ARMSTRONG ESTATES OF MANSFIELD
TOWNSHIP OF MULMUR
FUNCTIONAL SERVICING REPORT & CONSTRUCTION MITIGATION PLAN

Prepared by:

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APPENDICES

1.0 INTRODUCTION

1.1 General

The proposed development site is located north of the County Road 17 and Thomson Trail intersection. The property is legally described as Part of Lot 11, Concession 7, East of Hurontario Street, Township of Mulmur, County of Dufferin.

The subject property is approximately 21.51 hectares in area and is currently vacant. An existing gravel driveway off Airport Road provides access to the property. The site is bounded by existing agricultural lands to the north and east, Airport Road to the west, and County Road 17 to the south. The location of the subject site is illustrated on Figure 1.

The developer is proposing forty-three (43) single-family lots and four (4) semi-detached residential Blocks that will include an additional twenty eight (28) units, totaling 71 residential units. A parkland block is also proposed to the north with a temporary cul-de-sac.

Access to the development will be provided by new municipal road connections off Airport Road and County Road 17. One stormwater management block is proposed on the north side of the existing watercourse to service the single-family lots and parkland. A second stormwater management block is proposed on the south side of the existing watercourse to service the semi-detached Blocks.

A reduced copy of the proposed draft plan prepared by Innovative Planning Solutions is included in Appendix A for further information.

1.2 Purpose and Scope

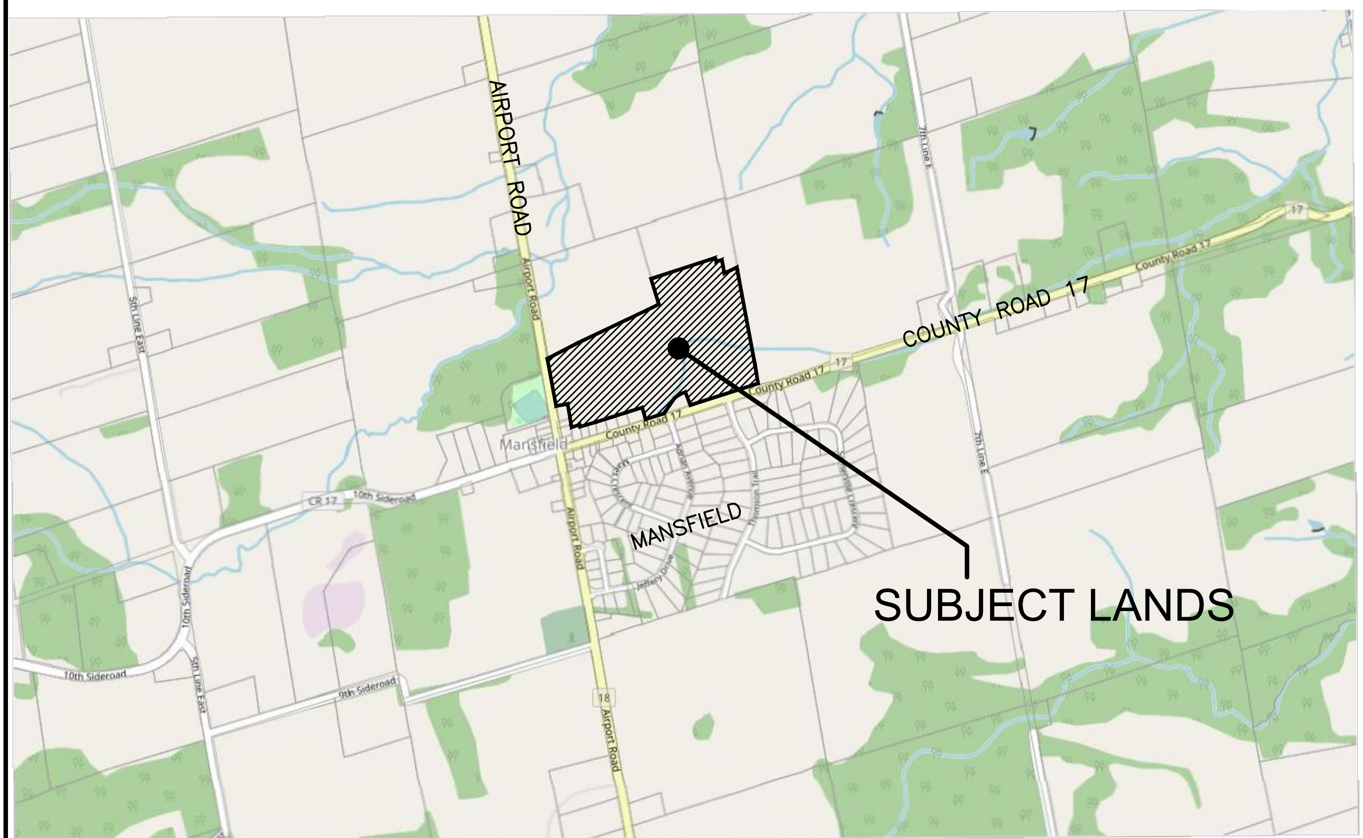
Pinestone Engineering Ltd. (PEL) has been retained by the developer to provide professional engineering services related to the preparation of a Functional Servicing Report (FSR) in support of draft plan approval. The purpose of this report is to describe the existing servicing infrastructure in the vicinity of the site, and provide recommendations for the provision of sanitary drainage, water distribution, and storm water management in accordance with Township and Nottawasaga Valley Conservation Authority (NVCA) criteria.

2.0 REFERENCE REPORTS

The following reports and studies have been used for reference in the preparation of this Functional Servicing Report:

i) *Ministry of the Environment Storm Water Management Planning and Design Manual, March 2003.*

ii) *Low Impact Development Manual prepared by Credit Valley Conservation and Toronto and Region Conservation, 2010.*



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MANSFIELD SUBDIVISION

LOCATION PLAN

DATE:	SCALE:	PROJECT No.	FIGURE No.
SEPT 2021	N.T.S.	20-11584B	FIGURE-1

iii) *NVCA Stormwater Technical Guide prepared by the Nottawasaga Valley Conservation Authority, 2013.*

iv) *2020 Summary Report for the Mansfield Water System, prepared by Dufferin Water Co. Ltd., February 2021.*

3.0 EXISTING CONDITIONS

3.1 General

The subject site is approximately 21.51 hectares in area and is currently being utilized for agricultural purposes. An existing gravel driveway off Airport Road provides access to the property. The site is located within the Township's urban servicing area and municipal water servicing is readily available for connection beneath County Road 17 and Airport Road. A watercourse (tributary of Pine River) bisects the property from the southwest to the southeast. Existing land use consists of undeveloped forest areas and agricultural fields.

3.2 Topography

Based on a review of the topographic survey provided by JoeTOPO SURVEYS AND CADD INC. in February 2021, the property has a moderate overall slope of 2.5%. The banks of the watercourse are steep with an average slope of 15% generally representing valley type lands. Lands to the north generally slope southerly towards the existing watercourse. Lands to the south slope northerly toward the existing watercourse. Elevations across the site range between 315.5m ASL at the northwest corner of the property to 300.0m ASL at the bottom of the existing watercourse to the southeast.

3.3 Site Geology

A geotechnical investigation was completed by Peto MacCallum Ltd., in May 2021. Field work for this investigation consisted of twelve (12) boreholes advanced to depths ranging from 5-10m below the ground surface. Based on our review of the report, the boreholes reveal various depths of topsoil encountered over sand and silt mixtures with layers of clayey silt, sandy silty clay, and clayey silt till. Groundwater monitoring, conducted in May and June of 2021 revealed local near surface perched groundwater stabilized at 1.0-5.8m below existing grade (302.2 to 306.3m ASL). The regional groundwater table is believed to be below the depth of exploration.

Based on Table 7-1, Chapter 7, Part 630 of the USDA National Engineering Handbook (2009), we have classified the site material as a Type BC under the Soil Conservation Service, hydrologic soil group. A copy of the geotechnical report prepared by Peto MacCallum Ltd., and excerpts from the USDA National Engineering Handbook are included in Appendix B.

3.4 Drainage Conditions

Drainage generated from the northern and southern portions of the property is generally conveyed in the form of overland sheet flow to the existing watercourse. Captured flows are conveyed northeasterly and ultimately discharge to Georgian Bay.

The site is located within a Nottawasaga Valley Conservation Authority (NVCA) regulated area based on available mapping on their website. Accordingly, the receiving outlet should be considered "sensitive" and an "enhanced" level of quality control applied in accordance with the NVCA Stormwater Technical Guide (NVCA, 2013), and the MECP Storm Water Management Planning and Design Manual (MECP, 2003).

4.0 PROPOSED DEVELOPMENT

The developer is proposing forty-three (43) single-family lots and four (4) semi-detached residential Blocks that will include an additional twenty-eight (28) units, totaling 71 residential units. A parkland block is also proposed to the north with a temporary cul-de-sac. Access to the development will be provided by new municipal road connections off Airport Road and County Road 17.

The proposed development is located within the Township of Mulmur's urban servicing boundary. Municipal water servicing is available within the Airport Road and County Road 17 right-of-way and new service connections to these mains will loop the watermain internally through the development. Onsite private sewage systems will be used to service the proposed development and details pertaining to sanitary servicing are provided in the Sewage Impact Study and Conceptual Septic Design Report prepared by Azimuth Environmental Consulting Inc. under separate cover.

The proposed development includes two (2) stormwater management facilities since development is split between the existing watercourse traversing the property. Drainage generated from the single-family lots, parkland, and a large portion of the urbanized streets, will be collected via storm sewers and conveyed to a proposed dry-type stormwater management facility for attenuation and treatment.

Drainage generated from the semi-detached Blocks and a portion of the urbanized streets, will be collected via storms sewers and conveyed to a proposed oil & grit separator for pre-treatment prior to discharging to a proposed dry-type stormwater management facility. Controlled flows from both stormwater management facilities will outlet to the existing watercourse.

5.0 WATER SERVICING

5.1 Existing Water Servicing

A 150mm diameter watermain exists beneath the east shoulder of Airport Road and the north shoulder of County Road 17. Water supply is provided by the Mansfield Water System owned by the Township of Mulmur and operated by Dufferin Water Co. Limited. The system is classified as a Large Municipal Residential Water System that currently services approximately 153 service connections. Water is supplied by three municipal wells, a standpipe, and a pumphouse. According to the Annual Summary Report for 2020, the maximum permitted flowrate is 661 L/min, and the average operating flowrate is 330 L/min.

For the proposed zoning amendment, onsite pressures and flows have been confirmed to ensure there is sufficient capacity available for both domestic and firefighting conditions.

We have utilized information obtained from the municipal hydrants in the vicinity of the subject site connected to the existing 150mm diameter watermain beneath County Road 17. Table 1 illustrates the flow results of the testing conducted by Vipond on August 25th, 2021.

Table 1
Results of Hydrant Flow Tests

Test #	Outlet Inside Dia. (in.)	Number of Outlets	Residual Reading (PSI)	Flow@ Residual (gal/min)
0	n/a	n/a	70 (static)	n/a
1	1.125	1	58	294
2	1.75	1	40	519
3	2.5	1	28	631

Refer to Appendix C for the flow testing information obtained by Vipond.

5.2 Proposed Water Demands

Based on the MECP Design Guidelines for Water Distribution Systems, the proposed water servicing must adhere to the following criteria:

- Maximum system pressure of 690 kPa (100 psi) during normal conditions (average day to peak hour flows).
- Minimum system pressure of 275 kPa (40 psi) during normal conditions (average day to peak hour flows).
- Minimum system pressure of 138 kPa (20 psi) during max day plus fire flow conditions.
- Max day factor of 2.75 and peak hour factor of 4.13 based on MECP Guidelines Table 3-1 in the Design Guidelines for Drinking Water Systems, 2008.
- Residential water demand of 450 L/cap/day.
- Population density of 3.25 PPU for single/semi-detached dwellings

Based on the above conditions, Table 2 illustrates the proposed domestic demands for the development:

Table 2
Domestic Water Demand

Population	Per Capita Flow (L/day)	Peaking Factors (based on MECP Guidelines)		Flows (L/sec)	
		Peak Hour	Maximum Day	Peak Hour	Maximum Day
231	450	4.13	2.75	4.96	3.31

As stated above, the Mansfield Water System currently services approximately 153 service connections, with an approximate equivalent population of 459 people per Table 3-3 of the MECP Design Guidelines for Drinking Water Systems. In accordance with Section 8.4.5 of the MECP Guidelines, if fire protection is to be provided by the communal water supply and distribution system, the minimum demand flowrate for the proposed development should be increased by an amount equal to the minimum fire flow for two hours. Per Table 8-1 of the MECP Guidelines, with an equivalent population of 667, the existing communal distribution system must be able to supply the proposed development with a minimum fire flowrate of 38 L/s for 2 hours.

5.3 Proposed Water Servicing

Based on the criteria listed above, the maximum day plus fire flow and peak hour flow is 41.31 L/sec and 4.96 L/sec respectively. Table 3 below represents the results of the water demand flowrate analysis completed using PIPE2008 modelling software by KYPIPE. The PIPE2008 software computes residual water pressures at selected junctions based on the available water supply and the proposed water demands. Available fire and domestic system pressures computed by the model are summarized below:

Table 3
KYPIPE Model Results

Scenario	Water Demand Input (L/sec)	Minimum Pressure (kPa)	Minimum and Maximum Allowable Pressure Range (kPa)
Peak Hour	4.96	468.97	275-690
Maximum Day	3.31	472.30	275-690
Maximum Day + Fire	41.31	144.15	>=138

Based on the model results, the existing 150mm dia. watermain beneath County Road 17 and Airport Road has sufficient volume and pressure to service the proposed residential subdivision. A proposed 200mm dia. watermain will have the capacity to distribute fire and domestic flows while maintaining a minimum residual pressure of 138 kPa within the modelled system. The results of the water demand flowrate analysis are included in Appendix C.

It is understood through recent correspondence with the Municipality and Municipal engineer that adequate domestic water supply is available to service the subject lands with a maximum fire flow rate of 38 L/sec provided. With this development built out, no further water supply is available within Mansfield to service the remaining settlement lands outlined in their Official Plan. As such, The Township is initiating a Municipal Class Environmental Assessment (EA) to identify the preferred method of providing for these future demands.

Water servicing details will conform to Township of Mulmur standards and the exact size and location of the service laterals will be determined during the detailed construction approval stage. A conceptual servicing layout is provided on the drawings included in Appendix E and the final servicing layout/main sizing will be updated to reflect the EA findings once available.

6.0 HYDROLOGY

6.1 Design Criteria

Based on a review of the NVCA's Storm Water Management (SWM) Guidelines, the following design criteria, in accordance with the current MECP SWM Planning and Design Manual (MECP, 2003) were established for the proposed development:

Quantity Control:

- Peak flow attenuation for the 2-year through 100-year storm events to pre-development rates using the Ministry of Transportation (MTO) IDF data for the Mansfield area.

- Both the 4-hour Chicago and 24-hour SCS Type II storms must be modelled for the specified storm events.

- Safe conveyance of the Regulatory flows through the site to a sufficient outlet is required. The Regulatory flows are taken as the greater of the uncontrolled 100-year or Timmins flows through the development.

Quality Control:

- The NVCA requires that all new storm water management facilities provide, as a minimum, the "enhanced" level of protection in accordance with the MECP Storm Water Management Planning and Design Manual (MECP, 2003).

- Preparation of phosphorus and water balance calculations to meet NVCA requirements (A water budget analysis was conducted and submitted by Peto MacCallum Ltd. under separate cover).

- Preparation of detailed erosion, sediment control, and construction mitigation plan to be implemented as part of the construction program.

6.2 Design Storms

We have selected the following design storms as part of our evaluation:

- 2-year design storm
- 5-year design storm
- 10-year design storm
- 25-year design storm
- 50-year design storm
- 100-year design storm
- 12-hr Timmins Regional storm

Rainfall intensity – duration – frequency (IDF) values for the Mansfield Area were entered into an equation that expresses the time – intensity relationship for specific frequency, in the form of:

$$i = \frac{a}{(t+b)^c}$$

where:
- i = intensity, mm/hr.
- t = time of concentration, minutes
- a,b,c = constants developed to fit IDF curve

The rainfall runoff event simulation model Visual OTTHYMO was used to simulate watershed response to design rainfall events. Derivation of the design storm hyetographs were based on the "Chicago" 4-hour distribution using IDF data. In addition to the “Chicago” storms, the 24-hour SCS Type II storms and the 12-hour Timmins Regional storm were also modelled as required by the NVCA.

A copy of the IDF values taken from the MTO IDF Curve Look-up Tool is included in Appendix D.

6.3 Drainage Catchments

Two (2) pre-development and four (4) post-development catchments have been delineated for the site in order to estimate the corresponding peak runoff rates for the site. The pre-development catchment areas represent the existing condition of the property, consisting of agricultural fields and forested lands. The post-development catchments represent the proposed grading concept for the property with the addition of buildings, paved surfaces, and landscaped area. The post-development catchments also include contributing external drainage area from adjacent properties and Airport Road. The pre-development and post-development catchment parameters are included in Appendix D. The catchment boundaries are illustrated on drawings PRE-1 and POST-1 included in Appendix E.

6.4 Model Results

The results of the hydrological modelling are displayed in Tables 4 and 5 below for the 12hr Timmins Regional Storm, and the 2-year to 100-year return frequency storm events for the 4hr Chicago distribution, and the 24hr SCS Type II distribution.

Table 4
Model Results - 4hr Chicago Distributions

Catchment ID	Design Storm Event					
	2Yr	**5Yr**	**10Yr**	**25Yr**	**50Yr**	**100Yr**
PRE-DEVELOPMENT (m^3/sec)						
Catchment 101 (lands on the north side of the watercourse)	0.159	0.302	0.415	0.567	0.689	0.832
Catchment 102 (lands on the south side of the watercourse)	0.032	0.062	0.087	0.120	0.147	0.178
Total Pre-Development Runoff Rate	**0.191**	**0.364**	**0.502**	**0.688**	**0.835**	**1.009**
POST-DEVELOPMENT (m^3/sec)						
Catchment 201 (single-family lots and parkland)	0.658	0.935	1.152	1.411	1.702	1.957
Catchment 202 (semi-detached and townhouse lots)	0.178	0.249	0.298	0.361	0.409	0.552
Catchment 203 (uncontrolled lands north of the watercourse)	0.018	0.035	0.048	0.067	0.082	0.100
Catchment 204 (uncontrolled lands south of the watercourse)	0.020	0.038	0.052	0.071	0.087	0.105
Total Post-Development Runoff Rate	**0.838**	**1.189**	**1.456**	**1.781**	**2.124**	**2.525**

Table 5
Model Results - 24hr SCS Type II and Timmins Regional Storm Distributions

Catchment ID	Design Storm Event						
	2Yr	**5Yr**	**10Yr**	**25Yr**	**50Yr**	**100Yr**	**Timmins**
PRE-DEVELOPMENT (m^3/sec)							
Catchment 101 (lands on the north side of the watercourse)	0.456	0.731	0.944	1.216	1.405	1.646	1.431
Catchment 102 (lands on the south side of the watercourse)	0.096	0.157	0.205	0.267	0.309	0.364	0.329
Total Pre-Development Runoff Rate	**0.553**	**0.888**	**1.149**	**1.480**	**1.711**	**2.008**	**1.760**
POST-DEVELOPMENT (m^3/sec)							
Catchment 201 (single-family lots and parkland)	0.789	1.178	1.683	2.160	2.486	2.909	1.468
Catchment 202 (semi-detached and townhouse lots)	0.159	0.223	0.274	0.335	0.377	0.430	0.161
Catchment 203 (uncontrolled lands north of the watercourse)	0.053	0.087	0.115	0.150	0.174	0.206	0.200
Catchment 204 (uncontrolled lands south of the watercourse)	0.056	0.092	0.120	0.156	0.181	0.213	0.198
Total Post-Development Runoff Rate	**0.988**	**1.474**	**2.057**	**2.631**	**3.024**	**3.534**	**2.003**

Based on the calculated results of the hydrological modelling, it is expected that post-development flows directed to the watercourse will increase due to the proposed construction of the buildings and paved surfaces. Visual OTTHYMO input/output files are included in Appendix D.

7.0 STORM WATER MANAGEMENT PLAN

7.1 Quantity Control

As noted in the comparison of the pre-development and post-development flows, an increase in runoff will occur due to the proposed construction of the buildings and paved surfaces. To satisfy the selected design criteria, peak flow attenuation of post-development flows to pre-development levels for all storm events up to and including the 100-year storm event will be provided by directing roof drainage and driveway/road runoff to proposed dry-type stormwater management facilities.

Runoff generated in Catchment 201, which includes approximately 67% of the property area, will be directed to a proposed dry pond (Pond ‘A’) on the north side of the watercourse. Lot line drainage swales constructed at minimum gradients of 1.0% will be provided to convey lot drainage to the paved streets. Driveway and street runoff will be collected by a network of catch basins connected by storm sewers which will convey drainage downgradient to the proposed SWM block adjacent to Lots 24 & 25.

Pond ‘A’ as designed, will provide approximately 3,725m^3 of active detention storage to attenuate peak flows to pre-development levels for up to and including the 100-year event, while maintaining a minimum freeboard depth of 0.3m. Flows will be attenuated by a two-stage outlet control structure consisting of a 450mm dia. tee equipped with a 270mm dia. orifice restriction on the run of the tee, and a 375mm dia. vertical standpipe off the branch which serves as a horizontal secondary control orifice. The outlet structure will be protected by a perforated CSP riser. A 2.0m wide river-stone overflow weir will convey flow from the pond to the watercourse in the event the outlet structure becomes blocked.

Runoff generated in Catchment 202, which includes approximately 7% of the property area, will be directed to a proposed dry pond (Pond ‘B’) on the south side of the watercourse. Lot line drainage swales will convey lot drainage to the paved streets. Driveway and street runoff will be collected by a proposed storm sewer system which will convey drainage downgradient to the proposed SWM block adjacent to Block 44.

Pond ‘B’ as designed, will provide approximately 950m^3 of active detention storage to attenuate peak flows to pre-development levels for up to and including the 100-year storm event, while maintaining a minimum freeboard depth of 0.3m. Flows will be attenuated by a two-stage outlet control structure consisting of a 450mm dia. tee equipped with an 80mm dia. vertical orifice restriction on the run of the tee, and a 300mm dia. vertical standpipe off the branch which serves as a horizontal secondary control orifice. The outlet structure will be protected by a perforated CSP riser. A 3.0m wide river-stone overflow weir will convey flow from the pond to the watercourse in the event the outlet structure becomes blocked.

Catchments 203 and 204, consisting of a small portion of building rooftops, landscaped areas, embankments, and areas to be preserved along the perimeter of the watercourse, will flow offsite uncontrolled similar to pre-development conditions.

The stage-storage-discharge relationship of the proposed storage facilities are summarized in Table 6. The location of the stormwater management facilities is illustrated on the conceptual drawings included in Appendix E (envelope at the rear of this report). Further details and specifications related to the pond outlets will be provided during the detailed design stage for construction and MECP environmental compliance approvals.

Table 6
Stage-Storage-Discharge Relationship of Dry Ponds

	Description	Depth (m)	Elevation (m ASL)	Volume (m^3)	Discharge (m^3/s)
Catchment 201: (Dry Pond 'A' with a 270mm dia. vertical orifice restriction on outlet pipe and a 375mm dia. horizontal secondary orifice)	Pond Bottom / Primary Orifice	0.00	305.50	0.00	0.0000
	Contour	0.15	305.65	62.55	0.0196
	Contour	0.30	305.80	137.70	0.0649
	Contour	0.45	305.95	225.45	0.0897
	Contour	0.60	306.10	325.80	0.1090
	Contour	0.75	306.25	441.97	0.1253
	Contour	0.90	306.40	577.16	0.1397
	Contour	1.05	306.55	731.40	0.1528
	Secondary Orifice	1.20	306.70	904.66	0.1649
	Contour	1.35	306.85	1096.95	0.3277
	Contour	1.50	307.00	1309.91	0.4010
	Contour	1.65	307.15	1548.30	0.4592
	Contour	1.80	307.30	1815.28	0.5093
	Contour	1.95	307.45	2110.90	0.5542
	Contour	2.10	307.60	2435.15	0.5953
	Overflow Weir	2.25	307.75	2788.03	0.6334
	Contour	2.40	307.90	3169.54	0.8993
	Contour	2.55	308.05	3579.67	1.4461
	Contour	2.70	308.20	4018.43	2.2696
	Contour	2.85	308.35	4485.82	3.3891
	Top of Pond Berm	2.90	308.40	4647.98	3.8317
Catchment 202: (Dry Pond 'B' with an 80mm dia. vertical orifice restriction on outlet pipe and a 300mm dia. horizontal secondary orifice)	Pond Bottom / Primary Orifice	0.00	305.50	0.00	0.0000
	Contour	0.15	305.65	22.58	0.0047
	Contour	0.30	305.80	51.34	0.0072
	Contour	0.45	305.95	86.26	0.0090
	Contour	0.60	306.10	127.35	0.0105
	Contour	0.75	306.25	174.61	0.0118
	Contour	0.90	306.40	228.04	0.0130
	Contour	1.05	306.55	287.63	0.0141
	Secondary Orifice	1.20	306.70	353.40	0.0151
	Contour	1.35	306.85	425.33	0.1131
	Contour	1.50	307.00	503.44	0.1541
	Contour	1.65	307.15	587.71	0.1858
	Contour	1.80	307.30	678.15	0.2126
	Overflow Weir	1.95	307.45	774.76	0.2363
	Contour	2.10	307.60	877.54	0.5866
	Contour	2.25	307.75	986.48	1.2999
	Contour	2.40	307.90	1101.60	2.3435
	Top of Pond Berm	2.50	308.00	1181.75	3.2269

7.1.1. Effectiveness

Tables 7 and 8 below summarize the effectiveness of the proposed stormwater attenuation features based on the hydrological model results.

Table 7
Model Results - 4hr Chicago Distributions

CATCHMENT ID	Design Storm Event					
	2Yr	**5Yr**	**10Yr**	**25Yr**	**50Yr**	**100Yr**
PRE-DEVELOPMENT (m^3/sec)						
Catchment 101 (lands on the north side of the watercourse)	0.159	0.302	0.415	0.567	0.689	0.832
Catchment 102 (lands on the south side of the watercourse)	0.032	0.062	0.087	0.120	0.147	0.178
Total Pre-Development Runoff Rate	**0.191**	**0.364**	**0.502**	**0.688**	**0.835**	**1.009**
POST-DEVELOPMENT WITH SWM (m^3/sec)						
Catchment 201 (single-family lots and parkland)	0.140	0.254	0.366	0.457	0.516	0.571
Catchment 202 (semi-detached and townhouse lots)	0.011	0.013	0.014	0.024	0.041	0.064
Catchment 203 (uncontrolled lands north of the watercourse)	0.018	0.035	0.048	0.067	0.082	0.100
Catchment 204 (uncontrolled lands south of the watercourse)	0.020	0.038	0.052	0.071	0.087	0.105
Total Post-Development Runoff Rate With SWM	**0.188**	**0.338**	**0.480**	**0.610**	**0.725**	**0.833**

Table 8
Model Results - 24hr SCS Type II and Timmins Regional Storm Distributions

Catchment ID	Design Storm Event						
	2Yr	**5Yr**	**10Yr**	**25Yr**	**50Yr**	**100Yr**	**Timmins**
PRE-DEVELOPMENT (m^3/sec)							
Catchment 101 (lands on the north side of the watercourse)	0.456	0.731	0.944	1.216	1.405	1.646	1.431
Catchment 102 (lands on the south side of the watercourse)	0.096	0.157	0.205	0.267	0.309	0.364	0.329
Total Pre-Development Runoff Rate	**0.553**	**0.888**	**1.149**	**1.480**	**1.711**	**2.008**	**1.760**
POST-DEVELOPMENT WITH SWM (m^3/sec)							
Catchment 201 (single-family lots and parkland)	0.347	0.491	0.575	0.746	1.026	1.439	1.244
Catchment 202 (semi-detached and townhouse lots)	0.013	0.020	0.062	0.117	0.138	0.164	0.145
Catchment 203 (uncontrolled lands north of the watercourse)	0.053	0.087	0.115	0.150	0.174	0.206	0.200
Catchment 204 (uncontrolled lands south of the watercourse)	0.056	0.092	0.120	0.156	0.181	0.213	0.198
Total Post-Development Runoff Rate With SWM	**0.470**	**0.685**	**0.863**	**1.137**	**1.496**	**1.998**	**1.780**

With the implementation of this stormwater management strategy, there will be no increase in runoff directed to adjacent private properties and there is no downstream flood impact concern associated with this development on the watercourse. Tables 9 and 10 below illustrate an approximate flowrate comparison of site drainage split between lands on the north side and south side of the watercourse, in the event that the development is phased.

Table 9
Model Results - 4hr Chicago Distributions

	4hr Chicago Storm Event					
	2Yr	**5Yr**	**10Yr**	**25Yr**	**50Yr**	**100Yr**
LANDS ON THE NORTH SIDE OF THE WATERCOURSE						
PRE-DEVELOPMENT (m^3/sec)	0.159	0.302	0.415	0.567	0.689	0.832
POST-DEVELOPMENT WITH SWM (m^3/sec)	0.158	0.288	0.414	0.524	0.597	0.671
LANDS ON THE SOUTH SIDE OF THE WATERCOURSE						
PRE-DEVELOPMENT (m^3/sec)	0.032	0.062	0.087	0.120	0.147	0.178
POST-DEVELOPMENT WITH SWM (m^3/sec)	0.031	0.050	0.066	0.086	0.128	0.165

Table 10
Model Results - SCS Type II, and Timmins Distributions

	SCS Type II and Timmins Storm Event						
	2Yr	**5Yr**	**10Yr**	**25Yr**	**50Yr**	**100Yr**	**Timmins**
LANDS ON THE NORTH SIDE OF THE WATERCOURSE							
PRE-DEVELOPMENT (m^3/sec)	0.456	0.731	0.944	1.216	1.405	1.646	1.431
POST-DEVELOPMENT WITH SWM (m^3/sec)	0.400	0.578	0.689	0.895	1.195	1.639	1.443
LANDS ON THE SOUTH SIDE OF THE WATERCOURSE							
PRE-DEVELOPMENT (m^3/sec)	0.096	0.157	0.205	0.267	0.309	0.364	0.329
POST-DEVELOPMENT WITH SWM (m^3/sec)	0.070	0.107	0.178	0.257	0.302	0.359	0.339

7.2 Quality Control

The primary objective of the stormwater management plan for this development is to maintain acceptable water quality within the receiving watercourse, by maintaining existing site drainage patterns and flowrates. In order to provide water quality enhancement to an "enhanced" level of protection (80% TSS removal) for this development, we have incorporated a "treatment train" approach consisting of the following elements:

- Provision of three (3) Imbrium Stormceptor EFO treatment units for oil and sediment removal of runoff generated in catchments 201 and 202. The PCSWMM For Stormceptor sizing program, by Imbrium Systems Inc., was utilized to design the appropriate treatment units. For a 7.74-hectare drainage area in catchment 201 that is 19.3% impervious, an EFO10 treatment unit (or an approved equivalent) is required. An EFO10 unit will provide 82% removal of total suspended solids. For a 5.83-hectare drainage area in catchment 201 that is 21.6% impervious, an EFO8 treatment unit (or an approved equivalent) is required. An EFO8 unit will provide 80% removal of total suspended solids. For a 1.41-hectare drainage area in catchment 202 that is 45% impervious, an EFO6 treatment unit (or an approved equivalent) is required. An EFO6 unit will provide 86% removal of total suspended solids. Design calculations utilizing the manufacturer's software, and applicable reports, are included in Appendix D.

- Provision of CB Shields installed within the double catch basins in catchments 203 and 204 for pre-treatment and scour prevention of runoff generated from a portion of the paved street. The CB Shield Design Chart was utilized to estimate the average annual TSS removal rate. For the CB Shields installed within DCB#8 and DCB#9, a TSS removal rate of 72.0% will be provided by each device for a shared 0.085-hectare drainage area that is 100% impervious. The manufacturer's design chart and applicable reports are included in Appendix D.

- Provision of "soft" landscaping where feasible.

- Yard grading using minimal surface slopes where possible to promote infiltration.

- Suitable construction mitigation measures to be utilized during the site development.

The potential treatment alternatives have been evaluated with respect to their applicability for this development and implemented in a manner to achieve the best total suspended solids (TSS) removal possible. Table 11 summarizes the proposed measures and their overall effectiveness.

Table 11
Proposed Approach for Water Quality Treatment

Catchment	Surface	Method	Effective TSS	Area (m²)	% Area of Site	Overall TSS Removal
201	Partial Paved Surfaces, and Landscape Area	Stormceptor EFO10	82%	66800	31.4	25.74%
	Partial Paved Surfaces, and Landscape Area	Stormceptor EFO8	80%	48410	22.7	18.20%
	Landscape Area	Natural Filtration / Evapotranspiration	80%	17340	8.1	6.52%
	Partial Building Rooftops	Inherent	100%	10750	5.1	5.05%
202	Paved Surfaces, and Landscape Area	Stormceptor EFO6	86%	11115	5.2	4.49%
	Partial Building Rooftops	Inherent	100%	2985	1.4	1.40%
	Landscape Area	Natural Filtration / Evapotranspiration	80%	1200	0.6	0.45%
203	Partial Uncontrolled Paved Surface	CB Shield	72%	500	0.2	0.17%
	Uncontrolled Landscape and Natural Areas	Natural Filtration / Evapotranspiration	80%	27500	12.9	10.34%
204	Partial Uncontrolled Paved Surface	CB Shield	72%	350	0.2	0.12%
	Partial Building Rooftops	Inherent	100%	1660	0.8	0.78%
	Uncontrolled Landscape and Natural Areas	Natural Filtration / Evapotranspiration	80%	24190	11.4	9.09%
Total	Total			212800	100.0	82.36%

With the implementation of the proposed quality control plan, the proposed measures in conglomeration will provide an overall long term TSS removal of 82.36%. This quality control plan will be refined at the detailed design stage for construction approvals.

7.3 Erosion Control

As per the NVCA Stormwater Technical Guide, to deal with erosion issues resulting from additional volume of runoff produced as a result of urbanization, a minimum retention volume equivalent to the first 5mm of rainfall should be retained onsite through infiltration measures, rainwater harvesting, or evapotranspiration. Based on a total property area of 212,800m^2, the first 5mm of rainfall to be retained on the site for infiltration equates to 1,064m^3. Initial abstraction values provided in the NVCA Stormwater Technical Guide are shown in Table 12.

Table 12
Initial Abstraction Values

Cover	Initial Abstraction / Depression Storage (mm)
Woods	10
Pasture/Meadow	8
Cultivated	7
Lawns	5
Wetland	12
Impervious Areas	2

Adapted from UNESCO, Manual on Drainage in Urbanized Areas, 1987

For the purpose of this calculation, the NVCA does not recognize initial abstraction storage for impervious area. Using the values provided in Table 12 above, with the exception of the initial abstraction value for impervious area set to 0, the subject property will provide 4.148mm of storage through initial abstraction during the first 5mm of rainfall. Approximately 883m^3 of rainfall will be retained on the property through initial abstraction in the post-development condition.

To improve stormwater retention in the post-development condition to meet the minimum retention volume requirement, the proposed dry-type stormwater management ponds servicing catchments 201 and 202 will be designed with shallow plunge pools to provide additional stormwater retention storage for infiltration. Pond ‘A’ will be designed with a 0.4m deep plunge pool and Pond ‘B; will be designed with a 0.3m depth plunge pool. In conglomeration, the plunge pools will provide approximately 189m^3 of stormwater during the first 5mm of rainfall.

The implementation of this stormwater management strategy will increase the overall site rainfall retention volume to 1,072m^3 which meets the minimum retention volume of 1,064m^3 for the first 5mm of rainfall. Further design details will be provided at the detailed design stage for construction approvals.

7.4 Phosphorus Budget

As part of the NVCA SWM guidelines, all new developments must be accompanied with an evaluation of anticipated changes in phosphorus loadings between pre-development and post-development conditions. The NVCA P-Tool was utilized to determine pre and post development phosphorus loadings for the property. In the pre-development condition, forest and agricultural land use was assumed for phosphorus loading. For the post-development condition, low-intensity residential land use was assumed for the single-family lots, urban residential land use was assumed for the semi-detached/townhouse lots, and the uncontrolled catchments were broken down into forest and low-density residential land uses. The calculated phosphorus loadings are illustrated in Table 13.

Table 13
Model Results – Phosphorus Loading

	P Load (kg/yr)
Pre-Development	3.70
Post Development with no BMP's	3.84
Post Development with BMP's	3.39

Oil and grit separators have some total phosphorus removal benefit. Sediment particles in captured runoff containing concentrations of total phosphorus are screened and settled-out in the lower chambers of the separator. ETV verified units are now be credited with a 20% total phosphorus removal efficiency.

With the implementation of Imbrium Stormceptor EFO units (or equivalent) for catchments 201 and 202, the proposed best management practices in conglomeration will achieve an overall post-development phosphorus reduction of 11.7% for the property.

A copy of the phosphorus calculations showing the proposed best management practices and their corresponding phosphorus load reductions is included in Appendix D. A refined phosphorus loading analysis will be provided at the detailed design stage for construction approvals.

8.0 EROSION AND SEDIMENT CONTROL

8.1 Mitigation Measures

Sedimentation and erosion control measures are required during construction and until such a time that all lot grading and building construction has been completed, the driveways have received their final surface treatment, and vegetation has been established in all landscape areas so that there are no open soils.

The use of various siltation control measures will be implemented to protect the adjacent properties and receiving waterbodies from migrating sediments. These works include but may not be limited to:

- Installation of siltation fencing along the perimeter of the development area, prior to earthwork operations.
- Installation of a vehicle tracking mud mat at the entrance to the site.
- Construction of temporary sediment basins.
- Installation of silt sacks within existing and proposed storm structures to prevent sedimentation.

Prior to carrying out site grading, the siltation barriers and mud mats shall be in place. Any onsite storm sewer works will not be permitted to outlet to the watercourse until the site has been stabilized.

Other temporary installations of silt fence or other appropriate measures may be required during grading to minimize silt migration from the site. The measures will need to be removed, replaced and relocated as required during the construction period until the site works have been completed and vegetation established. During construction, all stockpiled material will be placed up-gradient of the siltation controls with additional siltation fencing installed around the stockpiles.

Sediment and erosion control details will be provided during detailed design stage for construction approvals.

9.0 SUMMARY AND CONCLUSIONS

The findings of this report are summarized as follows:

- The max day plus fire flow rate of 41.31 L/sec can be delivered to the proposed development, via a new 200mm dia. watermain, from the existing 150mm dia. watermain beneath County Road 17 and Airport Road with a residual pressure of greater than 20 psi (138 kPa).
- The subject property is within an NVCA regulated area based on available mapping on their website.
- Attenuation of peak post-development flowrates to below pre-development levels will be provided by utilizing extended detention storage within proposed dry-type stormwater management ponds.
- Quality control for the development will be provided by the installation of oil/grit separators sized to provide 80% removal of TSS and 20% removal of annual total phosphorus for

catchments 201 and 202. CB Shields installed within specified catch basins will provide 72% TSS removal for street drainage generated in catchments 203 and 204. Landscaped and preserved vegetated areas will perform as natural filters of site runoff and promote infiltration.

- Suitable measures can be implemented during construction to protect the adjacent properties and receiving storm sewers from migrating sediments.

It is therefore recommended that:

1) This report and drawings are submitted to the Township of Mulmur and the NVCA for review and approval.

2) The construction mitigation measures outlined in this report are utilized as a guideline for construction mitigation measures for this site.

We trust this is satisfactory and should you have any questions, please call.

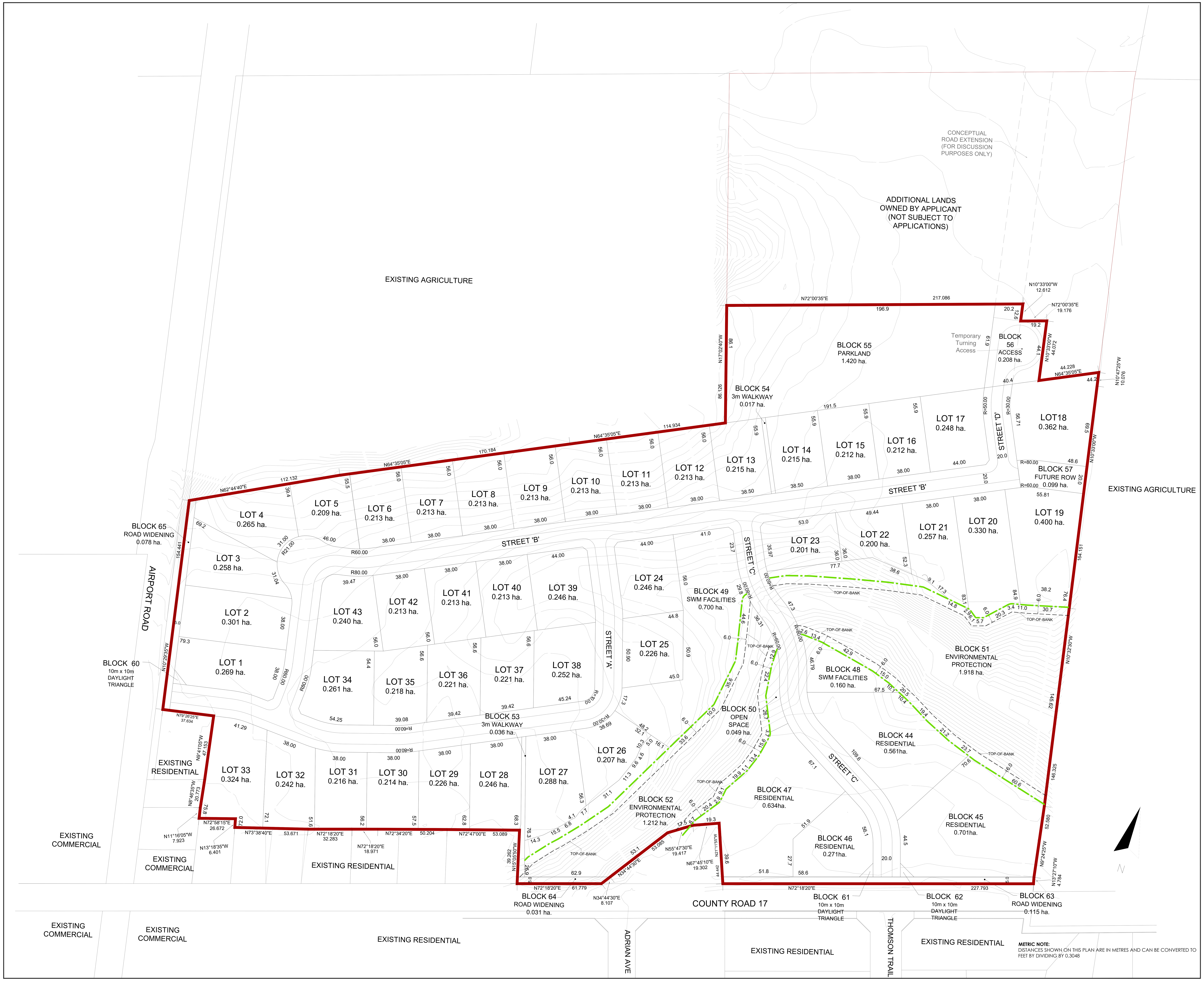
All of which is respectfully submitted by,

PINESTONE ENGINEERING LTD.

Joe Voisin, P.Eng
Senior Engineer

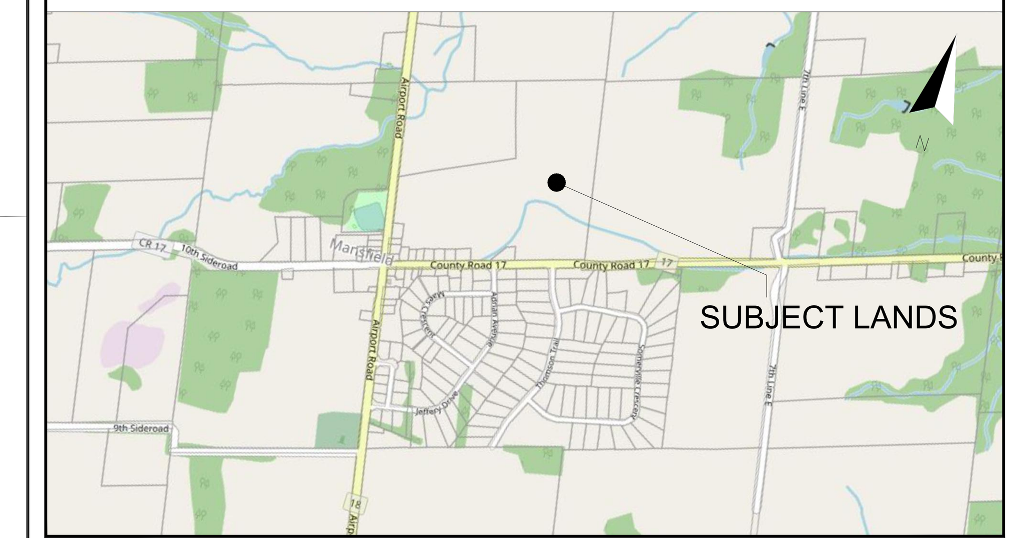
APPENDIX A

Proposed Draft Plan Concept



KEY MAP

Scale: 1:20,000



DRAFT PLAN OF SUBDIVISION ARMSTRONG ESTATES OF MANSFIELD

Part of Lot 11, Concession 7
East of Hurontario Street
Township of Mulmur
County of Dufferin

Scale 1:1250

0 25 50 75 100 125m

SUBJECT LANDS - 21.510 ha.

6.0m SETBACK FROM TOP-OF-BANK

LAND USE SCHEDULE

Land Use	Lot / Block No.	Units	Area (ha.)	%
RESIDENTIAL SINGLE LOT (30.0m / 2,000m^2)	1-43	43	10.38	48.2
RESIDENTIAL SEM-DETACHED BLOCKS (9.0m / 30')	44-47	28	2.17	10.1
STORMWATER MANAGEMENT FACILITIES	Blocks 48, 49		0.86	4.0
OPEN SPACE	Block 50		0.05	0.2
ENVIRONMENTAL PROTECTION	Blocks 51, 52		3.13	14.6
3.0m WALKWAYS	Blocks 60, 61		0.05	0.2
PARKLAND	Block 55		1.42	6.6
ACCESS	Block 56		0.21	1.0
FUTURE R.O.W.	Block 57		0.10	0.5
6.0m ACCESS	Block 59		0.04	0.2
DAYLIGHT TRIANGLES	Blocks 59-62		0.02	0.1
ROAD WIDENINGS	Blocks 63-65		0.23	1.0
STREETS	Streets A - D		2.85	13.3
TOTAL		71	21.50	100.0

OWNER'S CERTIFICATE

I, THE UNDERSIGNED, BEING THE REGISTERED OWNER OF THE SUBJECT LANDS, HEREBY AUTHORIZE INNOVATIVE PLANNING SOLUTIONS TO PREPARE THIS DRAFT PLAN OF SUBDIVISION AND TO SUBMIT SAME TO THE COUNTY OF DUFFERIN FOR APPROVAL.

DATE

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE

ADDITIONAL INFORMATION REQUIRED UNDER **SECTION 51(17)** OF THE PLANNING ACT

a) SHOWN ON PLAN
b) SHOWN ON PLAN
c) SHOWN ON PLAN
d) RESIDENTIAL, OPEN SPACE
e) SHOWN ON PLAN
f) SHOWN ON PLAN
f1) NONE
g) SHOWN ON PLAN
h) MUNCIPAL WATER
i) SAND
j) SHOWN ON PLAN
k) PRIVATE SEPTIC
l) NONE

SCHEDULE OF REVISIONS

No.	Date	Description	By
1	Sept. 7, 2021	Adjust top-of-bank limits;	A.S.
2	Sept. 8, 2021	Adjust top-of-bank limits;	A.S.
3	Sept. 27, 2021	Adjust EP Limits, updated lots & blocks	B.H.
4	Mar. 7, 2022	For Signature	B.H.
5	Apr. 4, 2022	Dimension Top-of-Bank Setback	B.H.
6	Dec. 1, 2022	Road & lot revisions	B.H.
7	Sept. 29, 2023	Road & lot revisions along Street C	B.H.
8	Dec. 22, 2023	Road & lot revisions along Street C	A.S.

IPS INNOVATIVE PLANNING SOLUTIONS
PLANNERS • PROJECT MANAGERS • LAND DEVELOPERS
647 WELHAM RD., UNIT 9, BARRIE, ONTARIO, L4N 0B7
tel: 705 • 812 • 3281 fax: 705 • 812 • 3438 e: info@ipsconsultinginc.com www.ipsconsultinginc.com

Date:	August 12, 2021	Drawn By:	BH
File:	20-1019	Checked:	GB

APPENDIX B

Geotechnical Investigation

PINESTONE ENGINEERING LTD.

Peto MacCallum Ltd.
CONSULTING ENGINEERS

GEOTECHNICAL/HYDROGEOLOGICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
937045 AIRPORT ROAD
MANSFIELD, ONTARIO

for

2735528 ONTARIO INC.

PETO MacCALLUM LTD.
19 CHURCHILL DRIVE
BARRIE, ONTARIO
L4N 8Z5
PHONE: (705) 734-3900
FAX: (705) 734-9911
EMAIL: barrie@petomaccallum.com

Distribution:
1 cc: 2735528 Ontario Inc. (email only)
1 cc: PML Barrie

PML Ref.: 21BF019
Report: 1 Revised
September 2021

Peto MacCallum Ltd.
CONSULTING ENGINEERS

September 21, 2021

PML Ref.: 21BF019
Report: 1 Revised

Mr. David Seaman
2735528 Ontario Inc.
12 Trotter Court
Barrie, Ontario
L4N 5S4

Dear Mr. Seaman

Geotechnical/Hydrogeological Investigation
Proposed Residential Development
937045 Airport Road
Mansfield, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the Geotechnical/Hydrogeological investigation recently completed at the above noted project site. Authorization for the work described in this report was provided by Mr. D. Seaman in the signed Engineering Services Agreement dated April 12, 2021.

It is understood that a 61 Lot subdivision is planned for the property at 937045 Airport Road in Mansfield (northeast corner of Airport Road and Dufferin County Road 17). The site is currently farm land with a seasonal creek severing the property into a larger northern section and smaller southern section. A culvert is being considered for the creek. Basements are proposed in the residences. Storm sewers and Storm Water Management (SWM) ponds are proposed along with private septic systems and municipal water supply. Paved roads will provide access for the site. The proposed site plan is shown on Drawing 1, appended.

The purpose of this investigation was to assess the subsurface conditions at the site, and based on this information, provide comments and Geotechnical/Hydrogeological engineering recommendations for earthworks, building foundations and basements, culvert foundations, site servicing, parameters for septic design, SWM ponds, pavement design, ground water flow direction and gradient, ground water quality and quantity, preliminary assessment of infiltration parameters for Low Impact Development features, a preliminary pre- and post-development water budget, and ground water level monitoring. An Erosion Hazard Limit Assessment is also required due to the valley surrounding the creek.

Geoenvironmental services (observations, recording, chemical testing or assessment of the environmental conditions of the soil) were not within the terms of reference for this assignment, and no work has been carried out in this regard. If excess excavated soils requiring transportation off-site are generated, a program of sampling and chemical testing will be needed to determine the chemical properties of the soil to evaluate appropriate receiving site options, in accordance with O.Reg. 406/19.

A total of 12 boreholes were advanced across the site. Beneath the topsoil, the boreholes typically revealed soils comprised of sand and silt mixtures with layers of clayey silt, sandy silty clay and clayey silt till. Ground water was encountered locally as perched water in some of the boreholes.

Typical construction methods should be applicable for the site.

19 Churchill Drive, Barrie, Ontario L4N 8Z5
Tel: (705) 734-3900 Fax: (705) 734-9911
E-mail: barrie@petomaccallum.com
BARRIE, COLLINGWOOD, HAMILTON, KITCHENER, LONDON, TORONTO

We trust the information in this report is sufficient for your present purpose. If you have any questions please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.

Geoffrey R. White, P.Eng.
Director
Manager, Geotechnical Services

AK/GRW:tc

TABLE OF CONTENTS

1. INTRODUCTION

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Geoenvironmental services (observations, recording, chemical testing or assessment of the environmental conditions of the soil) were not within the terms of reference for this assignment, and no work has been carried out in this regard. If excess excavated soils requiring transportation off-site are generated, a program of sampling and chemical testing will be needed to determine the chemical properties of the soil to evaluate appropriate receiving site options, in accordance with O.Reg. 406/19.

The comments and recommendations provided in this report are based on the site conditions at the time of the investigation, and are applicable only to the proposed works as addressed in the report. Any changes in the proposed plans will require review by PML to re-assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.

This report is subject to the Statement of Limitations that is included in Appendix A and must be read in conjunction with the report.

2. INVESTIGATION PROCEDURES

2.1 Geotechnical Investigation

2.1.1 Borehole Drilling

The Geotechnical field work for this investigation included a program of borehole drilling from May 12 to 14, 2021. Boreholes 1 to 12 were advanced to 5.0 o 10.0 m depth for the proposed development and cognizant of the EHLA. Borehole locations are shown on Drawing 1, appended.

PML laid out the boreholes in the field. The ground surface elevation at the borehole locations was obtained with a Sokkia SHC5000 Global Navigation Satellite System (GNSS). Vertical and horizontal accuracy of this unit are 0.1 and 0.5 m, respectively. All elevations in this report are geodetic and expressed in metres.

Co-ordination for clearances of underground utilities was provided by PML. The boreholes were drilled cognizant of the underground utilities.

The boreholes were advanced using continuous flight solid stem augers, powered by a track mounted D-50 drill rig and a truck mounted CME-75 drill rig, both equipped with an automatic hammer, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of PML’s engineering staff.

Where topsoil was encountered at the surface, the thickness was measured in hand dug divots.

Representative samples of the overburden were recovered at frequent depth intervals for identification purposes using a conventional 51 mm OD split spoon sampler. The sample excluded particles larger than 38 mm. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the subsoil. The ground water conditions in the boreholes were assessed during drilling by visual examination of the soil samples, the sampler, and drill rods as the samples were retrieved, and measurement of the water level in the open boreholes, if any.

All recovered samples were returned to our laboratory for detailed examination and moisture content determinations. Grain size analyses were carried out on eight samples of the major soil units and Atterberg limits testing was completed on two samples. The laboratory test results are provided on Figures 1 to 6, appended.

Geotechnical engineering considerations are addressed in Section 5.

2.1.2 Monitoring Well Installation

A monitoring well, comprised of 50 mm diameter PVC pipe with a 1.5 to 3.0 m long screen at the bottom, filter sand, bentonite seal and stick-up protective casing, was installed in eight boreholes to permit ground water level monitoring. The details of the monitoring well installation are shown on the applicable Log of Borehole sheets. It should be noted that the well becomes the property of the Owner and will have to be decommissioned by the Owner in accordance with O.Reg. 903. PML would be pleased to assist, if requested.

2.2 Hydrogeological Investigation

2.2.1 Borehole Permeability Testing

PML returned to site June 11, 2021 to complete borehole permeability testing in the monitoring wells in Boreholes 5, 7 and 10. The borehole permeability testing was completed after well development, which consisted of removing an equivalent of about ten times the well volume. The field permeability testing was conducted by using the rising head method, in which periodic water level measurements were recorded manually, as well as using an electronic data recorder or transducer, as the water level recovered inside the monitoring wells after rapid removal of a volume of water.

Aqtesolv, which is a specialized software designed to interpret aquifer tests, was utilized in the interpretation of the field permeability results. The results are further discussed in Section 6.2.1.

2.2.2 Ground Water Sampling

During the June 11, 2021 site visit, PML retrieved a ground water sample from the monitoring well in Borehole 7 and 10. Following well development and the borehole permeability testing the ground water sample was collected and submitted for chemical testing as described below. The ground water sample was kept cool with ice in a cooler until delivery to the laboratory for analysis.

The ground water sample was delivered to Caduceon Environmental Laboratories (Caduceon) for chemical analyses. Caduceon Laboratories is accredited by The Standards Council of Canada (SCC) and CALA.

The ground water sample was analyzed for Provincial Water Quality Objective (PWQO) metals, phosphorous, nitrate/nitrite and pH.

The Chain-of-Custody Record and the laboratory certificates of analyses are discussed further in Section 6.4.

2.2.3 Ground Water Level Monitoring Program

A twelve-month ground water level monitoring program is currently on-going and results will be provided under a separate cover when completed. Ground water levels recorded to date are provided in this report.

Hydrogeological considerations are presented in Section 6.

3. SITE SETTING

The site is irregular in shape and is approximately 24.5 ha in size. The site is located in the northeast quadrant of the County Road 17 and Airport Road intersection in Mansfield. The site is currently being utilized for agricultural purposes and is surrounding by residential and agricultural land uses.

3.1 Physiography and Topography

The site is located within the physiographic region known as the Horseshoe Moraines comprising glaciofluvial spillway deposits (Chapman and Putnam, 1984).

The borehole elevations indicate about 9.0 m of relief across the site, with elevations ranging from 304.05 to 313.20, gently sloping down to the seasonal Pine River tributary that crosses the eastern portion of the Site.

3.2 Drainage and Surface Water Flow

A seasonal tributary of the Pine River crosses the eastern portion of the site and the intermittent flow is towards the northeast and ultimately to Georgian Bay located over 30 km to the north. Surface drainage on the site is expected to follow the topography towards the seasonal Pine River tributary.

4. GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Geology

Bedrock below the overburden is mapped as shale and limestone of the Georgian Bay Formation from the Middle Ordovian period of the Paleozoic era of the Phanerzoic eon. Bedrock is anticipated at depths of 5.5 to 62 m based on the Ministry of Environment, Conservation and Parks (MECP) Water Well Records in the area.

4.2 Subsurface Conditions

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions, including topsoil thicknesses, soil classifications, inferred stratigraphy and thicknesses, Standard Penetration test N Values (N Values, blows per 300 mm penetration of the split spoon sampler), well installation details, ground water level observations and the results of laboratory moisture content determinations and Atterberg Limits tests.

Due to the soil sampling procedures and the limited size of samples, the depth/elevation demarcations on the borehole logs must be viewed as “transitional” zones, and cannot be construed as exact geologic boundaries between layers. PML should be retained to assist in defining the geological boundaries in the field during construction, if required.

Topsoil was encountered overlying soil typical comprise of sand and silt mixtures. Layers of clayey silt, sandy silty clay and clayey silt till were also encountered. A description of the distribution of the subsurface conditions encountered is provided below.

4.2.1 Soil

Topsoil was present at the surface of all boreholes, ranging in thickness from 50 to 600 mm.

Fill was revealed locally in Borehole 8, below the topsoil, extending to 1.4 m depth (elevation 308.5). The material comprised silty sand with some gravel. The material had N Values of 7 to 64 indicating variable compaction when placed. The layer was moist with a water content of 7 to 8%.

Below the topsoil and/or fill, a sand/silty sand/sand and gravel unit was encountered in all boreholes extending to 1.4 to 5.5 m depth (elevation 302.5 to 312.5) and the 5.0 and 6.5 m depth of exploration in Boreholes 3 and 10. In Borehole 1 the material was interrupted by a sandy silt layer then continued to the 6.5 m depth of exploration. The material had N Values of 2 to greater than 50 indicating very loose to very dense conditions. The material was moist to wet, with depth, and moisture contents were 2 to 26%.

Below the upper sand/silty sand/sand and gravel unit in Boreholes 1, 2, 5, 6, 8, 9, 11 and 12, locally below the sandy clayey silt unit in Borehole 4, a sandy silt/silt unit was encountered to 2.1 to 9.0 m depth (elevation 299.0 to 311.1) and to the 5.0 to 6.5 m depth of exploration in Boreholes 2, 4, 5 and 11. Six representative samples were submitted for gradation and the results are presented on Figures 1 and 2, appended. The material had a N Values of 4 to 74 indicating very loose to very dense conditions. The layer was moist to wet with moisture content of 7 to 22%.

Below the sandy silt unit in Borehole 9, a lower silty sand unit was encountered to the 5.0 m depth of exploration. The material had an N Value of 34 indicating dense conditions. The layer was moist with moisture content of 12%.

Below the sand unit in Boreholes 4 and 7, and below the silt/sandy silt unit in Boreholes 6, 8 and 12, a sandy clayey silt/clayey silt/clayey silt till unit was encountered to 2.9 m depth in Borehole 4 (elevation 306.4) and the 5.0 to 10.0 m depth of exploration in Boreholes 6, 7, 8 and 12. Two representative samples were submitted for gradation and the results are presented on Figures 3 and 5, appended. Atterberg Limits are plotted on Figures 4 and 6 (plastic limits of 15 and 16% and liquid limits of 31% and 38%). The material had a N Values of 12 to 44 indicating stiff to hard conditions. The material was drier than plastic limit to wetter than plastic limit with moisture content of 11 to 23%.

4.2.2 Ground Water

The first water strike (ground water first encountered during drilling), the ground water/wet cave levels measured in the boreholes upon completion of augering, and ground water level measured in the wells following completion are summarized in the table below, on a borehole by borehole basis.

BOREHOLE	FIRST STRIKE DURING DRILLING DEPTH (m) / ELEVATION	UPON COMPLETION OF AUGERING DEPTH (m) / ELEVATION	WATER LEVEL IN WELL DEPTH (m) / ELEVATION	
			2021-05-20	2021-06-11
1	No Water	No Water	Dry	Dry
2	No Water	No Water	Dry	Dry
3	No Water	No Water	--	--
4	1.5 / 307.8	No Water	--	--
5	4.6 / 304.6	4.3 / 304.9	4.2 / 305.0	4.3 / 304.9
6	0.8 / 303.7	1.2 / 303.3	--	--
7	0.8 / 303.3	0.9 / 307.2	1.0 / 303.1	1.3 / 302.8
8	6.4 / 303.5	4.6 / 305.3	7.2 / 302.7	7.2 / 302.7
9	3.1 / 308.3	No Water	--	--
10	3.1 / 307.4	4.3 / 306.2	4.2 / 306.3	4.3 / 306.2
11	4.6 / 304.5	5.5 / 303.6	4.6 / 304.5	3.8 / 304.3
12	2.3 / 305.7	No Water	5.7 / 302.3	5.8 / 302.2

The regional ground water table is believed to be below the depth of exploration. Local near surface perched ground water stabilized at 1.0 to 5.8 m below existing grade, corresponding to elevation 302.2 to 306.3.

The near surface ground water flow direction is towards the northeast, with a gradient of 0.9 to 2.0%.

The seasonal creek did not have visual active flow at the time of the investigation but the ground was wet and cattails were present in some areas. Based on the topographic information provided the base of the season creek is at elevation 306.5 in the west dropping to about 300.0 in the east, corresponding closely the ground water levels measured.

Ground water levels will fluctuate seasonally, and in response to variations in precipitation.

5. GEOTECHNICAL ENGINEERING CONSIDERATIONS

5.1 General

It is understood that a 61 Lot subdivision is planned for the property at 937045 Airport Road in Mansfield (northeast corner of Airport Road and Dufferin County Road 17). The site is currently farm land with a seasonal creek severing the property into a larger northern section and smaller southern section. A culvert is being considered for the creek. Basements are proposed in the residences. Storm sewers and SWM ponds are proposed along with private septic systems and municipal water supply. Paved roads will provide access for the site. The proposed site plan is shown on Drawing 1, appended.

5.2 Site Grading and Engineered Fill

It is understood that grading has not been established for the site, but will likely require some cut in higher areas and fill in lower areas to achieve a balance.

The existing topsoil and fill are not suitable to support footings or floor slabs due to concerns with settlement. In this regard, it is recommended that existing topsoil and fill be removed. Where grades are to be raised under structures (building, paved areas and site servicing) the fill needs to be constructed as engineered fill.

Reference is made to Appendix B for guidelines for engineered fill construction. The following general highlights are provided:

- Strip existing topsoil and/or fill, and other deleterious materials down to competent native soil, subject to geotechnical review during construction. The excavated native soil should be segregated and stockpiled separately for reuse or disposal, subject to geotechnical review;

- Proofroll exposed subgrade using a heavy roller to targeted 100% Standard Proctor maximum dry density (SPmdd) for the building areas and 95% SPmdd for pavement and servicing areas, under geotechnical review;

- Following geotechnical review and approval of the subgrade, spread approved material in maximum 200 mm thick lifts and uniformly compacted to 100% SPmdd in building areas and 95% SPmdd in parking areas. If wet subgrade conditions are present the use of Granular B Type II may be required for the first lift or two of engineered fill;

- Organics, topsoil, oversized material (over 150 mm in diameter) or otherwise deleterious materials are not suitable for reuse as engineered fill. The excavated inorganic site soil is generally considered suitable for reuse as engineered fill, subject to moisture content and geotechnical review during construction. Imported material should comprise OPSS Granular B or OPSS Select Subgrade Material (SSM). Other sources of imported material should be reviewed by our office to ensure suitability;

- The engineered fill pad must extend at least 1 m beyond the structure to be supported, then outwards and downwards at no steeper than 45° to the horizontal to meet the underlying approved native subgrade. In this regard, strict survey control and detailed documentation of the lateral and vertical extent of the engineered fill limits should be carried out to ensure that the engineered fill pad fully incorporates the structure to be supported;

- Engineered fill construction must be carried out under full-time field review by PML, to approve sub-excavation and subgrade preparation, backfill materials, placement and compaction procedures, and to verify that the specified compaction standards are achieved throughout.

5.3 Foundations

It is understood that grading has not been established for the site, however the inclusion of basements will likely mean that footings will be supported by the native soil, locally the engineered fill.

The available bearing resistance on the upper native soils, on a borehole-by-borehole basis is provided below (boreholes in building areas only). Bearing resistance at depth can be provided if requested:

BOREHOLE	DEPTH (m) / ELEVATION	ANTICIPATED SUBGRADE SOIL TYPE	GEOTECHNICAL BEARING RESISTANCE AT SLS (kPa)	FACTORED BEARING RESISTANCE AT ULS (kPa)
1	0.7 / 312.5	Sandy Silt	50	75
	1.5 / 311.7	Sandy Silt	150	225
2	1.5 / 311.3	Sand	60	90
3	0.7 / 309.9	Sand	40	60
	2.1 / 308.5		100	150
4	0.7 / 308.6	Sand	100	150
	2.1 / 307.2	Sandy Clayey Silt	200	300
5	0.7 / 308.5	Sand and Gravel	250	375
8	1.5 / 303.8	Sand	150	225
9	0.7 / 310.7	Sand and Gravel	250	375
10	0.7 / 309.8	Sand	150	225
11	0.7 / 308.4	Sand	150	225
12	0.7 / 307.3	Sand	80	120
	1.5 / 306.5	Sand	100	150
	2.2 / 305.8	Sand	150	225

SLS – Serviceability Limit State
ULS – Ultimate Limit State

As discussed earlier, any upfilling under buildings will need to be constructed as engineered fill. Footings founded on a minimum 1.0 m of engineered fill, constructed as described above can be designed for a net Geotechnical bearing resistance at SLS of 100 kPa and a factored bearing resistance at ULS of 150 kPa.

In general, it is recommended to adopt a Geotechnical bearing resistance at SLS of 100 kPa and a factored bearing resistance at ULS of 150 kPa for design of footings, with local areas of lower bearing resistance as shown in the table above.

The bearing resistance at SLS is based on total settlement of 25 mm in the bearing stratum with differential settlement of 75% of this value.

Footings subject to frost action should be provided with a minimum 1.2 m of earth cover or equivalent insulation. If there are any walkout basement areas, footings will have to be stepped down.

Prior to placement of structural concrete, all founding surfaces should be reviewed by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions revealed in the excavation.

Based on the soil profile revealed in the boreholes, Site Classification D is applicable for Seismic Site Response as set out in Table 4.1.8.4.A of the Ontario Building Code (2012). Based on the type and relative density of the soil cover at the site, there is a low potential for liquefaction of soils to occur.

5.4 Basement Walls and Floor Slabs

Based on the available data to date, where houses are proposed, the stabilized perched ground water is more than 4 m below existing grade, corresponding to elevation 302.2 to 306.3.

A twelve-month ground water level monitoring program is being undertaken by PML and will be reported under separate cover upon its completion. It is recommended that basements be established a minimum 0.5 m above the stabilized perched ground water level. Underfloor drains may be required when ground water is less than 1.0 m below the basement slab.

Full depth basements are proposed for the houses. As such, perimeter walls must be designed to resist the unbalanced horizontal earth pressure imposed by the backfill adjacent to the walls. The lateral earth pressure, P, may be computed using the following equation and assuming a triangular pressure distribution:

$$P = K(\gamma h + q) + C_p$$

Where
- P = lateral pressure at depth h (m) below ground surface (kPa)
- K = lateral earth pressure coefficient of compacted backfill = 0.5
- h = depth below grade (m) at which lateral pressure is calculated
- γ = unit weight of compacted backfill = 21.0 kN/m^3
- q = surcharge loads (kPa)
- C_p = compaction pressure

The above equation assumes that drainage measures will be incorporated to prevent the buildup of hydrostatic pressure. In this regard, foundation wall backfill should comprise free draining granular material conforming to OPSS Granular B in conjunction with a weeping tile system. The weeping tiles should be protected by a properly designed granular filter or geotextile to prevent migration of fines into the system. The drainage pipe should be placed on a positive grade and lead to a frost-free outlet. The basement walls should be damp proofed. Alternatively, the native soil can be utilized with a proprietary drainage board product.

Basement wall backfill should be placed in thin lifts compacted to a minimum 95% SPmdd. Over compaction close to the walls should be avoided as this could generate excessive pressure on the walls.

Basement floor slab construction is feasible on native soils or engineered fill, as discussed above. A minimum 200 mm thick base layer of crushed stone (nominal 19 mm size) is recommended directly under the slab. A polyethylene sheet vapour barrier is recommended as a vapour barrier.

Exterior grades should be established to promote surface drainage away from the buildings.

Reference is made to appended Figure 7, for general recommendations regarding drainage and backfill requirements.

5.5 Site Servicing

Design details were not finalized at the time of this report. For purposes of this report, inverts are assumed to be as much as 3.0 m below existing grade.

5.5.1 Trench Excavation and Ground Water Control

Trench excavation and ground water control are described later in the report under Excavation and Ground Water Control (Section 5.9).

5.5.2 Pipe Support, Pipe Bedding and Cover

Native soil is generally expected at invert levels, which is considered satisfactory for pipe support. Where existing fill or other deleterious material is encountered at the design invert level, such material should be sub-excavated and replaced with an increased thickness of bedding material, subject to geotechnical field review and approval.

OPSS bedding and cover thickness and compaction standards are recommended. Bedding and cover material should comprise OPSS Granular A.

5.5.3 Trench Backfill

Backfill in trenches should comprise select inorganic soil and be placed in maximum 200 mm thick loose lifts compacted to at least 95% SPmdd to minimize post construction settlement in the backfill. Topsoil, organic, excessively wet, frozen, oversized (greater than 150 mm in diameter), or otherwise deleterious material should not be incorporated as trench backfill. The moisture content of the trench backfill should be within 2% of the optimum moisture content in order to achieve the specified compaction and be close to optimum moisture content in the upper 1 m to prevent subgrade instability issues. Ideally the backfill should comprise excavated site soil, in order to minimize differential frost heave.

The excavated soil will predominately comprise the sand and silt soils, locally the clayey soils. Excavated inorganic site soil should generally be acceptable for reuse, subject to moisture content control (wet material will need to be dried out or mixed with drier soil in order to be suitable for reuse), removal of organics/deleterious material and geotechnical review during construction. Clayey soils will require a sheepsfoot compactor.

Earthworks operations should be inspected by PML to verify subgrade preparation, backfill materials, placement and compaction efforts and ensure the specified degree of compaction is achieved throughout.

5.6 Culvert

A culvert is proposed for the seasonal creek in order to construct a road to connect the two sections of land divided by the creek. Details of the culvert were not established at the time of this report, however a CSP or closed bottom concrete culvert are anticipated. Preliminary recommendations are provided below and should be reviewed once the culvert details have been established.

5.6.1 General

Reference is made to OPSS 400 Series and OPSD 800 Series for general culvert installation requirements, including granular bedding, cover material requirements and frost tapers. The following sections provide further details.

5.6.2 Foundations

Boreholes 6 and 7 were advance in the low-lying area were the culvert is proposed. The culvert can be founded on the native soil based on the bearing resistances noted below.

BOREHOLE	DEPTH (m) / ELEVATION	ANTICIPATED SUBGRADE SOIL TYPE	GEOTECHNICAL BEARING RESISTANCE AT SLS (kPa)	FACTORED BEARING RESISTANCE AT ULS (kPa)
6	0.7 / 303.8	Silty Sand	80	120
	1.5 / 303.0	Silty Sand	100	150
	2.3 / 302.2	Silt/Clayey Silt	130	185
7	0.7 / 303.4	Sand	80	120
	1.5 / 302.6	Clayey Silt	120	180

The bearing resistance at SLS is based on total settlement of 25 mm in the bearing stratum with differential settlement of 75% of this value.

Due to the nature of a creek, very loose/very soft native soil, fill, organics or other deleterious soil may be present at the invert level. These materials should be removed and replaced with a thickened bedding layer or unshrinkable fill.

A minimum bedding thickness of 300 mm is recommended, comprising OPSS Granular A compacted to 100% Standard Proctor maximum dry density (SPmdd), the upper 50 to 75 mm can be loose for culvert placement.

5.6.3 Lateral Earth Pressure

The culvert must resist the lateral earth pressure imposed by the backfill adjacent to the culvert. The lateral earth and water pressure, P (kPa), may be computed using the equivalent fluid pressure method presented in Section 6.12 of the Canadian Highway Bridge Design Code (CHBDC), CSA-S6-14, December 2014, or employing the following equation:

$$P = K(\gamma h + q) + C_p$$

Where
- P = lateral pressure at depth h (m) below ground surface (kPa)
- K = lateral earth pressure coefficient of compacted granular backfill
- h = depth below grade (m) at which lateral pressure is calculated
- γ = unit weight of compacted granular backfill
- q = vertical stress at depth h, due to surcharge loads (kPa)
- C_p = compaction pressure (refer to clause 6.12.3 of CHBDC)

In addition, there should be allowance for seismic events and appropriate factors of safety should be used in the design.

Free draining granular material should be used as backfill around the culvert, comprising OPSS Granular A or Granular B, placed in 200 mm thick lifts compacted to a minimum 95% SPmdd. The site soils are not suitable for use as free draining backfill. Over compaction close to the culvert should be avoided as this could generate excessive pressure on the culvert. The following parameters are recommended for design:

	Granular A	Granular B
Angle of Internal Friction (degrees)	35	32
Unit Weight (kN/m^3)	22.8	21.2
Active Earth Pressure Coefficient (K_a)	0.27	0.31
At Rest Earth Pressure Coefficient (K_o)	0.43	0.47
Passive Earth Pressure Coefficient (K_p)	3.70	3.23

A weeping tile system and/or weep holes should be installed to minimize the build-up of hydrostatic pressure behind the culvert. The weeping tiles should be surrounded by a properly designed granular filter or geotextile to prevent migration of fines into the system. The drainage pipe should be placed on a positive grade and lead to a frost free outlet.

5.7 Storm Water Management Ponds

The latest concept plan shows SWM facilities near Borehole 5. The design concepts were not established at the time of this report. The following preliminary recommendations are provided, and should be reviewed by PML when further details are finalized.

Borehole 5 was advanced in the SWM pond area and revealed sand/sand and gravel to 5.5 m depth (elevation 303.7) over sandy silt to the 6.5 m depth of exploration. Ground water was at 4.2 to 4.3 m depth (elevation 304.9 to 305.0).

Cognizant of the subsurface conditions, the following geotechnical comments and recommendations are provided for your consideration:

- Berms, where required, should be constructed as engineered fill, using select material (K of 1×10^{-6} cm/sec or less), compacted to minimum 95% SPmdd, and be a minimum of 3 m in width;

- Interior pond side slopes should be no steeper than five horizontal to one vertical (5H:1V) and protected with erosion control blankets or other vegetation. Rip rap will be required in areas of moving water;

- Exterior pond side slopes and ditch/berm side slopes should be no steeper than 3H:1V;

- If a wet pond is desired, a clay or synthetic liner is required;

- If the pond is to be used for infiltration purposes, the bottom of the pond should be a minimum 1.0 m above high ground water table (currently the proposed pond bottom would be at about elevation 306 for Borehole 5 and elevation 305.5 for Borehole 11). The sand unit has a permeability on the order of 1×10^{-3} to 1×10^{-4} cm/sec.

5.8 Pavement Design and Construction

Grading was not finalized at the time of this report. It is anticipated that the pavement subgrade will predominantly comprise near surface soils which typically consist of low to moderately frost susceptible sand soils. Based on the subgrade conditions, the following pavement structure thicknesses are recommended and should be reviewed when grading/subgrade soils are determined:

MATERIAL	LIGHT DUTY	HEAVY DUTY
Asphalt (mm) (Two Lifts)	90	120
Granular A Base Course (mm)	150	150
Granular B Subbase Course (mm)	300	450
Total Thickness (mm)	540	720

It is recommended that following rough grading to the subgrade level, subgrade preparation should include proofrolling and compacting the exposed subgrade with a heavy compactor to minimum 95% SPmdd under geotechnical review. Any unstable zones identified during this process should be sub-excavated and replaced with compacted select site material, subject to geotechnical field review. Any upfilling or soil replacement should be carried out as engineered fill as described earlier.

Imported material for the granular base and subbase should conform to OPSS gradation specifications for Granular A and Granular B, and should be compacted to 100% SPmdd. Asphalt should be compacted in accordance with OPSS 310.

If wet or unstable subgrade is encountered, additional excavation, additional granular subbase, the use of Granular B Type II and/or geotextile may be provided, subject to geotechnical review during construction.

For the pavement to function properly, it is essential that provisions be made for water to drain out of and not collect in the base material. Where curb and gutter are proposed, the incorporation of subdrains is recommended along pavement edges in conjunction with crowning of the final subgrade to promote drainage towards the pavement edge. Subdrains should be installed at least 300 mm below the subgrade level. Refer to OPSD 216 Series for details regarding pipe, filter fabric or filter sock, bedding and cover material. Maintenance hole/catchbasins should be backfilled with free draining Granular B and have stub drains extend out from the structure. The above measures will help drain the pavement structure as well as alleviate the problems of differential frost movement between the catchbasins and pavement. Where ditches are proposed, the road granular should daylight in the ditches and ditching should be established in accordance with OPSD 200.010.

5.9 Excavation and Ground Water Control

It is anticipated that excavation for engineered fill, foundations, culvert foundations, SWM ponds, and site servicing will extend as much as 3.0 m below existing grade. Excavation will typically encounter the upper sand/silty sand sand/sand and gravel, locally the silt/sandy silt and the clayey/till units. Harder digging and the occurrence of cobbles and boulders should be expected in the till soil or sand and gravel unit.

Subject to the ground water control as discussed below, the site soils encountered at the site should be considered as Type 3 soil requiring excavation sidewalls to be constructed at no steeper than 1H:1V from the base of the excavation in accordance with the Occupational Health and Safety Act.

The perched stabilized ground water table was typically measured more than 4.0 m below existing grade. Locally in the area of the proposed culvert adjacent to the seasonal creek the ground water level was about 1.0 m below existing grade (elevation 302.8).

Based on the soil conditions observed on-site, excavation will generally be above the ground water table. As such, conventional sump pumping techniques should be sufficient for ground water control.

Locally in the culvert area excavation to about 1 to 2 m below existing grade is anticipated (to be confirmed once design details are finalized). The upper soils in Boreholes 6 and 7 comprise sand/silty sand where more concentrated pumping will likely be required and or pumping from keg wells. Excavation during the dry time of the year, when ground water/creek water levels are at their lowest, is recommended in order to reduce the amount of ground water to be handled.

Water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Takings and Transfer Regulation O. Reg. 387/04. Section 34 of the OWRA requires anyone taking more than 50,000 L/d to notify the MECP. This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering, or permanent drainage improvements. Where it is assessed than more than 50,000 L/d but less than 400,000 L/d of ground water taking is required, the Owner can register online via the Environmental Activity and Sector Registry (EASR) system. Where it is assessed that more than 400,000 L/d of ground water taking is required then a Category 3 Permit-To-Take-Water (PTTW) is required.

Based on the conditions revealed in the boreholes and anticipated excavation depths discussed above, registry on the EASR system or a PTTW is not anticipated. However, registry on the EASR system may be required for the culvert installation. Once details of the site have been established, they should be reviewed by PML to establish dewatering requirements.

It is recommended that a test dig be conducted to permit prospective contractors an opportunity to observe and examine the conditions likely to be encountered, in order that they may assess for themselves the excavation and ground water control requirements.

5.10 Erosion Hazard Assessment

An EHLA was also required for the site. In this regard, reference is made to the Technical Guide – River and Stream Systems: Erosion Hazard Limit, Ontario Ministry of Natural Resources (MNR), 2002, (MNR Technical Guide). The Erosion Hazard Limit (EHL) is determined by:

- Toe Erosion Allowance
- Stable Slope Allowance
- Flooding Hazard Limit or Meander Belt Allowance
- Erosion Access Allowance

The seasonal creek is a Confined System (a valley surrounds the creek). Therefore, there is no requirement for a Flood Hazard Limit. As such, the EHL would be the sum of the toe erosion, the Stable Slope Component and the Erosion Access Allowance as described below.

5.10.1 Toe Erosion Allowance

This is a set back to accommodate potential erosion due to current action from a stream located within 15 m of the toe of valley slope that may weaken and/or undermine the toe, increasing the risk of sloughing, slumping and/or general instability of the slope. Where the creek is greater than 15 m from the toe of the valley slope the Toe Erosion Allowance component is removed from the assessment.

The seasonal creek is within 15 m of the toe of slope. Based on our site observations there is no active erosion and the full bank width is conservatively estimated to be between 5 and 30 m. A Toe Erosion Allowance for Category 4 Soil on Table 3, in the MNR Technical Guide, is 5 m. This value should be confirmed by specialists.

5.10.2 Stable Slope Allowance

The Stable Slope Allowance is a setback to ensure safety if slumping or failure of the existing slope should occur. In accordance with Table 4.3 of the MNR Technical Guide, a design minimum factor of safety of 1.3 to 1.5 is recommended for active land use (habitable structures).

PML attended the site on April 10, 2021, to review the existing conditions of the slopes. The existing slopes were rated using the Slope Stability Rating Chart, from the MNR Technical Guide, copy in Appendix C. Observations are tabulated on the Chart and described below with Photographs in Appendix C.

1. Slopes of 3H:1V or flatter were present, Photograph 1 and 2.
2. Based on the boreholes the slope comprises sand/silty sand/sand and gravel, possibly silt/sandy silt at the base.
3. No seepage was observed on the slopes.
4. The slopes are about 3 to 4 m in the west, as high as about 7 m in the east and about 9 m at the eastern edge of the property.
5. The slopes are occupied by small mature trees with surface vegetation (grasses and small bushes).
6. It appears that there may be minor drainage from the tableland over the slope, but there was no active erosion.
7. The season creek is at the base of the valley slopes.
8. There is no visual evidence of slope instability.

Based on the observations and Slope Stability Rating, there is a low potential for slope instability.

The topographic information provided showed the steepest slope was about 3.3H:1V in a localized area near Borehole 8, otherwise the slopes were about 4H:1V or flatter.

Based on the soil present in the boreholes the slopes are comprised of typically compact sand/silty sand sand/sand and gravel. A factor of safety for the slopes was based on a comparison of the existing slope inclinations and internal angle of friction of the native soils. An average internal angle of friction of 30º has been considered for the native sand soils. The steepest slope at 3.3H:1V has an inclination of about 17º. The computed minimum Factor of Safety was about 1.9 which is satisfactory against an overall slope failure. It is noted that local sloughing may occur. The Factor of Safey of 1.9 is above the guideline value of 1.5.

Due to the existing slope inclination, the stable toe of slope can be taken as the existing top of slope, and is shown conceptually on Drawing 1, appended.

5.10.3 Erosion Access Allowance

The Erosion Access Allowance is intended to facilitate access to maintain the slope, if required. This requirement should be confirmed by regulatory authorities.

An allowance of 6 m suggested in absence of regulatory input.

5.11 Geotechnical Review and Construction Inspection and Testing

It is recommended that the final design drawings be submitted to PML for geotechnical review for compatibility with site conditions and recommendations of this report.

Earthworks operations should be carried out under the supervision of PML to approve subgrade preparation, backfill materials, placement and compaction procedures and check the specified degree of compaction is achieved throughout.

Prior to placement of structural concrete, all founding surfaces must be inspected by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions.

The comments and recommendations provided in the report are based on information revealed in the boreholes. Conditions away from and between boreholes may vary. Geotechnical review during construction should be ongoing to confirm the subsurface conditions are substantially similar to those encountered in the boreholes, which may otherwise require modification to the original recommendations.

6. HYDROGEOLOGICAL CONSIDERATIONS

A Hydrogeological investigation has also been requested for the site to provide recommendations for a preliminary water balance, ground water quality and quality, ground water flow direction and gradient, preliminary assessment of infiltration parameters for LID features and septic parameters.

6.1 Aquifers and Local Ground Water Use

The Water Well Records (WWRs) shown on the MECP website within a 500 m study area are tabulated in Appendix D. A total of thirty-three WWRs were identified. Twenty-two of the records were for water supply (domestic, public/municipal, and/or irrigation) five were listed as “not in use”, and six were not listed. Shale bedrock was noted in ten WWRs at depths of 5.5 to 62 m.

The water supply wells were installed at depths of 33 to 61 m below the ground surface, at the time of drilling, with fresh water typically encountered in the well, with the exception of one WWR which indicated salt water was encountered. The wells were developed within sand deposits, with variable silt content, and ground water was noted at depths of 2.7 to 30 m.

It should be noted that the site is within two Well Head Protection Area (WHPA)’s for municipal water supply, one is located to the west of the site and one is to the southeast of the site.

6.2 Preliminary Infiltration Assessment

To assess the hydraulic conductivity (K) slug tests and grain size distribution analysis were completed.

6.2.1 Borehole Permeability Testing

Aqtesolv, which is a specialized software geared towards interpreting aquifer tests, was utilized in the interpretation of the field permeability results.

The hydraulic conductivity (K, m/s), was estimated by performing a slug test in the wells in Boreholes 5, 7 and 10. The permeability testing results were inputted into Aqtesolv where the Hvorslev expressions were applied.

Borehole permeability test plots are provided in Appendix E and the estimated K values are listed below:

BH/MW	DEPTH (m)	MATERIAL TYPE	ESTIMATED HYDRAULIC CONDUCTIVITY, K (m/sec)
5	4.6 – 6.1	Sand/ Sandy Silt	3.1×10^{-6}
7	3.1 – 4.6	Clayey Silt Till	6.1×10^{-8}
10	4.6 – 6.1	Silty Sand	6.6×10^{-6}

6.2.2 Grain Size Distribution

Grain size analysis testing was carried out on eight samples of the native site soils. The grain size analyses results are presented on Figures 1, 2, 3 and 5, attached, with the estimated coefficient of permeability, K, of the tested site soils tabulated below.

SAMPLE	DEPTH (m)	SOIL TYPE	ESTIMATED K (m/sec)
BH 4 SS4	2.3 to 2.7	Sandy Clayey Silt	1.9×10^{-9}
BH 6 SS4	2.3 to 2.7	Silt	4.1×10^{-8}
BH8 SS7	6.1 to 6.5	Silt	2.7×10^{-7}
BH9 SS4	2.3 to 2.7	Silt	1.1×10^{-8}
BH11 SS5	3.1 to 3.5	Sandy Silt	1.4×10^{-7}
BH12 SS5	3.1 to 3.5	Sandy Silt	2.9×10^{-6}
BH12 SS7	6.1 to 6.5	Silt	1.2×10^{-7}
BH12 SS9	9.6 to 10.0	Sandy Silty Clay	8.4×10^{-10} (Puckett)

Sand and silty sand are estimated to have a K value of 1×10^{-5} to 1×10^{-6} m/sec.

The Vukovic and Soro method was used to asses K. It is noted that the Puckett method was utilized to assess K for the sandy silty clay sample obtained from Borehole 12 SS9 as it was found to be a fine-grained cohesive soil. The K value derived from the particle size distribution curve does not take into consideration site specific details such as compaction, soil structure, organic content and/or the degree of saturation.

6.1 Septic System Considerations

6.1.1 Grain Size Distribution

Based on the grain size distribution curves (Figures 1, 2, 3 and 5, appended), the estimated permeability, K, and percolation rate, "T", for the samples tested based on OBC (2012) Supplementary Standards SB-6, are summarized as follows:

SOIL DESCRIPTION	ESTIMATED PERMEABILITY K (cm/sec)	"T"-TIME (min/cm)
Sandy Silt	10^{-4} to 10^{-5}	12 to 20
Silt	10^{-5} to 10^{-6}	20 to 50
Sandy Silty Clay/Sandy Clayey Silt	10^{-7} to 10^{-8}	>50

The upper sand and silty sand are conservatively estimated to have a K of 1×10^{-3} to 1×10^{-4} cm/sec, with corresponding T-Time of 8 to 12 (min/cm).

The K value derived from the particle size distribution curve does not take into consideration site specific details such as compaction, soil structure, organic content and/or the degree of saturation.

6.2 Ground Water Sample Chemical Test Results

The laboratory certificate of chemical analyses for the analysis carried out by Caduceon on ground water samples from BH/MW 7 and 10, in accordance with the chain-of-custody records and the protocols described in Section 2.2.3, are in included in Appendix F.

The ground water samples were analyzed for the Provincial Water Quality Objective (PWQO) metals, phosphorous, nitrate/nitrite and pH. In accordance with the PWQO guidelines select metal parameters require field filtering and as such PML submitted one filtered mercury bottle, one filtered metals bottle and one unfiltered metals bottle to satisfy the PWQO requirements.

The chemical test results complied with the applicable PWQO for the parameters tested with the exception of the parameters listed below:

<table>
<tr><th>LOCATION</th><th>PARAMETER</th><th>UNITS</th><th>PWQO</th><th>MEASURED CONCENTRATION</th></tr>
<tr><td rowspan="3">BH/MW7</td><td>Iron</td><td rowspan="3">µg/L</td><td>300</td><td>809</td></tr>
<tr><td>Silver</td><td>0.1</td><td>0.5</td></tr>
<tr><td>Zinc</td><td>30</td><td>62</td></tr>
<tr><td rowspan="2">BH/MW 10</td><td>Iron</td><td rowspan="2">µg/L</td><td>300</td><td>44,700</td></tr>
<tr><td>Zinc</td><td>30</td><td>102</td></tr>
</table>

6.3 Preliminary Water Balance

6.3.1 Climate

The site is located in Mansfield, eastern portion of Dufferin County. The climate of Mansfield is humid-continental, characterized by changeable weather patterns. Mansfield's location relative to Georgian Bay and Lake Simcoe, can result in disparities in weather over short distances. From Environment Canada data, the average annual temperature recorded at the Alliston Nelson weather station, (closest station with required data) located southeast of Mansfield, averages 7.7°C. The highest monthly average temperature is in July, at 21°C and the lowest monthly average temperature is in January, at -6.5°C. The average annual precipitation recorded at the Alliston Nelson weather station is 834.3 mm. Climate data is tabulated in Table 1, appended.

6.3.2 Water Balance: Pre-Development

To determine the amount of ground water infiltration relative to existing site conditions, a pre-development water balance was carried out to provide an estimate of the volume of infiltrating precipitation at the site. This method is based on classic storm water management principles and generally over-estimates the volume of runoff, providing a conservative assessment of infiltration volume. It is noted that the equations were developed for heavy rainfall events of short duration, where as a large volume of the precipitation occurs at a light to moderate rate over an extended period of time and would result in a much higher volume of infiltration.

For the purposes of our analysis, the following parameters were assumed:

- The annual precipitation at the Alliston Nelson weather station was recorded to be 834.30 mm/year, and the water surplus was computed to be 233.0 mm/year (computed by the Thornthwaite and Mather Method).
- The water available for infiltration was computed using the following infiltration factors:

  Topography……………………………..0.20
  Soil……………………………………….0.20
  Cover…………………………………….0.10
  Total……………………………………..0.50

- By multiplying the water surplus of 233.0 mm/year by the infiltration factor of 0.50, the infiltration rate was computed to be 116.5 mm/year.

The total existing catchment area for infiltrating precipitation was computed as follows:

- Total Approximate Site Area = 245,000 m^2
- Approximate Area of Existing Buildings = 0 m^2
- Approximate Area of Existing Parking Lots and Paved Laneway Areas (2018) = 0 m^2
- Total Approximate Impermeable Surface Area (existing building, parking lots and laneways) = 0 m^2
- Total Site Area less the Impermeable Surface Area = Area of Potential Infiltration = 245,000 m^2

The total pre-development infiltration at the site (potential for ground water recharge) was calculated utilizing the LSRCA procedures and was found to be 28,542,500 L/year (28,542.5 m^3/year).

6.3.3 Water Balance: Post Development

In order to assess the effect of site development, a post-development water balance for the site was carried out using the same approach and infiltration factors noted above. The proposed site plans are shown on Drawing 1, attached. It is understood that development plans include:

- Each lot will house a residential building with 350 m^2 footprint (21,350 m^2 total assuming 61 lots); and,
- Each lot will include an impermeable driveway surface with 100 m^2 footprint (6,100 m^2 total assuming 61 lots).
- The proposed roadway and/or sidewalk area is assumed to be approximately 18,650 m^2 based on the preliminary schematic provided.

The total post-development area for infiltrating precipitation was computed as follows:

- Total Approximate Site Area = 245,000 m^2
- Total Impermeable Surface Area (buildings, and paved driveways) = 46,100 m^2
- Total Site Area less the Impermeable Surface Area = Area of Potential Infiltration = 198,900 m^2

Based on the current site conditions and proposed development, the total post development infiltration at the site (potential for ground water recharge) was calculated utilizing the LSRCA procedures and was found to be 23,171,900 L/year (23,171.9 m^3/year), indicating a reduction of site infiltration of approximately 19%.

The results of the preliminary water balance for pre- and post-development are tabulated in Tables 2A to 2C.

6.4 Development Considerations

6.4.1 Ground Water Recharge Management

The Nottawasaga Valley Conservation Area (NVCA) guidelines call for the pre and post-development ground water infiltration volumes to be maintained as much as practically possible. The assessment provided above indicates a reduction in the volume of surface water infiltration following redevelopment of the site; hence, implementation of measures to reduce the infiltration deficit should be considered.

6.4.2 Mitigation Measures, Opportunities and Constraints

The following measures should be considered to reduce the post-development infiltration:

- Reduce the area of the impermeable surfaces;
- Create swales/depressed areas that will retard the rate of storm water runoff and promote infiltration;
- Promote surface water flow from impermeable surfaces into infiltration facilities, as opposed to directing surface water to catchbasins connected to the municipal storm sewers;
- Ensure that roof drains are not connected to the municipal storm water control system;
- Reduce the slope of the ground surface to promote increased infiltration.

Once mitigation measures are finalized Table 2C should be updated to include a comparison of pre-development to post-development including all mitigation features.

This assessment is subject to the Statement of Limitations that is included with this report (Appendix A) which must be read in conjunction with the report.

7. CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.

LICENSED PROFESSIONAL ENGINEER
G. R. WHITE
Sept. 21/2021
PROVINCE OF ONTARIO

Geoffrey R. White, P.Eng.
Director
Manager, Geotechnical Services

AK/GRW:tc

TABLE 1

Water Budget Summary (Using Thornthwaite Empirical Approach)

Month	*Mean Daily Av. Temp (C)	I	*Mean Montly Precipitation (mm)	Days	^Daylight Hours	Evapotranspiration (mm)	Actual Evapotranspiration Adjusted for Month and Daylight (mm)	Actual Water Balance (mm)
January	-6.5	0.00	53.9	31	9.25	0.00	0.00	53.90
February	-5.2	0.00	49.5	28	10.83	0.00	0.00	49.50
March	-0.7	0.00	53.8	31	11.97	0.00	0.00	53.80
April	6.7	1.56	63.6	30	13.52	28.21	31.78	31.82
May	13.1	4.30	78.3	31	14.85	60.39	77.23	1.07
June	18.4	7.19	81	30	15.50	88.82	114.73	-33.73
July	21.0	8.78	77.6	31	15.13	103.21	134.46	-56.86
August	20.0	8.16	82.3	31	13.97	97.64	117.46	-35.16
September	15.9	5.76	80.1	30	12.47	75.25	78.20	1.90
October	9.2	2.52	71.3	31	10.93	40.43	38.05	33.25
November	3.1	0.48	81.6	30	9.57	11.76	9.38	72.22
December	-2.9	0.00	61.3	31	8.87	0.00	0.00	61.30
Yearly Av./Total:	7.68	1.91	**834.30**		12.24	505.72	601.30	**233.00**

I (heat index)	40.66
a	1.14

a is a function of heat index

*Data from Environment Canada web site - Alliston Nelson
^from NSERC database

TABLE 2A

Water Budget Pre-Development (Water Balance/Water Budget Assessment)

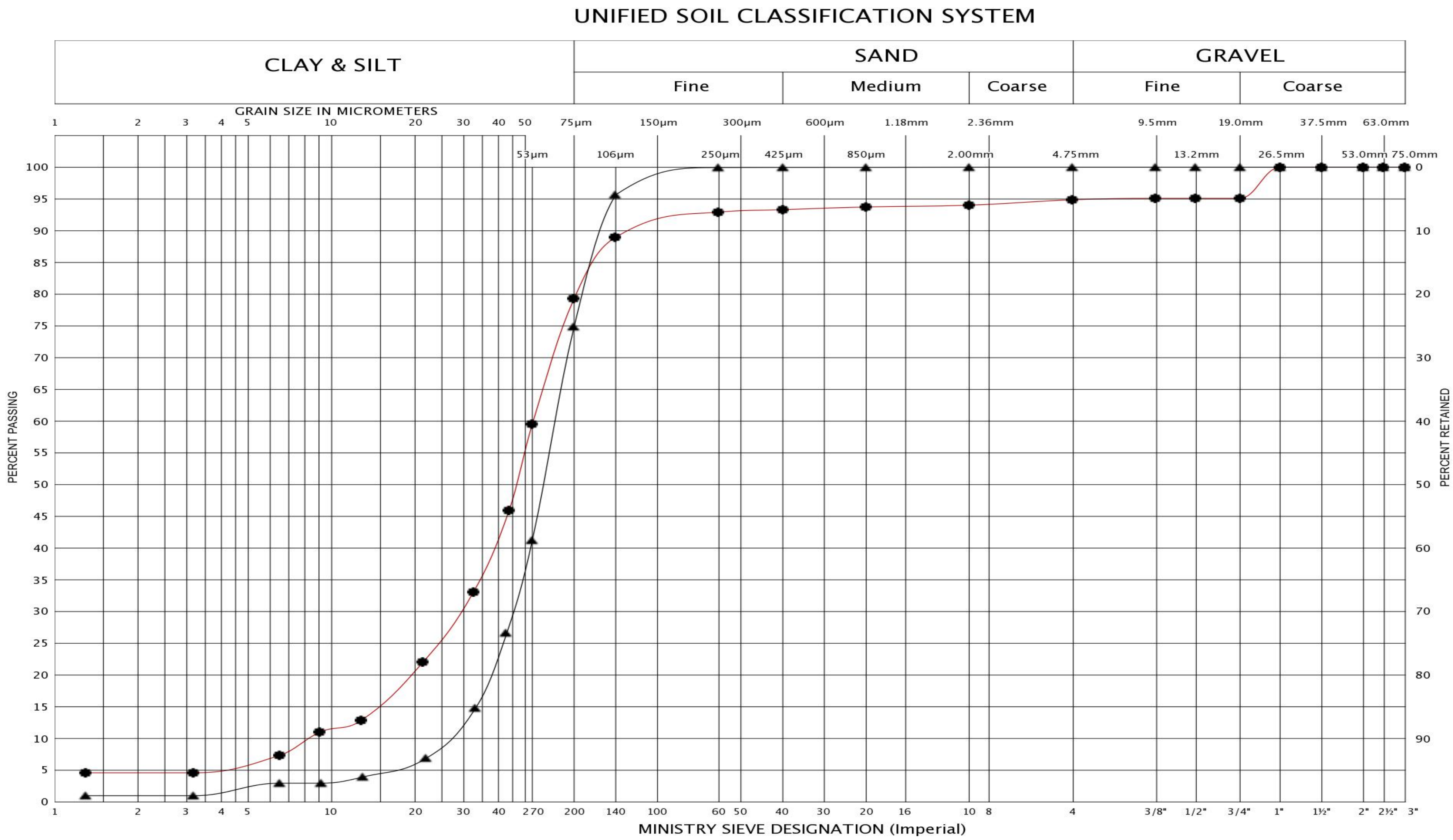
Catchment Designation	**Cultivated**	**Paved**	**Building**	**Total**
Area (m^2)	245,000	0	0	245,000
Pervious Area (m^2)	245,000	-	-	245,000
Impervious Area (m^2)	-	0	0	-
Infiltration Factors				
Topography Infiltraton Factor	0.2	0.2	0.2	--
Soil Infiltration Factor	0.2	0.2	0.2	
Land Cover Infiltration Factor	0.1	0.0	0.0	
MOE Infiltration Factor	0.5	0.0	0.0	
Actual Infilration Factor	0.5	0.0	0.0	
Run-Off Co-efficient	0.5	1.0	1.0	
Runoff from Impervious Surfaces	-	0.8	0.8	
Inputs (per Unit Area)				
Precipitation (mm/yr)	834.3	--	--	834.3
Run-on (mm/yr)	0.0	0.0	0.0	0.0
Other inputs (mm/yr)	0.0	0.0	0.0	0.0
Total Imputs (mm/yr)	834.3	-	-	834.3
Outputs (per Unit Area)				
Precipitation Surplus (mm/yr)	233.0	0.0	--	233.0
Net Surplus (mm/yr)	233.0	0.0	--	233.0
Evapotranspiration (mm/yr)	601.3	0.0	0.0	601.3
Infiltration (mm/yr)	116.5	0.0	0.0	116.50
Rooftop Infiltration (mm/yr)	0.0	0.0	0.0	0.0
Total Infiltration (mm/yr)	116.5	0.0	0.0	116.50
Runoff Pervious Areas (mm/yr)	116.5	0.0	0.0	116.5
Runoff Impervious Areas (mm/yr)	0.0	0.0	--	--
Total Runoff (mm/yr)	116.5	0.0	0.0	116.5
Total Outputs (mm/yr)	834.3	0.0	0.0	834.3
Difference (Inputs-Outputs)	0.00	0.00	0.00	0.00
Inputs (Volumes)				
Precipitation (m^3/yr)	204,403.5	-	-	204,403.5
Run-On (m^3/yr)	-	-	-	-
Other Inputs (m^3/yr)	-	-	-	-
Total Inputs (m3/yr)	204,403.5	-	-	204,403.5
Outputs (Volumes)				
Precipitation Surplus (m^3/yr)	57,085.0	-	--	57,085.0
Net Surplus (m^3/yr)	57,085.0	-	--	57,085.0
Evapotranspiration (m^3/yr)	147,318.5	-	-	147,318.5
Infiltration (m^3/yr)	28,542.5	-	-	28,542.5
Rooftop Infiltration (m^3/yr)	0.0	-	-	0.0
Total Infiltration (m^3/yr)	28,542.5	-	-	28,542.5
Runof Pervious Areas (m^3/yr)	28,542.5	-	-	28,542.5
Runoff Impervious Areas (m^3/yr)	0.0	-	--	-
Total Runoff (m^3/yr)	28,542.5	-	-	28,542.5
Total Outputs (m^3/yr)	204,403.5	-	-	204,403.5
Difference (Inputs-Outputs)	0.0	0.0	0.0	0.0

TABLE 2B

Water Budget Post-Development (Water Balance/Water Budget Assessment)

Catchment Designation	Cultivated	Paved	Building	Total
Area (m^2)	198,900	24,750	21,350	245,000
Pervious Area (m^2)	198,900	0.0	0.0	198,900
Impervious Area (m^2)	0.0	24,750	21,350	46,100
Infiltration Factors				
Topography Infiltraton Factor	0.2	0.2	0.2	--
Soil Infiltration Factor	0.2	0.2	0.2	
Land Cover Infiltration Factor	0.1	0.0	0.0	
MOE Infiltration Factor	0.5	0.0	0.0	
Actual Infilration Factor	0.5	0.0	0.0	
Run-Off Co-efficient	0.5	1.0	1.0	
Runoff from Impervious Surfaces	-	0.8	0.8	
Inputs (per Unit Area)				
Precipitation (mm/yr)	834.3	834.3	834.3	834.3
Run-on (mm/yr)	0.0	0.0	0.0	0.0
Other inputs (mm/yr)	0.0	0.0	0.0	0.0
Total Imputs (mm/yr)	834.3	834.3	834.3	834.3
Outputs (per Unit Area)				
Precipitation Surplus (mm/yr)	233.0	667.4	667.4	265.0
Net Surplus (mm/yr)	233.0	667.4	667.4	265.0
Evapotranspiration (mm/yr)	601.3	166.9	166.9	569.3
Infiltration (mm/yr)	116.5	0.0	0.0	94.6
Rooftop Infiltration (mm/yr)	0.0	0.0	0.0	0.0
Total Infiltration (mm/yr)	116.5	0.0	0.0	94.6
Runoff Pervious Areas (mm/yr)	116.5	0.0	0.0	116.5
Runoff Impervious Areas (mm/yr)	0.0	667.4	667.4	125.6
Total Runoff (mm/yr)	116.5	667.4	667.4	170.4
Total Outputs (mm/yr)	834.3	834.3	834.3	834.3
Difference (Inputs-Outputs)	-	-	-	-
Inputs (Volumes)				
Precipitation (m^3/yr)	165,942.3	20,648.9	17,812.3	204,403.5
Run-On (m^3/yr)	-	-	-	-
Other Inputs (m^3/yr)	-	-	-	-
Total Inputs (m3/yr)	165942.3	20648.9	17812.3	204,403.5
Outputs (Volumes)				
Precipitation Surplus (m^3/yr)	46,343.7	16,519.1	14,249.8	77,112.7
Net Surplus (m^3/yr)	46,343.7	16,519.1	14,249.8	77,112.7
Evapotranspiration (m^3/yr)	119,598.6	4,129.8	3,562.5	127,290.8
Infiltration (m^3/yr)	23,171.9	0.0	0.0	23,171.9
Rooftop Infiltration (m^3/yr)	0.0	0.0	0.0	0.0
Total Infiltration (m^3/yr)	23,171.9	0.0	0.0	23,171.9
Runof Pervious Areas (m^3/yr)	23,171.9	0.0	0.0	23,171.9
Runoff Impervious Areas (m^3/yr)	0.0	16,519.1	14,249.8	30,769.0
Total Runoff (m^3/yr)	23,171.9	16,519.1	14,249.8	53,940.8
Total Outputs (m^3/yr)	165,942.3	20,648.9	17,812.3	204,403.5
Difference (Inputs-Outputs)	0.0	0.0	0.0	0.0

TABLE 2C Water Budget Summary (Water Balance / Water Budget Assessment)			
Inputs (Volumes)			
	Pre-Development	**Post-Developmemt**	**Change (Pre- to Post-)**
Precipitation (m^3/yr)	204,403.5	204,403.5	0%
Run-On (m^3/yr)	-	-	0%
Other Inputs (m^3/yr)	-	-	0%
Total Inputs (m3/yr)	204,403.5	204,403.5	0%
Outputs (Volumes)			
Precipitation Surplus (m^3/yr)	57,085.0	77,112.7	35%
Net Surplus (m^3/yr)	57,085.0	77,112.7	35%
Evapotranspiration (m^3/yr)	147,318.5	127,290.8	-14%
Infiltration (m^3/yr)	28,542.5	23,171.9	-19%
Rooftop Infiltration (m^3/yr)	0.0	0.0	0%
Total Infiltration (m^3/yr)	28,542.5	23,171.9	-19%
Runof Pervious Areas (m^3/yr)	28,542.5	23,171.9	-19%
Runoff Impervious Areas (m^3/yr)	-	30,769.0	--
Total Runoff (m^3/yr)	28,542.5	53,940.8	89%
Total Outputs (m^3/yr)	204,403.5	204,403.5	0%



LEGEND	BH	11	12
	SAMPLE	5	5
	SYMBOL	⬣	▲

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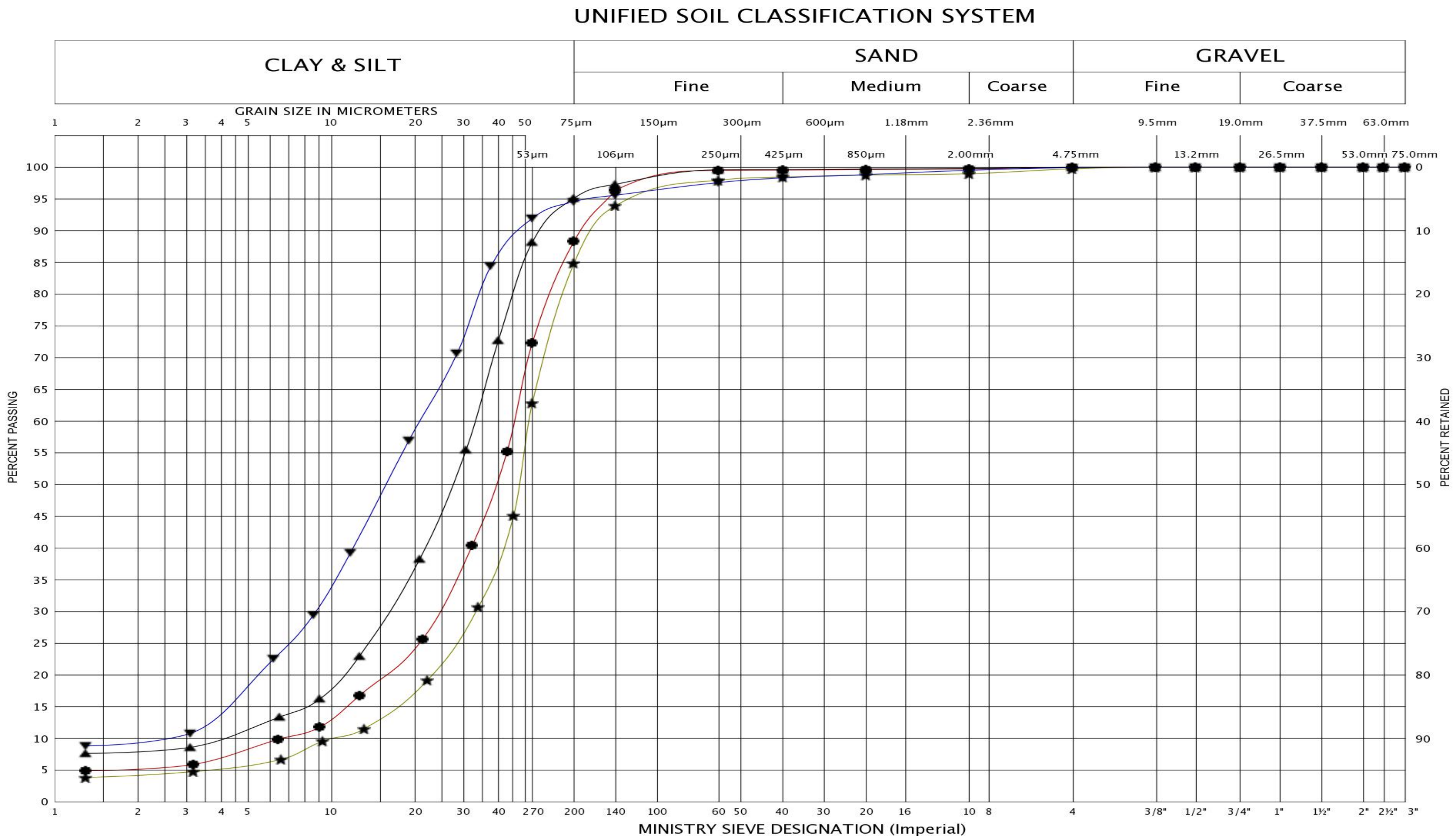
GRAIN SIZE DISTRIBUTION

SANDY SILT, Trace Clay, Trace Gravel

FIG No.: 1

Project No.: 21BF019



LEGEND					
	BH	6	8	9	12
	SAMPLE	4	7	4	7
	SYMBOL	▲	★	▼	⬢

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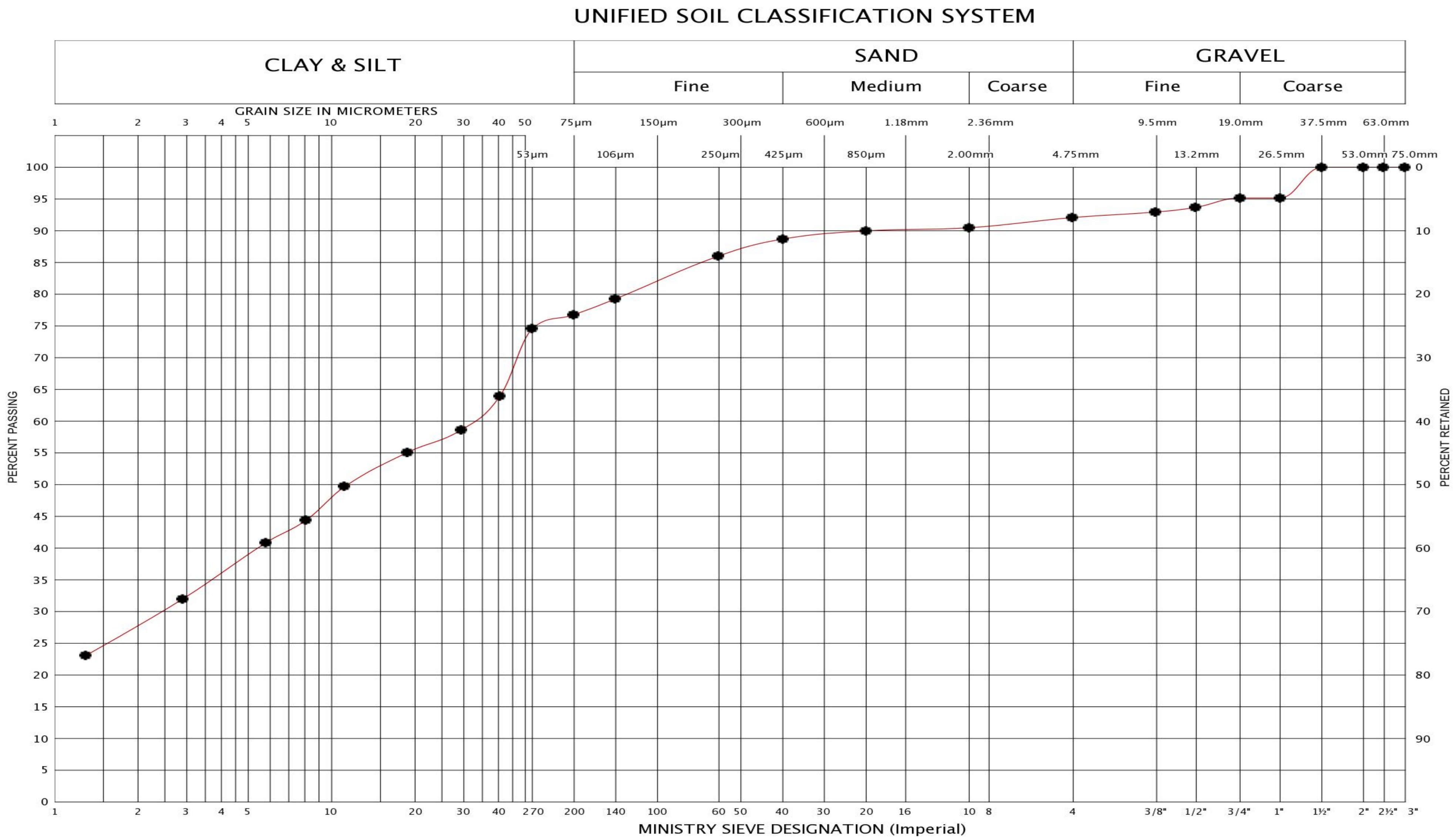
GRAIN SIZE DISTRIBUTION

SILT, Trace to Some Sand, Trace Clay

FIG No.: 2

Project No.: 21BF019



LEGEND		
	BH	4
	SAMPLE	4
	SYMBOL	●

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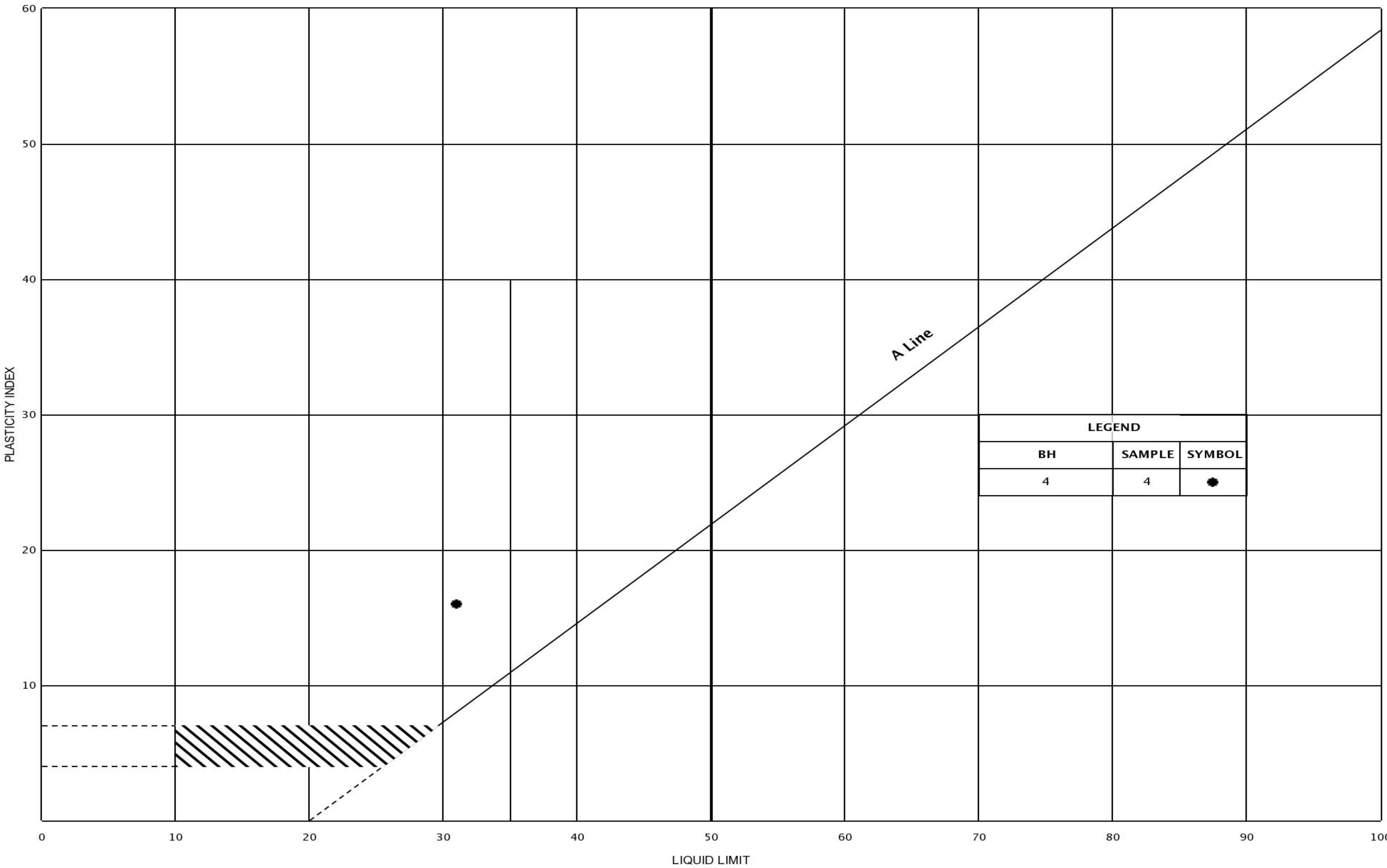
GRAIN SIZE DISTRIBUTION

SANDY CLAYEY SILT, Trace Gravel

FIG No.: 3

Project No.: 21BF019



PLASTICITY CHART

SANDY CLAYEY SILT, Trace Gravel

FIG No.:	4
HWY.:	
Proj No.	21BF019

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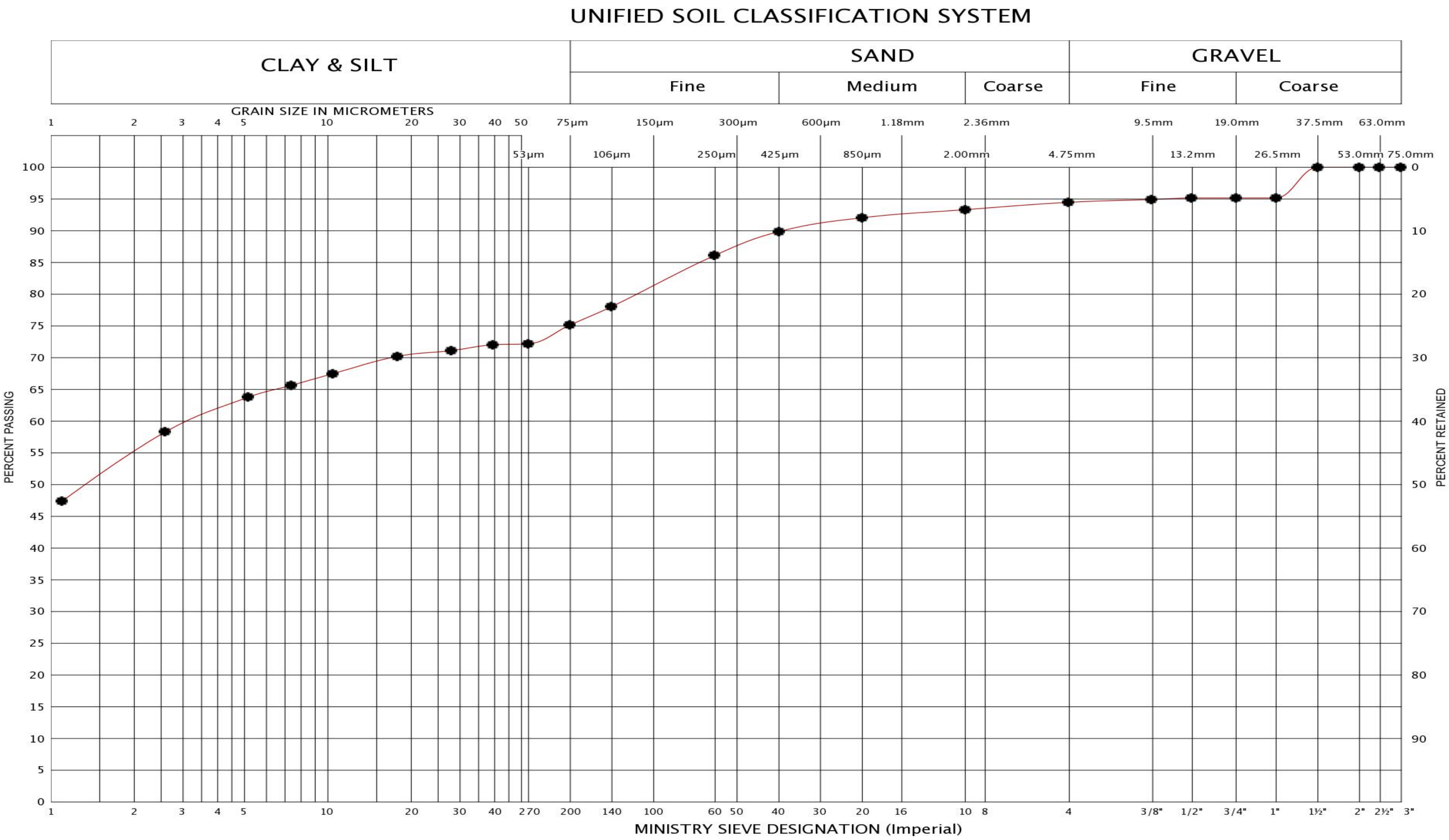

LEGEND	BH	12
	SAMPLE	9
	SYMBOL	⬣

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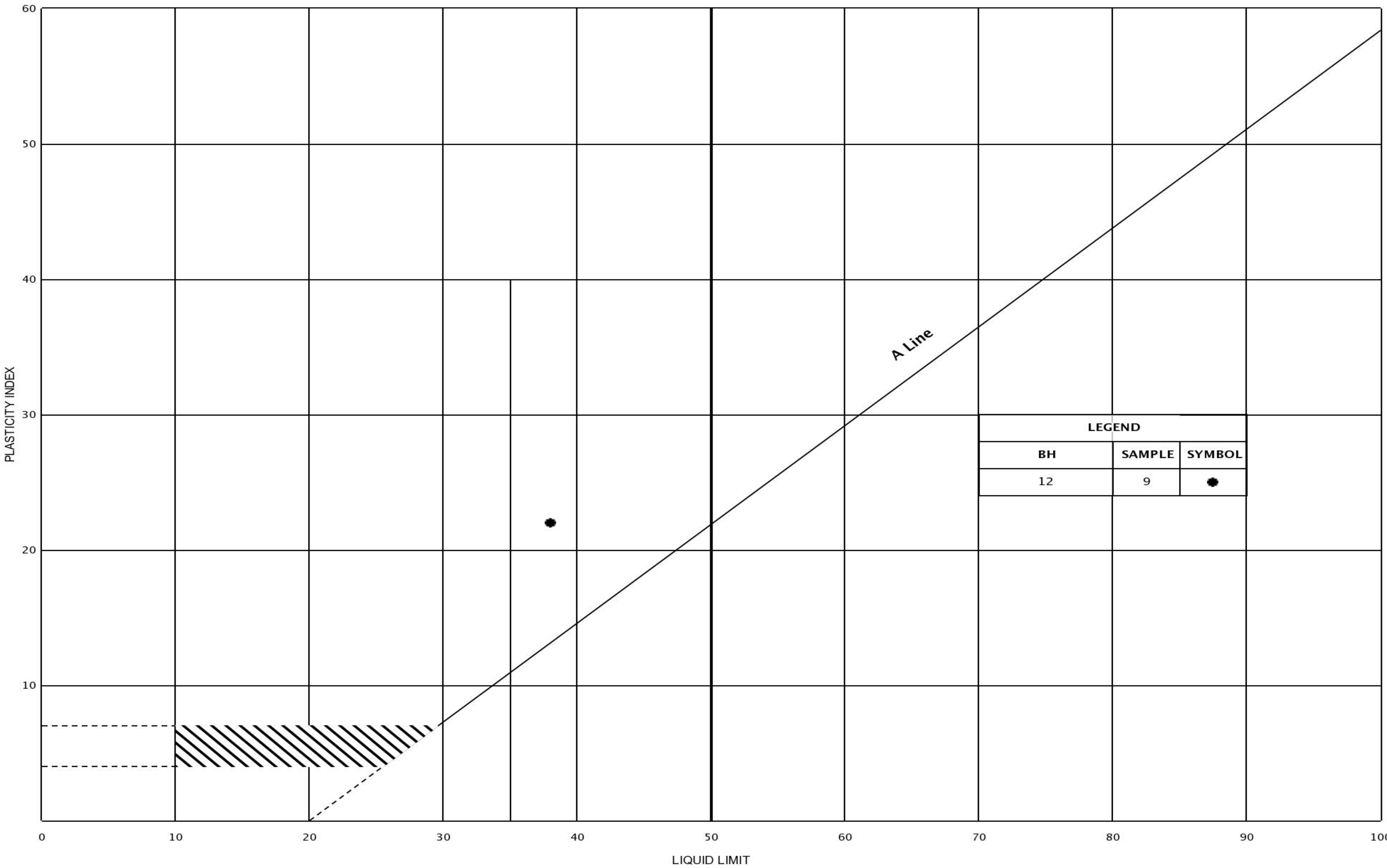
GRAIN SIZE DISTRIBUTION

SANDY SILTY CLAY, Trace Gravel

FIG No.: 5

Project No.: 21BF019



PLASTICITY CHART

SANDY SILTY CLAY, Trace Gravel

FIG No.:	6
HWY.:	
Proj No.	21BF019

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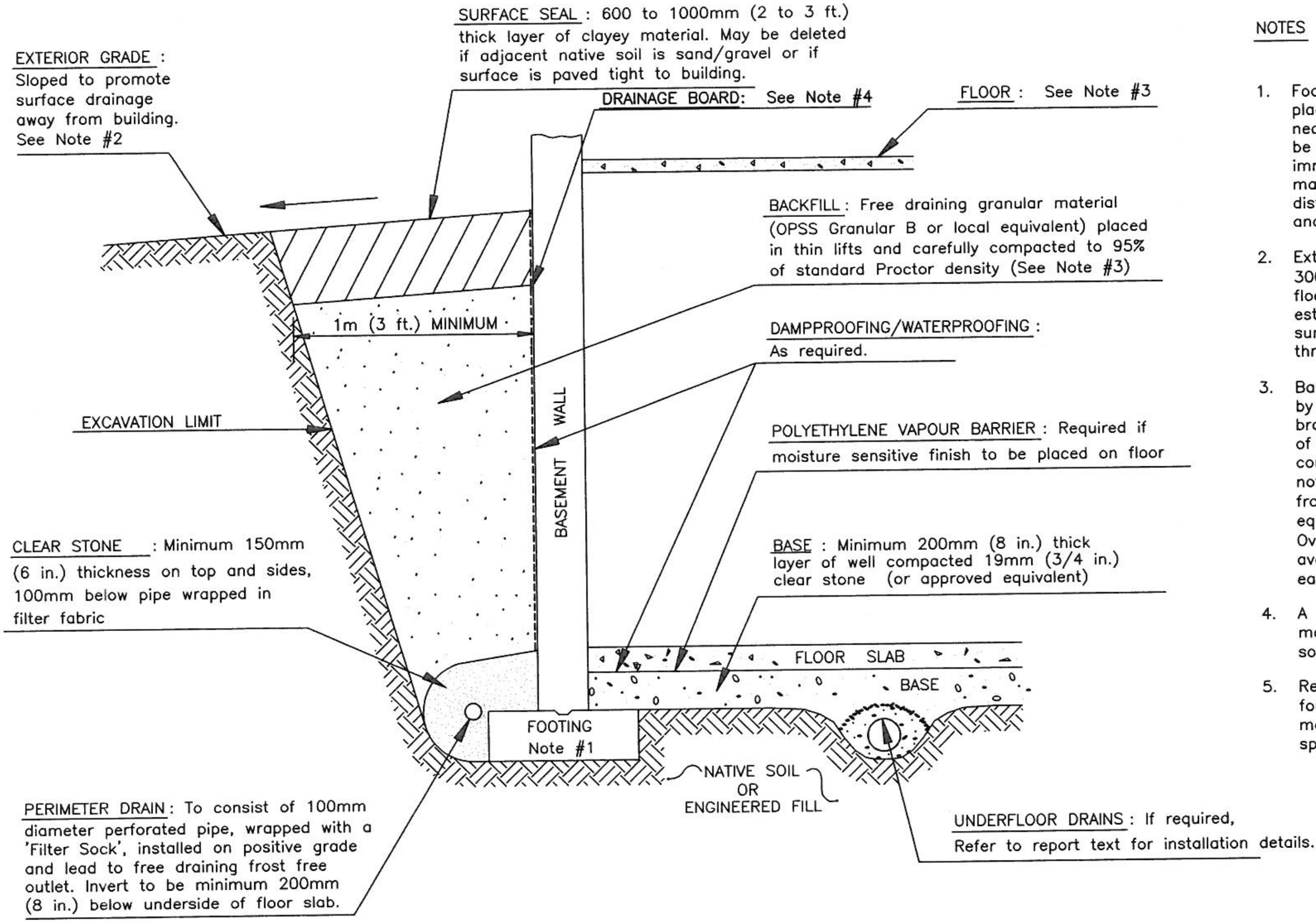
STD – GEO–A REV 1/2004



NOTES

1. Footing may be constructed by placement of structural concrete neat against natural soil. Drain to be installed in a similar manner immediately above footing maintaining 200mm (8 in.) distance between top of drain and underside of floor slab.
2. Exterior grade to be minimum 300mm (12 in.) below interior floor slab, or other means established to prevent entry of surface water into building through building openings.
3. Basement wall to be supported by floor system or interior bracing prior to commencement of backfill placement. Heavy construction equipment should not be permited within a distance from the foundation wall equivalent to half the wall height. Overcompaction of backfill to be avoided as excessive lateral earth pressure may result.
4. A proprietary drainage board product may be used with compacted native soil as backfill against the wall.
5. Refer to text for details regarding founding levels, competent bearing material and construction details specific to particular site.

STANDARD DRAWING

GENERAL RECOMMENDATIONS REGARDING DRAINAGE AND BACKFILL REQUIREMENTS FOR BASEMENT WALL AND FLOOR SLAB CONSTRUCTION

PML Peto MacCallum Ltd. CONSULTING ENGINEERS

DRAWN:	N/A	DATE	SCALE	JOB NO.	FIGURE NO.
CHECKED:	GW	SEPT. 2021	N.T.S.	21BF019	7
APPROVED:	GW				

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTLL	Wetter Than Liquid Limit
WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	ST	Slotted Tube Sample
WS	Washed Sample	TW	Thinwall Open
SB	Scraper Bucket Sample	TP	Thinwall Piston
AS	Auger Sample	OS	Oesterberg Sample
CS	Chunk Sample	FS	Foil Sample
GS	Grab Sample	RC	Rock Core

PH	Sample Advanced Hydraulically
PM	Sample Advanced Manually

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

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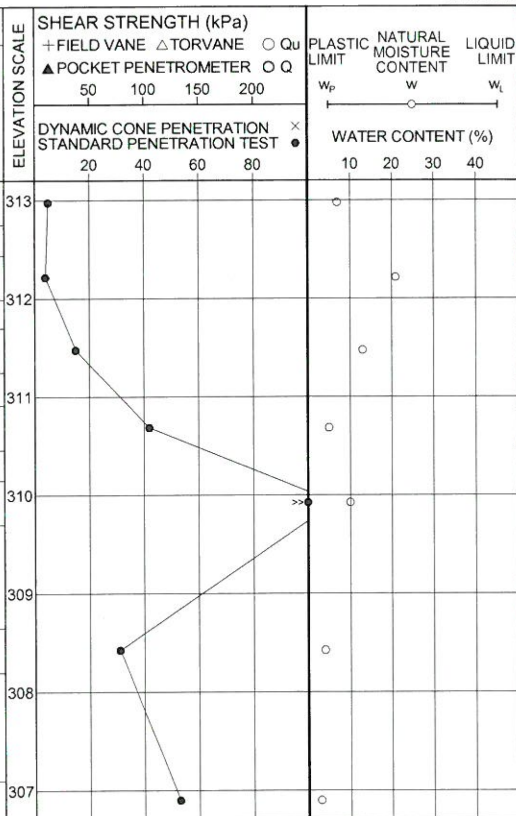
LOG OF BOREHOLE/MONITORING WELL NO. 1

17T 576894E 4891433N

PROJECT Proposed Residential Development
PML REF. 21BF019
LOCATION 937045 Airport Road, Mansfield, ON
BORING DATE May 13, 2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT/NT

SURFACE ELEVATION 313.20

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES
0.0	TOPSOIL: Brown, silty sand, trace gravel, moist	1	SS	5
0.40	SAND: Loose, brown, sand, trace silt, moist			
0.70 / 312.50	SANDY SILT: Loose to compact, brown, sandy silt, trace clay, trace gravel, very moist	2	SS	4
		3	SS	15
2.1 / 311.1	SAND: Dense, brown, sand, trace silt, trace to some gravel, moist	4	SS	42
2.9 / 310.3	SILTY SAND: Very dense to dense, brown, silty sand, trace gravel, moist	5	SS	80/290 mm
		6	SS	31
5.5 / 307.7	SAND: Very dense, brown, stratified sand, trace silt, trace gravel, moist	7	SS	53
6.5 / 306.7	BOREHOLE TERMINATED AT 6.5 m			



GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

UNIT WEIGHT kN/m³

- Stick-up casing
- Bentonite seal
- Filter sand
- 50 mm slotted pipe

Upon completion of augering
No water
No cave

Water Level Readings:

Date	Depth	Elev.
2021-05-20	DRY	--
2021-06-11	DRY	--

NOTES

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LOG OF BOREHOLE/MONITORING WELL NO. 2

17T 577120E 4891551N

PROJECT Proposed Residential Development
LOCATION 937045 Airport Road, Mansfield, ON
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE May 13, 2021
PML REF. 21BF019
ENGINEER GW
TECHNICIAN AT/NT

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	GROUND WATER OBSERVATIONS AND REMARKS
	SURFACE ELEVATION 312.80					
0.60	TOPSOIL: Brown, silty sand, trace gravel, moist	1	SS	4		Stick-up casing
312.20	SAND: Very loose to loose, brown, sand, some silt, trace gravel, moist	2	SS	2		
		3	SS	5		
2.9		4	SS	7		Bentonite seal
309.9	SILTY SAND: Loose, brown, silty sand, trace gravel, very moist	5	SS	7		
4.0 / 308.8	SANDY SILT: Very dense, brown, sandy silt, with sand layers, trace clay, very moist	6	SS	59		Filter sand; 50 mm slotted pipe
6.5		7	SS	64		
306.3	BOREHOLE TERMINATED AT 6.5 m					Upon completion of augering No water No cave Water Level Readings:

Date	Depth	Elev.
2021-05-20	DRY	--
2021-06-11	DRY	--

Chart headings: SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30 40; UNIT WEIGHT kN/m^3; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL; ELEVATION SCALE 312, 311, 310, 309, 308, 307.

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 3

17T 577257E 4891636N

PROJECT Proposed Residential Development
LOCATION 937045 Airport Road, Mansfield, ON
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE May 13, 2021
PML REF. 21BF019
ENGINEER GW
TECHNICIAN CM

SURFACE ELEVATION 310.60

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.20 / 310.40	TOPSOIL: Brown, silty sand, moist	1	SS	5	
	SAND: Very loose to compact, brown, sand, trace to some silt, trace gravel, moist to very moist				
		2	SS	3	
		3	SS	4	
		4	SS	11	
		5	SS	16	
		6	SS	16	
5.0 / 305.6	BOREHOLE TERMINATED AT 5.0 m				Upon completion of augering No water No cave

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; ELEVATION SCALE; SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q (50, 100, 150, 200); DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (20, 40, 60, 80); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (10, 20, 30, 40); UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Elevation scale: 310, 309, 308, 307, 306. Depth scale: 0.0 to 15.0.

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 4

17T 577078E 4891413N

PROJECT Proposed Residential Development
LOCATION 937045 Airport Road, Mansfield, ON
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE May 14, 2021
PML REF. 21BF019
ENGINEER GW
TECHNICIAN CM

SURFACE ELEVATION 309.30

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.15	TOPSOIL: Brown, silty sand, moist				
309.15	SAND: Loose to compact, brown, sand, trace silt, trace gravel, cobbles and boulders, moist to wet	1	SS	4	
		2	SS	13	
		3	SS	8	First water strike at 1.5 m
2.1 / 307.2	SANDY CLAYEY SILT: Hard, brown, sandy clayey silt, trace gravel, DTPL	4[1]	SS	33	
2.9 / 306.4	SANDY SILT: Very dense to dense, brown to grey, sandy silt, trace gravel, trace clay, moist	5	SS	74	
		6	SS	48	
5.0 / 304.3	BOREHOLE TERMINATED AT 5.0 m				Upon completion of augering No water No cave

SHEAR STRENGTH (kPa): + FIELD VANE, △ TORVANE, ○ Qu, ▲ POCKET PENETROMETER, ○ Q (50, 100, 150, 200)
DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ● (20, 40, 60, 80)
PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30, 40)
UNIT WEIGHT kN/m^3
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
ELEVATION SCALE: 309, 308, 307, 306, 305
Depth scale: 0.0 – 15.0

NOTES

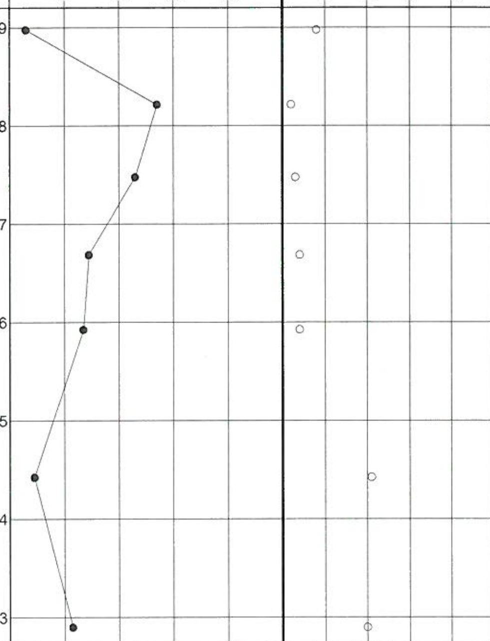
Peto MacCallum Ltd. CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 5

17T 577238E 4891392N

PROJECT Proposed Residential Development
PML REF. 21BF019
LOCATION 937045 Airport Road, Mansfield, ON
BORING DATE May 13, 2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN CM

DEPTH (m) / ELEV (m)	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.0	SURFACE ELEVATION 309.20				Stick-up casing
0.20 / 309.00	TOPSOIL: Brown, silty sand, trace gravel, moist	1	SS	6	
	SAND AND GRAVEL: Very dense to dense, brown, sand and gravel, trace silt, moist	2	SS	54	
		3	SS	46	Bentonite seal
		4	SS	29	
2.9 / 306.3	SAND: Compact to loose, brown, sand, trace to some silt, trace gravel, moist to wet	5	SS	27	Filter sand
		6	SS	9	First water strike at 4.6 m; 50 mm slotted pipe
5.5 / 303.7	SANDY SILT: Compact, brown, sandy silt, trace gravel, trace clay, very moist	7	SS	23	
6.5 / 302.7	BOREHOLE TERMINATED AT 6.5 m				Upon completion of augering Wet cave at 4.3 m



SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q (50, 100, 150, 200)
DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (20, 40, 60, 80)
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) (10, 20, 30, 40)
UNIT WEIGHT kN/m³
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Water Level Readings:

Date	Depth	Elev.
2021-05-20	4.2	305.0
2021-06-11	4.3	304.9

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

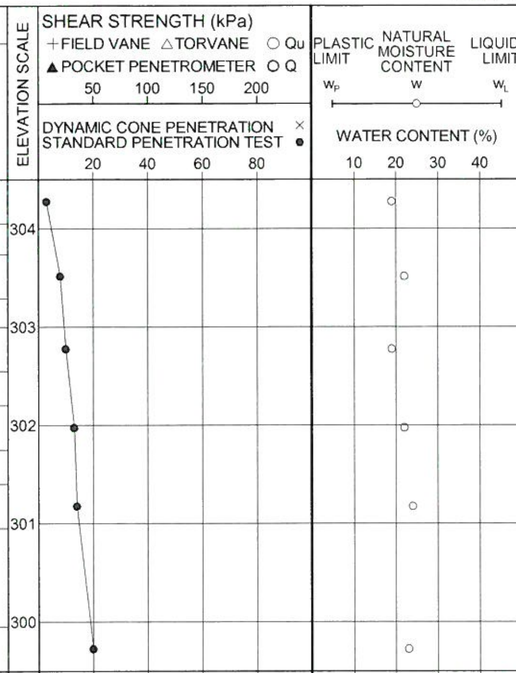
LOG OF BOREHOLE NO. 6

17T 577273E 4891513N

PROJECT Proposed Residential Development
LOCATION 937045 Airport Road, Mansfield, ON
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE May 12, 2021
PML REF. 21BF019
ENGINEER GW
TECHNICIAN CM

SURFACE ELEVATION 304.50

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.18 / 304.32	TOPSOIL: Dark brown, silty sand, moist	1	SS	3	
	SILTY SAND: Very loose to compact, brown, silty sand, wet	2	SS	8	First water strike at 0.8 m
		3	SS	10	
2.3 / 302.2	SILT: Compact, brown, sandy silt, trace sand, trace gravel, trace clay, wet	4[1]	SS	13	
3.1 / 301.4	CLAYEY SILT: Stiff to very stiff, grey, clayey silt, with sandly silt layers, trace sand, WTPL	5	SS	14	
		6	SS	20	
5.0 / 299.5	BOREHOLE TERMINATED AT 5.0 m				Upon completion of augering Water at 1.2 m Cave at 1.8 m



UNIT WEIGHT kN/m³ — GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 7

17T 577292E 4891491N

PROJECT Proposed Residential Development
LOCATION 937045 Airport Road, Mansfield, ON
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE May 12, 2021
PML REF. 21BF019
ENGINEER GW
TECHNICIAN CM

SURFACE ELEVATION 304.05

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%) approx.	GROUND WATER OBSERVATIONS AND REMARKS
0.20	TOPSOIL: Brown, silty sand, moist	1	SS	3		Stick-up casing
303.85	SAND: Very loose to loose, brown, sand, trace silt, wet	2	SS	8		First water strike at 0.8 m
1.4 / 302.7	CLAYEY SILT: Stiff, brown, clayey silt, sandy silt layers, trace sand, WTPL	3	SS	12		Bentonite seal
2.1 / 302.0	CLAYEY SILT TILL: Stiff, grey, clayey silt, trace gravel, trace sand, cobbles and boulders, APL to WTPL	4	SS	14		Filter sand
		5	SS	13		50 mm slotted pipe
		6	SS	14		
5.0 / 299.1	BOREHOLE TERMINATED AT 5.0 m					

Upon completion of augering
Water at 0.9 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-05-20	1.0	303.1
2021-06-11	1.3	302.8

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 8

17T 577389E 4891551N

PROJECT Proposed Residential Development
LOCATION 937045 Airport Road, Mansfield, ON
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE May 13, 2021
PML REF. 21BF019
ENGINEER GW
TECHNICIAN CM

SURFACE ELEVATION 309.85

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%) (approx.)	GROUND WATER OBSERVATIONS AND REMARKS
0.13 / 309.72	TOPSOIL: Brown, silty sand, moist	1	SS	7	~10	Stick-up casing
	FILL: Brown, silty sand, some gravel, trace organics, moist	2	SS	64	~9	
1.4 / 308.5	SAND: Compact, brown, sand, trace to some silt, trace gravel, moist to wet	3	SS	26	~10	
		4	SS	15	~3	Bentonite seal
		5	SS	16	~10	
		6	SS	25	~11	
5.5 / 304.4	SILT: Compact, brown, silt, trace to some sand, trace gravel, trace clay, moist to wet	7[1]	SS	25	~22	Filter sand; First water strike at 6.4 m; 50 mm slotted pipe
		8	SS	24	~20	
9.0 / 300.9	CLAYEY SILT TILL: Hard, brown to grey, clayey silt, trace sand, trace gravel, cobbles and boulders, APL	9	SS	44	~15	
10.0 / 299.9	BOREHOLE TERMINATED AT 10.0 m					Upon completion of augering Wet cave at 4.6 m

Chart headings: SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q (50, 100, 150, 200); DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● (20, 40, 60, 80); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (10, 20, 30, 40); UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL; ELEVATION SCALE 309–300; DEPTH 0.0–15.0.

Water Level Readings:

Date	Depth	Elev.
2021-05-20	7.2	302.7
2021-06-11	7.2	302.7

NOTES

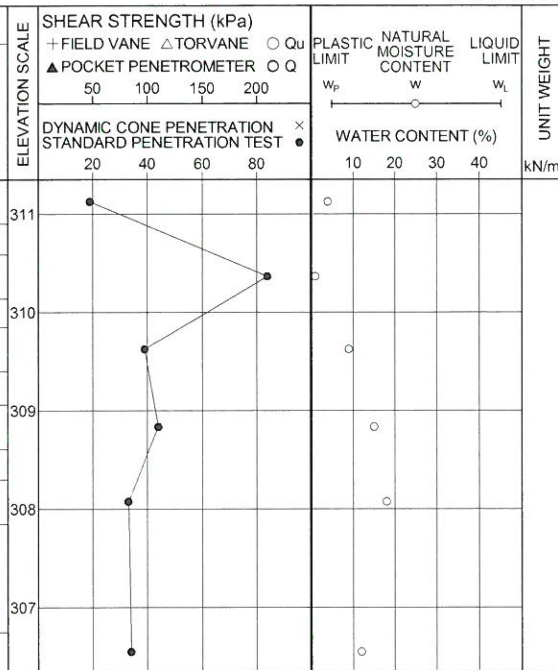
Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 9

17T 576946E 4891305N

PROJECT Proposed Residential Development
LOCATION 937045 Airport Road, Mansfield, ON
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE May 14, 2021
PML REF. 21BF019
ENGINEER GW
TECHNICIAN CM

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
	SURFACE ELEVATION 311.35				
0.05 / 311.30	TOPSOIL: Brown, silty sand, trace gravel, moist	1	SS	19	
0.70 / 310.65	SAND: Compact, brown, sand, trace silt, moist				
	SAND AND GRAVEL: Very dense to dense, brown, sand and gravel, trace silt, cobbles and boulders, moist to very moist	2	SS	84	
		3	SS	39	
2.1 / 309.3	SILT: Dense, brown to grey, silt, trace sand, trace clay, trace gravel, moist to wet	4[1]	SS	44	
		5	SS	33	First water strike at 3.1 m
4.0 / 307.4	SILTY SAND: Dense, brown, silty sand, trace gravel, moist	6	SS	34	
5.0 / 306.4	BOREHOLE TERMINATED AT 5.0 m				Upon completion of augering No water No cave



NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 10

17T 577162E 4891306N

PROJECT Proposed Residential Development
PML REF. 21BF019
LOCATION 937045 Airport Road, Mansfield, ON
BORING DATE May 14, 2021
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN CM

SURFACE ELEVATION 310.50

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%) (approx.)	GROUND WATER OBSERVATIONS AND REMARKS
0.10 / 310.40	TOPSOIL: Brown, silty sand, moist					Stick-up casing
	SAND: Loose to compact, brown, sand, trace to some silt, trace to some gravel, moist	1	SS	4	12	
		2	SS	24	4	
		3	SS	13	5	Bentonite seal
		4	SS	12	10	
2.9 / 307.6	SILTY SAND: Compact, brown, silty sand, trace gravel, wet	5	SS	17	17	First water strike at 3.1 m
						Filter sand
		6	SS	17	19	50 mm slotted pipe
		7	SS	22	19	
6.5 / 304.0	BOREHOLE TERMINATED AT 6.5 m					Upon completion of augering Wet cave at 4.3 m

Water Level Readings:

Date	Depth	Elev.
2021-05-20	4.2	306.3
2021-06-11	4.3	306.2

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; ELEVATION SCALE; SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q 50 100 150 200; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ● 20 40 60 80; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30 40; UNIT WEIGHT kN/m³; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 11

17T 577306E 4891413N

PROJECT Proposed Residential Development
LOCATION 937045 Airport Road, Mansfield, ON
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE May 12, 2021
PML REF. 21BF019
ENGINEER GW
TECHNICIAN CM

SURFACE ELEVATION 309.05

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	GROUND WATER OBSERVATIONS AND REMARKS
0.20 / 308.85	TOPSOIL: Brown, silty sand, trace gravel, moist	1	SS	8		Stick-up casing
	SAND: Loose to compact, brown, sand, trace silt, trace to some gravel, cobbles and boulders, moist	2	SS	17		
		3	SS	18		
2.1 / 307.0	SANDY SILT: Compact, brown, sandy silt, trace gravel, trace clay, moist with wet layers	4	SS	11		Bentonite seal
		5[1]	SS	13		
		6	SS	16		Filter sand; First water strike at 4.6 m; 50 mm slotted pipe
		7	SS	11		
6.5 / 302.6	BOREHOLE TERMINATED AT 6.5 m					

Upon completion of augering
Wet cave at 5.5 m

Water Level Readings:

Date	Depth	Elev.
2021-05-20	4.6	304.5
2021-06-11	4.8	304.3

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 12

17T 577451E 4891453N

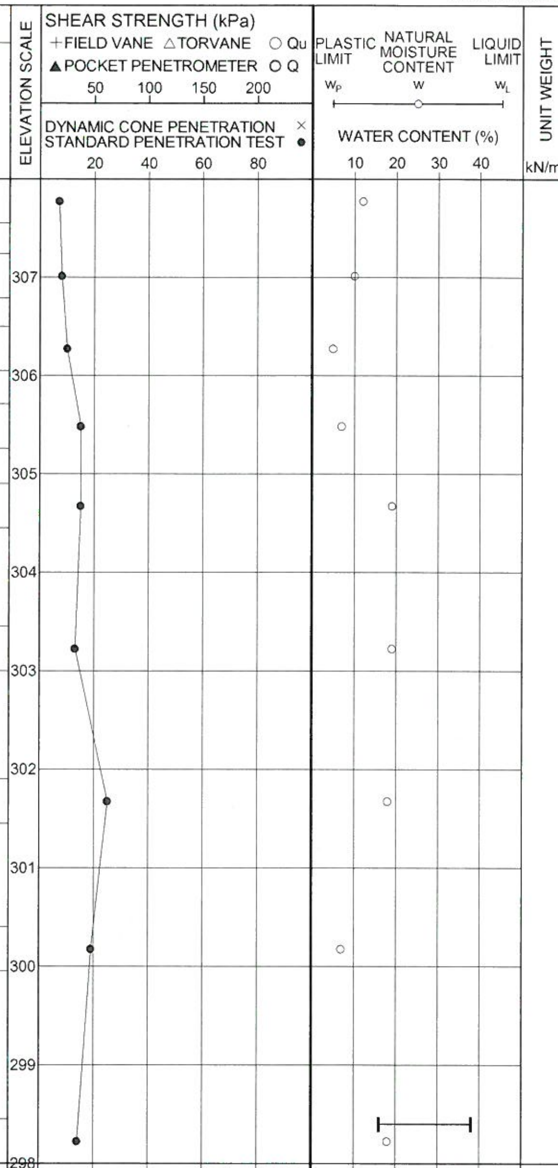
PROJECT Proposed Residential Development
LOCATION 937045 Airport Road, Mansfield, ON
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE May 12, 2021
PML REF. 21BF019
ENGINEER GW
TECHNICIAN CM

SURFACE ELEVATION 308.00

DEPTH / ELEV (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.20	TOPSOIL: Brown, silty sand, moist				Stick-up casing
307.80	SAND: Loose to compact, brown, sand, trace silt, moist to wet	1	SS	7	
		2	SS	8	
		3	SS	10	
		4	SS	15	First water strike at 2.3 m; Bentonite seal
2.9 / 305.1	SILTY FINE SAND: Compact, brown, silty fine sand, wet	5[1]	SS	15	
		6	SS	13	Filter sand
5.5 / 302.5	SANDY SILT: Compact, brown, sandy silt, trace clay, trace gravel, cobbles and boulders, moist to very moist				50 mm slotted pipe
		7[1]	SS	25	
		8	SS	19	
9.0 / 299.0	SANDY SILTY CLAY: Stiff, grey, sandy silty clay, trace gravel, APL	9[1]	SS	14	
10.0 / 298.0	BOREHOLE TERMINATED AT 10.0 m				Upon completion of augering: No water; No cave

Water Level Readings:

Date	Depth	Elev.
2021-05-20	5.7	302.3
2021-06-11	5.8	302.2



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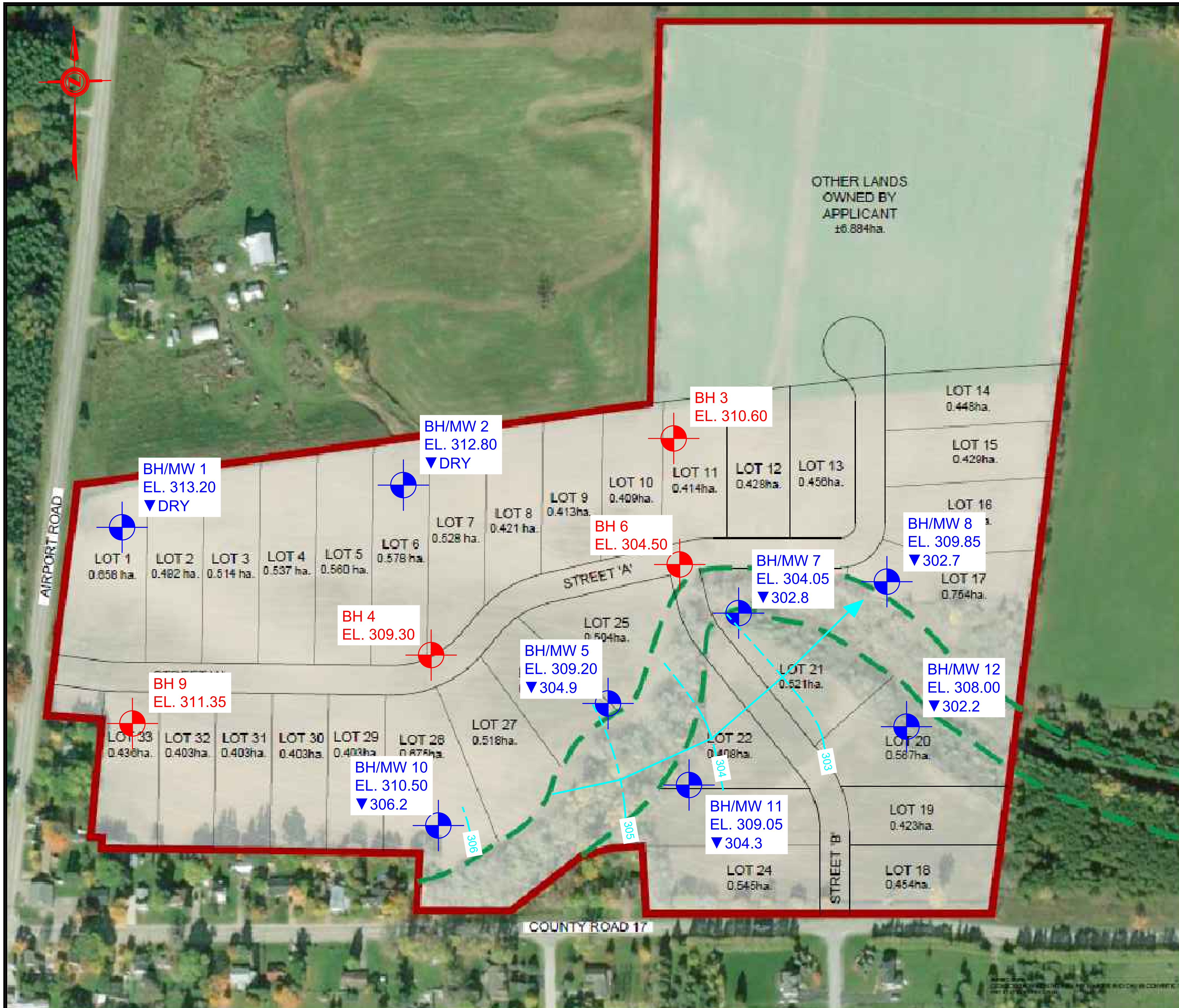


KEY PLAN
MANSFIELD, ONTARIO

LEGEND:

BH3 EL. 310.60	BOREHOLE LOCATION GROUND ELEVATION
BH/MW 1 EL. 313.20 ▼ DRY	BOREHOLE/MONITORING WELL LOCATION GROUND ELEVATION GROUND WATER ELEVATION (2021-06-11)
	SITE LIMITS
	INTERPRETED HYDROSTATIC GROUND WATER LEVEL CONTOUR
	INTERPRETED GROUND WATER FLOW DIRECTION

REFERENCE:
BASE PLAN PROVIDED BY THE CLIENT.

0m 30 60 90 120 150
SCALE

BOREHOLE/MONITORING WELL LOCATION PLAN

PROPOSED RESIDENTIAL DEVELOPMENT
937045 AIRPORT ROAD
MANSFIELD, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	NT	SEPT 2021	AS SHOWN	21BF019	1
CHECKED	AK				
APPROVED	GW				

APPENDIX A

Statement of Limitations

STATEMENT OF LIMITATIONS

This report is prepared for and made available for the sole use of the client named. Peto MacCallum Ltd. (PML) hereby disclaims any liability or responsibility to any person or entity, other than those for whom this report is specifically issued, for any loss, damage, expenses, or penalties that may arise or result from the use of any information or recommendations contained in this report. The contents of this report may not be used or relied upon by any other person without the express written consent and authorization of PML.

This report shall not be relied upon for any purpose other than as agreed with the client named without the written consent of PML. It shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. A portion of this report may not be used as a separate entity: that is to say the report is to be read in its entirety at all times.

The report is based solely on the scope of services which are specifically referred to in this report. No physical or intrusive testing has been performed, except as specifically referenced in this report. This report is not a certification of compliance with past or present regulations, codes, guidelines and policies.

The scope of services carried out by PML is based on details of the proposed development and land use to address certain issues, purposes and objectives with respect to the specific site as identified by the client. Services not expressly set forth in writing are expressly excluded from the services provided by PML. In other words, PML has not performed any observations, investigations, study analysis, engineering evaluation or testing that is not specifically listed in the scope of services in this report. PML assumes no responsibility or duty to the client for any such services and shall not be liable for failing to discover any condition, whose discovery would require the performance of services not specifically referred to in this report.

STATEMENT OF LIMITATIONS
(continued)

The findings and comments made by PML in this report are based on the conditions observed at the time of PML's site reconnaissance. No assurances can be made and no assurances are given with respect to any potential changes in site conditions following the time of completion of PML's field work. Furthermore, regulations, codes and guidelines may change at any time subsequent to the date of this report and these changes may effect the validity of the findings and recommendations given in this report.

The results and conclusions with respect to site conditions are therefore in no way intended to be taken as a guarantee or representation, expressed or implied, that the site is free from any contaminants from past or current land use activities or that the conditions in all areas of the site and beneath or within structures are the same as those areas specifically sampled.

Any investigation, examination, measurements or sampling explorations at a particular location may not be representative of conditions between sampled locations. Soil, ground water, surface water, or building material conditions between and beyond the sampled locations may differ from those encountered at the sampling locations and conditions may become apparent during construction which could not be detected or anticipated at the time of the intrusive sampling investigation.

Budget estimates contained in this report are to be viewed as an engineering estimate of probable costs and provided solely for the purposes of assisting the client in its budgeting process. It is understood and agreed that PML will not in any way be held liable as a result of any budget figures provided by it.

The Client expressly waives its right to withhold PML's fees, either in whole or in part, or to make any claim or commence an action or bring any other proceedings, whether in contract, tort, or otherwise against PML in anyway connected with advice or information given by PML relating to the cost estimate or Environmental Remediation/Cleanup and Restoration or Soil and Ground Water Management Plan Cost Estimate.

APPENDIX B

Engineered Fill

ENGINEERED FILL

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. <u>Purpose</u>

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

2. <u>Minimum Extent</u>

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and

- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

3. <u>Survey Control</u>

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.

APPENDIX C

Slope Stability

SLOPE STABILITY RATING CHART [1]			
Site Location: 937045 Airport Road, Mansfield, Ontario		**PML Ref:** 21BF019	
Property Owner: 2735528 Ontario Inc.		**Inspection Date:** April 10, 2021	
Inspected By: Geoffrey White, P.Eng.		**Weather: Mix of Sun and Cloud**, 18 C	
1.	**OVERALL SLOPE INCLINATION**		
	Degrees	**horiz : vert.**	
	a) 18 or less	3 : 1 or flatter	**0**
	b) 18 – 26	2 : 1 to more than 3 : 1	6
	c) more than 26	steeper than 2 : 1	16
2.	**SOIL STRATIGRAPHY**		
	a) Shale, Limestone, Granite (Bedrock)		0
	b) Sand, Gravel		**6**
	c) Glacial Till		9
	d) Clay, Silt		12
	e) Fill		16
	f) Leda Clay		24
3.	**SEEPAGE FROM SLOPE FACE**		
	a) None or Near bottom only		**0**
	b) Near mid-slope only		6
	c) Near crest only, or From several levels		12
4.	**SLOPE HEIGHT**		
	a) 2 m or less		0
	b) 2.1 to 5 m		2
	c) 5.1 to 10 m		**4**
	d) more than 10 m		8
5.	**VEGETATION COVER ON SLOPE FACE**		
	a) Well vegetated; heavy shrubs or forested with mature trees		0
	b) Light vegetation; Mostly grass, weeds, occasional trees, shrubs		**4**
	c) No vegetation, bare		8
6.	**TABLE LAND DRAINAGE**		
	a) Table land flat, no apparent drainage over slope		0
	b) Minor drainage over slope, no active erosion		**2**
	c) Drainage over slope, active erosion, gullies		4
7.	**PROXIMITY OF WATERCOURSE TO SLOPE TOE**		
	a) 15 metres or more from slope toe		0
	b) Less than 15 meters from slope toe		**6**
8.	**PREVIOUS LANDSLIDE ACTIVITY**		
	a) No		**0**
	b) Yes		6

SLOPE INSTABILITY RATING	RATING VALUES TOTAL	INVESTIGATION REQUIREMENTS	TOTAL 22
1. Low potential	**< 24**	**Site inspection only, confirmation, report letter.** ☑	
2. Slight potential	**25-35**	**Site inspection and surveying, preliminary study, detailed report.**	
3. Moderate potential	**> 35**	**Boreholes, piezometers, lab tests, surveying, detailed report.**	

APPENDIX D

MECP Water Well Records

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
MULMUR TOWNSHIP HS E 06 010	17 576926 4890894 W	1964/01 1308	30	FR 0037	37/46/ 1/1:0	DO		1700739 ()	BRWN CLAY MSND 0006 GRVL 0009 BRWN CLAY MSND 0024 BRWN CLAY MSND BLDR 0028 BRWN MSND 0044 BRWN CLAY MSND 0045
MULMUR TOWNSHIP HS E 06 011	17 576881 4891124 W	1956/05 1317	6 5	FR 0140 FR 0160	90///:	DO		1700740 ()	MSND 0100 QSND 0160 SHLE 0250
MULMUR TOWNSHIP HS E 06 011	17 576840 4891168 W	1957/05 1317	6					1700741 () A	MSND GRVL 0140 MSND CLAY 0162 GREY SHLE 0250
MULMUR TOWNSHIP HS E 06 011	17 576808 4891253 W	1965/07 3602	4	FR 0027 FR 0120	80/100 /5/50:0	PS MN	0123 6	1700742 ()	LOAM 0001 GRVL STNS 0016 CLAY GRVL MSND 0120 FSND 0129
MULMUR TOWNSHIP HS E 07 010	17 577018 4891071 W	1961/10 1308	30	FR 0010	10//1/:	ST		1700766 ()	PRDG 0012 BRWN CLAY MSND 0029
MULMUR TOWNSHIP HS E 07 011	17 576955 4891191 W	1961/11 1308	30	FR 0023	23//50/ 8:0	DO		1700767 ()	BRWN CLAY MSND 0002 GRVL 0010 MSND 0016 CLAY MSND 0028
MULMUR TOWNSHIP HS E 07 011	17 576929 4891235 W	1965/11 3602	4	FR 0070	40/54/ 9/15:0	ST DO		1700768 ()	LOAM 0001 CLAY 0010 MSND 0025 GREY CLAY 0070 MSND GRVL 0072
MULMUR TOWNSHIP HS E 06 011	17 576894 4891224 W	1965/01 1308	36					1700775 () A	LOAM 0003 LOAM MSND 0027 CLAY 0037 MSND GRVL 0043 MSND 0054 CLAY MSND 0063
MULMUR TOWNSHIP HS E 07 011	17 576934 4891233 W	1968/11 3602	4	FR 0103	//5/1:0	DO	0104 3	1700957 ()	LOAM 0001 CLAY GRVL 0010 FSND CLAY 0100 CLAY 0103 MSND 0107
MULMUR TOWNSHIP HS E 07 011	17 577064 4891173 W	1972/10 3602				NU		1701446 () A	BRWN CSND STNS 0025 BRWN SAND CLAY 0112 BLUE CLAY SHLE 0160
MULMUR TOWNSHIP HS E 06 012	17 576764 4891773 W	1975/09 3602	6	FR 0100	23/115 /1/1:30	ST DO		1702003 ()	BRWN LOAM 0001 BRWN CLAY 0018 GREY SHLE HARD LYRD 0120

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
MULMUR TOWNSHIP HS E 06 011	17 576814 4891073 W	1977/08 3602	4	FR 0106	/100/6/ 2:0	DO	0108 6	1702297 ()	BRWN SAND CLAY 0015 GREY CLAY GRVL HARD 0080 GREY CLAY STKY 0100 GREY CLAY SNDS 0105 BRWN SAND WBRG 0114
MULMUR TOWNSHIP HS E 06 012	17 576714 4891673 W	1979/08 3602	6	FR 0100	19/120 /1/0:30	DO		1702582 ()	BRWN CLAY 0015 GREY SHLE 0030 GREY SHLE HARD 0140
MULMUR TOWNSHIP HS E 06 012	17 576664 4891873 W	1979/08 3662	30 30 24	UK 0010	9/20/1/ 1:0	DO		1702588 ()	BRWN LOAM 0001 BRWN CLAY SAND 0009 BLUE CLAY STNS 0021
MULMUR TOWNSHIP HS E 06 012	17 576664 4891702 W	1981/10 3406	6	SA 0040	23/126 /2/1:30	DO		1702832 ()	GREY CLAY 0021 GREY SHLE 0127
MULMUR TOWNSHIP HS E 06 011	17 576652 4891699 W	1983/06 3602	8	SA 0045 FR 0060	20///:	DO		1702926 ()	BRWN LOAM 0001 GREY CLAY STNS SHLE 0018 GREY SHLE 0060
MULMUR TOWNSHIP HS E 06 011	17 576646 4891682 W	1985/10 3602	13	FR 0025 UK 0051	25//1/:	DO		1703175 () A	BRWN LOAM 0001 GREY CLAY STNS STNY 0015 GREY CLAY SHLE LYRD 0018 GREY SHLE 0051 GREY SHLE 0070
MULMUR TOWNSHIP HS E 07 010	17 577584 4891064 L	1990/03 2663	8			DO		1704164 (73098) A	LOAM 0003 SAND GRVL 0170
MULMUR TOWNSHIP HS E 07 010	17 577517 4890987 W	1990/04 4645	6	FR 0150	83/140 /20/4:0	DO	0142 8	1704196 (72559)	BRWN SAND SILT 0005 BRWN GRVL SAND LOOS 0016 BRWN SAND SILT CLAY 0040 GREY CLAY SILT 0050 BRWN CLAY SILT 0060 BRWN SILT SAND SOFT 0110 BRWN MSND SILT 0115 BRWN GRVL SAND SILT 0135 BRWN SAND SILT LYRD 0155 GREY SILT SOFT 0155
MULMUR TOWNSHIP HS E 06 011	17 576850 4891271 W	1991/06 3602	6	FR 0101	79/100 /30/2:3 0	DO		1704351 (103179)	BRWN LOAM 0001 BRWN SAND GRVL STNS 0023 BRWN FSND HARD DRY 0051 BRWN MSND HARD DRY 0079 BRWN SAND CLAY 0101 BRWN SAND WBRG CLN 0112 BRWN SAND 0123
MULMUR TOWNSHIP HS E 07 010	17 577581 4891063 L	2000/09 3406				NU		1705655 (217359) A	PRDR 0140
MULMUR TOWNSHIP HS E 07 010	17 577581 4891063 L	2000/09 3406				NU		1705656 (217358) A	

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
MULMUR TOWNSHIP HS E 07 011	17 577467 4891667 L	2003/07 3602				NU		1706073 (236468) A	
MULMUR TOWNSHIP HS E 07 010	17 577581 4891063 L	2003/09 4645	6 5	FR 0220	102/21 0/2/12: 0	DO		1706171 (256597)	PRDR 0180 BRWN UNKN HARD 0200 GREY CLAY PRDR DNSE 0205 GREY SHLE PRDR 0220
MULMUR TOWNSHIP HS E 07 010	17 577277 4890862 W	2006/04 1663	5.98		82///:	NU		1706679 (Z36798) A	
MULMUR TOWNSHIP	17 577796 4891478 W	2009/07 7219	6 10	FR 0112	55/93/ 7/1:	DO	0112 8	7127478 (Z098420) A085738	BRWN CLAY SAND GRVL 0016 GREY CLAY SOFT 0030 GREY SILT CLAY SAND 0112 GREY FSND MSND LOOS 0127
MULMUR TOWNSHIP HS E 06 011	17 576715 4891201 W	2015/09 4645	6.25	FR 0006	100/10 9//1:	DO	0122 4	7252774 (Z215708) A160053	BRWN SAND SILT LOOS 0007 BRWN CLAY HARD 0026 BRWN SAND CLAY LYRD 0110 BRWN SAND LOOS 0126 GREY CLAY HARD 0126
MULMUR TOWNSHIP	17 576895 4891117 W	2015/09 7324						7258925 (C28230) A180061 P	
MULMUR TOWNSHIP	17 576825 4891116 W	2016/05 7230						7267967 (C33919) A203320 P	
MULMUR TOWNSHIP HS E 06 015	17 576858 4891273 W	2018/05 4645	6.25 6.25 5.5			MN		7313419 (Z287207) A248504	
MULMUR TOWNSHIP HS E 07 010	17 577739 4891277 W	2020/05 4645	6.25	FR 0068	83/124 /55/2:	MN	0173 26	7359746 (Z328763) A286687	BRWN SAND GRVL LOOS 0021 BRWN SAND SILT LOOS 0050 BRWN CLAY SILT LYRD 0064 GREY CLAY SILT LYRD 0094 BRWN SAND LOOS 0095 GREY CLAY HARD 0102 BRWN FSND SILT LOOS 0122 GREY CLAY SILT LYRD 0168 BRWN SAND LOOS 0199 GREY SHLE HARD 0200
MULMUR TOWNSHIP HS E 07 010	17 577756 4891267 W	2020/05 4645	6.25					7359754 (Z336501) A	
MULMUR TOWNSHIP HS E 07 010	17 577785 4891243 W	2020/04 4645	5					7359755 (Z336502) A	

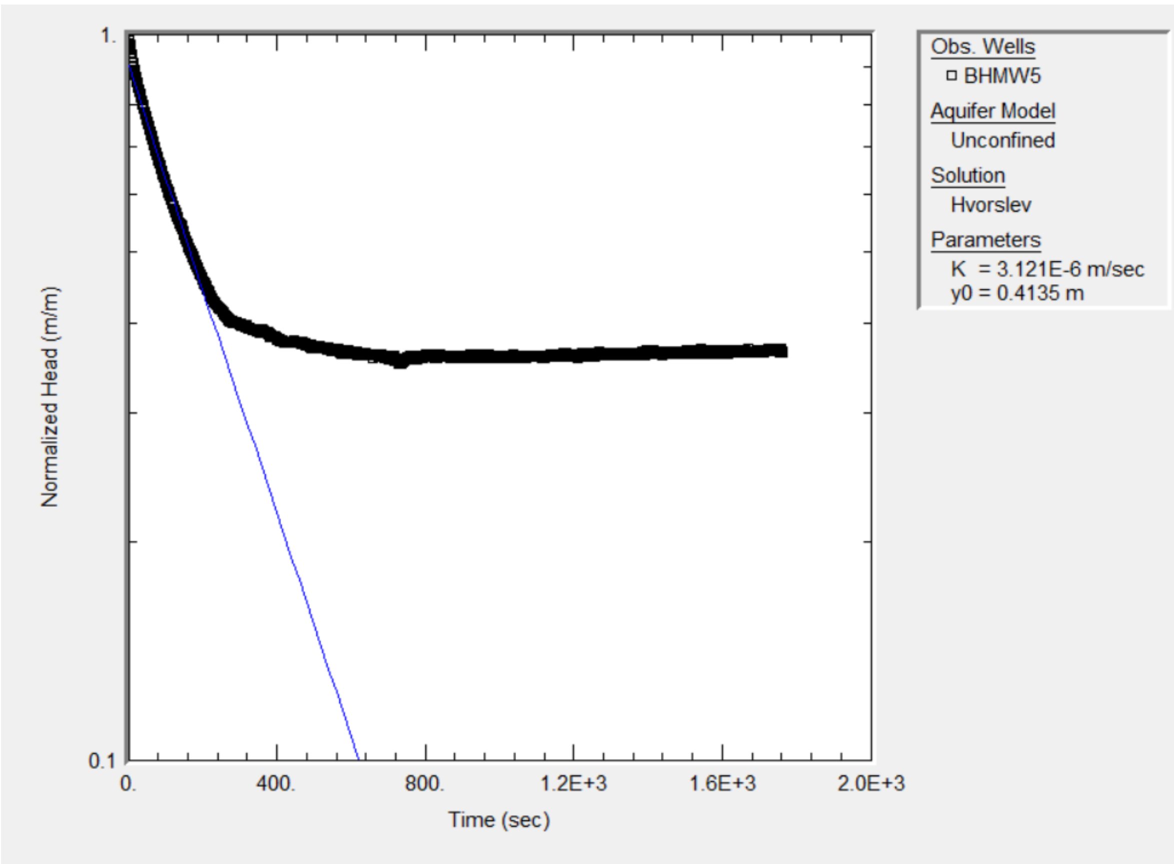
APPENDIX E

Borehole Permeability Testing

Estimation of K by Slug Test, based on Hvorslev equation

Date:	June 11, 2021
Conducted by:	A.Kimberley

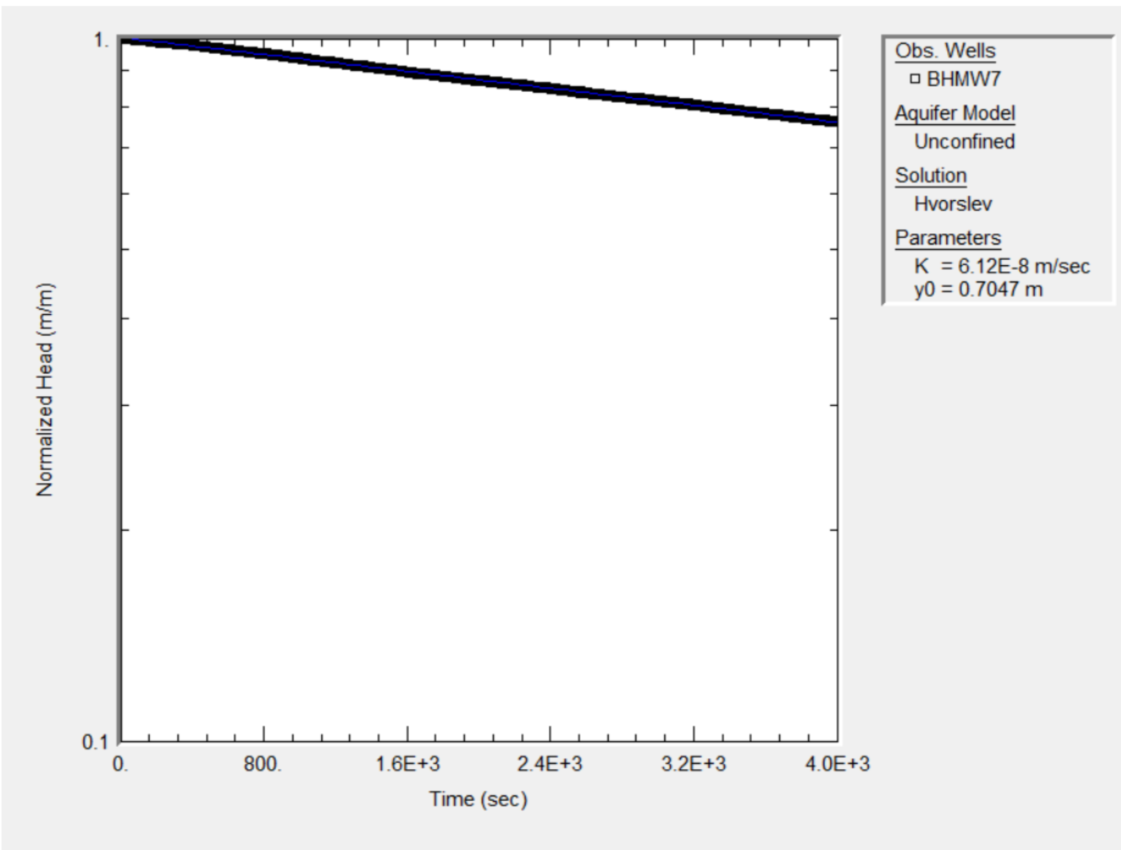
Well Number:	BH/MW5	
Well Screen Bottom:	6.10	mbgs
Top of Pipe:	0.76	mags
Well Casing Diameter:	5	cm
Well Elevation:	309.20	masl
Static Water Level:	4.29	mbgs
$K = r^2 \ln(L/R)/(2LTo)$ =	**3.1×10^{-6}**	m/s



Estimation of K by Slug Test, based on Hvorslev equation

Date:	June 11, 2021
Conducted by:	A.Kimberley

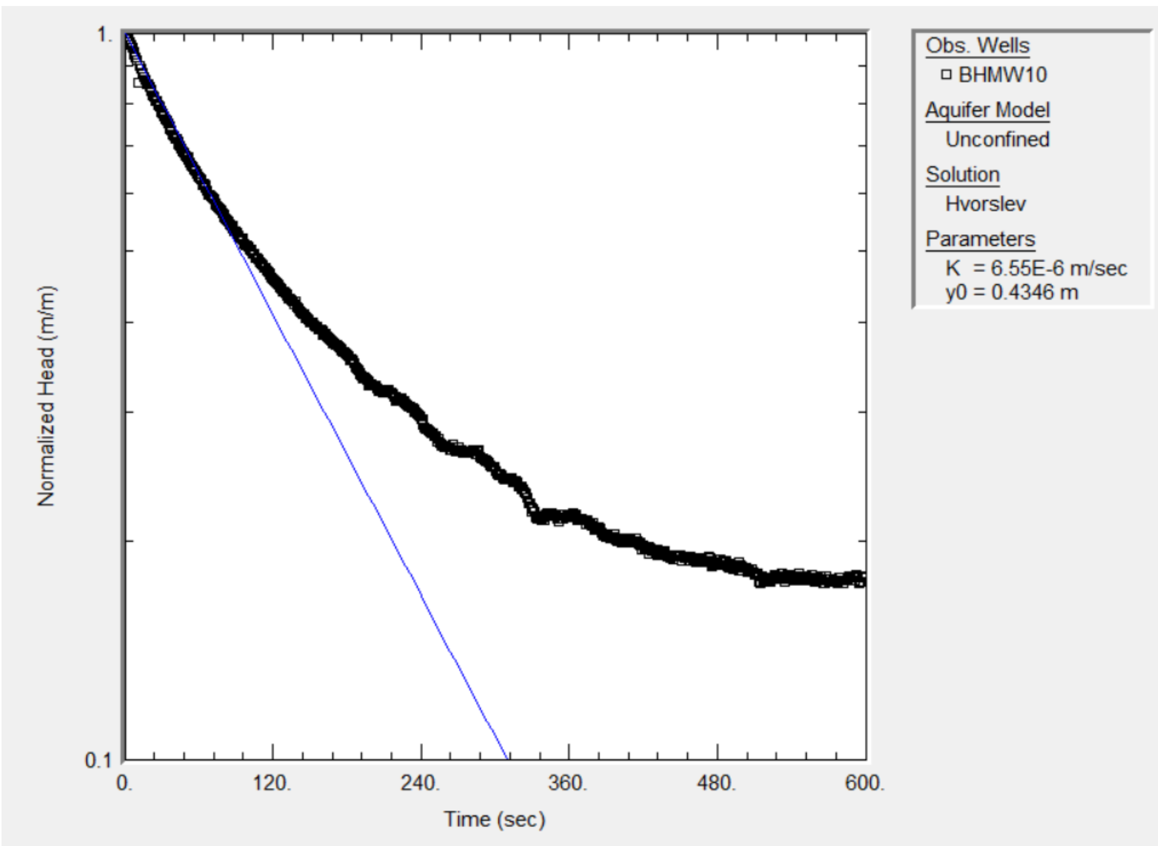
Well Number:	BH/MW7	
Well Screen Bottom:	4.60	mbgs
Top of Pipe:	0.88	mags
Well Casing Diameter:	5	cm
Well Elevation:	304.05	masl
Static Water Level:	1.28	mbgs
$K = r^2 \ln(L/R)/(2LTo)$ =	**6.1×10^{-8}**	m/s



Estimation of K by Slug Test, based on Hvorslev equation

Date:	June 11, 2021
Conducted by:	A.Kimberley

Well Number:	BH/MW10	
Well Screen Bottom:	6.10	mbgs
Top of Pipe:	0.85	mags
Well Casing Diameter:	5	cm
Well Elevation:	310.50	masl
Static Water Level:	4.34	mbgs
$K = r^2 \ln(L/R)/(2LTo)$ =	**6.6×10^{-6}**	m/s



APPENDIX F

Chain-of-Custody Records and Certificates of Analyses for Chemical Testing

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0256 **REPORT No. B21-17964**

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 11-Jun-21
DATE REPORTED: 15-Jun-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF019
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Anions	2	Holly Lane	pcu	15-Jun-21	A-IC-01 (o)	SM4110C
pH	2	Holly Lane	SYL	14-Jun-21	A-PH-01 (o)	SM 4500H
A - Wet Chem	2	Kingston	aro	14-Jun-21	A-TPTKN-001 (P)(k)	E3199A.1
Chromium (VI)	2	Holly Lane	LMG	15-Jun-21	D-CRVI-01 (o)	MOE E3056
Mercury	2	Holly Lane	PBK	15-Jun-21	D-HG-02 (o)	SM 3112 B
Metals - ICP-OES	2	Holly Lane	hmc	15-Jun-21	D-ICP-01 (o)	SM 3120
Metals - ICP-MS	2	Holly Lane	TPR	15-Jun-21	D-ICPMS-01 (o)	EPA 200.8

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

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DATE REPORTED: 15-Jun-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF019
WATERWORKS NO.

	Client I.D.		BHMW7	BHMW10			**PWQO**	
	Sample I.D.		B21-17964-1	B21-17964-2			**Interim PWQO**	**PWQO**
	Date Collected		11-Jun-21	11-Jun-21				
Parameter	**Units**	**R.L.**						
pH @25°C	pH Units		7.82	8.00				8.5
Nitrite (N)	µg/L	50	< 50	< 50				
Nitrate (N)	µg/L	50	1580	13600				
Phosphorus-Total	µg/L	10	**80**	**6950**			10	
Hardness (as CaCO3)	mg/L	1	435	336				
Aluminum	µg/L	10	70	50			75	
Aluminum (total)	µg/L	10	840	23400				
Antimony	µg/L	0.1	0.5	< 0.1			20	
Arsenic	µg/L	0.1	0.2	0.6			5	5
Beryllium	µg/L	2	< 2	< 2				11
Boron	µg/L	5	10	65			200	
Cadmium	µg/L	0.015	**0.108**	0.042			0.1	0.2
Chromium	µg/L	1	2	3				
Chromium (VI)	µg/L	1	< 1	1				1
Cobalt	µg/L	0.1	0.4	**2.0**			0.9	
Copper	µg/L	0.1	**5.4**	**6.7**			5	
Iron	µg/L	5	**809**	**44700**				300
Lead	µg/L	0.02	0.56	**2.10**			1	5
Mercury	µg/L	0.02	< 0.02	0.04				0.2
Molybdenum	µg/L	0.1	0.4	< 0.1			40	
Nickel	µg/L	0.2	10.4	3.5				25
Selenium	µg/L	1	< 1	< 1				100
Silver	µg/L	0.1	**0.5**	< 0.1				0.1
Thallium	µg/L	0.05	< 0.05	< 0.05			0.3	0.3

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

CBurke

Christine Burke
Lab Manager

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Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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Client committed. Quality assured.

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Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 11-Jun-21
DATE REPORTED: 15-Jun-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF019
WATERWORKS NO.

	Client I.D.		BHMW7	BHMW10			PWQO	
	Sample I.D.		B21-17964-1	B21-17964-2			Interim PWQO	PWQO
	Date Collected		11-Jun-21	11-Jun-21				
Parameter	**Units**	**R.L.**						
Tungsten	µg/L	10	< 10	< 10			30	
Uranium	µg/L	0.05	0.37	0.21			5	
Vanadium	µg/L	0.1	1.3	4.4			6	
Zinc	µg/L	5	**62**	**102**			20	30
Zirconium	µg/L	3	3	**36**			4	

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

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DATE RECEIVED: 11-Jun-21
DATE REPORTED: 15-Jun-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF019
WATERWORKS NO.

Summary of Exceedances

Interim PWQO

BHMW7	Found Value	Limit
Zinc (µg/L)	62	20
Phosphorus-Total (µg/L)	80	10
Copper (µg/L)	5.4	5
Cadmium (µg/L)	0.108	0.1
BHMW10	**Found Value**	**Limit**
Zirconium (µg/L)	36	4
Zinc (µg/L)	102	20
Phosphorus-Total (µg/L)	6950	10
Lead (µg/L)	2.10	1
Copper (µg/L)	6.7	5
Cobalt (µg/L)	2.0	0.9

Provincial Water Quality Objectives

BHMW7	Found Value	Limit
Zinc (µg/L)	62	30
Iron (µg/L)	809	300
Silver (µg/L)	0.5	0.1
BHMW10	**Found Value**	**Limit**
Zinc (µg/L)	102	30
Iron (µg/L)	44700	300

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

R.L. = Reporting Limit
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Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

GENERAL SAMPLE SUBMISSION FORM

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Proudly Canadian.

SAMPLES SUBMITTED TO:

Location	
Kingston	
Ottawa	
Richmond Hill	
Barrie	X
London	
Windsor	

TESTING REQUIREMENTS

X	O'Reg 153/04	1	Table (1 - 9)		Record of Site
	O'Reg 406/19		Table (1 - 9.1)		SPLP Table (1 - 9.1)
	RPI		ICC		Agricultural
	Coarse		Medium/Fine		O'Reg 558 TCLP
	MISA		PWQO		Landfill Monitoring
	Other:				

REPORT NUMBER (Lab Use): B21-17964

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? [ ] Yes [X] No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Organization:	Peto Maccallum Ltd.
Contact:	A. Kimberley
Tel:	705-734-3900
Fax:	705-734-9911
Email:	akimberley@petomaccallum.com
Additional Info (email, cell, etc):	
Address:	19 Churchill Drive, Barrie, ON L4N 8Z5, barrie@petomaccallum.com
Invoicing Address (if different):	
Quote #:	YD2021
P.O. #:	
Project Name/#:	21BF019
Additional Info:	

ANALYSES REQUESTED: PWQO metals, Phosphorous, Nitrate/nitrite, pH, Suspected Highly Contaminated

TURNAROUND SERVICE REQUESTED (see back page)
*Must be arranged in advance

	Service	Surcharge
	Platinum*	200% Surcharge
X	Gold*	100% Surcharge
X	Standard	5-7 days
	Silver	50% Surcharge
	Bronze	25% Surcharge
	Specific Date:	

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

Lab No.	Sample Source and/or Sample Identification	S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	PWQO metals	Phosphorous	Nitrate/nitrite	pH	X	Field pH	Field Temp.	# Bottles/ Sample	Field Filtered Y/N
1	BHMW7		GW	21-06-11		X	X	X	X					Y
2	BHMW10		GW	21-06-11		X	X	X	X					Y

Gen chem, metals, Hg, chromium → O
nut → K

SAMPLE SUBMISSION INFORMATION

	Sampled by:	Submitted by:
Print:	A.Kimberley	A.Kimberley
Sign:		
Date (yy-mm-dd)/Time:	21-06-11	21-06-11

SHIPPING INFORMATION

Courier (Client account)		Invoice
Courier (Caduceon account)		
Drop Off	X	# of Pieces
Caduceon (Pick-up)		

REPORTING / INVOICING

Report by Fax	
Report by Email	X
Invoice by Email	X
Invoice by Mail	

SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)

Received By (print):	Elie	Signature:	ES
Date Received (yy-mm-dd):	21-06-11	Time Received:	13:10
Laboratory Prepared Bottles:	X Yes		No
Sample Temperature °C:	20.7	Labeled by:	no

Comments:

Page 1 of 1

G H0256

Chapter 7 Hydrologic Soil Groups

630.0700 Introduction

This chapter defines four hydrologic soil groups, or HSGs, that, along with land use, management practices, and hydrologic conditions, determine a soil's associated runoff curve number (NEH630.09). Runoff curve numbers are used to estimate direct runoff from rainfall (NEH630.10).

A map unit is a collection of areas defined and named the same in terms of their soil components or miscellaneous areas or both (NSSH 627.03). Soil scientists assign map unit components to hydrologic soil groups. Map unit components assigned to a specific hydrologic soil group have similar physical and runoff characteristics. Soils in the United States, its territories, and Puerto Rico have been assigned to hydrologic soil groups. The assigned groups can be found by consulting the Natural Resources Conservation Service's (NRCS) Field Office Technical Guide; published soil survey data bases; the NRCS Soil Data Mart Web site (*http://soildatamart.nrcs.usda.gov/*); and/or the Web Soil Survey Web site (*http://websoilsurvey.nrcs.usda.gov/*).

The NRCS State soil scientist should be contacted if a soil survey does not exist for a given area or where the soils within a watershed have not been assigned to hydrologic groups.

630.0701 Hydrologic soil groups

Soils were originally assigned to hydrologic soil groups based on measured rainfall, runoff, and infiltrometer data (Musgrave 1955). Since the initial work was done to establish these groupings, assignment of soils to hydrologic soil groups has been based on the judgment of soil scientists. Assignments are made based on comparison of the characteristics of unclassified soil profiles with profiles of soils already placed into hydrologic soil groups. Most of the groupings are based on the premise that soils found within a climatic region that are similar in depth to a restrictive layer or water table, transmission rate of water, texture, structure, and degree of swelling when saturated, will have similar runoff responses. The classes are based on the following factors:

- intake and transmission of water under the conditions of maximum yearly wetness (thoroughly wet)
- soil not frozen
- bare soil surface
- maximum swelling of expansive clays

The slope of the soil surface is not considered when assigning hydrologic soil groups.

In its simplest form, hydrologic soil group is determined by the water transmitting soil layer with the lowest saturated hydraulic conductivity and depth to any layer that is more or less water impermeable (such as a fragipan or duripan) or depth to a water table (if present). The least transmissive layer can be any soil horizon that transmits water at a slower rate relative to those horizons above or below it. For example, a layer having a saturated hydraulic conductivity of 9.0 micrometers per second (1.3 inches per hour) is the least transmissive layer in a soil if the layers above and below it have a saturated hydraulic conductivity of 23 micrometers per second (3.3 inches per hour).

Water impermeable soil layers are among those types of layers recorded in the component restriction table of the National Soil Information System (NASIS) database. The saturated hydraulic conductivity of an impermeable or nearly impermeable layer may range from essentially 0 micrometers per second (0 inches per hour) to 0.9 micrometers per second (0.1 inches per hour). For simplicity, either case is considered impermeable for hydrologic soil group purposes. In some cases, saturated hydraulic conductivity (a quantitatively measured characteristic) data are not always readily available or obtainable. In these situations, other soil properties such as texture, compaction (bulk density), strength of soil structure, clay mineralogy, and organic matter are used to estimate water movement. Table 7–1 relates saturated hydraulic conductivity to hydrologic soil group.

The four hydrologic soil groups (HSGs) are described as:

Group A—Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Some soils having loamy sand, sandy loam, loam or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

The limits on the diagnostic physical characteristics of group A are as follows. The saturated hydraulic conductivity of all soil layers exceeds 40.0 micrometers per second (5.67 inches per hour). The depth to any water impermeable layer is greater than 50 centimeters [20 inches]. The depth to the water table is greater than 60 centimeters [24 inches]. Soils that are deeper than 100 centimeters [40 inches] to a water impermeable layer and a water table are in group A if the saturated hydraulic conductivity of all soil layers within 100 centimeters [40 inches] of the surface exceeds 10 micrometers per second (1.42 inches per hour).

