Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

CONCEPTUAL STORMWATER AND DRAINAGE MANAGEMENT PLAN

BURNCO WEST COCHRANE #2 GRAVEL PIT
NE ¼ 15-026-05 W5M, N ½ 14-026-05 W5M

Prepared for:
BURNCO ROCK PRODUCTS LTD.

Prepared by:
MATRIX SOLUTIONS INC.

Version 1.0
May 2022
Calgary, Alberta

Suite 600, 214 - 11 Ave. SW
Calgary, AB T2R 0K1
T 403.237.0606 F 403.263.2493
www.matrix-solutions.com

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BURNCO WEST COCHRANE #2 GRAVEL PIT

NE ¼ 15-026-05 W5M, N ½ 14-026-05 W5M

Prepared for BURNCO Rock Products Ltd., May 2022

Pierce Mimura, P.Eng.
Water Resources Engineer

reviewed by

Andrew Chan, M.Sc., P.Eng.
Principal Water Resources Engineer

PERMIT TO PRACTICE
MATRIX SOLUTIONS INC.

RM SIGNATURE: _____

RM APEGA ID #: 069881

DATE: 31 May 2022

PERMIT NUMBER: P005540
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

DISCLAIMER

Matrix Solutions Inc. certifies that this report is accurate and complete and accords with the information available during the project. Information obtained during the project or provided by third parties is believed to be accurate but is not guaranteed. Matrix Solutions Inc. has exercised reasonable skill, care, and diligence in assessing the information obtained during the preparation of this report.

This report was prepared for BURNCO Rock Products Ltd. The report may not be relied upon by any other person or entity without the written consent of Matrix Solutions Inc. and of BURNCO Rock Products Ltd. Any uses of this report by a third party, or any reliance on decisions made based on it, are the responsibility of that party. Matrix Solutions Inc. is not responsible for damages or injuries incurred by any third party, as a result of decisions made or actions taken based on this report.

VERSION CONTROL

Version	Date	Issue Type	Filename	Description
V0.1	30-May-2022	Draft	26388-512x R 2022-05-30 draft V0.1.docx	Issued to client for review
V1.0	31-May-2022	Final	26388-512x R 2022-05-31 final V1.0.docx	Issued to client

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1 INTRODUCTION

BURNCO Rock Products Ltd. (BURNCO) is currently operating the West Cochrane Gravel Pit also known as the McDougall Gravel Pit, which is located approximately 5 km west of Cochrane. The existing gravel pit is located within NW ¼ 13-026-05 W5M (first opened in 2016) and provides aggregate (sand and gravel) to construction projects in the Cochrane and Calgary areas.

This study focusses on West Cochrane #2 Gravel Pit, which is a new disturbance area that will be developed once the existing West Cochrane Gravel Pit is depleted (see Figure 1).

To meet with market needs, BURNCO is proposing to increase the permitted lands to secure the future of these lands and provide a long-term source of aggregate for the Cochrane and Calgary areas. It is envisioned that the West Cochrane #2 Gravel Pit site continue to supply aggregates in the years ahead and will also become a washing location which will provide high quality aggregates for use in asphalt and ready-mix production.

Matrix Solutions Inc. (Matrix) was retained by BURNCO to prepare a Conceptual Stormwater and Drainage Management Plan (SDMP) in association with the new site.

The objectives of this SDMP are to:

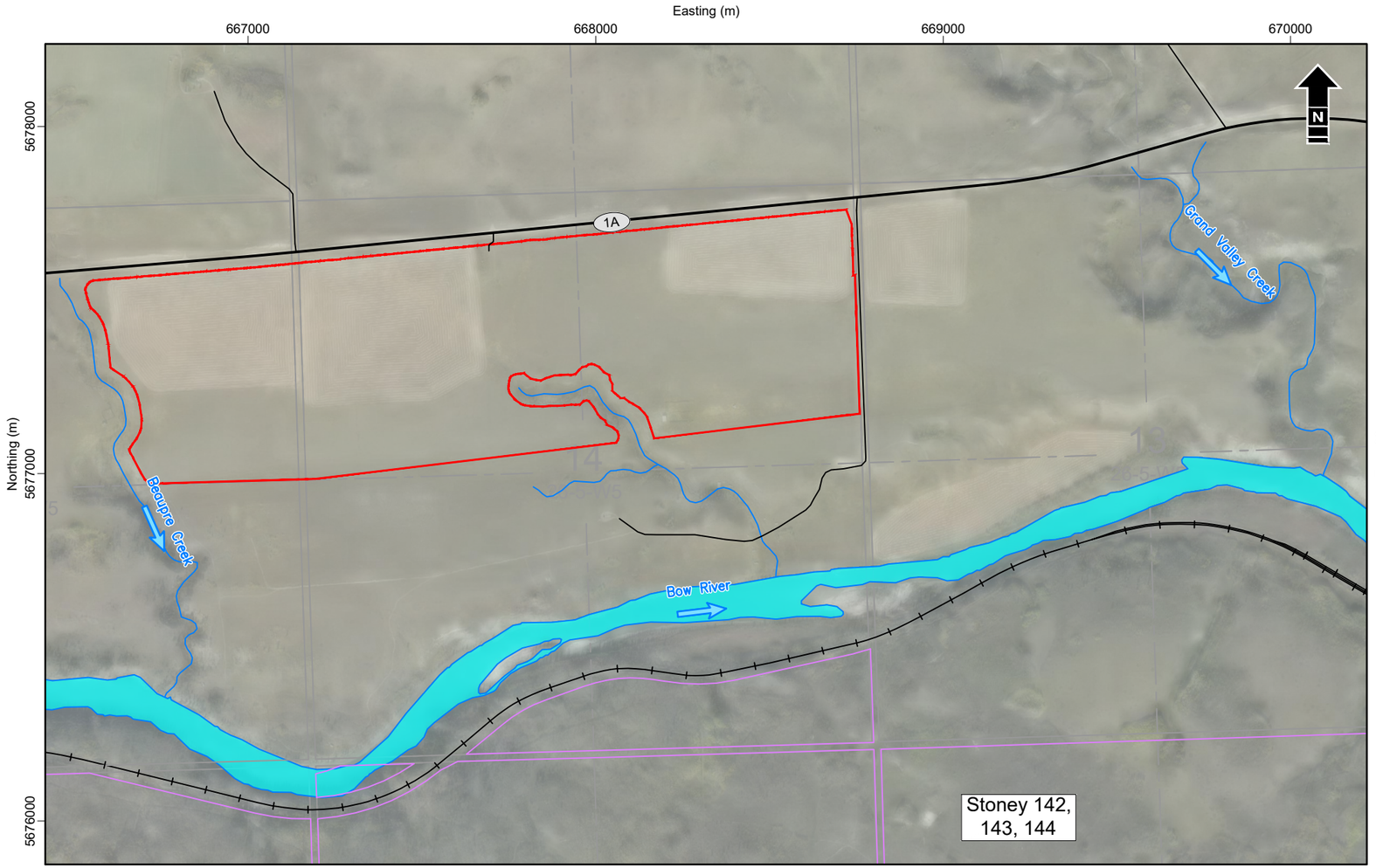
- delineate the watershed boundaries, based on GIS analysis of available Light Detection and Ranging (LiDAR) data and identify existing drainage patterns;
- complete a hydrological assessment of the project site, including pit water, to quantify runoff release rates and volumes; and
- develop an SDMP by locating drainage features to accommodate the collection, conveyance, storage, and discharge of surface drainage.

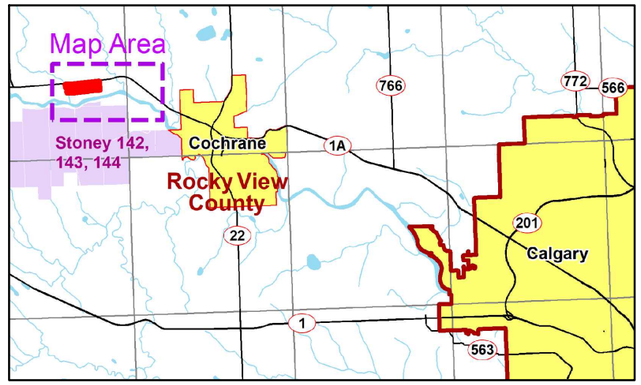
This report has been prepared to support a municipal permit for BURNCO's West Cochrane #2 Gravel Pit as shown on Figure 1.

2 PROJECT DESCRIPTION

2.1 Project Details and Study Area

The West Cochrane #2 Gravel Pit is located approximately 5 km west of Cochrane, Alberta, in Rocky View County. The project area is bounded by Highway 1A to the north. Lands to the south include private properties and the Bow River. The eastern edge of the project area is defined by Range Road 51 and the existing West Cochrane Gravel Pit located in NW ¼ 13-026-05 W5M. The west edge of the project area is Beaupre Creek within NE ¼ 13-026-05 W5M.





Inset
Not to Scale

LEGEND

- West Cochrane #2 Gravel Pit (Disturbance Area)
- Indian Reserve
- Water Body
- Watercourse (Field-Verified)
- Railway
- Highway
- Road

1 : 15,000
metres
150 0 150 300
UTM83-11

Reference: Aerial photograph obtained from Valtus Imagery Services, dated July 20 to October 14, 2013.
Contours derived from LiDAR, provided by Burnco, date unknown.

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BURNCO ROCK PRODUCTS LTD
SURFACE WATER MANAGEMENT PLAN, WEST COCHRANE #2 GRAVEL PIT

LOCATION PLAN

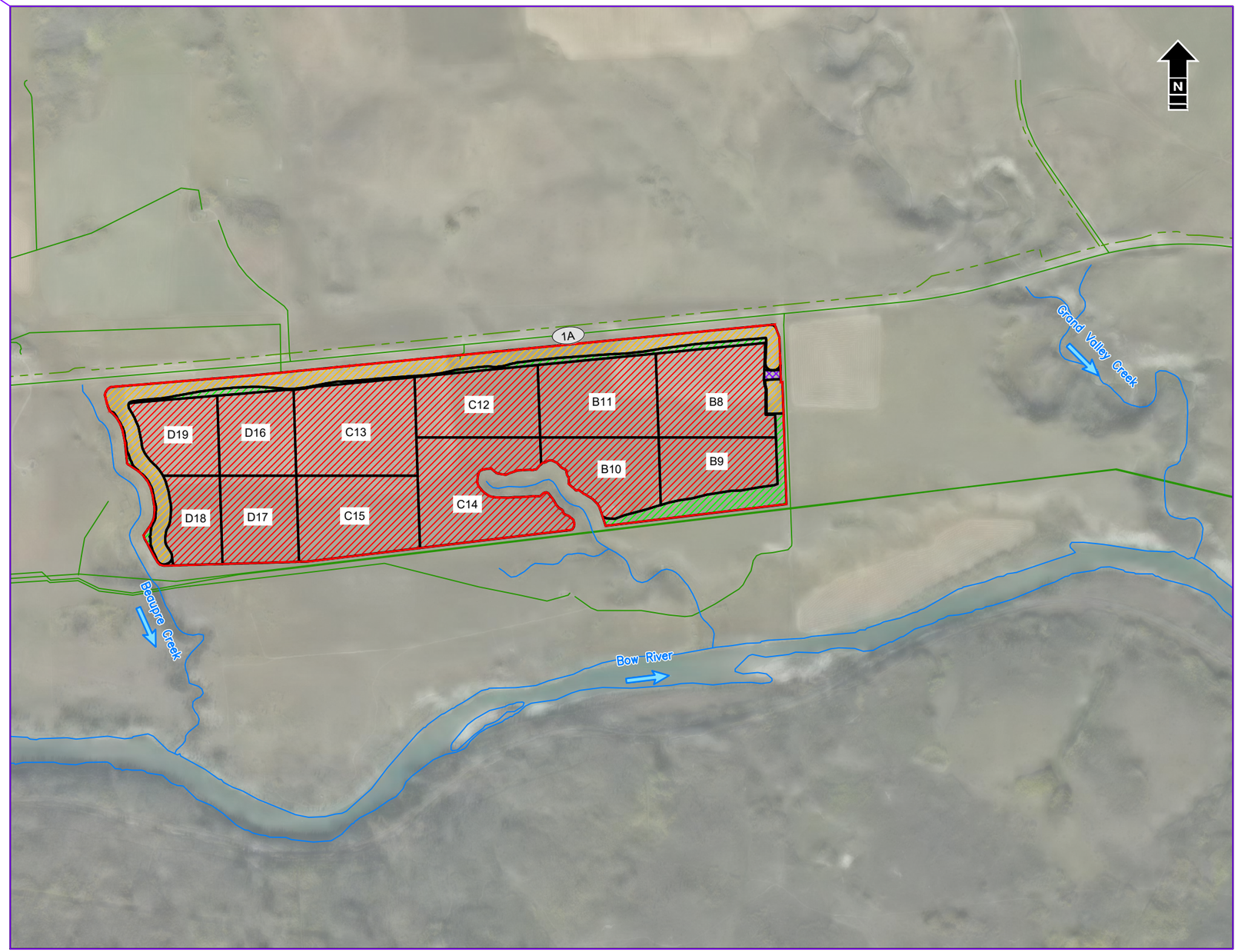
Date:	Project:	Submitter:	Reviewer:
MAY 2022	26388-LP	P. MIMURA	A. SORDI

Figure 1

The site plan with proposed mine phasing is shown on Figure 2. West Cochrane #2 Gravel Pit includes 12 new phases that are expected to be sized, as listed in Table 1.

TABLE 1 Development Phasing

Phase	Mining Area (ha)	Average Elevation (m)	Average Slope (%)
B8	10.55	1182.5	0.79
B9	7.05	1179.1	4.07
B10	7.57	1177.8	3.96
B11	9.89	1183.9	1.82
C12	8.77	1183.7	2.6
C13	12.03	1186.5	1.89
C14	12.81	1179.9	0.57
C15	10.31	1181.3	1.84
D16	6.81	1188.1	2.41
D17	7.12	1183.4	1.79
D18	4.99	1184.4	1.13
D19	6.27	1187.6	2.12



LEGEND

- West Cochrane #2 Gravel Pit (Disturbance Area)
- B1 — Planned Phases
- Planned Visibility Berm
- Planned Borrow Area
- Planned Mining Area
- Planned Access Road
- Flow Drection
- Telus
- Pipeline (Various)

1 : 15,000 metres

150 0 150 300

UTM83-11

Reference: Aerial photograph obtained from Valtus Imagery Services, dated July 20 to October 14, 2013. Contours derived from LiDAR, provided by Burnco, date unknown. Utilities from AltaLis, IHS and GDM.

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SURFACE WATER MANAGEMENT PLAN, WEST COCHRANE #2 GRAVEL PIT

MINE PHASING PLAN

Date:	Project:	Submitter:	Reviewer:
MAY 2022	26388-DA	P. MIMURA	A. CHAN

Figure 2

2.2 Scope of Analysis

The contents of this report as well as its findings are based on the best available information as provided by BURNCO and gathered during the desktop review phase, supplemented by a site visit conducted by Matrix personnel on August 17, 2018. Culvert sizes and locations (external to the site) were approximated by field staff during the site visit but have not been verified by survey.

The scope of work for this stormwater drainage assessment includes the following:

- data, background reports, and regulatory requirements review
- site visit and data collection of existing drainage patterns and hydraulic structures
- desktop assessment of existing regional surface water drainage patterns
- model simulation of pre-development, mining, and post-development (reclaimed) runoff volumes

2.3 Existing Topography and Catchment Areas

The project area is located on a large plateau north of the Bow River. The area consists of predominantly pasture and cultivated land. The lands are generally flat to slightly undulating with an overall gradient to the south toward the flood plain of the Bow River. Two watercourses have been identified near West Cochrane #2 Gravel Pit (Disturbance Area) which is to the west of the existing West Cochrane Gravel Pit; Beaupre Creek and one unnamed watercourse. One wetland has also been identified near the Disturbed Area.

Catchment boundaries were delineated using LiDAR data for the project site (provided by BURNCO) and additional topographical data upstream of the project site (20K digital elevation model data provided by AltaLIS Ltd.).

Highway 1A is located directly north of the Disturbed Area. All offsite drainage originates from areas north of the project site where it crosses the highway, collecting along the highway ditch on the south side of the road prior to entering the project site at various locations. Drainage from these areas flows along the southern highway ditch before entering the Disturbed Area as overland flow at low points along the ditch or via channelized flow through the ditches on either side of existing Range Road 51.

Beaupre Creek has a large upstream catchment area of 3,096 ha, resulting in high flow during flood events. The flow is carried across Highway 1A via a large diameter culvert (approximately 3200 mm) before draining south to the Bow River.

The remainder of the offsite drainage entering the site is conveyed across Highway 1A through several 800 mm diameter culverts (note: all culvert sizes and locations are approximate) and cattle crossings.

The existing drainage for the contributing catchments is shown on Figure 3. Figure 4 shows existing onsite drainage. The total areas and Highway 1A crossing details are summarized in Table 2.

LEGEND

- West Cochrane #2 Gravel Pit (Disturbance Area)
- A1 Existing Drainage Boundary
- Existing Major Ground Contour (50 m Interval)
- Existing Minor Ground Contour (10 m Interval)
- Overland Flow Direction

1 : 50,000 metres

500 0 500 1000

UTM83-11

Reference: Aerial photograph obtained from Valtus Imagery Services, dated July 20 to October 14, 2013. Contours derived from LiDAR, provided by Burnco, date unknown.

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SURFACE WATER MANAGEMENT PLAN, WEST COCHRANE #2 GRAVEL PIT

EXISTING UPSTREAM DRAINAGE

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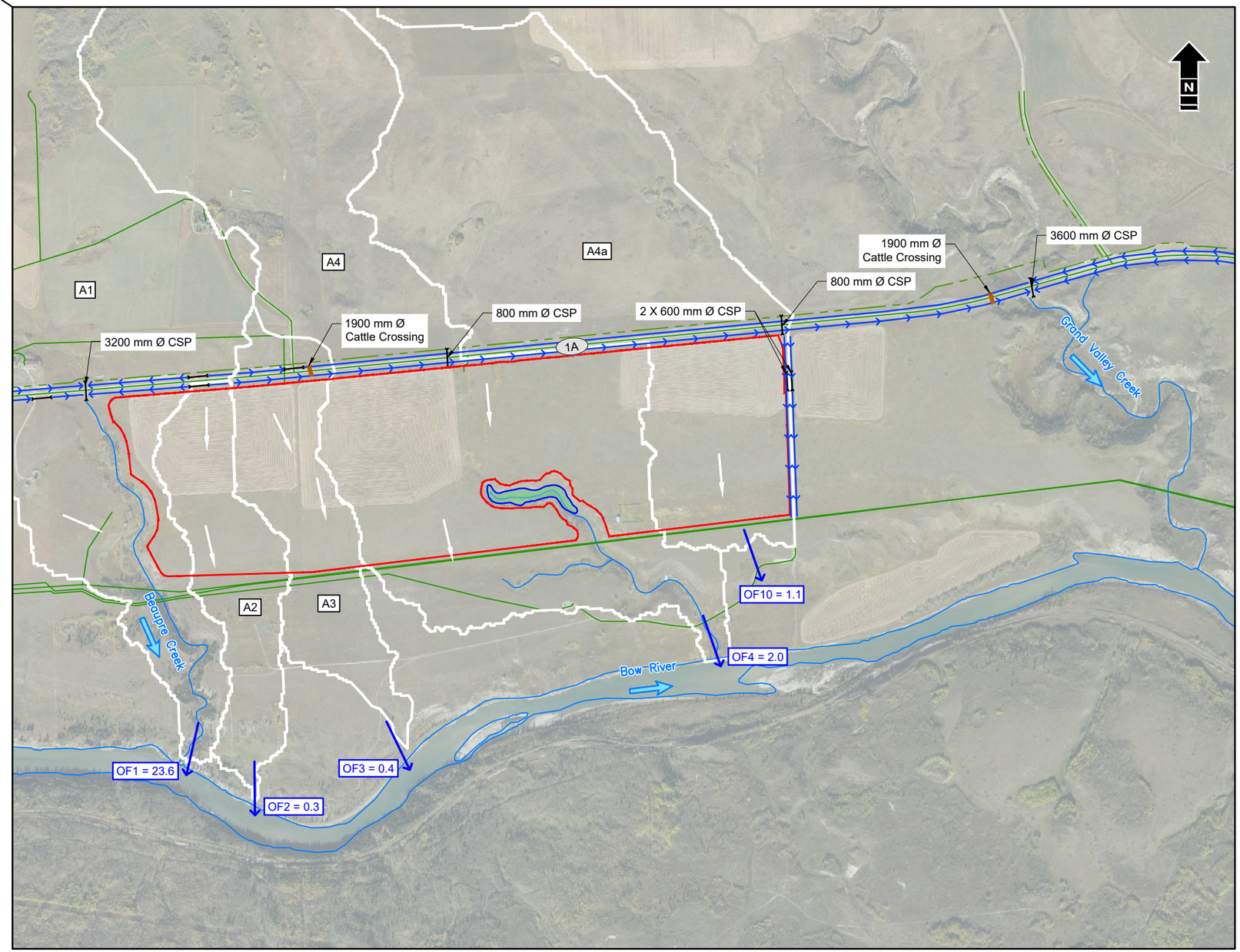
Figure 3



LEGEND

- West Cochrane #2 Gravel Pit (Disturbance Area)
- A1 — Existing Drainage Boundary
- Existing Major Ground Contour (25 m Interval)
- Existing Minor Ground Contour (5 m Interval)
- Existing Wetland
- Existing Culvert
- Existing Cattle Crossing
- Watercourse Flow Direction
- Ditch Flow Path
- Overland Flow Direction
- Telus
- Pipeline (Various)
- 0.28 — 1:100 Year Pre-development Flow Rate (m^3/s)

1 : 15,000 metres

150 0 150 300

UTM83-11

Reference: Aerial photograph obtained from Valtus Imagery Services, dated July 20 to October 14, 2013. Contours derived from LiDAR, provided by Burnco, date unknown. Utilities from AltaLis, IHS and GDM.

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SURFACE WATER MANAGEMENT PLAN, WEST COCHRANE #2 GRAVEL PIT

EXISTING ON-SITE DRAINAGE

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Figure 4

TABLE 2 Existing Drainage Areas

Drainage Area	Drainage Catchment Area (ha)	Disturbed Area within Drainage Area (ha)	Highway 1A Crossing	Onsite Receiving Water Body
A1	3,145.4	6.43	3200 mm dia. culvert	Beaupre Creek
A2	29.7	15.48	N/A	Overland Flow
A3	34.7	17.56	1900 mm dia. cattle crossing	Overland Flow
A4	227.8	58.64	800 mm dia. culvert	Unnamed Watercourse
A4a	131.4	27.69	800 mm dia. culvert	Overland Flow

2.4 Previous Stormwater Studies

A master site drainage plan was completed by Focus Corporation in 2014 for the existing McDougall Gravel Pit (Focus Corporation 2014). No master plans have been approved for the project area; however, the project does fall within the Bow Basin Watershed Management Plan (BRBC 2012), which recommends to limit discharges based on pre-development flow rates and volumes for new developments. Water quality objectives are also important considerations for the Bow River Watershed.

3 DRAINAGE CONCEPTS

This section describes the stormwater management concepts during the mining operation phase and during the post-development (reclaimed) phase.

3.1 Stormwater Management Concepts During Mining

3.1.1 Overview

The proposed stormwater drainage management plan for the project accommodates stormwater runoff from the mining areas as well as expected groundwater inflows to mining operations. This report provides sizing and locations of stormwater management concepts based on current mine planning; any variations in the sizing of development phases or the sizes of recharge pond and/or dewatering excavation may require additional analysis.

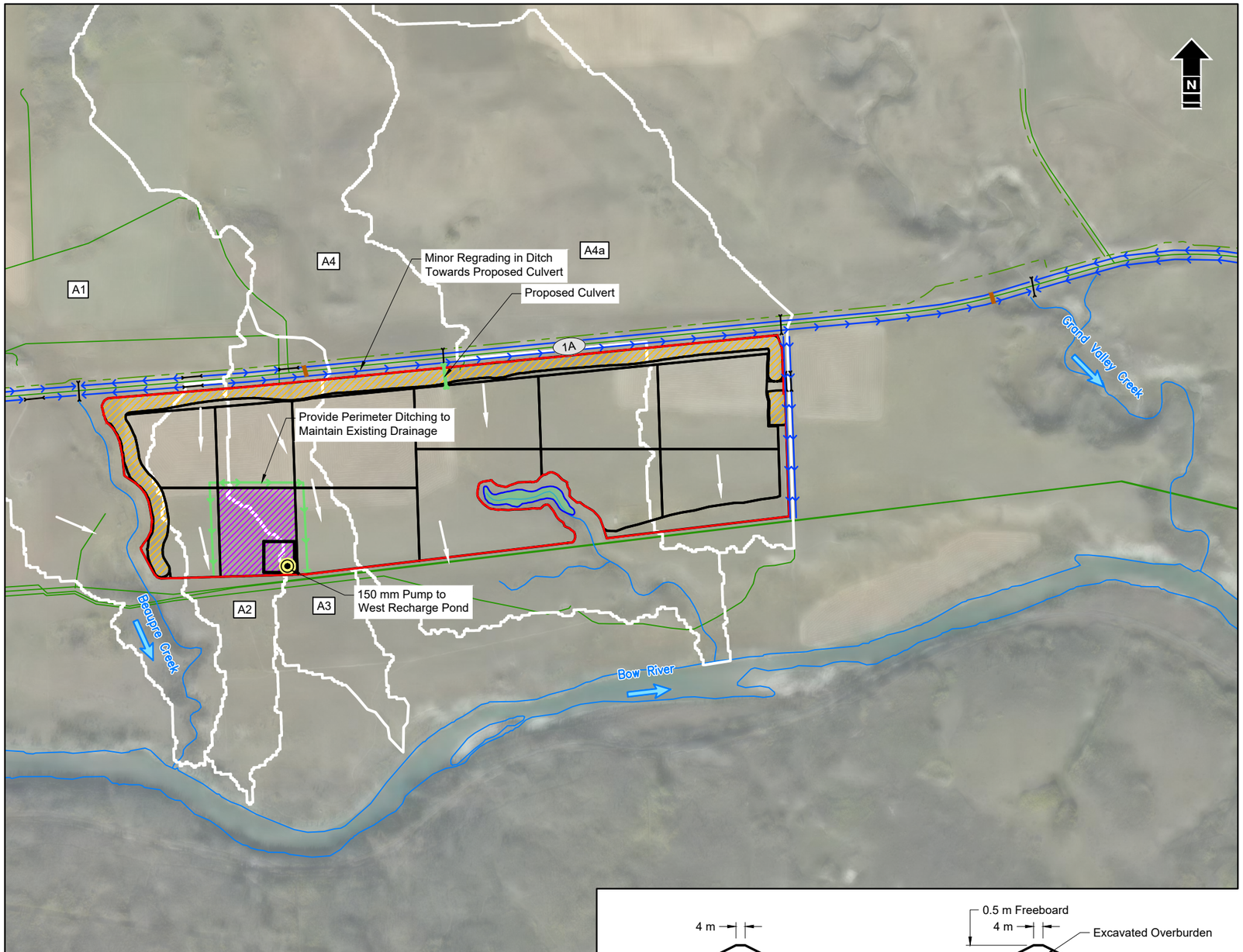
All stormwater runoff from mining areas (contact water) will be collected in dewatering excavation pits located within the mining area and will be pumped to a dedicated recharge pond located a sufficient distance away to allow for groundwater infiltration. Groundwater inflows to mining areas will also be collected in the dewatering excavation pits and pumped to the recharge pond. The recharge pond will be sized to accommodate stormwater runoff volumes from a 1:10 year, 24-hour design storm event plus pit water that would be pumped from the dewatering excavation.

In the event of a storm greater than 1:10 year, 24-hour design storm event, mining operations will be suspended, and any stormwater that exceeds either the pump capacity or recharge pond capacity will

reside in the dewatering excavation and/or mining pit (up to the 1:100 year, 24-hour storm) until water levels are lowered to allow mining operations to resume.

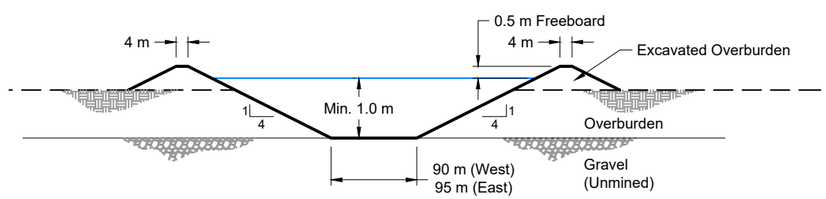
Overland flows from upstream sources (non-contact water) will be directed around active mining operations using interceptor ditches and/or berms. Adequate setback distances will be maintained from Beaupre Creek as well as the one unnamed watercourse identified near the Disturbed Area. Culverts of adequate capacity will be provided through the visibility berm in several locations, to convey the 1:100 year design flows. These culverts should be designed to meet Alberta Transportation requirements for highway culvert crossings. The conceptual stormwater drainage management plan, including proposed culvert locations, is shown on Figure 5.

Plot 1:1 = Tabloid (L)



LEGEND

- West Cochrane #2 Gravel Pit (Disturbance Area)
- A1 — Existing Drainage Boundary
- Existing Major Ground Contour (25 m Interval)
- Existing Minor Ground Contour (5 m Interval)
- Existing Wetland
- Existing Culvert
- Existing Cattle Crossing
- Watercourse Flow Direction
- Existing Ditch Flow Path
- Overland Flow Direction
- Telus
- Pipeline (Various)
- Existing Vegetated Visibility Berm
- Planned Visibility Berm
- Conceptual Active Mining Phase
- Proposed Ditch Flow Direction
- Proposed Culvert
- Proposed Pump



Recharge Pond Cross Section
NOT TO SCALE

1 : 15,000 metres
150 0 150 300
UTM83-11

Note: Figure(s) must be used in conjunction with the attached report and is subject to the limitations and conditions stated in the report.

Reference: Aerial photograph obtained from Valtus Imagery Services, dated July 20 to October 14, 2013. Contours derived from LiDAR, provided by Burnco, date unknown. Utilities from AltaLis, IHS and GDM.

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SURFACE WATER MANAGEMENT PLAN, WEST COCHRANE #2 GRAVEL PIT

CONCEPTUAL STORMWATER DRAINAGE MANAGEMENT PLAN

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Figure 5

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3.1.2 Criteria

The stormwater drainage management plan during mining is based on the following criteria:

- Each mining area will have a dewatering excavation area of adequate size to dewater the mining area. For the purposes of this report, a conservative dewatering excavation area of 6.25 ha is assumed for all mining phases; however, for most phases it is expected that the dewatering excavations will be smaller than 6.25 ha.

- The depth of the dewatering excavation is assumed to be equal to the maximum saturated thickness of the gravel layer in any given mining phase (or 1 m deep in cases where estimated maximum saturated thickness is <1 m). Saturated thickness is shown in Appendix B west of Grand Valley Creek.

- One recharge pond will be developed on the west side of Grand Valley Creek (West Recharge Pond). The exact pond location has not been provided in this report, as the recharge pond will likely need to be relocated as development proceeds to facilitate groundwater infiltration and avoid conflict with active mining operations.

- Only one mine phase is expected to be mined at a time, and each phase will be reclaimed after mining completion. However, the recharge pond has been sized conservatively to contain the maximum expected rates of groundwater inflow into any mining phase plus runoff from a 1:10 year, 24-hour design storm event from the two largest adjoining mining phases west of Grand Valley Creek. An additional 10% buffer has been added to the runoff area to account for uncertainty in the mining boundaries.

- The depth of excavation for the recharge pond will be equal to the overburden depth, and berms will be provided around the pond to provide adequate capacity and to ensure the recharge pond does not receive stormwater runoff from upstream sources. The recharge pond has been sized using conservative scenarios as outlined in Section 4.2 below.

- A freeboard of 0.5 m should be provided.

- During events greater than 1:10 year, 24-hour design storm event, it is expected that mining operations will be suspended and runoff will be contained within the dewatering excavation pit. Pumping from the dewatering excavation pit to the recharge pond will occur, as capacity allows, until mining operations can resume.

- A 150 mm (6 inch) pump with a constant pump rate of 0.032 m^3/s is assumed for modelling purposes.

- Groundwater inflows were estimated based on the hydrogeological analysis. The methodology for calculating groundwater inflows and a summary of the values used in the report is provided in Appendix B.

- No outflow via overland drainage is proposed from the recharge ponds under normal operations.

- Culverts must be provided through the visibility berm to maintain pre-development drainage routes through the Disturbed Area and ensure that there is no increase in offsite flows.

