNOW PACK AT THE END OF SIMULATION	5.9	0.0
WATER BALANCE (OVER PERIOD OF RECORD)	0.0	0.0

SUBCATCHMENT 3	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	33755551.0
AVERAGE PRECIPITATION	409.7	
MEDIAN PRECIPITATION	404.7	
TOTAL RUNOFF (INCLUDING SUBDRAIN)	973.8	1573055.6
% OF RAINFALL AS RUNOFF	4.7	
AVERAGE RUNOFF (INCLUDING SUBDRAIN)	19.1	30844.2
MEDIAN RUNOFF (INCLUDING SUBDRAIN)	14.1	22765.7
TOTAL IRRIGATION DEMAND	0.0	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	39.6	63956.3
AVERAGE EVAPORATION	368.0	594497.3
AVERAGE PERCOLATION	10.9	17540.1
TOTAL RUNOFF + EVAP + PERCOLATION	398.0	642881.6

SC3: IMPERVIOUS AREA	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	1553065.0
TOTAL RUNOFF	15516.1	1153156.6
% OF RAINFALL AS RUNOFF	74.3	
AVERAGE RUNOFF	304.2	22610.9
MEDIAN RUNOFF	299.3	22241.0
MAXIMUM RUNOFF (ANY TIMESTEP)	91.0	6763.1
TOTAL RUNON	0.0	0.0
TOTAL DEP STORAGE (EVAPORATION LOSS)	5018.5	372977.1
TOTAL SUBLIMATION LOSS	356.4	26489.9
SNOW PACK AT THE END OF SIMULATION	5.9	441.5
WATER BALANCE (OVER PERIOD OF RECORD)	0.0	0.0

FUTURE WETLAND WATER BALANCE MODEL

WBSCC

Water Balance Spreadsheet for the City of Calgary
Version 1.2

PROJECT SUMMARY SHEET

Project Name:	Lehigh Scott Property
Project Description:	Future Wetland Option 2 after Phase 6 mining comple-tion
Location:	Calgary
Date:	June 2, 2020
Designed by:	Daisy Zhang, P. Eng.
Company Name:	AECOM
Reviewed by:	Jagadish Kayastha, P. Eng.

WBSCC - PROJECT DATA SHEET - Environmental Information

Minimum Temperature to Trigger Runoff (^{o}C)	0
Sublimation Losses (%)	10
Precipitation Multiplication Factor (% Decrease)	0

Month	Is Winter or Summer?	Crop Water Requirement (mm/month)			
		KENTUCKY BLUE GRAS	SAGE BRUSH	Unnamed 1	Unnamed 2
January	Winter	0	0	0	0
February	Winter	0	0	0	0
March	Winter	0	0	0	0
April	Summer	0	0	0	0
May	Summer	110	50	0	0
June	Summer	110	50	0	0
July	Summer	110	60	0	0
August	Summer	110	50	0	0
September	Summer	110	50	0	0
October	Summer	0	20	0	0
November	Winter	0	0	0	0
December	Winter	0	0	0	0

Catchment Area Data

Sub-Catchment	Description of Sub-catchment Use	Area (ha)
Sub-Catchment 1	A1, A3, A4 and A5	126.847
Sub-Catchment 2		
Sub-Catchment 3		
Sub-Catchment 4		
Sub-Catchment 5		
Total		126.847

Pond Area Data

Pond	Description of Pond	Pond Area (m^2)
Pond 1	Pond	31482
Pond 2		31481

WBSCC - PROJECT DATA SHEET - Sub-Catchment 1: Parameters, Runoff Allocation

Usage: A1, A3, A4 and A5

Sub-catchment Parameters		Cover Type					
		Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Medium	Unassigned Area
Area (Total: 126.847)	(ha)	3.148	123.699	0	0	0	0
Depression Loss	(mm)	1.6					
Soil Type: Sand			88		100	90	
Silt			7	100	0	10	
Clay			5				
Custom							
Unassigned			0	0	0	0	
Soil or Media Depth	(mm)		200	300	200	600	
Porosity			0.437	0.46	0.512	0.469	
Field Capacity			0.105	0.271	0.132	0.092	
Wilting Point			0.047	0.126	0.057	0.038	
Saturated Hydraulic Conductivity	(m/s)		5.00E-06	5.00E-06	2.50E-05	3.50E-05	
Sub-soil Hydraulic Conductivity	(m/s)		1.00E-08	1.00E-08		5.00E-08	
Ponding Depth	(mm)		0	0	0	300	
Inv. Slope of Log. Tension Moisture Curve			4.75	4.98	4.55	4.32	
Subdrain Invert (above bottom of media)	(mm)					0	
Subdrain Capacity	(m^3/s)					0	

% of Runoff Allocated To:	Runoff Allocated from Cover Type/ Facility:						
	Impervious Surface	Pervious Surface	Absorbent Landscaping	Green Roof Media	Bioretention/ Bioswale Media	Storage/ Reuse Tank	Discharge
Pervious Surface	0			0			
Absorbent Landscaping	0	0		0			
Green Roof Media	0						
Storage/ Reuse Tank	0	0	0	0			
Bioretention/Bioswale Media	0	0	0	0			
Discharge	100	100	100	100	100	100	
Pond 1/Pond 2							POND #2

WBSCC - PROJECT DATA SHEET - Pond 2: Parameters, Elevation-Area-Discharge Relationship

Pond 2 Parametrs		Values
Base Elevation	(m)	1227.00
Starting Water Elevation	(m)	1227.00
Starting Discharge Elevation (UNWL)	(m)	1228.00
High Water Level (HWL)	(m)	1228.00
Lower Normal Water Level (LNWL)	(m)	1228.00
Seepage Rate	(mm/hr)	0.01
Discharge and Overflow Routed to:		OUTFALL

