APARTMENT DEVELOPMENT
202 DUNLOP STREET W - CITY OF BARRIE
STORMWATER MANAGEMENT REPORT & CONSTRUCTION MITIGATION PLAN

Prepared by:

Pinestone Engineering Ltd.
Barrie Office
20 Bell Farm Road
Barrie, Ontario L4M 6E4

Phone: 705-503-1777
Fax: 705-645-7262
Email: pinestone@pel.ca
Web: www.pel.ca

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1.0 INTRODUCTION

1.1 General

The proposed development is located at 202 Dunlop Street, 50m northeast of the intersection of Dunlop Street W and Frances Street. The property is legally described as Lots 7 & 8 and Part of Lot 6 of Registered Plan 27 in the City of Barrie, County of Simcoe.

The subject site is approximately 0.243 hectares (0.6 acres) in area. The property is currently occupied by two residential dwellings, a commercial building, and asphalt surfaces. Vegetation on the property generally consists of fair condition lawn. The site is bounded by Dunlop Street W to the south and residential development to the north, east, and west. The location of the subject site is illustrated on Figure 1.

The proposed development will include a 4-storey building with 33 apartment units and 120m^2 of commercial space. Access to the development will be provided by a single driveway connection to Dunlop Street W. Parking for the development will be provided via outdoor surface parking facility and a ground floor parking garage. A copy of the site plan prepared by Innovative Planning Solutions is included in Appendix A for further details.

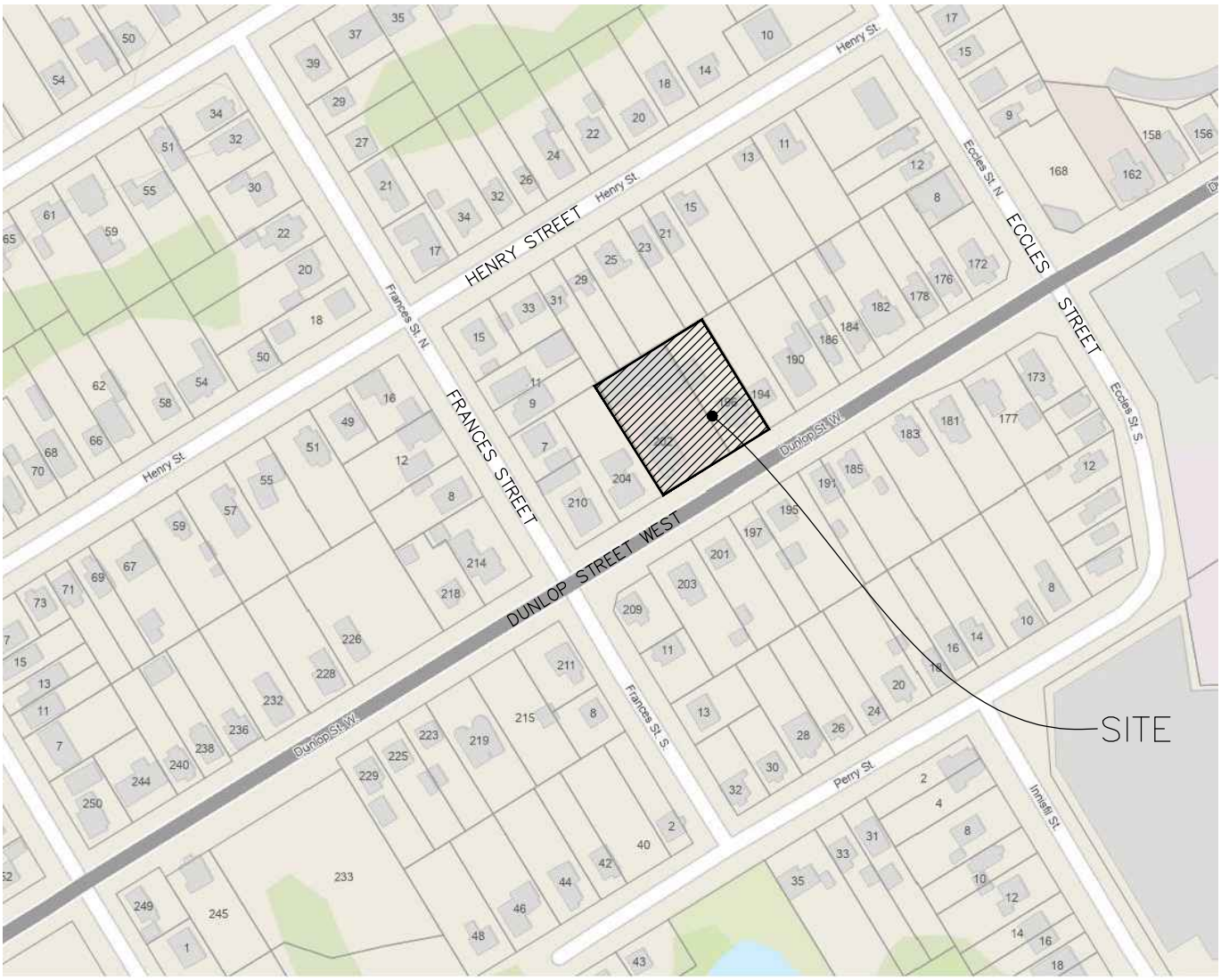
1.2 Purpose and Scope

Pinestone Engineering Ltd (PEL) has been retained by the property owner to prepare a Storm Water Management Report in support of a Site Plan Application. The report describes the stormwater quality and quantity control strategy for the site.

2.0 REFERENCE REPORTS

The following reports and studies have been used for reference in the preparation of this Storm Water Management Report:

i) *Stormwater Infrastructure Design Standard, prepared by the City of Barrie Engineering Department, June 2023.*
ii) *Technical Guidelines for Storm Water Management Submissions, prepared by the Lake Simcoe Region Conservation Authority (LSRCA), Effective Date: April 2022.*
iii) *Lake Simcoe Protection Plan, June 2009*
iv) *Development Manual, prepared by the City of Barrie Engineering Department, April 2023.*
v) *Storm Water Management Planning and Design Manual, prepared by the Ministry of the Environment, Conservation, and Parks (MECP), March 2003.*
vi) *Low Impact Development Manual, prepared by Credit Valley Conservation and Toronto and Region Conservation Authority (TRCA), 2010.*
vii) *City of Barrie Infiltration Low Impact Development Screening Process, 2017.*
viii) *Phosphorus Offsetting Policy, prepared by the LSRCA, Effective Date: May 2023.*
ix) *Water Balance Recharge Offsetting Policy, prepared by the LSRCA, Effective Date: May 2023.*



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202 DUNLOP STREET WEST
CITY OF BARRIE

LOCATION PLAN

DATE:	SCALE:	PROJECT No.	FIGURE No.
AUG. 2022	N.T.S.	22-11713B	FIGURE 1

3.0 EXISTING CONDITIONS

3.1 General

The subject site is approximately 0.243 hectares (0.6 acres) in area. The property is currently occupied by two residential dwellings, a commercial building, and asphalt surfaces. Vegetation on the property generally consists of fair condition lawn. The site is located within the City's urban servicing area and municipal services are available for connection beneath Dunlop Street. Existing services to the property not being utilized for the proposed development will be decommissioned in accordance with City of Barrie standards.

3.2 Topography

Based on a review of the topographic survey provided by KRCMAR SURVEYORS LTD., the property slopes southerly towards the Dunlop Street W ROW at an average slope of 2.0%. Elevations across the site range between 229.24m ASL at the northwestern corner of the site to 228.16m ASL at the southeastern corner of the site.

3.3 Site Geology

A geotechnical investigation for the subject property was completed by GEI Consultants in January 2022. The field investigation consisted of drilling three boreholes extending to depths of approximately 6.6m below grade. Based on our review of their report, the subsurface soils generally consist of a shallow layer of fill overlaying a deep layer of sand with traces of silt.

Monitoring wells were installed in all three boreholes to monitor the groundwater levels in the vicinity of the site. Groundwater level monitoring revealed measurements ranging from 4.82 – 5.0m below the ground surface across the site on December 9th, 2021 and January 7th, 2022.

Based on our review of the soil information provided by GEI Consultants, we have classified the site material as a Type AB under the Soil Conservation Service, hydrologic soil group as outlined in the *MTO Drainage Manual Volume 3, Design Chart 1.08*. Reference to this design chart, and a copy of the geotechnical investigation, is included in Appendix B.

3.4 Drainage Conditions

A 375mm diameter storm sewer exists beneath the eastbound lane of Dunlop Street W. Site drainage is directed to the existing catch basins in the Dunlop Street W ROW, via overland sheet flow, and discharges to the Dunlop Street W storm sewer system. The Dunlop Street W storm sewer ultimately conveys drainage easterly to Kidd's Creek.

The site is not located within an LSRCA regulated area based on available mapping on their website, however, the site is considered a "major development" as defined in the Lake Simcoe Protection Plan, therefore a phosphorus loading analysis is required in accordance with the LSRCA Phosphorus Offsetting Policy (2023), and a water balance analysis is required in accordance with the LSRCA Water Balance Recharge Offsetting Policy (2023).

4.0 PROPOSED DEVELOPMENT

The proposed development will include a 4-storey building with 33 apartment units and 120m^2 of commercial space. Access to the development will be provided by a single driveway connection to Dunlop Street W. Parking for the development will be provided via outdoor surface parking facility and a ground floor parking garage.

Catchment 201, consisting of drainage generated from the outdoor parking lot will be directed to a catch basin installed within the driveway. Stormwater will be attenuated within a surface cell created in the parking lot. Flows will be attenuated by an online orifice plate installed within the outlet pipe from CB#1. Drainage generated from catchment 202, consisting of rooftop and landscape area, with controlled flows from catchment 201 will be routed through a hydrodynamic separator for treatment, prior to discharging offsite via a storm sewer connection to the existing storm sewer network beneath Dunlop Street W. Drainage generated from catchment 203, consisting of perimeter landscape, balconies, and the driveway entrance, will continue to sheet flow to the Dunlop Street W ROW like pre-development conditions.

5.0 HYDROLOGY

5.1 Design Criteria

Based on a review of the City of Barrie's Stormwater Infrastructure Design Standard, and the LSRCA's Offsetting Policies, 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 allowable release rates using the City of Barrie's WPCC IDF parameters.
- Both the 4-hour Chicago and 24-hour SCS Type II storms will be modelled for the specified storm events.
- Safe conveyance of the regulatory flows through the site to a sufficient outlet is required. The regulatory storm for developments within the Kidd's Creek watershed is the Hurricane Hazel Flood Event Standard in accordance with Ontario Regulation 179/06.

Quality Control:

- The City of Barrie and the LSRCA in accordance with Ontario Regulation 219/09 regarding water quality and phosphorus loading to Lake Simcoe, 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 City of Barrie and LSRCA requirements and the Lake Simcoe Protection Plan.

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

5.2 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
- Hurricane Hazel Flood Event

Rainfall intensity - duration frequency (IDF) values for the Barrie Area were entered into an equation that expresses the time relationship intensity 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 the intensity, duration, frequency (IDF) data. In addition to the “Chicago” storms, the 24-hour SCS Type II storms, and the Hurricane Hazel regional storm were also modelled as required by the City of Barrie.

The IDF curve parameters for the City of Barrie are outlined in Table 1, below. A copy of the IDF values taken from the City’s Stormwater Infrastructure Design Standard are included in Appendix C.

Table 1
Barrie WPCC IDF Curve Parameters

Rainfall Event	Parameter		
	A	B	C
2 Yr	675.586	4.681	0.780
5 Yr	843.019	4.582	0.763
10 Yr	976.898	4.745	0.760
25 Yr	1133.123	4.734	0.756
50 Yr	1251.473	4.847	0.753
100 Yr	1383.628	4.905	0.754

5.3 Drainage Catchments

One (1) pre-development and three (3) 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 area represents the existing condition of the development area, which consists of residential buildings, a commercial building, pavement, and landscape area. The post-development catchments represent the new grading concept for the proposed development area with the addition of an apartment building, paved surfaces, and landscape area. The pre-development and post-development catchment parameters are included in Appendix C. Pre-development and post-development catchment areas are illustrated on drawings PRE-1 and POST-1 included in Appendix D.

5.4 Modelling Results

The results of the hydrologic modelling are displayed in Tables 2 and 3 below for the Hurricane Hazel 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 2
Model Results - 4hr Chicago Distributions

	2Yr	5Yr	10Yr	25Yr	50Yr	100Yr
PRE-DEVELOPMENT (m^3/sec)						
Catchment 101	0.054	0.071	0.083	0.100	0.112	0.124
Total Pre-Development Runoff Rate	**0.054**	**0.071**	**0.083**	**0.100**	**0.112**	**0.124**
POST-DEVELOPMENT (m^3/sec)						
Catchment 201	0.025	0.033	0.038	0.044	0.049	0.054
Catchment 202	0.026	0.034	0.039	0.047	0.052	0.057
Catchment 203	0.006	0.008	0.009	0.011	0.012	0.014
Total Post-Development Runoff Rate	**0.056**	**0.074**	**0.086**	**0.102**	**0.113**	**0.125**

Table 3
Model Results - 24hr SCS Type II and Hurricane Hazel Regional Storm Distributions

	2Yr	5Yr	10Yr	25Yr	50Yr	100Yr	Hazel
PRE-DEVELOPMENT (m^3/sec)							
Catchment 101	0.033	0.048	0.061	0.074	0.084	0.094	0.034
Total Pre-Development Runoff Rate	**0.033**	**0.048**	**0.061**	**0.074**	**0.084**	**0.094**	**0.034**
POST-DEVELOPMENT (m^3/sec)							
Catchment 201	0.015	0.021	0.025	0.031	0.035	0.038	0.013
Catchment 202	0.015	0.023	0.027	0.033	0.038	0.042	0.015
Catchment 203	0.004	0.006	0.008	0.010	0.012	0.013	0.007
Total Post-Development Runoff Rate	**0.034**	**0.050**	**0.060**	**0.074**	**0.084**	**0.093**	**0.034**

Based on the calculated results of the hydrological modelling, it is expected that post-development flows directed to the existing Dunlop Street W storm sewer will only slightly increase during the modelled storm events. In the pre-development condition, the property is approximately 69.3% impervious. In the post-development condition, the site experiences a slight increase in impervious area to approximately 72.2%. Visual OTTHYMO modelling files are included in Appendix C.

6.0 STORM WATER MANAGEMENT PLAN

6.1 Quantity Control

As noted in the comparison of the pre-development and post-development flows, a slight increase in runoff will occur due to the proposed construction of the building 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 attenuating pavement drainage in a surface storage cell created within the rear parking lot.

Catchment 201, consisting of drainage generated from the rear parking lot, will be directed to a private onsite storm sewer installed within the asphalt driveway. Flows will be attenuated by a 70mm dia. online orifice plate installed within the outlet pipe from the receiving catch basin (CB#1) at an elevation of 226.60m ASL. Storage volume is provided in a surface cell created within the parking lot once ponding elevations exceed the top of grate of CB#1 at an elevation of 228.15m ASL. The maximum ponding elevation for the 5-year and 100-year events will be 228.26m ASL and 228.34m ASL, respectively. This limits ponding above the asphalt surface to below 0.3m.

Drainage generated from catchment 202, consisting of rooftop and landscape area, with controlled flows from catchment 201 will be routed through a hydrodynamic separator for treatment, prior to discharging offsite via a storm sewer connection to the existing storm sewer network beneath Dunlop Street W. The new private storm sewer is sized to convey

the 100-year event flows to the existing municipal storm sewer, and a design sheet is included in Appendix C.

Major overland flow generated during storm events greater than the 100-year event from catchments 201 & 202 will overflow a curb outlet weir once water levels exceed 228.40m ASL in the parking lot and discharge to the Dunlop Street W ROW through perimeter swales.

Drainage generated from catchment 203, consisting of perimeter landscape, balconies, and the driveway entrance, will continue to sheet flow offsite to the existing storm sewer system beneath Dunlop Street W like pre-development conditions.

The stage-storage-discharge relationship of the proposed stormwater management facility is summarized in Table 4.

Table 4
Stage-Storage-Discharge Relationship of Storage Cells

	Description	Control Stage (m)	Elevation (m)	Volume (m^3)	Discharge (m^3/s)
Catchment 201: Parking Lot Surface Ponding (70mm Dia. Orifice in CB#1)	Orifice Invert	0.00	226.60	0.00	0.0000
	Contour	0.17	226.80	0.07	0.0044
	Contour	0.37	227.00	0.14	0.0065
	Contour	0.56	227.20	0.22	0.0081
	Contour	0.77	227.40	0.29	0.0094
	Contour	0.97	227.60	0.36	0.0105
	Contour	1.17	227.80	0.43	0.0116
	Contour	1.37	228.00	0.50	0.0125
	CB#1 Top of Grate	1.52	228.15	0.56	0.0132
	Contour	1.56	228.20	2.44	0.0134
	Contour	1.62	228.25	6.46	0.0136
	Contour	1.67	228.30	12.77	0.0139
	Contour	1.72	228.35	23.47	0.0141
	Curb Overflow Outlet	1.77	228.40	40.01	0.0143
	Contour	1.81	228.45	61.33	0.0333

Detailed calculations, including the control sizing for all orifices and weirs, are included in Appendix C. The location of the stormwater management facility and further design details are illustrated on the engineering drawings included in Appendix D (envelope at the rear of this report).

6.1.1. Effectiveness of SWM Facility

Table 5 and Table 6 summarize the effectiveness of the proposed stormwater attenuation features based on the hydrological model results.

Table 5
Model Results - 4hr Chicago Distributions

	2Yr	5Yr	10Yr	25Yr	50Yr	100Yr
PRE-DEVELOPMENT (m^3/sec)						
Total Pre-Development Runoff Rate	**0.054**	**0.071**	**0.083**	**0.100**	**0.112**	**0.124**
POST-DEVELOPMENT (m^3/sec)						
Total Post-Development Runoff Rate	**0.056**	**0.074**	**0.086**	**0.102**	**0.113**	**0.125**
POST-DEVELOPMENT SWM (m^3/sec)						
Catchment 201	0.013	0.014	0.014	0.014	0.014	0.014
Catchment 202	0.026	0.034	0.039	0.047	0.052	0.057
Catchment 203	0.006	0.008	0.009	0.011	0.012	0.014
Total Post-Development SWM Runoff Rate	**0.045**	**0.055**	**0.062**	**0.071**	**0.077**	**0.084**
Catchment 201 SWM Facility Storage Volume / Ponding Elevation (m^3 / m ASL)	4 / 228.23	6 / 228.25	8 / 228.27	11 / 228.29	14 / 228.31	16 / 228.33

Table 6
Model Results - 24hr SCS Type II and Hurricane Hazel Regional Storm Distributions

	2Yr	5Yr	10Yr	25Yr	50Yr	100Yr	Hazel
PRE-DEVELOPMENT (m^3/sec)							
Total Pre-Development Runoff Rate	**0.033**	**0.048**	**0.061**	**0.074**	**0.084**	**0.094**	**0.034**
POST-DEVELOPMENT (m^3/sec)							
Total Post-Development Runoff Rate	**0.034**	**0.050**	**0.060**	**0.074**	**0.084**	**0.093**	**0.034**
POST-DEVELOPMENT SWM (m^3/sec)							
Catchment 201	0.013	0.014	0.014	0.014	0.014	0.014	0.013
Catchment 202	0.015	0.023	0.027	0.033	0.038	0.042	0.015
Catchment 203	0.004	0.006	0.008	0.010	0.012	0.013	0.007
Total Post-Development SWM Runoff Rate	**0.033**	**0.042**	**0.049**	**0.057**	**0.063**	**0.069**	**0.034**
Catchment 201 SWM Facility Storage Volume / Ponding Elevation (m^3 / m ASL)	2 / 228.20	7 / 228.26	11 / 228.29	15 / 228.31	19 / 228.33	22 / 228.34	N/A

With the implementation of this stormwater management strategy, peak flow attenuation of post-development flows to pre-development levels, will be achieved. 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 municipal sewer system beneath Dunlop Street W, nor the ultimate receiving waterbody, Kidd's Creek.

6.2 Quality Control

The primary objective of the stormwater management plan for this development is to maintain acceptable water quality within the receiving storm sewer network and ultimate outfall, Kidd's Creek, 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 "soft" landscaping where feasible.
- Yard grading using minimal surface slopes where possible to promote infiltration.
- Provision of a hydrodynamic separator (Hydroworks Hydrostorm or equivalent) for oil and sediment removal from runoff generated from catchments 201 & 202. For a 0.193-hectare drainage area that is 81.3% impervious, an HS-4 treatment unit is required. An HS-4 unit will provide 82% removal of total suspended solids. Design calculations utilizing the manufacturer's software, and applicable reports, are included in Appendix C.
- Provision of perimeter landscape area in catchments 201-203. Landscape area will provide some TSS removal benefit as it performs as vegetative filter strips, cleansing runoff as it sheet flows to the existing storm sewer beneath Dunlop Street W. TSS removal benefit of vegetative filter strips range from 20-80% per the TRCA LID Manual. A conservative estimate of 50% was chosen for the site.
- 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 7 summarizes the proposed measures and their overall effectiveness.

Table 7
Proposed Approach for Water Quality Treatment

Catchment	Surface	Method	Effective TSS Removal	Area (m²)	% Area of Site	Overall TSS Removal
201	Impervious Surfaces, and Landscape Area	Hydroworks Hydrostorm HS-4	82.0%	890	36.6	30.0%
202	Building Rooftop	Inherent	100.0%	800	32.9	32.9%
	Landscape Area	Hydroworks Hydrostorm HS-4	82.0%	240	9.9	8.1%
203	Impervious Surfaces	Sidewalk Filtration Across Landscape Boulevard	32%	185	7.6	2.4%
	Landscape / Natural Areas	Natural Filtration, Evapotranspiration	50%	315	13.0	6.5%
Total	Total			2430	100.0	80.0%

With the implementation of the proposed quality control plan, the proposed measures in conglomeration will provide an overall long term TSS removal of 80% for the site.

6.3 Water Balance

As per City policy 4.1.3 of the Stormwater Infrastructure Design Standards, sites less than 5 ha shall minimize any anticipated changes in the water balance between pre-development and post-development conditions.

A water balance analysis was conducted in accordance with the LSRCA Technical Guidelines and the Water Balance Recharge Offsetting Policy. The analysis follows the Thornthwaite and Mather approach, where surplus is estimated based on precipitation minus evapotranspiration (Steenhuis and Van Der Molen, 1986). Annual precipitation and evapotranspiration data for sites within the Barrie Creeks watershed was taken from the LSRCA Lake Simcoe Climate Data: A Reference Document to Support the Completion of Water Balance Assessments (April 2017). In the pre-development and post-development condition, the property was broken down into rooftop, pavement, and landscape land uses. Results of the annual pre-development and post-development water balance are displayed in Table 8, below.

Table 8
Water Balance Summary

Characteristic	Site		
	Pre-Development	**Post-Development**	**Difference**
Inputs (Volumes)			
Precipitation (m^3/yr)	2313	2313	0.0%
Run-on (m^3/yr)	0	0	0.0%
Other Inputs (m^3/yr)	0	0	0.0%
Total Inputs (m^3/yr)	2313	2313	0.0%
Output (Volumes)			
Precipitation Surplus (m^3/yr)	1757	1787	1.7%
Net Surplus (m^3/yr)	1757	1787	1.7%
Evapotranspiration (m^3/yr)	557	526	-5.5%
Infiltration (m^3/yr)	188	170	-9.4%
Rooftop Infiltration (m^3/yr)	0	0	0.0%
Total Infiltration (m^3/yr)	**188**	**170**	**-9.4%**
Runoff Pervious Areas (m^3/yr)	125	113	-9.4%
Runoff Impervious Areas (m^3/yr)	1444	1504	0.0%
Total Runoff (m^3/yr)	1569	1617	3.1%
Total Outputs (m^3/yr)	2313	2313	0.0%

Based on the results of the water balance analysis, the site yields an overall stormwater storage volume of 188m^3/year and 170m^3/year in the pre-development and post-development condition, respectively, therefore the property would only experience a slight water balance deficit of 18m^3/year.

As the post-development water balance deficit is very low at less than 100m^3/year, no additional infiltration (LID) measures are proposed. The proposed development is excluded from a recharge compensation fee in accordance with section 6.2 of the LSRCA Water Balance Recharge Offsetting Policy.

6.4 Phosphorus Budget

In accordance with the LSRCA's Phosphorus Offsetting Policy, all new development must control phosphorus loading in the post-development scenario to pre-development levels, otherwise a phosphorus offsetting fee will be required by the LSRCA for the remaining load difference.

The MECP's P-Tool was utilized to determine pre and post development phosphorus loadings for the proposed development area. In the pre-development condition, high-intensity commercial and low-intensity development land uses were chosen to determine the

phosphorus loading. For the post-development condition, high-intensity residential and low-intensity development land uses were chosen. The calculated phosphorus loadings are illustrated in Table 9.

Table 9
Pre & Post Phosphorus Loading

	P Load (kg/yr)
Pre-Development	0.20
Post Development with no BMP's	0.24
Post Development with BMP's	0.20

The proposed Hydroworks Hydrostorm unit will provide 20% TP removal for intercepted flows from catchments 201 and 202, prior to discharging to the existing municipal storm sewer beneath Dunlop Street W.

The perimeter landscape area in catchments 201-203 will also provide some TP removal benefit as it performs as vegetative filter strips, cleansing runoff as it sheet flows to the existing storm sewer beneath Dunlop Street W.

An overall 17% (1-(0.2 kg/0.24kg)*100) post-development TP reduction can be achieved on the site by implementing best management practices. Pre and post development phosphorus budget calculations are included in Appendix C.

Since the post-development phosphorus loading of 0.20kg/year (with best management practices implemented) is equal to the pre-development phosphorus loading, a phosphorus offsetting fee is not required.

6.5 Hydrodynamic Separator Inspection and Maintenance

During construction operations, the Hydroworks Hydrostorm separator should be inspected every four weeks and after every large storm (>25 mm) due to the un-stabilized nature of the site (exposed soils and material stockpiles).

During post-construction operation for a normal stabilized site (paved driveways and vegetation established), the separator should be inspected on an annual basis. The initial inspection will indicate the required future frequency of inspection and maintenance if the unit was maintained after the construction period. A sample inspection checklist is provided in the Hydroworks Hydrostorm Operations & Maintenance Manual included in Appendix C.

Inspection procedure for a Hydrostorm separator consists of a visual inspection of floatable material and measurements of sediment accumulation in the unit.

Visual inspection for floatable material can be carried out by removing the top cover and looking down into the centre access tube of the separator. An inspection should be made for trash/debris and presence of an oil spill. If an oily sheen, frothing, or unusual colouring of the water is noticed, this may indicate the occurrence of an oil spill, and the unit should be cleaned out immediately.

Inspection for TSS build-up can be conducted using a sampling device such as a Sludge Judge, Core Pro, AccuSludge, or an equivalent device to measure the depth of water and sediment in the unit. Several readings (2-3) should be made at each access cover to ensure that an accurate sediment depth measurement is recorded.

During the construction phase, the Hydrostorm separator should be cleaned out when the depth of sediment within the unit reaches 24" (600mm). During normal operating conditions, post construction, clean-out for separators with standard sump depths should occur once sediment accumulation reaches the sediment maintenance depth provided in Table 2 of the Operations & Maintenance Manual. As a rule of thumb, a measurement of the total depth in the separator through the central access tube should be taken and compared to the sump depth given in Table 1 of the Hydroworks Hydrostorm Operations & Maintenance Manual. If the measured reading is larger than the standard sump depth value in Table 1, then the separator is designed with a larger sump for sediment storage and the sediment maintenance depth will be increased to the value given in Table 2 plus the difference in sump depth between the actual measured reading and the standard dimension provided in Table 1.

The Hydroworks Hydrostorm unit is typically maintained using a vacuum truck. The vacuum truck will remove all the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility. A central access opening (24" or greater) is provided to gain access to the lower treatment tank of the unit. This is the primary location to maintain by the vacuum truck. The pre-treatment area can also be vacuumed or flushed into the lower treatment tank of the separator for cleaning via the central access once the water level is lowered below the pre-treatment floor.

6.6 Storm Sewer Inspection and Maintenance

It is important to inspect all stormwater attenuation and conveyance features (sewer pipes, catch basins, manholes, etc..) on a regular basis for signs of sediment accumulation, blockages, or damage that may result in performance issues or system failure.

In order for the stormwater management facility to operate effectively, regular maintenance of the facility will be required. The frequency of cleaning will be governed by the site operations including the extent of sanding and salting carried out during the winter months. At minimum, structures should be inspected and cleaned out annually.

We recommend inspections be carried out as follows:

- After every major rainfall event (>25mm).
- Prior to first snowfall.
- Following a winter thaw.
- At a minimum once a week during spring thaw.

Inspection of the stormwater management facility during the construction phase and in the long-term should include the following:

- Implement appropriate traffic safety procedures (e.g., traffic cones) prior to and during the catch basin inspection and cleaning process.

- Work upstream to downstream while inspecting the system's catch basins and manholes.

- Inspect grate openings for trash, debris, and sediment. Remove any potential blockages as necessary.

- Inspect frame and grates for cracks or missing components. Replace if necessary.

- Remove the grates and visually inspect the inside of the catch basin or maintenance hole to determine cleaning needs.

    - If an oily sheen, frothing, or unusual colouring is observed in the sump of the catch basin or manhole, this may indicate the occurrence of an oil spill, and the structure should be cleaned out immediately.

    - If sediment/debris accumulation exceeds 60% of the sump depth within the catch basin or manhole, removal is required.

- Inspect inlet and outlet pipes for sedimentation, blockage, or damage. Cleaning is required when the sediment depth exceeds 20% of the pipe diameter.

- Inspect the physical condition of the catch basin/manhole structure. Cracks or fractures in the walls, bottom, or inlet/outlet pipe parging indicate need for repair.

- Inspect orifice restriction within the control manhole. Remove accumulated sediment, trash, and debris. Cracks, fractures, or missing components indicate need for repair or replacement if necessary.

Observations and findings during inspection of the stormwater management facility can be recorded and logged within the Inspection and Maintenance Checklist provided in Appendix C.

The following is a list of equipment and cleaning methods for the stormwater management facility:

- During the dry season, sediment can be removed by hand with a bucket and shovel. Where conditions permit, a bucket loader can be used to remove accumulated sediment. Use a high-pressure washer to clean any remaining material out of the structure while capturing the slurry with a vacuum. If necessary, after the structure is cleaned, use the rodder of the vacuum truck to clean the downstream pipe and pull back sediment that might have entered it.

- JetVac maintenance is recommended if sediment has accumulated within the storm sewer and clogged the pipes. The JetVac process utilizes a high-pressure water nozzle to propel itself down the storm sewer while scouring and suspending sediments. As the nozzle is retrieved, a wave of suspended sediments is flushed

back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/ JetVac combination vehicles. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” (1143 mm) are best.

7.0 EROSION AND SEDIMENT CONTROL

7.1 Mitigation Measures

Sedimentation and erosion control measures are required during construction and until such a time that site development has been completed and the driveway area has been paved.

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.
- Filter cloth / silt sack placement over drains.
- Installation of vehicle tracking mud mat at the entrance to the site.

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 municipal sewers 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 installation around the stockpiles.

7.2 Monitoring and Maintenance During Construction

It is the responsibility of the contractor and owner to maintain the siltation control devices until suitable grass cover has been established upon completion of construction.

A regular review of the facilities by the contractor should be carried out during the construction period to ensure that the facilities are being properly maintained, and if necessary, replaced. Inspection reports are to be completed monthly and distributed to the owner, contractor, and City.

If site works are to continue through the winter and spring the engineer should be contacted by the owner to review the measures in place with the contractor on a regular basis to ensure that the facilities are adequate and in good working order.

All reasonable methods to control erosion and sedimentation are to be taken during construction. The contractor should inspect the siltation devices immediately after each rainfall. Damaged devices should be repaired immediately, and additional devices installed if necessary. Silt should be removed from the fencing and related siltation devices when deposits are noticeable.

Should the erosion control measures fail, and sediment migrate beyond the limits of the control works, additional sedimentation facilities may need to be installed in the area of the migration and down gradient to contain the sediment.

8.0 SUMMARY AND CONCLUSIONS

The findings of this report are summarized as follows:

- Attenuation of peak post-development flowrates to below pre-development levels will be provided by utilizing a surface storage cell created within the asphalt parking lot. A 70mm dia. orifice plate installed on the outlet pipe from CB#1 will control flows to or below pre-development levels.

- Quality control for the development will be provided by a treatment train approach consisting of a hydrodynamic separator (82% TSS removal and 20% TP removal), and perimeter landscape as filter strips (50% TSS removal).

- The post-development phosphorus loading is equal to the pre-development phosphorus loading, therefore, no phosphorus offsetting fee is required by the LSRCA.

- The post-development water balance deficit is negligible, therefore, no additional LIDs are proposed, and a recharge compensation fee is not required by the LSRCA.

- 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 be submitted to the City of Barrie and the LSRCA 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.

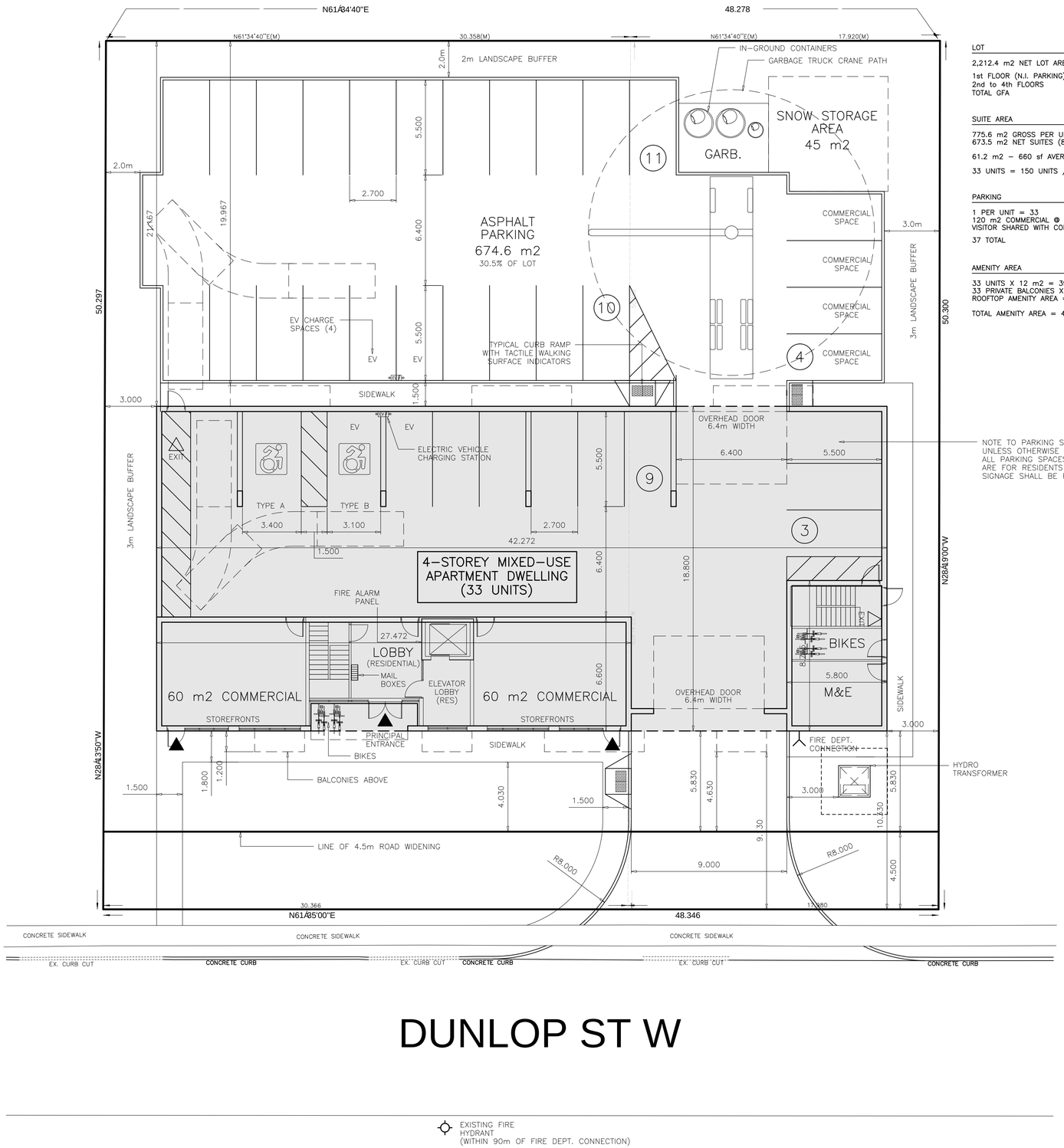
All of which is respectfully submitted.
PINESTONE ENGINEERING LTD.

Dwight Hordyk, P.Eng.
Project Engineer

APPENDIX A

SITE PLAN

PINESTONE ENGINEERING LTD.



1 SITE PLAN
A-0.1 SCALE: 1:125

LOT

2,212.4 m2 NET LOT AREA (0.2212 ha)

1st FLOOR (N.I. PARKING)	222.0 m2
2nd to 4th FLOORS	2,326.8 m2
TOTAL GFA	2,548.8 m2 (115%)

SUITE AREA

775.6 m2 GROSS PER UPPER FLOOR
673.5 m2 NET SUITES (87% EFF.) PER FLOOR

61.2 m2 – 660 sf AVERAGE SUITE SIZE

33 UNITS = 150 UNITS / ha DENSITY

PARKING

1 PER UNIT = 33
120 m2 COMMERCIAL @ 1/30 = 4
VISITOR SHARED WITH COMMERCIAL PARKING

37 TOTAL

AMENITY AREA

33 UNITS X 12 m2 = 396 m2 REQUIRED
33 PRIVATE BALCONIES X 4.9 m2 = 161.7 m2
ROOFTOP AMENITY AREA = 274.3 m2

TOTAL AMENITY AREA = 436 m2 (13.2 m2/UNIT)

NOTE TO PARKING SPACES:
UNLESS OTHERWISE IDENTIFIED ALL PARKING SPACES SHOWN ARE FOR RESIDENTS ONLY AND SIGNAGE SHALL BE PROVIDED

RESIDENTIAL MIXED USE CORRIDOR (MU2) ZONE

Provisions	Required	Provided
Min. Lot Area	-	2,212.4 m2
Min. Lot Frontage	-	48.346m
Front Yard Setback (Min.)	1m for 75% of frontage	5.83m
Front Yard Setback (Max.)	5m for 25% of frontage	5.83m
Side Yard Setback (Min.)	-	3.0m
Side Yard Setback (Max.)	3.0m	3.0m
Rear Yard Setback (Min.) Abutting Residential, OS, or EP Zone	7.0m	21.167m
Front Façade Step-back (min.)	45d at height above 80% of ROW with 3m step-backs	CONFORMS
Rear Façade Step-back (min.)	45d above 7.5m with 3m step-backs	CONFORMS
Ground Level Floor Height (min.)	4.5m	4.5m
Minimum Coverage for Commercial uses (% of first storey GFA)	50%	54%
Building Height (Min.)	7.5m	16.14m
Building Height (Max.)	25.5m	16.14m
Balcony Projection into Yard (Max.)	1.5m (but no closer than 1.8m to side lot line)	1.2m projection (not within required Yard)
Outdoor Amenity Area	12m2 per unit x 33 = 396 m2 (unconsolidated)	13.2m2 per unit = 436 m2
Landscape Buffers (Min.) abutting Residential Zone	3.0m	2.0m
Parking for Apartment Dwellings (maximum lot coverage)	35%	30.5%
Parking Spaces for Residential Dwellings	1 space per unit x 33 = 33	33
Parking Spaces for Office/Retail Use	1/30 m2 x 120 m2 = 4	4
Barrier Free Parking (26-50 spaces)	1 Type A + 1 Type B	1 Type A + 1 Type B
Use	Apartment Dwelling, Office Use, Retail/Commercial Use	CONFORMS

LOCATION
SCALE: 1:2000

pml.A

patrick markus luckie, Architect
7283 BENDIGO CIRCLE • MISSISSAUGA, ON • L5N 1Z4 • TEL: 416 885 0108

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This drawing, as an instrument of service, is provided by and is the property of Patrick Markus Luckie Architect and shall be used only for the project named on this drawing and solely for reference purposes only. The contractor is responsible for the coordination and verification of all dimensions contained herein and all measurements and conditions on site as they pertain to these documents. The contractor shall report any discrepancies to the consultant in writing prior to the commencement of any affected work.

Do Not scale this drawing

This drawing shall not be used for construction purposes unless countersigned

Patrick Markus Luckie Architect

NORTH

Revisions:

Date:	Particular:
JUL.15.22	ISSUED FOR REVIEW
SEP.28.23	REVISE STREET CURB RADIUS
APR.04.24	REVISE GARBAGE, BIKE RM, EV STATIONS
JUL.11.24	ADD T.FORMER, INCREASE FRONT YD TO 5.83m

Issue:

Date:	Particular:
MAY.18.23	ISSUED FOR SITE PLAN APPLICATION
APR.25.24	RE-ISSUED FOR SITE PLAN APPLICATION

196, 202 DUNLOP ST W
MIXED-USE APARTMENT

BARRIE

SITE PLAN

PROJECT No.:

A-0.1

APPENDIX B

GEOTECHNICAL REPORT

PINESTONE ENGINEERING LTD.

GEI Consultants

Consulting Engineers and Scientists

Geotechnical Investigation

202 Dunlop Street West

City of Barrie, Ontario

Submitted to:
Fresco Development Bayfield
115 Robert Berry Crescent,
King City, Ontario
L7B 0M3

Submitted by:
GEI Consultants, Inc.
647 Welham Road, Unit 14
Barrie, Ontario, L4N 0B7
705-719-7994

January 14, 2022
Project No. 2103921

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1. Introduction

GEI Consultants (GEI) was retained by Fresco Development Bayfield (Client) to complete a subsurface investigation and provide a geotechnical report to support the design and construction of a four (4) storey residential development at 202 Dunlop Street West, Barrie, Ontario (Site). A site location plan is enclosed as Figure 1.

The site is approximately 50 metres long (north to south) and 30 metres wide (east to west), with a total area of approximately 0.15 hectares. The site is bounded by Dunlop Street West to the south, and residential/commercial properties on all other sides. The property currently contains a residential dwelling in the southwest corner of the site and a low-rise commercial building (Dunlop Office Furniture) along the northern property line. The remainder of the site consists of asphalt paved parking areas or grassed landscape areas. The property is relatively flat with no appreciable topographical relief.

Based on GEI's review of the drawing "*Conceptual Site Plan – 27 Units, 202 Dunlop St. W – City of Barrie,"* File No. 21-1100, dated August 6, 2021, by Innovative Planning Solutions, it is understood that the project entails the following:

- A four (4) storey apartment building with parking and an office on the first level, and a total of 27 residential apartment units on the remaining levels. The apartment building is to be located in the western half of the site and it is understood that the building will not have a basement level;
- The construction of parking areas on the eastern half of the site; and
- New domestic water and sanitary sewer servicing throughout the site.

The geotechnical investigation was required to provide design parameters for the 202 Dunlop Street West development. This includes design recommendations for foundations, slabs-on-grade, earth pressures, seismic site classification, site servicing, drainage and pavements, as well as considerations for constructability such as soil excavation, compaction, and temporary groundwater control.

2. Procedures and Methodology

The fieldwork for the drilling program was carried out on November 29th, 2021 to assess the soil conditions present at the site. A total of three (3) boreholes (Boreholes 1 through 3) were advanced throughout the site to depths of 6.6 metres below existing grade (Local Elev. 93.3 to 92.9 metres). The boreholes were distributed evenly throughout the site in support of the construction of the proposed apartment building and associated parking areas.

The borehole locations were laid out in the field by GEI field staff prior to commencement of drilling operations. Ground surface elevations of the boreholes were surveyed by GEI relative to the top cap of the fire hydrant located immediately opposite the site on the south side of Dunlop Street West, which was assigned a temporary local elevation of 100.00 metres. Borehole position and coordinates (referencing NAD 83 geodetic datum) were provided by a handheld Garmin eTrex 10 GPS receiver. The borehole coordinates, and elevations are provided on the borehole logs in Appendix A. Borehole locations are shown on Figure 2A (aerial image of the site) and 2B (proposed site plan).

Drilling and sampling of the boreholes was completed using a truck mounted drill rig operated by Drilltech Drilling Ltd. of Newmarket, Ontario who was retained and supervised by GEI. The boreholes were advanced to predetermined depths though the use of solid or hollow stem augers, and sampling was conducted using 51 mm O.D. split spoon (SS) samplers. Standard Penetration Test (SPT) "N" Values were recorded for the sampled intervals as the number of blows required to drive an SS sampler 305 mm into the soil using a 63.5 kg drop hammer falling 750 mm, in accordance with ASTM D1586. Soil sampling was generally conducted at 0.75 metre intervals.

The GEI field staff examined, and classified characteristics of the soils encountered in the boreholes, including the presence of fill materials, made groundwater observations during and upon completion of the drilling, recorded observations of borehole advancement, and processed the recovered samples. All recovered soil samples were logged in the field, carefully packaged, and transported to the laboratory for more detailed examination and classification.

In the laboratory, the samples were classified as to their visual and textural characteristics and geotechnical laboratory testing for grain size was carried out with the results provided in Appendix B. Each of the boreholes were backfilled upon completion.

Three (3) monitoring wells were installed in Boreholes 1 through 3 to determine the static groundwater elevation at the site and subsequent monitoring or testing purposes. All borehole backfilling/capping activities and monitoring well installations were performed in accordance with Ontario Regulation (O.Reg.) 903.

3. Subsurface Conditions

3.1 General Overview

The soil conditions at the site generally consisted of a surficial pavement structure or topsoil overlying a zone of cohesionless earth fill. The earth fill was underlain by coarse textured glaciolacustrine deposits consisting predominantly of sand. These soils were encountered throughout each of the boreholes to their respective termination depths. Bedrock was not encountered in the investigation depths and each of the boreholes were terminated in native soils.

The borehole locations are shown on Figures 2A and 2B. Detailed soil profiles encountered in the GEI boreholes are indicated on the attached borehole logs in Appendix A, with the results of geotechnical laboratory testing included in Appendix B.

It should be noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the locations. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change.

In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including: visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (speed of drilling, shaking/grinding of the augers, etc.). The passage of time also may result in changes in conditions interpreted to exist at locations where sampling was conducted.

3.2 Stratigraphy

3.2.1 Pavement Structure and Topsoil

A pavement structure was encountered at the surface of Boreholes 1 and 2. The encountered asphalt varied in thickness from 50 to 70 mm and was underlain by 130 to 230 mm of granular material.

A layer of topsoil was encountered beneath the pavement structure in Borehole 2 and at the surface of Borehole 3. The topsoil layer was about 475 to 480 mm thick and extended to depths from about 0.5 to 0.8 metres below existing grade (Local Elev. 99.0 to 98.8 metres). The topsoil was noted as dark brown in colour, moist, and generally very loose at the time of the investigation.

3.2.2 Earth Fill

Deposits of cohesionless earth fill consisting of silty sand, sand, and gravelly sand were encountered beneath the pavement structure or topsoil in each of the boreholes advanced throughout the site. The deposits of earth fill extended to a depth of 2.3 metres below existing grade (Local Elev. 97.5 to 97.2 metres). The earth fill was noted as light brown to brown in colour and generally damp at the time of the investigation. SPT "N" Values measured within the earth fill ranged from 2 to 9 blows per 300 mm of penetration, indicating a very loose to loose relative density.

3.2.3 Native Soils

Cohesionless native deposits consisting of sand with trace silt were encountered beneath deposits of earth fill in each of the boreholes advanced throughout the site. The native cohesionless deposits were encountered at a depth of 2.3 metres below existing grade (Local Elev. 97.5 to 97.2 metres) and extended to the borehole termination depths of 6.6 metres below existing grade (Local Elev. 93.3 to 92.9 metres). The native deposits were noted as light brown to brown in colour and were generally damp to wet at the time of the investigation. SPT "N" Values measured in the native cohesionless deposits ranged from 6 to 74 blows per 300 mm of penetration, indicating a loose to very dense relative density. The deposit was typically compact to dense.

3.3 Groundwater

Unstabilized groundwater level measurements and borehole sloughing (caving) measurements were taken upon completion of drilling of each borehole. These measurements provide an estimate of possible excavation and temporary groundwater control issues that may arise during construction. Boreholes 1, 2, and 3 were outfitted as monitoring wells with 50 mm diameter PVC standpipe and 1.5-metre-long screens.

Monitoring well configurations and groundwater observations are summarized on the borehole logs in Appendix A and presented in the table below.

Borehole	Depth of Caving (m)	Unstabilized Ground Water Level Depth (m)	Well Screen Location		Strata Screened	Depth / Local Elev. (m) of Groundwater Table	
			Depth (m)	Local Elev. (m)		Dec. 9, 2021	Jan. 7, 2022
BH 1	4.9	5.2	4.6 to 6.1	95.2 to 93.7	Sand	4.96 / 94.87	4.95 / 94.87
BH 2	Open	5.2	4.6 to 6.1	95.6 to 93.5	Sand	4.88 / 94.69	4.82 / 94.75
BH 3	Open	5.2	4.6 to 6.1	94.8 to 93.3	Sand	5.00 / 94.45	4.97 / 94.48

Based on the stabilized groundwater measurements in the monitoring wells, unstabilized groundwater measurements at the time of drilling, and the moisture contents of the soil within

the boreholes, the groundwater table appears to be at depths from 4.8 to 5.0 metres below existing grade (Local Elev. 94.9 to 94.5 metres) for the proposed development area.

The cohesionless silty sand to gravelly earth fill and native cohesionless deposits of sand soils at the site (containing 3 to 4% fines) are permeable and will allow for the free flow of water when wet. Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions.

4. Engineering Design Parameters & Analysis

Based on GEI's review of the drawing "*Conceptual Site Plan – 27 Units, 202 Dunlop St. W – City of Barrie,"* File No. 21-1100, dated August 6, 2021, by Innovative Planning Solutions, it is understood that the project entails the following:

- A four (4) storey apartment building with parking and an office on the first level, and a total of 27 residential apartment units on the remaining levels. The apartment building is to be located in the western half of the site and it is understood that the building will not have a basement level;
- The construction of parking areas on the eastern half of the site; and
- New domestic water and sanitary sewer servicing throughout the site.

Detailed civil engineering drawings or other detailed design information were not available at the time of preparing this report.

4.1 Site Grading

Grading plans were not available for review at the time of preparing this report, however some site grading may be required to accommodate the proposed parking lot and land development. The generally loose earth fill or compact to dense cohesionless native sand deposits at the site are competent to support moderate grade raises throughout the site for a pavement structure or slab-on-grade.

The existing asphalt, topsoil, organic rich fill soils, deleterious soils, and vegetation must be stripped from any location where grades will be raised, prior to placing any fill. Existing cohesionless earth fill soil throughout the site may potentially be left in place, pending approval by the geotechnical engineer. Exposed soil subgrade must be inspected by the geotechnical engineer in advance of placing fill and the cohesionless fill or native soil subgrade must be proof-rolled with a loaded tandem-axle dump truck or large compaction equipment. Any soil subgrade areas observed containing excessive organics, soft or weak areas, or deleterious material should be further sub-excavated to a competent subgrade under the direction of the geotechnical engineer.

Once the subgrade is approved, all new material placed to raise the grades shall be inorganic soil sourced from the site or suitable imported fill compacted to a minimum of 98% SPMDD. The purpose of this compaction specification is to provide uniform support and to mitigate the potential of significant differential settlements. Additional soil compaction recommendations are provided in Section 5.3 of this report.

4.2 Frost Penetration Depth

Based on review of Ontario Provincial Standard Drawing (OPSD) 3090.101, the frost penetration depth beneath the site is estimated to be 1.5 metres.

4.3 Foundation Design

Boreholes 1 through 3 were advanced within or adjacent to the footprint of the proposed apartment building to be constructed within the western portion of the site. The boreholes generally encountered a surficial pavement structure or topsoil which was underlain by cohesionless earth fill soils which transitioned to native cohesionless deposits consisting of sand soils at a depth of 2.3 metres below existing grade. The native deposits varied from loose to very dense in relative density and were generally compact to dense throughout the site.

Topsoil, earth fill, existing pavement structures, and any weathered or disturbed soils are not suitable for the support of new foundations.

4.3.1 Foundations on Undisturbed Native Soils

There is opportunity for foundations at this site to be constructed as conventional shallow spread and strip footing foundations that bear on the undisturbed and compact to very dense native sand deposits.

Foundations for the proposed apartment building to be constructed within the western portion of the site set at a minimum depth of 3.0 metres below existing grade, bearing directly on the undisturbed and compact native sand deposits, may be designed using a geotechnical reaction at SLS of 150 kPa, for an estimated settlement of 25 mm or less. The maximum factored geotechnical resistance at ULS is 225 kPa.

4.3.2 General Foundation Considerations

The minimum strip and spread footing widths to be used shall be dictated as per the Ontario Building Code, regardless of loading considerations. Footings stepped from one level to another must be at a slope not exceeding 7 vertical to 10 horizontal. This concept should also be applied to excavations for new foundations in relation to existing footings or underground services unless rigid shoring is provided. All footings exposed to ambient air temperature throughout the year must be provided with a minimum of 1.5 metres of earth cover or equivalent insulation for frost protection.

The foundation design parameters provided above are predicated on the assumption that the foundation subgrade surface is undisturbed, and that all deleterious, softened, disturbed, organic, and caved material is removed. The foundation excavation must be done in such a way that groundwater is controlled to prevent any disturbance to the foundation base. Temporary groundwater control during construction is discussed in Section 5.2.

The foundation subgrade must be reviewed by the geotechnical engineer prior to the placement of any fill or concrete to verify the foundation design parameters provided are applicable, and to provide remedial recommendations if necessary. If foundation excavations will be open for a prolonged period of time, the foundation subgrade should be protected with a skim coat of lean mix concrete (after inspection by the geotechnical engineer), to ensure that no deterioration will occur due to weather effects.

4.4 Earth Pressure Design Parameters

The structures must be designed to resist unbalanced lateral earth pressures imparted from the weight of adjacent soils. Lateral earth pressures are calculated using the following equation:

$$\boldsymbol{P = K[\gamma h + q]}$$

where, **P** = the horizontal pressure at depth, **h** (m)
K = the earth pressure coefficient (dimensionless)
h = depth below surface in metres
γ = the bulk unit weight of soil, (kN/m^3)
q = surcharge loading (kPa)

The above equation assumes that a drainage system is present which prevents the build up of any hydrostatic pressure behind the structure subjected to the unbalanced lateral earth pressures. If this is not the case, the equation must be revised to also incorporate the submerged unit weight of the soil multiplied by the earth pressure coefficient, in addition to the water pressure itself.

The values for use in the design of structures subjected to unbalanced lateral earth pressures at this site are as follows:

Soil Type	γ - Bulk Unit Weight (kN/m^3)	φ - Friction Angle (degrees)	Earth Pressure Coefficient (dimensionless)		
			K_a - Active	K_o – At-Rest	K_p - Passive
Granular 'B' (OPSS.MUNI 1010)	21.0	32	0.31	0.47	3.25
Earth Fill or Native Loose Sand	19.0	30	0.33	0.50	3.00
Native Compact to Dense Sand	20.0	33	0.29	0.46	3.39

The calculation of the earth pressure coefficients is based on Rankine theory, which provides a conservative estimate as no friction between the soil and the structure is accounted for. The

earth pressure coefficients provided above are only applicable for flat ground surfaces beyond the structure and must be increased for sloping ground surfaces.

The earth pressure coefficients referenced within the above table are a function of the friction angle of the adjacent soil, and both the degree and direction of movement of the structure subjected to unbalanced lateral earth pressures. For structures that are restrained at the top (such as basement walls), the at-rest earth pressure coefficient will apply. For structures that allow for 0.1 to 1% of movement away from the soil, the full active earth pressure coefficient will apply. For structures that allow for 1 to 10% of movement into the soil, the full passive earth pressure coefficient will apply. The percentage movement is based on the height of the structure.

Other types of structures such as shoring walls with multiple rows of tiebacks and soil nail walls are subject to different loading conditions and must be analyzed separately.

4.5 Seismic Site Classification

Section 4.1.8.4 of the Ontario Building Code provides values of the acceleration and velocity-based site coefficients (F_a and F_v) for various time periods, associated with specific Site Classes. These Site Classes are based on the energy-corrected Average Standard Penetration Resistance values and undrained shear strength within the upper 30 metres of soil underlying the foundations of the proposed structure. As the boreholes were advanced less than this depth at the site, the site classification recommendation provided below assumes that the soil conditions are similar below the drilled depth.

Based on the SPT "N" Values averaging between 15 and 50 blows as measured within Boreholes 1 to 3, advanced within and adjacent to the footprint of the proposed apartment building, the Site Classification is "D" for the four-storey apartment building. Consideration could be made to carry out shear wave velocity testing in the site to potentially improve the seismic site classification.

4.6 Slab on Grade Design

The topsoil, asphalt, and any soils containing excessive organics are not suitable for the support of a slab on grade. Proof-rolled earth fill and native cohesionless soils are suitable for the support of a lightly supported unreinforced concrete slab-on-grade.

The subgrade for the slab on grade must be assessed by the geotechnical engineer, prior to the placement of an aggregate base. If any soft or weak subgrade areas are identified, or if there are areas containing excessive amounts of deleterious/organic material, they must be locally sub-excavated and backfilled with approved clean earth fill or imported granular material and compacted to a minimum of 98% SPMDD within 2% of optimum moisture content.

All building floor slabs must be provided with a capillary moisture barrier and drainage layer. This is made by placing the concrete slab on a minimum 200 mm layer of 19 mm clear stone (OPSS.MUNI 1004) compacted by vibration to a dense state. The upper 50 mm of clear stone can be replaced with 19 mm crusher run limestone for a working surface.

4.7 Perimeter Drainage

As the new structure will be slab on grade with no basement levels, perimeter drainage at the foundation level is not required, provided that the underside of concrete slab is at least 200 mm above the prevailing grade of the site and the surrounding surfaces slope away from the building at a gradient of at least 2% to promote surface water run-off and to reduce groundwater infiltration adjacent to foundations. To minimize infiltration of surface water, the upper 150 mm of backfill could comprise relatively impervious compacted soil material.

4.8 Site Servicing

It is understood that the servicing for this project will likely entail watermain and sanitary sewer construction for the proposed development. Detailed civil engineering drawings or other detailed design information were not available at the time of preparing this report. The minimum depth of cover for the watermain and sewers is expected to range from 1.7 to 2.5 metres, per:

- Revision No. 6 *"Water Transmission and Distribution Policies and Design Standard"* by the City of Barrie (January 2021)
- Revision No. 3 *"Sanitary Sewage Collection System Policies and Design Guidelines"* by the City of Barrie (October 2017)

The general stratigraphy encountered across the site was comprised of surficial topsoil or pavement structure underlain by cohesionless earth fill which transitioned to damp to wet and loose to very dense cohesionless sand deposits. The prevailing groundwater table across the site is approximately 4.9 to 5.0 metres below existing grade.

4.8.1 Bedding

The type of material and depth of granular bedding below the pipe will, to some extent, depend on the method of construction used by the contractor. Pipe bedding for flexible pipes should follow the requirements in Ontario Provincial Standard Drawing 802.010 or 802.013 or applicable municipal standards. Pipe bedding for rigid pipes should follow the requirements in Ontario Provincial Standard Drawings 802.030 to 802.033 or applicable municipal standards.

A subgrade consisting of the existing earth fill or native sands will provide adequate support for pipes with the bedding requirements as laid out in the above referenced OPS drawings. Where disturbance of the trench base has occurred from groundwater seepage, construction

traffic, etc., the disturbed soils should be sub-excavated and replaced with suitably compacted granular fill. Details on temporary groundwater control are provided in Section 5.2. If organic or weak soils are encountered at the subgrade, the bedding thickness may need to be increased to provide extra support. On-site geotechnical inspections are required to verify the subgrade conditions and provide remediation recommendations for subgrade support and bedding materials.

Regardless of whether flexible or rigid pipes are implemented, granular bedding and cover material should consist of a well graded, free draining material, such as Granular "A" (OPSS.MUNI 1010). All granular bedding must be compacted to a minimum of 98% SPMDD. Clear stone or high-performance bedding is permitted at this site provided it is fully wrapped in a non-woven filter fabric to prevent the migration of fines and loss of pipe support.

4.8.2 Backfill

Excavated earth fill and native non-organic cohesionless soils may be used as backfill in trenches provided they are moisture conditioned so that the moisture content is within 2% of optimum. The backfill should be compacted to a minimum of 98% SPMDD. In confined areas the layer thickness will have to be reduced to utilize smaller compaction equipment efficiently or by using granular material instead of locally sourced fill. Any backfill that is frozen, contains a high percentage of organic material (topsoil, peat, etc.) or moisture, or has otherwise unsuitable deleterious inclusion should not be used as backfill. The maximum cobble or boulder size should not exceed half of the loose lift thickness (i.e. all particles with a diameter greater than 100 mm should be removed).

Where trenches are within the traveled portions of a roadway or parking lot, backfill within the frost penetration depth of 1.5 metres should consist of native, non-organic, excavated material consistent with the soils surrounding the trench. If this technique is not undertaken, then frequently problems arise with yearly differential frost heave movements between the trench backfill and the adjacent native soil. This would occur, for example, if imported granular material is used to backfill trenches which is less susceptible to frost effects compared to the native soils on site. Alternatively, if different soil is used as the backfill due to issues with achieving compaction, a frost taper of 5H:1V can be implemented to help mitigate the potential for differential settlement and frost heave.

4.9 Pavement Design

It is understood that the pavement construction for this project entails the on-grade parking lot associated with the proposed apartment development. As noted previously, detailed civil engineering drawings or other detailed design information were not available at the time of preparing this report.

4.9.1 Subgrade Preparation

The general stratigraphy encountered throughout the site comprised of surficial topsoil and existing pavement structure underlain by cohesionless earth fill which transitioned to loose to very dense native deposits of cohesionless sand. The prevailing groundwater table throughout the study area varies from 4.9 to 5.0 metres below existing grade.

Surficial topsoil, the existing pavement structure and any encountered organic rich soils are not a suitable subgrade and must be removed. The pavement subgrade throughout the site will likely consist of compacted trench backfill or existing sandy earth fill. These types of soils may be considered adequate subgrade for the support of a pavement structure, provided the subgrade is proof-rolled and approved by a geotechnical engineer at the time of construction and does not contain excessive amounts of organics, moisture or deleterious materials. Zones with high moisture, deleterious materials, or excessive organics must be sub-excavated and replaced with clean earth fill, placed and compacted following the specifications in Section 5.3 to a minimum of 98% SPMDD. It is anticipated that the subgrade resilient modulus will be on the order of 25,000 kPa.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures must be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as possible when fill is placed, and the natural subgrade is not disturbed or weakened after it is exposed.

4.9.2 Drainage

Control of surface water is an important factor in long lasting pavements and the need for adequate subgrade drainage cannot be over-emphasized. It is recommended that surface drainage be managed through stormwater management features such as catch basins or Low Impact Development (LID) features, in combination with proper grading of the subgrade and pavement surfaces. The pavement subgrade must be free of depressions and sloped (at a minimum grade of 2 percent) to provide positive drainage to the edges of the roadway platform or into subdrains along the perimeter of the parking lot. Grading adjacent to pavement areas should be designed to ensure that water is not allowed to pond adjacent to the outside edges of the pavement.

Continuous pavement subdrains should be provided along the perimeter of the parking lots and drained into respective catch basins or other drainage features to facilitate drainage of the subgrade and the granular materials. The subdrain invert should be maintained at least 0.3 metres below subgrade level. To minimize the problems of differential movement between the pavement and catch basins / manholes due to frost action, the backfill around the structures should consist of free-draining granular material. Typical pavement drainage details are included in Appendix C.

4.9.3 Pavement Structure

The projected traffic volumes for the proposed development were unknown at the time of writing of this report. There are two different types of pavements that need to be designed for:

- Light duty: Includes driveways, internal roadways and parking lots which will not see frequent heavy traffic loads such as buses, delivery or fire trucks, etc., and will mostly service small vehicles such as cars or pickup trucks.
- Heavy Duty: Includes driveways, internal roadways and parking lots which are designated fire truck routes, or will see frequent heavy traffic loads such as buses, delivery or garbage trucks, etc.

The industry pavement design methods are based on a design life of 15 to 20 years for typical weather conditions depending on actual traffic volumes. The following pavement thickness designs are provided on the above noted considerations and subgrade basis for an asphaltic concrete pavement structure for the parking lot associated with the development:

Pavement Layer	Compaction Requirements	Light Duty Minimum Thickness	Heavy Duty Minimum Thickness
Surface Course Asphaltic Concrete: HL-3 (OPSS 1150) with PG 58-28 Asphalt Cement (OPSS.MUNI 1101)	OPSS 310	40 mm	40 mm
Binder Course Asphaltic Concrete: HL-4 (OPSS 1150) with PG 58-28 Asphalt Cement (OPSS.MUNI 1101)		50 mm	70 mm
Base Course: Granular A (OPSS.MUNI 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm	150 mm
Subbase Course: Granular B Type I or II (OPSS.MUNI 1010)		300 mm	450 mm

The granular materials should be placed in lifts 200 mm thick or less and be compacted to a minimum of 100% SPMDD for both granular base and subbase. Asphalt materials should be rolled and compacted as per OPSS 310. The granular and asphalt pavement materials and their placement should conform to OPSS 310, 501, 1010 and 1150.

Smooth transitions are required in all areas where the new pavement meets the existing asphalt surface. All longitudinal and transverse joints should meet the requirements of OPSS 310. All longitudinal joints should be staggered between the asphalt lifts. The staggering of the longitudinal joints should be accomplished by offsetting the paving edge in the upper asphalt course by a minimum of 150 mm.

If the pavement construction occurs in wet, winter, or inclement weather, it may be necessary to provide additional subgrade support for heavy construction traffic by increasing the thickness of the granular subbase, base, or both. Further, traffic areas for construction equipment may experience unstable subgrade conditions. These areas may be stabilized utilizing additional thickness of granular materials.

It should be noted that in addition to adherence of the above pavement design recommendations, a close control on the pavement construction process will also be required in order to obtain the desired pavement life. Therefore, it is recommended that regular inspection and testing should be conducted during the pavement construction to confirm material quality, thickness, and to ensure adequate compaction.

4.10 LID Features

Low impact development (LID) drainage features utilize natural processes such as infiltration and evapotranspiration to protect water quality and manage stormwater runoff. It is understood there is consideration for the implementation of LID features at the site, however the location, depth, dimensions, and composition of the LID features are unknown at this time.

Each of the boreholes advanced throughout the site encountered cohesionless silty sand to gravelly sand earth fill, which extended to a depth of 2.3 metres below existing grade, underlain by native cohesionless sand deposits which extended to the borehole termination depths of 6.6 metres below existing grade. The groundwater table is about 4.9 to 5.0 metres below grade across the site based on drilling and monitoring well observations.

Representative grain size distribution curves of the cohesionless native sand deposits beneath the site were developed by testing the soil samples in accordance with applicable Ontario LS standards in reference to ASTM D6913 (sieve analysis) and ASTM D7928 (sedimentation/hydrometer analysis). The results of the laboratory tests and graphical representation of these grain size analyses are provided in Appendix B.

Determination of percolation rates from the grain size analysis are based on the *"Ontario Ministry of Municipal Affairs and Housing (OMMAH), Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions, 1997."* Based on this document, the estimated percolation rate (T-Time) of the native sand is listed below and is related to infiltration rate using the relationship provided in *"Low Impact Development Stormwater Management Planning and Design Guide",* by CVC (Version 1.0, 2010).

- Native Sand, Trace Silt: T-Time (8 mins/cm), Infiltration Rate (75 mm/hr).

CVC guidelines recommend that a safety factor be applied to the infiltration rates. The recommended safety factor is 2.5 provided the soil is uniform within a horizon of 1.5 metres below the bottom the of LID measure, which is likely applicable for the site based on the borehole findings. The factored infiltration rate is therefore 30 mm/hr for the native

cohesionless sand deposit. Infiltration measures are typically designed to be 1 metre or more above the seasonal high groundwater table and infiltration into the existing earth fill is not recommended.

Some additional general LID considerations are provided below for bioretention and other infiltration systems. Detailed design of LID features will be carried out by others.

- Due to variability and deleterious materials that can occur within the earth fill zone, it is not recommended to infiltrate water into the earth fill.
- Bioretention infiltration elevations should be kept 1 metre or more above the seasonally high groundwater table to prevent groundwater from intersecting the filter bed and potentially contaminating the groundwater or causing the LID feature to fail.
- Care should be taken during construction to prevent disturbance or siltation of the cohesionless native sands at the proposed infiltration elevations.
- There is a risk of groundwater contamination in urban areas, especially from higher traffic roadways or parking lots where de-icing salts are applied. Pre-treatment of stormwater may be required.
- The LIDs should be kept at least 4 metres from any building foundations.
- Settlement of nearby dwellings due to infiltration is not considered to be an issue.
- Vegetation in bioretention facilities should be maintained to help reduce erosion.
- The bioretention facilities within or adjacent to the parking areas should be designed so that retained water is not allowed to pool within the granular base material of the pavement structure.

5. Constructability Considerations

5.1 Excavations

Excavations must be carried out in accordance with the Occupational Health and Safety Act, Ontario Regulation 213/91 (as amended), Construction Projects, Part III - Excavations, Section 222 through 242. Where workers must enter a trench or excavation the soil must be suitably sloped and/or braced in accordance with the OHSA. These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety. The regulation stipulates safe slopes of excavation as follows based on the earth fill and sands encountered at this site:

- Type 4 Soil (within the groundwater table): Trench sidewalls to be constructed no steeper than 3 horizontal to 1 vertical from the base of the excavation.
- Type 3 Soil (above the groundwater table or when dewatered): Trench sidewalls to be constructed no steeper than 1 horizontal to 1 vertical from the base of the excavation.

If more than one soil type is encountered in an excavation, the most conservative soil type must be followed for sloping the sidewalls of the excavation. For the purposes of design, excavations at this site are expected to remain above the groundwater table and should be conducted assuming a Type 3 soil unless otherwise directed by a geotechnical engineer on site.

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 238 and 241 of the OHSA and include provisions for timbering, shoring and moveable trench boxes. To reduce the potential for instability of the trench excavations, materials excavated from the service trenches and/or other fill materials or heavy equipment should not be placed near the crest of the trench excavations.

It is important to note that soils encountered in the construction excavations may vary significantly across the site. Our preliminary soil classifications are based solely on the materials encountered in the boreholes advanced on site. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, we recommend that GEI be contacted immediately to evaluate the conditions encountered.

5.2 Temporary Construction Groundwater Control

Based on the stabilized and unstabilized groundwater measurements and the moisture contents of the soil within the boreholes, the prevailing groundwater table appears to be at a depth on the order of 4.9 to 5.0 metres below existing grade (Local Elev. 94.9 to 94.5 metres) across the site.

The cohesionless native sand and zones of cohesionless earth fill at the site are permeable and will allow for the free flow of water when wet. Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions.

It is important to control the groundwater adequately. If the groundwater table is not controlled during construction, the base for the servicing or foundations may become unstable.

Based on the provided information, it is assumed that:

- Watermain and sanitary sewer servicing will be constructed at least 1.7 metres below existing grade, based on minimum soil cover depths specified in the relevant Design Criteria by the City of Barrie.
- Foundations for the proposed apartment building may be made at or below 3.0 metres below grade.

Excavations for site services and foundations are not expected to extend below the groundwater table. Any seepage from precipitation or minor perched water zones can be controlled using a conventional sump pump system. A hydrogeological study for the site may be required to address dewatering strategies for any deeper excavations extending into the prevailing groundwater table.

5.3 Compaction Specifications

Standard Proctor Maximum Dry Density (SPMDD) is the level to which a soil or aggregate is compacted. To achieve the specified SPMDD as indicated in this report, all soils or aggregates must be placed in lift thicknesses no greater than 200 mm. If this is not the case, only the upper portion of the lift will be adequately compacted, and the lower portion of the lift has a high probability of not meeting compaction specifications. In addition, industry standard equipment used to determine the degree of compaction consists of nuclear densometers. These devices have an inherent limitation in that they cannot test beyond 300 mm in depth, and so the degree of compaction beyond this depth cannot be quantitatively determined.

Along with lift thickness, ensuring that the soil or aggregate is within 2% of its optimum moisture content ensures that the specified compaction can be reached. If the soil or aggregate is too dry/wet, it is either very difficult or impossible to reach the specified compaction. This is especially true for when higher compaction specifications such as 98% and 100% SPMDD are required. Based on our review of the soil types encountered in the boreholes with associated moisture contents, the soils at this site are as follows:

- Approximately one third of earth fill and native soils are near optimum moisture content
- Approximately two thirds of earth fill and native soils are dry of optimum moisture content.

Moisture can be increased by adding water and mixing the soil prior to re-use, or by importing soil to the site that is at optimum and can be readily compacted. Moisture can be reduced by tilling or spreading out the soil to dry or blending it with drier material. In-situ moisture contents can change based on the season and local groundwater levels and can also change for stockpiled material due to precipitation.

In addition to the above compaction specifications, in any areas where compacted fill will be placed over the exposed native soil subgrade, any loose, soft, wet or unstable areas should be sub-excavated, and backfilled with clean earth fill or Granular 'B' (OPSS.MUNI 1010) compacted to a minimum of 98% SPMDD. This recommendation applies to site servicing and pavement subgrades.

5.4 Quality Verification Services

On-site quality verification services are an integral part of the geotechnical design function, and for engineered fill, foundations, and retaining walls, are required under the Ontario Building Code (OBC). Quality verification services are used to confirm that construction is being conducted in general conformance with the requirements as outlined in the drawings, reports and specifications prepared for the proposed development.

GEI Consultants can provide all the on-site quality verification services outlined below:

- The four-storey apartment building foundation subgrade must be field reviewed by the geotechnical engineer.
- Installation of retaining structures over 1.0 metres high and related backfilling operations must be field reviewed on a continuous basis by the geotechnical engineer as required in the OBC.
- Part-time monitoring of the subgrade support capabilities, material quality, lift thickness, moisture content, degree of compaction, etc. is recommended for the following areas to ensure the recommendations within this report are followed and they perform adequately in the long-term:
    - Slabs-on-grade;
    - Pavement structure (granular layers and asphalt); and
    - Bedding/backfilling of site servicing.
- Testing of the concrete (compressive strength, slump, air content, etc.) and testing of the asphalt (asphalt content and gradation) are recommended to ensure that the quality of the materials being brought to site meet the requirements of the project.