Group B—Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

The limits on the diagnostic physical characteristics of group B are as follows. The saturated hydraulic conductivity in the least transmissive layer between the surface and 50 centimeters [20 inches] ranges from 10.0 micrometers per second (1.42 inches per hour) to 40.0 micrometers per second (5.67 inches per hour). The depth to any water impermeable layer is greater than 50 centimeters [20 inches]. The depth to the water table is greater than 60 centimeters [24 inches]. Soils that are deeper than 100 centimeters [40 inches] to a water impermeable layer and a water table are in group B if the saturated hydraulic conductivity of all soil layers within 100 centimeters [40 inches] of the surface exceeds 4.0 micrometers per second (0.57 inches per hour) but is less than 10.0 micrometers per second (1.42 inches per hour).

Group C—Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

The limits on the diagnostic physical characteristics of group C are as follows. The saturated hydraulic conductivity in the least transmissive layer between the surface and 50 centimeters [20 inches] is between 1.0 micrometers per second (0.14 inches per hour) and 10.0 micrometers per second (1.42 inches per hour). The depth to any water impermeable layer is greater than 50 centimeters [20 inches]. The depth to the water table is greater than 60 centimeters [24 inches]. Soils that are deeper than 100 centimeters [40 inches] to a restriction and a water table are in group C if the saturated hydraulic conductivity of all soil layers within 100 centimeters [40 inches] of the surface exceeds 0.40 micrometers per second (0.06 inches per hour) but is less than 4.0 micrometers per second (0.57 inches per hour).

Group D—Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential. All soils with a depth to a water impermeable layer less than 50 centimeters [20 inches] and all soils with a water table within 60 centimeters [24 inches] of the surface are in this group, although some may have a dual classification, as described in the next section, if they can be adequately drained.

The limits on the physical diagnostic characteristics of group D are as follows. For soils with a water impermeable layer at a depth between 50 centimeters and 100 centimeters [20 and 40 inches], the saturated hydraulic conductivity in the least transmissive soil layer is less than or equal to 1.0 micrometers per second (0.14 inches per hour). For soils that are deeper than 100 centimeters [40 inches] to a restriction or water table, the saturated hydraulic conductivity of all soil layers within 100 centimeters [40 inches] of the surface is less than or equal to 0.40 micrometers per second (0.06 inches per hour).

Dual hydrologic soil groups—Certain wet soils are placed in group D based solely on the presence of a water table within 60 centimeters [24 inches] of the surface even though the saturated hydraulic conductivity may be favorable for water transmission. If these soils can be adequately drained, then they are assigned to dual hydrologic soil groups (A/D, B/D, and C/D) based on their saturated hydraulic conductivity and the water table depth when drained. The first letter applies to the drained condition and the second to the undrained condition. For the purpose of hydrologic soil group, adequately drained means that the seasonal high water table is kept at least 60 centimeters [24 inches] below the surface in a soil where it would be higher in a natural state.

Matrix of hydrologic soil group assignment criteria—The decision matrix in table 7–1 can be used to determine a soil's hydrologic soil group. If saturated hydraulic conductivity data are available and deemed to be reliable, then these data, along with water table depth information, should be used to place the soil into the appropriate hydrologic soil group. If these data are not available, the hydrologic soil group is determined by observing the properties of the soil in the field. Factors such as texture, compaction (bulk density), strength of soil structure, clay mineralogy, and organic matter are considered in estimating the hydraulic conductivity of each layer in the soil profile. The depth and hydraulic conductivity of any water impermeable layer and the depth to any high water table are used to determine correct hydrologic soil group for the soil. The property that is most limiting to water movement generally determines the soil's hydrologic group. In anomalous situations, when adjustments to hydrologic soil group become necessary, they shall be made by the NRCS State soil scientist in consultation with the State conservation engineer.

Table 7–1 Criteria for assignment of hydrologic soil group (HSG)

Depth to water impermeable layer 1/	Depth to high water table 2/	K_{sat} of least transmissive layer in depth range	K_{sat} depth range	HSG 3/
<50 cm [<20 in]	—	—	—	D
50 to 100 cm [20 to 40 in]	<60 cm [<24 in]	>40.0 µm/s (>5.67 in/h)	0 to 60 cm [0 to 24 in]	A/D
		>10.0 to ≤40.0 µm/s (>1.42 to ≤5.67 in/h)	0 to 60 cm [0 to 24 in]	B/D
		>1.0 to ≤10.0 µm/s (>0.14 to ≤1.42 in/h)	0 to 60 cm [0 to 24 in]	C/D
		≤1.0 µm/s (≤0.14 in/h)	0 to 60 cm [0 to 24 in]	D
	≥60 cm [≥24 in]	>40.0 µm/s (>5.67 in/h)	0 to 50 cm [0 to 20 in]	A
		>10.0 to ≤40.0 µm/s (>1.42 to ≤5.67 in/h)	0 to 50 cm [0 to 20 in]	B
		>1.0 to ≤10.0 µm/s (>0.14 to ≤1.42 in/h)	0 to 50 cm [0 to 20 in]	C
		≤1.0 µm/s (≤0.14 in/h)	0 to 50 cm [0 to 20 in]	D
>100 cm [>40 in]	<60 cm [<24 in]	>10.0 µm/s (>1.42 in/h)	0 to 100 cm [0 to 40 in]	A/D
		>4.0 to ≤10.0 µm/s (>0.57 to ≤1.42 in/h)	0 to 100 cm [0 to 40 in]	B/D
		>0.40 to ≤4.0 µm/s (>0.06 to ≤0.57 in/h)	0 to 100 cm [0 to 40 in]	C/D
		≤0.40 µm/s (≤0.06 in/h)	0 to 100 cm [0 to 40 in]	D
	60 to 100 cm [24 to 40 in]	>40.0 µm/s (>5.67 in/h)	0 to 50 cm [0 to 20 in]	A
		>10.0 to ≤40.0 µm/s (>1.42 to ≤5.67 in/h)	0 to 50 cm [0 to 20 in]	B
		>1.0 to ≤10.0 µm/s (>0.14 to ≤1.42 in/h)	0 to 50 cm [0 to 20 in]	C
		≤1.0 µm/s (≤0.14 in/h)	0 to 50 cm [0 to 20 in]	D
	>100 cm [>40 in]	>10.0 µm/s (>1.42 in/h)	0 to 100 cm [0 to 40 in]	A
		>4.0 to ≤ 10.0 µm/s (>0.57 to ≤1.42 in/h)	0 to 100 cm [0 to 40 in]	B
		>0.40 to ≤4.0 µm/s (>0.06 to ≤0.57 in/h)	0 to 100 cm [0 to 40 in]	C
		≤0.40 µm/s (≤0.06 in/h)	0 to 100 cm [0 to 40 in]	D

1/ An impermeable layer has a K_{sat} less than 0.01 µm/s [0.0014 in/h] or a component restriction of fragipan; duripan; petrocalcic; orstein; petrogypsic; cemented horizon; densic material; placic; bedrock, paralithic; bedrock, lithic; bedrock, densic; or permafrost.

2/ High water table during any month during the year.

3/ Dual HSG classes are applied only for wet soils (water table less than 60 cm [24 in]). If these soils can be drained, a less restrictive HSG can be assigned, depending on the K_{sat}.

630.0702 Disturbed soils

As a result of construction and other disturbances, the soil profile can be altered from its natural state and the listed group assignments generally no longer apply, nor can any supposition based on the natural soil be made that will accurately describe the hydrologic properties of the disturbed soil. In these circumstances, an onsite investigation should be made to determine the hydrologic soil group. A general set of guidelines for estimating saturated hydraulic conductivity from field observable characteristics is presented in the Soil Survey Manual (Soil Survey Staff 1993).

630.0703 References

Musgrave, G.W. 1955. How much of the rain enters the soil? *In* Water: U.S. Department of Agriculture. Yearbook. Washington, DC. pp. 151–159.

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Rawls, W.J., and D.L. Brakensiek. 1983. A procedure to predict Green-Ampt infiltration parameters. In Advances in infiltration. Proc. of the National Conference on Advances in Infiltration. Chicago, IL.

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U.S. Department of Agriculture, Natural Resources Conservation Service. 1993. National Engineering Handbook, title 210–VI. Part 630, chapters 9 and 10. Washington, DC. Available online at *http://directives.sc.egov.usda.gov/*.

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APPENDIX C

Water Servicing Calculations

PINESTONE ENGINEERING LTD.

DWCo. LTD

Dufferin Water Co. LTD
13 Rose Ridge Lane
Mono On
L9W 5Y3
Phone519 942 5695 Fax 519 940 3956

22 February 2021

Township of Mulmur
RR #2
Lisle, ON
L0M 1M0

Attn: John Wimetts, Director of Public Works

Re: Mansfield Water System – Annual Summary Report for 2020

Dear John:

Attached is the 2020 Summary Report for the Mansfield Water System. This report was prepared by Dufferin Water Co. Ltd on behalf of the Township of Mulmur in accordance with Schedule 22 of O. Reg 170/03 filed under the Safe Drinking Water Act (SDWA).

The summary report is required to be prepared, not later than March 31 of each year for the preceding calendar year and given to the members of the municipal council; please ensure this distribution.

Also attached to this letter is a copy of the 2020 Annual Report for the Mansfield Water Supply System. This report should be made available to the public at the Municipal office and if possible on the township website.

If you have any questions regarding either report please call.

Regards,

Joe Miedema P. Eng.
General Manager

Dufferin Water Co. LTD
13 Rose Ridge Lane
Mono On
L9W 5Y3
Phone519 942 5695 Fax 519 940 3956

DWCo. LTD

Mansfield Water System

Large Municipal Residential Drinking Water System

Schedule 22
Summary Report

For the Period:

January 01, 2020 to December 31, 2020

Prepared for the Township of Mulmur
By Dufferin Water Co. Ltd

Dufferin Water Co. LTD
13 Rose Ridge Lane
Mono On
L9W 5Y3
Phone519 942 5695 Fax 519 940 3956

Introduction

Schedule 22 of O. Reg 170/03 requires the preparation by the water system owner of a "Summary Report for Municipalities." This requirement only applies to large and small municipal residential systems. The Mansfield Water System is classified as a Large Municipal Residential Drinking Water System.

The Summary Report for the preceding year is to be issued by March 31 of the following year. This report was prepared by Dufferin Water Co. Ltd on behalf of the Township of Mulmur.

Distribution of the Summary Report is the responsibility of the owner. For a municipality that owns the water supply, all members of council are to receive the report. If the water system is owned by a municipal service board established under Section 195 of the Municipal Act, 2001 then all members of that board are to receive the report. Finally, if a water supply provides water to another municipality under contract, then the water supply owner shall, give by March 31 a copy of the Summary Report to the Municipality being supplied.

The contents of the Summary Report for the municipality must include the following:

1. A list of the requirements of the Safe Drinking Water Act and its regulations that the water system failed to meet during the reporting period, including the duration of the failure.
2. A list of the requirements of the water system's Certificate of Approval that the water system failed to meet during the report period, including the duration of the failure.
3. A list of any Orders that the water system failed to meet during the report time frame, including the duration of the failure.
4. For each of the above failures, a description of the measures taken to correct the failure.
5. A summary of the quantities and flow rates of water supplied "including monthly average, maximum daily flows, and daily instantaneous peak flow rates." *(Information is to enable the owner to assess the capability of the water system to meet existing and future demand).*
6. A statement that captures the comparison of the flow information to the rated capacity and flow rates stated in the water supply's approval.

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Issues of Non-Compliance

The following table lists the requirements of the Act, Regulations, System Approval (s) and any order that the system failed to meet at any time during the reporting period and measures taken to correct each failure:

Drinking Water Legislation	Requirements the system failed to meet	Duration	Corrective Action(s)	Status
Not Applicable				

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Assessment of System Flows and Rates of Water Taking

The following tables list the quantities and flow rates of the water supplied during this reporting period, including monthly average and maximum daily flows, daily instantaneous peak flow rates and a comparison to the rated capacity and flow rates specified in the system approval:

Well Number One

Approved Daily Volume: 326.88 cubic metres
Approved Flow Rate: 227 litres/minute

Month	Average Daily Volume (m^3)	Percent Of Approved Volume	Maximum Daily Volume (m^3)	Percent Of Approved Volume
January	123	38%	209	64%
February	122	37%	178	54%
March	127	39%	163	50%
April	177	54%	302	92%
May	143	44%	241	74%
June	102	31%	145	44%
July	99	30%	208	64%
August	95	29%	185	57%
September	103	31%	171	52%
October	85	26%	159	49%
November	90	27%	136	42%
December	129	39%	217	66%

Flow control is in the form of a pressure reducing valve that is equipped to open and close when the well pump is energized. The valve limits the flow of water from the well and prevents the pump from exceeding the permitted flow rates. Average flow rate when this well is operating is 204 litres per minute.

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Well Number Two

Approved Daily Volume: 262.08cubic metres
Approved Flow Rate: 182 litres/minute

Month	Average Daily Volume (m^3)	Percent Of Approved Volume	Maximum Daily Volume (m^3)	Percent Of Approved Volume
January	35	13%	56	21%
February	37	14%	53	20%
March	38	15%	49	19%
April	53	20%	94	36%
May	44	17%	74	28%
June	32	12%	45	17%
July	31	12%	70	27%
August	29	11%	59	23%
September	32	12%	53	20%
October	26	10%	49	19%
November	28	11%	42	16%
December	40	15%	67	26%

Flow control is in the form of a pressure reducing valve that is equipped to open and close when the well pump is energized. The valve limits the flow of water from the well and prevents the pump from exceeding the permitted flow rates. Average flow rate when this well is operating is 108 litres per minute

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DWCo. LTD

Well Number Three

Approved Daily Volume: 362.88 cubic metres
Approved Flow Rate: 252 litres/minute

Month	Average Daily Volume (m^3)	Percent Of Approved Volume	Maximum Daily Volume (m^3)	Percent Of Approved Volume
January	0	0%	0	0%
February	0	0%	0	0%
March	0	0%	0	0%
April	0	0%	0	0%
May	0	0%	0	0%
June	0	0%	0	0%
July	0	0%	0	0%
August	0	0%	0	0%
September	0	0%	0	0%
October	0	0%	0	0%
November	8	2%	155	43%
December	8	2%	199	55%

Flow control is in the form of a pressure reducing valve that is equipped to open and close when the well pump is energized. The valve limits the flow of water from the well and prevents the pump from exceeding the permitted flow rates. Average flow rate when this well is operating is 246 litres per minute

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DWCo. LTD

Distributed Water

Approved Daily Volume: 951.8 cubic **metres**
Approved Flow Rate: 661 Litres per **minute**

Month	Average Daily Volume (m^3)	Percent Of Approved Volume	Maximum Daily Volume (m^3)	Percent Of Approved Volume
January	158	17%	254	27%
February	160	17%	224	24%
March	166	17%	212	22%
April	232	24%	382	40%
May	186	20%	316	33%
June	134	14%	234	25%
July	131	14%	279	29%
August	124	13%	192	20%
September	135	14%	210	22%
October	111	12%	202	21%
November	119	12%	157	16%
December	168	18%	252	26%

Flow control is in the form of a pressure reducing valve located on the discharge side of each pressure pump. Theses valves limit the flow of treated water and prevents the distribution flow rate from exceeding the permitted flow rates. Average flow rate when pumps are operating is 330 litres per minute.

OPTIONAL ANNUAL REPORT TEMPLATE

Drinking Water System Number:	260063661
Drinking Water System Name:	Mansfield Well Supply
Drinking Water System Owner:	Township of Mulmur
Drinking Water System Category:	Large Municipal Residential
Period being reported:	January 01, 2020 to December 31, 2020

Complete if your Category is Large Municipal Residential or Small Municipal Residential

Does your Drinking Water System serve more than 10,000 people? Yes [ ] No[x]

Is your annual report available to the public at no charge on a web site on the Internet? Yes [X] No[]

Location where Summary Report required under O. Reg. 170/03 Schedule 22 will be available for inspection.

Report is available for inspection at the municipal office in Terra Nova

Complete for all other Categories

Number of Designated Facilities served:

N/A

Did you provide a copy of your annualreport to all Designated Facilities youserve?Yes[]No[]

Number of Interested Authorities you report to: N/A

Did you provide a copy of your annual report to all Interested Authorities you report to for each Designated Facility? Yes [] No []

***Note*: For the following tables below, additional rows or columns may be added, or an appendix may be attached to the report**

List all Drinking Water Systems (if any), which receive all their drinking water from your system:

Drinking Water System Name	Drinking Water System Number
N/A	

Did you provide a copy of your annual report to all Drinking Water System owners that are connected to you and to whom you provide all drinking water? Yes[ ] No[ ]

Indicate how you notified system users that your annual report is available and is free of charge.

[X] Public access/notice via the web
[ ] Public access/notice via Government Office
[ ]Public access/notice via a newspaper
[ ] Public access/notice via Public Request
[ ]Public access/notice via a Public Library
[ ]Public access/notice via other method________________

Describe your Drinking Water System

Water System is classified as a Large Municipal Residential Water System that currently serves approximately 153 service connections. The system is owned by the Township of Mulmur and operated by Dufferin Water Co. Ltd. Water is supplied via three municipal wells, a standpipe and a pumphouse. Inspection, maintenance and sampling are conducted on a regular basis in accordance with Ontario Regulation 170/03 to ensure the safety of the water supply

List all water treatment chemicals used over this reporting period

12 % Sodium Hypochlorite

Were any significant expenses incurred to?

[ ]Install required equipment
[ ]Repair required equipment
[X]Replace required equipment

Please provide a brief description and a breakdown of monetary expenses incurred

Replace Well 3 with new drilled well. +/- $40,000

Provide details on the notices submitted in accordance with subsection 18 (1) of the Safe Drinking Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre

Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
N/A					
N/A					

Microbiological testing done under the Schedule 10, 11 or 12 of Regulation 170/03,duringthisreportingperiod

		Number of Samples	Range of E. Coli Results (min#)-(max#)	Range of Total Coliform Results (min#)-(max#)	Number of HPC Samples	Range of HPC Results (min#)-(max#)
Raw		112	0 to 0	0 to 4	1	0 to 2
Treated		52	0 to 0	0 to 0	52	0 to 0
Distribution		116	0 to 0	0 to 0	52	0 to 3

Operational testing done under Schedule 7, 8 or 9 of Regulation 170/03 during the period covered by this Annual Report.

	Number of Grab Samples	Range of Results (min#)-(max#)	Unit of Measure
Turbidity	26	0.11-0.62	NTU
Chlorine	8760	1.42-2.47	Mg/L
Fluoride(If the DWS provides fluoridation)	N/A	N/A	N/A

NOTE: For continuous monitors use 8760 as the number of samples

Summary of additional testing and sampling carried out in accordance with the requirement of an approval, order or other legal instrument.

Date of legal instrument issued	Parameter	Date Sampled	Result	Unit of Measure
N/A				
N/A				

Summary of Inorganic parameters tested during this reporting period or the most recent sample results

Parameter	Sample Date	Result Value	Unit of Measure	Exceedance
Antimony	May 23/18	ND	ug/L	No
Arsenic	May 23/18	ND	ug/L	No
Barium	May 23/18	8.2	ug/L	No
Boron	May 23/18	36	ug/L	No
Cadmium	May 23/18	ND	ug/L	No
Chromium	May 23/18	ND	ug/L	No
*Lead	N/A	N/A	N/A	N/A
Mercury	May 23/18	ND	ug/L	No
Selenium	May 23/18	ND	ug/L	No
Sodium	May 23/18	15	mg/L	No
Uranium	May 23/18	ND	ug/L	No
Fluoride	May 23/18	0.1	mg/L	No
Nitrite	Dec 10/20	ND	mg/L	No
Nitrate	Dec 10/20	2.16	mg/L	No

***only for drinking water systems testing under Schedule 15.2; this includes large municipal non-residential systems, small municipal non-residential systems, non-municipal seasonal residential systems, large non-municipal non-residential systems, and small non-municipalnon-residential systems**

Summary of lead testing under Schedule 15.1 during this reporting period(applicabletothefollowingdrinkingwatersystems;largemunicipalresidentialsystems,smallmunicipalresidentialsystems,and non-municipalyear-roundresidentialsystems)

Location Type	Number of Samples	Range of Lead Results (min#)–(max #)	Unit of Measure	Number of Exceedances
Plumbing	N/A	N/A	N/A	N/A
Distribution	2	ND	Ug/L	0

Summary of Organic parameters sampled during this reporting period or the mostrecentsampleresults

Parameter	Sample Date	Result Value	Unit of Measure	Exceedance
Alachlor	May 23/18	ND	ug/L	No
Atrazine + N-dealkylated metobolites	May 23/18	ND	ug/L	No
Azinphos-methyl	May 23/18	ND	ug/L	No
Benzene	May 23/18	ND	ug/L	No
Benzo(a)pyrene	May 23/18	ND	ug/L	No
Bromoxynil	May 23/18	ND	ug/L	No
Carbaryl	May 23/18	ND	ug/L	No
Carbofuran	May 23/18	ND	ug/L	No
CarbonTetrachloride	May 23/18	ND	ug/L	No
Chlorpyrifos	May 23/18	ND	ug/L	No
Diazinon	May 23/18	ND	ug/L	No
Dicamba	May 23/18	ND	ug/L	No
1,2-Dichlorobenzene	May 23/18	ND	ug/L	No
1,4-Dichlorobenzene	May 23/18	ND	ug/L	No
1,2-Dichloroethane	May 23/18	ND	ug/L	No
1,1-Dichloroethylene(vinylidenechloride)	May 23/18	ND	ug/L	No
Dichloromethane	May 23/18	ND	ug/L	No
2-4Dichlorophenol	May 23/18	ND	ug/L	No
2,4-Dichlorophenoxyaceticacid(2,4-D)	May 23/18	ND	ug/L	No
Diclofop-methyl	May 23/18	ND	ug/L	No
Dimethoate	May 23/18	ND	ug/L	No
Diquat	May 23/18	ND	ug/L	No
Diuron	May 23/18	ND	ug/L	No
Glyphosate	May 23/18	ND	ug/L	No
HAAs(*Note*: show latest running annual average)	2020	ND	ug/L	NO
Lindane(Total)	May 23/18	ND	ug/L	No
Malathion	May 23/18	ND	ug/L	No
Metolachlor	May 23/18	ND	ug/L	No
Metribuzin	May 23/18	ND	ug/L	No
Monochlorobenzene	May 23/18	ND	ug/L	No

Paraquat	May 23/18	ND	ug/L	No
Pentachlorophenol	May 23/18	ND	ug/L	No
Phorate	May 23/18	ND	ug/L	No
Picloram	May 23/18	ND	ug/L	No
Polychlorinated Biphenyls (PCB)	May 23/18	ND	ug/L	No
Prometryne	May 23/18	ND	ug/L	No
Simazine	May 23/18	ND	ug/L	No
Terbufos	May 23/18	ND	ug/L	No
Tetrachloroethylene (perchloroethylene)	May 23/18	ND	ug/L	No
2,3,4,6-Tetrachlorophenol	May 23/18	ND	ug/L	No
THMs (*Note:* show latest running annual average)	2020	10.62	ug/L	NO
Triallate	May 23/18	ND	ug/L	No
Trichloroethylene	May 23/18	ND	ug/L	No
2,4,6-Trichlorophenol	May 23/18	ND	ug/L	No
Trifluralin	May 23/18	ND	ug/L	No
Vinyl Chloride	May 23/18	ND	ug/L	No
MCPA	May 23/18	ND	ug/L	No

List any Inorganic or Organic parameter(s) that exceeded half the standard prescribed in Schedule 2 of Ontario Drinking Water Quality Standards

Parameter	Result Value	Unit of Measure	Date of Sample
Sodium	15	Mg/L	May 23/18

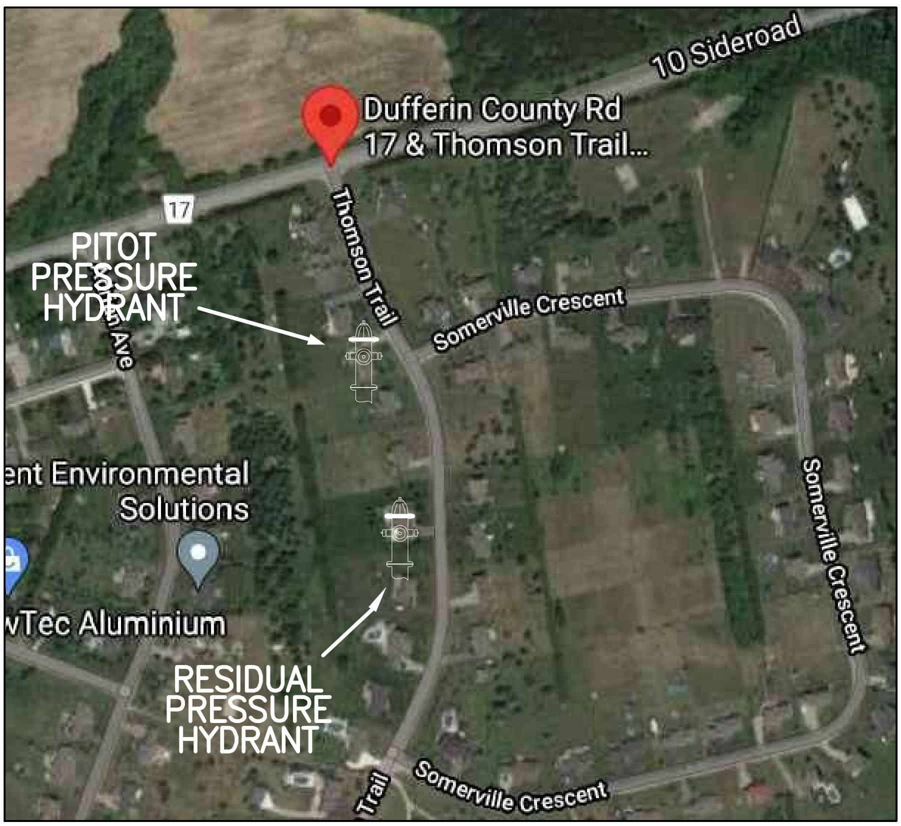
FLOW TEST RESULTS

FIRST FOR FIRE, LIFE SAFETY & SECURITY
VIPOND INC
est. 1945

DATE : AUG 25, 2021 TIME : 12:30 PM

LOCATION : 2-8 THOMSON TRAIL
MULMUR/MANSFIELD
ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



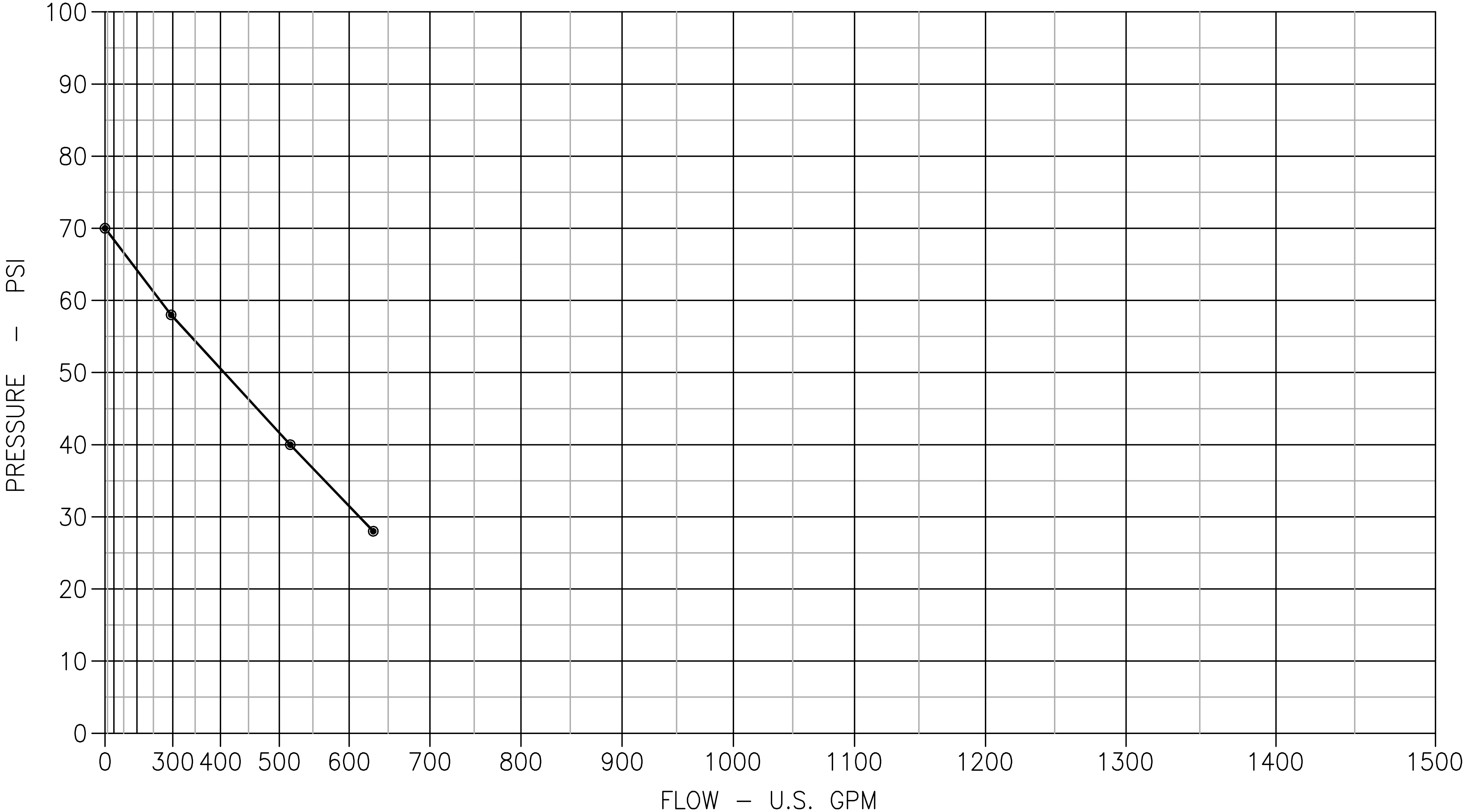
STATIC PRESSURE : 70 PSI

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1-1/8	0.995	58	62	294
2	1	1-3/4	0.90	40	34	519
3	1	2-1/2	0.90	28	14	631

2–8 THOMSON TRAIL	BY : LEN K./KRYSTIAN K
CITY OF MULMUR/MANSFIELD	OFFICE : BARRIE
ONTARIO	TEST BY : VIPOND & PUC
	DATE : AUG, 25, 2021

STATIC: 70 PSI

	RESIDUAL:		FLOW:
TEST#1	58 PSI	@	294 GPM
TEST#2	40 PSI	@	519 GPM
TEST#3	28 PSI	@	631 GPM



Designers considering a full-scale application of any new treatment technology should evaluate the above information and other details of any testing programs which have been undertaken by independent testing agencies necessary to ensure the viability of the proposed treatment and document their findings in the Design Brief (*Section 2.4.1 – Design Brief/Basis of Design*). Specific new technologies are not discussed in this guideline.

3.4 DESIGN FLOW

3.4.1 General

In general, water treatment plants should be designed on the basis of projected flows for a 20-year period. For large treatment plants, or where construction cost is an overriding factor, a lesser design period may be selected, but the minimum design period should not be less than 10 years. For intakes and/or outfalls, where the cost of the work is not substantially dependent on the size, a design period in excess of 20 years is recommended. Depending on circumstances, including the reliability of projections, a design to satisfy the ultimate requirements of the official plan for the plant service area under consideration may be appropriate. In all cases, the designer should also consider the flows at the start of the operation of the facilities and the potential for impact on unit process efficiency, delivered treated water quality due to stagnation, as well as flow metering difficulties.

The drinking-water system including the water treatment plant and treated water storage should be designed to satisfy the greater of the following demands:

- Maximum day demand plus fire flow (where ***fire protection*** is to be provided); or,
- ***Peak hour demand***.

The maximum day demand is the average usage on the maximum day. When actual water demand data are available, the designer should review the data and eliminate statistical outliers (e.g., excessive water demands that occurred as a result of a major trunk main break, and erroneous metering or recording) before selecting a value.

The fire flow demand will vary with the size of the municipality (chance of multiple fires at any time) and the nature of development (type of construction materials, building height and area, and density of development). The magnitude of the fire flow allowance is the responsibility of the municipality and the designer should consult with the municipality regarding its fire flow requirements (*Section 8.4 – Sizing of Storage Facilities* and *Section 10.1.2 – Fire Protection*).

The capacity of the treatment processes should be greater than the highest demand (typically maximum day demand) since allowance is needed for water required for in-plant use and process losses. Depending on the processes in the treatment plant, water may be lost as clarifier ***blowdown*** or ***membrane reject*** streams and treated water may be used for practices such as filter washing, service water, and chlorine injectors. Allowance is also needed for filter downtime during a wash cycle. The designer should be particularly careful in designing small treatment plants since in-plant water use can be a significant portion of total production.

The designer should consider the capacity of the plant to ensure that it is possible to produce sufficient water to satisfy the most onerous regularly occurring combination of water demand and raw water quality. This may occur in the spring when raw water quality from surface sources is often worse than average and raw water temperatures are low (reaction times are longer and the efficiency of sedimentation tanks and filters is reduced under peak solids loading). The design should be evaluated against the expected water demand at that time of the year. A most onerous condition also may occur at any time as a result of algal blooms. The designer should review the records for such challenging occurrences (*Section 3.6 – Plant Capacity Rating*).

3.4.2 Domestic Water Demands

Domestic water demands vary greatly from one water system to another. Depending upon such factors as the presence of service metering, lawn-watering practices, use of bleeders to prevent freezing, water quality, water conservation programs and leakage (*Section 3.5 – Water Conservation*), daily per capita consumption can vary from less than 180 L (48 USgal) to more than 1,500 L (396 USgal). For design purposes, existing reliable records should be used wherever possible. Domestic water demand used in design historically has ranged from 270 to 450 L/(cap·d) [70 to 120 USgal/(cap·d)]. With increased use of water metering and increased water conservation, the designer may find values at the low end of this range.

Minimum rate, maximum day and peak rate factors for the system should be based on existing flow data, where available. Table 3.1 provides peaking factors for use with average day demand when actual data are not available or are unreliable.

Table 3-1: Peaking Factors

POPULATION	MINIMUM RATE FACTOR (MINIMUM HOUR)	MAXIMUM DAY FACTOR	PEAK RATE FACTOR (PEAK HOUR)
500 - 1 000	0.40	2.75	4.13
1 001 - 2 000	0.45	2.50	3.75
2 001 - 3 000	0.45	2.25	3.38
3 001 - 10 000	0.50	2.00	3.00
10 001 - 25 000	0.60	1.90	2.85
25 001 - 50 000	0.65	1.80	2.70
50 001 - 75 000	0.65	1.75	2.62
75 001 -150 000	0.70	1.65	2.48
greater than 150 000	0.80	1.50	2.25

3.4.3 Commercial and Institutional Water Demands

Institutional and commercial flows should be determined by using historical records, where available. Where no records are available, the values in Table 3.2 should be used. For other commercial and tourist-commercial areas, an allowance of 28 m^3/(ha·d) [3000 USgal/(acre·d)] average flow should be used in the absence of reliable flow data.

When using the above unit demands, maximum day and peak rate factors should be developed. For establishments in operation for only a portion of the day such as schools and shopping plazas, the water usage should also be factored accordingly. For instance, with schools operating for 8 hours per day, the water use rate would be at an average rate of 70 L/(student·day) [19 USgal/(student·day)] x 24/8 or 210 L/student (55 USgal/student) over the 8-hour period of operation. The water use will drop to a residual amount during the remainder of the day. Schools generally do not exhibit large maximum day to average day ratios and a factor of 1.5 will generally cover this variation. For estimation of ***peak demand*** rates, an assessment of the water-using fixtures is generally necessary and a fixture-unit approach should be used.

8.4.1 Chemical Disinfection Contact & Water Treatment Plant Storage

Any volume required to provide chemical disinfection contact time is not available for storage and should not be included in storage calculations. Refer to *Section 5.9 – Disinfection* for more information on primary disinfection and contact time.

8.4.2 Sizing Treated Water Storage for Systems Providing Fire Protection

The following method for sizing water storage needs may not fulfill the fire protection requirements of the municipality insurance company or the Fire Underwriters Survey. For fire flow requirements, refer to the latest edition of the Fire Underwriters Survey document *Water Supply for Public Fire Protection*[12]. Historically, small municipalities in Ontario have used the following criteria.

Table 8-1: Fire Flow Requirements

EQUIVALENT POPULATION[1]	SUGGESTED FIRE FLOW (L/s)	DURATION (HOURS)
500 – 1 000	38 (10 ft/s)	2
1 000	64 (17 ft/s)	2
1 500	79 (21 ft/s)	2
2 000	95 (25 ft/s)	2
3 000	110 (29 ft/s)	2
4 000	125 (33 ft/s)	2
5 000	144 (38 ft/s)	2
6 000	159 (42 ft/s)	3
10 000	189 (50 ft/s)	3
13 000	220 (58 ft/s)	3
17 000	250 (66 ft/s)	4
27 000	318 (84 ft/s)	5
33 000	348 (92 ft/s)	5
40 000	378 (100 ft/s)	6
Note [1]: When determining the fire flow allowance for commercial or industrial areas, it is recommended that the area occupied by the commercial/industrial complex be considered at an equivalent population density to the surrounding residential lands.		

[12] Fire Underwriters Survey is a national organization administered by (c/o) CGI Insurance Business Services, 150 Commerce Valley Drive, Lockbox 200, Markham ON L3T 7Z3, 905-882-6300, in Ontario.

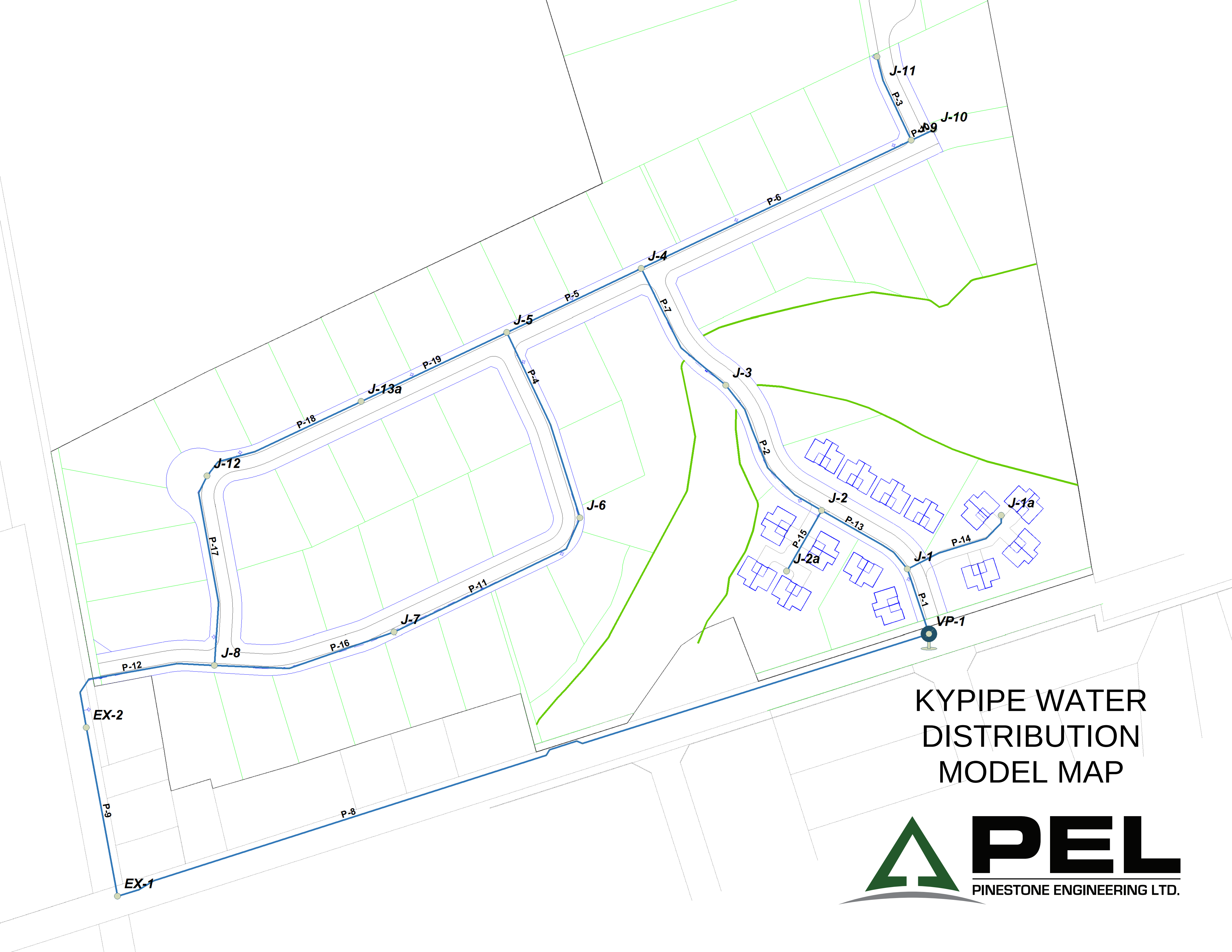
Table 3-1: Peaking Factors

POPULATION	MINIMUM RATE FACTOR (MINIMUM HOUR)	MAXIMUM DAY FACTOR	PEAK RATE FACTOR (PEAK HOUR)
500 - 1 000	0.40	2.75	4.13
1 001 - 2 000	0.45	2.50	3.75
2 001 - 3 000	0.45	2.25	3.38
3 001 - 10 000	0.50	2.00	3.00
10 001 - 25 000	0.60	1.90	2.85
25 001 - 50 000	0.65	1.80	2.70
50 001 - 75 000	0.65	1.75	2.62
75 001 -150 000	0.70	1.65	2.48
greater than 150 000	0.80	1.50	2.25

3.4.3 Commercial and Institutional Water Demands

Institutional and commercial flows should be determined by using historical records, where available. Where no records are available, the values in Table 3.2 should be used. For other commercial and tourist-commercial areas, an allowance of 28 m^3/(ha·d) [3000 USgal/(acre·d)] average flow should be used in the absence of reliable flow data.

When using the above unit demands, maximum day and peak rate factors should be developed. For establishments in operation for only a portion of the day such as schools and shopping plazas, the water usage should also be factored accordingly. For instance, with schools operating for 8 hours per day, the water use rate would be at an average rate of 70 L/(student·day) [19 USgal/(student·day)] x 24/8 or 210 L/student (55 USgal/student) over the 8-hour period of operation. The water use will drop to a residual amount during the remainder of the day. Schools generally do not exhibit large maximum day to average day ratios and a factor of 1.5 will generally cover this variation. For estimation of ***peak demand*** rates, an assessment of the water-using fixtures is generally necessary and a fixture-unit approach should be used.



KYPIPE WATER DISTRIBUTION MODEL MAP

PEL
PINESTONE ENGINEERING LTD.

ARMSTRONG ESTATES OF MANSFIELD - PROPOSED SUBDIVISION
WATERMAIN NETWORK ANALYSIS

File: 20-11584M
Date: January, 25th, 2024

NODE	PIPE ELEVATION (m)	Units	POPULATION	WATER DEMAND AVE DAY (L/S)	MAX DAY (L/S)	PEAK HOURLY (L/S)	Size (mm)
VP1	309.25	0	0	0.00	0.00	0.00	200
J-1	308.15	6	20	0.10	0.28	0.42	200
J-1a	308.30	8	26	0.14	0.37	0.56	200
J-2	307.00	6	20	0.10	0.28	0.42	200
J-2a	308.40	8	26	0.14	0.37	0.56	200
J-3	301.50	0	0	0.00	0.00	0.00	200
J-4	306.90	6	20	0.10	0.28	0.42	200
J-5	308.65	4	13	0.07	0.19	0.28	200
J-6	307.30	4	13	0.07	0.19	0.28	200
J-7	308.70	6	20	0.10	0.28	0.42	200
J-8	310.00	5	16	0.08	0.23	0.35	200
J-9	308.20	4	13	0.07	0.19	0.28	200
J-10	308.20	2	7	0.03	0.09	0.14	200
J-11	308.55	0	0	0.00	0.00	0.00	200
J-12	311.60	6	20	0.10	0.28	0.42	200
J-13a	310.10	6	20	0.10	0.28	0.42	200
EX-1	313.40						150
EX-2	312.80						150
TOTALS		71.00	231	1.20	3.31	4.96	

Notes:
1) Water demands based on 3.25 PPU for single detached / semi-detached dwellings
2) Max day factor = 2.75 and peaking factor = 4.13 as per MECP Guidelines (Table 3-1)
3) Average residential consumption rate of 450 Litres/Capita/Day
4) Fire demand of 38L/s used at J-12 per MECP Guidelines (Table 8-1) - Highest Watermain Elevation

MAX DAY KYPIPE
OUTPUT FILE

```
* * * * * * * * * * * * *  K Y P I P E  * * * * * * * * * * * *
*                                                             *
*  Pipe Network Modeling Software                             *
*                                                             *
*  CopyRighted by KYPIPE LLC (www.kypipe.com)                 *
*  Version: 10.009  10/01/2019                                *
*  Serial #:  8-10075593                                      *
*  Interface:  Classic                                        *
*  Licensed for Pipe2008                                      *
*                                                             *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Date & Time: Fri Jan 26 22:20:08 2024

Master File : c:\users\jvoisin\desktop\water servicing\11584b mansfield water model max day.KYP\11584b mansfield water model max day.P2K

****
S U M M A R Y   O F   O R I G I N A L   D A T A
****

U N I T S   S P E C I F I E D

FLOWRATE .... = liters/second
HEAD (HGL) .... = meters
PRESSURE .... = kpa

P I P E L I N E   D A T A

STATUS CODE: XX -CLOSED PIPE   CV -CHECK VALVE

P I P E N A M E	NODE NAMES #1	#2	LENGTH (m)	DIAMETER (mm)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-1	VP-1	J-1	44.36	200.00	138.0000	1.82
P-2	J-3	J-2	105.25	200.00	138.0000	1.85
P-3	J-9	J-11	58.60	200.00	138.0000	0.00
P-4	J-5	J-6	129.30	200.00	138.0000	1.90
P-5	J-4	J-5	96.45	200.00	138.0000	1.40
P-6	J-4	J-9	193.29	200.00	138.0000	4.05
P-7	J-3	J-4	95.43	200.00	138.0000	0.35

P-8	VP-1	EX-1	554.30	150.00	138.0000	0.00
P-9	EX-1	EX-2	110.98	150.00	138.0000	0.00
P-10	J-9	J-10	16.31	200.00	138.0000	0.00
P-11	J-6	J-7	145.62	200.00	138.0000	0.00
P-12	EX-2	J-8	115.23	200.00	138.0000	0.70
P-13	J-2	J-1	67.90	200.00	138.0000	0.00
P-14	J-1	J-1a	73.61	200.00	138.0000	0.00
P-15	J-2	J-2a	45.45	200.00	138.0000	0.00
P-16	J-7	J-8	120.33	200.00	138.0000	0.00
P-17	J-8	J-12	125.22	200.00	138.0000	0.00
P-18	J-12	J-13a	112.49	200.00	138.0000	0.00
P-19	J-13a	J-5	104.45	200.00	138.0000	0.00

P U M P/L O S S   E L E M E N T   D A T A

THERE IS A DEVICE AT NODE   VP-1 DESCRIBED BY THE FOLLOWING DATA: (ID= 1)

HEAD (m)	FLOWRATE (l/s)	EFFICIENCY (%)
51.01	0.00	75.00
21.49	39.81	75.00
-55.58	79.62	75.00

N O D E   D A T A

NODE NAME	NODE TITLE	EXTERNAL DEMAND (l/s)	JUNCTION ELEVATION (m)	EXTERNAL GRADE (m)
EX-1		0.00	311.80	
EX-2		0.00	311.30	
J-1		0.28	308.15	
J-2		0.28	307.00	
J-3		0.00	301.50	
J-4		0.28	306.90	
J-5		0.19	308.65	
J-6		0.19	307.30	
J-7		0.28	308.70	
J-8		0.23	310.00	
J-9		0.19	308.20	
J-10		0.09	308.20	
J-11		0.00	308.55	
J-12		0.28	311.60	
J-13a		0.28	310.10	

```
      J-1a                      0.37       308.30
      J-2a                      0.37       308.40
      VP-1                      ----       309.25        309.25
```

O U T P U T   O P T I O N   D A T A

```
 OUTPUT SELECTION:  ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
         MAXIMUM AND MINIMUM PRESSURES       =    5
         MAXIMUM AND MINIMUM VELOCITIES      =    5
         MAXIMUM AND MINIMUM HEAD LOSS/1000  =    5
```

S Y S T E M   C O N F I G U R A T I O N

```
     NUMBER OF PIPES ..................(P) =    19
     NUMBER OF END NODES ..............(J) =    17
     NUMBER OF PRIMARY LOOPS ..........(L) =     2
     NUMBER OF SUPPLY NODES ...........(F) =     1
     NUMBER OF SUPPLY ZONES ...........(Z) =     1
```

```
================================================================================
Case:   0
```

RESULTS OBTAINED AFTER   11 TRIALS: ACCURACY = 0.49338E-04

S I M U L A T I O N   D E S C R I P T I O N   (L A B E L)

P I P E L I N E   R E S U L T S

```
   STATUS CODE:   XX -CLOSED PIPE    CV -CHECK VALVE

   P I P E            NODE NUMBERS     FLOWRATE     HEAD  MINOR   LINE   HL+ML/
HL/
   N A M E            #1        #2                  LOSS   LOSS   VELO.   1000
1000
                                          lps         m      m      m/s    m/m
m/m

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

P-1	VP-1	J-1	2.70	0.00	0.00	0.09	0.07	0.05
P-2	J-3	J-2	-1.40	0.00	0.00	0.04	0.02	0.02
P-3	J-9	J-11	0.00	0.00	0.00	0.00	0.00	0.00
P-4	J-5	J-6	0.29	0.00	0.00	0.01	0.00	0.00
P-5	J-4	J-5	0.84	0.00	0.00	0.03	0.01	0.01
P-6	J-4	J-9	0.28	0.00	0.00	0.01	0.00	0.00
P-7	J-3	J-4	1.40	0.00	0.00	0.04	0.02	0.02
P-8	VP-1	EX-1	0.61	0.01	0.00	0.03	0.01	0.01
P-9	EX-1	EX-2	0.61	0.00	0.00	0.03	0.01	0.01
P-10	J-9	J-10	0.09	0.00	0.00	0.00	0.00	0.00
P-11	J-6	J-7	0.10	0.00	0.00	0.00	0.00	0.00
P-12	EX-2	J-8	0.61	0.00	0.00	0.02	0.00	0.00
P-13	J-2	J-1	-2.05	0.00	0.00	0.07	0.03	0.03
P-14	J-1	J-1a	0.37	0.00	0.00	0.01	0.00	0.00
P-15	J-2	J-2a	0.37	0.00	0.00	0.01	0.00	0.00
P-16	J-7	J-8	-0.18	0.00	0.00	0.01	0.00	0.00
P-17	J-8	J-12	0.20	0.00	0.00	0.01	0.00	0.00
P-18	J-12	J-13a	-0.08	0.00	0.00	0.00	0.00	0.00
P-19	J-13a	J-5	-0.36	0.00	0.00	0.01	0.00	0.00

P U M P/L O S S   E L E M E N T   R E S U L T S

NAME	FLOWRATE	INLET HEAD	OUTLET HEAD	PUMP HEAD	EFFIC- ENCY	USEFUL POWER	INCREMTL COST	TOTAL COST	#PUMPS PARALLEL	#PUMPS SERIES	NPSH Avail.	Case
	lps	m	m	m	%	kW	$	$				

m

VP-1	3.31	0.00	50.72	50.7	75.00	2.	0.1	0.1
**	**	10.1	0.0000					

N O D E   R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND lps	HYDRAULIC GRADE m	NODE ELEVATION m	PRESSURE HEAD m	NODE PRESSURE kPa
EX-1		0.00	359.96	311.80	48.16	472.30
EX-2		0.00	359.96	311.30	48.66	477.19
J-1		0.28	359.97	308.15	51.82	508.13
J-2		0.28	359.96	307.00	52.96	519.39
J-3		0.00	359.96	301.50	58.46	573.31
J-4		0.28	359.96	306.90	53.06	520.34
J-5		0.19	359.96	308.65	51.31	503.17
J-6		0.19	359.96	307.30	52.66	516.41
J-7		0.28	359.96	308.70	51.26	502.68
J-8		0.23	359.96	310.00	49.96	489.93
J-9		0.19	359.96	308.20	51.76	507.59
J-10		0.09	359.96	308.20	51.76	507.59
J-11		0.00	359.96	308.55	51.41	504.16
J-12		0.28	359.96	311.60	48.36	474.24
J-13a		0.28	359.96	310.10	49.86	488.95
J-1a		0.37	359.97	308.30	51.67	506.66
J-2a		0.37	359.96	308.40	51.56	505.66
VP-1		----	359.97	309.25	50.72	497.38

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES kPa	JUNCTION NUMBER	MINIMUM PRESSURES kPa
J-3	573.31	EX-1	472.30
J-4	520.34	J-12	474.24
J-2	519.39	EX-2	477.19
J-6	516.41	J-13a	488.95
J-1	508.13	J-8	489.93

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (m/s)	PIPE NUMBER	MINIMUM VELOCITY (m/s)
P-1	0.09	P-18	0.00
P-13	0.07	P-10	0.00
P-2	0.04	P-11	0.00
P-7	0.04	P-16	0.01
P-9	0.03	P-17	0.01

H L + M L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL+ML/1000 (m/m)	PIPE NUMBER	MINIMUM HL+ML/1000 (m/m)
P-1	0.07	P-18	0.00
P-13	0.03	P-10	0.00
P-2	0.02	P-11	0.00
P-7	0.02	P-16	0.00
P-9	0.01	P-17	0.00

H L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL/1000 (m/m)	PIPE NUMBER	MINIMUM HL/1000 (m/m)
P-1	0.05	P-18	0.00
P-13	0.03	P-10	0.00
P-2	0.02	P-11	0.00
P-7	0.02	P-16	0.00
P-9	0.01	P-17	0.00

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE lps	NODE TITLE
VP-1	3.31	

NET SYSTEM INFLOW = 3.31

```
 NET SYSTEM OUTFLOW =      0.00
 NET SYSTEM DEMAND  =      3.31
================================================================================
Total Power Cost


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

              TOTAL POWER COST($) FOR THIS SIMULATION =      0.11

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

           ***** HYDRAULIC ANALYSIS COMPLETED *****
```

PEAK HOUR KYPIPE
OUTPUT FILE

```
* * * * * * * * * * * *  K Y P I P E  * * * * * * * * * * * *
*                                                           *
*  Pipe Network Modeling Software                           *
*                                                           *
*  CopyRighted by KYPIPE LLC (www.kypipe.com)               *
*  Version: 10.009  10/01/2019                              *
*  Serial #:  8-10075593                                    *
*  Interface:  Classic                                      *
*  Licensed for Pipe2008                                    *
*                                                           *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Date & Time: Fri Jan 26 22:15:28 2024

Master File : c:\users\jvoisin\desktop\water servicing\11584b mansfield water model peak hour.KYP\11584b mansfield water model peak hour.P2K

```
***********************************************
 S U M M A R Y   O F   O R I G I N A L   D A T A
***********************************************
```

U N I T S   S P E C I F I E D

FLOWRATE .... = liters/second
HEAD (HGL) .... = meters
PRESSURE .... = kpa

P I P E L I N E   D A T A

STATUS CODE: XX -CLOSED PIPE   CV -CHECK VALVE

P I P E N A M E	NODE NAMES #1	#2	LENGTH (m)	DIAMETER (mm)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-1	VP-1	J-1	44.36	200.00	138.0000	1.82
P-2	J-3	J-2	105.25	200.00	138.0000	1.85
P-3	J-9	J-11	58.60	200.00	138.0000	0.00
P-4	J-5	J-6	129.30	200.00	138.0000	1.90
P-5	J-4	J-5	96.45	200.00	138.0000	1.40
P-6	J-4	J-9	193.29	200.00	138.0000	4.05
P-7	J-3	J-4	95.43	200.00	138.0000	0.35

P-8	VP-1	EX-1	554.30	150.00	138.0000	0.00
P-9	EX-1	EX-2	110.98	150.00	138.0000	0.00
P-10	J-9	J-10	16.31	200.00	138.0000	0.00
P-11	J-6	J-7	145.62	200.00	138.0000	0.00
P-12	EX-2	J-8	115.23	200.00	138.0000	0.70
P-13	J-2	J-1	67.90	200.00	138.0000	0.00
P-14	J-1	J-1a	73.61	200.00	138.0000	0.00
P-15	J-2	J-2a	45.45	200.00	138.0000	0.00
P-16	J-7	J-8	120.33	200.00	138.0000	0.00
P-17	J-8	J-12	125.22	200.00	138.0000	0.00
P-18	J-12	J-13a	112.49	200.00	138.0000	0.00
P-19	J-13a	J-5	104.45	200.00	138.0000	0.00

P U M P/L O S S   E L E M E N T   D A T A

THERE IS A DEVICE AT NODE VP-1 DESCRIBED BY THE FOLLOWING DATA: (ID= 1)

HEAD (m)	FLOWRATE (l/s)	EFFICIENCY (%)
51.01	0.00	75.00
21.49	39.81	75.00
-55.58	79.62	75.00

N O D E   D A T A

NODE NAME	NODE TITLE	EXTERNAL DEMAND (l/s)	JUNCTION ELEVATION (m)	EXTERNAL GRADE (m)
EX-1		0.00	311.80	
EX-2		0.00	311.30	
J-1		0.42	308.15	
J-2		0.42	307.00	
J-3		0.00	301.50	
J-4		0.42	306.90	
J-5		0.28	308.65	
J-6		0.28	307.30	
J-7		0.42	308.70	
J-8		0.35	310.00	
J-9		0.28	308.20	
J-10		0.14	308.20	
J-11		0.00	308.55	
J-12		0.42	311.60	
J-13a		0.42	310.10	

```
      J-1a                      0.56       308.30
      J-2a                      0.56       308.40
      VP-1                      ----       309.25         309.25



 O U T P U T   O P T I O N   D A T A

 OUTPUT SELECTION:  ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
         MAXIMUM AND MINIMUM PRESSURES       =    5
         MAXIMUM AND MINIMUM VELOCITIES      =    5
         MAXIMUM AND MINIMUM HEAD LOSS/1000  =    5



 S Y S T E M   C O N F I G U R A T I O N

     NUMBER OF PIPES ..................(P) =    19
     NUMBER OF END NODES ..............(J) =    17
     NUMBER OF PRIMARY LOOPS ..........(L) =     2
     NUMBER OF SUPPLY NODES ...........(F) =     1
     NUMBER OF SUPPLY ZONES ...........(Z) =     1

================================================================================
Case:   0


 RESULTS OBTAINED AFTER   11 TRIALS: ACCURACY = 0.17242E-06



 S I M U L A T I O N   D E S C R I P T I O N   (L A B E L)




 P I P E L I N E   R E S U L T S

   STATUS CODE:   XX -CLOSED PIPE    CV -CHECK VALVE

   P I P E             NODE NUMBERS     FLOWRATE     HEAD  MINOR   LINE   HL+ML/
HL/
   N A M E             #1        #2                  LOSS   LOSS   VELO.   1000
1000
                                          lps         m      m      m/s    m/m
m/m

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

P-1	VP-1	J-1	4.06	0.00	0.00	0.13	0.14	0.11
P-2	J-3	J-2	-2.10	0.00	0.00	0.07	0.04	0.03
P-3	J-9	J-11	0.00	0.00	0.00	0.00	0.00	0.00
P-4	J-5	J-6	0.43	0.00	0.00	0.01	0.00	0.00
P-5	J-4	J-5	1.26	0.00	0.00	0.04	0.01	0.01
P-6	J-4	J-9	0.42	0.00	0.00	0.01	0.00	0.00
P-7	J-3	J-4	2.10	0.00	0.00	0.07	0.03	0.03
P-8	VP-1	EX-1	0.91	0.02	0.00	0.05	0.03	0.03
P-9	EX-1	EX-2	0.91	0.00	0.00	0.05	0.03	0.03
P-10	J-9	J-10	0.14	0.00	0.00	0.00	0.00	0.00
P-11	J-6	J-7	0.15	0.00	0.00	0.00	0.00	0.00
P-12	EX-2	J-8	0.91	0.00	0.00	0.03	0.01	0.01
P-13	J-2	J-1	-3.08	0.00	0.00	0.10	0.07	0.07
P-14	J-1	J-1a	0.56	0.00	0.00	0.02	0.00	0.00
P-15	J-2	J-2a	0.56	0.00	0.00	0.02	0.00	0.00
P-16	J-7	J-8	-0.27	0.00	0.00	0.01	0.00	0.00
P-17	J-8	J-12	0.29	0.00	0.00	0.01	0.00	0.00
P-18	J-12	J-13a	-0.13	0.00	0.00	0.00	0.00	0.00
P-19	J-13a	J-5	-0.55	0.00	0.00	0.02	0.00	0.00

P U M P/L O S S   E L E M E N T   R E S U L T S

NAME	FLOWRATE	INLET HEAD	OUTLET HEAD	PUMP HEAD	EFFIC- ENCY	USEFUL POWER	INCREMTL COST	TOTAL COST	#PUMPS PARALLEL	#PUMPS SERIES	NPSH Avail.	Case
	lps	m	m	m	%	kW	$	$				

m

VP-1 4.97 0.00 50.39 50.4 75.00 2. 0.2 0.2
** ** 10.1 0.0000

N O D E   R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND lps	HYDRAULIC GRADE m	NODE ELEVATION m	PRESSURE HEAD m	NODE PRESSURE kPa
EX-1		0.00	359.62	311.80	47.82	468.97
EX-2		0.00	359.62	311.30	48.32	473.84
J-1		0.42	359.63	308.15	51.48	504.85
J-2		0.42	359.63	307.00	52.63	516.09
J-3		0.00	359.62	301.50	58.12	569.98
J-4		0.42	359.62	306.90	52.72	517.00
J-5		0.28	359.62	308.65	50.97	499.82
J-6		0.28	359.62	307.30	52.32	513.06
J-7		0.42	359.62	308.70	50.92	499.33
J-8		0.35	359.62	310.00	49.62	486.58
J-9		0.28	359.62	308.20	51.42	504.24
J-10		0.14	359.62	308.20	51.42	504.24
J-11		0.00	359.62	308.55	51.07	500.81
J-12		0.42	359.62	311.60	48.02	470.89
J-13a		0.42	359.62	310.10	49.52	485.60
J-1a		0.56	359.63	308.30	51.33	503.38
J-2a		0.56	359.63	308.40	51.23	502.35
VP-1		----	359.64	309.25	50.39	494.13

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES kPa	JUNCTION NUMBER	MINIMUM PRESSURES kPa
J-3	569.98	EX-1	468.97
J-4	517.00	J-12	470.89
J-2	516.09	EX-2	473.84
J-6	513.06	J-13a	485.60
J-1	504.85	J-8	486.58

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (m/s)	PIPE NUMBER	MINIMUM VELOCITY (m/s)
P-1	0.13	P-18	0.00
P-13	0.10	P-10	0.00
P-2	0.07	P-11	0.00
P-7	0.07	P-16	0.01
P-8	0.05	P-17	0.01

H L + M L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL+ML/1000 (m/m)	PIPE NUMBER	MINIMUM HL+ML/1000 (m/m)
P-1	0.14	P-18	0.00
P-13	0.07	P-10	0.00
P-2	0.04	P-11	0.00
P-7	0.03	P-16	0.00
P-8	0.03	P-17	0.00

H L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL/1000 (m/m)	PIPE NUMBER	MINIMUM HL/1000 (m/m)
P-1	0.11	P-18	0.00
P-13	0.07	P-10	0.00
P-2	0.03	P-11	0.00
P-7	0.03	P-16	0.00
P-8	0.03	P-17	0.00

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE lps	NODE TITLE
VP-1	4.97	

NET SYSTEM INFLOW = 4.97

```
 NET SYSTEM OUTFLOW =      0.00
 NET SYSTEM DEMAND  =      4.97
=================================================================================
Total Power Cost



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

              TOTAL POWER COST($) FOR THIS SIMULATION =      0.16

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


           ***** HYDRAULIC ANALYSIS COMPLETED *****
```

```
* * * * * * * * * * * *  K Y P I P E  * * * * * * * * * * * *
*                                                           *
*  Pipe Network Modeling Software                           *
*                                                           *
*  CopyRighted by KYPIPE LLC (www.kypipe.com)               *
*  Version: 10.009  10/01/2019                              *
*  Serial #:  8-10075593                                    *
*  Interface:  Classic                                      *
*  Licensed for Pipe2008                                    *
*                                                           *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Date & Time: Fri Jan 26 22:21:30 2024

Master File : c:\users\jvoisin\desktop\water servicing\11584b mansfield water model max day.KYP\11584b mansfield water model max day.P2K

```
************************************************
 S U M M A R Y   O F   O R I G I N A L   D A T A
************************************************
```

U N I T S   S P E C I F I E D

FLOWRATE .... = liters/second
HEAD (HGL) .... = meters
PRESSURE .... = kpa

P I P E L I N E   D A T A

STATUS CODE: XX -CLOSED PIPE   CV -CHECK VALVE

P I P E N A M E	NODE NAMES #1	#2	LENGTH (m)	DIAMETER (mm)	ROUGHNESS COEFF.	MINOR LOSS COEFF.
P-1	VP-1	J-1	44.36	200.00	138.0000	1.82
P-2	J-3	J-2	105.25	200.00	138.0000	1.85
P-3	J-9	J-11	58.60	200.00	138.0000	0.00
P-4	J-5	J-6	129.30	200.00	138.0000	1.90
P-5	J-4	J-5	96.45	200.00	138.0000	1.40
P-6	J-4	J-9	193.29	200.00	138.0000	4.05
P-7	J-3	J-4	95.43	200.00	138.0000	0.35

P-8	VP-1	EX-1	554.30	150.00	138.0000	0.00
P-9	EX-1	EX-2	110.98	150.00	138.0000	0.00
P-10	J-9	J-10	16.31	200.00	138.0000	0.00
P-11	J-6	J-7	145.62	200.00	138.0000	0.00
P-12	EX-2	J-8	115.23	200.00	138.0000	0.70
P-13	J-2	J-1	67.90	200.00	138.0000	0.00
P-14	J-1	J-1a	73.61	200.00	138.0000	0.00
P-15	J-2	J-2a	45.45	200.00	138.0000	0.00
P-16	J-7	J-8	120.33	200.00	138.0000	0.00
P-17	J-8	J-12	125.22	200.00	138.0000	0.00
P-18	J-12	J-13a	112.49	200.00	138.0000	0.00
P-19	J-13a	J-5	104.45	200.00	138.0000	0.00

P U M P/L O S S   E L E M E N T   D A T A

THERE IS A DEVICE AT NODE VP-1 DESCRIBED BY THE FOLLOWING DATA: (ID= 1)

HEAD (m)	FLOWRATE (l/s)	EFFICIENCY (%)
51.01	0.00	75.00
21.49	39.81	75.00
-55.58	79.62	75.00

N O D E   D A T A

NODE NAME	NODE TITLE	EXTERNAL DEMAND (l/s)	JUNCTION ELEVATION (m)	EXTERNAL GRADE (m)
EX-1		0.00	311.80	
EX-2		0.00	311.30	
J-1		0.28	308.15	
J-2		0.28	307.00	
J-3		0.00	301.50	
J-4		0.28	306.90	
J-5		0.19	308.65	
J-6		0.19	307.30	
J-7		0.28	308.70	
J-8		0.23	310.00	
J-9		0.19	308.20	
J-10		0.09	308.20	
J-11		0.00	308.55	
J-12		38.28	311.60	
J-13a		0.28	310.10	

```
      J-1a                      0.37       308.30
      J-2a                      0.37       308.40
      VP-1                      ----       309.25         309.25


 O U T P U T   O P T I O N   D A T A

 OUTPUT SELECTION:  ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
         MAXIMUM AND MINIMUM PRESSURES       =    5
         MAXIMUM AND MINIMUM VELOCITIES      =    5
         MAXIMUM AND MINIMUM HEAD LOSS/1000  =    5



 S Y S T E M   C O N F I G U R A T I O N

     NUMBER OF PIPES ...................(P) =    19
     NUMBER OF END NODES ...............(J) =    17
     NUMBER OF PRIMARY LOOPS ...........(L) =     2
     NUMBER OF SUPPLY NODES ............(F) =     1
     NUMBER OF SUPPLY ZONES ............(Z) =     1


================================================================================
Case:   0


 RESULTS OBTAINED AFTER    6 TRIALS: ACCURACY = 0.70923E-04



 S I M U L A T I O N   D E S C R I P T I O N   (L A B E L)




 P I P E L I N E   R E S U L T S

   STATUS CODE:   XX -CLOSED PIPE    CV -CHECK VALVE

   P I P E             NODE NUMBERS     FLOWRATE     HEAD  MINOR   LINE   HL+ML/
HL/
   N A M E             #1        #2                  LOSS   LOSS   VELO.   1000
1000
                                          lps         m      m      m/s    m/m
m/m

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

P-1	VP-1	J-1	29.92	0.20	0.08	0.95	6.34	4.44
P-2	J-3	J-2	-28.62	0.43	0.08	0.91	4.83	4.09
P-3	J-9	J-11	0.00	0.00	0.00	0.00	0.00	0.00
P-4	J-5	J-6	8.60	0.06	0.01	0.27	0.50	0.44
P-5	J-4	J-5	28.06	0.38	0.06	0.89	4.53	3.94
P-6	J-4	J-9	0.28	0.00	0.00	0.01	0.00	0.00
P-7	J-3	J-4	28.62	0.39	0.01	0.91	4.24	4.09
P-8	VP-1	EX-1	11.39	1.67	0.00	0.64	3.01	3.01
P-9	EX-1	EX-2	11.39	0.33	0.00	0.64	3.01	3.01
P-10	J-9	J-10	0.09	0.00	0.00	0.00	0.00	0.00
P-11	J-6	J-7	8.41	0.06	0.00	0.27	0.42	0.42
P-12	EX-2	J-8	11.39	0.09	0.00	0.36	0.78	0.74
P-13	J-2	J-1	-29.27	0.29	0.00	0.93	4.26	4.26
P-14	J-1	J-1a	0.37	0.00	0.00	0.01	0.00	0.00
P-15	J-2	J-2a	0.37	0.00	0.00	0.01	0.00	0.00
P-16	J-7	J-8	8.13	0.05	0.00	0.26	0.40	0.40
P-17	J-8	J-12	19.29	0.25	0.00	0.61	1.97	1.97
P-18	J-12	J-13a	-18.99	0.22	0.00	0.60	1.91	1.91
P-19	J-13a	J-5	-19.27	0.21	0.00	0.61	1.97	1.97

P U M P/L O S S   E L E M E N T   R E S U L T S

NAME	FLOWRATE	INLET HEAD	OUTLET HEAD	PUMP HEAD	EFFIC- ENCY	USEFUL POWER	INCREMTL COST	TOTAL COST	#PUMPS PARALLEL	#PUMPS SERIES	NPSH Avail.	Case
	lps	m	m	m	%	kW	$	$				

m

VP-1 41.31 0.00 19.39 19.4 75.00 8. 0.5 0.5
** ** 10.1 0.0000

N O D E   R E S U L T S

NODE NAME	NODE TITLE	EXTERNAL DEMAND lps	HYDRAULIC GRADE m	NODE ELEVATION m	PRESSURE HEAD m	NODE PRESSURE kPa
EX-1		0.00	326.97	311.80	15.17	148.78
EX-2		0.00	326.64	311.30	15.34	150.40
J-1		0.28	328.36	308.15	20.21	198.20
J-2		0.28	328.07	307.00	21.07	206.64
J-3		0.00	327.56	301.50	26.06	255.58
J-4		0.28	327.16	306.90	20.26	198.66
J-5		0.19	326.72	308.65	18.07	177.21
J-6		0.19	326.66	307.30	19.36	189.82
J-7		0.28	326.59	308.70	17.89	175.48
J-8		0.23	326.55	310.00	16.55	162.26
J-9		0.19	327.16	308.20	18.96	185.91
J-10		0.09	327.16	308.20	18.96	185.91
J-11		0.00	327.16	308.55	18.61	182.47
J-12		38.28	326.30	311.60	14.70	144.15
J-13a		0.28	326.51	310.10	16.41	160.98
J-1a		0.37	328.36	308.30	20.06	196.73
J-2a		0.37	328.07	308.40	19.67	192.91
VP-1		----	328.64	309.25	19.39	190.17

M A X I M U M   A N D   M I N I M U M   V A L U E S

P R E S S U R E S

JUNCTION NUMBER	MAXIMUM PRESSURES kPa	JUNCTION NUMBER	MINIMUM PRESSURES kPa
J-3	255.58	J-12	144.15
J-2	206.64	EX-1	148.78
J-4	198.66	EX-2	150.40
J-1	198.20	J-13a	160.98
J-1a	196.73	J-8	162.26

V E L O C I T I E S

PIPE NUMBER	MAXIMUM VELOCITY (m/s)	PIPE NUMBER	MINIMUM VELOCITY (m/s)
P-1	0.95	P-10	0.00
P-13	0.93	P-6	0.01
P-2	0.91	P-14	0.01
P-7	0.91	P-15	0.01
P-5	0.89	P-16	0.26

H L + M L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL+ML/1000 (m/m)	PIPE NUMBER	MINIMUM HL+ML/1000 (m/m)
P-1	6.34	P-10	0.00
P-2	4.83	P-6	0.00
P-5	4.53	P-14	0.00
P-13	4.26	P-15	0.00
P-7	4.24	P-16	0.40

H L / 1 0 0 0

PIPE NUMBER	MAXIMUM HL/1000 (m/m)	PIPE NUMBER	MINIMUM HL/1000 (m/m)
P-1	4.44	P-10	0.00
P-13	4.26	P-6	0.00
P-2	4.09	P-14	0.00
P-7	4.09	P-15	0.00
P-5	3.94	P-16	0.40

S U M M A R Y O F I N F L O W S A N D O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM SUPPLY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO SUPPLY NODES

NODE NAME	FLOWRATE lps	NODE TITLE
VP-1	41.31	

NET SYSTEM INFLOW = 41.31

```
 NET SYSTEM OUTFLOW =      0.00
 NET SYSTEM DEMAND  =     41.31
================================================================================
Total Power Cost



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

              TOTAL POWER COST($) FOR THIS SIMULATION =      0.52

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


           ***** HYDRAULIC ANALYSIS COMPLETED *****
```

APPENDIX D

SWM Design Calculations

PINESTONE ENGINEERING LTD.

Ontario IDF CURVE LOOKUP

Active coordinate

44° 10' 15" N, 80° 1' 45" W (44.170833,-80.029167)

Retrieved: Thu, 26 Aug 2021 19:46:40 GMT

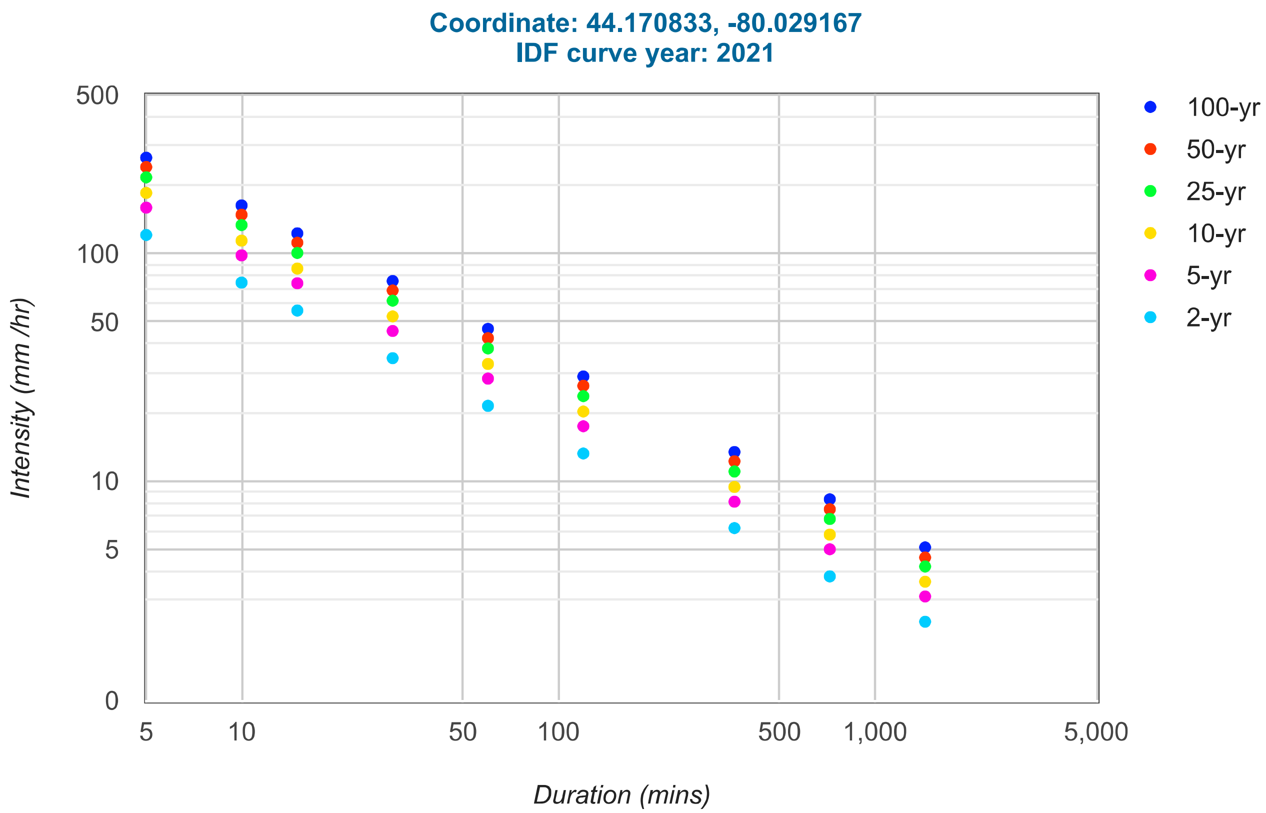
Location summary

These are the locations in the selection.

IDF Curve: 44° 10' 15" N, 80° 1' 45" W (44.170833,-80.029167)

Results

An IDF curve was found.



Coefficient summary

IDF Curve: 44° 10' 15" N, 80° 1' 45" W (44.170833,-80.029167)

Retrieved: Thu, 26 Aug 2021 19:46:40 GMT

Data year: 2010
IDF curve year: 2021

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	120.9	74.6	56.2	34.7	21.4	13.2	6.2	3.8	2.4
5-yr	159.5	98.4	74.1	45.7	28.2	17.4	8.1	5.0	3.1
10-yr	185.1	114.1	86.0	53.0	32.7	20.2	9.4	5.8	3.6
25-yr	216.9	133.7	100.8	62.1	38.3	23.6	11.0	6.8	4.2
50-yr	240.7	148.4	111.8	68.9	42.5	26.2	12.2	7.5	4.6
100-yr	264.6	163.1	122.9	75.8	46.7	28.8	13.4	8.3	5.1

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.1	12.4	14.1	17.4	21.4	26.4	37.2	45.6	57.6
5-yr	13.3	16.4	18.5	22.9	28.2	34.8	48.6	60.0	74.4
10-yr	15.4	19.0	21.5	26.5	32.7	40.4	56.4	69.6	86.4
25-yr	18.1	22.3	25.2	31.1	38.3	47.2	66.0	81.6	100.8
50-yr	20.1	24.7	27.9	34.5	42.5	52.4	73.2	90.0	110.4
100-yr	22.0	27.2	30.7	37.9	46.7	57.6	80.4	99.6	122.4

Terms of Use

Where:
X is equal to head divided by the downstream length of the weir (H/L)

This equation is valid until H/L is equal to 0.6, then the discharge coefficient is equal to 1.268.

This equation was derived by applying a line of best fit to the following chart taken from "Hydraulic Structures," C.D.Smith, University of Saskatchewan, Copyright 1995, ISBN 0-199-029288, pp.11-15 to 11-18.

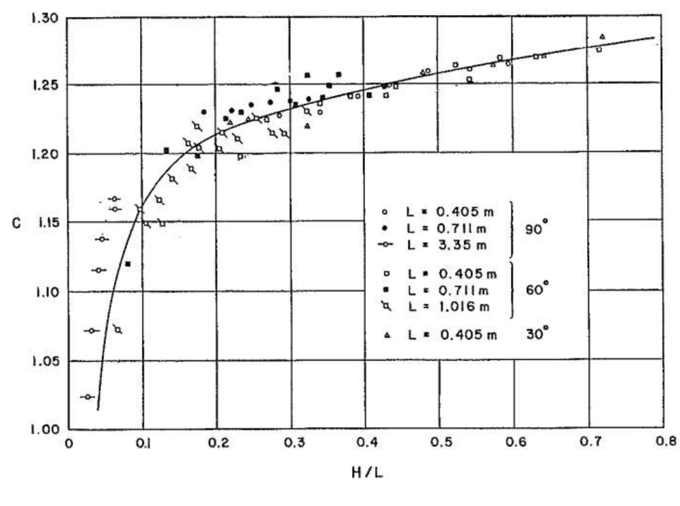


Figure 13. C vs H/L for a Triangular Broad Crested Weir

10 Hydrologic Parameters

10.1 SCS Curve Numbers

Table 10.1: SCS curve numbers

	Hydrologic Soil Group						
Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands/lakes /SWMFs	50	50	50	50	50	50	50
Woods	32	46	60	67	73	76	79
Meadows	38	51	65	71	76	79	81
Pasture/lawn	49	59	69	74	79	82	84
Cultivated	62	68	74	78	82	84	86
Impervious areas	100	100	100	100	100	100	100

Ref: Adapted from Design Chart 1.09, Ontario Ministry of Transportation, "MTO Drainage Management Manual," MTO. (1997)

Notes:

- Table 10.1 represents AMCII conditions and is not applicable to frozen soils or to the period where snowmelt contributes to runoff.
- CN values should be used as given above. The NVCA does not support the use of CN* based on the Paul Wisner Method.

10.2 Initial Abstraction/Depression Storage

Table 10.2: Initial abstraction/depression storage

Cover	Depth (mm)
Woods	10
Pasture/Meadow	8
Cultivated	7
Lawns	5
Wetland	12/16
Impervious areas	2

Ref: UNESCO, Manual on Drainage in Urbanized Areas, 1987.

Notes:

- The representative area method should be used to calculate the IA value for catchment areas.

10.3 Horton Method Parameters

Table 10.3: Horton method parameters

Soil Group	Minimum Infiltration Rate (mm/hr)	Maximum Infiltration Rate (mm/hr)
A	25	250
B	13	200
C	5	125
D	3	75

Ref: M.L. Terstriep and J.B Stall, Illinois Urban Drainage Area Simulator (ILLUDAS) Illinois State Water Survey Urbana, 1979.

The infiltration rate is an exponential decay equation. The decay parameter indicates how fast the maximum infiltration rate will decay to the minimum infiltration rate. ILLUDAS uses a value of 2 hours while the SWMM 5 Manual suggests typical values range between 2 and 7 hours. A larger value indicates a greater soil storage capacity.

10.5 Runoff Coefficients

Table 10.5: Runoff coefficient (Rational C) for urban catchments

Land Use		Runoff Coefficient Min	Runoff Coefficient Max
Pavement	asphalt or concrete	0.8	0.95
	brick	0.7	0.85
Gravel roads and shoulders		0.4	0.6
Roofs		0.7	0.95
Business*	downtown	0.7	0.95
	neighbourhood	0.5	0.7
	light	0.5	0.8
	heavy	0.6	0.9
Residential*	single family urban	0.3	0.5
	multiple, detached	0.4	0.6
	multiple, attached	0.6	0.75
	suburban	0.25	0.4
Industrial*	light	0.5	0.8
	heavy	0.6	0.9
Apartments*		0.5	0.7
Parks, cemeteries*		0.1	0.25
Playgrounds (unpaved)*		0.2	0.35
Railroad yards*		0.2	0.35
Unimproved areas*		0.1	0.3
Lawns	sandy soil		
	flat, to 2%	0.05	0.1
	average, 2 to 7%	0.1	0.15
	steep, over 7%	0.15	0.2
	clayey soil		
	flat, to 2%	0.13	0.17
	average, 2 to 7%	0.18	0.22
	steep, over 7%	0.25	0.35

Ref: Design Chart 1.07, Ontario Ministry of Transportation, "MTO Drainage Management Manual," MTO. (1997)

Notes:

- *Only to be used during preliminary design calculations.
- As per MTO Manual, increase coefficients for the 1:25-year storm by 1.1, the 1:50-year design storm by 1.2 and the 1:100-year design storm by 1.25 (to a maximum value of 1.0).
- Proposed gravel parking and storage areas must be modeled as asphalt.
- Minimum values should be used for catchments with slopes less than 2% and maximum values used for catchments with slopes greater than 7%. For all catchments with slopes between 2 and 7% a weighted average should be used to determine the appropriate value.

Table 10.6: Runoff coefficient (Rational C) for rural catchments

Land Use & Topography	Soil Texture		
	Open Sand Loam (A-AB)	**Loam or Silt Loam (B-BC)**	**Clay Loam or Clay (C-CD-D)**
Cultivated			
Flat 0- 5% Slopes Rolling 5 - 10% Slopes Hilly 10 - 30% Slopes	0.22 0.3 0.4	0.35 0.45 0.65	0.55 0.6 0.7
Pasture/Meadows			
Flat 0- 5% Slopes Rolling 5 - 10% Slopes Hilly 10 - 30% Slopes	0.1 0.15 0.22	0.28 0.35 0.4	0.4 0.45 0.55
Woodland or Cutover			
Flat 0- 5% Slopes Rolling 5 - 10% Slopes Hilly 10 - 30% Slopes	0.08 0.12 0.18	0.25 0.3 0.35	0.35 0.42 0.52
Bare Rock	Coverage		
	30%	50%	70%
Flat 0- 5% Slopes Rolling 5 - 10% Slopes Hilly 10 - 30% Slopes	0.4 0.5 0.55	0.55 0.65 0.7	0.75 0.8 0.85
Lakes and Wetlands	0.05		

Ref: Design Chart 1.07, Ontario Ministry of Transportation, "MTO Drainage Management Manual," MTO. (1997)

10.6 Time of Concentration

Hydrograph time of concentration should be calculated as per the MTO manual and should be based on the Airport Method for catchments with a runoff coefficient less than 0.40 or the Bransby-Williams Equation for catchments with a runoff coefficient greater than 0.40 (based on the weighted catchment C).

The Upland method may be more appropriate for certain topography and the NVCA will allow for the use of this method in place of the MTO specified method; however, the use of the Upland method will require justification to be provided by the consultant as to its usage. Please note that sketches identifying Upland travel paths and land use must be included with the submission if this method is used.

Time to peak should be calculated as $t_p = 0.67\ t_{c,}$ where t_c is time of concentration.

The number of linear reservoirs for the NASHYD command shall equal 3 unless calibration results indicate otherwise.

ARMSTRONG ESTATES OF MANSFIELD - PROPOSED SUBDIVISION

PRE-DEVELOPMENT SWM INPUT PARAMETERS

Township of Mulmur, Ontario

PINESTONE ENGINEERING LTD.

Project Number:	20-11584B
Date:	January 27, 2024
Design By:	DH
File:	Z:\Project Documents\11584B Mansfield Estate Subdivision\3rd Submission Jan 2024\SWM\HYMO SWM Calculations DH.xls

Runoff Coefficients	
Land Use	**"C"**
Lawns & Parks 2-7%	0.16
Cultivated	0.35
Single Family Rooftop Area	0.95
Townhouse Rooftop Area	0.95
Industrial Rooftop Area	0.95
Woodland (0-5%)	0.25
Woodland (10-30%)	0.35
Pasture/Meadow	0.28
Paved areas	0.95

* Values taken from the NVCA Stormwater Technical Guide (2013)

Pre-Development Runoff Coefficients:

Catchment	Total Area (m^2)	Green Field & Parks Area (m^2)	Pasture/Meadow Area (m^2)	Single Family Rooftop Area (m^2)	Townhouse Rooftop Area (m^2)	Industrial Rooftop Area (m^2)	Woodland (0-5%) Area (m^2)	Woodland (10-30%) Area (m^2)	Cultivated Area (m^2)	Impervious Area (m^2)	Weighted C
101	171,300							16,000	155,300		0.35
102	41,500							12,500	29,000		0.35

Time of Concentration Calculations:

Catchment Parameters				Catchment Parameters			
Catchment ID	=	101		Catchment ID	=	102	
Catchment Area	=	17.1300	ha	Catchment Area	=	4.1500	ha
Flow Length	=	660	m	Flow Length	=	480	m
Slope	=	0.027	m/m	Slope	=	0.015	m/m
Weighted Runoff Coefficient	=	0.35		Weighted Runoff Coefficient	=	0.35	
Time of Concentration Results				**Time of Concentration Results**			
Bransby Williams Formula (use for C>=0.4)	=	23.2	min.	Bransby Williams Formula (use for C>=0.4)	=	21.9	min.
Airport Formula (use for C<0.4)	=	45.3	min.	Airport Formula (use for C<0.4)	=	46.9	min.
Time to Peak				**Time to Peak**			
2/3 of Time of Concentration	=	0.50	hr	2/3 of Time of Concentration	=	0.52	hr

Pre-Development Curve Number (CN):

Catchment	Hydrologic Soil Group	Soil Texture	Total Area (m^2)	Lakes / Wetlands / SWMF's (m^2)	Forest / Woodlot Area (m^2)	Cultivated Area (m^2)	Pasture/Lawn Area (m^2)	Paved Area (m^2)	Rooftop Area (m^2)	Weighted CN
101	BC	Sandy Silt / Silt	171,300		16,000	155,300	0	0	0	77.0
102	BC	Sandy Silt / Silt	41,500		12,500	29,000	0	0	0	74.7

SCS Curve Numbers							
	Hydrologic Soil Group						
Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands / Lakes/ SWMF's	50	50	50	50	50	50	50
Forest/Woodlot	32	46	60	67	73	76	79
Meadow/Field	38	51	65	71	76	79	81
Pasture/Lawn	49	59	69	74	79	82	84
Cultivated	62	68	74	78	82	84	86
Impervious Areas	100	100	100	100	100	100	100

* Values taken from the NVCA Stormwater Technical Guide (2013)

Pre-Development Initial Abstraction (IA):

Catchment	Total Area (m^2)	Pasture/Lawn Area (m^2)	Forest/Woodlot Area (m^2)	Lakes / Wetlands SWMF (m^2)	Rooftop Area (m^2)	Cultivated Area (m^2)	Paved Area (m^2)	Weighted IA
101	171,300	0	16,000	0	0	155,300	0	7.3
102	41,500	0	12,500	0	0	29,000	0	7.9

Initial Abstraction / Depression Storage	
Cover	**Depth (mm)**
Wetlands / Lakes/ SWMF	12
Forest/Woodlot	10
Meadow/Field	8
Lawn	5
Cultivated	7
Impervious Areas	2

* Values taken from the NVCA Stormwater Technical Guide (2013)

ARMSTRONG ESTATES OF MANSFIELD - PROPOSED SUBDIVISION

POST-DEVELOPMENT SWM INPUT PARAMETERS

Township of Mulmur, Ontario

PINESTONE ENGINEERING LTD.

Project Number:	20-11584B
Date:	January 27, 2024
Design By:	DH
File:	Z:\Project Documents\11584B Mansfield Estate Subdivision\3rd Submission Jan 2024\SWM\HYMO SWM Calculations DH.xls

Runoff Coefficients

Land Use	"C"
Lawns & Parks 2-7%	0.16
Cultivated	0.35
Single Family Rooftop Area	0.95
Semi-Detached Rooftop Area	0.95
Industrial Rooftop Area	0.95
Gravel	0.50
Woodland (10-30%)	0.35
Pasture/Meadow	0.28
Paved areas	0.95

* Values taken from the NVCA Stormwater Technical Guide (2013)

Post-Development Runoff Coefficients:

Catchment	Total Area (m^2)	Lawns & Parks (2-7%) (m^2)	Pasture/Meadow Area (m^2)	Single Family Rooftop Area (m^2)	Semi-Detached Rooftop Area (m^2)	Lakes & Wetlands (m^2)	Cultivated Area (m^2)	Woodland (10-30%) Area (m^2)	Gravel Area (m^2)	Impervious Area (m^2)	Weighted C
201	155,700	116,450		10,750			8,000			20,500	0.33
202	15,300	8,415			2,985					3,900	0.52
203	28,000	13,410						14,090		500	0.27
204	26,200	12,490			1,660			11,700		350	0.31

Time of Concentration Calculations:

Catchment Parameters

Catchment ID	=	201	
Catchment Area	=	15.5700	ha
Flow Length	=	70	m
Impervious Slope	=	0.02	m/m
Pervious Slope	=	0.04	m/m
Weighted Runoff Coefficient	=	0.33	

Catchment Parameters

Catchment ID	=	202	
Catchment Area	=	1.5300	ha
Flow Length	=	25	m
Impervious Slope	=	0.02	m/m
Pervious Slope	=	0.04	m/m
Weighted Runoff Coefficient	=	0.52	

Catchment Parameters

Catchment ID	=	203	
Catchment Area	=	2.8000	ha
Flow Length	=	480	m
Slope	=	0.015	m/m
Weighted Runoff Coefficient	=	0.27	
Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	22.8	min.
Airport Formula (use for C<0.4)	=	51.9	min.
Time to Peak			
2/3 of Time of Concentration	=	0.58	hr

Catchment Parameters

Catchment ID	=	204	
Catchment Area	=	2.6200	ha
Flow Length	=	480	m
Slope	=	0.015	m/m
Weighted Runoff Coefficient	=	0.31	
Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	22.9	min.
Airport Formula (use for C<0.4)	=	49.6	min.
Time to Peak			
2/3 of Time of Concentration	=	0.55	hr

Post-Development Curve Number (CN):

Catchment	Hydrologic Soil Group	Soil Texture	Total Area (m^2)	Gravel Area (m^2)	Forest / Woodlot Area (m^2)	Cultivated Area (m^2)	Lawn Area (m^2)	Paved Area (m^2)	Rooftop Area (m^2)	Weighted CN
201	BC	Sandy Silt / Silt	124,450			8,000	116,450			74.3
202	BC	Sandy Silt / Silt	8,415				8,415			74.0
203	BC	Sandy Silt / Silt	28,000		14,090		13,410	500		70.9
204	BC	Sandy Silt / Silt	26,200		11,700		12,490	350	1,660	72.9

SCS Curve Numbers

Cover	A	AB	B	BC	C	CD	D
	Hydrologic Soil Group						
Wetlands / Lakes/ SWMF's	50	50	50	50	50	50	50
Forest/Woodlot	32	46	60	67	73	76	79
Gravel	76	81	85	87	89	90	91
Pasture/Lawn	49	59	69	74	79	82	84
Cultivated	62	68	74	78	82	84	86
Impervious Areas	100	100	100	100	100	100	100

* Values taken from the NVCA Stormwater Technical Guide (2013)

Post-Development Initial Abstraction (IA):

Catchment	Total Area (m^2)	Lawn Area (m^2)	Forest/Woodlot Area (m^2)	Gravel Area (m^2)	Rooftop Area (m^2)	Cultivated Area (m^2)	Paved Area (m^2)	Weighted IA
201	124,450	116,450			0	8,000		5.1
202	8,415	8,415			0			5.0
203	28,000	13,410	14,090		0		500	7.5
204	26,200	12,490	11,700		1,660		350	7.0

Initial Abstraction / Depression Storage

Cover	Depth (mm)
Wetlands / Lakes/ SWMF	12
Forest/Woodlot	10
Meadow/Field	8
Open Space	5
Crop	7
Impervious Areas	2

* Values taken from the NVCA Stormwater Technical Guide (2013)

For STANDHYD Command in Otthymo:

Pervious Area Calculations:	Catchment	Total Pervious Area (m2)				
	201	124,450				
Impervious Area Calulations:	**Catchment**	**Total Directly Connected Area (m2)**	**Total Indirectly Connected Area (m2)**	**Total Impervious Area (m2)**	**% Ximp**	**% Timp**
	201	26,950	4,300	31,250	17.3	20.1

Pervious Area Calculations:	Catchment	Total Pervious Area (m2)				
	202	8,415				
Impervious Area Calulations:	**Catchment**	**Total Directly Connected Area (m2)**	**Total Indirectly Connected Area (m2)**	**Total Impervious Area (m2)**	**% Ximp**	**% Timp**
	202	5,691	1,194	6,885	37.2	45.0

ARMSTRONG ESTATES OF MANSFIELD - PROPOSED SUBDIVISION
Dry-Type SWM Facility Storage Volumes
Township of Mulmur, Ontario

PINESTONE ENGINEERING LTD.