Pond 2 Pertinent Volumes (m^3)	Values
Volume at Base Elevation	0
Volume at Stating Water Elevation	0
Volume at LNWL	31481
Volume at UNWL	31481
Volume at HWL	31481

Pond 2 Bed Soil Parameters		
Soil Type: Sand		
Silt		100
Clay		
Custom		
Unassigned		0
Soil or Media Depth	(mm)	150
Porosity		0.46
Field Capacity		0.271
Wilting Point		0.126
Saturated Hydraulic Conductivity	(m/s)	5.00E-06
Sub-soil Hydraulic Conductivity	(m/s)	1.00E-08
Ponding Depth	(mm)	0
Inv. Slope of Log. Tension Moisture Curve		4.98

Elevation (m)	Area (m^2)	Discharge (m^3/s)
1227.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0
1228.00	31481	0

SUBCATCHMENT 1	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	26507217.6
AVERAGE PRECIPITATION	409.7	
MEDIAN PRECIPITATION	404.7	
TOTAL RUNOFF (INCLUDING SUBDRAIN)	493.6	626087.9
% OF RAINFALL AS RUNOFF	2.4	
AVERAGE RUNOFF (INCLUDING SUBDRAIN)	9.7	12276.2
MEDIAN RUNOFF (INCLUDING SUBDRAIN)	7.5	9524.0
TOTAL IRRIGATION DEMAND	0.0	0.0
MAXIMUM RUNOFF (ANY TIMESTEP)	32.7	41476.6
AVERAGE EVAPORATION	385.0	488307.8
AVERAGE PERCOLATION	5.4	6834.8
TOTAL RUNOFF + EVAP + PERCOLATION	400.0	507418.8

SC1: IMPERVIOUS AREA	(mm)	(m3)
TOTAL MSC PRECIPITATION	20897.0	657837.6
TOTAL RUNOFF	15516.1	488446.8
% OF RAINFALL AS RUNOFF	74.3	
AVERAGE RUNOFF	304.2	9577.4
MEDIAN RUNOFF	299.3	9420.7
MAXIMUM RUNOFF (ANY TIMESTEP)	91.0	2864.7
TOTAL RUNON	0.0	0.0
TOTAL DEP STORAGE (EVAPORATION LOSS)	5018.5	157983.3
TOTAL SUBLIMATION LOSS	356.4	11220.4
SNOW PACK AT THE END OF SIMULATION	5.9	187.0
WATER BALANCE (OVER PERIOD OF RECORD)	0.0	0.0

AECOM Imagine it. Delivered.

Appendix D

HYFRAN-Plus Results

PIT WETLAND

Post-construction Pit Wetland

Results of the fitting

3-parameter lognormal (Method of moments)

Number of observations 51

Parameters

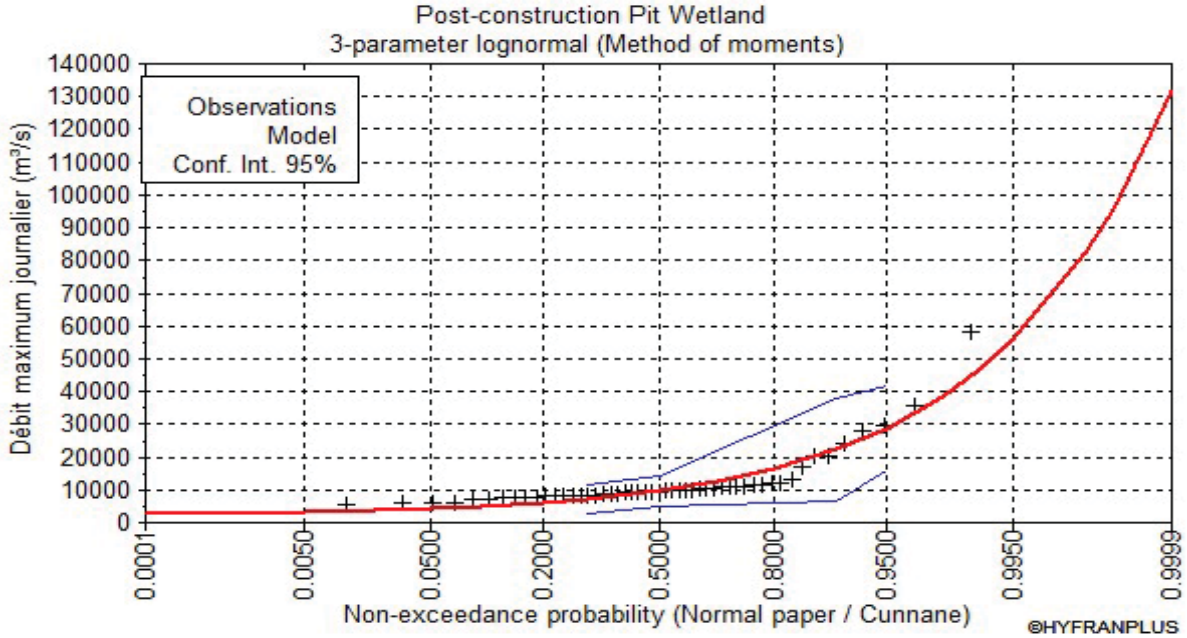
m	2176.558
mu	8.927811
sigma	0.764785

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard d	Confidence interval (95%)	
10000	0.9999	132000	2.63E+05	N/D	N/D
2000	0.9995	95600	1.43E+05	N/D	N/D
1000	0.999	82300	1.04E+05	N/D	N/D
200	0.995	56200	4.13E+04	N/D	N/D
100	0.99	46900	2.38E+04	N/D	N/D
50	0.98	38400	1.18E+04	N/D	N/D
20	0.95	28700	6.56E+03	1.58E+04	4.16E+04
10	0.9	22300	7.89E+03	6800	3.77E+04
5	0.8	16500	7.59E+03	N/D	N/D
3	0.6667	12700	5.47E+03	N/D	N/D
2	0.5	9720	2.37E+03	5070	1.44E+04