5.5 Site Work

The soils found at this site may become weakened when subjected to traffic, particularly when wet. If there is site work carried out during periods of wet weather, then it can be expected that the subgrade will be disturbed unless an adequate granular working surface is provided to

protect the integrity of the subgrade soils from construction traffic. Subgrade preparation works cannot be adequately accomplished during wet weather and the project must be scheduled accordingly. The disturbance caused by the traffic can result in the removal of disturbed soil and use of granular fill material for site restoration or underfloor fill that is not intrinsic to the project requirements.

The most severe loading conditions on the subgrade may occur during construction. Consequently, special provisions such as end dumping and forward spreading of earth and aggregate fills, restricted construction lanes, and half-loads during paving and other work may be required, especially if construction is carried out during unfavourable weather.

If construction proceeds during freezing weather conditions, adequate temporary frost protection for the founding subgrade and concrete must be provided. The soil at this site is susceptible to frost damage. Consideration must be given to frost effects, such as heave or softening, on exposed soil surfaces in the context of this project development.

6. Limitations and Conclusions

6.1 Limitations

The recommendations and comments provided are necessarily on-going as new information of underground conditions becomes available. More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operations. Consequently, conditions not observed during this investigation may become apparent. Should this occur, GEI should be contacted to assess the situation and additional testing and reporting may be required.

GEI should be retained for a general review of the final design drawings and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, GEI will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of the design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. could be greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

This report was prepared by GEI for the account of Fresco Development Bayfield. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. GEI accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

6.2 Conclusion

It is recognized that municipal/regional governing bodies, in their capacity as the planning and building authority under Provincial statues, will make use of and rely upon this report, cognizant of the limitations thereof, both as are expressed and implied.

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 contact our office.

Yours Truly,

GEI Consultants

Prepared By:

Jacob Bell, P.Eng.
Geotechnical Engineer

Reviewed By:

Russell Wiginton, P.Eng.
Senior Geotechnical Engineer

Figures

Site Location Plan

Borehole Location Plans

NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Property Lines: 'Tax Parcels', BarrieGIS. AGOL. Accessed Dec. 2021.

Legend

Site Location

N

0 50 100 m

1:10,000

Geotechnical Investigation
202 Dunlop Street West
Barrie, ON

Fresco Development Bayfield

GEI Consultants

Project 2103921

SITE LOCATION PLAN

December 2021

Fig. 1

NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © First Base Solutions, 2021. Imagery taken in 2020.

Legend

Approximate Property Boundary

Approximate Borehole/Monitoring Well Location

N

0 5 10 m

1:400

Geotechnical Investigation
202 Dunlop Street West
Barrie, ON

Fresco Development Bayfield

GEI Consultants

Project 2103921

BOREHOLE LOCATION PLAN
(AERIAL)

December 2021

Fig. 2A

NOTES:

1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. "Conceptual Site Plan – 27 Units, 202 Dunlop St. W – City of Barrie," File No. 21-1100, dated August 6, 2021, by Innovative Planning Solutions

Legend

Approximate Property Boundary

Approximate Borehole/Monitoring Well Location

N

0 5 10 m

1:400

Geotechnical Investigation
202 Dunlop Street West
Barrie, ON

Fresco Development Bayfield

GEI Consultants

Project 2103921

BOREHOLE LOCATION PLAN
(PROPOSED SITE PLAN)

December 2021

Fig. 2B

Appendix A

Borehole Logs

RECORD OF BOREHOLE No. 1

GEI Consultants

Project Number:	**2103921**				
Project Client:	**Fresco Development Bayfield**				
Project Name:	**202 Dunlop Street West**	Drilling Method:	**Solid Stem Augers**	Drilling Machine:	**Truck Mounted**
Project Location:	**Barrie, ON**	Logged By:	**SG**	Northing: **4915504**	Date Started: **2021-11-29**
Drilling Location:	**Per Attached Borehole Location Plan**	Reviewed By:	**JB**	Easting: **603555**	Date Completed: **2021-11-29**

LITHOLOGY PROFILE / SOIL SAMPLING

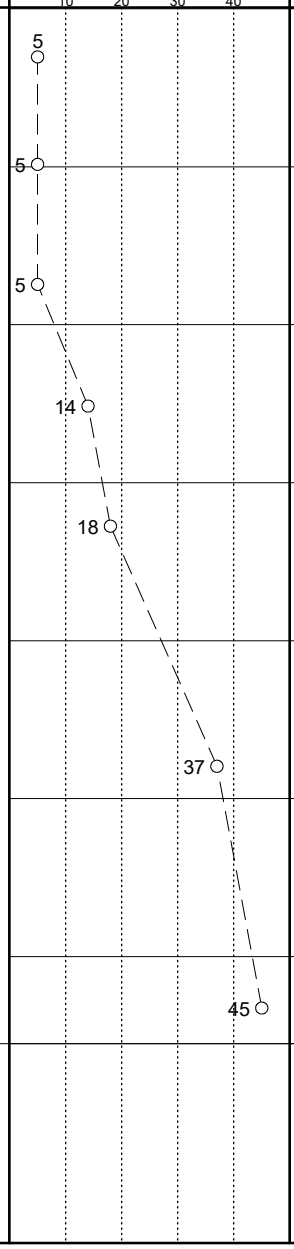
Local 99.83 m

Depth	Description	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	GR	SA	SI	CL
0.1 / 99.8	ASPHALT: 70 mm								
0.2 / 99.6	GRANULARS: 130 mm								
	FILL: gravelly sand, trace silt, brown, damp, loose	SS	1	75	5				
		SS	2	100	5				
		SS	3	100	5				
2.3 / 97.5	SAND: trace silt, brown with dark layering, damp, compact	SS	4	89	14				
		SS	5	89	18	-	97	3	-
	--- dense, moist ---	SS	6	94	37				
	--- trace gravel, wet ---	SS	7	89	45				
6.6 / 93.3	Borehole Terminated at 6.6 m								

FIELD TESTING

Shear Strength Testing (kPa): Other Test; Pocket Penetrometer; Field Vane (Intact); Field Vane (Remolded) — 40 80 120 160

Penetration Testing: SPT; DCPT — 10 20 30 40

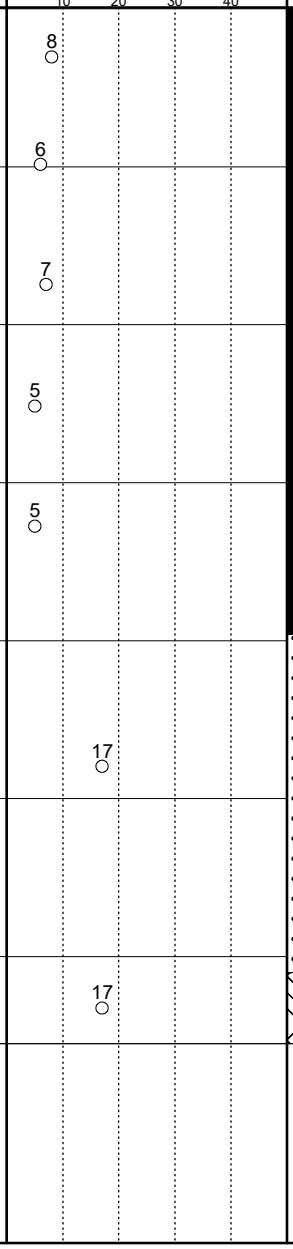


LAB TESTING

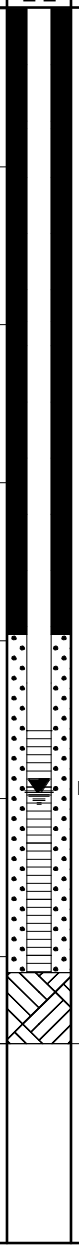
Combustible Organic Vapour (ppm); Combustible Organic Vapour (%LEL); Total Organic Vapour (ppm) — 100 200 300 400

Atterberg Limits: PL — LL

Water Content (%) — 10 20 30 40



Instrumentation Installation



First Water Strike at 4.88 m

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR | SA | SI | CL

GEI CONSULTANTS

647 Welham Road, Unit 14
Barrie, Ontario L4N 0B8
T : (705) 719-7994
www.geiconsultants.com

Groundwater depth encountered on completion of drilling: **5.2 m**

Cave depth after auger removal: **4.9 m**

Groundwater depth observed on **2021-12-09** at a depth of: **4.96 m**

Observed on **2022-01-07** at a depth of: **4.95 m**

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

RECORD OF BOREHOLE No. 2

GEI Consultants

Project Number:	**2103921**				
Project Client:	**Fresco Development Bayfield**				
Project Name:	**202 Dunlop Street West**	Drilling Method:	**Solid Stem Augers**	Drilling Machine:	**Truck Mounted**
Project Location:	**Barrie, ON**	Logged By:	**SG**	Northing: **4915506**	Date Started: **2021-11-29**
Drilling Location:	**Per Attached Borehole Location Plan**	Reviewed By:	**JB**	Easting: **603578**	Date Completed: **2021-11-29**

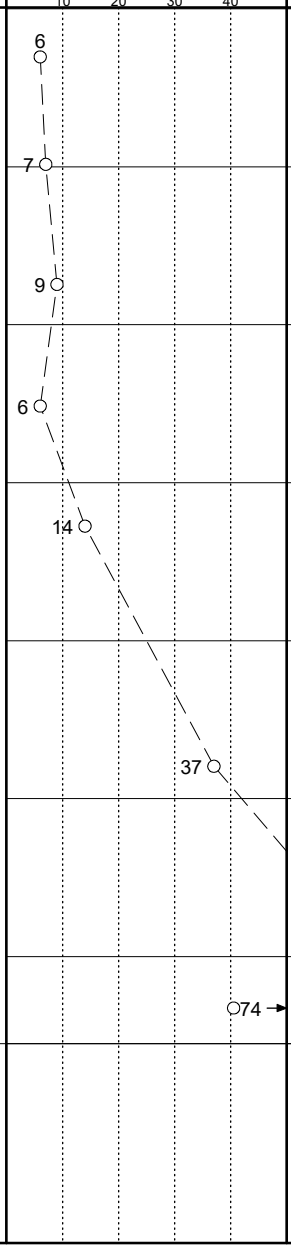
LITHOLOGY PROFILE / SOIL SAMPLING

Local	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	GR	SA	SI	CL
0.1 / 99.5	ASPHALT: 50 mm								
0.3 / 99.3	GRANULARS: 230 mm	SS	1	71	6				
	TOPSOIL: 480 mm								
0.8 / 98.8	FILL: silty sand, light brown, damp, loose	SS	2	78	7				
	--- some gravel ---	SS	3	83	9				
2.3 / 97.3	SAND: trace silt, trace gravel, brown with dark layering, damp, loose	SS	4	94	6	1	96	3	-
	--- brown with no layering, compact ---	SS	5	83	14				
	--- coarse, brown with dark layering, moist to wet, dense ---	SS	6	94	37				
6.6 / 93.0	--- brown with no layering, very dense ---	SS	7	100	74				
	Borehole Terminated at 6.6 m								

FIELD TESTING

Shear Strength Testing (kPa): × Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded) — 40, 80, 120, 160

Penetration Testing: ○ SPT ● DCPT — 10, 20, 30, 40

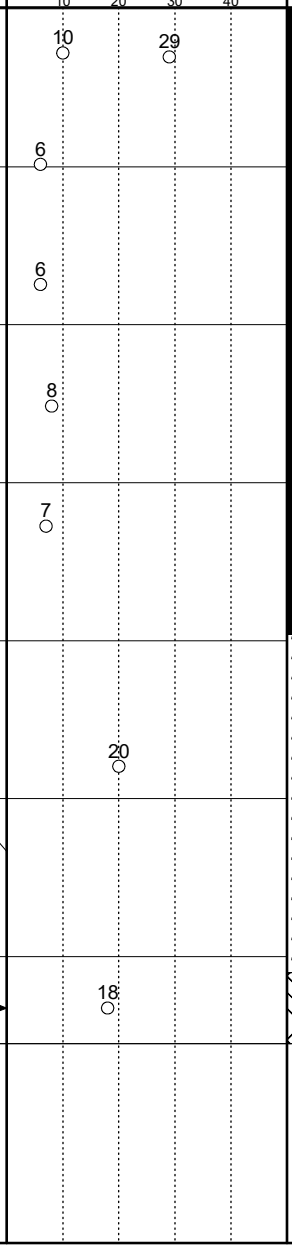


LAB TESTING

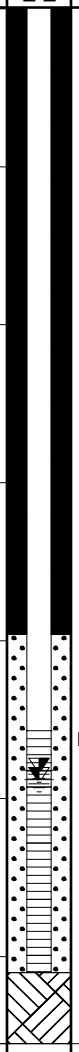
△ Combustible Organic Vapour (ppm); ▲ Combustible Organic Vapour (%LEL); ✳ Total Organic Vapour (ppm) — 100, 200, 300, 400

Atterberg Limits: PL — LL

○ Water Content (%) — 10, 20, 30, 40



Instrumentation Installation



First Water Strike at 4.57 m

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR | SA | SI | CL

GEI CONSULTANTS

647 Welham Road, Unit 14
Barrie, Ontario L4N 0B8
T : (705) 719-7994
www.geiconsultants.com

Groundwater depth encountered on completion of drilling: **5.2 m**

Cave depth after auger removal: **Open**

Groundwater depth observed on **2021-12-09** at a depth of: **4.88 m**

Observed on **2022-01-07** at a depth of: **4.82 m**

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

RECORD OF BOREHOLE No. 3

Project Number:	**2103921**				
Project Client:	**Fresco Development Bayfield**				
Project Name:	**202 Dunlop Street West**	Drilling Method:	**Solid Stem Augers**	Drilling Machine:	**Truck Mounted**
Project Location:	**Barrie, ON**	Logged By:	**SG**	Northing: **4915478**	Date Started: **2021-11-29**
Drilling Location:	**Per Attached Borehole Location Plan**	Reviewed By:	**JB**	Easting: **603574**	Date Completed: **2021-11-29**

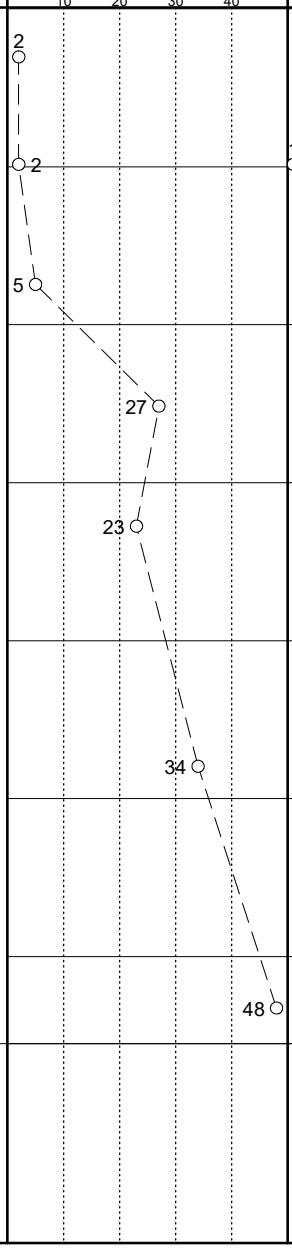
LITHOLOGY PROFILE / SOIL SAMPLING

Lithology Plot	DESCRIPTION (Local 99.45 m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value
	TOPSOIL: 475 mm (0.5 – 99.0)	SS	1	100	2
	FILL: sand, trace silt, brown, damp, loose	SS	2	100	2
		SS	3	100	5
	(2.3 – 97.2) SAND: coarse, trace silt, brown, damp, compact --- brown with dark layering ---	SS	4	100	27
		SS	5	94	23
	--- moist to wet, dense ---	SS	6	94	34
	--- wet --- (6.6 – 92.9)	SS	7	100	48
	Borehole Terminated at 6.6 m				

FIELD TESTING

Shear Strength Testing (kPa): × Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded) — 40 80 120 160

Penetration Testing: ○ SPT ● DCPT — 10 20 30 40

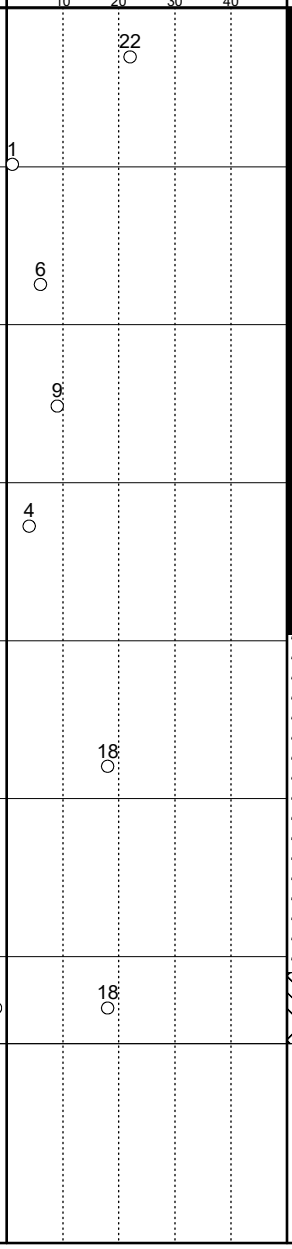


LAB TESTING

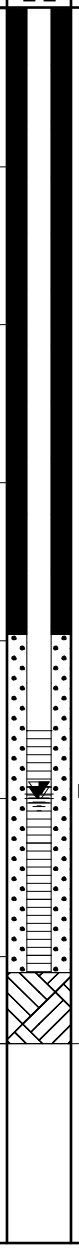
△ Combustible Organic Vapour (ppm); ▲ Combustible Organic Vapour (%LEL); ✳ Total Organic Vapour (ppm) — 100 200 300 400

Atterberg Limits: PL — LL

○ Water Content (%) — 10 20 30 40



Instrumentation Installation



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
-	96	4	-

First Water Strike at 4.88 m

GEI CONSULTANTS

647 Welham Road, Unit 14
Barrie, Ontario L4N 0B8
T : (705) 719-7994
www.geiconsultants.com

Groundwater depth encountered on completion of drilling: **5.2 m**

Cave depth after auger removal: **Open**

Groundwater depth observed on **2021-12-09** at a depth of: **5.00 m**

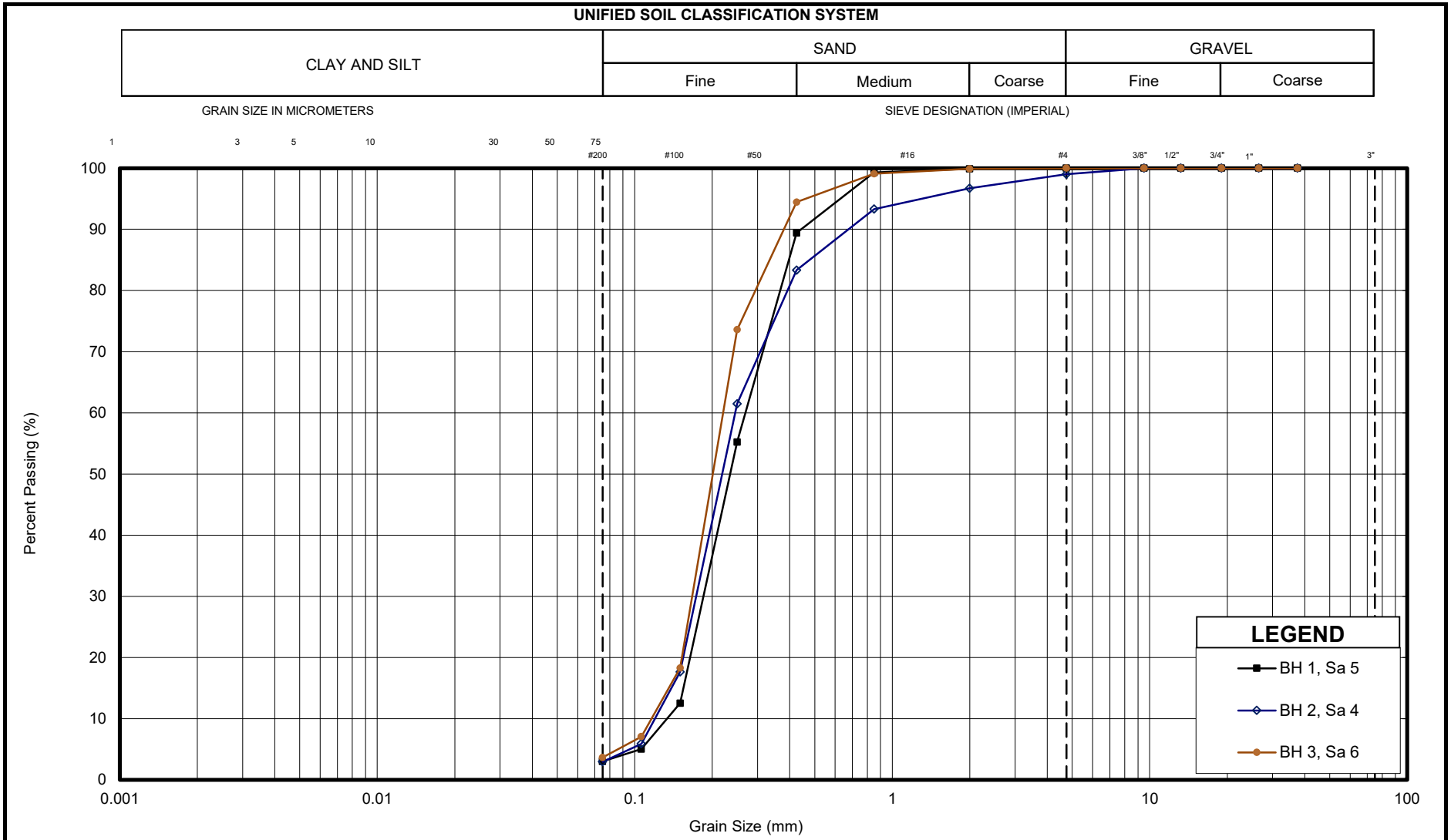
Observed on **2022-01-07** at a depth of: **4.97 m**

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

Appendix B

Geotechnical Laboratory Testing



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH1 Sa 5	SAND, Trace Silt	-	97	3	-	0.133	0.185	0.226	1.7	1.1
BH 2 Sa 4	SAND, Trace Silt, Trace Gravel	1	96	3	-	0.12	0.173	0.246	2.1	1.0
BH 3 Sa 6	SAND, Trace Silt	-	96	4	-	0.116	0.167	0.221	1.9	1.1

GEI Consultants

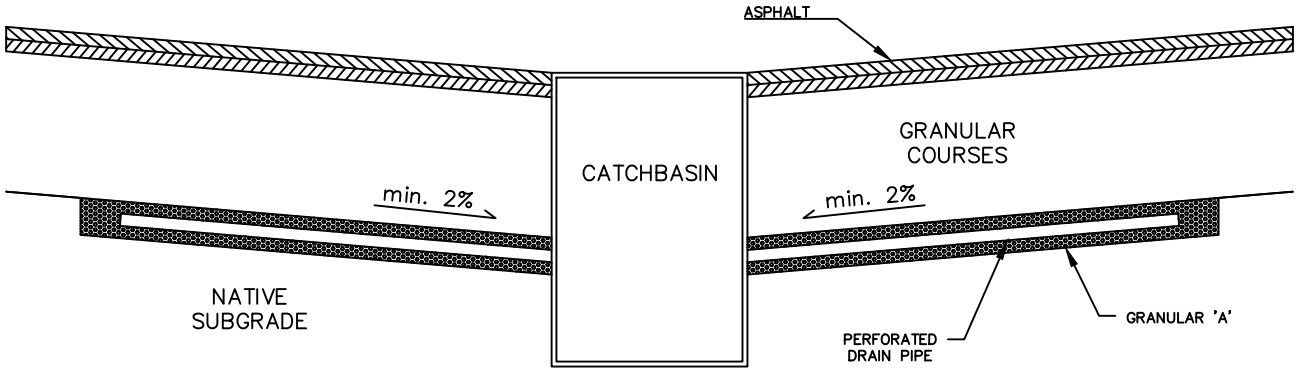
GRAIN SIZE DISTRIBUTION - 202 Dunlop Street

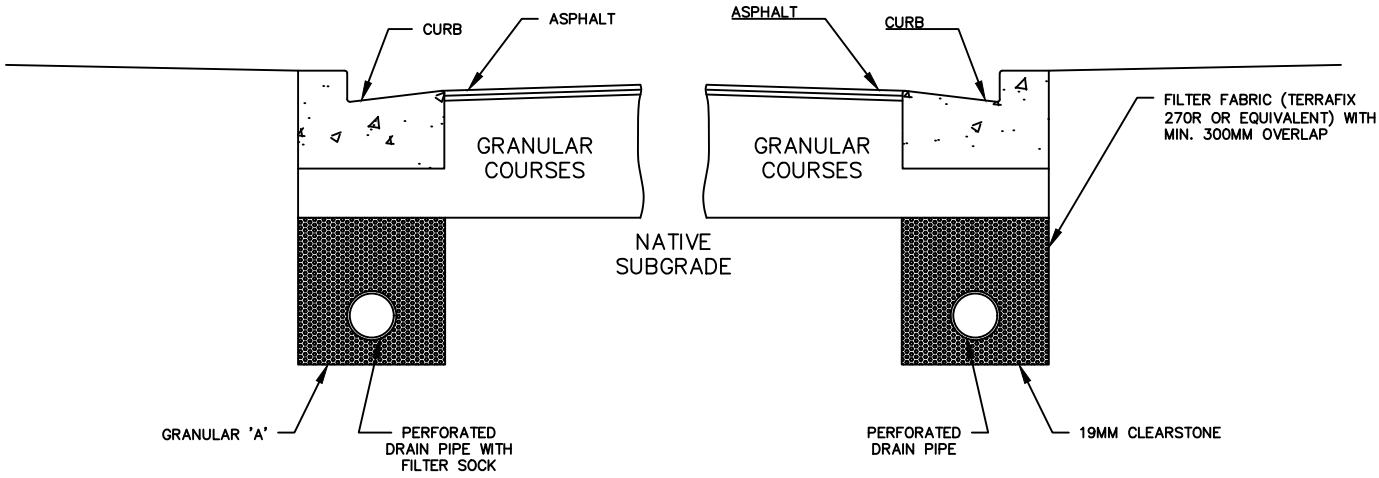
SAND

FIGURE No.	B1
REF. No.	2103921
DATE	December 2021

Appendix C

Typical Details

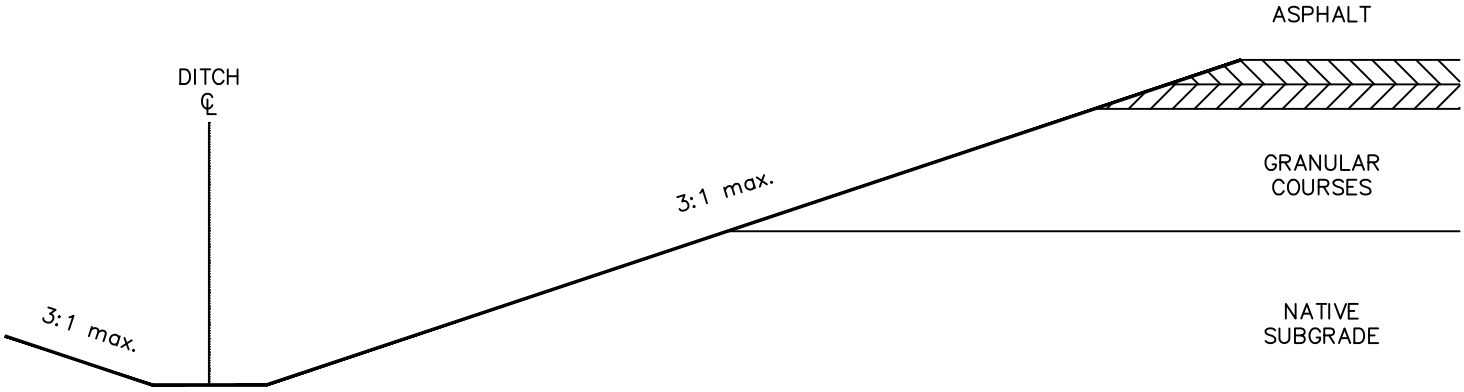




Unwrapped Trench

Wrapped Trench

Urban Cross Sections



Rural Cross Section

GEI Consultants
647 Welham Rd, Unit 14, Barrie, ON, L4N 0B7

PAVEMENT DRAINAGE ALTERNATIVES TYPICAL DETAILS

Design Chart 1.08: Hydrologic Soil Groups (Continued)

- Based on Soil Texture

Sands, Sandy Loams and Gravels	
- overlying sand, gravel or limestone bedrock, very well drained	A
- ditto, imperfectly drained	AB
- shallow, overlying Precambrian bedrock or clay subsoil	B
Medium to Coarse Loams	
- overlying sand, gravel or limestone, well drained	AB
- shallow, overlying Precambrian bedrock or clay subsoil	B
Medium Textured Loams	
- shallow, overlying limestone bedrock	B
- overlying medium textured subsoil	BC
Silt Loams, Some Loams	
- with good internal drainage	BC
- with slow internal drainage and good external drainage	C
Clays, Clay Loams, Silty Clay Loams	
- with good internal drainage	C
- with imperfect or poor external drainage	C
- with slow internal drainage and good external drainage	D

Source: U.S. Department of Agriculture (1972)

APPENDIX C

STORMWATER MANAGEMENT CALCULATIONS AND REFERENCE DOCUMENTS

PINESTONE ENGINEERING LTD.

where,

Q = the design flow in (m^3/s)

C = the site specific runoff coefficient

A = the drainage area (ha)

i = rainfall intensity (mm/hr)

The rainfall intensity shall be calculated in accordance with the following table and equation:

Table 3.1: Barrie WPCC IDF Curve Parameters - Adjusted to Account for Climate Change

Parameter	Return Period					
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
A	675.586	843.019	976.898	1133.123	1251.473	1383.628
B	4.681	4.582	4.745	4.734	4.847	4.905
C	0.780	0.763	0.760	0.756	0.753	0.754

Rainfall Intensity, I (mm/hr) = $A/(t+B)^C$, where t is time duration in minutes

Parameters based on rain gauge data for the period 1979 – 2003 for the Barrie WPCC Station #6110557

Based on a review of the literature, the IDF intensity values for Barrie WPCC Station were increased by 15% before calculating a, b, c values to account for climate change.

$$i = \frac{A}{(t_d + B)^C}$$

where,

i = the rainfall intensity (mm/hr)

t_d = the storm duration (minutes)

A, B, C = a function of the local intensity-duration data.

The storm duration is set to the time of concentration (i.e. the sewer inlet time plus the time of travel in the pipe or channel) for the total cumulative drainage area to the node of interest. The maximum inlet time for the first pipe of a storm sewer system is 10 minutes.

The runoff coefficient shall be calculated in accordance with the following table:

Table 3.2: Runoff Coefficients (Rational C) (5-yr to 10-yr) Based on Hydrologic Soil Group

Land Use	Runoff Coefficient "C"		
	A-AB	B-BC	C-D
Cultivated Land, 0 - 5% grade	0.22	0.35	0.55
Cultivated Land, 5 - 10% grade	0.30	0.45	0.60
Cultivated Land, 10 - 30% grade	0.40	0.65	0.70
Pasture Land, 0 - 5% grade	0.10	0.28	0.40
Pasture Land, 5 - 10% grade	0.15	0.35	0.45
Pasture Land, 10 - 30% grade	0.22	0.40	0.55
Woodlot or Cutover, 0 – 5% grade	0.08	0.25	0.35
Woodlot or Cutover, 5 - 10% grade	0.12	0.30	0.42
Woodlot or Cutover, 10 - 30% grade	0.18	0.35	0.52
Lakes and Wetlands	0.05	0.05	0.05
Impervious Area (i.e., buildings, roads, parking lots, etc.)	0.95	0.95	0.95
Gravel (not to be used for proposed parking or storage areas)	0.40	0.50	0.60
Residential – Single Family	0.30	0.40	0.50
Residential – Multiple (i.e., semi, townhouse, apartment)	0.50	0.60	0.70
Industrial – light	0.55	0.65	0.75
Industrial – heavy	0.65	0.75	0.85
Commercial	0.60	0.70	0.80
Unimproved Areas	0.10	0.20	0.30
Lawn, < 2% grade	0.05	0.11	0.17
Lawn, 2 - 7% grade	0.10	0.16	0.22
Lawn, > 7% grade	0.15	0.25	0.35

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

An approximation of the runoff coefficient can be calculated based on the following relationship with: $c = (0.7)(TIMP) + 0.2$

where,

c = the runoff coefficient

TIMP = total impervious fraction (dimensionless)

The runoff coefficient shall be adjusted for return period events greater than the 10-yr storm per the following table:

Table 3.3: Runoff Coefficient Adjustment for 25-yr to 100-yr Storms

Return Period	Runoff Coefficient "C"
25 years	$C_{25} = 1.1*C_5$
50 years	$C_{50} = 1.2*C_5$
100 years	$C_{100} = 1.25*C_5$

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

7.2.5 Calculation of Model Parameters

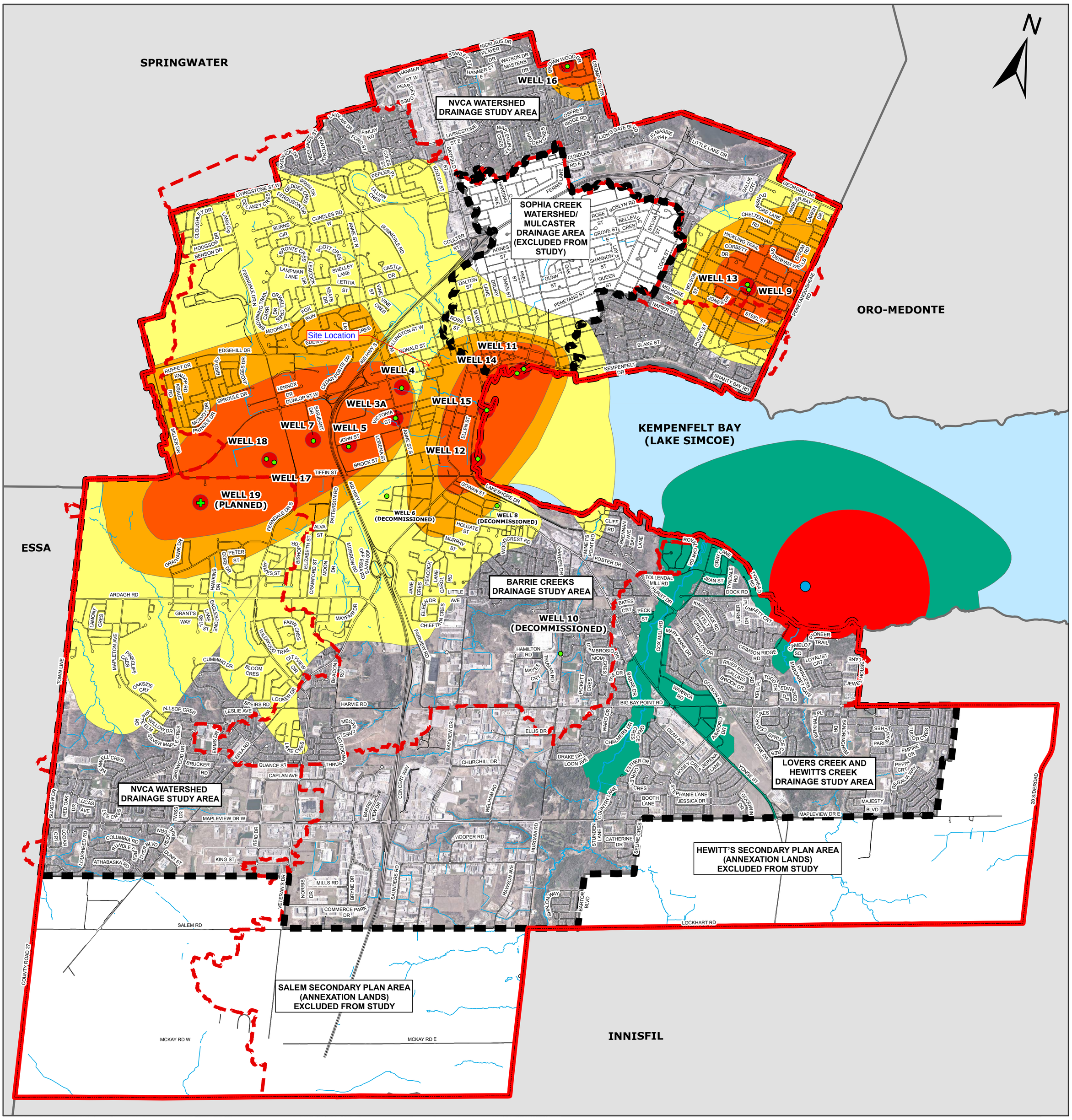
Model parameters shall be site specific, area weighted if required, and provided with the design documents. Soils information shall be obtained from on-site soil testing (*e.g.* borehole data) or soil survey mapping (*e.g. Soil Survey of Simcoe County*).

Table 7.4: Curve Numbers for Selected Land Uses

Land Use Description	Hydrologic Soil Group (AMC II)						
	A	AB	B	BC	C	CD	D
Cultivated Land (Fallow)	77	82	86	89	91	93	94
[2]**Cultivated Land** (Row Crops)							
---- without agricultural BMPs	72	77	81	85	88	90	91
---- [3]with agricultural BMPs	62	67	71	75	78	80	81
[4]**Cultivated Land (Small Grain)**							
---- without agricultural BMPs	65	71	76	80	84	86	88
---- with agricultural BMPs	59	65	70	74	78	80	81
[5]**Cultivated Land** (Close-seeded Legumes or Rotation Meadow)							
---- without agricultural BMPs	66	72	77	81	85	87	89
---- with agricultural BMPs	51	59	67	72	76	78	80
Pasture or Range Land							
---- [6]poor condition	68	74	79	83	86	88	89
---- [7]good condition	39	50	61	68	74	77	80
Meadow							
---- good condition	30	44	58	65	71	75	78
Wooded or Forest Land							
---- [8]poor cover	45	56	66	72	77	80	83
---- [9]good cover	25	40	55	63	70	74	77
Open Spaces, Lawns, Parks, Golf Courses, Cemeteries							
---- good condition (≥75% grass coverage)	39	50	61	68	74	77	80

---- fair condition (50% - 75% grass coverage)	49	59	69	74	79	82	84
Commercial and Business Areas (~85% impervious)	89	91	92	93	94	95	95
Industrial Areas (~72% impervious)	81	85	88	90	91	92	93
[10]**Residential Areas**							
---- ≤ 1/8 acre lot size (~65% impervious)	77	81	85	88	90	91	92
---- 1/4 acre lot size (~38% impervious)	61	68	75	79	83	85	87
---- 1/3 acre lot size (~30% impervious)	57	65	72	77	81	84	86
---- ½ acre lot size (~25% impervious)	54	62	70	75	80	83	85
---- 1 acre lot size (~20% impervious)	51	60	68	74	79	82	84
Paved Parking Lots, Roofs, Driveways	98	98	98	98	98	98	98
Streets and Roads							
---- paved with curb and storm sewer connection	98	98	98	98	98	98	98
---- gravel	76	81	85	87	89	90	91
---- dirt	72	77	82	85	87	88	89
[11]**Open Water Bodies** (Lakes, Wetlands, Ponds)	100	100	100	100	100	100	100

1 -- Adapted from U.S. Soil Conservation Service National Engineering Handbook (1972), MTC Drainage Manual Chapter B (1984), MTO Drainage Management Manual (1997).
2 -- Includes row crops such as soybeans, corn, sorghum hay, peanut, potato, etc.
3 -- Includes agricultural best management practices (BMPs) such as contouring and terracing.
4 -- Includes small grain crops such as winter wheat, spring wheat, durham wheat, barley, oats, rye, etc.
5 -- Includes close-seeded legumes such as alfalfa, timothy grass, grass hay, etc.
6 -- Poor condition is defined as heavily grazed, no mulch, or has plant cover on less than 50% of the area.
7 -- Good condition is defined as lightly grazed, more than 75% of the area has plant cover.
8 -- Poor cover is defined as heavily grazed or regularly burned so that litter, small trees and brush are regularly destroyed.
9 -- Good cover is defined as protected from grazing so that litter and shrubs cover the soil.
10 -- Curve numbers are calculated assuming that roof leaders are connected to the driveway and/or road with a minimum of additional infiltration.
11 – When a number of water bodies within a large multi-land use catchment is modeled, a CN value of 50 may be applied to the water bodies in calculating the area-weighted CN value. When isolating a water body and modeling as a separate catchment, then a CN value of 100 should be used and the catchment is typically routed through a reservoir.



Source: Approved Assessment Report: Lake Simcoe and Couchiching-Black River Source Protection Area Part 1. South Georgian Bay – Lake Simcoe Source Protection Committee (2011)

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Legend

- ROADS
- WATERCOURSES
- DRAINAGE STUDY AREA BOUNDARY
- OVERALL STUDY AREA
- ANNEXATION LANDS (EXCLUDED FROM STUDY)
- SOPHIA CREEK AND MULCASTER DRAINAGE AREAS (EXCLUDED FROM STUDY)
- MUNICIPAL BOARDER
- INTAKE PROTECTION ZONE 1 (VULNERABILITY SCORE 8)
- INTAKE PROTECTION ZONE 2 (VULNERABILITY SCORE 6.4)

WHPA

- WHPA-A (100m RADIUS)
- WHPA-B (2yr TIME OF TRAVEL)
- WHPA-C (10yr TIME OF TRAVEL)
- WHPA-D (25yr TIME OF TRAVEL)
- SURFACE WATER INTAKE (TYPE D)

TATHAM ENGINEERING

Barrie

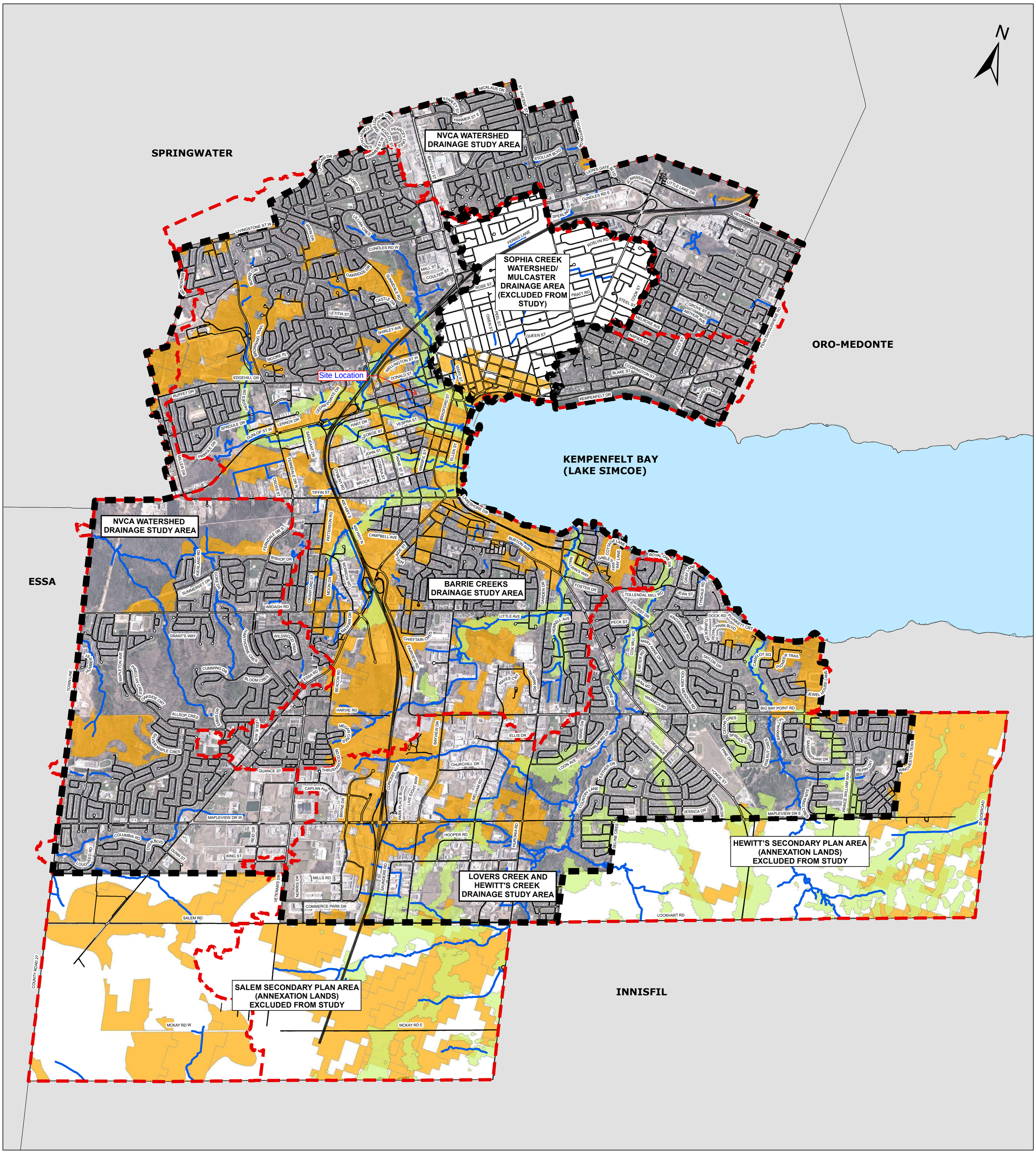
SCALE = 1:24,000

0 325 650 1,300 1,950 2,600 Meters

DRAINAGE MASTER PLAN

FIGURE 10 - KNOWN WELLHEAD PROTECTION AREA/INTAKE PROTECTION AREA PLAN

DATE: MARCH 2019



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LEGEND

- ROADS
- WATERCOURSES
- DRAINAGE STUDY AREA BOUNDARY
- OVERALL STUDY AREA
- SGRA *(SIGNIFICANT GROUNDWATER RECHARGE AREAS)*
- ESGRA *(ECOLOGICALLY SIGNIFICANT GROUNDWATER RECHARGE AREAS)*
- ANNEXATION LANDS (EXCLUDED FROM STUDY)
- SOPHIA CREEK AND MULCASTER DRAINAGE AREAS (EXCLUDED FROM STUDY)
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

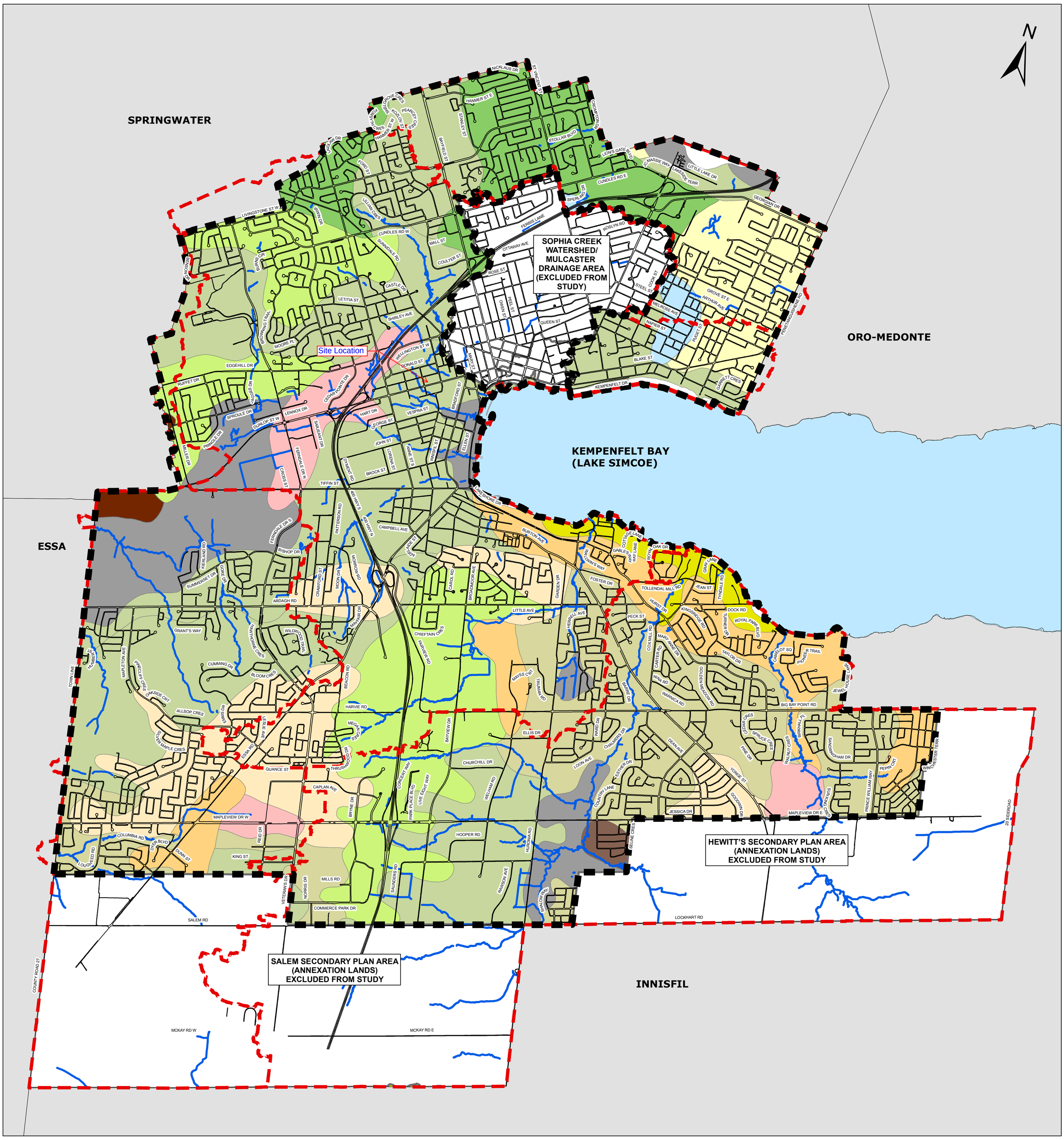
SCALE = 1:24,000

0 310 620 1,240 1,860 2,480 Meters

DRAINAGE MASTER PLAN

FIGURE 11 - GROUNDWATER RECHARGE AREA PLAN

DATE: MARCH 2019



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LEGEND

- ROADS
- WATERCOURSES
- DRAINAGE STUDY AREA BOUNDARY
- OVERALL STUDY AREA
- ANNEXATION LANDS (EXCLUDED FROM STUDY)
- SOPHIA CREEK WATERSHED AND MULCASTER DRAINAGE AREA (EXCLUDED FROM STUDY)
- MUNICIPAL BORDER

HYDROLOGIC SOIL GROUPS

- Ans - ALLISTON SANDY LOAM (AB)
- Bl - BONDHEAD LOAM (B)
- Bs - BONDHEAD SANDY LOAM (AB)
- Bs-b - BONDHEAD SANDY LOAM - STONY PHASE (AB)
- Bs-b - BONDHEAD SANDY LOAM - STONY PHASE (AB)
- Gsl - GRANBY SANDY LOAM
- Gul - GUERIN LOAM (B)
- M - MUCK (B)
- Shsc - SCHOMBERG SILTY CLAY LOAM (C)
- Smsc - SMITHFIELD SILTY CLAY LAOM
- Stsl - SARGENT GRAVELLY SANDY LOAM (A)
- Tis - TIOGA LOAMY SAND (A)
- Tis-b
- Tisl - TIOGA SANDY LOAM (A)
- Vasl - VASEY SANDY LOAM (AB)

TATHAM ENGINEERING

Barrie

SCALE = 1:24,000

0 310 620 1,240 1,860 2,480 Meters

DRAINAGE MASTER PLAN

FIGURE 12 - HYDROLOGIC SOIL GROUPS PLAN

DATE: MARCH 2019

APARTMENT DEVELOPMENT - 202 DUNLOP STREET WEST

PRE-DEVELOPMENT SWM INPUT PARAMETERS

City of Barrie, ON

Project Number: 22-11713B
Date: September 12, 2023
Design By: DH
File: Z:\Project Documents\11713B 202 Dunlop Street West, Barrie\REV 1 - Added Commercial Use to Ground Floor\SWM\11713B VO Modelling Parameters.xls

Runoff Coefficients	
Land Use	**"C"**
Lawns & Parks 2-7%	0.10
Unimproved areas	0.10
Rooftop Area	0.95
Townhouse Rooftop Area	0.95
Industrial Rooftop Area	0.95
Commercial	0.60
Gravel	0.40
Pasture/Meadow	0.10
Paved areas	0.95

* Values taken from the City of Barrie Stormwater Infrastructure Design Standard (2023)

Pre-Development Runoff Coefficients:

Catchment	Total Area (m^2)	Green Field & Parks Area (m^2)	Pasture/Meadow Area (m^2)	Rooftop Area (m^2)	Townhouse Rooftop Area (m^2)	Industrial Rooftop Area (m^2)	Commercial Area (m^2)	Gravel Area (m^2)	Unimproved Area (m^2)	Impervious Area (m^2)	Weighted C
101	2,430	745		670						1,015	0.69

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	101	
Catchment Area	=	0.2430	ha
Flow Length	=	40	m
Impervious Slope	=	0.02	m/m
Pervious Slope	=	0.02	m/m
Weighted Runoff Coefficient	=	0.69	

Pre-Development Curve Number (CN):

Catchment	Hydrologic Soil Group	Soil Texture	Total Area (m^2)	Lakes / Wetlands / SWMF's (m^2)	Gravel Area (m^2)	Good Open Space Area (m^2)	Fair Open Space Area (m^2)	Paved Area (m^2)	Rooftop Area (m^2)	Weighted CN
101	AB	Sand Trace Silt	745		0		745			59.0

SCS Curve Numbers							
	Hydrologic Soil Group						
Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands / Lakes/ SWMF's	100	100	100	100	100	100	100
Gravel	76	81	85	87	89	90	91
Meadow/Field	30	44	58	65	71	75	78
Open Space (Fair)	49	59	69	74	79	82	84
Open Space (Good)	39	50	61	68	74	77	80
Impervious Areas	98	98	98	98	98	98	98

* Values taken from the City of Barrie Stormwater Infrastructure Design Standard (2023)

Pre-Development Initial Abstraction (IA):

Catchment	Total Area (m^2)	Open Space Area (m^2)	Gravel Area (m^2)	Lakes / Wetlands SWMF (m^2)	Rooftop Area (m^2)	Crop Area (m^2)	Paved Area (m^2)	Weighted IA
101	745	745	0	0	0		0	5.00

Initial Abstraction / Depression Storage	
Cover	**Depth (mm)**
Wetlands / Lakes/ SWMF	0
Gravel	3.5
Meadow/Field	8
Open Space	5
Crop	7
Impervious Areas	2

* Values taken from the City of Barrie Stormwater Infrastructure Design Standard (2023)

For STANDHYD Command in Otthymo:

Pervious Area Calculations:	Catchment	Total Pervious Area (m2)				
	101	745				
Impervious Area Calulations:	**Catchment**	**Total Directly Connected Area (m2)**	**Total Indirectly Connected Area (m2)**	**Total Impervious Area (m2)**	**% Ximp**	**% Timp**
	101	1,685	0	1,685	69.3	69.3

APARTMENT DEVELOPMENT - 202 DUNLOP STREET WEST

POST-DEVELOPMENT SWM INPUT PARAMETERS

City of Barrie, ON

Project Number: 22-11713B
Date: September 12, 2023
Design By: DH
File: Z:\Project Documents\11713B 202 Dunlop Street West, Barrie\REV 1 - Added Commercial Use to Ground Floor\SWM\11713B VO Modelling Parameters.xls

PINESTONE ENGINEERING LTD.

Runoff Coefficients	
Land Use	**"C"**
Lawns & Parks 2-7%	0.10
Unimproved areas	0.10
Rooftop Area	0.95
Townhouse Rooftop Area	0.95
Industrial Rooftop Area	0.95
Commercial	0.60
Gravel	0.40
Pasture/Meadow	0.10
Paved areas	0.95

* Values taken from the City of Barrie Stormwater Infrastructure Design Standard (2023)

Post-Development Runoff Coefficients:

Catchment	Total Area (m^2)	Green Field & Parks Area (m^2)	Pasture/Meadow Area (m^2)	Rooftop Area (m^2)	Townhouse Rooftop Area (m^2)	Industrial Rooftop Area (m^2)	Commercial Area (m^2)	Gravel Area (m^2)	Unimproved Area (m^2)	Impervious Area (m^2)	Weighted C
201	890	120								770	0.84
202	1,040	240		800							0.75
203	500	315								185	0.41

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	201	
Catchment Area	=	0.0890	ha
Flow Length	=	25	m
Impervious Slope	=	0.03	m/m
Pervious Slope	=	0.04	m/m
Weighted Runoff Coefficient	=	0.84	

Catchment Parameters			
Catchment ID	=	202	
Catchment Area	=	0.1040	ha
Flow Length	=	30	m
Impervious Slope	=	0.02	m/m
Pervious Slope	=	0.02	m/m
Weighted Runoff Coefficient	=	0.75	

Catchment Parameters			
Catchment ID	=	203	
Catchment Area	=	0.0500	ha
Flow Length	=	15	m
Impervious Slope	=	0.04	m/m
Pervious Slope	=	0.04	m/m
Weighted Runoff Coefficient	=	0.41	

Post-Development Curve Number (CN):

Catchment	Hydrologic Soil Group	Soil Texture	Total Area (m^2)	Lakes / Wetlands / SWMF's (m^2)	Gravel Area (m^2)	Good Open Space Area (m^2)	Fair Open Space Area (m^2)	Paved Area (m^2)	Rooftop Area (m^2)	Weighted CN
201	AB	Sand Trace Silt	120		0	120				50.0
202	AB	Sand Trace Silt	240		0	240				50.0
203	AB	Sand Trace Silt	315		0	315				50.0

SCS Curve Numbers							
	Hydrologic Soil Group						
Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands / Lakes/ SWMF's	100	100	100	100	100	100	100
Gravel	76	81	85	87	89	90	91
Meadow/Field	30	44	58	65	71	75	78
Open Space (Fair)	49	59	69	74	79	82	84
Open Space (Good	39	50	61	68	74	77	80
Impervious Areas	98	98	98	98	98	98	98

* Values taken from the City of Barrie Stormwater Infrastructure Design Standard (2023)

Post-Development Initial Abstraction (IA):

Catchment	Total Area (m^2)	Open Space Area (m^2)	Gravel Area (m^2)	Lakes / Wetlands SWMF (m^2)	Rooftop Area (m^2)	Crop Area (m^2)	Paved Area (m^2)	Weighted IA
201	120	120	0	0	0		0	5.00
202	240	240	0	0	0		0	5.00
203	315	315	0	0	0		0	5.00

Initial Abstraction / Depression Storage	
Cover	**Depth (mm)**
Wetlands / Lakes/ SWMF	0
Gravel	3.5
Meadow/Field	8
Open Space	5
Crop	7
Impervious Areas	2

* Values taken from the City of Barrie Stormwater Infrastructure Design Standard (2023)

For STANDHYD Command in Otthymo:

Pervious Area Calculations:	Catchment	Total Pervious Area (m2)
	201	120

Impervious Area Calulations:	Catchment	Total Directly Connected Area (m2)	Total Indirectly Connected Area (m2)	Total Impervious Area (m2)	% Ximp	% Timp
	201	770	0	770	86.5	86.5

Pervious Area Calculations:	Catchment	Total Pervious Area (m2)
	202	240

Impervious Area Calulations:	Catchment	Total Directly Connected Area (m2)	Total Indirectly Connected Area (m2)	Total Impervious Area (m2)	% Ximp	% Timp
	202	800	0	800	76.9	76.9

Pervious Area Calculations:	Catchment	Total Pervious Area (m2)
	203	315

Impervious Area Calulations:	Catchment	Total Directly Connected Area (m2)	Total Indirectly Connected Area (m2)	Total Impervious Area (m2)	% Ximp	% Timp
	203	185	0	185	37.0	37.0

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT
Stormwater Management Facility Storage Volumes
Barrie, Ontario

Project Number: 22-11713B
Date: August 29, 2022
File: Z:\Project Documents\11713B 202 Dunlop Street West, Barrie\SWM\Pond Sizing Calculations.xls

STAGE-STORAGE RELATIONSHIP - PONDING VOLUMES

Elevation	Depth	Precast Concrete SWM Tanks	Manhole and Pipe Storage	Surface Ponding Facility				Comments
				Area	Avg. Area	Live	Accum. Live	
m	*m*	m^3	m^3	m^2	m^2	m^3	m^3	*m*
226.60	0.00		0.00				0.00	Orifice Invert
226.80	0.20		0.07				0.07	Contour
227.00	0.40		0.07				0.14	Contour
227.20	0.60		0.07				0.22	Contour
227.40	0.80		0.07				0.29	Contour
227.60	1.00		0.07				0.36	Contour
227.80	1.20		0.07				0.43	Contour
228.00	1.40		0.07				0.50	Contour
228.15	1.55		0.05	0.36			0.56	CB#1 Top of Grate
228.20	1.60		0.66	48.57	24.47	1.22	2.44	Contour
228.25	1.65		0.39	96.79	72.68	3.63	6.46	Contour
228.30	1.70		0.26	145.00	120.89	6.04	12.77	Contour
228.35	1.75		0.66	256.67	200.83	10.04	23.47	Contour
228.40	1.80		0.92	368.33	312.50	15.63	40.01	Curb Overflow Outlet
228.45	1.85		0.11	480.00	424.17	21.21	61.33	Contour

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT
STORMWATER MANAGEMENT FACILITY STAGE STORAGE DISCHARGE RELATIONSHIP
Barrie, Ontario

Project Number: 22-11713B
Date: August 29, 2022
File: Z:\Project Documents\11713B 202 Dunlop Street West, Barrie\SWM\Pond Sizing Calculations.xls

Orifice Calculations			
$Q_o=C_d*A_o*(2*g*H_o)$^0.5			
	Orifice 1	**Orifice 2**	
C_d	0.63		
Invert (m)	226.60		
Width (m)	0.000		
Diameter/Height (m)	0.070		
Type (H/V)	V		

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)	228.4
Length (m)	1
Side Slope (H:V)	0
Side Slope (rad)	0.000

Stage Discharge Relationship for Stormwater Management Facility:

Stage	Active Volume	Control 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	
226.60	0.00	0.0038	0.00	0.0000				0.0000	0.0000	Orifice Invert
226.80	0.07	0.0038	0.17	0.0044				0.0000	0.0044	Contour
227.00	0.14	0.0038	0.37	0.0065				0.0000	0.0065	Contour
227.20	0.22	0.0038	0.56	0.0081				0.0000	0.0081	Contour
227.40	0.29	0.0038	0.77	0.0094				0.0000	0.0094	Contour
227.60	0.36	0.0038	0.97	0.0105				0.0000	0.0105	Contour
227.80	0.43	0.0038	1.17	0.0116				0.0000	0.0116	Contour
228.00	0.50	0.0038	1.37	0.0125				0.0000	0.0125	Contour
228.15	0.56	0.0038	1.52	0.0132				0.0000	0.0132	CB#1 Top of Grate
228.20	2.44	0.0038	1.56	0.0134				0.0000	0.0134	Contour
228.25	6.46	0.0038	1.62	0.0136				0.0000	0.0136	Contour
228.30	12.77	0.0038	1.67	0.0139				0.0000	0.0139	Contour
228.35	23.47	0.0038	1.72	0.0141				0.0000	0.0141	Contour
228.40	40.01	0.0038	1.77	0.0143				0.0000	0.0143	Curb Overflow Outlet
228.45	61.33	0.0038	1.81	0.0145				0.0188	0.0333	Contour

PRE-DEVELOPMENT

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       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 *****


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DATE: 08-29-2022                          TIME: 01:48:58

USER:



COMMENTS: ____________________________________________________________


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  ************************************************
  ** SIMULATION : 100yr 24hr 5min SCS Type II   **
  ************************************************


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|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              9dd4d795-cab1-4b5c-8efe-8783d19d6977\9a4e6762
| Ptotal=137.63 mm |    Comments: 100yr 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	2.48	12.17	19.82	18.25	2.48
0.08	1.51	6.17	2.48	12.25	19.82	18.33	2.48
0.17	1.51	6.25	2.48	12.33	19.82	18.42	2.48
0.25	1.51	6.33	2.48	12.42	19.82	18.50	2.48
0.33	1.51	6.42	2.48	12.50	19.82	18.58	2.48
0.42	1.51	6.50	2.48	12.58	10.18	18.67	2.48
0.50	1.51	6.58	2.48	12.67	10.18	18.75	2.48
0.58	1.51	6.67	2.48	12.75	10.18	18.83	2.48
0.67	1.51	6.75	2.48	12.83	10.18	18.92	2.48
0.75	1.51	6.83	2.48	12.92	10.18	19.00	2.48
0.83	1.51	6.92	2.48	13.00	10.18	19.08	2.48
0.92	1.51	7.00	2.48	13.08	7.43	19.17	2.48
1.00	1.51	7.08	3.03	13.17	7.43	19.25	2.48
1.08	1.51	7.17	3.03	13.25	7.43	19.33	2.48
1.17	1.51	7.25	3.03	13.33	7.43	19.42	2.48
1.25	1.51	7.33	3.03	13.42	7.43	19.50	2.48
1.33	1.51	7.42	3.03	13.50	7.43	19.58	2.48
1.42	1.51	7.50	3.03	13.58	5.78	19.67	2.48
1.50	1.51	7.58	3.03	13.67	5.78	19.75	2.48
1.58	1.51	7.67	3.03	13.75	5.78	19.83	2.48
1.67	1.51	7.75	3.03	13.83	5.78	19.92	2.48
1.75	1.51	7.83	3.03	13.92	5.78	20.00	2.48
1.83	1.51	7.92	3.03	14.00	5.78	20.08	1.65
1.92	1.51	8.00	3.03	14.08	4.13	20.17	1.65
2.00	1.51	8.08	3.58	14.17	4.13	20.25	1.65
2.08	1.79	8.17	3.58	14.25	4.13	20.33	1.65
2.17	1.79	8.25	3.58	14.33	4.13	20.42	1.65
2.25	1.79	8.33	3.58	14.42	4.13	20.50	1.65
2.33	1.79	8.42	3.58	14.50	4.13	20.58	1.65
2.42	1.79	8.50	3.58	14.58	4.13	20.67	1.65
2.50	1.79	8.58	3.85	14.67	4.13	20.75	1.65
2.58	1.79	8.67	3.85	14.75	4.13	20.83	1.65
2.67	1.79	8.75	3.85	14.83	4.13	20.92	1.65
2.75	1.79	8.83	3.85	14.92	4.13	21.00	1.65
2.83	1.79	8.92	3.85	15.00	4.13	21.08	1.65
2.92	1.79	9.00	3.85	15.08	4.13	21.17	1.65
3.00	1.79	9.08	4.40	15.17	4.13	21.25	1.65
3.08	1.79	9.17	4.40	15.25	4.13	21.33	1.65
3.17	1.79	9.25	4.40	15.33	4.13	21.42	1.65
3.25	1.79	9.33	4.40	15.42	4.13	21.50	1.65
3.33	1.79	9.42	4.40	15.50	4.13	21.58	1.65
3.42	1.79	9.50	4.40	15.58	4.13	21.67	1.65
3.50	1.79	9.58	4.95	15.67	4.13	21.75	1.65
3.58	1.79	9.67	4.95	15.75	4.13	21.83	1.65
3.67	1.79	9.75	4.95	15.83	4.13	21.92	1.65

```
3.75    1.79 |  9.83    4.95 | 15.92    4.13 | 22.00    1.65
3.83    1.79 |  9.92    4.95 | 16.00    4.13 | 22.08    1.65
3.92    1.79 | 10.00    4.95 | 16.08    2.48 | 22.17    1.65
4.00    1.79 | 10.08    6.33 | 16.17    2.48 | 22.25    1.65
4.08    2.20 | 10.17    6.33 | 16.25    2.48 | 22.33    1.65
4.17    2.20 | 10.25    6.33 | 16.33    2.48 | 22.42    1.65
4.25    2.20 | 10.33    6.33 | 16.42    2.48 | 22.50    1.65
4.33    2.20 | 10.42    6.33 | 16.50    2.48 | 22.58    1.65
4.42    2.20 | 10.50    6.33 | 16.58    2.48 | 22.67    1.65
4.50    2.20 | 10.58    8.53 | 16.67    2.48 | 22.75    1.65
4.58    2.20 | 10.67    8.53 | 16.75    2.48 | 22.83    1.65
4.67    2.20 | 10.75    8.53 | 16.83    2.48 | 22.92    1.65
4.75    2.20 | 10.83    8.53 | 16.92    2.48 | 23.00    1.65
4.83    2.20 | 10.92    8.53 | 17.00    2.48 | 23.08    1.65
4.92    2.20 | 11.00    8.53 | 17.08    2.48 | 23.17    1.65
5.00    2.20 | 11.08   13.21 | 17.17    2.48 | 23.25    1.65
5.08    2.20 | 11.17   13.21 | 17.25    2.48 | 23.33    1.65
5.17    2.20 | 11.25   13.21 | 17.33    2.48 | 23.42    1.65
5.25    2.20 | 11.33   13.21 | 17.42    2.48 | 23.50    1.65
5.33    2.20 | 11.42   13.21 | 17.50    2.48 | 23.58    1.65
5.42    2.20 | 11.50   13.21 | 17.58    2.48 | 23.67    1.65
5.50    2.20 | 11.58   40.74 | 17.67    2.48 | 23.75    1.65
5.58    2.20 | 11.67   40.74 | 17.75    2.48 | 23.83    1.65
5.67    2.20 | 11.75   40.74 | 17.83    2.48 | 23.92    1.65
5.75    2.20 | 11.83  168.46 | 17.92    2.48 | 24.00    1.65
5.83    2.20 | 11.92  168.46 | 18.00    2.48 |
5.92    2.20 | 12.00  168.46 | 18.08    2.48 |
6.00    2.20 | 12.08   19.82 | 18.17    2.48 |

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

--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.46        83.35
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.98 (ii)    5.11 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.01          0.094 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     135.63        56.90         111.45
     TOTAL RAINFALL   (mm)=     137.63       137.63         137.63
     RUNOFF COEFFICIENT   =       0.99         0.41           0.81

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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 *****


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DATE: 08-29-2022                          TIME: 01:48:57

USER:
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COMMENTS: ____________________________________________________________


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  ************************************************
  ** SIMULATION : 100yr 4hr 5min Chicago        **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1383.628
| Ptotal= 87.45 mm |                          B=   4.905
--------------------                          C=   0.754
                        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    6.06 |  1.00   24.64 |  2.00   16.04 |  3.00    7.96
                 0.08    6.41 |  1.08   36.97 |  2.08   14.68 |  3.08    7.67
                 0.17    6.81 |  1.17   81.48 |  2.17   13.55 |  3.17    7.40
                 0.25    7.27 |  1.25  245.55 |  2.25   12.60 |  3.25    7.15
                 0.33    7.81 |  1.33  103.86 |  2.33   11.79 |  3.33    6.92
                 0.42    8.45 |  1.42   59.20 |  2.42   11.08 |  3.42    6.71
                 0.50    9.23 |  1.50   41.66 |  2.50   10.47 |  3.50    6.51
                 0.58   10.19 |  1.58   32.37 |  2.58    9.93 |  3.58    6.32
                 0.67   11.42 |  1.67   26.62 |  2.67    9.45 |  3.67    6.15
                 0.75   13.06 |  1.75   22.72 |  2.75    9.02 |  3.75    5.99
                 0.83   15.34 |  1.83   19.89 |  2.83    8.63 |  3.83    5.83
                 0.92   18.79 |  1.92   17.73 |  2.92    8.28 |  3.92    5.69


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     245.55        48.35
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.84 (ii)    4.40 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.01         0.124 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      85.45        26.25         67.26
     TOTAL RAINFALL   (mm)=      87.45        87.45         87.45
     RUNOFF COEFFICIENT   =       0.98         0.30          0.77

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\160f
7b3e-2cde-42a8-bd33-943b2b651e95\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\160f
7b3e-2cde-42a8-bd33-943b2b651e95\scen
```

DATE: 08-29-2022 TIME: 01:48:57

USER:

COMMENTS: _____

```
  ************************************************
  ** SIMULATION : 10yr 24hr 5min SCS Type II    **
  ************************************************
```