Project Number: 20-11584B
Date: January 31, 2024

STAGE-STORAGE RELATIONSHIP - POND 'A'

Elevation	Depth	Main Pond Areas				Comments
		Area	Avg. Area	Live	Accum. Live	
m	m	m^2	m2	m^3	m^3	m
305.50						
305.50	0.00	375	0.00	0.00	0.00	Pond Bottom / Primary Orifice
305.65	0.15	459.00	417.00	62.55	62.55	Contour
305.80	0.30	543.00	501.00	75.15	137.70	Contour
305.95	0.45	627.00	585.00	87.75	225.45	Contour
306.10	0.60	711.00	669.00	100.35	325.80	Contour
306.25	0.75	837.88	774.44	116.17	441.97	Contour
306.40	0.90	964.76	901.32	135.20	577.16	Contour
306.55	1.05	1091.65	1028.21	154.23	731.40	Contour
306.70	1.20	1218.53	1155.09	173.26	904.66	Secondary Orifice
306.85	1.35	1345.41	1281.97	192.30	1096.95	Contour
307.00	1.50	1494.00	1419.71	212.96	1309.91	Contour
307.15	1.65	1684.48	1589.24	238.39	1548.30	Contour
307.30	1.80	1875.34	1779.91	266.99	1815.28	Contour
307.45	1.95	2066.21	1970.78	295.62	2110.90	Contour
307.60	2.10	2257.07	2161.64	324.25	2435.15	Contour
307.75	2.25	2448.00	2352.53	352.88	2788.03	Overflow Weir
307.90	2.40	2638.79	2543.40	381.51	3169.54	Contour
308.05	2.55	2829.66	2734.22	410.13	3579.67	Contour
308.20	2.70	3020.52	2925.09	438.76	4018.43	Contour
308.35	2.85	3211.38	3115.95	467.39	4485.82	Contour
308.40	2.90	3275.00	3243.19	162.16	4647.98	Top of Pond Berm

ARMSTRONG ESTATES OF MANSFIELD - PROPOSED SUBDIVISION
DRY-TYPE SWM FACILITY STAGE STORAGE DISCHARGE RELATIONSHIP
Township of Mulmur, Ontario

Project Number: 20-11584B
Date: January 31, 2024

Orifice Calculations			
$Q_o=C_d*A_o*(2*g*H_o)$^0.5			
	Orifice 1	**Orifice 2**	
C_d	0.63	0.8	
Invert (m)	305.50	306.70	
Width (m)	0.000	0.000	
Diameter/Height (m)	0.270	0.375	
Type (H/V)	V	H	

Cd/Cw	Description
0.63	Orifice Plate
0.8	Orifice Tube
1.7	Broad Crested Weir

Overflow Weir Calculations	
$Q_w=C_w*(H_w)$^1.5*((L-0.2*H_w)+(0.8*TAN(THETA)*H_w))	
Cw	1.70
Invert (m)	307.75
Length (m)	2.0
Side Slope (H:V)	3
Side Slope (rad)	1.249

Stage Discharge Relationship for Pond 'A';

Stage	Active Volume	Control Orifice			Overflow Orifice			Overflow Weir Flow	Total Flow	Comments
		Area	H_o	Flow	Area	H_o	Flow			
m	m^3	m^2	m	m^3/s	m^2	m	m^3/s	m^3/s	m^3/s	
305.50	0.00	0.0573	0.00	0.0000				0.0000	0.0000	Pond Bottom / Primary Orifice
305.65	62.55	0.0573	0.01	0.0196				0.0000	0.0196	Contour
305.80	137.70	0.0573	0.17	0.0649				0.0000	0.0649	Contour
305.95	225.45	0.0573	0.31	0.0897				0.0000	0.0897	Contour
306.10	325.80	0.0573	0.47	0.1090				0.0000	0.1090	Contour
306.25	441.97	0.0573	0.62	0.1253				0.0000	0.1253	Contour
306.40	577.16	0.0573	0.76	0.1397				0.0000	0.1397	Contour
306.55	731.40	0.0573	0.92	0.1528				0.0000	0.1528	Contour
306.70	904.66	0.0573	1.06	0.1649	0.1104	0.00	0.0000	0.0000	0.1649	Secondary Orifice
306.85	1096.95	0.0573	1.22	0.1761	0.1104	0.15	0.1516	0.0000	0.3277	Contour
307.00	1309.91	0.0573	1.37	0.1867	0.1104	0.30	0.2144	0.0000	0.4010	Contour
307.15	1548.30	0.0573	1.51	0.1967	0.1104	0.45	0.2625	0.0000	0.4592	Contour
307.30	1815.28	0.0573	1.67	0.2062	0.1104	0.60	0.3032	0.0000	0.5093	Contour
307.45	2110.90	0.0573	1.81	0.2153	0.1104	0.75	0.3389	0.0000	0.5542	Contour
307.60	2435.15	0.0573	1.97	0.2240	0.1104	0.90	0.3713	0.0000	0.5953	Contour
307.75	2788.03	0.0573	2.12	0.2324	0.1104	1.05	0.4010	0.0000	0.6334	Overflow Weir
307.90	3169.54	0.0573	2.26	0.2405	0.1104	1.20	0.4287	0.2301	0.8993	Contour
308.05	3579.67	0.0573	2.42	0.2483	0.1104	1.35	0.4547	0.7430	1.4461	Contour
308.20	4018.43	0.0573	2.56	0.2559	0.1104	1.50	0.4793	1.5344	2.2696	Contour
308.35	4485.82	0.0573	2.72	0.2633	0.1104	1.65	0.5027	2.6231	3.3891	Contour
308.40	4647.98	0.0573	2.76	0.2657	0.1104	1.70	0.5103	3.0557	3.8317	Top of Pond Berm

ARMSTRONG ESTATES OF MANSFIELD - PROPOSED SUBDIVISION
Dry-Type SWM Facility Storage Volumes
Township of Mulmur, Ontario

PINESTONE ENGINEERING LTD.

Project Number: 20-11584B
Date: January 31, 2024

STAGE-STORAGE RELATIONSHIP - POND 'B'

Elevation	Depth	Main Pond Areas				Comments
		Area	Avg. Area	Live	Accum. Live	
m	m	m^2	m2	m^3	m^3	m
305.50						
305.50	0.00	130	0.00	0.00	0.00	Pond Bottom / Primary Orifice
305.65	0.15	171.13	150.56	22.58	22.58	Contour
305.80	0.30	212.25	191.69	28.75	51.34	Contour
305.95	0.45	253.38	232.81	34.92	86.26	Contour
306.10	0.60	294.50	273.94	41.09	127.35	Contour
306.25	0.75	335.63	315.06	47.26	174.61	Contour
306.40	0.90	376.75	356.19	53.43	228.04	Contour
306.55	1.05	417.88	397.31	59.60	287.63	Contour
306.70	1.20	459.00	438.44	65.77	353.40	Secondary Orifice
306.85	1.35	500.13	479.56	71.93	425.33	Contour
307.00	1.50	541.25	520.69	78.10	503.44	Contour
307.15	1.65	582.38	561.81	84.27	587.71	Contour
307.30	1.80	623.50	602.94	90.44	678.15	Contour
307.45	1.95	664.63	644.06	96.61	774.76	Overflow Weir
307.60	2.10	705.75	685.19	102.78	877.54	Contour
307.75	2.25	746.88	726.31	108.95	986.48	Contour
307.90	2.40	788.00	767.44	115.12	1101.60	Contour
308.00	2.50	815.00	801.50	80.15	1181.75	Top of Pond Berm

ARMSTRONG ESTATES OF MANSFIELD - PROPOSED SUBDIVISION
DRY-TYPE SWM FACILITY STAGE STORAGE DISCHARGE RELATIONSHIP
Township of Mulmur, Ontario

PEL
PINESTONE ENGINEERING LTD.

Project Number: 20-11584B
Date: January 31, 2024

Orifice Calculations

$Q_o=C_d*A_o*(2*g*H_o)$^0.5

	Orifice 1	Orifice 2	
C_d	0.63	0.8	
Invert (m)	305.50	306.70	
Width (m)	0.000	0.000	
Diameter/Height (m)	0.080	0.300	
Type (H/V)	V	H	

Cd/Cw	Description
0.63	Orifice Plate
0.8	Orifice Tube
1.7	Broad Crested Weir

Overflow Weir Calculations

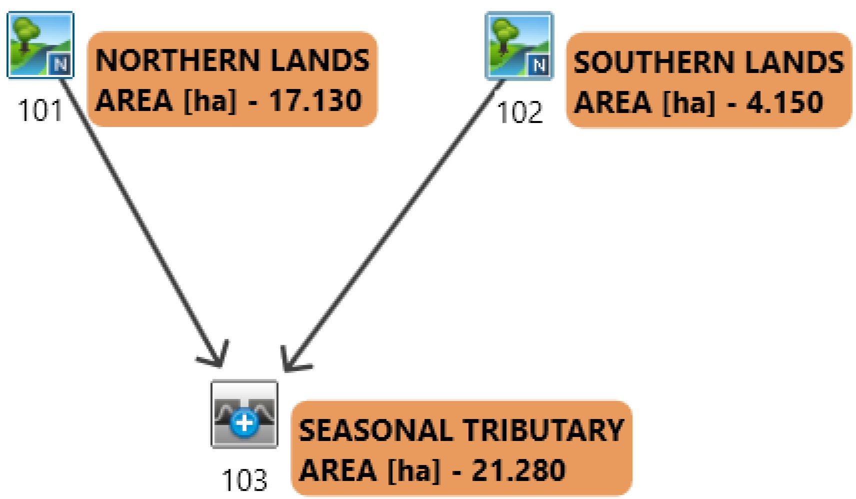
$Q_w=C_w*(H_w)$^1.5*((L-0.2*H_w)+(0.8*TAN(THETA)*H_w))

Cw	1.70
Invert (m)	307.45
Length (m)	3
Side Slope (H:V)	3
Side Slope (rad)	1.249

Stage Discharge Relationship for Pond 'B';

Stage	Active Volume	Control Orifice			Overflow Orifice			Overflow Weir Flow	Total Flow	Comments
		Area	H_o	Flow	Area	H_o	Flow			
m	m^3	m^2	m	m^3/s	m^2	m	m^3/s	m^3/s	m^3/s	
305.50	0.00	0.0050	0.00	0.0000				0.0000	0.0000	Pond Bottom / Primary Orifice
305.65	22.58	0.0050	0.11	0.0047				0.0000	0.0047	Contour
305.80	51.34	0.0050	0.26	0.0072				0.0000	0.0072	Contour
305.95	86.26	0.0050	0.41	0.0090				0.0000	0.0090	Contour
306.10	127.35	0.0050	0.56	0.0105				0.0000	0.0105	Contour
306.25	174.61	0.0050	0.71	0.0118				0.0000	0.0118	Contour
306.40	228.04	0.0050	0.86	0.0130				0.0000	0.0130	Contour
306.55	287.63	0.0050	1.01	0.0141				0.0000	0.0141	Contour
306.70	353.40	0.0050	1.16	0.0151	0.0707	0.00	0.0000	0.0000	0.0151	Secondary Orifice
306.85	425.33	0.0050	1.31	0.0161	0.0707	0.15	0.0970	0.0000	0.1131	Contour
307.00	503.44	0.0050	1.46	0.0169	0.0707	0.30	0.1372	0.0000	0.1541	Contour
307.15	587.71	0.0050	1.61	0.0178	0.0707	0.45	0.1680	0.0000	0.1858	Contour
307.30	678.15	0.0050	1.76	0.0186	0.0707	0.60	0.1940	0.0000	0.2126	Contour
307.45	774.76	0.0050	1.91	0.0194	0.0707	0.75	0.2169	0.0000	0.2363	Overflow Weir
307.60	877.54	0.0050	2.06	0.0201	0.0707	0.90	0.2376	0.3289	0.5866	Contour
307.75	986.48	0.0050	2.21	0.0209	0.0707	1.05	0.2567	1.0224	1.2999	Contour
307.90	1101.60	0.0050	2.36	0.0215	0.0707	1.20	0.2744	2.0476	2.3435	Contour
308.00	1181.75	0.0050	2.46	0.0220	0.0707	1.30	0.2856	2.9193	3.2269	Top of Pond Berm

PRE-DEVELOPMENT



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

       V    V   I    SSSSS  U    U    A     L              (v 6.2.2015)
       V    V   I    SS     U    U   A A    L
        V  V    I     SS    U    U  AAAAA   L
        V  V    I      SS   U    U  A   A   L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO    TTTTT  TTTTT  H    H  Y   Y  M    M   OOO     TM
       O   O    T      T     H    H   Y Y   MM MM  O   O
       O   O    T      T     H    H    Y    M    M  O   O
        OOO     T      T     H    H    Y    M    M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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5a19-6d16-4565-ad38-4dca8923e14a\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\3358
5a19-6d16-4565-ad38-4dca8923e14a\scen


DATE: 01-29-2024                           TIME: 03:21:04

USER:


COMMENTS: ____________________________________________________________


----------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : B - 2yr 4hr 5min Chicago      **
  ************************************************


--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 431.085
| Ptotal= 33.18 mm |                           B=   1.500
--------------------                           C=   0.720
```

```
                     used in:   INTENSITY =  A / (t + B)^C

                     Duration of storm  =  4.00 hrs
                     Storm time step    =  5.00 min
                     Time to peak ratio =  0.33

              TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
               hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.00    2.49 |  1.00    8.67 |  2.00    5.97 |  3.00    3.20
              0.08    2.62 |  1.08   12.33 |  2.08    5.52 |  3.08    3.09
              0.17    2.77 |  1.17   25.77 |  2.17    5.14 |  3.17    2.99
              0.25    2.94 |  1.25  112.01 |  2.25    4.82 |  3.25    2.90
              0.33    3.14 |  1.33   32.78 |  2.33    4.55 |  3.33    2.82
              0.42    3.37 |  1.42   18.79 |  2.42    4.30 |  3.42    2.74
              0.50    3.65 |  1.50   13.70 |  2.50    4.09 |  3.50    2.66
              0.58    3.99 |  1.58   10.98 |  2.58    3.90 |  3.58    2.59
              0.67    4.42 |  1.67    9.27 |  2.67    3.73 |  3.67    2.53
              0.75    4.98 |  1.75    8.08 |  2.75    3.58 |  3.75    2.47
              0.83    5.74 |  1.83    7.20 |  2.83    3.44 |  3.83    2.41
              0.92    6.85 |  1.92    6.51 |  2.92    3.31 |  3.92    2.35


----------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW      (cms)=   0.159 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=   6.582
     TOTAL RAINFALL   (mm)=  33.181
     RUNOFF COEFFICIENT   =   0.198

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

----------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW      (cms)=   0.032 (i)
     TIME TO PEAK    (hrs)=   2.083
```

```
     RUNOFF VOLUME    (mm)=   5.741
     TOTAL RAINFALL   (mm)=  33.181
     RUNOFF COEFFICIENT   =   0.173

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

------------------------------------------------------------------------------


--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0101):     17.13   0.159     2.08     6.58
     + ID2= 2 (  0102):      4.15   0.032     2.08     5.74
       ==================================================
       ID = 3 (  0103):     21.28   0.191     2.08     6.42

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
==================================================================================
=======================

       V    V   I    SSSSS  U    U    A     L              (v 6.2.2015)
       V    V   I    SS     U    U   A A    L
        V  V    I     SS    U    U  AAAAA   L
        V  V    I      SS   U    U  A   A   L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO    TTTTT  TTTTT  H    H  Y   Y  M    M   OOO     TM
       O   O    T      T     H    H   Y Y   MM MM  O   O
       O   O    T      T     H    H    Y    M    M  O   O
        OOO     T      T     H    H    Y    M    M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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  Summary filename:
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d7c8-21b3-4c53-a051-84774a8e921c\scen
```

```
DATE: 01-29-2024                           TIME: 03:21:05

USER:


COMMENTS: ____________________________________________________________


----------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : C - 2yr 24hr 5min SCS Type II **
  ************************************************


--------------------
|    READ STORM    |     Filename: C:\Users\dhordyk\AppD
|                  |               ata\Local\Temp\
|                  |               a47d99ab-1719-4be6-b0d1-3712435b20c8\63f6fc93
| Ptotal= 57.60 mm |     Comments: 2yr 24hr 5min SCS Type II
--------------------
              TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
               hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.00    0.00 |  6.08    1.04 | 12.17    9.87 | 18.25    1.01
              0.08    0.58 |  6.17    1.05 | 12.25    8.82 | 18.33    1.00
              0.17    0.58 |  6.25    1.06 | 12.33    7.77 | 18.42    0.98
              0.25    0.59 |  6.33    1.07 | 12.42    6.72 | 18.50    0.97
              0.33    0.59 |  6.42    1.08 | 12.50    5.67 | 18.58    0.96
              0.42    0.60 |  6.50    1.09 | 12.58    4.86 | 18.67    0.95
              0.50    0.60 |  6.58    1.10 | 12.67    4.62 | 18.75    0.93
              0.58    0.60 |  6.67    1.11 | 12.75    4.38 | 18.83    0.92
              0.67    0.61 |  6.75    1.12 | 12.83    4.14 | 18.92    0.91
              0.75    0.62 |  6.83    1.13 | 12.92    3.90 | 19.00    0.90
              0.83    0.62 |  6.92    1.14 | 13.00    3.66 | 19.08    0.89
              0.92    0.63 |  7.00    1.15 | 13.08    3.43 | 19.17    0.87
              1.00    0.63 |  7.08    1.16 | 13.17    3.30 | 19.25    0.86
              1.08    0.64 |  7.17    1.17 | 13.25    3.17 | 19.33    0.85
              1.17    0.64 |  7.25    1.18 | 13.33    3.05 | 19.42    0.84
              1.25    0.65 |  7.33    1.19 | 13.42    2.92 | 19.50    0.83
              1.33    0.65 |  7.42    1.19 | 13.50    2.79 | 19.58    0.81
              1.42    0.65 |  7.50    1.20 | 13.58    2.65 | 19.67    0.80
              1.50    0.66 |  7.58    1.22 | 13.67    2.56 | 19.75    0.79
              1.58    0.66 |  7.67    1.22 | 13.75    2.47 | 19.83    0.78
              1.67    0.67 |  7.75    1.23 | 13.83    2.37 | 19.92    0.77
              1.75    0.67 |  7.83    1.24 | 13.92    2.28 | 20.00    0.75
              1.83    0.68 |  7.92    1.25 | 14.00    2.19 | 20.08    0.75
              1.92    0.69 |  8.00    1.26 | 14.08    2.11 | 20.17    0.74
              2.00    0.69 |  8.08    1.30 | 14.17    2.08 | 20.25    0.74
              2.08    0.70 |  8.17    1.34 | 14.25    2.05 | 20.33    0.74
```

```
        2.17    0.70 |  8.25    1.39 | 14.33    2.01 | 20.42    0.74
        2.25    0.70 |  8.33    1.43 | 14.42    1.98 | 20.50    0.74
        2.33    0.71 |  8.42    1.48 | 14.50    1.95 | 20.58    0.73
        2.42    0.71 |  8.50    1.53 | 14.58    1.91 | 20.67    0.73
        2.50    0.72 |  8.58    1.58 | 14.67    1.88 | 20.75    0.73
        2.58    0.72 |  8.67    1.63 | 14.75    1.84 | 20.83    0.73
        2.67    0.73 |  8.75    1.68 | 14.83    1.81 | 20.92    0.72
        2.75    0.73 |  8.83    1.72 | 14.92    1.78 | 21.00    0.72
        2.83    0.74 |  8.92    1.77 | 15.00    1.75 | 21.08    0.72
        2.92    0.74 |  9.00    1.81 | 15.08    1.71 | 21.17    0.72
        3.00    0.74 |  9.08    1.84 | 15.17    1.67 | 21.25    0.71
        3.08    0.75 |  9.17    1.84 | 15.25    1.64 | 21.33    0.71
        3.17    0.75 |  9.25    1.84 | 15.33    1.61 | 21.42    0.71
        3.25    0.76 |  9.33    1.84 | 15.42    1.58 | 21.50    0.71
        3.33    0.77 |  9.42    1.84 | 15.50    1.55 | 21.58    0.70
        3.42    0.77 |  9.50    1.84 | 15.58    1.50 | 21.67    0.70
        3.50    0.78 |  9.58    1.89 | 15.67    1.48 | 21.75    0.70
        3.58    0.78 |  9.67    1.96 | 15.75    1.44 | 21.83    0.70
        3.67    0.79 |  9.75    2.04 | 15.83    1.41 | 21.92    0.70
        3.75    0.79 |  9.83    2.11 | 15.92    1.38 | 22.00    0.69
        3.83    0.79 |  9.92    2.18 | 16.00    1.34 | 22.08    0.69
        3.92    0.80 | 10.00    2.26 | 16.08    1.32 | 22.17    0.69
        4.00    0.80 | 10.08    2.37 | 16.17    1.31 | 22.25    0.69
        4.08    0.81 | 10.17    2.48 | 16.25    1.29 | 22.33    0.68
        4.17    0.82 | 10.25    2.59 | 16.33    1.28 | 22.42    0.68
        4.25    0.83 | 10.33    2.70 | 16.42    1.27 | 22.50    0.68
        4.33    0.84 | 10.42    2.82 | 16.50    1.26 | 22.58    0.67
        4.42    0.85 | 10.50    2.93 | 16.58    1.24 | 22.67    0.67
        4.50    0.86 | 10.58    3.11 | 16.67    1.23 | 22.75    0.67
        4.58    0.87 | 10.67    3.29 | 16.75    1.22 | 22.83    0.67
        4.67    0.88 | 10.75    3.48 | 16.83    1.21 | 22.92    0.67
        4.75    0.89 | 10.83    3.66 | 16.92    1.20 | 23.00    0.66
        4.83    0.90 | 10.92    3.85 | 17.00    1.19 | 23.08    0.66
        4.92    0.91 | 11.00    4.03 | 17.08    1.18 | 23.17    0.66
        5.00    0.92 | 11.08    4.42 | 17.17    1.16 | 23.25    0.66
        5.08    0.93 | 11.17    4.87 | 17.25    1.15 | 23.33    0.65
        5.17    0.94 | 11.25    5.31 | 17.33    1.14 | 23.42    0.65
        5.25    0.95 | 11.33    5.75 | 17.42    1.13 | 23.50    0.65
        5.33    0.96 | 11.42    6.19 | 17.50    1.12 | 23.58    0.65
        5.42    0.96 | 11.50    6.64 | 17.58    1.10 | 23.67    0.65
        5.50    0.97 | 11.58   13.73 | 17.67    1.09 | 23.75    0.64
        5.58    0.98 | 11.67   24.64 | 17.75    1.08 | 23.83    0.64
        5.67    0.99 | 11.75   37.36 | 17.83    1.07 | 23.92    0.64
        5.75    1.00 | 11.83   58.00 | 17.92    1.06 | 24.00    0.63
        5.83    1.01 | 11.92   74.12 | 18.00    1.04 |
        5.92    1.02 | 12.00   54.80 | 18.08    1.03 |
        6.00    1.03 | 12.08   10.92 | 18.17    1.02 |

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

```
--------------------
| CALIB              |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW       (cms)=   0.456 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  20.052
     TOTAL RAINFALL   (mm)=  57.600
     RUNOFF COEFFICIENT   =   0.348

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW       (cms)=   0.096 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  18.198
     TOTAL RAINFALL   (mm)=  57.600
     RUNOFF COEFFICIENT   =   0.316

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0101):    17.13   0.456    12.50    20.05
     + ID2= 2 (  0102):     4.15   0.096    12.50    18.20
       ================================================
       ID = 3 (  0103):    21.28   0.553    12.50    19.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
```

```
       V    V   I    SS     U   U    A A    L
        V  V    I     SS    U   U   AAAAA   L
        V  V    I      SS   U   U   A   A   L
         VV     I    SSSSS  UUUUU   A   A   LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```



```
                   *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\0c04
db97-8e74-49e0-8244-d87f41f63baf\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\0c04
db97-8e74-49e0-8244-d87f41f63baf\scen


DATE: 01-29-2024                            TIME: 03:21:04

USER:


COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : D - 5yr 4hr 5min Chicago      **
  **********************************************


--------------------
| CHICAGO STORM      |    IDF curve parameters: A= 573.118
| Ptotal= 43.63 mm |                            B=   1.500
--------------------                            C=   0.722
                        used in:    INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
```

```
                         Time to peak ratio =  0.33

                 TIME     RAIN |  TIME     RAIN |'  TIME    RAIN |  TIME     RAIN
                  hrs    mm/hr |   hrs    mm/hr |'   hrs   mm/hr |   hrs    mm/hr
                 0.00     3.26 |  1.00    11.36 |  2.00     7.81 |  3.00     4.18
                 0.08     3.43 |  1.08    16.19 |  2.08     7.22 |  3.08     4.04
                 0.17     3.62 |  1.17    33.93 |  2.17     6.73 |  3.17     3.91
                 0.25     3.85 |  1.25   148.36 |  2.25     6.31 |  3.25     3.79
                 0.33     4.10 |  1.33    43.20 |  2.33     5.95 |  3.33     3.68
                 0.42     4.41 |  1.42    24.71 |  2.42     5.63 |  3.42     3.57
                 0.50     4.77 |  1.50    17.99 |  2.50     5.35 |  3.50     3.48
                 0.58     5.22 |  1.58    14.41 |  2.58     5.10 |  3.58     3.39
                 0.67     5.78 |  1.67    12.16 |  2.67     4.88 |  3.67     3.30
                 0.75     6.51 |  1.75    10.59 |  2.75     4.68 |  3.75     3.22
                 0.83     7.51 |  1.83     9.43 |  2.83     4.50 |  3.83     3.14
                 0.92     8.97 |  1.92     8.53 |  2.92     4.33 |  3.92     3.07

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW       (cms)=   0.302 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  11.764
     TOTAL RAINFALL   (mm)=  43.632
     RUNOFF COEFFICIENT   =   0.270

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW       (cms)=   0.062 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  10.485
     TOTAL RAINFALL   (mm)=  43.632
     RUNOFF COEFFICIENT   =   0.240
```

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

------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    17.13   0.302     2.00    11.76
      + ID2= 2 (  0102):     4.15   0.062     2.08    10.49
        ==================================================
        ID = 3 (  0103):    21.28   0.364     2.00    11.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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       V    V   I    SSSSS  U    U    A    L              (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\4bb5
e6af-6802-4d30-ae7f-9313cafb8295\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\4bb5
e6af-6802-4d30-ae7f-9313cafb8295\scen


DATE: 01-29-2024                           TIME: 03:21:05

USER:
```

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COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : E - 5yr 24hr 5min SCS Type II **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              a47d99ab-1719-4be6-b0d1-3712435b20c8\124a23f6
| Ptotal= 74.40 mm |    Comments: 5yr 24hr 5min SCS Type II
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.00 |  6.08    1.35 | 12.17   12.75 | 18.25    1.30
                 0.08    0.75 |  6.17    1.36 | 12.25   11.39 | 18.33    1.29
                 0.17    0.75 |  6.25    1.37 | 12.33   10.04 | 18.42    1.27
                 0.25    0.76 |  6.33    1.38 | 12.42    8.68 | 18.50    1.26
                 0.33    0.77 |  6.42    1.39 | 12.50    7.32 | 18.58    1.24
                 0.42    0.77 |  6.50    1.41 | 12.58    6.28 | 18.67    1.22
                 0.50    0.78 |  6.58    1.42 | 12.67    5.97 | 18.75    1.21
                 0.58    0.78 |  6.67    1.43 | 12.75    5.66 | 18.83    1.19
                 0.67    0.79 |  6.75    1.44 | 12.83    5.35 | 18.92    1.18
                 0.75    0.80 |  6.83    1.46 | 12.92    5.04 | 19.00    1.16
                 0.83    0.80 |  6.92    1.47 | 13.00    4.73 | 19.08    1.15
                 0.92    0.81 |  7.00    1.48 | 13.08    4.43 | 19.17    1.13
                 1.00    0.81 |  7.08    1.50 | 13.17    4.27 | 19.25    1.11
                 1.08    0.83 |  7.17    1.51 | 13.25    4.10 | 19.33    1.10
                 1.17    0.83 |  7.25    1.52 | 13.33    3.93 | 19.42    1.08
                 1.25    0.83 |  7.33    1.53 | 13.42    3.77 | 19.50    1.07
                 1.33    0.84 |  7.42    1.54 | 13.50    3.60 | 19.58    1.05
                 1.42    0.84 |  7.50    1.55 | 13.58    3.42 | 19.67    1.04
                 1.50    0.86 |  7.58    1.57 | 13.67    3.30 | 19.75    1.02
                 1.58    0.86 |  7.67    1.58 | 13.75    3.18 | 19.83    1.01
                 1.67    0.87 |  7.75    1.59 | 13.83    3.07 | 19.92    0.99
                 1.75    0.87 |  7.83    1.61 | 13.92    2.95 | 20.00    0.97
                 1.83    0.88 |  7.92    1.62 | 14.00    2.83 | 20.08    0.97
                 1.92    0.89 |  8.00    1.63 | 14.08    2.73 | 20.17    0.96
                 2.00    0.89 |  8.08    1.67 | 14.17    2.68 | 20.25    0.96
                 2.08    0.90 |  8.17    1.73 | 14.25    2.64 | 20.33    0.96
                 2.17    0.90 |  8.25    1.79 | 14.33    2.60 | 20.42    0.95
                 2.25    0.91 |  8.33    1.85 | 14.42    2.56 | 20.50    0.95
                 2.33    0.92 |  8.42    1.91 | 14.50    2.52 | 20.58    0.94
                 2.42    0.92 |  8.50    1.97 | 14.58    2.46 | 20.67    0.94
```

```
                 2.50    0.93 |  8.58    2.05 | 14.67    2.43 | 20.75    0.94
                 2.58    0.93 |  8.67    2.11 | 14.75    2.38 | 20.83    0.94
                 2.67    0.94 |  8.75    2.17 | 14.83    2.34 | 20.92    0.94
                 2.75    0.94 |  8.83    2.22 | 14.92    2.30 | 21.00    0.93
                 2.83    0.95 |  8.92    2.28 | 15.00    2.25 | 21.08    0.93
                 2.92    0.96 |  9.00    2.34 | 15.08    2.21 | 21.17    0.92
                 3.00    0.96 |  9.08    2.38 | 15.17    2.16 | 21.25    0.92
                 3.08    0.97 |  9.17    2.38 | 15.25    2.12 | 21.33    0.92
                 3.17    0.97 |  9.25    2.38 | 15.33    2.08 | 21.42    0.92
                 3.25    0.98 |  9.33    2.38 | 15.42    2.04 | 21.50    0.92
                 3.33    0.99 |  9.42    2.38 | 15.50    2.00 | 21.58    0.91
                 3.42    0.99 |  9.50    2.38 | 15.58    1.94 | 21.67    0.91
                 3.50    1.00 |  9.58    2.44 | 15.67    1.91 | 21.75    0.90
                 3.58    1.00 |  9.67    2.54 | 15.75    1.86 | 21.83    0.90
                 3.67    1.02 |  9.75    2.63 | 15.83    1.82 | 21.92    0.90
                 3.75    1.02 |  9.83    2.73 | 15.92    1.78 | 22.00    0.89
                 3.83    1.03 |  9.92    2.82 | 16.00    1.73 | 22.08    0.89
                 3.92    1.03 | 10.00    2.92 | 16.08    1.70 | 22.17    0.89
                 4.00    1.03 | 10.08    3.07 | 16.17    1.69 | 22.25    0.89
                 4.08    1.05 | 10.17    3.21 | 16.25    1.67 | 22.33    0.88
                 4.17    1.06 | 10.25    3.35 | 16.33    1.66 | 22.42    0.88
                 4.25    1.07 | 10.33    3.49 | 16.42    1.64 | 22.50    0.88
                 4.33    1.08 | 10.42    3.64 | 16.50    1.63 | 22.58    0.87
                 4.42    1.10 | 10.50    3.78 | 16.58    1.61 | 22.67    0.87
                 4.50    1.11 | 10.58    4.02 | 16.67    1.60 | 22.75    0.87
                 4.58    1.12 | 10.67    4.26 | 16.75    1.58 | 22.83    0.86
                 4.67    1.14 | 10.75    4.49 | 16.83    1.56 | 22.92    0.86
                 4.75    1.15 | 10.83    4.73 | 16.92    1.55 | 23.00    0.86
                 4.83    1.16 | 10.92    4.97 | 17.00    1.53 | 23.08    0.86
                 4.92    1.17 | 11.00    5.21 | 17.08    1.52 | 23.17    0.85
                 5.00    1.18 | 11.08    5.71 | 17.17    1.50 | 23.25    0.85
                 5.08    1.20 | 11.17    6.29 | 17.25    1.49 | 23.33    0.85
                 5.17    1.21 | 11.25    6.86 | 17.33    1.47 | 23.42    0.84
                 5.25    1.22 | 11.33    7.43 | 17.42    1.46 | 23.50    0.84
                 5.33    1.23 | 11.42    8.00 | 17.50    1.44 | 23.58    0.83
                 5.42    1.25 | 11.50    8.57 | 17.58    1.42 | 23.67    0.83
                 5.50    1.26 | 11.58   17.74 | 17.67    1.41 | 23.75    0.83
                 5.58    1.27 | 11.67   31.83 | 17.75    1.39 | 23.83    0.83
                 5.67    1.28 | 11.75   48.26 | 17.83    1.38 | 23.92    0.82
                 5.75    1.30 | 11.83   74.91 | 17.92    1.36 | 24.00    0.82
                 5.83    1.31 | 11.92   95.74 | 18.00    1.35 |
                 5.92    1.32 | 12.00   70.78 | 18.08    1.33 |
                 6.00    1.33 | 12.08   14.11 | 18.17    1.31 |

------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
```

```
--------------------   U.H. Tp(hrs)=   0.50


     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW      (cms)=   0.731 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  31.490
     TOTAL RAINFALL   (mm)=  74.400
     RUNOFF COEFFICIENT   =   0.423

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW      (cms)=   0.157 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  28.992
     TOTAL RAINFALL   (mm)=  74.400
     RUNOFF COEFFICIENT   =   0.390

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

------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    17.13   0.731    12.50    31.49
      + ID2= 2 (  0102):     4.15   0.157    12.50    28.99
        ==================================================
        ID = 3 (  0103):    21.28   0.888    12.50    31.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
==================================================================================
========================

       V    V   I    SSSSS  U    U    A    L              (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL
```

```
        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```
Developed and Distributed by Smart City Water Inc

***** D E T A I L E D   O U T P U T *****

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\66ab
ab4f-357e-40af-8702-08699e6fcc20\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\66ab
ab4f-357e-40af-8702-08699e6fcc20\scen


DATE: 01-29-2024                           TIME: 03:21:04

USER:


COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : F - 10yr 4hr 5min Chicago     **
  **********************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 664.647
| Ptotal= 50.60 mm |                          B=   1.500
--------------------                          C=   0.722
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.78	1.00	13.18	2.00	9.06	3.00	4.85
0.08	3.97	1.08	18.77	2.08	8.38	3.08	4.68
0.17	4.20	1.17	39.35	2.17	7.81	3.17	4.53
0.25	4.46	1.25	172.06	2.25	7.32	3.25	4.39
0.33	4.76	1.33	50.10	2.33	6.90	3.33	4.27
0.42	5.11	1.42	28.65	2.42	6.53	3.42	4.14
0.50	5.54	1.50	20.86	2.50	6.21	3.50	4.03
0.58	6.06	1.58	16.72	2.58	5.92	3.58	3.93
0.67	6.71	1.67	14.10	2.67	5.66	3.67	3.83
0.75	7.55	1.75	12.28	2.75	5.43	3.75	3.73
0.83	8.71	1.83	10.94	2.83	5.22	3.83	3.65
0.92	10.41	1.92	9.90	2.92	5.02	3.92	3.56

```
---------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW      (cms)=   0.415 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  15.732
     TOTAL RAINFALL   (mm)=  50.600
     RUNOFF COEFFICIENT   =   0.311

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

---------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW      (cms)=   0.087 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  14.163
     TOTAL RAINFALL   (mm)=  50.600
     RUNOFF COEFFICIENT   =   0.280

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

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

```
--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0101):     17.13   0.415     2.00    15.73
     + ID2= 2 (  0102):      4.15   0.087     2.00    14.16
       ==================================================
       ID = 3 (  0103):     21.28   0.502     2.00    15.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
---------------------------------------------------------------------------------
===================================================================================
=======================

      V    V   I    SSSSS  U   U    A     L              (v 6.2.2015)
      V    V   I    SS     U   U   A A    L
       V  V    I     SS    U   U  AAAAA   L
       V  V    I      SS   U   U  A   A   L
        VV     I    SSSSS  UUUUU  A   A   LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```
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***** D E T A I L E D   O U T P U T *****

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\473b
dff2-cdfd-438c-921a-2fbc473d12fc\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\473b
dff2-cdfd-438c-921a-2fbc473d12fc\scen


DATE: 01-29-2024                           TIME: 03:21:05

USER:


COMMENTS: ____________________________________________________________
```

```
-----------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : G - 10yr 24hr 5min SCS Type I **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              a47d99ab-1719-4be6-b0d1-3712435b20c8\24397740
| Ptotal= 86.40 mm |    Comments: 10yr 24hr 5min SCS Type II
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.00	6.08	1.56	12.17	14.81	18.25	1.51
0.08	0.87	6.17	1.58	12.25	13.23	18.33	1.49
0.17	0.87	6.25	1.59	12.33	11.65	18.42	1.47
0.25	0.88	6.33	1.61	12.42	10.08	18.50	1.46
0.33	0.89	6.42	1.62	12.50	8.50	18.58	1.43
0.42	0.89	6.50	1.63	12.58	7.29	18.67	1.42
0.50	0.91	6.58	1.65	12.67	6.93	18.75	1.40
0.58	0.91	6.67	1.66	12.75	6.57	18.83	1.38
0.67	0.92	6.75	1.68	12.83	6.21	18.92	1.37
0.75	0.92	6.83	1.69	12.92	5.85	19.00	1.35
0.83	0.93	6.92	1.71	13.00	5.50	19.08	1.33
0.92	0.94	7.00	1.72	13.08	5.15	19.17	1.31
1.00	0.94	7.08	1.74	13.17	4.96	19.25	1.29
1.08	0.96	7.17	1.75	13.25	4.76	19.33	1.28
1.17	0.96	7.25	1.76	13.33	4.57	19.42	1.26
1.25	0.97	7.33	1.78	13.42	4.38	19.50	1.24
1.33	0.98	7.42	1.79	13.50	4.18	19.58	1.22
1.42	0.98	7.50	1.81	13.58	3.97	19.67	1.20
1.50	0.99	7.58	1.82	13.67	3.84	19.75	1.19
1.58	0.99	7.67	1.84	13.75	3.70	19.83	1.17
1.67	1.01	7.75	1.85	13.83	3.56	19.92	1.15
1.75	1.01	7.83	1.86	13.92	3.42	20.00	1.13
1.83	1.02	7.92	1.88	14.00	3.28	20.08	1.12
1.92	1.03	8.00	1.89	14.08	3.17	20.17	1.12
2.00	1.03	8.08	1.94	14.17	3.12	20.25	1.11
2.08	1.05	8.17	2.01	14.25	3.07	20.33	1.11
2.17	1.05	8.25	2.08	14.33	3.02	20.42	1.11
2.25	1.06	8.33	2.15	14.42	2.97	20.50	1.11
2.33	1.06	8.42	2.22	14.50	2.93	20.58	1.10
2.42	1.07	8.50	2.29	14.58	2.86	20.67	1.10
2.50	1.08	8.58	2.38	14.67	2.82	20.75	1.09
2.58	1.08	8.67	2.45	14.75	2.77	20.83	1.09
2.67	1.09	8.75	2.51	14.83	2.72	20.92	1.09
2.75	1.10	8.83	2.58	14.92	2.67	21.00	1.08

```
                 2.83    1.10 |  8.92    2.65 | 15.00    2.62 | 21.08    1.08
                 2.92    1.11 |  9.00    2.72 | 15.08    2.57 | 21.17    1.07
                 3.00    1.11 |  9.08    2.76 | 15.17    2.51 | 21.25    1.07
                 3.08    1.13 |  9.17    2.76 | 15.25    2.47 | 21.33    1.07
                 3.17    1.13 |  9.25    2.76 | 15.33    2.42 | 21.42    1.06
                 3.25    1.14 |  9.33    2.76 | 15.42    2.37 | 21.50    1.06
                 3.33    1.15 |  9.42    2.76 | 15.50    2.32 | 21.58    1.05
                 3.42    1.15 |  9.50    2.76 | 15.58    2.26 | 21.67    1.05
                 3.50    1.17 |  9.58    2.83 | 15.67    2.21 | 21.75    1.05
                 3.58    1.17 |  9.67    2.94 | 15.75    2.16 | 21.83    1.05
                 3.67    1.18 |  9.75    3.06 | 15.83    2.11 | 21.92    1.04
                 3.75    1.18 |  9.83    3.17 | 15.92    2.07 | 22.00    1.04
                 3.83    1.19 |  9.92    3.28 | 16.00    2.01 | 22.08    1.04
                 3.92    1.20 | 10.00    3.39 | 16.08    1.98 | 22.17    1.03
                 4.00    1.20 | 10.08    3.56 | 16.17    1.96 | 22.25    1.03
                 4.08    1.22 | 10.17    3.73 | 16.25    1.94 | 22.33    1.02
                 4.17    1.23 | 10.25    3.89 | 16.33    1.92 | 22.42    1.02
                 4.25    1.25 | 10.33    4.06 | 16.42    1.91 | 22.50    1.02
                 4.33    1.26 | 10.42    4.22 | 16.50    1.89 | 22.58    1.01
                 4.42    1.27 | 10.50    4.39 | 16.58    1.87 | 22.67    1.01
                 4.50    1.29 | 10.58    4.67 | 16.67    1.85 | 22.75    1.01
                 4.58    1.30 | 10.67    4.94 | 16.75    1.83 | 22.83    1.00
                 4.67    1.32 | 10.75    5.22 | 16.83    1.82 | 22.92    1.00
                 4.75    1.33 | 10.83    5.50 | 16.92    1.80 | 23.00    0.99
                 4.83    1.35 | 10.92    5.77 | 17.00    1.78 | 23.08    0.99
                 4.92    1.36 | 11.00    6.05 | 17.08    1.76 | 23.17    0.99
                 5.00    1.37 | 11.08    6.64 | 17.17    1.74 | 23.25    0.98
                 5.08    1.39 | 11.17    7.30 | 17.25    1.73 | 23.33    0.98
                 5.17    1.40 | 11.25    7.96 | 17.33    1.71 | 23.42    0.98
                 5.25    1.42 | 11.33    8.63 | 17.42    1.69 | 23.50    0.98
                 5.33    1.43 | 11.42    9.29 | 17.50    1.68 | 23.58    0.97
                 5.42    1.45 | 11.50    9.95 | 17.58    1.65 | 23.67    0.97
                 5.50    1.46 | 11.58   20.60 | 17.67    1.64 | 23.75    0.96
                 5.58    1.48 | 11.67   36.97 | 17.75    1.62 | 23.83    0.96
                 5.67    1.49 | 11.75   56.04 | 17.83    1.60 | 23.92    0.96
                 5.75    1.51 | 11.83   86.99 | 17.92    1.58 | 24.00    0.95
                 5.83    1.52 | 11.92  111.18 | 18.00    1.56 |
                 5.92    1.53 | 12.00   82.20 | 18.08    1.55 |
                 6.00    1.55 | 12.08   16.38 | 18.17    1.53 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW      (cms)=   0.944 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  40.372
     TOTAL RAINFALL   (mm)=  86.400
     RUNOFF COEFFICIENT   =   0.467

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW      (cms)=   0.205 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  37.452
     TOTAL RAINFALL   (mm)=  86.400
     RUNOFF COEFFICIENT   =   0.433

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    17.13   0.944    12.50    40.37
      + ID2= 2 (  0102):     4.15   0.205    12.50    37.45
        ==================================================
        ID = 3 (  0103):    21.28   1.149    12.50    39.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

         OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
        O   O    T      T    H   H   Y Y   MM MM  O   O
        O   O    T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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```


```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\3c32
15bd-ea34-429e-95cb-9311e4600bdb\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\3c32
15bd-ea34-429e-95cb-9311e4600bdb\scen


DATE: 01-29-2024                          TIME: 03:21:04

USER:


COMMENTS: ____________________________________________________________

-------------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : H - 25yr 4hr 5min Chicago     **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 779.866
| Ptotal= 59.05 mm |                          B=   1.500
--------------------                          C=   0.723
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    4.39 |  1.00   15.36 |  2.00   10.55 |  3.00    5.64
                 0.08    4.62 |  1.08   21.89 |  2.08    9.76 |  3.08    5.45
                 0.17    4.89 |  1.17   45.95 |  2.17    9.09 |  3.17    5.27
                 0.25    5.19 |  1.25  201.50 |  2.25    8.52 |  3.25    5.11
                 0.33    5.54 |  1.33   58.52 |  2.33    8.03 |  3.33    4.96
                 0.42    5.95 |  1.42   33.43 |  2.42    7.60 |  3.42    4.82
                 0.50    6.44 |  1.50   24.33 |  2.50    7.22 |  3.50    4.69
                 0.58    7.05 |  1.58   19.49 |  2.58    6.89 |  3.58    4.57
                 0.67    7.81 |  1.67   16.43 |  2.67    6.59 |  3.67    4.45
                 0.75    8.79 |  1.75   14.31 |  2.75    6.31 |  3.75    4.34
                 0.83   10.14 |  1.83   12.74 |  2.83    6.07 |  3.83    4.24
                 0.92   12.12 |  1.92   11.52 |  2.92    5.84 |  3.92    4.14


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW      (cms)=   0.567 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  20.981
     TOTAL RAINFALL   (mm)=  59.046
     RUNOFF COEFFICIENT   =   0.355

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW      (cms)=   0.120 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  19.069
     TOTAL RAINFALL   (mm)=  59.046
     RUNOFF COEFFICIENT   =   0.323

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
       ID1= 1 (  0101):    17.13   0.567     2.00    20.98
     + ID2= 2 (  0102):     4.15   0.120     2.00    19.07
       ==================================================
       ID = 3 (  0103):    21.28   0.688     2.00    20.61
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-------------------------------------------------------------------------------
====================================================================================
========================

   V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
   V    V   I    SS     U   U   A A   L
    V  V    I     SS    U   U  AAAAA  L
    V  V    I      SS   U   U  A   A  L
     VV     I    SSSSS  UUUUU  A   A  LLLLL

    OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
   O   O    T      T    H   H   Y Y   MM MM  O   O
   O   O    T      T    H   H    Y    M   M  O   O
    OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D   O U T P U T *****

Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\caa702ed-85eb-4654-ab25-15273ef26c66\scen
Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\caa702ed-85eb-4654-ab25-15273ef26c66\scen

DATE: 01-29-2024   TIME: 03:21:05

USER:

COMMENTS: ____

```
------------------------------------------------------------------------------------
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  ************************************************
```

** SIMULATION : I - 25yr 24hr 5min SCS Type I **

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

--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              a47d99ab-1719-4be6-b0d1-3712435b20c8\52718ccf
| Ptotal=100.80 mm |    Comments: 25yr 24hr 5min SCS Type II
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.00	6.08	1.82	12.17	17.27	18.25	1.76
0.08	1.02	6.17	1.84	12.25	15.43	18.33	1.74
0.17	1.02	6.25	1.86	12.33	13.60	18.42	1.72
0.25	1.03	6.33	1.87	12.42	11.76	18.50	1.70
0.33	1.04	6.42	1.89	12.50	9.92	18.58	1.67
0.42	1.04	6.50	1.91	12.58	8.51	18.67	1.66
0.50	1.06	6.58	1.93	12.67	8.09	18.75	1.63
0.58	1.06	6.67	1.94	12.75	7.67	18.83	1.61
0.67	1.07	6.75	1.96	12.83	7.25	18.92	1.60
0.75	1.08	6.83	1.97	12.92	6.83	19.00	1.57
0.83	1.09	6.92	1.99	13.00	6.41	19.08	1.55
0.92	1.10	7.00	2.01	13.08	6.01	19.17	1.53
1.00	1.10	7.08	2.03	13.17	5.78	19.25	1.51
1.08	1.12	7.17	2.04	13.25	5.56	19.33	1.49
1.17	1.12	7.25	2.06	13.33	5.33	19.42	1.47
1.25	1.13	7.33	2.07	13.42	5.10	19.50	1.45
1.33	1.14	7.42	2.09	13.50	4.88	19.58	1.42
1.42	1.14	7.50	2.11	13.58	4.64	19.67	1.41
1.50	1.16	7.58	2.13	13.67	4.48	19.75	1.38
1.58	1.16	7.67	2.14	13.75	4.31	19.83	1.36
1.67	1.18	7.75	2.16	13.83	4.15	19.92	1.34
1.75	1.18	7.83	2.18	13.92	3.99	20.00	1.32
1.83	1.19	7.92	2.19	14.00	3.83	20.08	1.31
1.92	1.20	8.00	2.21	14.08	3.70	20.17	1.30
2.00	1.20	8.08	2.27	14.17	3.63	20.25	1.30
2.08	1.22	8.17	2.35	14.25	3.58	20.33	1.30
2.17	1.22	8.25	2.43	14.33	3.53	20.42	1.29
2.25	1.23	8.33	2.51	14.42	3.47	20.50	1.29
2.33	1.24	8.42	2.59	14.50	3.42	20.58	1.28
2.42	1.24	8.50	2.67	14.58	3.34	20.67	1.28
2.50	1.26	8.58	2.77	14.67	3.29	20.75	1.27
2.58	1.26	8.67	2.85	14.75	3.23	20.83	1.27
2.67	1.28	8.75	2.93	14.83	3.17	20.92	1.27
2.75	1.28	8.83	3.01	14.92	3.12	21.00	1.26
2.83	1.29	8.92	3.09	15.00	3.05	21.08	1.26
2.92	1.30	9.00	3.18	15.08	2.99	21.17	1.25
3.00	1.30	9.08	3.23	15.17	2.93	21.25	1.25
3.08	1.32	9.17	3.23	15.25	2.88	21.33	1.25
3.17	1.32	9.25	3.23	15.33	2.82	21.42	1.24
3.25	1.33	9.33	3.23	15.42	2.76	21.50	1.24
3.33	1.34	9.42	3.23	15.50	2.71	21.58	1.23
3.42	1.34	9.50	3.23	15.58	2.63	21.67	1.23
3.50	1.36	9.58	3.31	15.67	2.58	21.75	1.22
3.58	1.36	9.67	3.44	15.75	2.52	21.83	1.22
3.67	1.38	9.75	3.56	15.83	2.47	21.92	1.22
3.75	1.38	9.83	3.69	15.92	2.41	22.00	1.21
3.83	1.39	9.92	3.82	16.00	2.35	22.08	1.21
3.92	1.40	10.00	3.95	16.08	2.31	22.17	1.20
4.00	1.40	10.08	4.15	16.17	2.28	22.25	1.20
4.08	1.42	10.17	4.35	16.25	2.27	22.33	1.20
4.17	1.44	10.25	4.54	16.33	2.25	22.42	1.19
4.25	1.45	10.33	4.73	16.42	2.22	22.50	1.19
4.33	1.47	10.42	4.93	16.50	2.21	22.58	1.18
4.42	1.49	10.50	5.12	16.58	2.18	22.67	1.18
4.50	1.50	10.58	5.44	16.67	2.16	22.75	1.17
4.58	1.52	10.67	5.77	16.75	2.14	22.83	1.17
4.67	1.54	10.75	6.09	16.83	2.12	22.92	1.17
4.75	1.55	10.83	6.41	16.92	2.10	23.00	1.16
4.83	1.57	10.92	6.73	17.00	2.08	23.08	1.16
4.92	1.59	11.00	7.06	17.08	2.06	23.17	1.15
5.00	1.60	11.08	7.74	17.17	2.03	23.25	1.15
5.08	1.62	11.17	8.52	17.25	2.01	23.33	1.15
5.17	1.64	11.25	9.29	17.33	1.99	23.42	1.14
5.25	1.66	11.33	10.06	17.42	1.97	23.50	1.14
5.33	1.67	11.42	10.84	17.50	1.96	23.58	1.13
5.42	1.69	11.50	11.61	17.58	1.93	23.67	1.13
5.50	1.70	11.58	24.03	17.67	1.91	23.75	1.12
5.58	1.72	11.67	43.13	17.75	1.89	23.83	1.12
5.67	1.74	11.75	65.38	17.83	1.87	23.92	1.12
5.75	1.76	11.83	101.49	17.92	1.85	24.00	1.11
5.83	1.77	11.92	129.71	18.00	1.82		
5.92	1.79	12.00	95.90	18.08	1.80		
6.00	1.80	12.08	19.11	18.17	1.78		

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

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW       (cms)=   1.216 (i)
     TIME TO PEAK    (hrs)=  12.417
     RUNOFF VOLUME    (mm)=  51.614
     TOTAL RAINFALL   (mm)= 100.800
     RUNOFF COEFFICIENT   =   0.512

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

-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW       (cms)=   0.267 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  48.232
     TOTAL RAINFALL   (mm)= 100.800
     RUNOFF COEFFICIENT   =   0.478

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

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0101):     17.13   1.216    12.42    51.61
     + ID2= 2 (  0102):      4.15   0.267    12.50    48.23
       ==================================================
       ID = 3 (  0103):     21.28   1.480    12.50    50.95
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-------------------------------------------------------------------------------
====================================================================================
========================

   V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
   V    V   I    SS     U   U   A A   L
    V  V    I     SS    U   U  AAAAA  L
    V  V    I      SS   U   U  A   A  L
     VV     I    SSSSS  UUUUU  A   A  LLLLL

    OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
   O   O    T      T    H   H   Y Y   MM MM  O   O
   O   O    T      T    H   H    Y    M   M  O   O
    OOO     T      T    H   H    Y    M   M   OOO
```

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```
              ***** D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\5080
8f4c-901d-4bb6-adf1-d21070254451\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\5080
8f4c-901d-4bb6-adf1-d21070254451\scen


DATE: 01-29-2024                           TIME: 03:21:04

USER:


COMMENTS: ____________________________________________________________

-----------------------------------------------------------------------------------
-----------------------
  **********************************************
  ** SIMULATION : J - 50yr 4hr 5min Chicago     **
  **********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 870.253
| Ptotal= 65.17 mm |                          B=   1.500
--------------------                          C=   0.725
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    4.81 |  1.00   16.90 |  2.00   11.60 |  3.00    6.18
                 0.08    5.07 |  1.08   24.12 |  2.08   10.72 |  3.08    5.98
                 0.17    5.36 |  1.17   50.78 |  2.17    9.98 |  3.17    5.78
                 0.25    5.69 |  1.25  224.02 |  2.25    9.36 |  3.25    5.61
                 0.33    6.07 |  1.33   64.73 |  2.33    8.82 |  3.33    5.44
                 0.42    6.53 |  1.42   36.90 |  2.42    8.34 |  3.42    5.29
                 0.50    7.07 |  1.50   26.82 |  2.50    7.93 |  3.50    5.14
                 0.58    7.74 |  1.58   21.46 |  2.58    7.56 |  3.58    5.01
                 0.67    8.57 |  1.67   18.09 |  2.67    7.23 |  3.67    4.88
                 0.75    9.66 |  1.75   15.74 |  2.75    6.93 |  3.75    4.76
                 0.83   11.15 |  1.83   14.01 |  2.83    6.66 |  3.83    4.65
                 0.92   13.33 |  1.92   12.67 |  2.92    6.41 |  3.92    4.54

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

    Unit Hyd Qpeak  (cms)=   1.309

    PEAK FLOW       (cms)=   0.689 (i)
    TIME TO PEAK    (hrs)=   1.917
    RUNOFF VOLUME    (mm)=  25.040
    TOTAL RAINFALL   (mm)=  65.171
    RUNOFF COEFFICIENT   =   0.384

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

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

    Unit Hyd Qpeak  (cms)=   0.305

    PEAK FLOW       (cms)=   0.147 (i)
    TIME TO PEAK    (hrs)=   2.000
    RUNOFF VOLUME    (mm)=  22.888
    TOTAL RAINFALL   (mm)=  65.171
    RUNOFF COEFFICIENT   =   0.351

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

-----------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0101):     17.13    0.689     1.92    25.04
     + ID2= 2 (  0102):      4.15    0.147     2.00    22.89
       ==================================================
       ID = 3 (  0103):     21.28    0.835     2.00    24.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
===================================================================================
=======================

       V    V   I    SSSSS  U    U    A    L              (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```

```
              ***** D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\ab20
d994-268d-4824-9139-157b09112577\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\ab20
d994-268d-4824-9139-157b09112577\scen


DATE: 01-29-2024                           TIME: 03:21:05

USER:


COMMENTS: ____________________________________________________________

-----------------------------------------------------------------------------------
-----------------------
  **********************************************
  ** SIMULATION : K - 50yr 24hr 5min SCS Type I **
  **********************************************

--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              a47d99ab-1719-4be6-b0d1-3712435b20c8\a68cd2f7
| Ptotal=110.40 mm |    Comments: 50yr 24hr 5min SCS Type II
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.00 |  6.08    2.00 | 12.17   18.92 | 18.25    1.93
                 0.08    1.12 |  6.17    2.02 | 12.25   16.90 | 18.33    1.91
                 0.17    1.12 |  6.25    2.03 | 12.33   14.89 | 18.42    1.88
                 0.25    1.13 |  6.33    2.05 | 12.42   12.88 | 18.50    1.87
                 0.33    1.14 |  6.42    2.07 | 12.50   10.86 | 18.58    1.83
                 0.42    1.14 |  6.50    2.09 | 12.58    9.32 | 18.67    1.81
                 0.50    1.16 |  6.58    2.11 | 12.67    8.86 | 18.75    1.79
                 0.58    1.16 |  6.67    2.13 | 12.75    8.40 | 18.83    1.77
                 0.67    1.18 |  6.75    2.14 | 12.83    7.94 | 18.92    1.75
                 0.75    1.18 |  6.83    2.16 | 12.92    7.48 | 19.00    1.72
                 0.83    1.19 |  6.92    2.18 | 13.00    7.02 | 19.08    1.70
                 0.92    1.20 |  7.00    2.20 | 13.08    6.58 | 19.17    1.67
                 1.00    1.20 |  7.08    2.22 | 13.17    6.33 | 19.25    1.65
                 1.08    1.23 |  7.17    2.24 | 13.25    6.09 | 19.33    1.63
                 1.17    1.23 |  7.25    2.25 | 13.33    5.84 | 19.42    1.61
                 1.25    1.24 |  7.33    2.27 | 13.42    5.59 | 19.50    1.59
                 1.33    1.25 |  7.42    2.29 | 13.50    5.34 | 19.58    1.56
                 1.42    1.25 |  7.50    2.31 | 13.58    5.08 | 19.67    1.54
                 1.50    1.27 |  7.58    2.33 | 13.67    4.90 | 19.75    1.51
                 1.58    1.27 |  7.67    2.35 | 13.75    4.73 | 19.83    1.49
                 1.67    1.29 |  7.75    2.36 | 13.83    4.55 | 19.92    1.47
                 1.75    1.29 |  7.83    2.38 | 13.92    4.37 | 20.00    1.45
                 1.83    1.30 |  7.92    2.40 | 14.00    4.20 | 20.08    1.44
                 1.92    1.31 |  8.00    2.42 | 14.08    4.05 | 20.17    1.43
                 2.00    1.31 |  8.08    2.48 | 14.17    3.98 | 20.25    1.42
                 2.08    1.34 |  8.17    2.57 | 14.25    3.92 | 20.33    1.42
                 2.17    1.34 |  8.25    2.66 | 14.33    3.86 | 20.42    1.41
                 2.25    1.35 |  8.33    2.75 | 14.42    3.80 | 20.50    1.41
                 2.33    1.36 |  8.42    2.84 | 14.50    3.74 | 20.58    1.40
                 2.42    1.36 |  8.50    2.93 | 14.58    3.65 | 20.67    1.40
                 2.50    1.38 |  8.58    3.04 | 14.67    3.60 | 20.75    1.40
                 2.58    1.38 |  8.67    3.12 | 14.75    3.54 | 20.83    1.39
                 2.67    1.40 |  8.75    3.21 | 14.83    3.47 | 20.92    1.39
                 2.75    1.40 |  8.83    3.30 | 14.92    3.42 | 21.00    1.38
                 2.83    1.41 |  8.92    3.39 | 15.00    3.35 | 21.08    1.38
                 2.92    1.42 |  9.00    3.48 | 15.08    3.28 | 21.17    1.37
                 3.00    1.42 |  9.08    3.53 | 15.17    3.21 | 21.25    1.37
                 3.08    1.45 |  9.17    3.53 | 15.25    3.15 | 21.33    1.36
                 3.17    1.45 |  9.25    3.53 | 15.33    3.09 | 21.42    1.36
                 3.25    1.46 |  9.33    3.53 | 15.42    3.02 | 21.50    1.36
                 3.33    1.47 |  9.42    3.53 | 15.50    2.97 | 21.58    1.35
                 3.42    1.47 |  9.50    3.53 | 15.58    2.88 | 21.67    1.35
```

```
                 3.50    1.49 |  9.58    3.62 | 15.67    2.83 | 21.75    1.34
                 3.58    1.49 |  9.67    3.76 | 15.75    2.76 | 21.83    1.34
                 3.67    1.51 |  9.75    3.90 | 15.83    2.70 | 21.92    1.33
                 3.75    1.51 |  9.83    4.05 | 15.92    2.64 | 22.00    1.32
                 3.83    1.52 |  9.92    4.19 | 16.00    2.57 | 22.08    1.32
                 3.92    1.53 | 10.00    4.33 | 16.08    2.53 | 22.17    1.32
                 4.00    1.53 | 10.08    4.55 | 16.17    2.50 | 22.25    1.31
                 4.08    1.56 | 10.17    4.76 | 16.25    2.48 | 22.33    1.31
                 4.17    1.57 | 10.25    4.97 | 16.33    2.46 | 22.42    1.30
                 4.25    1.59 | 10.33    5.18 | 16.42    2.44 | 22.50    1.30
                 4.33    1.61 | 10.42    5.40 | 16.50    2.42 | 22.58    1.29
                 4.42    1.63 | 10.50    5.61 | 16.58    2.38 | 22.67    1.29
                 4.50    1.64 | 10.58    5.96 | 16.67    2.37 | 22.75    1.29
                 4.58    1.67 | 10.67    6.31 | 16.75    2.34 | 22.83    1.28
                 4.67    1.68 | 10.75    6.67 | 16.83    2.32 | 22.92    1.28
                 4.75    1.70 | 10.83    7.02 | 16.92    2.30 | 23.00    1.27
                 4.83    1.72 | 10.92    7.37 | 17.00    2.27 | 23.08    1.27
                 4.92    1.74 | 11.00    7.73 | 17.08    2.25 | 23.17    1.26
                 5.00    1.76 | 11.08    8.48 | 17.17    2.23 | 23.25    1.26
                 5.08    1.78 | 11.17    9.33 | 17.25    2.21 | 23.33    1.25
                 5.17    1.80 | 11.25   10.17 | 17.33    2.18 | 23.42    1.25
                 5.25    1.81 | 11.33   11.02 | 17.42    2.16 | 23.50    1.25
                 5.33    1.83 | 11.42   11.87 | 17.50    2.14 | 23.58    1.24
                 5.42    1.85 | 11.50   12.72 | 17.58    2.11 | 23.67    1.24
                 5.50    1.87 | 11.58   26.32 | 17.67    2.09 | 23.75    1.23
                 5.58    1.89 | 11.67   47.23 | 17.75    2.07 | 23.83    1.23
                 5.67    1.91 | 11.75   71.61 | 17.83    2.04 | 23.92    1.22
                 5.75    1.92 | 11.83  111.16 | 17.92    2.02 | 24.00    1.21
                 5.83    1.94 | 11.92  142.07 | 18.00    2.00 |
                 5.92    1.96 | 12.00  105.03 | 18.08    1.98 |
                 6.00    1.98 | 12.08   20.93 | 18.17    1.95 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW       (cms)=   1.405 (i)
     TIME TO PEAK    (hrs)=  12.417
     RUNOFF VOLUME    (mm)=  59.390
     TOTAL RAINFALL   (mm)= 110.400
     RUNOFF COEFFICIENT   =   0.538

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

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW       (cms)=   0.309 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  55.725
     TOTAL RAINFALL   (mm)= 110.400
     RUNOFF COEFFICIENT   =   0.505

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    17.13   1.405    12.42    59.39
      + ID2= 2 (  0102):     4.15   0.309    12.50    55.73
        ===============================================
        ID = 3 (  0103):    21.28   1.711    12.42    58.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

         OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
        O   O    T      T    H   H   Y Y   MM MM  O   O
        O   O    T      T    H   H    Y    M   M  O   O
         OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```



```
                   *****  D E T A I L E D   O U T P U T *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\c14f
2153-5b73-4877-8cee-683530ca2a88\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\c14f
2153-5b73-4877-8cee-683530ca2a88\scen


DATE: 01-29-2024                           TIME: 03:21:05

USER:



COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : L - 100yr 4hr 5min Chicago    **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 952.739
| Ptotal= 72.14 mm |                          B=   1.500
--------------------                          C=   0.723
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |' TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
                 0.00    5.36 |  1.00   18.76 |  2.00   12.89 |  3.00    6.89
                 0.08    5.65 |  1.08   26.74 |  2.08   11.92 |  3.08    6.66
                 0.17    5.97 |  1.17   56.14 |  2.17   11.10 |  3.17    6.44
                 0.25    6.34 |  1.25  246.17 |  2.25   10.41 |  3.25    6.24
                 0.33    6.76 |  1.33   71.49 |  2.33    9.81 |  3.33    6.06
                 0.42    7.27 |  1.42   40.85 |  2.42    9.29 |  3.42    5.89
                 0.50    7.87 |  1.50   29.72 |  2.50    8.82 |  3.50    5.73
                 0.58    8.61 |  1.58   23.81 |  2.58    8.41 |  3.58    5.58
                 0.67    9.54 |  1.67   20.07 |  2.67    8.05 |  3.67    5.44
                 0.75   10.74 |  1.75   17.48 |  2.75    7.71 |  3.75    5.30
                 0.83   12.39 |  1.83   15.56 |  2.83    7.41 |  3.83    5.18
                 0.92   14.81 |  1.92   14.08 |  2.92    7.14 |  3.92    5.06
```

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW       (cms)=   0.832 (i)
     TIME TO PEAK    (hrs)=   1.917
     RUNOFF VOLUME    (mm)=  29.874
     TOTAL RAINFALL   (mm)=  72.135
     RUNOFF COEFFICIENT   =   0.414

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW       (cms)=   0.178 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  27.458
     TOTAL RAINFALL   (mm)=  72.135
     RUNOFF COEFFICIENT   =   0.381

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

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--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    17.13   0.832     1.92    29.87
      + ID2= 2 (  0102):     4.15   0.178     2.00    27.46
        ===============================================
        ID = 3 (  0103):    21.28   1.009     1.92    29.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
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```
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\cf82
e92c-bb77-4fba-8225-3011515e1efc\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\cf82
e92c-bb77-4fba-8225-3011515e1efc\scen


DATE: 01-29-2024                           TIME: 03:21:05

USER:


COMMENTS: ____________________________________________________________

-----------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : M - 100yr 24hr 5min SCS Type  **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              a47d99ab-1719-4be6-b0d1-3712435b20c8\2c4cdf56
```

```
| Ptotal=122.40 mm |    Comments: 100yr 24hr 5min SCS Type II
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.00 |  6.08    2.22 | 12.17   20.97 | 18.25    2.14
                 0.08    1.24 |  6.17    2.24 | 12.25   18.74 | 18.33    2.12
                 0.17    1.24 |  6.25    2.25 | 12.33   16.51 | 18.42    2.09
                 0.25    1.25 |  6.33    2.27 | 12.42   14.28 | 18.50    2.07
                 0.33    1.26 |  6.42    2.29 | 12.50   12.04 | 18.58    2.03
                 0.42    1.27 |  6.50    2.31 | 12.58   10.33 | 18.67    2.01
                 0.50    1.29 |  6.58    2.34 | 12.67    9.82 | 18.75    1.99
                 0.58    1.29 |  6.67    2.36 | 12.75    9.31 | 18.83    1.96
                 0.67    1.30 |  6.75    2.38 | 12.83    8.80 | 18.92    1.94
                 0.75    1.31 |  6.83    2.40 | 12.92    8.29 | 19.00    1.91
                 0.83    1.32 |  6.92    2.42 | 13.00    7.78 | 19.08    1.88
                 0.92    1.33 |  7.00    2.44 | 13.08    7.30 | 19.17    1.86
                 1.00    1.33 |  7.08    2.46 | 13.17    7.02 | 19.25    1.83
                 1.08    1.36 |  7.17    2.48 | 13.25    6.75 | 19.33    1.81
                 1.17    1.36 |  7.25    2.50 | 13.33    6.47 | 19.42    1.78
                 1.25    1.37 |  7.33    2.52 | 13.42    6.20 | 19.50    1.76
                 1.33    1.38 |  7.42    2.54 | 13.50    5.92 | 19.58    1.73
                 1.42    1.39 |  7.50    2.56 | 13.58    5.63 | 19.67    1.71
                 1.50    1.41 |  7.58    2.58 | 13.67    5.43 | 19.75    1.68
                 1.58    1.41 |  7.67    2.60 | 13.75    5.24 | 19.83    1.65
                 1.67    1.43 |  7.75    2.62 | 13.83    5.04 | 19.92    1.63
                 1.75    1.43 |  7.83    2.64 | 13.92    4.85 | 20.00    1.60
                 1.83    1.44 |  7.92    2.66 | 14.00    4.65 | 20.08    1.59
                 1.92    1.46 |  8.00    2.68 | 14.08    4.49 | 20.17    1.58
                 2.00    1.46 |  8.08    2.75 | 14.17    4.41 | 20.25    1.58
                 2.08    1.48 |  8.17    2.85 | 14.25    4.35 | 20.33    1.57
                 2.17    1.48 |  8.25    2.95 | 14.33    4.28 | 20.42    1.57
                 2.25    1.50 |  8.33    3.05 | 14.42    4.21 | 20.50    1.57
                 2.33    1.51 |  8.42    3.15 | 14.50    4.15 | 20.58    1.55
                 2.42    1.51 |  8.50    3.24 | 14.58    4.05 | 20.67    1.55
                 2.50    1.53 |  8.58    3.37 | 14.67    3.99 | 20.75    1.55
                 2.58    1.53 |  8.67    3.46 | 14.75    3.92 | 20.83    1.54
                 2.67    1.55 |  8.75    3.56 | 14.83    3.85 | 20.92    1.54
                 2.75    1.55 |  8.83    3.66 | 14.92    3.79 | 21.00    1.53
                 2.83    1.56 |  8.92    3.76 | 15.00    3.71 | 21.08    1.53
                 2.92    1.58 |  9.00    3.86 | 15.08    3.64 | 21.17    1.52
                 3.00    1.58 |  9.08    3.92 | 15.17    3.56 | 21.25    1.52
                 3.08    1.60 |  9.17    3.92 | 15.25    3.49 | 21.33    1.51
                 3.17    1.60 |  9.25    3.92 | 15.33    3.42 | 21.42    1.51
                 3.25    1.62 |  9.33    3.92 | 15.42    3.35 | 21.50    1.51
                 3.33    1.63 |  9.42    3.92 | 15.50    3.29 | 21.58    1.49
                 3.42    1.63 |  9.50    3.92 | 15.58    3.19 | 21.67    1.49
                 3.50    1.65 |  9.58    4.01 | 15.67    3.14 | 21.75    1.49
                 3.58    1.65 |  9.67    4.17 | 15.75    3.06 | 21.83    1.48
                 3.67    1.67 |  9.75    4.33 | 15.83    2.99 | 21.92    1.48
                 3.75    1.68 |  9.83    4.48 | 15.92    2.93 | 22.00    1.47
```

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                 3.83    1.69 |  9.92    4.64 | 16.00    2.85 | 22.08    1.47
                 3.92    1.70 | 10.00    4.80 | 16.08    2.80 | 22.17    1.46
                 4.00    1.70 | 10.08    5.04 | 16.17    2.77 | 22.25    1.46
                 4.08    1.73 | 10.17    5.28 | 16.25    2.75 | 22.33    1.45
                 4.17    1.75 | 10.25    5.51 | 16.33    2.73 | 22.42    1.44
                 4.25    1.77 | 10.33    5.75 | 16.42    2.70 | 22.50    1.44
                 4.33    1.78 | 10.42    5.98 | 16.50    2.68 | 22.58    1.43
                 4.42    1.80 | 10.50    6.22 | 16.58    2.64 | 22.67    1.43
                 4.50    1.82 | 10.58    6.61 | 16.67    2.62 | 22.75    1.42
                 4.58    1.85 | 10.67    7.00 | 16.75    2.60 | 22.83    1.42
                 4.67    1.87 | 10.75    7.39 | 16.83    2.57 | 22.92    1.42
                 4.75    1.89 | 10.83    7.78 | 16.92    2.55 | 23.00    1.41
                 4.83    1.91 | 10.92    8.18 | 17.00    2.52 | 23.08    1.41
                 4.92    1.93 | 11.00    8.57 | 17.08    2.50 | 23.17    1.40
                 5.00    1.95 | 11.08    9.40 | 17.17    2.47 | 23.25    1.40
                 5.08    1.97 | 11.17   10.34 | 17.25    2.45 | 23.33    1.39
                 5.17    1.99 | 11.25   11.28 | 17.33    2.42 | 23.42    1.38
                 5.25    2.01 | 11.33   12.22 | 17.42    2.39 | 23.50    1.38
                 5.33    2.03 | 11.42   13.16 | 17.50    2.37 | 23.58    1.37
                 5.42    2.05 | 11.50   14.10 | 17.58    2.34 | 23.67    1.37
                 5.50    2.07 | 11.58   29.18 | 17.67    2.32 | 23.75    1.36
                 5.58    2.09 | 11.67   52.37 | 17.75    2.29 | 23.83    1.36
                 5.67    2.11 | 11.75   79.40 | 17.83    2.27 | 23.92    1.36
                 5.75    2.13 | 11.83  123.24 | 17.92    2.24 | 24.00    1.35
                 5.83    2.15 | 11.92  157.51 | 18.00    2.22 |
                 5.92    2.17 | 12.00  116.45 | 18.08    2.19 |
                 6.00    2.19 | 12.08   23.21 | 18.17    2.16 |

-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=  17.13   Curve Number   (CN)= 77.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.30   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.50

     Unit Hyd Qpeak  (cms)=   1.309

     PEAK FLOW      (cms)=   1.646 (i)
     TIME TO PEAK    (hrs)=  12.417
     RUNOFF VOLUME    (mm)=  69.369
     TOTAL RAINFALL   (mm)= 122.400
     RUNOFF COEFFICIENT   =   0.567

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   4.15   Curve Number   (CN)= 74.7
```

```
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.90   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.52

     Unit Hyd Qpeak  (cms)=   0.305

     PEAK FLOW      (cms)=   0.364 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  65.376
     TOTAL RAINFALL   (mm)= 122.400
     RUNOFF COEFFICIENT   =   0.534

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

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    17.13    1.646    12.42    69.37
      + ID2= 2 (  0102):     4.15    0.364    12.50    65.38
        ==================================================
        ID = 3 (  0103):    21.28    2.008    12.42    68.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
===================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
```

C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\2d4d
5227-5979-49db-a7ee-1fae71c5d401\scen
Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\2d4d
5227-5979-49db-a7ee-1fae71c5d401\scen

DATE: 01-29-2024 TIME: 03:21:05

USER:

COMMENTS: ____

****
** SIMULATION : N - TIMMINS **
****

READ STORM	Filename: C:\Users\dhordyk\AppData\Local\Temp\a47d99ab-1719-4be6-b0d1-3712435b20c8\2ed90c06
Ptotal=193.00 mm	Comments: TIMMINS

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	15.00	3.00	3.00	6.00	43.00	9.00	13.00
0.25	15.00	3.25	3.00	6.25	43.00	9.25	13.00
0.50	15.00	3.50	3.00	6.50	43.00	9.50	13.00
0.75	15.00	3.75	3.00	6.75	43.00	9.75	13.00
1.00	20.00	4.00	5.00	7.00	20.00	10.00	13.00
1.25	20.00	4.25	5.00	7.25	20.00	10.25	13.00
1.50	20.00	4.50	5.00	7.50	20.00	10.50	13.00
1.75	20.00	4.75	5.00	7.75	20.00	10.75	13.00
2.00	10.00	5.00	20.00	8.00	23.00	11.00	8.00
2.25	10.00	5.25	20.00	8.25	23.00	11.25	8.00
2.50	10.00	5.50	20.00	8.50	23.00	11.50	8.00
2.75	10.00	5.75	20.00	8.75	23.00	11.75	8.00

CALIB	
NASHYD (0101)	Area (ha)= 17.13 Curve Number (CN)= 77.0
ID= 1 DT= 5.0 min	Ia (mm)= 7.30 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.50

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	15.00	3.083	3.00	6.083	43.00	9.08	13.00
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.250	15.00	3.250	3.00	6.250	43.00	9.25	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.417	15.00	3.417	3.00	6.417	43.00	9.42	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.583	15.00	3.583	3.00	6.583	43.00	9.58	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.750	15.00	3.750	3.00	6.750	43.00	9.75	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
0.917	15.00	3.917	3.00	6.917	43.00	9.92	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.083	20.00	4.083	5.00	7.083	20.00	10.08	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.250	20.00	4.250	5.00	7.250	20.00	10.25	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.417	20.00	4.417	5.00	7.417	20.00	10.42	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.583	20.00	4.583	5.00	7.583	20.00	10.58	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.750	20.00	4.750	5.00	7.750	20.00	10.75	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
1.917	20.00	4.917	5.00	7.917	20.00	10.92	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.083	10.00	5.083	20.00	8.083	23.00	11.08	8.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.250	10.00	5.250	20.00	8.250	23.00	11.25	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.583	10.00	5.583	20.00	8.583	23.00	11.58	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00
2.750	10.00	5.750	20.00	8.750	23.00	11.75	8.00
2.833	10.00	5.833	20.00	8.833	23.00	11.83	8.00
2.917	10.00	5.917	20.00	8.917	23.00	11.92	8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	8.00

Unit Hyd Qpeak (cms)= 1.309

PEAK FLOW (cms)= 1.431 (i)
TIME TO PEAK (hrs)= 7.167
RUNOFF VOLUME (mm)= 131.830
TOTAL RAINFALL (mm)= 193.000
RUNOFF COEFFICIENT = 0.683

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

CALIB	
NASHYD (0102)	Area (ha)= 4.15 Curve Number (CN)= 74.7
ID= 1 DT= 5.0 min	Ia (mm)= 7.90 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.52

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	15.00	3.083	3.00	6.083	43.00	9.08	13.00
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.250	15.00	3.250	3.00	6.250	43.00	9.25	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.417	15.00	3.417	3.00	6.417	43.00	9.42	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.583	15.00	3.583	3.00	6.583	43.00	9.58	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.750	15.00	3.750	3.00	6.750	43.00	9.75	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
0.917	15.00	3.917	3.00	6.917	43.00	9.92	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.083	20.00	4.083	5.00	7.083	20.00	10.08	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.250	20.00	4.250	5.00	7.250	20.00	10.25	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.417	20.00	4.417	5.00	7.417	20.00	10.42	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.583	20.00	4.583	5.00	7.583	20.00	10.58	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.750	20.00	4.750	5.00	7.750	20.00	10.75	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
1.917	20.00	4.917	5.00	7.917	20.00	10.92	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.083	10.00	5.083	20.00	8.083	23.00	11.08	8.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.250	10.00	5.250	20.00	8.250	23.00	11.25	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.583	10.00	5.583	20.00	8.583	23.00	11.58	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00
2.750	10.00	5.750	20.00	8.750	23.00	11.75	8.00
2.833	10.00	5.833	20.00	8.833	23.00	11.83	8.00
2.917	10.00	5.917	20.00	8.917	23.00	11.92	8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	8.00

Unit Hyd Qpeak (cms)= 0.305

PEAK FLOW (cms)= 0.329 (i)
TIME TO PEAK (hrs)= 7.167
RUNOFF VOLUME (mm)= 126.363
TOTAL RAINFALL (mm)= 193.000
RUNOFF COEFFICIENT = 0.655

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

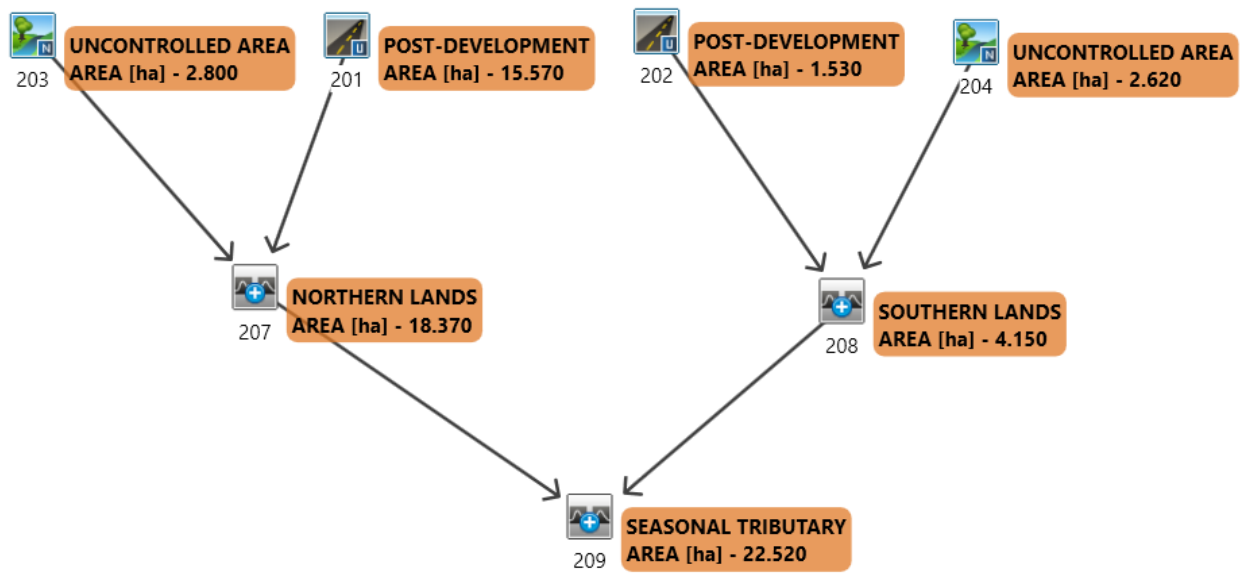
ADD HYD (0103) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0101):	17.13	1.431	7.17	131.83
+ ID2= 2 (0102):	4.15	0.329	7.17	126.36
ID = 3 (0103):	21.28	1.760	7.17	130.76

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

===

POST-DEVELOPMENT



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

      V    V   I    SSSSS  U    U    A     L              (v 6.2.2015)
      V    V   I    SS     U    U   A A    L
       V  V    I     SS    U    U  AAAAA   L
       V  V    I      SS   U    U  A    A  L
        VV     I    SSSSS  UUUUU  A    A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
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```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\ce53
d356-a9e7-408e-bc4b-2570c2ba619f\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\ce53
d356-a9e7-408e-bc4b-2570c2ba619f\scen


DATE: 01-29-2024                           TIME: 12:59:34

USER:


COMMENTS: ____________________________________________________________

-------------------------------------------------------------------------------------
------------------------
  **************************************************
  ** SIMULATION : B - 2yr 4hr 5min Chicago      **
  **************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 431.085
| Ptotal= 33.18 mm |                           B=   1.500
--------------------                           C=   0.720

                    used in:   INTENSITY =  A / (t + B)^C

                    Duration of storm  =  4.00 hrs
                    Storm time step    =  5.00 min
                    Time to peak ratio =  0.33

             TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.00    2.49 |  1.00    8.67 |  2.00    5.97 |  3.00    3.20
             0.08    2.62 |  1.08   12.33 |  2.08    5.52 |  3.08    3.09
             0.17    2.77 |  1.17   25.77 |  2.17    5.14 |  3.17    2.99
             0.25    2.94 |  1.25  112.01 |  2.25    4.82 |  3.25    2.90
             0.33    3.14 |  1.33   32.78 |  2.33    4.55 |  3.33    2.82
             0.42    3.37 |  1.42   18.79 |  2.42    4.30 |  3.42    2.74
             0.50    3.65 |  1.50   13.70 |  2.50    4.09 |  3.50    2.66
             0.58    3.99 |  1.58   10.98 |  2.58    3.90 |  3.58    2.59
             0.67    4.42 |  1.67    9.27 |  2.67    3.73 |  3.67    2.53
             0.75    4.98 |  1.75    8.08 |  2.75    3.58 |  3.75    2.47
             0.83    5.74 |  1.83    7.20 |  2.83    3.44 |  3.83    2.41
             0.92    6.85 |  1.92    6.51 |  2.92    3.31 |  3.92    2.35

-------------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   ( 0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW      (cms)=   0.020 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=   5.683
     TOTAL RAINFALL   (mm)=  33.181
     RUNOFF COEFFICIENT   =   0.171

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

-------------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD ( 0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     112.01        16.58
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.99 (ii)    6.83 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.03          0.178 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      31.18         7.76          16.47
     TOTAL RAINFALL   (mm)=      33.18        33.18          33.18
     RUNOFF COEFFICIENT   =       0.94         0.23           0.50

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.178     1.33    16.47
      + ID2= 2 (  0204):     2.62   0.020     2.17     5.68
        ==================================================
        ID = 3 (  0208):     4.15   0.179     1.33     9.66

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
---------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   ( 0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW      (cms)=   0.018 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=   5.075
     TOTAL RAINFALL   (mm)=  33.181
     RUNOFF COEFFICIENT   =   0.153

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

-------------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD ( 0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     112.01         8.05
                over (min)        5.00        30.00
     Storage Coeff.  (min)=       4.00 (ii)   25.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=       0.24         0.04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.64         0.15          0.658 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.83           1.33
     RUNOFF VOLUME    (mm)=      31.18         7.06          11.23
     TOTAL RAINFALL   (mm)=      33.18        33.18          33.18
     RUNOFF COEFFICIENT   =       0.94         0.21           0.34

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   0.658     1.33    11.23
      + ID2= 2 (  0203):     2.80   0.018     2.17     5.08
        ==================================================
        ID = 3 (  0207):    18.37   0.659     1.33    10.29