Post-construction Pit Wetland

Results of the fitting

Gamma (Method of moments)

Number of observations 51

Parameters

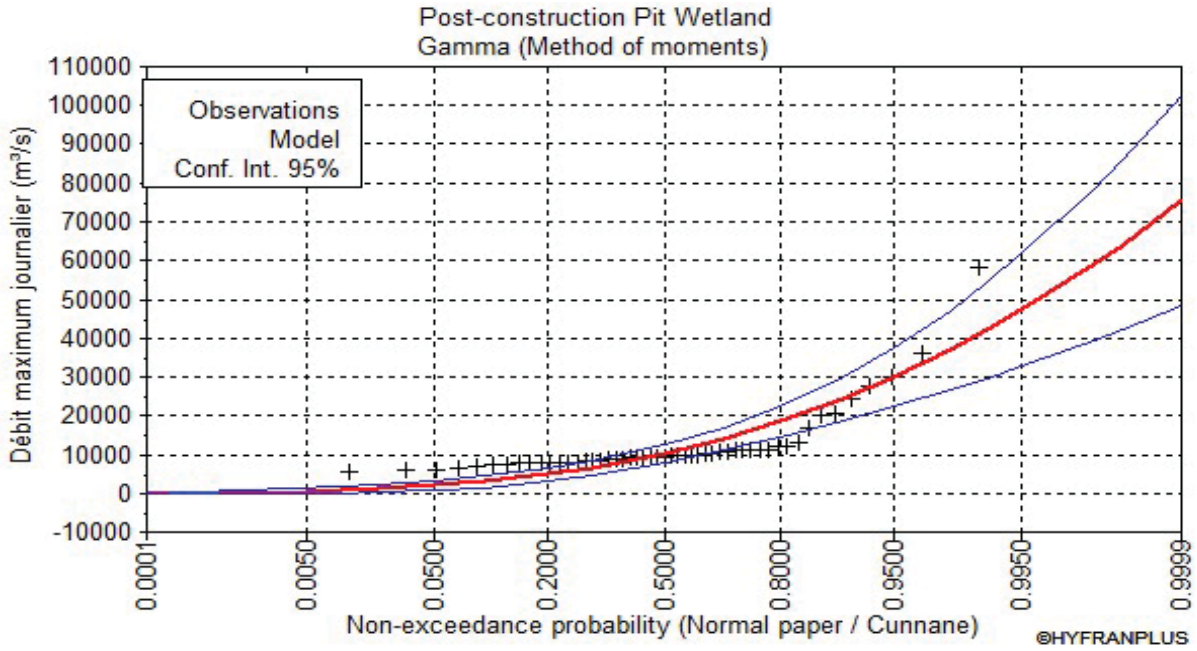
alpha	0.000151
lambda	1.858895

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard deviation	Confidence interval (95%)	
10000	0.9999	75500	1.38E+04	4.84E+04	1.03E+05
2000	0.9995	64000	1.12E+04	4.21E+04	8.58E+04
1000	0.999	59000	1.00E+04	3.93E+04	7.86E+04
200	0.995	47200	7420	3.27E+04	6.18E+04
100	0.99	42100	6320	2.97E+04	5.45E+04
50	0.98	36900	5240	2.66E+04	4.71E+04
20	0.95	29800	3860	2.22E+04	3.74E+04
10	0.9	24300	2870	1.87E+04	2.99E+04
5	0.8	18500	1980	1.47E+04	2.24E+04
3	0.6667	14200	1460	1.13E+04	1.70E+04
2	0.5	10200	1150	7890	1.24E+04
1.4286	0.3	6510	1010	4540	8490



Post-construction Pit Wetland

Results of the fitting

GEV (Maximum Likelihood)