READ STORM	Filename: C:\Users\dhordyk\AppD ata\Local\Temp\ 9dd4d795-cab1-4b5c-8efe-8783d19d6977\61f0dcdc
Ptotal= 93.03 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	1.67	12.17	13.40	18.25	1.67
0.08	1.02	6.17	1.67	12.25	13.40	18.33	1.67
0.17	1.02	6.25	1.67	12.33	13.40	18.42	1.67
0.25	1.02	6.33	1.67	12.42	13.40	18.50	1.67
0.33	1.02	6.42	1.67	12.50	13.40	18.58	1.67
0.42	1.02	6.50	1.67	12.58	6.88	18.67	1.67
0.50	1.02	6.58	1.67	12.67	6.88	18.75	1.67
0.58	1.02	6.67	1.67	12.75	6.88	18.83	1.67
0.67	1.02	6.75	1.67	12.83	6.88	18.92	1.67
0.75	1.02	6.83	1.67	12.92	6.88	19.00	1.67
0.83	1.02	6.92	1.67	13.00	6.88	19.08	1.67
0.92	1.02	7.00	1.67	13.08	5.02	19.17	1.67
1.00	1.02	7.08	2.05	13.17	5.02	19.25	1.67
1.08	1.02	7.17	2.05	13.25	5.02	19.33	1.67
1.17	1.02	7.25	2.05	13.33	5.02	19.42	1.67
1.25	1.02	7.33	2.05	13.42	5.02	19.50	1.67
1.33	1.02	7.42	2.05	13.50	5.02	19.58	1.67
1.42	1.02	7.50	2.05	13.58	3.91	19.67	1.67
1.50	1.02	7.58	2.05	13.67	3.91	19.75	1.67
1.58	1.02	7.67	2.05	13.75	3.91	19.83	1.67
1.67	1.02	7.75	2.05	13.83	3.91	19.92	1.67
1.75	1.02	7.83	2.05	13.92	3.91	20.00	1.67
1.83	1.02	7.92	2.05	14.00	3.91	20.08	1.12
1.92	1.02	8.00	2.05	14.08	2.79	20.17	1.12
2.00	1.02	8.08	2.42	14.17	2.79	20.25	1.12
2.08	1.21	8.17	2.42	14.25	2.79	20.33	1.12
2.17	1.21	8.25	2.42	14.33	2.79	20.42	1.12
2.25	1.21	8.33	2.42	14.42	2.79	20.50	1.12
2.33	1.21	8.42	2.42	14.50	2.79	20.58	1.12
2.42	1.21	8.50	2.42	14.58	2.79	20.67	1.12
2.50	1.21	8.58	2.60	14.67	2.79	20.75	1.12
2.58	1.21	8.67	2.60	14.75	2.79	20.83	1.12
2.67	1.21	8.75	2.60	14.83	2.79	20.92	1.12
2.75	1.21	8.83	2.60	14.92	2.79	21.00	1.12
2.83	1.21	8.92	2.60	15.00	2.79	21.08	1.12
2.92	1.21	9.00	2.60	15.08	2.79	21.17	1.12
3.00	1.21	9.08	2.98	15.17	2.79	21.25	1.12
3.08	1.21	9.17	2.98	15.25	2.79	21.33	1.12
3.17	1.21	9.25	2.98	15.33	2.79	21.42	1.12
3.25	1.21	9.33	2.98	15.42	2.79	21.50	1.12
3.33	1.21	9.42	2.98	15.50	2.79	21.58	1.12
3.42	1.21	9.50	2.98	15.58	2.79	21.67	1.12
3.50	1.21	9.58	3.35	15.67	2.79	21.75	1.12
3.58	1.21	9.67	3.35	15.75	2.79	21.83	1.12
3.67	1.21	9.75	3.35	15.83	2.79	21.92	1.12
3.75	1.21	9.83	3.35	15.92	2.79	22.00	1.12
3.83	1.21	9.92	3.35	16.00	2.79	22.08	1.12
3.92	1.21	10.00	3.35	16.08	1.67	22.17	1.12
4.00	1.21	10.08	4.28	16.17	1.67	22.25	1.12
4.08	1.49	10.17	4.28	16.25	1.67	22.33	1.12
4.17	1.49	10.25	4.28	16.33	1.67	22.42	1.12
4.25	1.49	10.33	4.28	16.42	1.67	22.50	1.12
4.33	1.49	10.42	4.28	16.50	1.67	22.58	1.12
4.42	1.49	10.50	4.28	16.58	1.67	22.67	1.12
4.50	1.49	10.58	5.77	16.67	1.67	22.75	1.12
4.58	1.49	10.67	5.77	16.75	1.67	22.83	1.12
4.67	1.49	10.75	5.77	16.83	1.67	22.92	1.12
4.75	1.49	10.83	5.77	16.92	1.67	23.00	1.12
4.83	1.49	10.92	5.77	17.00	1.67	23.08	1.12
4.92	1.49	11.00	5.77	17.08	1.67	23.17	1.12
5.00	1.49	11.08	8.93	17.17	1.67	23.25	1.12
5.08	1.49	11.17	8.93	17.25	1.67	23.33	1.12
5.17	1.49	11.25	8.93	17.33	1.67	23.42	1.12
5.25	1.49	11.33	8.93	17.42	1.67	23.50	1.12
5.33	1.49	11.42	8.93	17.50	1.67	23.58	1.12
5.42	1.49	11.50	8.93	17.58	1.67	23.67	1.12
5.50	1.49	11.58	27.54	17.67	1.67	23.75	1.12
5.58	1.49	11.67	27.54	17.75	1.67	23.83	1.12
5.67	1.49	11.75	27.54	17.83	1.67	23.92	1.12
5.75	1.49	11.83	113.87	17.92	1.67	24.00	1.12
5.83	1.49	11.92	113.87	18.00	1.67		
5.92	1.49	12.00	113.87	18.08	1.67		
6.00	1.49	12.08	13.40	18.17	1.67		

```
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     113.87        42.85
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.14 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.01          0.061 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      91.03        29.29          72.07
     TOTAL RAINFALL   (mm)=      93.03        93.03          93.03
     RUNOFF COEFFICIENT   =       0.98         0.31           0.77

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\9d1e
d2dc-74ee-4a1b-80e2-a119bce88569\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\9d1e
d2dc-74ee-4a1b-80e2-a119bce88569\scen


DATE: 08-29-2022                          TIME: 01:48:57

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
-----------------------
  ************************************************
  ** SIMULATION : 10yr 4hr 5min Chicago         **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 976.898
| Ptotal= 59.77 mm |                          B=   4.745
--------------------                          C=   0.760
                        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    4.04 |  1.00   16.64 |  2.00   10.79 |  3.00    5.32
                 0.08    4.28 |  1.08   25.08 |  2.08    9.86 |  3.08    5.13
                 0.17    4.55 |  1.17   55.96 |  2.17    9.10 |  3.17    4.94
                 0.25    4.86 |  1.25  173.13 |  2.25    8.45 |  3.25    4.78
                 0.33    5.22 |  1.33   71.59 |  2.33    7.91 |  3.33    4.62
                 0.42    5.65 |  1.42   40.40 |  2.42    7.43 |  3.42    4.48
                 0.50    6.18 |  1.50   28.30 |  2.50    7.02 |  3.50    4.34
                 0.58    6.83 |  1.58   21.92 |  2.58    6.65 |  3.58    4.22
```

```
                0.67    7.66 |  1.67   17.99 |  2.67    6.33 |  3.67    4.10
                0.75    8.77 |  1.75   15.33 |  2.75    6.04 |  3.75    3.99
                0.83   10.31 |  1.83   13.40 |  2.83    5.78 |  3.83    3.89
                0.92   12.65 |  1.92   11.94 |  2.92    5.54 |  3.92    3.79


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     173.13        23.46
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.97 (ii)    5.06 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.00          0.083 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      57.77        12.97          43.99
     TOTAL RAINFALL   (mm)=      59.77        59.77          59.77
     RUNOFF COEFFICIENT   =       0.97         0.22           0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\0c8e
591d-cf85-44eb-b3a3-2d8167fbe563\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\0c8e
591d-cf85-44eb-b3a3-2d8167fbe563\scen


DATE: 08-29-2022                          TIME: 01:48:57

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 25yr 24hr 5min SCS Type II    **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              9dd4d795-cab1-4b5c-8efe-8783d19d6977\62251d1d
| Ptotal=111.09 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    2.00 | 12.17   16.00 | 18.25    2.00
                 0.08    1.22 |  6.17    2.00 | 12.25   16.00 | 18.33    2.00
                 0.17    1.22 |  6.25    2.00 | 12.33   16.00 | 18.42    2.00
                 0.25    1.22 |  6.33    2.00 | 12.42   16.00 | 18.50    2.00
                 0.33    1.22 |  6.42    2.00 | 12.50   16.00 | 18.58    2.00
```

0.42	1.22	6.50	2.00	12.58	8.22	18.67	2.00
0.50	1.22	6.58	2.00	12.67	8.22	18.75	2.00
0.58	1.22	6.67	2.00	12.75	8.22	18.83	2.00
0.67	1.22	6.75	2.00	12.83	8.22	18.92	2.00
0.75	1.22	6.83	2.00	12.92	8.22	19.00	2.00
0.83	1.22	6.92	2.00	13.00	8.22	19.08	2.00
0.92	1.22	7.00	2.00	13.08	6.00	19.17	2.00
1.00	1.22	7.08	2.44	13.17	6.00	19.25	2.00
1.08	1.22	7.17	2.44	13.25	6.00	19.33	2.00
1.17	1.22	7.25	2.44	13.33	6.00	19.42	2.00
1.25	1.22	7.33	2.44	13.42	6.00	19.50	2.00
1.33	1.22	7.42	2.44	13.50	6.00	19.58	2.00
1.42	1.22	7.50	2.44	13.58	4.67	19.67	2.00
1.50	1.22	7.58	2.44	13.67	4.67	19.75	2.00
1.58	1.22	7.67	2.44	13.75	4.67	19.83	2.00
1.67	1.22	7.75	2.44	13.83	4.67	19.92	2.00
1.75	1.22	7.83	2.44	13.92	4.67	20.00	2.00
1.83	1.22	7.92	2.44	14.00	4.67	20.08	1.33
1.92	1.22	8.00	2.44	14.08	3.33	20.17	1.33
2.00	1.22	8.08	2.89	14.17	3.33	20.25	1.33
2.08	1.44	8.17	2.89	14.25	3.33	20.33	1.33
2.17	1.44	8.25	2.89	14.33	3.33	20.42	1.33
2.25	1.44	8.33	2.89	14.42	3.33	20.50	1.33
2.33	1.44	8.42	2.89	14.50	3.33	20.58	1.33
2.42	1.44	8.50	2.89	14.58	3.33	20.67	1.33
2.50	1.44	8.58	3.11	14.67	3.33	20.75	1.33
2.58	1.44	8.67	3.11	14.75	3.33	20.83	1.33
2.67	1.44	8.75	3.11	14.83	3.33	20.92	1.33
2.75	1.44	8.83	3.11	14.92	3.33	21.00	1.33
2.83	1.44	8.92	3.11	15.00	3.33	21.08	1.33
2.92	1.44	9.00	3.11	15.08	3.33	21.17	1.33
3.00	1.44	9.08	3.55	15.17	3.33	21.25	1.33
3.08	1.44	9.17	3.55	15.25	3.33	21.33	1.33
3.17	1.44	9.25	3.55	15.33	3.33	21.42	1.33
3.25	1.44	9.33	3.55	15.42	3.33	21.50	1.33
3.33	1.44	9.42	3.55	15.50	3.33	21.58	1.33
3.42	1.44	9.50	3.55	15.58	3.33	21.67	1.33
3.50	1.44	9.58	4.00	15.67	3.33	21.75	1.33
3.58	1.44	9.67	4.00	15.75	3.33	21.83	1.33
3.67	1.44	9.75	4.00	15.83	3.33	21.92	1.33
3.75	1.44	9.83	4.00	15.92	3.33	22.00	1.33
3.83	1.44	9.92	4.00	16.00	3.33	22.08	1.33
3.92	1.44	10.00	4.00	16.08	2.00	22.17	1.33
4.00	1.44	10.08	5.11	16.17	2.00	22.25	1.33
4.08	1.78	10.17	5.11	16.25	2.00	22.33	1.33
4.17	1.78	10.25	5.11	16.33	2.00	22.42	1.33
4.25	1.78	10.33	5.11	16.42	2.00	22.50	1.33
4.33	1.78	10.42	5.11	16.50	2.00	22.58	1.33
4.42	1.78	10.50	5.11	16.58	2.00	22.67	1.33
4.50	1.78	10.58	6.89	16.67	2.00	22.75	1.33
4.58	1.78	10.67	6.89	16.75	2.00	22.83	1.33
4.67	1.78	10.75	6.89	16.83	2.00	22.92	1.33
4.75	1.78	10.83	6.89	16.92	2.00	23.00	1.33
4.83	1.78	10.92	6.89	17.00	2.00	23.08	1.33
4.92	1.78	11.00	6.89	17.08	2.00	23.17	1.33
5.00	1.78	11.08	10.66	17.17	2.00	23.25	1.33
5.08	1.78	11.17	10.66	17.25	2.00	23.33	1.33
5.17	1.78	11.25	10.66	17.33	2.00	23.42	1.33
5.25	1.78	11.33	10.66	17.42	2.00	23.50	1.33
5.33	1.78	11.42	10.66	17.50	2.00	23.58	1.33
5.42	1.78	11.50	10.66	17.58	2.00	23.67	1.33
5.50	1.78	11.58	32.88	17.67	2.00	23.75	1.33
5.58	1.78	11.67	32.88	17.75	2.00	23.83	1.33
5.67	1.78	11.75	32.88	17.83	2.00	23.92	1.33
5.75	1.78	11.83	135.97	17.92	2.00	24.00	1.33
5.83	1.78	11.92	135.97	18.00	2.00		
5.92	1.78	12.00	135.97	18.08	2.00		
6.00	1.78	12.08	16.00	18.17	2.00		

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

--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     135.97        58.31
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.06 (ii)    5.57 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.01          0.074 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     109.09        39.83          87.82
     TOTAL RAINFALL   (mm)=     111.09       111.09         111.09
     RUNOFF COEFFICIENT   =       0.98         0.36           0.79

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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.

--------------------------------------------------------------------------------
================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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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c102-6e5e-46f6-9880-2d47e8f0bf43\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\e960
c102-6e5e-46f6-9880-2d47e8f0bf43\scen


DATE: 08-29-2022                          TIME: 01:48:57

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 25yr 4hr 5min Chicago         **
  ************************************************
```

```
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1133.123
| Ptotal= 70.87 mm |                          B=   4.734
--------------------                          C=   0.756
                        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	4.87	1.00	19.82	2.00	12.89	3.00	6.39
0.08	5.15	1.08	29.77	2.08	11.79	3.08	6.16
0.17	5.47	1.17	65.99	2.17	10.89	3.17	5.94
0.25	5.84	1.25	202.83	2.25	10.12	3.25	5.74
0.33	6.27	1.33	84.29	2.33	9.47	3.33	5.56
0.42	6.79	1.42	47.77	2.42	8.91	3.42	5.39
0.50	7.41	1.50	33.55	2.50	8.41	3.50	5.23
0.58	8.19	1.58	26.05	2.58	7.98	3.58	5.08
0.67	9.18	1.67	21.41	2.67	7.59	3.67	4.94
0.75	10.49	1.75	18.27	2.75	7.25	3.75	4.81
0.83	12.33	1.83	15.99	2.83	6.93	3.83	4.68
0.92	15.10	1.92	14.26	2.92	6.65	3.92	4.57

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     202.83        32.67
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.91 (ii)    4.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.01         0.100 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      68.87        17.90         53.21
     TOTAL RAINFALL   (mm)=      70.87        70.87         70.87
     RUNOFF COEFFICIENT   =       0.97         0.25          0.75
```

```
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\970b
5f1b-50ad-4c2b-bfc6-3d4686aca6c3\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\970b
5f1b-50ad-4c2b-bfc6-3d4686aca6c3\scen


DATE: 08-29-2022                          TIME: 01:48:58

USER:



COMMENTS: ____________________________________________________________
```

```
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------------------------
  ************************************************
  ** SIMULATION : 2yr 24hr 5min SCS Type II     **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              9dd4d795-cab1-4b5c-8efe-8783d19d6977\81710a3e
| Ptotal= 55.62 mm |    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	1.00	12.17	8.01	18.25	1.00
0.08	0.61	6.17	1.00	12.25	8.01	18.33	1.00
0.17	0.61	6.25	1.00	12.33	8.01	18.42	1.00
0.25	0.61	6.33	1.00	12.42	8.01	18.50	1.00
0.33	0.61	6.42	1.00	12.50	8.01	18.58	1.00
0.42	0.61	6.50	1.00	12.58	4.12	18.67	1.00
0.50	0.61	6.58	1.00	12.67	4.12	18.75	1.00
0.58	0.61	6.67	1.00	12.75	4.12	18.83	1.00
0.67	0.61	6.75	1.00	12.83	4.12	18.92	1.00
0.75	0.61	6.83	1.00	12.92	4.12	19.00	1.00
0.83	0.61	6.92	1.00	13.00	4.12	19.08	1.00
0.92	0.61	7.00	1.00	13.08	3.00	19.17	1.00
1.00	0.61	7.08	1.22	13.17	3.00	19.25	1.00
1.08	0.61	7.17	1.22	13.25	3.00	19.33	1.00
1.17	0.61	7.25	1.22	13.33	3.00	19.42	1.00
1.25	0.61	7.33	1.22	13.42	3.00	19.50	1.00
1.33	0.61	7.42	1.22	13.50	3.00	19.58	1.00
1.42	0.61	7.50	1.22	13.58	2.34	19.67	1.00
1.50	0.61	7.58	1.22	13.67	2.34	19.75	1.00
1.58	0.61	7.67	1.22	13.75	2.34	19.83	1.00
1.67	0.61	7.75	1.22	13.83	2.34	19.92	1.00
1.75	0.61	7.83	1.22	13.92	2.34	20.00	1.00
1.83	0.61	7.92	1.22	14.00	2.34	20.08	0.67
1.92	0.61	8.00	1.22	14.08	1.67	20.17	0.67
2.00	0.61	8.08	1.45	14.17	1.67	20.25	0.67
2.08	0.72	8.17	1.45	14.25	1.67	20.33	0.67
2.17	0.72	8.25	1.45	14.33	1.67	20.42	0.67
2.25	0.72	8.33	1.45	14.42	1.67	20.50	0.67
2.33	0.72	8.42	1.45	14.50	1.67	20.58	0.67
2.42	0.72	8.50	1.45	14.58	1.67	20.67	0.67
2.50	0.72	8.58	1.56	14.67	1.67	20.75	0.67
2.58	0.72	8.67	1.56	14.75	1.67	20.83	0.67
2.67	0.72	8.75	1.56	14.83	1.67	20.92	0.67
2.75	0.72	8.83	1.56	14.92	1.67	21.00	0.67
2.83	0.72	8.92	1.56	15.00	1.67	21.08	0.67

```
2.92    0.72 |  9.00    1.56 | 15.08    1.67 | 21.17    0.67
3.00    0.72 |  9.08    1.78 | 15.17    1.67 | 21.25    0.67
3.08    0.72 |  9.17    1.78 | 15.25    1.67 | 21.33    0.67
3.17    0.72 |  9.25    1.78 | 15.33    1.67 | 21.42    0.67
3.25    0.72 |  9.33    1.78 | 15.42    1.67 | 21.50    0.67
3.33    0.72 |  9.42    1.78 | 15.50    1.67 | 21.58    0.67
3.42    0.72 |  9.50    1.78 | 15.58    1.67 | 21.67    0.67
3.50    0.72 |  9.58    2.00 | 15.67    1.67 | 21.75    0.67
3.58    0.72 |  9.67    2.00 | 15.75    1.67 | 21.83    0.67
3.67    0.72 |  9.75    2.00 | 15.83    1.67 | 21.92    0.67
3.75    0.72 |  9.83    2.00 | 15.92    1.67 | 22.00    0.67
3.83    0.72 |  9.92    2.00 | 16.00    1.67 | 22.08    0.67
3.92    0.72 | 10.00    2.00 | 16.08    1.00 | 22.17    0.67
4.00    0.72 | 10.08    2.56 | 16.17    1.00 | 22.25    0.67
4.08    0.89 | 10.17    2.56 | 16.25    1.00 | 22.33    0.67
4.17    0.89 | 10.25    2.56 | 16.33    1.00 | 22.42    0.67
4.25    0.89 | 10.33    2.56 | 16.42    1.00 | 22.50    0.67
4.33    0.89 | 10.42    2.56 | 16.50    1.00 | 22.58    0.67
4.42    0.89 | 10.50    2.56 | 16.58    1.00 | 22.67    0.67
4.50    0.89 | 10.58    3.45 | 16.67    1.00 | 22.75    0.67
4.58    0.89 | 10.67    3.45 | 16.75    1.00 | 22.83    0.67
4.67    0.89 | 10.75    3.45 | 16.83    1.00 | 22.92    0.67
4.75    0.89 | 10.83    3.45 | 16.92    1.00 | 23.00    0.67
4.83    0.89 | 10.92    3.45 | 17.00    1.00 | 23.08    0.67
4.92    0.89 | 11.00    3.45 | 17.08    1.00 | 23.17    0.67
5.00    0.89 | 11.08    5.34 | 17.17    1.00 | 23.25    0.67
5.08    0.89 | 11.17    5.34 | 17.25    1.00 | 23.33    0.67
5.17    0.89 | 11.25    5.34 | 17.33    1.00 | 23.42    0.67
5.25    0.89 | 11.33    5.34 | 17.42    1.00 | 23.50    0.67
5.33    0.89 | 11.42    5.34 | 17.50    1.00 | 23.58    0.67
5.42    0.89 | 11.50    5.34 | 17.58    1.00 | 23.67    0.67
5.50    0.89 | 11.58   16.46 | 17.67    1.00 | 23.75    0.67
5.58    0.89 | 11.67   16.46 | 17.75    1.00 | 23.83    0.67
5.67    0.89 | 11.75   16.46 | 17.83    1.00 | 23.92    0.67
5.75    0.89 | 11.83   68.08 | 17.92    1.00 | 24.00    0.67
5.83    0.89 | 11.92   68.08 | 18.00    1.00 |
5.92    0.89 | 12.00   68.08 | 18.08    1.00 |
6.00    0.89 | 12.08    8.01 | 18.17    1.00 |

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

--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      68.08        11.76
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       1.40 (ii)   18.02 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.33         0.06
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00           0.033 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.25           12.08
     RUNOFF VOLUME    (mm)=      53.62        11.28           40.59
     TOTAL RAINFALL   (mm)=      55.62        55.62           55.62
     RUNOFF COEFFICIENT   =       0.96         0.20            0.73

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\ab0f
151d-6c04-44c2-999a-4ea850543eda\scen
```

```
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\ab0f
151d-6c04-44c2-999a-4ea850543eda\scen


DATE: 08-29-2022                          TIME: 01:48:57

USER:



COMMENTS: ____________________________________________________________


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

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 675.586
| Ptotal= 37.03 mm |                          B=   4.681
--------------------                          C=   0.780
                       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    2.31 |  1.00   10.03 |  2.00    6.39 |  3.00    3.08
                 0.08    2.45 |  1.08   15.38 |  2.08    5.82 |  3.08    2.96
                 0.17    2.61 |  1.17   35.54 |  2.17    5.36 |  3.17    2.85
                 0.25    2.80 |  1.25  114.99 |  2.25    4.96 |  3.25    2.75
                 0.33    3.01 |  1.33   45.86 |  2.33    4.63 |  3.33    2.66
                 0.42    3.27 |  1.42   25.27 |  2.42    4.34 |  3.42    2.57
                 0.50    3.59 |  1.50   17.44 |  2.50    4.09 |  3.50    2.49
                 0.58    3.98 |  1.58   13.36 |  2.58    3.87 |  3.58    2.42
                 0.67    4.48 |  1.67   10.88 |  2.67    3.68 |  3.67    2.35
                 0.75    5.15 |  1.75    9.21 |  2.75    3.50 |  3.75    2.29
                 0.83    6.10 |  1.83    8.01 |  2.83    3.35 |  3.83    2.22
                 0.92    7.55 |  1.92    7.10 |  2.92    3.20 |  3.92    2.17


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     114.99         8.86
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.14 (ii)    5.96 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00         0.054 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42          1.33
     RUNOFF VOLUME    (mm)=      35.03         4.92         25.78
     TOTAL RAINFALL   (mm)=      37.03        37.03         37.03
     RUNOFF COEFFICIENT   =       0.95         0.13          0.70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\9ea8
074b-0b1e-4f7d-b516-c610e473c5fe\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\9ea8
074b-0b1e-4f7d-b516-c610e473c5fe\scen


DATE: 08-29-2022                          TIME: 01:48:58

USER:



COMMENTS: ____________________________________________________________


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  ************************************************
  ** SIMULATION : 50yr 24hr 5min SCS Type II    **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              9dd4d795-cab1-4b5c-8efe-8783d19d6977\7eb1349e
| Ptotal=125.40 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    2.26 | 12.17   18.06 | 18.25    2.26
                0.08    1.38 |  6.17    2.26 | 12.25   18.06 | 18.33    2.26
                0.17    1.38 |  6.25    2.26 | 12.33   18.06 | 18.42    2.26
                0.25    1.38 |  6.33    2.26 | 12.42   18.06 | 18.50    2.26
                0.33    1.38 |  6.42    2.26 | 12.50   18.06 | 18.58    2.26
                0.42    1.38 |  6.50    2.26 | 12.58    9.28 | 18.67    2.26
                0.50    1.38 |  6.58    2.26 | 12.67    9.28 | 18.75    2.26
                0.58    1.38 |  6.67    2.26 | 12.75    9.28 | 18.83    2.26
                0.67    1.38 |  6.75    2.26 | 12.83    9.28 | 18.92    2.26
                0.75    1.38 |  6.83    2.26 | 12.92    9.28 | 19.00    2.26
                0.83    1.38 |  6.92    2.26 | 13.00    9.28 | 19.08    2.26
                0.92    1.38 |  7.00    2.26 | 13.08    6.77 | 19.17    2.26
                1.00    1.38 |  7.08    2.76 | 13.17    6.77 | 19.25    2.26
                1.08    1.38 |  7.17    2.76 | 13.25    6.77 | 19.33    2.26
                1.17    1.38 |  7.25    2.76 | 13.33    6.77 | 19.42    2.26
                1.25    1.38 |  7.33    2.76 | 13.42    6.77 | 19.50    2.26
                1.33    1.38 |  7.42    2.76 | 13.50    6.77 | 19.58    2.26
                1.42    1.38 |  7.50    2.76 | 13.58    5.27 | 19.67    2.26
                1.50    1.38 |  7.58    2.76 | 13.67    5.27 | 19.75    2.26
                1.58    1.38 |  7.67    2.76 | 13.75    5.27 | 19.83    2.26
                1.67    1.38 |  7.75    2.76 | 13.83    5.27 | 19.92    2.26
                1.75    1.38 |  7.83    2.76 | 13.92    5.27 | 20.00    2.26
                1.83    1.38 |  7.92    2.76 | 14.00    5.27 | 20.08    1.50
                1.92    1.38 |  8.00    2.76 | 14.08    3.76 | 20.17    1.50
                2.00    1.38 |  8.08    3.26 | 14.17    3.76 | 20.25    1.50
                2.08    1.63 |  8.17    3.26 | 14.25    3.76 | 20.33    1.50
                2.17    1.63 |  8.25    3.26 | 14.33    3.76 | 20.42    1.50
                2.25    1.63 |  8.33    3.26 | 14.42    3.76 | 20.50    1.50
                2.33    1.63 |  8.42    3.26 | 14.50    3.76 | 20.58    1.50
                2.42    1.63 |  8.50    3.26 | 14.58    3.76 | 20.67    1.50
                2.50    1.63 |  8.58    3.51 | 14.67    3.76 | 20.75    1.50
                2.58    1.63 |  8.67    3.51 | 14.75    3.76 | 20.83    1.50
                2.67    1.63 |  8.75    3.51 | 14.83    3.76 | 20.92    1.50
                2.75    1.63 |  8.83    3.51 | 14.92    3.76 | 21.00    1.50
                2.83    1.63 |  8.92    3.51 | 15.00    3.76 | 21.08    1.50
                2.92    1.63 |  9.00    3.51 | 15.08    3.76 | 21.17    1.50
                3.00    1.63 |  9.08    4.01 | 15.17    3.76 | 21.25    1.50
                3.08    1.63 |  9.17    4.01 | 15.25    3.76 | 21.33    1.50
                3.17    1.63 |  9.25    4.01 | 15.33    3.76 | 21.42    1.50
                3.25    1.63 |  9.33    4.01 | 15.42    3.76 | 21.50    1.50
                3.33    1.63 |  9.42    4.01 | 15.50    3.76 | 21.58    1.50
                3.42    1.63 |  9.50    4.01 | 15.58    3.76 | 21.67    1.50
                3.50    1.63 |  9.58    4.51 | 15.67    3.76 | 21.75    1.50
                3.58    1.63 |  9.67    4.51 | 15.75    3.76 | 21.83    1.50
                3.67    1.63 |  9.75    4.51 | 15.83    3.76 | 21.92    1.50
                3.75    1.63 |  9.83    4.51 | 15.92    3.76 | 22.00    1.50
                3.83    1.63 |  9.92    4.51 | 16.00    3.76 | 22.08    1.50
                3.92    1.63 | 10.00    4.51 | 16.08    2.26 | 22.17    1.50
                4.00    1.63 | 10.08    5.77 | 16.17    2.26 | 22.25    1.50
                4.08    2.01 | 10.17    5.77 | 16.25    2.26 | 22.33    1.50
                4.17    2.01 | 10.25    5.77 | 16.33    2.26 | 22.42    1.50
                4.25    2.01 | 10.33    5.77 | 16.42    2.26 | 22.50    1.50
                4.33    2.01 | 10.42    5.77 | 16.50    2.26 | 22.58    1.50
                4.42    2.01 | 10.50    5.77 | 16.58    2.26 | 22.67    1.50
                4.50    2.01 | 10.58    7.77 | 16.67    2.26 | 22.75    1.50
                4.58    2.01 | 10.67    7.77 | 16.75    2.26 | 22.83    1.50
                4.67    2.01 | 10.75    7.77 | 16.83    2.26 | 22.92    1.50
                4.75    2.01 | 10.83    7.77 | 16.92    2.26 | 23.00    1.50
                4.83    2.01 | 10.92    7.77 | 17.00    2.26 | 23.08    1.50
                4.92    2.01 | 11.00    7.77 | 17.08    2.26 | 23.17    1.50
                5.00    2.01 | 11.08   12.04 | 17.17    2.26 | 23.25    1.50
                5.08    2.01 | 11.17   12.04 | 17.25    2.26 | 23.33    1.50
                5.17    2.01 | 11.25   12.04 | 17.33    2.26 | 23.42    1.50
                5.25    2.01 | 11.33   12.04 | 17.42    2.26 | 23.50    1.50
                5.33    2.01 | 11.42   12.04 | 17.50    2.26 | 23.58    1.50
```

```
                 5.42    2.01 | 11.50   12.04 | 17.58    2.26 | 23.67    1.50
                 5.50    2.01 | 11.58   37.12 | 17.67    2.26 | 23.75    1.50
                 5.58    2.01 | 11.67   37.12 | 17.75    2.26 | 23.83    1.50
                 5.67    2.01 | 11.75   37.12 | 17.83    2.26 | 23.92    1.50
                 5.75    2.01 | 11.83  153.49 | 17.92    2.26 | 24.00    1.50
                 5.83    2.01 | 11.92  153.49 | 18.00    2.26 |
                 5.92    2.01 | 12.00  153.49 | 18.08    2.26 |
                 6.00    2.01 | 12.08   18.06 | 18.17    2.26 |

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--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.49        71.51
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.01 (ii)    5.31 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.01          0.084 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     123.40        48.82         100.49
     TOTAL RAINFALL   (mm)=     125.40       125.40         125.40
     RUNOFF COEFFICIENT   =       0.98         0.39           0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\461c
c312-ea7f-438a-8ace-64ff8f6b895d\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\461c
c312-ea7f-438a-8ace-64ff8f6b895d\scen


DATE: 08-29-2022                          TIME: 01:48:57

USER:



COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 50yr 4hr 5min Chicago         **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1251.473
| Ptotal= 79.54 mm |                          B=   4.847
--------------------                          C=   0.753
                        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    5.53 |  1.00   22.40 |  2.00   14.60 |  3.00    7.26
              0.08    5.85 |  1.08   33.57 |  2.08   13.36 |  3.08    6.99
              0.17    6.21 |  1.17   73.94 |  2.17   12.33 |  3.17    6.75
              0.25    6.63 |  1.25  223.60 |  2.25   11.47 |  3.25    6.52
              0.33    7.12 |  1.33   94.25 |  2.33   10.74 |  3.33    6.31
              0.42    7.70 |  1.42   53.72 |  2.42   10.10 |  3.42    6.12
              0.50    8.41 |  1.50   37.82 |  2.50    9.54 |  3.50    5.94
              0.58    9.29 |  1.58   29.40 |  2.58    9.05 |  3.58    5.77
              0.67   10.40 |  1.67   24.19 |  2.67    8.61 |  3.67    5.61
              0.75   11.89 |  1.75   20.65 |  2.75    8.22 |  3.75    5.46
              0.83   13.96 |  1.83   18.09 |  2.83    7.87 |  3.83    5.32
              0.92   17.09 |  1.92   16.14 |  2.92    7.55 |  3.92    5.19


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     223.60        40.32
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.87 (ii)    4.56 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.10         0.01         0.112 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      77.54        22.13         60.52
     TOTAL RAINFALL   (mm)=      79.54        79.54         79.54
     RUNOFF COEFFICIENT   =       0.97         0.28          0.76

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\2307
2745-41ee-465f-ae5a-65631cf48cb5\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\2307
2745-41ee-465f-ae5a-65631cf48cb5\scen


DATE: 08-29-2022                          TIME: 01:48:57

USER:



COMMENTS: ____________________________________________________________


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------------------------
  ************************************************
  ** SIMULATION : 5yr 24hr 5min SCS Type II     **
  ************************************************
```

```
--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              9dd4d795-cab1-4b5c-8efe-8783d19d6977\1767fa58
| Ptotal= 78.55 mm |    Comments: 5yr 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	1.41	12.17	11.31	18.25	1.41
0.08	0.86	6.17	1.41	12.25	11.31	18.33	1.41
0.17	0.86	6.25	1.41	12.33	11.31	18.42	1.41
0.25	0.86	6.33	1.41	12.42	11.31	18.50	1.41
0.33	0.86	6.42	1.41	12.50	11.31	18.58	1.41
0.42	0.86	6.50	1.41	12.58	5.81	18.67	1.41
0.50	0.86	6.58	1.41	12.67	5.81	18.75	1.41
0.58	0.86	6.67	1.41	12.75	5.81	18.83	1.41
0.67	0.86	6.75	1.41	12.83	5.81	18.92	1.41
0.75	0.86	6.83	1.41	12.92	5.81	19.00	1.41
0.83	0.86	6.92	1.41	13.00	5.81	19.08	1.41
0.92	0.86	7.00	1.41	13.08	4.24	19.17	1.41
1.00	0.86	7.08	1.73	13.17	4.24	19.25	1.41
1.08	0.86	7.17	1.73	13.25	4.24	19.33	1.41
1.17	0.86	7.25	1.73	13.33	4.24	19.42	1.41
1.25	0.86	7.33	1.73	13.42	4.24	19.50	1.41
1.33	0.86	7.42	1.73	13.50	4.24	19.58	1.41
1.42	0.86	7.50	1.73	13.58	3.30	19.67	1.41
1.50	0.86	7.58	1.73	13.67	3.30	19.75	1.41
1.58	0.86	7.67	1.73	13.75	3.30	19.83	1.41
1.67	0.86	7.75	1.73	13.83	3.30	19.92	1.41
1.75	0.86	7.83	1.73	13.92	3.30	20.00	1.41
1.83	0.86	7.92	1.73	14.00	3.30	20.08	0.94
1.92	0.86	8.00	1.73	14.08	2.36	20.17	0.94
2.00	0.86	8.08	2.04	14.17	2.36	20.25	0.94
2.08	1.02	8.17	2.04	14.25	2.36	20.33	0.94
2.17	1.02	8.25	2.04	14.33	2.36	20.42	0.94
2.25	1.02	8.33	2.04	14.42	2.36	20.50	0.94
2.33	1.02	8.42	2.04	14.50	2.36	20.58	0.94
2.42	1.02	8.50	2.04	14.58	2.36	20.67	0.94
2.50	1.02	8.58	2.20	14.67	2.36	20.75	0.94
2.58	1.02	8.67	2.20	14.75	2.36	20.83	0.94
2.67	1.02	8.75	2.20	14.83	2.36	20.92	0.94
2.75	1.02	8.83	2.20	14.92	2.36	21.00	0.94
2.83	1.02	8.92	2.20	15.00	2.36	21.08	0.94
2.92	1.02	9.00	2.20	15.08	2.36	21.17	0.94
3.00	1.02	9.08	2.51	15.17	2.36	21.25	0.94
3.08	1.02	9.17	2.51	15.25	2.36	21.33	0.94
3.17	1.02	9.25	2.51	15.33	2.36	21.42	0.94
3.25	1.02	9.33	2.51	15.42	2.36	21.50	0.94
3.33	1.02	9.42	2.51	15.50	2.36	21.58	0.94
3.42	1.02	9.50	2.51	15.58	2.36	21.67	0.94
3.50	1.02	9.58	2.83	15.67	2.36	21.75	0.94
3.58	1.02	9.67	2.83	15.75	2.36	21.83	0.94
3.67	1.02	9.75	2.83	15.83	2.36	21.92	0.94
3.75	1.02	9.83	2.83	15.92	2.36	22.00	0.94
3.83	1.02	9.92	2.83	16.00	2.36	22.08	0.94
3.92	1.02	10.00	2.83	16.08	1.41	22.17	0.94
4.00	1.02	10.08	3.61	16.17	1.41	22.25	0.94
4.08	1.26	10.17	3.61	16.25	1.41	22.33	0.94
4.17	1.26	10.25	3.61	16.33	1.41	22.42	0.94
4.25	1.26	10.33	3.61	16.42	1.41	22.50	0.94
4.33	1.26	10.42	3.61	16.50	1.41	22.58	0.94
4.42	1.26	10.50	3.61	16.58	1.41	22.67	0.94
4.50	1.26	10.58	4.87	16.67	1.41	22.75	0.94
4.58	1.26	10.67	4.87	16.75	1.41	22.83	0.94
4.67	1.26	10.75	4.87	16.83	1.41	22.92	0.94
4.75	1.26	10.83	4.87	16.92	1.41	23.00	0.94
4.83	1.26	10.92	4.87	17.00	1.41	23.08	0.94
4.92	1.26	11.00	4.87	17.08	1.41	23.17	0.94
5.00	1.26	11.08	7.54	17.17	1.41	23.25	0.94
5.08	1.26	11.17	7.54	17.25	1.41	23.33	0.94
5.17	1.26	11.25	7.54	17.33	1.41	23.42	0.94
5.25	1.26	11.33	7.54	17.42	1.41	23.50	0.94
5.33	1.26	11.42	7.54	17.50	1.41	23.58	0.94
5.42	1.26	11.50	7.54	17.58	1.41	23.67	0.94
5.50	1.26	11.58	23.25	17.67	1.41	23.75	0.94
5.58	1.26	11.67	23.25	17.75	1.41	23.83	0.94
5.67	1.26	11.75	23.25	17.83	1.41	23.92	0.94
5.75	1.26	11.83	96.15	17.92	1.41	24.00	0.94
5.83	1.26	11.92	96.15	18.00	1.41		
5.92	1.26	12.00	96.15	18.08	1.41		
6.00	1.26	12.08	11.31	18.17	1.41		

```
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.17	0.07
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	40.25	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		96.15	29.01
over (min)		5.00	15.00

```
     Storage Coeff.  (min)=       1.22 (ii)   12.80 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.33         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.048 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.17          12.08
     RUNOFF VOLUME    (mm)=      76.55        21.63          59.65
     TOTAL RAINFALL   (mm)=      78.55        78.55          78.55
     RUNOFF COEFFICIENT   =       0.97         0.28           0.76

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\698b
81c3-d473-49f0-a46c-6765a3687a12\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\698b
81c3-d473-49f0-a46c-6765a3687a12\scen
```

DATE: 08-29-2022 TIME: 01:48:57

USER:

COMMENTS: _____

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  ***********************************************
  ** SIMULATION : 5yr 4hr 5min Chicago         **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 843.019
| Ptotal= 50.76 mm |                          B=   4.582
--------------------                          C=   0.763
                       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	3.39	1.00	14.01	2.00	9.07	3.00	4.46
0.08	3.58	1.08	21.15	2.08	8.29	3.08	4.30
0.17	3.81	1.17	47.54	2.17	7.64	3.17	4.15
0.25	4.07	1.25	150.31	2.25	7.10	3.25	4.01
0.33	4.38	1.33	60.96	2.33	6.64	3.33	3.88
0.42	4.74	1.42	34.18	2.42	6.24	3.42	3.75
0.50	5.18	1.50	23.88	2.50	5.89	3.50	3.64
0.58	5.73	1.58	18.47	2.58	5.58	3.58	3.54
0.67	6.43	1.67	15.15	2.67	5.31	3.67	3.44
0.75	7.36	1.75	12.90	2.75	5.07	3.75	3.35
0.83	8.67	1.83	11.27	2.83	4.85	3.83	3.26
0.92	10.64	1.92	10.04	2.92	4.65	3.92	3.18

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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
```

```
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     150.31        16.98
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.02 (ii)    5.35 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.00          0.071 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      48.76         9.42          36.67
     TOTAL RAINFALL   (mm)=      50.76        50.76          50.76
     RUNOFF COEFFICIENT   =       0.96         0.19           0.72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  59.0    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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       V    V   I    SSSSS  U   U    A    L             (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\1bde
80ac-977e-4f62-9533-528cb496586a\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\1bde
80ac-977e-4f62-9533-528cb496586a\scen


DATE: 08-29-2022                          TIME: 11:15:00

USER:


COMMENTS: ____________________________________________________________


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  ************************************************
  ** SIMULATION : HAZEL                         **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              ac52cfe3-f0a1-42bf-b824-56f2f6c0e82b\1a6591ac
| Ptotal=212.00 mm |    Comments: HAZEL
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	6.00	3.00	13.00	6.00	23.00	9.00	53.00
0.20	6.00	3.20	13.00	6.20	23.00	9.20	53.00
0.40	6.00	3.40	13.00	6.40	23.00	9.40	53.00
0.60	6.00	3.60	13.00	6.60	23.00	9.60	53.00
0.80	6.00	3.80	13.00	6.80	23.00	9.80	53.00
1.00	4.00	4.00	17.00	7.00	13.00	10.00	38.00
1.20	4.00	4.20	17.00	7.20	13.00	10.20	38.00
1.40	4.00	4.40	17.00	7.40	13.00	10.40	38.00
1.60	4.00	4.60	17.00	7.60	13.00	10.60	38.00
1.80	4.00	4.80	17.00	7.80	13.00	10.80	38.00
2.00	6.00	5.00	13.00	8.00	13.00	11.00	13.00
2.20	6.00	5.20	13.00	8.20	13.00	11.20	13.00
2.40	6.00	5.40	13.00	8.40	13.00	11.40	13.00
2.60	6.00	5.60	13.00	8.60	13.00	11.60	13.00
2.80	6.00	5.80	13.00	8.80	13.00	11.80	13.00

```
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--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.24
|ID= 1 DT= 5.0 min |   Total Imp(%)=  69.30   Dir. Conn.(%)=  69.30
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.07
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      40.25        40.00
     Mannings n           =      0.013        0.250

         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	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00

0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

```
     Max.Eff.Inten.(mm/hr)=      53.00        47.10
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       1.55 (ii)   11.09 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.33         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.01          0.034 (iii)
     TIME TO PEAK    (hrs)=       9.58        10.00          10.00
     RUNOFF VOLUME    (mm)=     210.00       151.48         192.01
     TOTAL RAINFALL   (mm)=     212.00       212.00         212.00
     RUNOFF COEFFICIENT   =       0.99         0.71           0.91

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  77.0    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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 FINISH
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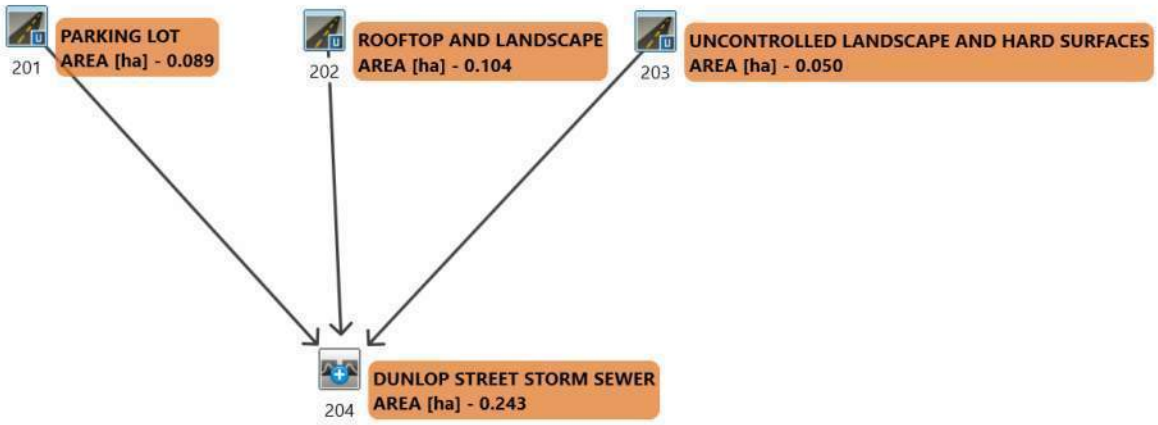
POST-DEVELOPMENT



```
================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\d0c0
de15-aa9d-4d13-8be9-8eb9bc10ebcb\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\d0c0
de15-aa9d-4d13-8be9-8eb9bc10ebcb\scen


DATE: 08-29-2022                          TIME: 11:21:27

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 100yr 24hr 5min SCS Type II   **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              60735bd2-222b-41ec-b982-5c3748ac1610\9a4e6762
| Ptotal=137.63 mm |    Comments: 100yr 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	2.48	12.17	19.82	18.25	2.48
0.08	1.51	6.17	2.48	12.25	19.82	18.33	2.48
0.17	1.51	6.25	2.48	12.33	19.82	18.42	2.48
0.25	1.51	6.33	2.48	12.42	19.82	18.50	2.48
0.33	1.51	6.42	2.48	12.50	19.82	18.58	2.48
0.42	1.51	6.50	2.48	12.58	10.18	18.67	2.48
0.50	1.51	6.58	2.48	12.67	10.18	18.75	2.48
0.58	1.51	6.67	2.48	12.75	10.18	18.83	2.48
0.67	1.51	6.75	2.48	12.83	10.18	18.92	2.48
0.75	1.51	6.83	2.48	12.92	10.18	19.00	2.48
0.83	1.51	6.92	2.48	13.00	10.18	19.08	2.48
0.92	1.51	7.00	2.48	13.08	7.43	19.17	2.48
1.00	1.51	7.08	3.03	13.17	7.43	19.25	2.48
1.08	1.51	7.17	3.03	13.25	7.43	19.33	2.48
1.17	1.51	7.25	3.03	13.33	7.43	19.42	2.48
1.25	1.51	7.33	3.03	13.42	7.43	19.50	2.48
1.33	1.51	7.42	3.03	13.50	7.43	19.58	2.48
1.42	1.51	7.50	3.03	13.58	5.78	19.67	2.48
1.50	1.51	7.58	3.03	13.67	5.78	19.75	2.48
1.58	1.51	7.67	3.03	13.75	5.78	19.83	2.48
1.67	1.51	7.75	3.03	13.83	5.78	19.92	2.48
1.75	1.51	7.83	3.03	13.92	5.78	20.00	2.48
1.83	1.51	7.92	3.03	14.00	5.78	20.08	1.65
1.92	1.51	8.00	3.03	14.08	4.13	20.17	1.65
2.00	1.51	8.08	3.58	14.17	4.13	20.25	1.65
2.08	1.79	8.17	3.58	14.25	4.13	20.33	1.65
2.17	1.79	8.25	3.58	14.33	4.13	20.42	1.65
2.25	1.79	8.33	3.58	14.42	4.13	20.50	1.65
2.33	1.79	8.42	3.58	14.50	4.13	20.58	1.65
2.42	1.79	8.50	3.58	14.58	4.13	20.67	1.65
2.50	1.79	8.58	3.85	14.67	4.13	20.75	1.65
2.58	1.79	8.67	3.85	14.75	4.13	20.83	1.65
2.67	1.79	8.75	3.85	14.83	4.13	20.92	1.65
2.75	1.79	8.83	3.85	14.92	4.13	21.00	1.65
2.83	1.79	8.92	3.85	15.00	4.13	21.08	1.65
2.92	1.79	9.00	3.85	15.08	4.13	21.17	1.65
3.00	1.79	9.08	4.40	15.17	4.13	21.25	1.65
3.08	1.79	9.17	4.40	15.25	4.13	21.33	1.65
3.17	1.79	9.25	4.40	15.33	4.13	21.42	1.65
3.25	1.79	9.33	4.40	15.42	4.13	21.50	1.65
3.33	1.79	9.42	4.40	15.50	4.13	21.58	1.65
3.42	1.79	9.50	4.40	15.58	4.13	21.67	1.65
3.50	1.79	9.58	4.95	15.67	4.13	21.75	1.65
3.58	1.79	9.67	4.95	15.75	4.13	21.83	1.65
3.67	1.79	9.75	4.95	15.83	4.13	21.92	1.65

```
3.75    1.79 |  9.83    4.95 | 15.92    4.13 | 22.00    1.65
3.83    1.79 |  9.92    4.95 | 16.00    4.13 | 22.08    1.65
3.92    1.79 | 10.00    4.95 | 16.08    2.48 | 22.17    1.65
4.00    1.79 | 10.08    6.33 | 16.17    2.48 | 22.25    1.65
4.08    2.20 | 10.17    6.33 | 16.25    2.48 | 22.33    1.65
4.17    2.20 | 10.25    6.33 | 16.33    2.48 | 22.42    1.65
4.25    2.20 | 10.33    6.33 | 16.42    2.48 | 22.50    1.65
4.33    2.20 | 10.42    6.33 | 16.50    2.48 | 22.58    1.65
4.42    2.20 | 10.50    6.33 | 16.58    2.48 | 22.67    1.65
4.50    2.20 | 10.58    8.53 | 16.67    2.48 | 22.75    1.65
4.58    2.20 | 10.67    8.53 | 16.75    2.48 | 22.83    1.65
4.67    2.20 | 10.75    8.53 | 16.83    2.48 | 22.92    1.65
4.75    2.20 | 10.83    8.53 | 16.92    2.48 | 23.00    1.65
4.83    2.20 | 10.92    8.53 | 17.00    2.48 | 23.08    1.65
4.92    2.20 | 11.00    8.53 | 17.08    2.48 | 23.17    1.65
5.00    2.20 | 11.08   13.21 | 17.17    2.48 | 23.25    1.65
5.08    2.20 | 11.17   13.21 | 17.25    2.48 | 23.33    1.65
5.17    2.20 | 11.25   13.21 | 17.33    2.48 | 23.42    1.65
5.25    2.20 | 11.33   13.21 | 17.42    2.48 | 23.50    1.65
5.33    2.20 | 11.42   13.21 | 17.50    2.48 | 23.58    1.65
5.42    2.20 | 11.50   13.21 | 17.58    2.48 | 23.67    1.65
5.50    2.20 | 11.58   40.74 | 17.67    2.48 | 23.75    1.65
5.58    2.20 | 11.67   40.74 | 17.75    2.48 | 23.83    1.65
5.67    2.20 | 11.75   40.74 | 17.83    2.48 | 23.92    1.65
5.75    2.20 | 11.83  168.46 | 17.92    2.48 | 24.00    1.65
5.83    2.20 | 11.92  168.46 | 18.00    2.48 |
5.92    2.20 | 12.00  168.46 | 18.08    2.48 |
6.00    2.20 | 12.08   19.82 | 18.17    2.48 |

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

--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.46        66.14
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.64 (ii)    2.85 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.28
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.038 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08         12.08
     RUNOFF VOLUME    (mm)=     135.63        45.50        123.46
     TOTAL RAINFALL   (mm)=     137.63       137.63        137.63
     RUNOFF COEFFICIENT   =       0.99         0.33          0.90

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.46        66.14
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.76 (ii)    4.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.042 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08         12.08
     RUNOFF VOLUME    (mm)=     135.63        45.50        114.80
     TOTAL RAINFALL   (mm)=     137.63       137.63        137.63
     RUNOFF COEFFICIENT   =       0.99         0.33          0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.46        66.14
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.49 (ii)    7.26 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.013 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.08
     RUNOFF VOLUME    (mm)=     135.63        45.50          78.77
     TOTAL RAINFALL   (mm)=     137.63       137.63         137.63
     RUNOFF COEFFICIENT   =       0.99         0.33           0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.038    12.08   123.46
      + ID2= 2 (  0202):     0.10   0.042    12.08   114.80
        ====================================================
        ID = 3 (  0204):     0.19   0.080    12.08   118.79

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.080    12.08   118.79
      + ID2= 2 (  0203):     0.05   0.013    12.08    78.77
        ====================================================
        ID = 1 (  0204):     0.24   0.093    12.08   110.56

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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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ed6d-135b-46a2-82e0-c74e58bb7e71\scen
  Summary filename:
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ed6d-135b-46a2-82e0-c74e58bb7e71\scen


DATE: 08-29-2022                          TIME: 11:21:27

USER:


COMMENTS: ____________________________________________________________


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  ********************************************
  ** SIMULATION : 100yr 4hr 5min Chicago       **
  ********************************************
```

```
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1383.628
| Ptotal= 87.45 mm |                          B=   4.905
--------------------                          C=   0.754
                       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	6.06	1.00	24.64	2.00	16.04	3.00	7.96
0.08	6.41	1.08	36.97	2.08	14.68	3.08	7.67
0.17	6.81	1.17	81.48	2.17	13.55	3.17	7.40
0.25	7.27	1.25	245.55	2.25	12.60	3.25	7.15
0.33	7.81	1.33	103.86	2.33	11.79	3.33	6.92
0.42	8.45	1.42	59.20	2.42	11.08	3.42	6.71
0.50	9.23	1.50	41.66	2.50	10.47	3.50	6.51
0.58	10.19	1.58	32.37	2.58	9.93	3.58	6.32
0.67	11.42	1.67	26.62	2.67	9.45	3.67	6.15
0.75	13.06	1.75	22.72	2.75	9.02	3.75	5.99
0.83	15.34	1.83	19.89	2.83	8.63	3.83	5.83
0.92	18.79	1.92	17.73	2.92	8.28	3.92	5.69

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     245.55        36.11
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.55 (ii)    2.45 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.30
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.054 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      85.45        20.20          76.63
     TOTAL RAINFALL   (mm)=      87.45        87.45          87.45
     RUNOFF COEFFICIENT   =       0.98         0.23           0.88

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     245.55        36.11
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.65 (ii)    3.70 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.057 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      85.45        20.20          70.36
     TOTAL RAINFALL   (mm)=      87.45        87.45          87.45
     RUNOFF COEFFICIENT   =       0.98         0.23           0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
```

```
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     245.55        36.11
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.42 (ii)    5.38 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.014 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      85.45        20.20          44.28
     TOTAL RAINFALL   (mm)=      87.45        87.45          87.45
     RUNOFF COEFFICIENT   =       0.98         0.23           0.51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.054     1.33    76.63
      + ID2= 2 (  0202):     0.10   0.057     1.33    70.36
        ===================================================
        ID = 3 (  0204):     0.19   0.111     1.33    73.25

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.111     1.33    73.25
      + ID2= 2 (  0203):     0.05   0.014     1.33    44.28
        ===================================================
        ID = 1 (  0204):     0.24   0.125     1.33    67.29

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

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================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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

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  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\c2e2
3bd0-de0b-4e52-b0a3-54ca83378b23\scen


DATE: 08-29-2022                          TIME: 11:21:27

USER:


COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : 10yr 24hr 5min SCS Type II    **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
```

| | 60735bd2-222b-41ec-b982-5c3748ac1610\61f0dcdc

| Ptotal= 93.03 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	1.67	12.17	13.40	18.25	1.67
0.08	1.02	6.17	1.67	12.25	13.40	18.33	1.67
0.17	1.02	6.25	1.67	12.33	13.40	18.42	1.67
0.25	1.02	6.33	1.67	12.42	13.40	18.50	1.67
0.33	1.02	6.42	1.67	12.50	13.40	18.58	1.67
0.42	1.02	6.50	1.67	12.58	6.88	18.67	1.67
0.50	1.02	6.58	1.67	12.67	6.88	18.75	1.67
0.58	1.02	6.67	1.67	12.75	6.88	18.83	1.67
0.67	1.02	6.75	1.67	12.83	6.88	18.92	1.67
0.75	1.02	6.83	1.67	12.92	6.88	19.00	1.67
0.83	1.02	6.92	1.67	13.00	6.88	19.08	1.67
0.92	1.02	7.00	1.67	13.08	5.02	19.17	1.67
1.00	1.02	7.08	2.05	13.17	5.02	19.25	1.67
1.08	1.02	7.17	2.05	13.25	5.02	19.33	1.67
1.17	1.02	7.25	2.05	13.33	5.02	19.42	1.67
1.25	1.02	7.33	2.05	13.42	5.02	19.50	1.67
1.33	1.02	7.42	2.05	13.50	5.02	19.58	1.67
1.42	1.02	7.50	2.05	13.58	3.91	19.67	1.67
1.50	1.02	7.58	2.05	13.67	3.91	19.75	1.67
1.58	1.02	7.67	2.05	13.75	3.91	19.83	1.67
1.67	1.02	7.75	2.05	13.83	3.91	19.92	1.67
1.75	1.02	7.83	2.05	13.92	3.91	20.00	1.67
1.83	1.02	7.92	2.05	14.00	3.91	20.08	1.12
1.92	1.02	8.00	2.05	14.08	2.79	20.17	1.12
2.00	1.02	8.08	2.42	14.17	2.79	20.25	1.12
2.08	1.21	8.17	2.42	14.25	2.79	20.33	1.12
2.17	1.21	8.25	2.42	14.33	2.79	20.42	1.12
2.25	1.21	8.33	2.42	14.42	2.79	20.50	1.12
2.33	1.21	8.42	2.42	14.50	2.79	20.58	1.12
2.42	1.21	8.50	2.42	14.58	2.79	20.67	1.12
2.50	1.21	8.58	2.60	14.67	2.79	20.75	1.12
2.58	1.21	8.67	2.60	14.75	2.79	20.83	1.12
2.67	1.21	8.75	2.60	14.83	2.79	20.92	1.12
2.75	1.21	8.83	2.60	14.92	2.79	21.00	1.12
2.83	1.21	8.92	2.60	15.00	2.79	21.08	1.12
2.92	1.21	9.00	2.60	15.08	2.79	21.17	1.12
3.00	1.21	9.08	2.98	15.17	2.79	21.25	1.12
3.08	1.21	9.17	2.98	15.25	2.79	21.33	1.12
3.17	1.21	9.25	2.98	15.33	2.79	21.42	1.12
3.25	1.21	9.33	2.98	15.42	2.79	21.50	1.12
3.33	1.21	9.42	2.98	15.50	2.79	21.58	1.12
3.42	1.21	9.50	2.98	15.58	2.79	21.67	1.12
3.50	1.21	9.58	3.35	15.67	2.79	21.75	1.12
3.58	1.21	9.67	3.35	15.75	2.79	21.83	1.12
3.67	1.21	9.75	3.35	15.83	2.79	21.92	1.12
3.75	1.21	9.83	3.35	15.92	2.79	22.00	1.12
3.83	1.21	9.92	3.35	16.00	2.79	22.08	1.12
3.92	1.21	10.00	3.35	16.08	1.67	22.17	1.12
4.00	1.21	10.08	4.28	16.17	1.67	22.25	1.12
4.08	1.49	10.17	4.28	16.25	1.67	22.33	1.12
4.17	1.49	10.25	4.28	16.33	1.67	22.42	1.12
4.25	1.49	10.33	4.28	16.42	1.67	22.50	1.12
4.33	1.49	10.42	4.28	16.50	1.67	22.58	1.12
4.42	1.49	10.50	4.28	16.58	1.67	22.67	1.12
4.50	1.49	10.58	5.77	16.67	1.67	22.75	1.12
4.58	1.49	10.67	5.77	16.75	1.67	22.83	1.12
4.67	1.49	10.75	5.77	16.83	1.67	22.92	1.12
4.75	1.49	10.83	5.77	16.92	1.67	23.00	1.12
4.83	1.49	10.92	5.77	17.00	1.67	23.08	1.12
4.92	1.49	11.00	5.77	17.08	1.67	23.17	1.12
5.00	1.49	11.08	8.93	17.17	1.67	23.25	1.12
5.08	1.49	11.17	8.93	17.25	1.67	23.33	1.12
5.17	1.49	11.25	8.93	17.33	1.67	23.42	1.12
5.25	1.49	11.33	8.93	17.42	1.67	23.50	1.12
5.33	1.49	11.42	8.93	17.50	1.67	23.58	1.12
5.42	1.49	11.50	8.93	17.58	1.67	23.67	1.12
5.50	1.49	11.58	27.54	17.67	1.67	23.75	1.12
5.58	1.49	11.67	27.54	17.75	1.67	23.83	1.12
5.67	1.49	11.75	27.54	17.83	1.67	23.92	1.12
5.75	1.49	11.83	113.87	17.92	1.67	24.00	1.12
5.83	1.49	11.92	113.87	18.00	1.67		
5.92	1.49	12.00	113.87	18.08	1.67		
6.00	1.49	12.08	13.40	18.17	1.67		

| CALIB |
| STANDHYD (0201)| Area (ha)= 0.09
|ID= 1 DT= 5.0 min | Total Imp(%)= 86.50 Dir. Conn.(%)= 86.50

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.08	0.01
Dep. Storage (mm)=	2.00	5.00
Average Slope (%)=	3.00	4.00
Length (m)=	24.36	40.00
Mannings n =	0.013	0.250
Max.Eff.Inten.(mm/hr)=	113.87	32.81
over (min)	5.00	5.00
Storage Coeff. (min)=	0.75 (ii)	3.34 (ii)
Unit Hyd. Tpeak (min)=	5.00	5.00
Unit Hyd. peak (cms)=	0.34	0.26
		TOTALS
PEAK FLOW (cms)=	0.02	0.00 0.025 (iii)

```
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      91.03        22.66          81.80
     TOTAL RAINFALL   (mm)=      93.03        93.03          93.03
     RUNOFF COEFFICIENT   =       0.98         0.24           0.88

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     113.87        32.81
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.88 (ii)    5.03 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.027 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      91.03        22.66          75.22
     TOTAL RAINFALL   (mm)=      93.03        93.03          93.03
     RUNOFF COEFFICIENT   =       0.98         0.24           0.81

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     113.87        32.81
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.58 (ii)    9.53 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.12
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.008 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
     RUNOFF VOLUME    (mm)=      91.03        22.66          47.90
     TOTAL RAINFALL   (mm)=      93.03        93.03          93.03
     RUNOFF COEFFICIENT   =       0.98         0.24           0.51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.025    12.08    81.80
      + ID2= 2 (  0202):     0.10   0.027    12.08    75.22
        ===================================================
        ID = 3 (  0204):     0.19   0.053    12.08    78.26

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.053    12.08    78.26
      + ID2= 2 (  0203):     0.05   0.008    12.08    47.90
        ===================================================
```

```
        ID = 1 (  0204):     0.24   0.060    12.08    72.01

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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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d381-0dce-4ecc-8a7e-a851ae545305\scen


DATE: 08-29-2022                          TIME: 11:21:27

USER:



COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 10yr 4hr 5min Chicago         **
  ************************************************
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 976.898
| Ptotal= 59.77 mm |                          B=   4.745
--------------------                          C=   0.760
                        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    4.04 |  1.00   16.64 |  2.00   10.79 |  3.00    5.32
                 0.08    4.28 |  1.08   25.08 |  2.08    9.86 |  3.08    5.13
                 0.17    4.55 |  1.17   55.96 |  2.17    9.10 |  3.17    4.94
                 0.25    4.86 |  1.25  173.13 |  2.25    8.45 |  3.25    4.78
                 0.33    5.22 |  1.33   71.59 |  2.33    7.91 |  3.33    4.62
                 0.42    5.65 |  1.42   40.40 |  2.42    7.43 |  3.42    4.48
                 0.50    6.18 |  1.50   28.30 |  2.50    7.02 |  3.50    4.34
                 0.58    6.83 |  1.58   21.92 |  2.58    6.65 |  3.58    4.22
                 0.67    7.66 |  1.67   17.99 |  2.67    6.33 |  3.67    4.10
                 0.75    8.77 |  1.75   15.33 |  2.75    6.04 |  3.75    3.99
                 0.83   10.31 |  1.83   13.40 |  2.83    5.78 |  3.83    3.89
                 0.92   12.65 |  1.92   11.94 |  2.92    5.54 |  3.92    3.79


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     173.13        17.13
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.63 (ii)    2.82 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.28
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00         0.038 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      57.77         9.71         51.28
     TOTAL RAINFALL   (mm)=      59.77        59.77         59.77
     RUNOFF COEFFICIENT   =       0.97         0.16          0.86
```

```
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     173.13        17.13
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.75 (ii)    4.25 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.039 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      57.77         9.71          46.65
     TOTAL RAINFALL   (mm)=      59.77        59.77          59.77
     RUNOFF COEFFICIENT   =       0.97         0.16           0.78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     173.13        14.26
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.49 (ii)   12.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.009 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58           1.33
     RUNOFF VOLUME    (mm)=      57.77         9.71          27.33
     TOTAL RAINFALL   (mm)=      59.77        59.77          59.77
     RUNOFF COEFFICIENT   =       0.97         0.16           0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.038     1.33    51.28
      + ID2= 2 (  0202):     0.10   0.039     1.33    46.65
        ===================================================
        ID = 3 (  0204):     0.19   0.077     1.33    48.79

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.077     1.33    48.79
      + ID2= 2 (  0203):     0.05   0.009     1.33    27.33
        ===================================================
        ID = 1 (  0204):     0.24   0.086     1.33    44.37

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

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================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\7271
95e5-08e5-4ca3-adcc-ddc9dd623553\scen


DATE: 08-29-2022                          TIME: 11:21:27

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 25yr 24hr 5min SCS Type II    **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              60735bd2-222b-41ec-b982-5c3748ac1610\62251d1d
| Ptotal=111.09 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	2.00	12.17	16.00	18.25	2.00
0.08	1.22	6.17	2.00	12.25	16.00	18.33	2.00
0.17	1.22	6.25	2.00	12.33	16.00	18.42	2.00
0.25	1.22	6.33	2.00	12.42	16.00	18.50	2.00
0.33	1.22	6.42	2.00	12.50	16.00	18.58	2.00
0.42	1.22	6.50	2.00	12.58	8.22	18.67	2.00
0.50	1.22	6.58	2.00	12.67	8.22	18.75	2.00
0.58	1.22	6.67	2.00	12.75	8.22	18.83	2.00
0.67	1.22	6.75	2.00	12.83	8.22	18.92	2.00
0.75	1.22	6.83	2.00	12.92	8.22	19.00	2.00
0.83	1.22	6.92	2.00	13.00	8.22	19.08	2.00
0.92	1.22	7.00	2.00	13.08	6.00	19.17	2.00
1.00	1.22	7.08	2.44	13.17	6.00	19.25	2.00
1.08	1.22	7.17	2.44	13.25	6.00	19.33	2.00
1.17	1.22	7.25	2.44	13.33	6.00	19.42	2.00
1.25	1.22	7.33	2.44	13.42	6.00	19.50	2.00
1.33	1.22	7.42	2.44	13.50	6.00	19.58	2.00
1.42	1.22	7.50	2.44	13.58	4.67	19.67	2.00
1.50	1.22	7.58	2.44	13.67	4.67	19.75	2.00
1.58	1.22	7.67	2.44	13.75	4.67	19.83	2.00
1.67	1.22	7.75	2.44	13.83	4.67	19.92	2.00
1.75	1.22	7.83	2.44	13.92	4.67	20.00	2.00
1.83	1.22	7.92	2.44	14.00	4.67	20.08	1.33
1.92	1.22	8.00	2.44	14.08	3.33	20.17	1.33
2.00	1.22	8.08	2.89	14.17	3.33	20.25	1.33
2.08	1.44	8.17	2.89	14.25	3.33	20.33	1.33
2.17	1.44	8.25	2.89	14.33	3.33	20.42	1.33
2.25	1.44	8.33	2.89	14.42	3.33	20.50	1.33
2.33	1.44	8.42	2.89	14.50	3.33	20.58	1.33
2.42	1.44	8.50	2.89	14.58	3.33	20.67	1.33
2.50	1.44	8.58	3.11	14.67	3.33	20.75	1.33
2.58	1.44	8.67	3.11	14.75	3.33	20.83	1.33
2.67	1.44	8.75	3.11	14.83	3.33	20.92	1.33
2.75	1.44	8.83	3.11	14.92	3.33	21.00	1.33
2.83	1.44	8.92	3.11	15.00	3.33	21.08	1.33
2.92	1.44	9.00	3.11	15.08	3.33	21.17	1.33
3.00	1.44	9.08	3.55	15.17	3.33	21.25	1.33
3.08	1.44	9.17	3.55	15.25	3.33	21.33	1.33
3.17	1.44	9.25	3.55	15.33	3.33	21.42	1.33
3.25	1.44	9.33	3.55	15.42	3.33	21.50	1.33
3.33	1.44	9.42	3.55	15.50	3.33	21.58	1.33
3.42	1.44	9.50	3.55	15.58	3.33	21.67	1.33
3.50	1.44	9.58	4.00	15.67	3.33	21.75	1.33
3.58	1.44	9.67	4.00	15.75	3.33	21.83	1.33
3.67	1.44	9.75	4.00	15.83	3.33	21.92	1.33

```
3.75    1.44 |  9.83    4.00 | 15.92    3.33 | 22.00    1.33
3.83    1.44 |  9.92    4.00 | 16.00    3.33 | 22.08    1.33
3.92    1.44 | 10.00    4.00 | 16.08    2.00 | 22.17    1.33
4.00    1.44 | 10.08    5.11 | 16.17    2.00 | 22.25    1.33
4.08    1.78 | 10.17    5.11 | 16.25    2.00 | 22.33    1.33
4.17    1.78 | 10.25    5.11 | 16.33    2.00 | 22.42    1.33
4.25    1.78 | 10.33    5.11 | 16.42    2.00 | 22.50    1.33
4.33    1.78 | 10.42    5.11 | 16.50    2.00 | 22.58    1.33
4.42    1.78 | 10.50    5.11 | 16.58    2.00 | 22.67    1.33
4.50    1.78 | 10.58    6.89 | 16.67    2.00 | 22.75    1.33
4.58    1.78 | 10.67    6.89 | 16.75    2.00 | 22.83    1.33
4.67    1.78 | 10.75    6.89 | 16.83    2.00 | 22.92    1.33
4.75    1.78 | 10.83    6.89 | 16.92    2.00 | 23.00    1.33
4.83    1.78 | 10.92    6.89 | 17.00    2.00 | 23.08    1.33
4.92    1.78 | 11.00    6.89 | 17.08    2.00 | 23.17    1.33
5.00    1.78 | 11.08   10.66 | 17.17    2.00 | 23.25    1.33
5.08    1.78 | 11.17   10.66 | 17.25    2.00 | 23.33    1.33
5.17    1.78 | 11.25   10.66 | 17.33    2.00 | 23.42    1.33
5.25    1.78 | 11.33   10.66 | 17.42    2.00 | 23.50    1.33
5.33    1.78 | 11.42   10.66 | 17.50    2.00 | 23.58    1.33
5.42    1.78 | 11.50   10.66 | 17.58    2.00 | 23.67    1.33
5.50    1.78 | 11.58   32.88 | 17.67    2.00 | 23.75    1.33
5.58    1.78 | 11.67   32.88 | 17.75    2.00 | 23.83    1.33
5.67    1.78 | 11.75   32.88 | 17.83    2.00 | 23.92    1.33
5.75    1.78 | 11.83  135.97 | 17.92    2.00 | 24.00    1.33
5.83    1.78 | 11.92  135.97 | 18.00    2.00 |
5.92    1.78 | 12.00  135.97 | 18.08    2.00 |
6.00    1.78 | 12.08   16.00 | 18.17    2.00 |

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

--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     135.97        45.34
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.70 (ii)    3.11 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.27
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.031 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08         12.08
     RUNOFF VOLUME    (mm)=     109.09        31.26         98.58
     TOTAL RAINFALL   (mm)=     111.09       111.09        111.09
     RUNOFF COEFFICIENT   =       0.98         0.28          0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     135.97        45.34
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.82 (ii)    4.68 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.033 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08         12.08
     RUNOFF VOLUME    (mm)=     109.09        31.26         91.10
     TOTAL RAINFALL   (mm)=     111.09       111.09        111.09
     RUNOFF COEFFICIENT   =       0.98         0.28          0.82

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     135.97        45.34
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.54 (ii)    8.40 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.010 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.08
     RUNOFF VOLUME    (mm)=     109.09        31.26          59.99
     TOTAL RAINFALL   (mm)=     111.09       111.09         111.09
     RUNOFF COEFFICIENT   =       0.98         0.28           0.54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.031    12.08    98.58
      + ID2= 2 (  0202):     0.10   0.033    12.08    91.10
        ===================================================
        ID = 3 (  0204):     0.19   0.064    12.08    94.55

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.064    12.08    94.55
      + ID2= 2 (  0203):     0.05   0.010    12.08    59.99
        ===================================================
        ID = 1 (  0204):     0.24   0.074    12.08    87.44

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\96d3
41b0-c756-4346-a8e7-aa261abe95fa\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\96d3
41b0-c756-4346-a8e7-aa261abe95fa\scen


DATE: 08-29-2022                          TIME: 11:21:27

USER:


COMMENTS: ____________________________________________________________


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  ********************************************
  ** SIMULATION : 25yr 4hr 5min Chicago        **
  ********************************************
```

```
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1133.123
| Ptotal= 70.87 mm |                          B=   4.734
--------------------                          C=   0.756
                       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	4.87	1.00	19.82	2.00	12.89	3.00	6.39
0.08	5.15	1.08	29.77	2.08	11.79	3.08	6.16
0.17	5.47	1.17	65.99	2.17	10.89	3.17	5.94
0.25	5.84	1.25	202.83	2.25	10.12	3.25	5.74
0.33	6.27	1.33	84.29	2.33	9.47	3.33	5.56
0.42	6.79	1.42	47.77	2.42	8.91	3.42	5.39
0.50	7.41	1.50	33.55	2.50	8.41	3.50	5.23
0.58	8.19	1.58	26.05	2.58	7.98	3.58	5.08
0.67	9.18	1.67	21.41	2.67	7.59	3.67	4.94
0.75	10.49	1.75	18.27	2.75	7.25	3.75	4.81
0.83	12.33	1.83	15.99	2.83	6.93	3.83	4.68
0.92	15.10	1.92	14.26	2.92	6.65	3.92	4.57

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     202.83        24.08
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.59 (ii)    2.65 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.29
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.044 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      68.87        13.56          61.40
     TOTAL RAINFALL   (mm)=      70.87        70.87          70.87
     RUNOFF COEFFICIENT   =       0.97         0.19           0.87
```

```
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     202.83        24.08
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.70 (ii)    3.99 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.047 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      68.87        13.56          56.08
     TOTAL RAINFALL   (mm)=      70.87        70.87          70.87
     RUNOFF COEFFICIENT   =       0.97         0.19           0.79

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
```

```
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     202.83        19.98
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.46 (ii)   11.37 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.011 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58           1.33
     RUNOFF VOLUME    (mm)=      68.87        13.56          33.90
     TOTAL RAINFALL   (mm)=      70.87        70.87          70.87
     RUNOFF COEFFICIENT   =       0.97         0.19           0.48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.044     1.33    61.40
      + ID2= 2 (  0202):     0.10   0.047     1.33    56.08
        ===================================================
        ID = 3 (  0204):     0.19   0.091     1.33    58.53

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.091     1.33    58.53
      + ID2= 2 (  0203):     0.05   0.011     1.33    33.90
        ===================================================
        ID = 1 (  0204):     0.24   0.102     1.33    53.46

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

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\9713
629a-df61-4030-ad5c-89e60afcd43b\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\9713
629a-df61-4030-ad5c-89e60afcd43b\scen


DATE: 08-29-2022                          TIME: 11:21:27

USER:


COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : 2yr 24hr 5min SCS Type II     **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
```

| | 60735bd2-222b-41ec-b982-5c3748ac1610\81710a3e
| Ptotal= 55.62 mm | 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	1.00	12.17	8.01	18.25	1.00
0.08	0.61	6.17	1.00	12.25	8.01	18.33	1.00
0.17	0.61	6.25	1.00	12.33	8.01	18.42	1.00
0.25	0.61	6.33	1.00	12.42	8.01	18.50	1.00
0.33	0.61	6.42	1.00	12.50	8.01	18.58	1.00
0.42	0.61	6.50	1.00	12.58	4.12	18.67	1.00
0.50	0.61	6.58	1.00	12.67	4.12	18.75	1.00
0.58	0.61	6.67	1.00	12.75	4.12	18.83	1.00
0.67	0.61	6.75	1.00	12.83	4.12	18.92	1.00
0.75	0.61	6.83	1.00	12.92	4.12	19.00	1.00
0.83	0.61	6.92	1.00	13.00	4.12	19.08	1.00
0.92	0.61	7.00	1.00	13.08	3.00	19.17	1.00
1.00	0.61	7.08	1.22	13.17	3.00	19.25	1.00
1.08	0.61	7.17	1.22	13.25	3.00	19.33	1.00
1.17	0.61	7.25	1.22	13.33	3.00	19.42	1.00
1.25	0.61	7.33	1.22	13.42	3.00	19.50	1.00
1.33	0.61	7.42	1.22	13.50	3.00	19.58	1.00
1.42	0.61	7.50	1.22	13.58	2.34	19.67	1.00
1.50	0.61	7.58	1.22	13.67	2.34	19.75	1.00
1.58	0.61	7.67	1.22	13.75	2.34	19.83	1.00
1.67	0.61	7.75	1.22	13.83	2.34	19.92	1.00
1.75	0.61	7.83	1.22	13.92	2.34	20.00	1.00
1.83	0.61	7.92	1.22	14.00	2.34	20.08	0.67
1.92	0.61	8.00	1.22	14.08	1.67	20.17	0.67
2.00	0.61	8.08	1.45	14.17	1.67	20.25	0.67
2.08	0.72	8.17	1.45	14.25	1.67	20.33	0.67
2.17	0.72	8.25	1.45	14.33	1.67	20.42	0.67
2.25	0.72	8.33	1.45	14.42	1.67	20.50	0.67
2.33	0.72	8.42	1.45	14.50	1.67	20.58	0.67
2.42	0.72	8.50	1.45	14.58	1.67	20.67	0.67
2.50	0.72	8.58	1.56	14.67	1.67	20.75	0.67
2.58	0.72	8.67	1.56	14.75	1.67	20.83	0.67
2.67	0.72	8.75	1.56	14.83	1.67	20.92	0.67
2.75	0.72	8.83	1.56	14.92	1.67	21.00	0.67
2.83	0.72	8.92	1.56	15.00	1.67	21.08	0.67
2.92	0.72	9.00	1.56	15.08	1.67	21.17	0.67
3.00	0.72	9.08	1.78	15.17	1.67	21.25	0.67
3.08	0.72	9.17	1.78	15.25	1.67	21.33	0.67
3.17	0.72	9.25	1.78	15.33	1.67	21.42	0.67
3.25	0.72	9.33	1.78	15.42	1.67	21.50	0.67
3.33	0.72	9.42	1.78	15.50	1.67	21.58	0.67
3.42	0.72	9.50	1.78	15.58	1.67	21.67	0.67
3.50	0.72	9.58	2.00	15.67	1.67	21.75	0.67
3.58	0.72	9.67	2.00	15.75	1.67	21.83	0.67
3.67	0.72	9.75	2.00	15.83	1.67	21.92	0.67
3.75	0.72	9.83	2.00	15.92	1.67	22.00	0.67
3.83	0.72	9.92	2.00	16.00	1.67	22.08	0.67
3.92	0.72	10.00	2.00	16.08	1.00	22.17	0.67
4.00	0.72	10.08	2.56	16.17	1.00	22.25	0.67
4.08	0.89	10.17	2.56	16.25	1.00	22.33	0.67
4.17	0.89	10.25	2.56	16.33	1.00	22.42	0.67
4.25	0.89	10.33	2.56	16.42	1.00	22.50	0.67
4.33	0.89	10.42	2.56	16.50	1.00	22.58	0.67
4.42	0.89	10.50	2.56	16.58	1.00	22.67	0.67
4.50	0.89	10.58	3.45	16.67	1.00	22.75	0.67
4.58	0.89	10.67	3.45	16.75	1.00	22.83	0.67
4.67	0.89	10.75	3.45	16.83	1.00	22.92	0.67
4.75	0.89	10.83	3.45	16.92	1.00	23.00	0.67
4.83	0.89	10.92	3.45	17.00	1.00	23.08	0.67
4.92	0.89	11.00	3.45	17.08	1.00	23.17	0.67
5.00	0.89	11.08	5.34	17.17	1.00	23.25	0.67
5.08	0.89	11.17	5.34	17.25	1.00	23.33	0.67
5.17	0.89	11.25	5.34	17.33	1.00	23.42	0.67
5.25	0.89	11.33	5.34	17.42	1.00	23.50	0.67
5.33	0.89	11.42	5.34	17.50	1.00	23.58	0.67
5.42	0.89	11.50	5.34	17.58	1.00	23.67	0.67
5.50	0.89	11.58	16.46	17.67	1.00	23.75	0.67
5.58	0.89	11.67	16.46	17.75	1.00	23.83	0.67
5.67	0.89	11.75	16.46	17.83	1.00	23.92	0.67
5.75	0.89	11.83	68.08	17.92	1.00	24.00	0.67
5.83	0.89	11.92	68.08	18.00	1.00		
5.92	0.89	12.00	68.08	18.08	1.00		
6.00	0.89	12.08	8.01	18.17	1.00		

| CALIB |
| STANDHYD (0201)| Area (ha)= 0.09
|ID= 1 DT= 5.0 min | Total Imp(%)= 86.50 Dir. Conn.(%)= 86.50