3.2 Post-Development (Reclaimed) Stormwater Management Concepts

The proposed final reclaimed condition is shown on Figure 6 based on a reclaimed land surface provided by BURNCO. Reclamation of the mining site is expected to occur as mining proceeds. Under the reclaimed condition, site drainage for the following areas varies from the existing condition:

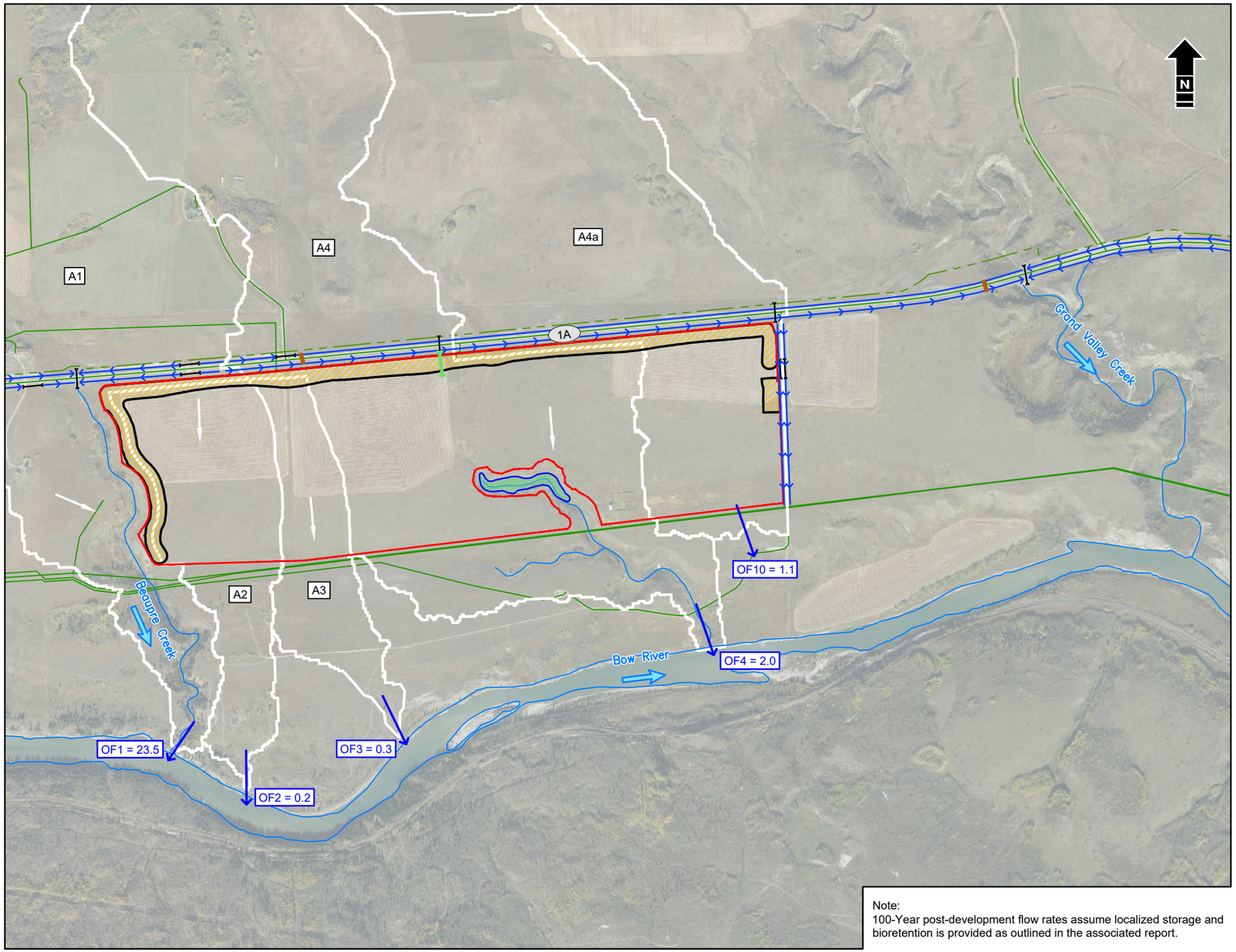
- The onsite drainage areas A2 and A4 increase slightly in size and drainage areas A1 and A3 are slightly reduced.

- A small upstream portion of A3 will be redirected to A4.

- The visibility berms and proposed culverts will remain in place in the reclaimed condition. Culverts must be properly sized and maintained to ensure offsite flows can continue to flow through the Disturbed Area.

- The mining areas will be restored to original condition as much as possible. It is assumed that the reclaimed sites will not be uniformly graded; local depressions and undulations will be provided to mimic existing site conditions.

Table 3 summarizes the drainage areas under the post-development reclaimed condition.



LEGEND

- West Cochrane #2 Gravel Pit (Disturbance Area)
- A1 — Reclaimed Drainage Boundary
- Reclaimed Major Ground Contour (25 m Interval)
- Reclaimed Minor Ground Contour (5 m Interval)
- Existing Wetland
- Existing Culvert
- Existing Cattle Crossing
- Watercourse Flow Direction
- Existing Ditch Flow Path
- Overland Flow Direction
- 0.28 — 1:100 Year Post-development Flow Rate (m^3/s)
- Proposed Ditch Flow Direction
- Proposed Culvert
- Existing Vegetated Visibility Berm
- Planned Visibility Berm
- Telus
- Pipeline (Various)

Note:
100-Year post-development flow rates assume localized storage and bioretention is provided as outlined in the associated report.

1 : 15,000
150 0 150 300 metres
UTM83-11

Reference: Aerial photograph obtained from Valtus Imagery Services, dated July 20 to October 14, 2013. Reclaimed Surface Contours from drawing file 2019-12-10_Surface Models.dwg Provided by the Burnco Rock products Ltd. on 2019-12-10. Utilities from AltaLis, IHS and GDM.

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SURFACE WATER MANAGEMENT PLAN, WEST COCHRANE #2 GRAVEL PIT

POST-DEVELOPMENT (RECLAIMED) ON-SITE DRAINAGE

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MAY 2022	26388-DA	P. MIMURA	A. CHAN

Figure 6

TABLE 3 Post-development (Reclaimed) Drainage Areas

Drainage Area	Drainage Catchment Area (ha)	Disturbed Area within Drainage Area (ha)	Highway 1A Crossing	Onsite Receiving Water Body
A1	3,142.3	2.9	3200 mm dia. culvert	Beaupre Creek
A2	39.4	25.5	N/A	Overland Flow
A3	23.7	11.5	1900 mm dia. cattle crossing	Overland Flow
A4	229.7	56.9	800 mm dia. culvert	Unnamed Watercourse
A4a	133.8	29.0	800 mm dia. culvert	Overland Flow

N/A - not applicable

4 ANALYSIS METHODOLOGY AND DATA

4.1 PCSWMM 2017 Professional

Matrix developed a stormwater computer model using PCSWMM Version 7.4 to assess the runoff and groundwater from both the single event design storm simulations and continuous simulations.

PCSWMM is a decision support system that integrates the full United States Environmental Protection Agency (U.S. EPA) Stormwater Management Model 5.1 (EPA SWMM Version 5.1) hydrology and hydraulics engine with a powerful GIS engine. EPA SWMM is a comprehensive dynamic rainfall-runoff simulation model that is used widely throughout the world in the analysis of complex hydrologic, hydraulic, and water quality problems for urban and rural areas. EPA SWMM, and its SWMM variants, has been used extensively for the simulation of surface runoff, transport of runoff through complex open-channel and closed conduit drainage networks, floodplain analysis, storage and treatment of runoff, soil erosion and sediment transport, and receiving water impacts.

4.2 Modelling Scenarios

The existing condition and post-development (reclaimed) condition were modelled using PCSWMM for the single event design storm analysis (1:10 year, 24-hour and 1:100 year, 24-hour design storms). The existing condition and post-development (reclaimed) condition simulations are used to evaluate any potential changes in runoff rates from existing conditions to reclaimed conditions.

Modelling was completed using PCSWMM for the single event design storm (1:10 year, 24-hour; 1:100 year, 24-hour) and continuous simulation (55 years of hourly data; 1960 - 2014). The modelling results were used to size the proposed recharge pond and assess potential impacts to runoff rates during mining.

Only one mine phase is expected to be mined at a time, the contributing stormwater area has been based on the two largest two adjoining mine phases plus an additional buffer of 10% of the mining area to account for potential overlap in mine phasing as development progresses. The modelled mining scenarios

are summarized in Table 4. Model schematics for models, along with input and output files, are included in Appendix A.

TABLE 4 Modelled Mining Scenario

Mining Scenario	Recharge Pond	Contributing Area (ha)	Maximum Saturated Thickness (m)	Maximum Groundwater Inflow to Dewatering Excavation (Estimated)* (m^3/s)
West Side	West Recharge Pond	25 *(Phase C13 + C15 + 10%)*	2	0.00786

* Groundwater inflows assume a 250 × 250 dewatering excavation.

4.3 Single Event Runoff Simulation

The single event modelling used the 'Chicago' design storm distribution for the 1:10 year, 24-hour and the 1:100 year, 24-hour design storms. The design storms were based on The City of Calgary's recommended Intensity-Duration-Frequency curve parameters in its Stormwater Management and Design Manual (City of Calgary 2011), which are summarized in Tables 5 and 6.

TABLE 5 City of Calgary Adjusted Intensity-Duration-Frequency Parameters

Parameter	Return Period	
	1:10 Year	1:100 Year
a	429.1	663.1
b	2.16	1.87
c	0.707	0.712

TABLE 6 City of Calgary Design Storms

Return Period	Total Precipitation (mm)	Duration (hours)	Timestep (min)
1:10 Year	60.48	24	5
1:100 Year	89.67	24	5

To assess the accuracy of the model, the results were compared against expected results calculated from a regional flood frequency analysis using historical hydrometric data as described in Section 5.1.1.

4.4 Continuous Simulation

Continuous simulation was completed using hourly climate data from January 1, 1960, to December 31, 2014, to simulate 55 years of data.

To assess the results of the model, in all cases where stormwater runoff governed recharge pond sizing, a frequency analysis using HYFRAN software was performed on the model's resulting maximum annual pond volumes. The best distribution was determined based on The City of Calgary's Frequency Analysis Spreadsheet, which completes a regression analysis of the results to determine the statistical distribution which best fits the model output.

4.5 Groundwater Simulations (Initial Dewatering and Mining Operations)

Two short continuous simulations were completed to assess the capacity of the recharge pond to handle the initial dewatering of the mining pits and determine the expected maximum annual groundwater diversion rates. In one scenario, the mining pits were set to an initial depth equivalent to the maximum saturated thickness (as shown in Table 4), to simulate the initial dewatering; in the other scenario, the mining pits were set to an initial depth of 0, and continuous simulation was conducted for 6 months to simulate 6 months of ongoing dewatering during mining operations. In both scenarios, stormwater runoff was set to zero to assess groundwater diversion rates only.

4.6 Model Parameters

4.6.1 General Parameters

The key hydrologic parameters used in the models are summarized in Tables 7 and 8.

TABLE 7 General Subcatchment Runoff Parameters

Parameter	Value	Notes
Infiltration Method	SCS	
Manning's n Impervious Area	0.013	
Manning's n Pervious Area	0.25	
Depression Storage Impervious Area (mm)	1.6	
Depression Storage Pervious Area (mm)	6.0	Similar depression storage in post-development conditions. Depression storage parameter has been increased in post-development condition for areas A2 and A4 to accommodate slightly increased post-development drainage areas.
Impervious Area with No Depression Storage (%)	0	
Pre-development Curve Number	74	Type B/C Soil, Pasture Land, Good Condition (USDA 1986).
Post-development (Reclaimed) Curve Number	76	Assumes reclaimed conditions will be similar, but slightly lower quality, than pre-development conditions.
Mining Scenario Curve Number: Mined areas	84	Type B/C Soil. Composite value assuming approximately 20% gravel access road condition (87) and 80% poor condition open space (83) (USDA 1986).
Mining Scenario Curve Number: Dewatering excavation/recharge pond	100	

TABLE 8 Recharge Pond Parameters

Parameter	Units	Value
Infiltration Method	-	Green-Ampt
Soil Type	-	Sandy Loam
Hydraulic Conductivity	mm/hour	10.92
Suction Head	mm	109.98
Initial Deficit (fraction)	-	0.368

Source: *Soil Characteristics* (CHI 2019)

The assumed pumping rates and startup and shutoff parameters used in the model are summarized in Table 9.

TABLE 9 Pumping Parameters

Parameter	Units	Value
Assumed 150 mm (6 inch) pump rate	m^3/s	0.032
Startup Depth	m	0.1
Shutoff Depth	m	0.01

4.6.2 Climate Parameters

4.6.2.1 Precipitation, Air Temperature, and Wind Speed

The 55-year climate dataset used hourly precipitation, daily temperature, and average monthly evaporation. Hourly precipitation and daily temperature data were obtained from The City of Calgary, for data recorded at Environment Canada's Calgary International Airport climate station (Station ID: 3031093). Average monthly wind speed was obtained from Environment Canada climate normals (1971-2000) from the same station. Average monthly values for precipitation, temperature, and wind speed are summarized in Table 10.

TABLE 10 Average Monthly Precipitation, Temperature, and Wind Speed

Month	Precipitation[1] (mm)	Maximum Daily Air Temperature[1] (°C)	Average Air Temperature[1] (°C)	Minimum Daily Air Temperature[1] (°C)	Average Wind Speed[1] (km/hour)
January	11.6	17.3	-8.5	-38.6	14.8
February	10.6	21.9	-5.8	-36.4	14.6
March	15.8	25.2	-2.3	-32.8	15.0
April	27.4	27.2	4.2	-20.6	16.6
May	56.7	31.3	9.9	-10.0	15.6
June	91.8	33.3	14.0	-1.9	15.6
July	66.0	34.3	16.7	1.7	14.0
August	51.4	34.4	15.8	-2.5	13.2
September	42.2	32.5	11.0	-8.2	14.1
October	17.3	28.7	5.4	-24.4	14.6
November	13.5	22.2	-2.5	-32.9	13.7
December	12.8	19.4	-7.2	-37.8	14.9

Month	Precipitation[1] (mm)	Maximum Daily Air Temperature[1] (°C)	Average Air Temperature[1] (°C)	Minimum Daily Air Temperature[1] (°C)	Average Wind Speed[1] (km/hour)
TOTAL	**416.9**	-	-	-	**14.8**

Sources:
1.The City of Calgary (data range: 1960 - 2014) (City of Calgary 2011)
2. Environment Canada Climate Normals for Station No. 3031093 (data range: 1971 - 2000) (Government of Canada 2018)

For the continuous simulation, the hourly precipitation data obtained from the Calgary International Airport climate station was adjusted upwards to account for higher long-term average precipitation values expected in the study area. To make this adjustment, the total annual precipitation (mm) recorded at the Calgary Airport was compared with interpolated weather data for 025-05 W5M and 025-04 W5M, gathered from interpolated data available from the Alberta Climate Information Service as shown on Figure 7. For the period between 1962 and 2018, the total annual precipitation for the two townships (the data for each township were averaged together) was 24% higher than the total annual precipitation observed at the Calgary International Airport. Based on this result, the hourly climate dataset for the Calgary International Airport was increased by 24% prior to running the simulation.

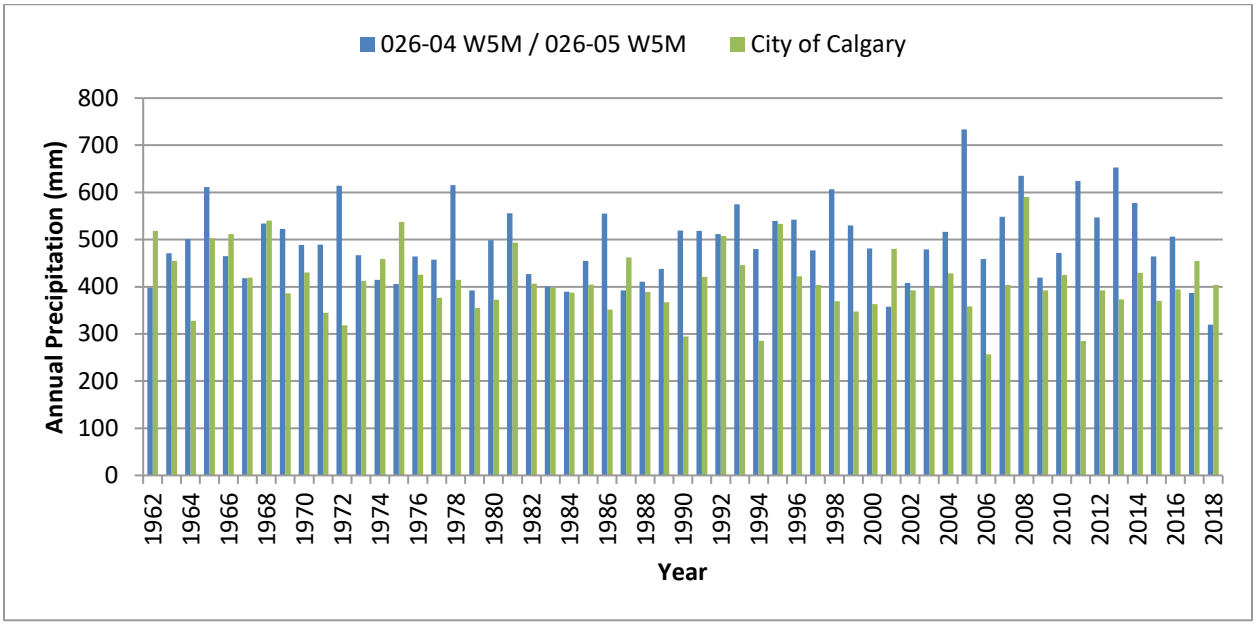

FIGURE 7 Annual Precipitation - Calgary International Airport Versus 026-04/05 W5M

4.6.2.2 Evaporation and Evapotranspiration

Evaporation can occur from open water sources, subsurface water in aquifers, and open channels. For the purposes of the continuous simulation, evaporation loses are largely from open water sources such as the recharge pond and dewatering excavations. As such, monthly values for shallow lake evaporation were used in PCSWMM. The average monthly shallow lake evaporation values used are summarized below in Table 11.

TABLE 11 Average Monthly Shallow Lake Evaporation

Month	Shallow Lake Evaporation[1] (mm)
January	3.5
February	11.2
March	34.6
April	72.5
May	113.0
June	136.7
July	154.9
August	122.9
September	67.4
October	30.3
November	8.3
December	2.3
TOTAL	**757.6**

Source:
1. *Data Table Compendium: Evaporation and Evapotranspiration in Alberta 1912-2009* (data range: 1960 - 2009) (GoA 2013)

4.6.2.3 Snowmelt Parameters

The snowmelt parameters used in PCSWMM are listed below in Table 12.

TABLE 12 Snowmelt and Snowpack Parameters

Parameter	Value
Dividing Temperature Between Snow and Rain (°C)	1
Antecedent Temperature Index weight (fraction)	0.5
Negative Melt Ratio (fraction)	0.6
Elevation above Mean Sea Level	1,000
Latitude	51
Longitude Correction	40
Min. Melt Coefficient (mm/hour/°C)	0.02
Max. Melt Coefficient Plowable/Impervious Area (mm/hour/°C)	0.1
Max. Melt Coefficient Pervious Area (mm/hour/°C)	0.15
Base Temperature (°C)	1
Fraction Free Water Capacity Plowable Area	0.03
Fraction Free Water Capacity Impervious Area	0.08
Fraction Free Water Capacity Pervious Area	0.3

Parameter	Value
Initial Snow Depth Plowable (mm)	0
Initial Snow Depth Impervious/Pervious (mm)	2.7
Initial Free Water Plowable (mm)	0
Initial Free Water Impervious/Pervious (mm)	1.0
Depth of 100% Cover (mm)	0

5 MODELLING RESULTS

5.1 Pre-development Analysis

Pre-development runoff rates were assessed for the 1:10 year and 1:100 year, 24-hour design storm events using PCSWMM and compared with results calculated from a regional flood frequency analysis.

5.1.1 Regional Flood Frequency Analysis

A regional flood frequency analysis was conducted of seven Water Survey of Canada (WSC) streamflow gauging stations within a 25 km radius of the project site. Missing instantaneous flow data was estimated based on maximum daily flow data. The WSC stations selected for the regional assessment are listed below in Table 13.

TABLE 13 Water Survey of Canada Stations

WSC ID	Station Name	Drainage Area (km^2)	Data Period
05BH009	Jumpingpound Creek Near the Mouth	571	1965-2006
05BH015	Jumpingpound Creek at Township Road No. 252	474	2006-2016
05BH013	Jumpingpound Creek Near Cox Hill	36.9	1976-2015
05BG001	Ghost River Near Cochrane	911	1911-1983
05BG006	Waiparous Creek Near the Mouth	333	1966-2014
05BG010	Ghost River Above Waiparous Creek	485	1983-2014
05CB002	Little Red Deer River Near Water Valley	451	1961-2016

Based on a Log-Pearson Type III distribution, the expected 1:10 year and 1:100 year flow rates were calculated for each of the WSC stations listed above. The average 1:10 year and 1:100 year UARR for these seven stations was determined to be 2.77 and 9.96 L/s/ha, respectively, which was applied to the pre-development catchment areas to estimate the pre-development flow rates for the drainage areas associated with the project. Table 14 shows expected flow rates for the full drainage areas; Table 15 shows expected flow rates for the site contributing areas only.

TABLE 14 Pre-development Flow Rates Based on Regional Flood Frequency Analysis

Drainage Area	Total Area (ha)	1:10 Year Flow (m^3/s)	1:100 Year Flow (m^3/s)
A1	3,145.4	8.71	31.33
A2	29.7	0.08	0.30
A3	34.7	0.10	0.35
A4	227.8	0.63	2.27
A4a	131.4	0.36	1.31

TABLE 15 Pre-development Flow Rates Based on Regional Flood Frequency Analysis (Contribution from Site Areas Only)

Drainage Area	Contributing Site Area (ha)	1:10 Year Flow (m^3/s)	1:100 Year Flow (m^3/s)
A1	6.4	0.02	0.06
A2	15.5	0.04	0.15
A3	17.6	0.05	0.17
A4	58.6	0.16	0.58
A4a	27.7	0.08	0.28

5.1.2 PCSWMM Model Results

The pre-development flow rate estimates for areas A1 to A4a are composite values, estimated by summing the expected flows coming from the areas upstream of the project site, flows from within the project boundary, and flows downstream of the project site. The resulting pre-development flow rates are expected to be conservative.

Table 16 outlines the composition of the full catchments to aid in understanding of the PCSWMM model.

TABLE 16 Composite Catchments (PCSWMM Model)

Drainage Area	Upstream Area	Onsite Area	Downstream Area	Outfall
A1	U1	S1	N/A	OF01
A2	US2	S2	D2	OF02
A3	U2b	S3	D3	OF03
A4	U2a	S4	D4	OF04
A4a	U03	S04a	D04a	OF10

N/A - not applicable

The expected 1:10 year UARR for these drainage areas from the PCSWMM model ranged from 2.47 to 3.45 L/s/ha, and the expected 1:100 year UARR ranged from 7.49 to 11.23 L/s/ha, for areas greater than 8 ha, which compares favourably to the calculated UARRs from the regional flood frequency analysis. The pre-development flow rate estimates from the PCSWMM model for each of the individual drainage areas are summarized in Table 17 below, and the flow rate estimates from the site areas are shown in Table 18.

TABLE 17 Pre-development Flow Rates - PCSWMM Model Results

Drainage Area	Outfall	Area (ha)	1:10 Year Flow from PCSWMM (m^3/s)	1:100 Year Flow from PCSWMM (m^3/s)
A1	OF01	3,145.4	7.77	23.57
A2	OF02	29.7	0.09	0.28
A3	OF03	34.7	0.12	0.39
A4	OF04	227.8	0.64	2.00
A4a	OF10	131.4	0.36	1.14

TABLE 18 Pre-development Flow Rates - PCSWMM Model Results (Contribution from Site Areas Only)

Drainage Area	Area (ha)	1:10 Year Flow from PCSWMM (m^3/s)	1:100 Year Flow from PCSWMM (m^3/s)
S1	6.4	0.02	0.01
S2	15.5	0.05	0.15
S3	17.6	0.05	0.17
S4	58.6	0.20	0.68
S4a	27.7	0.08	0.27

5.2 Post-development (Reclaimed) Analysis

5.2.1 PCSWMM Model Results

Post-development (reclaimed) runoff rates were assessed for the 1:10 year and 1:100 year, 24-hour design storm events using PCSWMM and compared against results calculated from the pre-development analysis. These results are summarized in Table 19. The post-development runoff rates assume that the site will not be uniformly graded as local depressions and undulations in grading will be provided to attenuate post-development flows and provide hydraulic grade control (i.e., 6 mm of depression storage is assumed for all onsite areas, equal to what was assumed in the pre-development condition).

As shown in Table 19, without additional mitigation the post-development peak flows are increased in areas A2, A4, and A4a.

To mimic the rates and volumes of the pre-development conditions, the following mitigations are proposed:

- increase the amount of onsite localized depression storage in area A2
- increase the amount of onsite localized depression storage in areas A4 and A4a

The proposed localized depression storage volumes for areas A2, A4, and A4a (represented in total volume and in unit depths) are summarized in Table 20. The depression storage indicated in this table would be spread throughout the onsite area and would be provided through localized depressions and undulations only.

TABLE 19 Post-development (Reclaimed) Flow Rates - Without Mitigations

Drainage Area	Outfall	Pre-Development Area (ha)	Post-Development Area (ha)	Post-Development 1:10 Year Flow PCSWMM (m^3/s)	Change from Pre-Development 1:10 Year Flow PCSWMM (m^3/s)	% Change in 1:10 Year Flow PCSWMM	Post-Development 1:100 Year Flow PCSWMM (m^3/s)	Change from Pre-Development 1:100 Year Flow PCSWMM (m^3/s)	% Change in 1:100 Year Flow PCSWMM
A1	OF01	3,145.4	3,142.3	7.76	-0.01	0.1%	23.53	-0.04	-0.2%
A2	OF02	29.7	39.4	0.13	0.04	44.4%	0.40	0.12	42.8%
A3	OF03	34.7	23.7	0.08	-0.04	-33.3%	0.26	-0.13	-32.1%
A4	OF04	227.8	229.7	0.66	0.03	4.5%	2.09	0.09	4.5%
A4a	OF10	131.4	133.8	0.39	0.03	8.0%	1.22	0.07	6.5%

TABLE 20 Localized Depression Storage Volumes Required for Areas A2, A4, and A4a

Drainage Area	Total Storage Volume to be Provided Through Local Contouring (m^3)	Total Storage Depth over Area (mm)
A2	4,847	19
A4	5,778	10
A4a	2,769	10

With the addition of these mitigation measures the post-development runoff conditions are equal to, or less than, pre-development for all drainage areas. The final post-development (reclaimed) flow rates with these mitigations are summarized in Table 21.

TABLE 21 Post-development (Reclaimed) Flow Rates (with Mitigations)

Drainage Area	Outfall	Pre-Development Area (ha)	Post-Development Area (ha)	Post-Development 1:10 Year Flow PCSWMM (m^3/s)	Change from Pre-Development 1:10 Year Flow PCSWMM (m^3/s)	% Change in 1:10 Year Flow PCSWMM	Post-Development 1:100 Year Flow PCSWMM (m^3/s)	Change from Pre-Development 1:100 Year Flow PCSWMM (m^3/s)	% Change in 1:100 Year Flow PCSWMM
A1	OF01	3,145.4	3,142.3	7.59	-0.18	-2.3%	23.53	-0.04	-0.2%
A2	OF02	29.7	39.4	0.06	-0.03	-37.5%	0.23	-0.05	-17.9%
A3	OF03	34.7	23.7	0.08	-0.04	-31.4%	0.26	-0.13	-33.3%
A4	OF04	227.8	229.7	0.61	-0.02	-3.7%	2.00	0.00	0.0%
A4a	OF10	131.4	133.8	0.36	-0.01	-2.2%	1.11	-0.03	-2.6%

5.3 West Recharge Pond Sizing (During Mining Operations)

The proposed recharge pond was assessed using the 1:10 year, 24-hour design storm event and a continuous simulation of 55 years with a subsequent frequency analysis of inundation to ensure that the recharge pond is adequately sized to accommodate stormwater runoff volumes from a 1:10 year, 24-hour design storm event plus pit water that would be pumped from the dewatering excavation.

5.3.1 PCSWMM Model Results

West Cochrane #2 Gravel Pit assumes a contributing runoff area of 25 ha (equivalent to the size of the two largest two adjoining phases on the west side + 10%) and a maximum saturated depth of 2 m (equivalent to the highest saturated depth in any mine phase on the west side of Grand Valley Creek and therefore the highest possible groundwater inflow rate in the western portion of the site). This scenario was analyzed using PCSWMM as described in Section 4 above with one 150 mm (6 inch) pump.

The model indicates that a recharge pond with a base area of 8,100 m^2 (assuming 4:1 (H:V) side slopes) would be sufficient to handle both pumped groundwater inflows and runoff from the 1:10 year, 24-hour storm on the west side of Grand Valley Creek.

The recommended minimum recharge pond size, based on the modelling scenario outlined above, is summarized below in Table 22.

TABLE 22 Recharge Pond Stage-Storage Relationship

Depth (m)	Area (m^2)	Volume (m^3)	Notes
West Recharge Pond - 90 m × 90 m bottom; Sideslope (H:1V): 4			
0	8,100	0	Bottom
0.5	8,836	4,234	
1.0	9,604	8,844	Design Depth
1.5	10,404	13,846	Freeboard

The pond capacity and expected maximum volume, based on the 1:10 year continuous simulation, is summarized in Table 24. An approximate breakdown showing the proportion of stormwater versus groundwater volume is shown in Table 23.

TABLE 23 West Recharge Pond Design Volumes for 1:10 Year Storm Event Plus Groundwater Inflow

Depth (m)	Volume (m^3)	Maximum 1:10 Year Design Volumes (Based on Pond Base Areas from Table 23 and Maximum Pumping Rate from Table 9) (m^3)	Approximate Stormwater vs. Groundwater Volumes	
			Stormwater Volume (m^3)	Groundwater Volume (m^3)
1.5*	13,878	6,960	4,750	2,210

* West Recharge Pond depth is based on volume required for initial dewatering outlined in Section 5.4 below.

As previously indicated, the recharge pond is sized to provide adequate storage capacity from both the 1:10 year, 24-hour design storm event and constant groundwater inflows to the pits. An additional 0.5 m of freeboard is recommended above the pond design depth of 1.0 m. The additional freeboard will allow for the initial dewatering volume to be adequately handled in the West Recharge Pond as illustrated in Section 5.4.

For events greater than the 1:10 year, 24-hour design storm event, mining operations will be suspended, and any runoff that exceeds the capacity of the pumps and/or recharge pond capacity will be collected in the dewatering excavation and/or mining pit, which is assumed to have sufficient capacity for the 1:100 year, 24-hour design storm event.

5.4 Groundwater Diversion Rates (During Initial Dewatering and Mining Operations)

Simulations were completed with no stormwater inputs to investigate groundwater diversion rates during initial dewatering and during mining operations. These simulations were used to determine expected maximum annual diversion rates, maximum daily pumping rates, and to confirm that the proposed recharge pond would have capacity to support the initial dewatering operations.

5.4.1 PCSWMM Results - Initial Dewatering Phase

In the initial dewatering phase, the initial depth of water in the dewatering pits is assumed to be equal to the maximum saturated depth on either side of Grand Valley Creek (i.e., the dewatering pit in the west mining scenario has an initial depth of 2 m). It is assumed that continuous pumping would be completed using a 150 mm (6 inch) pump with a maximum pump rate of 0.032 m^3/s. No stormwater runoff is included in this scenario; however, ongoing groundwater inflows are included based on the maximum saturated depth west of Grand Valley Creek, as illustrated in Table 4.

The model results indicate that the West Recharge Pond at 90 m × 90 m would require a depth of 1.22 m (above the deign depth but within the 0.5m freeboard) to contain the initial dewatering volume.

Based on these assumptions, initial dewatering of the West Cochrane #2 Gravel Pit is expected to take approximately 89 days.

TABLE 24 West Recharge Pond Design Volume for Initial Dewatering

Maximum Design Volume (Based on Pond Base Areas from Table 23 and Maximum Pumping Rate from Table 9) (m^3)	Minimum Number of Pumping Days
11,000	89

The model results indicate that the expected total diversion volumes during the initial dewatering phase to the West Recharge Pond is 244,486 m^3.

These volumes assume continuous pumping at a maximum rate of 0.032 m^3/s, giving a maximum daily diversion rate of 2,765 m^3/day.

5.4.2 PCSWMM Results - During Mining Operations

During ongoing mining operations, a simulation was conducted assuming dewatering would occur over a period of 6 months per year (183 days). To determine the groundwater diversion rates after dewatering, the initial depth of water in the dewatering pits is assumed to be equal to 0 m. It is assumed that pumping would be completed using a 150 mm (6 inch) pump with a maximum pump rate of 0.032 m^3/s. No stormwater runoff is included in this scenario; however, ongoing groundwater inflows are included, based on the maximum saturated depth west of Grand Valley Creek, as illustrated in Table 4.

The model results indicate that the expected maximum annual groundwater diversion rate to the West Recharge Pond is 123,100 m^3, assuming a maximum of six months of dewatering per year.

This volume assumes intermittent pumping at a maximum rate of 0.032 m^3/s, giving an average daily diversion rate of 722 m^3/day to the West Recharge Pond.

5.4.3 Summary of Groundwater Diversion Rates

The total annual diversion rate is summarized in Table 25. These results provide the expected maximum diversion rates assuming that the initial dewatering as well as six months of ongoing dewatering would occur in the same year, based on the expected maximum groundwater inflow rates.

TABLE 25 Annual Groundwater Diversion Rates

	Maximum Annual Groundwater Diversion Volume (m^3)		
Pond	During Initial Dewatering Phase	During Ongoing Mining (Assuming 6 months of dewatering)	Total
West Recharge Pond	244,486	123,100	367,586

6 CONCLUSIONS AND RECOMMENDATIONS

The West Cochrane #2 Gravel Pit is located approximately 5 km west of Cochrane, Alberta in Rocky View County. BURNCO will develop this site once the existing West Cochrane Gravel Pit is depleted and it will be used for long-term future operations.

The stormwater management and drainage recommendations provided in this report ensure that the overall drainage strategy for BURNCO's West Cochrane #2 Gravel Pit will meet both present and future

requirements for the site. Further investigation may be required as mining operations proceed, including detailed design for culverts and/or interceptor drainage ditches to ensure upstream flows can continue to be directed through the Disturbed Area.