Number of observations 51

Parameters

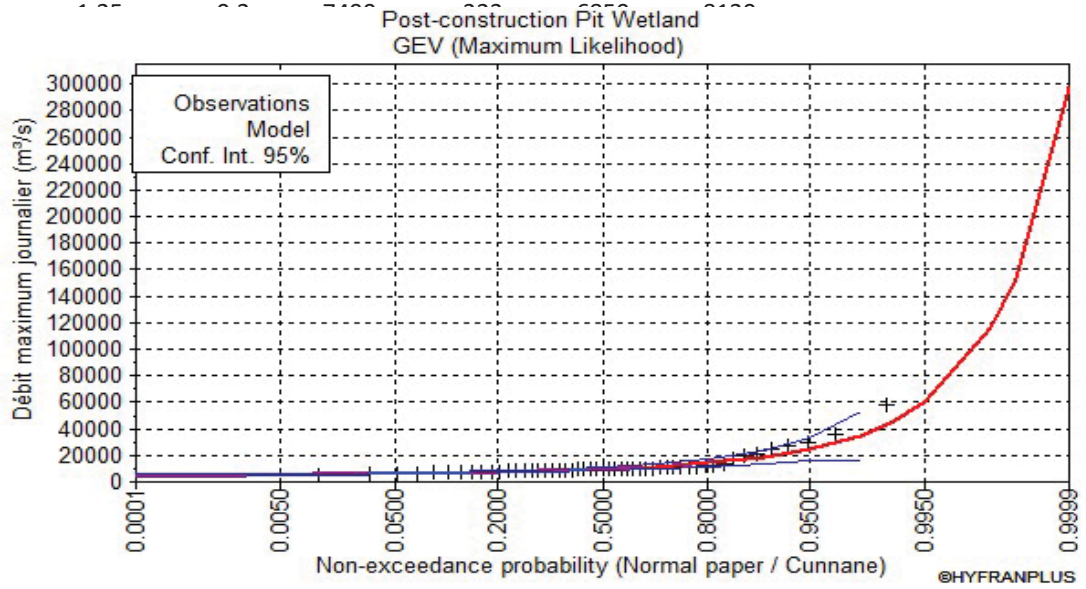
alpha	2688.608
k	-0.41469
u	8647.401

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard d	Confidence interval (95%)	
10000	0.9999	298000	2.69E+05	N/D	N/D
2000	0.9995	154000	1.08E+05	N/D	N/D
1000	0.999	116000	7.12E+04	N/D	N/D
200	0.995	60400	2.56E+04	N/D	N/D
100	0.99	45800	1.59E+04	N/D	N/D
50	0.98	34900	9520	1.62E+04	5.35E+04
20	0.95	24400	4550	1.55E+04	3.33E+04
10	0.9	18600	2470	1.38E+04	2.35E+04
5	0.8	14200	1280	1.17E+04	1.68E+04
3	0.6667	11600	792	1.00E+04	1.31E+04
2	0.5	9710	542	8650	1.08E+04
1.4286	0.3	8170	381	7420	8910



Post-construction Pit Wetland

Results of the fitting

Gumbel (Method of moments)

Number of observations 51

Parameters

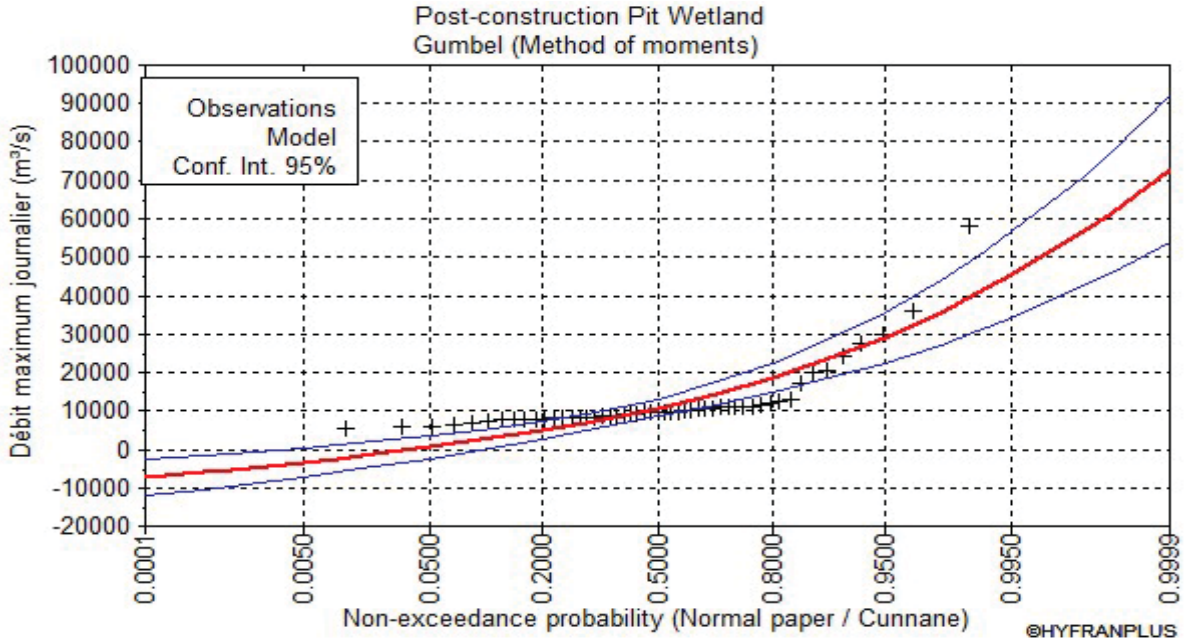
u	8223.936
alpha	7020.428

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard deviation	Confidence interval (95%)	
10000	0.9999	72900	9640	5.40E+04	9.18E+04
2000	0.9995	61600	8000	4.59E+04	7.73E+04
1000	0.999	56700	7290	4.24E+04	7.10E+04
200	0.995	45400	5650	3.43E+04	5.65E+04
100	0.99	40500	4950	3.08E+04	5.02E+04
50	0.98	35600	4250	2.73E+04	4.39E+04
20	0.95	29100	3330	2.26E+04	3.56E+04
10	0.9	24000	2630	1.89E+04	2.92E+04
5	0.8	18800	1950	1.49E+04	2.26E+04
3	0.6667	14600	1470	1.17E+04	1.74E+04
2	0.5	10800	1160	8530	1.31E+04



Post-construction Pit Wetland

Results of the fitting

Pearson type 3 (Method of moments)