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

```
--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.659     1.33    10.29
      + ID2= 2 (  0208):     4.15   0.179     1.33     9.66
        ===================================================
        ID = 3 (  0209):    22.52   0.838     1.33    10.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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=================================================================================
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       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\3f40
f725-a19d-4f5c-8ce6-c4bd718e8a46\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\3f40
f725-a19d-4f5c-8ce6-c4bd718e8a46\scen

DATE: 01-29-2024                           TIME: 12:59:33

USER:

COMMENTS: ____________________________________________________________
```

```
-----------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : C - 2yr 24hr 5min SCS Type II **
  **********************************************

--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              88f53ef1-126e-46c5-8e23-04870d1bcf26\63f6fc93
| Ptotal= 57.60 mm |    Comments: 2yr 24hr 5min SCS Type II
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.00 |  6.08    1.04 | 12.17    9.87 | 18.25    1.01
                 0.08    0.58 |  6.17    1.05 | 12.25    8.82 | 18.33    1.00
                 0.17    0.58 |  6.25    1.06 | 12.33    7.77 | 18.42    0.98
                 0.25    0.59 |  6.33    1.07 | 12.42    6.72 | 18.50    0.97
                 0.33    0.59 |  6.42    1.08 | 12.50    5.67 | 18.58    0.96
                 0.42    0.60 |  6.50    1.09 | 12.58    4.86 | 18.67    0.95
                 0.50    0.60 |  6.58    1.10 | 12.67    4.62 | 18.75    0.93
                 0.58    0.60 |  6.67    1.11 | 12.75    4.38 | 18.83    0.92
                 0.67    0.61 |  6.75    1.12 | 12.83    4.14 | 18.92    0.91
                 0.75    0.62 |  6.83    1.13 | 12.92    3.90 | 19.00    0.90
                 0.83    0.62 |  6.92    1.14 | 13.00    3.66 | 19.08    0.89
                 0.92    0.63 |  7.00    1.15 | 13.08    3.43 | 19.17    0.87
                 1.00    0.63 |  7.08    1.16 | 13.17    3.30 | 19.25    0.86
                 1.08    0.64 |  7.17    1.17 | 13.25    3.17 | 19.33    0.85
                 1.17    0.64 |  7.25    1.18 | 13.33    3.05 | 19.42    0.84
                 1.25    0.65 |  7.33    1.19 | 13.42    2.92 | 19.50    0.83
                 1.33    0.65 |  7.42    1.19 | 13.50    2.79 | 19.58    0.81
                 1.42    0.65 |  7.50    1.20 | 13.58    2.65 | 19.67    0.80
                 1.50    0.66 |  7.58    1.22 | 13.67    2.56 | 19.75    0.79
                 1.58    0.66 |  7.67    1.22 | 13.75    2.47 | 19.83    0.78
                 1.67    0.67 |  7.75    1.23 | 13.83    2.37 | 19.92    0.77
                 1.75    0.67 |  7.83    1.24 | 13.92    2.28 | 20.00    0.75
                 1.83    0.68 |  7.92    1.25 | 14.00    2.19 | 20.08    0.75
                 1.92    0.69 |  8.00    1.26 | 14.08    2.11 | 20.17    0.74
                 2.00    0.69 |  8.08    1.30 | 14.17    2.08 | 20.25    0.74
                 2.08    0.70 |  8.17    1.34 | 14.25    2.05 | 20.33    0.74
                 2.17    0.70 |  8.25    1.39 | 14.33    2.01 | 20.42    0.74
                 2.25    0.70 |  8.33    1.43 | 14.42    1.98 | 20.50    0.74
                 2.33    0.71 |  8.42    1.48 | 14.50    1.95 | 20.58    0.73
                 2.42    0.71 |  8.50    1.53 | 14.58    1.91 | 20.67    0.73
                 2.50    0.72 |  8.58    1.58 | 14.67    1.88 | 20.75    0.73
                 2.58    0.72 |  8.67    1.63 | 14.75    1.84 | 20.83    0.73
                 2.67    0.73 |  8.75    1.68 | 14.83    1.81 | 20.92    0.72
                 2.75    0.73 |  8.83    1.72 | 14.92    1.78 | 21.00    0.72
```

```
                 2.83    0.74 |  8.92    1.77 | 15.00    1.75 | 21.08    0.72
                 2.92    0.74 |  9.00    1.81 | 15.08    1.71 | 21.17    0.72
                 3.00    0.74 |  9.08    1.84 | 15.17    1.67 | 21.25    0.71
                 3.08    0.75 |  9.17    1.84 | 15.25    1.64 | 21.33    0.71
                 3.17    0.75 |  9.25    1.84 | 15.33    1.61 | 21.42    0.71
                 3.25    0.76 |  9.33    1.84 | 15.42    1.58 | 21.50    0.71
                 3.33    0.77 |  9.42    1.84 | 15.50    1.55 | 21.58    0.70
                 3.42    0.77 |  9.50    1.84 | 15.58    1.50 | 21.67    0.70
                 3.50    0.78 |  9.58    1.89 | 15.67    1.48 | 21.75    0.70
                 3.58    0.78 |  9.67    1.96 | 15.75    1.44 | 21.83    0.70
                 3.67    0.79 |  9.75    2.04 | 15.83    1.41 | 21.92    0.70
                 3.75    0.79 |  9.83    2.11 | 15.92    1.38 | 22.00    0.69
                 3.83    0.79 |  9.92    2.18 | 16.00    1.34 | 22.08    0.69
                 3.92    0.80 | 10.00    2.26 | 16.08    1.32 | 22.17    0.69
                 4.00    0.80 | 10.08    2.37 | 16.17    1.31 | 22.25    0.69
                 4.08    0.81 | 10.17    2.48 | 16.25    1.29 | 22.33    0.68
                 4.17    0.82 | 10.25    2.59 | 16.33    1.28 | 22.42    0.68
                 4.25    0.83 | 10.33    2.70 | 16.42    1.27 | 22.50    0.68
                 4.33    0.84 | 10.42    2.82 | 16.50    1.26 | 22.58    0.67
                 4.42    0.85 | 10.50    2.93 | 16.58    1.24 | 22.67    0.67
                 4.50    0.86 | 10.58    3.11 | 16.67    1.23 | 22.75    0.67
                 4.58    0.87 | 10.67    3.29 | 16.75    1.22 | 22.83    0.67
                 4.67    0.88 | 10.75    3.48 | 16.83    1.21 | 22.92    0.67
                 4.75    0.89 | 10.83    3.66 | 16.92    1.20 | 23.00    0.66
                 4.83    0.90 | 10.92    3.85 | 17.00    1.19 | 23.08    0.66
                 4.92    0.91 | 11.00    4.03 | 17.08    1.18 | 23.17    0.66
                 5.00    0.92 | 11.08    4.42 | 17.17    1.16 | 23.25    0.66
                 5.08    0.93 | 11.17    4.87 | 17.25    1.15 | 23.33    0.65
                 5.17    0.94 | 11.25    5.31 | 17.33    1.14 | 23.42    0.65
                 5.25    0.95 | 11.33    5.75 | 17.42    1.13 | 23.50    0.65
                 5.33    0.96 | 11.42    6.19 | 17.50    1.12 | 23.58    0.65
                 5.42    0.96 | 11.50    6.64 | 17.58    1.10 | 23.67    0.65
                 5.50    0.97 | 11.58   13.73 | 17.67    1.09 | 23.75    0.64
                 5.58    0.98 | 11.67   24.64 | 17.75    1.08 | 23.83    0.64
                 5.67    0.99 | 11.75   37.36 | 17.83    1.07 | 23.92    0.64
                 5.75    1.00 | 11.83   58.00 | 17.92    1.06 | 24.00    0.63
                 5.83    1.01 | 11.92   74.12 | 18.00    1.04 |
                 5.92    1.02 | 12.00   54.80 | 18.08    1.03 |
                 6.00    1.03 | 12.08   10.92 | 18.17    1.02 |

-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182
```

```
     PEAK FLOW       (cms)=   0.056 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  17.654
     TOTAL RAINFALL   (mm)=  57.600
     RUNOFF COEFFICIENT   =   0.306

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69        0.84
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       2.00        4.00
     Length            (m)=     101.00       25.00
     Mannings n           =      0.013       0.250

     Max.Eff.Inten.(mm/hr)=      74.12       33.93
               over (min)        5.00       10.00
     Storage Coeff.  (min)=       2.35 (ii)    9.02 (ii)
     Unit Hyd. Tpeak (min)=       5.00       10.00
     Unit Hyd. peak  (cms)=       0.30        0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.11        0.06         0.159 (iii)
     TIME TO PEAK    (hrs)=      12.00       12.08         12.00
     RUNOFF VOLUME    (mm)=      55.60       21.56         34.22
     TOTAL RAINFALL   (mm)=      57.60       57.60         57.60
     RUNOFF COEFFICIENT   =       0.97        0.37          0.59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.159    12.00    34.22
      + ID2= 2 (  0204):     2.62   0.056    12.50    17.65
        ===================================================
```

```
     ID = 3 (  0208):     4.15   0.176    12.08    23.76

  NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

    Unit Hyd Qpeak  (cms)=   0.184

    PEAK FLOW       (cms)=   0.053 (i)
    TIME TO PEAK    (hrs)=  12.583
    RUNOFF VOLUME    (mm)=  16.261
    TOTAL RAINFALL   (mm)=  57.600
    RUNOFF COEFFICIENT   =   0.282

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       3.13        12.44
    Dep. Storage     (mm)=       2.00         5.10
    Average Slope     (%)=       2.00         4.00
    Length            (m)=     322.18        70.00
    Mannings n          =      0.013        0.250

    Max.Eff.Inten.(mm/hr)=      74.12        26.14
               over (min)       5.00        20.00
    Storage Coeff.  (min)=       4.72 (ii)   18.44 (ii)
    Unit Hyd. Tpeak (min)=       5.00        20.00
    Unit Hyd. peak  (cms)=       0.22         0.06
                                                          *TOTALS*
    PEAK FLOW       (cms)=       0.49         0.50          0.789 (iii)
    TIME TO PEAK    (hrs)=      12.00        12.25          12.08
    RUNOFF VOLUME    (mm)=      55.60        20.17          26.30
    TOTAL RAINFALL   (mm)=      57.60        57.60          57.60
    RUNOFF COEFFICIENT   =       0.97         0.35           0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
           CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   0.789    12.08    26.30
      + ID2= 2 (  0203):     2.80   0.053    12.58    16.26
        ===================================================
        ID = 3 (  0207):    18.37   0.812    12.08    24.77

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.812    12.08    24.77
      + ID2= 2 (  0208):     4.15   0.176    12.08    23.76
        ===================================================
        ID = 3 (  0209):    22.52   0.988    12.08    24.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\ec80
5886-e36e-43c5-b9f3-f0b78fa7d2bf\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\ec80
5886-e36e-43c5-b9f3-f0b78fa7d2bf\scen


DATE: 01-29-2024                           TIME: 12:59:34

USER:



COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : D - 5yr 4hr 5min Chicago      **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 573.118
| Ptotal= 43.63 mm |                          B=   1.500
--------------------                          C=   0.722
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.26 |  1.00   11.36 |  2.00    7.81 |  3.00    4.18
                 0.08    3.43 |  1.08   16.19 |  2.08    7.22 |  3.08    4.04
                 0.17    3.62 |  1.17   33.93 |  2.17    6.73 |  3.17    3.91
                 0.25    3.85 |  1.25  148.36 |  2.25    6.31 |  3.25    3.79
                 0.33    4.10 |  1.33   43.20 |  2.33    5.95 |  3.33    3.68
                 0.42    4.41 |  1.42   24.71 |  2.42    5.63 |  3.42    3.57
                 0.50    4.77 |  1.50   17.99 |  2.50    5.35 |  3.50    3.48
                 0.58    5.22 |  1.58   14.41 |  2.58    5.10 |  3.58    3.39
                 0.67    5.78 |  1.67   12.16 |  2.67    4.88 |  3.67    3.30
                 0.75    6.51 |  1.75   10.59 |  2.75    4.68 |  3.75    3.22
                 0.83    7.51 |  1.83    9.43 |  2.83    4.50 |  3.83    3.14
                 0.92    8.97 |  1.92    8.53 |  2.92    4.33 |  3.92    3.07
```

```
--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

    Unit Hyd Qpeak  (cms)=   0.182

    PEAK FLOW       (cms)=   0.038 (i)
    TIME TO PEAK    (hrs)=   2.083
    RUNOFF VOLUME    (mm)=  10.238
    TOTAL RAINFALL   (mm)=  43.632
    RUNOFF COEFFICIENT   =   0.235

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.69         0.84
    Dep. Storage     (mm)=       2.00         5.00
    Average Slope     (%)=       2.00         4.00
    Length            (m)=     101.00        25.00
    Mannings n          =      0.013        0.250

    Max.Eff.Inten.(mm/hr)=     148.36        29.84
               over (min)       5.00        10.00
    Storage Coeff.  (min)=       1.78 (ii)    6.10 (ii)
    Unit Hyd. Tpeak (min)=       5.00        10.00
    Unit Hyd. peak  (cms)=       0.32         0.15
                                                          *TOTALS*
    PEAK FLOW       (cms)=       0.22         0.05          0.249 (iii)
    TIME TO PEAK    (hrs)=       1.33         1.42           1.33
    RUNOFF VOLUME    (mm)=      41.63        13.12          23.73
    TOTAL RAINFALL   (mm)=      43.63        43.63          43.63
    RUNOFF COEFFICIENT   =       0.95         0.30           0.54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

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

 --------------------------------------------------------------------------------


 --------------------
 | ADD HYD  (  0208)|
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.249     1.33    23.73
      + ID2= 2 (  0204):     2.62   0.038     2.08    10.24
        ==================================================
        ID = 3 (  0208):     4.15   0.252     1.33    15.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 --------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.035 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=   9.299
     TOTAL RAINFALL   (mm)=  43.632
     RUNOFF COEFFICIENT   =   0.213

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

 --------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | STANDHYD (  0201)|   Area    (ha)=  15.57
 |ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     148.36        16.49
                over (min)       5.00        25.00
     Storage Coeff.  (min)=       3.58 (ii)   20.07 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=       0.26         0.05
                                                                 *TOTALS*
```

```
     PEAK FLOW       (cms)=       0.89         0.31          0.935 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.75          1.33
     RUNOFF VOLUME    (mm)=      41.63        12.12         17.23
     TOTAL RAINFALL   (mm)=      43.63        43.63         43.63
     RUNOFF COEFFICIENT   =       0.95         0.28          0.39

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
 ***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------


 --------------------
 | ADD HYD  (  0207)|
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   0.935     1.33    17.23
      + ID2= 2 (  0203):     2.80   0.035     2.17     9.30
        ==================================================
        ID = 3 (  0207):    18.37   0.937     1.33    16.02

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


 --------------------
 | ADD HYD  (  0209)|
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.937     1.33    16.02
      + ID2= 2 (  0208):     4.15   0.252     1.33    15.21
        ==================================================
        ID = 3 (  0209):    22.52   1.189     1.33    15.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 --------------------------------------------------------------------------------
 ====================================================================================
 =======================

        V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
        V    V   I    SS     U   U   A A   L
         V  V    I     SS    U   U  AAAAA  L
         V  V    I      SS   U   U  A   A  L
          VV     I    SSSSS  UUUUU  A   A  LLLLL
```

```
         OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
        O   O    T      T    H   H   Y Y   MM MM  O   O
        O   O    T      T    H   H    Y    M   M  O   O
         OOO     T      T    H   H    Y    M   M   OOO
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                    *****  D E T A I L E D   O U T P U T *****


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

   Output  filename:
 C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\1561
 fe4d-6113-4262-9202-c7b8ff81d9bf\scen
   Summary filename:
 C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\1561
 fe4d-6113-4262-9202-c7b8ff81d9bf\scen


 DATE: 01-29-2024                           TIME: 12:59:32

 USER:



 COMMENTS: ____________________________________________________________


 ------------------------------------------------------------------------------------
 ------------------------
   **********************************************
   ** SIMULATION : E - 5yr 24hr 5min SCS Type II **
   **********************************************



 --------------------
 |    READ STORM    |    Filename: C:\Users\dhordyk\AppD
 |                  |              ata\Local\Temp\
 |                  |              88f53ef1-126e-46c5-8e23-04870d1bcf26\124a23f6
 | Ptotal= 74.40 mm |    Comments: 5yr 24hr 5min SCS Type II
 --------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME     RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs    mm/hr
                 0.00    0.00 |  6.08    1.35 | 12.17   12.75 | 18.25    1.30
                 0.08    0.75 |  6.17    1.36 | 12.25   11.39 | 18.33    1.29
                 0.17    0.75 |  6.25    1.37 | 12.33   10.04 | 18.42    1.27
                 0.25    0.76 |  6.33    1.38 | 12.42    8.68 | 18.50    1.26
```

```
      0.33    0.77 |  6.42    1.39 | 12.50    7.32 | 18.58    1.24
      0.42    0.77 |  6.50    1.41 | 12.58    6.28 | 18.67    1.22
      0.50    0.78 |  6.58    1.42 | 12.67    5.97 | 18.75    1.21
      0.58    0.78 |  6.67    1.43 | 12.75    5.66 | 18.83    1.19
      0.67    0.79 |  6.75    1.44 | 12.83    5.35 | 18.92    1.18
      0.75    0.80 |  6.83    1.46 | 12.92    5.04 | 19.00    1.16
      0.83    0.80 |  6.92    1.47 | 13.00    4.73 | 19.08    1.15
      0.92    0.81 |  7.00    1.48 | 13.08    4.43 | 19.17    1.13
      1.00    0.81 |  7.08    1.50 | 13.17    4.27 | 19.25    1.11
      1.08    0.83 |  7.17    1.51 | 13.25    4.10 | 19.33    1.10
      1.17    0.83 |  7.25    1.52 | 13.33    3.93 | 19.42    1.08
      1.25    0.83 |  7.33    1.53 | 13.42    3.77 | 19.50    1.07
      1.33    0.84 |  7.42    1.54 | 13.50    3.60 | 19.58    1.05
      1.42    0.84 |  7.50    1.55 | 13.58    3.42 | 19.67    1.04
      1.50    0.86 |  7.58    1.57 | 13.67    3.30 | 19.75    1.02
      1.58    0.86 |  7.67    1.58 | 13.75    3.18 | 19.83    1.01
      1.67    0.87 |  7.75    1.59 | 13.83    3.07 | 19.92    0.99
      1.75    0.87 |  7.83    1.61 | 13.92    2.95 | 20.00    0.97
      1.83    0.88 |  7.92    1.62 | 14.00    2.83 | 20.08    0.97
      1.92    0.89 |  8.00    1.63 | 14.08    2.73 | 20.17    0.96
      2.00    0.89 |  8.08    1.67 | 14.17    2.68 | 20.25    0.96
      2.08    0.90 |  8.17    1.73 | 14.25    2.64 | 20.33    0.96
      2.17    0.90 |  8.25    1.79 | 14.33    2.60 | 20.42    0.95
      2.25    0.91 |  8.33    1.85 | 14.42    2.56 | 20.50    0.95
      2.33    0.92 |  8.42    1.91 | 14.50    2.52 | 20.58    0.94
      2.42    0.92 |  8.50    1.97 | 14.58    2.46 | 20.67    0.94
      2.50    0.93 |  8.58    2.05 | 14.67    2.43 | 20.75    0.94
      2.58    0.93 |  8.67    2.11 | 14.75    2.38 | 20.83    0.94
      2.67    0.94 |  8.75    2.17 | 14.83    2.34 | 20.92    0.94
      2.75    0.94 |  8.83    2.22 | 14.92    2.30 | 21.00    0.93
      2.83    0.95 |  8.92    2.28 | 15.00    2.25 | 21.08    0.93
      2.92    0.96 |  9.00    2.34 | 15.08    2.21 | 21.17    0.92
      3.00    0.96 |  9.08    2.38 | 15.17    2.16 | 21.25    0.92
      3.08    0.97 |  9.17    2.38 | 15.25    2.12 | 21.33    0.92
      3.17    0.97 |  9.25    2.38 | 15.33    2.08 | 21.42    0.92
      3.25    0.98 |  9.33    2.38 | 15.42    2.04 | 21.50    0.92
      3.33    0.99 |  9.42    2.38 | 15.50    2.00 | 21.58    0.91
      3.42    0.99 |  9.50    2.38 | 15.58    1.94 | 21.67    0.91
      3.50    1.00 |  9.58    2.44 | 15.67    1.91 | 21.75    0.90
      3.58    1.00 |  9.67    2.54 | 15.75    1.86 | 21.83    0.90
      3.67    1.02 |  9.75    2.63 | 15.83    1.82 | 21.92    0.90
      3.75    1.02 |  9.83    2.73 | 15.92    1.78 | 22.00    0.89
      3.83    1.03 |  9.92    2.82 | 16.00    1.73 | 22.08    0.89
      3.92    1.03 | 10.00    2.92 | 16.08    1.70 | 22.17    0.89
      4.00    1.03 | 10.08    3.07 | 16.17    1.69 | 22.25    0.89
      4.08    1.05 | 10.17    3.21 | 16.25    1.67 | 22.33    0.88
      4.17    1.06 | 10.25    3.35 | 16.33    1.66 | 22.42    0.88
      4.25    1.07 | 10.33    3.49 | 16.42    1.64 | 22.50    0.88
      4.33    1.08 | 10.42    3.64 | 16.50    1.63 | 22.58    0.87
      4.42    1.10 | 10.50    3.78 | 16.58    1.61 | 22.67    0.87
```

```
                4.50    1.11 | 10.58    4.02 | 16.67    1.60 | 22.75    0.87
                4.58    1.12 | 10.67    4.26 | 16.75    1.58 | 22.83    0.86
                4.67    1.14 | 10.75    4.49 | 16.83    1.56 | 22.92    0.86
                4.75    1.15 | 10.83    4.73 | 16.92    1.55 | 23.00    0.86
                4.83    1.16 | 10.92    4.97 | 17.00    1.53 | 23.08    0.86
                4.92    1.17 | 11.00    5.21 | 17.08    1.52 | 23.17    0.85
                5.00    1.18 | 11.08    5.71 | 17.17    1.50 | 23.25    0.85
                5.08    1.20 | 11.17    6.29 | 17.25    1.49 | 23.33    0.85
                5.17    1.21 | 11.25    6.86 | 17.33    1.47 | 23.42    0.84
                5.25    1.22 | 11.33    7.43 | 17.42    1.46 | 23.50    0.84
                5.33    1.23 | 11.42    8.00 | 17.50    1.44 | 23.58    0.83
                5.42    1.25 | 11.50    8.57 | 17.58    1.42 | 23.67    0.83
                5.50    1.26 | 11.58   17.74 | 17.67    1.41 | 23.75    0.83
                5.58    1.27 | 11.67   31.83 | 17.75    1.39 | 23.83    0.83
                5.67    1.28 | 11.75   48.26 | 17.83    1.38 | 23.92    0.82
                5.75    1.30 | 11.83   74.91 | 17.92    1.36 | 24.00    0.82
                5.83    1.31 | 11.92   95.74 | 18.00    1.35 |
                5.92    1.32 | 12.00   70.78 | 18.08    1.33 |
                6.00    1.33 | 12.08   14.11 | 18.17    1.31 |

-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.092 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  28.071
     TOTAL RAINFALL   (mm)=  74.400
     RUNOFF COEFFICIENT   =   0.377

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      95.74        51.88
              over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.12 (ii)    7.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.15         0.10         0.223 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08         12.00
     RUNOFF VOLUME    (mm)=      72.40        33.09         47.71
     TOTAL RAINFALL   (mm)=      74.40        74.40         74.40
     RUNOFF COEFFICIENT   =       0.97         0.44          0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  74.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.223    12.00    47.71
      + ID2= 2 (  0204):     2.62   0.092    12.50    28.07
        ===============================================
        ID = 3 (  0208):     4.15   0.258    12.08    35.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.087 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  26.149
     TOTAL RAINFALL   (mm)=  74.400
     RUNOFF COEFFICIENT   =   0.351

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      95.74        40.77
              over (min)        5.00        20.00
     Storage Coeff.  (min)=       4.26 (ii)   15.74 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.23         0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.64         0.84         1.178 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.25         12.08
     RUNOFF VOLUME    (mm)=      72.40        31.27         38.38
     TOTAL RAINFALL   (mm)=      74.40        74.40         74.40
     RUNOFF COEFFICIENT   =       0.97         0.42          0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  74.3    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   1.178    12.08    38.38
      + ID2= 2 (  0203):     2.80   0.087    12.58    26.15
        ===============================================
        ID = 3 (  0207):    18.37   1.217    12.08    36.52

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   1.217    12.08    36.52
      + ID2= 2 (  0208):     4.15   0.258    12.08    35.31
        ===============================================
        ID = 3 (  0209):    22.52   1.474    12.08    36.30

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
====================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L               (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\3334
83b5-3ecc-42ce-9d56-acb49c30720f\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\3334
83b5-3ecc-42ce-9d56-acb49c30720f\scen


DATE: 01-29-2024                            TIME: 12:59:33

USER:


COMMENTS: ____________________________________________________________
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--------------------
  **********************************************
  ** SIMULATION : F - 10yr 4hr 5min Chicago     **
  **********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 664.647
| Ptotal= 50.60 mm |                          B=   1.500
--------------------                          C=   0.722
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.78 |  1.00   13.18 |  2.00    9.06 |  3.00    4.85
                 0.08    3.97 |  1.08   18.77 |  2.08    8.38 |  3.08    4.68
                 0.17    4.20 |  1.17   39.35 |  2.17    7.81 |  3.17    4.53
                 0.25    4.46 |  1.25  172.06 |  2.25    7.32 |  3.25    4.39
                 0.33    4.76 |  1.33   50.10 |  2.33    6.90 |  3.33    4.27
                 0.42    5.11 |  1.42   28.65 |  2.42    6.53 |  3.42    4.14
                 0.50    5.54 |  1.50   20.86 |  2.50    6.21 |  3.50    4.03
                 0.58    6.06 |  1.58   16.72 |  2.58    5.92 |  3.58    3.93
                 0.67    6.71 |  1.67   14.10 |  2.67    5.66 |  3.67    3.83
                 0.75    7.55 |  1.75   12.28 |  2.75    5.43 |  3.75    3.73
                 0.83    8.71 |  1.83   10.94 |  2.83    5.22 |  3.83    3.65
                 0.92   10.41 |  1.92    9.90 |  2.92    5.02 |  3.92    3.56

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.052 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  13.772
     TOTAL RAINFALL   (mm)=  50.600
     RUNOFF COEFFICIENT   =   0.272

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

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--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     172.06        40.00
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.68 (ii)    5.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.26         0.07         0.298 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42          1.33
     RUNOFF VOLUME    (mm)=      48.60        17.18         28.86
     TOTAL RAINFALL   (mm)=      50.60        50.60         50.60
     RUNOFF COEFFICIENT   =       0.96         0.34          0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):      1.53   0.298     1.33    28.86
      + ID2= 2 (  0204):      2.62   0.052     2.08    13.77
        ==================================================
        ID = 3 (  0208):      4.15   0.302     1.33    19.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58
```

```
     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.048 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  12.606
     TOTAL RAINFALL   (mm)=  50.600
     RUNOFF COEFFICIENT   =   0.249

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     172.06        26.31
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       3.37 (ii)   17.05 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.26         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.05         0.47         1.152 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58          1.33
     RUNOFF VOLUME    (mm)=      48.60        15.98         21.62
     TOTAL RAINFALL   (mm)=      50.60        50.60         50.60
     RUNOFF COEFFICIENT   =       0.96         0.32          0.43

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
```

```
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     15.57   1.152     1.33    21.62
      + ID2= 2 (  0203):      2.80   0.048     2.08    12.61
        ==================================================
        ID = 3 (  0207):     18.37   1.155     1.33    20.25

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):     18.37   1.155     1.33    20.25
      + ID2= 2 (  0208):      4.15   0.302     1.33    19.34
        ==================================================
        ID = 3 (  0209):     22.52   1.456     1.33    20.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
===================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H    H  Y    Y  M    M   OOO     TM
       O   O     T      T    H    H   Y Y    MM MM  O   O
       O   O     T      T    H    H    Y     M    M  O   O
        OOO      T      T    H    H    Y     M    M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\b28e
7211-b266-4059-8586-c324913ff82d\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\b28e
7211-b266-4059-8586-c324913ff82d\scen
```

```
DATE: 01-29-2024                          TIME: 12:59:34

USER:


COMMENTS: ____________________________________________________________

------------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : G - 10yr 24hr 5min SCS Type I **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              88f53ef1-126e-46c5-8e23-04870d1bcf26\24397740
| Ptotal= 86.40 mm |    Comments: 10yr 24hr 5min SCS Type II
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.00 |  6.08    1.56 | 12.17   14.81 | 18.25    1.51
                 0.08    0.87 |  6.17    1.58 | 12.25   13.23 | 18.33    1.49
                 0.17    0.87 |  6.25    1.59 | 12.33   11.65 | 18.42    1.47
                 0.25    0.88 |  6.33    1.61 | 12.42   10.08 | 18.50    1.46
                 0.33    0.89 |  6.42    1.62 | 12.50    8.50 | 18.58    1.43
                 0.42    0.89 |  6.50    1.63 | 12.58    7.29 | 18.67    1.42
                 0.50    0.91 |  6.58    1.65 | 12.67    6.93 | 18.75    1.40
                 0.58    0.91 |  6.67    1.66 | 12.75    6.57 | 18.83    1.38
                 0.67    0.92 |  6.75    1.68 | 12.83    6.21 | 18.92    1.37
                 0.75    0.92 |  6.83    1.69 | 12.92    5.85 | 19.00    1.35
                 0.83    0.93 |  6.92    1.71 | 13.00    5.50 | 19.08    1.33
                 0.92    0.94 |  7.00    1.72 | 13.08    5.15 | 19.17    1.31
                 1.00    0.94 |  7.08    1.74 | 13.17    4.96 | 19.25    1.29
                 1.08    0.96 |  7.17    1.75 | 13.25    4.76 | 19.33    1.28
                 1.17    0.96 |  7.25    1.76 | 13.33    4.57 | 19.42    1.26
                 1.25    0.97 |  7.33    1.78 | 13.42    4.38 | 19.50    1.24
                 1.33    0.98 |  7.42    1.79 | 13.50    4.18 | 19.58    1.22
                 1.42    0.98 |  7.50    1.81 | 13.58    3.97 | 19.67    1.20
                 1.50    0.99 |  7.58    1.82 | 13.67    3.84 | 19.75    1.19
                 1.58    0.99 |  7.67    1.84 | 13.75    3.70 | 19.83    1.17
                 1.67    1.01 |  7.75    1.85 | 13.83    3.56 | 19.92    1.15
                 1.75    1.01 |  7.83    1.86 | 13.92    3.42 | 20.00    1.13
                 1.83    1.02 |  7.92    1.88 | 14.00    3.28 | 20.08    1.12
                 1.92    1.03 |  8.00    1.89 | 14.08    3.17 | 20.17    1.12
```

```
                 2.00    1.03 |  8.08    1.94 | 14.17    3.12 | 20.25    1.11
                 2.08    1.05 |  8.17    2.01 | 14.25    3.07 | 20.33    1.11
                 2.17    1.05 |  8.25    2.08 | 14.33    3.02 | 20.42    1.11
                 2.25    1.06 |  8.33    2.15 | 14.42    2.97 | 20.50    1.11
                 2.33    1.06 |  8.42    2.22 | 14.50    2.93 | 20.58    1.10
                 2.42    1.07 |  8.50    2.29 | 14.58    2.86 | 20.67    1.10
                 2.50    1.08 |  8.58    2.38 | 14.67    2.82 | 20.75    1.09
                 2.58    1.08 |  8.67    2.45 | 14.75    2.77 | 20.83    1.09
                 2.67    1.09 |  8.75    2.51 | 14.83    2.72 | 20.92    1.09
                 2.75    1.10 |  8.83    2.58 | 14.92    2.67 | 21.00    1.08
                 2.83    1.10 |  8.92    2.65 | 15.00    2.62 | 21.08    1.08
                 2.92    1.11 |  9.00    2.72 | 15.08    2.57 | 21.17    1.07
                 3.00    1.11 |  9.08    2.76 | 15.17    2.51 | 21.25    1.07
                 3.08    1.13 |  9.17    2.76 | 15.25    2.47 | 21.33    1.07
                 3.17    1.13 |  9.25    2.76 | 15.33    2.42 | 21.42    1.06
                 3.25    1.14 |  9.33    2.76 | 15.42    2.37 | 21.50    1.06
                 3.33    1.15 |  9.42    2.76 | 15.50    2.32 | 21.58    1.05
                 3.42    1.15 |  9.50    2.76 | 15.58    2.26 | 21.67    1.05
                 3.50    1.17 |  9.58    2.83 | 15.67    2.21 | 21.75    1.05
                 3.58    1.17 |  9.67    2.94 | 15.75    2.16 | 21.83    1.05
                 3.67    1.18 |  9.75    3.06 | 15.83    2.11 | 21.92    1.04
                 3.75    1.18 |  9.83    3.17 | 15.92    2.07 | 22.00    1.04
                 3.83    1.19 |  9.92    3.28 | 16.00    2.01 | 22.08    1.04
                 3.92    1.20 | 10.00    3.39 | 16.08    1.98 | 22.17    1.03
                 4.00    1.20 | 10.08    3.56 | 16.17    1.96 | 22.25    1.03
                 4.08    1.22 | 10.17    3.73 | 16.25    1.94 | 22.33    1.02
                 4.17    1.23 | 10.25    3.89 | 16.33    1.92 | 22.42    1.02
                 4.25    1.25 | 10.33    4.06 | 16.42    1.91 | 22.50    1.02
                 4.33    1.26 | 10.42    4.22 | 16.50    1.89 | 22.58    1.01
                 4.42    1.27 | 10.50    4.39 | 16.58    1.87 | 22.67    1.01
                 4.50    1.29 | 10.58    4.67 | 16.67    1.85 | 22.75    1.01
                 4.58    1.30 | 10.67    4.94 | 16.75    1.83 | 22.83    1.00
                 4.67    1.32 | 10.75    5.22 | 16.83    1.82 | 22.92    1.00
                 4.75    1.33 | 10.83    5.50 | 16.92    1.80 | 23.00    0.99
                 4.83    1.35 | 10.92    5.77 | 17.00    1.78 | 23.08    0.99
                 4.92    1.36 | 11.00    6.05 | 17.08    1.76 | 23.17    0.99
                 5.00    1.37 | 11.08    6.64 | 17.17    1.74 | 23.25    0.98
                 5.08    1.39 | 11.17    7.30 | 17.25    1.73 | 23.33    0.98
                 5.17    1.40 | 11.25    7.96 | 17.33    1.71 | 23.42    0.98
                 5.25    1.42 | 11.33    8.63 | 17.42    1.69 | 23.50    0.98
                 5.33    1.43 | 11.42    9.29 | 17.50    1.68 | 23.58    0.97
                 5.42    1.45 | 11.50    9.95 | 17.58    1.65 | 23.67    0.97
                 5.50    1.46 | 11.58   20.60 | 17.67    1.64 | 23.75    0.96
                 5.58    1.48 | 11.67   36.97 | 17.75    1.62 | 23.83    0.96
                 5.67    1.49 | 11.75   56.04 | 17.83    1.60 | 23.92    0.96
                 5.75    1.51 | 11.83   86.99 | 17.92    1.58 | 24.00    0.95
                 5.83    1.52 | 11.92  111.18 | 18.00    1.56 |
                 5.92    1.53 | 12.00   82.20 | 18.08    1.55 |
                 6.00    1.55 | 12.08   16.38 | 18.17    1.53 |
```

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--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.120 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  36.267
     TOTAL RAINFALL   (mm)=  86.400
     RUNOFF COEFFICIENT   =   0.420

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     111.18        65.64
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.00 (ii)    6.85 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.13          0.274 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.00
     RUNOFF VOLUME    (mm)=      84.40        42.00          57.77
     TOTAL RAINFALL   (mm)=      86.40        86.40          86.40
     RUNOFF COEFFICIENT   =       0.98         0.49           0.67

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0202):      1.53   0.274    12.00    57.77
     + ID2= 2 (  0204):      2.62   0.120    12.50    36.27
       ===================================================
       ID = 3 (  0208):      4.15   0.322    12.08    44.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.115 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  33.988
     TOTAL RAINFALL   (mm)=  86.400
     RUNOFF COEFFICIENT   =   0.393

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     111.18        52.14
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       4.01 (ii)   14.42 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.24         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.76         1.18          1.683 (iii)
```

```
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
     RUNOFF VOLUME    (mm)=      84.40        39.90          47.60
     TOTAL RAINFALL   (mm)=      86.40        86.40          86.40
     RUNOFF COEFFICIENT   =       0.98         0.46           0.55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   1.683    12.08    47.60
      + ID2= 2 (  0203):     2.80   0.115    12.58    33.99
        ==================================================
        ID = 3 (  0207):    18.37   1.735    12.08    45.52

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   1.735    12.08    45.52
      + ID2= 2 (  0208):     4.15   0.322    12.08    44.19
        ==================================================
        ID = 3 (  0209):    22.52   2.057    12.08    45.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
```

```
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\885d
0b09-b2cd-4212-8313-c67aa8f8badc\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\885d
0b09-b2cd-4212-8313-c67aa8f8badc\scen


DATE: 01-29-2024                           TIME: 12:59:33

USER:


COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : H - 25yr 4hr 5min Chicago     **
  **********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 779.866
| Ptotal= 59.05 mm |                          B=   1.500
--------------------                          C=   0.723
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    4.39 |  1.00   15.36 |  2.00   10.55 |  3.00    5.64
                 0.08    4.62 |  1.08   21.89 |  2.08    9.76 |  3.08    5.45
```

```
                 0.17    4.89 |  1.17   45.95 |  2.17    9.09 |  3.17    5.27
                 0.25    5.19 |  1.25  201.50 |  2.25    8.52 |  3.25    5.11
                 0.33    5.54 |  1.33   58.52 |  2.33    8.03 |  3.33    4.96
                 0.42    5.95 |  1.42   33.43 |  2.42    7.60 |  3.42    4.82
                 0.50    6.44 |  1.50   24.33 |  2.50    7.22 |  3.50    4.69
                 0.58    7.05 |  1.58   19.49 |  2.58    6.89 |  3.58    4.57
                 0.67    7.81 |  1.67   16.43 |  2.67    6.59 |  3.67    4.45
                 0.75    8.79 |  1.75   14.31 |  2.75    6.31 |  3.75    4.34
                 0.83   10.14 |  1.83   12.74 |  2.83    6.07 |  3.83    4.24
                 0.92   12.12 |  1.92   11.52 |  2.92    5.84 |  3.92    4.14


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.071 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  18.493
     TOTAL RAINFALL   (mm)=  59.046
     RUNOFF COEFFICIENT   =   0.313

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     201.50        53.76
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.58 (ii)    5.40 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.31         0.10          0.361 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
```

```
     RUNOFF VOLUME    (mm)=      57.05        22.50          35.35
     TOTAL RAINFALL   (mm)=      59.05        59.05          59.05
     RUNOFF COEFFICIENT   =       0.97         0.38           0.60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.361     1.33    35.35
      + ID2= 2 (  0204):     2.62   0.071     2.08    18.49
        ==================================================
        ID = 3 (  0208):     4.15   0.366     1.33    24.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.067 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  17.053
     TOTAL RAINFALL   (mm)=  59.046
     RUNOFF COEFFICIENT   =   0.289

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
```

```
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     201.50        35.48
              over (min)        5.00        20.00
     Storage Coeff.  (min)=       3.16 (ii)   15.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.27         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.26         0.69          1.411 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58          1.33
     RUNOFF VOLUME    (mm)=      57.05        21.07         27.29
     TOTAL RAINFALL   (mm)=      59.05        59.05         59.05
     RUNOFF COEFFICIENT   =       0.97         0.36          0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   1.411     1.33    27.29
      + ID2= 2 (  0203):     2.80   0.067     2.08    17.05
        ===================================================
        ID = 3 (  0207):    18.37   1.415     1.33    25.73

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   1.415     1.33    25.73
      + ID2= 2 (  0208):     4.15   0.366     1.33    24.71
        ===================================================
        ID = 3 (  0209):    22.52   1.781     1.33    25.54

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

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====================================================================================
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       V    V   I    SSSSS  U    U    A    L              (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\b0d0
479b-8a5e-419d-b275-865c63e84cd5\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\b0d0
479b-8a5e-419d-b275-865c63e84cd5\scen


DATE: 01-29-2024                           TIME: 12:59:34

USER:



COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------
-----------------------
  ************************************************
  ** SIMULATION : I - 25yr 24hr 5min SCS Type I **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              88f53ef1-126e-46c5-8e23-04870d1bcf26\52718ccf
| Ptotal=100.80 mm |    Comments: 25yr 24hr 5min SCS Type II
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.00	6.08	1.82	12.17	17.27	18.25	1.76
0.08	1.02	6.17	1.84	12.25	15.43	18.33	1.74
0.17	1.02	6.25	1.86	12.33	13.60	18.42	1.72
0.25	1.03	6.33	1.87	12.42	11.76	18.50	1.70
0.33	1.04	6.42	1.89	12.50	9.92	18.58	1.67
0.42	1.04	6.50	1.91	12.58	8.51	18.67	1.66
0.50	1.06	6.58	1.93	12.67	8.09	18.75	1.63
0.58	1.06	6.67	1.94	12.75	7.67	18.83	1.61
0.67	1.07	6.75	1.96	12.83	7.25	18.92	1.60
0.75	1.08	6.83	1.97	12.92	6.83	19.00	1.57
0.83	1.09	6.92	1.99	13.00	6.41	19.08	1.55
0.92	1.10	7.00	2.01	13.08	6.01	19.17	1.53
1.00	1.10	7.08	2.03	13.17	5.78	19.25	1.51
1.08	1.12	7.17	2.04	13.25	5.56	19.33	1.49
1.17	1.12	7.25	2.06	13.33	5.33	19.42	1.47
1.25	1.13	7.33	2.07	13.42	5.10	19.50	1.45
1.33	1.14	7.42	2.09	13.50	4.88	19.58	1.42
1.42	1.14	7.50	2.11	13.58	4.64	19.67	1.41
1.50	1.16	7.58	2.13	13.67	4.48	19.75	1.38
1.58	1.16	7.67	2.14	13.75	4.31	19.83	1.36
1.67	1.18	7.75	2.16	13.83	4.15	19.92	1.34
1.75	1.18	7.83	2.18	13.92	3.99	20.00	1.32
1.83	1.19	7.92	2.19	14.00	3.83	20.08	1.31
1.92	1.20	8.00	2.21	14.08	3.70	20.17	1.30
2.00	1.20	8.08	2.27	14.17	3.63	20.25	1.30
2.08	1.22	8.17	2.35	14.25	3.58	20.33	1.30
2.17	1.22	8.25	2.43	14.33	3.53	20.42	1.29
2.25	1.23	8.33	2.51	14.42	3.47	20.50	1.29
2.33	1.24	8.42	2.59	14.50	3.42	20.58	1.28
2.42	1.24	8.50	2.67	14.58	3.34	20.67	1.28
2.50	1.26	8.58	2.77	14.67	3.29	20.75	1.27
2.58	1.26	8.67	2.85	14.75	3.23	20.83	1.27
2.67	1.28	8.75	2.93	14.83	3.17	20.92	1.27
2.75	1.28	8.83	3.01	14.92	3.12	21.00	1.26
2.83	1.29	8.92	3.09	15.00	3.05	21.08	1.26
2.92	1.30	9.00	3.18	15.08	2.99	21.17	1.25
3.00	1.30	9.08	3.23	15.17	2.93	21.25	1.25
3.08	1.32	9.17	3.23	15.25	2.88	21.33	1.25
3.17	1.32	9.25	3.23	15.33	2.82	21.42	1.24
3.25	1.33	9.33	3.23	15.42	2.76	21.50	1.24
3.33	1.34	9.42	3.23	15.50	2.71	21.58	1.23
3.42	1.34	9.50	3.23	15.58	2.63	21.67	1.23
3.50	1.36	9.58	3.31	15.67	2.58	21.75	1.22
3.58	1.36	9.67	3.44	15.75	2.52	21.83	1.22
3.67	1.38	9.75	3.56	15.83	2.47	21.92	1.22
3.75	1.38	9.83	3.69	15.92	2.41	22.00	1.21
3.83	1.39	9.92	3.82	16.00	2.35	22.08	1.21
3.92	1.40	10.00	3.95	16.08	2.31	22.17	1.20
4.00	1.40	10.08	4.15	16.17	2.28	22.25	1.20
4.08	1.42	10.17	4.35	16.25	2.27	22.33	1.20
4.17	1.44	10.25	4.54	16.33	2.25	22.42	1.19
4.25	1.45	10.33	4.73	16.42	2.22	22.50	1.19
4.33	1.47	10.42	4.93	16.50	2.21	22.58	1.18
4.42	1.49	10.50	5.12	16.58	2.18	22.67	1.18
4.50	1.50	10.58	5.44	16.67	2.16	22.75	1.17
4.58	1.52	10.67	5.77	16.75	2.14	22.83	1.17
4.67	1.54	10.75	6.09	16.83	2.12	22.92	1.17
4.75	1.55	10.83	6.41	16.92	2.10	23.00	1.16
4.83	1.57	10.92	6.73	17.00	2.08	23.08	1.16
4.92	1.59	11.00	7.06	17.08	2.06	23.17	1.15
5.00	1.60	11.08	7.74	17.17	2.03	23.25	1.15
5.08	1.62	11.17	8.52	17.25	2.01	23.33	1.15
5.17	1.64	11.25	9.29	17.33	1.99	23.42	1.14
5.25	1.66	11.33	10.06	17.42	1.97	23.50	1.14
5.33	1.67	11.42	10.84	17.50	1.96	23.58	1.13
5.42	1.69	11.50	11.61	17.58	1.93	23.67	1.13
5.50	1.70	11.58	24.03	17.67	1.91	23.75	1.12
5.58	1.72	11.67	43.13	17.75	1.89	23.83	1.12
5.67	1.74	11.75	65.38	17.83	1.87	23.92	1.12
5.75	1.76	11.83	101.49	17.92	1.85	24.00	1.11
5.83	1.77	11.92	129.71	18.00	1.82		
5.92	1.79	12.00	95.90	18.08	1.80		
6.00	1.80	12.08	19.11	18.17	1.78		

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

--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.156 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  46.743
     TOTAL RAINFALL   (mm)= 100.800
     RUNOFF COEFFICIENT   =   0.464

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

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```
| CALIB              |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     129.71        82.87
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.88 (ii)    6.44 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.14
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.20         0.17          0.335 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.00
     RUNOFF VOLUME    (mm)=      98.80        53.25          70.19
     TOTAL RAINFALL   (mm)=     100.80       100.80         100.80
     RUNOFF COEFFICIENT   =       0.98         0.53           0.70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.335    12.00    70.19
      + ID2= 2 (  0204):     2.62   0.156    12.50    46.74
        ===================================================
        ID = 3 (  0208):     4.15   0.401    12.08    55.39

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58
```

```
     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.150 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  44.062
     TOTAL RAINFALL   (mm)= 100.800
     RUNOFF COEFFICIENT   =   0.437

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     129.71        71.98
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.77 (ii)   12.92 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.25         0.08
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.89         1.59          2.160 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
     RUNOFF VOLUME    (mm)=      98.80        50.85          59.15
     TOTAL RAINFALL   (mm)=     100.80       100.80         100.80
     RUNOFF COEFFICIENT   =       0.98         0.50           0.59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
```

```
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   2.160    12.08    59.15
      + ID2= 2 (  0203):     2.80   0.150    12.58    44.06
        ===================================================
        ID = 3 (  0207):    18.37   2.230    12.08    56.85

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   2.230    12.08    56.85
      + ID2= 2 (  0208):     4.15   0.401    12.08    55.39
        ===================================================
        ID = 3 (  0209):    22.52   2.631    12.08    56.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
======================

       V    V   I    SSSSS  U    U    A    L               (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\a090
85c5-c3e1-42e5-a74a-85f7c28e7f39\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\a090
85c5-c3e1-42e5-a74a-85f7c28e7f39\scen
```

```
DATE: 01-29-2024                           TIME: 12:59:33

USER:


COMMENTS: ____________________________________________________________


----------------------------------------------------------------------------------
------------------------
  **************************************************
  ** SIMULATION : J - 50yr 4hr 5min Chicago      **
  **************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 870.253
| Ptotal= 65.17 mm |                           B=   1.500
--------------------                           C=   0.725
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    4.81 |  1.00   16.90 |  2.00   11.60 |  3.00    6.18
                 0.08    5.07 |  1.08   24.12 |  2.08   10.72 |  3.08    5.98
                 0.17    5.36 |  1.17   50.78 |  2.17    9.98 |  3.17    5.78
                 0.25    5.69 |  1.25  224.02 |  2.25    9.36 |  3.25    5.61
                 0.33    6.07 |  1.33   64.73 |  2.33    8.82 |  3.33    5.44
                 0.42    6.53 |  1.42   36.90 |  2.42    8.34 |  3.42    5.29
                 0.50    7.07 |  1.50   26.82 |  2.50    7.93 |  3.50    5.14
                 0.58    7.74 |  1.58   21.46 |  2.58    7.56 |  3.58    5.01
                 0.67    8.57 |  1.67   18.09 |  2.67    7.23 |  3.67    4.88
                 0.75    9.66 |  1.75   15.74 |  2.75    6.93 |  3.75    4.76
                 0.83   11.15 |  1.83   14.01 |  2.83    6.66 |  3.83    4.65
                 0.92   13.33 |  1.92   12.67 |  2.92    6.41 |  3.92    4.54


----------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182
```

```
     PEAK FLOW       (cms)=   0.087 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  22.174
     TOTAL RAINFALL   (mm)=  65.171
     RUNOFF COEFFICIENT   =   0.340

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

------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     224.02        64.81
              over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.51 (ii)    5.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.34         0.13          0.409 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      63.17        26.60          40.20
     TOTAL RAINFALL   (mm)=      65.17        65.17          65.17
     RUNOFF COEFFICIENT   =       0.97         0.41           0.62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.409     1.33    40.20
      + ID2= 2 (  0204):     2.62   0.087     2.00    22.17
```

```
        ==================================================
        ID = 3 (  0208):     4.15   0.416     1.33    28.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.082 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  20.539
     TOTAL RAINFALL   (mm)=  65.171
     RUNOFF COEFFICIENT   =   0.315

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

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     224.02        42.84
              over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.03 (ii)   14.29 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.27         0.08
                                                            *TOTALS*
     PEAK FLOW       (cms)=       1.42         0.89          1.702 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      63.17        25.01          31.61
     TOTAL RAINFALL   (mm)=      65.17        65.17          65.17
     RUNOFF COEFFICIENT   =       0.97         0.38           0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   1.702     1.33    31.61
      + ID2= 2 (  0203):     2.80   0.082     2.08    20.54
        ==================================================
        ID = 3 (  0207):    18.37   1.707     1.33    29.92

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   1.707     1.33    29.92
      + ID2= 2 (  0208):     4.15   0.416     1.33    28.82
        ==================================================
        ID = 3 (  0209):    22.52   2.124     1.33    29.72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
==================================================================================
======================

       V    V   I    SSSSS  U    U    A    L              (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO   TTTTT  TTTTT  H    H  Y   Y  M    M   OOO    TM
       O   O    T      T    H    H   Y Y   MM MM   O   O
       O   O    T      T    H    H    Y    M   M   O   O
        OOO     T      T    H    H    Y    M   M    OOO
Developed and Distributed by Smart City Water Inc
```



```
                   *****  D E T A I L E D   O U T P U T *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\f857
f3f2-6ce9-4be7-a70f-8c833d399d28\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\f857
f3f2-6ce9-4be7-a70f-8c833d399d28\scen


DATE: 01-29-2024                              TIME: 12:59:34

USER:


COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : K - 50yr 24hr 5min SCS Type I **
  **********************************************


--------------------
|    READ STORM     |    Filename: C:\Users\dhordyk\AppD
|                   |              ata\Local\Temp\
|                   |              88f53ef1-126e-46c5-8e23-04870d1bcf26\a68cd2f7
| Ptotal=110.40 mm |    Comments: 50yr 24hr 5min SCS Type II
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.00 |  6.08    2.00 | 12.17   18.92 | 18.25    1.93
                 0.08    1.12 |  6.17    2.02 | 12.25   16.90 | 18.33    1.91
                 0.17    1.12 |  6.25    2.03 | 12.33   14.89 | 18.42    1.88
                 0.25    1.13 |  6.33    2.05 | 12.42   12.88 | 18.50    1.87
                 0.33    1.14 |  6.42    2.07 | 12.50   10.86 | 18.58    1.83
                 0.42    1.14 |  6.50    2.09 | 12.58    9.32 | 18.67    1.81
                 0.50    1.16 |  6.58    2.11 | 12.67    8.86 | 18.75    1.79
                 0.58    1.16 |  6.67    2.13 | 12.75    8.40 | 18.83    1.77
                 0.67    1.18 |  6.75    2.14 | 12.83    7.94 | 18.92    1.75
                 0.75    1.18 |  6.83    2.16 | 12.92    7.48 | 19.00    1.72
                 0.83    1.19 |  6.92    2.18 | 13.00    7.02 | 19.08    1.70
                 0.92    1.20 |  7.00    2.20 | 13.08    6.58 | 19.17    1.67
                 1.00    1.20 |  7.08    2.22 | 13.17    6.33 | 19.25    1.65
                 1.08    1.23 |  7.17    2.24 | 13.25    6.09 | 19.33    1.63
```

```
  1.17    1.23 |  7.25    2.25 | 13.33    5.84 | 19.42    1.61
  1.25    1.24 |  7.33    2.27 | 13.42    5.59 | 19.50    1.59
  1.33    1.25 |  7.42    2.29 | 13.50    5.34 | 19.58    1.56
  1.42    1.25 |  7.50    2.31 | 13.58    5.08 | 19.67    1.54
  1.50    1.27 |  7.58    2.33 | 13.67    4.90 | 19.75    1.51
  1.58    1.27 |  7.67    2.35 | 13.75    4.73 | 19.83    1.49
  1.67    1.29 |  7.75    2.36 | 13.83    4.55 | 19.92    1.47
  1.75    1.29 |  7.83    2.38 | 13.92    4.37 | 20.00    1.45
  1.83    1.30 |  7.92    2.40 | 14.00    4.20 | 20.08    1.44
  1.92    1.31 |  8.00    2.42 | 14.08    4.05 | 20.17    1.43
  2.00    1.31 |  8.08    2.48 | 14.17    3.98 | 20.25    1.42
  2.08    1.34 |  8.17    2.57 | 14.25    3.92 | 20.33    1.42
  2.17    1.34 |  8.25    2.66 | 14.33    3.86 | 20.42    1.41
  2.25    1.35 |  8.33    2.75 | 14.42    3.80 | 20.50    1.41
  2.33    1.36 |  8.42    2.84 | 14.50    3.74 | 20.58    1.40
  2.42    1.36 |  8.50    2.93 | 14.58    3.65 | 20.67    1.40
  2.50    1.38 |  8.58    3.04 | 14.67    3.60 | 20.75    1.40
  2.58    1.38 |  8.67    3.12 | 14.75    3.54 | 20.83    1.39
  2.67    1.40 |  8.75    3.21 | 14.83    3.47 | 20.92    1.39
  2.75    1.40 |  8.83    3.30 | 14.92    3.42 | 21.00    1.38
  2.83    1.41 |  8.92    3.39 | 15.00    3.35 | 21.08    1.38
  2.92    1.42 |  9.00    3.48 | 15.08    3.28 | 21.17    1.37
  3.00    1.42 |  9.08    3.53 | 15.17    3.21 | 21.25    1.37
  3.08    1.45 |  9.17    3.53 | 15.25    3.15 | 21.33    1.36
  3.17    1.45 |  9.25    3.53 | 15.33    3.09 | 21.42    1.36
  3.25    1.46 |  9.33    3.53 | 15.42    3.02 | 21.50    1.36
  3.33    1.47 |  9.42    3.53 | 15.50    2.97 | 21.58    1.35
  3.42    1.47 |  9.50    3.53 | 15.58    2.88 | 21.67    1.35
  3.50    1.49 |  9.58    3.62 | 15.67    2.83 | 21.75    1.34
  3.58    1.49 |  9.67    3.76 | 15.75    2.76 | 21.83    1.34
  3.67    1.51 |  9.75    3.90 | 15.83    2.70 | 21.92    1.33
  3.75    1.51 |  9.83    4.05 | 15.92    2.64 | 22.00    1.32
  3.83    1.52 |  9.92    4.19 | 16.00    2.57 | 22.08    1.32
  3.92    1.53 | 10.00    4.33 | 16.08    2.53 | 22.17    1.32
  4.00    1.53 | 10.08    4.55 | 16.17    2.50 | 22.25    1.31
  4.08    1.56 | 10.17    4.76 | 16.25    2.48 | 22.33    1.31
  4.17    1.57 | 10.25    4.97 | 16.33    2.46 | 22.42    1.30
  4.25    1.59 | 10.33    5.18 | 16.42    2.44 | 22.50    1.30
  4.33    1.61 | 10.42    5.40 | 16.50    2.42 | 22.58    1.29
  4.42    1.63 | 10.50    5.61 | 16.58    2.38 | 22.67    1.29
  4.50    1.64 | 10.58    5.96 | 16.67    2.37 | 22.75    1.29
  4.58    1.67 | 10.67    6.31 | 16.75    2.34 | 22.83    1.28
  4.67    1.68 | 10.75    6.67 | 16.83    2.32 | 22.92    1.28
  4.75    1.70 | 10.83    7.02 | 16.92    2.30 | 23.00    1.27
  4.83    1.72 | 10.92    7.37 | 17.00    2.27 | 23.08    1.27
  4.92    1.74 | 11.00    7.73 | 17.08    2.25 | 23.17    1.26
  5.00    1.76 | 11.08    8.48 | 17.17    2.23 | 23.25    1.26
  5.08    1.78 | 11.17    9.33 | 17.25    2.21 | 23.33    1.25
  5.17    1.80 | 11.25   10.17 | 17.33    2.18 | 23.42    1.25
  5.25    1.81 | 11.33   11.02 | 17.42    2.16 | 23.50    1.25
```

```
  5.33    1.83 | 11.42   11.87 | 17.50    2.14 | 23.58    1.24
  5.42    1.85 | 11.50   12.72 | 17.58    2.11 | 23.67    1.24
  5.50    1.87 | 11.58   26.32 | 17.67    2.09 | 23.75    1.23
  5.58    1.89 | 11.67   47.23 | 17.75    2.07 | 23.83    1.23
  5.67    1.91 | 11.75   71.61 | 17.83    2.04 | 23.92    1.22
  5.75    1.92 | 11.83  111.16 | 17.92    2.02 | 24.00    1.21
  5.83    1.94 | 11.92  142.07 | 18.00    2.00 |
  5.92    1.96 | 12.00  105.03 | 18.08    1.98 |
  6.00    1.98 | 12.08   20.93 | 18.17    1.95 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   ( 0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.181 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  54.044
     TOTAL RAINFALL   (mm)= 110.400
     RUNOFF COEFFICIENT   =   0.490

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n          =       0.013        0.250

     Max.Eff.Inten.(mm/hr)=     142.07        94.68
                over (min)       5.00        10.00
     Storage Coeff.  (min)=       1.81 (ii)    6.21 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.22         0.19          0.377 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.00
     RUNOFF VOLUME    (mm)=     108.40        61.03          78.65
```

```
     TOTAL RAINFALL   (mm)=     110.40       110.40         110.40
     RUNOFF COEFFICIENT   =       0.98         0.55           0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.377    12.00    78.65
      + ID2= 2 (  0204):     2.62   0.181    12.50    54.04
        ==================================================
        ID = 3 (  0208):     4.15   0.456    12.08    63.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   ( 0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.174 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  51.113
     TOTAL RAINFALL   (mm)= 110.400
     RUNOFF COEFFICIENT   =   0.463

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
```

```
     Length            (m)=     322.18        70.00
     Mannings n          =       0.013        0.250

     Max.Eff.Inten.(mm/hr)=     142.07        82.50
                over (min)       5.00        15.00
     Storage Coeff.  (min)=       3.64 (ii)   12.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.25         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.98         1.87          2.486 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
     RUNOFF VOLUME    (mm)=     108.40        58.44          67.08
     TOTAL RAINFALL   (mm)=     110.40       110.40         110.40
     RUNOFF COEFFICIENT   =       0.98         0.53           0.61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   2.486    12.08    67.08
      + ID2= 2 (  0203):     2.80   0.174    12.58    51.11
        ==================================================
        ID = 3 (  0207):    18.37   2.569    12.08    64.65

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   2.569    12.08    64.65
      + ID2= 2 (  0208):     4.15   0.456    12.08    63.12
        ==================================================
        ID = 3 (  0209):    22.52   3.024    12.08    64.37

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

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 FINISH
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      V    V   I    SSSSS  U    U    A     L              (v 6.2.2015)
      V    V   I    SS     U    U   A A    L
       V  V    I     SS    U    U  AAAAA   L
       V  V    I      SS   U    U  A    A  L
        VV     I    SSSSS  UUUUU  A    A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


```
                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\15c3
60ee-34d7-403a-b8ba-3fdb9b7f8f49\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\15c3
60ee-34d7-403a-b8ba-3fdb9b7f8f49\scen


DATE: 01-29-2024                          TIME: 12:59:32

USER:


COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------
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  **********************************************
  ** SIMULATION : L - 100yr 4hr 5min Chicago    **
  **********************************************
```

```
-------------------
| CHICAGO STORM    |    IDF curve parameters: A= 952.739
| Ptotal= 72.14 mm |                          B=   1.500
-------------------                           C=   0.723
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    5.36 |  1.00   18.76 |  2.00   12.89 |  3.00    6.89
                0.08    5.65 |  1.08   26.74 |  2.08   11.92 |  3.08    6.66
                0.17    5.97 |  1.17   56.14 |  2.17   11.10 |  3.17    6.44
                0.25    6.34 |  1.25  246.17 |  2.25   10.41 |  3.25    6.24
                0.33    6.76 |  1.33   71.49 |  2.33    9.81 |  3.33    6.06
                0.42    7.27 |  1.42   40.85 |  2.42    9.29 |  3.42    5.89
                0.50    7.87 |  1.50   29.72 |  2.50    8.82 |  3.50    5.73
                0.58    8.61 |  1.58   23.81 |  2.58    8.41 |  3.58    5.58
                0.67    9.54 |  1.67   20.07 |  2.67    8.05 |  3.67    5.44
                0.75   10.74 |  1.75   17.48 |  2.75    7.71 |  3.75    5.30
                0.83   12.39 |  1.83   15.56 |  2.83    7.41 |  3.83    5.18
                0.92   14.81 |  1.92   14.08 |  2.92    7.14 |  3.92    5.06

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
-------------------    U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.105 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  26.588
     TOTAL RAINFALL   (mm)=  72.135
     RUNOFF COEFFICIENT   =   0.369

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

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
-------------------
```

```
                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     246.17        77.10
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.46 (ii)    4.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.22
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.38         0.17         0.552 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      70.14        31.46         45.85
     TOTAL RAINFALL   (mm)=      72.14        72.14         72.14
     RUNOFF COEFFICIENT   =       0.97         0.44          0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

-------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.552     1.33    45.85
      + ID2= 2 (  0204):     2.62   0.105     2.00    26.59
        ================================================
        ID = 3 (  0208):     4.15   0.561     1.33    33.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
-------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
-------------------    U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.100 (i)
     TIME TO PEAK    (hrs)=   2.083
```

```
     RUNOFF VOLUME    (mm)=  24.736
     TOTAL RAINFALL   (mm)=  72.135
     RUNOFF COEFFICIENT   =   0.343

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

-------------------------------------------------------------------------------
-------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
-------------------
                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     246.17        65.26
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.92 (ii)   12.43 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.28         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=       1.58         1.17         1.957 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50          1.33
     RUNOFF VOLUME    (mm)=      70.14        29.70         36.69
     TOTAL RAINFALL   (mm)=      72.14        72.14         72.14
     RUNOFF COEFFICIENT   =       0.97         0.41          0.51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

-------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
-------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   1.957     1.33    36.69
      + ID2= 2 (  0203):     2.80   0.100     2.08    24.74
        ================================================
```

```
       ID = 3 (  0207):    18.37   1.964     1.33    34.87

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0207):    18.37   1.964     1.33    34.87
     + ID2= 2 (  0208):     4.15   0.561     1.33    33.69
       ==================================================
       ID = 3 (  0209):    22.52   2.525     1.33    34.65

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
======================

       V    V   I    SSSSS  U    U    A    L              (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


```
                   *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\4783
5c5b-6289-4857-8e2c-93eb64908753\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\4783
5c5b-6289-4857-8e2c-93eb64908753\scen

DATE: 01-29-2024                           TIME: 12:59:33

USER:
```

```
COMMENTS: ____________________________________________________________

------------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : M - 100yr 24hr 5min SCS Type  **
  **********************************************

--------------------
|    READ STORM     |    Filename: C:\Users\dhordyk\AppD
|                   |              ata\Local\Temp\
|                   |              88f53ef1-126e-46c5-8e23-04870d1bcf26\2c4cdf56
| Ptotal=122.40 mm |    Comments: 100yr 24hr 5min SCS Type II
--------------------
                 TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                  hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                 0.00     0.00 |  6.08     2.22 | 12.17    20.97 | 18.25     2.14
                 0.08     1.24 |  6.17     2.24 | 12.25    18.74 | 18.33     2.12
                 0.17     1.24 |  6.25     2.25 | 12.33    16.51 | 18.42     2.09
                 0.25     1.25 |  6.33     2.27 | 12.42    14.28 | 18.50     2.07
                 0.33     1.26 |  6.42     2.29 | 12.50    12.04 | 18.58     2.03
                 0.42     1.27 |  6.50     2.31 | 12.58    10.33 | 18.67     2.01
                 0.50     1.29 |  6.58     2.34 | 12.67     9.82 | 18.75     1.99
                 0.58     1.29 |  6.67     2.36 | 12.75     9.31 | 18.83     1.96
                 0.67     1.30 |  6.75     2.38 | 12.83     8.80 | 18.92     1.94
                 0.75     1.31 |  6.83     2.40 | 12.92     8.29 | 19.00     1.91
                 0.83     1.32 |  6.92     2.42 | 13.00     7.78 | 19.08     1.88
                 0.92     1.33 |  7.00     2.44 | 13.08     7.30 | 19.17     1.86
                 1.00     1.33 |  7.08     2.46 | 13.17     7.02 | 19.25     1.83
                 1.08     1.36 |  7.17     2.48 | 13.25     6.75 | 19.33     1.81
                 1.17     1.36 |  7.25     2.50 | 13.33     6.47 | 19.42     1.78
                 1.25     1.37 |  7.33     2.52 | 13.42     6.20 | 19.50     1.76
                 1.33     1.38 |  7.42     2.54 | 13.50     5.92 | 19.58     1.73
                 1.42     1.39 |  7.50     2.56 | 13.58     5.63 | 19.67     1.71
                 1.50     1.41 |  7.58     2.58 | 13.67     5.43 | 19.75     1.68
                 1.58     1.41 |  7.67     2.60 | 13.75     5.24 | 19.83     1.65
                 1.67     1.43 |  7.75     2.62 | 13.83     5.04 | 19.92     1.63
                 1.75     1.43 |  7.83     2.64 | 13.92     4.85 | 20.00     1.60
                 1.83     1.44 |  7.92     2.66 | 14.00     4.65 | 20.08     1.59
                 1.92     1.46 |  8.00     2.68 | 14.08     4.49 | 20.17     1.58
                 2.00     1.46 |  8.08     2.75 | 14.17     4.41 | 20.25     1.58
                 2.08     1.48 |  8.17     2.85 | 14.25     4.35 | 20.33     1.57
                 2.17     1.48 |  8.25     2.95 | 14.33     4.28 | 20.42     1.57
                 2.25     1.50 |  8.33     3.05 | 14.42     4.21 | 20.50     1.57
                 2.33     1.51 |  8.42     3.15 | 14.50     4.15 | 20.58     1.55
```

```
                 2.42     1.51 |  8.50     3.24 | 14.58     4.05 | 20.67     1.55
                 2.50     1.53 |  8.58     3.37 | 14.67     3.99 | 20.75     1.55
                 2.58     1.53 |  8.67     3.46 | 14.75     3.92 | 20.83     1.54
                 2.67     1.55 |  8.75     3.56 | 14.83     3.85 | 20.92     1.54
                 2.75     1.55 |  8.83     3.66 | 14.92     3.79 | 21.00     1.53
                 2.83     1.56 |  8.92     3.76 | 15.00     3.71 | 21.08     1.53
                 2.92     1.58 |  9.00     3.86 | 15.08     3.64 | 21.17     1.52
                 3.00     1.58 |  9.08     3.92 | 15.17     3.56 | 21.25     1.52
                 3.08     1.60 |  9.17     3.92 | 15.25     3.49 | 21.33     1.51
                 3.17     1.60 |  9.25     3.92 | 15.33     3.42 | 21.42     1.51
                 3.25     1.62 |  9.33     3.92 | 15.42     3.35 | 21.50     1.51
                 3.33     1.63 |  9.42     3.92 | 15.50     3.29 | 21.58     1.49
                 3.42     1.63 |  9.50     3.92 | 15.58     3.19 | 21.67     1.49
                 3.50     1.65 |  9.58     4.01 | 15.67     3.14 | 21.75     1.49
                 3.58     1.65 |  9.67     4.17 | 15.75     3.06 | 21.83     1.48
                 3.67     1.67 |  9.75     4.33 | 15.83     2.99 | 21.92     1.48
                 3.75     1.68 |  9.83     4.48 | 15.92     2.93 | 22.00     1.47
                 3.83     1.69 |  9.92     4.64 | 16.00     2.85 | 22.08     1.47
                 3.92     1.70 | 10.00     4.80 | 16.08     2.80 | 22.17     1.46
                 4.00     1.70 | 10.08     5.04 | 16.17     2.77 | 22.25     1.46
                 4.08     1.73 | 10.17     5.28 | 16.25     2.75 | 22.33     1.45
                 4.17     1.75 | 10.25     5.51 | 16.33     2.73 | 22.42     1.44
                 4.25     1.77 | 10.33     5.75 | 16.42     2.70 | 22.50     1.44
                 4.33     1.78 | 10.42     5.98 | 16.50     2.68 | 22.58     1.43
                 4.42     1.80 | 10.50     6.22 | 16.58     2.64 | 22.67     1.43
                 4.50     1.82 | 10.58     6.61 | 16.67     2.62 | 22.75     1.42
                 4.58     1.85 | 10.67     7.00 | 16.75     2.60 | 22.83     1.42
                 4.67     1.87 | 10.75     7.39 | 16.83     2.57 | 22.92     1.42
                 4.75     1.89 | 10.83     7.78 | 16.92     2.55 | 23.00     1.41
                 4.83     1.91 | 10.92     8.18 | 17.00     2.52 | 23.08     1.41
                 4.92     1.93 | 11.00     8.57 | 17.08     2.50 | 23.17     1.40
                 5.00     1.95 | 11.08     9.40 | 17.17     2.47 | 23.25     1.40
                 5.08     1.97 | 11.17    10.34 | 17.25     2.45 | 23.33     1.39
                 5.17     1.99 | 11.25    11.28 | 17.33     2.42 | 23.42     1.38
                 5.25     2.01 | 11.33    12.22 | 17.42     2.39 | 23.50     1.38
                 5.33     2.03 | 11.42    13.16 | 17.50     2.37 | 23.58     1.37
                 5.42     2.05 | 11.50    14.10 | 17.58     2.34 | 23.67     1.37
                 5.50     2.07 | 11.58    29.18 | 17.67     2.32 | 23.75     1.36
                 5.58     2.09 | 11.67    52.37 | 17.75     2.29 | 23.83     1.36
                 5.67     2.11 | 11.75    79.40 | 17.83     2.27 | 23.92     1.36
                 5.75     2.13 | 11.83   123.24 | 17.92     2.24 | 24.00     1.35
                 5.83     2.15 | 11.92   157.51 | 18.00     2.22 |
                 5.92     2.17 | 12.00   116.45 | 18.08     2.19 |
                 6.00     2.19 | 12.08    23.21 | 18.17     2.16 |

--------------------------------------------------------------------------------

--------------------
| CALIB             |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
```

```
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.213 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  63.466
     TOTAL RAINFALL   (mm)= 122.400
     RUNOFF COEFFICIENT   =   0.519

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     157.51       109.72
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.74 (ii)    5.96 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.25         0.23          0.430 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.00
     RUNOFF VOLUME    (mm)=     120.40        71.00          89.37
     TOTAL RAINFALL   (mm)=     122.40       122.40         122.40
     RUNOFF COEFFICIENT   =       0.98         0.58           0.73

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0208)|
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|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.430    12.00    89.37
      + ID2= 2 (  0204):     2.62   0.213    12.50    63.47
        ==================================================
        ID = 3 (  0208):     4.15   0.525    12.08    73.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.206 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  60.239
     TOTAL RAINFALL   (mm)= 122.400
     RUNOFF COEFFICIENT   =   0.492

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

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--------------------
| CALIB             |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     157.51        95.92
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.49 (ii)   11.65 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.26         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.10         2.23          2.909 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
     RUNOFF VOLUME    (mm)=     120.40        68.20          77.23
     TOTAL RAINFALL   (mm)=     122.40       122.40         122.40
     RUNOFF COEFFICIENT   =       0.98         0.56           0.63
```

```
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   2.909    12.08    77.23
      + ID2= 2 (  0203):     2.80   0.206    12.58    60.24
        ==================================================
        ID = 3 (  0207):    18.37   3.009    12.08    74.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   3.009    12.08    74.64
      + ID2= 2 (  0208):     4.15   0.525    12.08    73.02
        ==================================================
        ID = 3 (  0209):    22.52   3.534    12.08    74.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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====================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO    TTTTT  TTTTT  H   H  Y   Y  M   M  OOO    TM
      O   O     T      T    H   H   Y Y   MM MM  O   O
      O   O     T      T    H   H    Y    M   M  O   O
       OOO      T      T    H   H    Y    M   M  OOO
Developed and Distributed by Smart City Water Inc
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\3cb5
ce0d-9cbe-4cbe-b0be-87ef01a717c9\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\3cb5
ce0d-9cbe-4cbe-b0be-87ef01a717c9\scen


DATE: 01-29-2024                           TIME: 12:59:33

USER:


COMMENTS: ____________________________________________________________


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  ************************************************
  ** SIMULATION : N - TIMMINS                   **
  ************************************************


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|    READ STORM    |     Filename: C:\Users\dhordyk\AppD
|                  |               ata\Local\Temp\
|                  |               88f53ef1-126e-46c5-8e23-04870d1bcf26\2ed90c06
| Ptotal=193.00 mm |     Comments: TIMMINS
--------------------
                    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                    0.00   15.00 |  3.00    3.00 |  6.00   43.00 |  9.00   13.00
                    0.25   15.00 |  3.25    3.00 |  6.25   43.00 |  9.25   13.00
                    0.50   15.00 |  3.50    3.00 |  6.50   43.00 |  9.50   13.00
                    0.75   15.00 |  3.75    3.00 |  6.75   43.00 |  9.75   13.00
                    1.00   20.00 |  4.00    5.00 |  7.00   20.00 | 10.00   13.00
                    1.25   20.00 |  4.25    5.00 |  7.25   20.00 | 10.25   13.00
                    1.50   20.00 |  4.50    5.00 |  7.50   20.00 | 10.50   13.00
                    1.75   20.00 |  4.75    5.00 |  7.75   20.00 | 10.75   13.00
                    2.00   10.00 |  5.00   20.00 |  8.00   23.00 | 11.00    8.00
                    2.25   10.00 |  5.25   20.00 |  8.25   23.00 | 11.25    8.00
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                    2.50   10.00 |  5.50   20.00 |  8.50   23.00 | 11.50    8.00
                    2.75   10.00 |  5.75   20.00 |  8.75   23.00 | 11.75    8.00

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--------------------
| CALIB             |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
                    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                   0.083   15.00 | 3.083    3.00 | 6.083   43.00 |  9.08   13.00
                   0.167   15.00 | 3.167    3.00 | 6.167   43.00 |  9.17   13.00
                   0.250   15.00 | 3.250    3.00 | 6.250   43.00 |  9.25   13.00
                   0.333   15.00 | 3.333    3.00 | 6.333   43.00 |  9.33   13.00
                   0.417   15.00 | 3.417    3.00 | 6.417   43.00 |  9.42   13.00
                   0.500   15.00 | 3.500    3.00 | 6.500   43.00 |  9.50   13.00
                   0.583   15.00 | 3.583    3.00 | 6.583   43.00 |  9.58   13.00
                   0.667   15.00 | 3.667    3.00 | 6.667   43.00 |  9.67   13.00
                   0.750   15.00 | 3.750    3.00 | 6.750   43.00 |  9.75   13.00
                   0.833   15.00 | 3.833    3.00 | 6.833   43.00 |  9.83   13.00
                   0.917   15.00 | 3.917    3.00 | 6.917   43.00 |  9.92   13.00
                   1.000   15.00 | 4.000    3.00 | 7.000   43.00 | 10.00   13.00
                   1.083   20.00 | 4.083    5.00 | 7.083   20.00 | 10.08   13.00
                   1.167   20.00 | 4.167    5.00 | 7.167   20.00 | 10.17   13.00
                   1.250   20.00 | 4.250    5.00 | 7.250   20.00 | 10.25   13.00
                   1.333   20.00 | 4.333    5.00 | 7.333   20.00 | 10.33   13.00
                   1.417   20.00 | 4.417    5.00 | 7.417   20.00 | 10.42   13.00
                   1.500   20.00 | 4.500    5.00 | 7.500   20.00 | 10.50   13.00
                   1.583   20.00 | 4.583    5.00 | 7.583   20.00 | 10.58   13.00
                   1.667   20.00 | 4.667    5.00 | 7.667   20.00 | 10.67   13.00
                   1.750   20.00 | 4.750    5.00 | 7.750   20.00 | 10.75   13.00
                   1.833   20.00 | 4.833    5.00 | 7.833   20.00 | 10.83   13.00
                   1.917   20.00 | 4.917    5.00 | 7.917   20.00 | 10.92   13.00
                   2.000   20.00 | 5.000    5.00 | 8.000   20.00 | 11.00   13.00
                   2.083   10.00 | 5.083   20.00 | 8.083   23.00 | 11.08    8.00
                   2.167   10.00 | 5.167   20.00 | 8.167   23.00 | 11.17    8.00
                   2.250   10.00 | 5.250   20.00 | 8.250   23.00 | 11.25    8.00
                   2.333   10.00 | 5.333   20.00 | 8.333   23.00 | 11.33    8.00
                   2.417   10.00 | 5.417   20.00 | 8.417   23.00 | 11.42    8.00
                   2.500   10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
                   2.583   10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
                   2.667   10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
                   2.750   10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
```

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             2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
             2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
             3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.198 (i)
     TIME TO PEAK    (hrs)=   7.167
     RUNOFF VOLUME    (mm)= 123.366
     TOTAL RAINFALL   (mm)= 193.000
     RUNOFF COEFFICIENT   =   0.639

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

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--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n          =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                         ---- TRANSFORMED HYETOGRAPH ----
              TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
               hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.083   15.00 | 3.083    3.00 | 6.083   43.00 |  9.08   13.00
             0.167   15.00 | 3.167    3.00 | 6.167   43.00 |  9.17   13.00
             0.250   15.00 | 3.250    3.00 | 6.250   43.00 |  9.25   13.00
             0.333   15.00 | 3.333    3.00 | 6.333   43.00 |  9.33   13.00
             0.417   15.00 | 3.417    3.00 | 6.417   43.00 |  9.42   13.00
             0.500   15.00 | 3.500    3.00 | 6.500   43.00 |  9.50   13.00
             0.583   15.00 | 3.583    3.00 | 6.583   43.00 |  9.58   13.00
             0.667   15.00 | 3.667    3.00 | 6.667   43.00 |  9.67   13.00
             0.750   15.00 | 3.750    3.00 | 6.750   43.00 |  9.75   13.00
             0.833   15.00 | 3.833    3.00 | 6.833   43.00 |  9.83   13.00
             0.917   15.00 | 3.917    3.00 | 6.917   43.00 |  9.92   13.00
             1.000   15.00 | 4.000    3.00 | 7.000   43.00 | 10.00   13.00
             1.083   20.00 | 4.083    5.00 | 7.083   20.00 | 10.08   13.00
             1.167   20.00 | 4.167    5.00 | 7.167   20.00 | 10.17   13.00
             1.250   20.00 | 4.250    5.00 | 7.250   20.00 | 10.25   13.00
             1.333   20.00 | 4.333    5.00 | 7.333   20.00 | 10.33   13.00
             1.417   20.00 | 4.417    5.00 | 7.417   20.00 | 10.42   13.00
```

```
             1.500   20.00 | 4.500    5.00 | 7.500   20.00 | 10.50   13.00
             1.583   20.00 | 4.583    5.00 | 7.583   20.00 | 10.58   13.00
             1.667   20.00 | 4.667    5.00 | 7.667   20.00 | 10.67   13.00
             1.750   20.00 | 4.750    5.00 | 7.750   20.00 | 10.75   13.00
             1.833   20.00 | 4.833    5.00 | 7.833   20.00 | 10.83   13.00
             1.917   20.00 | 4.917    5.00 | 7.917   20.00 | 10.92   13.00
             2.000   20.00 | 5.000    5.00 | 8.000   20.00 | 11.00   13.00
             2.083   10.00 | 5.083   20.00 | 8.083   23.00 | 11.08    8.00
             2.167   10.00 | 5.167   20.00 | 8.167   23.00 | 11.17    8.00
             2.250   10.00 | 5.250   20.00 | 8.250   23.00 | 11.25    8.00
             2.333   10.00 | 5.333   20.00 | 8.333   23.00 | 11.33    8.00
             2.417   10.00 | 5.417   20.00 | 8.417   23.00 | 11.42    8.00
             2.500   10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
             2.583   10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
             2.667   10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
             2.750   10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
             2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
             2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
             3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Max.Eff.Inten.(mm/hr)=      43.00        40.44
                over (min)       5.00        10.00
     Storage Coeff.  (min)=       2.93 (ii)    9.14 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.28         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.09          0.161 (iii)
     TIME TO PEAK    (hrs)=       6.75         7.00           7.00
     RUNOFF VOLUME    (mm)=     191.00       133.36         154.80
     TOTAL RAINFALL   (mm)=     193.00       193.00         193.00
     RUNOFF COEFFICIENT   =       0.99         0.69           0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     1.53   0.161     7.00   154.80
      + ID2= 2 (  0204):     2.62   0.198     7.17   123.37
        ==================================================
        ID = 3 (  0208):     4.15   0.349     7.00   134.95
```

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     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                         ---- TRANSFORMED HYETOGRAPH ----
              TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
               hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.083   15.00 | 3.083    3.00 | 6.083   43.00 |  9.08   13.00
             0.167   15.00 | 3.167    3.00 | 6.167   43.00 |  9.17   13.00
             0.250   15.00 | 3.250    3.00 | 6.250   43.00 |  9.25   13.00
             0.333   15.00 | 3.333    3.00 | 6.333   43.00 |  9.33   13.00
             0.417   15.00 | 3.417    3.00 | 6.417   43.00 |  9.42   13.00
             0.500   15.00 | 3.500    3.00 | 6.500   43.00 |  9.50   13.00
             0.583   15.00 | 3.583    3.00 | 6.583   43.00 |  9.58   13.00
             0.667   15.00 | 3.667    3.00 | 6.667   43.00 |  9.67   13.00
             0.750   15.00 | 3.750    3.00 | 6.750   43.00 |  9.75   13.00
             0.833   15.00 | 3.833    3.00 | 6.833   43.00 |  9.83   13.00
             0.917   15.00 | 3.917    3.00 | 6.917   43.00 |  9.92   13.00
             1.000   15.00 | 4.000    3.00 | 7.000   43.00 | 10.00   13.00
             1.083   20.00 | 4.083    5.00 | 7.083   20.00 | 10.08   13.00
             1.167   20.00 | 4.167    5.00 | 7.167   20.00 | 10.17   13.00
             1.250   20.00 | 4.250    5.00 | 7.250   20.00 | 10.25   13.00
             1.333   20.00 | 4.333    5.00 | 7.333   20.00 | 10.33   13.00
             1.417   20.00 | 4.417    5.00 | 7.417   20.00 | 10.42   13.00
             1.500   20.00 | 4.500    5.00 | 7.500   20.00 | 10.50   13.00
             1.583   20.00 | 4.583    5.00 | 7.583   20.00 | 10.58   13.00
             1.667   20.00 | 4.667    5.00 | 7.667   20.00 | 10.67   13.00
             1.750   20.00 | 4.750    5.00 | 7.750   20.00 | 10.75   13.00
             1.833   20.00 | 4.833    5.00 | 7.833   20.00 | 10.83   13.00
             1.917   20.00 | 4.917    5.00 | 7.917   20.00 | 10.92   13.00
             2.000   20.00 | 5.000    5.00 | 8.000   20.00 | 11.00   13.00
             2.083   10.00 | 5.083   20.00 | 8.083   23.00 | 11.08    8.00
             2.167   10.00 | 5.167   20.00 | 8.167   23.00 | 11.17    8.00
             2.250   10.00 | 5.250   20.00 | 8.250   23.00 | 11.25    8.00
             2.333   10.00 | 5.333   20.00 | 8.333   23.00 | 11.33    8.00
             2.417   10.00 | 5.417   20.00 | 8.417   23.00 | 11.42    8.00
             2.500   10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
             2.583   10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
             2.667   10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
             2.750   10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
             2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
             2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
```

```
             3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.200 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)= 118.754
     TOTAL RAINFALL   (mm)= 193.000
     RUNOFF COEFFICIENT   =   0.615

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n          =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                         ---- TRANSFORMED HYETOGRAPH ----
              TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
               hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.083   15.00 | 3.083    3.00 | 6.083   43.00 |  9.08   13.00
             0.167   15.00 | 3.167    3.00 | 6.167   43.00 |  9.17   13.00
             0.250   15.00 | 3.250    3.00 | 6.250   43.00 |  9.25   13.00
             0.333   15.00 | 3.333    3.00 | 6.333   43.00 |  9.33   13.00
             0.417   15.00 | 3.417    3.00 | 6.417   43.00 |  9.42   13.00
             0.500   15.00 | 3.500    3.00 | 6.500   43.00 |  9.50   13.00
             0.583   15.00 | 3.583    3.00 | 6.583   43.00 |  9.58   13.00
             0.667   15.00 | 3.667    3.00 | 6.667   43.00 |  9.67   13.00
             0.750   15.00 | 3.750    3.00 | 6.750   43.00 |  9.75   13.00
             0.833   15.00 | 3.833    3.00 | 6.833   43.00 |  9.83   13.00
             0.917   15.00 | 3.917    3.00 | 6.917   43.00 |  9.92   13.00
             1.000   15.00 | 4.000    3.00 | 7.000   43.00 | 10.00   13.00
             1.083   20.00 | 4.083    5.00 | 7.083   20.00 | 10.08   13.00
             1.167   20.00 | 4.167    5.00 | 7.167   20.00 | 10.17   13.00
             1.250   20.00 | 4.250    5.00 | 7.250   20.00 | 10.25   13.00
             1.333   20.00 | 4.333    5.00 | 7.333   20.00 | 10.33   13.00
             1.417   20.00 | 4.417    5.00 | 7.417   20.00 | 10.42   13.00
             1.500   20.00 | 4.500    5.00 | 7.500   20.00 | 10.50   13.00
             1.583   20.00 | 4.583    5.00 | 7.583   20.00 | 10.58   13.00
```

```
                1.667   20.00 | 4.667    5.00 | 7.667   20.00 | 10.67   13.00
                1.750   20.00 | 4.750    5.00 | 7.750   20.00 | 10.75   13.00
                1.833   20.00 | 4.833    5.00 | 7.833   20.00 | 10.83   13.00
                1.917   20.00 | 4.917    5.00 | 7.917   20.00 | 10.92   13.00
                2.000   20.00 | 5.000    5.00 | 8.000   20.00 | 11.00   13.00
                2.083   10.00 | 5.083   20.00 | 8.083   23.00 | 11.08    8.00
                2.167   10.00 | 5.167   20.00 | 8.167   23.00 | 11.17    8.00
                2.250   10.00 | 5.250   20.00 | 8.250   23.00 | 11.25    8.00
                2.333   10.00 | 5.333   20.00 | 8.333   23.00 | 11.33    8.00
                2.417   10.00 | 5.417   20.00 | 8.417   23.00 | 11.42    8.00
                2.500   10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
                2.583   10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
                2.667   10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
                2.750   10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
                2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
                2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
                3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Max.Eff.Inten.(mm/hr)=      43.00        35.67
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       5.87 (ii)   17.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.19         0.06
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.32         1.15          1.468 (iii)
     TIME TO PEAK    (hrs)=       7.00         7.00           7.00
     RUNOFF VOLUME    (mm)=     191.00       129.59         140.21
     TOTAL RAINFALL   (mm)=     193.00       193.00         193.00
     RUNOFF COEFFICIENT   =       0.99         0.67           0.73

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------

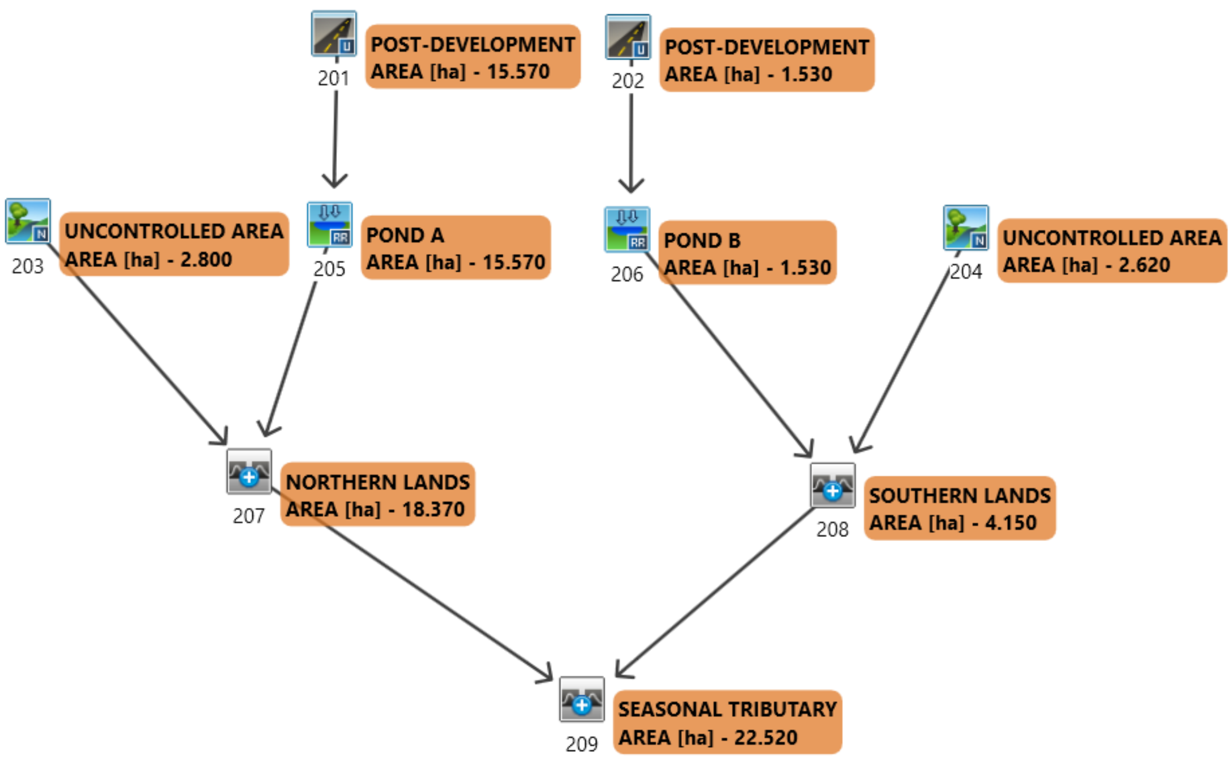
--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):    15.57   1.468     7.00   140.21
      + ID2= 2 (  0203):     2.80   0.200     7.25   118.75
        ====================================================
        ID = 3 (  0207):    18.37   1.655     7.00   136.94
```

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   1.655     7.00   136.94
      + ID2= 2 (  0208):     4.15   0.349     7.00   134.95
        ====================================================
        ID = 3 (  0209):    22.52   2.003     7.00   136.57

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

POST-DEVELOPMENT WITH SWM



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

      V    V   I    SSSSS  U    U    A    L               (v 6.2.2015)
      V    V   I    SS     U    U   A A   L
       V  V    I     SS    U    U  AAAAA  L
       V  V    I      SS   U    U  A   A  L
        VV     I    SSSSS  UUUUU  A    A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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68a4-a88c-411d-9486-7caab3effb46\scen
  Summary filename:
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68a4-a88c-411d-9486-7caab3effb46\scen


DATE: 01-30-2024                           TIME: 04:37:34

USER:


COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------------
-----------------------
  **********************************************
  ** SIMULATION : B - 2yr 4hr 5min Chicago      **
  **********************************************


--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 431.085
| Ptotal= 33.18 mm |                           B=   1.500
--------------------                           C=   0.720
```

```
                     used in:   INTENSITY =  A / (t + B)^C

                     Duration of storm  =  4.00 hrs
                     Storm time step    =  5.00 min
                     Time to peak ratio =  0.33

              TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
               hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.00    2.49 |  1.00    8.67 |  2.00    5.97 |  3.00    3.20
              0.08    2.62 |  1.08   12.33 |  2.08    5.52 |  3.08    3.09
              0.17    2.77 |  1.17   25.77 |  2.17    5.14 |  3.17    2.99
              0.25    2.94 |  1.25  112.01 |  2.25    4.82 |  3.25    2.90
              0.33    3.14 |  1.33   32.78 |  2.33    4.55 |  3.33    2.82
              0.42    3.37 |  1.42   18.79 |  2.42    4.30 |  3.42    2.74
              0.50    3.65 |  1.50   13.70 |  2.50    4.09 |  3.50    2.66
              0.58    3.99 |  1.58   10.98 |  2.58    3.90 |  3.58    2.59
              0.67    4.42 |  1.67    9.27 |  2.67    3.73 |  3.67    2.53
              0.75    4.98 |  1.75    8.08 |  2.75    3.58 |  3.75    2.47
              0.83    5.74 |  1.83    7.20 |  2.83    3.44 |  3.83    2.41
              0.92    6.85 |  1.92    6.51 |  2.92    3.31 |  3.92    2.35

-------------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW      (cms)=   0.020 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=   5.683
     TOTAL RAINFALL   (mm)=  33.181
     RUNOFF COEFFICIENT   =   0.171

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

-------------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
```

```
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     112.01        16.58
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.99 (ii)    6.83 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.14
                                                         *TOTALS*
     PEAK FLOW      (cms)=        0.17         0.03          0.178 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      31.18         7.76          16.47
     TOTAL RAINFALL   (mm)=      33.18        33.18          33.18
     RUNOFF COEFFICIENT   =       0.94         0.23           0.50

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
                          0.0151     0.0353   |   3.2269     0.1182

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530      0.178      1.33      16.47
   OUTFLOW: ID= 1 (  0206)      1.530      0.011      2.58      16.39

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.27
                   TIME SHIFT OF PEAK FLOW         (min)= 75.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0153

-------------------------------------------------------------------------------

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```

```
| ADD HYD  (  0208)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):      2.62   0.020     2.17     5.68
      + ID2= 2 (  0206):      1.53   0.011     2.58    16.39
        ===============================================
        ID = 3 (  0208):      4.15   0.031     2.17     9.63

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW      (cms)=   0.018 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=   5.075
     TOTAL RAINFALL   (mm)=  33.181
     RUNOFF COEFFICIENT   =   0.153

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

-------------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     112.01         8.05
                over (min)        5.00        30.00
     Storage Coeff.  (min)=       4.00 (ii)   25.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=       0.24         0.04
                                                         *TOTALS*
     PEAK FLOW      (cms)=        0.64         0.15          0.658 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.83           1.33
     RUNOFF VOLUME    (mm)=      31.18         7.06          11.23
     TOTAL RAINFALL   (mm)=      33.18        33.18          33.18
     RUNOFF COEFFICIENT   =       0.94         0.21           0.34
```

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.3 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| RESERVOIR(0205) | IN= 2---> OUT= 1 | DT= 5.0 min

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.4010	0.1310
0.0196	0.0063	0.4592	0.1548
0.0649	0.0138	0.5093	0.1815
0.0897	0.0225	0.5542	0.2111
0.1090	0.0326	0.5953	0.2435
0.1253	0.0442	0.6334	0.2788
0.1397	0.0577	0.8993	0.3170
0.1528	0.0731	1.4461	0.3580
0.1649	0.0905	2.2696	0.4018
0.3277	0.1097	3.3891	0.4486

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0201)	15.570	0.658	1.33	11.23
OUTFLOW: ID= 1 (0205)	15.570	0.140	2.42	11.22

PEAK FLOW REDUCTION [Qout/Qin](%)= 21.28
TIME SHIFT OF PEAK FLOW (min)= 65.00
MAXIMUM STORAGE USED (ha.m.)= 0.0582

| ADD HYD (0207) | 1 + 2 = 3 |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0203):	2.80	0.018	2.17	5.08
+ ID2= 2 (0205):	15.57	0.140	2.42	11.22
ID = 3 (0207):	18.37	0.158	2.33	10.29

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ADD HYD (0209) | 1 + 2 = 3 |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0207):	18.37	0.158	2.33	10.29
+ ID2= 2 (0208):	4.15	0.031	2.17	9.63
ID = 3 (0209):	22.52	0.188	2.25	10.17

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
  V    V   I    SSSSS  U    U    A     L              (v 6.2.2015)
  V    V   I    SS     U    U   A A    L
   V  V    I     SS    U    U  AAAAA   L
   V  V    I      SS   U    U  A   A   L
    VV     I    SSSSS  UUUUU  A    A   LLLLL

  OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
 O   O     T      T    H   H   Y Y   MM MM  O   O
 O   O     T      T    H   H    Y    M   M  O   O
  OOO      T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
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Summary filename:
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DATE: 01-30-2024 TIME: 04:37:35

USER:

COMMENTS: ____

****
** SIMULATION : C - 2yr 24hr 5min SCS Type II **
****

| READ STORM | Ptotal= 57.60 mm |

Filename: C:\Users\dhordyk\AppData\Local\Temp\f6764074-2747-4e2d-b552-b793471f1267\63f6fc93
Comments: 2yr 24hr 5min SCS Type II

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.00	6.08	1.04	12.17	9.87	18.25	1.01
0.08	0.58	6.17	1.05	12.25	8.82	18.33	1.00
0.17	0.58	6.25	1.06	12.33	7.77	18.42	0.98
0.25	0.59	6.33	1.07	12.42	6.72	18.50	0.97
0.33	0.59	6.42	1.08	12.50	5.67	18.58	0.96
0.42	0.60	6.50	1.09	12.58	4.86	18.67	0.95
0.50	0.60	6.58	1.10	12.67	4.62	18.75	0.93
0.58	0.60	6.67	1.11	12.75	4.38	18.83	0.92
0.67	0.61	6.75	1.12	12.83	4.14	18.92	0.91
0.75	0.62	6.83	1.13	12.92	3.90	19.00	0.90
0.83	0.62	6.92	1.14	13.00	3.66	19.08	0.89
0.92	0.63	7.00	1.15	13.08	3.43	19.17	0.87
1.00	0.63	7.08	1.16	13.17	3.30	19.25	0.86
1.08	0.64	7.17	1.17	13.25	3.17	19.33	0.85
1.17	0.64	7.25	1.18	13.33	3.05	19.42	0.84
1.25	0.65	7.33	1.19	13.42	2.92	19.50	0.83
1.33	0.65	7.42	1.19	13.50	2.79	19.58	0.81
1.42	0.65	7.50	1.20	13.58	2.65	19.67	0.80
1.50	0.66	7.58	1.22	13.67	2.56	19.75	0.79
1.58	0.66	7.67	1.22	13.75	2.47	19.83	0.78
1.67	0.67	7.75	1.23	13.83	2.37	19.92	0.77
1.75	0.67	7.83	1.24	13.92	2.28	20.00	0.75
1.83	0.68	7.92	1.25	14.00	2.19	20.08	0.75
1.92	0.69	8.00	1.26	14.08	2.11	20.17	0.74
2.00	0.69	8.08	1.30	14.17	2.08	20.25	0.74
2.08	0.70	8.17	1.34	14.25	2.05	20.33	0.74
2.17	0.70	8.25	1.39	14.33	2.01	20.42	0.74
2.25	0.70	8.33	1.43	14.42	1.98	20.50	0.74
2.33	0.71	8.42	1.48	14.50	1.95	20.58	0.73
2.42	0.71	8.50	1.53	14.58	1.91	20.67	0.73
2.50	0.72	8.58	1.58	14.67	1.88	20.75	0.73
2.58	0.72	8.67	1.63	14.75	1.84	20.83	0.73
2.67	0.73	8.75	1.68	14.83	1.81	20.92	0.72
2.75	0.73	8.83	1.72	14.92	1.78	21.00	0.72
2.83	0.74	8.92	1.77	15.00	1.75	21.08	0.72
2.92	0.74	9.00	1.81	15.08	1.71	21.17	0.72
3.00	0.74	9.08	1.84	15.17	1.67	21.25	0.71
3.08	0.75	9.17	1.84	15.25	1.64	21.33	0.71
3.17	0.75	9.25	1.84	15.33	1.61	21.42	0.71
3.25	0.76	9.33	1.84	15.42	1.58	21.50	0.71
3.33	0.77	9.42	1.84	15.50	1.55	21.58	0.70
3.42	0.77	9.50	1.84	15.58	1.50	21.67	0.70
3.50	0.78	9.58	1.89	15.67	1.48	21.75	0.70
3.58	0.78	9.67	1.96	15.75	1.44	21.83	0.70
3.67	0.79	9.75	2.04	15.83	1.41	21.92	0.70
3.75	0.79	9.83	2.11	15.92	1.38	22.00	0.69
3.83	0.79	9.92	2.18	16.00	1.34	22.08	0.69
3.92	0.80	10.00	2.26	16.08	1.32	22.17	0.69
4.00	0.80	10.08	2.37	16.17	1.31	22.25	0.69
4.08	0.81	10.17	2.48	16.25	1.29	22.33	0.68
4.17	0.82	10.25	2.59	16.33	1.28	22.42	0.68
4.25	0.83	10.33	2.70	16.42	1.27	22.50	0.68
4.33	0.84	10.42	2.82	16.50	1.26	22.58	0.67
4.42	0.85	10.50	2.93	16.58	1.24	22.67	0.67
4.50	0.86	10.58	3.11	16.67	1.23	22.75	0.67
4.58	0.87	10.67	3.29	16.75	1.22	22.83	0.67
4.67	0.88	10.75	3.48	16.83	1.21	22.92	0.67
4.75	0.89	10.83	3.66	16.92	1.20	23.00	0.66
4.83	0.90	10.92	3.85	17.00	1.19	23.08	0.66
4.92	0.91	11.00	4.03	17.08	1.18	23.17	0.66
5.00	0.92	11.08	4.42	17.17	1.16	23.25	0.66
5.08	0.93	11.17	4.87	17.25	1.15	23.33	0.65
5.17	0.94	11.25	5.31	17.33	1.14	23.42	0.65
5.25	0.95	11.33	5.75	17.42	1.13	23.50	0.65
5.33	0.96	11.42	6.19	17.50	1.12	23.58	0.65
5.42	0.96	11.50	6.64	17.58	1.10	23.67	0.65
5.50	0.97	11.58	13.73	17.67	1.09	23.75	0.64
5.58	0.98	11.67	24.64	17.75	1.08	23.83	0.64
5.67	0.99	11.75	37.36	17.83	1.07	23.92	0.64
5.75	1.00	11.83	58.00	17.92	1.06	24.00	0.63
5.83	1.01	11.92	74.12	18.00	1.04		
5.92	1.02	12.00	54.80	18.08	1.03		
6.00	1.03	12.08	10.92	18.17	1.02		

| CALIB | NASHYD (0204) | ID= 1 DT= 5.0 min |

Area (ha)= 2.62 Curve Number (CN)= 72.9
Ia (mm)= 7.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.55

Unit Hyd Qpeak (cms)= 0.182

```
     PEAK FLOW       (cms)=   0.056 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  17.654
     TOTAL RAINFALL   (mm)=  57.600
     RUNOFF COEFFICIENT   =   0.306

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

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      74.12        33.93
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.35 (ii)    9.02 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.30         0.12
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.06          0.159 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.00
     RUNOFF VOLUME    (mm)=      55.60        21.56          34.22
     TOTAL RAINFALL   (mm)=      57.60        57.60          57.60
     RUNOFF COEFFICIENT   =       0.97         0.37           0.59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
```

```
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
                          0.0151     0.0353   |   3.2269     0.1182

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530     0.159     12.00      34.22
   OUTFLOW: ID= 1 (  0206)      1.530     0.013     13.00      34.14

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.41
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0247

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62   0.056    12.50    17.65
      + ID2= 2 (  0206):     1.53   0.013    13.00    34.14
        ==================================================
        ID = 3 (  0208):     4.15   0.070    12.50    23.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.053 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  16.261
     TOTAL RAINFALL   (mm)=  57.600
     RUNOFF COEFFICIENT   =   0.282

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n          =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      74.12        26.14
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       4.72 (ii)   18.44 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.22         0.06
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.49         0.50          0.789 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.25          12.08
     RUNOFF VOLUME    (mm)=      55.60        20.17          26.30
     TOTAL RAINFALL   (mm)=      57.60        57.60          57.60
     RUNOFF COEFFICIENT   =       0.97         0.35           0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010     0.1310
                          0.0196     0.0063   |   0.4592     0.1548
                          0.0649     0.0138   |   0.5093     0.1815
                          0.0897     0.0225   |   0.5542     0.2111
                          0.1090     0.0326   |   0.5953     0.2435
                          0.1253     0.0442   |   0.6334     0.2788
                          0.1397     0.0577   |   0.8993     0.3170
                          0.1528     0.0731   |   1.4461     0.3580
                          0.1649     0.0905   |   2.2696     0.4018
                          0.3277     0.1097   |   3.3891     0.4486

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
```

```
   INFLOW : ID= 2 (  0201)     15.570     0.789     12.08      26.30
   OUTFLOW: ID= 1 (  0205)     15.570     0.347     12.58      26.29

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 43.97
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1154

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0203):     2.80   0.053    12.58    16.26
      + ID2= 2 (  0205):    15.57   0.347    12.58    26.29
        ==================================================
        ID = 3 (  0207):    18.37   0.400    12.58    24.76

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.400    12.58    24.76
      + ID2= 2 (  0208):     4.15   0.070    12.50    23.73
        ==================================================
        ID = 3 (  0209):    22.52   0.470    12.58    24.57

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

       V    V   I    SSSSS  U    U    A    L               (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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```
                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\1aca
4de8-e0ba-46de-b488-055a66f2aa89\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\1aca
4de8-e0ba-46de-b488-055a66f2aa89\scen


DATE: 01-30-2024                           TIME: 04:37:34

USER:



COMMENTS: ____________________________________________________________



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------------------------
  **********************************************
  ** SIMULATION : D - 5yr 4hr 5min Chicago      **
  **********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 573.118
| Ptotal= 43.63 mm |                          B=   1.500
--------------------                          C=   0.722
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.26 |  1.00   11.36 |  2.00    7.81 |  3.00   4.18
                 0.08    3.43 |  1.08   16.19 |  2.08    7.22 |  3.08   4.04
                 0.17    3.62 |  1.17   33.93 |  2.17    6.73 |  3.17   3.91
                 0.25    3.85 |  1.25  148.36 |  2.25    6.31 |  3.25   3.79
                 0.33    4.10 |  1.33   43.20 |  2.33    5.95 |  3.33   3.68
                 0.42    4.41 |  1.42   24.71 |  2.42    5.63 |  3.42   3.57
                 0.50    4.77 |  1.50   17.99 |  2.50    5.35 |  3.50   3.48
                 0.58    5.22 |  1.58   14.41 |  2.58    5.10 |  3.58   3.39
                 0.67    5.78 |  1.67   12.16 |  2.67    4.88 |  3.67   3.30
                 0.75    6.51 |  1.75   10.59 |  2.75    4.68 |  3.75   3.22
```

```
                 0.83    7.51 |  1.83    9.43 |  2.83    4.50 |  3.83    3.14
                 0.92    8.97 |  1.92    8.53 |  2.92    4.33 |  3.92    3.07

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW      (cms)=   0.038 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  10.238
     TOTAL RAINFALL   (mm)=  43.632
     RUNOFF COEFFICIENT   =   0.235

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

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69        0.84
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       2.00        4.00
     Length            (m)=     101.00       25.00
     Mannings n           =      0.013       0.250

     Max.Eff.Inten.(mm/hr)=     148.36       29.84
                over (min)       5.00       10.00
     Storage Coeff.  (min)=       1.78 (ii)    6.10 (ii)
     Unit Hyd. Tpeak (min)=       5.00       10.00
     Unit Hyd. peak  (cms)=       0.32        0.15
                                                         *TOTALS*
     PEAK FLOW      (cms)=       0.22        0.05         0.249 (iii)
     TIME TO PEAK    (hrs)=       1.33        1.42          1.33
     RUNOFF VOLUME    (mm)=      41.63       13.12         23.73
     TOTAL RAINFALL   (mm)=      43.63       43.63         43.63
     RUNOFF COEFFICIENT   =       0.95        0.30          0.54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
```

```
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
                          0.0151     0.0353   |   3.2269     0.1182

                                AREA     QPEAK     TPEAK      R.V.
                                (ha)     (cms)     (hrs)      (mm)
   INFLOW : ID= 2 (  0202)      1.530     0.249     1.33      23.73
   OUTFLOW: ID= 1 (  0206)      1.530     0.013     3.00      23.65

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.27
                  TIME SHIFT OF PEAK FLOW         (min)=100.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0236

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62   0.038     2.08    10.24
      + ID2= 2 (  0206):     1.53   0.013     3.00    23.65
        ===================================================
        ID = 3 (  0208):     4.15   0.050     2.08    15.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184
```

```
     PEAK FLOW      (cms)=   0.035 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=   9.299
     TOTAL RAINFALL   (mm)=  43.632
     RUNOFF COEFFICIENT   =   0.213

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

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13       12.44
     Dep. Storage     (mm)=       2.00        5.10
     Average Slope     (%)=       2.00        4.00
     Length            (m)=     322.18       70.00
     Mannings n           =      0.013       0.250

     Max.Eff.Inten.(mm/hr)=     148.36       16.49
                over (min)       5.00       25.00
     Storage Coeff.  (min)=       3.58 (ii)   20.07 (ii)
     Unit Hyd. Tpeak (min)=       5.00       25.00
     Unit Hyd. peak  (cms)=       0.26        0.05
                                                         *TOTALS*
     PEAK FLOW      (cms)=       0.89        0.31         0.935 (iii)
     TIME TO PEAK    (hrs)=       1.33        1.75          1.33
     RUNOFF VOLUME    (mm)=      41.63       12.12         17.23
     TOTAL RAINFALL   (mm)=      43.63       43.63         43.63
     RUNOFF COEFFICIENT   =       0.95        0.28          0.39