6.1 Stormwater Management During Mining

The overall drainage strategy for the site during mining is to capture stormwater runoff from mining areas (contact water) in the dewatering excavation pits and pump this stormwater to a dedicated recharge pond. Groundwater inflows to mining areas will also be collected in the dewatering excavation pits and pumped to the recharge pond. The recharge pond will be sized to accommodate stormwater runoff volumes from a 1:10 year, 24-hour design storm event plus pit water that would be pumped from the dewatering pit. No direct discharge of contact water is planned. Overland flows from upstream sources (non-contact water) will be directed around active mining operations using interceptor ditches and/or berms.

6.1.1 Recommended Recharge Pond

One recharge pond will be located west of Grand Valley Creek. For events greater than the 1:10 year, 24-hour design storm, mining operations will be suspended, and any stormwater that exceeds either the pump capacity or recharge pond capacity will reside in the dewatering excavation and/or mining pit (up to the 1:100 year, 24-hour storm) until water levels are lowered to allow mining operations to resume.

The sizing and location of the West Recharge Pond is summarized in Table 26 below.

TABLE 26 Recommended West Recharge Pond Design

Parameters	Recharge Pond
Minimum Base Pond Area Size (m^2)	8,100
Minimum Base Width (assuming square geometry) (m)	90
Volume (m^3) at Design Depth	8,844
Design Depth (m)	1.0
Freeboard (m)	0.5
Side Slope	4

6.1.2 Overland Flows from Upstream Sources

Overland flows from upstream sources will continue to pass through the Disturbed Area via proposed culverts through the visibility berm and will be directed around active mining operations using interceptor ditches and/or berms. An adequately sized culvert should be provided to allow overland flow from the existing 800 mm corrugated steel pipe culvert crossing Highway 1A to continue to flow overland from the upstream portion of A4 to the unnamed creek onsite. The small upstream area of A3 that crosses the highway via the cattle crossing can be directed to the unnamed creek onsite via minor grading north of the visibility berm.

Appropriate erosion and sediment control measures should be provided downstream of the proposed culverts, and adequate setback distances should be maintained from Beaupre Creek as well as one unnamed watercourse identified near the Disturbed Area.

6.1.3 Emergency Releases

Temporary authorizations to release water may need to be obtained from AEP for events greater than 1:100 year design storm should water levels in the dewatering excavation pit or recharge pond become excessive. These authorizations would be subject to water quality standards for discharge as stipulated by AEP in the *Code of Practice for Pits* (GoA 2004). Adequate erosion and sediment control would be required for any overland releases (i.e., releases that do not discharge directly into the river), and the release rate must not exceed the minimum pre-development 1:100 year UARRs for the project site (7.49 L/s/ha).

6.2 Post-development (Reclaimed) Stormwater Management

In the final reclaimed condition, the drainage patterns are expected to have minimal impact on the surrounding area, provided the following recommendations are implemented:

- Because visibility berms will remain in place, the proposed culvert must be adequately sized and adequately maintained to ensure upstream flows can continue to flow through the Disturbed Area after mining is completed.

- To ensure that post-development runoff rates are equal to or less than pre-development runoff rates, localized depression storage must be provided as follows:

    - The site will not be uniformly graded; local depressions and undulations will be provided to attenuate post-development flows and provide hydraulic grade control.

    - The local depressions and undulations are critical in areas A2 and A4, where the onsite drainage areas have increased. Specific volume targets have been provided for these areas in Table 20.

- Adequate erosion and sediment control measures must be implemented to minimize downstream impacts.

7 REFERENCES

Bow River Basin Council (BRBC). 2012. *Bow Basin Watershed Management Plan, 2012*. Land Use, Headwaters,Wetlands, Riparian Lands, Water Quality.

CHI. 2019. *Soil Characteristics*. https://support.chiwater.com/77766/soil-characteristics

Focus Corporation. 2014. *McDougall Gravel Pit, NW 13-26-5 W5M, Mater Site Drainage Plan (Revised)*. Prepared for BURNCO Rock Products Ltd. Rocky View County, Alberta. November 2014.

Government of Alberta (GoA). 2013. *Data Table Compendium: Evaporation and Evapotranspiration in Alberta 1912-2009*. Edmonton, Alberta. April 2013. 2013. http://environment.gov.ab.ca/info/library/8938.pdf.

Government of Alberta (GoA). 2004. *Code of Practice for Pits*. Alberta Queen's Printer. Edmonton, Alberta. September 1, 2004. http://www.qp.alberta.ca/documents/Codes/PITS.pdf

Government of Canada. 2018. *Historical Data*. Modified July 20, 2018. http://climate.weather.gc.ca/historical_data/search_historic_data_e.html

Matrix Solutions Inc. (Matrix). 2019. *Biophysical Impact Assessment, Burnco West Cochrane Gravel Pit, NE ¼ 15-026-05 W5M to SE ¼ 17-026-04 W5M*. Version 1.0. Prepared for BURNCO Rock Products Ltd. Calgary, Alberta. September 2019.

City of Calgary. 2011. *Stormwater Management & Design Manual*. Calgary, Alberta. September 2011. http://www.calgary.ca/PDA/pd/Documents/urban_development/bulletins/2011-stormwater-management-and-Design.pdf

United States Department of Agriculture (USDA). 1986. *Urban Hydrology for Small Watersheds, TR-55*. June 1986. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044171.pdf

APPENDIX A
PCSWMM Output Files

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LIST OF FIGURES

1 PRE-DEVELOPMENT MODEL

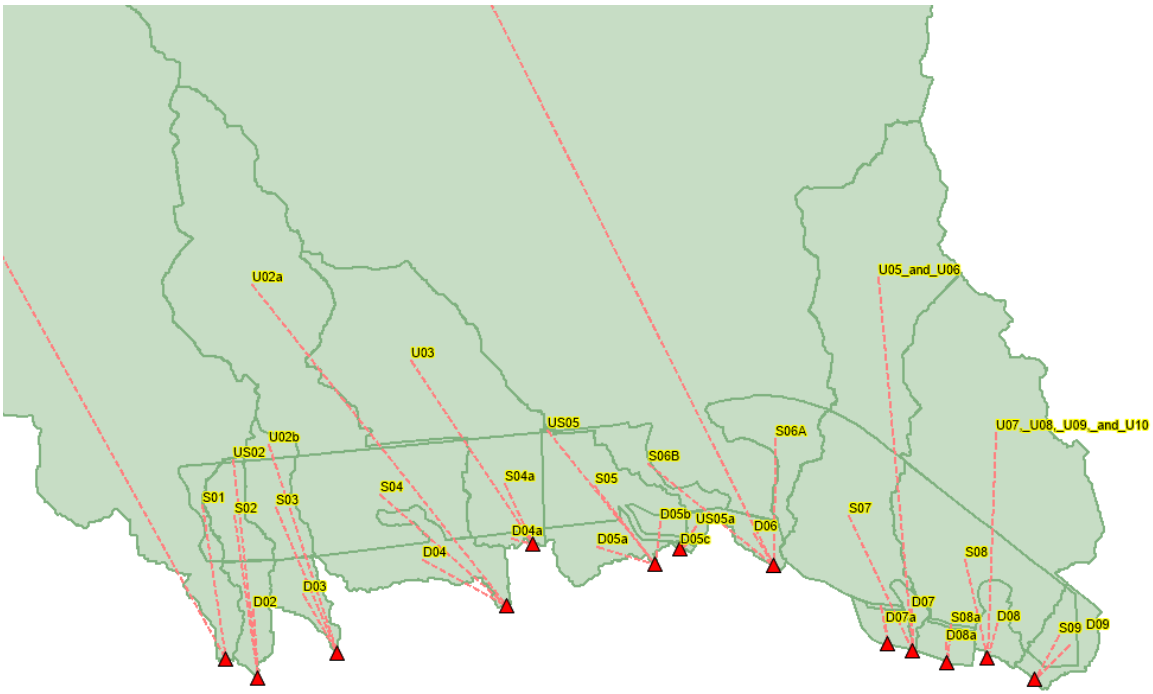

FIGURE A1 Pre-development Model Schematic

1.1 Burnco Pre-development 100 Year Event Simulation

```
  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------

  This model is the single event pre-development model for the 2021 Burnco Report
update (2 scenarios are modelled the 1:10 year 24 hour and the 1:100 year 24 hour)


  *************
  Element Count
  *************
  Number of rain gages ...... 3
  Number of subcatchments ... 37
  Number of nodes ........... 13
  Number of links ........... 0
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                      Data       Recording
  Name                 Data Source                    Type       Interval
  ------------------------------------------------------------------------
```

```
  100yr-24hr           Calgary_24h_100y              INTENSITY    5 min.
  10Yr-24hr            Calgary_24h_10y               INTENSITY    5 min.
  50yr-24hr            Calgary_24h_50y               INTENSITY    5 min.


  ********************
  Subcatchment Summary
  ********************
  Name                         Area     Width   %Imperv    %Slope Rain Gage
Outlet
  ------------------------------------------------------------------------------
-----------------------
  D02                         13.86    286.98      0.00    2.7000 10Yr-24hr
OF2
  D03                         12.17    449.00      0.00    1.4000 10Yr-24hr
OF3
  D04                         30.42    742.00      0.00    1.4000 10Yr-24hr
OF4
  D04a                         3.27    348.08      0.00    0.6900 10Yr-24hr
OF10
  D05a                        16.78    851.73      0.00    1.5000 10Yr-24hr
OF5
  D05b                         4.25    424.60      0.00    1.5000 10Yr-24hr
OF5
  D05c                         0.21     89.26      0.00    2.4300 10Yr-24hr
OF11
  D06                          8.40    373.38      0.00   13.7000 10Yr-24hr
OF6
  D07                          3.62    210.46      0.00   12.6000 10Yr-24hr
OF7
  D07a                         6.76    307.45      0.00   13.4200 10Yr-24hr
OF12
  D08                         10.36    811.68      0.00   12.5000 10Yr-24hr
OF8
  D08a                         7.22    355.76      0.00   14.0400 10Yr-24hr
OF13
  D09                          8.71    248.63      0.00    3.4000 10Yr-24hr
OF9
  S01                          6.43    204.78      0.00    3.9000 10Yr-24hr
OF1
  S02                         15.48    323.26      0.00    2.4000 10Yr-24hr
OF2
  S03                         17.56    392.82      0.00    2.5000 10Yr-24hr
OF3
  S04                         58.64   1526.98      0.00    3.4000 10Yr-24hr
OF4
  S04a                        27.68    642.34      0.00    2.1000 10Yr-24hr
OF10
  S05                         32.89    763.13      0.00    2.1000 10Yr-24hr
OF5
  S05a                         0.42    104.17      0.00    5.3700 10Yr-24hr
OF11
  S06A                        25.82    938.87      0.00    5.4000 10Yr-24hr
OF6
  S06B                        13.24    696.95      0.00    2.3000 10Yr-24hr
OF6
  S07                         61.86   1154.16      0.00    1.4000 10Yr-24hr
OF7
  S07a                         0.63    223.57      0.00   25.5200 10Yr-24hr
OF12
  S08                         56.04   1425.88      0.00    5.9000 10Yr-24hr
OF8
```

```
  S08a                      0.70     69.80      0.00    0.5000 10Yr-24hr
OF13
  S09                       9.17    267.26      0.00    3.8000 10Yr-24hr
OF9
  U01_and_D01            3138.90  20211.85      0.00   10.8000 10Yr-24hr
OF1
  U02a                    138.77   1104.86      0.00    8.4000 10Yr-24hr
OF4
  U02b                      5.00    455.00      0.00    6.5000 10Yr-24hr
OF3
  U03                     100.41   1186.88      0.00    4.8000 10Yr-24hr
OF10
  U04                    9042.70  38349.03      0.00   11.2000 10Yr-24hr
OF6
  U05_and_U06             115.94    936.51      0.00    8.2000 10Yr-24hr
OF7
  U07,_U08,_U09,_and_U10     126.65   1332.45      0.00    7.1000 10Yr-24hr
OF8
  US02                      0.32    160.90      0.00    2.4000 10Yr-24hr
OF2
  US05                      0.15     77.05      0.00    1.0300 10Yr-24hr
OF5
  US05a                     2.30    115.05      0.00   18.0000 10Yr-24hr
OF11


  ************
  Node Summary
  ************
                                        Invert      Max.     Ponded    External
  Name                  Type             Elev.     Depth      Area    Inflow
  ------------------------------------------------------------------------------
  OF1                   OUTFALL           0.00      0.00       0.0
  OF10                  OUTFALL           0.00      0.00       0.0
  OF11                  OUTFALL           0.00      0.00       0.0
  OF12                  OUTFALL           0.00      0.00       0.0
  OF13                  OUTFALL           0.00      0.00       0.0
  OF2                   OUTFALL           0.00      0.00       0.0
  OF3                   OUTFALL           0.00      0.00       0.0
  OF4                   OUTFALL           0.00      0.00       0.0
  OF5                   OUTFALL           0.00      0.00       0.0
  OF6                   OUTFALL           0.00      0.00       0.0
  OF7                   OUTFALL           0.00      0.00       0.0
  OF8                   OUTFALL           0.00      0.00       0.0
  OF9                   OUTFALL           0.00      0.00       0.0


  ********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  ********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... CMS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
```

```
  Flow Routing ..... NO
  Water Quality ..... NO
Infiltration Method ..... CURVE_NUMBER
Surcharge Method ..... EXTRAN
Starting Date ..... 11/13/2018 00:00:00
Ending Date ..... 11/20/2018 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:05:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......       789.596        60.166
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........       590.830        45.020
Surface Runoff ...........       182.328        13.893
Final Storage ............        16.445         1.253
Continuity Error (%) .....        -0.001


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       182.328      1823.295
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       182.328      1823.295
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000


***************************
Subcatchment Runoff Summary
***************************

-----------------------------------------------------------------------------------------
-----------------------------------------
                           Total      Total      Total      Total     Imperv
Perv      Total       Total     Peak  Runoff
                         Precip      Runon       Evap      Infil     Runoff
Runoff     Runoff      Runoff   Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm
mm         mm    10^6 ltr      CMS
-----------------------------------------------------------------------------------------
-----------------------------------------
  D02                      60.17       0.00       0.00      43.42       0.00
15.47      15.47        2.14     0.04   0.257
  D03                      60.17       0.00       0.00      43.03       0.00
15.88      15.88        1.93     0.04   0.264
  D04                      60.17       0.00       0.00      43.73       0.00
15.17      15.17        4.62     0.09   0.252
  D04a                     60.17       0.00       0.00      42.18       0.00
16.72      16.72        0.55     0.01   0.278
```

D05a			60.17	0.00	0.00	42.55	0.00
16.35	16.35	2.74	0.07	0.272			
D05b			60.17	0.00	0.00	41.91	0.00
17.00	17.00	0.72	0.02	0.283			
D05c			60.17	0.00	0.00	41.10	0.00
17.81	17.81	0.04	0.00	0.296			
D06			60.17	0.00	0.00	41.69	0.00
17.21	17.21	1.45	0.05	0.286			
D07			60.17	0.00	0.00	41.56	0.00
17.34	17.34	0.63	0.02	0.288			
D07a			60.17	0.00	0.00	41.69	0.00
17.22	17.22	1.16	0.04	0.286			
D08			60.17	0.00	0.00	41.43	0.00
17.49	17.49	1.81	0.07	0.291			
D08a			60.17	0.00	0.00	41.63	0.00
17.28	17.28	1.25	0.04	0.287			
D09			60.17	0.00	0.00	42.77	0.00
16.14	16.14	1.41	0.03	0.268			
S01			60.17	0.00	0.00	42.55	0.00
16.36	16.36	1.05	0.03	0.272			
S02			60.17	0.00	0.00	43.53	0.00
15.38	15.38	2.38	0.05	0.256			
S03			60.17	0.00	0.00	43.36	0.00
15.54	15.54	2.73	0.05	0.258			
S04			60.17	0.00	0.00	42.90	0.00
16.02	16.02	9.39	0.20	0.266			
S04a			60.17	0.00	0.00	43.45	0.00
15.45	15.45	4.28	0.08	0.257			
S05			60.17	0.00	0.00	43.45	0.00
15.45	15.45	5.08	0.10	0.257			
S05a			60.17	0.00	0.00	41.15	0.00
17.77	17.77	0.07	0.00	0.295			
S06A			60.17	0.00	0.00	42.22	0.00
16.68	16.68	4.31	0.11	0.277			
S06B			60.17	0.00	0.00	42.29	0.00
16.62	16.62	2.20	0.06	0.276			
S07			60.17	0.00	0.00	44.30	0.00
14.62	14.62	9.04	0.16	0.243			
S07a			60.17	0.00	0.00	40.91	0.00
18.02	18.02	0.11	0.01	0.299			
S08			60.17	0.00	0.00	42.57	0.00
16.34	16.34	9.16	0.22	0.272			
S08a			60.17	0.00	0.00	42.42	0.00
16.50	16.50	0.12	0.00	0.274			
S09			60.17	0.00	0.00	42.66	0.00
16.24	16.24	1.49	0.03	0.270			
U01_and_D01			60.17	0.00	0.00	44.39	0.00
14.52	14.52	455.83	7.75	0.241			
U02a			60.17	0.00	0.00	44.19	0.00
14.71	14.71	20.42	0.36	0.245			
U02b			60.17	0.00	0.00	41.50	0.00
17.40	17.40	0.87	0.03	0.289			
U03			60.17	0.00	0.00	43.95	0.00
14.96	14.96	15.02	0.27	0.249			
U04			60.17	0.00	0.00	45.39	0.00
13.52	13.52	1222.60	18.79	0.225			
U05_and_U06			60.17	0.00	0.00	44.19	0.00
14.72	14.72	17.07	0.30	0.245			
U07,_U08,_U09,_and_U10			60.17	0.00	0.00	43.80	0.00
15.12	15.12	19.14	0.35	0.251			
US02			60.17	0.00	0.00	41.08	0.00
17.84	17.84	0.06	0.00	0.297			

```
  US05                      60.17       0.00       0.00      41.17       0.00
17.74      17.74        0.03     0.00   0.295
  US05a                     60.17       0.00       0.00      41.56       0.00
17.36      17.36        0.40     0.01   0.288


  Analysis begun on:  Fri Nov 19 10:01:34 2021
  Analysis ended on:  Fri Nov 19 10:01:35 2021
  Total elapsed time: 00:00:01
```

1.2 Burnco Pre-development Continuous Simulation

```
  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  ---------------------------------------------------------------


  *************
  Element Count
  *************
  Number of rain gages ...... 3
  Number of subcatchments ... 38
  Number of nodes ........... 13
  Number of links ........... 0
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                        Data       Recording
  Name                 Data Source                      Type       Interval
  ------------------------------------------------------------------------
  100yr-24hr           Calgary_24h_100y                 INTENSITY    5 min.
  10Yr-24hr            Calgary_24h_10y                  INTENSITY    5 min.
  Precip_1960-2014     C:\Users\pmimura\OneDrive - Matrix Solutions Inc\Remote Access
to Desktop and Documents from OneDrive\Desktop\Burnco 2021 Update\PCSWMM
Data\Climatology Data From 2020 Model\Precip60_14_V5.dat


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width   %Imperv    %Slope Rain Gage
Outlet
  ------------------------------------------------------------------------------------
------------------------
  D02                       13.86    286.98      0.00    2.7000 Precip_1960-2014
OF2
  D03                       12.17    449.00      0.00    1.4000 Precip_1960-2014
OF3
  D04                       30.42    742.00      0.00    1.4000 Precip_1960-2014
OF4
```

D04a	3.27	348.08	0.00	0.6900	Precip_1960-2014
OF10					
D05	26.10	1324.77	0.00	1.5000	Precip_1960-2014
OF5					
D05a	16.78	851.73	0.00	1.5000	Precip_1960-2014
OF5					
D05b	4.25	424.60	0.00	1.5000	Precip_1960-2014
OF5					
D05c	0.21	89.26	0.00	2.4300	Precip_1960-2014
OF11					
D06	8.40	373.38	0.00	13.7000	Precip_1960-2014
OF6					
D07	3.62	210.46	0.00	12.6000	Precip_1960-2014
OF7					
D07a	6.76	307.45	0.00	13.4200	Precip_1960-2014
OF12					
D08	10.36	811.68	0.00	12.5000	Precip_1960-2014
OF8					
D08a	7.22	355.76	0.00	14.0400	Precip_1960-2014
OF13					
D09	8.71	248.63	0.00	3.4000	Precip_1960-2014
OF9					
S01	6.43	204.78	0.00	3.9000	Precip_1960-2014
OF1					
S02	15.48	323.26	0.00	2.4000	Precip_1960-2014
OF2					
S03	17.56	392.82	0.00	2.5000	Precip_1960-2014
OF3					
S04	58.64	1526.98	0.00	3.4000	Precip_1960-2014
OF4					
S04a	27.68	642.34	0.00	2.1000	Precip_1960-2014
OF10					
S05	32.89	763.13	0.00	2.1000	Precip_1960-2014
OF5					
S05a	0.42	104.17	0.00	5.3700	Precip_1960-2014
OF11					
S06A	25.82	938.87	0.00	5.4000	Precip_1960-2014
OF6					
S06B	13.24	696.95	0.00	2.3000	Precip_1960-2014
OF6					
S07	61.86	1154.16	0.00	1.4000	Precip_1960-2014
OF7					
S07a	0.63	223.57	0.00	25.5200	Precip_1960-2014
OF12					
S08	56.04	1425.88	0.00	5.9000	Precip_1960-2014
OF8					
S08a	0.70	69.80	0.00	0.5000	Precip_1960-2014
OF13					
S09	9.17	267.26	0.00	3.8000	Precip_1960-2014
OF9					
U01_and_D01	3138.90	20211.85	0.00	10.8000	Precip_1960-2014
OF1					
U02a	138.77	1104.86	0.00	8.4000	Precip_1960-2014
OF4					
U02b	5.00	455.00	0.00	6.5000	Precip_1960-2014
OF3					
U03	100.41	1186.88	0.00	4.8000	Precip_1960-2014
OF10					
U04	9042.70	38349.03	0.00	11.2000	Precip_1960-2014
OF6					
U05_and_U06	115.94	936.51	0.00	8.2000	Precip_1960-2014
OF7					

```
  U07,_U08,_U09,_and_U10     126.65   1332.45      0.00    7.1000 Precip_1960-2014
OF8
  US02                       0.32    160.90       0.00    2.4000 Precip_1960-2014
OF2
  US05                       0.15     77.05       0.00    1.0300 Precip_1960-2014
OF5
  US05a                      2.30    115.05       0.00   18.0000 Precip_1960-2014
OF11
```

```
  ************
  Node Summary
  ************
                                          Invert      Max.     Ponded    External
  Name                 Type                Elev.     Depth      Area    Inflow
  ---------------------------------------------------------------------------
  OF1                  OUTFALL             0.00      0.00       0.0
  OF10                 OUTFALL             0.00      0.00       0.0
  OF11                 OUTFALL             0.00      0.00       0.0
  OF12                 OUTFALL             0.00      0.00       0.0
  OF13                 OUTFALL             0.00      0.00       0.0
  OF2                  OUTFALL             0.00      0.00       0.0
  OF3                  OUTFALL             0.00      0.00       0.0
  OF4                  OUTFALL             0.00      0.00       0.0
  OF5                  OUTFALL             0.00      0.00       0.0
  OF6                  OUTFALL             0.00      0.00       0.0
  OF7                  OUTFALL             0.00      0.00       0.0
  OF8                  OUTFALL             0.00      0.00       0.0
  OF9                  OUTFALL             0.00      0.00       0.0
```

```
  **********************
  Rainfall File Summary
  **********************
  Station    First        Last         Recording   Periods    Periods    Periods
  ID         Date         Date         Frequency  w/Precip    Missing    Malfunc.
  ---------------------------------------------------------------------------
  3031093    01/02/1960   12/29/2014      60 min     40313          0          0
```

```
  ********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  ********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... CMS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... YES
    Groundwater ............ NO
    Flow Routing ........... NO
    Water Quality .......... NO
  Infiltration Method ...... CURVE_NUMBER
  Surcharge Method ......... EXTRAN
  Starting Date ............ 01/01/1960 00:00:00
  Ending Date .............. 12/31/2014 23:59:00
  Antecedent Dry Days ...... 0.0
```

```
  Report Time Step ......... 01:00:00
  Wet Time Step ............ 00:05:00
  Dry Time Step ............ 00:30:00


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Initial Snow Cover .......         0.000         0.000
  Total Precipitation ......    367434.415     27942.148
  Evaporation Loss .........     40528.830      3082.081
  Infiltration Loss ........    305734.130     23250.049
  Surface Runoff ...........     21229.976      1614.468
  Snow Removed .............         0.000         0.000
  Final Snow Cover .........         0.000         0.000
  Final Storage ............         0.000         0.000
  Continuity Error (%) .....        -0.016


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......     21229.976    212301.974
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.000
  External Outflow .........     21263.485    212637.069
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.000         0.000
  Continuity Error (%) .....        -0.158


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ---------------------------------------------------------------------------------------
---------------------------------------
                            Total      Total      Total      Total     Imperv
Perv      Total       Total     Peak  Runoff
                         Precip      Runon       Evap      Infil     Runoff
Runoff     Runoff      Runoff    Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm
mm         mm    10^6 ltr      CMS
  ---------------------------------------------------------------------------------------
---------------------------------------
  D02                   27942.15       0.00    2968.76   23232.21       0.00
1745.82    1745.82      241.99     0.29   0.062
  D03                   27942.15       0.00    2927.02   23250.18       0.00
1769.55    1769.55      215.32     0.31   0.063
  D04                   27942.15       0.00    2999.81   23219.24       0.00
1727.65    1727.65      525.59     0.58   0.062
  D04a                  27942.15       0.00    2840.90   23267.28       0.00
1838.80    1838.80       60.17     0.15   0.066
  D05                   27942.15       0.00    2870.80   23290.38       0.00
1785.81    1785.81      466.06     0.89   0.064
  D05a                  27942.15       0.00    2870.80   23290.38       0.00
1785.81    1785.81      299.64     0.57   0.064
```

D05b		27942.15		0.00	2806.05	23258.08	0.00
1882.86	1882.86	79.95	0.24	0.067			
D05c		27942.15		0.00	2683.96	23280.24	0.00
1983.95	1983.95	4.07	0.02	0.071			
D06		27942.15		0.00	2781.84	23255.54	0.00
1909.82	1909.82	160.45	0.56	0.068			
D07		27942.15		0.00	2764.34	23248.15	0.00
1934.85	1934.85	70.08	0.27	0.069			
D07a		27942.15		0.00	2780.93	23255.15	0.00
1911.14	1911.14	129.27	0.45	0.068			
D08		27942.15		0.00	2745.32	23240.31	0.00
1961.63	1961.63	203.17	0.88	0.070			
D08a		27942.15		0.00	2767.87	23256.51	0.00
1922.89	1922.89	138.87	0.51	0.069			
D09		27942.15		0.00	2893.33	23291.46	0.00
1762.05	1762.05	153.51	0.26	0.063			
S01		27942.15		0.00	2869.58	23289.72	0.00
1787.70	1787.70	114.95	0.22	0.064			
S02		27942.15		0.00	2976.12	23234.98	0.00
1735.65	1735.65	268.75	0.31	0.062			
S03		27942.15		0.00	2963.20	23230.13	0.00
1753.49	1753.49	307.90	0.37	0.063			
S04		27942.15		0.00	2911.71	23270.97	0.00
1764.08	1764.08	1034.39	1.61	0.063			
S04a		27942.15		0.00	2970.62	23232.70	0.00
1743.46	1743.46	482.68	0.57	0.062			
S05		27942.15		0.00	2970.62	23232.70	0.00
1743.46	1743.46	573.44	0.67	0.062			
S05a		27942.15		0.00	2690.25	23283.31	0.00
1974.33	1974.33	8.23	0.04	0.071			
S06A		27942.15		0.00	2845.49	23267.18	0.00
1834.29	1834.29	473.60	1.11	0.066			
S06B		27942.15		0.00	2850.87	23270.35	0.00
1825.73	1825.73	241.76	0.54	0.065			
S07		27942.15		0.00	3026.48	23251.20	0.00
1669.09	1669.09	1032.56	1.03	0.060			
S07a		27942.15		0.00	2648.62	23274.88	0.00
2025.98	2025.98	12.68	0.07	0.073			
S08		27942.15		0.00	2871.66	23290.54	0.00
1784.79	1784.79	1000.15	1.89	0.064			
S08a		27942.15		0.00	2855.50	23284.50	0.00
1807.01	1807.01	12.61	0.03	0.065			
S09		27942.15		0.00	2880.84	23295.16	0.00
1770.87	1770.87	162.34	0.29	0.063			
U01_and_D01		27942.15		0.00	3032.84	23254.20	0.00
1659.68	1659.68	52095.96	51.29	0.059			
U02a		27942.15		0.00	3020.75	23247.17	0.00
1678.85	1678.85	2329.75	2.35	0.060			
U02b		27942.15		0.00	2754.75	23246.89	0.00
1945.61	1945.61	97.38	0.40	0.070			
U03		27942.15		0.00	3007.15	23236.35	0.00
1703.28	1703.28	1710.28	1.79	0.061			
U04		27942.15		0.00	3111.85	23248.75	0.00
1585.93	1585.93	143412.04	120.87	0.057			
U05_and_U06		27942.15		0.00	3020.41	23247.08	0.00
1679.28	1679.28	1946.97	1.97	0.060			
U07,_U08,_U09,_and_U10		27942.15		0.00	3002.65	23222.35	0.00
1721.70	1721.70	2180.55	2.36	0.062			
US02		27942.15		0.00	2681.24	23275.16	0.00
1991.80	1991.80	6.41	0.04	0.071			
US05		27942.15		0.00	2697.25	23266.46	0.00
1984.12	1984.12	2.90	0.02	0.071			

```
  US05a                   27942.15       0.00    2762.66   23246.89       0.00
1937.82    1937.82       44.59     0.17    0.069


  Analysis begun on:  Mon Nov 15 15:37:35 2021
  Analysis ended on:  Mon Nov 15 15:38:13 2021
  Total elapsed time: 00:00:38
```

2 POST-DEVELOPMENT MODEL

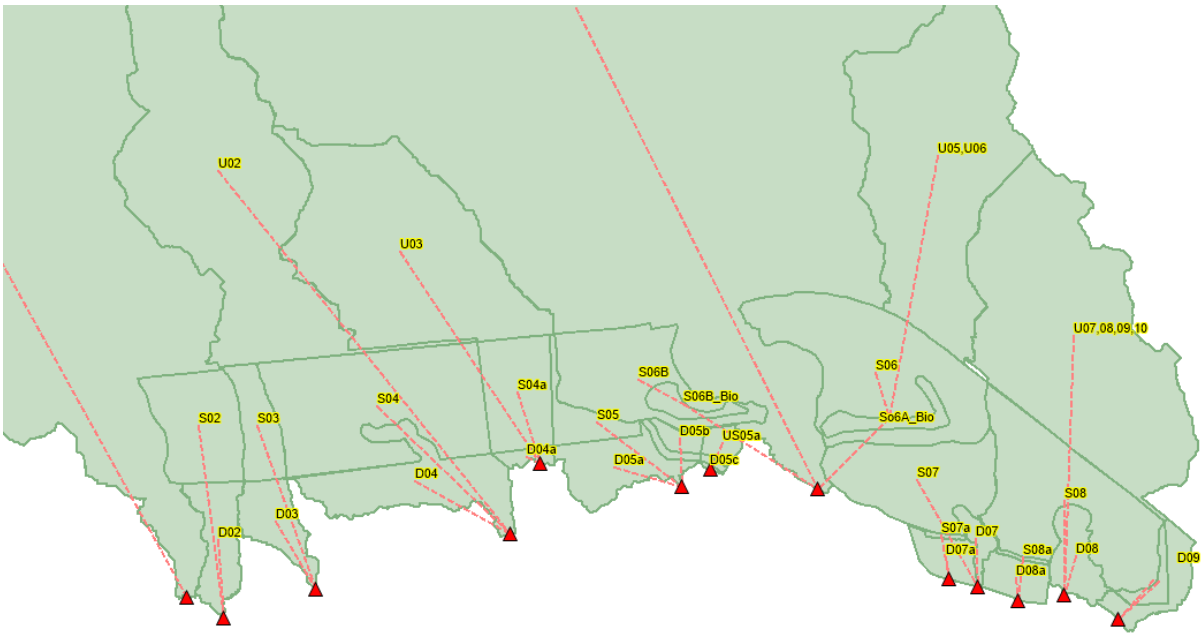

FIGURE A2 Post-development Model Schematic

2.1 Burnco Post-development 100 Year Event Simulation

```
  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  ---------------------------------------------------------------

  This model is the post-development model run of the post-development conditions WITH
bioretention cells (mitigations)


  *************
  Element Count
  *************
  Number of rain gages ...... 2
  Number of subcatchments ... 34
  Number of nodes ........... 13
  Number of links ........... 0
  Number of pollutants ...... 0
  Number of land uses ....... 0
```

```
  ****************
  Raingage Summary
  ****************
                                                    Data       Recording
  Name                 Data Source                  Type       Interval
  ---------------------------------------------------------------------
  100Yr.24hr           Calgary_24h_100y             INTENSITY    5 min.
  10Yr.24hr            Calgary_24h_10y              INTENSITY    5 min.


  ********************
  Subcatchment Summary
  ********************
  Name                         Area     Width   %Imperv    %Slope Rain Gage
Outlet
  ------------------------------------------------------------------------------------
------------------------
  D02                         13.86    286.98      0.00    2.7000 10Yr.24hr
OF2
  D03                         12.16    448.67      0.00    1.4000 10Yr.24hr
OF3
  D04                         30.42    742.00      0.00    1.4000 10Yr.24hr
OF4
  D04a                         3.27    348.08      0.00    0.6900 10Yr.24hr
OF10
  D05a                        16.78    851.83      0.00    1.5000 10Yr.24hr
OF5
  D05b                         3.08    308.00      0.00    1.5000 10Yr.24hr
OF5
  D05c                         0.21     89.26      0.00    2.4300 10Yr.24hr
OF11
  D07                          3.62    210.46      0.00   12.6000 10Yr.24hr
OF7
  D07a                         6.76    307.45      0.00   13.4200 10Yr.24hr
OF12
  D08                         10.41    815.83      0.00   12.5000 10Yr.24hr
OF8
  D08a                         7.22    355.76      0.00   14.0400 10Yr.24hr
OF13
  D09                          8.52    243.15      0.00    3.4000 10Yr.24hr
OF9
  S02                         25.51    532.63      0.00    2.4000 10Yr.24hr
OF2
  S03                         11.95    267.40      0.00    2.5000 10Yr.24hr
OF3
  S04                         57.78   1504.79      0.00    3.4000 10Yr.24hr
OF4
  S04a                        27.68    720.96      0.00    3.4000 10Yr.24hr
OF10
  S05                          9.71    225.18      2.30    2.1000 10Yr.24hr
OF5
  S05a                         0.60    148.82      8.40    5.3700 10Yr.24hr
OF11
  S06                         59.35   2158.14      0.00    5.4000 10Yr.24hr
So6A_Bio
  S06B                        32.25   1697.32      0.00    2.3000 10Yr.24hr
S06B_Bio
  S06B_Bio                     4.00    166.67      0.00    0.5000 10Yr.24hr
OF6
  S07                         34.26    639.12      0.00    1.4000 10Yr.24hr
OF7
```