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.08	0.01
Dep. Storage (mm)=	2.00	5.00
Average Slope (%)=	3.00	4.00
Length (m)=	24.36	40.00
Mannings n =	0.013	0.250
Max.Eff.Inten.(mm/hr)=	68.08	12.11
over (min)	5.00	5.00
Storage Coeff. (min)=	0.92 (ii)	4.10 (ii)
Unit Hyd. Tpeak (min)=	5.00	5.00
Unit Hyd. peak (cms)=	0.34	0.24
		TOTALS
PEAK FLOW (cms)=	0.01	0.00 0.015 (iii)

```
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      53.62         8.41          47.52
     TOTAL RAINFALL   (mm)=      55.62        55.62          55.62
     RUNOFF COEFFICIENT   =       0.96         0.15           0.85

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      68.08         8.63
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       1.09 (ii)   19.90 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.34         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.015 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.33          12.08
     RUNOFF VOLUME    (mm)=      53.62         8.41          43.16
     TOTAL RAINFALL   (mm)=      55.62        55.62          55.62
     RUNOFF COEFFICIENT   =       0.96         0.15           0.78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      68.08        10.93
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.71 (ii)   14.60 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.004 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.25          12.08
     RUNOFF VOLUME    (mm)=      53.62         8.41          21.37
     TOTAL RAINFALL   (mm)=      55.62        55.62          55.62
     RUNOFF COEFFICIENT   =       0.96         0.15           0.38

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.015    12.08    47.52
      + ID2= 2 (  0202):     0.10   0.015    12.08    43.16
        ===================================================
        ID = 3 (  0204):     0.19   0.030    12.08    45.17

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.030    12.08    45.17
      + ID2= 2 (  0203):     0.05   0.004    12.08    21.37
        ===================================================
```

```
        ID = 1 (  0204):     0.24   0.034    12.08    40.27

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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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0a7c-2826-4cca-8695-7b1ef78285b9\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\e153
0a7c-2826-4cca-8695-7b1ef78285b9\scen


DATE: 08-29-2022                          TIME: 11:21:28

USER:



COMMENTS: ____________________________________________________________


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

```
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 675.586
| Ptotal= 37.03 mm |                          B=   4.681
--------------------                          C=   0.780
                        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	2.31	1.00	10.03	2.00	6.39	3.00	3.08
0.08	2.45	1.08	15.38	2.08	5.82	3.08	2.96
0.17	2.61	1.17	35.54	2.17	5.36	3.17	2.85
0.25	2.80	1.25	114.99	2.25	4.96	3.25	2.75
0.33	3.01	1.33	45.86	2.33	4.63	3.33	2.66
0.42	3.27	1.42	25.27	2.42	4.34	3.42	2.57
0.50	3.59	1.50	17.44	2.50	4.09	3.50	2.49
0.58	3.98	1.58	13.36	2.58	3.87	3.58	2.42
0.67	4.48	1.67	10.88	2.67	3.68	3.67	2.35
0.75	5.15	1.75	9.21	2.75	3.50	3.75	2.29
0.83	6.10	1.83	8.01	2.83	3.35	3.83	2.22
0.92	7.55	1.92	7.10	2.92	3.20	3.92	2.17

```
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     114.99         6.34
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.74 (ii)    3.32 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.26
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00         0.025 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      35.03         3.59         30.79
     TOTAL RAINFALL   (mm)=      37.03        37.03         37.03
     RUNOFF COEFFICIENT   =       0.95         0.10          0.83
```

```
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     114.99         6.34
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.88 (ii)    5.01 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.026 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      35.03         3.59          27.76
     TOTAL RAINFALL   (mm)=      37.03        37.03          37.03
     RUNOFF COEFFICIENT   =       0.95         0.10           0.75

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     114.99         4.62
                over (min)        5.00        25.00
     Storage Coeff.  (min)=       0.57 (ii)   20.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=       0.34         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.006 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.75           1.33
     RUNOFF VOLUME    (mm)=      35.03         3.59          15.07
     TOTAL RAINFALL   (mm)=      37.03        37.03          37.03
     RUNOFF COEFFICIENT   =       0.95         0.10           0.41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.025     1.33    30.79
      + ID2= 2 (  0202):     0.10   0.026     1.33    27.76
        ===================================================
        ID = 3 (  0204):     0.19   0.050     1.33    29.15

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.050     1.33    29.15
      + ID2= 2 (  0203):     0.05   0.006     1.33    15.07
        ===================================================
        ID = 1 (  0204):     0.24   0.056     1.33    26.26

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

```
 FINISH
================================================================================
========================

================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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 *****


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  Output  filename:
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  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\1e35
c2b4-ef43-4ef8-b9a0-5e6b77334ba9\scen


DATE: 08-29-2022                           TIME: 11:21:26

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 50yr 24hr 5min SCS Type II    **
  ************************************************
```

```
--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              60735bd2-222b-41ec-b982-5c3748ac1610\7eb1349e
| Ptotal=125.40 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	2.26	12.17	18.06	18.25	2.26
0.08	1.38	6.17	2.26	12.25	18.06	18.33	2.26
0.17	1.38	6.25	2.26	12.33	18.06	18.42	2.26
0.25	1.38	6.33	2.26	12.42	18.06	18.50	2.26
0.33	1.38	6.42	2.26	12.50	18.06	18.58	2.26
0.42	1.38	6.50	2.26	12.58	9.28	18.67	2.26
0.50	1.38	6.58	2.26	12.67	9.28	18.75	2.26
0.58	1.38	6.67	2.26	12.75	9.28	18.83	2.26
0.67	1.38	6.75	2.26	12.83	9.28	18.92	2.26
0.75	1.38	6.83	2.26	12.92	9.28	19.00	2.26
0.83	1.38	6.92	2.26	13.00	9.28	19.08	2.26
0.92	1.38	7.00	2.26	13.08	6.77	19.17	2.26
1.00	1.38	7.08	2.76	13.17	6.77	19.25	2.26
1.08	1.38	7.17	2.76	13.25	6.77	19.33	2.26
1.17	1.38	7.25	2.76	13.33	6.77	19.42	2.26
1.25	1.38	7.33	2.76	13.42	6.77	19.50	2.26
1.33	1.38	7.42	2.76	13.50	6.77	19.58	2.26
1.42	1.38	7.50	2.76	13.58	5.27	19.67	2.26
1.50	1.38	7.58	2.76	13.67	5.27	19.75	2.26
1.58	1.38	7.67	2.76	13.75	5.27	19.83	2.26
1.67	1.38	7.75	2.76	13.83	5.27	19.92	2.26
1.75	1.38	7.83	2.76	13.92	5.27	20.00	2.26
1.83	1.38	7.92	2.76	14.00	5.27	20.08	1.50
1.92	1.38	8.00	2.76	14.08	3.76	20.17	1.50
2.00	1.38	8.08	3.26	14.17	3.76	20.25	1.50
2.08	1.63	8.17	3.26	14.25	3.76	20.33	1.50
2.17	1.63	8.25	3.26	14.33	3.76	20.42	1.50
2.25	1.63	8.33	3.26	14.42	3.76	20.50	1.50
2.33	1.63	8.42	3.26	14.50	3.76	20.58	1.50
2.42	1.63	8.50	3.26	14.58	3.76	20.67	1.50
2.50	1.63	8.58	3.51	14.67	3.76	20.75	1.50
2.58	1.63	8.67	3.51	14.75	3.76	20.83	1.50
2.67	1.63	8.75	3.51	14.83	3.76	20.92	1.50
2.75	1.63	8.83	3.51	14.92	3.76	21.00	1.50
2.83	1.63	8.92	3.51	15.00	3.76	21.08	1.50
2.92	1.63	9.00	3.51	15.08	3.76	21.17	1.50
3.00	1.63	9.08	4.01	15.17	3.76	21.25	1.50
3.08	1.63	9.17	4.01	15.25	3.76	21.33	1.50
3.17	1.63	9.25	4.01	15.33	3.76	21.42	1.50
3.25	1.63	9.33	4.01	15.42	3.76	21.50	1.50

3.33	1.63	9.42	4.01	15.50	3.76	21.58	1.50
3.42	1.63	9.50	4.01	15.58	3.76	21.67	1.50
3.50	1.63	9.58	4.51	15.67	3.76	21.75	1.50
3.58	1.63	9.67	4.51	15.75	3.76	21.83	1.50
3.67	1.63	9.75	4.51	15.83	3.76	21.92	1.50
3.75	1.63	9.83	4.51	15.92	3.76	22.00	1.50
3.83	1.63	9.92	4.51	16.00	3.76	22.08	1.50
3.92	1.63	10.00	4.51	16.08	2.26	22.17	1.50
4.00	1.63	10.08	5.77	16.17	2.26	22.25	1.50
4.08	2.01	10.17	5.77	16.25	2.26	22.33	1.50
4.17	2.01	10.25	5.77	16.33	2.26	22.42	1.50
4.25	2.01	10.33	5.77	16.42	2.26	22.50	1.50
4.33	2.01	10.42	5.77	16.50	2.26	22.58	1.50
4.42	2.01	10.50	5.77	16.58	2.26	22.67	1.50
4.50	2.01	10.58	7.77	16.67	2.26	22.75	1.50
4.58	2.01	10.67	7.77	16.75	2.26	22.83	1.50
4.67	2.01	10.75	7.77	16.83	2.26	22.92	1.50
4.75	2.01	10.83	7.77	16.92	2.26	23.00	1.50
4.83	2.01	10.92	7.77	17.00	2.26	23.08	1.50
4.92	2.01	11.00	7.77	17.08	2.26	23.17	1.50
5.00	2.01	11.08	12.04	17.17	2.26	23.25	1.50
5.08	2.01	11.17	12.04	17.25	2.26	23.33	1.50
5.17	2.01	11.25	12.04	17.33	2.26	23.42	1.50
5.25	2.01	11.33	12.04	17.42	2.26	23.50	1.50
5.33	2.01	11.42	12.04	17.50	2.26	23.58	1.50
5.42	2.01	11.50	12.04	17.58	2.26	23.67	1.50
5.50	2.01	11.58	37.12	17.67	2.26	23.75	1.50
5.58	2.01	11.67	37.12	17.75	2.26	23.83	1.50
5.67	2.01	11.75	37.12	17.83	2.26	23.92	1.50
5.75	2.01	11.83	153.49	17.92	2.26	24.00	1.50
5.83	2.01	11.92	153.49	18.00	2.26		
5.92	2.01	12.00	153.49	18.08	2.26		
6.00	2.01	12.08	18.06	18.17	2.26		

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--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.49        56.23
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.66 (ii)    2.96 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.28
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.035 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     123.40        38.72         111.97
     TOTAL RAINFALL   (mm)=     125.40       125.40         125.40
     RUNOFF COEFFICIENT   =       0.98         0.31           0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.49        56.23
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.79 (ii)    4.46 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.23
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.038 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     123.40        38.72         103.83
     TOTAL RAINFALL   (mm)=     125.40       125.40         125.40
     RUNOFF COEFFICIENT   =       0.98         0.31           0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.49        56.23
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.51 (ii)    7.73 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.13
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.012 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.08
     RUNOFF VOLUME    (mm)=     123.40        38.72          69.98
     TOTAL RAINFALL   (mm)=     125.40       125.40         125.40
     RUNOFF COEFFICIENT   =       0.98         0.31           0.56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.035    12.08   111.97
      + ID2= 2 (  0202):     0.10   0.038    12.08   103.83
        ==================================================
        ID = 3 (  0204):     0.19   0.073    12.08   107.58

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.073    12.08   107.58
      + ID2= 2 (  0203):     0.05   0.012    12.08    69.98
        ==================================================
        ID = 1 (  0204):     0.24   0.084    12.08    99.84

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\1ffe
6c38-696d-4e77-8d10-c1c1b8c00eca\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\1ffe
6c38-696d-4e77-8d10-c1c1b8c00eca\scen


DATE: 08-29-2022                          TIME: 11:21:27

USER:


COMMENTS: ____________________________________________________________

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  ************************************************
  ** SIMULATION : 50yr 4hr 5min Chicago         **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1251.473
| Ptotal= 79.54 mm |                          B=   4.847
--------------------                          C=   0.753
                        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    5.53 |  1.00   22.40 |  2.00   14.60 |  3.00    7.26
                 0.08    5.85 |  1.08   33.57 |  2.08   13.36 |  3.08    6.99
                 0.17    6.21 |  1.17   73.94 |  2.17   12.33 |  3.17    6.75
                 0.25    6.63 |  1.25  223.60 |  2.25   11.47 |  3.25    6.52
                 0.33    7.12 |  1.33   94.25 |  2.33   10.74 |  3.33    6.31
                 0.42    7.70 |  1.42   53.72 |  2.42   10.10 |  3.42    6.12
                 0.50    8.41 |  1.50   37.82 |  2.50    9.54 |  3.50    5.94
                 0.58    9.29 |  1.58   29.40 |  2.58    9.05 |  3.58    5.77
                 0.67   10.40 |  1.67   24.19 |  2.67    8.61 |  3.67    5.61
                 0.75   11.89 |  1.75   20.65 |  2.75    8.22 |  3.75    5.46
                 0.83   13.96 |  1.83   18.09 |  2.83    7.87 |  3.83    5.32
                 0.92   17.09 |  1.92   16.14 |  2.92    7.55 |  3.92    5.19


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     223.60        29.93
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.57 (ii)    2.55 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.29
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.049 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      77.54        16.91          69.35
     TOTAL RAINFALL   (mm)=      79.54        79.54          79.54
     RUNOFF COEFFICIENT   =       0.97         0.21           0.87

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     223.60        29.93
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.68 (ii)    3.84 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.052 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      77.54        16.91          63.52
     TOTAL RAINFALL   (mm)=      79.54        79.54          79.54
     RUNOFF COEFFICIENT   =       0.97         0.21           0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
```

```
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     223.60        29.93
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.44 (ii)    9.73 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.11
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.012 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      77.54        16.91          39.21
     TOTAL RAINFALL   (mm)=      79.54        79.54          79.54
     RUNOFF COEFFICIENT   =       0.97         0.21           0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.049     1.33    69.35
      + ID2= 2 (  0202):     0.10   0.052     1.33    63.52
        ===================================================
        ID = 3 (  0204):     0.19   0.100     1.33    66.21

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.100     1.33    66.21
      + ID2= 2 (  0203):     0.05   0.012     1.33    39.21
        ===================================================
        ID = 1 (  0204):     0.24   0.113     1.33    60.66

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\a7de
9883-aa86-4b88-b581-4d90592d04ef\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\a7de
9883-aa86-4b88-b581-4d90592d04ef\scen


DATE: 08-29-2022                           TIME: 11:21:27

USER:



COMMENTS: ____________________________________________________________


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------------------------
  **********************************************
  ** SIMULATION : 5yr 24hr 5min SCS Type II     **
  **********************************************
```

```
--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              60735bd2-222b-41ec-b982-5c3748ac1610\1767fa58
| Ptotal= 78.55 mm |    Comments: 5yr 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	1.41	12.17	11.31	18.25	1.41
0.08	0.86	6.17	1.41	12.25	11.31	18.33	1.41
0.17	0.86	6.25	1.41	12.33	11.31	18.42	1.41
0.25	0.86	6.33	1.41	12.42	11.31	18.50	1.41
0.33	0.86	6.42	1.41	12.50	11.31	18.58	1.41
0.42	0.86	6.50	1.41	12.58	5.81	18.67	1.41
0.50	0.86	6.58	1.41	12.67	5.81	18.75	1.41
0.58	0.86	6.67	1.41	12.75	5.81	18.83	1.41
0.67	0.86	6.75	1.41	12.83	5.81	18.92	1.41
0.75	0.86	6.83	1.41	12.92	5.81	19.00	1.41
0.83	0.86	6.92	1.41	13.00	5.81	19.08	1.41
0.92	0.86	7.00	1.41	13.08	4.24	19.17	1.41
1.00	0.86	7.08	1.73	13.17	4.24	19.25	1.41
1.08	0.86	7.17	1.73	13.25	4.24	19.33	1.41
1.17	0.86	7.25	1.73	13.33	4.24	19.42	1.41
1.25	0.86	7.33	1.73	13.42	4.24	19.50	1.41
1.33	0.86	7.42	1.73	13.50	4.24	19.58	1.41
1.42	0.86	7.50	1.73	13.58	3.30	19.67	1.41
1.50	0.86	7.58	1.73	13.67	3.30	19.75	1.41
1.58	0.86	7.67	1.73	13.75	3.30	19.83	1.41
1.67	0.86	7.75	1.73	13.83	3.30	19.92	1.41
1.75	0.86	7.83	1.73	13.92	3.30	20.00	1.41
1.83	0.86	7.92	1.73	14.00	3.30	20.08	0.94
1.92	0.86	8.00	1.73	14.08	2.36	20.17	0.94
2.00	0.86	8.08	2.04	14.17	2.36	20.25	0.94
2.08	1.02	8.17	2.04	14.25	2.36	20.33	0.94
2.17	1.02	8.25	2.04	14.33	2.36	20.42	0.94
2.25	1.02	8.33	2.04	14.42	2.36	20.50	0.94
2.33	1.02	8.42	2.04	14.50	2.36	20.58	0.94
2.42	1.02	8.50	2.04	14.58	2.36	20.67	0.94
2.50	1.02	8.58	2.20	14.67	2.36	20.75	0.94
2.58	1.02	8.67	2.20	14.75	2.36	20.83	0.94
2.67	1.02	8.75	2.20	14.83	2.36	20.92	0.94
2.75	1.02	8.83	2.20	14.92	2.36	21.00	0.94
2.83	1.02	8.92	2.20	15.00	2.36	21.08	0.94
2.92	1.02	9.00	2.20	15.08	2.36	21.17	0.94
3.00	1.02	9.08	2.51	15.17	2.36	21.25	0.94
3.08	1.02	9.17	2.51	15.25	2.36	21.33	0.94
3.17	1.02	9.25	2.51	15.33	2.36	21.42	0.94
3.25	1.02	9.33	2.51	15.42	2.36	21.50	0.94
3.33	1.02	9.42	2.51	15.50	2.36	21.58	0.94
3.42	1.02	9.50	2.51	15.58	2.36	21.67	0.94
3.50	1.02	9.58	2.83	15.67	2.36	21.75	0.94
3.58	1.02	9.67	2.83	15.75	2.36	21.83	0.94
3.67	1.02	9.75	2.83	15.83	2.36	21.92	0.94
3.75	1.02	9.83	2.83	15.92	2.36	22.00	0.94
3.83	1.02	9.92	2.83	16.00	2.36	22.08	0.94
3.92	1.02	10.00	2.83	16.08	1.41	22.17	0.94
4.00	1.02	10.08	3.61	16.17	1.41	22.25	0.94
4.08	1.26	10.17	3.61	16.25	1.41	22.33	0.94
4.17	1.26	10.25	3.61	16.33	1.41	22.42	0.94
4.25	1.26	10.33	3.61	16.42	1.41	22.50	0.94
4.33	1.26	10.42	3.61	16.50	1.41	22.58	0.94
4.42	1.26	10.50	3.61	16.58	1.41	22.67	0.94
4.50	1.26	10.58	4.87	16.67	1.41	22.75	0.94
4.58	1.26	10.67	4.87	16.75	1.41	22.83	0.94
4.67	1.26	10.75	4.87	16.83	1.41	22.92	0.94
4.75	1.26	10.83	4.87	16.92	1.41	23.00	0.94
4.83	1.26	10.92	4.87	17.00	1.41	23.08	0.94
4.92	1.26	11.00	4.87	17.08	1.41	23.17	0.94
5.00	1.26	11.08	7.54	17.17	1.41	23.25	0.94
5.08	1.26	11.17	7.54	17.25	1.41	23.33	0.94
5.17	1.26	11.25	7.54	17.33	1.41	23.42	0.94
5.25	1.26	11.33	7.54	17.42	1.41	23.50	0.94
5.33	1.26	11.42	7.54	17.50	1.41	23.58	0.94
5.42	1.26	11.50	7.54	17.58	1.41	23.67	0.94
5.50	1.26	11.58	23.25	17.67	1.41	23.75	0.94
5.58	1.26	11.67	23.25	17.75	1.41	23.83	0.94
5.67	1.26	11.75	23.25	17.83	1.41	23.92	0.94
5.75	1.26	11.83	96.15	17.92	1.41	24.00	0.94
5.83	1.26	11.92	96.15	18.00	1.41		
5.92	1.26	12.00	96.15	18.08	1.41		
6.00	1.26	12.08	11.31	18.17	1.41		

```
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      96.15        23.87
                over (min)        5.00         5.00
```

```
     Storage Coeff.  (min)=       0.80 (ii)    3.57 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.26
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.021 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      76.55        16.52          68.44
     TOTAL RAINFALL   (mm)=      78.55        78.55          78.55
     RUNOFF COEFFICIENT   =       0.97         0.21           0.87

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      96.15        23.87
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.95 (ii)    5.38 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.023 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      76.55        16.52          62.67
     TOTAL RAINFALL   (mm)=      78.55        78.55          78.55
     RUNOFF COEFFICIENT   =       0.97         0.21           0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      96.15        21.78
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.62 (ii)   11.16 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.006 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.17          12.08
     RUNOFF VOLUME    (mm)=      76.55        16.52          36.32
     TOTAL RAINFALL   (mm)=      78.55        78.55          78.55
     RUNOFF COEFFICIENT   =       0.97         0.21           0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.021    12.08    68.44
      + ID2= 2 (  0202):     0.10   0.023    12.08    62.67
        ===================================================
        ID = 3 (  0204):     0.19   0.044    12.08    65.33

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

--------------------
| ADD HYD  (  0204)|
```

```
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.044    12.08    65.33
      + ID2= 2 (  0203):     0.05   0.006    12.08    36.32
        ====================================================
        ID = 1 (  0204):     0.24   0.050    12.08    59.36

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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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6927-c4d4-4e92-9aba-ab53e49ee828\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\a229
6927-c4d4-4e92-9aba-ab53e49ee828\scen


DATE: 08-29-2022                          TIME: 11:21:27

USER:



COMMENTS: ____________________________________________________________


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

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 843.019
| Ptotal= 50.76 mm |                          B=   4.582
--------------------                          C=   0.763
                        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	3.39	1.00	14.01	2.00	9.07	3.00	4.46
0.08	3.58	1.08	21.15	2.08	8.29	3.08	4.30
0.17	3.81	1.17	47.54	2.17	7.64	3.17	4.15
0.25	4.07	1.25	150.31	2.25	7.10	3.25	4.01
0.33	4.38	1.33	60.96	2.33	6.64	3.33	3.88
0.42	4.74	1.42	34.18	2.42	6.24	3.42	3.75
0.50	5.18	1.50	23.88	2.50	5.89	3.50	3.64
0.58	5.73	1.58	18.47	2.58	5.58	3.58	3.54
0.67	6.43	1.67	15.15	2.67	5.31	3.67	3.44
0.75	7.36	1.75	12.90	2.75	5.07	3.75	3.35
0.83	8.67	1.83	11.27	2.83	4.85	3.83	3.26
0.92	10.64	1.92	10.04	2.92	4.65	3.92	3.18

```
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     150.31        12.30
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.67 (ii)    2.99 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.28
                                                          *TOTALS*
```

```
     PEAK FLOW       (cms)=       0.03         0.00          0.033 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      48.76         6.98          43.11
     TOTAL RAINFALL   (mm)=      50.76        50.76          50.76
     RUNOFF COEFFICIENT   =       0.96         0.14           0.85

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     150.31        12.30
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.79 (ii)    4.50 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.034 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      48.76         6.98          39.10
     TOTAL RAINFALL   (mm)=      50.76        50.76          50.76
     RUNOFF COEFFICIENT   =       0.96         0.14           0.77

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     150.31        10.26
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.52 (ii)   14.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.008 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58           1.33
     RUNOFF VOLUME    (mm)=      48.76         6.98          22.26
     TOTAL RAINFALL   (mm)=      50.76        50.76          50.76
     RUNOFF COEFFICIENT   =       0.96         0.14           0.44

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.033     1.33    43.11
      + ID2= 2 (  0202):     0.10   0.034     1.33    39.10
        ================================================
        ID = 3 (  0204):     0.19   0.067     1.33    40.95

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.067     1.33    40.95
      + ID2= 2 (  0203):     0.05   0.008     1.33    22.26
```

```
     ====================================================
     ID = 1 (  0204):     0.24   0.074     1.33    37.10

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

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================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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 *****


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  Output  filename:
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7e80-bb41-4348-ad6f-a1416d60ea37\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\62f5
7e80-bb41-4348-ad6f-a1416d60ea37\scen


DATE: 08-29-2022                          TIME: 11:15:53

USER:


COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : HAZEL                         **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              fea704ae-ef77-4ac1-a826-5d89c68609e7\1a6591ac
| Ptotal=212.00 mm |    Comments: HAZEL
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	6.00	3.00	13.00	6.00	23.00	9.00	53.00
0.20	6.00	3.20	13.00	6.20	23.00	9.20	53.00
0.40	6.00	3.40	13.00	6.40	23.00	9.40	53.00
0.60	6.00	3.60	13.00	6.60	23.00	9.60	53.00
0.80	6.00	3.80	13.00	6.80	23.00	9.80	53.00
1.00	4.00	4.00	17.00	7.00	13.00	10.00	38.00
1.20	4.00	4.20	17.00	7.20	13.00	10.20	38.00
1.40	4.00	4.40	17.00	7.40	13.00	10.40	38.00
1.60	4.00	4.60	17.00	7.60	13.00	10.60	38.00
1.80	4.00	4.80	17.00	7.80	13.00	10.80	38.00
2.00	6.00	5.00	13.00	8.00	13.00	11.00	13.00
2.20	6.00	5.20	13.00	8.20	13.00	11.20	13.00
2.40	6.00	5.40	13.00	8.40	13.00	11.40	13.00
2.60	6.00	5.60	13.00	8.60	13.00	11.60	13.00
2.80	6.00	5.80	13.00	8.80	13.00	11.80	13.00

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

--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

         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	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00

0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

```
     Max.Eff.Inten.(mm/hr)=      53.00        43.74
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.02 (ii)    4.53 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.013 (iii)
     TIME TO PEAK    (hrs)=       9.33        10.00          10.00
     RUNOFF VOLUME    (mm)=     210.00       135.66         199.94
     TOTAL RAINFALL   (mm)=     212.00       212.00         212.00
     RUNOFF COEFFICIENT   =       0.99         0.64           0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    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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--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

         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	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00

2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

```
     Max.Eff.Inten.(mm/hr)=      53.00        43.74
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       1.20 (ii)   11.03 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.33         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.015 (iii)
     TIME TO PEAK    (hrs)=       9.58        10.00          10.00
     RUNOFF VOLUME    (mm)=     210.00       135.66         192.76
     TOTAL RAINFALL   (mm)=     212.00       212.00         212.00
     RUNOFF COEFFICIENT   =       0.99         0.64           0.91

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    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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--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

         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	6.00	3.083	13.00	6.083	23.00	9.08	53.00
0.167	6.00	3.167	13.00	6.167	23.00	9.17	53.00
0.250	6.00	3.250	13.00	6.250	23.00	9.25	53.00
0.333	6.00	3.333	13.00	6.333	23.00	9.33	53.00
0.417	6.00	3.417	13.00	6.417	23.00	9.42	53.00
0.500	6.00	3.500	13.00	6.500	23.00	9.50	53.00
0.583	6.00	3.583	13.00	6.583	23.00	9.58	53.00
0.667	6.00	3.667	13.00	6.667	23.00	9.67	53.00
0.750	6.00	3.750	13.00	6.750	23.00	9.75	53.00
0.833	6.00	3.833	13.00	6.833	23.00	9.83	53.00
0.917	6.00	3.917	13.00	6.917	23.00	9.92	53.00
1.000	6.00	4.000	13.00	7.000	23.00	10.00	53.00
1.083	4.00	4.083	17.00	7.083	13.00	10.08	38.00
1.167	4.00	4.167	17.00	7.167	13.00	10.17	38.00
1.250	4.00	4.250	17.00	7.250	13.00	10.25	38.00
1.333	4.00	4.333	17.00	7.333	13.00	10.33	38.00
1.417	4.00	4.417	17.00	7.417	13.00	10.42	38.00
1.500	4.00	4.500	17.00	7.500	13.00	10.50	38.00
1.583	4.00	4.583	17.00	7.583	13.00	10.58	38.00
1.667	4.00	4.667	17.00	7.667	13.00	10.67	38.00
1.750	4.00	4.750	17.00	7.750	13.00	10.75	38.00
1.833	4.00	4.833	17.00	7.833	13.00	10.83	38.00
1.917	4.00	4.917	17.00	7.917	13.00	10.92	38.00
2.000	4.00	5.000	17.00	8.000	13.00	11.00	38.00
2.083	6.00	5.083	13.00	8.083	13.00	11.08	13.00
2.167	6.00	5.167	13.00	8.167	13.00	11.17	13.00
2.250	6.00	5.250	13.00	8.250	13.00	11.25	13.00
2.333	6.00	5.333	13.00	8.333	13.00	11.33	13.00
2.417	6.00	5.417	13.00	8.417	13.00	11.42	13.00
2.500	6.00	5.500	13.00	8.500	13.00	11.50	13.00
2.583	6.00	5.583	13.00	8.583	13.00	11.58	13.00
2.667	6.00	5.667	13.00	8.667	13.00	11.67	13.00
2.750	6.00	5.750	13.00	8.750	13.00	11.75	13.00
2.833	6.00	5.833	13.00	8.833	13.00	11.83	13.00
2.917	6.00	5.917	13.00	8.917	13.00	11.92	13.00
3.000	6.00	6.000	13.00	9.000	13.00	12.00	13.00

```
     Max.Eff.Inten.(mm/hr)=      53.00        43.74
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.78 (ii)    8.76 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.007 (iii)
     TIME TO PEAK    (hrs)=       9.58        10.00          10.00
     RUNOFF VOLUME    (mm)=     210.00       135.66         163.05
     TOTAL RAINFALL   (mm)=     212.00       212.00         212.00
     RUNOFF COEFFICIENT   =       0.99         0.64           0.77

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  70.0    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  (  0204)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0201):     0.09   0.013    10.00   199.94
      + ID2= 2 (  0202):     0.10   0.015    10.00   192.76
        ===================================================
        ID = 3 (  0204):     0.19   0.027    10.00   196.07

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

--------------------
| ADD HYD  (  0204)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0204):     0.19   0.027    10.00   196.07
      + ID2= 2 (  0203):     0.05   0.007    10.00   163.05
        ===================================================
        ID = 1 (  0204):     0.24   0.034    10.00   189.28

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

 FINISH
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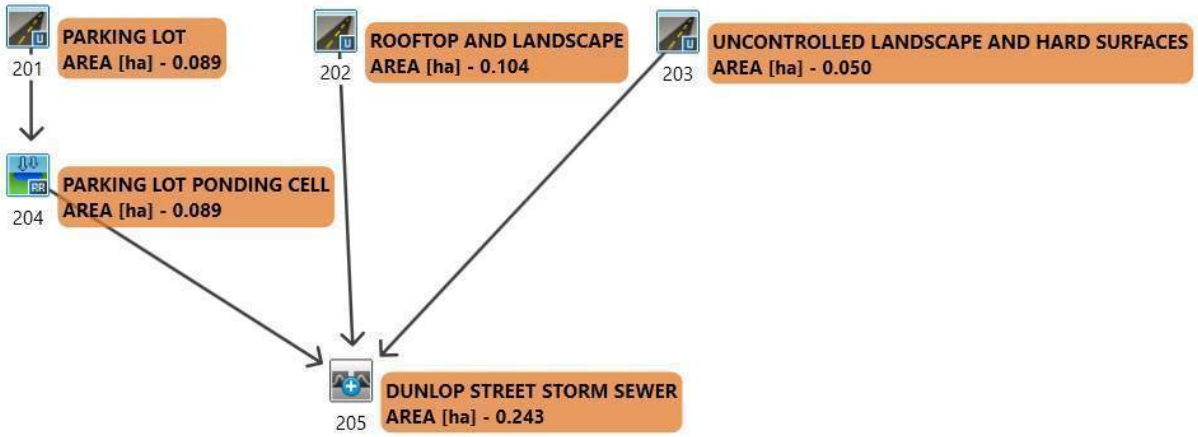
```

POST-DEVELOPMENT SWM



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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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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1497-f6e6-40de-b321-35c609027bcc\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\54e2
1497-f6e6-40de-b321-35c609027bcc\scen


DATE: 08-29-2022                          TIME: 01:19:46

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 100yr 24hr 5min SCS Type II   **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              d11cd9cc-cf94-4899-9c38-96dc5711d302\9a4e6762
| Ptotal=137.63 mm |    Comments: 100yr 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	2.48	12.17	19.82	18.25	2.48
0.08	1.51	6.17	2.48	12.25	19.82	18.33	2.48
0.17	1.51	6.25	2.48	12.33	19.82	18.42	2.48
0.25	1.51	6.33	2.48	12.42	19.82	18.50	2.48
0.33	1.51	6.42	2.48	12.50	19.82	18.58	2.48
0.42	1.51	6.50	2.48	12.58	10.18	18.67	2.48
0.50	1.51	6.58	2.48	12.67	10.18	18.75	2.48
0.58	1.51	6.67	2.48	12.75	10.18	18.83	2.48
0.67	1.51	6.75	2.48	12.83	10.18	18.92	2.48
0.75	1.51	6.83	2.48	12.92	10.18	19.00	2.48
0.83	1.51	6.92	2.48	13.00	10.18	19.08	2.48
0.92	1.51	7.00	2.48	13.08	7.43	19.17	2.48
1.00	1.51	7.08	3.03	13.17	7.43	19.25	2.48
1.08	1.51	7.17	3.03	13.25	7.43	19.33	2.48
1.17	1.51	7.25	3.03	13.33	7.43	19.42	2.48
1.25	1.51	7.33	3.03	13.42	7.43	19.50	2.48
1.33	1.51	7.42	3.03	13.50	7.43	19.58	2.48
1.42	1.51	7.50	3.03	13.58	5.78	19.67	2.48
1.50	1.51	7.58	3.03	13.67	5.78	19.75	2.48
1.58	1.51	7.67	3.03	13.75	5.78	19.83	2.48
1.67	1.51	7.75	3.03	13.83	5.78	19.92	2.48
1.75	1.51	7.83	3.03	13.92	5.78	20.00	2.48
1.83	1.51	7.92	3.03	14.00	5.78	20.08	1.65
1.92	1.51	8.00	3.03	14.08	4.13	20.17	1.65
2.00	1.51	8.08	3.58	14.17	4.13	20.25	1.65
2.08	1.79	8.17	3.58	14.25	4.13	20.33	1.65
2.17	1.79	8.25	3.58	14.33	4.13	20.42	1.65
2.25	1.79	8.33	3.58	14.42	4.13	20.50	1.65
2.33	1.79	8.42	3.58	14.50	4.13	20.58	1.65
2.42	1.79	8.50	3.58	14.58	4.13	20.67	1.65
2.50	1.79	8.58	3.85	14.67	4.13	20.75	1.65
2.58	1.79	8.67	3.85	14.75	4.13	20.83	1.65
2.67	1.79	8.75	3.85	14.83	4.13	20.92	1.65
2.75	1.79	8.83	3.85	14.92	4.13	21.00	1.65
2.83	1.79	8.92	3.85	15.00	4.13	21.08	1.65
2.92	1.79	9.00	3.85	15.08	4.13	21.17	1.65
3.00	1.79	9.08	4.40	15.17	4.13	21.25	1.65
3.08	1.79	9.17	4.40	15.25	4.13	21.33	1.65
3.17	1.79	9.25	4.40	15.33	4.13	21.42	1.65
3.25	1.79	9.33	4.40	15.42	4.13	21.50	1.65
3.33	1.79	9.42	4.40	15.50	4.13	21.58	1.65
3.42	1.79	9.50	4.40	15.58	4.13	21.67	1.65
3.50	1.79	9.58	4.95	15.67	4.13	21.75	1.65
3.58	1.79	9.67	4.95	15.75	4.13	21.83	1.65
3.67	1.79	9.75	4.95	15.83	4.13	21.92	1.65

```
3.75    1.79 |  9.83    4.95 | 15.92    4.13 | 22.00    1.65
3.83    1.79 |  9.92    4.95 | 16.00    4.13 | 22.08    1.65
3.92    1.79 | 10.00    4.95 | 16.08    2.48 | 22.17    1.65
4.00    1.79 | 10.08    6.33 | 16.17    2.48 | 22.25    1.65
4.08    2.20 | 10.17    6.33 | 16.25    2.48 | 22.33    1.65
4.17    2.20 | 10.25    6.33 | 16.33    2.48 | 22.42    1.65
4.25    2.20 | 10.33    6.33 | 16.42    2.48 | 22.50    1.65
4.33    2.20 | 10.42    6.33 | 16.50    2.48 | 22.58    1.65
4.42    2.20 | 10.50    6.33 | 16.58    2.48 | 22.67    1.65
4.50    2.20 | 10.58    8.53 | 16.67    2.48 | 22.75    1.65
4.58    2.20 | 10.67    8.53 | 16.75    2.48 | 22.83    1.65
4.67    2.20 | 10.75    8.53 | 16.83    2.48 | 22.92    1.65
4.75    2.20 | 10.83    8.53 | 16.92    2.48 | 23.00    1.65
4.83    2.20 | 10.92    8.53 | 17.00    2.48 | 23.08    1.65
4.92    2.20 | 11.00    8.53 | 17.08    2.48 | 23.17    1.65
5.00    2.20 | 11.08   13.21 | 17.17    2.48 | 23.25    1.65
5.08    2.20 | 11.17   13.21 | 17.25    2.48 | 23.33    1.65
5.17    2.20 | 11.25   13.21 | 17.33    2.48 | 23.42    1.65
5.25    2.20 | 11.33   13.21 | 17.42    2.48 | 23.50    1.65
5.33    2.20 | 11.42   13.21 | 17.50    2.48 | 23.58    1.65
5.42    2.20 | 11.50   13.21 | 17.58    2.48 | 23.67    1.65
5.50    2.20 | 11.58   40.74 | 17.67    2.48 | 23.75    1.65
5.58    2.20 | 11.67   40.74 | 17.75    2.48 | 23.83    1.65
5.67    2.20 | 11.75   40.74 | 17.83    2.48 | 23.92    1.65
5.75    2.20 | 11.83  168.46 | 17.92    2.48 | 24.00    1.65
5.83    2.20 | 11.92  168.46 | 18.00    2.48 |
5.92    2.20 | 12.00  168.46 | 18.08    2.48 |
6.00    2.20 | 12.08   19.82 | 18.17    2.48 |

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

--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.46        66.14
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.64 (ii)    2.85 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.28
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.038 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     135.63        45.50         123.46
     TOTAL RAINFALL   (mm)=     137.63       137.63         137.63
     RUNOFF COEFFICIENT   =       0.99         0.33           0.90

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.038     12.08     123.46
   OUTFLOW: ID= 1 (  0204)      0.089      0.014     12.17     124.24

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 36.56
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0022

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250
```

```
     Max.Eff.Inten.(mm/hr)=     168.46        66.14
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.76 (ii)    4.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.042 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     135.63        45.50         114.80
     TOTAL RAINFALL   (mm)=     137.63       137.63         137.63
     RUNOFF COEFFICIENT   =       0.99         0.33           0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     168.46        66.14
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.49 (ii)    7.26 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.013 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.08
     RUNOFF VOLUME    (mm)=     135.63        45.50          78.77
     TOTAL RAINFALL   (mm)=     137.63       137.63         137.63
     RUNOFF COEFFICIENT   =       0.99         0.33           0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.042    12.08   114.80
      + ID2= 2 (  0203):     0.05   0.013    12.08    78.77
        ===================================================
        ID = 3 (  0205):     0.15   0.055    12.08   103.10

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.055    12.08   103.10
      + ID2= 2 (  0204):     0.09   0.014    12.17   124.24
        ===================================================
        ID = 1 (  0205):     0.24   0.069    12.08   110.84

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\5434
d5f9-17d0-4e9e-be9c-938464cb9f42\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\5434
d5f9-17d0-4e9e-be9c-938464cb9f42\scen


DATE: 08-29-2022                          TIME: 01:19:46

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 100yr 4hr 5min Chicago        **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1383.628
| Ptotal= 87.45 mm |                          B=   4.905
--------------------                          C=   0.754
                       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    6.06 |  1.00   24.64 |  2.00   16.04 |  3.00    7.96
                 0.08    6.41 |  1.08   36.97 |  2.08   14.68 |  3.08    7.67
                 0.17    6.81 |  1.17   81.48 |  2.17   13.55 |  3.17    7.40
                 0.25    7.27 |  1.25  245.55 |  2.25   12.60 |  3.25    7.15
                 0.33    7.81 |  1.33  103.86 |  2.33   11.79 |  3.33    6.92
                 0.42    8.45 |  1.42   59.20 |  2.42   11.08 |  3.42    6.71
                 0.50    9.23 |  1.50   41.66 |  2.50   10.47 |  3.50    6.51
                 0.58   10.19 |  1.58   32.37 |  2.58    9.93 |  3.58    6.32
                 0.67   11.42 |  1.67   26.62 |  2.67    9.45 |  3.67    6.15
                 0.75   13.06 |  1.75   22.72 |  2.75    9.02 |  3.75    5.99
                 0.83   15.34 |  1.83   19.89 |  2.83    8.63 |  3.83    5.83
                 0.92   18.79 |  1.92   17.73 |  2.92    8.28 |  3.92    5.69
```

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     245.55        36.11
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.55 (ii)    2.45 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.30
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.054 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      85.45        20.20          76.63
     TOTAL RAINFALL   (mm)=      87.45        87.45          87.45
     RUNOFF COEFFICIENT   =       0.98         0.23           0.88

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
```

```
   INFLOW : ID= 2 (  0201)      0.089      0.054      1.33      76.63
   OUTFLOW: ID= 1 (  0204)      0.089      0.014      1.50      76.69

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 25.86
                    TIME SHIFT OF PEAK FLOW         (min)= 10.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0016

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     245.55        36.11
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.65 (ii)    3.70 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.057 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      85.45        20.20          70.36
     TOTAL RAINFALL   (mm)=      87.45        87.45          87.45
     RUNOFF COEFFICIENT   =       0.98         0.23           0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     245.55        36.11
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.42 (ii)    5.38 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.014 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      85.45        20.20          44.28
     TOTAL RAINFALL   (mm)=      87.45        87.45          87.45
     RUNOFF COEFFICIENT   =       0.98         0.23           0.51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.057     1.33    70.36
      + ID2= 2 (  0203):     0.05   0.014     1.33    44.28
        ==================================================
        ID = 3 (  0205):     0.15   0.071     1.33    61.89

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.071     1.33    61.89
      + ID2= 2 (  0204):     0.09   0.014     1.50    76.69
        ==================================================
        ID = 1 (  0205):     0.24   0.084     1.33    67.31

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

```
V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\c816
8d78-5c23-4637-8f64-b4d224717f9b\scen
Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\c816
8d78-5c23-4637-8f64-b4d224717f9b\scen

DATE: 08-29-2022 TIME: 01:19:46

USER:

COMMENTS: _____

****
** SIMULATION : 10yr 24hr 5min SCS Type II **
****

```
--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              d11cd9cc-cf94-4899-9c38-96dc5711d302\61f0dcdc
| Ptotal= 93.03 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	1.67	12.17	13.40	18.25	1.67
0.08	1.02	6.17	1.67	12.25	13.40	18.33	1.67
0.17	1.02	6.25	1.67	12.33	13.40	18.42	1.67
0.25	1.02	6.33	1.67	12.42	13.40	18.50	1.67
0.33	1.02	6.42	1.67	12.50	13.40	18.58	1.67
0.42	1.02	6.50	1.67	12.58	6.88	18.67	1.67
0.50	1.02	6.58	1.67	12.67	6.88	18.75	1.67
0.58	1.02	6.67	1.67	12.75	6.88	18.83	1.67
0.67	1.02	6.75	1.67	12.83	6.88	18.92	1.67
0.75	1.02	6.83	1.67	12.92	6.88	19.00	1.67
0.83	1.02	6.92	1.67	13.00	6.88	19.08	1.67
0.92	1.02	7.00	1.67	13.08	5.02	19.17	1.67
1.00	1.02	7.08	2.05	13.17	5.02	19.25	1.67
1.08	1.02	7.17	2.05	13.25	5.02	19.33	1.67
1.17	1.02	7.25	2.05	13.33	5.02	19.42	1.67
1.25	1.02	7.33	2.05	13.42	5.02	19.50	1.67
1.33	1.02	7.42	2.05	13.50	5.02	19.58	1.67
1.42	1.02	7.50	2.05	13.58	3.91	19.67	1.67
1.50	1.02	7.58	2.05	13.67	3.91	19.75	1.67
1.58	1.02	7.67	2.05	13.75	3.91	19.83	1.67
1.67	1.02	7.75	2.05	13.83	3.91	19.92	1.67
1.75	1.02	7.83	2.05	13.92	3.91	20.00	1.67
1.83	1.02	7.92	2.05	14.00	3.91	20.08	1.12
1.92	1.02	8.00	2.05	14.08	2.79	20.17	1.12
2.00	1.02	8.08	2.42	14.17	2.79	20.25	1.12
2.08	1.21	8.17	2.42	14.25	2.79	20.33	1.12
2.17	1.21	8.25	2.42	14.33	2.79	20.42	1.12
2.25	1.21	8.33	2.42	14.42	2.79	20.50	1.12
2.33	1.21	8.42	2.42	14.50	2.79	20.58	1.12
2.42	1.21	8.50	2.42	14.58	2.79	20.67	1.12
2.50	1.21	8.58	2.60	14.67	2.79	20.75	1.12
2.58	1.21	8.67	2.60	14.75	2.79	20.83	1.12
2.67	1.21	8.75	2.60	14.83	2.79	20.92	1.12
2.75	1.21	8.83	2.60	14.92	2.79	21.00	1.12
2.83	1.21	8.92	2.60	15.00	2.79	21.08	1.12
2.92	1.21	9.00	2.60	15.08	2.79	21.17	1.12
3.00	1.21	9.08	2.98	15.17	2.79	21.25	1.12
3.08	1.21	9.17	2.98	15.25	2.79	21.33	1.12
3.17	1.21	9.25	2.98	15.33	2.79	21.42	1.12
3.25	1.21	9.33	2.98	15.42	2.79	21.50	1.12
3.33	1.21	9.42	2.98	15.50	2.79	21.58	1.12
3.42	1.21	9.50	2.98	15.58	2.79	21.67	1.12
3.50	1.21	9.58	3.35	15.67	2.79	21.75	1.12
3.58	1.21	9.67	3.35	15.75	2.79	21.83	1.12
3.67	1.21	9.75	3.35	15.83	2.79	21.92	1.12
3.75	1.21	9.83	3.35	15.92	2.79	22.00	1.12
3.83	1.21	9.92	3.35	16.00	2.79	22.08	1.12

```
3.92    1.21 | 10.00    3.35 | 16.08    1.67 | 22.17    1.12
4.00    1.21 | 10.08    4.28 | 16.17    1.67 | 22.25    1.12
4.08    1.49 | 10.17    4.28 | 16.25    1.67 | 22.33    1.12
4.17    1.49 | 10.25    4.28 | 16.33    1.67 | 22.42    1.12
4.25    1.49 | 10.33    4.28 | 16.42    1.67 | 22.50    1.12
4.33    1.49 | 10.42    4.28 | 16.50    1.67 | 22.58    1.12
4.42    1.49 | 10.50    4.28 | 16.58    1.67 | 22.67    1.12
4.50    1.49 | 10.58    5.77 | 16.67    1.67 | 22.75    1.12
4.58    1.49 | 10.67    5.77 | 16.75    1.67 | 22.83    1.12
4.67    1.49 | 10.75    5.77 | 16.83    1.67 | 22.92    1.12
4.75    1.49 | 10.83    5.77 | 16.92    1.67 | 23.00    1.12
4.83    1.49 | 10.92    5.77 | 17.00    1.67 | 23.08    1.12
4.92    1.49 | 11.00    5.77 | 17.08    1.67 | 23.17    1.12
5.00    1.49 | 11.08    8.93 | 17.17    1.67 | 23.25    1.12
5.08    1.49 | 11.17    8.93 | 17.25    1.67 | 23.33    1.12
5.17    1.49 | 11.25    8.93 | 17.33    1.67 | 23.42    1.12
5.25    1.49 | 11.33    8.93 | 17.42    1.67 | 23.50    1.12
5.33    1.49 | 11.42    8.93 | 17.50    1.67 | 23.58    1.12
5.42    1.49 | 11.50    8.93 | 17.58    1.67 | 23.67    1.12
5.50    1.49 | 11.58   27.54 | 17.67    1.67 | 23.75    1.12
5.58    1.49 | 11.67   27.54 | 17.75    1.67 | 23.83    1.12
5.67    1.49 | 11.75   27.54 | 17.83    1.67 | 23.92    1.12
5.75    1.49 | 11.83  113.87 | 17.92    1.67 | 24.00    1.12
5.83    1.49 | 11.92  113.87 | 18.00    1.67 |
5.92    1.49 | 12.00  113.87 | 18.08    1.67 |
6.00    1.49 | 12.08   13.40 | 18.17    1.67 |

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

--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     113.87        32.81
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.75 (ii)    3.34 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.26
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.025 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      91.03        22.66          81.80
     TOTAL RAINFALL   (mm)=      93.03        93.03          93.03
     RUNOFF COEFFICIENT   =       0.98         0.24           0.88

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.025     12.08      81.80
   OUTFLOW: ID= 1 (  0204)      0.089      0.014     12.17      82.05

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 53.92
                   TIME SHIFT OF PEAK FLOW         (min)=  5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0011

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     113.87        32.81
                over (min)        5.00        10.00
```

```
     Storage Coeff.  (min)=       0.88 (ii)    5.03 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.027 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      91.03        22.66          75.22
     TOTAL RAINFALL   (mm)=      93.03        93.03          93.03
     RUNOFF COEFFICIENT   =       0.98         0.24           0.81

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     113.87        32.81
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.58 (ii)    9.53 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.008 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.08
     RUNOFF VOLUME    (mm)=      91.03        22.66          47.90
     TOTAL RAINFALL   (mm)=      93.03        93.03          93.03
     RUNOFF COEFFICIENT   =       0.98         0.24           0.51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.027    12.08    75.22
      + ID2= 2 (  0203):     0.05   0.008    12.08    47.90
        ==================================================
        ID = 3 (  0205):     0.15   0.035    12.08    66.35

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.035    12.08    66.35
      + ID2= 2 (  0204):     0.09   0.014    12.17    82.05
        ==================================================
        ID = 1 (  0205):     0.24   0.049    12.08    72.10

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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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58f0-10b5-4fe8-a507-4008e3fe2a29\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\fa92
58f0-10b5-4fe8-a507-4008e3fe2a29\scen


DATE: 08-29-2022                          TIME: 01:19:47

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 10yr 4hr 5min Chicago         **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 976.898
| Ptotal= 59.77 mm |                          B=   4.745
--------------------                          C=   0.760
                       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    4.04 |  1.00   16.64 |  2.00   10.79 |  3.00    5.32
                  0.08    4.28 |  1.08   25.08 |  2.08    9.86 |  3.08    5.13
                  0.17    4.55 |  1.17   55.96 |  2.17    9.10 |  3.17    4.94
                  0.25    4.86 |  1.25  173.13 |  2.25    8.45 |  3.25    4.78
                  0.33    5.22 |  1.33   71.59 |  2.33    7.91 |  3.33    4.62
                  0.42    5.65 |  1.42   40.40 |  2.42    7.43 |  3.42    4.48
                  0.50    6.18 |  1.50   28.30 |  2.50    7.02 |  3.50    4.34
                  0.58    6.83 |  1.58   21.92 |  2.58    6.65 |  3.58    4.22
                  0.67    7.66 |  1.67   17.99 |  2.67    6.33 |  3.67    4.10
                  0.75    8.77 |  1.75   15.33 |  2.75    6.04 |  3.75    3.99
                  0.83   10.31 |  1.83   13.40 |  2.83    5.78 |  3.83    3.89
                  0.92   12.65 |  1.92   11.94 |  2.92    5.54 |  3.92    3.79


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     173.13        17.13
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.63 (ii)    2.82 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.28
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00           0.038 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33            1.33
     RUNOFF VOLUME    (mm)=      57.77         9.71           51.28
     TOTAL RAINFALL   (mm)=      59.77        59.77           59.77
     RUNOFF COEFFICIENT   =       0.97         0.16            0.86

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.038      1.33      51.28
   OUTFLOW: ID= 1 (  0204)      0.089      0.014      1.42      51.32
```

```
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 36.44
                    TIME SHIFT OF PEAK FLOW         (min)=  5.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0008

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     173.13        17.13
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.75 (ii)    4.25 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.039 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      57.77         9.71          46.65
     TOTAL RAINFALL   (mm)=      59.77        59.77          59.77
     RUNOFF COEFFICIENT   =       0.97         0.16           0.78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     173.13        14.26
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.49 (ii)   12.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.009 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58           1.33
     RUNOFF VOLUME    (mm)=      57.77         9.71          27.33
     TOTAL RAINFALL   (mm)=      59.77        59.77          59.77
     RUNOFF COEFFICIENT   =       0.97         0.16           0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.039     1.33    46.65
      + ID2= 2 (  0203):     0.05   0.009     1.33    27.33
        ===================================================
        ID = 3 (  0205):     0.15   0.049     1.33    40.38

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.049     1.33    40.38
      + ID2= 2 (  0204):     0.09   0.014     1.42    51.32
        ===================================================
        ID = 1 (  0205):     0.24   0.062     1.33    44.39

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
```

```
       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:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\89d6771a-191d-4679-bf91-78f0f2d23e18\scen

DATE: 08-29-2022 TIME: 01:19:47

USER:

COMMENTS: _____

```
  ************************************************
  ** SIMULATION : 25mm 4hr 5min Chicago         **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 456.030
| Ptotal= 25.00 mm |                          B=   4.681
--------------------                          C=   0.780
                        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	1.56	1.00	6.77	2.00	4.32	3.00	2.08
0.08	1.66	1.08	10.38	2.08	3.93	3.08	2.00
0.17	1.76	1.17	23.99	2.17	3.62	3.17	1.92
0.25	1.89	1.25	77.62	2.25	3.35	3.25	1.86
0.33	2.03	1.33	30.96	2.33	3.13	3.33	1.79
0.42	2.21	1.42	17.06	2.42	2.93	3.42	1.74
0.50	2.42	1.50	11.77	2.50	2.76	3.50	1.68
0.58	2.69	1.58	9.02	2.58	2.61	3.58	1.63
0.67	3.03	1.67	7.34	2.67	2.48	3.67	1.59
0.75	3.48	1.75	6.22	2.75	2.36	3.75	1.54
0.83	4.12	1.83	5.41	2.83	2.26	3.83	1.50
0.92	5.09	1.92	4.79	2.92	2.16	3.92	1.46

```
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      77.62         2.31
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.87 (ii)    3.89 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00         0.017 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42          1.33
     RUNOFF VOLUME    (mm)=      23.00         1.46         20.09
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.00
     RUNOFF COEFFICIENT   =       0.92         0.06          0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.017      1.33      20.09
   OUTFLOW: ID= 1 (  0204)      0.089      0.013      1.33      20.09

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 79.57
                   TIME SHIFT OF PEAK FLOW         (min)=  0.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0001

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      77.62         2.31
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.03 (ii)    5.86 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.017 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      23.00         1.46          18.02
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.92         0.06           0.72
```

```
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      77.62         1.32
                over (min)        5.00        35.00
     Storage Coeff.  (min)=       0.67 (ii)   33.04 (ii)
     Unit Hyd. Tpeak (min)=       5.00        35.00
     Unit Hyd. peak  (cms)=       0.34         0.03
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.004 (iii)
     TIME TO PEAK    (hrs)=       1.33         2.00           1.33
     RUNOFF VOLUME    (mm)=      23.00         1.46           9.24
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.92         0.06           0.37

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.017     1.33    18.02
      + ID2= 2 (  0203):     0.05   0.004     1.33     9.24
        ==================================================
```

```
        ID = 3 (  0205):     0.15   0.021     1.33    15.17

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.021     1.33    15.17
      + ID2= 2 (  0204):     0.09   0.013     1.33    20.09
        ====================================================
        ID = 1 (  0205):     0.24   0.034     1.33    16.97

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

 FINISH
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\3484
c0f7-a02b-4b50-a8b9-1afe0693bdea\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\3484
c0f7-a02b-4b50-a8b9-1afe0693bdea\scen
```

DATE: 08-29-2022 TIME: 01:19:46

USER:

COMMENTS: _____

```
--------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : 25yr 24hr 5min SCS Type II    **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              d11cd9cc-cf94-4899-9c38-96dc5711d302\62251d1d
| Ptotal=111.09 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	2.00	12.17	16.00	18.25	2.00
0.08	1.22	6.17	2.00	12.25	16.00	18.33	2.00
0.17	1.22	6.25	2.00	12.33	16.00	18.42	2.00
0.25	1.22	6.33	2.00	12.42	16.00	18.50	2.00
0.33	1.22	6.42	2.00	12.50	16.00	18.58	2.00
0.42	1.22	6.50	2.00	12.58	8.22	18.67	2.00
0.50	1.22	6.58	2.00	12.67	8.22	18.75	2.00
0.58	1.22	6.67	2.00	12.75	8.22	18.83	2.00
0.67	1.22	6.75	2.00	12.83	8.22	18.92	2.00
0.75	1.22	6.83	2.00	12.92	8.22	19.00	2.00
0.83	1.22	6.92	2.00	13.00	8.22	19.08	2.00
0.92	1.22	7.00	2.00	13.08	6.00	19.17	2.00
1.00	1.22	7.08	2.44	13.17	6.00	19.25	2.00
1.08	1.22	7.17	2.44	13.25	6.00	19.33	2.00
1.17	1.22	7.25	2.44	13.33	6.00	19.42	2.00
1.25	1.22	7.33	2.44	13.42	6.00	19.50	2.00
1.33	1.22	7.42	2.44	13.50	6.00	19.58	2.00
1.42	1.22	7.50	2.44	13.58	4.67	19.67	2.00
1.50	1.22	7.58	2.44	13.67	4.67	19.75	2.00
1.58	1.22	7.67	2.44	13.75	4.67	19.83	2.00
1.67	1.22	7.75	2.44	13.83	4.67	19.92	2.00
1.75	1.22	7.83	2.44	13.92	4.67	20.00	2.00
1.83	1.22	7.92	2.44	14.00	4.67	20.08	1.33
1.92	1.22	8.00	2.44	14.08	3.33	20.17	1.33

2.00	1.22	8.08	2.89	14.17	3.33	20.25	1.33
2.08	1.44	8.17	2.89	14.25	3.33	20.33	1.33
2.17	1.44	8.25	2.89	14.33	3.33	20.42	1.33
2.25	1.44	8.33	2.89	14.42	3.33	20.50	1.33
2.33	1.44	8.42	2.89	14.50	3.33	20.58	1.33
2.42	1.44	8.50	2.89	14.58	3.33	20.67	1.33
2.50	1.44	8.58	3.11	14.67	3.33	20.75	1.33
2.58	1.44	8.67	3.11	14.75	3.33	20.83	1.33
2.67	1.44	8.75	3.11	14.83	3.33	20.92	1.33
2.75	1.44	8.83	3.11	14.92	3.33	21.00	1.33
2.83	1.44	8.92	3.11	15.00	3.33	21.08	1.33
2.92	1.44	9.00	3.11	15.08	3.33	21.17	1.33
3.00	1.44	9.08	3.55	15.17	3.33	21.25	1.33
3.08	1.44	9.17	3.55	15.25	3.33	21.33	1.33
3.17	1.44	9.25	3.55	15.33	3.33	21.42	1.33
3.25	1.44	9.33	3.55	15.42	3.33	21.50	1.33
3.33	1.44	9.42	3.55	15.50	3.33	21.58	1.33
3.42	1.44	9.50	3.55	15.58	3.33	21.67	1.33
3.50	1.44	9.58	4.00	15.67	3.33	21.75	1.33
3.58	1.44	9.67	4.00	15.75	3.33	21.83	1.33
3.67	1.44	9.75	4.00	15.83	3.33	21.92	1.33
3.75	1.44	9.83	4.00	15.92	3.33	22.00	1.33
3.83	1.44	9.92	4.00	16.00	3.33	22.08	1.33
3.92	1.44	10.00	4.00	16.08	2.00	22.17	1.33
4.00	1.44	10.08	5.11	16.17	2.00	22.25	1.33
4.08	1.78	10.17	5.11	16.25	2.00	22.33	1.33
4.17	1.78	10.25	5.11	16.33	2.00	22.42	1.33
4.25	1.78	10.33	5.11	16.42	2.00	22.50	1.33
4.33	1.78	10.42	5.11	16.50	2.00	22.58	1.33
4.42	1.78	10.50	5.11	16.58	2.00	22.67	1.33
4.50	1.78	10.58	6.89	16.67	2.00	22.75	1.33
4.58	1.78	10.67	6.89	16.75	2.00	22.83	1.33
4.67	1.78	10.75	6.89	16.83	2.00	22.92	1.33
4.75	1.78	10.83	6.89	16.92	2.00	23.00	1.33
4.83	1.78	10.92	6.89	17.00	2.00	23.08	1.33
4.92	1.78	11.00	6.89	17.08	2.00	23.17	1.33
5.00	1.78	11.08	10.66	17.17	2.00	23.25	1.33
5.08	1.78	11.17	10.66	17.25	2.00	23.33	1.33
5.17	1.78	11.25	10.66	17.33	2.00	23.42	1.33
5.25	1.78	11.33	10.66	17.42	2.00	23.50	1.33
5.33	1.78	11.42	10.66	17.50	2.00	23.58	1.33
5.42	1.78	11.50	10.66	17.58	2.00	23.67	1.33
5.50	1.78	11.58	32.88	17.67	2.00	23.75	1.33
5.58	1.78	11.67	32.88	17.75	2.00	23.83	1.33
5.67	1.78	11.75	32.88	17.83	2.00	23.92	1.33
5.75	1.78	11.83	135.97	17.92	2.00	24.00	1.33
5.83	1.78	11.92	135.97	18.00	2.00		
5.92	1.78	12.00	135.97	18.08	2.00		
6.00	1.78	12.08	16.00	18.17	2.00		

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

--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     135.97        45.34
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.70 (ii)    3.11 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.27
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.031 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     109.09        31.26          98.58
     TOTAL RAINFALL   (mm)=     111.09       111.09         111.09
     RUNOFF COEFFICIENT   =       0.98         0.28           0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000
                                 AREA     QPEAK     TPEAK       R.V.
```

```
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.031     12.08      98.58
   OUTFLOW: ID= 1 (  0204)      0.089      0.014     12.17      98.58

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 45.29
                    TIME SHIFT OF PEAK FLOW         (min)=  5.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0015

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     135.97        45.34
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.82 (ii)    4.68 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.22
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.033 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     109.09        31.26          91.10
     TOTAL RAINFALL   (mm)=     111.09       111.09         111.09
     RUNOFF COEFFICIENT   =       0.98         0.28           0.82

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     135.97        45.34
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.54 (ii)    8.40 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.12
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.010 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.08
     RUNOFF VOLUME    (mm)=     109.09        31.26          59.99
     TOTAL RAINFALL   (mm)=     111.09       111.09         111.09
     RUNOFF COEFFICIENT   =       0.98         0.28           0.54

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.033    12.08    91.10
      + ID2= 2 (  0203):     0.05   0.010    12.08    59.99
        ===================================================
        ID = 3 (  0205):     0.15   0.043    12.08    81.00

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.043    12.08    81.00
      + ID2= 2 (  0204):     0.09   0.014    12.17    98.58
        ===================================================
        ID = 1 (  0205):     0.24   0.057    12.08    87.44

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

```
=======================
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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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d608-eb29-462c-beca-b8bc63fe0540\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\5b81
d608-eb29-462c-beca-b8bc63fe0540\scen


DATE: 08-29-2022                          TIME: 01:19:46

USER:



COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 25yr 4hr 5min Chicago         **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1133.123
| Ptotal= 70.87 mm |                          B=   4.734
--------------------                          C=   0.756
                       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	4.87	1.00	19.82	2.00	12.89	3.00	6.39
0.08	5.15	1.08	29.77	2.08	11.79	3.08	6.16
0.17	5.47	1.17	65.99	2.17	10.89	3.17	5.94
0.25	5.84	1.25	202.83	2.25	10.12	3.25	5.74
0.33	6.27	1.33	84.29	2.33	9.47	3.33	5.56
0.42	6.79	1.42	47.77	2.42	8.91	3.42	5.39
0.50	7.41	1.50	33.55	2.50	8.41	3.50	5.23
0.58	8.19	1.58	26.05	2.58	7.98	3.58	5.08
0.67	9.18	1.67	21.41	2.67	7.59	3.67	4.94
0.75	10.49	1.75	18.27	2.75	7.25	3.75	4.81
0.83	12.33	1.83	15.99	2.83	6.93	3.83	4.68
0.92	15.10	1.92	14.26	2.92	6.65	3.92	4.57

```
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     202.83        24.08
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.59 (ii)    2.65 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.29
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00         0.044 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      68.87        13.56         61.40
     TOTAL RAINFALL   (mm)=      70.87        70.87         70.87
     RUNOFF COEFFICIENT   =       0.97         0.19          0.87

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.044      1.33      61.40
   OUTFLOW: ID= 1 (  0204)      0.089      0.014      1.50      61.41

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 31.20
                    TIME SHIFT OF PEAK FLOW         (min)= 10.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0011

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     202.83        24.08
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.70 (ii)    3.99 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.047 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      68.87        13.56          56.08
     TOTAL RAINFALL   (mm)=      70.87        70.87          70.87
     RUNOFF COEFFICIENT   =       0.97         0.19           0.79

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     202.83        19.98
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.46 (ii)   11.37 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.011 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58           1.33
     RUNOFF VOLUME    (mm)=      68.87        13.56          33.90
     TOTAL RAINFALL   (mm)=      70.87        70.87          70.87
     RUNOFF COEFFICIENT   =       0.97         0.19           0.48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 1 (  0202):     0.10   0.047     1.33    56.08
      + ID2= 2 (  0203):     0.05   0.011     1.33    33.90
        ===================================================
        ID = 3 (  0205):     0.15   0.057     1.33    48.88

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.057     1.33    48.88
      + ID2= 2 (  0204):     0.09   0.014     1.50    61.41
        ===================================================
        ID = 1 (  0205):     0.24   0.071     1.33    53.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\cd53
a051-2582-41a0-bbeb-b6c56e78e02c\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\cd53
a051-2582-41a0-bbeb-b6c56e78e02c\scen
```

DATE: 08-29-2022 TIME: 01:19:47

USER:

COMMENTS: _____

```
--------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : 2yr 24hr 5min SCS Type II     **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              d11cd9cc-cf94-4899-9c38-96dc5711d302\81710a3e
| Ptotal= 55.62 mm |    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	1.00	12.17	8.01	18.25	1.00
0.08	0.61	6.17	1.00	12.25	8.01	18.33	1.00
0.17	0.61	6.25	1.00	12.33	8.01	18.42	1.00
0.25	0.61	6.33	1.00	12.42	8.01	18.50	1.00
0.33	0.61	6.42	1.00	12.50	8.01	18.58	1.00
0.42	0.61	6.50	1.00	12.58	4.12	18.67	1.00
0.50	0.61	6.58	1.00	12.67	4.12	18.75	1.00
0.58	0.61	6.67	1.00	12.75	4.12	18.83	1.00
0.67	0.61	6.75	1.00	12.83	4.12	18.92	1.00
0.75	0.61	6.83	1.00	12.92	4.12	19.00	1.00
0.83	0.61	6.92	1.00	13.00	4.12	19.08	1.00
0.92	0.61	7.00	1.00	13.08	3.00	19.17	1.00
1.00	0.61	7.08	1.22	13.17	3.00	19.25	1.00
1.08	0.61	7.17	1.22	13.25	3.00	19.33	1.00
1.17	0.61	7.25	1.22	13.33	3.00	19.42	1.00
1.25	0.61	7.33	1.22	13.42	3.00	19.50	1.00
1.33	0.61	7.42	1.22	13.50	3.00	19.58	1.00
1.42	0.61	7.50	1.22	13.58	2.34	19.67	1.00
1.50	0.61	7.58	1.22	13.67	2.34	19.75	1.00
1.58	0.61	7.67	1.22	13.75	2.34	19.83	1.00
1.67	0.61	7.75	1.22	13.83	2.34	19.92	1.00
1.75	0.61	7.83	1.22	13.92	2.34	20.00	1.00
1.83	0.61	7.92	1.22	14.00	2.34	20.08	0.67
1.92	0.61	8.00	1.22	14.08	1.67	20.17	0.67
2.00	0.61	8.08	1.45	14.17	1.67	20.25	0.67
2.08	0.72	8.17	1.45	14.25	1.67	20.33	0.67

2.17	0.72	8.25	1.45	14.33	1.67	20.42	0.67
2.25	0.72	8.33	1.45	14.42	1.67	20.50	0.67
2.33	0.72	8.42	1.45	14.50	1.67	20.58	0.67
2.42	0.72	8.50	1.45	14.58	1.67	20.67	0.67
2.50	0.72	8.58	1.56	14.67	1.67	20.75	0.67
2.58	0.72	8.67	1.56	14.75	1.67	20.83	0.67
2.67	0.72	8.75	1.56	14.83	1.67	20.92	0.67
2.75	0.72	8.83	1.56	14.92	1.67	21.00	0.67
2.83	0.72	8.92	1.56	15.00	1.67	21.08	0.67
2.92	0.72	9.00	1.56	15.08	1.67	21.17	0.67
3.00	0.72	9.08	1.78	15.17	1.67	21.25	0.67
3.08	0.72	9.17	1.78	15.25	1.67	21.33	0.67
3.17	0.72	9.25	1.78	15.33	1.67	21.42	0.67
3.25	0.72	9.33	1.78	15.42	1.67	21.50	0.67
3.33	0.72	9.42	1.78	15.50	1.67	21.58	0.67
3.42	0.72	9.50	1.78	15.58	1.67	21.67	0.67
3.50	0.72	9.58	2.00	15.67	1.67	21.75	0.67
3.58	0.72	9.67	2.00	15.75	1.67	21.83	0.67
3.67	0.72	9.75	2.00	15.83	1.67	21.92	0.67
3.75	0.72	9.83	2.00	15.92	1.67	22.00	0.67
3.83	0.72	9.92	2.00	16.00	1.67	22.08	0.67
3.92	0.72	10.00	2.00	16.08	1.00	22.17	0.67
4.00	0.72	10.08	2.56	16.17	1.00	22.25	0.67
4.08	0.89	10.17	2.56	16.25	1.00	22.33	0.67
4.17	0.89	10.25	2.56	16.33	1.00	22.42	0.67
4.25	0.89	10.33	2.56	16.42	1.00	22.50	0.67
4.33	0.89	10.42	2.56	16.50	1.00	22.58	0.67
4.42	0.89	10.50	2.56	16.58	1.00	22.67	0.67
4.50	0.89	10.58	3.45	16.67	1.00	22.75	0.67
4.58	0.89	10.67	3.45	16.75	1.00	22.83	0.67
4.67	0.89	10.75	3.45	16.83	1.00	22.92	0.67
4.75	0.89	10.83	3.45	16.92	1.00	23.00	0.67
4.83	0.89	10.92	3.45	17.00	1.00	23.08	0.67
4.92	0.89	11.00	3.45	17.08	1.00	23.17	0.67
5.00	0.89	11.08	5.34	17.17	1.00	23.25	0.67
5.08	0.89	11.17	5.34	17.25	1.00	23.33	0.67
5.17	0.89	11.25	5.34	17.33	1.00	23.42	0.67
5.25	0.89	11.33	5.34	17.42	1.00	23.50	0.67
5.33	0.89	11.42	5.34	17.50	1.00	23.58	0.67
5.42	0.89	11.50	5.34	17.58	1.00	23.67	0.67
5.50	0.89	11.58	16.46	17.67	1.00	23.75	0.67
5.58	0.89	11.67	16.46	17.75	1.00	23.83	0.67
5.67	0.89	11.75	16.46	17.83	1.00	23.92	0.67
5.75	0.89	11.83	68.08	17.92	1.00	24.00	0.67
5.83	0.89	11.92	68.08	18.00	1.00		
5.92	0.89	12.00	68.08	18.08	1.00		
6.00	0.89	12.08	8.01	18.17	1.00		

```
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      68.08        12.11
                over (min)       5.00         5.00
     Storage Coeff.  (min)=       0.92 (ii)    4.10 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00         0.015 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08         12.08
     RUNOFF VOLUME    (mm)=      53.62         8.41         47.52
     TOTAL RAINFALL   (mm)=      55.62        55.62         55.62
     RUNOFF COEFFICIENT   =       0.96         0.15          0.85

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089     0.015     12.08      47.52
```

```
   OUTFLOW: ID= 1 (  0204)      0.089      0.013     12.08      48.34

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 89.10
                    TIME SHIFT OF PEAK FLOW         (min)=  0.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0002

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      68.08         8.63
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       1.09 (ii)   19.90 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.34         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.015 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.33          12.08
     RUNOFF VOLUME    (mm)=      53.62         8.41          43.16
     TOTAL RAINFALL   (mm)=      55.62        55.62          55.62
     RUNOFF COEFFICIENT   =       0.96         0.15           0.78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      68.08        10.93
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.71 (ii)   14.60 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.004 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.25          12.08
     RUNOFF VOLUME    (mm)=      53.62         8.41          21.37
     TOTAL RAINFALL   (mm)=      55.62        55.62          55.62
     RUNOFF COEFFICIENT   =       0.96         0.15           0.38

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.015    12.08    43.16
      + ID2= 2 (  0203):     0.05   0.004    12.08    21.37
        ===================================================
        ID = 3 (  0205):     0.15   0.019    12.08    36.08

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.019    12.08    36.08
      + ID2= 2 (  0204):     0.09   0.013    12.08    48.34
        ===================================================
        ID = 1 (  0205):     0.24   0.033    12.08    40.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\ebb1e589-a847-4b0d-9ea9-66f4a6bd0bc5\scen
Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\ebb1e589-a847-4b0d-9ea9-66f4a6bd0bc5\scen

DATE: 08-29-2022 TIME: 01:19:47

USER:

COMMENTS: _____

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

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 675.586
| Ptotal= 37.03 mm |                          B=   4.681
--------------------                          C=   0.780
                        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	2.31	1.00	10.03	2.00	6.39	3.00	3.08
0.08	2.45	1.08	15.38	2.08	5.82	3.08	2.96
0.17	2.61	1.17	35.54	2.17	5.36	3.17	2.85
0.25	2.80	1.25	114.99	2.25	4.96	3.25	2.75
0.33	3.01	1.33	45.86	2.33	4.63	3.33	2.66
0.42	3.27	1.42	25.27	2.42	4.34	3.42	2.57
0.50	3.59	1.50	17.44	2.50	4.09	3.50	2.49
0.58	3.98	1.58	13.36	2.58	3.87	3.58	2.42
0.67	4.48	1.67	10.88	2.67	3.68	3.67	2.35
0.75	5.15	1.75	9.21	2.75	3.50	3.75	2.29
0.83	6.10	1.83	8.01	2.83	3.35	3.83	2.22
0.92	7.55	1.92	7.10	2.92	3.20	3.92	2.17

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     114.99         6.34
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.74 (ii)    3.32 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.26
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00         0.025 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      35.03         3.59         30.79
     TOTAL RAINFALL   (mm)=      37.03        37.03         37.03
     RUNOFF COEFFICIENT   =       0.95         0.10          0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.025      1.33      30.79
   OUTFLOW: ID= 1 (  0204)      0.089      0.013      1.42      30.79

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 54.38
                   TIME SHIFT OF PEAK FLOW         (min)=  5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0004

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     114.99         6.34
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.88 (ii)    5.01 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.026 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42           1.33
     RUNOFF VOLUME    (mm)=      35.03         3.59          27.76
     TOTAL RAINFALL   (mm)=      37.03        37.03          37.03
     RUNOFF COEFFICIENT   =       0.95         0.10           0.75
```

```
***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     114.99         4.62
                over (min)        5.00        25.00
     Storage Coeff.  (min)=       0.57 (ii)   20.19 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=       0.34         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.006 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.75           1.33
     RUNOFF VOLUME    (mm)=      35.03         3.59          15.07
     TOTAL RAINFALL   (mm)=      37.03        37.03          37.03
     RUNOFF COEFFICIENT   =       0.95         0.10           0.41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.026     1.33    27.76
      + ID2= 2 (  0203):     0.05   0.006     1.33    15.07
```

```
        ==================================================
        ID = 3 (  0205):     0.15   0.032     1.33    23.64

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.032     1.33    23.64
      + ID2= 2 (  0204):     0.09   0.013     1.42    30.79
        ==================================================
        ID = 1 (  0205):     0.24   0.045     1.33    26.26

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\c5f7
d951-9789-41b4-995c-df7c1c0f04ae\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\c5f7
d951-9789-41b4-995c-df7c1c0f04ae\scen


DATE: 08-29-2022                           TIME: 01:19:46


USER:


COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : 50yr 24hr 5min SCS Type II    **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              d11cd9cc-cf94-4899-9c38-96dc5711d302\7eb1349e
| Ptotal=125.40 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    2.26 | 12.17   18.06 | 18.25    2.26
                 0.08    1.38 |  6.17    2.26 | 12.25   18.06 | 18.33    2.26
                 0.17    1.38 |  6.25    2.26 | 12.33   18.06 | 18.42    2.26
                 0.25    1.38 |  6.33    2.26 | 12.42   18.06 | 18.50    2.26
                 0.33    1.38 |  6.42    2.26 | 12.50   18.06 | 18.58    2.26
                 0.42    1.38 |  6.50    2.26 | 12.58    9.28 | 18.67    2.26
                 0.50    1.38 |  6.58    2.26 | 12.67    9.28 | 18.75    2.26
                 0.58    1.38 |  6.67    2.26 | 12.75    9.28 | 18.83    2.26
                 0.67    1.38 |  6.75    2.26 | 12.83    9.28 | 18.92    2.26
                 0.75    1.38 |  6.83    2.26 | 12.92    9.28 | 19.00    2.26
                 0.83    1.38 |  6.92    2.26 | 13.00    9.28 | 19.08    2.26
                 0.92    1.38 |  7.00    2.26 | 13.08    6.77 | 19.17    2.26
                 1.00    1.38 |  7.08    2.76 | 13.17    6.77 | 19.25    2.26
                 1.08    1.38 |  7.17    2.76 | 13.25    6.77 | 19.33    2.26
                 1.17    1.38 |  7.25    2.76 | 13.33    6.77 | 19.42    2.26
                 1.25    1.38 |  7.33    2.76 | 13.42    6.77 | 19.50    2.26
                 1.33    1.38 |  7.42    2.76 | 13.50    6.77 | 19.58    2.26
                 1.42    1.38 |  7.50    2.76 | 13.58    5.27 | 19.67    2.26
                 1.50    1.38 |  7.58    2.76 | 13.67    5.27 | 19.75    2.26
                 1.58    1.38 |  7.67    2.76 | 13.75    5.27 | 19.83    2.26
                 1.67    1.38 |  7.75    2.76 | 13.83    5.27 | 19.92    2.26
                 1.75    1.38 |  7.83    2.76 | 13.92    5.27 | 20.00    2.26
                 1.83    1.38 |  7.92    2.76 | 14.00    5.27 | 20.08    1.50
                 1.92    1.38 |  8.00    2.76 | 14.08    3.76 | 20.17    1.50
                 2.00    1.38 |  8.08    3.26 | 14.17    3.76 | 20.25    1.50
                 2.08    1.63 |  8.17    3.26 | 14.25    3.76 | 20.33    1.50
                 2.17    1.63 |  8.25    3.26 | 14.33    3.76 | 20.42    1.50
                 2.25    1.63 |  8.33    3.26 | 14.42    3.76 | 20.50    1.50
```

2.33	1.63	8.42	3.26	14.50	3.76	20.58	1.50
2.42	1.63	8.50	3.26	14.58	3.76	20.67	1.50
2.50	1.63	8.58	3.51	14.67	3.76	20.75	1.50
2.58	1.63	8.67	3.51	14.75	3.76	20.83	1.50
2.67	1.63	8.75	3.51	14.83	3.76	20.92	1.50
2.75	1.63	8.83	3.51	14.92	3.76	21.00	1.50
2.83	1.63	8.92	3.51	15.00	3.76	21.08	1.50
2.92	1.63	9.00	3.51	15.08	3.76	21.17	1.50
3.00	1.63	9.08	4.01	15.17	3.76	21.25	1.50
3.08	1.63	9.17	4.01	15.25	3.76	21.33	1.50
3.17	1.63	9.25	4.01	15.33	3.76	21.42	1.50
3.25	1.63	9.33	4.01	15.42	3.76	21.50	1.50
3.33	1.63	9.42	4.01	15.50	3.76	21.58	1.50
3.42	1.63	9.50	4.01	15.58	3.76	21.67	1.50
3.50	1.63	9.58	4.51	15.67	3.76	21.75	1.50
3.58	1.63	9.67	4.51	15.75	3.76	21.83	1.50
3.67	1.63	9.75	4.51	15.83	3.76	21.92	1.50
3.75	1.63	9.83	4.51	15.92	3.76	22.00	1.50
3.83	1.63	9.92	4.51	16.00	3.76	22.08	1.50
3.92	1.63	10.00	4.51	16.08	2.26	22.17	1.50
4.00	1.63	10.08	5.77	16.17	2.26	22.25	1.50
4.08	2.01	10.17	5.77	16.25	2.26	22.33	1.50
4.17	2.01	10.25	5.77	16.33	2.26	22.42	1.50
4.25	2.01	10.33	5.77	16.42	2.26	22.50	1.50
4.33	2.01	10.42	5.77	16.50	2.26	22.58	1.50
4.42	2.01	10.50	5.77	16.58	2.26	22.67	1.50
4.50	2.01	10.58	7.77	16.67	2.26	22.75	1.50
4.58	2.01	10.67	7.77	16.75	2.26	22.83	1.50
4.67	2.01	10.75	7.77	16.83	2.26	22.92	1.50
4.75	2.01	10.83	7.77	16.92	2.26	23.00	1.50
4.83	2.01	10.92	7.77	17.00	2.26	23.08	1.50
4.92	2.01	11.00	7.77	17.08	2.26	23.17	1.50
5.00	2.01	11.08	12.04	17.17	2.26	23.25	1.50
5.08	2.01	11.17	12.04	17.25	2.26	23.33	1.50
5.17	2.01	11.25	12.04	17.33	2.26	23.42	1.50
5.25	2.01	11.33	12.04	17.42	2.26	23.50	1.50
5.33	2.01	11.42	12.04	17.50	2.26	23.58	1.50
5.42	2.01	11.50	12.04	17.58	2.26	23.67	1.50
5.50	2.01	11.58	37.12	17.67	2.26	23.75	1.50
5.58	2.01	11.67	37.12	17.75	2.26	23.83	1.50
5.67	2.01	11.75	37.12	17.83	2.26	23.92	1.50
5.75	2.01	11.83	153.49	17.92	2.26	24.00	1.50
5.83	2.01	11.92	153.49	18.00	2.26		
5.92	2.01	12.00	153.49	18.08	2.26		
6.00	2.01	12.08	18.06	18.17	2.26		

```
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.49        56.23
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.66 (ii)    2.96 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.28
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.035 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     123.40        38.72         111.97
     TOTAL RAINFALL   (mm)=     125.40       125.40         125.40
     RUNOFF COEFFICIENT   =       0.98         0.31           0.89

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.035     12.08     111.97
   OUTFLOW: ID= 1 (  0204)      0.089      0.014     12.17     112.65
```

```
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 40.12
                    TIME SHIFT OF PEAK FLOW         (min)=  5.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0019

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.49        56.23
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.79 (ii)    4.46 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.23
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.038 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=     123.40        38.72         103.83
     TOTAL RAINFALL   (mm)=     125.40       125.40         125.40
     RUNOFF COEFFICIENT   =       0.98         0.31           0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     153.49        56.23
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.51 (ii)    7.73 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.13
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.012 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.08
     RUNOFF VOLUME    (mm)=     123.40        38.72          69.98
     TOTAL RAINFALL   (mm)=     125.40       125.40         125.40
     RUNOFF COEFFICIENT   =       0.98         0.31           0.56

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.038    12.08   103.83
      + ID2= 2 (  0203):     0.05   0.012    12.08    69.98
        ===================================================
        ID = 3 (  0205):     0.15   0.049    12.08    92.84

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.049    12.08    92.84
      + ID2= 2 (  0204):     0.09   0.014    12.17   112.65
        ===================================================
        ID = 1 (  0205):     0.24   0.063    12.08   100.10

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\c87e
3537-aa05-4984-ba03-1ae58abb8e33\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\c87e
3537-aa05-4984-ba03-1ae58abb8e33\scen


DATE: 08-29-2022                          TIME: 01:19:47

USER:



COMMENTS: ____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ************************************************
  ** SIMULATION : 50yr 4hr 5min Chicago         **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1251.473
| Ptotal= 79.54 mm |                          B=   4.847
--------------------                          C=   0.753
                        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	5.53	1.00	22.40	2.00	14.60	3.00	7.26
0.08	5.85	1.08	33.57	2.08	13.36	3.08	6.99
0.17	6.21	1.17	73.94	2.17	12.33	3.17	6.75
0.25	6.63	1.25	223.60	2.25	11.47	3.25	6.52
0.33	7.12	1.33	94.25	2.33	10.74	3.33	6.31
0.42	7.70	1.42	53.72	2.42	10.10	3.42	6.12
0.50	8.41	1.50	37.82	2.50	9.54	3.50	5.94
0.58	9.29	1.58	29.40	2.58	9.05	3.58	5.77
0.67	10.40	1.67	24.19	2.67	8.61	3.67	5.61
0.75	11.89	1.75	20.65	2.75	8.22	3.75	5.46
0.83	13.96	1.83	18.09	2.83	7.87	3.83	5.32
0.92	17.09	1.92	16.14	2.92	7.55	3.92	5.19

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     223.60        29.93
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.57 (ii)    2.55 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.29
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00         0.049 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      77.54        16.91         69.35
     TOTAL RAINFALL   (mm)=      79.54        79.54         79.54
     RUNOFF COEFFICIENT   =       0.97         0.21          0.87

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.049      1.33      69.35
   OUTFLOW: ID= 1 (  0204)      0.089      0.014      1.50      69.60

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 28.37
                    TIME SHIFT OF PEAK FLOW         (min)= 10.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0014

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     223.60        29.93
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.68 (ii)    3.84 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.25
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.052 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      77.54        16.91          63.52
     TOTAL RAINFALL   (mm)=      79.54        79.54          79.54
     RUNOFF COEFFICIENT   =       0.97         0.21           0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     223.60        29.93
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.44 (ii)    9.73 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.11
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.012 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      77.54        16.91          39.21
     TOTAL RAINFALL   (mm)=      79.54        79.54          79.54
     RUNOFF COEFFICIENT   =       0.97         0.21           0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.052     1.33    63.52
      + ID2= 2 (  0203):     0.05   0.012     1.33    39.21
        ==================================================
        ID = 3 (  0205):     0.15   0.064     1.33    55.63
```

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.064     1.33    55.63
      + ID2= 2 (  0204):     0.09   0.014     1.50    69.60
        ==================================================
        ID = 1 (  0205):     0.24   0.077     1.33    60.74

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\8706
7e11-0931-4c52-953e-52703275d205\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\8706
7e11-0931-4c52-953e-52703275d205\scen


DATE: 08-29-2022                           TIME: 01:19:46

USER:
```

COMMENTS: _____

```
--------------------------------------------------------------------------------
------------------------
  ***********************************************
  ** SIMULATION : 5yr 24hr 5min SCS Type II     **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\dhordyk\AppD
|                  |              ata\Local\Temp\
|                  |              d11cd9cc-cf94-4899-9c38-96dc5711d302\1767fa58
| Ptotal= 78.55 mm |    Comments: 5yr 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	1.41	12.17	11.31	18.25	1.41
0.08	0.86	6.17	1.41	12.25	11.31	18.33	1.41
0.17	0.86	6.25	1.41	12.33	11.31	18.42	1.41
0.25	0.86	6.33	1.41	12.42	11.31	18.50	1.41
0.33	0.86	6.42	1.41	12.50	11.31	18.58	1.41
0.42	0.86	6.50	1.41	12.58	5.81	18.67	1.41
0.50	0.86	6.58	1.41	12.67	5.81	18.75	1.41
0.58	0.86	6.67	1.41	12.75	5.81	18.83	1.41
0.67	0.86	6.75	1.41	12.83	5.81	18.92	1.41
0.75	0.86	6.83	1.41	12.92	5.81	19.00	1.41
0.83	0.86	6.92	1.41	13.00	5.81	19.08	1.41
0.92	0.86	7.00	1.41	13.08	4.24	19.17	1.41
1.00	0.86	7.08	1.73	13.17	4.24	19.25	1.41
1.08	0.86	7.17	1.73	13.25	4.24	19.33	1.41
1.17	0.86	7.25	1.73	13.33	4.24	19.42	1.41
1.25	0.86	7.33	1.73	13.42	4.24	19.50	1.41
1.33	0.86	7.42	1.73	13.50	4.24	19.58	1.41
1.42	0.86	7.50	1.73	13.58	3.30	19.67	1.41
1.50	0.86	7.58	1.73	13.67	3.30	19.75	1.41
1.58	0.86	7.67	1.73	13.75	3.30	19.83	1.41
1.67	0.86	7.75	1.73	13.83	3.30	19.92	1.41
1.75	0.86	7.83	1.73	13.92	3.30	20.00	1.41
1.83	0.86	7.92	1.73	14.00	3.30	20.08	0.94
1.92	0.86	8.00	1.73	14.08	2.36	20.17	0.94
2.00	0.86	8.08	2.04	14.17	2.36	20.25	0.94
2.08	1.02	8.17	2.04	14.25	2.36	20.33	0.94
2.17	1.02	8.25	2.04	14.33	2.36	20.42	0.94
2.25	1.02	8.33	2.04	14.42	2.36	20.50	0.94
2.33	1.02	8.42	2.04	14.50	2.36	20.58	0.94
2.42	1.02	8.50	2.04	14.58	2.36	20.67	0.94

2.50	1.02	8.58	2.20	14.67	2.36	20.75	0.94
2.58	1.02	8.67	2.20	14.75	2.36	20.83	0.94
2.67	1.02	8.75	2.20	14.83	2.36	20.92	0.94
2.75	1.02	8.83	2.20	14.92	2.36	21.00	0.94
2.83	1.02	8.92	2.20	15.00	2.36	21.08	0.94
2.92	1.02	9.00	2.20	15.08	2.36	21.17	0.94
3.00	1.02	9.08	2.51	15.17	2.36	21.25	0.94
3.08	1.02	9.17	2.51	15.25	2.36	21.33	0.94
3.17	1.02	9.25	2.51	15.33	2.36	21.42	0.94
3.25	1.02	9.33	2.51	15.42	2.36	21.50	0.94
3.33	1.02	9.42	2.51	15.50	2.36	21.58	0.94
3.42	1.02	9.50	2.51	15.58	2.36	21.67	0.94
3.50	1.02	9.58	2.83	15.67	2.36	21.75	0.94
3.58	1.02	9.67	2.83	15.75	2.36	21.83	0.94
3.67	1.02	9.75	2.83	15.83	2.36	21.92	0.94
3.75	1.02	9.83	2.83	15.92	2.36	22.00	0.94
3.83	1.02	9.92	2.83	16.00	2.36	22.08	0.94
3.92	1.02	10.00	2.83	16.08	1.41	22.17	0.94
4.00	1.02	10.08	3.61	16.17	1.41	22.25	0.94
4.08	1.26	10.17	3.61	16.25	1.41	22.33	0.94
4.17	1.26	10.25	3.61	16.33	1.41	22.42	0.94
4.25	1.26	10.33	3.61	16.42	1.41	22.50	0.94
4.33	1.26	10.42	3.61	16.50	1.41	22.58	0.94
4.42	1.26	10.50	3.61	16.58	1.41	22.67	0.94
4.50	1.26	10.58	4.87	16.67	1.41	22.75	0.94
4.58	1.26	10.67	4.87	16.75	1.41	22.83	0.94
4.67	1.26	10.75	4.87	16.83	1.41	22.92	0.94
4.75	1.26	10.83	4.87	16.92	1.41	23.00	0.94
4.83	1.26	10.92	4.87	17.00	1.41	23.08	0.94
4.92	1.26	11.00	4.87	17.08	1.41	23.17	0.94
5.00	1.26	11.08	7.54	17.17	1.41	23.25	0.94
5.08	1.26	11.17	7.54	17.25	1.41	23.33	0.94
5.17	1.26	11.25	7.54	17.33	1.41	23.42	0.94
5.25	1.26	11.33	7.54	17.42	1.41	23.50	0.94
5.33	1.26	11.42	7.54	17.50	1.41	23.58	0.94
5.42	1.26	11.50	7.54	17.58	1.41	23.67	0.94
5.50	1.26	11.58	23.25	17.67	1.41	23.75	0.94
5.58	1.26	11.67	23.25	17.75	1.41	23.83	0.94
5.67	1.26	11.75	23.25	17.83	1.41	23.92	0.94
5.75	1.26	11.83	96.15	17.92	1.41	24.00	0.94
5.83	1.26	11.92	96.15	18.00	1.41		
5.92	1.26	12.00	96.15	18.08	1.41		
6.00	1.26	12.08	11.31	18.17	1.41		

```
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      96.15        23.87
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.80 (ii)    3.57 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.26
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00         0.021 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08         12.08
     RUNOFF VOLUME    (mm)=      76.55        16.52         68.44
     TOTAL RAINFALL   (mm)=      78.55        78.55         78.55
     RUNOFF COEFFICIENT   =       0.97         0.21          0.87

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     0.089      0.021     12.08      68.44
   OUTFLOW: ID= 1 (  0204)     0.089      0.014     12.08      68.45

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 63.72
                    TIME SHIFT OF PEAK FLOW         (min)=  0.00
```

```
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0007

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      96.15        23.87
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.95 (ii)    5.38 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.023 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      76.55        16.52          62.67
     TOTAL RAINFALL   (mm)=      78.55        78.55          78.55
     RUNOFF COEFFICIENT   =       0.97         0.21           0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      96.15        21.78
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.62 (ii)   11.16 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.006 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.17          12.08
     RUNOFF VOLUME    (mm)=      76.55        16.52          36.32
     TOTAL RAINFALL   (mm)=      78.55        78.55          78.55
     RUNOFF COEFFICIENT   =       0.97         0.21           0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.023    12.08    62.67
      + ID2= 2 (  0203):     0.05   0.006    12.08    36.32
        ===================================================
        ID = 3 (  0205):     0.15   0.029    12.08    54.12

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

--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.029    12.08    54.12
      + ID2= 2 (  0204):     0.09   0.014    12.08    68.45
        ===================================================
        ID = 1 (  0205):     0.24   0.042    12.08    59.36

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2011)
       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\3bc39c5e-a1df-45d1-8dcb-dff00282859c\3499
c75e-49dc-4f29-b7c8-22da745e8310\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\3bc39c5e-a1df-45d1-8dcb-dff00282859c\3499
c75e-49dc-4f29-b7c8-22da745e8310\scen


DATE: 08-29-2022                          TIME: 01:19:46

USER:



COMMENTS: ____________________________________________________________


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

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 843.019
| Ptotal= 50.76 mm |                          B=   4.582
--------------------                          C=   0.763
                       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    3.39 |  1.00   14.01 |  2.00    9.07 |  3.00    4.46
                 0.08    3.58 |  1.08   21.15 |  2.08    8.29 |  3.08    4.30
                 0.17    3.81 |  1.17   47.54 |  2.17    7.64 |  3.17    4.15
                 0.25    4.07 |  1.25  150.31 |  2.25    7.10 |  3.25    4.01
                 0.33    4.38 |  1.33   60.96 |  2.33    6.64 |  3.33    3.88
                 0.42    4.74 |  1.42   34.18 |  2.42    6.24 |  3.42    3.75
                 0.50    5.18 |  1.50   23.88 |  2.50    5.89 |  3.50    3.64
                 0.58    5.73 |  1.58   18.47 |  2.58    5.58 |  3.58    3.54
                 0.67    6.43 |  1.67   15.15 |  2.67    5.31 |  3.67    3.44
                 0.75    7.36 |  1.75   12.90 |  2.75    5.07 |  3.75    3.35
                 0.83    8.67 |  1.83   11.27 |  2.83    4.85 |  3.83    3.26
                 0.92   10.64 |  1.92   10.04 |  2.92    4.65 |  3.92    3.18


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--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  86.50   Dir. Conn.(%)=  86.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.01
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       3.00         4.00
     Length            (m)=      24.36        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     150.31        12.30
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.67 (ii)    2.99 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.28
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00         0.033 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      48.76         6.98         43.11
     TOTAL RAINFALL   (mm)=      50.76        50.76         50.76
     RUNOFF COEFFICIENT   =       0.96         0.14          0.85

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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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| RESERVOIR(  0204)|     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   |   0.0132      0.0001
                          0.0044     0.0000   |   0.0134      0.0002
                          0.0065     0.0000   |   0.0137      0.0006
                          0.0081     0.0000   |   0.0139      0.0013
                          0.0094     0.0000   |   0.0141      0.0023
                          0.0105     0.0000   |   0.0143      0.0040
                          0.0116     0.0000   |   0.0333      0.0061
                          0.0126     0.0000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      0.089      0.033      1.33      43.11
   OUTFLOW: ID= 1 (  0204)      0.089      0.014      1.42      43.44

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 41.88
                   TIME SHIFT OF PEAK FLOW         (min)=  5.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0006

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--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   0.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  76.90   Dir. Conn.(%)=  76.90
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.08         0.02
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      26.33        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     150.31        12.30
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.79 (ii)    4.50 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.23
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.034 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      48.76         6.98          39.10
     TOTAL RAINFALL   (mm)=      50.76        50.76          50.76
     RUNOFF COEFFICIENT   =       0.96         0.14           0.77

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0203)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  37.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.03
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=      18.26        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     150.31        10.26
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.52 (ii)   14.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.008 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58           1.33
     RUNOFF VOLUME    (mm)=      48.76         6.98          22.26
     TOTAL RAINFALL   (mm)=      50.76        50.76          50.76
     RUNOFF COEFFICIENT   =       0.96         0.14           0.44

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    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  (  0205)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     0.10   0.034     1.33    39.10
      + ID2= 2 (  0203):     0.05   0.008     1.33    22.26
        ==================================================
        ID = 3 (  0205):     0.15   0.042     1.33    33.63

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

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--------------------
| ADD HYD  (  0205)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0205):     0.15   0.042     1.33    33.63
      + ID2= 2 (  0204):     0.09   0.014     1.42    43.44
        ==================================================
        ID = 1 (  0205):     0.24   0.055     1.33    37.22

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
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202 DUNLOP STREET APARTMENT DEVELOPMENT

City of Barrie

Project Number: 22-11713B
Date: July 17, 2024
Design By: DPH
Checked By: JHV
File:

STORM SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Drainage Area Plan No: POST-1

Design Parameters

100 YEAR STORM

Q=kAIR, k=0.00278
Intensity (I) = a/(tc+b)^c
a = 1383.628
b = 4.905
c = 0.754

Manning's "n" 0.013
Min. Velocity 0.750 m/s
Max. Velocity 4.000 m/s

PEL PINESTONE ENGINEERING LTD.

LOCATION				STORMWATER FLOW								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME TOTAL	CONCENTRATION TIME IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY
				ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/s*	*mm*	*m*	*%*	*L/s*	*m/s*	*m/s*
	201	CB#1	STMMH#1	**100 YEAR CONTROLLED DESIGN FLOW FROM VO MODELLING**							14.00000	300	7.2	0.60	74.90409	1.0597	0.8111
		CB#2	STMMH#1	0.020	0.13	0.0025	0.0025	10.0000	1.2616	180.43759	1.24953	250	28.8	0.50	42.04989	0.8566	0.3805
	202	BLDG	STMMH#1	**100 YEAR CONTROLLED DESIGN FLOW FROM VO MODELLING**							57.00000	200	1.5	4.00	65.59688	2.0880	2.3515
	201 & 202	STMMH#1	HS-4	**100 YEAR CONTROLLED DESIGN FLOW FROM VO MODELLING**							71.00000	300	16.7	0.70	80.90566	1.1446	1.2909
	201 & 202	HS-4	CBMH#1	**100 YEAR CONTROLLED DESIGN FLOW FROM VO MODELLING**							71.00000	300	27.1	1.00	96.70076	1.3680	1.4947
		CBMH#1	EXSTMSR	0.005	0.13	0.0006	0.0006	10.0000	0.1927	180.43759	71.31238	300	17.3	1.00	96.70076	1.3680	1.4961

Inspection and Maintenance Checklist
Stormwater Collection and Conveyance System

Date of Inspection: _____ Inspection Area: _____

Field Inspector(s): _____ Reason for Inspection: _____

Current Weather: _____ Rain (inches): In Last 24 hrs: _____ In Last Week: _____

Facility Type	Location		Sediment Build-up		Maintenance Needed		Maintenance Follow-up	
(CB, Pond, etc)	GIS#/GPS	Description	Depth (in)	Needs Removal?	Code	Description/Action Needed	Date Completed	Initials

Maintenance Codes:

1 – Accumulated Sediment
2 – Trash & Debris
3 – Vegetation Concerns
4 – Water Quality Concerns
5 – Impeded Water Flow
6 – Erosion
7 – Structural Repairs
8 – Cover/Frame/Grate
9 – Damaged Pipes
10 – Mosquito/Vector Breeding
11 – Other
12 – Could Not Locate

See maintenance standards for detailed code descriptions for each facility type.

Make additional copies of this page as needed for field inspections.

Maintenance Standards
Catch Basins and Manholes

Maintenance Code	Type	Conditions When Maintenance Is Needed
1	Sediment	Sediment exceeds 60% of sump depth. Sediment depth within 6 inches of the invert of the lowest pipe.
2	Trash & Debris	Trash or debris in front of catch basin opening or blocking inlet by more than 10%. Trash or debris exceeds 60% of sump depth. Trash or debris within 6 inches of the invert of the lowest pipe. Trash or debris blocking more than 1/3 of any inlet or outlet pipe. Trash and debris blocking more than 20% of grate surface. Dead animals or vegetation that generate odors and cause complaints or dangerous gases (e.g., methane).
3	Vegetation	Vegetation growing across and blocking more than 10% of the grate opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall.
4	Water Quality	Any evidence of oil, gasoline, contaminants, or other pollutants. Water flowing in catch basin during dry weather – report as potential illicit discharge concern.
5	Water Flow	Impeded water flow due to vegetation or sediment (use appropriate code from above).
6	Erosion	N/A
7	Cover/Frame/ Grate	Cover is missing or only partially in place. One maintenance person cannot remove lid after applying normal lifting pressure. Frame separated by more than ¾ inch from top slab. Frame not securely attached. Locking mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread. Grate with opening wider than 7/8 inch. Grate damaged or missing.
8	Structure	Top slab with holes larger than 2 square inches or cracks wider than 1/4 inch. Fractures or cracks in basin walls or bottom. Grout at inlet/outlet pipes has separated or cracked wider than ½ inch and longer than one foot. Soil is entering the catch basin through cracks in the structure. Settlement has created a safety, function, or design problem. Field inspector judges that structure is unsound.
9	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.

Maintenance Code	Type	Conditions When Maintenance Is Needed
10	Mosquito Vector Breeding	Suitable habitat exists for mosquito production (e.g., standing water for more than 72 hours in areas accessible to mosquitoes.)
11	Other	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges. Catch basin insert requires replacement if: • Sediment, trash, or debris blocks water flow through the insert, • Effluent water from the insert has a visible sheen, or • Insert is saturated with water or oil and can no longer absorb.
12	Could Not Locate	Field inspectors are unable to locate the catch basin or manhole.

Maintenance Standards
Control Structures

Maintenance Code	Type	Conditions When Maintenance Is Needed
1	Sediment	Sediment depth exceeds 60% of sump depth. Sediment accumulated within 6 inches of the orifice plate or lowest pipe invert.
2	Trash & Debris	Trash or debris exceeds 60% of sump depth. Trash or debris within 6 inches of the orifice plate or lowest pipe invert. Trash or debris blocking openings in the control structure. Trash or debris blocking more than 1/3 of any inlet or outlet pipe. Dead animals or vegetation that generate odors and cause complaints or dangerous gases (e.g., methane).
3	Vegetation	Vegetation growing in inlet/outlet pipe joints that is more than six inches tall.
4	Water Quality	Any evidence of oil, gasoline, contaminants, or other pollutants.
5	Water Flow	Impeded water flow due to vegetation or sediment (use appropriate code from above).
6	Erosion	N/A
7	Cover/Frame/ Grate	Cover is missing or only partially in place. One maintenance person cannot remove lid after applying normal lifting pressure. Frame separated by more than ¾ inch from top slab. Frame not securely attached. Locking mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.
8	Structure	Damaged or missing orifice plate. Control structure is not securely attached to manhole wall. Control structure is not in upright position. Connection between control structure and outlet pipe is not watertight. Holes (other than design openings) in the control structure. Cleanout gate is not watertight, is missing, is rusted, or cannot be moved up and down by one maintenance person applying normal pressure. Top slab with holes larger than 2 square inches or cracks wider than 1/4 inch. Fractures or cracks in basin walls or bottom. Grout at inlet/outlet pipes has separated or cracked wider than ½ inch and longer than one foot. Soil is entering the catch basin through cracks in the structure. Settlement has created a safety, function, or design problem. Field inspector judges that structure is unsound.
9	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.

Maintenance Code	Type	Conditions When Maintenance Is Needed
10	Mosquito Vector Breeding	Suitable habitat exists for mosquito production (e.g., standing water for more than 72 hours in areas accessible to mosquitoes.)
11	Other	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.
12	Could Not Locate	Field inspectors are unable to locate the structure.

Maintenance Standards
Conveyance Systems (Pipes and Ditches)

Maintenance Code	Type	Conditions When Maintenance Is Needed
1	Sediment	Sediment or debris exceeds 20% of pipe diameter or 20% of debris barrier openings. Accumulated sediment that exceeds 20% of the design depth of the ditch.
2	Trash & Debris	Trash and debris accumulated in pipe or ditch. Visual evidence of dumping
3	Vegetation	Vegetation reduces movement of water through pipes. Excessive vegetation that reduces free movement of water through ditches.
4	Water Quality	Any evidence of oil, gasoline, contaminants, or other pollutants. Water flowing in pipes or ditch during dry weather – report as potential illicit discharge concern.
5	Water Flow	Impeded water flow due to vegetation or sediment (use appropriate code from above). Standing water in the pipe or swale between storm events.
6	Erosion	Erosion damage over 2 inches deep where cause is still present or there is potential for continued erosion. Native soil is visible beneath the rock lining of a conveyance ditch.
7	Cover/Frame/ Grate	N/A
8	Structure	Debris barrier/trash rack is missing or not attached to pipe. Debris barrier/trash rack bars are bent by more than 3 inches. Debris barrier/trash rack bars are loose, or rust is causing 50% deterioration to any part of the barrier.
9	Damaged Pipes	Protective coating is damaged, or rust is causing more than 50% deterioration to any part of pipe. Any dent that decreases the flow area by more than 20% or puncture that impacts performance.
10	Mosquito Vector Breeding	Suitable habitat exists for mosquito production (e.g., standing water for more than 72 hours in areas accessible to mosquitoes.)
11	Other	
12	Could Not Locate	Field inspectors are unable to locate the pipe or ditch.

Maintenance Standards
Vaults, Tanks, and Storage Pipes

Maintenance Code	Type	Conditions When Maintenance Is Needed
1	Sediment	Sediment depth exceeds 10% of storage depth for half-length of storage facility, or any point depth exceeds 15% of storage depth. (Example: 72-inch depth storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)
2	Trash & Debris	Trash or debris exceeds the limits for sediment described above.
3	Vegetation	N/A
4	Water Quality	Prevalent and visible oil sheen. Evidence of oil, gasoline, contaminants, or other pollutants.
5	Water Flow	First cell (if applicable) is empty, doesn't hold water.
6	Erosion	N/A
7	Cover/Frame/ Grate	Cover is missing or only partially in place. One maintenance person cannot remove lid after applying normal lifting pressure. Locking mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.
8	Structure	See Control Structures for additional maintenance standards. Openings or voids between tank or pipe sections allowing material to be transported into facility. Tank/pipe is bent more than 10% of its design shape. Cracks wider than 1/2-inch. Evidence of soil particles entering structure through cracks. The vault is not structurally sound. One-half of the cross section of an air vent is blocked or vent is damaged.
9	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.
10	Mosquito Vector Breeding	Suitable habitat exists for mosquito production (e.g., standing water for more than 72 hours in areas accessible to mosquitoes.)
11	Other	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.
12	Could Not Locate	Field inspectors are unable to locate the facility.

Cipolletti Weir (Curb Outlet Weir Design Sheet)

Label	Solve For	Discharge (L/s)	Headwater Elevation (m)	Crest Elevation (m)	Tailwater Elevation (m)
Curb Outlet Weir	Headwater Elevation	54.00	228.45	228.40	228.40

Weir Coefficient (m^(1/2)/s)	Crest Length (m)	Headwater Height Above Crest (m)	Tailwater Height Above Crest (m)	Equal Side Slopes (m/m)	Flow Area (m²)
1.70	2.5	0.05	0.00	4.000	0.1

Velocity (m/s)	Wetted Perimeter (m)	Top Width (m)	Notes	Messages
0.39	2.6	2.53	100-Year Chicago Uncontrolled Runoff Flowrate Generated From Catchment 201 (VO Modelling).	

Hydroworks Sizing Summary

APARTMENT DEVELOPMENT - 202 DUNLOP STREET W CITY OF BARRIE

04-29-2024

Recommended Size: HydroStorm HS 4i

A HydroStorm HS 4i is recommended to provide 80 % annual TSS removal based on a drainage area of 0.193 (ha) with an imperviousness of 81.3 % and Barrie WPCC, Ontario rainfall for the City of Toronto particle size distribution.

The recommended HydroStorm HS 4i treats 99 % of the annual runoff and provides 82 % annual TSS removal for the Barrie WPCC rainfall records and City of Toronto particle size distribution.

The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .1 (m3/s) for the given 300 (mm) pipe diameter at 1% slope. The headloss was calculated to be 99 (mm) based on a flow depth of 300 (mm) (full pipe flow).

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroStorm .

TSS Removal Sizing Summary

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Video | Other

Site Parameters

Area (ha): 0.193

Imperviousness (%): 81.3

Units

☐ U.S.

☑ Metric

Rainfall Station

Barrie WPCC — Ontario

1968 To 2007 — Rainfall Timestep = 60 min.

Project Title (2 lines): APARTMENT DEVELOPMENT - 202 DUNLOP STREET W

CITY OF BARRIE

Outlet Pipe

Diam. (mm): 300 — Peak Design Flow (m3/s):

Slope (%): 1.0

ETV Lab Testing Results ☐ Post Treatment Recharge

HydroStorm Annual Sizing Results

Model #	Qlow (m3/s)	Qtot (m3/s)	Flow Capture (%)	TSS Removal (%)
Unavailable	.019	.097	98 %	76 %
HS 4	.033	.097	99 %	82 %
HS 5	.041	.097	100 %	87 %
HS 6	.05	.097	100 %	91 %
Unavailable	.069	.097	100 %	93 %
HS 8	.089	.097	100 %	95 %
HS 10	.097	.097	100 %	98 %
HS 12	.097	.097	100 %	99 %

Particle Size Distribution

Size (um)	%	SG
20	20	2.65
30	10	2.65
50	10	2.65
100	20	2.65
250	20	2.65
1000	20	2.65

Note: Results vary significantly based on particle size distribution

Simulate

TSS Particle Size Distribution

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Video | Other

TSS Particle Size Distribution

Size (um)	%	SG
20	20	2.65
30	10	2.65
50	10	2.65
100	20	2.65
250	20	2.65
1000	20	2.65

Notes:

1. To change data just click a cell and type in the new value(s)
2. To add a row just go to the bottom of the table and start typing.
3. To delete a row, select the row by clicking on the first pointer column, then press delete
4. To sort the table click on one of the column headings

TSS Distributions

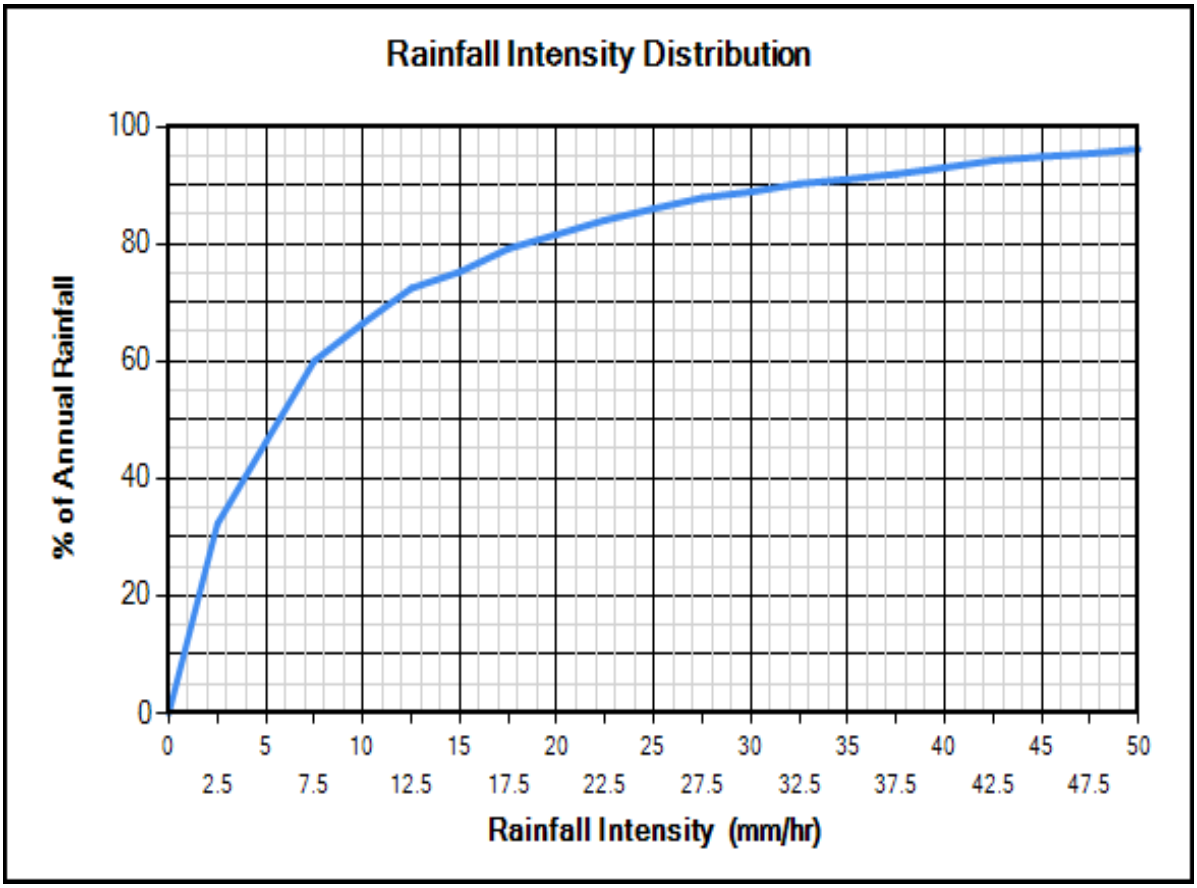
- ○ ETV Canada / NJDEP
- ○ Standard HDS Design
- ○ Alden Laboratory
- ○ OK110
- ◉ Toronto
- ○ Ontario Fine
- ○ Calgary Forebay
- ○ Kitchener
- ○ User Defined

Clear

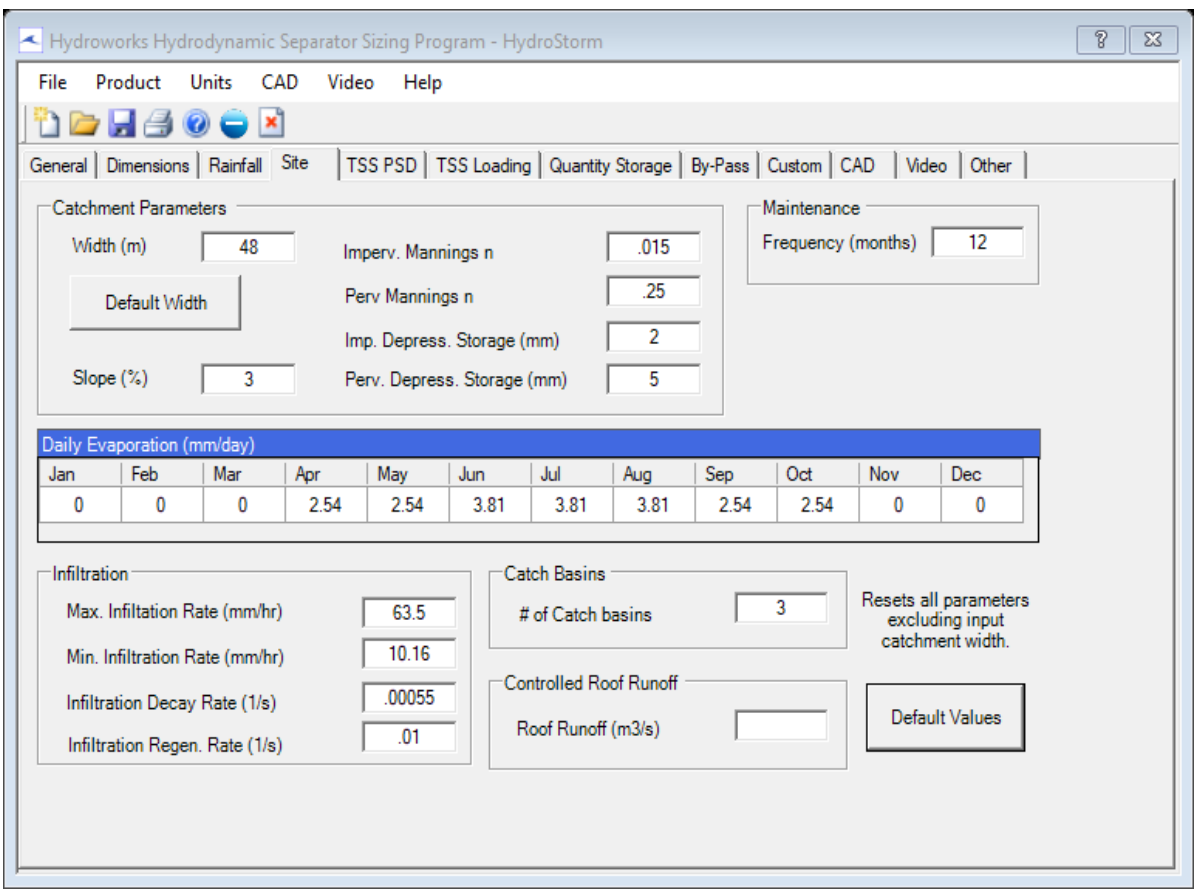
You must select a particle size distribution for TSS to simulate TSS removal

Water Temp (C): 20

Rainfall Station - Barrie WPCC, Ontario(1968 To 2007)



Site Physical Characteristics



Dimensions And Capacities

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

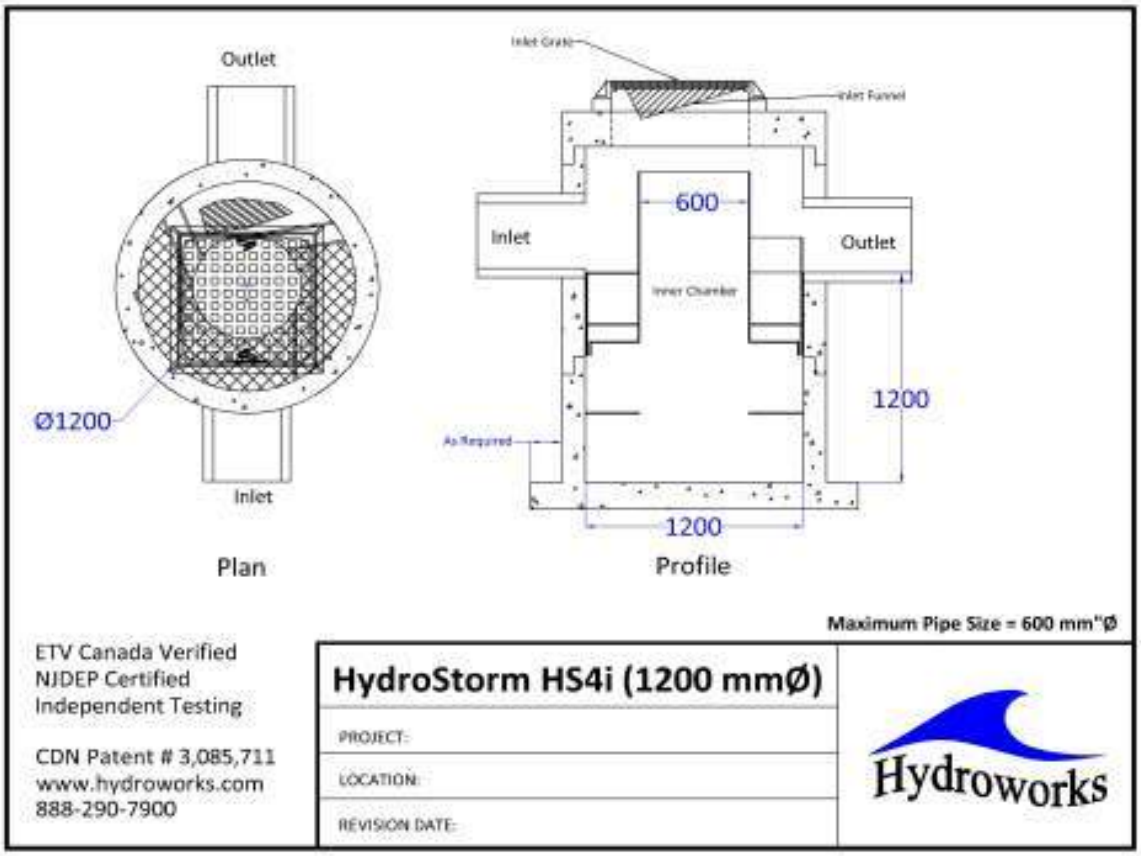
General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Video | Other

Dimensions and Capacities

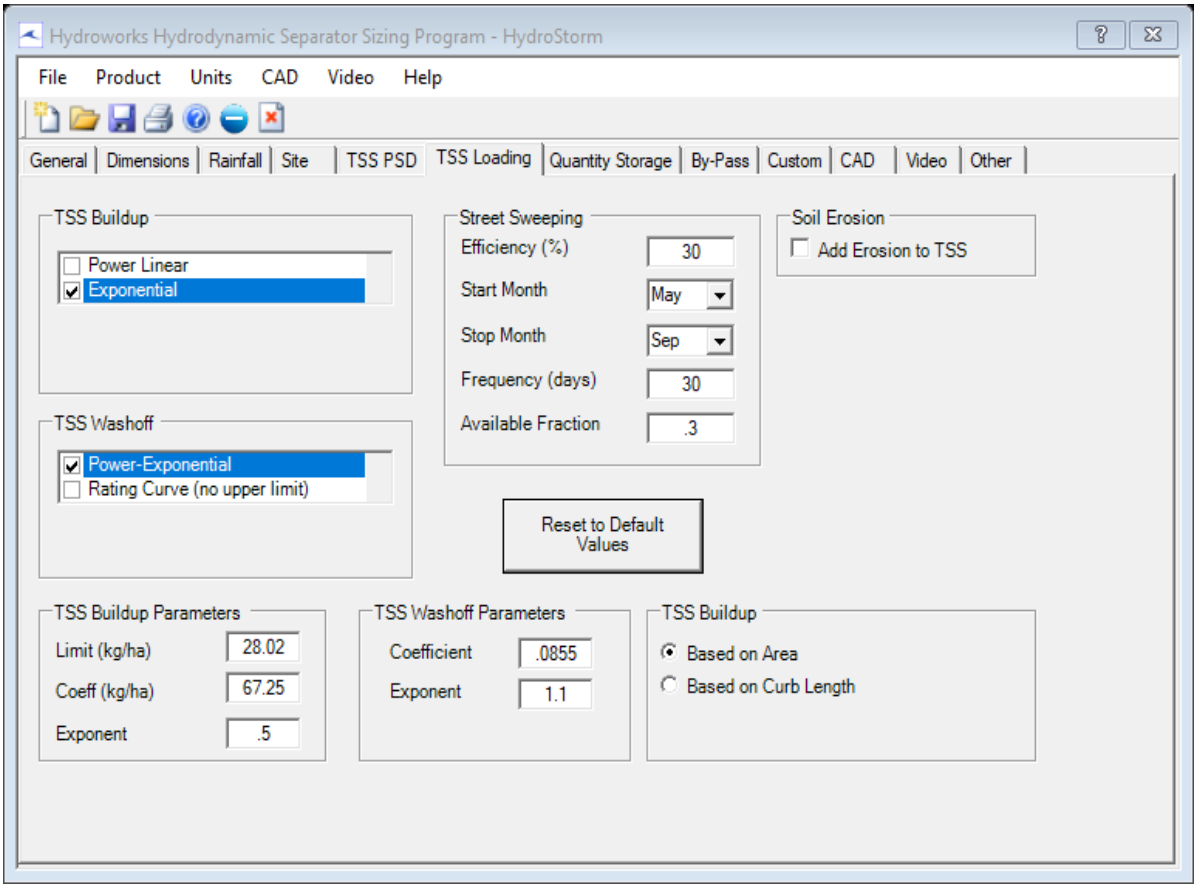
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 3	0.91	1.07	185	0.4	0.7
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

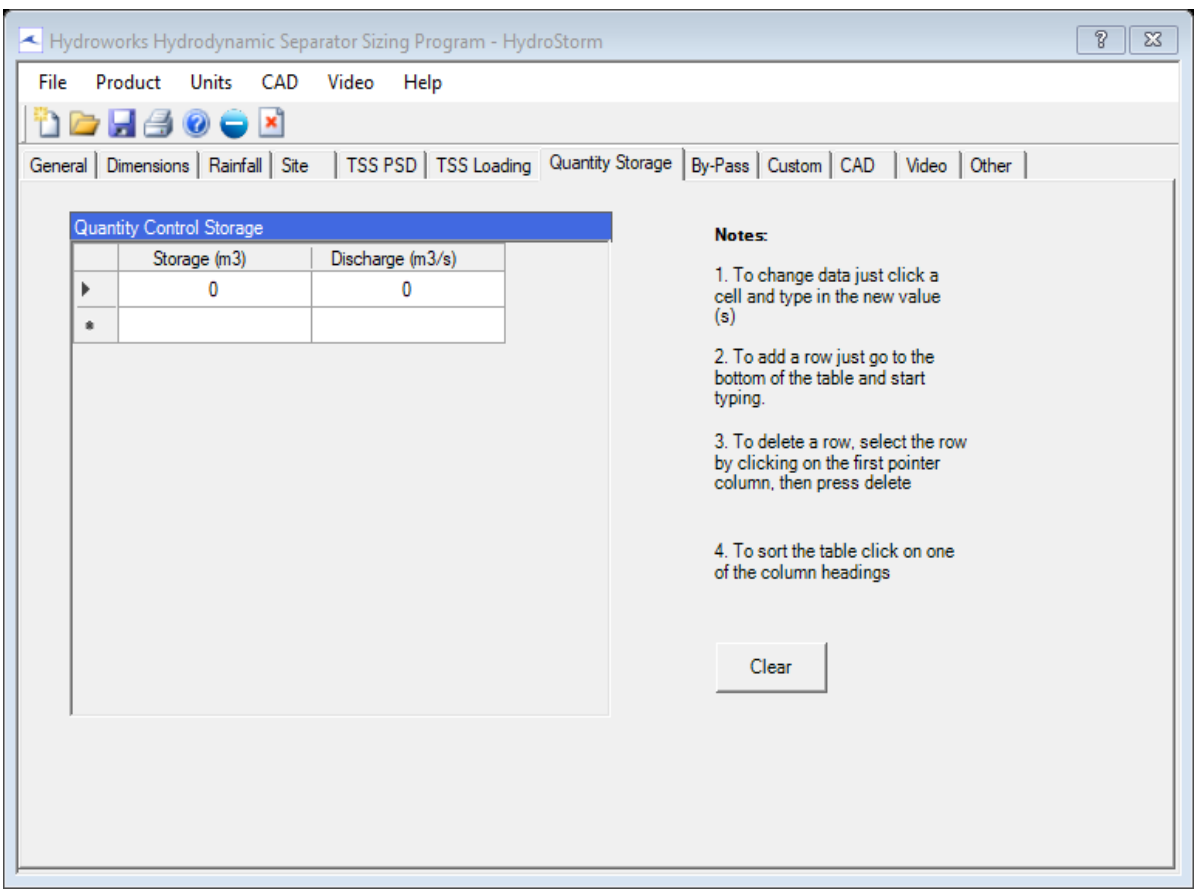
Generic HS 4i CAD Drawing



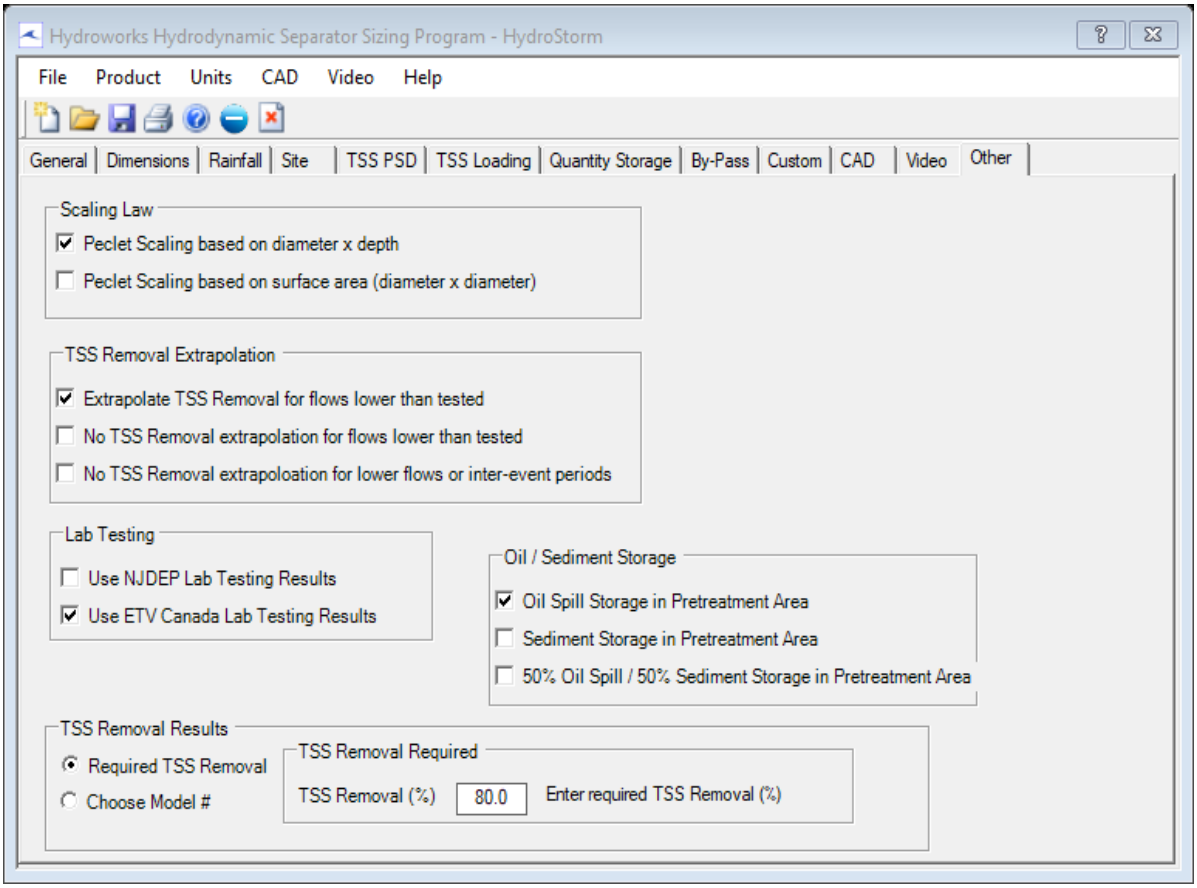
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

None

Hydroworks Sizing Program - Version 5.8
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1-800-290-7900
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Verification Testing of the Hydroworks HS 4 Stormwater Treatment System

In Accordance with the Canadian ETV Program

"Procedure for Laboratory Testing of Oil-Grit Separators", 2014

Technical Evaluation Report

Alden Report No. : 1152HS4SVT-CETV-R1

Submitted to:

Hydroworks, LLC
Clark, NJ

Prepared by

James Mailloux
Senior Engineer
Alden Research Laboratory

February 2018

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1.0 Introduction

Under a contract from Hydroworks, LLC, verification testing of a Hydroworks HydroStorm 4-ft diameter Hydrodynamic Separator (HS 4), was conducted at Alden Research Laboratory, Inc. (Alden) in Holden, Massachusetts. The purpose of the testing was to define the performance characteristics of the HS 4 treatment unit under controlled laboratory conditions, utilizing established standard testing methodologies. The testing was conducted in accordance with the Canadian Environmental Technology Verification (CETV) Program "Procedure for Laboratory Testing of Oil-Grit Separators 2014", to establish the following parameters:

a) **Hydraulic Characteristics Curves:**
Define the flow capacity and system losses

b) **Sediment Scour Testing:**
Quantify the sediment mass by particle size fractions that are washed out of the unit at defined flows.

c) **Sediment Removal Efficiency Curve:**
Quantify the sediment removal characteristics at various surface loading rates, including particle size fractions, using a mass balance methodology.

d) **Light liquid Re-entrainment:**
Perform testing to qualitatively assess the unit's ability to retain light liquid at defined flows using a plastic bead surrogate.

e) **Particle Size Distribution (PSD):**
At a minimum, the particle size distribution of the influent, effluent and/or captured material for all sediment test conditions.

2.0 Test Unit Description

The HS 4 test unit was a concrete cylindrical device measuring 1.22 m in diameter with a sump depth of 1.2 m and a collection sump area of 1.17 m^2. Aluminum inlet and outlet pipes, 0.35 m in diameter, were oriented along the centerline of the unit, with the inverts located 1.24 m and 1.19 m above the sump floor, respectively. The pipes were set with 0.25% slopes. The internal geometry was divided into an annular pretreatment channel, 0.61 m diameter inner chamber, and lower collection sump. The pretreatment channel extended 0.305 m below the outlet pipe invert and contained three (3) intermediate low-flow weirs, 0.305 m high (flush with the outlet invert), and two (2) downstream bypass weirs, 0.508 m high (0.203 m above the outlet invert). Grating was positioned over the channel to help displace the inflow turbulence and protect the captured sediment from scour. Openings were located upstream of each weir to allow the flow to be conveyed into the inner chamber and lower sump. The flow passed along the outside of a lower outlet disk and through an opening in the pretreatment disk, downstream of the bypass weirs, where it was conveyed into the outlet pipe. An annular secondary horizontal plate was located within the lower sump to protect the collected sediment from scour. Initial testing was performed using a solid plate. After the completion of testing, the plate was replaced with a perforated plate and a test was repeated to demonstrate that the treatment was not sensitive to the plate geometry. Drawings of the HS 4 test unit are shown on **Figure 1.** A photograph showing the unit installed in the test loop is shown on **Figure 2.**

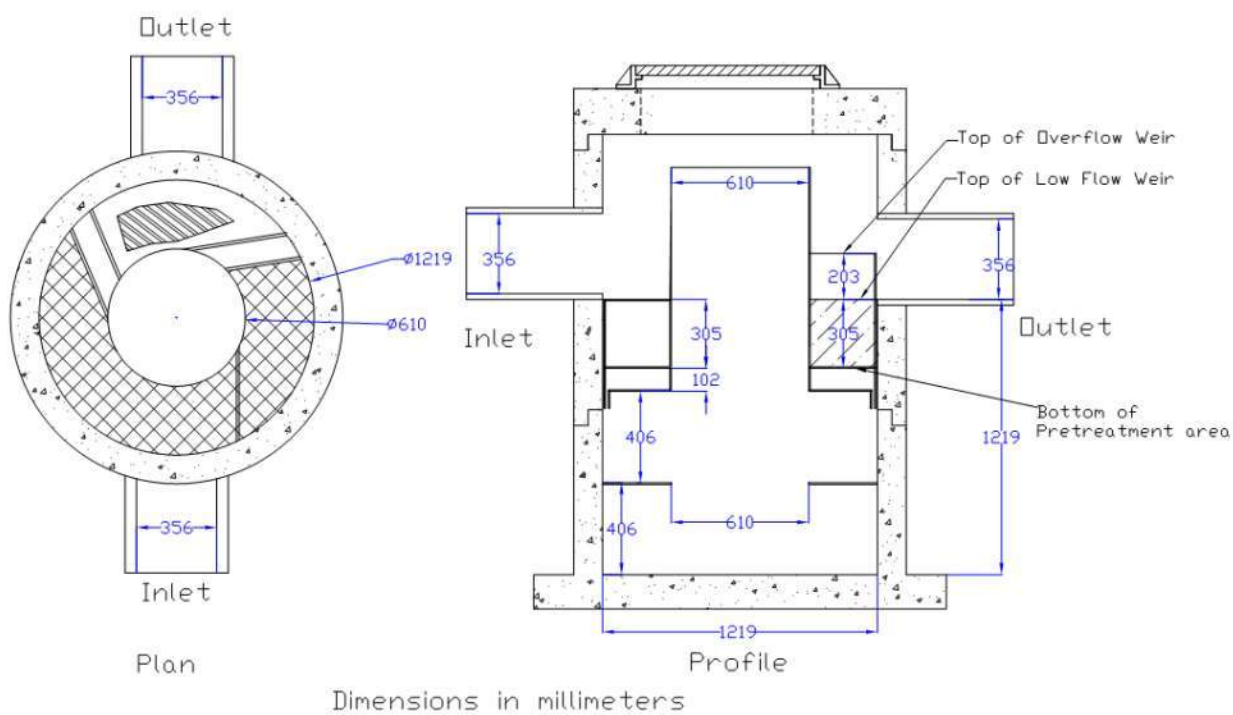


Figure 1: Drawing of the HS 4 Treatment Unit

Figure 2: HS 4 Test Unit Installed in Alden Flow Loop

3.0 Materials and Methods

3.1 Experimental Design

The HS 4 test unit was installed in the Alden test loop, shown on **Figure 3,** which was set up as a recirculation system. The loop was designed to provide metered flow up to approximately 17 cfs (481 L/s). Flow was supplied to the unit using either a 20HP or 50HP laboratory pump (flow dependent), drawing water from a 50,000-gallon (190,000 L) supply sump. Thirty feet (9.1m) of straight 14-inch (0.35m) pipe conveyed the metered flow to the unit. The influent and effluent pipes were set at 0.25% slopes. A 14-inch (0.35m) tee was located 4 pipe-diameters upstream of the test unit for injecting sediment into the crown of the influent pipe. This location deviated from the recommended distance of 5 pipe-diameters. However, the shorter distance was considered conservative for collecting sediment in the influent pipe and provided a better assessment of the unit's ability to capture sediment. Filtration of the test-loop flow, to reduce background concentration, was performed with an inline filter wall containing 1-micron filter bags.

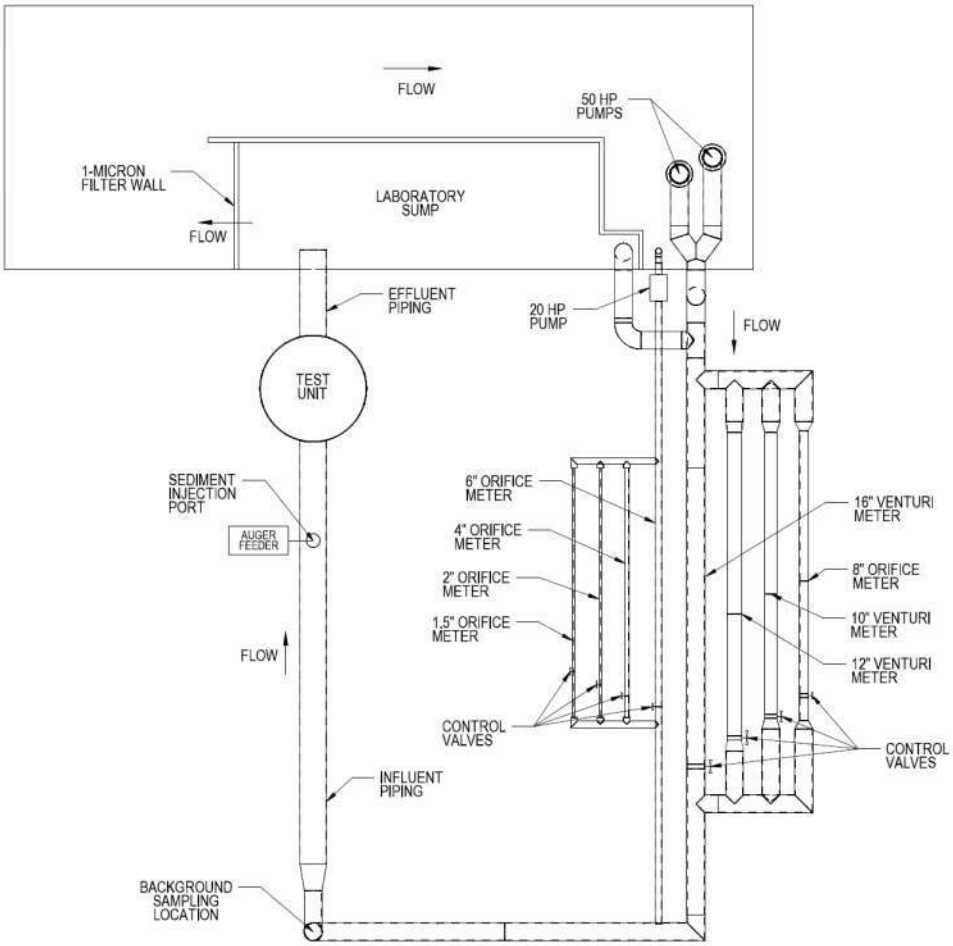


Figure 3: Plan View of Alden Flow Loop

3.2 Testing

3.2.1 Hydraulic Testing

The HS 4 unit was tested with clean water to determine its hydraulic characteristics, including loss coefficients (Cd's) and/or K factors, as well as the maximum flow prior to bypass. Flow and water level measurements were recorded for fifteen steady-state flow conditions using a computer Data-Acquisition (DA) system, which included a data collect program, a 0-250" Rosemount Differential Pressure (DP) cell, and a Druck 0-2 psi Absolute Pressure (AP) cell. Flows were set and measured using calibrated differential-pressure flow meters and control valves. Each test flow was set and operated at steady state for approximately 10 minutes, after which time a minimum of 60 seconds of flow and pressure data were averaged and recorded for each pressure tap location. Water elevations were measured within the treatment unit in the pretreatment channel, inner chamber and upstream of the outlet area. Measurements within the influent and effluent pipes were taken one pipe-diameter upstream and downstream of the unit.