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010     0.1310
```

```
                    0.0196     0.0063   |   0.4592      0.1548
                    0.0649     0.0138   |   0.5093      0.1815
                    0.0897     0.0225   |   0.5542      0.2111
                    0.1090     0.0326   |   0.5953      0.2435
                    0.1253     0.0442   |   0.6334      0.2788
                    0.1397     0.0577   |   0.8993      0.3170
                    0.1528     0.0731   |   1.4461      0.3580
                    0.1649     0.0905   |   2.2696      0.4018
                    0.3277     0.1097   |   3.3891      0.4486

                          AREA     QPEAK     TPEAK       R.V.
                          (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     15.570      0.935      1.33      17.23
   OUTFLOW: ID= 1 (  0205)     15.570      0.254      2.25      17.22

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 27.16
                  TIME SHIFT OF PEAK FLOW         (min)= 55.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1011

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0203):     2.80   0.035     2.17     9.30
     + ID2= 2 (  0205):    15.57   0.254     2.25    17.22
       ==============================================
       ID = 3 (  0207):    18.37   0.288     2.25    16.01

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0207):    18.37   0.288     2.25    16.01
     + ID2= 2 (  0208):     4.15   0.050     2.08    15.18
       ==============================================
       ID = 3 (  0209):    22.52   0.338     2.17    15.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
===================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
```

```
         V  V    I      SS   U   U  A    A  L
          VV     I    SSSSS  UUUUU  A    A  LLLLL

         OOO    TTTTT  TTTTT  H   H  Y   Y  M   M  OOO    TM
        O   O     T      T    H   H   Y Y   MM MM  O   O
        O   O     T      T    H   H    Y    M   M  O   O
         OOO      T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\1709
5a42-7982-46f4-acca-de19e3f147f7\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\1709
5a42-7982-46f4-acca-de19e3f147f7\scen

DATE: 01-30-2024                          TIME: 04:37:34

USER:

COMMENTS: ____________________________________________________________

-----------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : E - 5yr 24hr 5min SCS Type II **
  ************************************************

--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              f6764074-2747-4e2d-b552-b793471f1267\124a23f6
| Ptotal= 74.40 mm |    Comments: 5yr 24hr 5min SCS Type II
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.00 |  6.08    1.35 | 12.17   12.75 | 18.25    1.30
```

```
     0.08    0.75 |  6.17    1.36 | 12.25   11.39 | 18.33    1.29
     0.17    0.75 |  6.25    1.37 | 12.33   10.04 | 18.42    1.27
     0.25    0.76 |  6.33    1.38 | 12.42    8.68 | 18.50    1.26
     0.33    0.77 |  6.42    1.39 | 12.50    7.32 | 18.58    1.24
     0.42    0.77 |  6.50    1.41 | 12.58    6.28 | 18.67    1.22
     0.50    0.78 |  6.58    1.42 | 12.67    5.97 | 18.75    1.21
     0.58    0.78 |  6.67    1.43 | 12.75    5.66 | 18.83    1.19
     0.67    0.79 |  6.75    1.44 | 12.83    5.35 | 18.92    1.18
     0.75    0.80 |  6.83    1.46 | 12.92    5.04 | 19.00    1.16
     0.83    0.80 |  6.92    1.47 | 13.00    4.73 | 19.08    1.15
     0.92    0.81 |  7.00    1.48 | 13.08    4.43 | 19.17    1.13
     1.00    0.81 |  7.08    1.50 | 13.17    4.27 | 19.25    1.11
     1.08    0.83 |  7.17    1.51 | 13.25    4.10 | 19.33    1.10
     1.17    0.83 |  7.25    1.52 | 13.33    3.93 | 19.42    1.08
     1.25    0.83 |  7.33    1.53 | 13.42    3.77 | 19.50    1.07
     1.33    0.84 |  7.42    1.54 | 13.50    3.60 | 19.58    1.05
     1.42    0.84 |  7.50    1.55 | 13.58    3.42 | 19.67    1.04
     1.50    0.86 |  7.58    1.57 | 13.67    3.30 | 19.75    1.02
     1.58    0.86 |  7.67    1.58 | 13.75    3.18 | 19.83    1.01
     1.67    0.87 |  7.75    1.59 | 13.83    3.07 | 19.92    0.99
     1.75    0.87 |  7.83    1.61 | 13.92    2.95 | 20.00    0.97
     1.83    0.88 |  7.92    1.62 | 14.00    2.83 | 20.08    0.97
     1.92    0.89 |  8.00    1.63 | 14.08    2.73 | 20.17    0.96
     2.00    0.89 |  8.08    1.67 | 14.17    2.68 | 20.25    0.96
     2.08    0.90 |  8.17    1.73 | 14.25    2.64 | 20.33    0.96
     2.17    0.90 |  8.25    1.79 | 14.33    2.60 | 20.42    0.95
     2.25    0.91 |  8.33    1.85 | 14.42    2.56 | 20.50    0.95
     2.33    0.92 |  8.42    1.91 | 14.50    2.52 | 20.58    0.94
     2.42    0.92 |  8.50    1.97 | 14.58    2.46 | 20.67    0.94
     2.50    0.93 |  8.58    2.05 | 14.67    2.43 | 20.75    0.94
     2.58    0.93 |  8.67    2.11 | 14.75    2.38 | 20.83    0.94
     2.67    0.94 |  8.75    2.17 | 14.83    2.34 | 20.92    0.94
     2.75    0.94 |  8.83    2.22 | 14.92    2.30 | 21.00    0.93
     2.83    0.95 |  8.92    2.28 | 15.00    2.25 | 21.08    0.93
     2.92    0.96 |  9.00    2.34 | 15.08    2.21 | 21.17    0.92
     3.00    0.96 |  9.08    2.38 | 15.17    2.16 | 21.25    0.92
     3.08    0.97 |  9.17    2.38 | 15.25    2.12 | 21.33    0.92
     3.17    0.97 |  9.25    2.38 | 15.33    2.08 | 21.42    0.92
     3.25    0.98 |  9.33    2.38 | 15.42    2.04 | 21.50    0.92
     3.33    0.99 |  9.42    2.38 | 15.50    2.00 | 21.58    0.91
     3.42    0.99 |  9.50    2.38 | 15.58    1.94 | 21.67    0.91
     3.50    1.00 |  9.58    2.44 | 15.67    1.91 | 21.75    0.90
     3.58    1.00 |  9.67    2.54 | 15.75    1.86 | 21.83    0.90
     3.67    1.02 |  9.75    2.63 | 15.83    1.82 | 21.92    0.90
     3.75    1.02 |  9.83    2.73 | 15.92    1.78 | 22.00    0.89
     3.83    1.03 |  9.92    2.82 | 16.00    1.73 | 22.08    0.89
     3.92    1.03 | 10.00    2.92 | 16.08    1.70 | 22.17    0.89
     4.00    1.03 | 10.08    3.07 | 16.17    1.69 | 22.25    0.89
     4.08    1.05 | 10.17    3.21 | 16.25    1.67 | 22.33    0.88
     4.17    1.06 | 10.25    3.35 | 16.33    1.66 | 22.42    0.88
```

```
                 4.25    1.07 | 10.33    3.49 | 16.42    1.64 | 22.50    0.88
                 4.33    1.08 | 10.42    3.64 | 16.50    1.63 | 22.58    0.87
                 4.42    1.10 | 10.50    3.78 | 16.58    1.61 | 22.67    0.87
                 4.50    1.11 | 10.58    4.02 | 16.67    1.60 | 22.75    0.87
                 4.58    1.12 | 10.67    4.26 | 16.75    1.58 | 22.83    0.86
                 4.67    1.14 | 10.75    4.49 | 16.83    1.56 | 22.92    0.86
                 4.75    1.15 | 10.83    4.73 | 16.92    1.55 | 23.00    0.86
                 4.83    1.16 | 10.92    4.97 | 17.00    1.53 | 23.08    0.86
                 4.92    1.17 | 11.00    5.21 | 17.08    1.52 | 23.17    0.85
                 5.00    1.18 | 11.08    5.71 | 17.17    1.50 | 23.25    0.85
                 5.08    1.20 | 11.17    6.29 | 17.25    1.49 | 23.33    0.85
                 5.17    1.21 | 11.25    6.86 | 17.33    1.47 | 23.42    0.84
                 5.25    1.22 | 11.33    7.43 | 17.42    1.46 | 23.50    0.84
                 5.33    1.23 | 11.42    8.00 | 17.50    1.44 | 23.58    0.83
                 5.42    1.25 | 11.50    8.57 | 17.58    1.42 | 23.67    0.83
                 5.50    1.26 | 11.58   17.74 | 17.67    1.41 | 23.75    0.83
                 5.58    1.27 | 11.67   31.83 | 17.75    1.39 | 23.83    0.83
                 5.67    1.28 | 11.75   48.26 | 17.83    1.38 | 23.92    0.82
                 5.75    1.30 | 11.83   74.91 | 17.92    1.36 | 24.00    0.82
                 5.83    1.31 | 11.92   95.74 | 18.00    1.35 |
                 5.92    1.32 | 12.00   70.78 | 18.08    1.33 |
                 6.00    1.33 | 12.08   14.11 | 18.17    1.31 |

-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=    2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=    7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.092 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  28.071
     TOTAL RAINFALL   (mm)=  74.400
     RUNOFF COEFFICIENT   =   0.377

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=    1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=   45.00   Dir. Conn.(%)=   37.20
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
```

```
     Average Slope     (%)=       2.00        4.00
     Length            (m)=     101.00       25.00
     Mannings n           =      0.013       0.250

     Max.Eff.Inten.(mm/hr)=      95.74       51.88
              over (min)         5.00       10.00
     Storage Coeff.  (min)=       2.12 (ii)    7.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00       10.00
     Unit Hyd. peak  (cms)=       0.31        0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.15        0.10          0.223 (iii)
     TIME TO PEAK    (hrs)=      12.00       12.08          12.00
     RUNOFF VOLUME    (mm)=      72.40       33.09          47.71
     TOTAL RAINFALL   (mm)=      74.40       74.40          74.40
     RUNOFF COEFFICIENT   =       0.97        0.44           0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
                          0.0151     0.0353   |   3.2269     0.1182

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530     0.223     12.00      47.71
   OUTFLOW: ID= 1 (  0206)      1.530     0.020     12.83      47.63

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.03
                   TIME SHIFT OF PEAK FLOW         (min)= 50.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0357

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

```
--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62   0.092    12.50    28.07
      + ID2= 2 (  0206):     1.53   0.020    12.83    47.63
        ==================================================
        ID = 3 (  0208):     4.15   0.107    12.50    35.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.087 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  26.149
     TOTAL RAINFALL   (mm)=  74.400
     RUNOFF COEFFICIENT   =   0.351

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------

                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      95.74        40.77
              over (min)         5.00        20.00
     Storage Coeff.  (min)=       4.26 (ii)   15.74 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.23         0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.64         0.84          1.178 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.25          12.08
     RUNOFF VOLUME    (mm)=      72.40        31.27          38.38
```

```
     TOTAL RAINFALL   (mm)=      74.40       74.40          74.40
     RUNOFF COEFFICIENT   =       0.97        0.42           0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010     0.1310
                          0.0196     0.0063   |   0.4592     0.1548
                          0.0649     0.0138   |   0.5093     0.1815
                          0.0897     0.0225   |   0.5542     0.2111
                          0.1090     0.0326   |   0.5953     0.2435
                          0.1253     0.0442   |   0.6334     0.2788
                          0.1397     0.0577   |   0.8993     0.3170
                          0.1528     0.0731   |   1.4461     0.3580
                          0.1649     0.0905   |   2.2696     0.4018
                          0.3277     0.1097   |   3.3891     0.4486

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     15.570     1.178     12.08      38.38
   OUTFLOW: ID= 1 (  0205)     15.570     0.491     12.58      38.38

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 41.69
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1719

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0203):     2.80   0.087    12.58    26.15
      + ID2= 2 (  0205):    15.57   0.491    12.58    38.38
        ==================================================
        ID = 3 (  0207):    18.37   0.578    12.58    36.51
```

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.578    12.58    36.51
      + ID2= 2 (  0208):     4.15   0.107    12.50    35.28
        ==================================================
        ID = 3 (  0209):    22.52   0.685    12.58    36.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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====================================================================================
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       V    V   I    SSSSS  U    U    A    L              (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

         OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
        O   O    T      T    H   H   Y Y   MM MM  O   O
        O   O    T      T    H   H    Y    M   M  O   O
         OOO     T      T    H   H    Y    M   M   OOO
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```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\31e5
d250-8637-47c8-b878-1cff67d9115b\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\31e5
d250-8637-47c8-b878-1cff67d9115b\scen


DATE: 01-30-2024                           TIME: 04:37:34

USER:
```

```
COMMENTS: ____________________________________________________________


----------------------------------------------------------------------------------
-----------------------
  **************************************************
  ** SIMULATION : F - 10yr 4hr 5min Chicago     **
  **************************************************

--------------------
| CHICAGO STORM     |    IDF curve parameters: A= 664.647
| Ptotal= 50.60 mm  |                          B=   1.500
--------------------                           C=   0.722
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  4.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.78 |  1.00   13.18 |  2.00    9.06 |  3.00    4.85
                 0.08    3.97 |  1.08   18.77 |  2.08    8.38 |  3.08    4.68
                 0.17    4.20 |  1.17   39.35 |  2.17    7.81 |  3.17    4.53
                 0.25    4.46 |  1.25  172.06 |  2.25    7.32 |  3.25    4.39
                 0.33    4.76 |  1.33   50.10 |  2.33    6.90 |  3.33    4.27
                 0.42    5.11 |  1.42   28.65 |  2.42    6.53 |  3.42    4.14
                 0.50    5.54 |  1.50   20.86 |  2.50    6.21 |  3.50    4.03
                 0.58    6.06 |  1.58   16.72 |  2.58    5.92 |  3.58    3.93
                 0.67    6.71 |  1.67   14.10 |  2.67    5.66 |  3.67    3.83
                 0.75    7.55 |  1.75   12.28 |  2.75    5.43 |  3.75    3.73
                 0.83    8.71 |  1.83   10.94 |  2.83    5.22 |  3.83    3.65
                 0.92   10.41 |  1.92    9.90 |  2.92    5.02 |  3.92    3.56


-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.052 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  13.772
     TOTAL RAINFALL   (mm)=  50.600
     RUNOFF COEFFICIENT   =   0.272
```

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

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69        0.84
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       2.00        4.00
     Length            (m)=     101.00       25.00
     Mannings n          =      0.013       0.250

     Max.Eff.Inten.(mm/hr)=     172.06       40.00
                over (min)       5.00       10.00
     Storage Coeff.  (min)=       1.68 (ii)    5.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00       10.00
     Unit Hyd. peak  (cms)=       0.32        0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.26        0.07         0.298 (iii)
     TIME TO PEAK    (hrs)=       1.33        1.42          1.33
     RUNOFF VOLUME    (mm)=      48.60       17.18         28.86
     TOTAL RAINFALL   (mm)=      50.60       50.60         50.60
     RUNOFF COEFFICIENT   =       0.96        0.34          0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
```

```
                          0.0151     0.0353   |   3.2269     0.1182

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0202)      1.530     0.298      1.33      28.86
  OUTFLOW: ID= 1 (  0206)      1.530     0.014      3.33      28.79

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.79
                TIME SHIFT OF PEAK FLOW         (min)=120.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0299

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0204):      2.62   0.052     2.08    13.77
     + ID2= 2 (  0206):      1.53   0.014     3.33    28.79
       ==================================================
       ID = 3 (  0208):      4.15   0.066     2.08    19.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.048 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  12.606
     TOTAL RAINFALL   (mm)=  50.600
     RUNOFF COEFFICIENT   =   0.249

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

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13       12.44
     Dep. Storage     (mm)=       2.00        5.10
     Average Slope     (%)=       2.00        4.00
```

```
     Length            (m)=     322.18       70.00
     Mannings n          =      0.013       0.250

     Max.Eff.Inten.(mm/hr)=     172.06       26.31
                over (min)       5.00       20.00
     Storage Coeff.  (min)=       3.37 (ii)   17.05 (ii)
     Unit Hyd. Tpeak (min)=       5.00       20.00
     Unit Hyd. peak  (cms)=       0.26        0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.05        0.47         1.152 (iii)
     TIME TO PEAK    (hrs)=       1.33        1.58          1.33
     RUNOFF VOLUME    (mm)=      48.60       15.98         21.62
     TOTAL RAINFALL   (mm)=      50.60       50.60         50.60
     RUNOFF COEFFICIENT   =       0.96        0.32          0.43

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010     0.1310
                          0.0196     0.0063   |   0.4592     0.1548
                          0.0649     0.0138   |   0.5093     0.1815
                          0.0897     0.0225   |   0.5542     0.2111
                          0.1090     0.0326   |   0.5953     0.2435
                          0.1253     0.0442   |   0.6334     0.2788
                          0.1397     0.0577   |   0.8993     0.3170
                          0.1528     0.0731   |   1.4461     0.3580
                          0.1649     0.0905   |   2.2696     0.4018
                          0.3277     0.1097   |   3.3891     0.4486

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0201)     15.570     1.152      1.33      21.62
  OUTFLOW: ID= 1 (  0205)     15.570     0.366      2.08      21.62

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 31.78
                TIME SHIFT OF PEAK FLOW         (min)= 45.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.1211
```

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-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0203):     2.80   0.048     2.08    12.61
      + ID2= 2 (  0205):    15.57   0.366     2.08    21.62
        ==================================================
        ID = 3 (  0207):    18.37   0.414     2.08    20.24

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.414     2.08    20.24
      + ID2= 2 (  0208):     4.15   0.066     2.08    19.31
        ==================================================
        ID = 3 (  0209):    22.52   0.480     2.08    20.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
===================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\bc0b
66e1-a33f-4049-a6a4-cc185337e77f\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\bc0b
66e1-a33f-4049-a6a4-cc185337e77f\scen


DATE: 01-30-2024                           TIME: 04:37:35

USER:


COMMENTS: ____________________________________________________________


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------------------------
  ************************************************
  ** SIMULATION : G - 10yr 24hr 5min SCS Type I **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              f6764074-2747-4e2d-b552-b793471f1267\24397740
| Ptotal= 86.40 mm |    Comments: 10yr 24hr 5min SCS Type II
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.00 |  6.08    1.56 | 12.17   14.81 | 18.25    1.51
                 0.08    0.87 |  6.17    1.58 | 12.25   13.23 | 18.33    1.49
                 0.17    0.87 |  6.25    1.59 | 12.33   11.65 | 18.42    1.47
                 0.25    0.88 |  6.33    1.61 | 12.42   10.08 | 18.50    1.46
                 0.33    0.89 |  6.42    1.62 | 12.50    8.50 | 18.58    1.43
                 0.42    0.89 |  6.50    1.63 | 12.58    7.29 | 18.67    1.42
                 0.50    0.91 |  6.58    1.65 | 12.67    6.93 | 18.75    1.40
                 0.58    0.91 |  6.67    1.66 | 12.75    6.57 | 18.83    1.38
                 0.67    0.92 |  6.75    1.68 | 12.83    6.21 | 18.92    1.37
                 0.75    0.92 |  6.83    1.69 | 12.92    5.85 | 19.00    1.35
                 0.83    0.93 |  6.92    1.71 | 13.00    5.50 | 19.08    1.33
                 0.92    0.94 |  7.00    1.72 | 13.08    5.15 | 19.17    1.31
                 1.00    0.94 |  7.08    1.74 | 13.17    4.96 | 19.25    1.29
                 1.08    0.96 |  7.17    1.75 | 13.25    4.76 | 19.33    1.28
                 1.17    0.96 |  7.25    1.76 | 13.33    4.57 | 19.42    1.26
                 1.25    0.97 |  7.33    1.78 | 13.42    4.38 | 19.50    1.24
                 1.33    0.98 |  7.42    1.79 | 13.50    4.18 | 19.58    1.22
                 1.42    0.98 |  7.50    1.81 | 13.58    3.97 | 19.67    1.20
                 1.50    0.99 |  7.58    1.82 | 13.67    3.84 | 19.75    1.19
                 1.58    0.99 |  7.67    1.84 | 13.75    3.70 | 19.83    1.17
                 1.67    1.01 |  7.75    1.85 | 13.83    3.56 | 19.92    1.15
                 1.75    1.01 |  7.83    1.86 | 13.92    3.42 | 20.00    1.13
                 1.83    1.02 |  7.92    1.88 | 14.00    3.28 | 20.08    1.12
                 1.92    1.03 |  8.00    1.89 | 14.08    3.17 | 20.17    1.12
                 2.00    1.03 |  8.08    1.94 | 14.17    3.12 | 20.25    1.11
                 2.08    1.05 |  8.17    2.01 | 14.25    3.07 | 20.33    1.11
                 2.17    1.05 |  8.25    2.08 | 14.33    3.02 | 20.42    1.11
                 2.25    1.06 |  8.33    2.15 | 14.42    2.97 | 20.50    1.11
                 2.33    1.06 |  8.42    2.22 | 14.50    2.93 | 20.58    1.10
                 2.42    1.07 |  8.50    2.29 | 14.58    2.86 | 20.67    1.10
                 2.50    1.08 |  8.58    2.38 | 14.67    2.82 | 20.75    1.09
                 2.58    1.08 |  8.67    2.45 | 14.75    2.77 | 20.83    1.09
                 2.67    1.09 |  8.75    2.51 | 14.83    2.72 | 20.92    1.09
                 2.75    1.10 |  8.83    2.58 | 14.92    2.67 | 21.00    1.08
                 2.83    1.10 |  8.92    2.65 | 15.00    2.62 | 21.08    1.08
                 2.92    1.11 |  9.00    2.72 | 15.08    2.57 | 21.17    1.07
                 3.00    1.11 |  9.08    2.76 | 15.17    2.51 | 21.25    1.07
                 3.08    1.13 |  9.17    2.76 | 15.25    2.47 | 21.33    1.07
                 3.17    1.13 |  9.25    2.76 | 15.33    2.42 | 21.42    1.06
                 3.25    1.14 |  9.33    2.76 | 15.42    2.37 | 21.50    1.06
                 3.33    1.15 |  9.42    2.76 | 15.50    2.32 | 21.58    1.05
                 3.42    1.15 |  9.50    2.76 | 15.58    2.26 | 21.67    1.05
                 3.50    1.17 |  9.58    2.83 | 15.67    2.21 | 21.75    1.05
                 3.58    1.17 |  9.67    2.94 | 15.75    2.16 | 21.83    1.05
                 3.67    1.18 |  9.75    3.06 | 15.83    2.11 | 21.92    1.04
                 3.75    1.18 |  9.83    3.17 | 15.92    2.07 | 22.00    1.04
                 3.83    1.19 |  9.92    3.28 | 16.00    2.01 | 22.08    1.04
                 3.92    1.20 | 10.00    3.39 | 16.08    1.98 | 22.17    1.03
                 4.00    1.20 | 10.08    3.56 | 16.17    1.96 | 22.25    1.03
                 4.08    1.22 | 10.17    3.73 | 16.25    1.94 | 22.33    1.02
                 4.17    1.23 | 10.25    3.89 | 16.33    1.92 | 22.42    1.02
                 4.25    1.25 | 10.33    4.06 | 16.42    1.91 | 22.50    1.02
                 4.33    1.26 | 10.42    4.22 | 16.50    1.89 | 22.58    1.01
                 4.42    1.27 | 10.50    4.39 | 16.58    1.87 | 22.67    1.01
                 4.50    1.29 | 10.58    4.67 | 16.67    1.85 | 22.75    1.01
                 4.58    1.30 | 10.67    4.94 | 16.75    1.83 | 22.83    1.00
                 4.67    1.32 | 10.75    5.22 | 16.83    1.82 | 22.92    1.00
                 4.75    1.33 | 10.83    5.50 | 16.92    1.80 | 23.00    0.99
                 4.83    1.35 | 10.92    5.77 | 17.00    1.78 | 23.08    0.99
                 4.92    1.36 | 11.00    6.05 | 17.08    1.76 | 23.17    0.99
                 5.00    1.37 | 11.08    6.64 | 17.17    1.74 | 23.25    0.98
                 5.08    1.39 | 11.17    7.30 | 17.25    1.73 | 23.33    0.98
                 5.17    1.40 | 11.25    7.96 | 17.33    1.71 | 23.42    0.98
                 5.25    1.42 | 11.33    8.63 | 17.42    1.69 | 23.50    0.98
                 5.33    1.43 | 11.42    9.29 | 17.50    1.68 | 23.58    0.97
                 5.42    1.45 | 11.50    9.95 | 17.58    1.65 | 23.67    0.97
                 5.50    1.46 | 11.58   20.60 | 17.67    1.64 | 23.75    0.96
                 5.58    1.48 | 11.67   36.97 | 17.75    1.62 | 23.83    0.96
                 5.67    1.49 | 11.75   56.04 | 17.83    1.60 | 23.92    0.96
                 5.75    1.51 | 11.83   86.99 | 17.92    1.58 | 24.00    0.95
                 5.83    1.52 | 11.92  111.18 | 18.00    1.56 |
                 5.92    1.53 | 12.00   82.20 | 18.08    1.55 |
                 6.00    1.55 | 12.08   16.38 | 18.17    1.53 |

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--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=    2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=    7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.120 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  36.267
     TOTAL RAINFALL   (mm)=  86.400
     RUNOFF COEFFICIENT   =   0.420

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=       0.69         0.84
     Dep. Storage      (mm)=       2.00         5.00
     Average Slope      (%)=       2.00         4.00
     Length             (m)=     101.00        25.00
     Mannings n            =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     111.18        65.64
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.00 (ii)    6.85 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.13         0.274 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08         12.00
     RUNOFF VOLUME    (mm)=      84.40        42.00         57.77
     TOTAL RAINFALL   (mm)=      86.40        86.40         86.40
     RUNOFF COEFFICIENT   =       0.98         0.49          0.67

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
```

```
      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  74.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
                          0.0151     0.0353   |   3.2269     0.1182

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530      0.274     12.00      57.77
   OUTFLOW: ID= 1 (  0206)      1.530      0.062     12.33      57.70

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.66
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0389

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0204):     2.62   0.120    12.50    36.27
     + ID2= 2 (  0206):     1.53   0.062    12.33    57.70
       ==================================================
       ID = 3 (  0208):     4.15   0.178    12.42    44.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58
```

```
     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.115 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  33.988
     TOTAL RAINFALL   (mm)=  86.400
     RUNOFF COEFFICIENT   =   0.393

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n          =       0.013        0.250

     Max.Eff.Inten.(mm/hr)=     111.18        52.14
                over (min)      5.00        15.00
     Storage Coeff.  (min)=       4.01 (ii)   14.42 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.24         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.76         1.18          1.683 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
     RUNOFF VOLUME    (mm)=      84.40        39.90          47.60
     TOTAL RAINFALL   (mm)=      86.40        86.40          86.40
     RUNOFF COEFFICIENT   =       0.98         0.46           0.55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  74.3    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010     0.1310
                          0.0196     0.0063   |   0.4592     0.1548
                          0.0649     0.0138   |   0.5093     0.1815
                          0.0897     0.0225   |   0.5542     0.2111
                          0.1090     0.0326   |   0.5953     0.2435
                          0.1253     0.0442   |   0.6334     0.2788
                          0.1397     0.0577   |   0.8993     0.3170
                          0.1528     0.0731   |   1.4461     0.3580
                          0.1649     0.0905   |   2.2696     0.4018
                          0.3277     0.1097   |   3.3891     0.4486

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     15.570      1.683     12.08      47.60
   OUTFLOW: ID= 1 (  0205)     15.570      0.575     12.58      47.59

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 34.15
                   TIME SHIFT OF PEAK FLOW         (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.2275

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0203):     2.80   0.115    12.58    33.99
     + ID2= 2 (  0205):    15.57   0.575    12.58    47.59
       ==================================================
       ID = 3 (  0207):    18.37   0.689    12.58    45.52

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0207):    18.37   0.689    12.58    45.52
     + ID2= 2 (  0208):     4.15   0.178    12.42    44.17
       ==================================================
       ID = 3 (  0209):    22.52   0.863    12.50    45.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
======================

       V    V   I    SSSSS  U    U    A     L              (v 6.2.2015)
```

```
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\55b4
0dce-1fc7-431e-b9ca-ca8b962b8335\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\55b4
0dce-1fc7-431e-b9ca-ca8b962b8335\scen


DATE: 01-30-2024                           TIME: 04:37:35

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  **********************************************
  ** SIMULATION : H - 25yr 4hr 5min Chicago     **
  **********************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 779.866
| Ptotal= 59.05 mm |                          B=   1.500
--------------------                          C=   0.723
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
```

```
                    Time to peak ratio =  0.33

             TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.00    4.39 |  1.00   15.36 |  2.00   10.55 |  3.00    5.64
             0.08    4.62 |  1.08   21.89 |  2.08    9.76 |  3.08    5.45
             0.17    4.89 |  1.17   45.95 |  2.17    9.09 |  3.17    5.27
             0.25    5.19 |  1.25  201.50 |  2.25    8.52 |  3.25    5.11
             0.33    5.54 |  1.33   58.52 |  2.33    8.03 |  3.33    4.96
             0.42    5.95 |  1.42   33.43 |  2.42    7.60 |  3.42    4.82
             0.50    6.44 |  1.50   24.33 |  2.50    7.22 |  3.50    4.69
             0.58    7.05 |  1.58   19.49 |  2.58    6.89 |  3.58    4.57
             0.67    7.81 |  1.67   16.43 |  2.67    6.59 |  3.67    4.45
             0.75    8.79 |  1.75   14.31 |  2.75    6.31 |  3.75    4.34
             0.83   10.14 |  1.83   12.74 |  2.83    6.07 |  3.83    4.24
             0.92   12.12 |  1.92   11.52 |  2.92    5.84 |  3.92    4.14

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   ( 0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.071 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  18.493
     TOTAL RAINFALL   (mm)=  59.046
     RUNOFF COEFFICIENT   =   0.313

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

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD ( 0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     201.50        53.76
                over (min)        5.00        10.00
```

```
     Storage Coeff.  (min)=       1.58 (ii)    5.40 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.31         0.10          0.361 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      57.05        22.50          35.35
     TOTAL RAINFALL   (mm)=      59.05        59.05          59.05
     RUNOFF COEFFICIENT   =       0.97         0.38           0.60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
                          0.0151     0.0353   |   3.2269     0.1182

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530     0.361      1.33      35.35
   OUTFLOW: ID= 1 (  0206)      1.530     0.024      2.58      35.27

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.72
                TIME SHIFT OF PEAK FLOW         (min)= 75.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0360

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62   0.071     2.08    18.49
```

```
      + ID2= 2 (  0206):     1.53   0.024     2.58    35.27
        ==================================================
        ID = 3 (  0208):     4.15   0.086     2.08    24.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   ( 0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.067 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  17.053
     TOTAL RAINFALL   (mm)=  59.046
     RUNOFF COEFFICIENT   =   0.289

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

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD ( 0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     201.50        35.48
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       3.16 (ii)   15.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.27         0.07
                                                            *TOTALS*
     PEAK FLOW       (cms)=       1.26         0.69          1.411 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58           1.33
     RUNOFF VOLUME    (mm)=      57.05        21.07          27.29
     TOTAL RAINFALL   (mm)=      59.05        59.05          59.05
     RUNOFF COEFFICIENT   =       0.97         0.36           0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010     0.1310
                          0.0196     0.0063   |   0.4592     0.1548
                          0.0649     0.0138   |   0.5093     0.1815
                          0.0897     0.0225   |   0.5542     0.2111
                          0.1090     0.0326   |   0.5953     0.2435
                          0.1253     0.0442   |   0.6334     0.2788
                          0.1397     0.0577   |   0.8993     0.3170
                          0.1528     0.0731   |   1.4461     0.3580
                          0.1649     0.0905   |   2.2696     0.4018
                          0.3277     0.1097   |   3.3891     0.4486

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     15.570     1.411      1.33      27.29
   OUTFLOW: ID= 1 (  0205)     15.570     0.457      2.08      27.29

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 32.35
                TIME SHIFT OF PEAK FLOW         (min)= 45.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.1539

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0203):     2.80   0.067     2.08    17.05
      + ID2= 2 (  0205):    15.57   0.457     2.08    27.29
        ==================================================
        ID = 3 (  0207):    18.37   0.524     2.08    25.73

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

--------------------
| ADD HYD  (  0209)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
```

```
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.524     2.08    25.73
      + ID2= 2 (  0208):     4.15   0.086     2.08    24.68
        ===================================================
        ID = 3 (  0209):    22.52   0.610     2.08    25.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
====================================================================================
========================

       V    V   I    SSSSS  U   U    A    L               (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\e128
e8c7-813d-427d-b7ce-7d87eaafe689\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\e128
e8c7-813d-427d-b7ce-7d87eaafe689\scen


DATE: 01-30-2024                           TIME: 04:37:36

USER:


COMMENTS: ____________________________________________________________

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

```
  ************************************************
  ** SIMULATION : I - 25yr 24hr 5min SCS Type I **
  ************************************************


--------------------
|    READ STORM     |     Filename: C:\Users\dhordyk\AppD
|                   |               ata\Local\Temp\
|                   |               f6764074-2747-4e2d-b552-b793471f1267\52718ccf
| Ptotal=100.80 mm  |     Comments: 25yr 24hr 5min SCS Type II
--------------------
                 TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                  hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                 0.00     0.00 |  6.08     1.82 | 12.17    17.27 | 18.25     1.76
                 0.08     1.02 |  6.17     1.84 | 12.25    15.43 | 18.33     1.74
                 0.17     1.02 |  6.25     1.86 | 12.33    13.60 | 18.42     1.72
                 0.25     1.03 |  6.33     1.87 | 12.42    11.76 | 18.50     1.70
                 0.33     1.04 |  6.42     1.89 | 12.50     9.92 | 18.58     1.67
                 0.42     1.04 |  6.50     1.91 | 12.58     8.51 | 18.67     1.66
                 0.50     1.06 |  6.58     1.93 | 12.67     8.09 | 18.75     1.63
                 0.58     1.06 |  6.67     1.94 | 12.75     7.67 | 18.83     1.61
                 0.67     1.07 |  6.75     1.96 | 12.83     7.25 | 18.92     1.60
                 0.75     1.08 |  6.83     1.97 | 12.92     6.83 | 19.00     1.57
                 0.83     1.09 |  6.92     1.99 | 13.00     6.41 | 19.08     1.55
                 0.92     1.10 |  7.00     2.01 | 13.08     6.01 | 19.17     1.53
                 1.00     1.10 |  7.08     2.03 | 13.17     5.78 | 19.25     1.51
                 1.08     1.12 |  7.17     2.04 | 13.25     5.56 | 19.33     1.49
                 1.17     1.12 |  7.25     2.06 | 13.33     5.33 | 19.42     1.47
                 1.25     1.13 |  7.33     2.07 | 13.42     5.10 | 19.50     1.45
                 1.33     1.14 |  7.42     2.09 | 13.50     4.88 | 19.58     1.42
                 1.42     1.14 |  7.50     2.11 | 13.58     4.64 | 19.67     1.41
                 1.50     1.16 |  7.58     2.13 | 13.67     4.48 | 19.75     1.38
                 1.58     1.16 |  7.67     2.14 | 13.75     4.31 | 19.83     1.36
                 1.67     1.18 |  7.75     2.16 | 13.83     4.15 | 19.92     1.34
                 1.75     1.18 |  7.83     2.18 | 13.92     3.99 | 20.00     1.32
                 1.83     1.19 |  7.92     2.19 | 14.00     3.83 | 20.08     1.31
                 1.92     1.20 |  8.00     2.21 | 14.08     3.70 | 20.17     1.30
                 2.00     1.20 |  8.08     2.27 | 14.17     3.63 | 20.25     1.30
                 2.08     1.22 |  8.17     2.35 | 14.25     3.58 | 20.33     1.30
                 2.17     1.22 |  8.25     2.43 | 14.33     3.53 | 20.42     1.29
                 2.25     1.23 |  8.33     2.51 | 14.42     3.47 | 20.50     1.29
                 2.33     1.24 |  8.42     2.59 | 14.50     3.42 | 20.58     1.28
                 2.42     1.24 |  8.50     2.67 | 14.58     3.34 | 20.67     1.28
                 2.50     1.26 |  8.58     2.77 | 14.67     3.29 | 20.75     1.27
                 2.58     1.26 |  8.67     2.85 | 14.75     3.23 | 20.83     1.27
                 2.67     1.28 |  8.75     2.93 | 14.83     3.17 | 20.92     1.27
                 2.75     1.28 |  8.83     3.01 | 14.92     3.12 | 21.00     1.26
                 2.83     1.29 |  8.92     3.09 | 15.00     3.05 | 21.08     1.26
                 2.92     1.30 |  9.00     3.18 | 15.08     2.99 | 21.17     1.25
                 3.00     1.30 |  9.08     3.23 | 15.17     2.93 | 21.25     1.25
```

```
                 3.08     1.32 |  9.17     3.23 | 15.25     2.88 | 21.33     1.25
                 3.17     1.32 |  9.25     3.23 | 15.33     2.82 | 21.42     1.24
                 3.25     1.33 |  9.33     3.23 | 15.42     2.76 | 21.50     1.24
                 3.33     1.34 |  9.42     3.23 | 15.50     2.71 | 21.58     1.23
                 3.42     1.34 |  9.50     3.23 | 15.58     2.63 | 21.67     1.23
                 3.50     1.36 |  9.58     3.31 | 15.67     2.58 | 21.75     1.22
                 3.58     1.36 |  9.67     3.44 | 15.75     2.52 | 21.83     1.22
                 3.67     1.38 |  9.75     3.56 | 15.83     2.47 | 21.92     1.22
                 3.75     1.38 |  9.83     3.69 | 15.92     2.41 | 22.00     1.21
                 3.83     1.39 |  9.92     3.82 | 16.00     2.35 | 22.08     1.21
                 3.92     1.40 | 10.00     3.95 | 16.08     2.31 | 22.17     1.20
                 4.00     1.40 | 10.08     4.15 | 16.17     2.28 | 22.25     1.20
                 4.08     1.42 | 10.17     4.35 | 16.25     2.27 | 22.33     1.20
                 4.17     1.44 | 10.25     4.54 | 16.33     2.25 | 22.42     1.19
                 4.25     1.45 | 10.33     4.73 | 16.42     2.22 | 22.50     1.19
                 4.33     1.47 | 10.42     4.93 | 16.50     2.21 | 22.58     1.18
                 4.42     1.49 | 10.50     5.12 | 16.58     2.18 | 22.67     1.18
                 4.50     1.50 | 10.58     5.44 | 16.67     2.16 | 22.75     1.17
                 4.58     1.52 | 10.67     5.77 | 16.75     2.14 | 22.83     1.17
                 4.67     1.54 | 10.75     6.09 | 16.83     2.12 | 22.92     1.17
                 4.75     1.55 | 10.83     6.41 | 16.92     2.10 | 23.00     1.16
                 4.83     1.57 | 10.92     6.73 | 17.00     2.08 | 23.08     1.16
                 4.92     1.59 | 11.00     7.06 | 17.08     2.06 | 23.17     1.15
                 5.00     1.60 | 11.08     7.74 | 17.17     2.03 | 23.25     1.15
                 5.08     1.62 | 11.17     8.52 | 17.25     2.01 | 23.33     1.15
                 5.17     1.64 | 11.25     9.29 | 17.33     1.99 | 23.42     1.14
                 5.25     1.66 | 11.33    10.06 | 17.42     1.97 | 23.50     1.14
                 5.33     1.67 | 11.42    10.84 | 17.50     1.96 | 23.58     1.13
                 5.42     1.69 | 11.50    11.61 | 17.58     1.93 | 23.67     1.13
                 5.50     1.70 | 11.58    24.03 | 17.67     1.91 | 23.75     1.12
                 5.58     1.72 | 11.67    43.13 | 17.75     1.89 | 23.83     1.12
                 5.67     1.74 | 11.75    65.38 | 17.83     1.87 | 23.92     1.12
                 5.75     1.76 | 11.83   101.49 | 17.92     1.85 | 24.00     1.11
                 5.83     1.77 | 11.92   129.71 | 18.00     1.82 |
                 5.92     1.79 | 12.00    95.90 | 18.08     1.80 |
                 6.00     1.80 | 12.08    19.11 | 18.17     1.78 |

--------------------------------------------------------------------------------

--------------------
| CALIB             |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.156 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  46.743
```

```
     TOTAL RAINFALL   (mm)= 100.800
     RUNOFF COEFFICIENT   =   0.464

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69        0.84
     Dep. Storage     (mm)=       2.00        5.00
     Average Slope     (%)=       2.00        4.00
     Length            (m)=     101.00       25.00
     Mannings n          =       0.013       0.250

     Max.Eff.Inten.(mm/hr)=     129.71       82.87
               over (min)        5.00       10.00
     Storage Coeff.  (min)=       1.88 (ii)    6.44 (ii)
     Unit Hyd. Tpeak (min)=       5.00       10.00
     Unit Hyd. peak  (cms)=       0.32        0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.20        0.17          0.335 (iii)
     TIME TO PEAK    (hrs)=      12.00       12.08          12.00
     RUNOFF VOLUME    (mm)=      98.80       53.25          70.19
     TOTAL RAINFALL   (mm)=     100.80      100.80         100.80
     RUNOFF COEFFICIENT   =       0.98        0.53           0.70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  74.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
```

```
                    0.0130     0.0228   |   1.2999      0.0986
                    0.0141     0.0288   |   2.3435      0.1102
                    0.0151     0.0353   |   3.2269      0.1182

                          AREA     QPEAK     TPEAK       R.V.
                          (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530      0.335     12.00      70.19
   OUTFLOW: ID= 1 (  0206)      1.530      0.117     12.25      70.12

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 34.97
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0434

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62   0.156    12.50    46.74
      + ID2= 2 (  0206):     1.53   0.117    12.25    70.12
        ==================================================
        ID = 3 (  0208):     4.15   0.257    12.33    55.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.150 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  44.062
     TOTAL RAINFALL   (mm)= 100.800
     RUNOFF COEFFICIENT   =   0.437

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
```

```
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     129.71        71.98
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.77 (ii)   12.92 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.25         0.08
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.89         1.59          2.160 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
     RUNOFF VOLUME    (mm)=      98.80        50.85          59.15
     TOTAL RAINFALL   (mm)=     100.80       100.80         100.80
     RUNOFF COEFFICIENT   =       0.98         0.50           0.59

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010      0.1310
                          0.0196     0.0063   |   0.4592      0.1548
                          0.0649     0.0138   |   0.5093      0.1815
                          0.0897     0.0225   |   0.5542      0.2111
                          0.1090     0.0326   |   0.5953      0.2435
                          0.1253     0.0442   |   0.6334      0.2788
                          0.1397     0.0577   |   0.8993      0.3170
                          0.1528     0.0731   |   1.4461      0.3580
                          0.1649     0.0905   |   2.2696      0.4018
                          0.3277     0.1097   |   3.3891      0.4486

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     15.570      2.160     12.08      59.15
   OUTFLOW: ID= 1 (  0205)     15.570      0.746     12.50      59.14

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 34.56
```

```
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.2959

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0203):     2.80   0.150    12.58    44.06
      + ID2= 2 (  0205):    15.57   0.746    12.50    59.14
        ==================================================
        ID = 3 (  0207):    18.37   0.895    12.50    56.84

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.895    12.50    56.84
      + ID2= 2 (  0208):     4.15   0.257    12.33    55.36
        ==================================================
        ID = 3 (  0209):    22.52   1.137    12.50    56.57

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

 FINISH
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       V    V   I    SSSSS  U    U    A    L              (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO    TTTTT  TTTTT  H    H  Y    Y  M    M   OOO     TM
       O   O     T      T    H    H   Y  Y   MM MM  O   O
       O   O     T      T    H    H    Y     M   M  O   O
        OOO      T      T    H    H    Y     M    M   OOO
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```

```
                         *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\5f49
ccbd-742a-495a-9168-a5fb09e818ea\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\5f49
ccbd-742a-495a-9168-a5fb09e818ea\scen


DATE: 01-30-2024                          TIME: 04:37:35

USER:



COMMENTS: ____________________________________________________________


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  **********************************************
  ** SIMULATION : J - 50yr 4hr 5min Chicago    **
  **********************************************


--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 870.253
| Ptotal= 65.17 mm |                           B=   1.500
--------------------                           C=   0.725
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  4.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.33

                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.00    4.81 |  1.00   16.90 |  2.00   11.60 |  3.00    6.18
                  0.08    5.07 |  1.08   24.12 |  2.08   10.72 |  3.08    5.98
                  0.17    5.36 |  1.17   50.78 |  2.17    9.98 |  3.17    5.78
                  0.25    5.69 |  1.25  224.02 |  2.25    9.36 |  3.25    5.61
                  0.33    6.07 |  1.33   64.73 |  2.33    8.82 |  3.33    5.44
                  0.42    6.53 |  1.42   36.90 |  2.42    8.34 |  3.42    5.29
                  0.50    7.07 |  1.50   26.82 |  2.50    7.93 |  3.50    5.14
                  0.58    7.74 |  1.58   21.46 |  2.58    7.56 |  3.58    5.01
                  0.67    8.57 |  1.67   18.09 |  2.67    7.23 |  3.67    4.88
```

```
                0.75    9.66 |  1.75   15.74 |  2.75    6.93 |  3.75    4.76
                0.83   11.15 |  1.83   14.01 |  2.83    6.66 |  3.83    4.65
                0.92   13.33 |  1.92   12.67 |  2.92    6.41 |  3.92    4.54

 ------------------------------------------------------------------------------
 --------------------
 | CALIB              |
 | NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.087 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  22.174
     TOTAL RAINFALL   (mm)=  65.171
     RUNOFF COEFFICIENT   =   0.340

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

 ------------------------------------------------------------------------------
 --------------------
 | CALIB              |
 | STANDHYD (  0202)|   Area    (ha)=   1.53
 |ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     224.02        64.81
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.51 (ii)    5.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.34         0.13          0.409 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      63.17        26.60          40.20
     TOTAL RAINFALL   (mm)=      65.17        65.17          65.17
     RUNOFF COEFFICIENT   =       0.97         0.41           0.62

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0206)|     OVERFLOW IS OFF
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.1131     0.0425
                           0.0047     0.0023   |   0.1541     0.0503
                           0.0072     0.0051   |   0.1858     0.0588
                           0.0090     0.0086   |   0.2126     0.0678
                           0.0105     0.0127   |   0.2363     0.0775
                           0.0118     0.0175   |   0.5866     0.0878
                           0.0130     0.0228   |   1.2999     0.0986
                           0.0141     0.0288   |   2.3435     0.1102
                           0.0151     0.0353   |   3.2269     0.1182

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
    INFLOW : ID= 2 (  0202)      1.530     0.409      1.33      40.20
    OUTFLOW: ID= 1 (  0206)      1.530     0.041      2.08      40.13

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.13
                   TIME SHIFT OF PEAK FLOW        (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0373

 ------------------------------------------------------------------------------

 --------------------
 | ADD HYD  (  0208)|
 |   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
 --------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62   0.087     2.00    22.17
      + ID2= 2 (  0206):     1.53   0.041     2.08    40.13
        ===================================================
        ID = 3 (  0208):     4.15   0.128     2.00    28.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ------------------------------------------------------------------------------
 --------------------
 | CALIB              |
 | NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.082 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  20.539
     TOTAL RAINFALL   (mm)=  65.171
     RUNOFF COEFFICIENT   =   0.315

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

 ------------------------------------------------------------------------------
 --------------------
 | CALIB              |
 | STANDHYD (  0201)|   Area    (ha)=  15.57
 |ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     224.02        42.84
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.03 (ii)   14.29 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.27         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.42         0.89          1.702 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      63.17        25.01          31.61
     TOTAL RAINFALL   (mm)=      65.17        65.17          65.17
     RUNOFF COEFFICIENT   =       0.97         0.38           0.49

 ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
 ***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0205)|     OVERFLOW IS OFF
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.4010     0.1310
                           0.0196     0.0063   |   0.4592     0.1548
                           0.0649     0.0138   |   0.5093     0.1815
                           0.0897     0.0225   |   0.5542     0.2111
                           0.1090     0.0326   |   0.5953     0.2435
                           0.1253     0.0442   |   0.6334     0.2788
                           0.1397     0.0577   |   0.8993     0.3170
                           0.1528     0.0731   |   1.4461     0.3580
                           0.1649     0.0905   |   2.2696     0.4018
                           0.3277     0.1097   |   3.3891     0.4486

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
    INFLOW : ID= 2 (  0201)     15.570     1.702      1.33      31.61
    OUTFLOW: ID= 1 (  0205)     15.570     0.516      2.00      31.60

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 30.30
                   TIME SHIFT OF PEAK FLOW        (min)= 40.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1860

 ------------------------------------------------------------------------------

 --------------------
 | ADD HYD  (  0207)|
 |   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
 --------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0203):     2.80   0.082     2.08    20.54
      + ID2= 2 (  0205):    15.57   0.516     2.00    31.60
        ===================================================
        ID = 3 (  0207):    18.37   0.597     2.08    29.92

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

 --------------------
 | ADD HYD  (  0209)|
 |   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
 --------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.597     2.08    29.92
      + ID2= 2 (  0208):     4.15   0.128     2.00    28.79
        ===================================================
        ID = 3 (  0209):    22.52   0.725     2.08    29.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ------------------------------------------------------------------------------
 ==================================================================================
 ========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
```

```
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\ce8b
214a-f7e2-41ba-b907-b5658d74b837\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\ce8b
214a-f7e2-41ba-b907-b5658d74b837\scen


DATE: 01-30-2024                           TIME: 04:37:36

USER:


COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : K - 50yr 24hr 5min SCS Type I **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              f6764074-2747-4e2d-b552-b793471f1267\a68cd2f7
| Ptotal=110.40 mm |    Comments: 50yr 24hr 5min SCS Type II
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	' TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.00	6.08	2.00	12.17	18.92	18.25	1.93
0.08	1.12	6.17	2.02	12.25	16.90	18.33	1.91
0.17	1.12	6.25	2.03	12.33	14.89	18.42	1.88
0.25	1.13	6.33	2.05	12.42	12.88	18.50	1.87
0.33	1.14	6.42	2.07	12.50	10.86	18.58	1.83
0.42	1.14	6.50	2.09	12.58	9.32	18.67	1.81
0.50	1.16	6.58	2.11	12.67	8.86	18.75	1.79
0.58	1.16	6.67	2.13	12.75	8.40	18.83	1.77
0.67	1.18	6.75	2.14	12.83	7.94	18.92	1.75
0.75	1.18	6.83	2.16	12.92	7.48	19.00	1.72
0.83	1.19	6.92	2.18	13.00	7.02	19.08	1.70
0.92	1.20	7.00	2.20	13.08	6.58	19.17	1.67
1.00	1.20	7.08	2.22	13.17	6.33	19.25	1.65
1.08	1.23	7.17	2.24	13.25	6.09	19.33	1.63
1.17	1.23	7.25	2.25	13.33	5.84	19.42	1.61
1.25	1.24	7.33	2.27	13.42	5.59	19.50	1.59
1.33	1.25	7.42	2.29	13.50	5.34	19.58	1.56
1.42	1.25	7.50	2.31	13.58	5.08	19.67	1.54
1.50	1.27	7.58	2.33	13.67	4.90	19.75	1.51
1.58	1.27	7.67	2.35	13.75	4.73	19.83	1.49
1.67	1.29	7.75	2.36	13.83	4.55	19.92	1.47
1.75	1.29	7.83	2.38	13.92	4.37	20.00	1.45
1.83	1.30	7.92	2.40	14.00	4.20	20.08	1.44
1.92	1.31	8.00	2.42	14.08	4.05	20.17	1.43
2.00	1.31	8.08	2.48	14.17	3.98	20.25	1.42
2.08	1.34	8.17	2.57	14.25	3.92	20.33	1.42
2.17	1.34	8.25	2.66	14.33	3.86	20.42	1.41
2.25	1.35	8.33	2.75	14.42	3.80	20.50	1.41
2.33	1.36	8.42	2.84	14.50	3.74	20.58	1.40
2.42	1.36	8.50	2.93	14.58	3.65	20.67	1.40
2.50	1.38	8.58	3.04	14.67	3.60	20.75	1.40
2.58	1.38	8.67	3.12	14.75	3.54	20.83	1.39
2.67	1.40	8.75	3.21	14.83	3.47	20.92	1.39
2.75	1.40	8.83	3.30	14.92	3.42	21.00	1.38
2.83	1.41	8.92	3.39	15.00	3.35	21.08	1.38
2.92	1.42	9.00	3.48	15.08	3.28	21.17	1.37
3.00	1.42	9.08	3.53	15.17	3.21	21.25	1.37
3.08	1.45	9.17	3.53	15.25	3.15	21.33	1.36
3.17	1.45	9.25	3.53	15.33	3.09	21.42	1.36
3.25	1.46	9.33	3.53	15.42	3.02	21.50	1.36
3.33	1.47	9.42	3.53	15.50	2.97	21.58	1.35
3.42	1.47	9.50	3.53	15.58	2.88	21.67	1.35
3.50	1.49	9.58	3.62	15.67	2.83	21.75	1.34
3.58	1.49	9.67	3.76	15.75	2.76	21.83	1.34
3.67	1.51	9.75	3.90	15.83	2.70	21.92	1.33
3.75	1.51	9.83	4.05	15.92	2.64	22.00	1.32
3.83	1.52	9.92	4.19	16.00	2.57	22.08	1.32
3.92	1.53	10.00	4.33	16.08	2.53	22.17	1.32
4.00	1.53	10.08	4.55	16.17	2.50	22.25	1.31
4.08	1.56	10.17	4.76	16.25	2.48	22.33	1.31
4.17	1.57	10.25	4.97	16.33	2.46	22.42	1.30
4.25	1.59	10.33	5.18	16.42	2.44	22.50	1.30
4.33	1.61	10.42	5.40	16.50	2.42	22.58	1.29
4.42	1.63	10.50	5.61	16.58	2.38	22.67	1.29
4.50	1.64	10.58	5.96	16.67	2.37	22.75	1.29
4.58	1.67	10.67	6.31	16.75	2.34	22.83	1.28
4.67	1.68	10.75	6.67	16.83	2.32	22.92	1.28
4.75	1.70	10.83	7.02	16.92	2.30	23.00	1.27
4.83	1.72	10.92	7.37	17.00	2.27	23.08	1.27
4.92	1.74	11.00	7.73	17.08	2.25	23.17	1.26
5.00	1.76	11.08	8.48	17.17	2.23	23.25	1.26
5.08	1.78	11.17	9.33	17.25	2.21	23.33	1.25
5.17	1.80	11.25	10.17	17.33	2.18	23.42	1.25
5.25	1.81	11.33	11.02	17.42	2.16	23.50	1.25
5.33	1.83	11.42	11.87	17.50	2.14	23.58	1.24
5.42	1.85	11.50	12.72	17.58	2.11	23.67	1.24
5.50	1.87	11.58	26.32	17.67	2.09	23.75	1.23
5.58	1.89	11.67	47.23	17.75	2.07	23.83	1.23
5.67	1.91	11.75	71.61	17.83	2.04	23.92	1.22
5.75	1.92	11.83	111.16	17.92	2.02	24.00	1.21
5.83	1.94	11.92	142.07	18.00	2.00		
5.92	1.96	12.00	105.03	18.08	1.98		
6.00	1.98	12.08	20.93	18.17	1.95		

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

--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.181 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  54.044
     TOTAL RAINFALL   (mm)= 110.400
     RUNOFF COEFFICIENT   =   0.490

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     142.07        94.68
              over (min)         5.00        10.00
     Storage Coeff.  (min)=       1.81 (ii)    6.21 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.22         0.19         0.377 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08        12.00
     RUNOFF VOLUME    (mm)=     108.40        61.03        78.65
     TOTAL RAINFALL   (mm)=     110.40       110.40       110.40
     RUNOFF COEFFICIENT   =       0.98         0.55         0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
                          0.0151     0.0353   |   3.2269     0.1182

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530     0.377     12.00      78.65
   OUTFLOW: ID= 1 (  0206)      1.530     0.138     12.25      78.57

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 36.55
                TIME SHIFT OF PEAK FLOW         (min)= 15.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0474
```

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

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62   0.181    12.50    54.04
      + ID2= 2 (  0206):     1.53   0.138    12.25    78.57
        ==================================================
        ID = 3 (  0208):     4.15   0.302    12.42    63.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.174 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  51.113
     TOTAL RAINFALL   (mm)= 110.400
     RUNOFF COEFFICIENT   =   0.463

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     142.07        82.50
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.64 (ii)   12.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.25         0.09
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.98         1.87          2.486 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
```

```
     RUNOFF VOLUME    (mm)=     108.40        58.44          67.08
     TOTAL RAINFALL   (mm)=     110.40       110.40         110.40
     RUNOFF COEFFICIENT   =       0.98         0.53           0.61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010     0.1310
                          0.0196     0.0063   |   0.4592     0.1548
                          0.0649     0.0138   |   0.5093     0.1815
                          0.0897     0.0225   |   0.5542     0.2111
                          0.1090     0.0326   |   0.5953     0.2435
                          0.1253     0.0442   |   0.6334     0.2788
                          0.1397     0.0577   |   0.8993     0.3170
                          0.1528     0.0731   |   1.4461     0.3580
                          0.1649     0.0905   |   2.2696     0.4018
                          0.3277     0.1097   |   3.3891     0.4486

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     15.570     2.486     12.08      67.08
   OUTFLOW: ID= 1 (  0205)     15.570     1.026     12.42      67.08

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 41.28
                  TIME SHIFT OF PEAK FLOW         (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.3280

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0203):     2.80   0.174    12.58    51.11
      + ID2= 2 (  0205):    15.57   1.026    12.42    67.08
        ==================================================
        ID = 3 (  0207):    18.37   1.195    12.50    64.64
```

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   1.195    12.50    64.64
      + ID2= 2 (  0208):     4.15   0.302    12.42    63.09
        ==================================================
        ID = 3 (  0209):    22.52   1.496    12.42    64.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
==================================================================================
=======================

       V    V   I    SSSSS  U    U    A    L              (v 6.2.2015)
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO   TTTTT  TTTTT  H    H  Y    Y  M    M   OOO     TM
       O   O    T      T    H    H   Y Y    MM MM   O   O
       O   O    T      T    H    H    Y     M    M  O   O
        OOO     T      T    H    H    Y     M    M   OOO
Developed and Distributed by Smart City Water Inc
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\5421
f49b-abce-4c0f-a4bd-2658e4312910\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\5421
f49b-abce-4c0f-a4bd-2658e4312910\scen


DATE: 01-30-2024                           TIME: 04:37:35

USER:
```

```
COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : L - 100yr 4hr 5min Chicago    **
  ***********************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 952.739
| Ptotal= 72.14 mm |                           B=   1.500
--------------------                           C=   0.723
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  4.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.33

                 TIME     RAIN |  TIME     RAIN |'  TIME    RAIN |  TIME     RAIN
                  hrs    mm/hr |   hrs    mm/hr |'   hrs   mm/hr |   hrs    mm/hr
                 0.00     5.36 |  1.00    18.76 |  2.00   12.89 |  3.00     6.89
                 0.08     5.65 |  1.08    26.74 |  2.08   11.92 |  3.08     6.66
                 0.17     5.97 |  1.17    56.14 |  2.17   11.10 |  3.17     6.44
                 0.25     6.34 |  1.25   246.17 |  2.25   10.41 |  3.25     6.24
                 0.33     6.76 |  1.33    71.49 |  2.33    9.81 |  3.33     6.06
                 0.42     7.27 |  1.42    40.85 |  2.42    9.29 |  3.42     5.89
                 0.50     7.87 |  1.50    29.72 |  2.50    8.82 |  3.50     5.73
                 0.58     8.61 |  1.58    23.81 |  2.58    8.41 |  3.58     5.58
                 0.67     9.54 |  1.67    20.07 |  2.67    8.05 |  3.67     5.44
                 0.75    10.74 |  1.75    17.48 |  2.75    7.71 |  3.75     5.30
                 0.83    12.39 |  1.83    15.56 |  2.83    7.41 |  3.83     5.18
                 0.92    14.81 |  1.92    14.08 |  2.92    7.14 |  3.92     5.06


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.105 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=  26.588
     TOTAL RAINFALL   (mm)=  72.135
```

```
     RUNOFF COEFFICIENT   =   0.369

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     246.17        77.10
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.46 (ii)    4.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.38         0.17          0.552 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      70.14        31.46          45.85
     TOTAL RAINFALL   (mm)=      72.14        72.14          72.14
     RUNOFF COEFFICIENT   =       0.97         0.44           0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
                          0.0151     0.0353   |   3.2269     0.1182

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530     0.552      1.33      45.85
   OUTFLOW: ID= 1 (  0206)      1.530     0.064      1.83      45.77

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.60
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0390

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62   0.105     2.00    26.59
      + ID2= 2 (  0206):     1.53   0.064     1.83    45.77
        ===================================================
        ID = 3 (  0208):     4.15   0.165     1.92    33.66

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.100 (i)
     TIME TO PEAK    (hrs)=   2.083
     RUNOFF VOLUME    (mm)=  24.736
     TOTAL RAINFALL   (mm)=  72.135
     RUNOFF COEFFICIENT   =   0.343

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     246.17        65.26
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.92 (ii)   12.43 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.28         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.58         1.17          1.957 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      70.14        29.70          36.69
     TOTAL RAINFALL   (mm)=      72.14        72.14          72.14
     RUNOFF COEFFICIENT   =       0.97         0.41           0.51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010     0.1310
                          0.0196     0.0063   |   0.4592     0.1548
                          0.0649     0.0138   |   0.5093     0.1815
                          0.0897     0.0225   |   0.5542     0.2111
                          0.1090     0.0326   |   0.5953     0.2435
                          0.1253     0.0442   |   0.6334     0.2788
                          0.1397     0.0577   |   0.8993     0.3170
                          0.1528     0.0731   |   1.4461     0.3580
                          0.1649     0.0905   |   2.2696     0.4018
                          0.3277     0.1097   |   3.3891     0.4486

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     15.570     1.957      1.33      36.69
   OUTFLOW: ID= 1 (  0205)     15.570     0.571      2.08      36.69

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 29.19
                  TIME SHIFT OF PEAK FLOW         (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.2249

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0203):     2.80   0.100     2.08    24.74
      + ID2= 2 (  0205):    15.57   0.571     2.08    36.69
        ===================================================
        ID = 3 (  0207):    18.37   0.671     2.08    34.87

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37   0.671     2.08    34.87
      + ID2= 2 (  0208):     4.15   0.165     1.92    33.66
        ===================================================
        ID = 3 (  0209):    22.52   0.833     2.00    34.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================
========================

       V    V   I    SSSSS  U    U    A     L              (v 6.2.2015)
       V    V   I    SS     U    U   A A    L
        V  V    I     SS    U    U  AAAAA   L
        V  V    I      SS   U    U  A   A   L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO    TTTTT  TTTTT  H    H  Y    Y  M    M   OOO    TM
       O   O     T      T    H    H   Y Y    MM MM  O   O
       O   O     T      T    H    H    Y     M    M  O   O
        OOO      T      T    H    H    Y     M    M   OOO
Developed and Distributed by Smart City Water Inc
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
```

```
  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\20ff
6675-389a-41b3-9c34-56271388c630\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\20ff
6675-389a-41b3-9c34-56271388c630\scen


DATE: 01-30-2024                           TIME: 04:37:34

USER:



COMMENTS: ____________________________________________________________


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------------------------
  **********************************************
  ** SIMULATION : M - 100yr 24hr 5min SCS Type  **
  **********************************************


--------------------
|    READ STORM     |    Filename: C:\Users\dhordyk\AppD
|                   |              ata\Local\Temp\
|                   |              f6764074-2747-4e2d-b552-b793471f1267\2c4cdf56
| Ptotal=122.40 mm  |    Comments: 100yr 24hr 5min SCS Type II
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    0.00 |  6.08    2.22 | 12.17   20.97 | 18.25    2.14
                 0.08    1.24 |  6.17    2.24 | 12.25   18.74 | 18.33    2.12
                 0.17    1.24 |  6.25    2.25 | 12.33   16.51 | 18.42    2.09
                 0.25    1.25 |  6.33    2.27 | 12.42   14.28 | 18.50    2.07
                 0.33    1.26 |  6.42    2.29 | 12.50   12.04 | 18.58    2.03
                 0.42    1.27 |  6.50    2.31 | 12.58   10.33 | 18.67    2.01
                 0.50    1.29 |  6.58    2.34 | 12.67    9.82 | 18.75    1.99
                 0.58    1.29 |  6.67    2.36 | 12.75    9.31 | 18.83    1.96
                 0.67    1.30 |  6.75    2.38 | 12.83    8.80 | 18.92    1.94
                 0.75    1.31 |  6.83    2.40 | 12.92    8.29 | 19.00    1.91
                 0.83    1.32 |  6.92    2.42 | 13.00    7.78 | 19.08    1.88
                 0.92    1.33 |  7.00    2.44 | 13.08    7.30 | 19.17    1.86
                 1.00    1.33 |  7.08    2.46 | 13.17    7.02 | 19.25    1.83
                 1.08    1.36 |  7.17    2.48 | 13.25    6.75 | 19.33    1.81
                 1.17    1.36 |  7.25    2.50 | 13.33    6.47 | 19.42    1.78
                 1.25    1.37 |  7.33    2.52 | 13.42    6.20 | 19.50    1.76
                 1.33    1.38 |  7.42    2.54 | 13.50    5.92 | 19.58    1.73
                 1.42    1.39 |  7.50    2.56 | 13.58    5.63 | 19.67    1.71
```

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                 1.50    1.41 |  7.58    2.58 | 13.67    5.43 | 19.75    1.68
                 1.58    1.41 |  7.67    2.60 | 13.75    5.24 | 19.83    1.65
                 1.67    1.43 |  7.75    2.62 | 13.83    5.04 | 19.92    1.63
                 1.75    1.43 |  7.83    2.64 | 13.92    4.85 | 20.00    1.60
                 1.83    1.44 |  7.92    2.66 | 14.00    4.65 | 20.08    1.59
                 1.92    1.46 |  8.00    2.68 | 14.08    4.49 | 20.17    1.58
                 2.00    1.46 |  8.08    2.75 | 14.17    4.41 | 20.25    1.58
                 2.08    1.48 |  8.17    2.85 | 14.25    4.35 | 20.33    1.57
                 2.17    1.48 |  8.25    2.95 | 14.33    4.28 | 20.42    1.57
                 2.25    1.50 |  8.33    3.05 | 14.42    4.21 | 20.50    1.57
                 2.33    1.51 |  8.42    3.15 | 14.50    4.15 | 20.58    1.55
                 2.42    1.51 |  8.50    3.24 | 14.58    4.05 | 20.67    1.55
                 2.50    1.53 |  8.58    3.37 | 14.67    3.99 | 20.75    1.55
                 2.58    1.53 |  8.67    3.46 | 14.75    3.92 | 20.83    1.54
                 2.67    1.55 |  8.75    3.56 | 14.83    3.85 | 20.92    1.54
                 2.75    1.55 |  8.83    3.66 | 14.92    3.79 | 21.00    1.53
                 2.83    1.56 |  8.92    3.76 | 15.00    3.71 | 21.08    1.53
                 2.92    1.58 |  9.00    3.86 | 15.08    3.64 | 21.17    1.52
                 3.00    1.58 |  9.08    3.92 | 15.17    3.56 | 21.25    1.52
                 3.08    1.60 |  9.17    3.92 | 15.25    3.49 | 21.33    1.51
                 3.17    1.60 |  9.25    3.92 | 15.33    3.42 | 21.42    1.51
                 3.25    1.62 |  9.33    3.92 | 15.42    3.35 | 21.50    1.51
                 3.33    1.63 |  9.42    3.92 | 15.50    3.29 | 21.58    1.49
                 3.42    1.63 |  9.50    3.92 | 15.58    3.19 | 21.67    1.49
                 3.50    1.65 |  9.58    4.01 | 15.67    3.14 | 21.75    1.49
                 3.58    1.65 |  9.67    4.17 | 15.75    3.06 | 21.83    1.48
                 3.67    1.67 |  9.75    4.33 | 15.83    2.99 | 21.92    1.48
                 3.75    1.68 |  9.83    4.48 | 15.92    2.93 | 22.00    1.47
                 3.83    1.69 |  9.92    4.64 | 16.00    2.85 | 22.08    1.47
                 3.92    1.70 | 10.00    4.80 | 16.08    2.80 | 22.17    1.46
                 4.00    1.70 | 10.08    5.04 | 16.17    2.77 | 22.25    1.46
                 4.08    1.73 | 10.17    5.28 | 16.25    2.75 | 22.33    1.45
                 4.17    1.75 | 10.25    5.51 | 16.33    2.73 | 22.42    1.44
                 4.25    1.77 | 10.33    5.75 | 16.42    2.70 | 22.50    1.44
                 4.33    1.78 | 10.42    5.98 | 16.50    2.68 | 22.58    1.43
                 4.42    1.80 | 10.50    6.22 | 16.58    2.64 | 22.67    1.43
                 4.50    1.82 | 10.58    6.61 | 16.67    2.62 | 22.75    1.42
                 4.58    1.85 | 10.67    7.00 | 16.75    2.60 | 22.83    1.42
                 4.67    1.87 | 10.75    7.39 | 16.83    2.57 | 22.92    1.42
                 4.75    1.89 | 10.83    7.78 | 16.92    2.55 | 23.00    1.41
                 4.83    1.91 | 10.92    8.18 | 17.00    2.52 | 23.08    1.41
                 4.92    1.93 | 11.00    8.57 | 17.08    2.50 | 23.17    1.40
                 5.00    1.95 | 11.08    9.40 | 17.17    2.47 | 23.25    1.40
                 5.08    1.97 | 11.17   10.34 | 17.25    2.45 | 23.33    1.39
                 5.17    1.99 | 11.25   11.28 | 17.33    2.42 | 23.42    1.38
                 5.25    2.01 | 11.33   12.22 | 17.42    2.39 | 23.50    1.38
                 5.33    2.03 | 11.42   13.16 | 17.50    2.37 | 23.58    1.37
                 5.42    2.05 | 11.50   14.10 | 17.58    2.34 | 23.67    1.37
                 5.50    2.07 | 11.58   29.18 | 17.67    2.32 | 23.75    1.36
                 5.58    2.09 | 11.67   52.37 | 17.75    2.29 | 23.83    1.36
```

```
                 5.67    2.11 | 11.75   79.40 | 17.83    2.27 | 23.92    1.36
                 5.75    2.13 | 11.83  123.24 | 17.92    2.24 | 24.00    1.35
                 5.83    2.15 | 11.92  157.51 | 18.00    2.22 |
                 5.92    2.17 | 12.00  116.45 | 18.08    2.19 |
                 6.00    2.19 | 12.08   23.21 | 18.17    2.16 |

-------------------------------------------------------------------------------

--------------------
| CALIB             |
| NASHYD   (  0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.213 (i)
     TIME TO PEAK    (hrs)=  12.500
     RUNOFF VOLUME    (mm)=  63.466
     TOTAL RAINFALL   (mm)= 122.400
     RUNOFF COEFFICIENT   =   0.519

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

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     157.51       109.72
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.74 (ii)    5.96 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.25         0.23         0.430 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08        12.00
     RUNOFF VOLUME    (mm)=     120.40        71.00        89.37
     TOTAL RAINFALL   (mm)=     122.40       122.40       122.40
     RUNOFF COEFFICIENT   =       0.98         0.58          0.73

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
```

```
     (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
          CN*  =  74.0    Ia = Dep. Storage  (Above)
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131     0.0425
                          0.0047     0.0023   |   0.1541     0.0503
                          0.0072     0.0051   |   0.1858     0.0588
                          0.0090     0.0086   |   0.2126     0.0678
                          0.0105     0.0127   |   0.2363     0.0775
                          0.0118     0.0175   |   0.5866     0.0878
                          0.0130     0.0228   |   1.2999     0.0986
                          0.0141     0.0288   |   2.3435     0.1102
                          0.0151     0.0353   |   3.2269     0.1182

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530     0.430     12.00      89.37
   OUTFLOW: ID= 1 (  0206)      1.530     0.164     12.25      89.30

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 38.03
                  TIME SHIFT OF PEAK FLOW         (min)= 15.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0532

-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0208)|
|  1 +  2 =  3     |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62   0.213    12.50    63.47
      + ID2= 2 (  0206):     1.53   0.164    12.25    89.30
        ===============================================
        ID = 3 (  0208):     4.15   0.359    12.42    72.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58
```

```
     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.206 (i)
     TIME TO PEAK    (hrs)=  12.583
     RUNOFF VOLUME    (mm)=  60.239
     TOTAL RAINFALL   (mm)= 122.400
     RUNOFF COEFFICIENT   =   0.492

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD ( 0201)|   Area    (ha)=  15.57
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.13        12.44
     Dep. Storage     (mm)=       2.00         5.10
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     322.18        70.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     157.51        95.92
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.49 (ii)   11.65 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.26         0.09
                                                            *TOTALS*
     PEAK FLOW       (cms)=       1.10         2.23          2.909 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
     RUNOFF VOLUME    (mm)=     120.40        68.20          77.23
     TOTAL RAINFALL   (mm)=     122.40       122.40         122.40
     RUNOFF COEFFICIENT   =       0.98         0.56           0.63

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
```

```
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |   0.4010     0.1310
                         0.0196     0.0063    |   0.4592     0.1548
                         0.0649     0.0138    |   0.5093     0.1815
                         0.0897     0.0225    |   0.5542     0.2111
                         0.1090     0.0326    |   0.5953     0.2435
                         0.1253     0.0442    |   0.6334     0.2788
                         0.1397     0.0577    |   0.8993     0.3170
                         0.1528     0.0731    |   1.4461     0.3580
                         0.1649     0.0905    |   2.2696     0.4018
                         0.3277     0.1097    |   3.3891     0.4486

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 ( 0201)     15.570     2.909     12.08      77.23
   OUTFLOW: ID= 1 ( 0205)     15.570     1.439     12.42      77.22

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 49.47
                  TIME SHIFT OF PEAK FLOW        (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.3599

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0207)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0203):     2.80    0.206    12.58    60.24
      + ID2= 2 (  0205):    15.57    1.439    12.42    77.22
        =================================================
        ID = 3 (  0207):    18.37    1.639    12.42    74.63

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

--------------------
| ADD HYD  (  0209)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0207):    18.37    1.639    12.42    74.63
      + ID2= 2 (  0208):     4.15    0.359    12.42    72.99
        =================================================
        ID = 3 (  0209):    22.52    1.998    12.42    74.33

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

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```



```
                   *****  D E T A I L E D   O U T P U T *****


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

   Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\9c12
15b1-1846-4bad-8d45-32de01f5cfbc\scen
   Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\e6b5b667-a614-4391-ac0a-9f748cfe23f1\9c12
15b1-1846-4bad-8d45-32de01f5cfbc\scen


DATE: 01-30-2024                           TIME: 04:37:35

USER:


COMMENTS: ____________________________________________________________


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------------------------
  ************************************************
  ** SIMULATION : N - TIMMINS                   **
  ************************************************


--------------------
|    READ STORM     |    Filename: C:\Users\dhordyk\AppD
|                   |              ata\Local\Temp\
|                   |              f6764074-2747-4e2d-b552-b793471f1267\2ed90c06
| Ptotal=193.00 mm |    Comments: TIMMINS
--------------------
```

```
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00   15.00 |  3.00    3.00 |  6.00   43.00 |  9.00   13.00
                 0.25   15.00 |  3.25    3.00 |  6.25   43.00 |  9.25   13.00
                 0.50   15.00 |  3.50    3.00 |  6.50   43.00 |  9.50   13.00
                 0.75   15.00 |  3.75    3.00 |  6.75   43.00 |  9.75   13.00
                 1.00   20.00 |  4.00    5.00 |  7.00   20.00 | 10.00   13.00
                 1.25   20.00 |  4.25    5.00 |  7.25   20.00 | 10.25   13.00
                 1.50   20.00 |  4.50    5.00 |  7.50   20.00 | 10.50   13.00
                 1.75   20.00 |  4.75    5.00 |  7.75   20.00 | 10.75   13.00
                 2.00   10.00 |  5.00   20.00 |  8.00   23.00 | 11.00    8.00
                 2.25   10.00 |  5.25   20.00 |  8.25   23.00 | 11.25    8.00
                 2.50   10.00 |  5.50   20.00 |  8.50   23.00 | 11.50    8.00
                 2.75   10.00 |  5.75   20.00 |  8.75   23.00 | 11.75    8.00

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--------------------
| CALIB             |
| NASHYD   ( 0204)|   Area    (ha)=   2.62   Curve Number   (CN)= 72.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.55

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083   15.00 | 3.083    3.00 | 6.083   43.00 |  9.08   13.00
                0.167   15.00 | 3.167    3.00 | 6.167   43.00 |  9.17   13.00
                0.250   15.00 | 3.250    3.00 | 6.250   43.00 |  9.25   13.00
                0.333   15.00 | 3.333    3.00 | 6.333   43.00 |  9.33   13.00
                0.417   15.00 | 3.417    3.00 | 6.417   43.00 |  9.42   13.00
                0.500   15.00 | 3.500    3.00 | 6.500   43.00 |  9.50   13.00
                0.583   15.00 | 3.583    3.00 | 6.583   43.00 |  9.58   13.00
                0.667   15.00 | 3.667    3.00 | 6.667   43.00 |  9.67   13.00
                0.750   15.00 | 3.750    3.00 | 6.750   43.00 |  9.75   13.00
                0.833   15.00 | 3.833    3.00 | 6.833   43.00 |  9.83   13.00
                0.917   15.00 | 3.917    3.00 | 6.917   43.00 |  9.92   13.00
                1.000   15.00 | 4.000    3.00 | 7.000   43.00 | 10.00   13.00
                1.083   20.00 | 4.083    5.00 | 7.083   20.00 | 10.08   13.00
                1.167   20.00 | 4.167    5.00 | 7.167   20.00 | 10.17   13.00
                1.250   20.00 | 4.250    5.00 | 7.250   20.00 | 10.25   13.00
                1.333   20.00 | 4.333    5.00 | 7.333   20.00 | 10.33   13.00
                1.417   20.00 | 4.417    5.00 | 7.417   20.00 | 10.42   13.00
                1.500   20.00 | 4.500    5.00 | 7.500   20.00 | 10.50   13.00
                1.583   20.00 | 4.583    5.00 | 7.583   20.00 | 10.58   13.00
                1.667   20.00 | 4.667    5.00 | 7.667   20.00 | 10.67   13.00
                1.750   20.00 | 4.750    5.00 | 7.750   20.00 | 10.75   13.00
```

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               1.833   20.00 | 4.833    5.00 | 7.833   20.00 | 10.83   13.00
               1.917   20.00 | 4.917    5.00 | 7.917   20.00 | 10.92   13.00
               2.000   20.00 | 5.000    5.00 | 8.000   20.00 | 11.00   13.00
               2.083   10.00 | 5.083   20.00 | 8.083   23.00 | 11.08    8.00
               2.167   10.00 | 5.167   20.00 | 8.167   23.00 | 11.17    8.00
               2.250   10.00 | 5.250   20.00 | 8.250   23.00 | 11.25    8.00
               2.333   10.00 | 5.333   20.00 | 8.333   23.00 | 11.33    8.00
               2.417   10.00 | 5.417   20.00 | 8.417   23.00 | 11.42    8.00
               2.500   10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
               2.583   10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
               2.667   10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
               2.750   10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
               2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
               2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
               3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Unit Hyd Qpeak  (cms)=   0.182

     PEAK FLOW       (cms)=   0.198 (i)
     TIME TO PEAK    (hrs)=   7.167
     RUNOFF VOLUME    (mm)= 123.366
     TOTAL RAINFALL   (mm)= 193.000
     RUNOFF COEFFICIENT   =   0.639

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0202)|   Area    (ha)=   1.53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  37.20
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.69         0.84
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     101.00        25.00
     Mannings n          =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |' TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
               0.083   15.00 | 3.083    3.00 | 6.083   43.00 |  9.08   13.00
               0.167   15.00 | 3.167    3.00 | 6.167   43.00 |  9.17   13.00
               0.250   15.00 | 3.250    3.00 | 6.250   43.00 |  9.25   13.00
               0.333   15.00 | 3.333    3.00 | 6.333   43.00 |  9.33   13.00
               0.417   15.00 | 3.417    3.00 | 6.417   43.00 |  9.42   13.00
```

```
               0.500   15.00 | 3.500    3.00 | 6.500   43.00 |  9.50   13.00
               0.583   15.00 | 3.583    3.00 | 6.583   43.00 |  9.58   13.00
               0.667   15.00 | 3.667    3.00 | 6.667   43.00 |  9.67   13.00
               0.750   15.00 | 3.750    3.00 | 6.750   43.00 |  9.75   13.00
               0.833   15.00 | 3.833    3.00 | 6.833   43.00 |  9.83   13.00
               0.917   15.00 | 3.917    3.00 | 6.917   43.00 |  9.92   13.00
               1.000   15.00 | 4.000    3.00 | 7.000   43.00 | 10.00   13.00
               1.083   20.00 | 4.083    5.00 | 7.083   20.00 | 10.08   13.00
               1.167   20.00 | 4.167    5.00 | 7.167   20.00 | 10.17   13.00
               1.250   20.00 | 4.250    5.00 | 7.250   20.00 | 10.25   13.00
               1.333   20.00 | 4.333    5.00 | 7.333   20.00 | 10.33   13.00
               1.417   20.00 | 4.417    5.00 | 7.417   20.00 | 10.42   13.00
               1.500   20.00 | 4.500    5.00 | 7.500   20.00 | 10.50   13.00
               1.583   20.00 | 4.583    5.00 | 7.583   20.00 | 10.58   13.00
               1.667   20.00 | 4.667    5.00 | 7.667   20.00 | 10.67   13.00
               1.750   20.00 | 4.750    5.00 | 7.750   20.00 | 10.75   13.00
               1.833   20.00 | 4.833    5.00 | 7.833   20.00 | 10.83   13.00
               1.917   20.00 | 4.917    5.00 | 7.917   20.00 | 10.92   13.00
               2.000   20.00 | 5.000    5.00 | 8.000   20.00 | 11.00   13.00
               2.083   10.00 | 5.083   20.00 | 8.083   23.00 | 11.08    8.00
               2.167   10.00 | 5.167   20.00 | 8.167   23.00 | 11.17    8.00
               2.250   10.00 | 5.250   20.00 | 8.250   23.00 | 11.25    8.00
               2.333   10.00 | 5.333   20.00 | 8.333   23.00 | 11.33    8.00
               2.417   10.00 | 5.417   20.00 | 8.417   23.00 | 11.42    8.00
               2.500   10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
               2.583   10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
               2.667   10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
               2.750   10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
               2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
               2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
               3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Max.Eff.Inten.(mm/hr)=      43.00        40.44
              over (min)          5.00        10.00
     Storage Coeff.  (min)=       2.93 (ii)    9.14 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.28         0.12
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.09          0.161 (iii)
     TIME TO PEAK    (hrs)=       6.75         7.00           7.00
     RUNOFF VOLUME    (mm)=     191.00       133.36         154.80
     TOTAL RAINFALL   (mm)=     193.00       193.00         193.00
     RUNOFF COEFFICIENT   =       0.99         0.69           0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  74.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
```

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

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0206)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1131      0.0425
                          0.0047     0.0023   |   0.1541      0.0503
                          0.0072     0.0051   |   0.1858      0.0588
                          0.0090     0.0086   |   0.2126      0.0678
                          0.0105     0.0127   |   0.2363      0.0775
                          0.0118     0.0175   |   0.5866      0.0878
                          0.0130     0.0228   |   1.2999      0.0986
                          0.0141     0.0288   |   2.3435      0.1102
                          0.0151     0.0353   |   3.2269      0.1182

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      1.530      0.161      7.00     154.80
   OUTFLOW: ID= 1 (  0206)      1.530      0.145      7.00     154.72

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 89.93
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0488

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--------------------
| ADD HYD  (  0208)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0204):     2.62    0.198     7.17   123.37
      + ID2= 2 (  0206):     1.53    0.145     7.00   154.72
        ==================================================
        ID = 3 (  0208):     4.15    0.339     7.08   134.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0203)|   Area    (ha)=   2.80   Curve Number   (CN)= 70.9
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.58

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
```

```
                TIME    RAIN |  TIME    RAIN |' TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
               0.083   15.00 | 3.083    3.00 | 6.083   43.00 |  9.08   13.00
               0.167   15.00 | 3.167    3.00 | 6.167   43.00 |  9.17   13.00
               0.250   15.00 | 3.250    3.00 | 6.250   43.00 |  9.25   13.00
               0.333   15.00 | 3.333    3.00 | 6.333   43.00 |  9.33   13.00
               0.417   15.00 | 3.417    3.00 | 6.417   43.00 |  9.42   13.00
               0.500   15.00 | 3.500    3.00 | 6.500   43.00 |  9.50   13.00
               0.583   15.00 | 3.583    3.00 | 6.583   43.00 |  9.58   13.00
               0.667   15.00 | 3.667    3.00 | 6.667   43.00 |  9.67   13.00
               0.750   15.00 | 3.750    3.00 | 6.750   43.00 |  9.75   13.00
               0.833   15.00 | 3.833    3.00 | 6.833   43.00 |  9.83   13.00
               0.917   15.00 | 3.917    3.00 | 6.917   43.00 |  9.92   13.00
               1.000   15.00 | 4.000    3.00 | 7.000   43.00 | 10.00   13.00
               1.083   20.00 | 4.083    5.00 | 7.083   20.00 | 10.08   13.00
               1.167   20.00 | 4.167    5.00 | 7.167   20.00 | 10.17   13.00
               1.250   20.00 | 4.250    5.00 | 7.250   20.00 | 10.25   13.00
               1.333   20.00 | 4.333    5.00 | 7.333   20.00 | 10.33   13.00
               1.417   20.00 | 4.417    5.00 | 7.417   20.00 | 10.42   13.00
               1.500   20.00 | 4.500    5.00 | 7.500   20.00 | 10.50   13.00
               1.583   20.00 | 4.583    5.00 | 7.583   20.00 | 10.58   13.00
               1.667   20.00 | 4.667    5.00 | 7.667   20.00 | 10.67   13.00
               1.750   20.00 | 4.750    5.00 | 7.750   20.00 | 10.75   13.00
               1.833   20.00 | 4.833    5.00 | 7.833   20.00 | 10.83   13.00
               1.917   20.00 | 4.917    5.00 | 7.917   20.00 | 10.92   13.00
               2.000   20.00 | 5.000    5.00 | 8.000   20.00 | 11.00   13.00
               2.083   10.00 | 5.083   20.00 | 8.083   23.00 | 11.08    8.00
               2.167   10.00 | 5.167   20.00 | 8.167   23.00 | 11.17    8.00
               2.250   10.00 | 5.250   20.00 | 8.250   23.00 | 11.25    8.00
               2.333   10.00 | 5.333   20.00 | 8.333   23.00 | 11.33    8.00
               2.417   10.00 | 5.417   20.00 | 8.417   23.00 | 11.42    8.00
               2.500   10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
               2.583   10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
               2.667   10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
               2.750   10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
               2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
               2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
               3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Unit Hyd Qpeak  (cms)=   0.184

     PEAK FLOW       (cms)=   0.200 (i)
     TIME TO PEAK    (hrs)=   7.250
     RUNOFF VOLUME    (mm)= 118.754
     TOTAL RAINFALL   (mm)= 193.000
     RUNOFF COEFFICIENT   =   0.615