S07a	0.63	223.57	0.00	25.5200	10Yr.24hr
OF12					
S08	50.13	1275.47	0.00	5.9000	10Yr.24hr
OF8					
S08a	0.70	69.80	0.00	0.5000	10Yr.24hr
OF13					
S09	3.49	101.87	0.00	3.8000	10Yr.24hr
OF9					
So6A_Bio	6.00	300.00	0.00	0.5000	10Yr.24hr
OF6					
U01,D01	3142.30	20233.74	0.00	10.8000	10Yr.24hr
OF1					
U02	143.75	1144.48	0.00	8.4000	10Yr.24hr
OF4					
U03	100.23	1184.74	0.00	4.8000	10Yr.24hr
OF10					
U04,D06	9051.23	38385.20	0.00	11.2000	10Yr.24hr
OF6					
U05,U06	115.94	936.51	0.00	8.2000	10Yr.24hr
So6A_Bio					
U07,08,09,10	126.45	1330.35	0.00	7.1000	10Yr.24hr
OF8					
US05a	3.48	174.05	0.00	18.0000	10Yr.24hr
OF11					

****
LID Control Summary
****

Subcatchment	LID Control	No. of Units	Unit Area	Unit Width	% Area Covered	% Imperv Treated	% Perv Treated
S06B_Bio	S06_Bio	1	40000.00	167.00	100.00	0.00	0.00
So6A_Bio	S06_Bio	1	60000.00	300.00	100.00	0.00	0.00

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	0.00	0.00	0.0	
OF10	OUTFALL	0.00	0.00	0.0	
OF11	OUTFALL	0.00	0.00	0.0	
OF12	OUTFALL	0.00	0.00	0.0	
OF13	OUTFALL	0.00	0.00	0.0	
OF2	OUTFALL	0.00	0.00	0.0	
OF3	OUTFALL	0.00	0.00	0.0	
OF4	OUTFALL	0.00	0.00	0.0	
OF5	OUTFALL	0.00	0.00	0.0	
OF6	OUTFALL	0.00	0.00	0.0	
OF7	OUTFALL	0.00	0.00	0.0	
OF8	OUTFALL	0.00	0.00	0.0	
OF9	OUTFALL	0.00	0.00	0.0	

```
  ***********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  ***********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... CMS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... NO
    Water Quality .......... NO
  Infiltration Method ...... CURVE_NUMBER
  Surcharge Method ......... EXTRAN
  Starting Date ............ 11/13/2018 00:00:00
  Ending Date .............. 11/20/2018 00:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:05:00
  Wet Time Step ............ 00:05:00
  Dry Time Step ............ 00:05:00


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Initial LID Storage ......         0.680         0.052
  Total Precipitation ......       789.596        60.165
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........       591.274        45.054
  Surface Runoff ...........       179.237        13.658
  Final Storage ............        19.772         1.507
  Continuity Error (%) .....        -0.001


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------      ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......       179.237      1792.392
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.000
  External Outflow .........       179.237      1792.392
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.000         0.000
  Continuity Error (%) .....         0.000


  ***************************
  Subcatchment Runoff Summary
  ***************************

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

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
D02	60.17	0.00	0.00	43.42	0.00	15.47	15.47	2.14	0.04	0.257
D03	60.17	0.00	0.00	43.03	0.00	15.88	15.88	1.93	0.04	0.264
D04	60.17	0.00	0.00	43.73	0.00	15.17	15.17	4.62	0.09	0.252
D04a	60.17	0.00	0.00	42.18	0.00	16.72	16.72	0.55	0.01	0.278
D05a	60.17	0.00	0.00	42.55	0.00	16.35	16.35	2.74	0.07	0.272
D05b	60.17	0.00	0.00	41.91	0.00	17.00	17.00	0.52	0.02	0.283
D05c	60.17	0.00	0.00	41.10	0.00	17.81	17.81	0.04	0.00	0.296
D07	60.17	0.00	0.00	41.56	0.00	17.34	17.34	0.63	0.02	0.288
D07a	60.17	0.00	0.00	41.69	0.00	17.22	17.22	1.16	0.04	0.286
D08	60.17	0.00	0.00	41.43	0.00	17.49	17.49	1.82	0.07	0.291
D08a	60.17	0.00	0.00	41.63	0.00	17.28	17.28	1.25	0.04	0.287
D09	60.17	0.00	0.00	42.77	0.00	16.14	16.14	1.38	0.03	0.268
S02	60.17	0.00	0.00	54.67	0.00	4.24	4.24	1.08	0.03	0.070
S03	60.17	0.00	0.00	41.77	0.00	17.14	17.14	2.05	0.04	0.285
S04	60.17	0.00	0.00	45.30	0.00	13.61	13.61	7.86	0.16	0.226
S04a	60.17	0.00	0.00	45.30	0.00	13.61	13.61	3.77	0.08	0.226
S05	60.17	0.00	0.00	40.85	1.35	16.70	18.04	1.75	0.07	0.300
S05a	60.17	0.00	0.00	36.24	4.93	17.74	22.66	0.13	0.01	0.377
S06	60.17	0.00	0.00	40.65	0.00	18.26	18.26	10.84	0.30	0.304
S06B	60.17	0.00	0.00	40.71	0.00	18.21	18.21	5.87	0.16	0.303
S06B_Bio	60.17	146.78	0.00	75.58	0.00	0.00	0.00	0.00	0.00	0.000
S07	60.17	0.00	0.00	42.69	0.00	16.22	16.22	5.56	0.10	0.270
S07a	60.17	0.00	0.00	39.35	0.00	19.60	19.60	0.12	0.01	0.326
S08	60.17	0.00	0.00	40.99	0.00	17.93	17.93	8.99	0.22	0.298
S08a	60.17	0.00	0.00	40.83	0.00	18.08	18.08	0.13	0.00	0.301
S09	60.17	0.00	0.00	41.09	0.00	17.83	17.83	0.62	0.01	0.296
So6A_Bio	60.17	465.06	0.00	76.14	0.00	0.00	93.48	5.61	0.23	0.178

```
  U01,D01                    60.17       0.00       0.00       44.39       0.00
14.52       14.52       456.32      7.76    0.241
  U02                        60.17       0.00       0.00       44.19       0.00
14.71       14.71        21.15      0.37    0.245
  U03                        60.17       0.00       0.00       43.95       0.00
14.96       14.96        14.99      0.27    0.249
  U04,D06                    60.17       0.00       0.00       45.39       0.00
13.52       13.52      1223.75     18.80    0.225
  U05,U06                    60.17       0.00       0.00       44.19       0.00
14.72       14.72        17.07      0.30    0.245
  U07,08,09,10               60.17       0.00       0.00       43.80       0.00
15.12       15.12        19.11      0.35    0.251
  US05a                      60.17       0.00       0.00       41.56       0.00
17.36       17.36         0.60      0.02    0.288


  ***********************
  LID Performance Summary
  ***********************

  ------------------------------------------------------------------------------------------
--------------------------------
                                            Total      Evap      Infil    Surface     Drain
Initial     Final   Continuity
                                          Inflow      Loss      Loss    Outflow    Outflow
Storage   Storage        Error
  Subcatchment      LID Control              mm        mm        mm         mm         mm
mm          mm            %
  ------------------------------------------------------------------------------------------
--------------------------------
  S06B_Bio          S06_Bio             206.94      0.00      75.58       0.00       0.00
68.00     199.40       -0.02
  So6A_Bio          S06_Bio             525.23      0.00      76.14      93.48       0.00
68.00     423.64       -0.01

  Analysis begun on:  Fri Nov 19 09:59:19 2021
  Analysis ended on:  Fri Nov 19 09:59:19 2021
  Total elapsed time: < 1 sec
```

3 POND SIZING MODEL

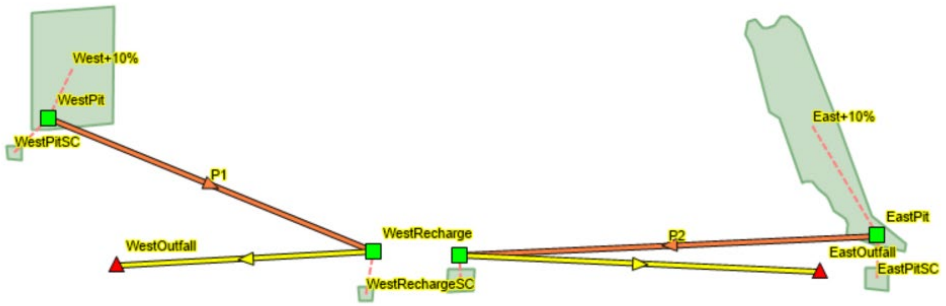

FIGURE A3 Pond Sizing Model Schematic

3.1 Pond Sizing 10 Year Event Simulation

```
[TITLE]
Burnco pond sizing 10-year event simulation


[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           CMS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    YES
START_DATE           06/04/2018
START_TIME           00:00:00
REPORT_START_DATE    06/04/2018
REPORT_START_TIME    00:00:00
END_DATE             06/04/2019
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:05:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4
IGNORE_SNOWMELT      YES

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
Calgary_24h_100y INTENSITY 0:05   1.0    TIMESERIES Calgary_24h_100y
Calgary_24h_10y  INTENSITY 0:05   1.0    TIMESERIES Calgary_24h_10y
Precip_1960-2014 VOLUME    1:00   1.0    FILE       "F:\26388\512\Surface Water\2 - SWMP\070 - Design\PCSWMM
Model\Precip60_14_V5.dat" 3031093    MM

[SUBCATCHMENTS]
;;                                                 Total     Pcnt.             Pcnt.     Curb      Snow
;;Name           Raingage         Outlet           Area      Imperv   Width    Slope     Length    Pack
;;-------------- ---------------- ---------------- --------- -------- -------- --------- --------- --------
East+10%         Calgary_24h_10y  EastPit          23.75     25       1187.5   0.5       0         Calgary
EastPitSC        Calgary_24h_10y  EastPit          6.25      100      250      0.5       0         Calgary
EastRechargeSC   Calgary_24h_10y  EastRecharge     1.145     100      107      0.5       0         Calgary
;C14+C15+10%
West+10%         Calgary_24h_10y  WestPit          18.75     25       937.5    0.5       0         Calgary
WestPitSC        Calgary_24h_10y  WestPit          6.25      100      250      0.5       0         Calgary
WestRechargeSC   Calgary_24h_10y  WestRecharge     1.04      100      102      0.5       0         Calgary

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
East+10%         0.013      0.25       1.6        0          0          PERVIOUS   100
EastPitSC        0.013      0.25       1.6        0          0          OUTLET
EastRechargeSC   0.013      0.25       1.6        0          0          OUTLET
West+10%         0.013      0.25       1.6        0          0          PERVIOUS   100
WestPitSC        0.013      0.25       1.6        0          0          OUTLET
WestRechargeSC   0.013      0.25       1.6        0          0          OUTLET
```

```
[INFILTRATION]
;;Subcatchment   CurveNum   HydCon     DryTime
;;-------------- ---------- ---------- ----------
East+10%         84         0.5        7
EastPitSC        100        0.5        7
EastRechargeSC   100        0.5        7
West+10%         84         0.5        7
WestPitSC        100        0.5        7
WestRechargeSC   100        0.5        7

[SNOWPACKS]
Calgary          PLOWABLE   0.02       0.1        1          0.03       0.00       0.00       0.0
Calgary          IMPERVIOUS 0.02       0.1        1          0.08       2.7        1          0
Calgary          PERVIOUS   0.02       0.1        1          0.3        2.7        1          0
Calgary          REMOVAL    6.53       0.0        0.0        1          0.0        0.0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
EastOutfall      0          FREE                          NO
WestOutfall      0          FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                                Evap.
;;Name             Elev.      Depth     Depth     Curve        Params                                Frac.
Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- -----------
-----------
EastPit          0        3        0        TABULAR    250x250Pit_!mDeep           0       0
EastRecharge     0        1        0        TABULAR    95x95Pond                   0       0        109.98
10.92    0.368
WestPit          0        2        0        TABULAR    250x250Pit_!mDeep           0       0
WestRecharge     0        1        0        TABULAR    90x90Pond                   0       0        109.98
10.92    0.368

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- -----
-----
C1               WestRecharge     WestOutfall      100        0.01       2.5        0          0          0
C2               EastRecharge     EastOutfall      100        0.01       2.5        0          0          0

[PUMPS]
;;               Inlet            Outlet           Pump             Init.  Startup  Shutoff
;;Name           Node             Node             Curve            Status Depth    Depth
;;-------------- ---------------- ---------------- ---------------- ------ -------- --------
P1               WestPit          WestRecharge     P1               OFF    0.1      0.01
P2               EastPit          EastRecharge     P1               OFF    0.1      0.01

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C1               TRAPEZOIDAL  0.5              4          2          2          1
C2               TRAPEZOIDAL  0.4              4          2          2          1

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------

[INFLOWS]
;;                                                Param    Units    Scale    Baseline Baseline
;;Node           Parameter        Time Series      Type     Factor   Factor   Value    Pattern
;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
EastPit          FLOW             ""               FLOW     1.0      0        0.014838
WestPit          FLOW             ""               FLOW     1.0      0        0.007859

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Off              Pump4      0          0

P1               Pump4      0          0
P1                          0.001      0.032
P1                          2          0.032


100x100Pond      Storage    0          10000
100x100Pond                 1          11664
100x100Pond                 1.5        12544
```

```
100x100Pond                2          13456
100x100Pond                2.5        14400

150x150Pit_1mDeep Storage    0          21316
150x150Pit_1mDeep            1          22500

250x250Pit_!mDeep Storage    0          60516
250x250Pit_!mDeep            1          62500

70x70Pond        Storage    0          4900
70x70Pond                   1          6084
70x70Pond                   1.5        6724
70x70Pond                   2          7396
70x70Pond                   2.5        8100

75x75Pond        Storage    0          5625
75x75Pond                   1          6889
75x75Pond                   1.5        7569
75x75Pond                   2          8281
75x75Pond                   2.5        9025

80x80Pond        Storage    0          6400
80x80Pond                   1          7744
80x80Pond                   1.5        8464
80x80Pond                   2          9216
80x80Pond                   2.5        10000

85x85Pond        Storage    0          7225
85x85Pond                   2.5        11025

90x90Pond        Storage    0          8100
90x90Pond                   2.5        12100

95x95Pond        Storage    0          9025
95x95Pond                   2.5        13225

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------

;Calgary_24h_10y design storm, rain interval = 5 minutes, rain units = mm/hr.
Calgary_24h_10y             0:00       0
Calgary_24h_10y             0:05       0.747
Calgary_24h_10y             0:10       0.753
Calgary_24h_10y             0:15       0.76
Calgary_24h_10y             0:20       0.766
Calgary_24h_10y             0:25       0.773
Calgary_24h_10y             0:30       0.78
Calgary_24h_10y             0:35       0.787
Calgary_24h_10y             0:40       0.794
Calgary_24h_10y             0:45       0.801
Calgary_24h_10y             0:50       0.809
Calgary_24h_10y             0:55       0.817
Calgary_24h_10y             1:00       0.824
Calgary_24h_10y             1:05       0.832
Calgary_24h_10y             1:10       0.841
Calgary_24h_10y             1:15       0.849
Calgary_24h_10y             1:20       0.858
Calgary_24h_10y             1:25       0.867
Calgary_24h_10y             1:30       0.876
Calgary_24h_10y             1:35       0.885
Calgary_24h_10y             1:40       0.894
Calgary_24h_10y             1:45       0.904
Calgary_24h_10y             1:50       0.914
Calgary_24h_10y             1:55       0.925
Calgary_24h_10y             2:00       0.935
Calgary_24h_10y             2:05       0.946
Calgary_24h_10y             2:10       0.957
Calgary_24h_10y             2:15       0.969
Calgary_24h_10y             2:20       0.981
Calgary_24h_10y             2:25       0.993
Calgary_24h_10y             2:30       1.006
Calgary_24h_10y             2:35       1.019
Calgary_24h_10y             2:40       1.032
Calgary_24h_10y             2:45       1.046
Calgary_24h_10y             2:50       1.06
Calgary_24h_10y             2:55       1.075
Calgary_24h_10y             3:00       1.09
Calgary_24h_10y             3:05       1.106
Calgary_24h_10y             3:10       1.123
Calgary_24h_10y             3:15       1.14
```

Calgary_24h_10y	3:20	1.157
Calgary_24h_10y	3:25	1.176
Calgary_24h_10y	3:30	1.195
Calgary_24h_10y	3:35	1.214
Calgary_24h_10y	3:40	1.235
Calgary_24h_10y	3:45	1.257
Calgary_24h_10y	3:50	1.279
Calgary_24h_10y	3:55	1.302
Calgary_24h_10y	4:00	1.327
Calgary_24h_10y	4:05	1.352
Calgary_24h_10y	4:10	1.379
Calgary_24h_10y	4:15	1.407
Calgary_24h_10y	4:20	1.437
Calgary_24h_10y	4:25	1.468
Calgary_24h_10y	4:30	1.501
Calgary_24h_10y	4:35	1.536
Calgary_24h_10y	4:40	1.572
Calgary_24h_10y	4:45	1.611
Calgary_24h_10y	4:50	1.652
Calgary_24h_10y	4:55	1.696
Calgary_24h_10y	5:00	1.743
Calgary_24h_10y	5:05	1.793
Calgary_24h_10y	5:10	1.847
Calgary_24h_10y	5:15	1.904
Calgary_24h_10y	5:20	1.966
Calgary_24h_10y	5:25	2.034
Calgary_24h_10y	5:30	2.107
Calgary_24h_10y	5:35	2.187
Calgary_24h_10y	5:40	2.275
Calgary_24h_10y	5:45	2.371
Calgary_24h_10y	5:50	2.478
Calgary_24h_10y	5:55	2.598
Calgary_24h_10y	6:00	2.733
Calgary_24h_10y	6:05	2.885
Calgary_24h_10y	6:10	3.061
Calgary_24h_10y	6:15	3.264
Calgary_24h_10y	6:20	3.503
Calgary_24h_10y	6:25	3.79
Calgary_24h_10y	6:30	4.14
Calgary_24h_10y	6:35	4.58
Calgary_24h_10y	6:40	5.153
Calgary_24h_10y	6:45	5.936
Calgary_24h_10y	6:50	7.085
Calgary_24h_10y	6:55	8.972
Calgary_24h_10y	7:00	12.807
Calgary_24h_10y	7:05	27.274
Calgary_24h_10y	7:10	106.693
Calgary_24h_10y	7:15	36.52
Calgary_24h_10y	7:20	21.432
Calgary_24h_10y	7:25	15.694
Calgary_24h_10y	7:30	12.604
Calgary_24h_10y	7:35	10.647
Calgary_24h_10y	7:40	9.284
Calgary_24h_10y	7:45	8.275
Calgary_24h_10y	7:50	7.493
Calgary_24h_10y	7:55	6.868
Calgary_24h_10y	8:00	6.355
Calgary_24h_10y	8:05	5.925
Calgary_24h_10y	8:10	5.559
Calgary_24h_10y	8:15	5.242
Calgary_24h_10y	8:20	4.966
Calgary_24h_10y	8:25	4.723
Calgary_24h_10y	8:30	4.506
Calgary_24h_10y	8:35	4.312
Calgary_24h_10y	8:40	4.137
Calgary_24h_10y	8:45	3.978
Calgary_24h_10y	8:50	3.833
Calgary_24h_10y	8:55	3.7
Calgary_24h_10y	9:00	3.578
Calgary_24h_10y	9:05	3.465
Calgary_24h_10y	9:10	3.36
Calgary_24h_10y	9:15	3.263
Calgary_24h_10y	9:20	3.172
Calgary_24h_10y	9:25	3.087
Calgary_24h_10y	9:30	3.007
Calgary_24h_10y	9:35	2.932
Calgary_24h_10y	9:40	2.862
Calgary_24h_10y	9:45	2.795
Calgary_24h_10y	9:50	2.732
Calgary_24h_10y	9:55	2.672
Calgary_24h_10y	10:00	2.616

Calgary_24h_10y	10:05	2.562
Calgary_24h_10y	10:10	2.511
Calgary_24h_10y	10:15	2.462
Calgary_24h_10y	10:20	2.415
Calgary_24h_10y	10:25	2.371
Calgary_24h_10y	10:30	2.328
Calgary_24h_10y	10:35	2.287
Calgary_24h_10y	10:40	2.248
Calgary_24h_10y	10:45	2.211
Calgary_24h_10y	10:50	2.175
Calgary_24h_10y	10:55	2.14
Calgary_24h_10y	11:00	2.107
Calgary_24h_10y	11:05	2.075
Calgary_24h_10y	11:10	2.044
Calgary_24h_10y	11:15	2.014
Calgary_24h_10y	11:20	1.985
Calgary_24h_10y	11:25	1.957
Calgary_24h_10y	11:30	1.93
Calgary_24h_10y	11:35	1.904
Calgary_24h_10y	11:40	1.879
Calgary_24h_10y	11:45	1.854
Calgary_24h_10y	11:50	1.831
Calgary_24h_10y	11:55	1.808
Calgary_24h_10y	12:00	1.785
Calgary_24h_10y	12:05	1.764
Calgary_24h_10y	12:10	1.743
Calgary_24h_10y	12:15	1.722
Calgary_24h_10y	12:20	1.703
Calgary_24h_10y	12:25	1.683
Calgary_24h_10y	12:30	1.664
Calgary_24h_10y	12:35	1.646
Calgary_24h_10y	12:40	1.628
Calgary_24h_10y	12:45	1.611
Calgary_24h_10y	12:50	1.594
Calgary_24h_10y	12:55	1.578
Calgary_24h_10y	13:00	1.561
Calgary_24h_10y	13:05	1.546
Calgary_24h_10y	13:10	1.53
Calgary_24h_10y	13:15	1.516
Calgary_24h_10y	13:20	1.501
Calgary_24h_10y	13:25	1.487
Calgary_24h_10y	13:30	1.473
Calgary_24h_10y	13:35	1.459
Calgary_24h_10y	13:40	1.446
Calgary_24h_10y	13:45	1.433
Calgary_24h_10y	13:50	1.42
Calgary_24h_10y	13:55	1.407
Calgary_24h_10y	14:00	1.395
Calgary_24h_10y	14:05	1.383
Calgary_24h_10y	14:10	1.371
Calgary_24h_10y	14:15	1.36
Calgary_24h_10y	14:20	1.349
Calgary_24h_10y	14:25	1.338
Calgary_24h_10y	14:30	1.327
Calgary_24h_10y	14:35	1.316
Calgary_24h_10y	14:40	1.306
Calgary_24h_10y	14:45	1.296
Calgary_24h_10y	14:50	1.286
Calgary_24h_10y	14:55	1.276
Calgary_24h_10y	15:00	1.266
Calgary_24h_10y	15:05	1.257
Calgary_24h_10y	15:10	1.247
Calgary_24h_10y	15:15	1.238
Calgary_24h_10y	15:20	1.229
Calgary_24h_10y	15:25	1.22
Calgary_24h_10y	15:30	1.212
Calgary_24h_10y	15:35	1.203
Calgary_24h_10y	15:40	1.195
Calgary_24h_10y	15:45	1.186
Calgary_24h_10y	15:50	1.178
Calgary_24h_10y	15:55	1.17
Calgary_24h_10y	16:00	1.162
Calgary_24h_10y	16:05	1.155
Calgary_24h_10y	16:10	1.147
Calgary_24h_10y	16:15	1.14
Calgary_24h_10y	16:20	1.132
Calgary_24h_10y	16:25	1.125
Calgary_24h_10y	16:30	1.118
Calgary_24h_10y	16:35	1.111
Calgary_24h_10y	16:40	1.104
Calgary_24h_10y	16:45	1.097

Calgary_24h_10y	16:50	1.09
Calgary_24h_10y	16:55	1.084
Calgary_24h_10y	17:00	1.077
Calgary_24h_10y	17:05	1.071
Calgary_24h_10y	17:10	1.064
Calgary_24h_10y	17:15	1.058
Calgary_24h_10y	17:20	1.052
Calgary_24h_10y	17:25	1.046
Calgary_24h_10y	17:30	1.04
Calgary_24h_10y	17:35	1.034
Calgary_24h_10y	17:40	1.028
Calgary_24h_10y	17:45	1.022
Calgary_24h_10y	17:50	1.017
Calgary_24h_10y	17:55	1.011
Calgary_24h_10y	18:00	1.006
Calgary_24h_10y	18:05	1
Calgary_24h_10y	18:10	0.995
Calgary_24h_10y	18:15	0.989
Calgary_24h_10y	18:20	0.984
Calgary_24h_10y	18:25	0.979
Calgary_24h_10y	18:30	0.974
Calgary_24h_10y	18:35	0.969
Calgary_24h_10y	18:40	0.964
Calgary_24h_10y	18:45	0.959
Calgary_24h_10y	18:50	0.954
Calgary_24h_10y	18:55	0.949
Calgary_24h_10y	19:00	0.945
Calgary_24h_10y	19:05	0.94
Calgary_24h_10y	19:10	0.935
Calgary_24h_10y	19:15	0.931
Calgary_24h_10y	19:20	0.926
Calgary_24h_10y	19:25	0.922
Calgary_24h_10y	19:30	0.917
Calgary_24h_10y	19:35	0.913
Calgary_24h_10y	19:40	0.908
Calgary_24h_10y	19:45	0.904
Calgary_24h_10y	19:50	0.9
Calgary_24h_10y	19:55	0.896
Calgary_24h_10y	20:00	0.892
Calgary_24h_10y	20:05	0.888
Calgary_24h_10y	20:10	0.884
Calgary_24h_10y	20:15	0.88
Calgary_24h_10y	20:20	0.876
Calgary_24h_10y	20:25	0.872
Calgary_24h_10y	20:30	0.868
Calgary_24h_10y	20:35	0.864
Calgary_24h_10y	20:40	0.86
Calgary_24h_10y	20:45	0.856
Calgary_24h_10y	20:50	0.853
Calgary_24h_10y	20:55	0.849
Calgary_24h_10y	21:00	0.845
Calgary_24h_10y	21:05	0.842
Calgary_24h_10y	21:10	0.838
Calgary_24h_10y	21:15	0.835
Calgary_24h_10y	21:20	0.831
Calgary_24h_10y	21:25	0.828
Calgary_24h_10y	21:30	0.824
Calgary_24h_10y	21:35	0.821
Calgary_24h_10y	21:40	0.818
Calgary_24h_10y	21:45	0.814
Calgary_24h_10y	21:50	0.811
Calgary_24h_10y	21:55	0.808
Calgary_24h_10y	22:00	0.805
Calgary_24h_10y	22:05	0.801
Calgary_24h_10y	22:10	0.798
Calgary_24h_10y	22:15	0.795
Calgary_24h_10y	22:20	0.792
Calgary_24h_10y	22:25	0.789
Calgary_24h_10y	22:30	0.786
Calgary_24h_10y	22:35	0.783
Calgary_24h_10y	22:40	0.78
Calgary_24h_10y	22:45	0.777
Calgary_24h_10y	22:50	0.774
Calgary_24h_10y	22:55	0.771
Calgary_24h_10y	23:00	0.768
Calgary_24h_10y	23:05	0.765
Calgary_24h_10y	23:10	0.763
Calgary_24h_10y	23:15	0.76
Calgary_24h_10y	23:20	0.757
Calgary_24h_10y	23:25	0.754
Calgary_24h_10y	23:30	0.752

```
Calgary_24h_10y             23:35      0.749
Calgary_24h_10y             23:40      0.746
Calgary_24h_10y             23:45      0.743
Calgary_24h_10y             23:50      0.741
Calgary_24h_10y             23:55      0.738
Calgary_24h_10y             24:00      0.736

 [PATTERNS]
;;Name           Type       Multipliers
;;-------------- ---------- -----------
Hourly           HOURLY     1.0   1.0   1.0   1.0   1.0   1.0
Hourly                       1.0   1.0   1.0   1.0   1.0   1.0
Hourly                       1.0   1.0   1.0   1.0   1.0   1.0
Hourly                       1.0   1.0   1.0   1.0   1.0   1.0


[REPORT]
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       -12758440.8667574 6625487.70304261 -12750804.5167033 6627979.47594509
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
EastOutfall      -12751819.402    6625830.05
WestOutfall      -12757239.252    6625880.054
EastPit          -12751373.089    6626106.784
EastRecharge     -12754597.508    6625952.573
WestPit          -12757773.348    6627008.087
WestRecharge     -12755263.687    6625981.545

[VERTICES]
;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------

[POLYGONS]
;;Subcatchment   X-Coord          Y-Coord
;;-------------- ---------------- ----------------
East+10%         -12752206.192    6627060.21
East+10%         -12752333.938    6627543.497
East+10%         -12752354.031    6627585.108
East+10%         -12752394.293    6627652.25
East+10%         -12752373.462    6627753.852
East+10%         -12752314.302    6627774.789
East+10%         -12752258.068    6627707.369
East+10%         -12752232.655    6627701.198
East+10%         -12752175.891    6627727.203
East+10%         -12752117.815    6627787.511
East+10%         -12752065.987    6627787.567
East+10%         -12751963.513    6627702.112
East+10%         -12751705.838    6627031.623
East+10%         -12751416.581    6626256.673
East+10%         -12751151.624    6626045.775
East+10%         -12751162.992    6625990.172
East+10%         -12751293.339    6626019.406
East+10%         -12751389.57     6626035.743
East+10%         -12751617.726    6626112.528
East+10%         -12751607.213    6626199.433
East+10%         -12751623.307    6626238.431
East+10%         -12751711.746    6626295.479
East+10%         -12751746.819    6626386.884
East+10%         -12751773.31     6626414.075
East+10%         -12751826.126    6626463.972
East+10%         -12751880.806    6626522.378
East+10%         -12751939.606    6626522.734
East+10%         -12751958.873    6626510.504
East+10%         -12752128.698    6627009.114
East+10%         -12752206.192    6627060.21
EastPitSC        -12751464.214    6625700.227
EastPitSC        -12751464.214    6625861.448
EastPitSC        -12751295.983    6625861.448
EastPitSC        -12751295.983    6625686.208
EastPitSC        -12751464.214    6625700.227
```

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EastRechargeSC   -12754688.632    6625847.429
EastRechargeSC   -12754485.354    6625847.429
EastRechargeSC   -12754492.363    6625679.198
EastRechargeSC   -12754695.642    6625672.188
EastRechargeSC   -12754688.632    6625847.429
West+10%         -12757904.886    6626923.932
West+10%         -12757904.249    6627820.451
West+10%         -12757272.267    6627866.214
West+10%         -12757272.974    6626968.667
West+10%         -12757789.554    6626923.756
West+10%         -12757904.886    6626923.932
WestPitSC        -12758093.76     6626798.928
WestPitSC        -12757983.238    6626798.928
WestPitSC        -12757985.363    6626692.657
WestPitSC        -12758085.258    6626696.908
WestPitSC        -12758093.76     6626798.928
WestRechargeSC   -12755380.952    6625707.236
WestRechargeSC   -12755270.43     6625707.236
WestRechargeSC   -12755272.555    6625600.965
WestRechargeSC   -12755372.45     6625605.216
WestRechargeSC   -12755380.952    6625707.236

[SYMBOLS]
;;Gage           X-Coord          Y-Coord
;;-------------- ---------------- ----------------


  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
  --------------------------------------------------------------

  Burnco pond sizing 10-year event simulation



  *************
  Element Count
  *************
  Number of rain gages ...... 3
  Number of subcatchments ... 6
  Number of nodes ........... 6
  Number of links ........... 4
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                      Data       Recording
  Name                 Data Source                    Type       Interval
  ---------------------------------------------------------------------------
  Calgary_24h_100y     Calgary_24h_100y               INTENSITY    5 min.
  Calgary_24h_10y      Calgary_24h_10y                INTENSITY    5 min.
  Precip_1960-2014     F:\26388\512\Surface Water\2 - SWMP\070 - Design\PCSWMM Model\Precip60_14_V5.dat


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
  ------------------------------------------------------------------------------------------------------------
  East+10%                   23.75   1187.50     25.00    0.5000 Calgary_24h_10y      EastPit
  EastPitSC                   6.25    250.00    100.00    0.5000 Calgary_24h_10y      EastPit
  EastRechargeSC              1.15    107.00    100.00    0.5000 Calgary_24h_10y      EastRecharge
  West+10%                   18.75    937.50     25.00    0.5000 Calgary_24h_10y      WestPit
  WestPitSC                   6.25    250.00    100.00    0.5000 Calgary_24h_10y      WestPit
  WestRechargeSC              1.04    102.00    100.00    0.5000 Calgary_24h_10y      WestRecharge


  ************
  Node Summary
  ************
                                        Invert      Max.    Ponded    External
  Name                 Type              Elev.     Depth      Area    Inflow
  ---------------------------------------------------------------------------
  EastOutfall          OUTFALL           0.00      0.40       0.0
  WestOutfall          OUTFALL           0.00      0.50       0.0
  EastPit              STORAGE           0.00      3.00       0.0    Yes
  EastRecharge         STORAGE           0.00      1.00       0.0
  WestPit              STORAGE           0.00      2.00       0.0    Yes
  WestRecharge         STORAGE           0.00      1.00       0.0
```

```
************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-------------------------------------------------------------------------------------------
C1               WestRecharge     WestOutfall      CONDUIT          100.0    2.5008    0.0100
C2               EastRecharge     EastOutfall      CONDUIT          100.0    2.5008    0.0100
P1               WestPit          WestRecharge     TYPE4 PUMP
P2               EastPit          EastRecharge     TYPE4 PUMP


*********************
Cross Section Summary
*********************
                                    Full     Full     Hyd.     Max.   No. of     Full
Conduit          Shape             Depth     Area     Rad.    Width  Barrels     Flow
-------------------------------------------------------------------------------------
C1               TRAPEZOIDAL        0.50     2.50     0.40     6.00        1    21.50
C2               TRAPEZOIDAL        0.40     1.92     0.33     5.60        1    14.55


*********************
Rainfall File Summary
*********************
Station    First        Last         Recording   Periods    Periods    Periods
ID         Date         Date         Frequency  w/Precip    Missing    Malfunc.
-------------------------------------------------------------------------------
3031093    01/02/1960   12/29/2014      60 min     40313          0          0


***********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
***********************************************************

***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Starting Date ............ 06/04/2018 00:00:00
Ending Date .............. 06/04/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Initial Snow Cover .......         0.186         3.247
Total Precipitation ......         3.441        60.165
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.889        15.539
Surface Runoff ...........         2.518        44.031
Snow Removed .............         0.000         0.000
Final Snow Cover .........         0.186         3.247
Final Storage ............         0.041         0.708
Continuity Error (%) .....        -0.177


**************************        Volume        Volume
```