3.2.2 Removal Efficiency Testing

Removal testing was conducted on a clean unit utilizing the mass balance methodology. A false floor was installed at the 50% collection sump sediment storage depth of 6" (0.15m), as stated by Hydroworks. All tests were run with clean water containing a sediment solids concentration (SSC) of less than 20 mg/L.

A minimum of seven sediment removal efficiency tests were conducted at loading rates corresponding to 40, 80, 200, 400, 600, 1000 and 1400 L/min/m^2 of effective treatment area. The HS 4 treatment area was 1.17 m^2, resulting in test flows of 47, 94, 234, 468, 702, 1170 and 1638 L/min.

The 600 L/min/m^2 test was repeated with a perforated secondary plate installed to determine the impact of the plate design on removal efficiency.

The test sediment was prepared by Alden to meet the PSD gradation of 1-1000 microns in accordance with the distribution shown in **Table 1.** The sediment is silica based, with a specific gravity of 2.65. Samples of each test batch were analyzed for PSD compliance by GeoTesting Express, Inc., an independent certified analytical laboratory, using the ASTM D422-63 (2007)e1 analytical method. The average of all the samples was used for compliance with the protocol specification.

The target influent sediment concentration was 200 mg/L (+/-25 mg/L) for all tests. The concentration was verified by collecting a minimum of six timed dry samples at the injector and correlating the data with the measured flow rate to produce the resulting influent concentration values for each test. The allowed Coefficient of Variance (COV) for the measured samples was 0.10.

A minimum of 11.3 kg of test sediment was introduced into the influent pipe for each test. In addition, the criteria of 25 minutes of test time, eight collection sump volume exchanges, and a supply water

temperature below 25 degrees Celsius were met for all tests conducted. The moisture content of the test sediment was determined using ASTM D4959-07 for each test conducted.

A minimum of 5 background samples of the supply water were collected at evenly-spaced intervals throughout each test. Samples were collected every hour for any test that was greater than 5 hours in duration. Collected samples were analyzed for Suspended Solids Concentration (SSC) using the ASTM D3977-97 (2013).

After completion of a selected test, the unit was decanted over a period not exceeding 30 hours. The remaining water and sediment was collected from the treatment unit and dried in designated pre-weighed nonferrous trays in compliance with ASTM D4959-07.

Table 1:
Target CETV Test Sediment Particle Size Distribution

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

3.2.3 Sediment Scour Testing

A sediment scour test was conducted on the test unit to evaluate the ability to retain captured material through a range of flows. The solids storage sump of the test unit was pre-loaded to the 50% storage capacity level of 15.2 cm with the 1-1000 micron sediment listed in **Table 1**. A false floor was installed in the sump to reduce the quantity of material required for the test. However, a minimum sediment depth of 10.2 cm was preloaded as per the protocol specification. The solid secondary plate, located just above the collection sump, was also preloaded to 10.2 cm with the 1-1000 sediment, as requested by Toronto Region Conservation Authority (TRCA). All test sediment was evenly distributed and levelled. The pretreatment channel was preloaded with a conservative blend consisting of all the material captured during the 40, 80 and 200 L/min/m^2 removal efficiency tests and an additional 30% of 1-1000 micron sediment. The material was preloaded in the areas of deposition observed during the removal testing.

The unit was filled with clean water (< 20 mg/L background) to the invert of the outlet pipe prior to testing. Testing was conducted at a temperature not exceeding 25 degrees C. The test was conducted within 96 hours of filling the unit.

The test was conducted sequentially at five surface loading rates equal to 200, 800, 1400, 2000 and 2600 L/min/m^2. Testing consisted of conveying the selected target flow through the unit and collecting 5 pairs of time-stamped effluent samples (every 1 minute) for SSC and PSD analysis, and a minimum of 5 time-stamped background samples evenly spaced throughout the test. Each target flow was reached within 1 minute of commencement of the flow change. Flow data was continuously recorded every 10 seconds throughout the test and correlated with the samples. The first target flow was reached within 1 minute of initiating the test.

It was necessary to change flow meters during the test, as the required flows exceeded the minimum and/or maximum range of any single meter, while maintaining the required COV of 0.04. When the flow capacity of the selected meter was reached, the flow was shut down over a period of approximately 10 seconds and all flow data saved. The next flow meter data-acquisition file was executed and the flow increased at a rate that corresponded to reaching each previous target flow after a period of 1-minute, thereby preventing artificially-induced scour due to flow surge.

Effluent samples for PSD and sediment concentration were collected in 1-L wide-mouth bottles from the end of the outlet pipe for all flows.

An additional scour test was conducted using the same methodology but with a perforated secondary plate installed in the sump. The lower sump was preloaded to the 50% capacity level with 1-1000 micron sediment. The pretreatment channel was preloaded with a sediment distribution that reflected the distribution captured during removal testing. This is considered a scientifically sound approach, as the channel is designed to capture the coarse particles prior to the flow entering the inner chamber.

3.2.4 Light-liquid Re-entrainment Testing

A test was conducted to assess the ability to retain light liquid within the unit. The unit was tested with a false floor installed at the 50% capture elevation, as in the sediment removal testing. The test flows were the same as in the sediment scour tests (200, 800, 1400, 2000 and 2600 L/min/m^2) and were conducted to the same time criteria (1-minute transition, 5-minute test).

The ETV protocol prescribes low-density polyethylene beads as a surrogate to represent floating liquid for a qualitative assessment of liquid behavior during operation. Dow Chemical Dowlex^{tm} 2517, with a density of 0.917 g/cm^2, has been specified as the acceptable surrogate material.

The pellets were preloaded within the inner-chamber area to a volume equal to a depth of 50.8 mm over the sedimentation area. The corresponding mass of the test material was measured and recorded prior to loading the unit.

The effluent was collected in flow-designated nets to allow for quantification of any re-entrained pellets for each flow rate. The collected pellets for each flow, as well as the interim periods, were dried and the volume and mass of collected pellets was quantified for each flow rate, as well as the overall test.

3.3 Instrumentation and Measuring Techniques

3.3.1 Flow

The inflow to the test unit was measured using one of five (5) calibrated differential-pressure flow meters (2”, 4”, 6”, 8” or 12”) [51mm, 102mm, 152mm, 203mm, 305mm]. Each meter is fabricated per ASME guidelines and calibrated in Alden’s Calibration Department. The 12” meter was used during hydraulic testing only. The high and low pressure lines from each meter were connected to manifolds containing isolation valves. Flows were set with a butterfly valve and the differential head from the meter was measured using a Rosemount® 0 to 250-inch (6.35m) Differential Pressure (DP) cell, also calibrated at Alden prior to testing. The test flow was averaged and recorded every 5-30 seconds (flow dependent) throughout the duration of the test using an in-house computer data acquisition (DA) program. The accuracy of the flow measurement is ±2%. A photograph of the flow meters is shown on **Figure 4** and the pumps on **Figure 5.**

Figure 4: Photograph Showing Laboratory Flow Meters

Figure 5: Photograph Showing Laboratory Pumps

3.3.2 Temperature

Water temperature measurements within the supply sump were obtained using a calibrated Omega® DP25 temperature probe and readout device. The calibration was performed at the laboratory prior to testing. The temperature reading was documented at the start and end of each test and/or day (for multi-day tests), to assure an acceptable testing temperature of less than 25 degrees C.

3.3.3 Pressure Head

Pressure head measurements were recorded at multiple locations using piezometer taps and a Druck®, model PTX510, 0 - 2.0 psi cell. The pressure cell was calibrated at Alden prior to testing. Accuracy of the readings is $\pm$ 0.3 mm. The cell was installed at a known datum above the unit floor, allowing for elevation readings through the full range of flows. A minimum of 60 seconds of pressure data was averaged and recorded for each pressure tap, under steady-state flow conditions, using the computer DA program. A photograph of the pressure instrumentation is shown on **Figure 6**.

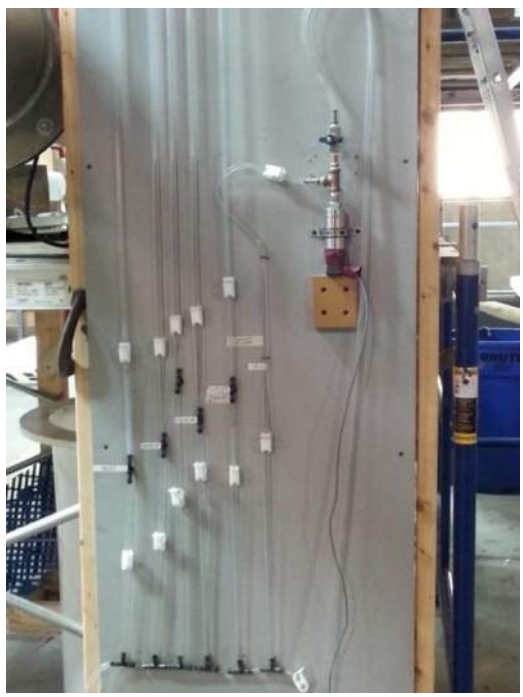


Figure 6: Pressure Measurement Instrumentation

3.3.4 Sediment Injection

The test sediment was injected into the crown of the influent pipe using an Auger® volumetric screw feeder, model VF-1, shown on **Figure 7.** The feed screws used in testing ranged in size from 9.5mm to 25mm, depending on the test flow. Each auger screw, driven with a variable-speed drive, was calibrated with the test sediment prior to testing, to establish a relationship between the auger speed (0-100%) and feed rate in mg/minute. The calibration, as well as test verification of the sediment feed was accomplished by collecting 1-minute timed dry samples and weighing them on an Ohaus® 4000g x 0.1g,

model SCD-010 digital scale. The feeder has a hopper at the upper end of the auger to provide a constant supply of dry test sediment.

Figure 7: Photograph Showing Variable-speed Auger Feeder

3.3.5 Sample Collection

Scour testing effluent samples were collected in 1-L bottles from the end of the pipe for sediment concentration and PSD analyses. Background concentration samples were collected from the center of the vertical pipe upstream of the test unit with the use of a 19mm diameter isokinetic sampler, shown on **Figure 8.**

Figure 8: Photograph Showing the Background Isokinetic Sampler

3.3.6 Sample Concentration Analyses

Effluent and background concentration samples were analyzed by Alden in accordance with Method B, as described in ASTM Designation: D 3977-97 (Re-approved 2013), "Standard Test Methods for Determining Sediment Concentration in Water Samples". The required silica material used in the sediment testing did not result in any dissolved solids in the samples and therefore, simplified the ASTM testing methods for determining sediment concentration.

3.3.7 Mass Balance Analysis

A modified mass balance method, in which the influent and captured sediment mass is quantified, was used to determine the sediment removal efficiency at each designated test flow. The mass of injected sediment was determined by weighing the prepared test batch prior to testing and subtracting the mass remaining in the injection hopper at the conclusion of the test. All captured material was collected in designated pre-weighed non-ferrous trays and dried in a Binder® laboratory oven; model ED-400, in accordance with ASTM Method D 4959-07, "Standard Test Method for Determination of Water (Moisture) Content of Soil By Direct Heating". Depending on collected mass, each tray was weighed on either an Ohaus® 4000g x 0.1g; model SCD-010, or Ohaus® 30kg x 0.001kg; model RD-30LS digital scale.

3.4 Data Management and Acquisition

A designated Laboratory Records Book was used to document the conditions and pertinent data entries for each test conducted. All entries are initialed and dated.

A computer running an Alden in-house Labview® Data Acquisition (DA) program was used to record all data related to instrument calibration and testing. A 16-bit National Instruments® NI6212 Analog to Digital (A/D) board was used to convert the signal from the pressure cells to a voltage. Alden's in-house data collection software, by default, collects one second averages of data collected at a raw rate of 250 Hz. The system allows contiguous data collection by continuously writing the collected 1 second averages and their RMS values to disk. The data output from the program is in tab delimited text format with a user-defined number of significant figures.

Test flow and pressure data was continuously collected at a frequency of 250 Hz. The flow data was averaged and recorded to file every 5 to 30 seconds, depending on the duration of the test. Steady-state pressure data was averaged and recorded over a duration of 60 seconds for each point. The recorded data files were imported into Excel for further analysis and plotting.

Excel based data sheets were used to record all sediment related data used for quantifying injection rate, effluent and background sample concentrations, captured mass and PSD data. The data was input to the designated spreadsheet for final processing.

3.5 Preparation of Test Sediment

The sediment PSD used for scour and removal efficiency testing was comprised of 1-1000 micron silica particles with a SG of 2.65, as shown in Table 1. Sediment batches were prepared by Alden to meet the protocol specifications using commercially-available silica products. A random sample from each test batch was analyzed in accordance with ASTM D422-63 (2007)e1, by GeoTesting Express, an AALA ISO/IEC 17025 accredited independent laboratory, prior to testing. The specified less-than (%-finer) values of the sample average were within the specifications listed in **Table 1**, as defined by the protocol. The D_{50} of the sample average was 69 microns. The PSD data of the samples are shown in **Table 2** and the corresponding curves are shown on **Figure 9**.

Table 2:
PSD Analyses of the 1-1000 micron Test Batches

Particle size	40 l/m/m^2	80 l/m/m^2	200 l/m/m^2	400 l/m/m^2	600 l/m/m^2	1000 l/m/m^2	1400 l/m/m^2	Average	CETV	QA / QC Compliant
(micron)	%-Finer	%-Finer	%-Finer	%-Finer	%-Finer	%-Finer	%-Finer	%-Finer	%-Finer	
1000	100	100	100	100	100	100	100	**100**	**100**	Y
500	95	97	95	95	96	96	95	**96**	**95**	Y
250	91	93	90	90	92	92	90	**91**	**90**	Y
150	77	74	76	74	79	73	74	**75**	**75**	Y
110	65	63	64	63	65	63	63	**64**	**60**	Y
75	53	51	51	51	54	51	50	**52**	**50**	Y
53	47	47	47	45	47	47	45	**46**	**45**	Y
20	35	36	36	35	36	37	35	**36**	**35**	Y
8	22	20	22	20	18	21	21	**21**	**20**	Y
5	16	14	16	14	13	15	15	**15**	**10**	Y
2	7	6	7	7	4	6	6	**6**	**5**	Y
D50	64	69	69	71	62	69	75	**69**	**75**	Y

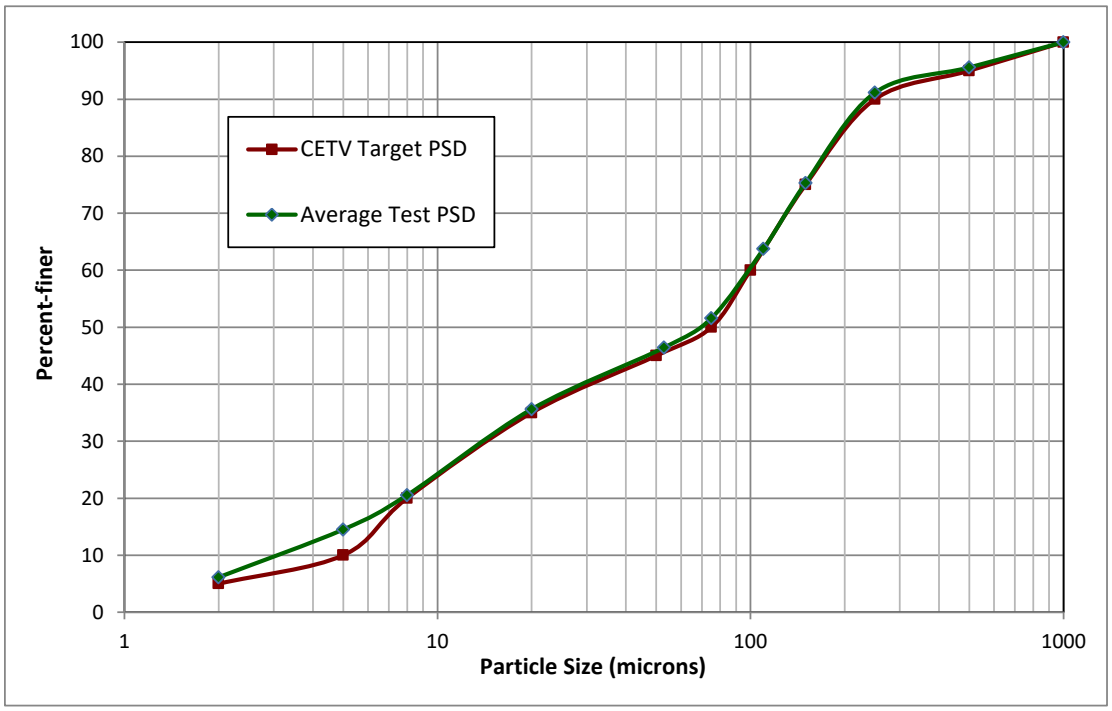


Figure 9: PSD Curves of Test Sediment Average and CETV Specifications

3.6 Data Analysis

The following equations and procedures were used in analyzing the data collected on the Hydroworks HS 4 test unit:

3.6.1 Hydraulics

The pressure cell was mounted at an elevation of 0.067m below the outlet pipe invert. This datum value was added to all measurements taken to calculate the water height above the invert. The system energy loss across the unit was determined by adding the velocity head to the elevation measurements taken in the inlet and outlet pipes.

The velocity head is defined by:

$$\mathbf{H = V^2/2g} \tag{1}$$

where,

H = velocity head (m), V = velocity (m/sec), and g = gravity (9.81 m/sec^2).

The velocity is defined by:

$$\mathbf{V = Q/A} \tag{2}$$

where,

V = velocity (m/sec), Q = flow (m^3/sec), and A = area (m^2).

The area in the partial pipe flow was calculated using:

$$\boldsymbol{A = 0.125(\theta - Sin\theta)D^2} \tag{3}$$

where,

A = area (m^2), θ = angle of inclusion (radians), and D = pipe diameter (m).

The angle of inclusion of the water surface (θ) was calculated using:

$$\boldsymbol{\theta = 2\pi - 2\left(ACos\left(\frac{y-\frac{D}{2}}{\frac{D}{2}}\right)\right)} \tag{4}$$

where,

Y = measured water depth (m), and D = pipe diameter (m).

The system and pipe loss coefficient (Cd) was calculated using:

$$\boldsymbol{Cd = \frac{Q}{A(2g\Delta H)^{0.5}}} \tag{5}$$

where,

Q = flow (m^3/sec), A = area of insert outlet opening (m^2), g = gravity (9.81 m/s^2), and ΔH = energy loss across unit (m).

3.6.2 Removal Efficiency

The injected mass was calculated by:

$$\mathbf{M_{inj} = \Delta M - (\Delta M \text{ x } w)} \tag{6}$$

where,

M_{inj} = final mass of injected sediment (kg), ΔM = measured mass of injected sediment (kg), w = moisture content of sediment (%).

The sediment removal efficiency was calculated by:

$$\mathbf{\% \text{ Removal} = (M_c / M_{inj}) \text{ x } 100} \tag{7}$$

where,

M_c = captured mass (g), M_{inj} = total mass of injected sediment (g)

The background sample concentrations were calculated as follows:

$$\mathbf{BG \text{ (mg/L)} = \text{ Sediment Wt (mg) / Sample Volume (L)}} \tag{8}$$

The auger injector verification concentrations were determined by the following:

$$\mathbf{C_i = M_f / Q_{avg}} \quad (9)$$

where,

C_i = influent concentration (mg/L), M_f = sediment mass feed (mg/min), Q_{avg} = average flow (L/min)

3.7 Laboratory Analysis

The following Test Methods were used to analyze the various dry and aqueous sediment and plastic samples:

- **Sediment Concentration**

  ASTM Designation: D 3977-97 (Re-approved 2013), "Standard Test Methods for Determining Sediment Concentration in Water Samples"

- **Sediment Moisture Content**

  ASTM Designation: D4959-07, "Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating"

- **Dry Sediment Particle Size Distribution**

  ASTM D422-63 (2007), "Standard Test Method for Particle Size Analysis of Soils"

- **Aqueous Sample Particle Size Distribution**

  ISO 13320-1 (2009) Particle Size Analysis – Laser Diffraction Methods

- **Light-Liquid Surrogate Plastic Density**

  ASTM D792-13 Method A "Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement"

3.7.1 Independent Analytical Laboratories

All dry sediment PSD analyses were performed by GeoTesting Express, Inc., Acton, Massachusetts. GeoTesting is an AALA ISO/IEC 17025 accredited independent laboratory

All aqueous PSD samples were analyzed by Microtrac, Inc. Particle Analysis Laboratory, York, Pennsylvania. Microtrac is an ISO 9001, ISO 13320 and ISO/IEC 17021 accredited laboratory.

3.8 Quality Assurance and Control

A Test Plan was submitted and approved outlining the testing methodologies and procedures used for conducting the verification tests. The Test Plan was followed throughout the testing.

All instruments were calibrated prior to testing and periodically checked throughout the test program. The instrumentation calibrations are shown in Appendix B.

3.8.1 Flow

The flow meters and Pressure Cells were calibrated in Alden's Calibration Laboratory, which is ISO 17025 accredited. A standard water manometer board and Engineers Rule were used to verify the computer measurement of each flow meter.

3.8.2 Sediment Injection

The sediment feed in g/min was verified with the use of a digital stop watch and 4000g calibrated digital scale. The tare weight of the sample container was recorded prior to collection of each sample. The final sediment concentrations were adjusted for moisture.

3.8.3 Sediment Concentration Analysis

All sediment concentration samples were processed at Alden in accordance with the ASTM D3977-97 (2013) analytical method. Gross sample weights were measured using a 4000g x 0.1g calibrated digital scale. The dried sample weights were measured with a calibrated 0.0001g analytical balance. The change in filter weight due to processing was accounted for by including three control filters with each test set. The average of the three values, which was typically (+/- 0.1mg), was used in the final concentration calculations.

Analytical accuracy was verified by preparing two blind control samples and processing using the ASTM method. The final calculated values were within 0.26% and 0.87% of the theoretical sample concentrations, with an average of 0.57% accuracy.

4.0 Results and Discussion

4.1 Sediment Removal Performance

Removal efficiency tests were conducted at the seven required flows of 40, 80, 200, 400, 600, 1000 and 1400 L/min/m^2. The target influent sediment concentration was 200 mg/l. The HS 4 treatment area was 1.17 m^2, resulting in target test flows of 47, 94, 234, 468, 702, 1170 and 1638 L/min, respectively. A summary of the calculated test parameters is shown in **Table 3**.

Table 3:
Calculated Test Parameter summary

	L/m/m^2	**40**	**80**	**200**	**400**	**600**	**1000**	**1400**
TARGET FLOW	L/min	**47**	**94**	**234**	**468**	**702**	**1170**	**1638**
	L/s	0.8	1.6	3.9	7.8	11.7	19.5	27.3
8X Treatment Unit Vol	**cu.m.**	10.0	10.2	10.8	11.1	11.4	12.2	13.1
Run Time	**(min)**	212.8	109.4	46.2	25.9	14.9	11.1	8.0
Sediment Quantity per Test	(Kg)	**12.0**	**12.0**	**12.0**	**12.0**	**12.0**	**12.0**	**12.0**
feed rate	(g/min)	**9.4**	**18.7**	**46.8**	**93.6**	**140.4**	**234.0**	**327.6**
Approx. Total Run Time	(min)	**1282**	**641**	**256**	**128**	**85**	**51**	**37**
	(hours)	21.4	10.7	4.3	2.1	1.4	0.9	0.6

The target and measured flow and temperature parameters are shown in **Table 4** and the injected sediment data is shown in **Table 5**.

Table 4:
Test Flow and Temperature Summary

Target Flow		**Actual Flow**	**Deviation from Target**	**Flow Measurement COV**	**Maximum Temperature**	**QA / QC Compliant**
L/min/m^2	L/min	L/min			Deg. C	
40	47	**46**	-0.7%	0.004	22.6	**Y**
80	94	**93**	-0.3%	0.002	20.1	**Y**
200	234	**233**	-0.4%	0.002	22.1	**Y**
400	468	**425**	-9.2%	0.001	18.8	**Y**
600	702	**736**	4.9%	0.002	23.8	**Y**
1000	1170	**1104**	-5.7%	0.004	19.9	**Y**
1400	1638	**1628**	-0.6%	0.002	18.8	**Y**

Table 5:
Injected Sediment Summary

Target Flow		Target Concentration	Injector Wts. Concentration	Injector Measurements	Mass/Volume Concentration	Total Injected Mass	QA / QC Compliant
L/min/m^2	L/min	mg/L	mg/L	COV	mg/L	kg	
40	47	200	202	0.01	**203**	**11.7**	**Y**
80	94	200	203	0.02	**196**	**11.9**	**Y**
200	234	200	200	0.00	**201**	**11.9**	**Y**
400	468	200	201	0.01	**194**	**12.3**	**Y**
600	702	200	199	0.00	**199**	**12.2**	**Y**
1000	1170	200	200	0.00	**197**	**12.4**	**Y**
1400	1638	200	200	0.00	**194**	**12.6**	**Y**

At the end of each test run, the captured sediment was collected and quantified from the inlet pipe and treatment unit. The calculated removal efficiencies ranged from 35.7% to 68.6% for the seven flows tested. The %-removal summary is shown in **Table 6**, with the corresponding removal curve shown on **Figure 10**. The %-removal curves for the collected regions are shown on **Figure 11**.

Table 6:
Removal Efficiency Captured Mass Summary

Flow	Tested Flow	Removal Efficiency	Inlet Pipe	Pretreatment Channel	Secondary Plate	Outlet Dispersion Plate	Collection Sump
L/min/m^2	L/min	%	%	%	%	%	%
40	**46**	**68.6**	**0.0**	**52.3**	**8.2**	**1.6**	**6.5**
80	**93**	**64.0**	**0.0**	**44.8**	**9.1**	**2.3**	**7.7**
200	**233**	**60.0**	**0.0**	**44.5**	**6.6**	**1.5**	**7.4**
400	**425**	**56.1**	**0.0**	**37.4**	**8.6**	**2.4**	**7.7**
600	**736**	**46.1**	**0.0**	**24.7**	**8.5**	**3.1**	**9.9**
1000	**1104**	**41.2**	**0.0**	**20.5**	**8.3**	**2.8**	**9.6**
1400	**1628**	**35.7**	**0.5**	**20.0**	**4.3**	**1.7**	**9.3**

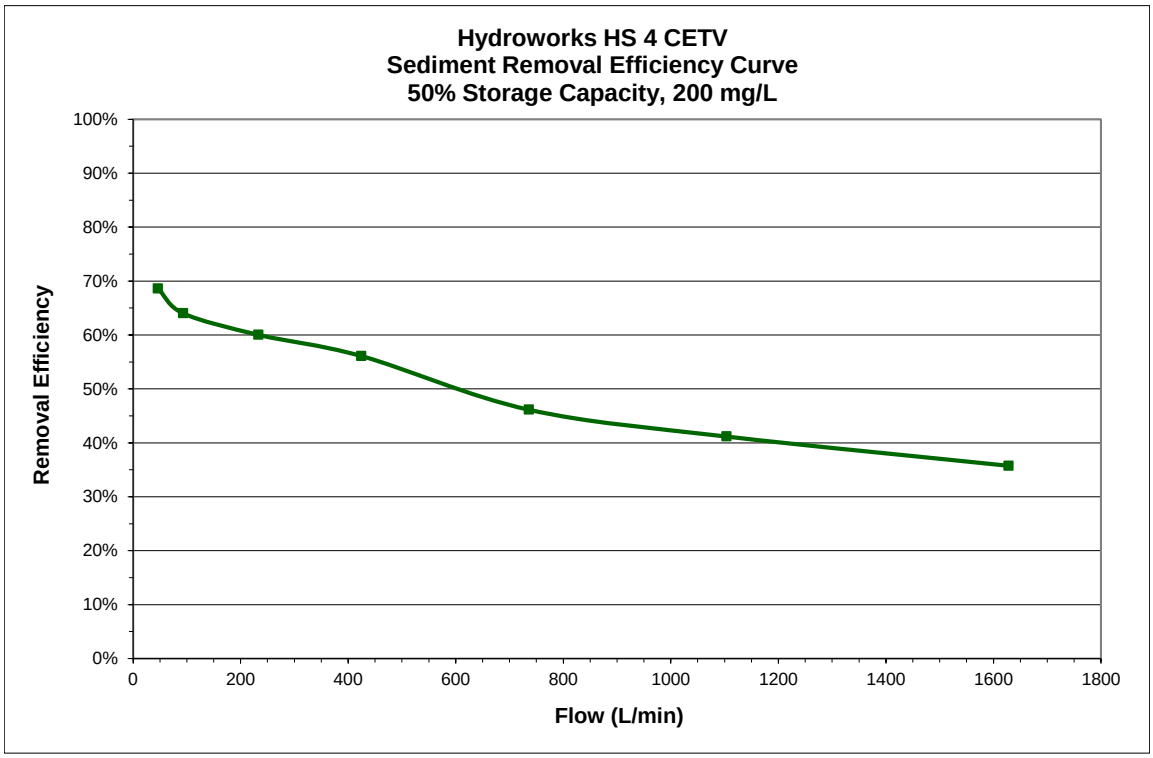


Figure 10: HS 4 Removal Efficiency Curve

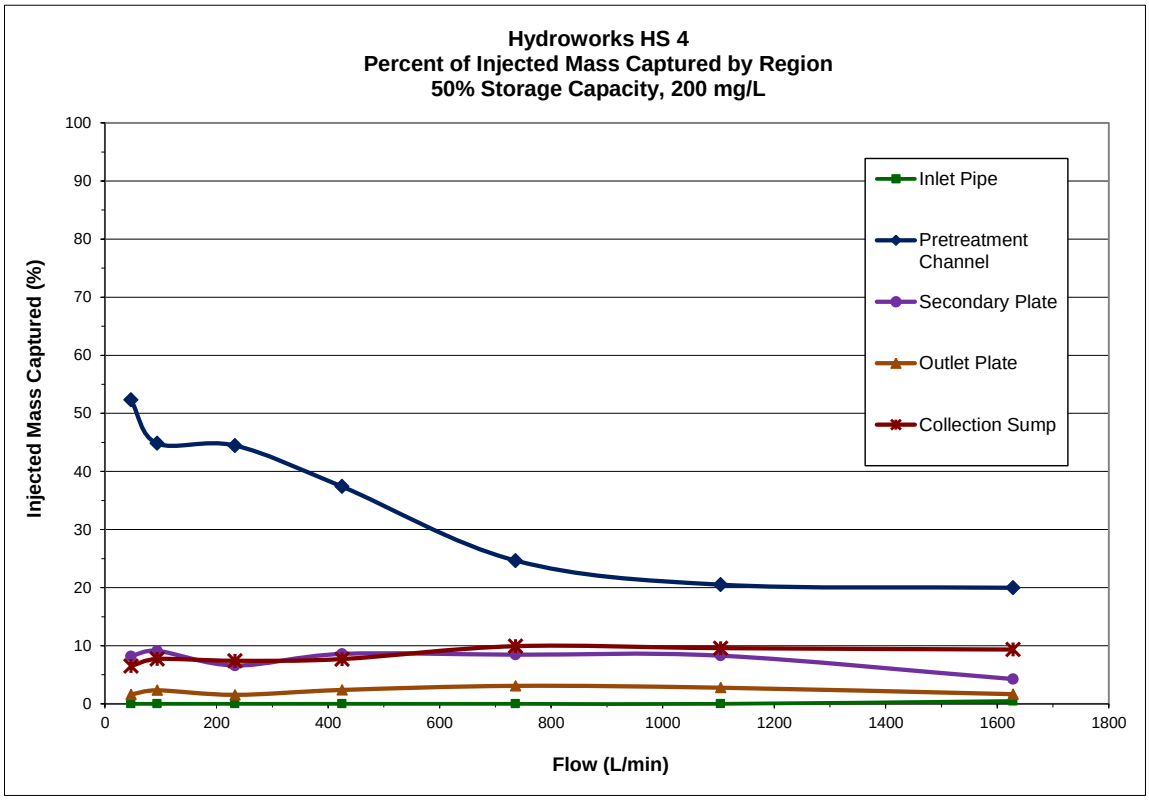


Figure 11: Captured Mass by Region

The particle size fractions of the captured sediment for all tests conducted are summarized in **Table 7.** The average test sediment data is included in column 2 as a benchmark. The percent of the size fractions of the injected sediment captured by the unit at each test flow is shown in **Table 8**. Some reported capture values are outside the absolute limit (+100%), or below the expected value. This is especially true at the larger size fractions (fewer particles) and those with small retained values. Factors that affect the accuracy of the data include how well the initial mix and collected sediment was blended and sampled, as well as accuracy and reporting of the PSD analyses. All sieve results were reported as whole numbers. Consequently, comparative values of 4.4% and 4.5% (2% difference) would be reported as 4% and 5% (25% difference).

PSD samples were analyzed for each deposition location only for the 40 L/min/m^2 test. For the remaining tests, the collected sediment from the sump, secondary plate and outlet plate were blended prior to taking a sample for analysis. A sample was collected from the pretreatment channel for each test. Details of the PSD data are presented in each removal test discussion section.

Table 7:
PSD Data Summary of Captured Sediment by Size Fraction

Particle Range (µm)	Average Test Sediment	40 L/min/m^2	80 L/min/m^2	200 L/min/m^2	400 L/min/m^2	600 L/min/m^2	1000 L/min/m^2	1400 L/min/m^2
>1000	0%	0%	0%	0%	0%	0%	0%	0%
500-1000	4%	4%	6%	5%	3%	4%	4%	1%
250-500	4%	4%	5%	5%	3%	5%	4%	2%
150-250	16%	15%	14%	12%	12%	12%	11%	11%
105-150	12%	11%	12%	13%	13%	11%	10%	10%
75-105	12%	12%	9%	10%	11%	7%	7%	6%
53-75	5%	5%	6%	7%	7%	4%	3%	3%
20-53	11%	8%	6%	5%	4%	2%	1%	1%
8-20	15%	5%	4%	2%	1%	0%	0%	0%
5-8	6%	1%	0%	0%	0%	0%	0%	0%
2-5	8%	1%	0%	0%	0%	0%	0%	0%

Table 8:
Injected Sediment Captured by Size Fraction at Each Flow

Particle Range (µm)	**40** L/min/m^2	**80** L/min/m^2	**200** L/min/m^2	**400** L/min/m^2	**600** L/min/m^2	**1000** L/min/m^2	**1400** L/min/m^2
>500	73%	194%	98%	67%	111%	103%	26%
250-500	100%	135%	92%	64%	115%	98%	48%
150-250	110%	75%	89%	72%	89%	60%	69%
105-150	94%	109%	107%	119%	78%	99%	91%
75-105	96%	76%	79%	95%	68%	54%	46%
53-75	87%	142%	170%	118%	56%	69%	65%
20-53	71%	54%	46%	44%	19%	14%	10%
8-20	38%	23%	15%	8%	2%	2%	2%
5-8	13%	6%	1%	1%	0%	0%	0%
2-5	8%	0%	0%	0%	0%	0%	0%

4.1.1 40 L/min/m^2 (46.7 L/min)

The test was conducted over a period of 3 days to meet the minimum 11.3 kg feed requirement. The total test duration was 21.4 hours. The test flow was averaged and recorded every 20 seconds throughout the test. The average recorded test flow for each day was 46.3, 46.5 and 46.6 L/min, respectively. The overall average was 46.5 L/min, with a COV of 0.004. The recorded temperature for the full test ranged from 22.1 to 22.6 degrees C.

The injection feed rate of 9.3 g/min was verified by collecting timed weight samples from the injector. The measured influent injection concentrations for the full test ranged from 197 mg/L to 206 mg/L, with a mean of 202 mg/L and COV of 0.01. The total mass injected into the unit was 11.693 kg. The calculated mass-flow concentration for the test was 203 mg/L. The measured influent concentration data for the complete test is shown on **Figure 12**.

Twenty-four (24) background concentrations samples were collected throughout the test and ranged from 0.9 to 3.0 mg/L. The background curve is shown on **Figure 13**.

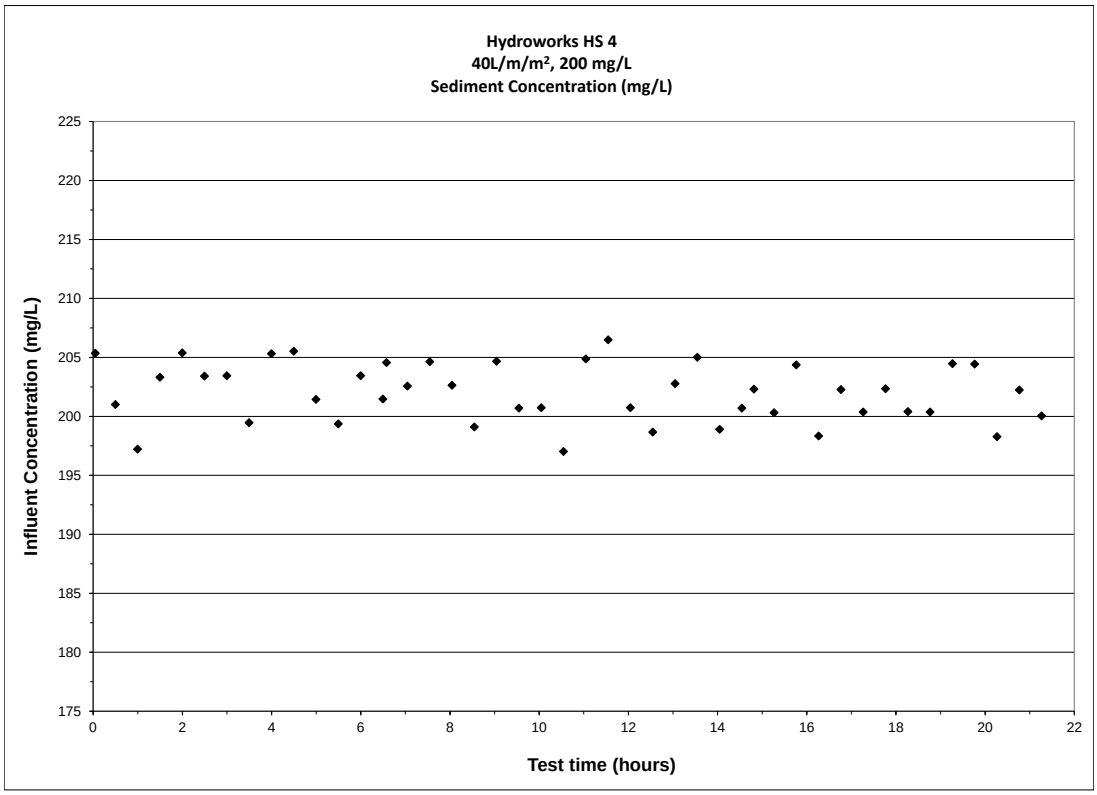


Figure 12: 40 L/min/m² Measured Influent Concentrations

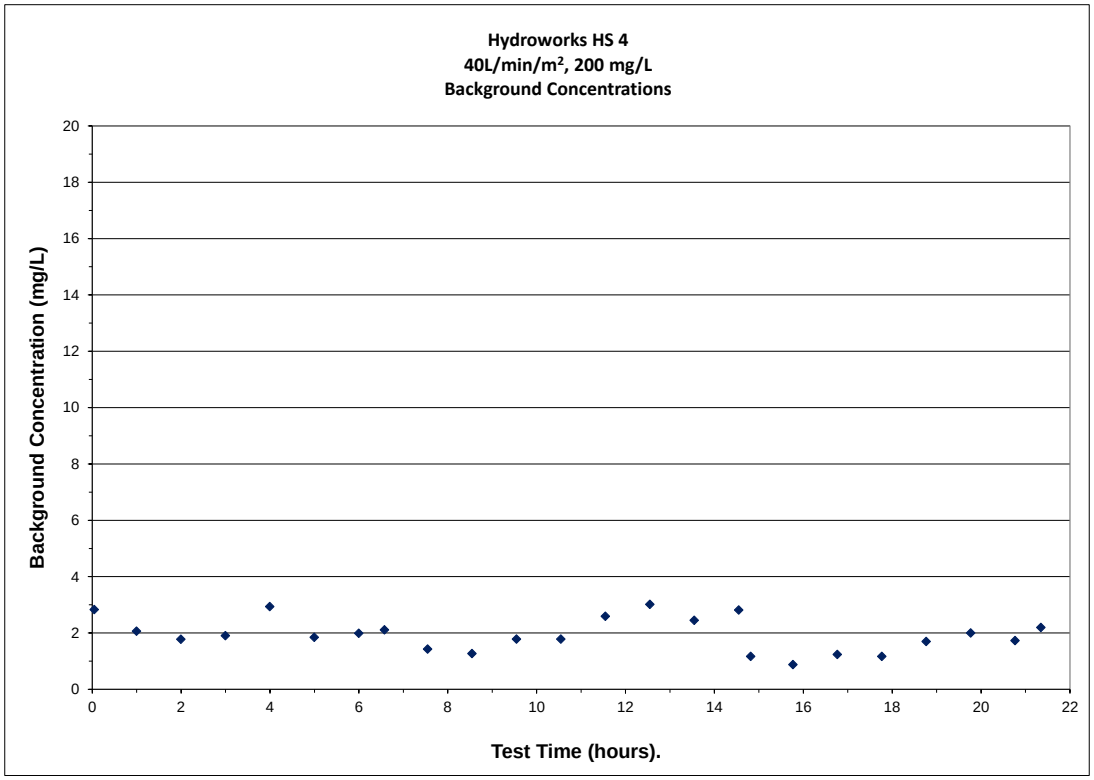


Figure 13: 40 L/min/m² Measured Background Concentrations

The total collected mass from the unit was 8.023 kg, resulting in a removal efficiency of 68.6%. The mass collected from each settling region was quantified based on the % of total captured mass, as well as % of total injected mass. The resulting data is shown in **Table 9**.

Table 9:
40 L/min/m^2 Breakdown of Captured Mass by Region

	Pretreatment Channel	Secondary Plate	Sump	Outlet Dispersion Plate	Total
mass (g)	6116.5	958.4	760.3	188.1	8023.3
% of captured	76.2%	11.9%	9.5%	2.3%	100.0%
% of Injected	52.3%	8.2%	6.5%	1.6%	68.6%

Particle Size Distribution

A well-mixed random dry sample from the test batch was collected and analyzed for PSD by the independent analytical laboratory. A well-mixed dry sediment sample from each capture region was analyzed for PSD. The PSD breakdown of the percent of injected mass captured within each region is shown in **Table 10** and the %-finer curves are shown on **Figure 14**.

Table 10:
40 L/min/m^2 PSD Breakdown of Injected Mass Captured

PSD Size Fraction microns	Test Sediment PSD	Pretreatment Channel	Secondary Plate	Collection Sump	Outlet Dispersion Plate	Total Retained
500-1000	5%	4%	0%	0%	0%	4%
250-500	4%	4%	0%	0%	0%	4%
150-250	14%	15%	0%	0%	0%	15%
100-150	12%	10%	1%	1%	0%	11%
75-100	12%	9%	2%	1%	0%	12%
50-75	6%	4%	1%	0%	0%	5%
20-50	12%	3%	2%	2%	1%	8%
8-20	14%	1%	2%	2%	1%	5%
5-8	6%	0%	0%	0%	0%	1%
2-5	9%	0%	0%	0%	0%	1%

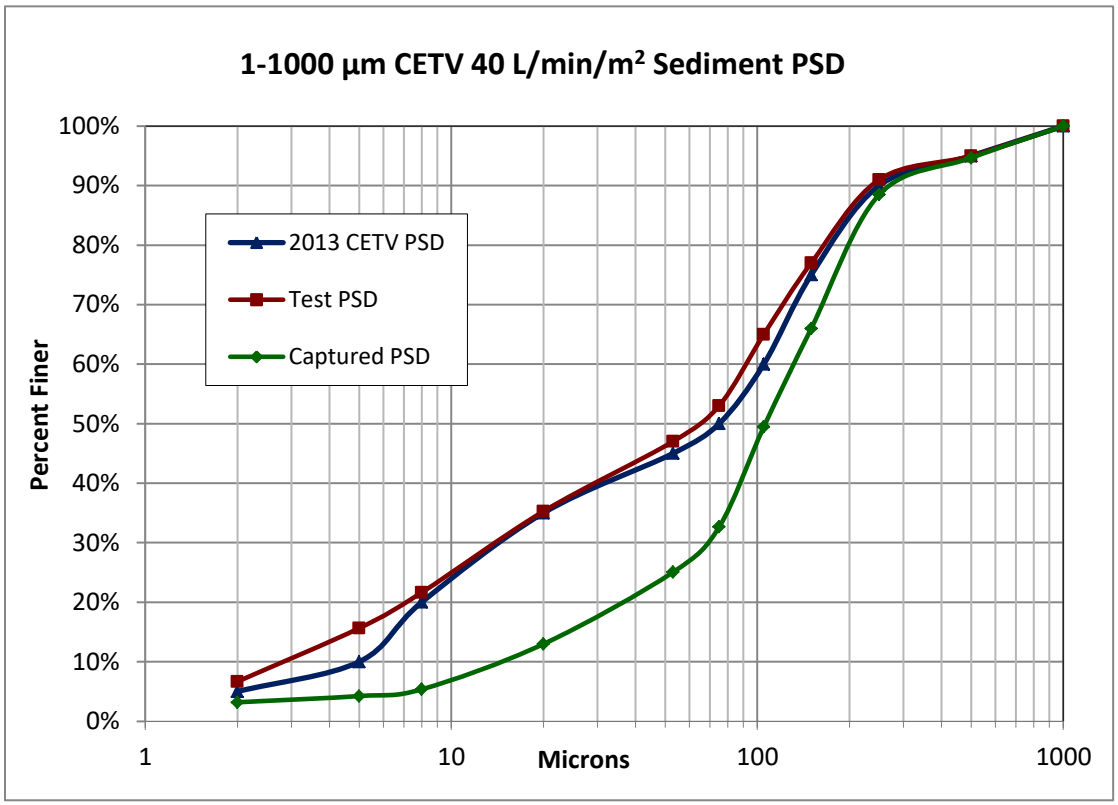


Figure 14: 40 L/min/m² %-Finer Curves of Test Sediment and Total Captured Mass

4.1.2 80 L/min/m² (93.4 L/min)

The test was conducted over a period of 2 days to meet the minimum 11.3 kg feed requirement. The total test duration was 11.1 hours. The test flow was averaged and recorded every 20 seconds throughout the test. The average recorded test flow for each day was 93.4 and 93.3 L/min, respectively. The overall average was 93.4 L/min, with a maximum COV of 0.002. The recorded temperature for the full test ranged from 19.6 to 20.1 degrees C.

The injection feed rate of 18.7 g/min was verified by collecting timed weight samples from the injector. The measured influent injection concentrations for the full test ranged from 198 mg/L to 208 mg/L, with a mean of 203 mg/L and COV of 0.02. The total mass injected into the unit was 11.930 kg. The calculated mass-flow concentration for the test was 196 mg/L. The measured influent concentration data for the complete test is shown on **Figure 15**.

Thirteen (13) background concentrations samples were collected throughout the test and ranged from 1.3 to 5.0 mg/L. The background curve is shown on **Figure 16**.

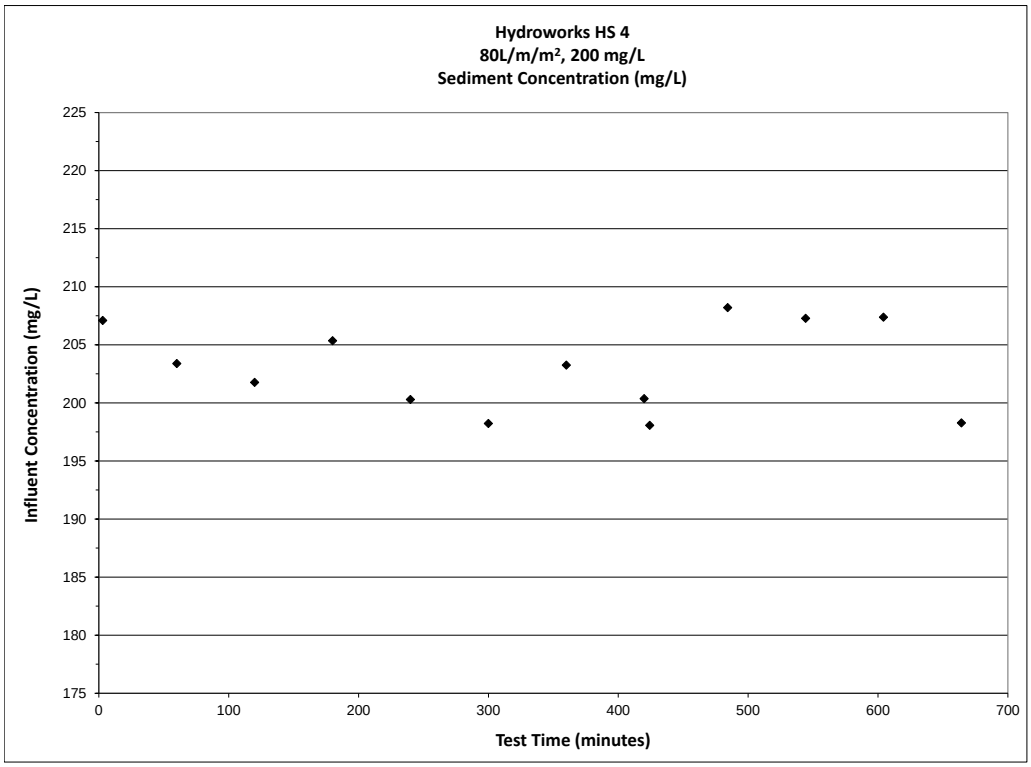


Figure 15: 80 L/min/m² Measured Influent Concentrations

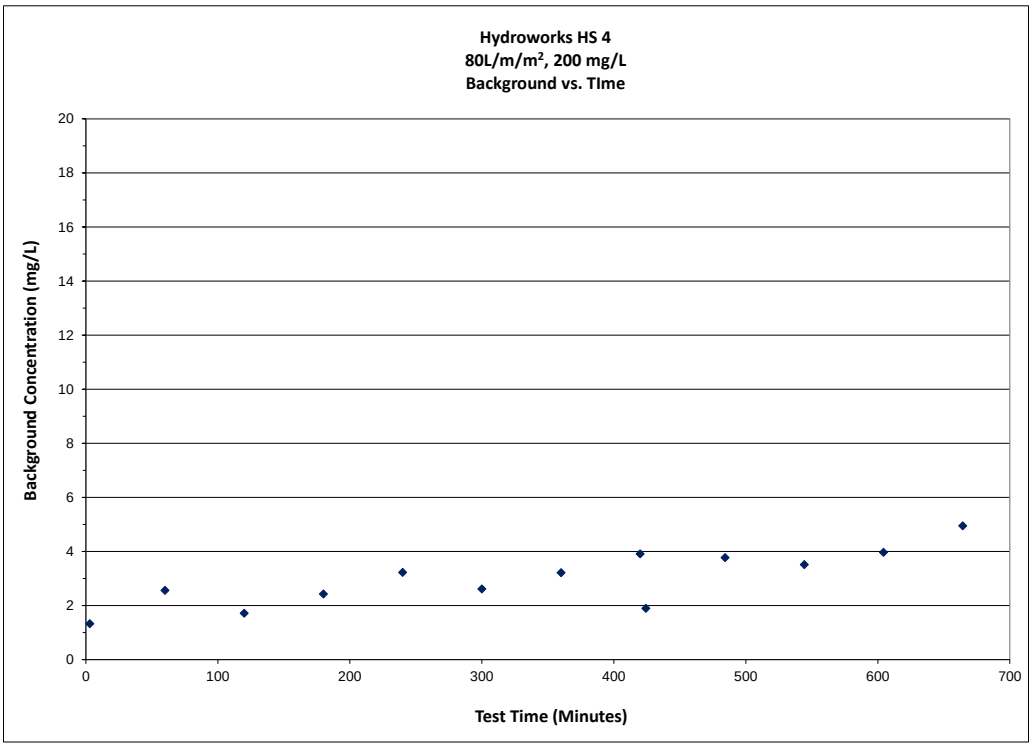


Figure 16: 80 L/min/m² Measured Background Concentrations

The total mass collected from the unit was 7.636 kg, resulting in a removal efficiency of 64.0

Particle Size Distribution

A well-mixed random dry sample from the test batch was collected and analyzed for PSD by the independent analytical laboratory. A well-mixed dry sediment sample from each capture region was analyzed for PSD. The PSD breakdown of the percent of injected mass captured within each region is shown in **Table 11** and the %-finer curves are shown on **Figure 17**.

Table 11:
80 L/min/m² PSD Breakdown of Injected Mass Captured

PSD Size Fraction microns	Test Sediment PSD	Total Retained
500-1000	3%	6%
250-500	4%	5%
150-250	19%	14%
100-150	11%	12%
75-100	12%	9%
50-75	4%	6%
20-50	11%	6%
8-20	16%	4%
5-8	6%	0%
2-5	8%	0%

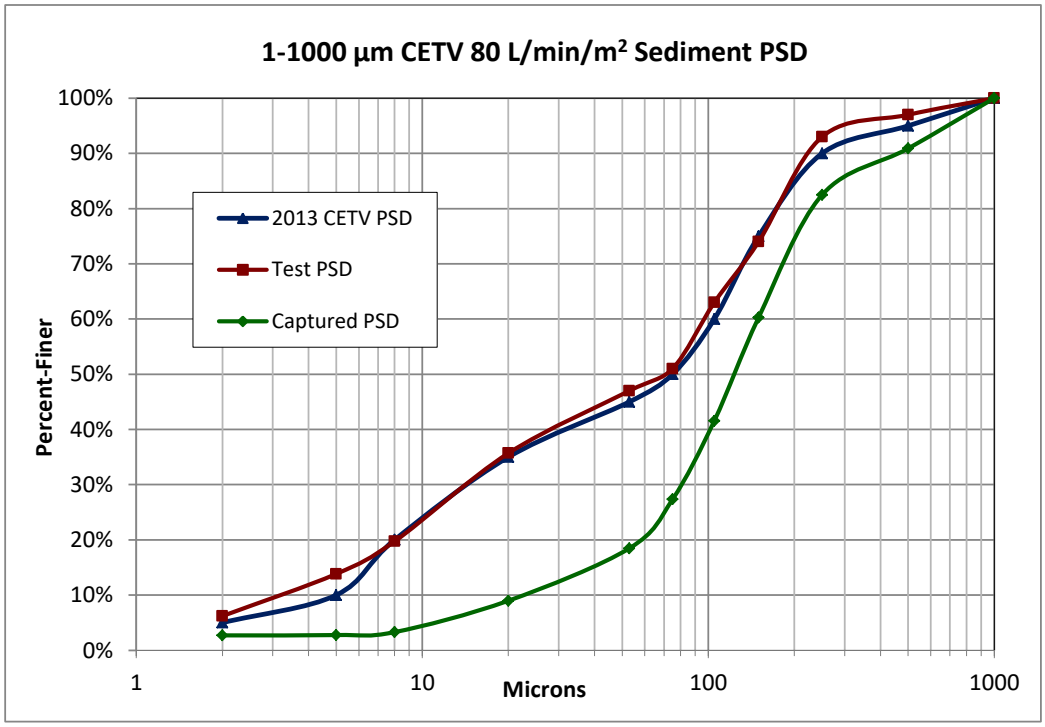


Figure 17: 80 L/min/m² Percent-Finer Curves of Test Sediment and Total Captured Mass

4.1.3 200 L/min/m^2 (233.4 L/min)

The test was conducted over a duration of 265 minutes to meet the minimum 11.3 kg feed requirement. The test flow was averaged and recorded every 10 seconds throughout the test. The average recorded test flow was 233.2 L/min, with a COV of 0.002. The maximum recorded temperature for the full test was 22.1 degrees C.

The injection feed rate of 46.8 g/min was verified by collecting timed weight samples from the injector. The measured influent injection concentrations for the full test ranged from 199 mg/L to 202 mg/L, with a mean of 200 mg/L and COV of 0.00. The total mass injected into the unit was 11.946 kg. The calculated mass-flow concentration for the test was 201 mg/L. The measured influent concentration data for the complete test is shown on **Figure 18**.

Eight (8) background concentrations samples were collected throughout the test and ranged from 1.7 to8.1 mg/L. The background curve is shown on **Figure 19**.

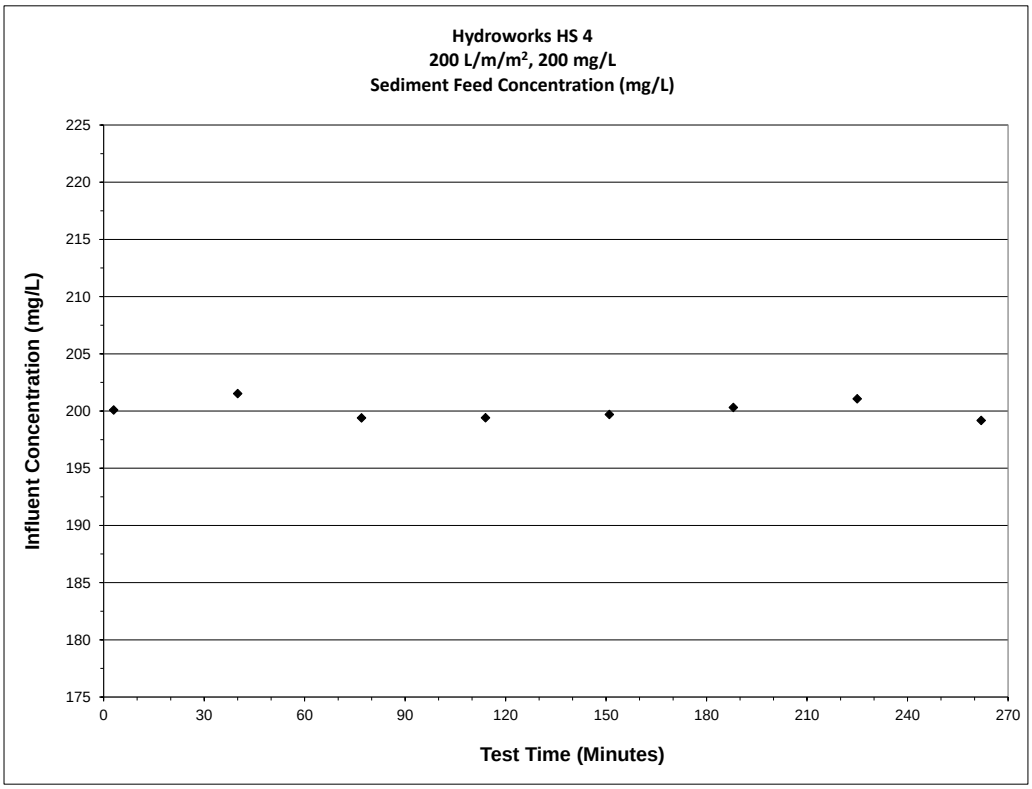


Figure 18: 200 L/min/m^2 Measured Influent Concentrations

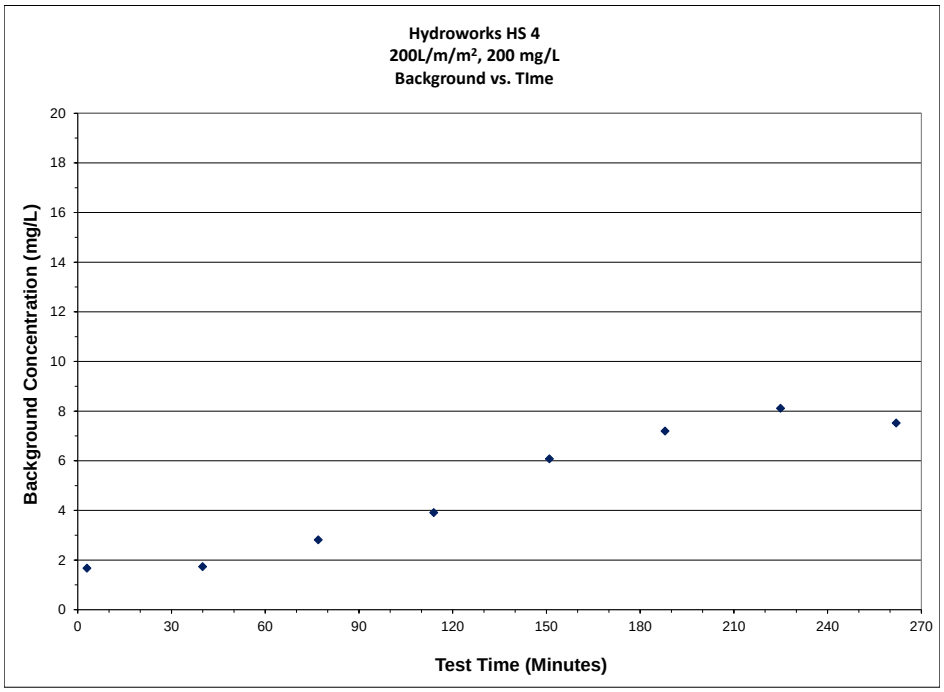


Figure 19: 200 L/min/m² Measured Background Concentrations

The total mass collected from the unit was 7.170 kg, resulting in a removal efficiency of 60.0%.

Particle Size Distribution

A well-mixed random dry sample from the test batch was collected and analyzed for PSD by the independent analytical laboratory. A well-mixed dry sediment sample from each capture region was analyzed for PSD. The PSD breakdown of the percent of injected mass captured within each region is shown in **Table 12** and the %-finer curves are shown on **Figure 20**.

Table 12:
200 L/min/m² PSD Breakdown of Injected Mass Captured

PSD Size Fraction microns	Test Sediment PSD	Total Retained
500-1000	5%	5%
250-500	5%	5%
150-250	14%	12%
100-150	12%	13%
75-100	13%	10%
50-75	4%	7%
20-50	11%	5%
8-20	14%	2%
5-8	6%	0%
2-5	9%	0%

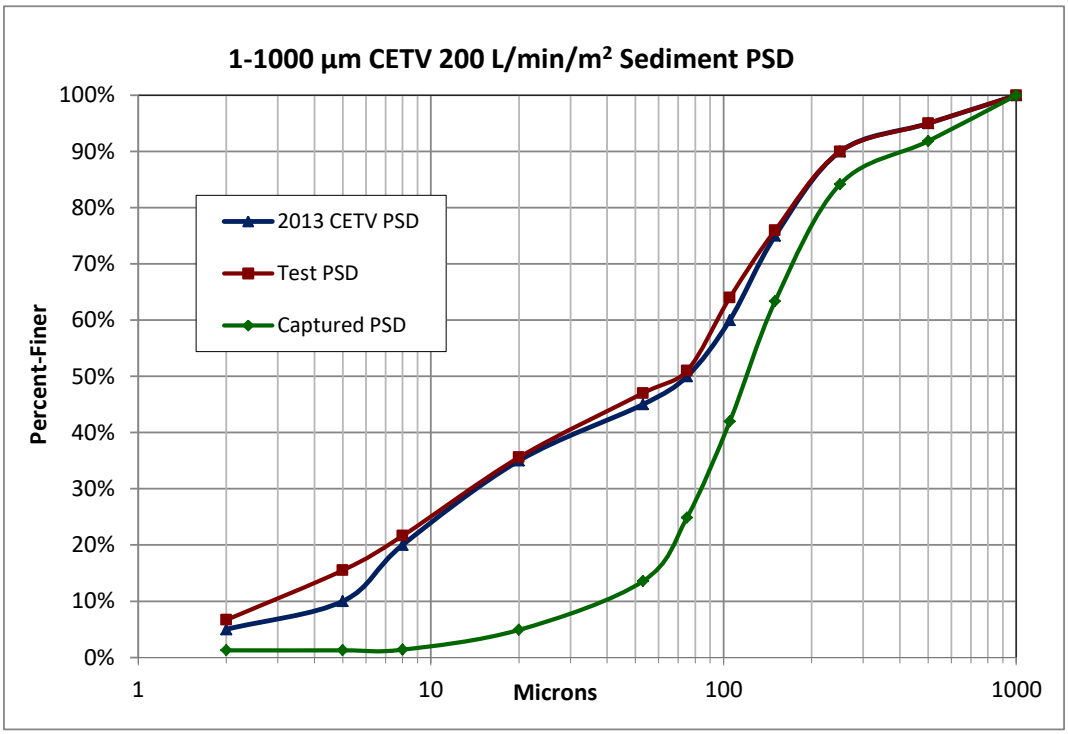


Figure 20: 200 L/min/m² Percent-Finer Curves of Test Sediment and Total Captured Mass

4.1.4 400 L/min/m² (466.8 L/min)

The test was conducted over a duration of 157 minutes to meet the minimum 11.3 kg feed requirement. The test flow was averaged and recorded every 10 seconds throughout the test. The average recorded test flow was 424.8 L/min, with a COV of 0.001. This flow is lower than the target of 467 L/min, but is within the 10% tolerance stated in the protocol. The maximum recorded temperature for the full test was 18.8 degrees C.

The injection feed rate of 84.8 g/min was verified by collecting timed weight samples from the injector. The measured influent injection concentrations for the full test ranged from 199 mg/L to 202 mg/L, with a mean of 201 mg/L and COV of 0.01. The total mass injected into the unit was 12.345 kg. The calculated mass-flow concentration for the test was 194 mg/L. The measured influent concentration data for the complete test is shown on **Figure 21**.

Eight (8) background concentrations samples were collected throughout the test and ranged from 1.4 to8.9 mg/L. The background curve is shown on **Figure 22**.

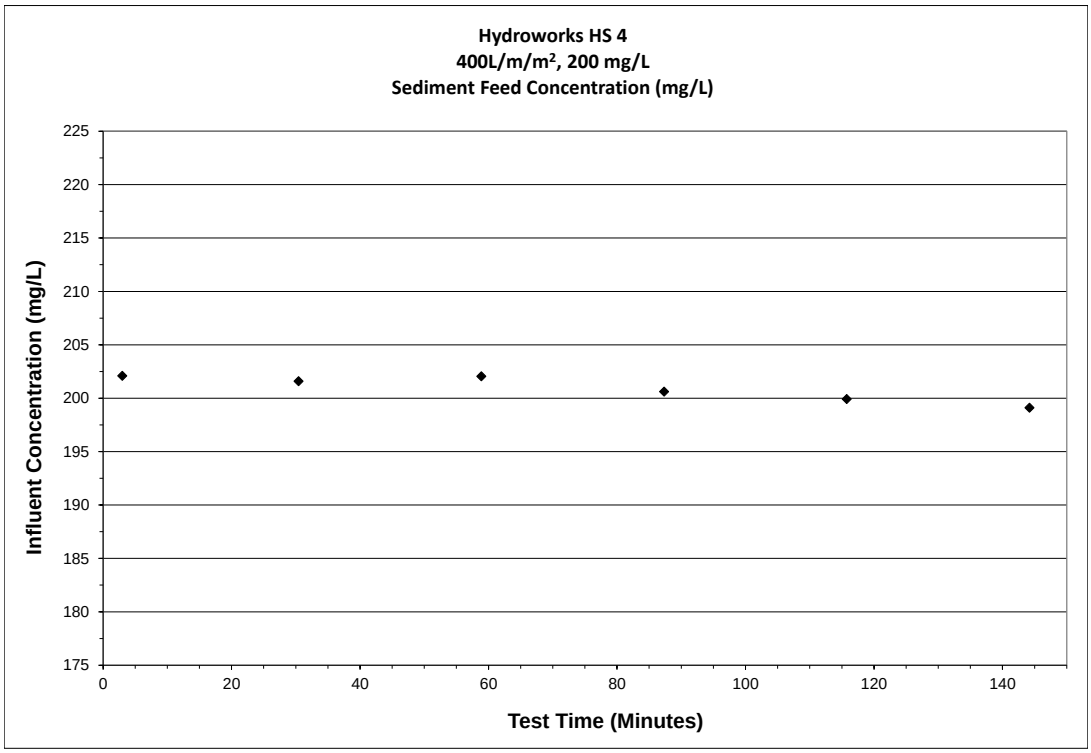


Figure 21: 400 L/min/m^2 Measured Influent Concentrations

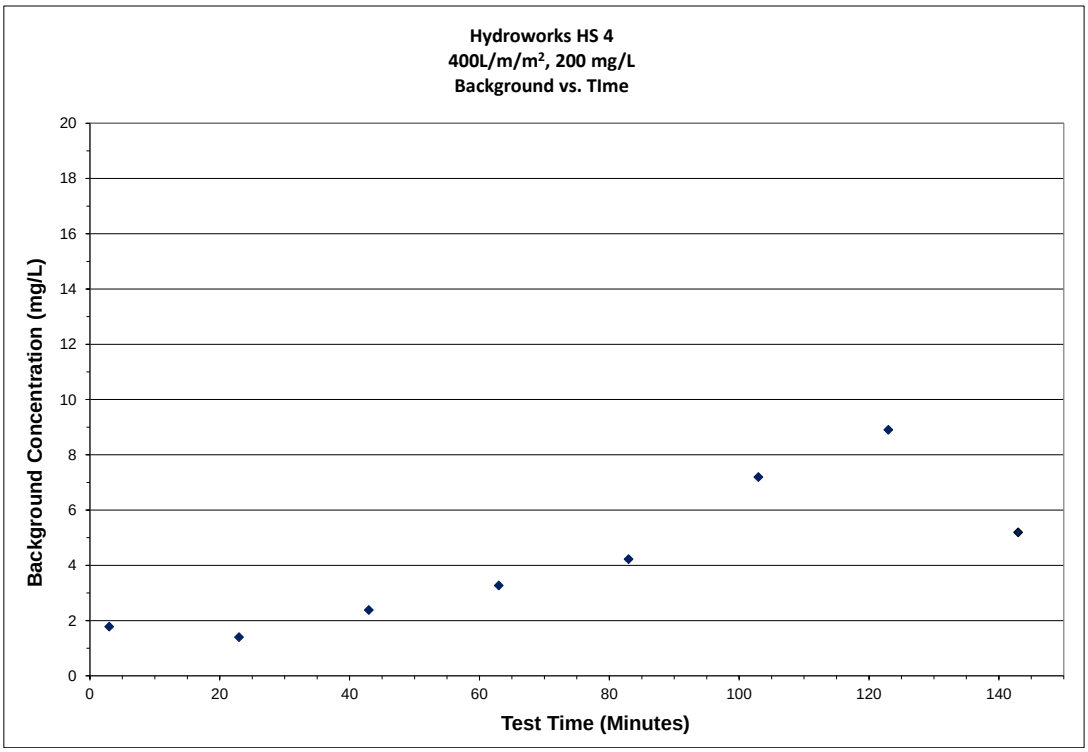


Figure 22: 400 L/min/m^2 Measured Background Concentrations

The total mass collected from the unit was 6.924 kg, resulting in a removal efficiency of 56.1%.

Particle Size Distribution

A well-mixed random dry sample from the test batch was collected and analyzed for PSD by the independent analytical laboratory. A well-mixed dry sediment sample from each capture region was analyzed for PSD. The PSD breakdown of the percent of injected mass captured within each region is shown in **Table 13** and the %-finer curves are shown on **Figure 23**.

Table 13:
400 L/min/m² PSD Breakdown of Injected Mass Captured

PSD Size Fraction microns	Test Sediment PSD	Total Retained
500-1000	5%	3%
250-500	5%	3%
150-250	16%	12%
100-150	11%	13%
75-100	12%	11%
50-75	6%	7%
20-50	10%	4%
8-20	15%	1%
5-8	7%	0%
2-5	7%	0%

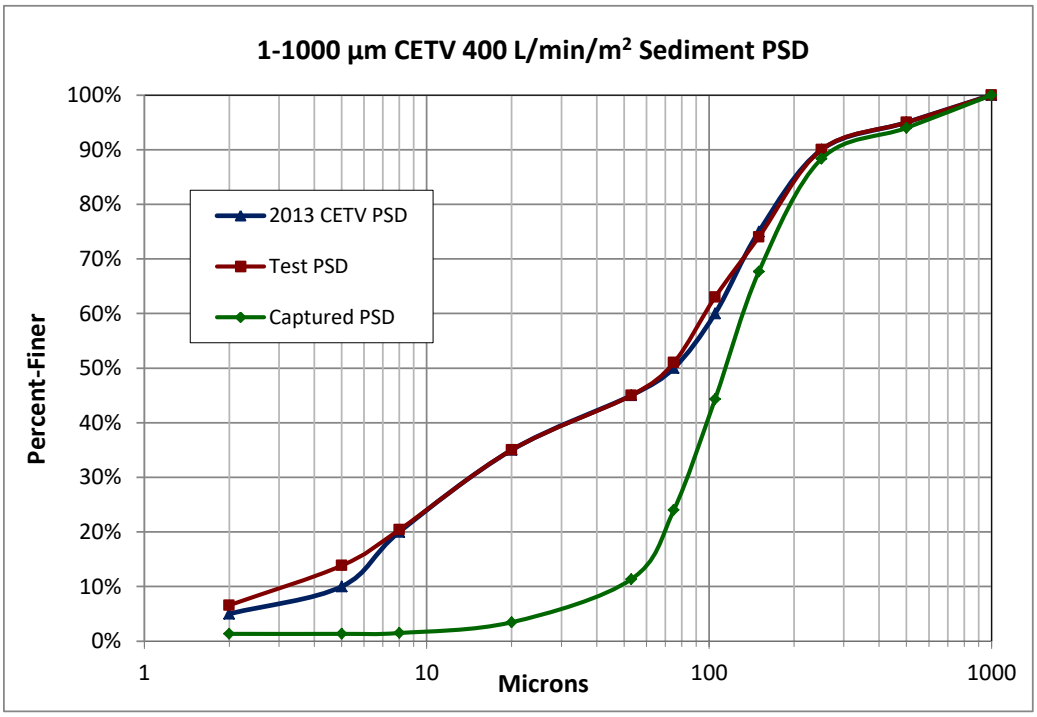


Figure 23: 400 L/min/m² Percent-Finer Curves of Test Sediment and Total Captured Mass

4.1.5 600 L/min/m^2 (700.1 L/min)

The test was conducted over a duration of 90 minutes to meet the minimum 11.3 kg feed requirement. The test flow was averaged and recorded every 10 seconds throughout the test. The average recorded test flow was 736.2 L/min, with a COV of 0.002. The maximum recorded temperature for the full test was 23.8 degrees C.