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

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```

```
 --------------------
 | CALIB            |
 | STANDHYD (  0201)|   Area    (ha)=  15.57
 |ID= 1 DT= 5.0 min |   Total Imp(%)=  20.10   Dir. Conn.(%)=  17.30
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       3.13        12.44
      Dep. Storage     (mm)=       2.00         5.10
      Average Slope     (%)=       2.00         4.00
      Length            (m)=     322.18        70.00
      Mannings n          =      0.013        0.250

          NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                   TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                    hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.083   15.00 | 3.083    3.00 | 6.083   43.00 |  9.08   13.00
                  0.167   15.00 | 3.167    3.00 | 6.167   43.00 |  9.17   13.00
                  0.250   15.00 | 3.250    3.00 | 6.250   43.00 |  9.25   13.00
                  0.333   15.00 | 3.333    3.00 | 6.333   43.00 |  9.33   13.00
                  0.417   15.00 | 3.417    3.00 | 6.417   43.00 |  9.42   13.00
                  0.500   15.00 | 3.500    3.00 | 6.500   43.00 |  9.50   13.00
                  0.583   15.00 | 3.583    3.00 | 6.583   43.00 |  9.58   13.00
                  0.667   15.00 | 3.667    3.00 | 6.667   43.00 |  9.67   13.00
                  0.750   15.00 | 3.750    3.00 | 6.750   43.00 |  9.75   13.00
                  0.833   15.00 | 3.833    3.00 | 6.833   43.00 |  9.83   13.00
                  0.917   15.00 | 3.917    3.00 | 6.917   43.00 |  9.92   13.00
                  1.000   15.00 | 4.000    3.00 | 7.000   43.00 | 10.00   13.00
                  1.083   20.00 | 4.083    5.00 | 7.083   20.00 | 10.08   13.00
                  1.167   20.00 | 4.167    5.00 | 7.167   20.00 | 10.17   13.00
                  1.250   20.00 | 4.250    5.00 | 7.250   20.00 | 10.25   13.00
                  1.333   20.00 | 4.333    5.00 | 7.333   20.00 | 10.33   13.00
                  1.417   20.00 | 4.417    5.00 | 7.417   20.00 | 10.42   13.00
                  1.500   20.00 | 4.500    5.00 | 7.500   20.00 | 10.50   13.00
                  1.583   20.00 | 4.583    5.00 | 7.583   20.00 | 10.58   13.00
                  1.667   20.00 | 4.667    5.00 | 7.667   20.00 | 10.67   13.00
                  1.750   20.00 | 4.750    5.00 | 7.750   20.00 | 10.75   13.00
                  1.833   20.00 | 4.833    5.00 | 7.833   20.00 | 10.83   13.00
                  1.917   20.00 | 4.917    5.00 | 7.917   20.00 | 10.92   13.00
                  2.000   20.00 | 5.000    5.00 | 8.000   20.00 | 11.00   13.00
                  2.083   10.00 | 5.083   20.00 | 8.083   23.00 | 11.08    8.00
                  2.167   10.00 | 5.167   20.00 | 8.167   23.00 | 11.17    8.00
                  2.250   10.00 | 5.250   20.00 | 8.250   23.00 | 11.25    8.00
                  2.333   10.00 | 5.333   20.00 | 8.333   23.00 | 11.33    8.00
                  2.417   10.00 | 5.417   20.00 | 8.417   23.00 | 11.42    8.00
                  2.500   10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
                  2.583   10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
                  2.667   10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
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                  2.750   10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
                  2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
                  2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
                  3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Max.Eff.Inten.(mm/hr)=      43.00        35.67
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       5.87 (ii)   17.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.19         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.32         1.15          1.468 (iii)
     TIME TO PEAK    (hrs)=       7.00         7.00           7.00
     RUNOFF VOLUME    (mm)=     191.00       129.59         140.21
     TOTAL RAINFALL   (mm)=     193.00       193.00         193.00
     RUNOFF COEFFICIENT   =       0.99         0.67           0.73

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.3    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0205)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.4010      0.1310
                          0.0196     0.0063   |   0.4592      0.1548
                          0.0649     0.0138   |   0.5093      0.1815
                          0.0897     0.0225   |   0.5542      0.2111
                          0.1090     0.0326   |   0.5953      0.2435
                          0.1253     0.0442   |   0.6334      0.2788
                          0.1397     0.0577   |   0.8993      0.3170
                          0.1528     0.0731   |   1.4461      0.3580
                          0.1649     0.0905   |   2.2696      0.4018
                          0.3277     0.1097   |   3.3891      0.4486

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     15.570      1.468      7.00     140.21
   OUTFLOW: ID= 1 (  0205)     15.570      1.244      7.17     140.21

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 84.75
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
```

```
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.3434

 -------------------------------------------------------------------------------

 --------------------
 | ADD HYD  (  0207)|
 |   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
 --------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0203):      2.80    0.200     7.25   118.75
       + ID2= 2 (  0205):     15.57    1.244     7.17   140.21
         ==================================================
         ID = 3 (  0207):     18.37    1.443     7.17   136.94

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

 --------------------
 | ADD HYD  (  0209)|
 |   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
 --------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0207):     18.37    1.443     7.17   136.94
       + ID2= 2 (  0208):      4.15    0.339     7.08   134.93
         ==================================================
         ID = 3 (  0209):     22.52    1.780     7.17   136.57

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

Stormceptor®

Rinker MATERIALS™

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/30/2024

Province:	Ontario
City:	Mansfield
Nearest Rainfall Station:	BARRIE-ORO
Climate Station Id:	6117700
Years of Rainfall Data:	14

Site Name:	POND 'A' NORTH INLET

Drainage Area (ha):	7.74
% Imperviousness:	19.30

Runoff Coefficient 'c': 0.41

Project Name:	ARMSTRONG ESTATES OF MANSFIELD
Project Number:	20-11584B
Designer Name:	Dwight Hordyk
Designer Company:	Pinestone Engineering Limited
Designer Email:	dhordyk@pel.ca
Designer Phone:	705-646-3143
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	104.88
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	100
Estimated Average Annual Sediment Load (kg/yr):	783
Estimated Average Annual Sediment Volume (L/yr):	636

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	48
EFO6	64
EFO8	75
EFO10	82
EFO12	86

Recommended Stormceptor EFO Model:	**EFO10**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**82**
Water Quality Runoff Volume Capture (%):	**> 90**

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

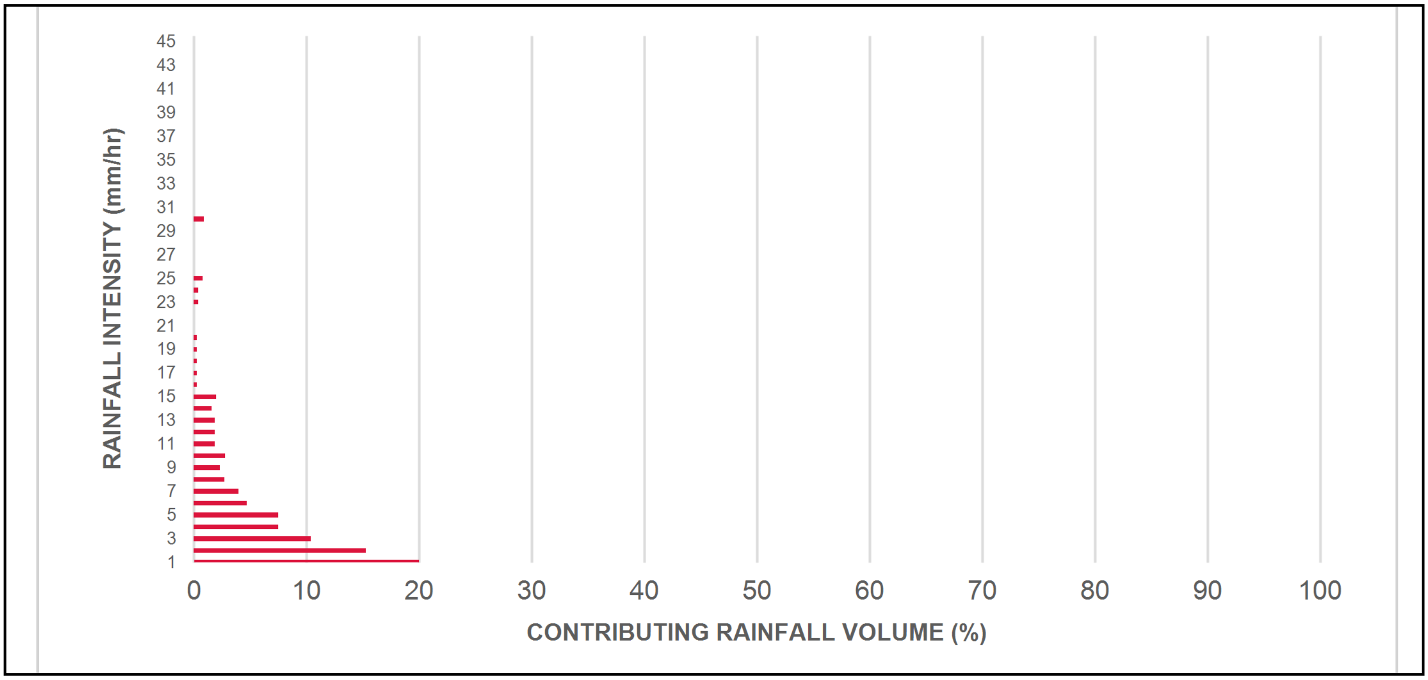
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

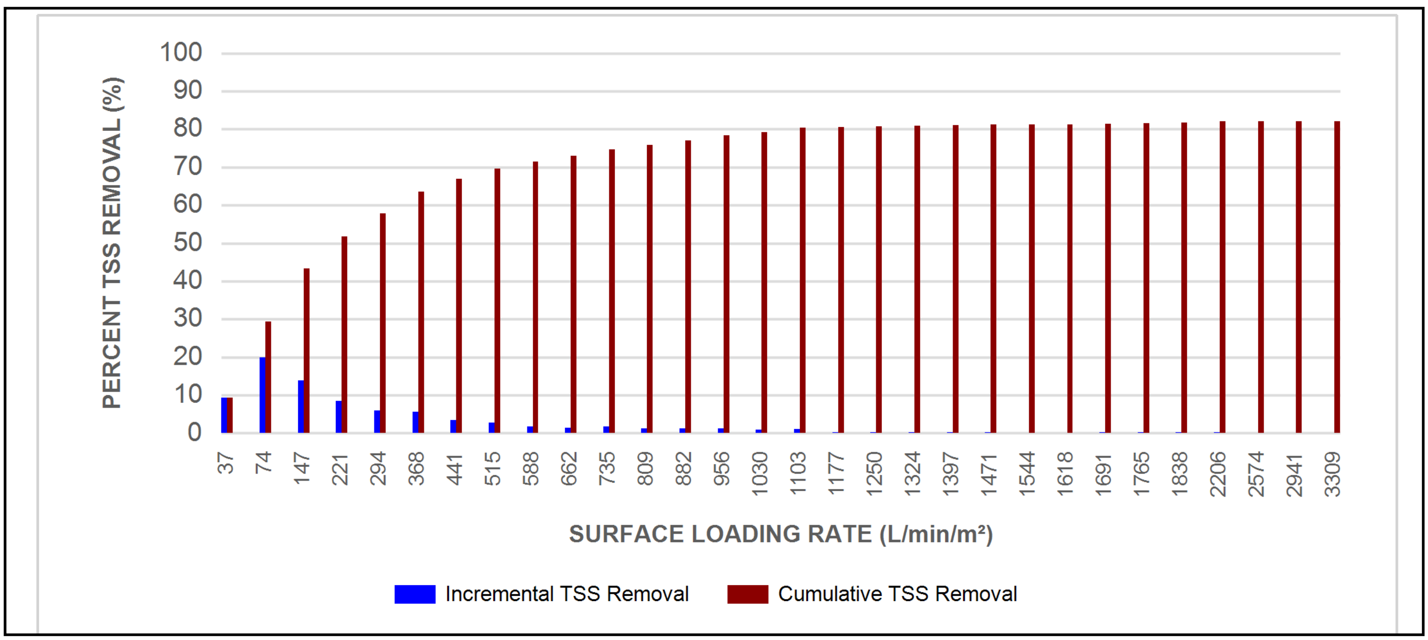
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	9.4	9.4	4.47	268.0	37.0	100	9.4	9.4
1.00	20.0	29.4	8.95	537.0	74.0	100	20.0	29.4
2.00	15.3	44.7	17.89	1074.0	147.0	91	13.9	43.3
3.00	10.4	55.1	26.84	1610.0	221.0	82	8.5	51.8
4.00	7.5	62.6	35.79	2147.0	294.0	79	5.9	57.8
5.00	7.5	70.1	44.73	2684.0	368.0	76	5.7	63.5
6.00	4.7	74.9	53.68	3221.0	441.0	72	3.4	66.9
7.00	4.0	78.8	62.63	3758.0	515.0	69	2.7	69.6
8.00	2.7	81.6	71.57	4294.0	588.0	66	1.8	71.4
9.00	2.3	83.9	80.52	4831.0	662.0	64	1.5	72.9
10.00	2.8	86.6	89.47	5368.0	735.0	64	1.8	74.6
11.00	1.9	88.6	98.42	5905.0	809.0	63	1.2	75.9
12.00	1.9	90.5	107.36	6442.0	882.0	62	1.2	77.1
13.00	1.9	92.4	116.31	6979.0	956.0	62	1.2	78.3
14.00	1.6	94.0	125.26	7515.0	1030.0	61	1.0	79.2
15.00	2.0	96.0	134.20	8052.0	1103.0	59	1.2	80.4
16.00	0.3	96.3	143.15	8589.0	1177.0	58	0.2	80.5
17.00	0.3	96.6	152.10	9126.0	1250.0	56	0.2	80.7
18.00	0.3	96.9	161.04	9663.0	1324.0	54	0.2	80.9
19.00	0.3	97.2	169.99	10199.0	1397.0	53	0.2	81.0
20.00	0.3	97.5	178.94	10736.0	1471.0	50	0.2	81.2
21.00	0.0	97.5	187.88	11273.0	1544.0	48	0.0	81.2
22.00	0.0	97.5	196.83	11810.0	1618.0	45	0.0	81.2
23.00	0.4	97.9	205.78	12347.0	1691.0	43	0.2	81.4
24.00	0.4	98.3	214.72	12883.0	1765.0	42	0.2	81.5
25.00	0.8	99.1	223.67	13420.0	1838.0	40	0.3	81.8
30.00	0.9	100.0	268.41	16104.0	2206.0	33	0.3	82.1
35.00	0.0	100.0	313.14	18788.0	2574.0	28	0.0	82.1
40.00	0.0	100.0	357.87	21472.0	2941.0	25	0.0	82.1
45.00	0.0	100.0	402.61	24156.0	3309.0	22	0.0	82.1
Estimated Net Annual Sediment (TSS) Load Reduction =								**82 %**

Climate Station ID: 6117700 *Years of Rainfall Data*: 14

RAINFALL DATA FROM BARRIE-ORO RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

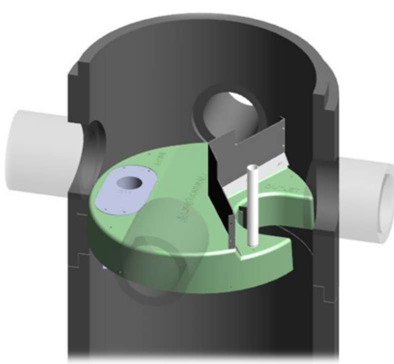
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

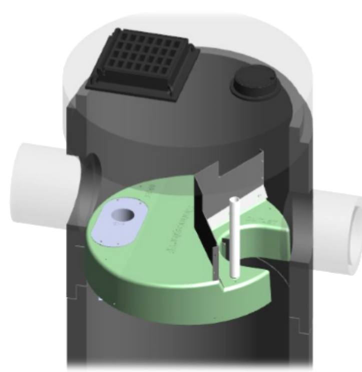
DESIGN FLEXIBILITY

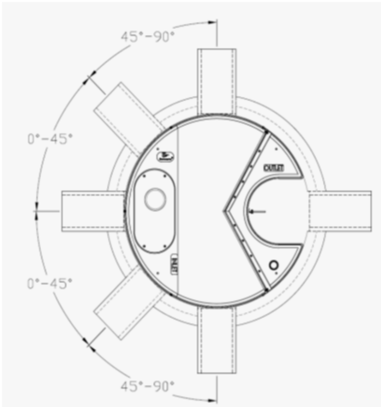
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/30/2024

Province:	Ontario
City:	Mansfield
Nearest Rainfall Station:	BARRIE-ORO
Climate Station Id:	6117700
Years of Rainfall Data:	14

Site Name:	POND 'A' SOUTH INLET

Drainage Area (ha):	5.83
% Imperviousness:	21.60

Runoff Coefficient 'c': 0.42

Project Name:	ARMSTRONG ESTATES OF MANSFIELD
Project Number:	20-11584B
Designer Name:	Dwight Hordyk
Designer Company:	Pinestone Engineering Limited
Designer Email:	dhordyk@pel.ca
Designer Phone:	705-646-3143
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	81.62
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	100
Estimated Average Annual Sediment Load (kg/yr):	644
Estimated Average Annual Sediment Volume (L/yr):	523

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	53
EFO6	70
EFO8	80
EFO10	85
EFO12	89

Recommended Stormceptor EFO Model:	**EFO8**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**80**
Water Quality Runoff Volume Capture (%):	**> 90**

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

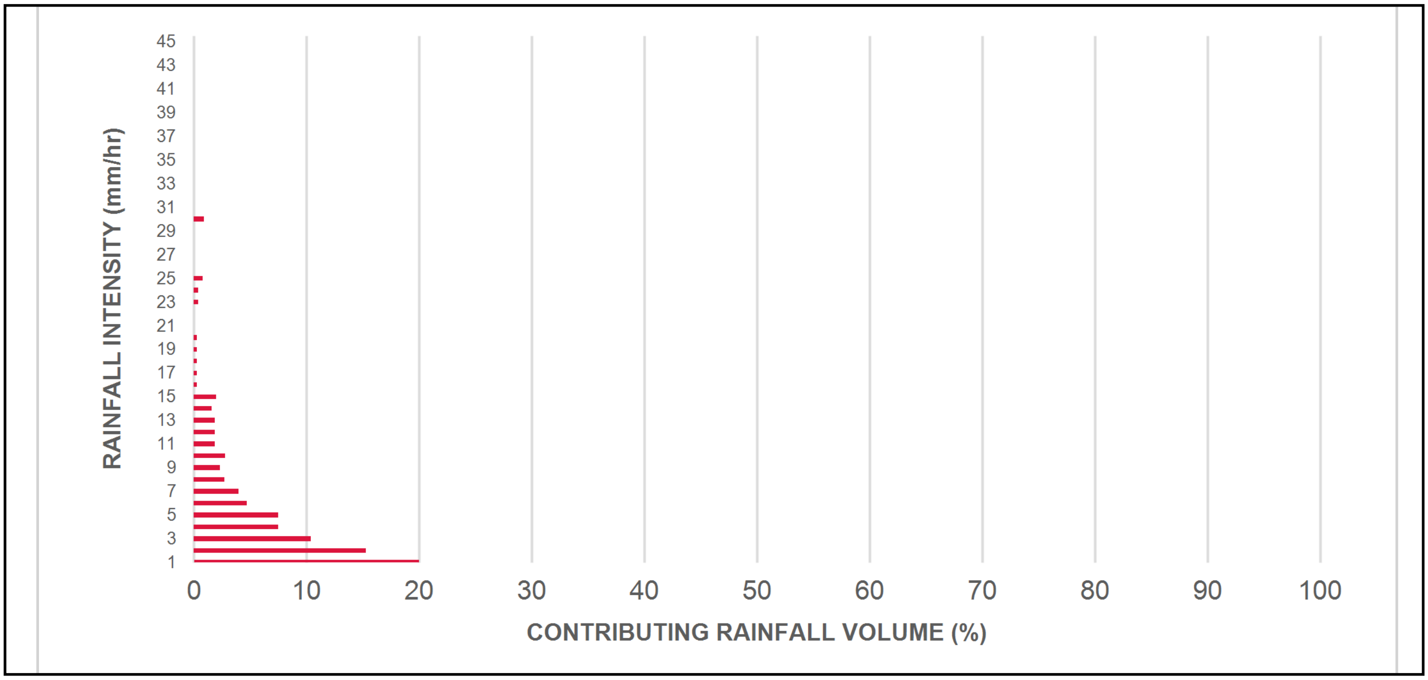
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

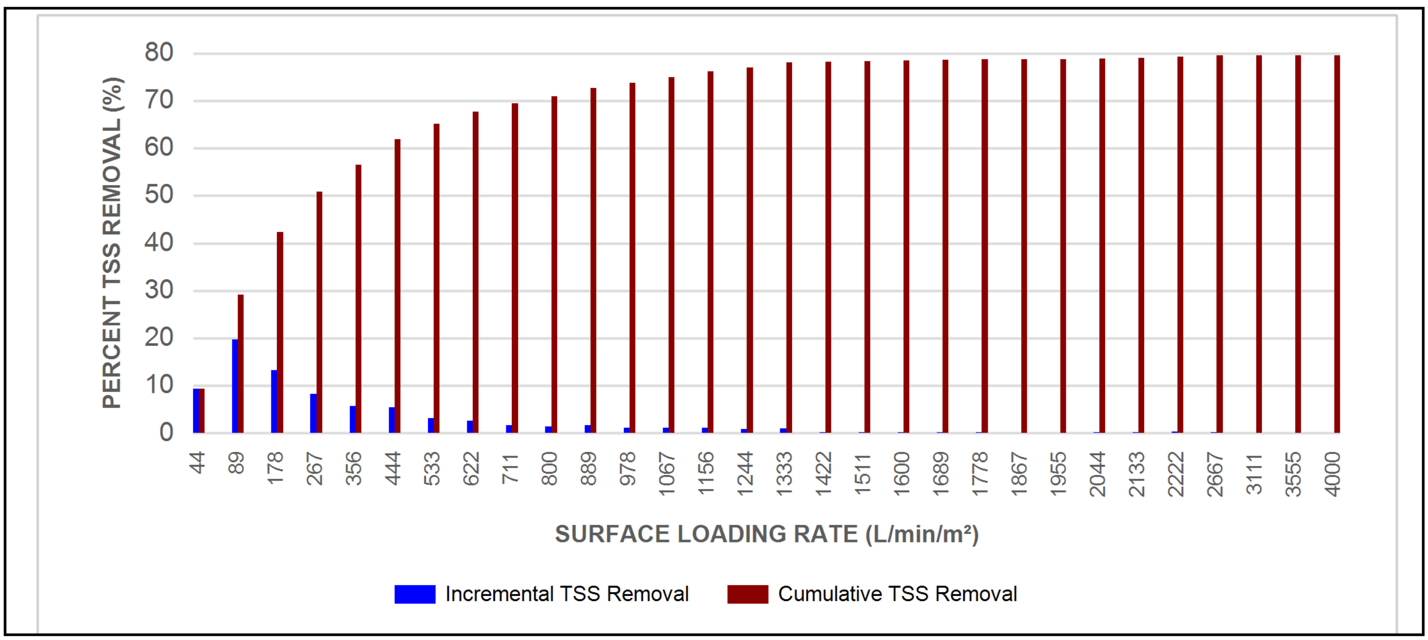
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	9.4	9.4	3.48	209.0	44.0	100	9.4	9.4
1.00	20.0	29.4	6.96	418.0	89.0	98	19.7	29.1
2.00	15.3	44.7	13.93	836.0	178.0	87	13.3	42.4
3.00	10.4	55.1	20.89	1253.0	267.0	80	8.3	50.8
4.00	7.5	62.6	27.85	1671.0	356.0	76	5.7	56.5
5.00	7.5	70.1	34.81	2089.0	444.0	72	5.4	61.9
6.00	4.7	74.9	41.78	2507.0	533.0	68	3.2	65.1
7.00	4.0	78.8	48.74	2924.0	622.0	64	2.6	67.7
8.00	2.7	81.6	55.70	3342.0	711.0	64	1.7	69.4
9.00	2.3	83.9	62.66	3760.0	800.0	63	1.5	70.9
10.00	2.8	86.6	69.63	4178.0	889.0	62	1.7	72.6
11.00	1.9	88.6	76.59	4595.0	978.0	62	1.2	73.8
12.00	1.9	90.5	83.55	5013.0	1067.0	60	1.2	75.0
13.00	1.9	92.4	90.52	5431.0	1156.0	58	1.1	76.1
14.00	1.6	94.0	97.48	5849.0	1244.0	56	0.9	77.0
15.00	2.0	96.0	104.44	6266.0	1333.0	54	1.1	78.0
16.00	0.3	96.3	111.40	6684.0	1422.0	52	0.1	78.2
17.00	0.3	96.6	118.37	7102.0	1511.0	48	0.1	78.3
18.00	0.3	96.9	125.33	7520.0	1600.0	46	0.1	78.4
19.00	0.3	97.2	132.29	7937.0	1689.0	44	0.1	78.6
20.00	0.3	97.5	139.25	8355.0	1778.0	41	0.1	78.7
21.00	0.0	97.5	146.22	8773.0	1867.0	39	0.0	78.7
22.00	0.0	97.5	153.18	9191.0	1955.0	38	0.0	78.7
23.00	0.4	97.9	160.14	9609.0	2044.0	36	0.1	78.8
24.00	0.4	98.3	167.10	10026.0	2133.0	34	0.1	79.0
25.00	0.8	99.1	174.07	10444.0	2222.0	33	0.3	79.2
30.00	0.9	100.0	208.88	12533.0	2667.0	28	0.3	79.5
35.00	0.0	100.0	243.69	14622.0	3111.0	24	0.0	79.5
40.00	0.0	100.0	278.51	16710.0	3555.0	21	0.0	79.5
45.00	0.0	100.0	313.32	18799.0	4000.0	18	0.0	79.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**80 %**

Climate Station ID: 6117700 *Years of Rainfall Data*: 14

RAINFALL DATA FROM BARRIE-ORO RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

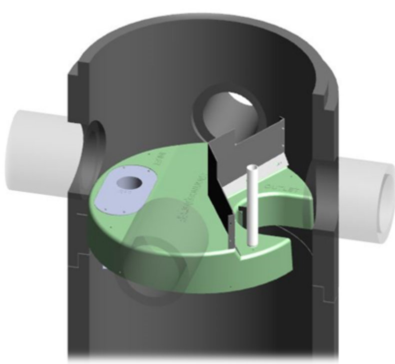
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

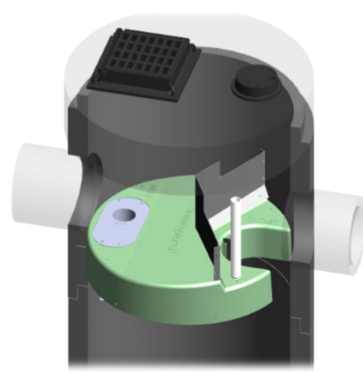
DESIGN FLEXIBILITY

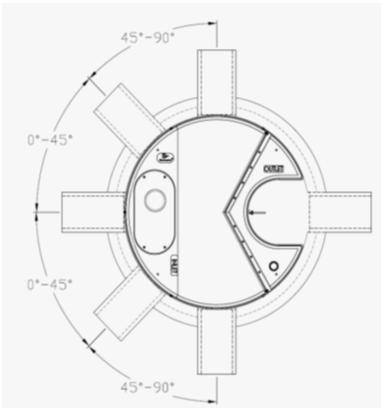
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR
“OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program’s **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Stormceptor® EF Sizing Report

Imbrium® Systems

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/30/2024

Province:	Ontario
City:	Mansfield
Nearest Rainfall Station:	BARRIE-ORO
Climate Station Id:	6117700
Years of Rainfall Data:	14

Site Name:	POND 'B' INLET

Drainage Area (ha):	1.41
% Imperviousness:	45.00

Runoff Coefficient 'c': 0.57

Project Name:	ARMSTRONG ESTATES OF MANSFIELD
Project Number:	20-11584B
Designer Name:	Dwight Hordyk
Designer Company:	Pinestone Engineering Limited
Designer Email:	dhordyk@pel.ca
Designer Phone:	705-646-3143
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	26.19
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	100
Estimated Average Annual Sediment Load (kg/yr):	349
Estimated Average Annual Sediment Volume (L/yr):	283

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	76
EFO6	86
EFO8	92
EFO10	96
EFO12	98

Recommended Stormceptor EFO Model:	**EFO6**
Estimated Net Annual Sediment (TSS) Load Reduction (%):	**86**
Water Quality Runoff Volume Capture (%):	**> 90**

THIRD-PARTY TESTING AND VERIFICATION

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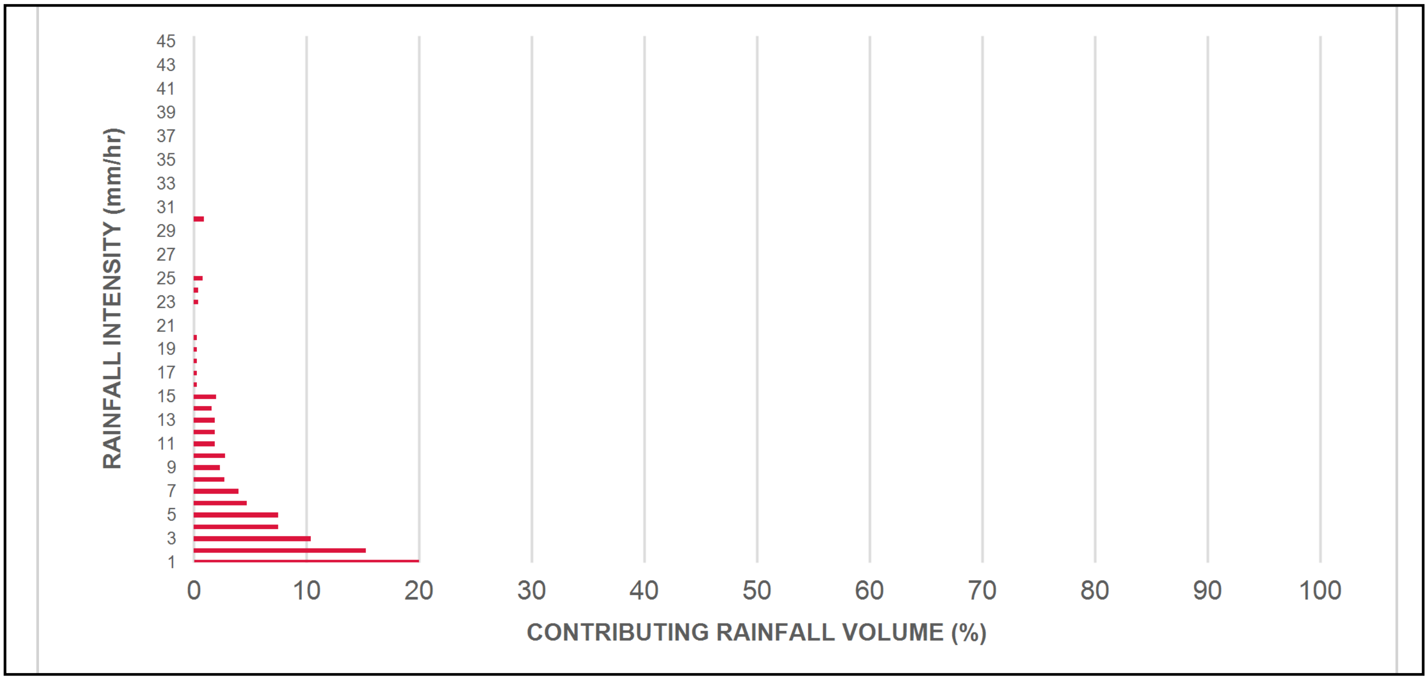
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

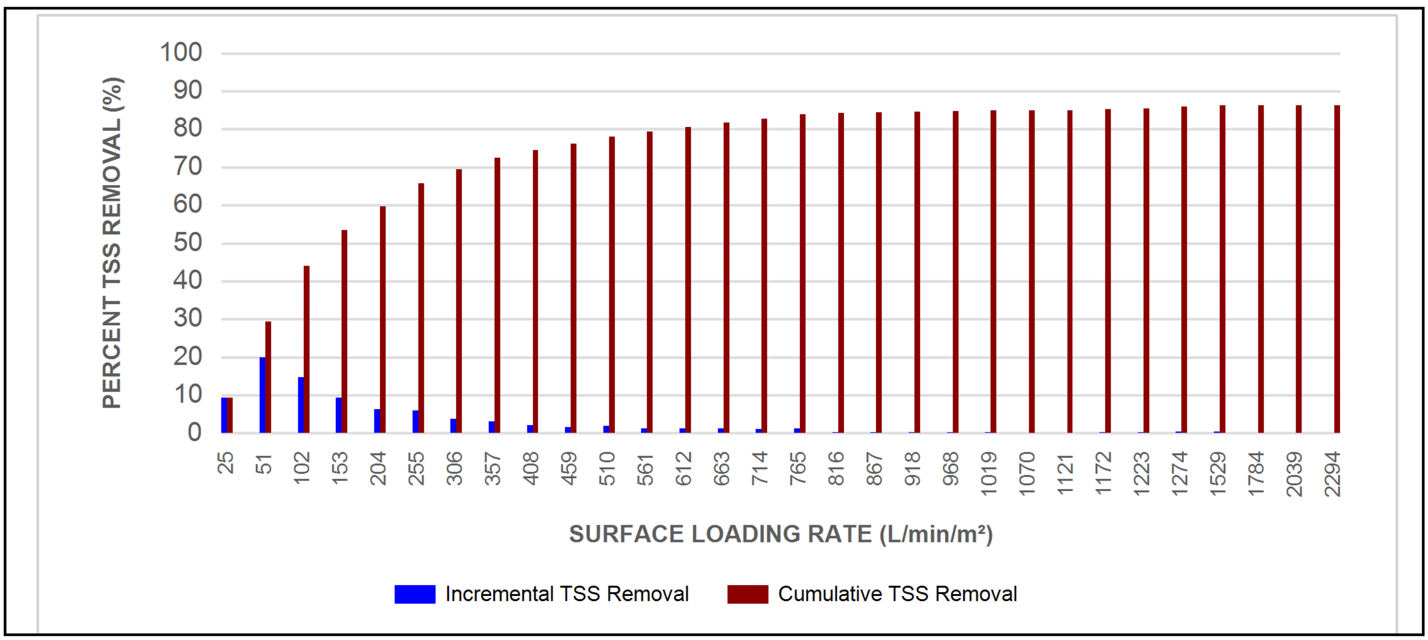
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	9.4	9.4	1.12	67.0	25.0	100	9.4	9.4
1.00	20.0	29.4	2.23	134.0	51.0	100	20.0	29.4
2.00	15.3	44.7	4.47	268.0	102.0	96	14.7	44.1
3.00	10.4	55.1	6.70	402.0	153.0	89	9.3	53.4
4.00	7.5	62.6	8.94	536.0	204.0	83	6.3	59.6
5.00	7.5	70.1	11.17	670.0	255.0	81	6.1	65.7
6.00	4.7	74.9	13.41	804.0	306.0	78	3.7	69.4
7.00	4.0	78.8	15.64	938.0	357.0	76	3.0	72.4
8.00	2.7	81.6	17.87	1072.0	408.0	74	2.0	74.5
9.00	2.3	83.9	20.11	1207.0	459.0	72	1.7	76.1
10.00	2.8	86.6	22.34	1341.0	510.0	69	1.9	78.0
11.00	1.9	88.6	24.58	1475.0	561.0	66	1.3	79.3
12.00	1.9	90.5	26.81	1609.0	612.0	65	1.3	80.6
13.00	1.9	92.4	29.05	1743.0	663.0	64	1.2	81.8
14.00	1.6	94.0	31.28	1877.0	714.0	64	1.0	82.8
15.00	2.0	96.0	33.51	2011.0	765.0	63	1.2	84.0
16.00	0.3	96.3	35.75	2145.0	816.0	63	0.2	84.2
17.00	0.3	96.6	37.98	2279.0	867.0	63	0.2	84.4
18.00	0.3	96.9	40.22	2413.0	918.0	62	0.2	84.6
19.00	0.3	97.2	42.45	2547.0	968.0	62	0.2	84.8
20.00	0.3	97.5	44.69	2681.0	1019.0	61	0.2	85.0
21.00	0.0	97.5	46.92	2815.0	1070.0	60	0.0	85.0
22.00	0.0	97.5	49.15	2949.0	1121.0	59	0.0	85.0
23.00	0.4	97.9	51.39	3083.0	1172.0	58	0.2	85.2
24.00	0.4	98.3	53.62	3217.0	1223.0	56	0.2	85.4
25.00	0.8	99.1	55.86	3351.0	1274.0	55	0.5	85.9
30.00	0.9	100.0	67.03	4022.0	1529.0	48	0.4	86.3
35.00	0.0	100.0	78.20	4692.0	1784.0	41	0.0	86.3
40.00	0.0	100.0	89.37	5362.0	2039.0	36	0.0	86.3
45.00	0.0	100.0	100.54	6033.0	2294.0	32	0.0	86.3
							Estimated Net Annual Sediment (TSS) Load Reduction =	**86 %**

Climate Station ID: 6117700 *Years of Rainfall Data*: 14

RAINFALL DATA FROM BARRIE-ORO RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

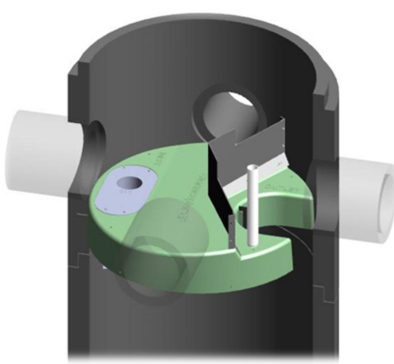
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

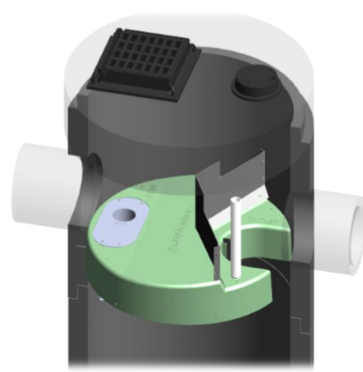
DESIGN FLEXIBILITY

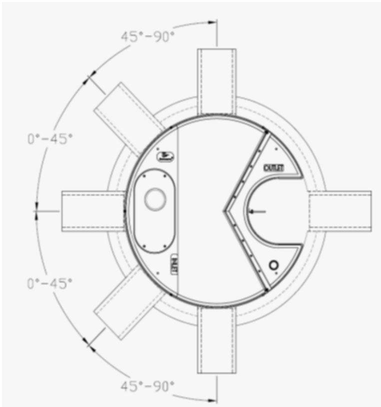
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

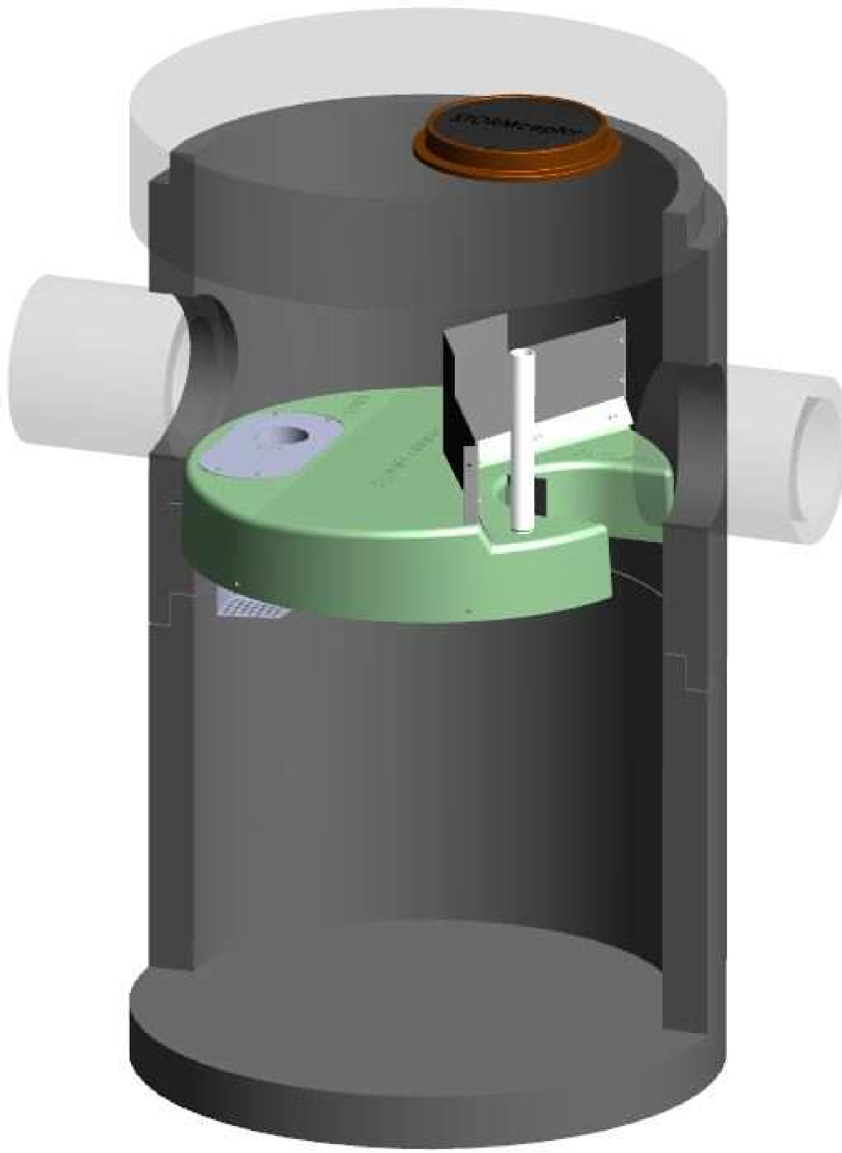
The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Stormceptor® EF

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,180,305
Canadian Patent No. 2,327,768
Canadian Patent No. 2,694,159
Canadian Patent No. 2,697,287
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 729,096
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Japanese Patent No. 5,997,750
Japanese Patent No. 5,555,160
Korean Patent No. 0519212
Korean Patent No. 1451593
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Patent pending

Table of Contents:

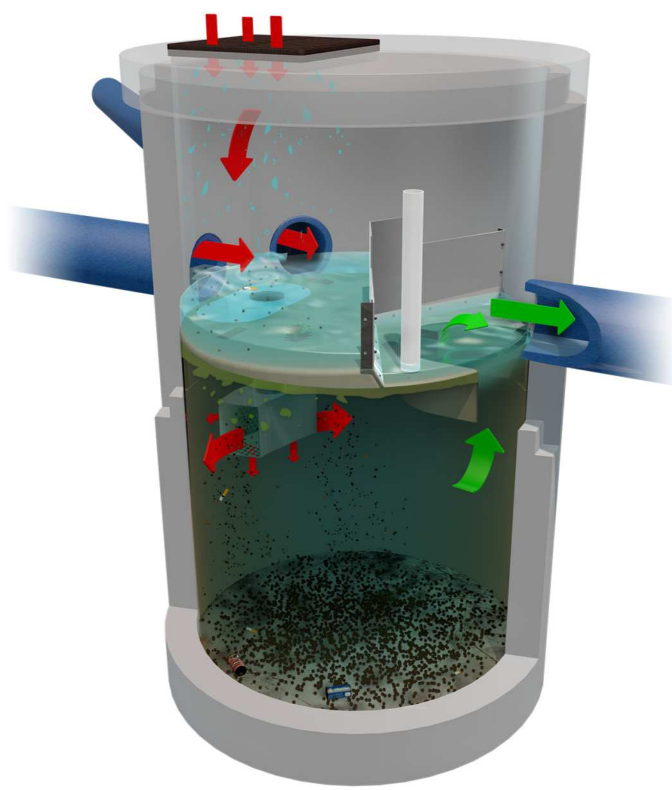
OVERVIEW

Stormceptor® EF is a continuation and evolution of the most globally recognized oil grit separator (OGS) stormwater treatment technology - ***Stormceptor®***. Also known as a hydrodynamic separator, the enhanced flow Stormceptor EF is a high performing oil grit separator that effectively removes a wide variety of pollutants from stormwater and snowmelt runoff at flow rates higher than the original Stormceptor. Stormceptor EF captures and retains sediment (TSS), free oils, gross pollutants and other pollutants that attach to particles, such as nutrients and metals. Stormceptor EF's patent-pending treatment and scour prevention platform ensures sediment is retained during all rainfall events.

Stormceptor EF offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe, multiple inlet pipes, and/or from the surface through an inlet grate. Stormceptor EF can also serve as a junction structure, accommodate a 90-degree inlet to outlet bend angle, and be modified to ensure performance in submerged conditions. With its scour prevention and internal bypass, Stormceptor EF can be installed online, eliminating the need for costly additional bypass structures.

OPERATION

- Stormwater enters the Stormceptor upper chamber through the inlet pipe(s) or a surface inlet grate. A specially designed insert reduces the influent velocity by creating a pond upstream of the insert's weir. Sediment particles immediately begin to settle. Swirling flow sweeps water, sediment, and floatables across the sloped surface of the insert to the inlet opening of the drop pipe, where a strong vortex draws water, sediment, oil, and debris down the drop pipe cone.
- Influent exits the cone into the drop pipe duct. The duct has two large rectangular outlet openings as well as perforations in the backside and floor of the duct. Influent is diffused through these various opening in multiple directions and at low velocity into the lower chamber.
- Free oils and other floatables rise up within the channel surrounding the central riser pipe and are trapped beneath the insert, while sediment settles to the sump. Pollutants are retained for later removal during maintenance cleaning.
- Treated effluent enters the outlet riser, moves upward, and discharges to the top side of the insert downstream of the weir, where it flows out the outlet pipe.
- During intense storm events with very high influent flow rates, the pond height on the upstream side of the weir may exceed the height of the weir, and the excess flow passes over the top of the weir to the downstream side of the insert, and exits through the outlet pipe. This internal bypass feature allows for in-line installation, avoiding the cost of additional bypass structures. During bypass, the pond separates sediment from all incoming flows, while full treatment in the lower chamber continues at the maximum flow rate.
- Stormceptor EF's patent-pending enhanced flow and scour prevention technology ensures pollutants are captured and retained, allowing excess flows to bypass during infrequent, high intensity storms.



COMPONENTS

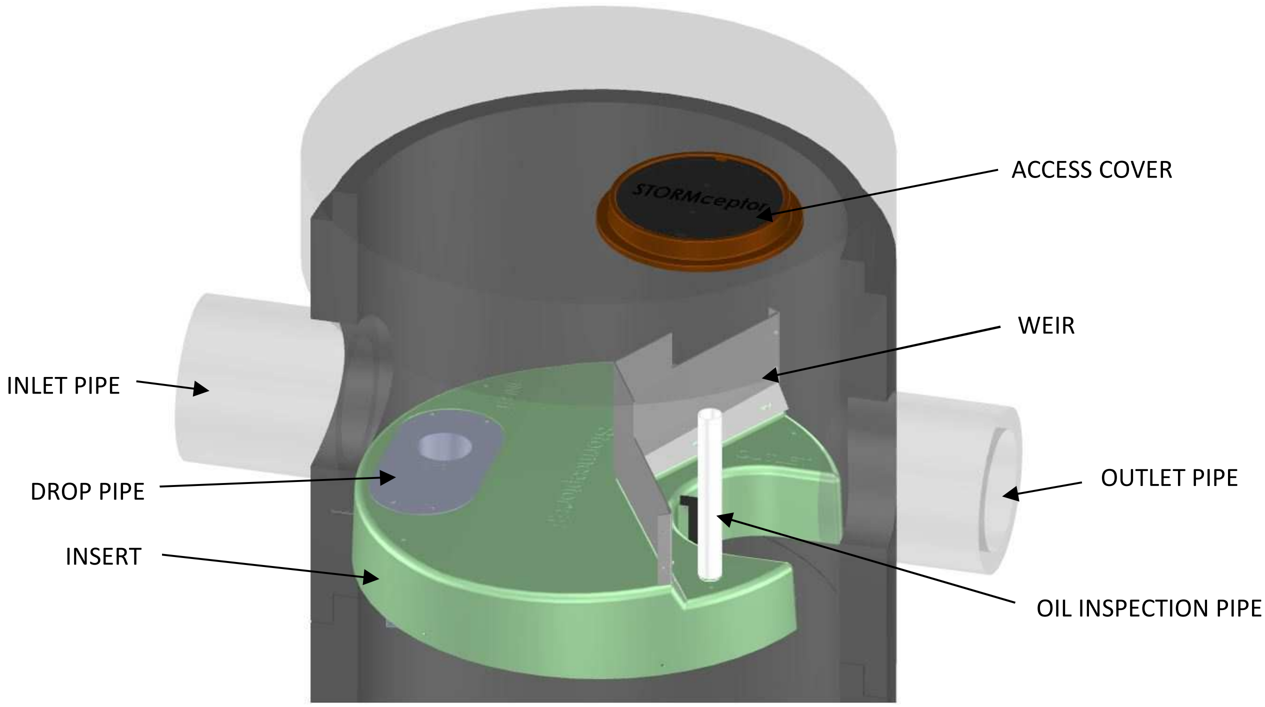


Figure 1

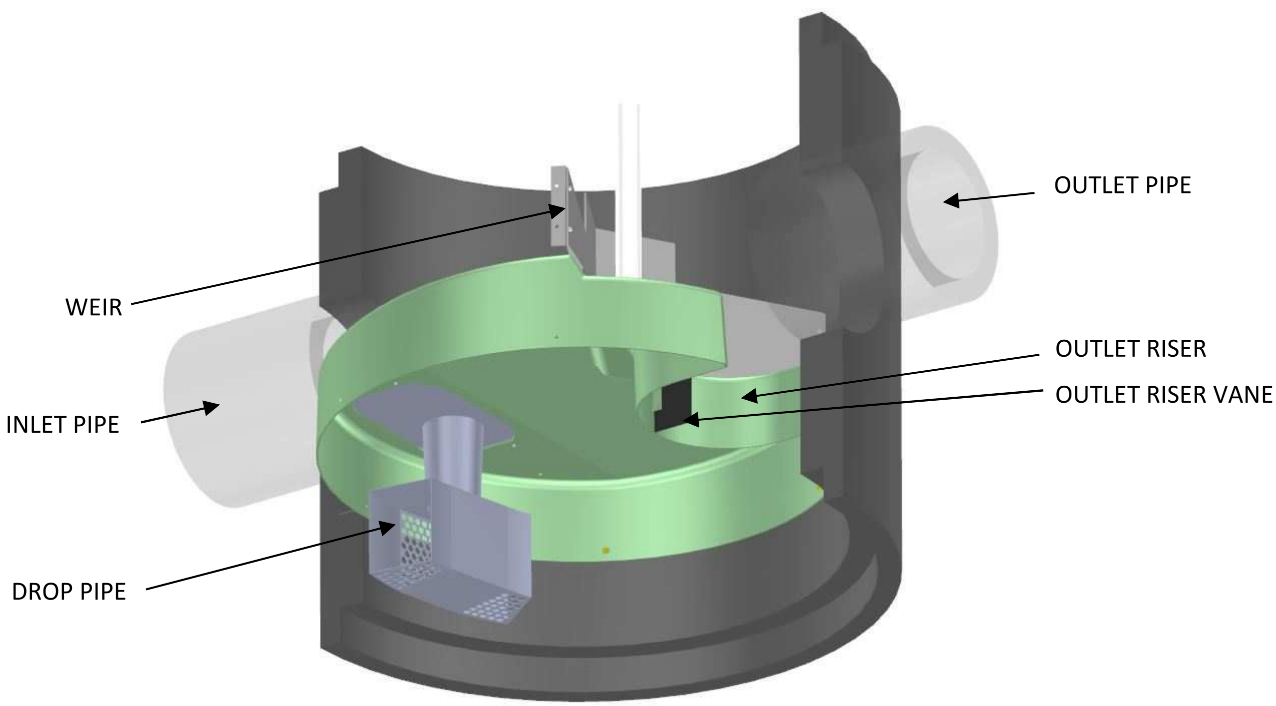


Figure 2

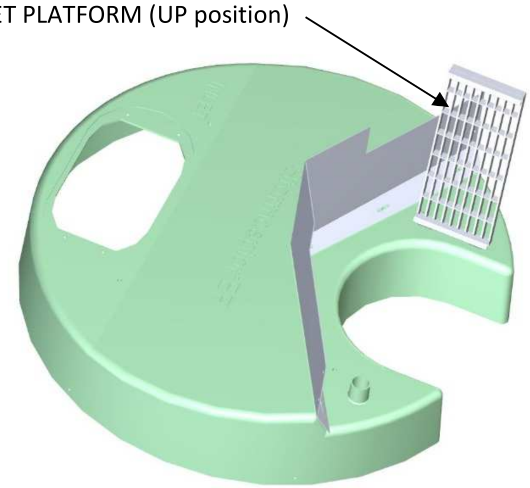


Figure 3A

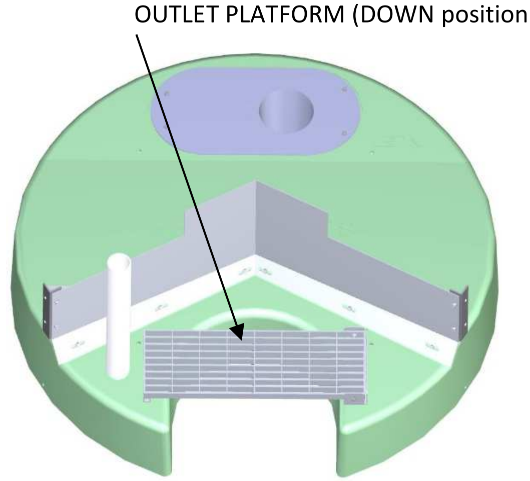


Figure 3B

- **Insert** – separates vessel into upper and lower chambers, and provides double-wall containment of hydrocarbons
- **Weir** – creates stormwater ponding and driving head on top side of insert
- **Drop pipe** – conveys stormwater and pollutants into the lower chamber
- **Outlet riser** – conveys treated stormwater from the lower chamber to the outlet pipe, and provides primary inspection and maintenance access into the lower chamber
- **Outlet riser vane** – prevents formation of a vortex in the outlet riser during high flow rate conditions
- **Outlet platform (optional)** – safety platform in the event of manned entry into the unit
- **Oil inspection pipe** – primary access for measuring oil depth

PRODUCT DETAILS

METRIC DIMENSIONS AND CAPACITIES

Table 1

Stormceptor Model	Inside Diameter (m)	Minimum Surface to Outlet Invert Depth (mm)	Depth Below Outlet Pipe Invert (mm)	Wet Volume (L)	Sediment Capacity [1] (m^3)	Hydrocarbon Storage Capacity [2] (L)	Maximum Flow Rate into Lower Chamber [3] (L/s)	Peak Conveyance Flow Rate [4] (L/s)
EF4 / EFO4	1.22	915	1524	1780	1.19	265	22.1 / 10.4	425
EF6 / EFO6	1.83	915	1930	5070	3.47	610	49.6 / 23.4	990
EF8 / EFO8	2.44	1219	2591	12090	8.78	1070	88.3 / 41.6	1700
EF10 / EFO10	3.05	1219	3251	23700	17.79	1670	138 / 65	2830
EF12 / EFO12	3.66	1524	3886	40800	31.22	2475	198.7 / 93.7	2830

[1] Sediment Capacity is measured from the floor to the bottom of the drop pipe cone. Sediment Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.
[2] Hydrocarbon Storage Capacity is measured from the bottom of the outlet riser to the underside of the insert. Hydrocarbon Storage Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.
[3] EF Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 1135 L/min/m^2.
EFO Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 535 L/min/m^2.
[4] Peak Conveyance Flow Rate is limited by a maximum velocity of 1.5 m/s.

U.S. DIMENSIONS AND CAPACITIES

Table 2

Stormceptor Model	Inside Diameter (ft)	Minimum Surface to Outlet Invert Depth (in)	Depth Below Outlet Pipe Invert (in)	Wet Volume (gal)	Sediment Capacity [1] (ft^3)	Hydrocarbon Storage Capacity [2] (gal)	Maximum Flow Rate into Lower Chamber [3] (cfs)	Peak Conveyance Flow Rate [4] (cfs)
EF4 / EFO4	4	36	60	471	42	70	0.78 / 0.37	15
EF6 / EFO6	6	36	76	1339	123	160	1.75 / 0.83	35
EF8 / EFO8	8	48	102	3194	310	280	3.12 / 1.47	60
EF10 / EFO10	10	48	128	6261	628	440	4.87 / 2.30	100
EF12 / EFO12	12	60	153	10779	1103	655	7.02 / 3.31	100

[1] Sediment Capacity is measured from the floor to the bottom of the drop pipe cone. Sediment Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.
[2] Hydrocarbon Storage Capacity is measured from the bottom of the outlet riser to the underside of the insert. Hydrocarbon Storage Capacity can be increased to accommodate specific site designs and pollutant loads. Contact your local representative for assistance.
[3] EF Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 27.9 gpm/ft^2.
EFO Maximum Flow Rate into Lower Chamber is based on a maximum surface loading rate (SLR) into the lower chamber of 13.1 gpm/ft^2.
[4] Peak Conveyance Flow Rate is limited by a maximum velocity of 5 fps.

IDENTIFICATION

Each Stormceptor EF/EFO unit is easily identifiable by the trade name ***Stormceptor***® embossed on the access cover at grade as shown in **Figure 3**. The tradename ***Stormceptor***® is also embossed on the top of the insert upstream of the weir as shown in **Figure 3**.

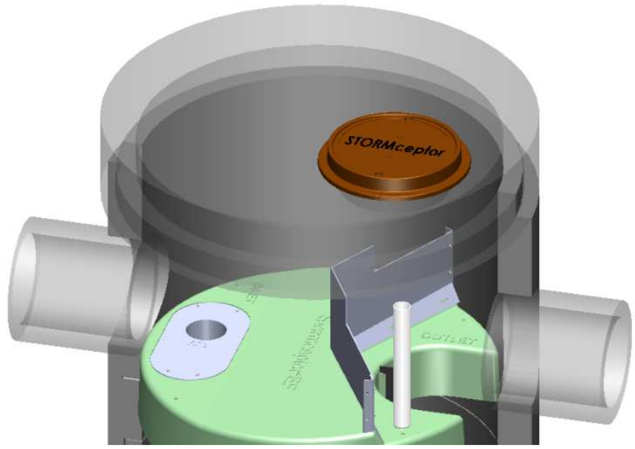


Figure 4

The specific Stormceptor EF/EFO model number is identified on the top of the aluminum Drop Pipe as shown in **Figure 4**. The unit serial number is identified on the top of the insert upstream of the weir as shown in **Figure 4**.

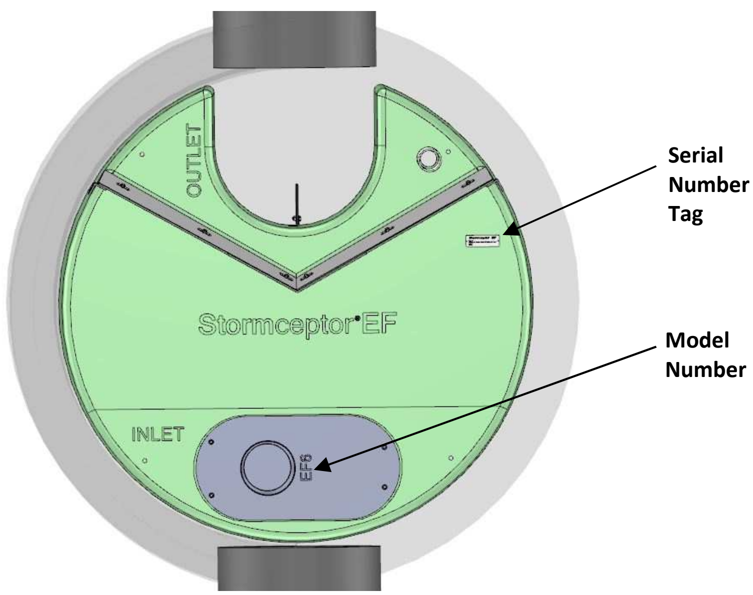


Figure 5

INSPECTION AND MAINTENANCE

It is very important to perform regular inspection and maintenance. Regular inspection and maintenance ensures maximum operation efficiency, keeps maintenance costs low, and provides continued of natural waterways.

Quick Reference

- Typical inspection and maintenance is performed from grade
- Remove manhole **cover(s)** or **inlet grate** to access insert and lower chamber
  NOTE: EF4/EFO4 requires the removal of a **flow deflector** beneath inlet grate
- Use Sludge Judge® or similar sediment probe to check sediment depth through the **outlet riser**
- Oil dipstick can be inserted through the **oil inspection pipe**
- Visually inspect the **insert** for debris, remove debris if present
- Visually inspect the **drop pipe** opening for blockage, remove blockage if present
- Visually inspect **insert** and **weir** for damage, schedule repair if needed
- Insert vacuum hose and jetting wand through the outlet riser and extract sediment and floatables
- Replace flow deflector (EF4/EFO4), inlet grate, and cover(s)
- **NOTE:** If the unit has an **outlet platform**, the outlet platform is typically in the UP position (see Figure 3A) for normal treatment conditions, and for inspection and maintenance. If manned entry into the unit is required, the outlet platform must first be placed in the DOWN position (see Figure 3B). After manned entry is completed, return the outlet platform to the UP position for treatment.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess pollutant accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

What equipment is typically required for inspection?

- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

When is maintenance cleaning needed?

- If the post-construction inspection indicates presence of construction sediment of a depth greater than a few inches, maintenance is recommended at that time.
- For optimum performance and normal operation the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, see **Table 3**.
- Maintain immediately after an oil, fuel, or other chemical spill.

Table 3

Recommended Sediment Depths for Maintenance Service*	
MODEL	Sediment Depth (in/mm)
EF4 / EFO4	8 / 203
EF6 / EFO6	12 /305
EF8 / EFO8	24 / 610
EF10 / EFO10	24 / 610
EF12 / EFO12	24 / 610

* Based on a minimum distance of 40 inches (1,016 mm) from bottom of outlet riser to top of sediment bed

The frequency of inspection and maintenance may need to be adjusted based on site conditions to ensure the unit is operating and performing as intended. Maintenance costs will vary based on the size of the unit, site conditions, local requirements, disposal costs, and transportation distance.

What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required (adhere to all OSHA / CCOSH standards)

What conditions can compromise Stormceptor performance?

- Presence of construction sediment and debris in the unit prior to activation
- Excessive sediment depth beyond the recommended maintenance depth
- Oil spill in excess of the oil storage capacity
- Clogging or restriction of the drop pipe inlet opening with debris
- Downstream blockage that results in a backwater condition

Maintenance Procedures

- Maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is maintained from grade through a standard surface manhole access cover or inlet grate.
- In the case of submerged or tailwater conditions, extra measures are likely required, such as plugging the inlet and outlet pipes prior to conducting maintenance.
- Inspection and maintenance of upstream catch basins and other stormwater conveyance structures is also recommended to extend the time between future maintenance cycles.

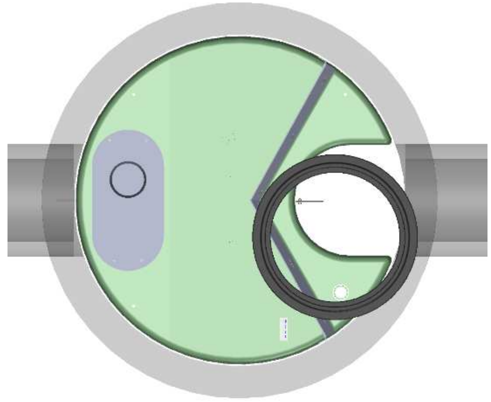


Figure 6

- Sediment depth inspections are performed through the **Outlet Riser** and oil presence can be determined through the **Oil Inspection Pipe**.
- Oil presence and sediment depth are determined by inserting a Sludge Judge® or measuring stick to quantify the pollutant depths.

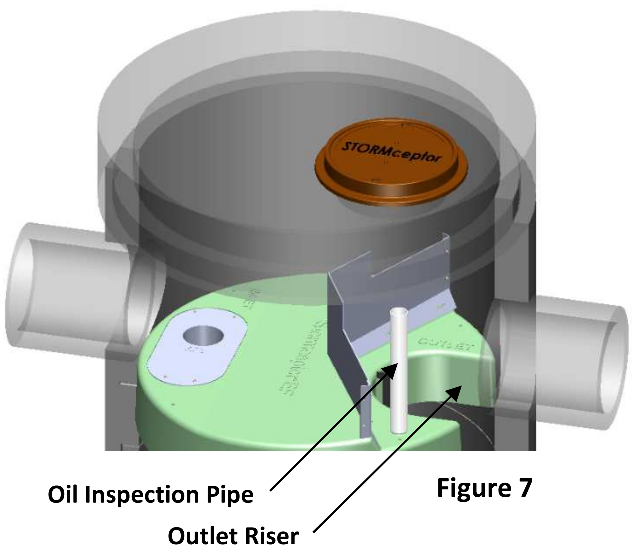


Figure 7

Figure 8

- Visually inspect the insert, weir, and drop pipe inlet opening to ensure there is no damage or blockage.
- **NOTE:** If the unit has an **outlet platform**, the outlet platform is typically in the UP position (see Figure 3A) for normal treatment conditions, and for inspection and maintenance. If manned entry into the unit is required, the outlet platform must first be placed in the DOWN position (see Figure 3B). After manned entry is completed, return the outlet platform to the UP position for treatment.

- When maintenance is required, a standard vacuum truck is used to remove the pollutants from the lower chamber of the unit through the **Outlet Riser**.

Figure 9

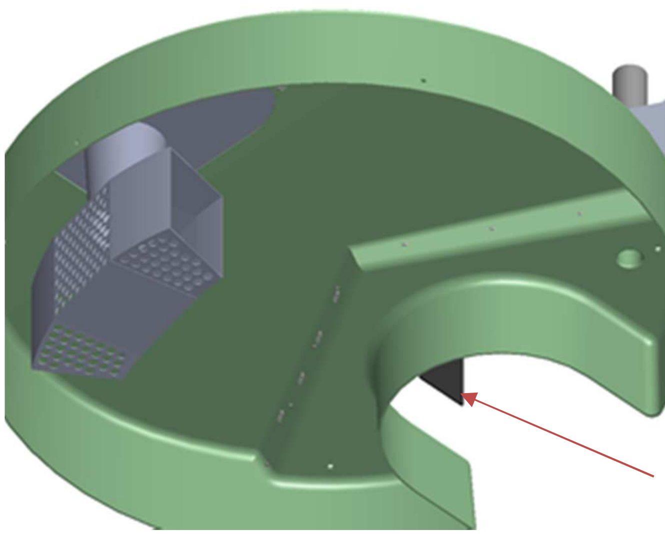


Figure 10

NOTE: The Outlet Riser Vane is durable and flexible and designed to allow maintenance activities with minimal, if any, interference.

Removable Flow Deflector

- Top grated inlets for the Stormceptor EF4/EFO4 model requires a removable flow deflector staged underneath a 24-inch x 24-inch (600 mm x 600 mm) square inlet grate to direct flow towards the inlet side of the insert, and avoid flow and pollutants from entering the outlet side of the insert from grade. The EF6/EFO6 and larger models do not require the flow deflector.

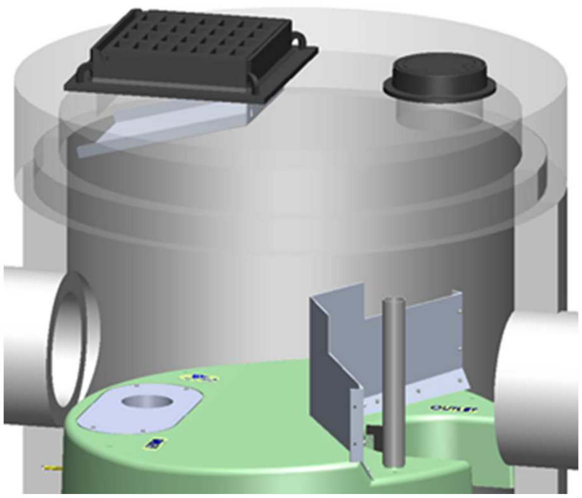
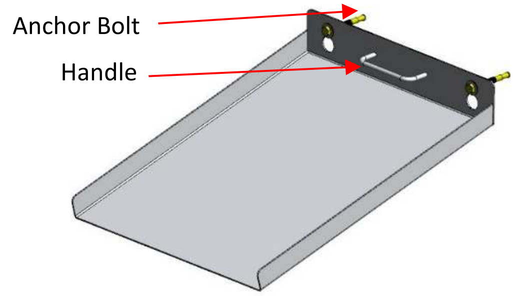


Figure 11

How to Remove:

1. Loosen anchor bolts
2. Pull up and out using the handle



Removable Flow Deflector

Hydrocarbon Spills

Stormceptor is often installed on high pollutant load hotspot sites with vehicular traffic where hydrocarbon spill potential exists. Should a spill occur, or presence of oil be identified within a Stormceptor EF/EFO, it should be cleaned immediately by a licensed liquid waste hauler.

Disposal

Maintenance providers are to follow all federal, state/ provincial, and local requirements for disposal of material.

Oil Sheens

When oil is present in stormwater runoff, a sheen may be noticeable at the Stormceptor outlet. An oil rainbow or sheen can be noticeable at very low oil concentrations (< 10 mg/L). Despite the appearance of a sheen, Stormceptor EF/EFO may still be functioning as intended.

Oil Level Alarm

To mitigate spill liability with 24/7 detection, an electronic monitoring system can be employed to trigger a visual and audible alarm when a pre-set level of oil is captured within the lower chamber or when an oil spill occurs. The oil level alarm is available as an optional feature to include with Stormceptor EF/EFO as shown in **Figure 11**. For additional details about the Oil Level Alarm please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-systems.

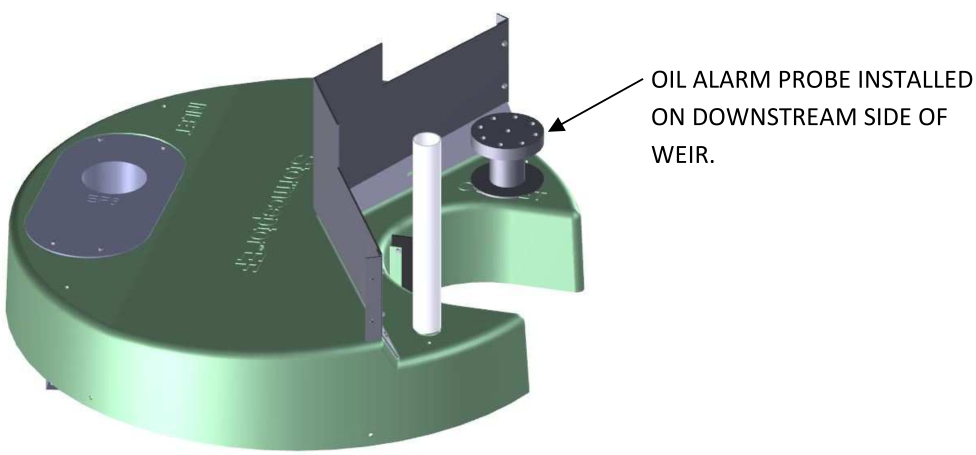


Figure 12

Replacement Parts

Stormceptor has no moving parts to wear out. Therefore inspection and maintenance activities are generally focused on pollutant removal. Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. However, if replacement parts are necessary, they may be purchased by contacting your local Stormceptor representative.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: ________________________

Serial Number: ________________________

Installation Date: ________________________

Location Description of Unit: ________________________

Recommended Sediment Maintenance Depth: ________________________

DATE	SEDIMENT DEPTH (inch or mm)	OIL DEPTH (inch or mm)	SERVICE REQUIRED (Yes / No)	MAINTENANCE PERFORMED	MAINTENANCE PROVIDER	COMMENTS

Other Comments:

Contact Information

Questions regarding Stormceptor EF/EFO can be addressed by contacting your local Stormceptor representative or by visiting our website at **www.stormceptor.com**.

Imbrium Systems Inc. & Imbrium Systems LLC

Canada	1-416-960-9900 / 1-800-565-4801
United States	1-301-279-8827 / 1-888-279-8826
International	+1-416-960-9900 / +1-301-279-8827

www.imbriumsystems.com
www.stormceptor.com
info@imbriumsystems.com

Average Annual Sediment Removal Rates (%) using a CB Shield
(based on MOECC Sediment - 20 to 2000 micron Particle Size Distribution)

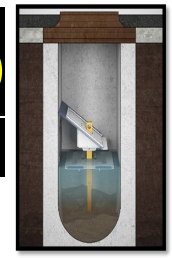
Area to CB (ha)	Imperviousness[1] (%)					
	20%	35%	50%	65%	80%	100%
0.02	73%	73%	73%	73%	73%	73%
0.05	73%	73%	73%	72%	72%	72%
0.10	72%	72%	72%	71%	70%	69%
0.20	71%	70%	69%	67%	66%	64%
0.30	70%	68%	66%	64%	62%	60%
0.40	70%	66%	63%	61%	59%	57%
0.50	68%	64%	61%	59%	57%	54%
0.60	66%	63%	60%	57%	54%	51%

Notes:
1. Runoff Coefficient 'C' is approximately equal to 0.05 + 0.9*Impervious Fraction.
2. Above chart is based on long term continuous hydrologic analysis of Toronto, Ontario (Bloor St) rainfall data.
3. Assumes 0.6 m sump in CB and that maintenance is performed (i.e. CB cleaning) when required by sediment/pollutant build-up or otherwise.
4. See accompanying chart for suggested maintenance scheduling - AND - get CB Shield Inc. to monitor it for you in field.
5. Sediment/Pollutant removal rates based on third party certified laboratory testing using MOECC sediment (PSD available on request).
6. See additional discussion regarding scour protection from CB Shield during more infrequent runoff events.

CB SHIELD: OPERATIONS INFO

REMOVING AND INSTALLING A SHIELD

CBSHIELD.COM/MAINTENANCE OR 226-802-1749



CB Shield is a Canadian owned and operated company aimed at improving stormwater quality. CB shields are a catch basin insert used to maintain sediment and improve water quality. Shields are put to work as water flows off the “slope” and into the basin wall opposite to the outlet pipe; grates allow sediment from the slowed water to pass to the sump below. See below on steps for removing and installing these.

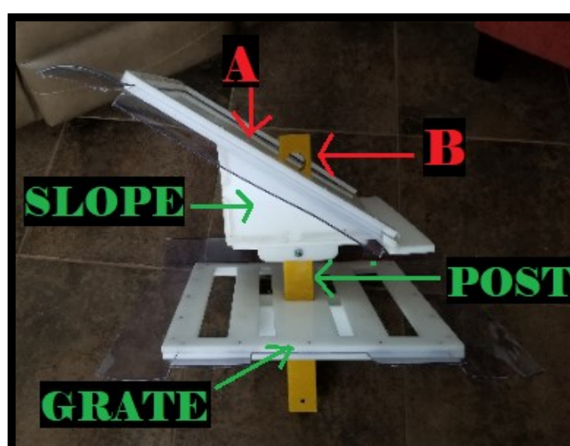
You open a catch basin and you see this device

What you need is one these specialized sticks we provide called a “Gandalf stick.” These can be provided beforehand or are sometimes left with cb shields after the unit has been installed. Please contact us if these are needed.

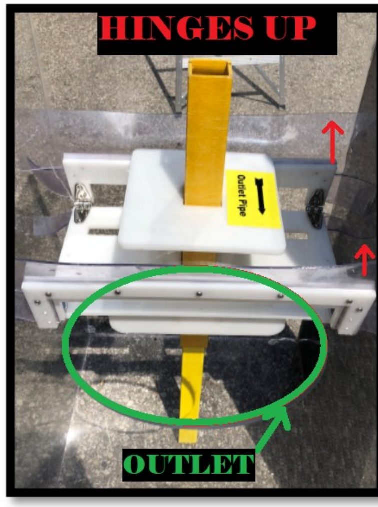
What you will need to do next depends on the type of shield you find. They have changed over time.

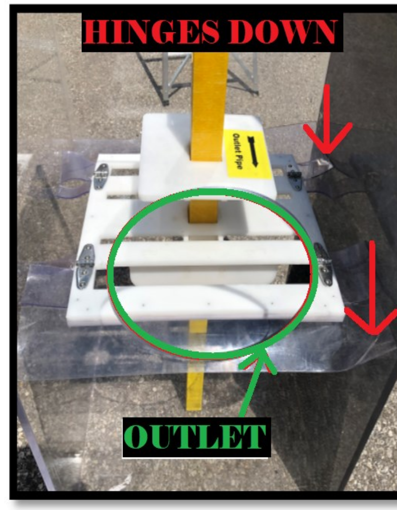
For a one piece unit: pull the unit up by the rope in the middle post

For a two piece unit, the top slope can slide off the post. The slope will have a rope (a), the post has an eye hole (b). Sometimes these will have to be removed separately.



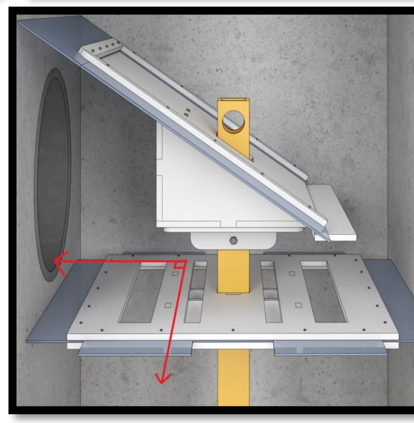
CB SHIELD: OPERATIONS INFO





Some two piece units have hinges. Follow the same steps a standard two piece unit, except pull up both hinges to remove unit, and fully extend them when reinstalling it.

Once the unit is removed and the sediment is cleaned out, you can reinstall the unit. Clean off the grates of debris and ensure the grate slots are perpendicular to the lowest outlet pipe.



We have several variations of "spacers" used to keep shields propped in place for double catch basins. Reinstall these as you find

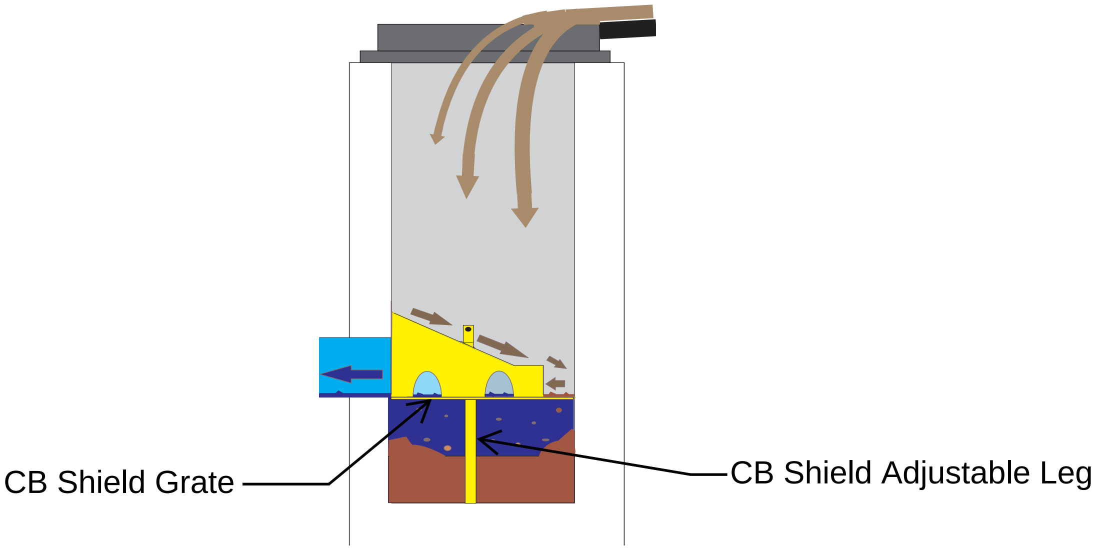
Tips and Facts:

1) Try to reinstall units the way you found them. Taking a photo of how they were before you start can help save time and confusion.
2) When in doubt, use the lowest outlet pipe as the reference point: the grate should be at the same height as it, and the slope should be headed down from it.
3) For videos and more information go to cbshield.com/maintenance
4) Let's improve water quality together. Please call if you have any questions at 226-802-1749

CB Shield Operations Manual

Installing CB Shield

It is important the catch basin frame and cover is aligned properly with the catch basin below
If it is misaligned it may be difficult to install the CB Shield insert
Determine the depth of the sump (i.e. the distance from the invert of the outlet pipe to the bottom of the catch basin). If the catch basin is in service the sump depth will be the depth of the water. The grate section of the CB Shield insert should be the same elevation as the water depth in the sump.



Adjust the leg of the CB Shield to achieve the appropriate elevation
The CB Shield is lowered into place with the rope attached to the top of the leg. The high side of the sloped plate should face the wall with the outlet pipe. (The incoming water should be directed to the wall furthest from the outlet)
The flexible plastic skirt around the outer edges of the CB Shield insert may interfere with some misaligned frame and grates. If so a slice can be cut into the skirt with a utility knife at the point of interference.
Make sure the grate is at the desired level or remove CB Shield and re-adjust the leg length.

Inspecting a CB Shield Enhanced Catch Basin

Open grate
A lifting rope is attached to the top of the centered leg of the CB Shield insert. Lift and remove the insert.
Inspect CB Shield for any possible damage. Quite often leaves will accumulate on the grate. This can actually improve the Shield's ability to capture sediment and assist in preventing leave litter from being washed down stream.
Use a Sludge Judge to measure the sediment depth in 4 - 6 locations of the sump.
If the sediment depth is 300mm – 600mm deep it is recommended that the unit be cleaned.

Cleaning a CB Shield Enhanced Catch Basin

Open grate and remove CB Shield with lift rope.
Clean catch basin as usual with a Vacuum truck.
Clean CB Shield (if needed) and re-install into catch basin.
If there is any significant damage to a CB Shield please send a picture and its location to CB Shield Inc. (info@cbshield.com).

Canadian ETV Verification Report

Performance Testing of Catch Basin Shield Technology

FINAL – STRICTLY CONFIDENTIAL

Date: 17 October 2016

Prepared For:
GLOBE Performance Solutions
World Trade Centre
404 – 999 Canada Place
Vancouver, British Columbia
V6C 3E2
Canada

Prepared By:
Toronto and Region Conservation Authority
101 Exchange Ave
Concord, Ontario
L4K 5R6
Canada

Authentication

Dated: 17 October 2016
Approved by:

Name: Tim Van Seters
Title/Position: Senior Manager
Department: Sustainable Technologies,
Organization: Toronto and Region Conservation Authority

Verification Report Outline for CB Shield Inc.

Catch Basin Shield Technology

Contents

Disclaimer

The Toronto and Region Conservation Authority ("TRCA") including its employees and Directors, (the "Verifier") has participated in the Canadian Environmental Technology Verification (ETV) Program verification of the CB Shield (the "Vendor") Catch Basin Shield Technology.

Any reference to the "Technology" refers to the Vendor's Catch Basin Shield Technology.

The Verifier is in no way affiliated with the Vendor.

The Vendor shall not edit or modify the report in any way or make any attempt to misrepresent data to the benefit of the Vendor. Selectively using sections of the report in order to change or misrepresent its overall meaning is also prohibited.

Claim verification by the Verifier does not represent any guarantee of the performance or safety of the Technology.

The Verifier shall not be liable in any way in the event that the Technology fails to perform as advertised by the Vendor and/or CB Shield Technology does not meet government-mandated health and safety standards.

To the extent permitted by law, the Verifier denies all liability to the Vendor or to any other person or entity for any loss, damage, costs, expenses and/or other compensation, arising directly or indirectly from the use of the report (in whole or on part) and/or any information contained therein.

The Vendor is wholly responsible for ensuring that the Technology complies with all applicable legislation, regulations, and other authorities.

Executive Summary

The CB Shield Technology was subjected to verification in accordance with the Canadian ETV Program General Verification Protocol, and taking into account the current draft of the proposed FDIS ISO 14034.

The verification process was mutually agreed upon by GLOBE Performance Solutions, the Verification Body, and Toronto and Region Conservation Authority ("TRCA"), the subcontracted Verification Expert. The purpose of this verification is to provide objective and quality-assured performance data on environmental technologies, so that users, developers, regulators, and consultants can make informed decisions about purchasing and applying these technologies.

This report, prepared by TRCA according to the criteria and guidelines set out in the Canadian ETV Program General Verification Protocol (GVP) of June 2012, is an official audit of the testing report generated through the performance testing of the CB Shield technology. The report is based on the Canadian ETV Program.

In addition, through guidance provided by GPS, the TRCA completed its verification of the CB Shield technology performance taking into account the principles and requirements of FDIS ISO 14034.

Performance testing for this verification took place at Good Harbour Laboratories in Mississauga, Ontario, Canada. Good Harbour Laboratories conducted the testing and followed the test sediment particle size distribution and many of the methods outlined in the *Procedure for Laboratory Testing of Oil-Grit Separators* developed by Toronto and Region Conservation Authority for the Canadian ETV Program.

CB Shield Technology is based on established scientific and technical principles in the field of fluid dynamics, sedimentation/settling, hydrology and sediment transport.

The technology incorporates an insert for catchbasins that aims to deflect and reduce the energy of inflows and thereby increase capture and reduce scour of sediment found in stormwater runoff.

After examination and audit of the test report and based on the test data submitted, the TRCA has concluded that _the CB Shield insert provides an environmental benefit related to capture and scour prevention of suspended sediments in stormwater runoff.

Accordingly, the TRCA recommends that the performance claims be worded as follows:

1. During the sediment capture test, for a catch basin with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent sediment concentration of 200 mg/L, the catch basin with a CB Shield insert removed 64, 59.9, 52.4, 42.6, 25.2, and 26.7 percent of influent sediment by mass at inflow rates of 0.24, 0.48, 1.20, 2.40, 6.00, and 8.40 L/s, respectively.

2. For a catchbasin filled to three quarters of the manufacturer's recommended maximum sediment storage depth, with the CB Shield™ insert, scouring of test sediment is at most 8% of the control catchbasin during a continuous 30 minute scour test run with 5 minute duration inflows of 1.2, 4.8, 8.4, 12.0, and 15.6 L/s.

1. Introduction

GLOBE Performance Solutions (GPS) which operates the Canadian ETV Program on behalf of Environment Canada has engaged the Toronto and Region Conservation Authority ("TRCA") to verify the performance of CB Shield Technology within the framework of a subcontracted agreement. The CB Shield technology is a technology for capturing sediment from storm water runoff when inserted inside street drains (catchbasins) and retaining sediment by preventing scour and re-suspension.

GLOBE Performance Solutions, in collaboration with the TRCA, has further agreed to prepare a verification report and verification statement that will meet the requirements of the Canadian ETV Program.

This verification report, prepared by the TRCA (the Verifier), in its capacity as a Canadian ETV Program Verification Expert (VE), constitutes a review of the application of the CB Shield technology based on the Canadian ETV Program General Verification Protocol (GVP) and taking into account the principles and requirements of FDIS ISO 14034.

The verification report is a summary record of the audit undertaken by the TRCA to verify the Vendor's technology performance claim.

CB Shield applied for technology verification through GLOBE Performance Solutions. Testing was carried out by the Good Harbour Laboratories in accordance with ISO 17025 requirements. TRCA examined the test report and prepared the verification report.

The CB Shield Technology is based on established scientific and technical principles in the field of _fluid dynamics, sedimentation/settling, hydrology and sediment transport. The technology incorporates an insert for catchbasins that deflects incoming water to the sidewalls dissipating its energy and passing it over a grate where velocity is decreased and residence time is increased allowing sediments to drop out of suspension and be captured. The dissipation of influent water energy also reduces scouring of already captured sediment during subsequent storms.

CB Shield's performance claims as submitted were:

1. For a catch basin containing sediment up to 150mm below the outlet invert, use of a CB Shield™ reduces scour of ETV sediment by a factor of at least 20 for stormwater inflows from 1.2-15.6L/s.
2. In addition use of CB Shield™ increases capture of ETV test sediment in all cases and by at least 370% to 490% respectively for flows of 2.4L/s and 8.4L/s.

Results showed that the initial claim for capture test could not be verified for individual flow rates as independence between samples of different flow rates could not be maintained since the captured sediment was not removed between the tests of different flow rates. A re-test was requested for the capture test. The re-test was done on a catchbasin with CB Shield insert without reference to a control catch basin. Results showed removal efficiencies ranging from 64.0 - 26.7% for inflow rates ranging from 0.24 - 8.40 L/s respectively.

The scour test was evaluated as a continuous test. Comparing the CB Shield to the Control treatment indicated that the CB Shield scoured much less than the control catch basin at 5 minute duration inflow rates of 1.2, 4.8, 8.4, 12.0, and 15.6 L/s.

1.1 Objectives

The objective of this report is to verify the performance claim made by CB Shield for the Catch Basin Shield Technology. This report summarizes the findings of the Canadian ETV Program Verification Expert, the TRCA, based on information and data contained in the Formal Application submitted by CB Shield to GLOBE Performance Solutions.

1.2 Scope

This verification was conducted by the TRCA using the June 2012 Canadian ETV Program General Verification Protocol and the most recent version (June 2015) of the international ETV standard (FDIS ISO 14034).

2. Review of the Application

2.1 Introduction

This section provides a summary of the information provided by the applicant included with the pre-screening application and formal application forms submitted to GLOBE Performance Solutions and reviewed by the TRCA pursuant to the Canadian ETV Program and the new international ETV standard (FDIS ISO 14034).

2.2 Applicant Organization

CB Shield Inc.
233 Cross Avenue, Suite 302
Oakville, ON L6J 2W9

Canada

2.3 Documents Reviewed

The technology and all information provided by the Applicant with the Formal Application, the formal application binder and all subsequent transmittals to the Verification Expert were reviewed. The results of this Application Review are summarized in the Application Review Checklist (Table 1) below.

Table 1: Application Review Checklist – Mandatory Information

Ref.	Criteria		Yes	No	Verifier Comments
1.1	Signed Formal Application.		☑	☐	
1.2	Signed Declaration Regarding Codes & Standards submitted with signed formal application.		☑	☐	
1.3	Technology provides an environmental benefit.		☑	☐	When installed in storm water catch basin, the device reduces souring and re-suspension of retained sediment, thereby reducing discharge of sediment into the environment.
1.4	A copy of "Claim to be Verified" for each performance claim to be verified included with the Formal Application.		☑	☐	"Claim to be Verified" submitted with application.
1.5	Performance Claim composed in a way that satisfies "Criteria for Specifying Claims":		☐	☐	
	1.5.1	Include Technology name (and model number)	☑	☐	CB Shield™
	1.5.2	Include application of the technology	☑	☐	Applied as an insert into catchbasins to improve capture and reduce scour of stormwater runoff sediment.
	1.5.3	Include specific operating conditions during testing	☑	☐	Test sediment: ETV test sediment <u>Capture (Claim 1):</u> Constant influent concentration of 200 mg/L. False floor set to 50% of the manufacturer's recommended maximum sediment storage (300 mm below the outlet invert) Inflow rates of 0.24, 0.48, 1.20, 2.40, 6.00 and 8.40 L/s. <u>Scour (Claim 2):</u> Catchbasin filled to ¾ of the manufacturer's recommended maximum sediment storage depth Claim based on continuous 30 minute test with 5 minute duration inflows of 1.2, 4.8, 8.4, 12.0, and 15.6 L/s.
	1.5.4	Does it meet the minimum requirement for the majority of Canadian Standards / Guidelines?	☑	☐	Signed Declaration Regarding Codes & Standards submitted with signed formal
	1.5.5	Does it specify the performance achievable by the technology?	☑	☐	<u>Capture:</u> Removal efficiencies of 64, 59.9, 52.4, 42.6, 25.2, and 26.7 for inflow rates of 0.24, 0.48, 1.20, 2.40, 6.00, and 8.40 L/s respectively with a constant influent sediment concentration of 200 mg/L. <u>Scour:</u> Scouring is at most 8% of the control catchbasin during a continuous 30 minute scour test run with 5 minute duration inflows of 1.2, 4.8, 8.4, 12.0, and 15.6 L/s.

	1.5.6	Is the performance measurable?	☑	☐	Capture: To measure the capture performance at each flow rate, a modified mass balance calculation is required, which can be done using mass of the sediment added to the sediment feeder, mass of sediment remaining in the feeder, and mass of captured sediment. Scour: To compare scouring potential for the continuous test between the control and CB Shield treatments the total effluent load is calculated for the entire duration of the test based on flow rate, duration, and sediment concentration of individual samples.
1.6	Standard operating practices and a description of operating conditions for each individual performance claim specified.		☑	☐	Tests are done in a lab on a simulated street scape with catchbasins clean of litter/debris. In the field, on average there are 5 catch basins per hectare. Therefore, the results from the maximum flow rate (15.6L/s) during the scour test will be meaningful for runoff flows up to 78 L/s per hectare. The range of flows tested is anticipated to match the range of flows expected at most installations. ETV test sediment: AGSCO 1-1000 micron silica sediment blend. Background samples are taken to account for all sources of sediment input. Capture Test (Claim 1) Background samples taken at least three times per run to account for all sources of sediment input Influent sediment concentration is constant at 200 mg/L (+/- 25mg/L) Tested flows: 0.24, 0.48, 1.2, 2.4, 6, and 8.4 L/s. These flow rates comply with surface loading rates specified in the CETV OGS testing procedures (40, 80, 200, 400, 1000, and 1400 L/min/m^2), based on the effective treatment area (0.36m^2) of the device. The specified loading rate of 600 L/min/m^2 was not tested. Conducted with a false bottom set at 300 mm below the outlet invert. Effluent was not recirculated; single pass through. Sediment injected 16.5 mm away from the inlet Scour Test (Claim 2) Tested flows: 1.2, 4.8, 8.4, 12, and 15.6 L/s. These flow rates comply with surface loading rates specified in the CETV OGS testing procedures (200, 800, 1400, 2000, and 2600 L/min/m^2), based on the effective treatment area (0.36m^2) of the device. Conducted with a false bottom set at 254 mm below the invert and preloaded with sediment up to 152 mm below the outlet invert. Water is filled to the effluent pipe and allowed to settle for 12-24 hours. Initial start time and flow rate transition times shall not exceed 1 minute. Effluent filtered using a 10µm filter before recirculation.

1.7	The proponent has supplied significant references describing or supporting scientific and engineering principles of the technology.	☐	☐	Proponent claimed that scientific principles underlying the CB Shield are based on widely accepted knowledge of fluid dynamics, sedimentation/settling, hydrology and sediment transport. Link to EPA paper was broken.
1.8	Two or more names and contact information of independent experts (with no vested interest in the technology), qualified (backgrounds of experts are needed) to review the scientific and engineering principles on which the technology is based. These experts must be willing to be contacted by the VE.	☑	☐	Greg Williams (Ph.D., P.Eng), Jenn Drake (Ph.D)
1.9	Brief summary of significant human or environmental health and safety issues associated with the technology. (Note: this criterion complements but does not replace the obligation for the applicant to submit a duly signed "Declaration Regarding Codes and Standards")	☑	☐	Brief descriptions given about health and safety issues associated with the working environment during installation, removal, the cleanout of catchbasins (considering they are confined spaces), and sediment disposal. Persons involved with installing, removing, and or maintaining CB Shield inserts need to be trained in accordance with requirements for servicing regular catchbasins.
1.10	Brief summary of training requirements needed for safe, effective operation of technology, and a list of available documents describing these requirements. (Note: this criterion complements but does not replace the obligation for the applicant to submit a duly signed "Declaration Regarding Codes and Standards")	☑	☐	Link to video instructions that guides installation and removal of the CB Shield is provided; a list of general practices is also given.
1.11	Process flow diagram(s), design drawings, photographs, equipment specification sheets (including response parameters and operating conditions), and/or other information identifying the unit processes or specific operating steps in the technology. If feasible, a site visit to inspect the process should be part of the technology assessment.	☑	☐	Photographs of lab setup, flow diagrams of water flow through the simulated streetscape, and links to videos showing test runs and sampling methods were provided.
1.12	Supplemental materials (optional) have been supplied which offer additional insight into the technology application integrity and performance, including one or more of the following:	☐	☑	
	A copy of patent(s) for the technology, patent pending or submitted.	☐	☑	
	User manual(s).	☐	☑	
	Maintenance manuals.	☐	☑	
	Operator manuals.	☐	☑	
	Quality assurance procedures.	☐	☑	
	Sensor/monitor calibration program.	☐	☑	
	Certification for ISO 9001, ISO 14000, or similar.	☐	☑	
	Material Safety Data Sheet (MSDS) information.	☐	☑	
	Workplace Hazardous Materials Information System (WHMIS) information.	☐	☑	
	Health and Safety plan.	☐	☑	
	Emergency response plan.	☐	☑	
	Protective equipment identified.	☐	☑	
	Technical brochures.	☑	☐	Website link provided with technical drawings and information.
1.13	The applicant provided adequate documentation and data. There is sufficient information on the technology and performance claim for the verification. [Note: The Verifier should communicate with the Canadian ETV Program, through GPS, to request copies of the necessary documentation and required data that are available to support the claims.]	☑	☐	Adequate documentation given for reviewing testing protocol. All collected data including laboratory work book were submitted. Methodology for testing was clearly outlined in application. Videos of testing protocol, and installation/removal of CB Shield were also provided.

3. Review of the Technology

3.1 Technology Review Criteria

The results of the Technology Review are summarized in the Technology Review Criteria Checklist (Table 2) below.

Table 2: Technology Review Criteria Checklist

Ref	Criteria	Yes	No	Verifier Comments
2.1	The technology is based on scientific and technical principles. (Note: It will be necessary for the Verifier to read the key articles and citations listed in the Formal Application. It may also be necessary to contact the independent experts listed in the Formal Application to obtain additional information)	☑	☐	The technology is a flow deflection device that dissipates the energy of inflows, preventing scour and increasing capture. The scientific principles underlying the technology are based on well-known areas of fluid dynamics, sedimentation/settling, hydrology and sediment transport.
2.2	The technology is supported by peer review technical literature or references. (Note: Peer review literature and texts must be supplied with the Formal Application as well as relevant regulations and standards that are pertinent to the performance claim)	☐	☐	Currently the link to peer review article is inaccessible.
2.3	The technology is designed, manufactured, and/or operated reliably. (Note: Historical data from the applicant, not conforming to all data criteria, may be useful for the Verifier to review to assess the viability of the technology not for verification, but for insight purposes)	☑	☐	CB Shield is said to be constructed in Canada using quality fiberglass. No details from long term studies to comment on long term reliability.
2.4	The technology is designed to provide an environmental benefit and not create an alternative environmental issue. (e.g., It does not create a more hazardous and/ or unmanaged byproduct and it does not result in the transfer of an environmental problem from one media to another media without appropriate management of the subsequent contaminated media)	☑	☐	The technology provides an environmental benefit of controlling sediment washoff at upstream locations by capturing and retaining sediment from stormwater runoff within the catchbasin. However, long term reliability specifically about the clogging of grate opening by debris which would decrease its hydraulic capacity requires further attention.
2.5	The technology conforms to standards for health and safety of workers and the public. (Note: The vendor must submit a signed "Declaration Regarding Codes & Standards", with the Formal Application. The Verifier should ensure that this signed document is included with the information that is reviewed for the performance claim verification)	☑	☐	Signed Declaration Regarding Codes and Standards was submitted.
Environmental Standards				
2.6	Technology achieves federal, provincial, and/or municipal regulations or guidelines for management of contaminated and/or treated soils, sediments, sludges, or other solid-phase materials.	☑	☐	
2.7	Technology achieves federal, provincial, and/or municipal regulations or guidelines for all (contaminated and or treated) aqueous discharges as determined by the applicant's information.	☑	☐	
2.8	Technology achieves federal, provincial, and/or municipal regulations or guidelines for all (direct or indirect) air emissions. If the environmental technology results in the transfer of contaminants directly or indirectly to the atmosphere, then, where required, all regulations or guidelines (at any level of government) relating to the management of air emissions must be satisfied by the applicant's information.	☑	☐	
Commercial Readiness				
2.9	Technology and all components (apparatus, processes, products) is full-scale, commercially-available, or alternatively see 2.10 or 2.11, and, data supplied to the Verifier is from the use or demonstration of a commercial unit.	☑	☐	Technology and components used for testing are full-scale and commercially available. At the time of this verification, the vendor has the capacity to produce many hundred units per month.

2.10	Technology is a final prototype design prior to manufacture or supply of commercial units, or alternatively see 2.11. (Note: Verification of the performance claim for the technology is valid if based on a prototype unit, if that prototype is the final design and represents a pre- commercial unit. The verification will apply to any subsequent commercial unit that is based on the prototype unit design. The verification will not be valid for any commercial unit that includes any technology design change from the prototype unit used to generate the supporting data for the verification.	☐	☐	NA
2.11	Technology is a pilot scale unit used to provide data which when used with demonstrated scale up factors, proves that the commercial unit satisfies the performance claim.	☐	☐	NA
Operating Conditions				
2.12	All operating conditions affecting technology performance and the performance claim have been identified.	☑	☐	Operating conditions affecting technology performance were identified. Please see Ref. 1.6.
2.13	The relationships among operating conditions and their impacts on technology performance have been identified. (Note: It is the responsibility of the Verifier to understand the relationship between the operating conditions and the performance of the technology, and to ensure that the impacts of the operating conditions and the responses of the technology are compatible)	☑	☐	Background concentration – needs to be < 20 mg/L to allow for accurate assessment of performance in the laboratory Water temperature – needs to be <25 °C; higher water temperatures have reduced viscosity allowing suspended sediments to settle quicker. However, water temperature has a negligible impact on settling velocity. Standardized test sediment - ensures comparability between units and a fair assessment of performance based on range of sediment sizes. Flow rates - lower flow rates should allow higher percentage of capture and retention. False floor (used storage capacity) – higher false floor will lower capture and retention performance as sediment will be held closer to the outlet invert <u>Capture test</u> Influent sediment concentration - held constant at 200 mg/L; studies have shown this to be a reasonable average sediment concentration in stormwater runoff from paved surfaces. Higher or lower influent concentrations may change the removal efficiencies
2.14	Technology designed to respond predictably when operated at normal conditions (i.e. conditions given in 2.12), and/or alternatively see 2.15. (Note: The Verifier must be satisfied that these data do not demonstrate a performance that is different than the performance indicated in the Performance Claim to be validated)	☑	☐	Based on the test results, the technology does respond predictably when operated at normal conditions. The discrepancy with the S5 run result during the control treatment of the scour test showing the second lowest scour rate for the highest flow rate is likely the result of a lack of finer sediments in the sump to scour.
2.15	Effects of variable operating conditions, including start up and shut down, are important to the performance of the technology and have been described completely as a qualifier to the performance claim under assessment.	☑	☐	A range of inflow rates were tested and the samples taken when changing from one flow rate to the next were clearly distinguished.
Throughput Parameters				

2.16	Effects of variable contaminant loading or throughput rate must be assessed and input/output limits established for the technology. Note: If the application of the technology is to a variable waste source or expected (designed) variable operating conditions, then it will be necessary to establish acceptable upper and lower ranges for the operating conditions, applications and/or technology responses. Sufficient, quality data must be supplied to validate the performance of the technology at the upper and lower ranges for the operating conditions, applications and or technology responses detailed in the performance claim.	☑	☐	<u>Scour:</u> The tested flow rates were between 1.2 and 15.6 L/s. The catch basins with and without CB Shield were pre-loaded with test sediment. Influent was clean water. Testing was continuous from one flow rate to the next with 1 minute transition periods. <u>Capture:</u> The tested lower and upper throughput rates are 0.24 and 8.40 L/s. Contaminant loading rates were controlled to have a constant inflow sediment concentration of 200mg/L.
Other Relevant Parameters/Variables/Operating Conditions Note: The Verifier is expected to understand the technology and identify and record all relevant criteria, parameters, variables or operating conditions that potentially can or will affect the performance of the technology under assessment. It is practical to include all of these variables in Table 2 (i.e., from 2.17 to …).		☑	☐	Parameters mentioned from 2.12 to 2.16 will also affect field performance accordingly (e.g., the false floor represents the accumulated amount of sediment). Additionally, in the field, debris may accumulate and affect performance which was not evaluated in the lab setting but can be evaluated in a field case study.
2.17				
2.18				

4. Review of Test Plan, Test Execution and Data

4.1 Review of Test Plan and Execution of Test Plan

The results of the Test Plan Review are summarized in the Test Plan Design Assessment Criteria Checklist (Table 3) below.

Table 3: Test Plan Design Assessment Criteria Checklist

Ref.	Criteria			Verifier Comments
3.1	Was a statistician, or an expert with specialized capabilities in the design of experiments, consulted prior to the completion of the test program, and if so please provide the contact details	☑	☐	Greg Williams 416-624-2007 gwilliams@goodharbourlabs.com
3.2	Is a statistically testable hypothesis or hypotheses provided? (such that an objective, specific test is possible)	☑	☐	The testable hypothesis is that a catchbasin with the CB Shield insert will retain more sediment in stormwater runoff than a catch basin without the insert. The hypothesis can be tested by a capture and comparative scour test as follows: <u>Capture test:</u> The OGS testing protocol requires the total amount of sediment to be accounted for by means of a modified mass balance. As a result, statistics will not be required since the whole “population” is taken into account instead of taking samples. <u>Scour test:</u> The scour test is a continuous test where samples taken within and between flow rates are not independent of each other. Since the assumption of independence fails, a mix model approach is required to compare the means between the control and CB shield catchbasin and confirm a significance difference. A measure of difference can be calculated between the two treatments by finding the quotient of their total effluent loads.
3.3a-c	Does the performance test generate data suitable for testing the hypothesis being postulated? Namely:	☑	☐	

3.3a	Does the test measure the parameters used in the performance claim hypothesis?	☑	☐	Capture test: Total amount of sediment added into the feeder is measured as well as the total amount captured after each flow rate test. A modified mass balance is undertaken to calculate exactly how much sediment was fed through the feeder as influent into the catchbasin and what percentage was retained for both treatments. Scour test: Performance test measures effluent concentrations of control and CB Shield treatments.
3.3b	Does the performance test control for extraneous variability?	☑	☐	The test was conducted under controlled laboratory conditions, following well defined procedures, thereby limiting extraneous variability. More specifically, influent flow was sampled to account for any background concentrations that would add to the controlled influent sediment feed. Inflow concentration was measured for each flow rate to ensure auger feed rates were synced to influent flow rate to achieve target influent concentrations. When concentrations of samples were analyzed, a blank, 20 mg/L standard, and 100 mg/L standard were also tested to account for instrumental or systematic errors. For sediment re-suspension test, pre-loaded sediment is allowed to settle for 12-24 hours before tests are started. Water temperature were monitored to not exceed 25°C as higher temperature can decrease water viscosity and thereby increase sediment settling velocity.
3.3c	Does the performance test include only those effects attributable to the technology being evaluated?	☑	☐	To ensure effects are attributable to the technology evaluated, the catchbasin with a CB shield insert is evaluated against a catchbasin without the insert (control) as part of the scour test.
3.4	Does the performance test generate data suitable for analysis using the SAWs? (Note: It is preferable that tests are designed with the SAWS in mind before test plans are written)	☐	☑	The mixed model approach required to compare control and CB Shield catchbasin scour test results requires a test outside of recommended SAWs (the R statistical program was used)
3.5	Does the performance test generate data suitable for analysis using other generic experimental designs? (Note: Performance testing and verification studies should be designed with the final data analysis in mind to facilitate interpretation and reduce costs)	☑	☐	Capture and scour tests generally followed the experimental design proposed by the OGS testing protocol which do not require statistical analysis. However, scour test claim compares control and CB Shield catchbasin which requires further analysis (mixed model) to prove significance difference between control and CB Shield catchbasin.
3.6	Are the appropriate parameters, specific to the technology and performance claim, measured? (Note: It is essential that the Verifier and the technology developer ensure that all parameters – e.g. temperature, etc - that could affect the performance evaluation are either restricted to pre-specified operating conditions or are measured)	☑	☐	Water temperature, influent flow rate, background concentration Capture test: Influent concentration, total influent mass, total captured mass Scour test: influent flow rate, preloaded sediment mass, effluent concentration
3.7a-d	Are samples representative of process characteristics at specified locations? Namely:	☑	☐	

3.7a	Are samples collected in a manner representative of typical process characteristics at the sampling locations? (e.g., the samples are collected from the source stream fully mixed, etc.)	☑	☐	Capture test: Sampling done according to OGS test Procedure. Upon completion of test, the remaining water from the catchbasin is decanted over a period of less than 30hrs. The total sediment captured is removed, dried and weighed. Mass of sediment remaining in the feeder is weighed and subtracted from total mass of sediment added at the beginning of the test to establish actual amount fed. Scour test: Effluent grab samples are taken at the catch basin outlet which will reflect effluent concentrations. A minimum of 500 ml samples was taken in 1000 mL jars that were attempted to be held under the whole effluent stream or passed under the stream such that the sample collection would be complete with a single pass.
3.7b	Is data representative of the current technology?	☑	☐	The data reflects the effect of a CB shield inserted into a normal catchbasin without any other alterations to the catchbasin. The inserted CB Shield is the unit that is currently commercially available.
3.7c	Have samples been collected after a sufficient period of time for the process to stabilize?	☑	☐	Samples were collected according to OGS testing procedure, which was developed based on scientific principles to ensure, among other things, sampling is conducted in a representative and replicable manner. Capture test: Sediment is only fed once target flows are reached and stabilized. A maximum of 30hrs is given to decant remaining water after a test run before captured sediment is removed, dried and weighed. Scour: Once sediment is pre-loaded, the device is filled up with water to the invert and allowed to sit for 12-24 hours before starting the tests. Changes in flow rates were done within 60s and an effluent sample was taken at approximately 30s to determine if additional scouring was taking place while flow rates were stabilizing.
3.7d	Have samples been collected over a sufficient period of time to ensure that the samples are representative of process performance?	☑	☐	Capture test: Total captured sediment is collected at the end of each flow run. The test duration for tested flow rates of 0.24, 0.48, 1.20, 2.40, 6.00, and 8.40 L/s are 420, 420, 360, 180, 70, and 50 mins respectively. Scour test: Effluent samples were taken every 1 minute for test durations of 5 minutes for flow rates of 1.2, 4.8, 8.4, 12.0, and 15.6 L/s. Transition samples were taken within 30 seconds of switching to a new flow rate. The system was shut down between flow rates of 8.4 and 12.0 L/s and between 12.0 and 15.6 L/s due to standpipe overflow.

3.8	Are samples representative of operating conditions? (Note: A time lag occurs between establishing steady state conditions and stabilization of the observed process performance. This time lag depends in part on the time scale of the process)	☑	☐	Long term operating conditions need to be evaluated. The effect of debris accumulation in an in situ field setting needs to be considered as affecting the performance. <u>Capture test:</u> Flow rates are monitored and influent sediment is only added once each target flow is stabilized in order to match performance to specific flow rates that cover the expected range of catchbasin inflow. Performance is representative of catchbasin that has used up 50% of the manufacture recommended Maximum Sediment Storage Depth and a constant inflow concentration of 200 mg/L. Because the sediment is collected at the end of each run, it accounts for the performance of the unit during start up and shut down as well. <u>Scour test:</u> Samples are representative for a specific operating condition of having the catch basin ¾ full of sediment. Scouring results are from a continuous test where scouring from a previous flow will affect subsequent scouring rates. After pre-loading the sediment time is given for agitated sediments to settle over a period of 12-24 hours. Flow changes are done within 1 minute and a sample is taken at approximately 30s to capture the scouring potential when altering flow rates.
3.9	Are samples representative of known, measured and appropriate operating conditions? (Note: This includes technologies that operate on short cycles and so have start and stop cycles which affects the operation of the technology. If the operating conditions are not vital but are recommended, then the reviewer must evaluate operating conditions)	☑	☐	The device is a passive device working to deflect and reduce the energy of stormwater inflow, which increases capture and reduces scour. The data were collected under controlled laboratory conditions using a test sediment that includes clay, silt and sand sized particles characteristic of stormwater runoff. The effects of debris on performance were not evaluated.
3.10	Were samples and data prepared or provided by a third party? (Note: In some cases, where the expertise rests with the applicant, an independent unbiased third party should witness and audit the collection of information and data about the technology. The witness auditor must not have any vested interest in the technology.)	☑	☐	Data samples were analyzed and prepared by a third party laboratory (Good Harbour Laboratories). Good Harbour Laboratories 2596 Dunwin Drive, Mississauga ON, L5L 1J5 905 696 7276 goodharbourlabs.com
3.11a-c	Performance Test Design is Acceptable - Namely:	☑	☐	
3.11a	The samples have been collected when the technology was operated under controlled and monitored conditions.	☑	☐	<u>Capture test:</u> flow rate, and influent concentrations were monitored and adjusted as required <u>Scour test:</u> flow rates were monitored and adjusted as required
3.11b	The test plan design should have been established prior to testing to ensure that the data were collected using a systematic and rational approach	☑	☐	Test plan design generally satisfied the OGS testing protocol.

3.11c	The test plan design should have defined the acceptable values or ranges of values for key operating conditions, and the data collection and analysis methodology	☑	☐	Operating conditions: Flows tested (operating conditions) are the expected general range of flows through a catchbasin: capture test (0.24-8.4L/s), scour test: (1.2-15.6 L/s). Water temperature needs to be below 25°C. Unit tested having 50% of its maximum storage capacity filled. Data collection and analysis: follows the OGS testing protocol. However, the scour test is run additionally with a control catch basin for comparison.

4.3 Data Validity Checklist

The results of the Data Validity Review are summarized in the Data Validity Checklist (Table 4) below.

Table 4: Data Validity Checklist

Ref.	Criteria	Yes	No	Verifier Comments
4.1	Were appropriate sample collection methods used (e.g. random, judgmental, systematic etc)? For example: simple grab samples are appropriate if the process characteristics at a sampling location remain constant over time. Composites of aliquots instead may be suitable for flows with fluctuating process characteristics at a sampling location. (Note: Sampling methods appropriate for specific processes may sometimes be described in federal, provincial or local monitoring regulations)	☑	☐	Capture test: The mass of sediments fed into the catchbasin and captured is measured in order to carry out a modified mass balance. Scour test: Multiple effluent grab samples are appropriate to evaluate the effluent concentrations and thereby the scouring potential at each flow rate.
4.2	Were apparatus and/or facilities for the test(s) adequate for generation of relevant data? (i.e. testing was performed at a location and under operating conditions and environmental conditions for which the performance claim has been defined)	☑	☐	Facility/apparatus sufficiently simulated a streetscape with a catchbasin with and without a CB Shield insert. Slurry feeder was calibrated and the auger feed rate was monitored. The facility had the capacity to manage the large amounts of water required for testing.
4.3	Were operating conditions during the test monitored and documented and provided?	☑	☐	Monitored/ documented operating conditions: background concentration, water temperature, PSD of test sediment Capture test: False floor height, flow rates, influent sediment concentration, amount of sediment injected Scour test: False floor height, flow rates, time limits, sampling frequency
4.4	Has the information and/or data on operating conditions and measuring equipment measurements and calibrations been supplied to the Verifier?	☑	☐	Measurements of monitored flow, water temperature and concentrations of sediment added were provided. Calibration of flow meter and PSD of sediment used were also provided.

4.5	Were acceptable protocols used for sample collection, preservation and transport? (Note: Acceptable protocols include those developed by a recognized authority in environmental testing such as a provincial regulatory body, ASTM, USEPA, Standard Methods)	☑	☐	
4.6	Were Quality Assurance/Quality Control (QA/QC) (e.g. use of field blanks, standards, replicates, spikes etc) procedures followed during sample collection? A formal QA/QC program, although highly desirable, is not essential, if it has been demonstrated by the vendor's information that quality assurance has been applied to the data generation and collection.	☑	☐	Replicates were taken and kept for 7 days (refrigerated) for each sample. Blank, 20 mg/L standard, and 100 mg/L standard run during sample analysis.
4.7	Were samples analyzed using approved analytical protocols? (e.g. samples analyzed using a protocol recognized by an authority in environmental testing such as Standard Methods, EPA. ASTM etc. Were the chemical analyses at the site in conformance with the SOPs (Standard Operating Procedures)?	☑	☐	The SSC samples were analyzed by GHL as detailed in ASTM D3977-97 (2013), Standard Test Methods for Determining Sediment Concentration in Water Samples.
4.8	Were samples analysed within recommended analysis times (especially for time sensitive analysis such as bacteria)	☑	☐	Recommended storage time is 7 days but samples were analyzed within 2.
4.9 a-e	Were QA/QC procedures followed during sample analysis? Namely:	☐	☐	
4.9a	Maintaining control charts	☑	☐	QA/QC (e.g., flow rates monitored to not vary more than expected COV (<0.04)
4.9b	Establishing minimum detection limits	☑	☐	MDL is 1.26 mg/L.
4.9c	Establishing recovery values	☐	☑	
4.9d	Determining precision for analytical results	☐	☑	
4.9e	Determining accuracy for analytical results	☐	☑	
4.10 a-c	Was a chain-of-custody (full tracing of the sample from collection to analysis) methodology used for sample handling and analysis - Namely:	☐	☐	
4.10a	Are completed and signed chain-of-custody forms used for each sample submitted from the field to the analytical lab provided for inspection by the Verifier?	☑	☐	Chain of custody provided for ETV test sediment analysis. Sampling and analyzing were done by GHL in their laboratory.
4.10b	Are completed and easily readable field logbooks available for the Verifier to inspect?	☑	☐	Field logbook from GHL was made available to the verifier.
4.10c	Are there other chain-of-custody methodology actions and documentation recorded/available (e.g. sample labels, sample seals, sample submission sheet, sample receipt log and assignment for analysis)?	☑	☐	GHL provided certificate of analysis for effluent concentration of the scour test.
4.11	Experimental Data Set is Acceptable (i.e., the quality of the data submitted is established using the best professional judgment of the Verifier)	☑	☐	The Verifier believes that the experimental data quality set is acceptable as overseen by Good Harbour Laboratories.

4.5 Data Analysis Checklist

The intent of the data analysis checklist is to ensure that the appropriate statistical tools can be used in a rigorous, defensible manner (Environment Canada 2012). The checklist also emphasizes that an initial performance claim may be rewritten and updated to better reflect what the data support, using the expertise of the Verifier and other pertinent resources. In this case, the performance claims were modified and restated by the Verifier. The updated performance claims are presented in the conclusion of this report.

Table 5: Data Analysis Checklist

Ref.	Criteria	Yes	No	Verifier Comments

5.1	Does the analysis test the performance claim being postulated? (Note: When conducting performance evaluations, under the Canadian ETV program, the alternative hypothesis of a "significant difference" without stating the direction of the expected difference will usually be unacceptable)	☑	☐	Capture test: analysis not required since modified mass balance will be done. Scour test: mixed model is used to evaluate whether there is a significant difference in effluent concentrations between CB shield and Control treatments. A confidence interval for the quotient of means between the control and CB Shield treatment will be calculated for comparison. The standard error of the distributions that is required to calculate the confidence intervals is calculated using a bootstrap method in R statistical program. This method is less stringent on the assumption of normality which the data set does not fully satisfy.
5.2	Does the analysis fit into a generic verification study design? For example, many other "generic" designs exist that are not explicitly covered by the Canadian ETV Program (e.g. ANOVA, ANCOVA, regression, etc.) that are potentially useful.	☑	☐	Capture test: Since there are no replications, results of the tests are presented as they are. Scour test: Mixed model analysis is carried to determine if there is a significant difference, a type of comparison of means taking into account non-independence. The quotient between the Control and the CB Shield treatments are used to compare the treatments.
5.2 a-c	Are the assumptions of the analysis met? Namely: (Note: A negative response means the Verifier needs to request further information)	☑	☐	Scour test: assumptions for a linear model include: 1. Linearity –dependent variable is the result of a linear combination of independent variable(s) 2. Absence of collinearity – fixed effects should not be collinear to each other 3. Homoskedasticity – variance of your data should be approximately equal across the range of predicted values 4. Normality or residuals (least important) – residuals of the regression need to be normally distributed 5. Absence of influential data points 6. Independence – most important for a linear model. Samples need to be independent. Since this assumption is not satisfied, a mixed model is used in place of a linear model. The mixed model allows for non-independent samples.
5.2.a	Did the data analyst check the assumptions of the statistical test used?	☑	☐	
5.2.b	Are the tests of assumptions presented?	☑	☐	
5.2.c	Do the tests of the assumptions validate the use of the test and hence the validity of the inferences?	☑	☐	
5.3	Data Analysis is Acceptable The data analysis is acceptable if the statistical test employed tests the hypothesis being postulated by the technology developer, the assumptions of the statistical test is met and the test is performed correctly.	☑	☐	Data analysis is acceptable.

4.7 Data Interpretation Checklist

The intent of the data interpretation checklist is to ensure that the data analyses results are reviewed in a manner that emphasizes the applicability to the specific performance claim and the statistical power of the performance test.

Table 6: Data Interpretation Checklist

Ref	Criteria	Yes	No	Verifier Comments

6.1a	Are the results statistically or operationally significant? Did the performance test result in a statistically significant test of hypothesis?	☑	☐	Capture test: Results are operationally significant. Removal efficiencies ranged from 64 to 26.7% for flow rates of 0.24 – 8.40 L/s. Scour test: results reflect comparison between control and CB Shield for a continuous scour test of different flow rates (0.24-8.4L/s) at 5 minute intervals. Under a mixed model analysis that takes into account non-independence between samples (since it is a continuous test, the previous sample will affect subsequent sample) it was shown that the treatment (control vs. CB Shield) had a significant effect on scouring.
6.1b	To be operationally significant, does the technology meet regulatory guidelines and applicable laws?	☑	☐	Declaration regarding codes & standards have been signed.
6.2	Does the performance test have sufficient power to support the claim being made? Note: For performance test designs where acceptance of the null hypothesis results in a performance claim being met, the statistical power of the test must be determined (Note: A statistical power of at least 0.8 is the target. If the power of the verification experiment is less than this value, the Verifier should contact the Canadian ETV Program to discuss an appropriate course of action)	☑	☐	Capture test: No statistical tests were conducted. Instead, a mass balance approach was used, which is regarded as a direct and robust and scientifically valid means of evaluating capture in stormwater sedimentation devices. Scour test: No suitable method of testing the power of a mixed model statistical test was available. However, the differences between the control catch basin and CB shield catch basin were very significant, and the number of effluent samples collected was suitable for the selected statistical method of evaluation.
6.3	Is the interpretation phrased in a defensible manner? Note: The final performance claim should reflect any changes to the claim made during the course of the analyses, variations or restrictions on operating conditions, etc. that changed the scope of the performance claim. The initial performance claim should be viewed as a tentative claim that is subject to modification as the verification progresses. A thoughtful open-minded verification will in the end, prove to be of greatest benefit to the technology developer.	☑	☐	Both claims were revised Capture test: Results for the capture test cannot undergo a statistical test due to a lack of replicates. However, since the analysis was performed in a control laboratory setting, it is assumed that results would be replicable and therefore interpreted as results for a given set of testing conditions. Scour test: Since the scour test was run as a continuous test, comparison between specific flow rates cannot be made, but rather on the entire series. Using mixed models to account for non-independence between samples, a significant difference was found between the two treatments. The interpretation is specific to testing conditions, but can be generalized to state the CB Shield scours much less than the control catchbasin.
6.4	Data Interpretation is Acceptable The data interpretation is acceptable if the data analyses results are reviewed in a manner that emphasizes the applicability to the specific performance claim and the statistical power of the verification experiment.	☑	☐	In general, the data interpretation is acceptable.

5. Statistical Evaluation of Claims

The statistical evaluation of the claims put forward by the Vendor was carried out using the R statistical software based on some of the principles presented in Statistical Analysis Worksheets (SAWs) provided by GPS (as per Environment Canada 2012). The first claim (capture test) does not require a statistical evaluation since the entire "population" is sampled (total mass of influent and captured sediments are accounted for) and n = 1 for each flow rate. The capture test follows the OGS protocol published by CETV and the analysis of which specifies a modified mass balance approach.

The data set resulting from the scour test does not satisfy the assumption of independence. Therefore, the second claim (scour test) cannot be evaluated statistically using the provided standard SAWs that require normality. A mixed model approach is taken to confirm significant difference between results of control catchbasin and one with a CB Shield. A bootstrap simulation method is used in R to calculate the standard deviation from which confidence intervals for their quotient is derived to make estimates of the minimum performance limit.

5.1 Statistical Evaluation of Claim #1: Capture test

A modified mass balance approach is taken to analyze the treatment performance of capturing suspended sediments at various loading rates. Each flow rate is run only once due to feasibility related to testing duration and cost, but the total influent sediment and total captured sediment is weighed and accounted for. Since there are no repeated tests, statistical analysis is not carried out but rather the results of the modified mass balance is given as is.

5.1.1 Raw Data

The raw data provided by the Vendor is presented in Appendix D of the formal application.

5.1.2 Assessing Normality

This procedure is used to determine if the data variable is normally distributed or log-normally distributed. This is important as the assumption of normality is often invoked in subsequent calculations.

– Not applicable

Assumptions:
- Not applicable

5.1.3 Testing if the Mean is Equal to Specified Value

This test is used to determine at a level of 95% confidence that the mean is not equal to some pre-specified value, μ_o. The value μ_o will often be the performance that a technology is claiming to achieve.
$H_0 : \mu_1 = \mu_o$

– Not applicable

Assumptions:
- Not applicable

Inferences:
No statistical inferences are made. Based on the modified mass balance approach, under specified operating conditions of a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent sediment concentration of 200 mg/L, the catch basin with a CB Shield insert removed 64, 59.9, 52.4, 42.6, 25.2, and 26.7 percent of influent sediment by mass at inflow rates of 0.24, 0.48, 1.20, 2.40, 6.00, and 8.40 L/s, respectively.

Table Z1: Summary of Acceptable Data Sets for Verification

Acceptable Data Set(s) Identification	SAWs Used	Supports Claim (Y/N)
Table 9. Removal efficiency based on mass balance (from Performance testing of the CB Shield for the enhancement of catch basin sediment capture – 24 Aug 2016)	Not applicable	Yes

5.2 Statistical Evaluation of Claim #2: Scour Test

5.2.1 Raw Data

The raw data provided by the Vendor is presented in Appendix D of the formal application.

5.2.2 Mixed model analysis: Testing for significant difference between scour test effluent loads of control and CB Shield treatment using

The scour test is run continuously with test sediment of a specified PSD preloaded and having flow rates altered at 5 minute intervals (1.2, 4.8, 8.4, 12.0, and 15.6 L/s). Effluent loads of the two treatments cannot be compared separately at each flow rate since preceding flow rates affect the amount of sediment left to scour during subsequent flow rates. As a result, for each treatment all collected effluent concentrations are treated as part of a single dataset. However, conventional statistics used for comparison of means analysis (i.e., t-test) requires each sample to be independent of each other, put forth as the assumption of independence. Since data from the scour test fails to meet this assumption, a mixed model approach is taken.

A mix model is a linear model that includes a “mix” of fixed and random effects. Effects that are constant for each sample are fixed effects (i.e., the treatment) while effects that are variable for each sample(run/flow rate) are random effects and in part treated as a random error term. A “full” model is created with all fixed and random effects along with a “null” model that excludes the fixed effect that is in question of having a significant effect. The treatment effect (CB Shield vs. control) will be excluded in the null model. An ANOVA is used to compare the two models which if determined to be significantly different from each other identifies the fixed effect in question (i.e., treatment) to be a significant effect.

Assumptions:

- Linearity: The dependent variable has to be a result of a linear combination of the independent variables. A residual plot can be used as an indicator. Residuals should not exhibit a recognizable pattern (e.g., exhibit an increase or decrease or a curved relationship)

- Homoscedasticity: Variance of the data should be approximately equal across the range of predicted values. Residuals on a residual plot should be approximately equal distance from the Y=0 line.

- Absence of collinearity: Fixed effects should not be collinear (very closely related) to each other so that it would not be difficult to distinguish between their effects.

- Normality of residuals: Linear model are relatively robust against violations of normality assumption so this is the least important assumption to satisfy. Normality of residuals can be checked using a q-q plot.

- Absence of influential data points

5.2.3 Calculating the 95% confidence interval for the effluent load mean quotient of the two treatments

To make a claim on the effluent load performance of the CB Shield relative to the control treatment, the quotient of the mean effluent loads is calculated and expressed as a percentage. The 95% confidence interval of the quotient of means is calculated and the lower limit is used in the claim to reference the minimum performance as required by CETV instead of the mean performance.

A bootstrap simulation method is used in R to calculate the standard deviation of the distribution of effluent loads of the two treatments as an effective means of correcting for non-normal distribution. The calculated standard deviation is used with GraphPad’s web application (http://www.graphpad.com/quickcalcs/errorProp1/) to estimate the 95% confidence intervals of the quotient. The application assumes normal distributions for the datasets, which although not satisfied, the robust bootstrapping method used to calculate the standard deviations is believed to give very good estimates of the minimum performance without introducing complications of transforming and retransforming variables.

Assumptions:

- Data set is normally distributed: although not satisfied, the robust bootstrapping method used to calculate the standard deviations is believed to give good estimates of the calculated minimum performance without introducing abstractions of transforming and retransforming variables.

Inferences:
Based upon the above inferences, it can be concluded that for a catchbasin filled to three quarters of the manufacturer's recommended maximum sediment storage depth, with the CB Shield™ insert, scouring of test sediment is at most 8% of the control catchbasin during a continuous 30 minute scour test run with 5 minute duration inflows of 1.2, 4.8, 8.4, 12.0, and 15.6 L/s.

Table Z2: Summary of Acceptable Data Sets for Verification

Acceptable Data Set(s) Identification	Analysis Used	Supports Claim (Y/N)
Table 2. Scour test results for CB Shield protected and control catch basins (from Environmental Technology Verification (ETV): Supporting documentation for Canadian ETV program formal application – October 2015)	Mixed model regression is used (R statistical package)	Y
Table 2. Scour test results for CB Shield protected and control catch basins (from Environmental Technology Verification (ETV): Supporting documentation for Canadian ETV program formal application – October 2015)	Bootstrap simulation is run in R to find the standard error for the mean percent change (between scour results of the control and CB Shield treatments)	Y

Table 2. Scour test results for CB Shield protected and control catch basins (from Environmental Technology Verification (ETV): Supporting documentation for Canadian ETV program formal application – October 2015)	GraphPad web application is used to calculate 95% confidence interval of the quotient of mean effluent loads of the two treatments.	Y

6. Audit Trail

The items in Table 8 are useful in determining reasons for data discrepancies.

Table 8: Key documents

Raw data sheets and summary data	Yes
Signature pages	Yes
Signed Formal Application	Yes
Declaration Regarding Codes & Standards	Yes
Patent(s)	NA (Patent Pending)
Sample security: e.g. chain of custody sheets for each sample	Chain of custody for sediment, not for effluent sample since collected and analyzed by same lab.
Operation and maintenance manual	Operation and maintenance videos.
Field notebooks	Provided
Certificate of accreditation of laboratories	GHL not accredited but allowed by the verifier since an internal verification documented in the validation report TR-AA20120409-01.

7. Conclusion

CB Shield's technology performance claims have been verified as follows:

1. Capture test:

   During the sediment capture test, for a catch basin with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent sediment concentration of 200 mg/L, the catch basin with a CB Shield insert removed 64, 59.9, 52.4, 42.6, 25.2, and 26.7 percent of influent sediment by mass at inflow rates of 0.24, 0.48, 1.20, 2.40, 6.00, and 8.40 L/s, respectively.

2. Scour Test:

   For a catchbasin filled to three quarters of the manufacturer's recommended maximum sediment storage depth, with the CB Shield™ insert, scouring of test sediment is lowered by at least 81% compared to a control catchbasin during a continuous 30 minute scour test run with 5 minute duration inflows of 1.2, 4.8, 8.4, 12.0, and 15.6 L/s.

The verified claims concur with the verification report.

8. References

Environment Canada. 2012. Environmental Technology Verification – General Verification Protocol (GVP). Review of Application & Assessment of Technology. [online] http://etvcanada.ca/wp-content/uploads/2013/05/General-Verification-Protocol_Canadian-ETV-Program_June2012-May2013.pdf [accessed June 2016]. Environment Canada, Science and Technology Programs, Science and Technologies Strategies Directorate, Science and Technology Branch, Gatineau, QC.

ISO/FDIS 14034:2015, Environmental management – Environmental technology verification (ETV)

ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories

Appendices

Appendix A. Statistical Analysis

Appendix A contains the detailed worksheets of the statistical analysis undertaken to confirm the CB Shield Technology performance claims.

A.1 Claim 1: Capture Test

No statistical analysis performed. It is not feasible to do repeated tests for the capture test. Instead, a modified mass balance is calculated by weighing the mass of all influent and captured materials to arrive at removal efficiencies.

A.2 Claim 2: Scour Test

A.2.1 Mixed model analysis: Testing for significant difference between scour test effluent loads of control and CB Shield treatment using

A "linear mixed model" approach is taken to compare the effluent loads of the CB Shield and Control treatment.

The scour test is run continuously with test sediment of a specified PSD preloaded and having flow rates altered at 5 minute intervals (1.2, 4.8, 8.4, 12.0, and 15.6 L/s). Effluent loads of the two treatments cannot be compared separately at each flow rate since preceding flow rates affect the amount of sediment left to scour during subsequent flow rates. As a result, for each treatment all collected effluent concentrations are treated as part of a single dataset. However, conventional statics used for comparison of means analysis (i.e., t-test) requires each sample to be independent of each other, put forth as the assumption of independence. Since data from the scour test fails to meet this assumption, a mixed model approach is taken.

A mixed model can represent a "mix" of fixed and random variables. In our study, treatment will be a fixed effect while each run (different flow rate) will be treated as a random effect. More specifically, we account for the interaction of the treatment and run factor as the random effect. The analysis is carried out in "R" statistical software using the "lmer" function of the "lme4" package. To assess if the fixed factor "treatment" (CB Shield, Control) has a significant effect on the model, both a "full" model and a "null" model are created, with and without the fixed effect of "treatment" respectively. An ANOVA is run to compare the "full" and "null" model and a significant difference between the two models indicates that the fixed factor "treatment" is a significant effect. This indicates a significant difference in the responses (effluent loads) of the two treatments.

There are 6 assumptions for linear models:

1. Linearity: The dependent variable has to be a result of a linear combination of the independent variables. A residual plot can be used as an indicator. Residuals should not exhibit a recognizable pattern (e.g., exhibit an increase or decrease or a curved relationship)

2. Homoscedasticity: Variance of the data should be approximately equal across the range of predicted values. Residuals on a residual plot should be approximately equal distance from the Y=0 line.

3. Absence of collinearity: Fixed effects should not be collinear (very closely related) to each other so that it would not be difficult to distinguish between them.

4. Normality of residuals: Linear model are relatively robust against violations of normality assumption so this is the least important assumption to satisfy. Normality of residuals can be check using a q-q plot.

5. Absence of influential data points: Influential data points can change interpretation of results. The "influence" and "dfbetas" function for the "influence.ME" package can be used in R to check for this.

6. Independence: This is the most important assumption for a linear model. If the assumption is not satisfied, and linear "mixed model" is used.

The "full" and "null" models are built using the following codes. Notice that loads is the response variable, treatment is the fixed effect (constant for samples) and the interaction of the treatment and run variables is the random effect (varies for each sample) .