Flow Routing Continuity	hectare-m	10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	2.518	25.179
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	71.569	715.700
External Outflow	0.000	0.000
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	73.159	731.601
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.928	9.282
Continuity Error (%)	-0.000	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	4.50 sec
Average Time Step	:	5.00 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.01
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
East+10%	60.17	0.00	0.00	20.91	38.95	9.25	0.43	0.647
EastPitSC	60.17	0.00	0.00	0.00	58.72	3.67	0.82	0.976
EastRechargeSC	60.17	0.00	0.00	0.00	58.83	0.67	0.22	0.978
West+10%	60.17	0.00	0.00	20.91	38.95	7.30	0.34	0.647
WestPitSC	60.17	0.00	0.00	0.00	58.72	3.67	0.82	0.976
WestRechargeSC	60.17	0.00	0.00	0.00	58.83	0.61	0.21	0.978

Node Depth Summary

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
EastOutfall	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
WestOutfall	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
EastPit	STORAGE	0.06	0.20	0.20	1 03:30	0.20
EastRecharge	STORAGE	0.04	0.19	0.19	9 00:55	0.19
WestPit	STORAGE	0.06	0.16	0.16	1 01:50	0.16
WestRecharge	STORAGE	0.03	0.22	0.22	5 13:18	0.22

Node Inflow Summary

	Maximum Lateral Inflow	Maximum Total Inflow	Time of Max Occurrence	Lateral Inflow Volume	Total Inflow Volume	Flow Balance Error

Node	Type	CMS	CMS	days hr:min	10^6 ltr	10^6 ltr	Percent	
EastOutfall	OUTFALL	0.000	0.000	0 00:00	0	0	0.000	ltr
WestOutfall	OUTFALL	0.000	0.000	0 00:00	0	0	0.000	ltr
EastPit	STORAGE	1.051	1.051	0 07:20	481	481	0.002	
EastRecharge	STORAGE	0.223	0.223	0 07:15	0.674	479	-0.000	
WestPit	STORAGE	0.982	0.982	0 07:20	259	259	-0.004	
WestRecharge	STORAGE	0.207	0.207	0 07:15	0.612	253	0.001	

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
EastPit	3.418	2	0	0	11.942	6	1 03:30	0.032
EastRecharge	0.367	4	0	100	1.731	18	9 00:55	0.110
WestPit	3.362	3	0	0	9.535	8	1 01:50	0.032
WestRecharge	0.249	3	0	100	1.854	21	5 13:18	0.097

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
EastOutfall	0.00	0.000	0.000	0.000
WestOutfall	0.00	0.000	0.000	0.000
System	0.00	0.000	0.000	0.000

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.000	0 00:00	0.00	0.00	0.00
C2	CONDUIT	0.000	0 00:00	0.00	0.00	0.00
P1	PUMP	0.032	0 10:32		1.00	
P2	PUMP	0.032	0 09:32		1.00	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


***************
Pumping Summary
***************

-----------------------------------------------------------------------------------------------------------
                                          Min       Avg       Max     Total     Power    % Time Off
                        Percent  Number of Flow      Flow      Flow    Volume    Usage    Pump Curve
Pump                  Utilized  Start-Ups  CMS       CMS       CMS  10^6 ltr    Kw-hr    Low   High
-----------------------------------------------------------------------------------------------------------
P1                       25.06         34  0.00      0.03      0.03   252.826    52.72    0.0    0.0
P2                       47.41         46  0.00      0.03      0.03   478.417    80.78    0.0    0.0


Analysis begun on:  Wed Feb 05 11:06:22 2020
Analysis ended on:  Wed Feb 05 11:06:41 2020
Total elapsed time: 00:00:19
```

3.2 Pond Sizing Continuous Simulation

```
[TITLE]
Burnco pond sizing continuous event simulation


[OPTIONS]
;;Options             Value
;;------------------- ------------
FLOW_UNITS           CMS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    YES
START_DATE           01/01/1960
START_TIME           00:00:00
REPORT_START_DATE    01/01/1960
REPORT_START_TIME    00:00:00
END_DATE             12/31/2014
END_TIME             23:59:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:05:00
DRY_STEP             00:30:00
ROUTING_STEP         60
INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
```

```
Calgary_24h_100y INTENSITY 0:05   1.0    TIMESERIES Calgary_24h_100y
Calgary_24h_10y  INTENSITY 0:05   1.0    TIMESERIES Calgary_24h_10y
Precip_1960-2014 VOLUME    1:00    1.0     FILE        "F:\26388\512\Surface Water\2 - SWMP\070 - Design\PCSWMM
Model\Precip60_14_V5.dat" 3031093    MM

[SUBCATCHMENTS]
;;                                                Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet          Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- --------------- -------- -------- -------- -------- -------- --------
East+10%         Precip_1960-2014 EastPit         23.75    25       1187.5   0.5      0        Calgary
EastPitSC        Precip_1960-2014 EastPit         6.25     100      250      0.5      0        Calgary
EastRechargeSC   Precip_1960-2014 EastRecharge    1.145    100      107.009  0.5      0        Calgary
;C14+C15+10%
West+10%         Precip_1960-2014 WestPit         18.75    25       937.5    0.5      0        Calgary
WestPitSC        Precip_1960-2014 WestPit         6.25     100      250      0.5      0        Calgary
WestRechargeSC   Precip_1960-2014 WestRecharge    1.04     100      101.981  0.5      0        Calgary

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
East+10%         0.013      0.25       1.6        0          0          PERVIOUS   100
EastPitSC        0.013      0.25       1.6        0          0          OUTLET
EastRechargeSC   0.013      0.25       1.6        0          0          OUTLET
West+10%         0.013      0.25       1.6        0          0          PERVIOUS   100
WestPitSC        0.013      0.25       1.6        0          0          OUTLET
WestRechargeSC   0.013      0.25       1.6        0          0          OUTLET

[INFILTRATION]
;;Subcatchment   CurveNum   HydCon     DryTime
;;-------------- ---------- ---------- ----------
East+10%         84         0.5        7
EastPitSC        100        0.5        7
EastRechargeSC   100        0.5        7
West+10%         84         0.5        7
WestPitSC        100        0.5        7
WestRechargeSC   100        0.5        7

[SNOWPACKS]
Calgary          PLOWABLE   0.02       0.1        1          0.03       0.00       0.00       0.0
Calgary          IMPERVIOUS 0.02       0.1        1          0.08       2.7        1          0
Calgary          PERVIOUS   0.02       0.1        1          0.3        2.7        1          0
Calgary          REMOVAL    6.53       0.0        0.0        1          0.0        0.0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
EastOutfall      0          FREE                          NO
WestOutfall      0          FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                                Evap.
;;Name              Elev.     Depth     Depth     Curve        Params                                Frac.
Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- -----------
------------
EastPit          0        3        0        TABULAR    250x250Pit_!mDeep           0       0
EastRecharge     0        2.5      0        TABULAR    95x95Pond                   0       0        109.98
10.92    0.368
WestPit          0        2        0        TABULAR    250x250Pit_!mDeep           0       0
WestRecharge     0        2.5      0        TABULAR    90x90Pond                   0       0        109.98
10.92    0.368

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- -----
-----
C1               WestRecharge     WestOutfall      100        0.01       2.5        0          0          0
C2               EastRecharge     EastOutfall      100        0.01       2.5        0          0          0

[PUMPS]
;;               Inlet            Outlet           Pump             Init.  Startup  Shutoff
;;Name           Node             Node             Curve            Status Depth    Depth
;;-------------- ---------------- ---------------- ---------------- ------ -------- --------
P1               WestPit          WestRecharge     P1               OFF    0.1      0.01
P2               EastPit          EastRecharge     P1               OFF    0.1      0.01

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
```

```
C1               TRAPEZOIDAL  0.5              4          2          2          1
C2               TRAPEZOIDAL  0.4              4          2          2          1

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------

[INFLOWS]
;;                                                 Param    Units    Scale    Baseline Baseline
;;Node           Parameter        Time Series      Type     Factor   Factor   Value    Pattern
;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
EastPit          FLOW             ""               FLOW     1.0      0        0.014838
WestPit          FLOW             ""               FLOW     1.0      0        0.007859

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Off              Pump4      0          0

P1               Pump4      0          0
P1                          0.001      0.032
P1                          2          0.032

100x100Pond      Storage    0          10000
100x100Pond                 1          11664
100x100Pond                 1.5        12544
100x100Pond                 2          13456
100x100Pond                 2.5        14400

250x250Pit_!mDeep Storage    0          60516
250x250Pit_!mDeep            1          62500

70x70Pond        Storage    0          4900
70x70Pond                   1          6084
70x70Pond                   1.5        6724
70x70Pond                   2          7396
70x70Pond                   2.5        8100

75x75Pond        Storage    0          5625
75x75Pond                   1          6889
75x75Pond                   1.5        7569
75x75Pond                   2          8281
75x75Pond                   2.5        9025

80x80Pond        Storage    0          6400
80x80Pond                   1          7744
80x80Pond                   1.5        8464
80x80Pond                   2          9216
80x80Pond                   2.5        10000

85x85Pond        Storage    0          7225
85x85Pond                   2.5        11025

90x90Pond        Storage    0          8100
90x90Pond                   2.5        12100

95x95Pond        Storage    0          9025
95x95Pond                   2.5        13225

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;Calgary_24h_100y design storm, rain interval = 5 minutes, rain units = mm/hr.
Calgary_24h_100y            0:00       0
Calgary_24h_100y            0:05       1.094
Calgary_24h_100y            0:10       1.103
Calgary_24h_100y            0:15       1.113
Calgary_24h_100y            0:20       1.122
Calgary_24h_100y            0:25       1.132
Calgary_24h_100y            0:30       1.143
Calgary_24h_100y            0:35       1.153
Calgary_24h_100y            0:40       1.163
Calgary_24h_100y            0:45       1.174
Calgary_24h_100y            0:50       1.185
Calgary_24h_100y            0:55       1.197
Calgary_24h_100y            1:00       1.208
Calgary_24h_100y            1:05       1.22
Calgary_24h_100y            1:10       1.232
Calgary_24h_100y            1:15       1.245
Calgary_24h_100y            1:20       1.257
Calgary_24h_100y            1:25       1.27
```

Calgary_24h_100y	1:30	1.284
Calgary_24h_100y	1:35	1.297
Calgary_24h_100y	1:40	1.311
Calgary_24h_100y	1:45	1.326
Calgary_24h_100y	1:50	1.341
Calgary_24h_100y	1:55	1.356
Calgary_24h_100y	2:00	1.372
Calgary_24h_100y	2:05	1.388
Calgary_24h_100y	2:10	1.404
Calgary_24h_100y	2:15	1.421
Calgary_24h_100y	2:20	1.439
Calgary_24h_100y	2:25	1.457
Calgary_24h_100y	2:30	1.476
Calgary_24h_100y	2:35	1.495
Calgary_24h_100y	2:40	1.515
Calgary_24h_100y	2:45	1.535
Calgary_24h_100y	2:50	1.556
Calgary_24h_100y	2:55	1.578
Calgary_24h_100y	3:00	1.601
Calgary_24h_100y	3:05	1.624
Calgary_24h_100y	3:10	1.648
Calgary_24h_100y	3:15	1.674
Calgary_24h_100y	3:20	1.7
Calgary_24h_100y	3:25	1.727
Calgary_24h_100y	3:30	1.755
Calgary_24h_100y	3:35	1.784
Calgary_24h_100y	3:40	1.815
Calgary_24h_100y	3:45	1.846
Calgary_24h_100y	3:50	1.88
Calgary_24h_100y	3:55	1.914
Calgary_24h_100y	4:00	1.95
Calgary_24h_100y	4:05	1.988
Calgary_24h_100y	4:10	2.028
Calgary_24h_100y	4:15	2.07
Calgary_24h_100y	4:20	2.113
Calgary_24h_100y	4:25	2.159
Calgary_24h_100y	4:30	2.208
Calgary_24h_100y	4:35	2.259
Calgary_24h_100y	4:40	2.313
Calgary_24h_100y	4:45	2.371
Calgary_24h_100y	4:50	2.432
Calgary_24h_100y	4:55	2.497
Calgary_24h_100y	5:00	2.566
Calgary_24h_100y	5:05	2.64
Calgary_24h_100y	5:10	2.719
Calgary_24h_100y	5:15	2.805
Calgary_24h_100y	5:20	2.897
Calgary_24h_100y	5:25	2.997
Calgary_24h_100y	5:30	3.105
Calgary_24h_100y	5:35	3.224
Calgary_24h_100y	5:40	3.354
Calgary_24h_100y	5:45	3.497
Calgary_24h_100y	5:50	3.656
Calgary_24h_100y	5:55	3.833
Calgary_24h_100y	6:00	4.033
Calgary_24h_100y	6:05	4.259
Calgary_24h_100y	6:10	4.519
Calgary_24h_100y	6:15	4.821
Calgary_24h_100y	6:20	5.176
Calgary_24h_100y	6:25	5.601
Calgary_24h_100y	6:30	6.12
Calgary_24h_100y	6:35	6.773
Calgary_24h_100y	6:40	7.624
Calgary_24h_100y	6:45	8.785
Calgary_24h_100y	6:50	10.488
Calgary_24h_100y	6:55	13.283
Calgary_24h_100y	7:00	18.961
Calgary_24h_100y	7:05	40.516
Calgary_24h_100y	7:10	168.138
Calgary_24h_100y	7:15	54.372
Calgary_24h_100y	7:20	31.748
Calgary_24h_100y	7:25	23.236
Calgary_24h_100y	7:30	18.66
Calgary_24h_100y	7:35	15.763
Calgary_24h_100y	7:40	13.746
Calgary_24h_100y	7:45	12.251
Calgary_24h_100y	7:50	11.093
Calgary_24h_100y	7:55	10.166
Calgary_24h_100y	8:00	9.405
Calgary_24h_100y	8:05	8.768
Calgary_24h_100y	8:10	8.225

Calgary_24h_100y	8:15	7.756
Calgary_24h_100y	8:20	7.346
Calgary_24h_100y	8:25	6.985
Calgary_24h_100y	8:30	6.664
Calgary_24h_100y	8:35	6.376
Calgary_24h_100y	8:40	6.116
Calgary_24h_100y	8:45	5.88
Calgary_24h_100y	8:50	5.665
Calgary_24h_100y	8:55	5.468
Calgary_24h_100y	9:00	5.287
Calgary_24h_100y	9:05	5.119
Calgary_24h_100y	9:10	4.964
Calgary_24h_100y	9:15	4.819
Calgary_24h_100y	9:20	4.684
Calgary_24h_100y	9:25	4.558
Calgary_24h_100y	9:30	4.44
Calgary_24h_100y	9:35	4.329
Calgary_24h_100y	9:40	4.224
Calgary_24h_100y	9:45	4.125
Calgary_24h_100y	9:50	4.032
Calgary_24h_100y	9:55	3.943
Calgary_24h_100y	10:00	3.859
Calgary_24h_100y	10:05	3.78
Calgary_24h_100y	10:10	3.704
Calgary_24h_100y	10:15	3.631
Calgary_24h_100y	10:20	3.562
Calgary_24h_100y	10:25	3.496
Calgary_24h_100y	10:30	3.433
Calgary_24h_100y	10:35	3.373
Calgary_24h_100y	10:40	3.315
Calgary_24h_100y	10:45	3.259
Calgary_24h_100y	10:50	3.206
Calgary_24h_100y	10:55	3.154
Calgary_24h_100y	11:00	3.105
Calgary_24h_100y	11:05	3.057
Calgary_24h_100y	11:10	3.011
Calgary_24h_100y	11:15	2.967
Calgary_24h_100y	11:20	2.924
Calgary_24h_100y	11:25	2.883
Calgary_24h_100y	11:30	2.843
Calgary_24h_100y	11:35	2.805
Calgary_24h_100y	11:40	2.767
Calgary_24h_100y	11:45	2.731
Calgary_24h_100y	11:50	2.696
Calgary_24h_100y	11:55	2.662
Calgary_24h_100y	12:00	2.629
Calgary_24h_100y	12:05	2.597
Calgary_24h_100y	12:10	2.566
Calgary_24h_100y	12:15	2.536
Calgary_24h_100y	12:20	2.506
Calgary_24h_100y	12:25	2.478
Calgary_24h_100y	12:30	2.45
Calgary_24h_100y	12:35	2.423
Calgary_24h_100y	12:40	2.396
Calgary_24h_100y	12:45	2.371
Calgary_24h_100y	12:50	2.346
Calgary_24h_100y	12:55	2.321
Calgary_24h_100y	13:00	2.297
Calgary_24h_100y	13:05	2.274
Calgary_24h_100y	13:10	2.252
Calgary_24h_100y	13:15	2.229
Calgary_24h_100y	13:20	2.208
Calgary_24h_100y	13:25	2.187
Calgary_24h_100y	13:30	2.166
Calgary_24h_100y	13:35	2.146
Calgary_24h_100y	13:40	2.126
Calgary_24h_100y	13:45	2.107
Calgary_24h_100y	13:50	2.088
Calgary_24h_100y	13:55	2.069
Calgary_24h_100y	14:00	2.051
Calgary_24h_100y	14:05	2.034
Calgary_24h_100y	14:10	2.016
Calgary_24h_100y	14:15	1.999
Calgary_24h_100y	14:20	1.983
Calgary_24h_100y	14:25	1.966
Calgary_24h_100y	14:30	1.95
Calgary_24h_100y	14:35	1.935
Calgary_24h_100y	14:40	1.919
Calgary_24h_100y	14:45	1.904
Calgary_24h_100y	14:50	1.889
Calgary_24h_100y	14:55	1.875

Calgary_24h_100y	15:00	1.86
Calgary_24h_100y	15:05	1.846
Calgary_24h_100y	15:10	1.833
Calgary_24h_100y	15:15	1.819
Calgary_24h_100y	15:20	1.806
Calgary_24h_100y	15:25	1.793
Calgary_24h_100y	15:30	1.78
Calgary_24h_100y	15:35	1.767
Calgary_24h_100y	15:40	1.755
Calgary_24h_100y	15:45	1.743
Calgary_24h_100y	15:50	1.731
Calgary_24h_100y	15:55	1.719
Calgary_24h_100y	16:00	1.707
Calgary_24h_100y	16:05	1.696
Calgary_24h_100y	16:10	1.685
Calgary_24h_100y	16:15	1.673
Calgary_24h_100y	16:20	1.663
Calgary_24h_100y	16:25	1.652
Calgary_24h_100y	16:30	1.641
Calgary_24h_100y	16:35	1.631
Calgary_24h_100y	16:40	1.621
Calgary_24h_100y	16:45	1.611
Calgary_24h_100y	16:50	1.601
Calgary_24h_100y	16:55	1.591
Calgary_24h_100y	17:00	1.581
Calgary_24h_100y	17:05	1.572
Calgary_24h_100y	17:10	1.562
Calgary_24h_100y	17:15	1.553
Calgary_24h_100y	17:20	1.544
Calgary_24h_100y	17:25	1.535
Calgary_24h_100y	17:30	1.526
Calgary_24h_100y	17:35	1.517
Calgary_24h_100y	17:40	1.509
Calgary_24h_100y	17:45	1.5
Calgary_24h_100y	17:50	1.492
Calgary_24h_100y	17:55	1.484
Calgary_24h_100y	18:00	1.476
Calgary_24h_100y	18:05	1.467
Calgary_24h_100y	18:10	1.46
Calgary_24h_100y	18:15	1.452
Calgary_24h_100y	18:20	1.444
Calgary_24h_100y	18:25	1.436
Calgary_24h_100y	18:30	1.429
Calgary_24h_100y	18:35	1.421
Calgary_24h_100y	18:40	1.414
Calgary_24h_100y	18:45	1.407
Calgary_24h_100y	18:50	1.399
Calgary_24h_100y	18:55	1.392
Calgary_24h_100y	19:00	1.385
Calgary_24h_100y	19:05	1.378
Calgary_24h_100y	19:10	1.372
Calgary_24h_100y	19:15	1.365
Calgary_24h_100y	19:20	1.358
Calgary_24h_100y	19:25	1.352
Calgary_24h_100y	19:30	1.345
Calgary_24h_100y	19:35	1.339
Calgary_24h_100y	19:40	1.332
Calgary_24h_100y	19:45	1.326
Calgary_24h_100y	19:50	1.32
Calgary_24h_100y	19:55	1.313
Calgary_24h_100y	20:00	1.307
Calgary_24h_100y	20:05	1.301
Calgary_24h_100y	20:10	1.295
Calgary_24h_100y	20:15	1.289
Calgary_24h_100y	20:20	1.284
Calgary_24h_100y	20:25	1.278
Calgary_24h_100y	20:30	1.272
Calgary_24h_100y	20:35	1.266
Calgary_24h_100y	20:40	1.261
Calgary_24h_100y	20:45	1.255
Calgary_24h_100y	20:50	1.25
Calgary_24h_100y	20:55	1.244
Calgary_24h_100y	21:00	1.239
Calgary_24h_100y	21:05	1.234
Calgary_24h_100y	21:10	1.229
Calgary_24h_100y	21:15	1.223
Calgary_24h_100y	21:20	1.218
Calgary_24h_100y	21:25	1.213
Calgary_24h_100y	21:30	1.208
Calgary_24h_100y	21:35	1.203
Calgary_24h_100y	21:40	1.198

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Calgary_24h_100y            21:45      1.193
Calgary_24h_100y            21:50      1.188
Calgary_24h_100y            21:55      1.184
Calgary_24h_100y            22:00      1.179
Calgary_24h_100y            22:05      1.174
Calgary_24h_100y            22:10      1.17
Calgary_24h_100y            22:15      1.165
Calgary_24h_100y            22:20      1.16
Calgary_24h_100y            22:25      1.156
Calgary_24h_100y            22:30      1.151
Calgary_24h_100y            22:35      1.147
Calgary_24h_100y            22:40      1.143
Calgary_24h_100y            22:45      1.138
Calgary_24h_100y            22:50      1.134
Calgary_24h_100y            22:55      1.13
Calgary_24h_100y            23:00      1.125
Calgary_24h_100y            23:05      1.121
Calgary_24h_100y            23:10      1.117
Calgary_24h_100y            23:15      1.113
Calgary_24h_100y            23:20      1.109
Calgary_24h_100y            23:25      1.105
Calgary_24h_100y            23:30      1.101
Calgary_24h_100y            23:35      1.097
Calgary_24h_100y            23:40      1.093
Calgary_24h_100y            23:45      1.089
Calgary_24h_100y            23:50      1.085
Calgary_24h_100y            23:55      1.081
Calgary_24h_100y            24:00      1.077

;Calgary_24h_10y design storm, rain interval = 5 minutes, rain units = mm/hr.
Calgary_24h_10y             0:00       0
Calgary_24h_10y             0:05       0.747
Calgary_24h_10y             0:10       0.753
Calgary_24h_10y             0:15       0.76
Calgary_24h_10y             0:20       0.766
Calgary_24h_10y             0:25       0.773
Calgary_24h_10y             0:30       0.78
Calgary_24h_10y             0:35       0.787
Calgary_24h_10y             0:40       0.794
Calgary_24h_10y             0:45       0.801
Calgary_24h_10y             0:50       0.809
Calgary_24h_10y             0:55       0.817
Calgary_24h_10y             1:00       0.824
Calgary_24h_10y             1:05       0.832
Calgary_24h_10y             1:10       0.841
Calgary_24h_10y             1:15       0.849
Calgary_24h_10y             1:20       0.858
Calgary_24h_10y             1:25       0.867
Calgary_24h_10y             1:30       0.876
Calgary_24h_10y             1:35       0.885
Calgary_24h_10y             1:40       0.894
Calgary_24h_10y             1:45       0.904
Calgary_24h_10y             1:50       0.914
Calgary_24h_10y             1:55       0.925
Calgary_24h_10y             2:00       0.935
Calgary_24h_10y             2:05       0.946
Calgary_24h_10y             2:10       0.957
Calgary_24h_10y             2:15       0.969
Calgary_24h_10y             2:20       0.981
Calgary_24h_10y             2:25       0.993
Calgary_24h_10y             2:30       1.006
Calgary_24h_10y             2:35       1.019
Calgary_24h_10y             2:40       1.032
Calgary_24h_10y             2:45       1.046
Calgary_24h_10y             2:50       1.06
Calgary_24h_10y             2:55       1.075
Calgary_24h_10y             3:00       1.09
Calgary_24h_10y             3:05       1.106
Calgary_24h_10y             3:10       1.123
Calgary_24h_10y             3:15       1.14
Calgary_24h_10y             3:20       1.157
Calgary_24h_10y             3:25       1.176
Calgary_24h_10y             3:30       1.195
Calgary_24h_10y             3:35       1.214
Calgary_24h_10y             3:40       1.235
Calgary_24h_10y             3:45       1.257
Calgary_24h_10y             3:50       1.279
Calgary_24h_10y             3:55       1.302
Calgary_24h_10y             4:00       1.327
Calgary_24h_10y             4:05       1.352
Calgary_24h_10y             4:10       1.379
```

Calgary_24h_10y	4:15	1.407
Calgary_24h_10y	4:20	1.437
Calgary_24h_10y	4:25	1.468
Calgary_24h_10y	4:30	1.501
Calgary_24h_10y	4:35	1.536
Calgary_24h_10y	4:40	1.572
Calgary_24h_10y	4:45	1.611
Calgary_24h_10y	4:50	1.652
Calgary_24h_10y	4:55	1.696
Calgary_24h_10y	5:00	1.743
Calgary_24h_10y	5:05	1.793
Calgary_24h_10y	5:10	1.847
Calgary_24h_10y	5:15	1.904
Calgary_24h_10y	5:20	1.966
Calgary_24h_10y	5:25	2.034
Calgary_24h_10y	5:30	2.107
Calgary_24h_10y	5:35	2.187
Calgary_24h_10y	5:40	2.275
Calgary_24h_10y	5:45	2.371
Calgary_24h_10y	5:50	2.478
Calgary_24h_10y	5:55	2.598
Calgary_24h_10y	6:00	2.733
Calgary_24h_10y	6:05	2.885
Calgary_24h_10y	6:10	3.061
Calgary_24h_10y	6:15	3.264
Calgary_24h_10y	6:20	3.503
Calgary_24h_10y	6:25	3.79
Calgary_24h_10y	6:30	4.14
Calgary_24h_10y	6:35	4.58
Calgary_24h_10y	6:40	5.153
Calgary_24h_10y	6:45	5.936
Calgary_24h_10y	6:50	7.085
Calgary_24h_10y	6:55	8.972
Calgary_24h_10y	7:00	12.807
Calgary_24h_10y	7:05	27.274
Calgary_24h_10y	7:10	106.693
Calgary_24h_10y	7:15	36.52
Calgary_24h_10y	7:20	21.432
Calgary_24h_10y	7:25	15.694
Calgary_24h_10y	7:30	12.604
Calgary_24h_10y	7:35	10.647
Calgary_24h_10y	7:40	9.284
Calgary_24h_10y	7:45	8.275
Calgary_24h_10y	7:50	7.493
Calgary_24h_10y	7:55	6.868
Calgary_24h_10y	8:00	6.355
Calgary_24h_10y	8:05	5.925
Calgary_24h_10y	8:10	5.559
Calgary_24h_10y	8:15	5.242
Calgary_24h_10y	8:20	4.966
Calgary_24h_10y	8:25	4.723
Calgary_24h_10y	8:30	4.506
Calgary_24h_10y	8:35	4.312
Calgary_24h_10y	8:40	4.137
Calgary_24h_10y	8:45	3.978
Calgary_24h_10y	8:50	3.833
Calgary_24h_10y	8:55	3.7
Calgary_24h_10y	9:00	3.578
Calgary_24h_10y	9:05	3.465
Calgary_24h_10y	9:10	3.36
Calgary_24h_10y	9:15	3.263
Calgary_24h_10y	9:20	3.172
Calgary_24h_10y	9:25	3.087
Calgary_24h_10y	9:30	3.007
Calgary_24h_10y	9:35	2.932
Calgary_24h_10y	9:40	2.862
Calgary_24h_10y	9:45	2.795
Calgary_24h_10y	9:50	2.732
Calgary_24h_10y	9:55	2.672
Calgary_24h_10y	10:00	2.616
Calgary_24h_10y	10:05	2.562
Calgary_24h_10y	10:10	2.511
Calgary_24h_10y	10:15	2.462
Calgary_24h_10y	10:20	2.415
Calgary_24h_10y	10:25	2.371
Calgary_24h_10y	10:30	2.328
Calgary_24h_10y	10:35	2.287
Calgary_24h_10y	10:40	2.248
Calgary_24h_10y	10:45	2.211
Calgary_24h_10y	10:50	2.175
Calgary_24h_10y	10:55	2.14

Calgary_24h_10y	11:00	2.107
Calgary_24h_10y	11:05	2.075
Calgary_24h_10y	11:10	2.044
Calgary_24h_10y	11:15	2.014
Calgary_24h_10y	11:20	1.985
Calgary_24h_10y	11:25	1.957
Calgary_24h_10y	11:30	1.93
Calgary_24h_10y	11:35	1.904
Calgary_24h_10y	11:40	1.879
Calgary_24h_10y	11:45	1.854
Calgary_24h_10y	11:50	1.831
Calgary_24h_10y	11:55	1.808
Calgary_24h_10y	12:00	1.785
Calgary_24h_10y	12:05	1.764
Calgary_24h_10y	12:10	1.743
Calgary_24h_10y	12:15	1.722
Calgary_24h_10y	12:20	1.703
Calgary_24h_10y	12:25	1.683
Calgary_24h_10y	12:30	1.664
Calgary_24h_10y	12:35	1.646
Calgary_24h_10y	12:40	1.628
Calgary_24h_10y	12:45	1.611
Calgary_24h_10y	12:50	1.594
Calgary_24h_10y	12:55	1.578
Calgary_24h_10y	13:00	1.561
Calgary_24h_10y	13:05	1.546
Calgary_24h_10y	13:10	1.53
Calgary_24h_10y	13:15	1.516
Calgary_24h_10y	13:20	1.501
Calgary_24h_10y	13:25	1.487
Calgary_24h_10y	13:30	1.473
Calgary_24h_10y	13:35	1.459
Calgary_24h_10y	13:40	1.446
Calgary_24h_10y	13:45	1.433
Calgary_24h_10y	13:50	1.42
Calgary_24h_10y	13:55	1.407
Calgary_24h_10y	14:00	1.395
Calgary_24h_10y	14:05	1.383
Calgary_24h_10y	14:10	1.371
Calgary_24h_10y	14:15	1.36
Calgary_24h_10y	14:20	1.349
Calgary_24h_10y	14:25	1.338
Calgary_24h_10y	14:30	1.327
Calgary_24h_10y	14:35	1.316
Calgary_24h_10y	14:40	1.306
Calgary_24h_10y	14:45	1.296
Calgary_24h_10y	14:50	1.286
Calgary_24h_10y	14:55	1.276
Calgary_24h_10y	15:00	1.266
Calgary_24h_10y	15:05	1.257
Calgary_24h_10y	15:10	1.247
Calgary_24h_10y	15:15	1.238
Calgary_24h_10y	15:20	1.229
Calgary_24h_10y	15:25	1.22
Calgary_24h_10y	15:30	1.212
Calgary_24h_10y	15:35	1.203
Calgary_24h_10y	15:40	1.195
Calgary_24h_10y	15:45	1.186
Calgary_24h_10y	15:50	1.178
Calgary_24h_10y	15:55	1.17
Calgary_24h_10y	16:00	1.162
Calgary_24h_10y	16:05	1.155
Calgary_24h_10y	16:10	1.147
Calgary_24h_10y	16:15	1.14
Calgary_24h_10y	16:20	1.132
Calgary_24h_10y	16:25	1.125
Calgary_24h_10y	16:30	1.118
Calgary_24h_10y	16:35	1.111
Calgary_24h_10y	16:40	1.104
Calgary_24h_10y	16:45	1.097
Calgary_24h_10y	16:50	1.09
Calgary_24h_10y	16:55	1.084
Calgary_24h_10y	17:00	1.077
Calgary_24h_10y	17:05	1.071
Calgary_24h_10y	17:10	1.064
Calgary_24h_10y	17:15	1.058
Calgary_24h_10y	17:20	1.052
Calgary_24h_10y	17:25	1.046
Calgary_24h_10y	17:30	1.04
Calgary_24h_10y	17:35	1.034
Calgary_24h_10y	17:40	1.028