The injection feed rate of 147.6 g/min was verified by collecting timed weight samples from the injector. The measured influent injection concentrations for the full test ranged from 199 mg/L to 200 mg/L, with a mean of 199 mg/L and COV of 0.00. The total mass injected into the unit was 12.177 kg. The calculated mass-flow concentration for the test was 199 mg/L. The measured influent concentration data for the complete test is shown on **Figure 24**.

Eight (8) background concentrations samples were collected throughout the test and ranged from 0.1 to 2.6 mg/L. The background curve is shown on **Figure 25.**

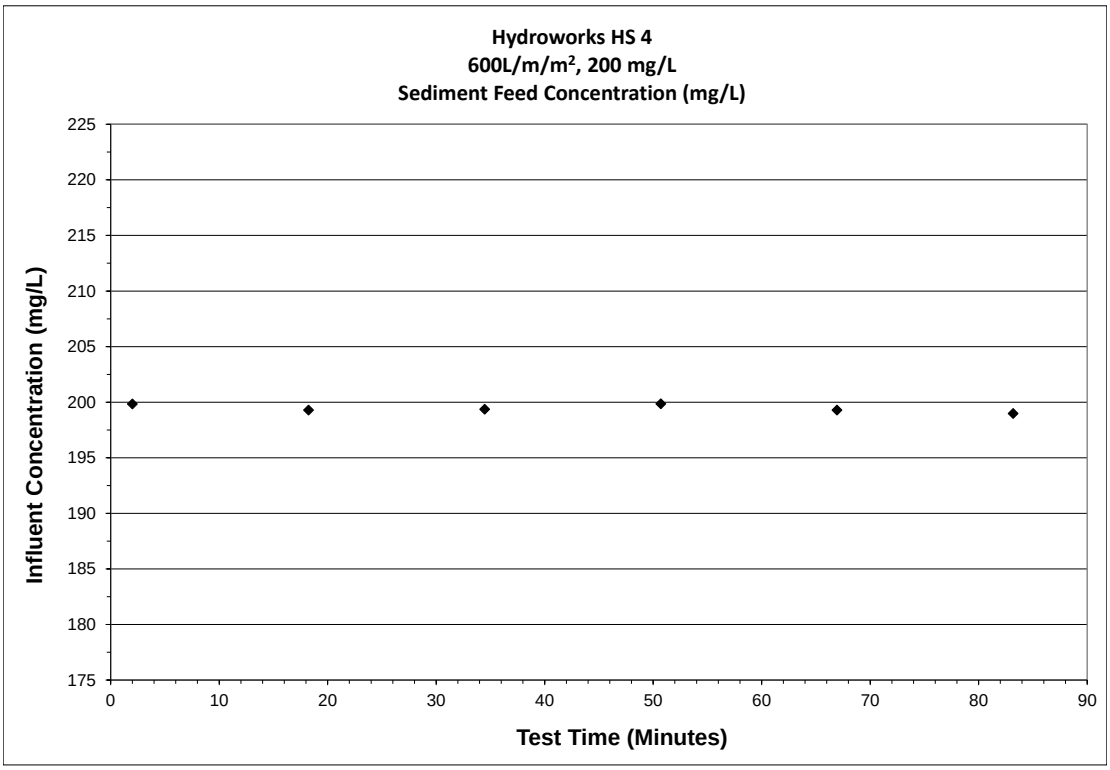


Figure 24: 600 L/min/m^2 Measured Influent Concentrations

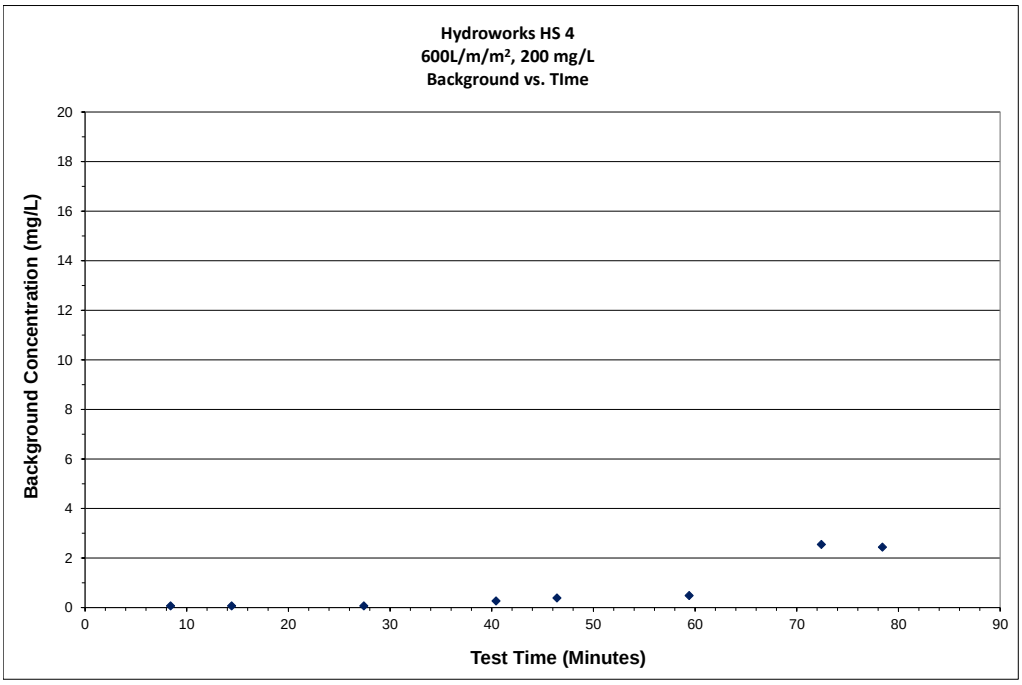


Figure 25: 600 L/min/m^2 Measured Background Concentrations

The total mass collected from the unit was 5.618 kg, resulting in a removal efficiency of 46.1%.

Particle Size Distribution

A well-mixed random dry sample from the test batch was collected and analyzed for PSD by the independent analytical laboratory. A well-mixed dry sediment sample from each capture region was analyzed for PSD. The PSD breakdown of the percent of injected mass captured within each region is shown in **Table 14** and the %-finer curves are shown on **Figure 26**.

Table 14:
600 L/min/m^2 PSD Breakdown of Injected Mass Captured

PSD Size Fraction microns	Test Sediment PSD	Total Retained
500-1000	4%	4%
250-500	4%	5%
150-250	13%	12%
100-150	14%	11%
75-100	11%	7%
50-75	7%	4%
20-50	11%	2%
8-20	18%	0%
5-8	5%	0%
2-5	8%	0%

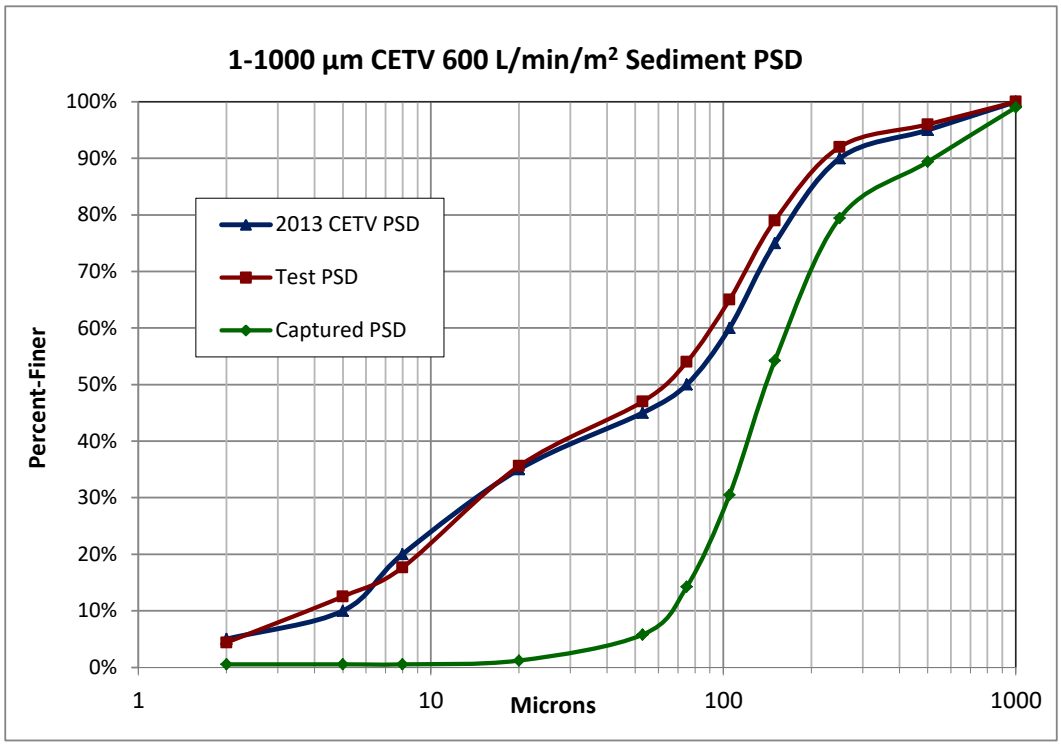


Figure 26: 600 L/min/m² Percent-Finer Curves of Test Sediment and Total Captured Mass

4.1.6 1000 L/min/m² (1167 L/min)

The test was conducted over a duration of 65 minutes to meet the minimum 11.3 kg feed requirement. The test flow was averaged and recorded every 10 seconds throughout the test. The average recorded test flow was 1104 L/min, with a COV of 0.004. The maximum recorded temperature for the full test was 19.9 degrees C.

The injection feed rate of 220.8 g/min was verified by collecting timed weight samples from the injector. The measured influent injection concentrations for the full test ranged from 199 mg/L to 200 mg/L, with a mean of 200 mg/L and COV of 0.00. The total mass injected into the unit was 12.372 kg. The calculated mass-flow concentration for the test was 197 mg/L. The measured influent concentration data for the complete test is shown on **Figure 27**.

Eight (8) background concentrations samples were collected throughout the test and ranged from 1.2 to 7.6 mg/L. The background curve is shown on **Figure 28**.

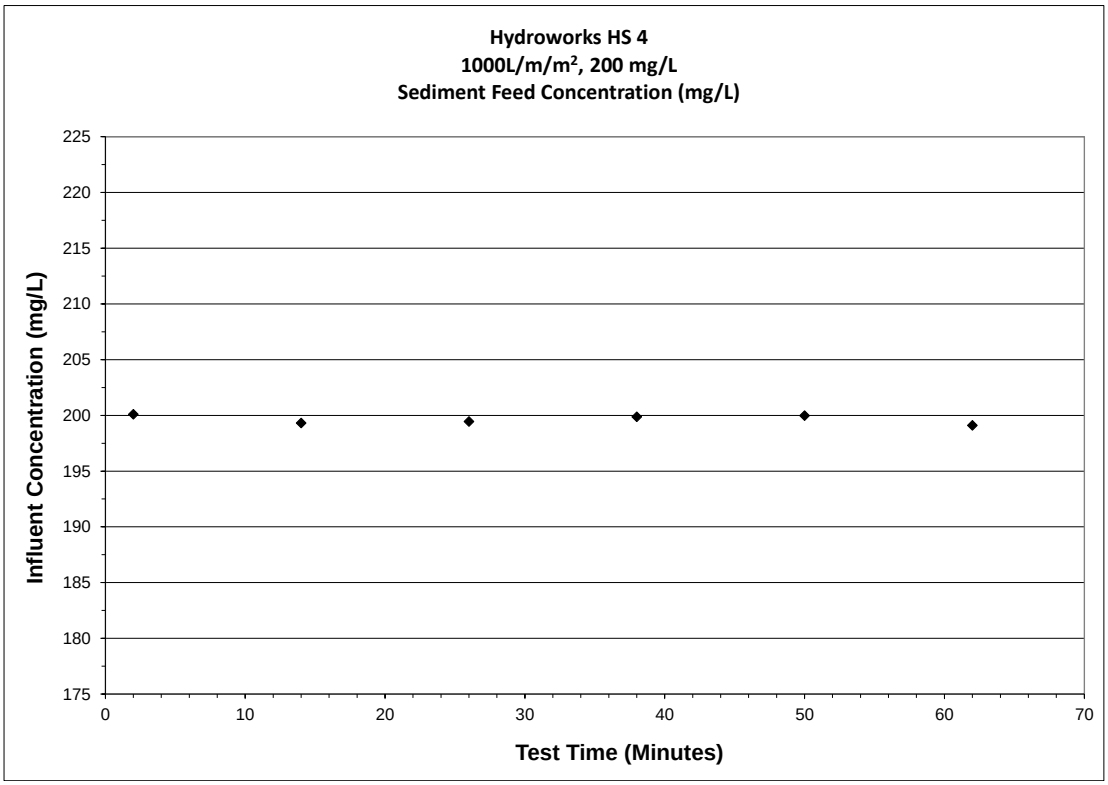


Figure 27: 1000 L/min/m^2 Measured Influent Concentrations

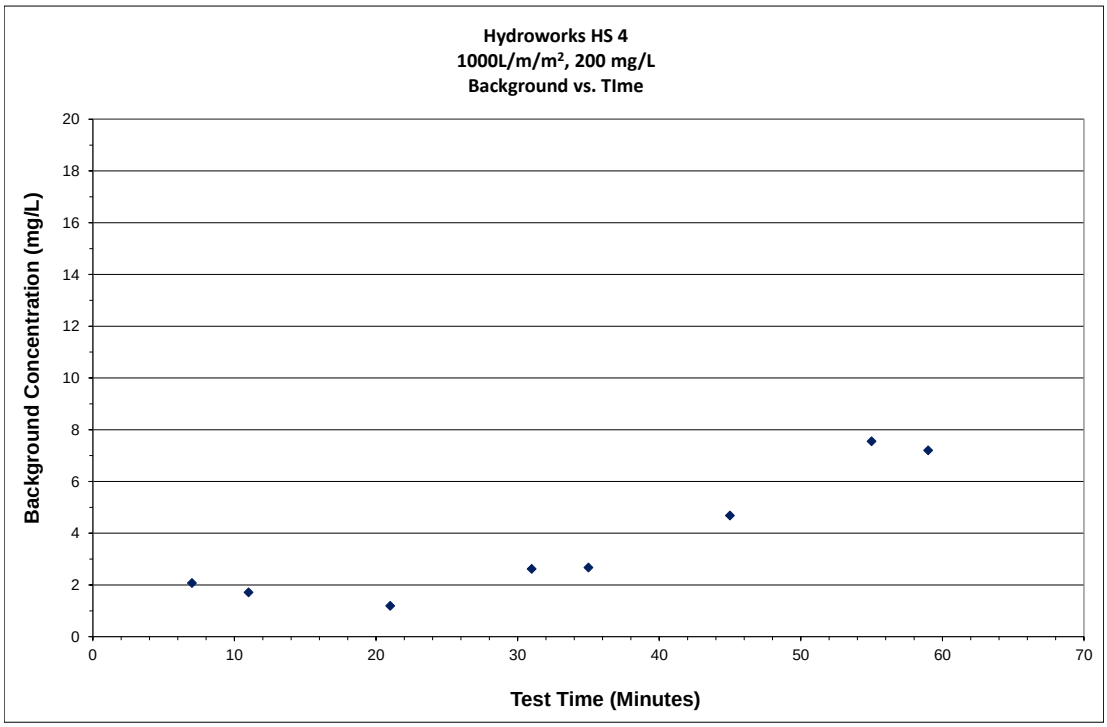


Figure 28: 1000 L/min/m^2 Measured Background Concentrations

The total mass collected from the unit was 5.093 kg, resulting in a removal efficiency of 41.2%.**4**

Particle Size Distribution

A well-mixed random dry sample from the test batch was collected and analyzed for PSD by the independent analytical laboratory. A well-mixed dry sediment sample from each capture region was analyzed for PSD. The PSD breakdown of the percent of injected mass captured within each region is shown in **Table 15** and the %-finer curves are shown on **Figure 29**.

Table 15:
1000 L/min/m² PSD Breakdown of Injected Mass Captured

PSD Size Fraction microns	Test Sediment PSD	Total Retained
500-1000	4%	4%
250-500	4%	4%
150-250	19%	11%
100-150	10%	10%
75-100	12%	7%
50-75	4%	3%
20-50	10%	1%
8-20	16%	0%
5-8	6%	0%
2-5	9%	0%

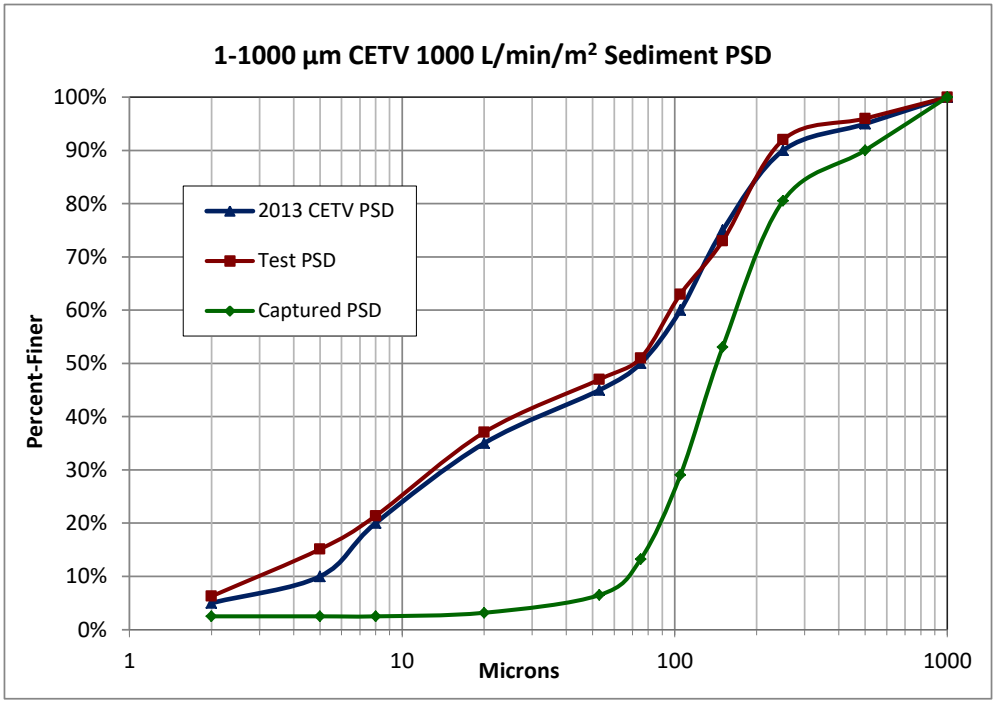


Figure 29: 1000 L/min/m² Percent-Finer Curves of Test Sediment and Total Captured Mass

4.1.7 1400 L/min/m^2 (1634 L/min)

The test was conducted over a duration of 45 minutes to meet the minimum 11.3 kg feed requirement. The test flow was averaged and recorded every 5 seconds throughout the test. The average recorded test flow was 1628 L/min, with a COV of 0.002. The maximum recorded temperature for the full test was 18.8 degrees C.

The injection feed rate of 327.6 g/min was verified by collecting timed weight samples from the injector. The measured influent injection concentrations for the full test ranged from 199 mg/L to 200 mg/L, with a mean of 200 mg/L and COV of 0.00. The total mass injected into the unit was 12.586 kg. The calculated mass-flow concentration for the test was 194 mg/L. The measured influent concentration data for the complete test is shown on **Figure 30.**

Eight (8) background concentrations samples were collected throughout the test and ranged from 0.3 to 4.0 mg/L. The background curve is shown on **Figure 31**.

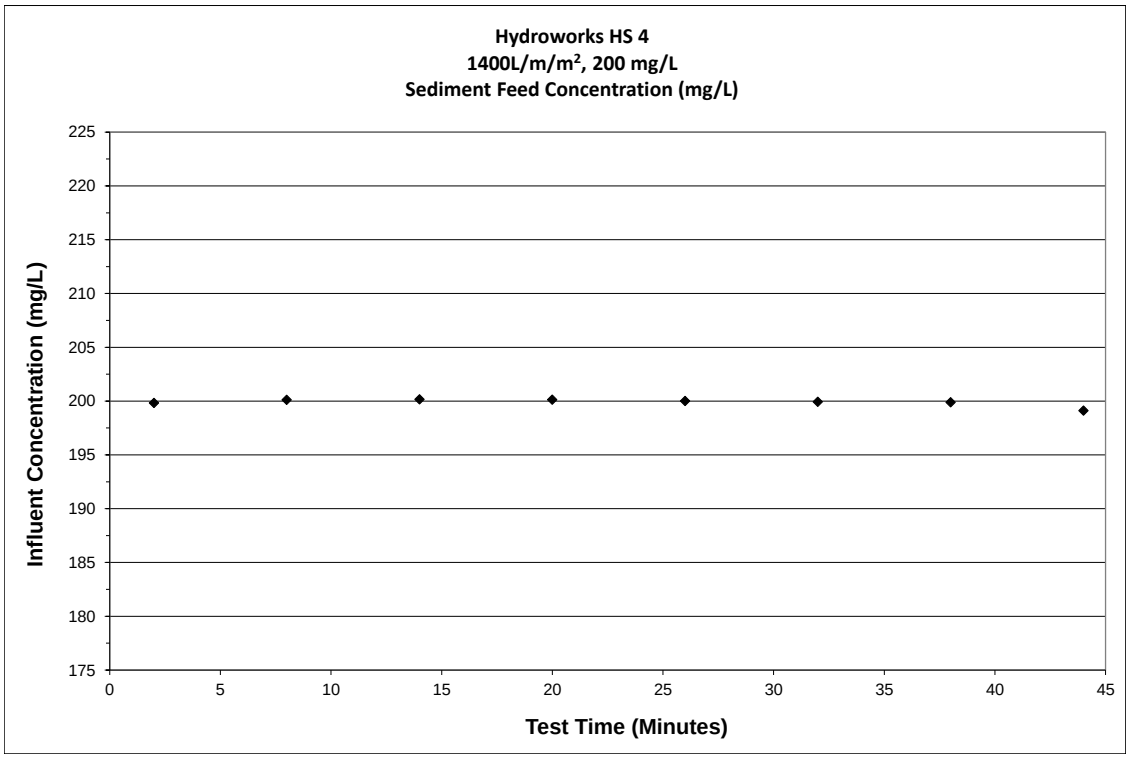


Figure 30: 1400 L/min/m^2 Measured Influent Concentrations

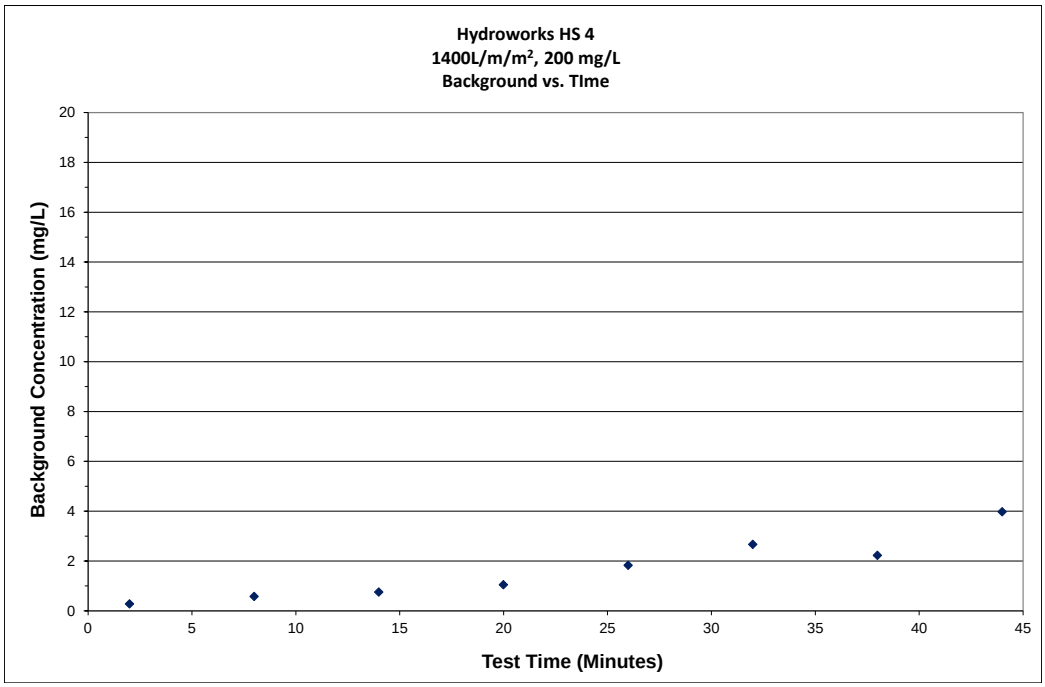


Figure 31: 1400 L/min/m^2 Measured Background Concentrations

The total mass collected from the unit was 4.498 kg, resulting in a removal efficiency of 35.7%.

Particle Size Distribution

A well-mixed random dry sample from the test batch was collected and analyzed for PSD by the independent analytical laboratory. A well-mixed dry sediment sample from each capture region was analyzed for PSD. The PSD breakdown of the percent of injected mass captured within each region is shown in **Table 16** and the %-finer curves are shown on **Figure 32**.

Table 16:
1400 L/min/m^2 PSD Breakdown of Injected Mass Captured

PSD Size Fraction microns	Test Sediment PSD	Total Retained
500-1000	5%	1%
250-500	5%	2%
150-250	16%	11%
100-150	11%	10%
75-100	13%	6%
50-75	5%	3%
20-50	10%	1%
8-20	14%	0%
5-8	6%	0%
2-5	9%	0%

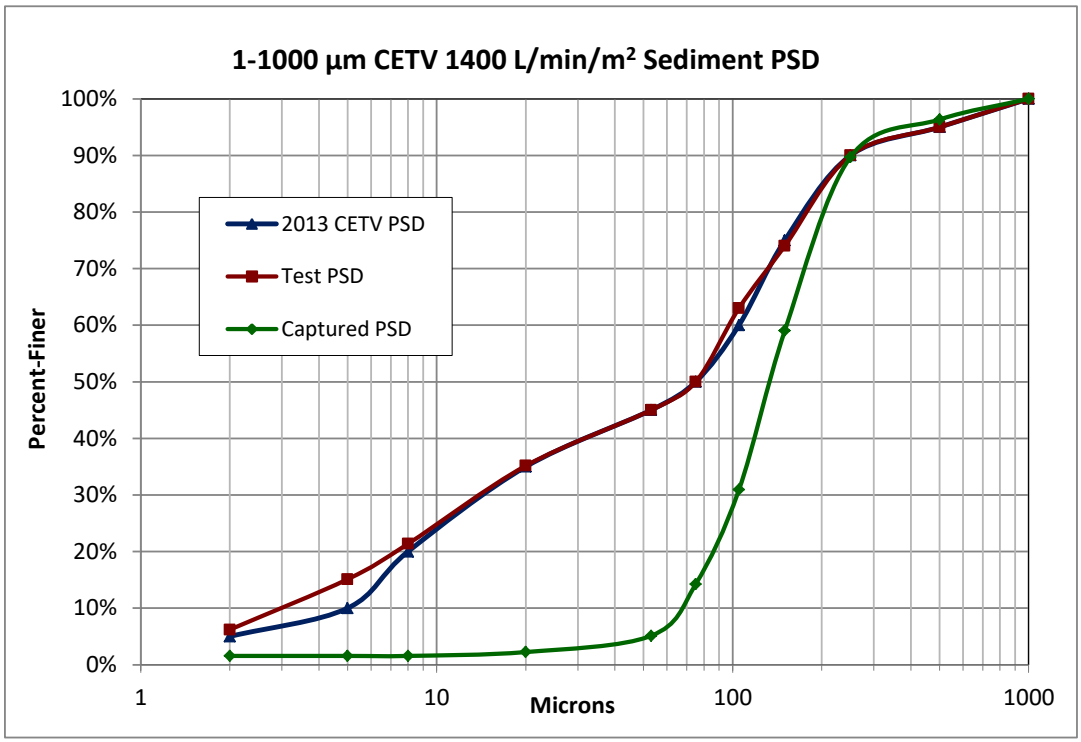


Figure 32: 1400 L/min/m² Percent-Finer Curves of Test Sediment and Total Captured Mass

4.1.8 Perforated Secondary Plate Test 600 L/min/m² (700.1 L/min)

The certification tests resulted in sediment deposition on the solid secondary plate, which consequently required the plate to be preloaded for scour testing. Taking into account the close proximity of the plate to the collection sump, as well as our knowledge of sediment transport, it is expected that the deposited sediment would have settled in the lower sump, with no impact on removal efficiency, if the plate was removed. Since the purpose of the plate is to protect the sump from potential scour, the plate was replaced with a 32% open-area perforated plate of the same geometry (size and orientation). The plate would provide a means for the sediment to deposit in the sump, while still providing a sufficient level of protection against scour. A repeat test was conducted at 600 L/min/m² to confirm that the new plate would produce the same flow and removal characteristics as the solid plate. PSD analyses were not conducted, being unnecessary to achieve the goal of the test.

The test was conducted over a duration of 90 minutes to meet the minimum 11.3 kg feed requirement. The test flow was averaged and recorded every 10 seconds throughout the test. The average recorded test flow was 740.9 L/min, with a COV of 0.003. The maximum recorded temperature for the full test was 16.1 degrees C.

The injection feed rate of 147.6 g/min was verified by collecting timed weight samples from the injector. The measured influent injection concentrations for the full test ranged from 199 mg/L to 200 mg/L, with a mean of 199 mg/L and COV of 0.00. The total mass injected into the unit was 12.035 kg. The

calculated mass-flow concentration for the test was 194 mg/L. The measured influent concentration data for the complete test is shown on **Figure 24**.

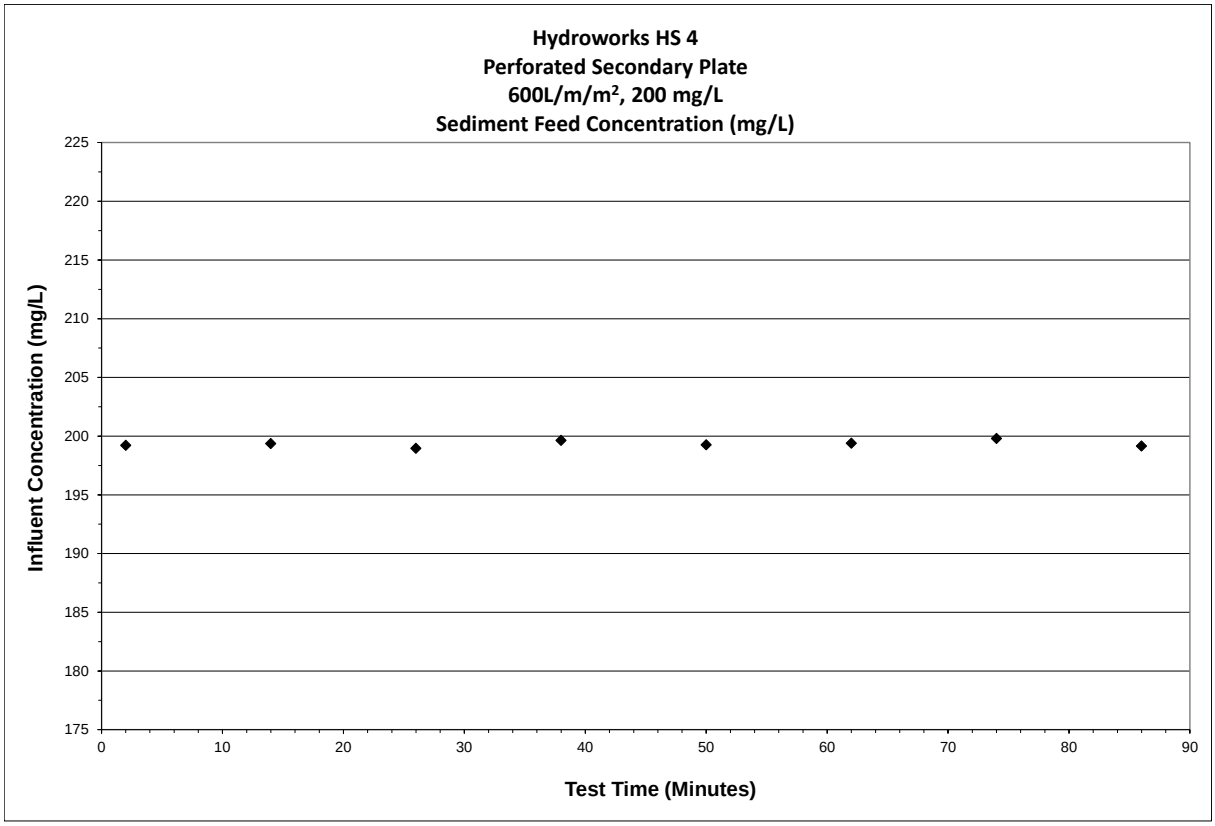


Figure 33: 600 L/min/m^2 Perforated Plate Measured Influent Concentrations

Eight (8) background concentrations samples were collected throughout the test. Approximately halfway through the test, it was observed that an internal sump wall had developed a crack, which allowed raw effluent to bypass the filtration wall. The testing was not terminated for the following reasons: 1) the impact of the breach on the background concentrations would not be known until the test was completed, and 2) being a closed-loop system, any increase in concentration is a result of the fine injected particles not being captured by the treatment system and therefore, will not skew the mass balance results. The concentration did exceed the 20 mg/L limit, with values ranging from 0.2 to 28.4 mg/L. The background curve is shown on **Figure 25.**

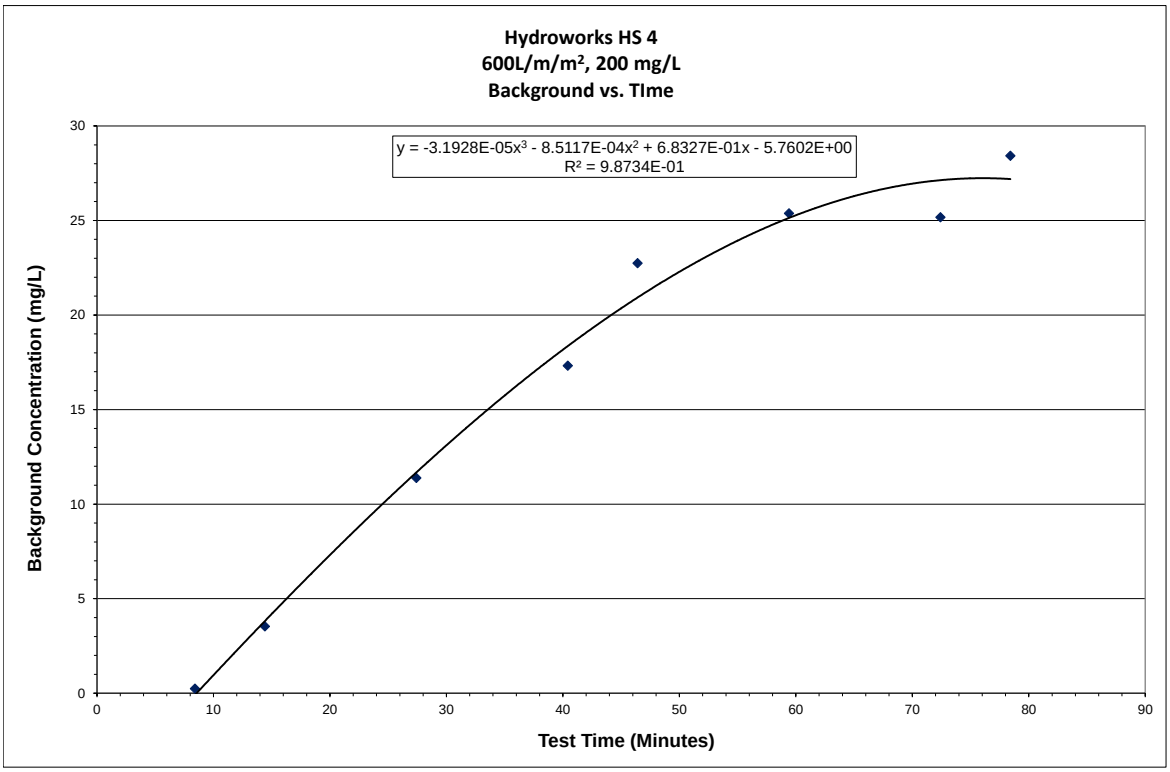


Figure 34: 600 L/min/m^2 Measured Background Concentrations

The total mass collected from the unit was 5.529 kg, resulting in a removal efficiency of 45.9%. This matches well with the previous test removal of 46.1%. The quantified deposition from the perforated plate was 2.7%, significantly lower than the 8.5% collected from the solid plate. This material was collected along the outer edge of the plate where it attaches to the mounting ring. The quantity of sediment collected from the sump increased by the same margin, validating the statement that the material from the solid plate would have been collected in the lower sump. The capture splits for the solid and perforated plate tests are summarized in **Table 17**.

Table 17:
600 L/min/m^2 Summary of Injected Mass Captured

	Flow	Tested Flow	Removal Efficiency	Pretreatment Channel	Secondary Plate	Outlet Dispersion Plate	Collection Sump
	L/min/m^2	L/min	%	%	%	%	%
Solid Plate	600	736.2	46.1	24.7	8.5	3.1	9.9
Perforated Plate	600	740.9	45.9	25.8	2.7	3.0	14.5

4.2 Sediment Re-Suspension and Washout

A false floor was installed in the collection sump to reduce the quantity of sediment required for the test. The sump was uniformly preloaded to the 50% sump capacity level (15.2 cm), with a minimum depth of 10.2 cm of 1-1000 micron sediment shown in **Table 1**.

Removal efficiency testing resulted in sediment deposition of <10% on the secondary plate at the lower flows (<5% at 1400 SLR). However, TRCA requested that the Secondary Plate surface be preloaded to a depth of 10.2 cm prior to conducting the re-suspension test. The leading edge was tapered at an angle of approximately 45 degrees to reduce slumping. The test was conducted as described in **Section 3.2.3** , with target surface loading rates of 200, 800, 1400, 2000 and 2600 L/min/m^2.

The average measured flow data recorded throughout the test is shown in Error! Reference source not found. and all recorded data on **Figure 35.** Seven (7) background samples were collected throughout the duration of the test. The measured concentrations ranged from 0.7 to 17.1 mg/L, as shown on **Figure 36**. A 3rd-order curve equation was established for adjusting the effluent concentrations.

Table 18:
Resuspension Flow Summary

Target SLR	Measured SLR	Deviation from Target	COV	QA / QC Compliant
200	204.8	2.4%	0.019	**Yes**
800	804.2	0.5%	0.004	**Yes**
1400	1407.8	0.6%	0.027	**Yes**
2000	2023.8	1.2%	0.002	**Yes**
2600	2622.7	0.9%	0.002	**Yes**

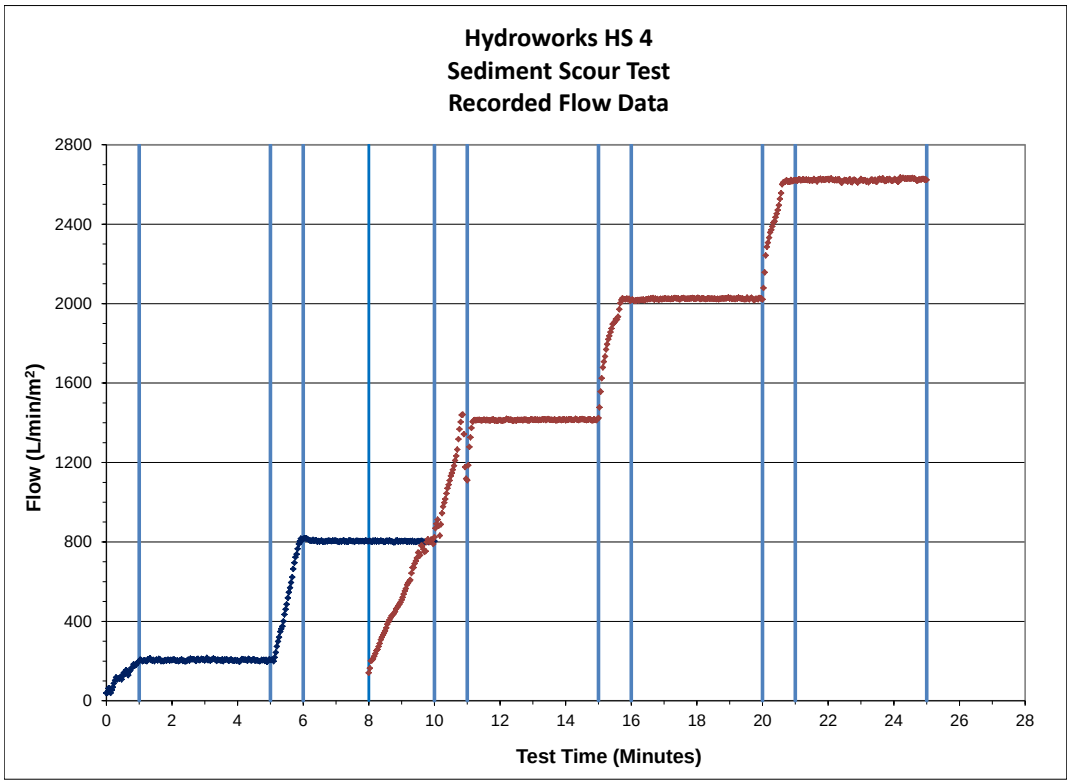


Figure 35: Scour Test Recorded Flow Data

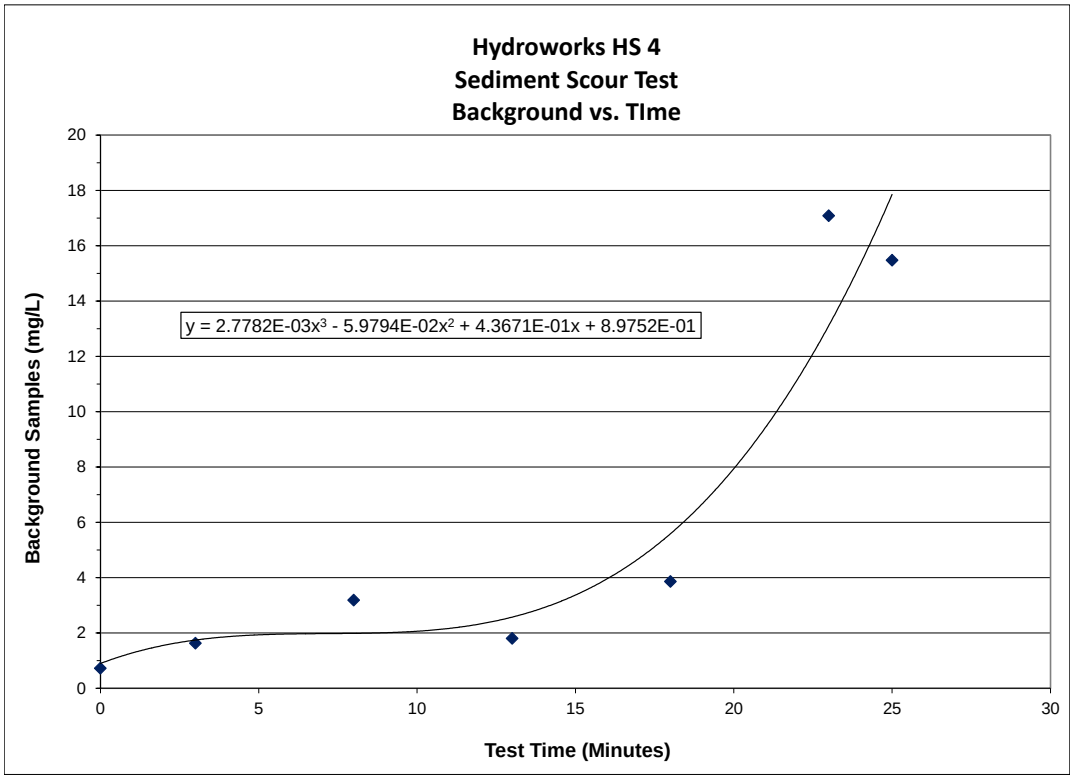


Figure 36: Measured Background Concentrations

Measured effluent sediment concentrations (adjusted for background) increased over the surface loading rates of 200, 800 and 1400 L/min/m^2, after which it decreased due to bypass flow. The average concentration for each tested SLR was 40.2, 71.0, 271.2, 227.1 and 128.5 mg/L, respectively. The concentrations were adjusted for particle size, based on a D_5 of 7.0 microns for the 40 L/min/m^2 removal efficiency test. The D_5 adjusted effluent concentrations were 11.3, 28.9, 196.7, 175.4 and 99.9 mg/L, respectively. The effluent data is shown in Error! Reference source not found. and the corresponding curves are shown on Error! Reference source not found..

The unit was slowly decanted after the completion of the test. It was observed that most of the Secondary Plate was devoid of sediment. A measurement of the sump depth revealed an increase of approximately 7 cm. This leads to a conclusion that most of the sediment from the Secondary Plate was carried into the lower sump. It can also be concluded that the fine material loaded on the Secondary Plate was re-suspended and conveyed out of the unit with the flow, as the velocity in the unit is higher than the fall velocity of the fine sediment.

Table 19
Measured Scour Effluent Concentrations (mg/L) Adjusted for Background

Measured Concentration at Each surface Loading Rate					
Effluent Sample No.	200 L/min/m^2	800 L/min/m^2	1400 L/min/m^2	2000 L/min/m^2	2600 L/min/m^2
1	32.4	58.0	68.5	255.7	138.5
2	38.8	120.7	188.1	254.8	128.6
3	37.4	75.5	329.0	238.0	113.6
4	40.1	55.8	417.5	216.7	144.7
5	52.1	44.9	352.9	170.3	117.1
Average	**40.2**	**71.0**	**271.2**	**227.1**	**128.5**
D_5 Correction	**11.3**	**28.9**	**196.7**	**175.4**	**99.9**

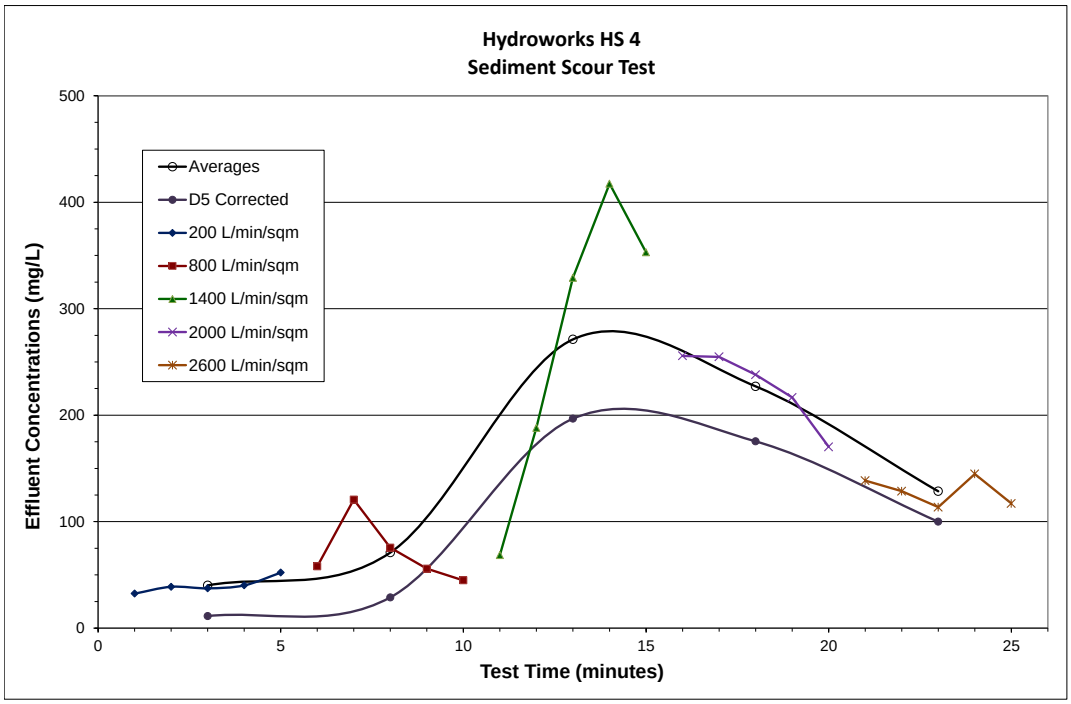


Figure 37: Scour Testing Effluent Concentrations Adjusted for Background

4.2.1 Perforated Plate Sediment Re-Suspension and Washout

A repeat scour test was conducted with the perforated secondary plate installed. The sump was uniformly preloaded to the 50% sump capacity level (15.2 cm), with a minimum depth of 10.2 cm of 1-1000 micron sediment shown in **Table 1**. The pretreatment channel was preloaded with 22 kg of sediment that was collected at the lower flows during removal testing, as shown on **Figure 38**. This is the scientifically correct approach, as the channel is designed to capture the coarse particles prior to the flow entering the inner chamber. A sieve analysis conducted on the material showed good correlation above 53 microns and a finer distribution below 53 microns. This indicates that there was still "flour" material (<53 microns) remaining from the previous adjusted scour test blend and is still conservative.

The average measured flow data recorded throughout the test is shown in Error! Reference source not found. and all recorded data on **Figure 35.** Seven (7) background samples were collected throughout the duration of the test. The measured concentrations ranged from 2.4 to 10.4 mg/L, as shown on **Figure 36**. A 3rd-order curve equation was established for adjusting the effluent concentrations.

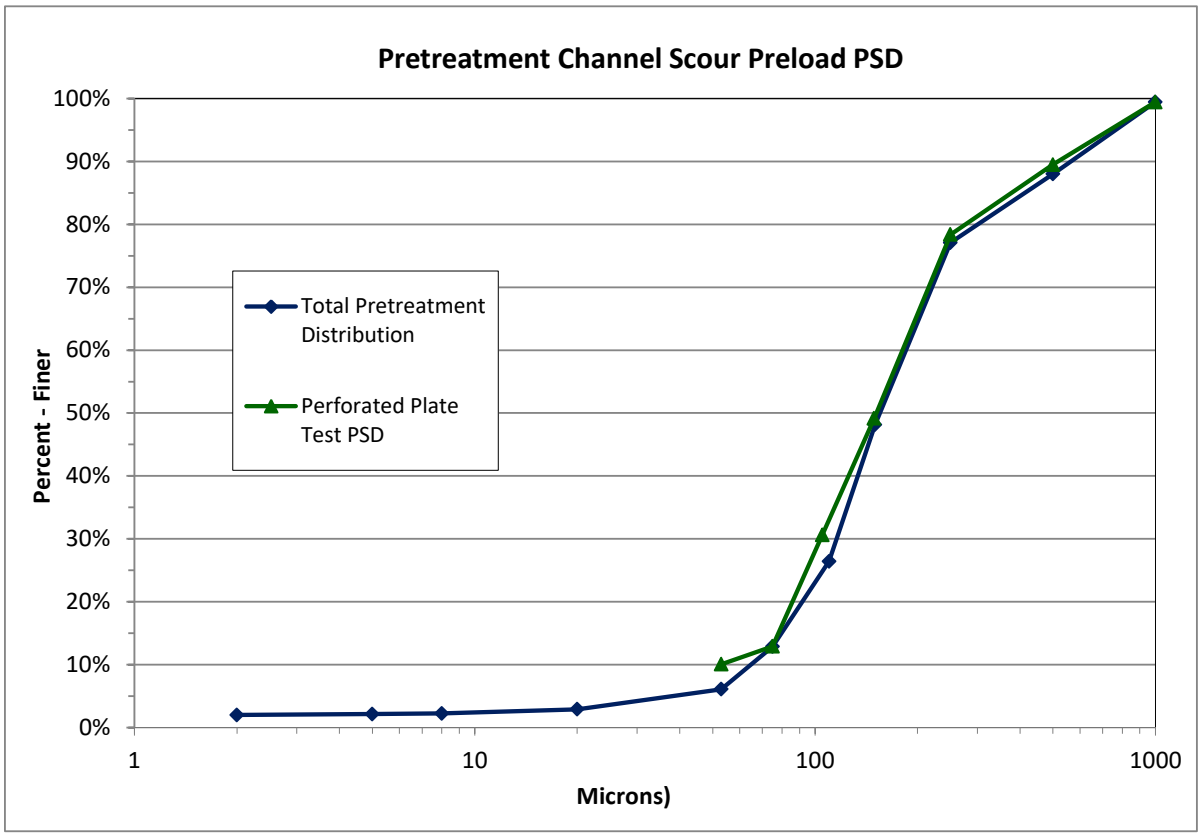


Figure 38: Repeat Scour Test Pretreatment Channel Preloaded PSD

Table 20
Repeat Scour Test Flow Summary

Target SLR	Measured SLR	Deviation from Target	COV	QA / QC Compliant
200	201.0	0.5%	0.020	**Yes**
800	805.9	0.7%	0.003	**Yes**
1400	1428.2	2.0%	0.006	**Yes**
2000	2009.9	0.5%	0.002	**Yes**
2600	2609.8	0.4%	0.002	**Yes**

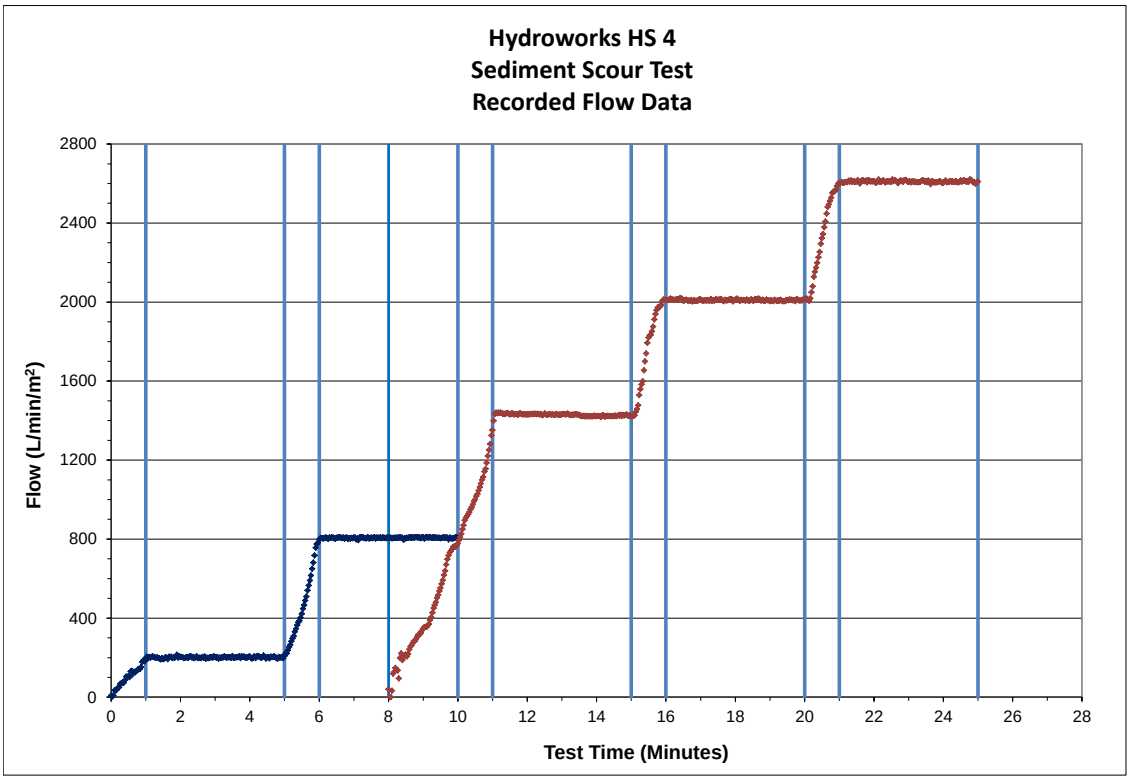


Figure 39: Repeat Scour Test Recorded Flow Data

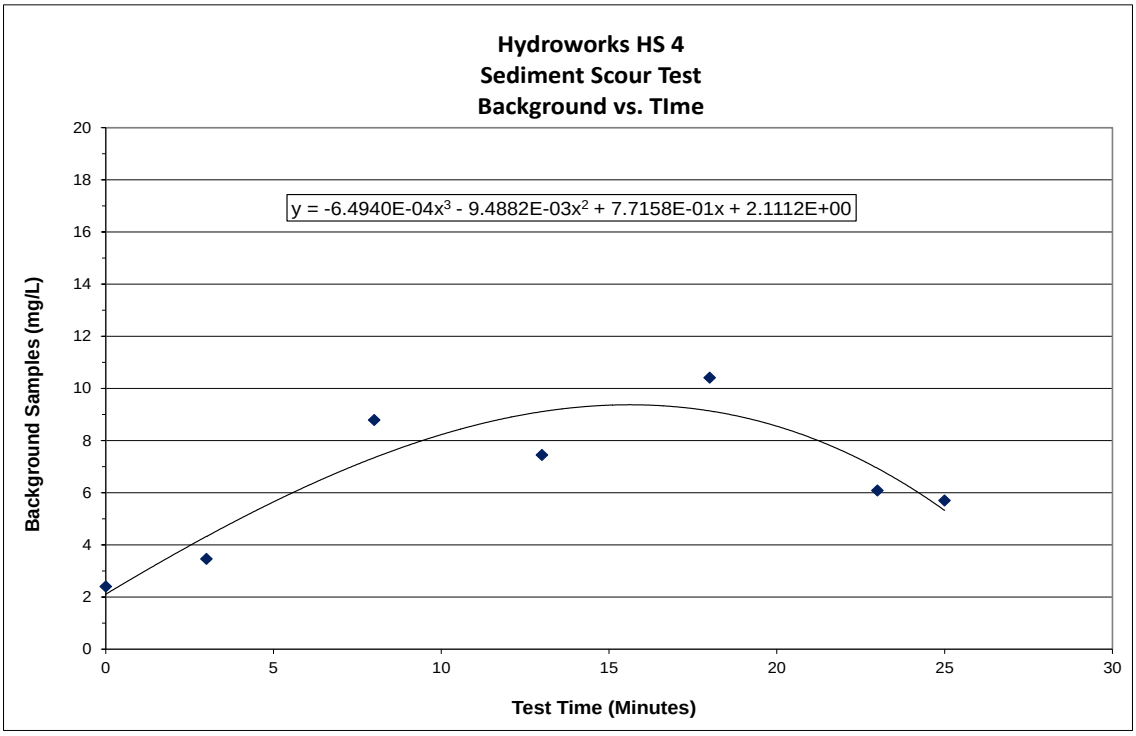


Figure 40: Measured Background Concentrations

The average concentration for each tested SLR was 37.2, 37.1, 24.1, 24.1 and 29.8 mg/L, respectively. The concentrations were adjusted for particle size, based on a D_5 of 7.0 microns for the 40 L/min/m^2 removal efficiency test. The D_5 adjusted effluent concentrations were 22.4, 28.5, 20.0, 19.1 and 24.4 mg/L, respectively. The effluent data is shown in Error! Reference source not found. and the corresponding curves are shown on Error! Reference source not found..

Table 21
Measured Scour Effluent Concentrations (mg/L) Adjusted for Background

Measured Concentration at Each surface Loading Rate					
Effluent Sample No.	200 L/min/m^2	800 L/min/m^2	1400 L/min/m^2	2000 L/min/m^2	2600 L/min/m^2
1	50.6	18.2	14.7	17.3	30.5
2	49.4	59.1	27.4	34.6	35.2
3	38.6	43.0	36.3	28.4	33.1
4	27.4	39.0	24.1	21.6	24.8
5	19.9	26.0	18.1	18.5	25.5
Average	**37.2**	**37.1**	**24.1**	**24.1**	**29.8**
D_5 Correction	**22.4**	**28.5**	**20.0**	**19.1**	**24.4**

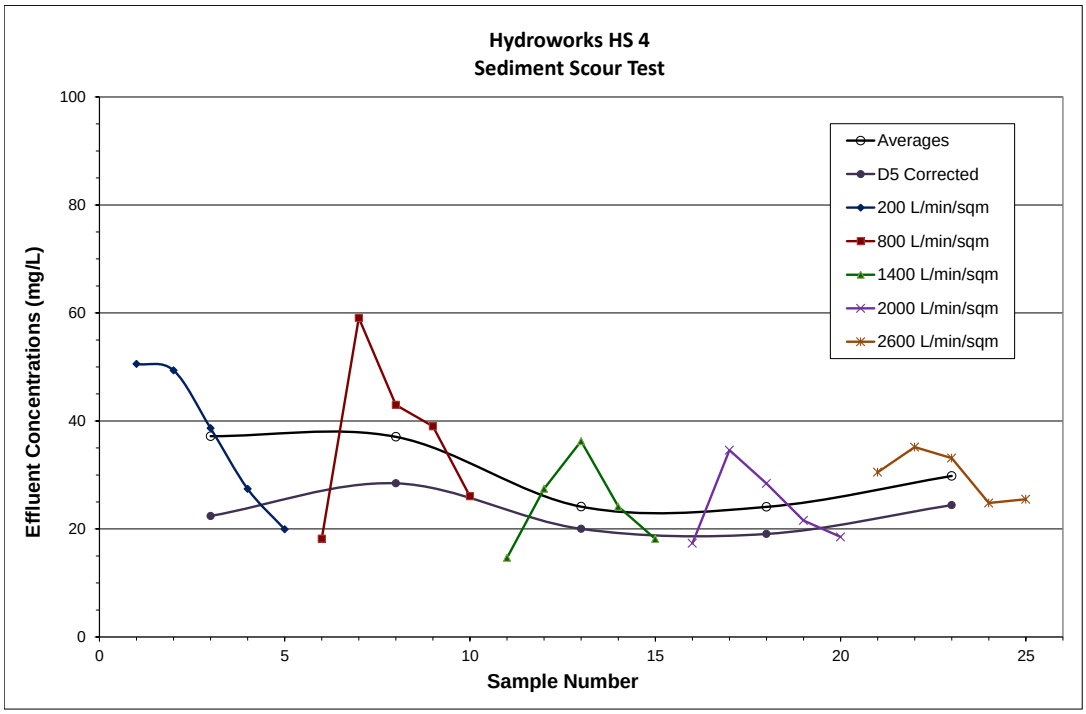


Figure 41: Scour Testing Effluent Concentrations Adjusted for Background

4.3 Light-Liquid Re-Entrainment Simulation

A light-liquid re-entrainment test was conducted using Dow Chemical Dowlex^{tm} 2517 low-density polyethylene beads. The product density of 0.917 g/cm^2 was verified by an independent analytical laboratory using ASTM D1238 and ASTM D792 methods.

The inner chamber of the HS 4 unit was filled with 58.3 liters (33.4 kg) of pellets, which corresponded to a 5cm depth over the collection sump area of 1.17m^2. The test was conducted in accordance with the procedure described in **Section 3.2.4**, at the SLR of 200, 800, 1400, 2000 and 2600 L/min/m^2.

The recorded SLR flow data for the test is graphically shown on Error! Reference source not found.. All recorded flows were within 1% of the targets, with a maximum COV of 0.011. The recorded average flow data, as well as quantified volume and mass of collected pellets for each target SLR and overall test, is shown in Error! Reference source not found.. The maximum re-entrainment of 4.6% occurred at 1400 L/min/m^2, which is the 100% treatment flow and start of bypass. The re-entrainment diminished to 4.3% and 2.5% with each subsequent flow. The total volume re-entrained from the oil collection region for the entire test was 11.7%, for a retention rate of 88.3%.

Table 22:
Light-liquid Recorded Flow and Re-entrainment Data

Light-liquid Re-Suspension Data				Starting Volume	(Liters) 58.3	Starting Mass	(grams) 33399	Hydroworks HG4	
						Measured		Calculated Percentages	
Action	Time Stamp (minutes)	Meter	Target Flow (L/min/m^2)	Recorded Flow (L/min/m^2)	COV	Collected Volume (Liters)	Collected Mass (grams)	Collected Volume (Liters)	Collected Mass (grams)
Start D.A. Recording	0.0								
Flow set	1.0	4"	200	**199**	0.021	0	0	**0.0%**	**0.0%**
Stop Collection	6.0			-0.6%					
Flow set	7.0	4"	800	**807**	0.005	0.1	49	**0.1%**	**0.1%**
Stop Collection	12.0			0.9%					
Flow set	13.0	8"	1400	**1408**	0.002	2.7	1523	**4.6%**	**4.6%**
Stop Collection	18.0			0.6%					
Flow set	19.0	8"	2000	**2014**	0.002	2.5	1445	**4.3%**	**4.3%**
Stop Collection	24.0			0.7%					
Flow set	25.0	8"	2600	**2608**	0.002	1.5	847	**2.5%**	**2.5%**
Stop Collection	30.0			0.3%					
				Interim Collection Net		0.1	39	**0.1%**	**0.1%**
				Total		**6.8**	**3902**	**11.7%**	**11.7%**
						Pellets Retained		**88.3%**	**88.3%**

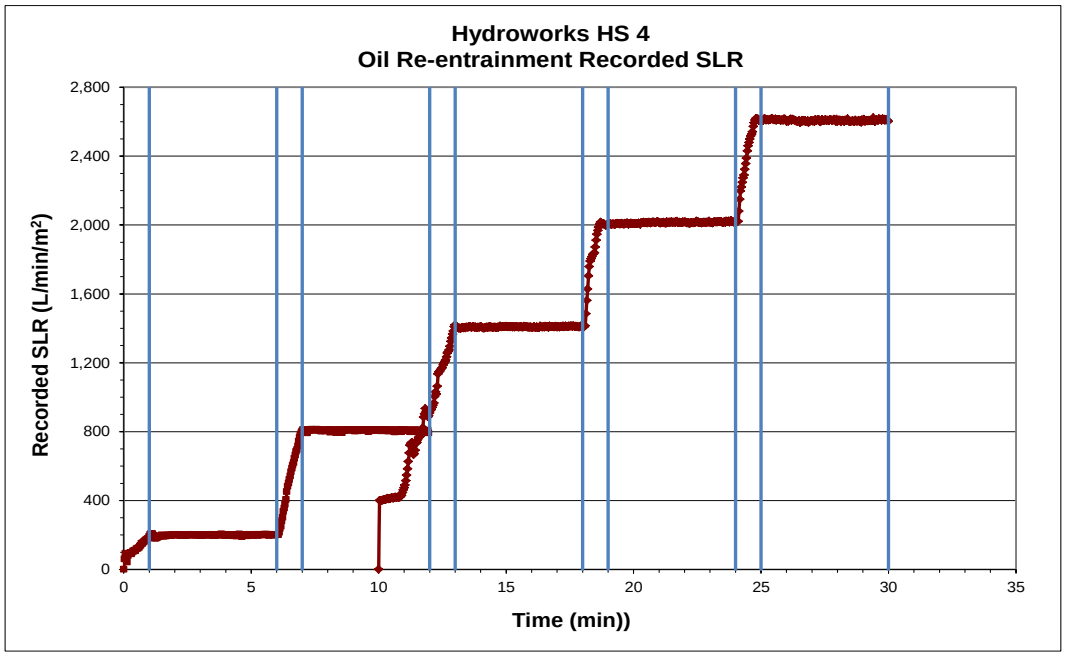


Figure 42: Recorded Light-liquid SLR Flow Data

4.4 Hydraulic Characteristics

Piezometer taps were installed in the unit as described in **Section 3.2.1**. Flow (L/min) and water level (meters) within the unit were measured for 15 flows ranging from 0 to 6606 L/min. The influent pipe was flowing full at approximately 5730 L/min. The entrance to the effluent pipe was submerged at approximately 6600 L/min. The flow reached bypass at 1630 L/min. The recorded data is shown in **Table 23** and the Elevation Curves for each pressure tap location are shown on Error! Reference source not found.**.** The pressure data for the inlet and outlet pipes were corrected for energy.

Table 23:
Recorded Flow and Elevation Data

Measured Flow	Water Elevations (adjusted to outlet invert)						Losses			
	Inlet Pipe	Inlet Area	Pretreatment Channel	Inner Chamber	Outlet Shelf	Outlet Pipe	Inlet El. (A')	Outlet El. (E')	System Energy Loss	Loss Coeff.
	A		B	C	D	E	Corrected for Energy	Corrected for Energy	A'-E'	Outlet Area
L/min	m	sq-m	m	m	m	m	m	m	m	Cd
0.0	0.052	0.000	0.000	0.000	0.000	-0.003	0.052	0.000	0.000	0.000
94.7	0.076	0.003	0.047	0.039	0.039	0.020	0.091	0.047	0.043	0.025
190.0	0.087	0.005	0.061	0.057	0.057	0.029	0.107	0.064	0.042	0.050
379.9	0.099	0.008	0.086	0.081	0.080	0.044	0.132	0.085	0.047	0.095
571.2	0.109	0.010	0.110	0.101	0.098	0.056	0.152	0.101	0.051	0.137
764.9	0.119	0.013	0.132	0.119	0.113	0.067	0.168	0.116	0.051	0.182
1052.7	0.158	0.025	0.166	0.143	0.132	0.081	0.183	0.135	0.048	0.260
1325.0	0.197	0.038	0.199	0.164	0.147	0.091	0.214	0.152	0.062	0.288
1631.9	0.244	0.055	0.245	0.188	0.165	0.104	0.257	0.168	0.089	0.296
1901.7	0.262	0.061	0.266	0.205	0.182	0.113	0.275	0.182	0.093	0.337
2278.9	0.279	0.067	0.283	0.222	0.195	0.127	0.296	0.199	0.096	0.397
2657.4	0.293	0.072	0.297	0.237	0.214	0.141	0.312	0.216	0.097	0.462
3783.6	0.333	0.084	0.333	0.276	0.243	0.174	0.362	0.261	0.101	0.643
5730.5	0.393	0.098	0.395	0.348	0.312	0.221	0.441	0.332	0.110	0.934
6606.4	0.428	0.099	0.429	0.387	0.365	0.222	0.491	0.367	0.123	1.016

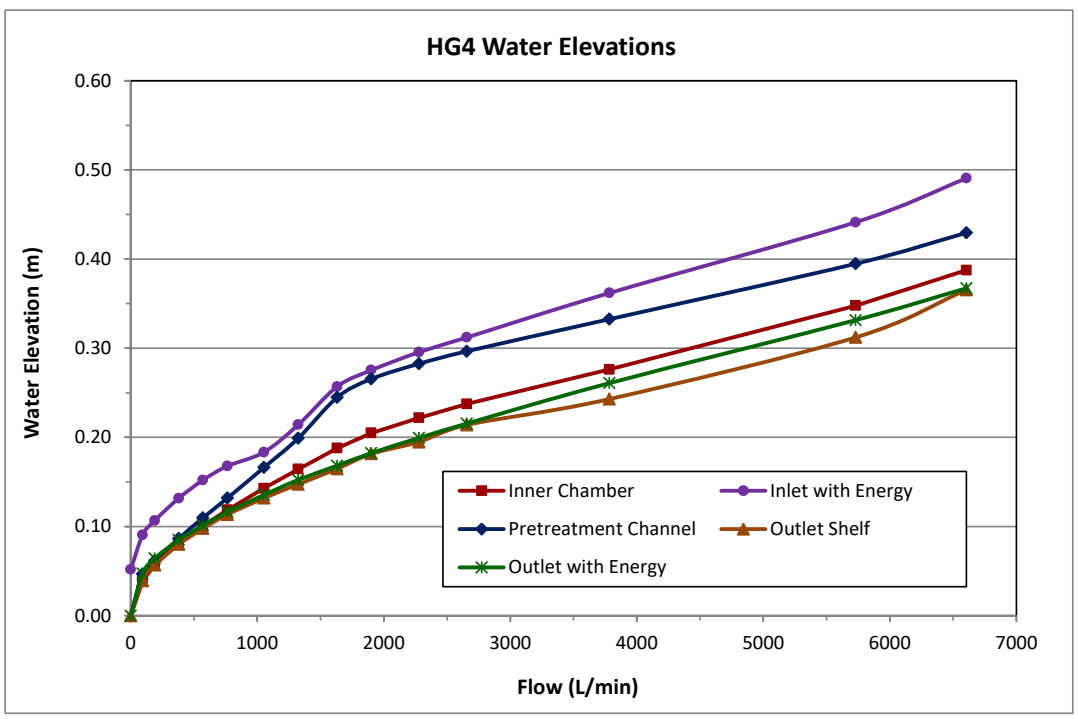


Figure 43: Measured Flow vs Water Elevations

As seen on Error! Reference source not found., the calculated system energy loss (influent to effluent) ranged from 0 to 0.089 m at the point of bypass. The loss decreased as expected due to bypass flow and

started increasing once the water elevation reached the top of the outlet pipe. The loss coefficient (Cd) for the insert was based on the area of the insert outlet (0.07 m^2). The Cd values prior to bypass ranged from 0.03 to 0.30. The calculated losses are shown in **Table 233**.