```
Code [
model_full = lmer(loads_g ~ treatment + (treatment|run), data=test.data, REML=FALSE)
model_null = lmer(loads_g ~ (1|run), data=test.data, REML=FALSE)
]
```

<u>Assumptions 1 and 2: Linearity and homoscedasticity</u>
Both assumption 1 and 2 can be checked using a residual plot.

```
Code [
```

plot(fitted(model_full), residuals(model_full))
]

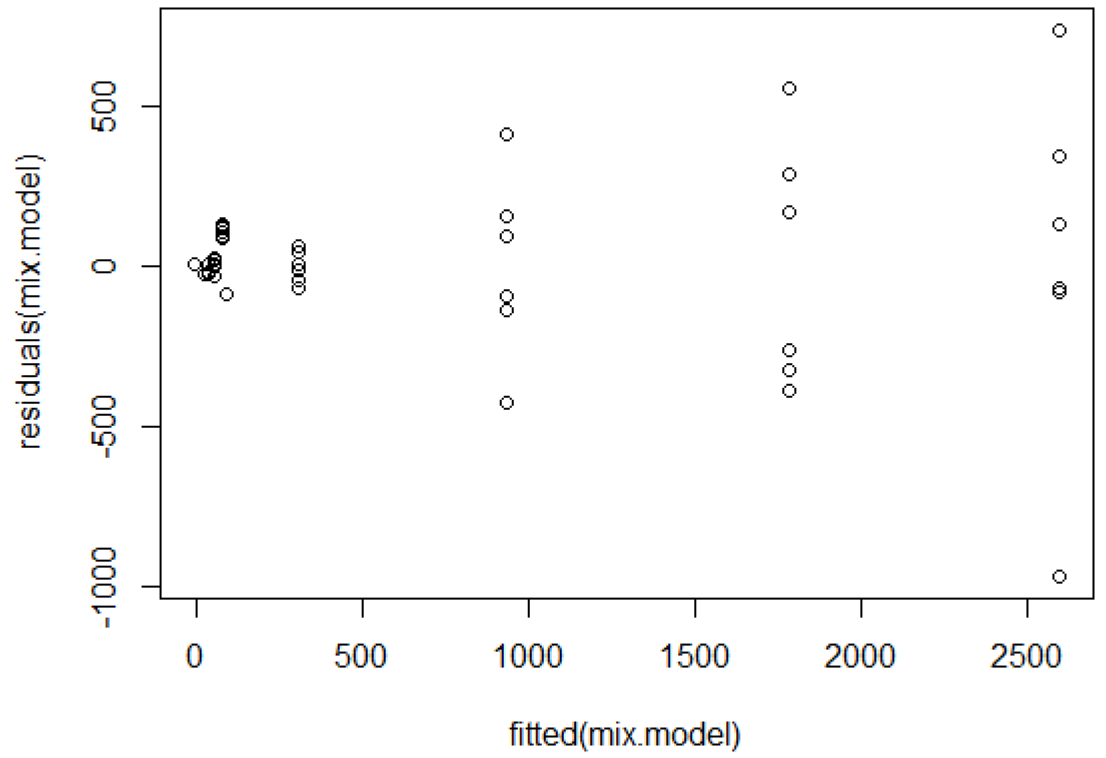


Figure A1. Residual vs. fitted model.

There seems to be a pattern where the residuals of this model are increasingly dispersed. As a result, the response variable (loads) is transformed logarithmically and the assumptions are re-tested.

Code [
model_full = lmer(loads_g_log ~ treatment + (treatment|run), data=test.data, REML=FALSE)
model_null = lmer(loads_g_log ~ (1|run), data=test.data, REML=FALSE)

plot(fitted(model_full), residuals(model_full))
]

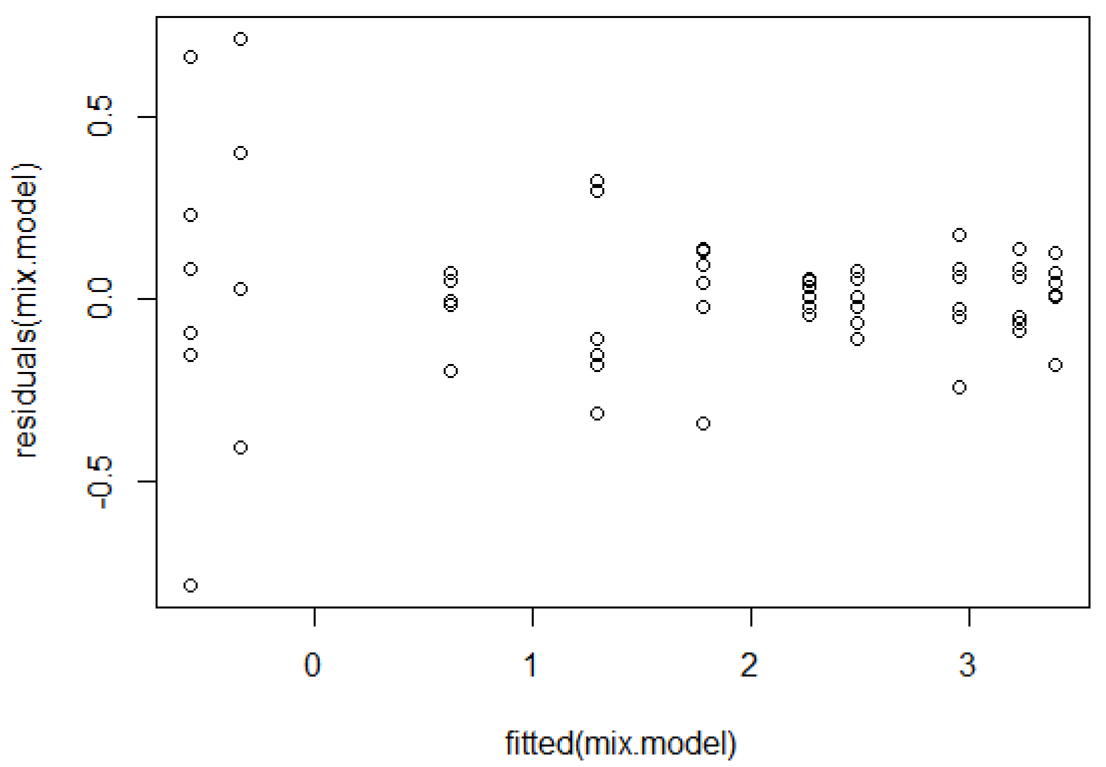


Figure A2. Residual vs. fitted model with log transformed response variable.

This model satisfactorily meets the assumptions 1 and 2. Residuals do not exhibit a clear recognizable pattern and are relatively equidistant from the Y=0 line.

<u>Assumption 3: Absence of collinearity</u>
This assumption is satisfied as the model only identifies one fixed effect with no other closely related variables.

<u>Assumption 4: Normality of residuals</u>

Code[
# LOAD LIBRARY
library(fitdistrplus)

# PLOT THE FITTED MODEL AGAINST THE NORMAL DISTRIBUTION
fit.norm <- fitdist(residuals(model_full), "norm")

plot(fit.norm)
]

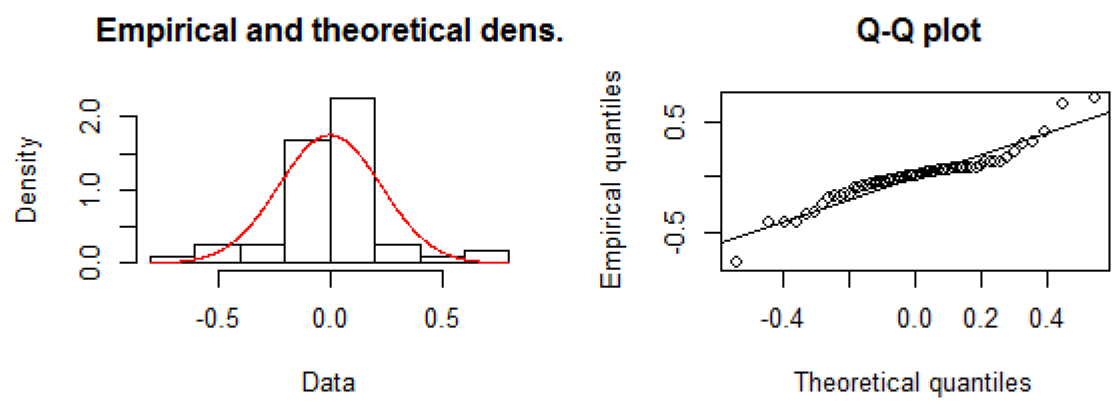


Figure A3. Histogram and Q-Q plot of residuals

Based on figure A3, the model satisfies assumption 4.

Assumption 5: Absence of influential data points

```
Code[
#LOAD LIBRARY
library(influence.ME)

# DFBETA VALUES SHOULD NOT BE MORE THAN 2/sqrt of n;  "n" BEING NUMBER OF VALUES
FOR THE GROUPING FACTOR (THERE ARE 5 RUNS/FLOW RATES)
2/(sqrt(5)) # equals 0.8944272

estex.mix.model <- influence(mix.model, "run")
dfbetas(estex.mix.model, parameter =c(0))
]
```

Table A1. DFBETAS values fixed factor by runs.

Run/flow rates	Intercept	treatmentControl
S1	-0.64651330	-0.02705247
S2	-0.50157391	0.88798512
S3	-0.05102875	0.34856408
S4	0.45949187	-0.29719975
S5	0.81812841	-0.93360428

All DFBETA values are less than 2/sqrt of n (2/(sqrt(5)) = 0.8944272); "n" being number of values for the grouping factor (there are 5 runs/flow rates). Assumption 5 is also satisfied.

ANOVA comparing the full and null model, with and without the fixed factor of treatment respectively

```
Code[
anova(model_full, model_null)
]
```

Table A2. Results for ANOVA comparing the full and null model with and without the fixed factor of treatment, respectively.

Model	Df	AIC	BIC	logLik	Deviance	Chisq	Pr(>Chisq)
Model_null	3	206.187	212.470	-100.094	200.187		
Model_full	6	59.523	72.089	-23.761	47.523	152.66	<2.2e-16

Based on table A2, there is significant difference between the models with and without the fixed factor of treatment. It can be inferred that the treatment has a significant effect, and therefore a significant difference can be claimed between the effluent loads from the CB Shield and Control treatments.

A.2.2 Calculating the 95% confidence interval for the effluent load mean quotient of the two treatments

Table A3. Calculated total/mean loads, bootstrapped standard error, standard deviation, and variance for the scour test results.

	N	Total load (g)	Mean load (g)	Bootstrap standard error[a]	Standard deviation	Variance
CB Shield	30	1564.42	52.11	12.69	69.52	4832.47
Control	30	33957.38	1131.91	176.50	966.75	934597.15

[a]Since datasets are not well suited to satisfy a normal distribution, a bootstrap method was used to calculate standard errors in the R statistical program. The bootstrap method is less stringent on satisfying the normality assumption for calculation of standard errors.

Ratio of mean effluent loads between the control and CB Shield treatments:

Mean of CB Shield/ Mean of Control
= 52.150/1131.910
=0.046
= The mean effluent load of the CB Shield treatment is 5% of the Control treatment.

Confidence Interval:
Using the standard deviation calculated in Table A1, the following GraphPad web application was used to find the confidence interval:
http://www.graphpad.com/quickcalcs/errorProp1/

CI of a sum, difference, quotient or product
Mean of CB Shield **divided by** Mean of Control = 0.046

Table A2. Confidence intervals calculated using bootstrapped standard error at the 90, 95, and 99 percentile (using GraphPad web application)

90% CI:	0.026	to	0.073
95% CI:	**0.023**	**to**	**0.080**
99% CI:	0.016	to	0.096

"These results assume that both variables follow a Gaussian distribution and that the measurements of CB Shield are not paired or matched to measurements of Control. Although the datasets are not entirely normally distributed, the standard error used to calculate the standard deviation was derived using a bootstrap method which is assumed to decrease the stringency on the requirement of normality.

Results computed by the method of EC Fieller, Suppl to J.R.Statist.Soc, 7,1-64 summarized here. "

Based on the calculated confidence interval, the effluent load of the CB Shield during the scour test is at most 8% of that of the Control treatment.

Appendix B. Supplemental Verification Checklist Pursuant to ISO/FDIS 14034:2015

Appendix B provides a supplemental verification checklist pursuant to ISO/FDIS 14034:2015. It may be useful for the verifier to include this completed Appendix in the final Verification Report.

ISO/FDIS 14034:2015 Checklist Principles, procedures and requirements for ETV		
Reference	Requirements (Criteria)	Verifier Comments
1. Applicant Information	1.1 Applicant name(s), address(es) and physical location(s)	Applicant names and addresses provided.
2. Technology Description	2.1 A unique identifier for the technology (e.g., a commercial name, an identification number or applicable version)	The technology is uniquely identified as CB Shield™.
3. Information about the intended application of the technology NOTE: More than one technology purpose, type of material and measurable property can be provided.	3.1 Purpose of the technology	The technology is a flow deflection device that when inserted into catchbasins dissipates the energy of inflows by deflecting flows to the side walls which prevents scour and increases capture of sediments within storm water runoff by increasing its residence time inside the catchbasin.
	3.2 Type of material for which the technology is intended	The technology is intended to catch suspended sediments from stormwater runoff.
	3.3 Measurable property that is affected by the technology and the way in which it is affected	The effluent sediment concentration of stormwater catchbasins is reduced by the technology.
	3.4 Information sufficient to understand the operation and performance of the technology	Applicant has provided sufficient information to understand the operation (i.e., videos and written instructions) and performance of the technology (lab test results).
	3.5 Development status of the	Technology is ready for the market. Production

	technology proposed for verification and its readiness for market (Note: Technology proposed for verification shall be either already available on the market or available at least at a stage where no substantial change affecting its performance will be implemented before market entry)	line is set up to make 100s at a time.
	3.6 Information on relevant alternatives of the technology, including relevant performance and environmental impacts	Current alternatives are in some form of fine mesh either as a guard surrounding the catchbasin inlet or as a pouch directly under the inlet through which all inflow passes through. More similar alternatives to the CB shield include OGS units, but are more expensive to install or retrofit while the CB Shield can be simply inserted into an existing catch basin.
	3.7 Information on significant environmental impacts of the technology proposed for verification and its environmental added value, if applicable.	Yes, the technology will reduce downstream transport of suspended sediment within stormwater runoff received in the catchbasin.
	3.8 Does the technology fulfil the definition of environmental technology?	Definition: "technology that either results in an environmental added value or measures parameters that indicate an environmental impact". The CB Shield inserted into a catchbasin results in an environmental added value of decreased effluent suspended sediment concentration from catchbasins.
4. Operational aspects	4.1 Are the Installation and operating requirements and conditions described?	Yes, installation, operating requirements, and conditions are detailed within the application in addition to links for videos that show installation and lab testing.
	4.2 Are the service and maintenance requirements described?	Yes, service and maintenance would be that required by normal catchbasins in terms of cleanout. The technology is manufactured with strong fiberglass material making it very durable.
	4.3 Is information provided on the expected length of time for which the technology functions under normal operating conditions?	The applicant expects the technology to operate normally given its durability combined with a regular cleanout cycle of less than 2 years; no specific life expectancy is provided.
5. Legal and regulatory context	5.1 Is information provided on the relevant legal requirements and/or standards related to the technology and its use?	Yes.
	5.2 Does the technology adhere to applicable regulatory requirements?	Yes it adheres to requirements for technologies fitted into a catchbasin.
6.Health and Safety	6.1 Are there any applicable health and safety requirements and considerations?	Health and safety requirements follow those set out for cleaning and maintaining regular catchbasins.
7. Performance claim(s) and parameters	7.1 Do the performance claims for the intended application of the technology address the needs of the interested parties?	Yes, the performance claim addresses typical flows that can be expected for a catchbasin and the performance as a result of the CB Shield insert.
	7.2 Is the information on the technology sufficient to review the performance claim(s)?	Yes, the technology is a fairly straight forward flow deflection device and information provided is sufficient to review performance claims.
	7.3 Do the performance claim(s) to be verified include proposed performance parameters and numerical values?	Yes.

	7.4 Are the performance parameters relevant and sufficient for verification of the performance of the environmental technology, and the environmental added value, if applicable?	Yes, the performance parameters indicate the improvement to sediment capture and retention.
	7.5 Can the performance claims be quantitatively verified through testing?	For the claim regarding removal efficiencies determined through the capture test, the results will be simply stated in the form of a claim. For the scour analysis, a significance difference between control and CB shield catchbasin can be verified and the absolute difference stated.
	7.6 Can their numerical values be verified under set operating conditions, using existing verification plans and relevant technical references, including standardized testing methods, preferably based on international standards?	Their numerical values and analysis for the performance claims were attained by 3rd party Good Harbour Laboratory under set operating conditions following for the greater part the OGS testing protocol published by TRCA.
8. Test data	8.1 Are relevant test data and the methods for acquiring these data provided to support the performance claim?	Testing methodology, videos taken during testing, and relevant test data were provided to support the performance claims.
	8.2 Are specifications of the requirements for the test data provided, including quality and quantity and testing conditions?	Specific testing conditions were listed in report regarding flow rates, time for each run, height of the sump (false floor), and amount of sediment added to list a few.
	8.3 Is a description provided of the methods for the assessment of the test data and their quality?	Description of the methods used to assess test data and its quality were provided.
	8.4 Are the data at a quality level generally accepted by the scientific community for the technology and/or the industrial sector concerned?	Yes.
	8.5 Are the data of sufficient quality in terms of reproducibility, repeatability, ranges of confidence, accuracy, and uncertainties?	Yes for the most part. There were a few discrepancies related to the filter of recycled effluent flow not working optimally which increased the background sediment concentration and not having enough sediment left over for scour in the control catchbasin for the final flow rate.
	8.6 Are other relevant technical references included, such as other existing verification plans, applicable legislation, standardized test methods and international standards?	Yes, applicant refrenced OGS testing protocol upon which much of the testing for the CB Shield was based on.
	8.7 Was information provided to explain deviations from the test plan?	Yes deviations from the OGS testing protocol were evident in the testing methodology.
9. Verification	9.1 Were the test data assessed against the performance specified in the verification plan?	Yes.

	9.2 Do the test data confirm the performance of the technology, achieved under the same conditions, constraints and limitations as those specified?	Yes. Few requests made for proof of analysis and for alteration of claim composition were satisfied.
	9.3 Are the performance claims verified as originally stated?	No.
	9.4 If the performance claims are not verified as originally stated, how should they be modified?	<u>Capture test:</u> During the sediment capture test, for a catch basin with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent sediment concentration of 200 mg/L, the catch basin with a CB Shield insert removed 64, 59.9, 52.4, 42.6, 25.2, and 26.7 percent of influent test sediment by mass at inflow rates of 0.24, 0.48, 1.20, 2.40, 6.00, and 8.40 L/s, respectively. <u>Scour test:</u> For a catchbasin filled to three quarters of the manufacturer's recommended maximum sediment storage depth, with the CB Shield™ insert, scouring of test sediment is at most 8% of the control catchbasin during a continuous 30 minute scour test run with 5 minute duration inflows of 1.2, 4.8, 8.4, 12.0, and 15.6 L/s.

Appendix C. Verification Guidance Pursuant to ISO/FDIS 14034:2015

Appendix C provides guidance on performance testing and verification of technologies pursuant to ISO/FDIS 14034:2015

1. Definition of Roles:

Verifier - Organization that performs environmental technology verification

Test body - Organization that performs testing, test-implementation and reporting on the testing of an environmental technology

Applicant – Organization proposing a technology for which performance will be verified through environmental technology verification

2. Terminology

2.1 Terms related to verification

Verification - Confirmation through the provision of objective evidence

Verification Plan - Detailed planning document for implementation of the environmental technology verification

Verification Report - Document detailing the environmental technology verification and its results

Verification Statement - Document summarizing the results of the environmental technology verification

Test Plan - Detailed planning document specifying the principles, testing methods, conditions and procedures, required to carry out testing and to produce test data

Data Quality - Characteristics of data that relate to their ability to satisfy stated requirements [SOURCE: ISO 14040:2006]

Test Report - Document describing conditions and results of testing

2.2 Terms related to technology

Technology - Application of scientific knowledge, tools, techniques, crafts, or systems in order to solve a problem or achieve an objective, which can result in a product or process

Product - Any goods or service [SOURCE: ISO 14050:2009]

Process - Set of interrelated or interacting activities that transforms inputs into outputs [SOURCE: ISO 14001]

Environmental Technology - Technology that either results in an environmental added value or measures parameters that indicate an environmental impact

Environmental Technology Verification - Verification of the performance of an environmental technology by a verifier

Environmental Impact - Change to the environment, whether adverse or beneficial, wholly or partially resulting from material acquisition, design, production, use, or end-of-use of a technology [SOURCE: adapted from ISO 14001]

Environmental Added Value - More beneficial or less adverse environmental impact of a technology with respect to the relevant alternative

Relevant Alternative - Technology applied currently in similar situation as the environmental technology for which performance will be verified through environmental technology verification

2.3 Terms related to performance

Performance - Measurable result; Performance relates to measurable results supported by numerical quantitative findings. [SOURCE: adapted from ISO 14001]

Performance Claim - Statement of the performance of the environmental technology declared by the applicant

Performance Parameter - Numerical or other measurable factor of the performance of a technology

3. General principles and requirements

3.1 Principles

General - The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively.

Factual approach - Verification statements are based on factual and relevant evidence collected through an objective confirmation of the performance of environmental technologies.

Sustainability - Environmental technology verification is a tool in support of sustainability, by providing credible information on the performance of environmental technologies.

Transparency and credibility - Environmental technology verification is based on reliable test results and robust procedures. The process is facilitated such that, to the greatest extent feasible, methods and data are fully disclosed and reports are clear, complete, objective and useful to the interested parties.

Flexibility - Environmental technology verification allows for flexibility in the specification of performance parameters and test methods. This is achieved through dialogue among the applicant, verifier and interested parties to maximize utility of environmental technology verification.

3.2 Requirements

When verifying performance of environmental technologies, the requirements of ISO/FDIS 14034 and the current version of ISO/IEC 17020 Conformity assessment – requirements for the operation of various types of bodies performing inspection - shall be applied and demonstrated.

4. Application review

4.1 Administrative review

Administrative review shall ensure that all information requested for the application has been provided in accordance with the requirements specified.

4.2 Technical review

Technical review shall ensure that:
a) The technology fulfils the definition of environmental technology
b) The performance claim for the intended application of the technology addresses the needs of the interested parties
c) The information on the technology is sufficient to review the performance claim.

4.3 Feedback to Applicant

Any issues related to the acceptance or rejection of the application that may arise from the administrative or the technical review shall be resolved prior to the verification. Acceptance or rejection of the application shall be communicated to the applicant with justification.

5. Pre-verification

5.1 Specification of performance to be verified

Performance to be verified shall be specified in consultation with the applicant prior to the establishment of the verification plan.

Performance parameters shall be specified considering that:
a) They are relevant and sufficient for the verification of the performance of the environmental technology, and the environmental added value, if applicable;
b) They correspond in full to the needs of the interested parties;
c) They can be quantitatively verified through testing;
d) Their numerical values can be verified under set operating conditions, using existing verification plans and relevant technical references, including standardized testing methods, preferably based on international standards.

5.2 Verification plan

The verification plan shall detail the verification procedure specific to the technology and the performance to be verified. The testing conditions specified in the verification plan shall be identical to the operational conditions of the technology defined. The verification plan shall include at a minimum:
a) Identification of the verifier;

b) Identification of the applicant;
c) Unique identification of the verification plan and date of issue;
d) Description of the technology;
e) A list of performance parameters and their assigned numerical values and the description of how they will be verified;
f) Technical and operational details of the planned verification;
g) Specification of the requirements for the test data, including quality and quantity and testing conditions;
h) Description of methods for the assessment of the test data and their quality.

NOTE:
- Requirements on data and data quality should refer to the quality level (e.g. regarding reproducibility, repeatability, ranges of confidence, accuracy, uncertainties,) generally accepted by the scientific community for the technology or (by default) in the industrial sector concerned.
- Other existing verification plans, similar relevant technical references including applicable legislation and standardized test methods, preferably international standards, should be used or referred to wherever available.

6. Verification

The verification of the performance shall be organized as follows: i) acceptance of existing test data; ii) generation of additional test data if needed and iii) confirmation of the performance based on the results of test data assessment.

6.1 Acceptance of existing test data

Test data provided by the applicant which were generated prior to verification may be accepted for the verification if they meet the following requirements:
a) They are relevant for the performance to be verified;
b) They are produced and reported according to the requirements of ISO/IEC 17025;
c) They meet the requirements specified in the verification plan.

If the existing test data do not meet the above requirements then additional test data shall be generated. This shall be communicated to the applicant.

6.2 Generation of additional test data

If any additional test data is required, they shall be produced meeting the requirements specified. This shall be communicated to the applicant.

6.3 Confirmation of performance

Existing test data, that is accepted and additional test data that is generated shall be assessed against the performance specified in the verification plan. The result of the assessment shall be a confirmation of the performance of the technology, achieved under the same conditions, constraints and limitations as those specified for the generation of the test data used for verification.

7. Reporting

7.1 Verification report

A verification report shall be developed. It shall adhere to the verification plan and shall include at a minimum:
a) Identification of the verifier;
b) Identification of the applicant;
c) Unique identification of the report and date of issue;
d) Date of verification;
e) Description of the technology;
f) Test results;
g) Verification results including the verified performance, test conditions, constraints and limitations under which they are met;
h) Description on how the requirements for the verification of the performance and for the test data, as specified in the verification plan, were met, including reporting of any deviations;
i) Signature or other indication of approval by verifier;

If it is necessary to include, information not verified under the environmental technology verification, this shall be clearly stated and explained. The report shall be submitted to the applicant for review and comment. The comments may be incorporated as deemed appropriate.

7.2 Verification statement

A short document summarizing the verification report shall be developed. It shall include at a minimum:

a) Identification of the verifier;
b) Identification of the applicant;
c) Unique identification of the statement and date of issue;
d) A summary description of the technology;
e) A summary description on how the requirements specified in the verification plan were met;
f) Verification results including the verified performance;
g) Description on how the requirements of the verification specified in the verification plan were met including reporting of any deviations
h) A summary of the verification results including the verified performance, test conditions, constraints and limitations under which they are met;
i) A statement that the verification plan has been addressed,
j) Any other information necessary to understand and use the verification statement
k) Signature or other indication of approval by the verifier.

If it is necessary to include, information not verified under the environmental technology verification this shall be clearly stated and explained. The statement shall be submitted to the applicant for review and comment. The comments may be incorporated as deemed appropriate.

8. Post-verification

8.1 Publication

At a minimum, the verification statement should be made available publicly. The publication shall be included in a publicly available directory (e.g. website).

The applicant shall make the statement available to interested parties in full and shall not use parts of the statement for any purpose.

8.2 Validity of the verification report / verification statement

The applicant shall:
a) Ensure that the technology which performance has been verified is conforming to the conditions as per its verification, published verification statement and report, if relevant;
b) Inform the verifier, in writing, of any changes that are made to the technology.

Based on the information provided by the applicant, the verifier shall determine the impact of any changes on the verified performance of the technology to the verification conditions, and therefore the validity of the verification statement and the verification report.

If it is determined that the verification statement and verification report are no longer valid, it shall be communicated to the applicant and made publicly available

8.3 Expiration

An expiration date may be established on the verification statement. After the defined time period, upon demonstration that no changes affecting the verified performance have occurred in the technology, the validity of the verification statement could be extended under the same conditions.

9. References

ISO/IEC 14001, Environmental management systems - Requirements with guidance for use

ISO/IEC 14025, Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO/IEC 14040, Environmental management — Life cycle assessment — Principles and framework

ISO/IEC 14050, Environmental management — Vocabulary

ISO/IEC 17020, General criteria for the operation of various types of bodies performing inspection

ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories

ISO Guide 82, Guidelines for addressing sustainability in standards

Appendix D. Raw data

Capture test raw data

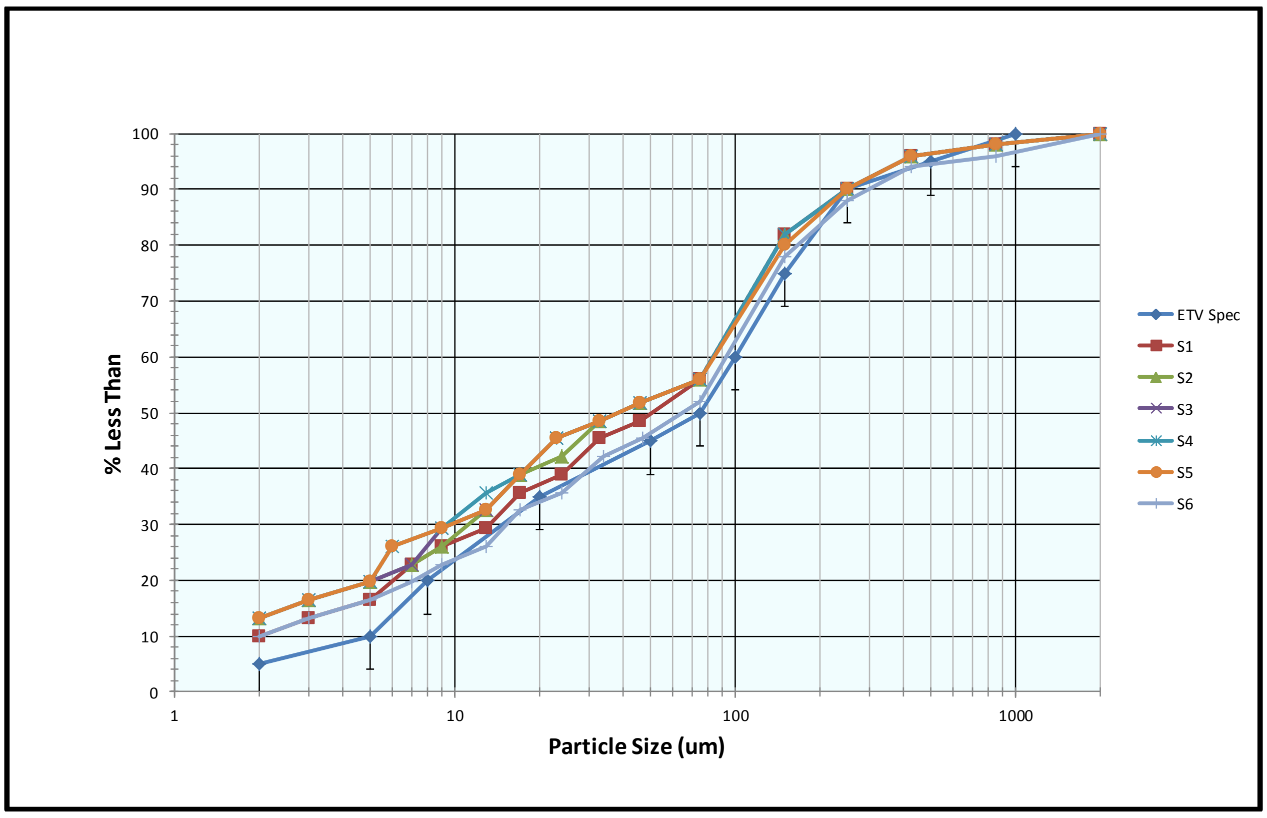


Figure D1. Feed sediment particle size distribution.

Table D1. Removal efficiency based on mass balance.

Run		S1	S2	S3	S4	S5	S6
Target Flow Rate	**(L/s)**	0.24	0.48	1.2	2.4	6.0	8.4
	(gpm)	3.8	7.7	19.0	38.0	95.1	133
Sediment Mass Added	**(kg)**	1.217	2.302	5.072	5.150	4.921	4.812
Sediment Captured in Catch Basin	**(kg)**	0.765	1.368	2.643	2.184	1.238	1.287
Sediment Captured on FCS and Grate	**(kg)**	0.013	0.010	0.016	0.012	0	0
Total Mass Captured	**(kg)**	0.778	1.378	2.659	2.196	1.238	1.287
Removal Efficiency	**(%)**	64.0	59.9	52.4	42.6	25.2	26.7

Scour test raw data

Run Summary for CB Shield – Simulated Streetscape

- Control (No CB Shield Installed)

Run Date: March 6th, 2015

Sediment Pre-load:

- The test sediment was the AGSCO silica sand (1-1000 micron)
- Sediment was pre-loaded on March 5th
- The total sediment load was 53 kg
- Following the preload, the sump was filled with water and allowed to sit overnight

Water Temperature:

Temperature at 1:00 minutes into run: 18.1 °C
Temperature at 7:00 minutes into run: 12.3 °C
Temperature at 13:00 minutes into run: 11.7 °C
Temperature at 52:30 minutes into run: 12.5 °C

Run Data:

Target Flow Rate	Run Time	Flow Rate
1.2 L/S (19 GPM)	0:00	19.3[1]
	0:30	19.7[1]
	1:00	19.8
	1:30	19.9
	2:00	19.9
	2:30	19.9
	3:00	19.9
	3:30	19.9
	4:00	19.8
	4:30	19.9
	5:00	19.9
	5:30	20.0
	6:00	22.3
Average Flow Rate (US GPM):		20.1
4.8 L/S (76 GPM)	6:30	74.2[1]
	7:00	76.3
	7:30	76.3
	8:00	76.3
	8:30	76.2
	9:00	76.2
	9:30	76.2
	10:00	76.0
	10:30	76.2
	11:00	76.1

	11:30	76.0
	12:00	80.7
Average Flow Rate (US GPM):		76.6
[1] Transition flow rate, not included in the average		
Target Flow Rate	Run Time	Flow Rate
8.4 L/S (133 GPM)	12:30	134.6[1]
	13:00	132.6
	13:30	132.9
	14:00	132.4
	14:30	132.5
	15:00	132.9
	15:30	132.8
	16:00	132.5
	16:30	132.7
	17:00	132.4
	17:30	132.6
	18:00	132.4
Average Flow Rate (US GPM):		132.6
12.0 L/S [2] (190 GPM)	25:00	185.2[1]
	25:30	188.7
	26:00	189.3
	26:30	189.5
	27:00	191.0
	27:30	191.0
	28:00	190.8
	28:30	190.8
	29:00	190.6
	29:30	191.0
	30:00	190.7
	30:30	191.2
Average Flow Rate (US GPM):		190.4
15.6 L/S [3] (247 GPM)	52:00	245.7[1]
	52:30	249.1
	53:00	248.2
	53:30	248.6
	54:00	248.0
	54:30	247.9
	55:00	247.9
	55:30	247.7
	56:00	248.1
	56:30	247.9
	57:00	247.8
	57:30	247.7
Average Flow Rate (US GPM):		248.1

[1] Transition flow rate, not included in the average

[2] The system was shut down between flow 8.4 L/s and flow 12.0 L/s due to standpipe overflow

[3] The system was shut down between flow 12.0 L/s and flow 15.6 L/s due to standpipe overflow

Effluent Analysis:

Run Time (minutes)	Sample ID	Sample Description	SSC (mg/L)	
			Measured	Corrected[4]
0:00	Background 1-1	Background sample taken at 1.2 L/s	< MDL	-
0:30	Effluent 1-1	1.2 L/s transition sample #1	94.3	94.3
1:00	Effluent 2-1	1st sample taken at 1.2 L/s	129.2	129.2
2:00	Effluent 3-1	2nd sample taken at 1.2 L/s	185.3	185.3
3:00	Effluent 4-1	3rd sample taken at 1.2 L/s	206.0	206.0
4:00	Effluent 5-1	4th sample taken at 1.2 L/s	176.0	176.0
5:00	Effluent 6-1	5th sample taken at 1.2 L/s	523.6	523.6
6:00	Effluent 7-1	6th sample taken at 1.2 L/s	495.7	495.7
7:00	Background 2-1	Background sample taken at 4.8 L/s	< MDL	-
6:30	Effluent 8-1	4.8 L/s transition sample #1	6420	6420
7:00	Effluent 9-1	1st sample taken at 4.8 L/s	7164	7164
8:00	Effluent 10-1	2nd sample taken at 4.8 L/s	8094	8094
9:00	Effluent 11-1	3rd sample taken at 4.8 L/s	6762	6762
10:00	Effluent 12-1	4th sample taken at 4.8 L/s	4842	4842
11:00	Effluent 13-1	5th sample taken at 4.8 L/s	5266	5266
12:00	Effluent 14-1	6th sample taken at 4.8 L/s	4768	4768
13:00	Background 3-1	Background sample taken at 8.4 L/s	1.8	-
12:30	Effluent 15-1	8.4 L/s transition sample #1	6665	6663
13:00	Effluent 16-1	1st sample taken at 8.4 L/s	5431	5429
14:00	Effluent 17-1	2nd sample taken at 8.4 L/s	6649	6648
15:00	Effluent 18-1	3rd sample taken at 8.4 L/s	5027	5025
16:00	Effluent 19-1	4th sample taken at 8.4 L/s	5861	5859
17:00	Effluent 20-1	5th sample taken at 8.4 L/s	5021	5019
18:00	Effluent 21-1	6th sample taken at 8.4 L/s	3251	3249
The system was shut down due to standpipe overflow				
25:30	Background 4-1	Background sample taken at 12.0 L/s	41.2	-
25:00	Effluent 22-1	12.0 L/s transition sample #1	1569	1528
25:30	Effluent 23-1	1st sample taken at 12.0 L/s	1927	1886
26:30	Effluent 24-1	2nd sample taken at 12.0 L/s	1474	1432
27:30	Effluent 25-1	3rd sample taken at 12.0 L/s	1208	1167
28:30	Effluent 26-1	4th sample taken at 12.0 L/s	1550	1508
29:30	Effluent 27-1	5th sample taken at 12.0 L/s	1141	1100
30:30	Effluent 28-1	6th sample taken at 12.0 L/s	749.5	708
The system was shut down due to standpipe overflow				
52:00	Effluent 29-1	15.6 L/s transition sample #1	Not tested	
52:30	Background 5-1	1st Background sample taken at 15.6 L/s	145.6	-
52:30	Effluent 30-1	1st effluent sample taken at 15.6 L/s	532.5	386.9
53:30	Background 6-1	2nd Background sample taken at 15.6 L/s	179.2	-
53:30	Effluent 31-1	2nd effluent sample taken at 15.6 L/s	432.0	252.7
54:30	Background 7-1	3rd Background sample taken at 15.6 L/s	182.4	-
54:30	Effluent 32-1	3rd effluent sample taken at 15.6 L/s	554.9	372.5
55:30	Background 8-1	4th Background sample taken at 15.6 L/s	198.2	-
55:30	Effluent 33-1	4th effluent sample taken at 15.6 L/s	530.6	332.4

56:30	Background 9-1	5th Background sample taken at 15.6 L/s	200.3	-
56:30	Effluent 34-1	5th effluent sample taken at 15.6 L/s	480.1	279.8
57:30	Background 10-1	6th Background sample taken at 15.6 L/s	210.0	-
57:30	Effluent 35-1	6th effluent sample taken at 15.6 L/s	520.2	310.2

MDL – Method detection limit

[4] $SSC_{corrected} = SSC_{measured} - SSC_{background}$

Run Summary for CB Shield Scour Testing

– Simulated Streetscape - With CB Shield Insert

Run Date: March 13th, 2015

Sediment Pre-load:

- The test sediment was the AGSCO silica sand (1-1000 micron)
- Sediment was pre-loaded on March 12th
- The total sediment load was 53 kg
- Following the preload, the sump was filled with water and allowed to sit overnight

Water Temperature:

Temperature at 1:00 minutes into run: 17.1 °C
Temperature at 7:00 minutes into run: 10.6 °C
Temperature at 13:00 minutes into run: 10.0 °C
Temperature at 19:00 minutes into run: 10.4 °C
Temperature at 25:00 minutes into run: 10.7 °C

Run Data:

Target Flow Rate	Run Time	Flow Rate
1.2 L/S (19 GPM)	0:00	17.7[1]
	0:30	18.8[1]
	1:00	18.8
	1:30	18.9
	2:00	18.9
	2:30	19.0
	3:00	18.9
	3:30	19.0
	4:00	18.9
	4:30	18.9
	5:00	18.9
	5:30	18.9
	6:00	18.9
Average Flow Rate (US GPM):		18.9
4.8 L/S (76 GPM)	6:30	50.9[1]
	7:00	76.6
	7:30	76.5
	8:00	76.2
	8:30	76.0
	9:00	75.8
	9:30	76.0
	10:00	76.0
	10:30	75.8

	11:00	75.8
	11:30	76.0
	12:00	75.9
Average Flow Rate (US GPM):		76.1
[1] Transition flow rate, not included in the average		
Target Flow Rate	Run Time	Flow Rate
8.4 L/S (133 GPM)	12:30	131.0[1]
	13:00	132.6
	13:30	132.5
	14:00	132.8
	14:30	132.7
	15:00	132.6
	15:30	133.0
	16:00	132.8
	16:30	132.8
	17:00	132.8
	17:30	132.8
	18:00	132.6
Average Flow Rate (US GPM):		132.7
12.0 L/S (190 GPM)	25:00	181.9[1]
	25:30	187.6
	26:00	188.5
	26:30	189.8
	27:00	189.4
	27:30	189.2
	28:00	190.0
	28:30	189.4
	29:00	189.6
	29:30	190.0
	30:00	189.9
	30:30	189.9
Average Flow Rate (US GPM):		189.4
15.6 L/S (247 GPM)	52:00	247.5[1]
	52:30	248.0
	53:00	247.8
	53:30	247.6
	54:00	247.5
	54:30	247.6
	55:00	247.7
	55:30	247.6
	56:00	247.6
	56:30	247.7
	57:00	247.6
	57:30	247.5
Average Flow Rate (US GPM):		247.7

[1] Transition flow rate, not included in the average

Effluent Analysis:

Run Time (minutes)	Sample ID	Sample Description	SSC (mg/L)	
			Measured	Corrected[2]
0:00	Background 1-1	Background sample taken at 1.2 L/s	< MDL	-
0:30	Effluent 1-1	1.2 L/s transition sample #1	31.5	31.5
1:00	Effluent 2-1	1st sample taken at 1.2 L/s	17.7	17.7
2:00	Effluent 3-1	2nd sample taken at 1.2 L/s	6.5	6.5
3:00	Effluent 4-1	3rd sample taken at 1.2 L/s	2.7	2.7
4:00	Effluent 5-1	4th sample taken at 1.2 L/s	3.1	3.1
5:00	Effluent 6-1	5th sample taken at 1.2 L/s	4.6	4.6
6:00	Effluent 7-1	6th sample taken at 1.2 L/s	< MDL	< MDL
7:00	Background 2-1	Background sample taken at 4.8 L/s	< MDL	-
6:30	Effluent 8-1	4.8 L/s transition sample #1	3.0	3.0
7:00	Effluent 9-1	1st sample taken at 4.8 L/s	8.2	8.2
8:00	Effluent 10-1	2nd sample taken at 4.8 L/s	4.0	4.0
9:00	Effluent 11-1	3rd sample taken at 4.8 L/s	< MDL	< MDL
10:00	Effluent 12-1	4th sample taken at 4.8 L/s	< MDL	< MDL
11:00	Effluent 13-1	5th sample taken at 4.8 L/s	1.7	1.7
12:00	Effluent 14-1	6th sample taken at 4.8 L/s	< MDL	< MDL
13:00	Background 3-1	Background sample taken at 8.4 L/s	< MDL	-
12:30	Effluent 15-1	8.4 L/s transition sample #1	2.5	2.5
13:00	Effluent 16-1	1st sample taken at 8.4 L/s	5.4	5.4
14:00	Effluent 17-1	2nd sample taken at 8.4 L/s	10	10
15:00	Effluent 18-1	3rd sample taken at 8.4 L/s	9.5	9.5
16:00	Effluent 19-1	4th sample taken at 8.4 L/s	10	10
17:00	Effluent 20-1	5th sample taken at 8.4 L/s	8.4	8.4
18:00	Effluent 21-1	6th sample taken at 8.4 L/s	8.2	8.2
19:00	Background 4-1	Background sample taken at 12.0 L/s	1.6	-
18:30	Effluent 22-1	12.0 L/s transition sample #1	21.1	19.5
19:00	Effluent 23-1	1st sample taken at 12.0 L/s	40.0	38.4
20:00	Effluent 24-1	2nd sample taken at 12.0 L/s	81.0	79.4
21:00	Effluent 25-1	3rd sample taken at 12.0 L/s	115	113
22:00	Effluent 26-1	4th sample taken at 12.0 L/s	104	103
23:00	Effluent 27-1	5th sample taken at 12.0 L/s	116	114
24:00	Effluent 28-1	6th sample taken at 12.0 L/s	93.9	92.3
25:00	Background 5-1	1st Background sample taken at 15.6 L/s	2.0	-
24:30	Effluent 29-1	15.6 L/s transition sample #1	131.3	128.0
25:00	Effluent 30-1	1st sample taken at 15.6 L/s	180.8	177.4
26:00	Effluent 31-1	2nd sample taken at 15.6 L/s	214.9	211.6
27:00	Effluent 32-1	3rd sample taken at 15.6 L/s	223.7	220.3

28:00	Effluent 33-1	4th sample taken at 15.6 L/s	191.1	187.8
29:00	Effluent 34-1	5th sample taken at 15.6 L/s	227.7	224.4
30:00	Effluent 35-1	6th sample taken at 15.6 L/s	202.5	199.2
30:00	Background 6-1	2nd Background sample taken at 15.6 L/s	4.6	-

MDL – Method detection limit

[2] $SSC_{corrected} = SSC_{measured} - SSC_{background}$

For additional datasets please request for vendor's CETV formal application.

Development Export Summary

Development :ARMSTRONG ESTATES OF MANSFIELD

Pre-Development Phosphorus Export

DEVELOPMENT : ARMSTRONG ESTATES OF MANSFIELD

Landuse		Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Agricultural				
Cropland	Agricultural Fields	18.43		3.53
	Agricultural Land use Class Total :	**18.43**		**3.53**
Natural Heritage				
Forest		2.85	0.06	0.17
	Natural Heritage Land use Class Total :	**2.85**		**0.17**
	Development Total :	**21.28**		**3.70**

Cropland Site Sediment & Phosphorus Pre-Development Export

DEVELOPMENT : ARMSTRONG ESTATES OF MANSFIELD

COLOUR KEY : Site Specific Input | Constant / Lookup | Calculation

SubArea : Agricultural Fields

Slope Area (ha)	18.43	R (rainfall / runoff for Lake Simcoe)	90.00
Surface Slope Gradient (%)	4.00	K (soil errodability factor)	0.49
Length of Slope (m)	300.00	NN (determined by slope)	0.40
Cropt Type Factor)	0.02	LS (slope length gradient factor)	1.00
Tillage Type Factor	0.90	C (crop management factor)	0.02
		P (prevention + capture)	0.25
		Soil Loss (kg/year)	0.20
		Phosphorus export (kg/ha/yr)	0.19
		Phosphorus load (kg/yr)	3.53

PRE Developed Area (ha) :	**18.43**
Phosphorus export (kg/ha/yr) :	**0.19**
Phosphorus load (kg/yr) :	**3.53**

Updated : Sept 2014

Post-Development Phosphorus Export

DEVELOPMENT : ARMSTRONG ESTATES OF MANSFIELD

Landuse	Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Natural Heritage			
Forest	2.58	0.06	0.15
Low Intensity Residential	1.43	0.13	0.19
Low Intensity Residential	14.33	0.13	1.86
Natural Heritage Land use Class Total :	**18.33**		**2.20**
Urban			
Residential	1.42	0.41	0.24
Residential	1.53	0.41	1.40
Urban Land use Class Total :	**2.95**		**1.64**
Development Total :	**21.28**		**3.84**

1/31/2024 Page 1 of 1

Updated : Sept 2014

Cropland Site Sediment & Phosphorus Post-Development Export

DEVELOPMENT : ARMSTRONG ESTATES OF MANSFIELD

COLOUR KEY : Site Specific Input | Constant / Lookup | Calculation

SubArea :

Slope Area (ha)
Surface Slope Gradient (%)
Length of Slope (m)

Cropt Type Factor)
Tillage Type Factor

R (rainfall / runoff for Lake Simcoe)
K (soil errodability factor)
NN (determined by slope)

LS (slope length gradient factor)
C (crop management factor)
P (prevention + capture)
Soil Loss (kg/year)
Phosphorus export (kg/ha/yr)
Phosphorus load (kg/yr)

PRE Developed Area (ha) :
Phosphorus export (kg/ha/yr) :
Phosphorus load (kg/yr) :

1/31/2024 Page 1 of 1

Updated : Sept 2014

Post Dev BMP

Area (ha)	Treated Area %	P coefficient	P coefficient	P Load Reduction (kg/yr)	Rationale
Best Management Practices (BMP) Applied (and Rationale)					
Low Intensity Residential					
14.33	87	0.13	20 %	0.32	Catchment 201: Imbrium Stormceptor EFO units are ETV certified and are credited with 20% TP Removal.
User Entry					
Residential					
1.53	100	0.41	20 %	0.13	Catchment 202: Imbrium Stormceptor EFO units are ETV certified and are credited with 20% TP Removal.
User Entry					

Updated : Sept 2014

Development Area P and BMP Summary

Total PreDevelopment Area (ha):	21.28
PreDevelopment Area excluding Wetlands (ha):	21.28
Total PostDevelopment Area (ha):	21.28
Total Area treated by BMP's (ha):	14.00
Treated Area total:	15.86
Total PreDevelopment Load (kg/yr):	3.70
Total PostDevelopment Load (kg/yr):	3.84
Total P Load Reduction with BMP's (kg/yr):	0.45
Minimum P Load Reduction Required:	0.14
Total PostDevelopment Load with BMP's (kg/yr)	3.39

Conclusion : Net increase in P load, additional reduction is required.

Updated : Sept 2014

Post Dev Construction

Sediment Control Measures - Filtration Controls

Storm Drain Inlet Protection

Sediment Control Measures - Perimeter Controls

Sediment/Silt Fence
Vehicle Tracking Control/Mud Mat

Sediment Control Measures - Settling Controls

Storm Drain Outfall Protection

APPENDIX E

Preliminary Engineering Drawings

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them

Drawings shall not be used for construction unless sealed and signed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

Any errors and/or omissions shall be reported to Pinestone Engineering Ltd. without delay.

PEL
PINESTONE ENGINEERING LIMITED | www.pel.ca

BENCHMARK

BM#1
TOP OF IRON BAR AT NORTH WEST CORNER OF THE SITE
ELEV. 310.14

SEAL

DRAWN BY:	CHECKED BY:
C.A.	J.V.
DESIGNED BY:	
D.H.	
SCALE:	DATE:
1:1000	OCT. 2021

NO.	YY.MM.DD	REVISION	BY

NORTH ARROW

PROJECT:
MANSFIELD SUBDIVISION
TOWNSHIP OF MULMUR

DRAWING:
EXISTING CONDITIONS PLAN

PROJECT No. :
20-11584B

DRAWING No.
EX-1

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them

Drawings shall not be used for construction unless sealed and signed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

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PEL
PINESTONE ENGINEERING LIMITED | www.pel.ca

BENCHMARK

BM#1
TOP OF IRON BAR AT NORTH WEST CORNER OF THE SITE
ELEV. 310.14

SEAL

DRAWN BY:	CHECKED BY:
C.A.	J.V.
DESIGNED BY: D.H.	
SCALE: 1:1000	DATE: JAN 2024

NO.	YY.MM.DD	REVISION	BY

NORTH ARROW

PROJECT:
MANSFIELD SUBDIVISION
TOWNSHIP OF MULMUR

DRAWING:
CONCEPTUAL GRADING PLAN

PROJECT No. : 20-11584B

DRAWING No. GP-1

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them

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Any errors and/or omissions shall be reported to Pinestone Engineering Ltd. without delay.

PEL
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BENCHMARK
BM#1
TOP OF IRON BAR AT NORTH WEST CORNER OF THE SITE
ELEV. 310.14

SEAL

DRAWN BY:	CHECKED BY:
C.A.	J.V.
DESIGNED BY:	
D.H.	
SCALE:	DATE:
1:1000	JAN 2024

NO.	YY.MM.DD	REVISION	BY

NORTH ARROW

PROJECT:
MANSFIELD SUBDIVISION
TOWNSHIP OF MULMUR

DRAWING:
CONCEPTUAL SERVICING PLAN

PROJECT No. :
20-11584B

DRAWING No.
SERV-1

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BENCHMARK

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SEAL

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DESIGNED BY: D.H.	
SCALE: 1:1000	DATE: JAN 2024

NO.	YY.MM.DD	REVISION	BY

NORTH ARROW

PROJECT:
MANSFIELD SUBDIVISION
TOWNSHIP OF MULMUR

DRAWING:
PRE-DEVELOPMENT CATCHMENT PLAN

PROJECT No. : 20-11584B

DRAWING No. PRE-1

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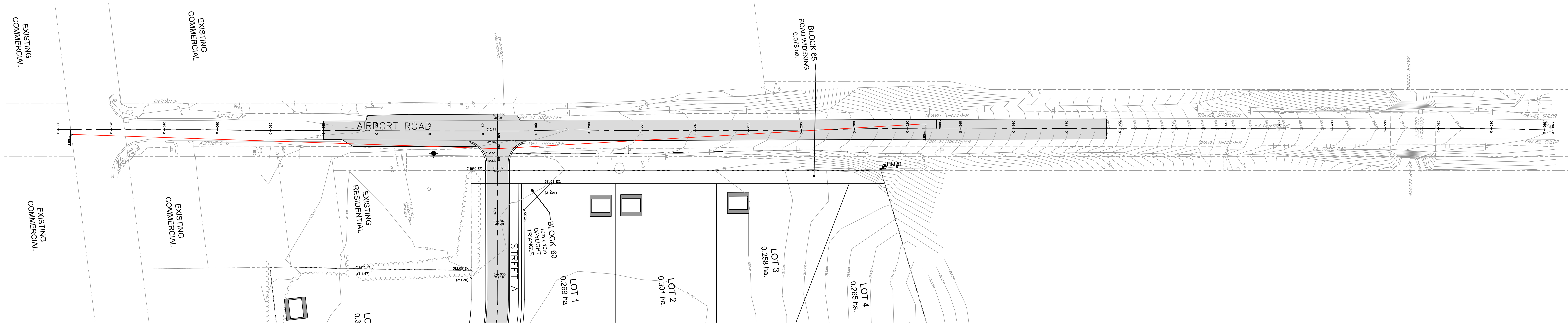
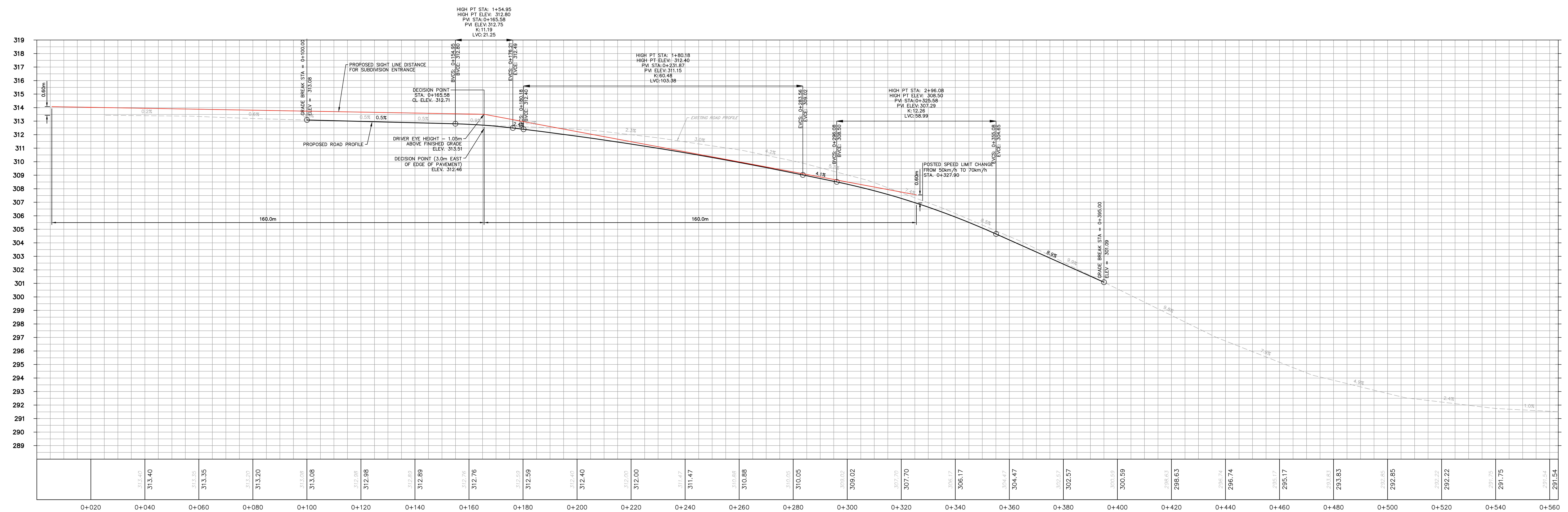
SEAL	DRAWN BY: C.A.	CHECKED BY: J.V.
	DESIGNED BY: D.H.	
	SCALE: 1:1000	DATE: JAN 2024

NO.	YY.MM.DD	REVISION	BY

NORTH ARROW

PROJECT:	PROJECT No. :
MANSFIELD SUBDIVISION TOWNSHIP OF MULMUR	20-11584B
DRAWING:	DRAWING No.
POST-DEVELOPMENT CATCHMENT PLAN	POST-1





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SEAL

DRAWN BY:	CHECKED BY:
C.A.	J.V.
DESIGNED BY: J.V./C.A.	
SCALE: HOR. 1:750 VERT. 1:150	DATE: JAN 2024

NO.	YY.MM.DD	REVISION	BY

NORTH ARROW

PROJECT:
MANSFIELD SUBDIVISION
TOWNSHIP OF MULMUR

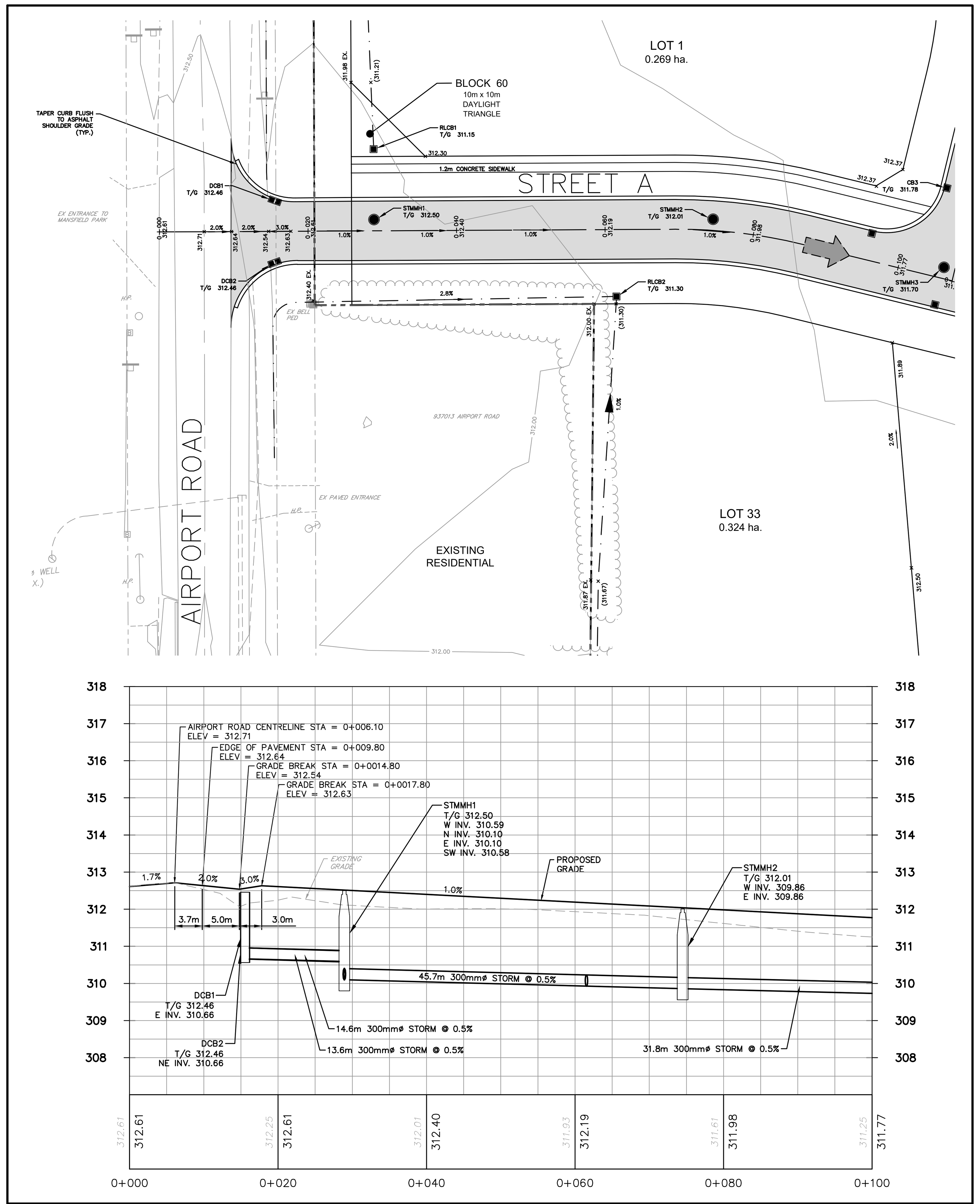
DRAWING:
AIRPORT ROAD SIGHT LINE PROFILE
0.25m BELOW CENTRELINE ELEVATION

PROJECT No. : 20-11584B

DRAWING No. PP-2

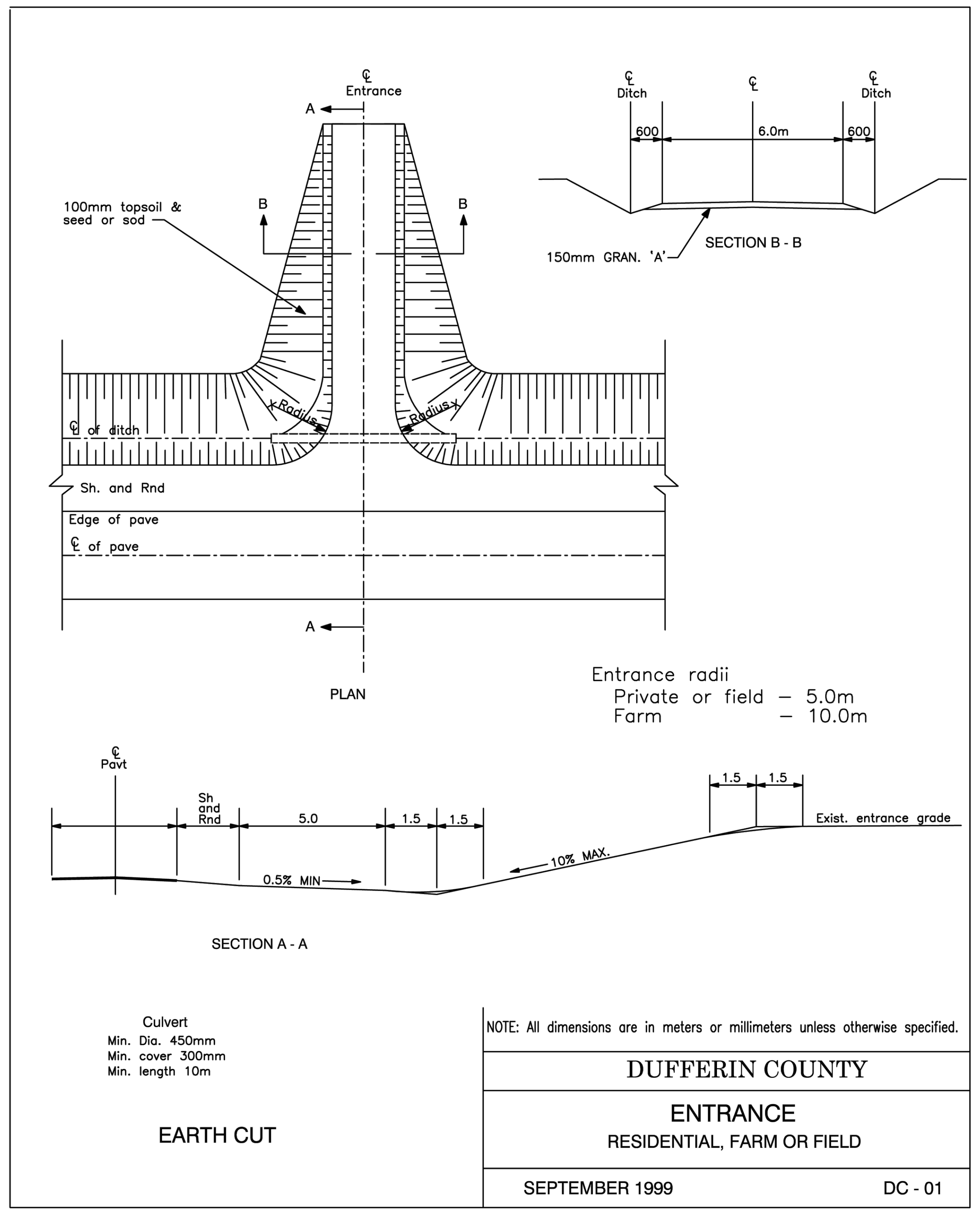
GENERAL NOTES

1. All standards in accordance with current Ontario Provincial Standard Drawings (OPSD) and Ontario Provincial
2. Standard Specifications (OPSS) unless otherwise noted.
3. All dimensions are in metres. Pipe sizes in millimetres unless otherwise noted.
4. Notify Bell Canada, ICG, Water and Sewer, Hydro and Cable Departments (where applicable) 72 hours prior to commencement for locates.
5. All construction to be completed to the satisfaction of the Engineer.
6. All services and utilities to be supported as per OPSD–1007.01
7. All trenching to be in accordance with the Occupational Health and Safety Act.
8. All traffic control and signage to be in accordance with M.T.O. requirements.
9. Township of Mulmur and Engineer to be notified at least 72 hours prior to construction.
10. Wherever pipes are passing through uncompacted fill areas, the bedding trench shall be excavated to the undisturbed ground level and backfilled with Granular 'A' compacted to 95% standard proctor density or as otherwise shown on the drawings.
11. The location of underground and above ground utilities and structures shown on drawings is approximate only and may not be complete. The exact location of all utilities and structures shall be determined by consulting the municipal authorities and utilities companies concerned. The contractor shall prove the exact location of all utilities and structures before construction and shall be responsible for adequately protecting them against damage, assuming all liabilities for damage of such.
12. The Contractor must check and verify dimensions, obtain all utility locates, and obtain all required permits and licenses and verify existing service elevations before proceeding with any work.
13. Latest approved drawings to be used for construction and all discrepancies reported to the engineer.
14. Drawings are not to be scaled.
15. Pipe length as labeled is measured horizontally along pipe centre line and may differ from baseline chainage where baseline is not parallel to pipe.
16. Utilize erosion and siltation controls as necessary during construction.
17. Ensure accessibility to existing residential driveways at all times.
18. Ensure adequate protection to all culverts.



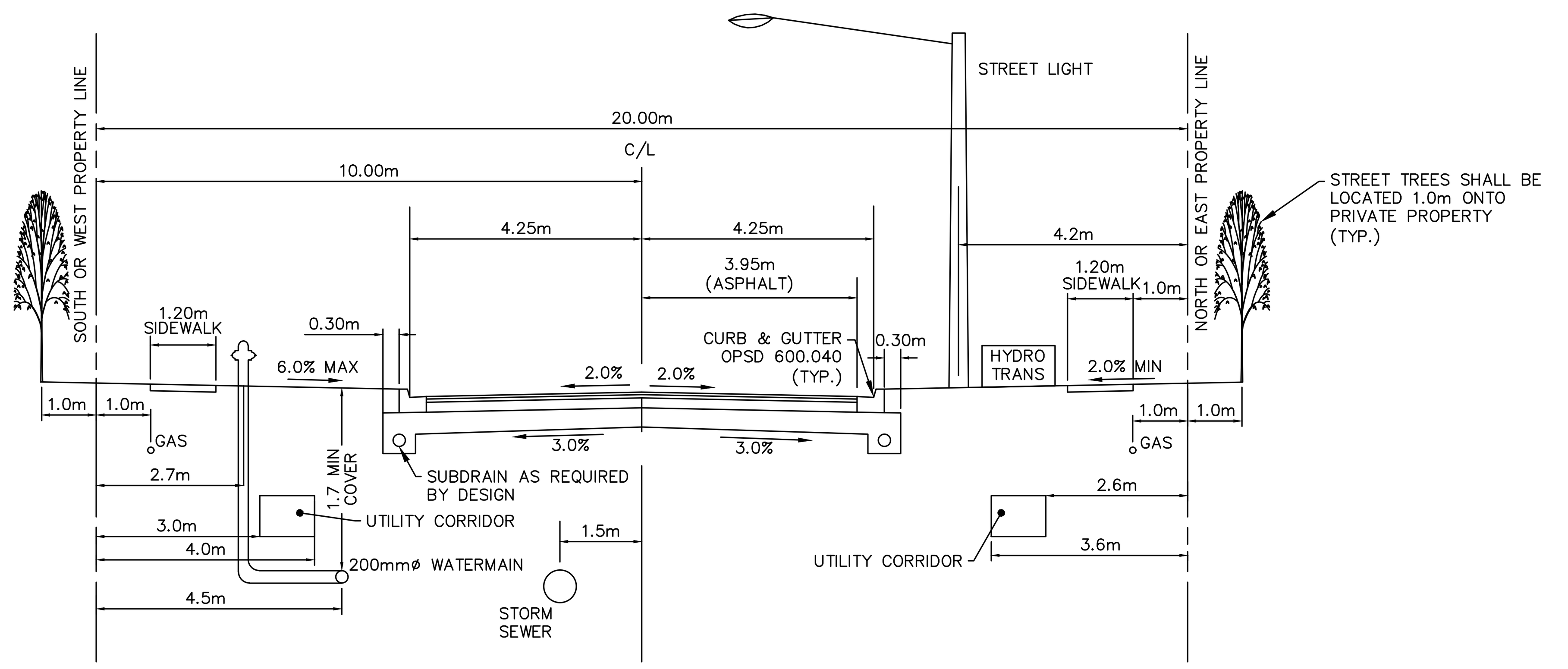
STREET A ENTRANCE DETAIL

HOR. 1:500
VER. 1:100



NOTES:
1. GRANULAR ROAD BASE TO BE COMPACTED TO 100% S.P.D.
2. LIGHTING FIXTURES TO BE L.E.D. (TYPE TO BE APPROVED BY TOWNSHIP ENGINEER)
3. THICKNESS OF ASPHALT AND GRANULAR BASE AS PER GEOTECHNICAL RECOMMENDATIONS
4. BOULEVARDS TO RECEIVE 150mm DEPTH TOPSOIL AND SOD.
5. SIDEWALK TO BE INSTALLED ON ONE SIDE OF THE STREET ONLY.

MINIMUM ROAD BASE REQUIREMENTS
- 40mm HL–3 SURFACE COURSE
- 50mm HL–8 BASE COURSE
- 150mm GRANULAR 'A'
- 300mm GRANULAR 'B'



TYPICAL ROAD CROSS SECTION
20.0m ROAD ALLOWANCE – URBAN SECTION

HOR. 1:500

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NORTH ARROW

PROJECT:
MANSFIELD SUBDIVISION
TOWNSHIP OF MULMUR

DRAWING:
AIRPORT ROAD DETAILS PLAN

PROJECT No. :
20-11584B

DRAWING No.
DET-1