Number of observations 51

Parameters

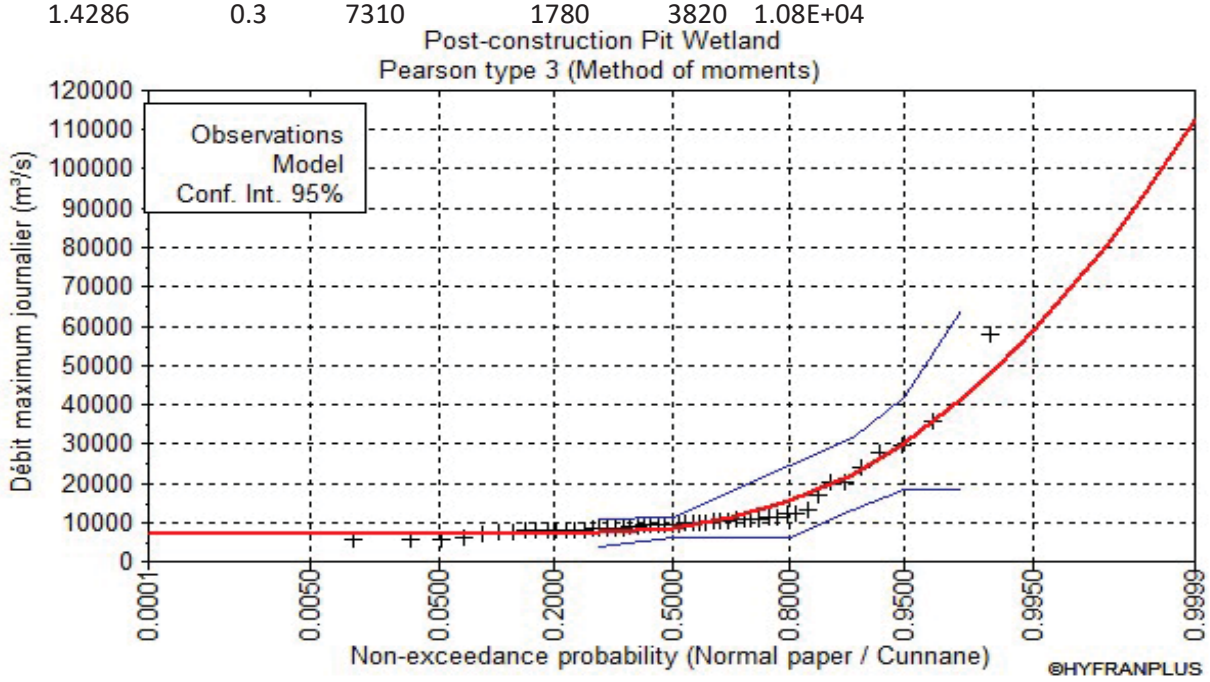
alpha	0.000066
lambda	0.349479
m	6953.339

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard devia	Confidence interval (95%)	
10000	0.9999	113000	6.85E+04	N/D	N/D
2000	0.9995	90100	4.93E+04	N/D	N/D
1000	0.999	80600	4.14E+04	N/D	N/D
200	0.995	59000	2.41E+04	N/D	N/D
100	0.99	50000	1.75E+04	N/D	N/D
50	0.98	41200	1.16E+04	1.85E+04	6.39E+04
20	0.95	30100	6000	1.83E+04	4.19E+04
10	0.9	22300	4720	1.31E+04	3.16E+04
5	0.8	15400	4700	6160	2.46E+04
3	0.6667	11400	3470	N/D	N/D
2	0.5	8580	1300	6040	1.11E+04
1.4286	0.3	7310	1780	3820	1.08E+04



PHASES 1 TO 6

Sub-catchment 1_Post-construction **Phase 1**

Results of the fitting

Pearson type 3 (Method of moments)

Number of observations 8

Parameters

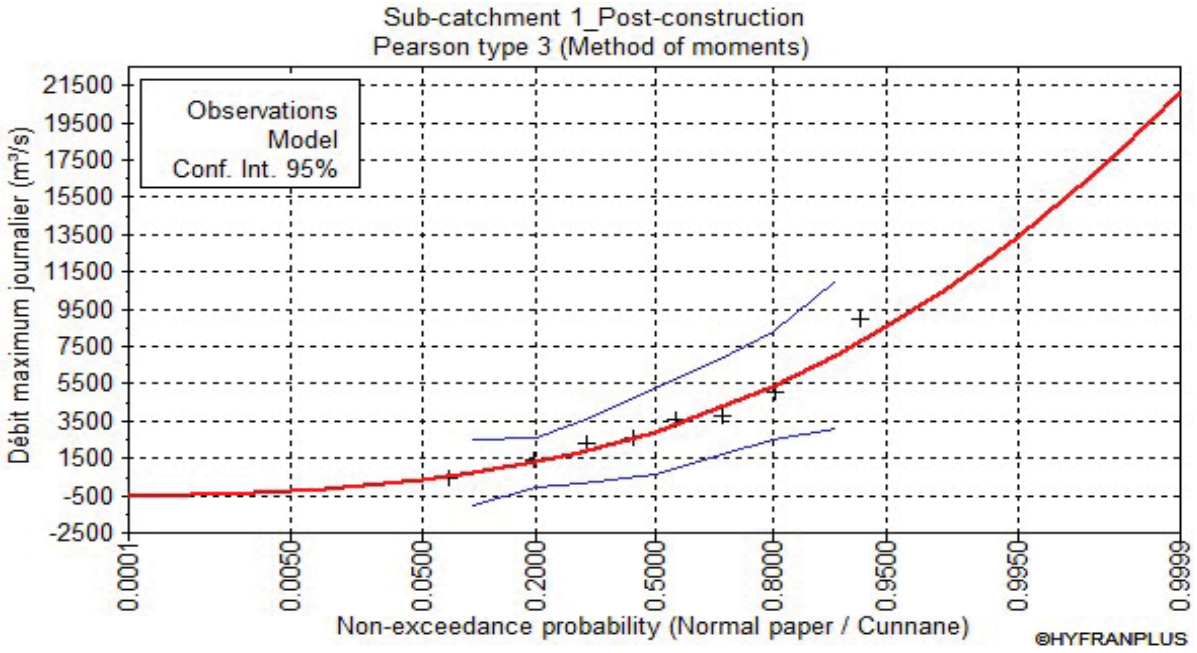
alpha	0.000574
lambda	2.295245
m	-501.29

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard d	Confidence interval (95%)	
10000	0.9999	2.11E+04	1.59E+04	N/D	N/D
2000	0.9995	1.80E+04	1.22E+04	N/D	N/D
1000	0.999	1.67E+04	1.06E+04	N/D	N/D
200	0.995	1.34E+04	7180	N/D	N/D
100	0.99	1.20E+04	5790	N/D	N/D
50	0.98	1.06E+04	4480	N/D	N/D
20	0.95	8590	2940	N/D	N/D
10	0.9	7030	2020	3070	1.10E+04
5	0.8	5390	1480	2500	8280
3	0.6667	4120	1300	1570	6670
2	0.5	2930	1170	636	5230



Sub-catchment 2_Post-construction **Phase 2**

Results of the fitting

Pearson type 3 (Method of moments)