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Calgary_24h_10y             17:45      1.022
Calgary_24h_10y             17:50      1.017
Calgary_24h_10y             17:55      1.011
Calgary_24h_10y             18:00      1.006
Calgary_24h_10y             18:05      1
Calgary_24h_10y             18:10      0.995
Calgary_24h_10y             18:15      0.989
Calgary_24h_10y             18:20      0.984
Calgary_24h_10y             18:25      0.979
Calgary_24h_10y             18:30      0.974
Calgary_24h_10y             18:35      0.969
Calgary_24h_10y             18:40      0.964
Calgary_24h_10y             18:45      0.959
Calgary_24h_10y             18:50      0.954
Calgary_24h_10y             18:55      0.949
Calgary_24h_10y             19:00      0.945
Calgary_24h_10y             19:05      0.94
Calgary_24h_10y             19:10      0.935
Calgary_24h_10y             19:15      0.931
Calgary_24h_10y             19:20      0.926
Calgary_24h_10y             19:25      0.922
Calgary_24h_10y             19:30      0.917
Calgary_24h_10y             19:35      0.913
Calgary_24h_10y             19:40      0.908
Calgary_24h_10y             19:45      0.904
Calgary_24h_10y             19:50      0.9
Calgary_24h_10y             19:55      0.896
Calgary_24h_10y             20:00      0.892
Calgary_24h_10y             20:05      0.888
Calgary_24h_10y             20:10      0.884
Calgary_24h_10y             20:15      0.88
Calgary_24h_10y             20:20      0.876
Calgary_24h_10y             20:25      0.872
Calgary_24h_10y             20:30      0.868
Calgary_24h_10y             20:35      0.864
Calgary_24h_10y             20:40      0.86
Calgary_24h_10y             20:45      0.856
Calgary_24h_10y             20:50      0.853
Calgary_24h_10y             20:55      0.849
Calgary_24h_10y             21:00      0.845
Calgary_24h_10y             21:05      0.842
Calgary_24h_10y             21:10      0.838
Calgary_24h_10y             21:15      0.835
Calgary_24h_10y             21:20      0.831
Calgary_24h_10y             21:25      0.828
Calgary_24h_10y             21:30      0.824
Calgary_24h_10y             21:35      0.821
Calgary_24h_10y             21:40      0.818
Calgary_24h_10y             21:45      0.814
Calgary_24h_10y             21:50      0.811
Calgary_24h_10y             21:55      0.808
Calgary_24h_10y             22:00      0.805
Calgary_24h_10y             22:05      0.801
Calgary_24h_10y             22:10      0.798
Calgary_24h_10y             22:15      0.795
Calgary_24h_10y             22:20      0.792
Calgary_24h_10y             22:25      0.789
Calgary_24h_10y             22:30      0.786
Calgary_24h_10y             22:35      0.783
Calgary_24h_10y             22:40      0.78
Calgary_24h_10y             22:45      0.777
Calgary_24h_10y             22:50      0.774
Calgary_24h_10y             22:55      0.771
Calgary_24h_10y             23:00      0.768
Calgary_24h_10y             23:05      0.765
Calgary_24h_10y             23:10      0.763
Calgary_24h_10y             23:15      0.76
Calgary_24h_10y             23:20      0.757
Calgary_24h_10y             23:25      0.754
Calgary_24h_10y             23:30      0.752
Calgary_24h_10y             23:35      0.749
Calgary_24h_10y             23:40      0.746
Calgary_24h_10y             23:45      0.743
Calgary_24h_10y             23:50      0.741
Calgary_24h_10y             23:55      0.738
Calgary_24h_10y             24:00      0.736

[PATTERNS]
;;Name           Type       Multipliers
;;-------------- ---------- -----------
Hourly           HOURLY     1.0   1.0   1.0   1.0   1.0   1.0
```

```
Hourly                   1.0   1.0   1.0   1.0   1.0   1.0
Hourly                   1.0   1.0   1.0   1.0   1.0   1.0
Hourly                   1.0   1.0   1.0   1.0   1.0   1.0


[REPORT]
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       -12758440.8667574 6625487.70304261 -12750804.5167033 6627979.47594509
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
EastOutfall      -12751819.402    6625830.05
WestOutfall      -12757239.252    6625880.054
EastPit          -12751373.089    6626106.784
EastRecharge     -12754597.508    6625952.573
WestPit          -12757773.348    6627008.087
WestRecharge     -12755263.687    6625981.545

[VERTICES]
;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------

[POLYGONS]
;;Subcatchment   X-Coord          Y-Coord
;;-------------- ---------------- ----------------
East+10%         -12752206.192    6627060.21
East+10%         -12752333.938    6627543.497
East+10%         -12752354.031    6627585.108
East+10%         -12752394.293    6627652.25
East+10%         -12752373.462    6627753.852
East+10%         -12752314.302    6627774.789
East+10%         -12752258.068    6627707.369
East+10%         -12752232.655    6627701.198
East+10%         -12752175.891    6627727.203
East+10%         -12752117.815    6627787.511
East+10%         -12752065.987    6627787.567
East+10%         -12751963.513    6627702.112
East+10%         -12751705.838    6627031.623
East+10%         -12751416.581    6626256.673
East+10%         -12751151.624    6626045.775
East+10%         -12751162.992    6625990.172
East+10%         -12751293.339    6626019.406
East+10%         -12751389.57     6626035.743
East+10%         -12751617.726    6626112.528
East+10%         -12751607.213    6626199.433
East+10%         -12751623.307    6626238.431
East+10%         -12751711.746    6626295.479
East+10%         -12751746.819    6626386.884
East+10%         -12751773.31     6626414.075
East+10%         -12751826.126    6626463.972
East+10%         -12751880.806    6626522.378
East+10%         -12751939.606    6626522.734
East+10%         -12751958.873    6626510.504
East+10%         -12752128.698    6627009.114
East+10%         -12752206.192    6627060.21
EastPitSC        -12751464.214    6625700.227
EastPitSC        -12751464.214    6625861.448
EastPitSC        -12751295.983    6625861.448
EastPitSC        -12751295.983    6625686.208
EastPitSC        -12751464.214    6625700.227
EastRechargeSC   -12754688.632    6625847.429
EastRechargeSC   -12754485.354    6625847.429
EastRechargeSC   -12754492.363    6625679.198
EastRechargeSC   -12754695.642    6625672.188
EastRechargeSC   -12754688.632    6625847.429
West+10%         -12757904.886    6626923.932
West+10%         -12757904.249    6627820.451
West+10%         -12757272.267    6627866.214
West+10%         -12757272.974    6626968.667
West+10%         -12757789.554    6626923.756
West+10%         -12757904.886    6626923.932
```

```
WestPitSC        -12758093.76     6626798.928
WestPitSC        -12757983.238    6626798.928
WestPitSC        -12757985.363    6626692.657
WestPitSC        -12758085.258    6626696.908
WestPitSC        -12758093.76     6626798.928
WestRechargeSC   -12755380.952    6625707.236
WestRechargeSC   -12755270.43     6625707.236
WestRechargeSC   -12755272.555    6625600.965
WestRechargeSC   -12755372.45     6625605.216
WestRechargeSC   -12755380.952    6625707.236

[SYMBOLS]
;;Gage           X-Coord          Y-Coord
;;-------------- ---------------- ----------------


  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
  --------------------------------------------------------------

        Burnco pond sizing continuous event simulation


  *************
  Element Count
  *************
  Number of rain gages ...... 3
  Number of subcatchments ... 6
  Number of nodes ........... 6
  Number of links ........... 4
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                  Data       Recording
  Name                 Data Source                Type       Interval
  ------------------------------------------------------------------
  Calgary_24h_100y     Calgary_24h_100y           INTENSITY    5 min.
  Calgary_24h_10y      Calgary_24h_10y            INTENSITY    5 min.
  Precip_1960-2014     F:\26388\512\Surface Water\2 - SWMP\070 - Design\PCSWMM Model\Precip60_14_V5.dat


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
  ------------------------------------------------------------------------------------------------
  East+10%                   23.75   1187.50     25.00    0.5000 Precip_1960-2014     EastPit
  EastPitSC                   6.25    250.00    100.00    0.5000 Precip_1960-2014     EastPit
  EastRechargeSC              1.15    107.01    100.00    0.5000 Precip_1960-2014     EastRecharge
  West+10%                   18.75    937.50     25.00    0.5000 Precip_1960-2014     WestPit
  WestPitSC                   6.25    250.00    100.00    0.5000 Precip_1960-2014     WestPit
  WestRechargeSC              1.04    101.98    100.00    0.5000 Precip_1960-2014     WestRecharge


  ************
  Node Summary
  ************
                                        Invert      Max.    Ponded    External
  Name                 Type              Elev.     Depth      Area    Inflow
  ------------------------------------------------------------------------
  EastOutfall          OUTFALL           0.00      0.40       0.0
  WestOutfall          OUTFALL           0.00      0.50       0.0
  EastPit              STORAGE           0.00      3.00       0.0    Yes
  EastRecharge         STORAGE           0.00      2.50       0.0
  WestPit              STORAGE           0.00      2.00       0.0    Yes
  WestRecharge         STORAGE           0.00      2.50       0.0


  ************
  Link Summary
  ************
  Name             From Node        To Node          Type            Length    %Slope Roughness
  ---------------------------------------------------------------------------------------------
  C1               WestRecharge     WestOutfall      CONDUIT          100.0    2.5008    0.0100
  C2               EastRecharge     EastOutfall      CONDUIT          100.0    2.5008    0.0100
  P1               WestPit          WestRecharge     TYPE4 PUMP
  P2               EastPit          EastRecharge     TYPE4 PUMP
```

```
**********
Cross Section Summary
**********
                                    Full      Full      Hyd.      Max.   No. of      Full
Conduit          Shape             Depth      Area      Rad.     Width  Barrels      Flow
-------------------------------------------------------------------------------------------
C1               TRAPEZOIDAL        0.50      2.50      0.40      6.00        1     21.50
C2               TRAPEZOIDAL        0.40      1.92      0.33      5.60        1     14.55


**********
Rainfall File Summary
**********
Station    First        Last         Recording   Periods    Periods    Periods
ID         Date         Date         Frequency  w/Precip    Missing    Malfunc.
-------------------------------------------------------------------------------
3031093    01/02/1960   12/29/2014      60 min     40313          0          0


************************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
************************************************************

***************
Analysis Options
***************
Flow Units ..............  CMS
Process Models:
  Rainfall/Runoff ........  YES
  RDII ...................  NO
  Snowmelt ...............  YES
  Groundwater ............  NO
  Flow Routing ...........  YES
  Ponding Allowed ........  YES
  Water Quality ..........  NO
Infiltration Method ......  CURVE_NUMBER
Flow Routing Method ......  DYNWAVE
Starting Date ............  01/01/1960 00:00:00
Ending Date ..............  12/31/2014 23:59:00
Antecedent Dry Days ......  0.0
Report Time Step .........  01:00:00
Wet Time Step ............  00:05:00
Dry Time Step ............  00:30:00
Routing Time Step ........  60.00 sec
Variable Time Step .......  YES
Maximum Trials ...........  8
Number of Threads ........  1
Head Tolerance ...........  0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Initial Snow Cover .......         0.186         3.247
Total Precipitation ......      1597.872     27942.148
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........       674.644     11797.575
Surface Runoff ...........       923.885     16156.076
Snow Removed .............         0.000         0.000
Final Snow Cover .........         0.000         0.000
Final Storage ............         0.045         0.778
Continuity Error (%) .....        -0.032

**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       923.885      9238.948
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........      3939.054     39390.953
External Outflow .........         0.000         0.000
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........      4863.107     48631.578
Initial Stored Volume ....         0.000         0.000
```

```
Final Stored Volume ......          0.797         7.966
Continuity Error (%) .....         -0.020


**************************
Time-Step Critical Elements
**************************
None


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    58.50 sec
Average Time Step           :    60.00 sec
Maximum Time Step           :    60.00 sec
Percent in Steady State     :     2.21
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00


**************************
Subcatchment Runoff Summary
**************************
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
East+10%	27942.15	0.00	0.00	15873.98	12079.05	2868.79	1.84	0.432
EastPitSC	27942.15	0.00	0.00	0.00	27954.24	1747.15	1.14	1.000
EastRechargeSC	27942.15	0.00	0.00	0.00	27961.99	320.17	0.21	1.001
West+10%	27942.15	0.00	0.00	15873.98	12079.05	2264.84	1.45	0.432
WestPitSC	27942.15	0.00	0.00	0.00	27954.24	1747.15	1.14	1.000
WestRechargeSC	27942.15	0.00	0.00	0.00	27962.55	290.81	0.19	1.001

```
******************
Node Depth Summary
******************
```

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
EastOutfall	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
WestOutfall	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
EastPit	STORAGE	0.06	0.75	0.75	16595 11:56	0.75
EastRecharge	STORAGE	0.06	0.89	0.89	19552 11:34	0.89
WestPit	STORAGE	0.06	0.53	0.53	16595 09:49	0.53
WestRecharge	STORAGE	0.04	1.06	1.06	16619 23:50	1.06

```
******************
Node Inflow Summary
******************
```

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
EastOutfall	OUTFALL	0.000	0.000	0 00:00	0	0	0.000 ltr
WestOutfall	OUTFALL	0.000	0.000	0 00:00	0	0	0.000 ltr
EastPit	STORAGE	2.988	2.988	17322 20:00	3.04e+004	3.04e+004	0.123
EastRecharge	STORAGE	0.208	0.240	17322 20:00	320	3.07e+004	0.061
WestPit	STORAGE	2.594	2.594	17322 20:00	1.77e+004	1.77e+004	-0.259
WestRecharge	STORAGE	0.189	0.221	17322 20:00	291	1.8e+004	0.041

```
**********************
Node Surcharge Summary
```

****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
EastPit	3.870	2	0	0	46.070	24	16595 11:56	0.032
EastRecharge	0.578	2	0	100	8.740	31	19552 11:34	0.074
WestPit	3.504	3	0	0	32.578	26	16595 09:49	0.032
WestRecharge	0.337	1	0	100	9.455	37	16619 23:50	0.099

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
EastOutfall	0.00	0.000	0.000	0.000
WestOutfall	0.00	0.000	0.000	0.000
System	0.00	0.000	0.000	0.000

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.000	0 00:00	0.00	0.00	0.00
C2	CONDUIT	0.000	0 00:00	0.00	0.00	0.00
P1	PUMP	0.032	6 05:17		1.00	
P2	PUMP	0.032	3 10:59		1.00	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow CMS	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump Curve Low	% Time Off Pump Curve High
P1	31.88	1962	0.00	0.03	0.03	17706.900	4377.08	0.0	0.0
P2	54.64	2289	0.00	0.03	0.03	30343.019	7114.26	0.0	0.0

Analysis begun on: Wed Feb 05 16:37:35 2020
Analysis ended on: Wed Feb 05 16:39:54 2020
Total elapsed time: 00:02:19

4 GROUNDWATER DIVERSION CONTINUOUS MODEL

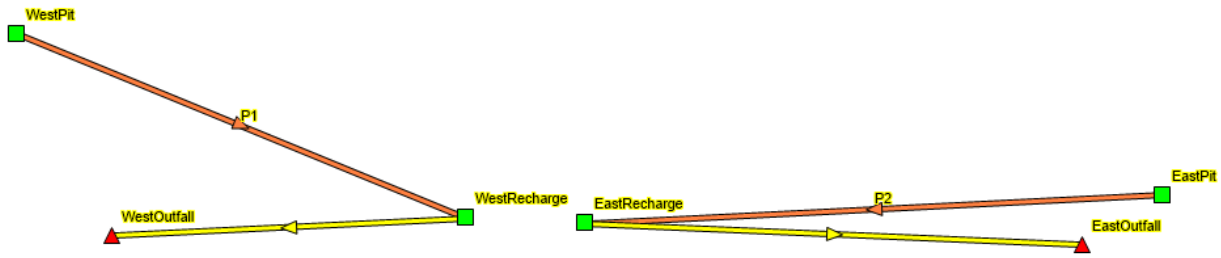

FIGURE A4 Groundwater Diversion Model Schematic

4.1 Initial Dewatering Model

```
[TITLE]
Initial dewatering model

[OPTIONS]
;;Options             Value
;;------------------- ------------
FLOW_UNITS           CMS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    YES
START_DATE           04/01/1960
START_TIME           00:00:00
REPORT_START_DATE    04/01/1960
REPORT_START_TIME    00:00:00
END_DATE             10/01/1960
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:05:00
DRY_STEP             00:30:00
ROUTING_STEP         60
INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time    Snow    Data
;;Name           Type      Intrvl  Catch   Source
;;-------------- --------- ------ ------ ----------
Calgary_24h_100y INTENSITY 0:05   1.0    TIMESERIES Calgary_24h_100y
Calgary_24h_10y  INTENSITY 0:05   1.0    TIMESERIES Calgary_24h_10y
Precip_1960-2014 VOLUME    1:00   1.0    FILE       "F:\26388\512\Surface Water\2 - SWMP\070 - Design\PCSWMM
Model\Precip60_14_V5.dat" 3031093    MM
```

```
[SNOWPACKS]
Calgary          PLOWABLE   0.02       0.1        1          0.03       0.00       0.00       0.0
Calgary          IMPERVIOUS 0.02       0.1        1          0.08       2.7        1          0
Calgary          PERVIOUS   0.02       0.1        1          0.3        2.7        1          0
Calgary          REMOVAL    6.53       0.0        0.0        1          0.0        0.0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
EastOutfall      0          FREE                          NO
WestOutfall      0          FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                              Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                             Frac.
Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- ----------
-------------
EastPit          0        3        3        TABULAR    250x250Pit_!mDeep           0       0
EastRecharge     0        1        0        TABULAR    95x95Pond                  0        0        109.98
10.92    0.368
WestPit          0        2        2        TABULAR    250x250Pit_!mDeep           0       0
WestRecharge     0        1.5      0        TABULAR    90x90Pond                  0        0        109.98
10.92    0.368

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----
------
C1               WestRecharge     WestOutfall      100        0.01       2.5        0          0          0
C2               EastRecharge     EastOutfall      100        0.01       2.5        0          0          0

[PUMPS]
;;               Inlet            Outlet           Pump             Init.  Startup  Shutoff
;;Name           Node             Node             Curve            Status Depth    Depth
;;-------------- ---------------- ---------------- ---------------- ------ -------- --------
P1               WestPit          WestRecharge     P1               OFF    0.1      0.01
P2               EastPit          EastRecharge     P1               OFF    0.1      0.01

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C1               TRAPEZOIDAL  0.5              4          2          2          1
C2               TRAPEZOIDAL  0.4              4          2          2          1

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------

[INFLOWS]
;;                                                Param    Units    Scale    Baseline Baseline
;;Node           Parameter        Time Series      Type     Factor   Factor   Value    Pattern
;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
EastPit          FLOW             ""               FLOW     1.0      1        0.014838
WestPit          FLOW             ""               FLOW     1.0      1        0.007859

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Off              Pump4      0          0

P1               Pump4      0          0
P1                          0.001      0.032
P1                          2          0.032

;Two Pumps
P2               Pump4      0          0
P2                          0.001      0.064
P2                          2          0.064

100x100Pit       Storage    0          8464
100x100Pit                  2          10000

100x100Pond      Storage    0          10000
100x100Pond                 1          11664
100x100Pond                 1.5        12544
100x100Pond                 2          13456
100x100Pond                 2.5        14400
```

```
150x150Pit_1mDeep Storage    0          21316
150x150Pit_1mDeep            1          22500

250x250Pit_!mDeep Storage    0          60516
250x250Pit_!mDeep            1          62500

50x50Pond        Storage     0          2500
50x50Pond                    1          3364
50x50Pond                    1.5        3844

55x55Pond        Storage     0          3025
55x55Pond                    1          3969

60x60Pond        Storage     0          3600
60x60Pond                    1          4624
60x60Pond                    1.5        5184

65x65Pond        Storage     0          4225
65x65Pond                    1          5329

70x70Pond        Storage     0          4900
70x70Pond                    1          6084
70x70Pond                    1.5        6724
70x70Pond                    2          7396
70x70Pond                    2.5        8100

75x75Pond        Storage     0          5625
75x75Pond                    1          6889
75x75Pond                    1.5        7569
75x75Pond                    2          8281
75x75Pond                    2.5        9025

80x80Pond        Storage     0          6400
80x80Pond                    1          7744
80x80Pond                    1.5        8464
80x80Pond                    2          9216
80x80Pond                    2.5        10000

85x85Pond        Storage     0          7225
85x85Pond                    2.5        11025

90x90Pond        Storage     0          8100
90x90Pond                    2.5        12100

95x95Pond        Storage     0          9025
95x95Pond                    2.5        13225

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;Calgary_24h_100y design storm, rain interval = 5 minutes, rain units = mm/hr.
Calgary_24h_100y             0:00       0
Calgary_24h_100y             0:05       1.094
Calgary_24h_100y             0:10       1.103
Calgary_24h_100y             0:15       1.113
Calgary_24h_100y             0:20       1.122
Calgary_24h_100y             0:25       1.132
Calgary_24h_100y             0:30       1.143
Calgary_24h_100y             0:35       1.153
Calgary_24h_100y             0:40       1.163
Calgary_24h_100y             0:45       1.174
Calgary_24h_100y             0:50       1.185
Calgary_24h_100y             0:55       1.197
Calgary_24h_100y             1:00       1.208
Calgary_24h_100y             1:05       1.22
Calgary_24h_100y             1:10       1.232
Calgary_24h_100y             1:15       1.245
Calgary_24h_100y             1:20       1.257
Calgary_24h_100y             1:25       1.27
Calgary_24h_100y             1:30       1.284
Calgary_24h_100y             1:35       1.297
Calgary_24h_100y             1:40       1.311
Calgary_24h_100y             1:45       1.326
Calgary_24h_100y             1:50       1.341
Calgary_24h_100y             1:55       1.356
Calgary_24h_100y             2:00       1.372
Calgary_24h_100y             2:05       1.388
Calgary_24h_100y             2:10       1.404
Calgary_24h_100y             2:15       1.421
Calgary_24h_100y             2:20       1.439
Calgary_24h_100y             2:25       1.457
```

Calgary_24h_100y	2:30	1.476
Calgary_24h_100y	2:35	1.495
Calgary_24h_100y	2:40	1.515
Calgary_24h_100y	2:45	1.535
Calgary_24h_100y	2:50	1.556
Calgary_24h_100y	2:55	1.578
Calgary_24h_100y	3:00	1.601
Calgary_24h_100y	3:05	1.624
Calgary_24h_100y	3:10	1.648
Calgary_24h_100y	3:15	1.674
Calgary_24h_100y	3:20	1.7
Calgary_24h_100y	3:25	1.727
Calgary_24h_100y	3:30	1.755
Calgary_24h_100y	3:35	1.784
Calgary_24h_100y	3:40	1.815
Calgary_24h_100y	3:45	1.846
Calgary_24h_100y	3:50	1.88
Calgary_24h_100y	3:55	1.914
Calgary_24h_100y	4:00	1.95
Calgary_24h_100y	4:05	1.988
Calgary_24h_100y	4:10	2.028
Calgary_24h_100y	4:15	2.07
Calgary_24h_100y	4:20	2.113
Calgary_24h_100y	4:25	2.159
Calgary_24h_100y	4:30	2.208
Calgary_24h_100y	4:35	2.259
Calgary_24h_100y	4:40	2.313
Calgary_24h_100y	4:45	2.371
Calgary_24h_100y	4:50	2.432
Calgary_24h_100y	4:55	2.497
Calgary_24h_100y	5:00	2.566
Calgary_24h_100y	5:05	2.64
Calgary_24h_100y	5:10	2.719
Calgary_24h_100y	5:15	2.805
Calgary_24h_100y	5:20	2.897
Calgary_24h_100y	5:25	2.997
Calgary_24h_100y	5:30	3.105
Calgary_24h_100y	5:35	3.224
Calgary_24h_100y	5:40	3.354
Calgary_24h_100y	5:45	3.497
Calgary_24h_100y	5:50	3.656
Calgary_24h_100y	5:55	3.833
Calgary_24h_100y	6:00	4.033
Calgary_24h_100y	6:05	4.259
Calgary_24h_100y	6:10	4.519
Calgary_24h_100y	6:15	4.821
Calgary_24h_100y	6:20	5.176
Calgary_24h_100y	6:25	5.601
Calgary_24h_100y	6:30	6.12
Calgary_24h_100y	6:35	6.773
Calgary_24h_100y	6:40	7.624
Calgary_24h_100y	6:45	8.785
Calgary_24h_100y	6:50	10.488
Calgary_24h_100y	6:55	13.283
Calgary_24h_100y	7:00	18.961
Calgary_24h_100y	7:05	40.516
Calgary_24h_100y	7:10	168.138
Calgary_24h_100y	7:15	54.372
Calgary_24h_100y	7:20	31.748
Calgary_24h_100y	7:25	23.236
Calgary_24h_100y	7:30	18.66
Calgary_24h_100y	7:35	15.763
Calgary_24h_100y	7:40	13.746
Calgary_24h_100y	7:45	12.251
Calgary_24h_100y	7:50	11.093
Calgary_24h_100y	7:55	10.166
Calgary_24h_100y	8:00	9.405
Calgary_24h_100y	8:05	8.768
Calgary_24h_100y	8:10	8.225
Calgary_24h_100y	8:15	7.756
Calgary_24h_100y	8:20	7.346
Calgary_24h_100y	8:25	6.985
Calgary_24h_100y	8:30	6.664
Calgary_24h_100y	8:35	6.376
Calgary_24h_100y	8:40	6.116
Calgary_24h_100y	8:45	5.88
Calgary_24h_100y	8:50	5.665
Calgary_24h_100y	8:55	5.468
Calgary_24h_100y	9:00	5.287
Calgary_24h_100y	9:05	5.119
Calgary_24h_100y	9:10	4.964

Calgary_24h_100y	9:15	4.819
Calgary_24h_100y	9:20	4.684
Calgary_24h_100y	9:25	4.558
Calgary_24h_100y	9:30	4.44
Calgary_24h_100y	9:35	4.329
Calgary_24h_100y	9:40	4.224
Calgary_24h_100y	9:45	4.125
Calgary_24h_100y	9:50	4.032
Calgary_24h_100y	9:55	3.943
Calgary_24h_100y	10:00	3.859
Calgary_24h_100y	10:05	3.78
Calgary_24h_100y	10:10	3.704
Calgary_24h_100y	10:15	3.631
Calgary_24h_100y	10:20	3.562
Calgary_24h_100y	10:25	3.496
Calgary_24h_100y	10:30	3.433
Calgary_24h_100y	10:35	3.373
Calgary_24h_100y	10:40	3.315
Calgary_24h_100y	10:45	3.259
Calgary_24h_100y	10:50	3.206
Calgary_24h_100y	10:55	3.154
Calgary_24h_100y	11:00	3.105
Calgary_24h_100y	11:05	3.057
Calgary_24h_100y	11:10	3.011
Calgary_24h_100y	11:15	2.967
Calgary_24h_100y	11:20	2.924
Calgary_24h_100y	11:25	2.883
Calgary_24h_100y	11:30	2.843
Calgary_24h_100y	11:35	2.805
Calgary_24h_100y	11:40	2.767
Calgary_24h_100y	11:45	2.731
Calgary_24h_100y	11:50	2.696
Calgary_24h_100y	11:55	2.662
Calgary_24h_100y	12:00	2.629
Calgary_24h_100y	12:05	2.597
Calgary_24h_100y	12:10	2.566
Calgary_24h_100y	12:15	2.536
Calgary_24h_100y	12:20	2.506
Calgary_24h_100y	12:25	2.478
Calgary_24h_100y	12:30	2.45
Calgary_24h_100y	12:35	2.423
Calgary_24h_100y	12:40	2.396
Calgary_24h_100y	12:45	2.371
Calgary_24h_100y	12:50	2.346
Calgary_24h_100y	12:55	2.321
Calgary_24h_100y	13:00	2.297
Calgary_24h_100y	13:05	2.274
Calgary_24h_100y	13:10	2.252
Calgary_24h_100y	13:15	2.229
Calgary_24h_100y	13:20	2.208
Calgary_24h_100y	13:25	2.187
Calgary_24h_100y	13:30	2.166
Calgary_24h_100y	13:35	2.146
Calgary_24h_100y	13:40	2.126
Calgary_24h_100y	13:45	2.107
Calgary_24h_100y	13:50	2.088
Calgary_24h_100y	13:55	2.069
Calgary_24h_100y	14:00	2.051
Calgary_24h_100y	14:05	2.034
Calgary_24h_100y	14:10	2.016
Calgary_24h_100y	14:15	1.999
Calgary_24h_100y	14:20	1.983
Calgary_24h_100y	14:25	1.966
Calgary_24h_100y	14:30	1.95
Calgary_24h_100y	14:35	1.935
Calgary_24h_100y	14:40	1.919
Calgary_24h_100y	14:45	1.904
Calgary_24h_100y	14:50	1.889
Calgary_24h_100y	14:55	1.875
Calgary_24h_100y	15:00	1.86
Calgary_24h_100y	15:05	1.846
Calgary_24h_100y	15:10	1.833
Calgary_24h_100y	15:15	1.819
Calgary_24h_100y	15:20	1.806
Calgary_24h_100y	15:25	1.793
Calgary_24h_100y	15:30	1.78
Calgary_24h_100y	15:35	1.767
Calgary_24h_100y	15:40	1.755
Calgary_24h_100y	15:45	1.743
Calgary_24h_100y	15:50	1.731
Calgary_24h_100y	15:55	1.719

Calgary_24h_100y	16:00	1.707
Calgary_24h_100y	16:05	1.696
Calgary_24h_100y	16:10	1.685
Calgary_24h_100y	16:15	1.673
Calgary_24h_100y	16:20	1.663
Calgary_24h_100y	16:25	1.652
Calgary_24h_100y	16:30	1.641
Calgary_24h_100y	16:35	1.631
Calgary_24h_100y	16:40	1.621
Calgary_24h_100y	16:45	1.611
Calgary_24h_100y	16:50	1.601
Calgary_24h_100y	16:55	1.591
Calgary_24h_100y	17:00	1.581
Calgary_24h_100y	17:05	1.572
Calgary_24h_100y	17:10	1.562
Calgary_24h_100y	17:15	1.553
Calgary_24h_100y	17:20	1.544
Calgary_24h_100y	17:25	1.535
Calgary_24h_100y	17:30	1.526
Calgary_24h_100y	17:35	1.517
Calgary_24h_100y	17:40	1.509
Calgary_24h_100y	17:45	1.5
Calgary_24h_100y	17:50	1.492
Calgary_24h_100y	17:55	1.484
Calgary_24h_100y	18:00	1.476
Calgary_24h_100y	18:05	1.467
Calgary_24h_100y	18:10	1.46
Calgary_24h_100y	18:15	1.452
Calgary_24h_100y	18:20	1.444
Calgary_24h_100y	18:25	1.436
Calgary_24h_100y	18:30	1.429
Calgary_24h_100y	18:35	1.421
Calgary_24h_100y	18:40	1.414
Calgary_24h_100y	18:45	1.407
Calgary_24h_100y	18:50	1.399
Calgary_24h_100y	18:55	1.392
Calgary_24h_100y	19:00	1.385
Calgary_24h_100y	19:05	1.378
Calgary_24h_100y	19:10	1.372
Calgary_24h_100y	19:15	1.365
Calgary_24h_100y	19:20	1.358
Calgary_24h_100y	19:25	1.352
Calgary_24h_100y	19:30	1.345
Calgary_24h_100y	19:35	1.339
Calgary_24h_100y	19:40	1.332
Calgary_24h_100y	19:45	1.326
Calgary_24h_100y	19:50	1.32
Calgary_24h_100y	19:55	1.313
Calgary_24h_100y	20:00	1.307
Calgary_24h_100y	20:05	1.301
Calgary_24h_100y	20:10	1.295
Calgary_24h_100y	20:15	1.289
Calgary_24h_100y	20:20	1.284
Calgary_24h_100y	20:25	1.278
Calgary_24h_100y	20:30	1.272
Calgary_24h_100y	20:35	1.266
Calgary_24h_100y	20:40	1.261
Calgary_24h_100y	20:45	1.255
Calgary_24h_100y	20:50	1.25
Calgary_24h_100y	20:55	1.244
Calgary_24h_100y	21:00	1.239
Calgary_24h_100y	21:05	1.234
Calgary_24h_100y	21:10	1.229
Calgary_24h_100y	21:15	1.223
Calgary_24h_100y	21:20	1.218
Calgary_24h_100y	21:25	1.213
Calgary_24h_100y	21:30	1.208
Calgary_24h_100y	21:35	1.203
Calgary_24h_100y	21:40	1.198
Calgary_24h_100y	21:45	1.193
Calgary_24h_100y	21:50	1.188
Calgary_24h_100y	21:55	1.184
Calgary_24h_100y	22:00	1.179
Calgary_24h_100y	22:05	1.174
Calgary_24h_100y	22:10	1.17
Calgary_24h_100y	22:15	1.165
Calgary_24h_100y	22:20	1.16
Calgary_24h_100y	22:25	1.156
Calgary_24h_100y	22:30	1.151
Calgary_24h_100y	22:35	1.147
Calgary_24h_100y	22:40	1.143