Number of observations 8

Parameters

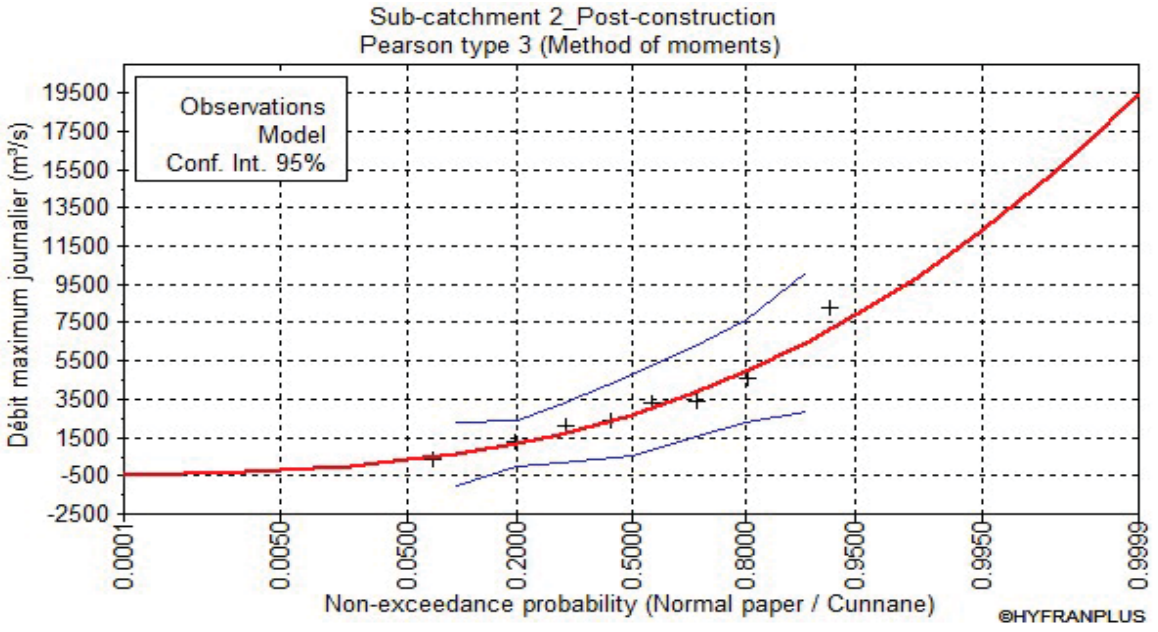
alpha	0.000625
lambda	2.297359
m	-462.16

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard d	Confidence interval (95%)	
10000	0.9999	1.94E+04	1.46E+04	N/D	N/D
2000	0.9995	1.65E+04	1.12E+04	N/D	N/D
1000	0.999	1.53E+04	9740	N/D	N/D
200	0.995	1.23E+04	6590	N/D	N/D
100	0.99	1.10E+04	5310	N/D	N/D
50	0.98	9690	4110	N/D	N/D
20	0.95	7880	2690	N/D	N/D
10	0.9	6460	1850	2820	1.01E+04
5	0.8	4950	1350	2290	7600
3	0.6667	3780	1190	1440	6130
2	0.5	2690	1080	584	4800



Sub-catchment 3_Post-construction **Phase 3**

Results of the fitting

Pearson type 3 (Method of moments)

Number of observations 8

Parameters

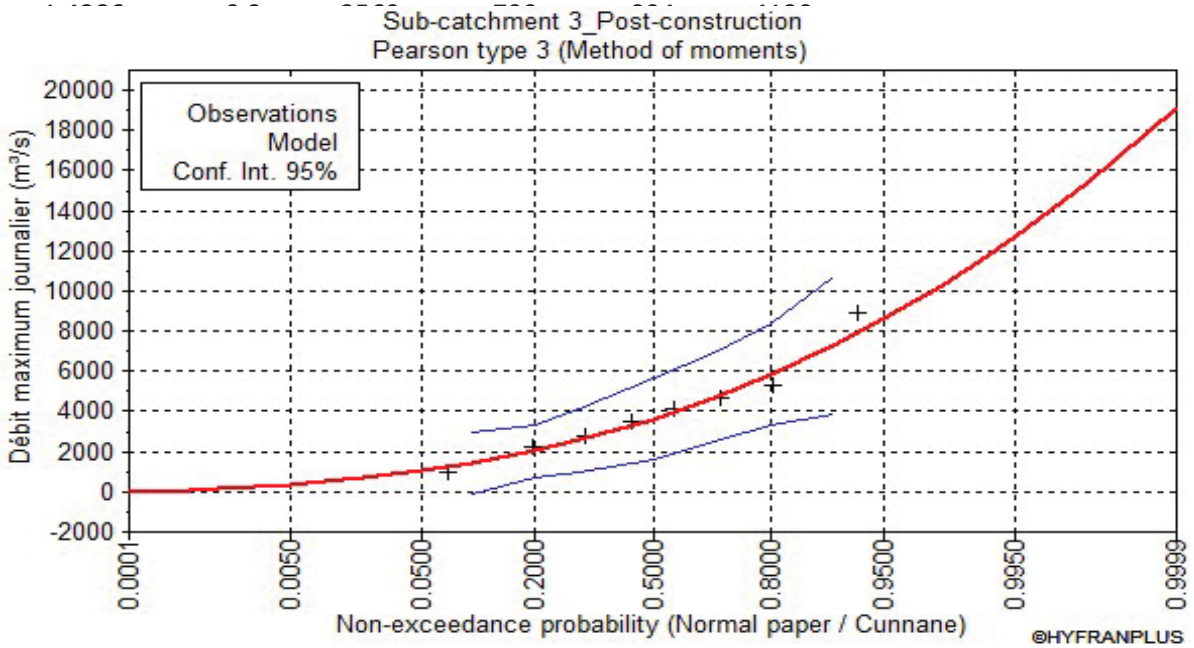
alpha	0.000731
lambda	3.071315
m	-139.727

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard d	Confidence interval (95%)	
10000	0.9999	1.91E+04	1.26E+04	N/D	N/D
2000	0.9995	1.65E+04	9710	N/D	N/D
1000	0.999	1.54E+04	8510	N/D	N/D
200	0.995	1.27E+04	5830	N/D	N/D
100	0.99	1.15E+04	4740	N/D	N/D
50	0.98	1.03E+04	3710	N/D	N/D
20	0.95	8620	2500	N/D	N/D
10	0.9	7280	1750	3840	1.07E+04
5	0.8	5840	1290	3320	8360
3	0.6667	4700	1120	2500	6910
2	0.5	3620	1030	1600	5630



Sub-catchment 4_Post-construction **Phase 4**

Results of the fitting

Pearson type 3 (Method of moments)

Number of observations 8

Parameters

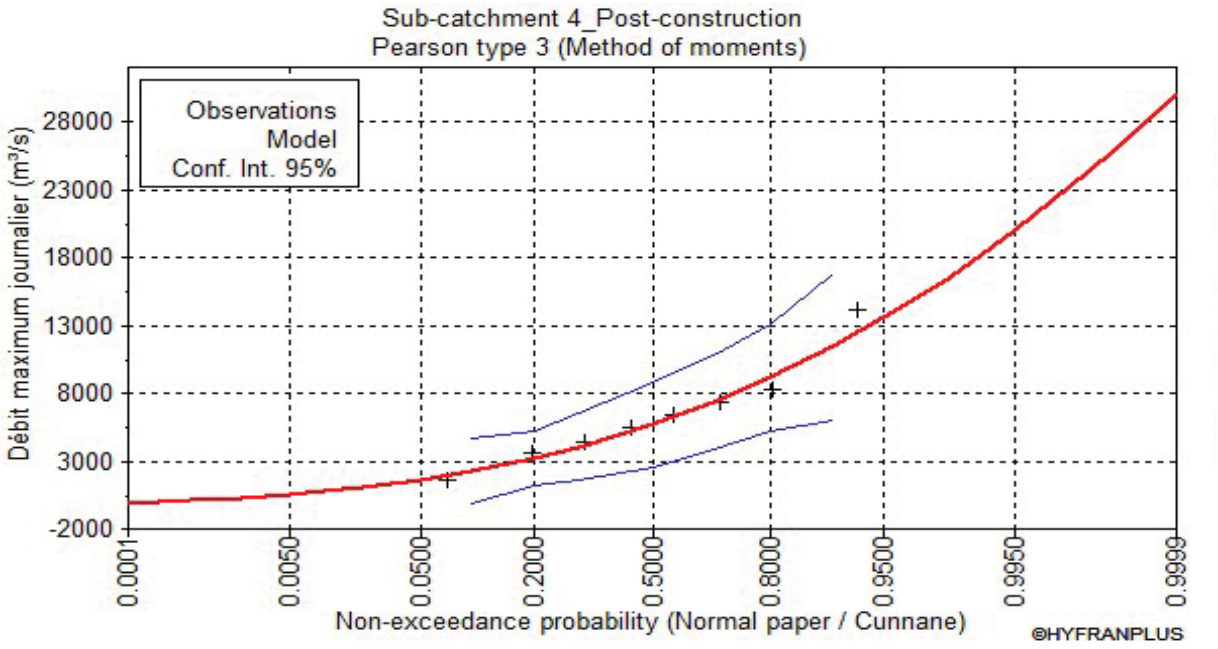
alpha	0.000465
lambda	3.069236
m	-216.922

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard d	Confidence interval (95%)	
10000	0.9999	3.00E+04	1.98E+04	N/D	N/D
2000	0.9995	2.60E+04	1.53E+04	N/D	N/D
1000	0.999	2.42E+04	1.34E+04	N/D	N/D
200	0.995	2.00E+04	9160	N/D	N/D
100	0.99	1.81E+04	7450	N/D	N/D
50	0.98	1.62E+04	5840	N/D	N/D
20	0.95	1.35E+04	3920	N/D	N/D
10	0.9	1.14E+04	2760	6030	1.68E+04
5	0.8	9170	2020	5210	1.31E+04
3	0.6667	7390	1770	3930	1.09E+04
2	0.5	5680	1610	2520	8840



Sub-catchment 5_Post-construction **Phase 5**

Results of the fitting

Pearson type 3 (Method of moments)