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Calgary_24h_100y            22:45       1.138
Calgary_24h_100y            22:50       1.134
Calgary_24h_100y            22:55       1.13
Calgary_24h_100y            23:00       1.125
Calgary_24h_100y            23:05       1.121
Calgary_24h_100y            23:10       1.117
Calgary_24h_100y            23:15       1.113
Calgary_24h_100y            23:20       1.109
Calgary_24h_100y            23:25       1.105
Calgary_24h_100y            23:30       1.101
Calgary_24h_100y            23:35       1.097
Calgary_24h_100y            23:40       1.093
Calgary_24h_100y            23:45       1.089
Calgary_24h_100y            23:50       1.085
Calgary_24h_100y            23:55       1.081
Calgary_24h_100y            24:00       1.077

;Calgary_24h_10y design storm, rain interval = 5 minutes, rain units = mm/hr.
Calgary_24h_10y             0:00        0
Calgary_24h_10y             0:05        0.747
Calgary_24h_10y             0:10        0.753
Calgary_24h_10y             0:15        0.76
Calgary_24h_10y             0:20        0.766
Calgary_24h_10y             0:25        0.773
Calgary_24h_10y             0:30        0.78
Calgary_24h_10y             0:35        0.787
Calgary_24h_10y             0:40        0.794
Calgary_24h_10y             0:45        0.801
Calgary_24h_10y             0:50        0.809
Calgary_24h_10y             0:55        0.817
Calgary_24h_10y             1:00        0.824
Calgary_24h_10y             1:05        0.832
Calgary_24h_10y             1:10        0.841
Calgary_24h_10y             1:15        0.849
Calgary_24h_10y             1:20        0.858
Calgary_24h_10y             1:25        0.867
Calgary_24h_10y             1:30        0.876
Calgary_24h_10y             1:35        0.885
Calgary_24h_10y             1:40        0.894
Calgary_24h_10y             1:45        0.904
Calgary_24h_10y             1:50        0.914
Calgary_24h_10y             1:55        0.925
Calgary_24h_10y             2:00        0.935
Calgary_24h_10y             2:05        0.946
Calgary_24h_10y             2:10        0.957
Calgary_24h_10y             2:15        0.969
Calgary_24h_10y             2:20        0.981
Calgary_24h_10y             2:25        0.993
Calgary_24h_10y             2:30        1.006
Calgary_24h_10y             2:35        1.019
Calgary_24h_10y             2:40        1.032
Calgary_24h_10y             2:45        1.046
Calgary_24h_10y             2:50        1.06
Calgary_24h_10y             2:55        1.075
Calgary_24h_10y             3:00        1.09
Calgary_24h_10y             3:05        1.106
Calgary_24h_10y             3:10        1.123
Calgary_24h_10y             3:15        1.14
Calgary_24h_10y             3:20        1.157
Calgary_24h_10y             3:25        1.176
Calgary_24h_10y             3:30        1.195
Calgary_24h_10y             3:35        1.214
Calgary_24h_10y             3:40        1.235
Calgary_24h_10y             3:45        1.257
Calgary_24h_10y             3:50        1.279
Calgary_24h_10y             3:55        1.302
Calgary_24h_10y             4:00        1.327
Calgary_24h_10y             4:05        1.352
Calgary_24h_10y             4:10        1.379
Calgary_24h_10y             4:15        1.407
Calgary_24h_10y             4:20        1.437
Calgary_24h_10y             4:25        1.468
Calgary_24h_10y             4:30        1.501
Calgary_24h_10y             4:35        1.536
Calgary_24h_10y             4:40        1.572
Calgary_24h_10y             4:45        1.611
Calgary_24h_10y             4:50        1.652
Calgary_24h_10y             4:55        1.696
Calgary_24h_10y             5:00        1.743
Calgary_24h_10y             5:05        1.793
Calgary_24h_10y             5:10        1.847
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Calgary_24h_10y	5:15	1.904
Calgary_24h_10y	5:20	1.966
Calgary_24h_10y	5:25	2.034
Calgary_24h_10y	5:30	2.107
Calgary_24h_10y	5:35	2.187
Calgary_24h_10y	5:40	2.275
Calgary_24h_10y	5:45	2.371
Calgary_24h_10y	5:50	2.478
Calgary_24h_10y	5:55	2.598
Calgary_24h_10y	6:00	2.733
Calgary_24h_10y	6:05	2.885
Calgary_24h_10y	6:10	3.061
Calgary_24h_10y	6:15	3.264
Calgary_24h_10y	6:20	3.503
Calgary_24h_10y	6:25	3.79
Calgary_24h_10y	6:30	4.14
Calgary_24h_10y	6:35	4.58
Calgary_24h_10y	6:40	5.153
Calgary_24h_10y	6:45	5.936
Calgary_24h_10y	6:50	7.085
Calgary_24h_10y	6:55	8.972
Calgary_24h_10y	7:00	12.807
Calgary_24h_10y	7:05	27.274
Calgary_24h_10y	7:10	106.693
Calgary_24h_10y	7:15	36.52
Calgary_24h_10y	7:20	21.432
Calgary_24h_10y	7:25	15.694
Calgary_24h_10y	7:30	12.604
Calgary_24h_10y	7:35	10.647
Calgary_24h_10y	7:40	9.284
Calgary_24h_10y	7:45	8.275
Calgary_24h_10y	7:50	7.493
Calgary_24h_10y	7:55	6.868
Calgary_24h_10y	8:00	6.355
Calgary_24h_10y	8:05	5.925
Calgary_24h_10y	8:10	5.559
Calgary_24h_10y	8:15	5.242
Calgary_24h_10y	8:20	4.966
Calgary_24h_10y	8:25	4.723
Calgary_24h_10y	8:30	4.506
Calgary_24h_10y	8:35	4.312
Calgary_24h_10y	8:40	4.137
Calgary_24h_10y	8:45	3.978
Calgary_24h_10y	8:50	3.833
Calgary_24h_10y	8:55	3.7
Calgary_24h_10y	9:00	3.578
Calgary_24h_10y	9:05	3.465
Calgary_24h_10y	9:10	3.36
Calgary_24h_10y	9:15	3.263
Calgary_24h_10y	9:20	3.172
Calgary_24h_10y	9:25	3.087
Calgary_24h_10y	9:30	3.007
Calgary_24h_10y	9:35	2.932
Calgary_24h_10y	9:40	2.862
Calgary_24h_10y	9:45	2.795
Calgary_24h_10y	9:50	2.732
Calgary_24h_10y	9:55	2.672
Calgary_24h_10y	10:00	2.616
Calgary_24h_10y	10:05	2.562
Calgary_24h_10y	10:10	2.511
Calgary_24h_10y	10:15	2.462
Calgary_24h_10y	10:20	2.415
Calgary_24h_10y	10:25	2.371
Calgary_24h_10y	10:30	2.328
Calgary_24h_10y	10:35	2.287
Calgary_24h_10y	10:40	2.248
Calgary_24h_10y	10:45	2.211
Calgary_24h_10y	10:50	2.175
Calgary_24h_10y	10:55	2.14
Calgary_24h_10y	11:00	2.107
Calgary_24h_10y	11:05	2.075
Calgary_24h_10y	11:10	2.044
Calgary_24h_10y	11:15	2.014
Calgary_24h_10y	11:20	1.985
Calgary_24h_10y	11:25	1.957
Calgary_24h_10y	11:30	1.93
Calgary_24h_10y	11:35	1.904
Calgary_24h_10y	11:40	1.879
Calgary_24h_10y	11:45	1.854
Calgary_24h_10y	11:50	1.831
Calgary_24h_10y	11:55	1.808

Calgary_24h_10y	12:00	1.785
Calgary_24h_10y	12:05	1.764
Calgary_24h_10y	12:10	1.743
Calgary_24h_10y	12:15	1.722
Calgary_24h_10y	12:20	1.703
Calgary_24h_10y	12:25	1.683
Calgary_24h_10y	12:30	1.664
Calgary_24h_10y	12:35	1.646
Calgary_24h_10y	12:40	1.628
Calgary_24h_10y	12:45	1.611
Calgary_24h_10y	12:50	1.594
Calgary_24h_10y	12:55	1.578
Calgary_24h_10y	13:00	1.561
Calgary_24h_10y	13:05	1.546
Calgary_24h_10y	13:10	1.53
Calgary_24h_10y	13:15	1.516
Calgary_24h_10y	13:20	1.501
Calgary_24h_10y	13:25	1.487
Calgary_24h_10y	13:30	1.473
Calgary_24h_10y	13:35	1.459
Calgary_24h_10y	13:40	1.446
Calgary_24h_10y	13:45	1.433
Calgary_24h_10y	13:50	1.42
Calgary_24h_10y	13:55	1.407
Calgary_24h_10y	14:00	1.395
Calgary_24h_10y	14:05	1.383
Calgary_24h_10y	14:10	1.371
Calgary_24h_10y	14:15	1.36
Calgary_24h_10y	14:20	1.349
Calgary_24h_10y	14:25	1.338
Calgary_24h_10y	14:30	1.327
Calgary_24h_10y	14:35	1.316
Calgary_24h_10y	14:40	1.306
Calgary_24h_10y	14:45	1.296
Calgary_24h_10y	14:50	1.286
Calgary_24h_10y	14:55	1.276
Calgary_24h_10y	15:00	1.266
Calgary_24h_10y	15:05	1.257
Calgary_24h_10y	15:10	1.247
Calgary_24h_10y	15:15	1.238
Calgary_24h_10y	15:20	1.229
Calgary_24h_10y	15:25	1.22
Calgary_24h_10y	15:30	1.212
Calgary_24h_10y	15:35	1.203
Calgary_24h_10y	15:40	1.195
Calgary_24h_10y	15:45	1.186
Calgary_24h_10y	15:50	1.178
Calgary_24h_10y	15:55	1.17
Calgary_24h_10y	16:00	1.162
Calgary_24h_10y	16:05	1.155
Calgary_24h_10y	16:10	1.147
Calgary_24h_10y	16:15	1.14
Calgary_24h_10y	16:20	1.132
Calgary_24h_10y	16:25	1.125
Calgary_24h_10y	16:30	1.118
Calgary_24h_10y	16:35	1.111
Calgary_24h_10y	16:40	1.104
Calgary_24h_10y	16:45	1.097
Calgary_24h_10y	16:50	1.09
Calgary_24h_10y	16:55	1.084
Calgary_24h_10y	17:00	1.077
Calgary_24h_10y	17:05	1.071
Calgary_24h_10y	17:10	1.064
Calgary_24h_10y	17:15	1.058
Calgary_24h_10y	17:20	1.052
Calgary_24h_10y	17:25	1.046
Calgary_24h_10y	17:30	1.04
Calgary_24h_10y	17:35	1.034
Calgary_24h_10y	17:40	1.028
Calgary_24h_10y	17:45	1.022
Calgary_24h_10y	17:50	1.017
Calgary_24h_10y	17:55	1.011
Calgary_24h_10y	18:00	1.006
Calgary_24h_10y	18:05	1
Calgary_24h_10y	18:10	0.995
Calgary_24h_10y	18:15	0.989
Calgary_24h_10y	18:20	0.984
Calgary_24h_10y	18:25	0.979
Calgary_24h_10y	18:30	0.974
Calgary_24h_10y	18:35	0.969
Calgary_24h_10y	18:40	0.964

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Calgary_24h_10y             18:45      0.959
Calgary_24h_10y             18:50      0.954
Calgary_24h_10y             18:55      0.949
Calgary_24h_10y             19:00      0.945
Calgary_24h_10y             19:05      0.94
Calgary_24h_10y             19:10      0.935
Calgary_24h_10y             19:15      0.931
Calgary_24h_10y             19:20      0.926
Calgary_24h_10y             19:25      0.922
Calgary_24h_10y             19:30      0.917
Calgary_24h_10y             19:35      0.913
Calgary_24h_10y             19:40      0.908
Calgary_24h_10y             19:45      0.904
Calgary_24h_10y             19:50      0.9
Calgary_24h_10y             19:55      0.896
Calgary_24h_10y             20:00      0.892
Calgary_24h_10y             20:05      0.888
Calgary_24h_10y             20:10      0.884
Calgary_24h_10y             20:15      0.88
Calgary_24h_10y             20:20      0.876
Calgary_24h_10y             20:25      0.872
Calgary_24h_10y             20:30      0.868
Calgary_24h_10y             20:35      0.864
Calgary_24h_10y             20:40      0.86
Calgary_24h_10y             20:45      0.856
Calgary_24h_10y             20:50      0.853
Calgary_24h_10y             20:55      0.849
Calgary_24h_10y             21:00      0.845
Calgary_24h_10y             21:05      0.842
Calgary_24h_10y             21:10      0.838
Calgary_24h_10y             21:15      0.835
Calgary_24h_10y             21:20      0.831
Calgary_24h_10y             21:25      0.828
Calgary_24h_10y             21:30      0.824
Calgary_24h_10y             21:35      0.821
Calgary_24h_10y             21:40      0.818
Calgary_24h_10y             21:45      0.814
Calgary_24h_10y             21:50      0.811
Calgary_24h_10y             21:55      0.808
Calgary_24h_10y             22:00      0.805
Calgary_24h_10y             22:05      0.801
Calgary_24h_10y             22:10      0.798
Calgary_24h_10y             22:15      0.795
Calgary_24h_10y             22:20      0.792
Calgary_24h_10y             22:25      0.789
Calgary_24h_10y             22:30      0.786
Calgary_24h_10y             22:35      0.783
Calgary_24h_10y             22:40      0.78
Calgary_24h_10y             22:45      0.777
Calgary_24h_10y             22:50      0.774
Calgary_24h_10y             22:55      0.771
Calgary_24h_10y             23:00      0.768
Calgary_24h_10y             23:05      0.765
Calgary_24h_10y             23:10      0.763
Calgary_24h_10y             23:15      0.76
Calgary_24h_10y             23:20      0.757
Calgary_24h_10y             23:25      0.754
Calgary_24h_10y             23:30      0.752
Calgary_24h_10y             23:35      0.749
Calgary_24h_10y             23:40      0.746
Calgary_24h_10y             23:45      0.743
Calgary_24h_10y             23:50      0.741
Calgary_24h_10y             23:55      0.738
Calgary_24h_10y             24:00      0.736

 [PATTERNS]
;;Name           Type       Multipliers
;;-------------- ---------- -----------
Hourly           HOURLY     1.0   1.0   1.0   1.0   1.0   1.0
Hourly                       1.0   1.0   1.0   1.0   1.0   1.0
Hourly                       1.0   1.0   1.0   1.0   1.0   1.0
Hourly                       1.0   1.0   1.0   1.0   1.0   1.0


[REPORT]
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL
```

```
[TAGS]

[MAP]
DIMENSIONS       -12758093.3609691 6625771.14816084 -12751053.0760587 6627066.98862238
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
EastOutfall      -12751819.402    6625830.05
WestOutfall      -12757239.252    6625880.054
EastPit          -12751373.089    6626106.784
EastRecharge     -12754597.508    6625952.573
WestPit          -12757773.348    6627008.087
WestRecharge     -12755263.687    6625981.545

[VERTICES]
;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------

[SYMBOLS]
;;Gage           X-Coord          Y-Coord
;;-------------- ---------------- ----------------


 EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
 --------------------------------------------------------------


 *************
 Element Count
 *************
 Number of rain gages ...... 3
 Number of subcatchments ... 0
 Number of nodes ........... 6
 Number of links ........... 4
 Number of pollutants ...... 0
 Number of land uses ....... 0


 ****************
 Raingage Summary
 ****************
                                                  Data       Recording
 Name                 Data Source                 Type       Interval
 ---------------------------------------------------------------------
 Calgary_24h_100y     Calgary_24h_100y            INTENSITY    5 min.
 Calgary_24h_10y      Calgary_24h_10y             INTENSITY    5 min.
 Precip_1960-2014     F:\26388\512\Surface Water\2 - SWMP\070 - Design\PCSWMM Model\Precip60_14_V5.dat


 ************
 Node Summary
 ************
                                     Invert      Max.    Ponded    External
 Name                 Type             Elev.     Depth      Area    Inflow
 ---------------------------------------------------------------------------
 EastOutfall          OUTFALL          0.00      0.40       0.0
 WestOutfall          OUTFALL          0.00      0.50       0.0
 EastPit              STORAGE          0.00      3.00       0.0    Yes
 EastRecharge         STORAGE          0.00      1.00       0.0
 WestPit              STORAGE          0.00      2.00       0.0    Yes
 WestRecharge         STORAGE          0.00      1.50       0.0


 ************
 Link Summary
 ************
 Name             From Node        To Node          Type            Length    %Slope Roughness
 ---------------------------------------------------------------------------------------------
 C1               WestRecharge     WestOutfall      CONDUIT          100.0    2.5008    0.0100
 C2               EastRecharge     EastOutfall      CONDUIT          100.0    2.5008    0.0100
 P1               WestPit          WestRecharge     TYPE4 PUMP
 P2               EastPit          EastRecharge     TYPE4 PUMP


 *********************
 Cross Section Summary
 *********************
                                    Full     Full     Hyd.     Max.   No. of     Full
```

Conduit	Shape	Depth	Area	Rad.	Width	Barrels	Flow
C1	TRAPEZOIDAL	0.50	2.50	0.40	6.00	1	21.50
C2	TRAPEZOIDAL	0.40	1.92	0.33	5.60	1	14.55

****
Rainfall File Summary
****

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
3031093	01/02/1960	12/29/2014	60 min	40313	0	0

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... YES
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... YES
  Water Quality ..... NO
Flow Routing Method ..... DYNWAVE
Starting Date 04/01/1960 00:00:00
Ending Date 10/01/1960 00:00:00
Antecedent Dry Days 0.0
Report Time Step 01:00:00
Routing Time Step ..... 60.00 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 1
Head Tolerance ..... 0.001500 m

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	35.883	358.830
External Outflow	0.000	0.000
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	66.688	666.891
Initial Stored Volume	31.544	315.444
Final Stored Volume	0.743	7.433
Continuity Error (%)	-0.007	

****
Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 59.50 sec
Average Time Step : 60.00 sec
Maximum Time Step : 60.00 sec

```
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
EastOutfall	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
WestOutfall	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
EastPit	STORAGE	1.09	3.00	3.00	0 00:00	3.00
EastRecharge	STORAGE	0.46	0.83	0.83	128 01:32	0.83
WestPit	STORAGE	0.37	2.00	2.00	0 00:00	2.00
WestRecharge	STORAGE	0.30	1.21	1.21	59 15:31	1.21

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
EastOutfall	OUTFALL	0.000	0.000	0 00:00	0	0	0.000 ltr
WestOutfall	OUTFALL	0.000	0.000	0 00:00	0	0	0.000 ltr
EastPit	STORAGE	0.015	0.015	0 00:00	235	425	-0.005
EastRecharge	STORAGE	0.000	0.032	0 00:00	0	424	-0.001
WestPit	STORAGE	0.008	0.008	0 00:00	124	249	-0.005
WestRecharge	STORAGE	0.000	0.032	0 00:00	0	244	-0.004

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
EastPit	67.868	36	0	0	190.476	100	0 00:00	0.032
EastRecharge	4.431	45	0	100	8.075	82	128 01:32	0.048
WestPit	22.694	18	0	0	125.000	100	0 00:00	0.032
WestRecharge	2.615	19	0	100	11.001	79	59 15:31	0.048

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
EastOutfall	0.00	0.000	0.000	0.000
WestOutfall	0.00	0.000	0.000	0.000

```
System                0.00     0.000     0.000       0.000

********************
Link Flow Summary
********************

-------------------------------------------------------------------------------
                              Maximum  Time of Max   Maximum    Max/    Max/
                              |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type        CMS  days hr:min     m/sec    Flow   Depth
-------------------------------------------------------------------------------
C1                   CONDUIT   0.000     0  00:00      0.00    0.00    0.00
C2                   CONDUIT   0.000     0  00:00      0.00    0.00    0.00
P1                   PUMP      0.032     0  00:00              1.00
P2                   PUMP      0.032     0  00:00              1.00


***************************
Flow Classification Summary
***************************

-------------------------------------------------------------------------------------------
                    Adjusted    ---------- Fraction of Time in Flow Class ----------
                     /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------------
C1                      1.00   1.00 0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
C2                      1.00   1.00 0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


***************
Pumping Summary
***************

-----------------------------------------------------------------------------------------------------------------
                                                  Min       Avg       Max     Total     Power    % Time Off
                        Percent   Number of      Flow      Flow      Flow    Volume     Usage    Pump Curve
Pump                  Utilized   Start-Ups       CMS       CMS       CMS  10^6 ltr    Kw-hr    Low    High
-----------------------------------------------------------------------------------------------------------------
P1                       48.33          12      0.00      0.03      0.03   244.486   367.14    0.0     0.0
P2                       83.71           8      0.00      0.03      0.03   423.507  1075.78    0.0    28.8


  Analysis begun on:  Fri Apr 03 16:54:49 2020
  Analysis ended on:  Fri Apr 03 16:54:50 2020
  Total elapsed time: 00:00:01
```

4.2 Dewatering During Mining Operations Model

```
[TITLE]
Dewatering during mining operations


[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           CMS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    YES
START_DATE           04/01/1960
START_TIME           00:00:00
REPORT_START_DATE    04/01/1960
REPORT_START_TIME    00:00:00
END_DATE             10/01/1960
END_TIME             00:00:00
SWEEP_START          01/01
```

```
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:05:00
DRY_STEP             00:30:00
ROUTING_STEP         60
INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
Calgary_24h_100y INTENSITY 0:05   1.0    TIMESERIES Calgary_24h_100y
Calgary_24h_10y  INTENSITY 0:05   1.0    TIMESERIES Calgary_24h_10y
Precip_1960-2014 VOLUME    1:00   1.0    FILE       "F:\26388\512\Surface Water\2 - SWMP\070 - Design\PCSWMM
Model\Precip60_14_V5.dat" 3031093    MM

[SNOWPACKS]
Calgary          PLOWABLE   0.02       0.1        1          0.03       0.00       0.00       0.0
Calgary          IMPERVIOUS 0.02       0.1        1          0.08       2.7        1          0
Calgary          PERVIOUS   0.02       0.1        1          0.3        2.7        1          0
Calgary          REMOVAL    6.53       0.0        0.0        1          0.0        0.0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
EastOutfall      0          FREE                          NO
WestOutfall      0          FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                              Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                             Frac.
Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -----------
------------
EastPit          0        3        0        TABULAR    250x250Pit_!mDeep           0       0
EastRecharge     0        1        0        TABULAR    95x95Pond                   0       0        109.98
10.92    0.368
WestPit          0        2        0        TABULAR    250x250Pit_!mDeep           0       0
WestRecharge     0        1.5      0        TABULAR    90x90Pond                   0       0        109.98
10.92    0.368

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- -----
-----
C1               WestRecharge     WestOutfall      100        0.01       2.5        0          0          0
C2               EastRecharge     EastOutfall      100        0.01       2.5        0          0          0

[PUMPS]
;;               Inlet            Outlet           Pump             Init.  Startup  Shutoff
;;Name           Node             Node             Curve            Status Depth    Depth
;;-------------- ---------------- ---------------- ---------------- ------ -------- --------
P1               WestPit          WestRecharge     P1               OFF    0.1      0.01
P2               EastPit          EastRecharge     P1               OFF    0.1      0.01

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C1               TRAPEZOIDAL  0.5              4          2          2          1
C2               TRAPEZOIDAL  0.4              4          2          2          1
```

```
[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------

[INFLOWS]
;;                                                Param    Units    Scale    Baseline Baseline
;;Node           Parameter        Time Series      Type     Factor   Factor   Value    Pattern
;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
EastPit          FLOW             ""               FLOW     1.0      1        0.014838
WestPit          FLOW             ""               FLOW     1.0      1        0.007859

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Off              Pump4      0          0

P1               Pump4      0          0
P1                          0.001      0.032
P1                          2          0.032

;Two Pumps
P2               Pump4      0          0
P2                          0.001      0.064
P2                          2          0.064

100x100Pit       Storage    0          8464
100x100Pit                  2          10000

100x100Pond      Storage    0          10000
100x100Pond                 1          11664
100x100Pond                 1.5        12544
100x100Pond                 2          13456
100x100Pond                 2.5        14400

150x150Pit_1mDeep Storage    0          21316
150x150Pit_1mDeep            1          22500

250x250Pit_!mDeep Storage    0          60516
250x250Pit_!mDeep            1          62500

50x50Pond        Storage    0          2500
50x50Pond                   1          3364
50x50Pond                   1.5        3844

55x55Pond        Storage    0          3025
55x55Pond                   1          3969

60x60Pond        Storage    0          3600
60x60Pond                   1          4624
60x60Pond                   1.5        5184

65x65Pond        Storage    0          4225
65x65Pond                   1          5329

70x70Pond        Storage    0          4900
70x70Pond                   1          6084
70x70Pond                   1.5        6724
70x70Pond                   2          7396
70x70Pond                   2.5        8100

75x75Pond        Storage    0          5625
75x75Pond                   1          6889
75x75Pond                   1.5        7569
75x75Pond                   2          8281
75x75Pond                   2.5        9025

80x80Pond        Storage    0          6400
80x80Pond                   1          7744
80x80Pond                   1.5        8464
80x80Pond                   2          9216
80x80Pond                   2.5        10000

85x85Pond        Storage    0          7225
85x85Pond                   2.5        11025

90x90Pond        Storage    0          8100
90x90Pond                   2.5        12100

95x95Pond        Storage    0          9025
95x95Pond                   2.5        13225
```

```
[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;Calgary_24h_100y design storm, rain interval = 5 minutes, rain units = mm/hr.
Calgary_24h_100y            0:00       0
Calgary_24h_100y            0:05       1.094
Calgary_24h_100y            0:10       1.103
Calgary_24h_100y            0:15       1.113
Calgary_24h_100y            0:20       1.122
Calgary_24h_100y            0:25       1.132
Calgary_24h_100y            0:30       1.143
Calgary_24h_100y            0:35       1.153
Calgary_24h_100y            0:40       1.163
Calgary_24h_100y            0:45       1.174
Calgary_24h_100y            0:50       1.185
Calgary_24h_100y            0:55       1.197
Calgary_24h_100y            1:00       1.208
Calgary_24h_100y            1:05       1.22
Calgary_24h_100y            1:10       1.232
Calgary_24h_100y            1:15       1.245
Calgary_24h_100y            1:20       1.257
Calgary_24h_100y            1:25       1.27
Calgary_24h_100y            1:30       1.284
Calgary_24h_100y            1:35       1.297
Calgary_24h_100y            1:40       1.311
Calgary_24h_100y            1:45       1.326
Calgary_24h_100y            1:50       1.341
Calgary_24h_100y            1:55       1.356
Calgary_24h_100y            2:00       1.372
Calgary_24h_100y            2:05       1.388
Calgary_24h_100y            2:10       1.404
Calgary_24h_100y            2:15       1.421
Calgary_24h_100y            2:20       1.439
Calgary_24h_100y            2:25       1.457
Calgary_24h_100y            2:30       1.476
Calgary_24h_100y            2:35       1.495
Calgary_24h_100y            2:40       1.515
Calgary_24h_100y            2:45       1.535
Calgary_24h_100y            2:50       1.556
Calgary_24h_100y            2:55       1.578
Calgary_24h_100y            3:00       1.601
Calgary_24h_100y            3:05       1.624
Calgary_24h_100y            3:10       1.648
Calgary_24h_100y            3:15       1.674
Calgary_24h_100y            3:20       1.7
Calgary_24h_100y            3:25       1.727
Calgary_24h_100y            3:30       1.755
Calgary_24h_100y            3:35       1.784
Calgary_24h_100y            3:40       1.815
Calgary_24h_100y            3:45       1.846
Calgary_24h_100y            3:50       1.88
Calgary_24h_100y            3:55       1.914
Calgary_24h_100y            4:00       1.95
Calgary_24h_100y            4:05       1.988
Calgary_24h_100y            4:10       2.028
Calgary_24h_100y            4:15       2.07
Calgary_24h_100y            4:20       2.113
Calgary_24h_100y            4:25       2.159
Calgary_24h_100y            4:30       2.208
Calgary_24h_100y            4:35       2.259
Calgary_24h_100y            4:40       2.313
Calgary_24h_100y            4:45       2.371
Calgary_24h_100y            4:50       2.432
Calgary_24h_100y            4:55       2.497
Calgary_24h_100y            5:00       2.566
Calgary_24h_100y            5:05       2.64
Calgary_24h_100y            5:10       2.719
Calgary_24h_100y            5:15       2.805
Calgary_24h_100y            5:20       2.897
Calgary_24h_100y            5:25       2.997
Calgary_24h_100y            5:30       3.105
Calgary_24h_100y            5:35       3.224
Calgary_24h_100y            5:40       3.354
Calgary_24h_100y            5:45       3.497
Calgary_24h_100y            5:50       3.656
Calgary_24h_100y            5:55       3.833
Calgary_24h_100y            6:00       4.033
Calgary_24h_100y            6:05       4.259
Calgary_24h_100y            6:10       4.519
Calgary_24h_100y            6:15       4.821
Calgary_24h_100y            6:20       5.176
```

Calgary_24h_100y	6:25	5.601
Calgary_24h_100y	6:30	6.12
Calgary_24h_100y	6:35	6.773
Calgary_24h_100y	6:40	7.624
Calgary_24h_100y	6:45	8.785
Calgary_24h_100y	6:50	10.488
Calgary_24h_100y	6:55	13.283
Calgary_24h_100y	7:00	18.961
Calgary_24h_100y	7:05	40.516
Calgary_24h_100y	7:10	168.138
Calgary_24h_100y	7:15	54.372
Calgary_24h_100y	7:20	31.748
Calgary_24h_100y	7:25	23.236
Calgary_24h_100y	7:30	18.66
Calgary_24h_100y	7:35	15.763
Calgary_24h_100y	7:40	13.746
Calgary_24h_100y	7:45	12.251
Calgary_24h_100y	7:50	11.093
Calgary_24h_100y	7:55	10.166
Calgary_24h_100y	8:00	9.405
Calgary_24h_100y	8:05	8.768
Calgary_24h_100y	8:10	8.225
Calgary_24h_100y	8:15	7.756
Calgary_24h_100y	8:20	7.346
Calgary_24h_100y	8:25	6.985
Calgary_24h_100y	8:30	6.664
Calgary_24h_100y	8:35	6.376
Calgary_24h_100y	8:40	6.116
Calgary_24h_100y	8:45	5.88
Calgary_24h_100y	8:50	5.665
Calgary_24h_100y	8:55	5.468
Calgary_24h_100y	9:00	5.287
Calgary_24h_100y	9:05	5.119
Calgary_24h_100y	9:10	4.964
Calgary_24h_100y	9:15	4.819
Calgary_24h_100y	9:20	4.684
Calgary_24h_100y	9:25	4.558
Calgary_24h_100y	9:30	4.44
Calgary_24h_100y	9:35	4.329
Calgary_24h_100y	9:40	4.224
Calgary_24h_100y	9:45	4.125
Calgary_24h_100y	9:50	4.032
Calgary_24h_100y	9:55	3.943
Calgary_24h_100y	10:00	3.859
Calgary_24h_100y	10:05	3.78
Calgary_24h_100y	10:10	3.704
Calgary_24h_100y	10:15	3.631
Calgary_24h_100y	10:20	3.562
Calgary_24h_100y	10:25	3.496
Calgary_24h_100y	10:30	3.433
Calgary_24h_100y	10:35	3.373
Calgary_24h_100y	10:40	3.315
Calgary_24h_100y	10:45	3.259
Calgary_24h_100y	10:50	3.206
Calgary_24h_100y	10:55	3.154
Calgary_24h_100y	11:00	3.105
Calgary_24h_100y	11:05	3.057
Calgary_24h_100y	11:10	3.011
Calgary_24h_100y	11:15	2.967
Calgary_24h_100y	11:20	2.924
Calgary_24h_100y	11:25	2.883
Calgary_24h_100y	11:30	2.843
Calgary_24h_100y	11:35	2.805
Calgary_24h_100y	11:40	2.767
Calgary_24h_100y	11:45	2.731
Calgary_24h_100y	11:50	2.696
Calgary_24h_100y	11:55	2.662
Calgary_24h_100y	12:00	2.629
Calgary_24h_100y	12:05	2.597
Calgary_24h_100y	12:10	2.566
Calgary_24h_100y	12:15	2.536
Calgary_24h_100y	12:20	2.506
Calgary_24h_100y	12:25	2.478
Calgary_24h_100y	12:30	2.45
Calgary_24h_100y	12:35	2.423
Calgary_24h_100y	12:40	2.396
Calgary_24h_100y	12:45	2.371
Calgary_24h_100y	12:50	2.346
Calgary_24h_100y	12:55	2.321
Calgary_24h_100y	13:00	2.297
Calgary_24h_100y	13:05	2.274