Number of observations 8

Parameters

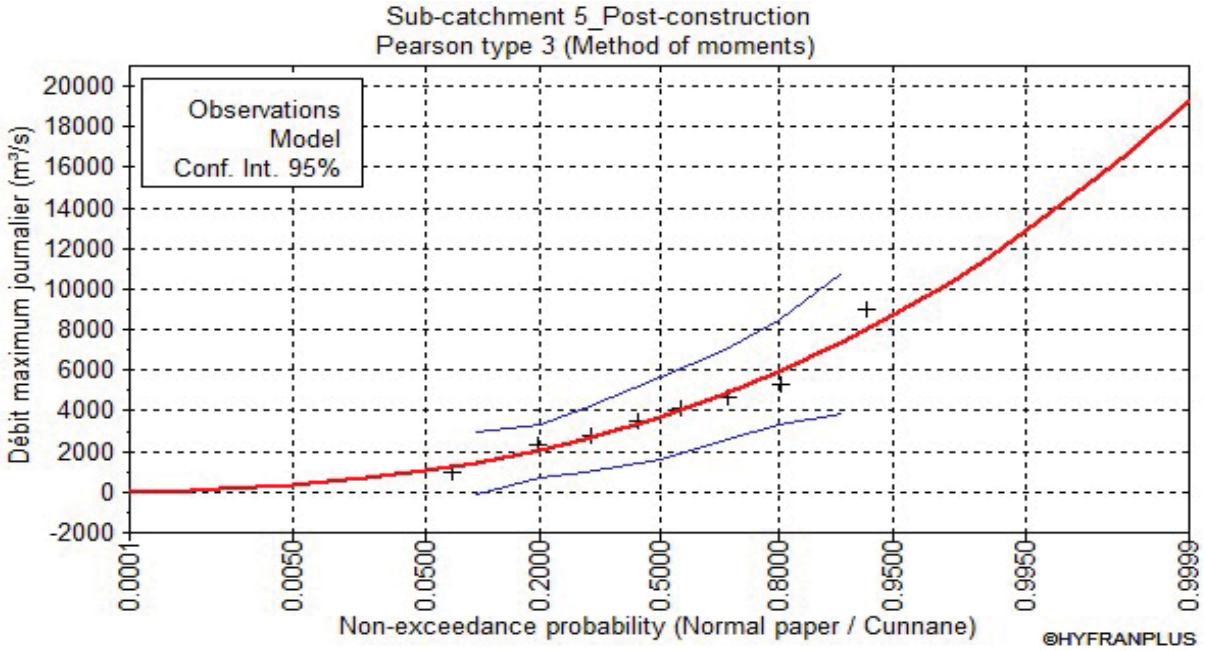
alpha	0.000724
lambda	3.070836
m	-140.496

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard d	Confidence interval (95%)	
10000	0.9999	1.93E+04	1.27E+04	N/D	N/D
2000	0.9995	1.67E+04	9800	N/D	N/D
1000	0.999	1.56E+04	8590	N/D	N/D
200	0.995	1.28E+04	5890	N/D	N/D
100	0.99	1.16E+04	4790	N/D	N/D
50	0.98	1.04E+04	3750	N/D	N/D
20	0.95	8700	2520	N/D	N/D
10	0.9	7350	1770	3880	1.08E+04
5	0.8	5890	1300	3350	8440
3	0.6667	4750	1130	2520	6970
2	0.5	3650	1040	1620	5680



Sub-catchment 6_Post-construction **Phase 6**

Results of the fitting

Pearson type 3 (Method of moments)

Number of observations 8

Parameters

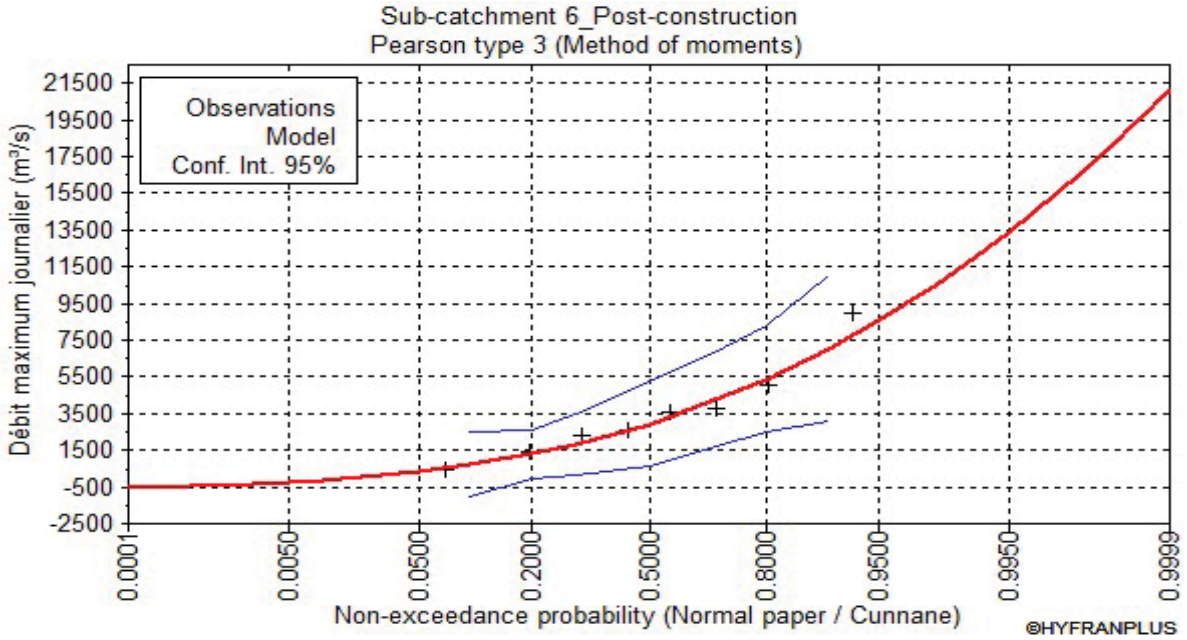
alpha	0.000574
lambda	2.295245
m	-501.29

Quantiles

q = F(X) : non-exceedance probability

T = 1/(1-q)

T	q	XT	Standard d	Confidence interval (95%)	
10000	0.9999	2.11E+04	1.59E+04	N/D	N/D
2000	0.9995	1.80E+04	1.22E+04	N/D	N/D
1000	0.999	1.67E+04	1.06E+04	N/D	N/D
200	0.995	1.34E+04	7180	N/D	N/D
100	0.99	1.20E+04	5790	N/D	N/D
50	0.98	1.06E+04	4480	N/D	N/D
20	0.95	8590	2940	N/D	N/D
10	0.9	7030	2020	3070	1.10E+04
5	0.8	5390	1480	2500	8280
3	0.6667	4120	1300	1570	6670
2	0.5	2930	1170	636	5230



Contact

Jagadish Kayastha
Technical Lead Water Resources
T +1 (403) 819-1129
Jagadish.kayastha@aecom.com

Robin Reese
Technical Leader Permitting
T +1 (403) 270-9283
Robin.leese@aecom.com

aecom.com