Calgary_24h_100y	13:10	2.252
Calgary_24h_100y	13:15	2.229
Calgary_24h_100y	13:20	2.208
Calgary_24h_100y	13:25	2.187
Calgary_24h_100y	13:30	2.166
Calgary_24h_100y	13:35	2.146
Calgary_24h_100y	13:40	2.126
Calgary_24h_100y	13:45	2.107
Calgary_24h_100y	13:50	2.088
Calgary_24h_100y	13:55	2.069
Calgary_24h_100y	14:00	2.051
Calgary_24h_100y	14:05	2.034
Calgary_24h_100y	14:10	2.016
Calgary_24h_100y	14:15	1.999
Calgary_24h_100y	14:20	1.983
Calgary_24h_100y	14:25	1.966
Calgary_24h_100y	14:30	1.95
Calgary_24h_100y	14:35	1.935
Calgary_24h_100y	14:40	1.919
Calgary_24h_100y	14:45	1.904
Calgary_24h_100y	14:50	1.889
Calgary_24h_100y	14:55	1.875
Calgary_24h_100y	15:00	1.86
Calgary_24h_100y	15:05	1.846
Calgary_24h_100y	15:10	1.833
Calgary_24h_100y	15:15	1.819
Calgary_24h_100y	15:20	1.806
Calgary_24h_100y	15:25	1.793
Calgary_24h_100y	15:30	1.78
Calgary_24h_100y	15:35	1.767
Calgary_24h_100y	15:40	1.755
Calgary_24h_100y	15:45	1.743
Calgary_24h_100y	15:50	1.731
Calgary_24h_100y	15:55	1.719
Calgary_24h_100y	16:00	1.707
Calgary_24h_100y	16:05	1.696
Calgary_24h_100y	16:10	1.685
Calgary_24h_100y	16:15	1.673
Calgary_24h_100y	16:20	1.663
Calgary_24h_100y	16:25	1.652
Calgary_24h_100y	16:30	1.641
Calgary_24h_100y	16:35	1.631
Calgary_24h_100y	16:40	1.621
Calgary_24h_100y	16:45	1.611
Calgary_24h_100y	16:50	1.601
Calgary_24h_100y	16:55	1.591
Calgary_24h_100y	17:00	1.581
Calgary_24h_100y	17:05	1.572
Calgary_24h_100y	17:10	1.562
Calgary_24h_100y	17:15	1.553
Calgary_24h_100y	17:20	1.544
Calgary_24h_100y	17:25	1.535
Calgary_24h_100y	17:30	1.526
Calgary_24h_100y	17:35	1.517
Calgary_24h_100y	17:40	1.509
Calgary_24h_100y	17:45	1.5
Calgary_24h_100y	17:50	1.492
Calgary_24h_100y	17:55	1.484
Calgary_24h_100y	18:00	1.476
Calgary_24h_100y	18:05	1.467
Calgary_24h_100y	18:10	1.46
Calgary_24h_100y	18:15	1.452
Calgary_24h_100y	18:20	1.444
Calgary_24h_100y	18:25	1.436
Calgary_24h_100y	18:30	1.429
Calgary_24h_100y	18:35	1.421
Calgary_24h_100y	18:40	1.414
Calgary_24h_100y	18:45	1.407
Calgary_24h_100y	18:50	1.399
Calgary_24h_100y	18:55	1.392
Calgary_24h_100y	19:00	1.385
Calgary_24h_100y	19:05	1.378
Calgary_24h_100y	19:10	1.372
Calgary_24h_100y	19:15	1.365
Calgary_24h_100y	19:20	1.358
Calgary_24h_100y	19:25	1.352
Calgary_24h_100y	19:30	1.345
Calgary_24h_100y	19:35	1.339
Calgary_24h_100y	19:40	1.332
Calgary_24h_100y	19:45	1.326
Calgary_24h_100y	19:50	1.32

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Calgary_24h_100y            19:55      1.313
Calgary_24h_100y            20:00      1.307
Calgary_24h_100y            20:05      1.301
Calgary_24h_100y            20:10      1.295
Calgary_24h_100y            20:15      1.289
Calgary_24h_100y            20:20      1.284
Calgary_24h_100y            20:25      1.278
Calgary_24h_100y            20:30      1.272
Calgary_24h_100y            20:35      1.266
Calgary_24h_100y            20:40      1.261
Calgary_24h_100y            20:45      1.255
Calgary_24h_100y            20:50      1.25
Calgary_24h_100y            20:55      1.244
Calgary_24h_100y            21:00      1.239
Calgary_24h_100y            21:05      1.234
Calgary_24h_100y            21:10      1.229
Calgary_24h_100y            21:15      1.223
Calgary_24h_100y            21:20      1.218
Calgary_24h_100y            21:25      1.213
Calgary_24h_100y            21:30      1.208
Calgary_24h_100y            21:35      1.203
Calgary_24h_100y            21:40      1.198
Calgary_24h_100y            21:45      1.193
Calgary_24h_100y            21:50      1.188
Calgary_24h_100y            21:55      1.184
Calgary_24h_100y            22:00      1.179
Calgary_24h_100y            22:05      1.174
Calgary_24h_100y            22:10      1.17
Calgary_24h_100y            22:15      1.165
Calgary_24h_100y            22:20      1.16
Calgary_24h_100y            22:25      1.156
Calgary_24h_100y            22:30      1.151
Calgary_24h_100y            22:35      1.147
Calgary_24h_100y            22:40      1.143
Calgary_24h_100y            22:45      1.138
Calgary_24h_100y            22:50      1.134
Calgary_24h_100y            22:55      1.13
Calgary_24h_100y            23:00      1.125
Calgary_24h_100y            23:05      1.121
Calgary_24h_100y            23:10      1.117
Calgary_24h_100y            23:15      1.113
Calgary_24h_100y            23:20      1.109
Calgary_24h_100y            23:25      1.105
Calgary_24h_100y            23:30      1.101
Calgary_24h_100y            23:35      1.097
Calgary_24h_100y            23:40      1.093
Calgary_24h_100y            23:45      1.089
Calgary_24h_100y            23:50      1.085
Calgary_24h_100y            23:55      1.081
Calgary_24h_100y            24:00      1.077

;Calgary_24h_10y design storm, rain interval = 5 minutes, rain units = mm/hr.
Calgary_24h_10y             0:00       0
Calgary_24h_10y             0:05       0.747
Calgary_24h_10y             0:10       0.753
Calgary_24h_10y             0:15       0.76
Calgary_24h_10y             0:20       0.766
Calgary_24h_10y             0:25       0.773
Calgary_24h_10y             0:30       0.78
Calgary_24h_10y             0:35       0.787
Calgary_24h_10y             0:40       0.794
Calgary_24h_10y             0:45       0.801
Calgary_24h_10y             0:50       0.809
Calgary_24h_10y             0:55       0.817
Calgary_24h_10y             1:00       0.824
Calgary_24h_10y             1:05       0.832
Calgary_24h_10y             1:10       0.841
Calgary_24h_10y             1:15       0.849
Calgary_24h_10y             1:20       0.858
Calgary_24h_10y             1:25       0.867
Calgary_24h_10y             1:30       0.876
Calgary_24h_10y             1:35       0.885
Calgary_24h_10y             1:40       0.894
Calgary_24h_10y             1:45       0.904
Calgary_24h_10y             1:50       0.914
Calgary_24h_10y             1:55       0.925
Calgary_24h_10y             2:00       0.935
Calgary_24h_10y             2:05       0.946
Calgary_24h_10y             2:10       0.957
Calgary_24h_10y             2:15       0.969
Calgary_24h_10y             2:20       0.981
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Calgary_24h_10y	2:25	0.993
Calgary_24h_10y	2:30	1.006
Calgary_24h_10y	2:35	1.019
Calgary_24h_10y	2:40	1.032
Calgary_24h_10y	2:45	1.046
Calgary_24h_10y	2:50	1.06
Calgary_24h_10y	2:55	1.075
Calgary_24h_10y	3:00	1.09
Calgary_24h_10y	3:05	1.106
Calgary_24h_10y	3:10	1.123
Calgary_24h_10y	3:15	1.14
Calgary_24h_10y	3:20	1.157
Calgary_24h_10y	3:25	1.176
Calgary_24h_10y	3:30	1.195
Calgary_24h_10y	3:35	1.214
Calgary_24h_10y	3:40	1.235
Calgary_24h_10y	3:45	1.257
Calgary_24h_10y	3:50	1.279
Calgary_24h_10y	3:55	1.302
Calgary_24h_10y	4:00	1.327
Calgary_24h_10y	4:05	1.352
Calgary_24h_10y	4:10	1.379
Calgary_24h_10y	4:15	1.407
Calgary_24h_10y	4:20	1.437
Calgary_24h_10y	4:25	1.468
Calgary_24h_10y	4:30	1.501
Calgary_24h_10y	4:35	1.536
Calgary_24h_10y	4:40	1.572
Calgary_24h_10y	4:45	1.611
Calgary_24h_10y	4:50	1.652
Calgary_24h_10y	4:55	1.696
Calgary_24h_10y	5:00	1.743
Calgary_24h_10y	5:05	1.793
Calgary_24h_10y	5:10	1.847
Calgary_24h_10y	5:15	1.904
Calgary_24h_10y	5:20	1.966
Calgary_24h_10y	5:25	2.034
Calgary_24h_10y	5:30	2.107
Calgary_24h_10y	5:35	2.187
Calgary_24h_10y	5:40	2.275
Calgary_24h_10y	5:45	2.371
Calgary_24h_10y	5:50	2.478
Calgary_24h_10y	5:55	2.598
Calgary_24h_10y	6:00	2.733
Calgary_24h_10y	6:05	2.885
Calgary_24h_10y	6:10	3.061
Calgary_24h_10y	6:15	3.264
Calgary_24h_10y	6:20	3.503
Calgary_24h_10y	6:25	3.79
Calgary_24h_10y	6:30	4.14
Calgary_24h_10y	6:35	4.58
Calgary_24h_10y	6:40	5.153
Calgary_24h_10y	6:45	5.936
Calgary_24h_10y	6:50	7.085
Calgary_24h_10y	6:55	8.972
Calgary_24h_10y	7:00	12.807
Calgary_24h_10y	7:05	27.274
Calgary_24h_10y	7:10	106.693
Calgary_24h_10y	7:15	36.52
Calgary_24h_10y	7:20	21.432
Calgary_24h_10y	7:25	15.694
Calgary_24h_10y	7:30	12.604
Calgary_24h_10y	7:35	10.647
Calgary_24h_10y	7:40	9.284
Calgary_24h_10y	7:45	8.275
Calgary_24h_10y	7:50	7.493
Calgary_24h_10y	7:55	6.868
Calgary_24h_10y	8:00	6.355
Calgary_24h_10y	8:05	5.925
Calgary_24h_10y	8:10	5.559
Calgary_24h_10y	8:15	5.242
Calgary_24h_10y	8:20	4.966
Calgary_24h_10y	8:25	4.723
Calgary_24h_10y	8:30	4.506
Calgary_24h_10y	8:35	4.312
Calgary_24h_10y	8:40	4.137
Calgary_24h_10y	8:45	3.978
Calgary_24h_10y	8:50	3.833
Calgary_24h_10y	8:55	3.7
Calgary_24h_10y	9:00	3.578
Calgary_24h_10y	9:05	3.465

Calgary_24h_10y	9:10	3.36
Calgary_24h_10y	9:15	3.263
Calgary_24h_10y	9:20	3.172
Calgary_24h_10y	9:25	3.087
Calgary_24h_10y	9:30	3.007
Calgary_24h_10y	9:35	2.932
Calgary_24h_10y	9:40	2.862
Calgary_24h_10y	9:45	2.795
Calgary_24h_10y	9:50	2.732
Calgary_24h_10y	9:55	2.672
Calgary_24h_10y	10:00	2.616
Calgary_24h_10y	10:05	2.562
Calgary_24h_10y	10:10	2.511
Calgary_24h_10y	10:15	2.462
Calgary_24h_10y	10:20	2.415
Calgary_24h_10y	10:25	2.371
Calgary_24h_10y	10:30	2.328
Calgary_24h_10y	10:35	2.287
Calgary_24h_10y	10:40	2.248
Calgary_24h_10y	10:45	2.211
Calgary_24h_10y	10:50	2.175
Calgary_24h_10y	10:55	2.14
Calgary_24h_10y	11:00	2.107
Calgary_24h_10y	11:05	2.075
Calgary_24h_10y	11:10	2.044
Calgary_24h_10y	11:15	2.014
Calgary_24h_10y	11:20	1.985
Calgary_24h_10y	11:25	1.957
Calgary_24h_10y	11:30	1.93
Calgary_24h_10y	11:35	1.904
Calgary_24h_10y	11:40	1.879
Calgary_24h_10y	11:45	1.854
Calgary_24h_10y	11:50	1.831
Calgary_24h_10y	11:55	1.808
Calgary_24h_10y	12:00	1.785
Calgary_24h_10y	12:05	1.764
Calgary_24h_10y	12:10	1.743
Calgary_24h_10y	12:15	1.722
Calgary_24h_10y	12:20	1.703
Calgary_24h_10y	12:25	1.683
Calgary_24h_10y	12:30	1.664
Calgary_24h_10y	12:35	1.646
Calgary_24h_10y	12:40	1.628
Calgary_24h_10y	12:45	1.611
Calgary_24h_10y	12:50	1.594
Calgary_24h_10y	12:55	1.578
Calgary_24h_10y	13:00	1.561
Calgary_24h_10y	13:05	1.546
Calgary_24h_10y	13:10	1.53
Calgary_24h_10y	13:15	1.516
Calgary_24h_10y	13:20	1.501
Calgary_24h_10y	13:25	1.487
Calgary_24h_10y	13:30	1.473
Calgary_24h_10y	13:35	1.459
Calgary_24h_10y	13:40	1.446
Calgary_24h_10y	13:45	1.433
Calgary_24h_10y	13:50	1.42
Calgary_24h_10y	13:55	1.407
Calgary_24h_10y	14:00	1.395
Calgary_24h_10y	14:05	1.383
Calgary_24h_10y	14:10	1.371
Calgary_24h_10y	14:15	1.36
Calgary_24h_10y	14:20	1.349
Calgary_24h_10y	14:25	1.338
Calgary_24h_10y	14:30	1.327
Calgary_24h_10y	14:35	1.316
Calgary_24h_10y	14:40	1.306
Calgary_24h_10y	14:45	1.296
Calgary_24h_10y	14:50	1.286
Calgary_24h_10y	14:55	1.276
Calgary_24h_10y	15:00	1.266
Calgary_24h_10y	15:05	1.257
Calgary_24h_10y	15:10	1.247
Calgary_24h_10y	15:15	1.238
Calgary_24h_10y	15:20	1.229
Calgary_24h_10y	15:25	1.22
Calgary_24h_10y	15:30	1.212
Calgary_24h_10y	15:35	1.203
Calgary_24h_10y	15:40	1.195
Calgary_24h_10y	15:45	1.186
Calgary_24h_10y	15:50	1.178

Calgary_24h_10y	15:55	1.17
Calgary_24h_10y	16:00	1.162
Calgary_24h_10y	16:05	1.155
Calgary_24h_10y	16:10	1.147
Calgary_24h_10y	16:15	1.14
Calgary_24h_10y	16:20	1.132
Calgary_24h_10y	16:25	1.125
Calgary_24h_10y	16:30	1.118
Calgary_24h_10y	16:35	1.111
Calgary_24h_10y	16:40	1.104
Calgary_24h_10y	16:45	1.097
Calgary_24h_10y	16:50	1.09
Calgary_24h_10y	16:55	1.084
Calgary_24h_10y	17:00	1.077
Calgary_24h_10y	17:05	1.071
Calgary_24h_10y	17:10	1.064
Calgary_24h_10y	17:15	1.058
Calgary_24h_10y	17:20	1.052
Calgary_24h_10y	17:25	1.046
Calgary_24h_10y	17:30	1.04
Calgary_24h_10y	17:35	1.034
Calgary_24h_10y	17:40	1.028
Calgary_24h_10y	17:45	1.022
Calgary_24h_10y	17:50	1.017
Calgary_24h_10y	17:55	1.011
Calgary_24h_10y	18:00	1.006
Calgary_24h_10y	18:05	1
Calgary_24h_10y	18:10	0.995
Calgary_24h_10y	18:15	0.989
Calgary_24h_10y	18:20	0.984
Calgary_24h_10y	18:25	0.979
Calgary_24h_10y	18:30	0.974
Calgary_24h_10y	18:35	0.969
Calgary_24h_10y	18:40	0.964
Calgary_24h_10y	18:45	0.959
Calgary_24h_10y	18:50	0.954
Calgary_24h_10y	18:55	0.949
Calgary_24h_10y	19:00	0.945
Calgary_24h_10y	19:05	0.94
Calgary_24h_10y	19:10	0.935
Calgary_24h_10y	19:15	0.931
Calgary_24h_10y	19:20	0.926
Calgary_24h_10y	19:25	0.922
Calgary_24h_10y	19:30	0.917
Calgary_24h_10y	19:35	0.913
Calgary_24h_10y	19:40	0.908
Calgary_24h_10y	19:45	0.904
Calgary_24h_10y	19:50	0.9
Calgary_24h_10y	19:55	0.896
Calgary_24h_10y	20:00	0.892
Calgary_24h_10y	20:05	0.888
Calgary_24h_10y	20:10	0.884
Calgary_24h_10y	20:15	0.88
Calgary_24h_10y	20:20	0.876
Calgary_24h_10y	20:25	0.872
Calgary_24h_10y	20:30	0.868
Calgary_24h_10y	20:35	0.864
Calgary_24h_10y	20:40	0.86
Calgary_24h_10y	20:45	0.856
Calgary_24h_10y	20:50	0.853
Calgary_24h_10y	20:55	0.849
Calgary_24h_10y	21:00	0.845
Calgary_24h_10y	21:05	0.842
Calgary_24h_10y	21:10	0.838
Calgary_24h_10y	21:15	0.835
Calgary_24h_10y	21:20	0.831
Calgary_24h_10y	21:25	0.828
Calgary_24h_10y	21:30	0.824
Calgary_24h_10y	21:35	0.821
Calgary_24h_10y	21:40	0.818
Calgary_24h_10y	21:45	0.814
Calgary_24h_10y	21:50	0.811
Calgary_24h_10y	21:55	0.808
Calgary_24h_10y	22:00	0.805
Calgary_24h_10y	22:05	0.801
Calgary_24h_10y	22:10	0.798
Calgary_24h_10y	22:15	0.795
Calgary_24h_10y	22:20	0.792
Calgary_24h_10y	22:25	0.789
Calgary_24h_10y	22:30	0.786
Calgary_24h_10y	22:35	0.783

```
Calgary_24h_10y             22:40      0.78
Calgary_24h_10y             22:45      0.777
Calgary_24h_10y             22:50      0.774
Calgary_24h_10y             22:55      0.771
Calgary_24h_10y             23:00      0.768
Calgary_24h_10y             23:05      0.765
Calgary_24h_10y             23:10      0.763
Calgary_24h_10y             23:15      0.76
Calgary_24h_10y             23:20      0.757
Calgary_24h_10y             23:25      0.754
Calgary_24h_10y             23:30      0.752
Calgary_24h_10y             23:35      0.749
Calgary_24h_10y             23:40      0.746
Calgary_24h_10y             23:45      0.743
Calgary_24h_10y             23:50      0.741
Calgary_24h_10y             23:55      0.738
Calgary_24h_10y             24:00      0.736

[PATTERNS]
;;Name           Type       Multipliers
;;-------------- ---------- -----------
Hourly           HOURLY     1.0   1.0   1.0   1.0   1.0   1.0
Hourly                       1.0   1.0   1.0   1.0   1.0   1.0
Hourly                       1.0   1.0   1.0   1.0   1.0   1.0
Hourly                       1.0   1.0   1.0   1.0   1.0   1.0


[REPORT]
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       -12758440.8667574 6625487.70304261 -12750804.5167033 6627979.47594509
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
EastOutfall      -12751819.402    6625830.05
WestOutfall      -12757239.252    6625880.054
EastPit          -12751373.089    6626106.784
EastRecharge     -12754597.508    6625952.573
WestPit          -12757773.348    6627008.087
WestRecharge     -12755263.687    6625981.545

[VERTICES]
;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------

[SYMBOLS]
;;Gage           X-Coord          Y-Coord
;;-------------- ---------------- ----------------


  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
  --------------------------------------------------------------


  *************
  Element Count
  *************
  Number of rain gages ...... 3
  Number of subcatchments ... 0
  Number of nodes ........... 6
  Number of links ........... 4
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                  Data       Recording
  Name                 Data Source                Type       Interval
  ---------------------------------------------------------------------
  Calgary_24h_100y     Calgary_24h_100y           INTENSITY    5 min.
```

```
Calgary_24h_10y      Calgary_24h_10y               INTENSITY    5 min.
Precip_1960-2014     F:\26388\512\Surface Water\2 - SWMP\070 - Design\PCSWMM Model\Precip60_14_V5.dat


************
Node Summary
************
                                      Invert      Max.    Ponded    External
Name                 Type              Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
EastOutfall          OUTFALL             0.00      0.40       0.0
WestOutfall          OUTFALL             0.00      0.50       0.0
EastPit              STORAGE             0.00      3.00       0.0    Yes
EastRecharge         STORAGE             0.00      1.00       0.0
WestPit              STORAGE             0.00      2.00       0.0    Yes
WestRecharge         STORAGE             0.00      1.50       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
-------------------------------------------------------------------------------------------------
C1               WestRecharge     WestOutfall      CONDUIT          100.0    2.5008    0.0100
C2               EastRecharge     EastOutfall      CONDUIT          100.0    2.5008    0.0100
P1               WestPit          WestRecharge     TYPE4 PUMP
P2               EastPit          EastRecharge     TYPE4 PUMP


*********************
Cross Section Summary
*********************
                                    Full      Full      Hyd.      Max.   No. of      Full
Conduit          Shape             Depth      Area      Rad.     Width  Barrels      Flow
-------------------------------------------------------------------------------------------
C1               TRAPEZOIDAL        0.50      2.50      0.40      6.00       1     21.50
C2               TRAPEZOIDAL        0.40      1.92      0.33      5.60       1     14.55


*********************
Rainfall File Summary
*********************
Station    First        Last         Recording   Periods    Periods    Periods
ID         Date         Date         Frequency  w/Precip    Missing    Malfunc.
-------------------------------------------------------------------------------
3031093    01/02/1960   12/29/2014      60 min     40313          0          0


***********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
***********************************************************

****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... YES
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Flow Routing Method ...... DYNWAVE
Starting Date ............ 04/01/1960 00:00:00
Ending Date .............. 10/01/1960 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Routing Time Step ........ 60.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
```

```
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.000         0.000
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........        35.883       358.830
External Outflow .........         0.000         0.000
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........        35.559       355.595
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.326         3.261
Continuity Error (%) .....        -0.007


***************************
Time-Step Critical Elements
***************************
None


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


************************
Routing Time Step Summary
************************
Minimum Time Step           :    59.50 sec
Average Time Step           :    60.00 sec
Maximum Time Step           :    60.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00


******************
Node Depth Summary
******************

-------------------------------------------------------------------------------
                            Average  Maximum  Maximum  Time of Max    Reported
                              Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type    Meters   Meters   Meters  days hr:min      Meters
-------------------------------------------------------------------------------
EastOutfall          OUTFALL   0.00     0.00     0.00     0  00:00        0.00
WestOutfall          OUTFALL   0.00     0.00     0.00     0  00:00        0.00
EastPit              STORAGE   0.05     0.10     0.10   100  00:08        0.10
EastRecharge         STORAGE   0.04     0.14     0.14   175  03:23        0.14
WestPit              STORAGE   0.05     0.10     0.10    94  04:33        0.10
WestRecharge         STORAGE   0.03     0.19     0.19   182  01:33        0.19


*******************
Node Inflow Summary
*******************

-------------------------------------------------------------------------------------------------
                            Maximum  Maximum                  Lateral       Total        Flow
                            Lateral    Total  Time of Max      Inflow      Inflow     Balance
                             Inflow   Inflow   Occurrence      Volume      Volume       Error
Node                 Type       CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
-------------------------------------------------------------------------------------------------
EastOutfall          OUTFALL  0.000    0.000     0  00:00           0           0       0.000 ltr
WestOutfall          OUTFALL  0.000    0.000     0  00:00           0           0       0.000 ltr
EastPit              STORAGE  0.015    0.015     0  00:00         235         235       0.002
EastRecharge         STORAGE  0.000    0.032     4  17:31           0         234      -0.009
WestPit              STORAGE  0.008    0.008     0  00:00         124         124       0.002
WestRecharge         STORAGE  0.000    0.032     8  22:19           0         123      -0.011


**********************
Node Surcharge Summary
**********************

No nodes were surcharged.


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

Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum Outflow CMS
EastPit	3.327	2	0	0	6.062	3	100	00:08	0.032
EastRecharge	0.336	3	0	99	1.325	13	175	03:23	0.044
WestPit	3.306	3	0	0	6.062	5	94	04:33	0.032
WestRecharge	0.225	2	0	100	1.545	11	182	01:33	0.044

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
EastOutfall	0.00	0.000	0.000	0.000
WestOutfall	0.00	0.000	0.000	0.000
System	0.00	0.000	0.000	0.000

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
C2	CONDUIT	0.000	0	00:00	0.00	0.00	0.00
P1	PUMP	0.032	8	22:19		1.00	
P2	PUMP	0.032	4	17:31		1.00	

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow CMS	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump Curve Low	% Time Off Pump Curve High
P1	24.31	17	0.00	0.03	0.03	123.007	24.25	0.0	0.0

```
P2                     46.23          23      0.00      0.03      0.03   233.856     37.25    0.0     0.0


Analysis begun on:  Fri Apr 03 16:49:05 2020
Analysis ended on:  Fri Apr 03 16:49:06 2020
Total elapsed time: 00:00:01
```

APPENDIX B
Hydrogeology Inputs

MEMORANDUM

TO: Duncan Gordon, BURNCO Rock Products Ltd.

FROM: Ryley Killam and Goetz Aust, Matrix Solutions Inc.

SUBJECT: Estimated Dewatering Flow Rates from Gravel Pits for the Purpose of Sizing Storage Ponds

DATE: November 26, 2021

VERSION: 1.0

1 OBJECTIVE

The objective of this memorandum is to determine estimated groundwater flow rates for gravel pit dewatering. Information was collected to aid in the sizing of storage ponds. The analyses were conducted to provide conservative estimates of dewatering requirements to ensure adequate sizing of the storage ponds.

2 METHODOLOGY

2.1 Saturated Thickness

A saturated thickness map was generated using water elevation data and the base of sand and gravel supplied by BURNCO.

Water elevations were adjusted to account for estimated maximum seasonal fluctuations. This data was imported into Surfer to create a grid and bedrock structure contours. The same process was applied to water elevations. The difference of both grids was applied to generate a saturated thickness map (Figure #B1).

A preliminary mine plan was imported into surfer as a base map and the saturated thickness contours (m) were overlaid to assess the saturated thickness of the gravel deposits.

2.2 Hydraulic Conductivity

No K-testing was conducted on the new groundwater monitoring wells installed in Area 4 in 2018. Slug tests were completed on four wells in the west project area by Levelton Consultants in 2014. The highest K-value (25 m/day) was used in the flow rate calculations in order to be conservative.

2.3 Dewatering Formulas

2.3.1 Radial Flow in a Water Table Aquifer

The radial flow in a water table aquifer equation was used for the hydrogeological analysis for dewatering. This equation is used when the dewatering system assumes a rectangular shape (pit). The equation (Powers 1992) is as follows:

$$Q = \frac{\pi K(H^2 - {h_w}^2)}{\ln \frac{R_o}{r_w}}$$

Q = flow rate (m^3/day)

K = hydraulic conductivity (m/day)

H = hydraulic head of original water table (m) or saturated thickness

h_w = hydraulic head at maximum dewatering (m)

R_o = radius of influence of well or point source (m) beyond the radius of the well

r_w = equivalent radius of well (m)

h_w was assumed to be 0.5 m.

r_w was approximated using:

$$r_w = \sqrt{\frac{ab}{\pi}}$$

Where a and b are the length and width of the pit and assumed to act as a circular system of the same enclosed area.

R_o (calculated) was approximated using the Sichart and Kryieleis method (Sichart and Kyrieleis 1930) and gives R_o as a function of drawdown:

$$R_o = 3000(H - h_w)\sqrt{K}$$

Where K = hydraulic conductivity (m/sec)

A value of 100 m, R_o (r_w+100 m), was selected as a conservative constant as recharge to the aquifer is expected to occur at more than 100 m from the gravel pit boundaries, and recharge from surface water bodies will be beyond 100 m due to buffer zones.

2.3.2 Water Table Flow From a Line Source to a Drainage Trench

The flow to a drainage trench from a line source equation was used for the hydrogeological analysis for dewatering and yields flow from one side per unit length. The equation is used when a trench is the system for dewatering. The equation is as follows:

$$\frac{Q}{X} = \frac{K(H^2 - h^2)}{2L}$$

Q/*X* = flow rate (m^3/day) per unit length of trench

K = hydraulic conductivity (m/day)

H = hydraulic head of original water table (m) or saturated thickness

H = hydraulic head at maximum dewatering (m) assumed to be 0.5 m

L = radius of influence (recharge) length (m)

Based on site conditions, value of 100 m for L was used as a constant and is considered a conservative value. The flow rate values are double to represent flow from both sides of the trench.

3 RESULTS

Conservative flow rates in m^3/day for pit dewatering are presented in Tables B1 and B2 depending upon the style of dewatering.

TABLE B1 Pit Flow Rates (m^3/day)

Saturated Thickness (H) in Metres	100 × 100 m Pit Using R_o Calculated	100 × 100 m Using R_o 100 m	150 × 150 m Pit Using R_o Calculated	150 × 150 m Using R_o 100 m	250 × 250 m Pit Using R_o Calculated	250 × 250 m Using R_o 100 m
1	158	58	224	76	354	110
2	344	289	457	378	679	550
3	581	674	748	881	1,067	1,282
4	867	1,213	1,090	1,586	1,512	2,308
5	1,197	1,906	1,482	2,492	2,012	3,627
6	1,571	2,753	1,920	3,599	2,564	5,239
7	1,985	3,755	2,403	4,908	3,166	7,145
8	2,440	4,910	2,930	6,418	3,816	9,343

TABLE B2 Trench Flow Rates From Both Sides of Trench (m^3/day)

Saturated Thickness (H) in Metres	50 m Trench Length	100 m Trench Length	150 m Trench Length	200 m Trench Length
1	9	19	28	38
2	47	94	141	188
3	109	219	328	438
4	197	394	591	788
5	309	619	928	1,238
6	447	894	1,341	1,788
7	609	1,219	1,828	2,438
8	797	1,594	2,391	3,188

4 REFERENCES

Powers J.P. 1992. *Construction Dewatering: New Methods and Applications*. Second Edition. John Wiley & Sons, Inc. 1992.

Sichart W. and W. Kyrieleis. 1930. *Grunwasser Abeskungen bei Fundierungs Arbeiten*. Berlin. 1930.

VERSION CONTROL

Version	Date	Issue Type	Filename	Description
V0.1	18-Jan-2019	Draft	26388-512 Memo 2019-01-18 draft V0.1.docx	Issued to client for review
V1.0	26-Nov-2021	Final	26388-512 Memo 2021-11-26 final V1.0.docx	Issued to client

Easting (m)

666000 667000 668000 669000 670000 671000 672000

Northing (m)

5678000 5677000 5676000

N

22 26-5-W5 | 23 26-5-W5 | 24 26-5-W5 | 19 26-4-W5 | 20 26-4-W5

15 26-5-W5 | 14 26-5-W5 | 13 26-5-W5 | 18 26-4-W5 | 17 26-4-W5

10 26-5-W5 | 11 26-5-W5 | 12 26-5-W5 | 07 26-4-W5 | 08 26-4-W5

1A

Beamer Creek

Grand Valley Creek

Twp. 26

Rg. 5 W5M Rg. 4

Assessment Area 1 to 4
Existing Operating Site
Water Body
Watercourse (Field-Verified)
Railway
Highway
Road

Saturated Thickness (m)

0
0 - 1
1 - 2
2 - 3
3 - 3.4

1:17,500 metres
150 0 150 300
NAD 1983 UTM Zone 11N

Reference: Data obtained from AltaLIS © Government of Alberta and GeoBase® used under license. GDM midstream and transportation infrastructure data provided by IHS © 2019 used under license. Imagery (2013) obtained from Valtus © (2019) used under license.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

Burnco Rock Products Ltd.
West Cochrane Gravel Pit

Saturated Gravel Thickness in the Project Area

Date:	Project:	Submitter:	Reviewer:
May 2019	26388	R. Killam	G. Aust

Figure B1

I:\Burnco\26388\Figures\AndTables\REG\2018\Report\GIA\Figure-8-Saturated_Gravel_Thickness_in_the_Project_Area.mxd - TabJod_L - 02-May-19, 01:17 PM - mpfeifer - TD004