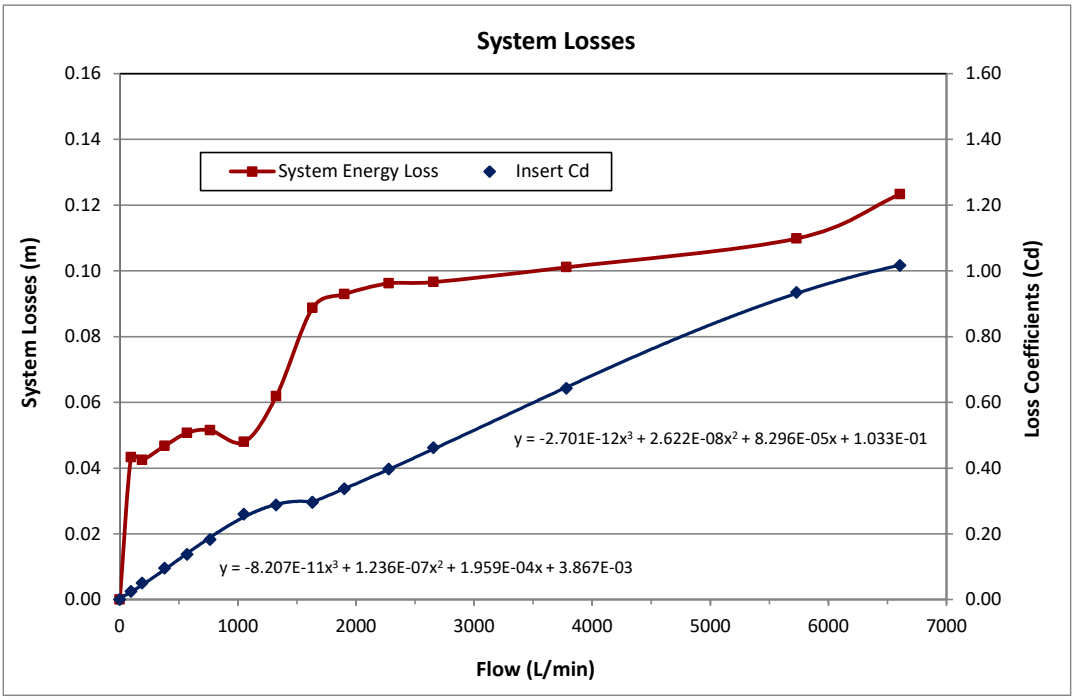


Figure 44: Calculated Losses and Insert Outlet Cd

5.0 Conclusions

The Hydroworks HS 4 Stormwater Treatment Unit achieved sediment removal efficiencies from 35.7% to 68.6% for surface loading rates ranging from 40 to 1400 L/min/m^2, respectively, using CETV specified 1-1000 micron PSD.

Light-liquid testing results showed that the unit was able to retain 88.3% of the pre-loaded pellets through the full range of SLRs from 200 to 2600 L/min/m^2.

Sediment scour testing resulted in average effluent concentrations ranging from 11 to 197 mg/L for loading rates up to 2600 L/min/m^2. This testing was conducted with the Secondary Plate preloaded to 10.2 cm.

Hydraulic testing was conducted at flows ranging from 0 to 6600 L/min. Bypass was reached at 1630 L/min. The maximum calculated system loss at 6600 L/min was 0.12 m.

The solid secondary plate was replaced with a 32% open-area plate and the 600 L/min/m2 test was repeated. The solid and perforated plate tests produced removal efficiencies of 46.1% and 45.9%, respectively. This indicates that the flow patterns and particle settling characteristics are not sensitive to the plate geometry.

A repeat scour test was conducted with the perforated plate installed. The calculated average effluent concentrations ranged from 19.1 to 28.5 mg/L. This is a significant drop from the solid plate maximum concentration of 197 mg/L and verifies that the perforated plate meets its intended purpose of protecting the sump from excessive scour.

6.0 Nomenclature and Abbreviations

A	= area	(L^2)
°C	= degree centigrade	(T)
Cd	= coefficient of discharge	
Ci	= influent sediment concentration	(M/L^3)
Cfs	= cubic feet per second	(L^3/T)
Cm^3	= cubic centimeters	(L^3)
COV	= coefficient of variance	
D	= diameter	(L)
D_{50}	= median particle size	(L)
DA	= data acquisition	
DP	= differential pressure	(ΔL)
g	= grams	(M)
g	= gravity	(L/T^2)
H	= head	(L)
Hz	= hertz	(T)
Kg	= kilogram	(M)
L	= liters	(L^3)
L/m	= liters per minute	(L^3/T)
L/s	= liters per second	(L^3/T)
m	= meter	(L)
mg/L	= milligram per liter	(M/L^3)
min	= minute	(T)
mm	= millimeters	(L)
PSD	= particle size distribution	
Q	= flow	(L^3/T)
sec	= seconds	(T)
SLR	= surface loading rate	($L^3/T/L^2$)
SSC	= suspended solids concentration	
V	= velocity	(L/T)
w	= moisture content (%)	

7.0 References

ASTM (2013), "Standard Test Methods for Determining Sediment Concentration in Water Samples", Annual Book of ASTM Standards, D3977-97, Vol. 11.02.

ASTM (2007), "Standard Test Method for Particle Size Analysis of Soils", Annual Book of ASTM Standards, D422-63, Vol. 04.08.

ASTM (2007), "Standard Test Methods for Determination of Water (Moisture) Content of Soil by Direct Heating", Annual Book of ASTM Standards, D4959-07, Vol. 04.08.

ASME (1971), "Fluid Meters Their Theory and Application- Sixth Edition".

CETV (2014), "Procedure for Laboratory Testing of Oil-Grit Separators", The Canadian Environmental Technology Verification Program.

APPENDIX A

ALDEN QUALIFICATIONS

Founded in 1894, Alden is the oldest continuously operating hydraulic laboratory in the United States and one of the oldest in the world. From the early days of hydropower development and aviation, through World Wars I and II, and into the modern world defined by environmental needs, Alden has been a recognized leader in the field of fluid dynamics consulting, research and development. In the 21st Century, Alden is a vibrant, growing organization consisting of engineers, scientists, biologists, and support staff in five specialty areas. Much of our work supports the power generating, environmental, manufacturing, and process industries.

Alden offers a scope of specialized services including: conceptual design, detailed design, verification testing, analytical modeling, Computational Fluid Dynamics (CFD), field measurements, physical modeling, precision flow meter calibrations, and field testing. Decades of combined experience in numerical simulation techniques, physical modeling, and field studies provide the broad knowledge that is essential for recognizing which method is best suited to solving a problem.

Unusually large facilities (more than 125,000 square feet of enclosed space) and sophisticated data acquisition systems are available for each study. Approximately twenty buildings, located on thirty acres at our headquarters in Holden, MA are equipped with flow supplies and control systems for conducting hydraulic modeling, verification and equipment testing, fish testing, air/gas flow modeling, and numerous other types of flow testing. Fixed facilities providing air and water flow and an inventory of movable flow related equipment such as pumps, valves, meter devices, fish screens, etc. are located on the premises at our Massachusetts laboratory. Fully equipped and staffed carpentry, machine, and instrumentation shops provide rapid and efficient project support.

Alden has performed verification testing on approximately twenty Hydrodynamic Separator and Filtration Manufactured Treatment Devices (MTDs) for multiple manufacturers under various state and federal testing protocols. Alden's senior stormwater engineer, James Mailloux, has served on the ASTM and SWEMA Stormwater Technical committees, providing guidance in the area of testing methodologies. He has a Master's Degree in Environmental Engineering from Worcester Polytechnic Institute and has been conducting testing at Alden for more than 25 years. Mr. Mailloux has contributed to articles related to laboratory testing in Stormwater Magazine, as well as presented on multiple testing and regulatory topics at various conferences, including StormCon, WefTec and the National Precast Concrete Association training seminars.

APPENDIX B
INSTRUMENTATION CALIBRATIONS

Hydroworks® HydroStorm

Operations & Maintenance Manual

Version 1.2

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please email a copy of the completed checklist to Hydroworks at for our records.

Introduction

The HydroStorm is a state-of-the-art hydrodynamic separator. Hydrodynamic separators remove solids, debris and lighter than water (oil, trash, floating debris) pollutants from stormwater. Hydrodynamic separators and other water quality measures are mandated by regulatory agencies (Town/City, State, Federal Government) to protect storm water quality from pollution generated by urban development (traffic, people) as part of new development permitting requirements.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. Therefore, it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The HydroStorm is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their HydroStorm.

Hydroworks® HydroStorm Operation

The Hydroworks HydroStorm (HS) separator is a unique hydrodynamic by-pass separator. It incorporates a protected submerged pretreatment zone to collect larger solids, a treatment tank to remove finer solids, and a dual set of weirs to create a high flow bypass. High flows are conveyed directly to the outlet and do not enter the treatment area, however, the submerged pretreatment area still allows removal of coarse solids during high flows.

Under normal or low flows, water enters an inlet area with a horizontal grate. The area underneath the grate is submerged with openings to the main treatment area of the separator. Coarse solids fall through the grate and are either trapped in the pretreatment area or conveyed into the main treatment area depending on the flow rate. Fines are transported into the main treatment area. Openings and weirs in the pretreatment area allow entry of water and solids into the main treatment area and cause water to rotate in the main treatment area creating a vortex motion. Water in the main treatment area is forced to rise along the walls of the separator to discharge from the treatment area to the downstream pipe.

The vortex motion forces solids and floatables to the middle of the inner chamber. Floatables are trapped since the inlet to the treatment area is submerged. The design maximizes the retention of settled solids since solids are forced to the center of the inner chamber by the vortex motion of water while water must flow up the walls of the separator to discharge into the downstream pipe.

A set of high flow weirs near the outlet pipe create a high flow bypass over both the pretreatment area and main treatment chamber. The rate of flow into the treatment area is regulated by the number and size of openings into the treatment chamber and the height of by-pass weirs. High flows flow over the weirs directly to the outlet pipe preventing the scour and resuspension of any fines collected in the treatment chamber.

A central access tube is located in the structure to provide access for cleaning. The arrangement of the inlet area and bypass weirs near the outlet pipe facilitate the use of multiple inlet pipes.

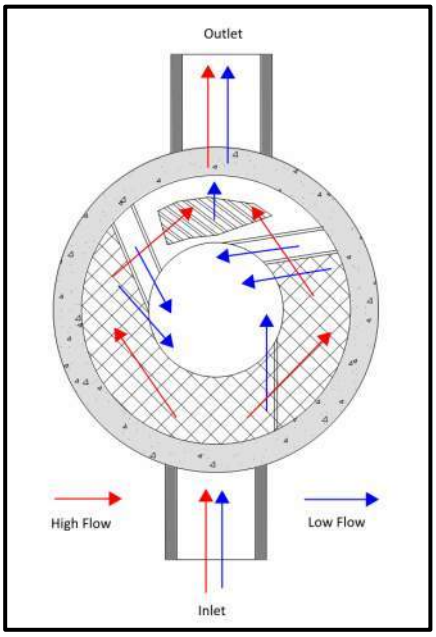


Figure 1. Hydroworks HydroStorm Operation – Plan View

Figure 2 is a profile view of the HydroStorm separator showing the flow patterns for low and high flows.

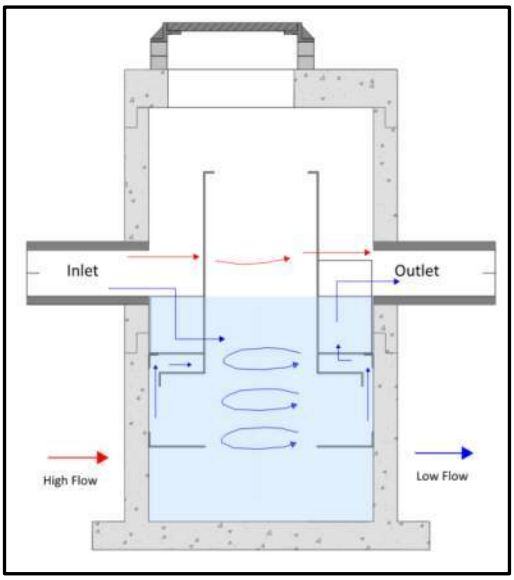


Figure 2. Hydroworks HydroStorm Operation – Profile View

Hydroworks

The HS 4i is an inlet version of the HS 4 separator. There is a catch-basin grate on top of the HS 4i. A funnel sits sits underneath the grate on the frame and directs the water to the inlet side of the separator to ensure all lows flows are properly treated. The whole funnel is removed for inspection and cleaning.

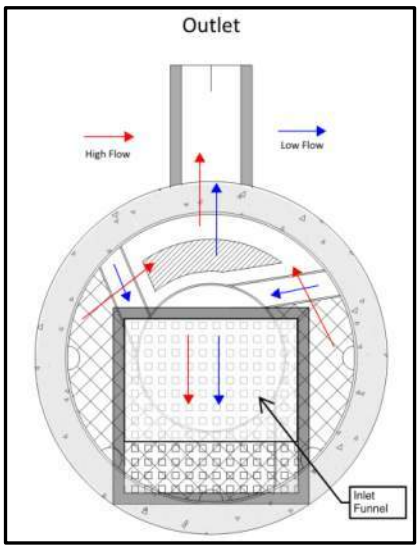


Figure 3. Hydroworks HS 4i Funnel

Construction Materials

The inner chamber and outlet baffle are made out of a copolymer plastic. The shell of the structure is pre-cast concrete. Pre-cast concrete is readily accepted by all municipalities since it has the following advantages:

- long service life
- ease of installation (less dependent on backfill (contractor proficiency) for structural integrity)
- concrete structures are designed for both anti-buoyancy and traffic loading without any field requirements (such as structural loading slabs in traffic areas and anti-buoyancy slabs to prevent groundwater uplift).
- low maintenance requirements

Hydroworks HS Separator Dimensions and Capacities

The HS separator is manufactured in a variety of sizes from 4 ft inside diameter to 12 ft inside diameter as shown in Table 1. Larger sizes may not be available in all areas. Please check with Hydroworks to ensure availability of the larger model sizes.

Table 1. Hydroworks HS Separator Dimensions*					
Model	Structure Inside Diam. (SID) (mm)	Structure Depth (mm)*	Sediment/ Sinking Trash Volume (L)	Oil/Floating Trash Volume (L)	Permanent Pool Wet Volume (L)
HS 3	900	1050	420	150	700
HS 4	1200	1200	845	355	1420
HS 5	1500	1500	1695	620	2775
HS 6	1800	1800	3110	1020	4800
HS 7	2100	1950	4530	1550	7080
HS 8	2400	2100	6225	2325	9960
HS 9	2700	2400	9200	3195	14410
HS 10	3000	2700	13025	4275	20015
HS 12	3600	3000	20525	7095	30535

*Dimensions vary with project requirements

The volumes provided in Table 1 for oil and sediment are to full capacity and not indicative of recommended depths/volumes for maintenance.

Headloss

Any water quality system implemented in a storm drain network will create headloss in the system. In general, depending on the configuration of the by-pass, systems designed to treat high flows or all of the flow will have a higher headloss impact on the storm drain network than systems that by-pass high flows.

The headloss created by the HS separator was measured in an independent laboratory (Alden Research Laboratory) for a full-scale HS 4. The K value (h = K v2/(2g)) for headloss calculations was determined to be 1.04 as shown in Figure 3.

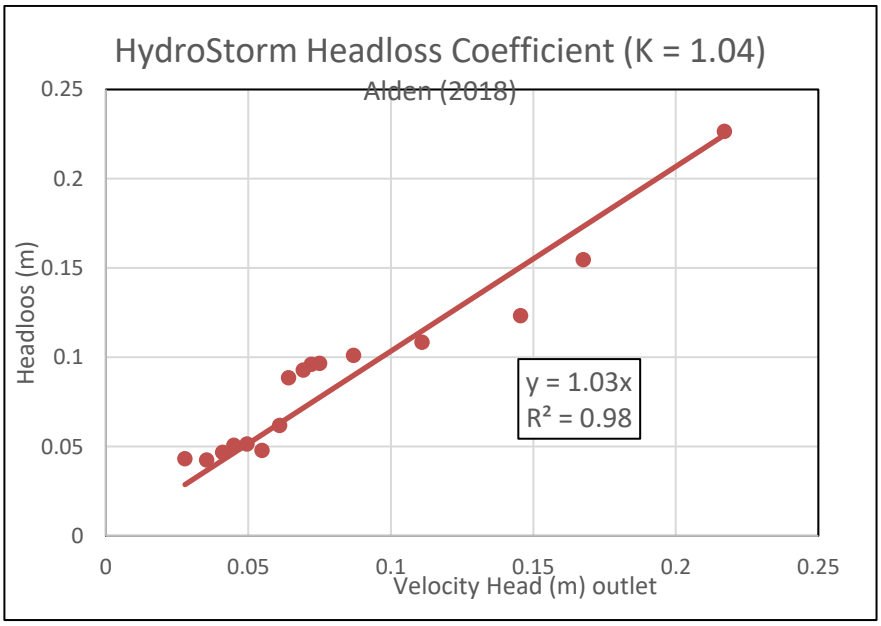


Figure 3. HydroStorm Headloss K Factor (1.04)

Hydroworks

Inspection

Procedure

Floatables

A visual inspection can be conducted for floatables by removing the covers and looking down into the center access tube of the separator. Separators with an inlet grate (HS 4i or custom separator) will have a plastic funnel located under the grate that must be removed from the frame prior to inspection or maintenance. If you are missing a funnel please contact Hydroworks at the numbers provided at the end of this document.

TSS/Sediment

Inspection for TSS build-up can be conducted using a Sludge Judge®, Core Pro®, AccuSludge® or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. These devices typically have a ball valve at the bottom of the tube that allows water and TSS to flow into the tube when lowering the tube into the unit. Once the unit touches the bottom of the device, it is quickly pulled upward such that the water and TSS in the tube forces the ball valve closed allowing the user to see a full core of water/TSS in the unit. The unit should be inspected for TSS through each of the access covers. Several readings (2 or 3) should be made at each access cover to ensure that an accurate TSS depth measurement is recorded.

Frequency

Construction Period

The HydroStorm separator should be inspected every four weeks and after every large storm (over 0.5” (12.5 mm) of rain) during the construction period.

Post-Construction Period

The Hydroworks HydroStorm separator should be inspected during the first year of operation for normal stabilized sites (grassed or paved areas). If the unit is subject to oil spills or runoff from unstabilized (storage piles, exposed soils) areas the HydroStorm separator should be inspected more frequently (4 times per year). The initial annual inspection will indicate the required future frequency of inspection and maintenance if the unit was maintained after the construction period.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

The Hydroworks HydroStorm unit is typically maintained using a vacuum truck. There are numerous companies that can maintain the HydroStorm separator. Maintenance with a vacuum truck involves removing all of the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility.

A central access opening (24” (600 mm) or greater) is provided to the gain access to the lower treatment tank of the unit. This is the primary location to maintain by vacuum truck. The pretreatment area can also be vacuumed and/or flushed into the lower treatment tank of the separator for cleaning via the central access once the water level is lowered below the pretreatment floor.

In instances where a vacuum truck is not available other maintenance methods (i.e. clamshell bucket) can be used, but they will be less effective. If a clamshell bucket is used the water must be decanted prior to cleaning since the sediment is under water and typically fine in nature.

The local municipality should be consulted for the allowable disposal options for both water and sediments prior to any maintenance operation. Once the water is decanted the sediment can be removed with the clamshell bucket.

Disposal of the contents of the separator depend on local requirements. Maintenance of a Hydroworks HydroStorm unit will typically take 1 to 2 hours based on a vacuum truck and longer for other cleaning methods (i.e. clamshell bucket).

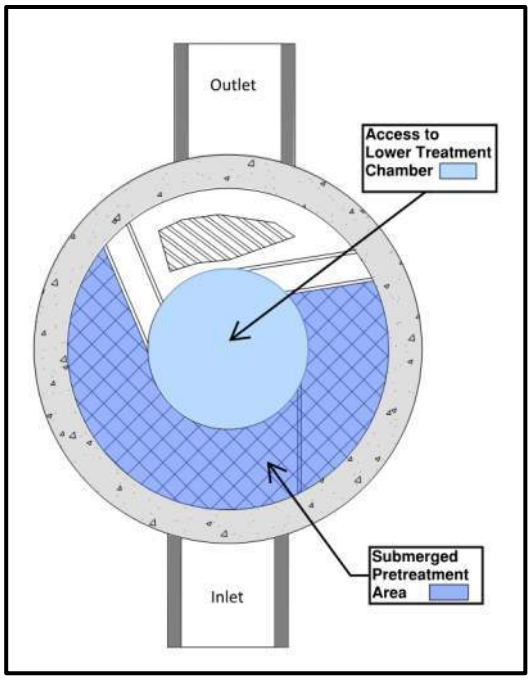


Figure 3. Maintenance Access

Frequency

Construction Period

A HydroStorm separator can fill with construction sediment quickly during the construction period. The HydroStorm must be maintained during the construction period when the depth of TSS/sediment reaches 24” (600 mm). It must also be maintained during the construction period if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the area of the separator

The HydroStorm separator should be maintained at the end of the construction period, prior to operation for the post-construction period.

Post-Construction Period

The HydroStorm was independently tested by Alden Research Laboratory in 2017. A HydroStorm HS 4 was tested for scour with a 50% sediment depth of 0.5 ft.(150 mm). The sump depths given in Table 1 are scaled larger than required based on standard scaling requirements (NJDEP, ETV Canada). Accordingly maintenance depths for units larger than the HS 4 will be larger than 300 mm.

There will be designs with increased sediment storage based on specifications or site-specific criteria. A measurement of the total depth in the separator through the central access tube should be taken and compared to sump depth given in Table 1.

The standard sump depth from Table 1 should be subtracted from the measured depth and the resulting extra depth should be added to the values given in Table 2 to determine the site-specific sediment maintenance depth for that separator.

For example, if the measured sump depth in the HS-7 is 7.5 feet, then the sediment maintenance depth for that HS-7 is 2.25 ft (= 0.5 + 1.75) and the separator does not need to be cleaned for sediment accumulation until the measure sediment depth is 2.25 ft.

The HydroStorm separator must also be maintained if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the water surface of the separator.

Table 2 Standard Maintenance Depths for HydroStorm Models

Model	Diameter ft (mm)	Sediment Maintenance Depth for Total Water Depth ft (mm)*
HS-3	3 (900)	1 (300)
HS-4	4 (1200)	1 (300)
HS-5	5 (1500)	1.75 (530)
HS-6	6 (1800)	2 (610)
HS-7	7 (2100)	1.75 (535)
HS-8	8 (2400)	1.5 (465)
HS-9	9 (2700)	1.75 (540)
HS-10	10 (3000)	2 (615)
HS-12	12 (3600)	1.5 (470)

*based on standard sump depths in Table 1

HYDROSTORM INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

HydroStorm	**Yes**	**No**
Obstructions in the inlet or outlet	☐ *	☐
Missing internal components	☐ **	☐
Improperly installed inlet or outlet pipes	☐ ***	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the separator (oil, leaves, trash)	☐	☐
Large debris visible in the separator	☐ *	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐
Water seepage (water level not at outlet pipe invert)	☐ ***	☐

Water level depth below outlet pipe invert _____"

Routine Measurements

Floating debris depth	**< 0.5" (13mm)**	☐	**>0.5" 13mm)**	☐ *
Floating debris coverage	**< 50% of surface area**	☐	**> 50% surface area**	☐ *
Sludge depth	**< 12" (300mm)**	☐	**> 12" (300mm)**	☐ *

* Maintenance required
** Repairs required
*** Further investigation is required

Hydroworks

Other Comments:

Hydroworks

Hydroworks® HydroStorm

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks HydroStorm to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the separator has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 136 Central Ave., Clark, NJ 07066 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks HydroStorm are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the HydroStorm, or the cost of other goods or services related to the purchase and installation of the HydroStorm. For this Limited Warranty to apply, the HydroStorm must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the HydroStorm arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the HydroStorm, whether the claim is based upon contract, tort, or other legal basis.

Specifications

1. Must be independently tested to the 2013 NJDEP Laboratory Protocol and 2013 ETV Canada protocol (ISO 14024:2016). Separator must be sized based on this data.

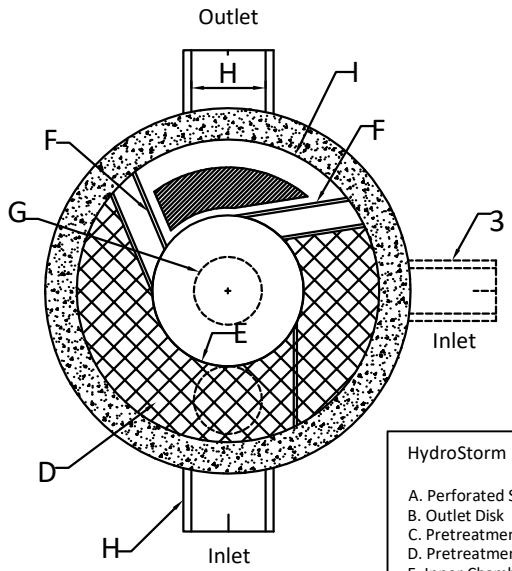
2. Any testing performed by the manufacturer is unacceptable to demonstrate an alternate equal.

3. Field Testing is unreliable, site and storm specific, and subject to compounding equipment and analytical errors and therefore is unacceptable as verification of an alternate equal. TARP verfication as per NJDEP is testing consistent with the 2013 NJDEP laboratory protocol.

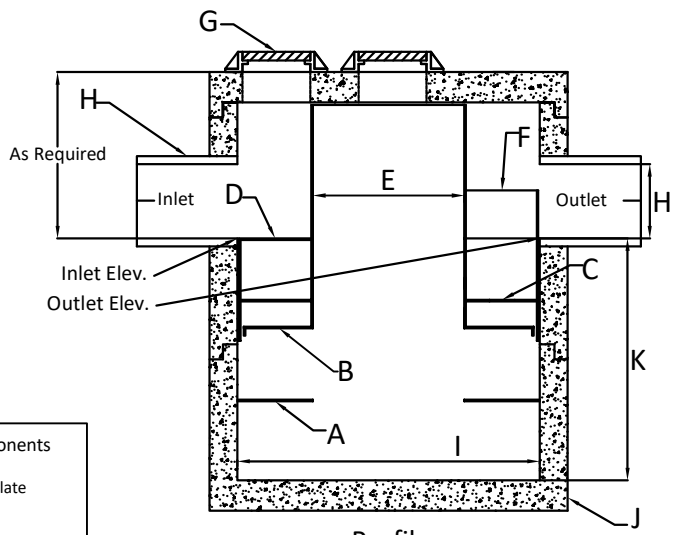
4. The separator must be designed based on the following criteria:

Flow Criteria	
Water Quality FLow Rate cfs (L/s)	
Peak Design Flow Rate cfs (L/s)	

TSS Removal Criteria	
Annual TSS Removal (%)	
NJDEP/ETV Canada TSS	
OK110 Sand	
City of Toronto	
Other	



Plan



Profile

HydroStorm Components

A. Perforated Scour Plate
B. Outlet Disk
C. Pretreatment Disk
D. Pretreatment Grate
E. Inner Chamber
F. By-Pass Weirs
G. Frame and Cover (1-2)
H. Inlet and Outlet Pipes
I. Structure Diameter
J. Base Extension (HS4 - HS6)
K. Sump Depth

HydroStorm by Hydroworks, LLC
US Patent No. 10,710,907
www.hydroworks.com
888-290-7900

HydroStorm Dimensions / Capacities

Model	Diameter ft (m) (9)	Sump Depth ft (m) (11)	Inner Chamber Diam. ft (m) (5)	Max. Pipe in (mm) (8)	Oil Spill Volume gal (L)	Sediment Volume ft3 (m3)	Total Volume gal (L)
HS 3	3 (0.9)	3 (0.9)	1.5 (0.45)	18 (450)	40 (155)	10 (0.35)	155 (600)
HS 4	4 (1.2)	4 (1.2)	2 (0.6)	24 (600)	95 (375)	30 (0.85)	375 (1420)
HS 5	5 (1.5)	5 (1.5)	2.5 (0.8)	30 (750)	165 (635)	60 (1.8)	730 (2780)
HS 6	6 (1.8)	6 (1.8)	3 (0.9)	36 (900)	270 (1030)	110 (3.2)	1265 (4800)
HS 7	7 (2.1)	6.5 (2.0)	3.5 (1.0)	42 (1050)	410 (1560)	160 (4.6)	1870 (7080)
HS 8	8 (2.4)	7 (2.1)	4 (1.2)	48 (1200)	615 (2330)	220 (6.2)	2630 (9960)
HS 10	10 (3.0)	9 (2.7)	5 (1.5)	60 (1500)	1130 (4285)	465 (13.1)	5285 (20015)
HS 12	12 (3.6)	11 (3.3)	6 (1.8)	72 (1800)	1875 (7100)	835 (23.7)	9305 (35225)

Notes:

1. Headloss K factor of 1.04 for hydraulic gradeline calculations

2. Sump depths shown are typical. Additional depth can be added as required

3. Multiple inlet pipes allowed

4. Drops allowed

5. Inlet invert elevations should be the same or higher than the outlet invert elevation. Inlet can be up to 12" (300 mm) lower than outlet if pretreatment area is omitted but 12" (300 mm) must be added to sump depth to maintain overall treatment volume.

6. Solid Cover shown. HydroStorm can be desiged with an inlet grate if required.

7. Oil capacities given are spill capacities.

8. Sediment depths are maximum holding capacities and not recommended capacities for regular maintenance.

9. Capacities are rounded down to nearest 5 gal or ft3 (1L or 0.1 m3 for metric units)

10. Base Extensions not provided on standard units larger than the HS 6. Extensions can be provided if required due to groundwater/buoyancy concerns at the request of the engineer of record.

11. HS4 to HS6 models require one frame and cover. HS7 to HS12 models require two covers

Hydroworks HydroStorm

PROJECT:

LOCATION:

REVISION DATE: 08/07/2020

Hydroworks

Appendix A: Climate Data Tables

Barrie Creeks Subwatershed

	Hydrologic Soil Group	Subwatershed Area (km^2)	Mean Annual Precipitation (mm/yr.)	Actual Evapotranspiration (mm/yr.)	Precipitation Surplus (mm/yr.)
Urban Lawns/Golf Courses					
Fine Sand	A	1.74	952	525	427
Fine Sandy Loam	B		952	539	413
Silt Loam	C		952	573	380
Clay	D		952	643	310
Forest					
Fine Sand	A	4.12	952	521	431
Fine Sandy Loam	B		952	540	412
Silt Loam	C		952	434	518
Clay	D		952	598	354
Pasture & Shrubs					
Fine Sand	A	0.40	952	565	387
Fine Sandy Loam	B		952	546	406
Silt Loam	C		952	558	394
Clay	D		-	-	-
Non-Intensive Agriculture (e.g. Hay)					
Fine Sand	A	0.92	952	528	424
Fine Sandy Loam	B		952	636	316
Silt Loam	C		-	-	-
Clay	D		-	-	-
Intensive Agriculture (e.g. Row crop)					
Fine Sand	A	0.43	952	556	396
Fine Sandy Loam	B		952	532	420
Silt Loam	C		-	-	-
Clay	D		-	-	-
Open Alvar					
Fine Sand	A	-	-	-	-
Fine Sandy Loam	B		-	-	-
Silt Loam	C		-	-	-
Clay	D		-	-	-
Aggregates					
Fine Sand	A	0.62	952	471	481
Fine Sandy Loam	B		952	456	496
Silt Loam	C		-	-	-
Clay	D		-	-	-
Mean Annual			**952**	**446**	**506**

Notes: Precipitation and Actual Evapotranspiration values are the AVERAGE ANNUAL estimates obtained from the Lake Simcoe PRMS model (Earthfx, 2010).

APARTMENT DEVELOPMENT - 202 DUNLOP STREET W

PRE-DEVELOPMENT WATER BALANCE

City of Barrie, Ontario

Project Number: 22-11713B

Date: September 12, 2023

Design By: DPH

BARRIE CREEKS SUBWATERSHED (LSRCA Lake Simcoe Climate Data Version 1, April 2017)				
Designation	**Hydrologic Soil Group**	**Annual Precipitation (mm/yr)**	**Actual Evapotranspiration (mm/yr)**	**Precipitation Surplus (mm/yr)**
Urban Lawn	AB	952	532	420

Catchment Designation	**Pre-Development Condition**				
	Forest	**Lawn**	**Building**	**Impervious**	**Totals**
Area(m2)	0	745	670	1015	2430
Pervious Area (m2)	0	745	0	0	745
Impervious Area (m2)	0	0	670	1015	1685
Infiltration Factors					
Topography Infiltration Factor	0.15	0.15	0	0	
Soil Infiltration Factor	0.35	0.35	0	0	
Land Cover Infiltration Factor	0.2	0.1	0	0	
MOE Infiltration Factor (Sum)	***0.7***	***0.6***	***0***	***0***	
Actual Infiltration Factor	0.7	0.6	0	0	
Run-off Coefficient	0.3	0.4	1	1	
Run-off from impervious surfaces*	0	0	0.9	0.9	
Inputs (per Unit Area)					
Precipitation (mm/yr)	952	952	952	952	952
Run-on (mm/yr)	0	0	0	0	0
Other inputs (mm/yr)	0	0	0	0	0
Total inputs (mm/yr)	**952**	**952**	**952**	**952**	**952**
Outputs (per Unit Area)					
Precipitation Surplus (mm/yr)	420	420	857	857	723
Net Surplus (mm/yr)	420	420	857	857	723
Evapotranspiration (mm/yr)	532	532	95	95	229
Infiltration (mm/yr)	294	252	0	0	77
Rooftop Infiltration (mm/yr)	0	0	0	0	0
Total Infiltration (mm/yr)	294	252	0	0	77
Runoff Pervious Areas (mm/yr)	126	168	0	0	52
Runoff Impervious Areas (mm/yr)	0	0	857	857	594
Total Runoff (mm/yr)	126	168	857	857	646
Total Outputs (mm/yr)	**952**	**952**	**952**	**952**	**952**
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**
Inputs (Volumes)					
Precipitation (m3/yr)	0	709	638	966	2313
Run-on (m3/yr)	0	0	0	0	0
Other inputs (m3/yr)	0	0	0	0	0
Total Inputs (m3/yr)	**0**	**709**	**638**	**966**	**2313**
Outputs (Volumes)					
Precipitation Surplus (m3/yr)	0	313	574	870	1757
Net Surplus (m3/yr)	0	313	574	870	1757
Evapotranspiration (m3/yr)	0	396	64	97	557
Infiltration (m3/yr)	0	188	0	0	188
Rooftop Infiltration (m3/yr)	0	0	0	0	0
Total Infiltration (m3/yr)	0	188	0	0	188
Runoff Pervious Areas (m3/yr)	0	125	0	0	125
Runoff Impervious Areas (m3/yr)	0	0	574	870	1444
Total Runoff (m3/yr)	0	125	574	870	1569
Total Outputs (m3/yr)	**0**	**709**	**638**	**966**	**2313**
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**

* Evaporation from impervious areas was assumed to be 10% of precipitation value.

APARTMENT DEVELOPMENT - 202 DUNLOP STREET W

POST DEVELOPMENT WATER BALANCE WITHOUT MITIGATION

City of Barrie, Ontario

Project Number: 22-11713B

Date: September 12, 2023

Design By: DPH

BARRIE CREEKS SUBWATERSHED (LSRCA Lake Simcoe Climate Data Version 1, April 2017)				
Designation	**Hydrologic Soil Group**	**Annual Precipitation (mm/yr)**	**Actual Evapotranspiration (mm/yr)**	**Precipitation Surplus (mm/yr)**
Urban Lawn	AB	952	532	420

Catchment Designation	**Post Development Condition**				
	Forest	**Lawn**	**Building**	**Impervious**	**Totals**
Area(m2)	0	675	800	955	2430
Pervious Area (m2)	0	675	0	0	675
Impervious Area (m2)	0	0	800	955	1755
Infiltration Factors					
Topography Infiltration Factor	0.15	0.15	0	0	
Soil Infiltration Factor	0.35	0.35	0	0	
Land Cover Infiltration Factor	0.2	0.1	0	0	
MOE Infiltration Factor (Sum)	***0.7***	***0.6***	***0***	***0***	
Actual Infiltration Factor	0.7	0.6	0	0	
Run-off Coefficient	0.3	0.4	1	1	
Run-off from impervious surfaces*	0	0	0.9	0.9	
Inputs (per Unit Area)					
Precipitation (mm/yr)	952	952	952	952	952
Run-on (mm/yr)	0	0	0	0	0
Other inputs (mm/yr)	0	0	0	0	0
Total inputs (mm/yr)	**952**	**952**	**952**	**952**	**952**
Outputs (per Unit Area)					
Precipitation Surplus (mm/yr)	420	420	857	857	735
Net Surplus (mm/yr)	420	420	857	857	735
Evapotranspiration (mm/yr)	532	532	95	95	217
Infiltration (mm/yr)	294	252	0	0	70
Rooftop Infiltration (mm/yr)	0	0	0	0	0
Total Infiltration (mm/yr)	294	252	0	0	70
Runoff Pervious Areas (mm/yr)	126	168	0	0	47
Runoff Impervious Areas (mm/yr)	0	0	857	857	619
Total Runoff (mm/yr)	126	168	857	857	665
Total Outputs (mm/yr)	**952**	**952**	**952**	**952**	**952**
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**
Inputs (Volumes)					
Precipitation (m3/yr)	0	643	762	909	2313
Run-on (m3/yr)	0	0	0	0	0
Other inputs (m3/yr)	0	0	0	0	0
Total Inputs (m3/yr)	**0**	**643**	**762**	**909**	**2313**
Outputs (Volumes)					
Precipitation Surplus (m3/yr)	0	284	685	818	1787
Net Surplus (m3/yr)	0	284	685	818	1787
Evapotranspiration (m3/yr)	0	359	76	91	526
Infiltration (m3/yr)	0	170	0	0	170
Rooftop Infiltration (m3/yr)	0	0	0	0	0
Total Infiltration (m3/yr)	0	170	0	0	170
Runoff Pervious Areas (m3/yr)	0	113	0	0	113
Runoff Impervious Areas (m3/yr)	0	0	685	818	1504
Total Runoff (m3/yr)	0	113	685	818	1617
Total Outputs (m3/yr)	**0**	**643**	**762**	**909**	**2313**
Difference (Inputs - Outputs)	**0**	**0**	**0**	**0**	**0**

* Evaporation from impervious areas was assumed to be 10% of precipitation value.

APARTMENT DEVELOPMENT - 202 DUNLOP STREET W

WATER BALANCE SUMMARY

City of Barrie, Ontario

Project Number: 22-11713B

Date: September 12, 2023

Design By: DPH

Characteristic	Site				
	Pre-Development	Post Development	Change (Pre to Post)	Post Devlopment with Mitigation	Change (Pre to Post with Mitigation)
Inputs (Volumes)					
Precipitation (m3/yr)	2313	2313	0.0%	2313	0.0%
Run-on (m3/yr)	0	0	0.0%	0	0.0%
Other Inputs (m3/yr)	0	0	0.0%	0	0.0%
Total Inputs (m3/yr)	2313	2313	**0.0%**	2313	**0.0%**
Output (volumes)					
Precipitation Surplus (m3/yr)	1757	1787	1.7%	1787	1.7%
Net Surplus (m3/yr)	1757	1787	1.7%	1787	1.7%
Evapotranspiration (m3/yr)	557	526	-5.5%	526	-5.5%
Infiltration (m3/yr)	188	170	-9.4%	170	-9.4%
Rooftop Infiltration (m3/yr)	0	0	0.0%	0	0.0%
Total Infiltration (m3/yr)	188	170	-9.4%	170	-9.4%
Runoff Pervious Areas (m3/yr)	125	113	-9.4%	113	-9.4%
Runoff Impervious Areas (m3/yr)	1444	1504	0.0%	1504	0.0%
Total Runoff (m3/yr)	1569	1617	3.1%	1617	3.1%
Total Outputs (m3/yr)	2313	2313	**0.0%**	2313	0.0%

Table 3.1: Hydrologic Cycle Component Values

	Water Holding Capacity mm	Hydrologic Soil Group	Precipitation mm	Evapo-transpiration mm	Runoff mm	Infiltration* mm
Urban Lawns/Shallow Rooted Crops (spinach, beans, beets, carrots)						
Fine Sand	50	A	940	515	149	276
Fine Sandy Loam	75	B	940	525	187	228
Silt Loam	125	C	940	536	222	182
Clay Loam	100	CD	940	531	245	164
Clay	75	D	940	525	270	145
Moderately Rooted Crops (corn and cereal grains)						
Fine Sand	75	A	940	525	125	291
Fine Sandy Loam	150	B	940	539	160	241
Silt Loam	200	C	940	543	199	199
Clay Loam	200	CD	940	543	218	179
Clay	150	D	940	539	241	160
Pasture and Shrubs						
Fine Sand	100	A	940	531	102	307
Fine Sandy Loam	150	B	940	539	140	261
Silt Loam	250	C	940	546	177	217
Clay Loam	250	CD	940	546	197	197
Clay	200	D	940	543	218	179
Mature Forests						
Fine Sand	250	A	940	546	79	315
Fine Sandy Loam	300	B	940	548	118	274
Silt Loam	400	C	940	550	156	234
Clay Loam	400	CD	940	550	176	215
Clay	350	D	940	549	196	196

Notes: Hydrologic Soil Group A represents soils with low runoff potential and Soil Group D represents soils with high runoff potential. The evapotranspiration values are for mature vegetation. Streamflow is composed of baseflow and runoff.

** This is the total infiltration of which some discharges back to the stream as base flow. The infiltration factor is determined by summing a factor for topography, soils and cover.*

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

To obtain a phosphorus removal credit, a best management practice (BMP) needs to be constructed as part of the proposed development. Phosphorus removal credit(s) will not be applied to existing natural features such as wetlands or stream buffers.

Phosphorus loading and percentage removal efficiencies are to comply with the applicable phosphorus tool (Ministry of the Environment (MOE) Tool, 2012 or latest version, or the low impact development (L.I.D.) TTT Tool) and associated documentation, unless otherwise specified below.

Supported Phosphorus Percentage Removal Efficiency by Tool

Ministry of the Environment (MOE) Tool

MOE Lake Simcoe Phosphorus Loading Development Tool (2012), including the supporting report titled "Phosphorus Budget Tool in Support of Sustainable Development for the Lake Simcoe Watershed" (Hutchinson, March 2012).

Land uses are to be consistent with Table 1 in the Hutchinson report.

Subsequent versions of this tool and documentation should be used to obtain the latest Ministry of the Environment, Conservation and Parks (MECP) accepted removal rates:

- Constructed Wetlands – 77%
- Dry Detention Ponds – 10%
- Infiltration Trenches – 60%
- Perforated Pipe Infiltration / Exfiltration System (not infiltration trenches) – 87%
- Sand or Media Filters – 45%
- Sorbtive Media Interceptors – 79%
- Vegetated Filter Strips / Stream Buffers – 65%
- Wet Detention Ponds – 63%
- Enhanced swale – 25%
- Oil and Grit Separators (O.G.S.) units, Environmental Technology Verification (ETV) verified – 20% (unless otherwise stated by ETV)
- Filter units (ETV verified/ Technology Assessment Protocol-Ecology (T.A.P.E.) approved) – 40% (unless otherwise verified by ETV/ T.A.P.E.)

Note: Facilities are to be designed in accordance with the MECP and Sustainable Technologies Evaluation Program (STEP) World Internet Knowledge Index (WIKI) L.I.D. Guidelines, to achieve enhanced quality control in order to be eligible for the above phosphorus reduction credits.

L.I.D. TTT Tool

- The default rates included within the L.I.D. TTT Tool should not be altered.

Ontario

MINISTRY OF THE ENVIRONMENT

Database Version: **V 2.0 Release Update**
Update Date: **30-Mar-12**

Project DEVELOPMENT Summary

DEVELOPMENT: **202 DUNLOP STREET W APARTMENT DEVELOPMENT**
Subwatershed: **Barrie Creeks**

Total Pre-Development Area (ha):	**0.2430**	Total Pre-Development Phosphorus Load (kg/yr):	**0.20**

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
High Intensity - Comm/Industria	0.1	1.82	0.18
Low Intensity Development	0.143	0.13	0.02

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
High Intensity - Residential	0.0185	1.32	NONE	0%	0.02

Catchment 203 (Impervious Area)

High Intensity - Residential	0.157	1.32	Other	20%	0.17

Catchment 201 & 202 (Impervious Area): 20% TP Removal Credit from Hydroworks Hydrostorm HS-4 that is ETV Certified.

Low Intensity Development	0.0315	0.13	NONE	0%	0.00

Catchment 203 (Landscape Area)

Low Intensity Development	0.036	0.13	Other	20%	0.00

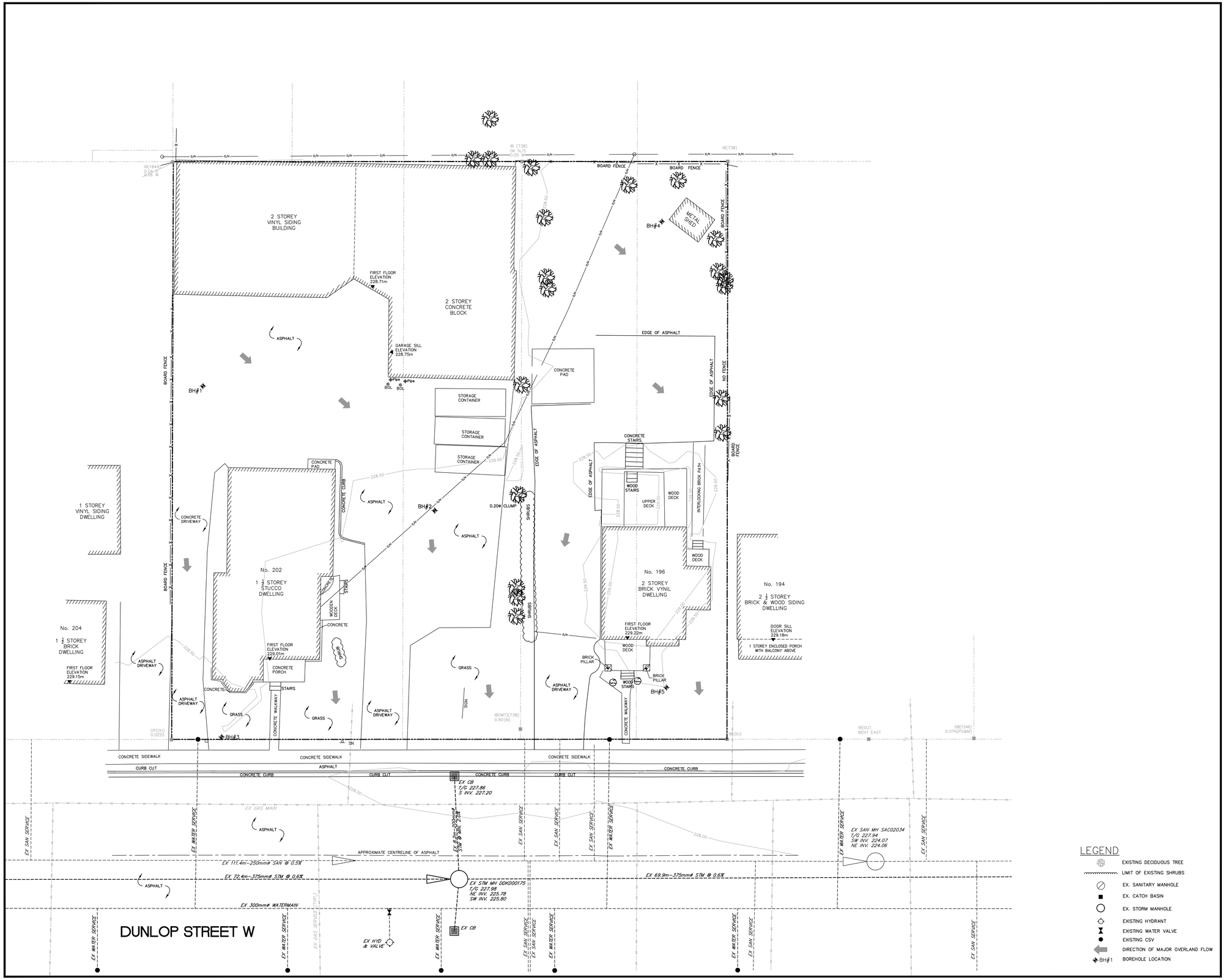
Catchment 201 & 202 (Landscape Area): 20% TP Removal Credit from Hydroworks Hydrostorm HS-4 that is ETV Certified.

			P Load (kg/yr)
Post-Development Area Altered:	**0.24**		
Total Pre-Development Area:	**0.24**	Pre-Development:	**0.20**
Unaffected Area:	**0**	Post-Development:	**0.24**
		Change (Pre - Post):	**-0.04**
		20% Net Increase in Load	
		Post-Development (with BMPs):	**0.20**
		Change (Pre - Post):	**0.00**
		1% Net Reduction in Load	

APPENDIX D

ENGINEERING DRAWINGS (ENVELOPE AT REAR OF REPORT)

PINESTONE ENGINEERING LTD.



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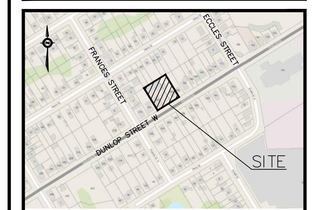

KEY MAP

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ELEV. 226.540

NO.	YY.MM.DD	REVISION	BY.
1	24.03.21	REVISED PER AGENCY COMMENTS	C.A.

SEAL

LICENSED PROFESSIONAL ENGINEER
D. P. HORDYK
100530228
2024-07-19
PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED	J.V.
DATE:	SEPT 2023
SCALE:	1:150

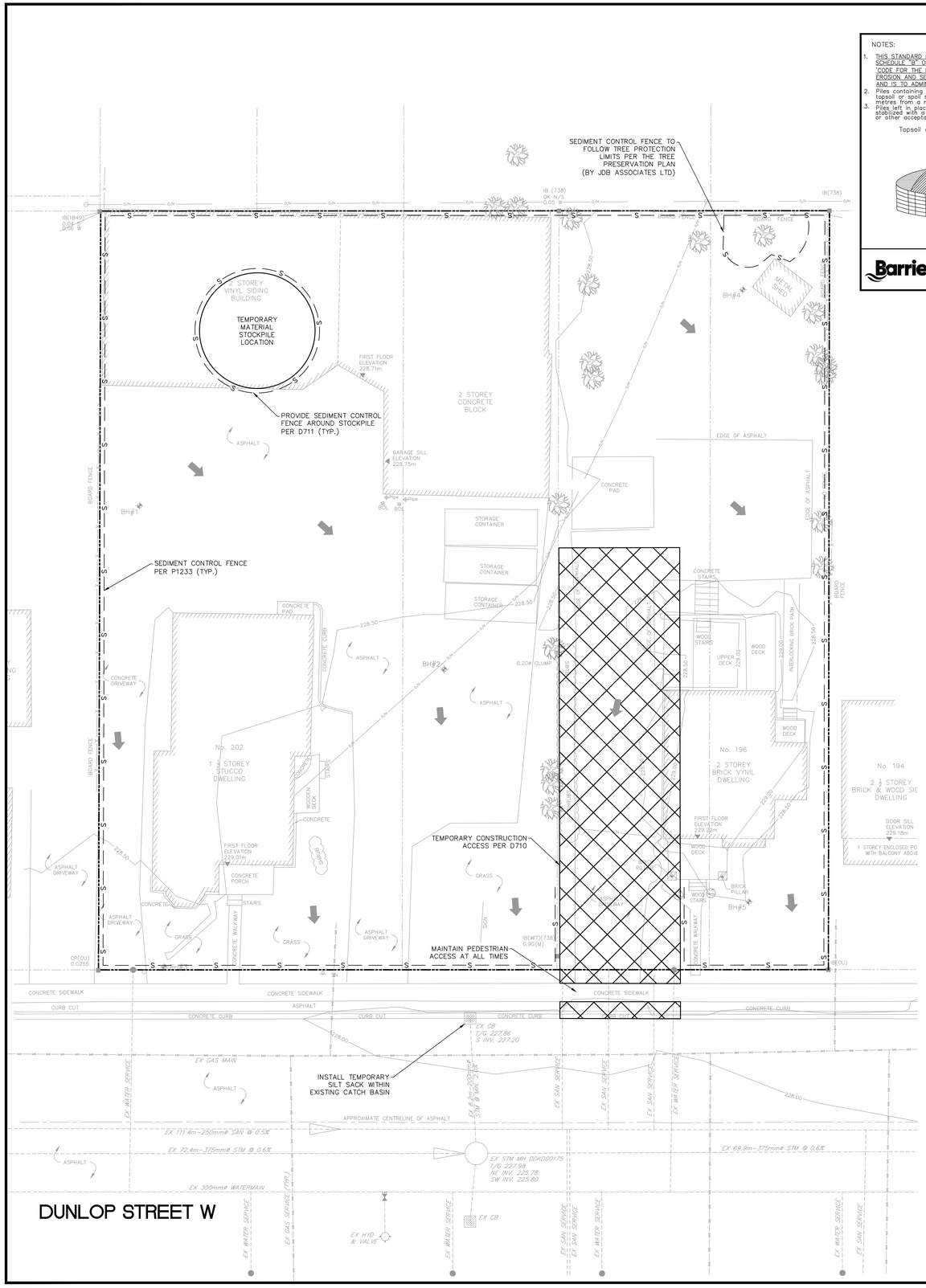
CLIENT/PROJECT

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT

DRAWING TITLE

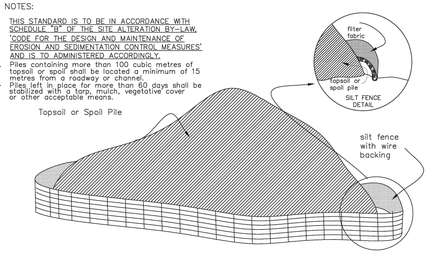
EXISTING CONDITIONS PLAN

PROJECT NO.	DRAWING NO.	REVISION
22-11713-B	EX-1	1

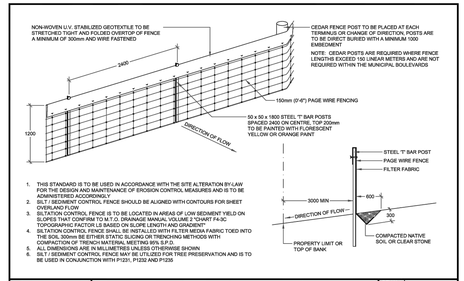


NOTES:

1. THIS STANDARD IS TO BE IN ACCORDANCE WITH SCHEDULE "B" OF THE SITE ALTERATION BY-LAW, 'CODE FOR THE DESIGN AND MAINTENANCE OF EROSION AND SEDIMENTATION CONTROL MEASURES' AND IS TO ADMINISTERED ACCORDINGLY.
2. Piles containing more than 100 cubic metres of topsoil or spoil shall be located a minimum of 15 metres from a roadway or channel.
3. Piles left in place for more than 60 days shall be stabilized with a tarp, mulch, vegetative cover or other acceptable means.

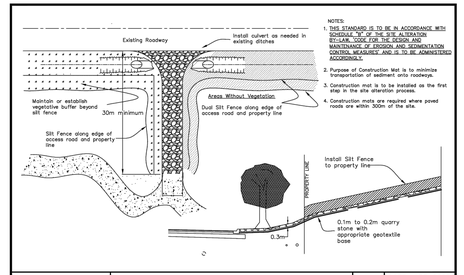


Barrie | Siltation Control | REV No. 1 | DATE: APR 2023 | SCALE: N.T.S | D711



1. THIS STANDARD IS TO BE USED IN ACCORDANCE WITH THE SITE ALTERATION BY-LAW FOR THE DESIGN AND MAINTENANCE OF EROSION CONTROL MEASURES AND IS TO BE ADMINISTERED ACCORDINGLY
2. SILT / SEDIMENT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW
3. SILTATION CONTROL FENCE IS TO BE LOCATED IN AREAS OF LOW SEDIMENT YIELD ON SITE WITH SLOPES NOT EXCEEDING 50% AND WITH A TOPOGRAPHIC FACTOR (LS BASED ON SLOPE LENGTH AND GRADIENT)
4. SILTATION CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TOED INTO THE SOIL 300mm BE EITHER STATIC SLICING OR TRENCHING METHODS WITH COMPACTION OF TRENCH MATERIAL MEETING 95% S.P.D.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN
6. SILT / SEDIMENT CONTROL FENCE MAY BE UTILIZED FOR TREE PRESERVATION AND IS TO BE USED IN CONJUNCTION WITH P1231, P1232 AND P1233

Barrie | FENCE SILTATION CONTROL | REV No. 3 | DATE: APR 2023 | SCALE: N.T.S. | P1233



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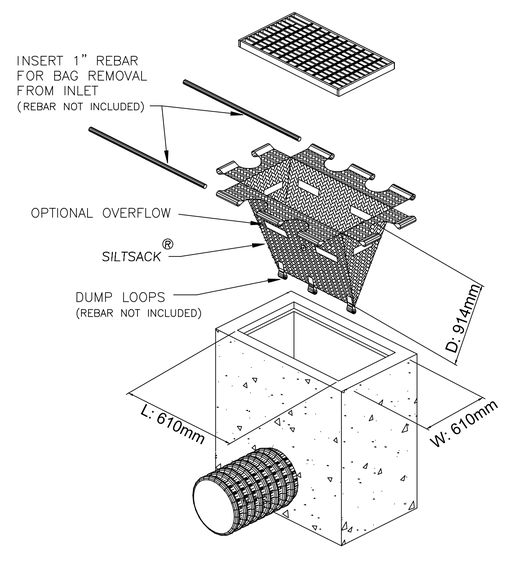
2. Purpose of Construction Mat is to minimize transportation of sediment onto roadways.
3. Construction mat is to be installed as the first step in the site alteration process.
4. Construction mats are required where paved roads are within 30m of the site.

Barrie | Construction Entrance | REV No. 2 | DATE: APR 2023 | SCALE: N.T.S | D710



TYPICAL SLIT SACK CONSTRUCTION TYPE B

LEGEND

- EXISTING TREE
- LIMIT OF EXISTING VEGETAION
- EX. SANITARY MANHOLE
- EX. CATCH BASIN
- EX. STORM MANHOLE
- EXISTING HYDRANT
- EXISTING WATER VALVE
- EXISTING CSV
- DIRECTION OF MAJOR OVERLAND FLOW
- BH1 BOREHOLE LOCATION
- PROP. SILT FENCE
- CONSTRUCTION ENTRANCE MAT

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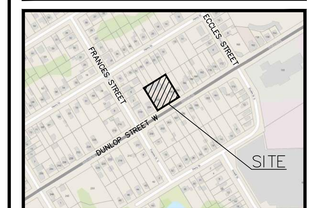

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ELEV. 226.540

NO.	YY.MM.DD	REVISION	BY
1	24.03.21	REVISED PER AGENCY COMMENTS	C.A.

SEAL

LICENSED PROFESSIONAL ENGINEER
D. P. HORDYK
100530728
2024-07-19
PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED:	J.V.
DATE:	SEPT 2023
SCALE:	1:150

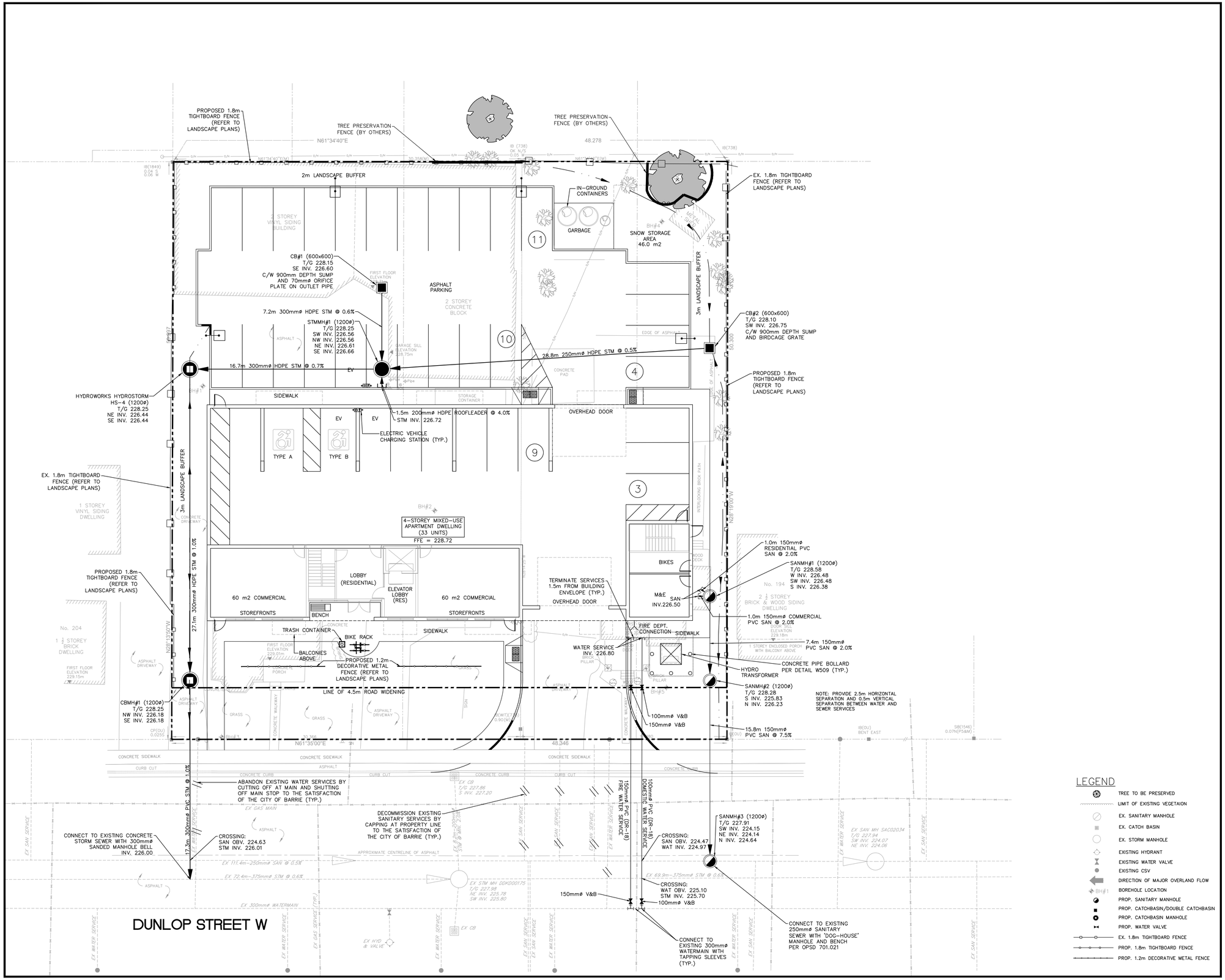
CLIENT/PROJECT

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT

DRAWING TITLE

EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	DRAWING NO.	REVISION
22-11713-B	ESC-1	1



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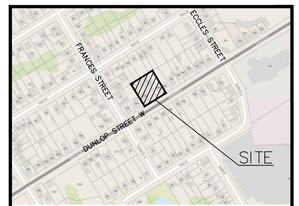

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ELEV. 226.540

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1	24.03.21	REVISED PER AGENCY COMMENTS	C.A.

SEAL

LICENSED PROFESSIONAL ENGINEER
D. P. HORDYK
100530228
2024-07-19
PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED:	J.V.
DATE:	SEPT 2023
SCALE:	1:150

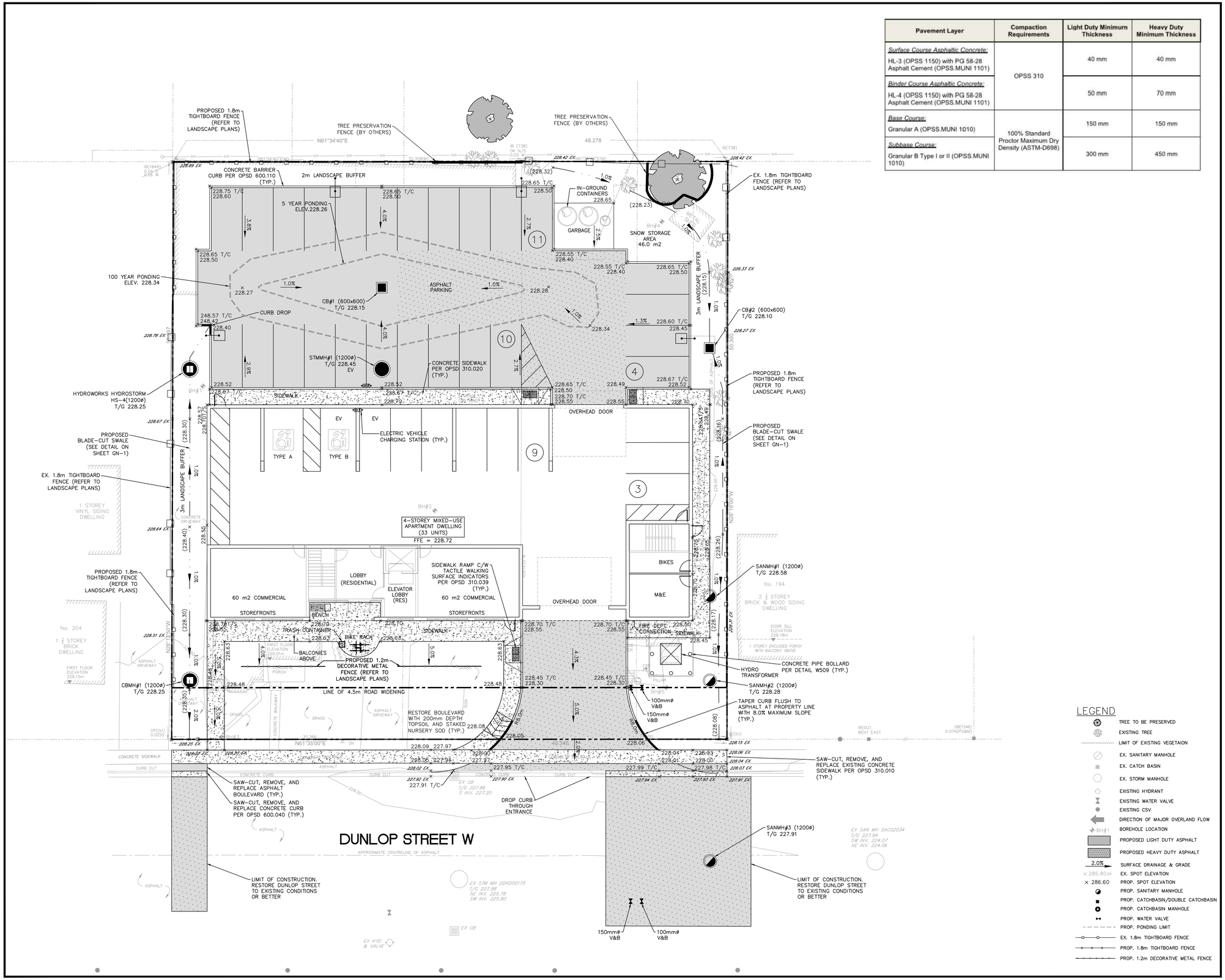
CLIENT/PROJECT

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT

DRAWING TITLE

SITE SERVICING PLAN

PROJECT NO.	DRAWING NO.	REVISION
22-11713-B	SERV-1	1



Pavement Layer	Compaction Requirements	Light Duty Minimum Thickness	Heavy Duty Minimum Thickness
Surface Course Asphaltic Concrete: HL-3 (OPSS 1150) with PG 58-28 Asphalt Cement (OPSS.MUNI 1101)	OPSS 310	40 mm	40 mm
Binder Course Asphaltic Concrete: HL-4 (OPSS 1150) with PG 58-28 Asphalt Cement (OPSS.MUNI 1101)		50 mm	70 mm
Base Course: Granular A (OPSS.MUNI 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm	150 mm
Subbase Course: Granular B Type I or II (OPSS.MUNI 1010)		300 mm	450 mm

LEGEND

- TREE TO BE PRESERVED
- EXISTING TREE
- LIMIT OF EXISTING VEGETAION
- EX. SANITARY MANHOLE
- EX. CATCH BASIN
- EX. STORM MANHOLE
- EXISTING HYDRANT
- EXISTING WATER VALVE
- EXISTING CSV
- DIRECTION OF MAJOR OVERLAND FLOW
- BH#1 BOREHOLE LOCATION
- PROPOSED LIGHT DUTY ASPHALT
- PROPOSED HEAVY DUTY ASPHALT
- 2.0% SURFACE DRAINAGE & GRADE
- × 285.80 ex EX. SPOT ELEVATION
- × 286.60 PROP. SPOT ELEVATION
- PROP. SANITARY MANHOLE
- PROP. CATCHBASIN/DOUBLE CATCHBASIN
- PROP. CATCHBASIN MANHOLE
- PROP. WATER VALVE
- PROP. PONDING LIMIT
- EX. 1.8m TIGHTBOARD FENCE
- PROP. 1.8m TIGHTBOARD FENCE
- PROP. 1.2m DECORATIVE METAL FENCE

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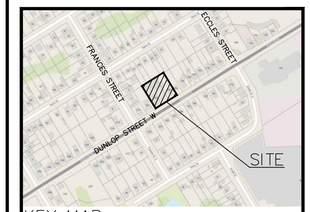

KEY MAP

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2024-07-19
PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED:	J.V.
DATE:	SEPT 2023
SCALE:	1:150

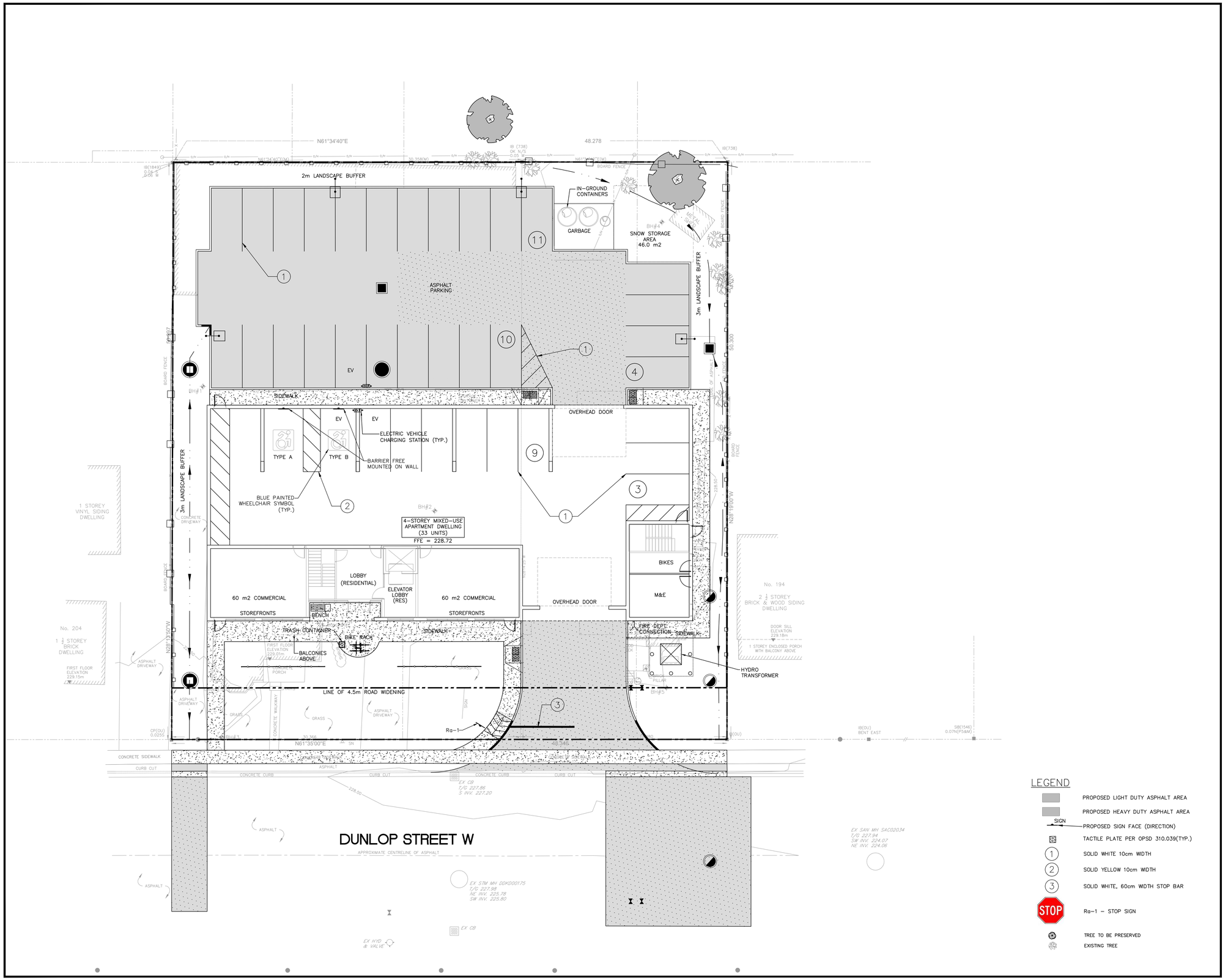
CLIENT/PROJECT

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT

DRAWING TITLE

SITE GRADING PLAN

PROJECT NO.	DRAWING NO.	REVISION
22-11713-B	GP-1	1



LEGEND

- PROPOSED LIGHT DUTY ASPHALT AREA
- PROPOSED HEAVY DUTY ASPHALT AREA
- SIGN — PROPOSED SIGN FACE (DIRECTION)
- TACTILE PLATE PER OPSD 310.039(TYP.)
- (1) SOLID WHITE 10cm WIDTH
- (2) SOLID YELLOW 10cm WIDTH
- (3) SOLID WHITE, 60cm WIDTH STOP BAR
- STOP — Ra-1 – STOP SIGN
- TREE TO BE PRESERVED
- EXISTING TREE

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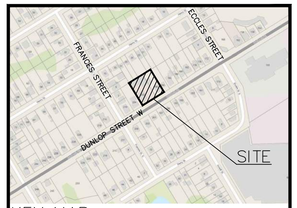

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VERTICAL CONTROL MONUMENTS
03120080022: MONUMENT LOCATED ON SE CORNER OF INNISFIL STREET AND VESPRA STREET APPROXIMATELY 18.5m FROM CENTERLINE OF INNISFIL STREET AND APPROXIMATELY 13m FROM CENTERLINE OF VESPRA STREET
ELEV. 222.437
03120080023: MONUMENT LOCATED IN BROCK PARK APPROXIMATELY 22m EAST OF CENTERLINE OF INNISFIL STREET AND APPROXIMATELY 87m NORTH OF BROCK STREET.
ELEV. 226.540

NO.	YY.MM.DD	REVISION	BY
1	24.03.21	REVISED PER AGENCY COMMENTS	C.A.

SEAL

LICENSED PROFESSIONAL ENGINEER
D. P. HORDYK
100530228
2024-07-19
PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED	J.V.
DATE:	SEPT 2023
SCALE:	1:150

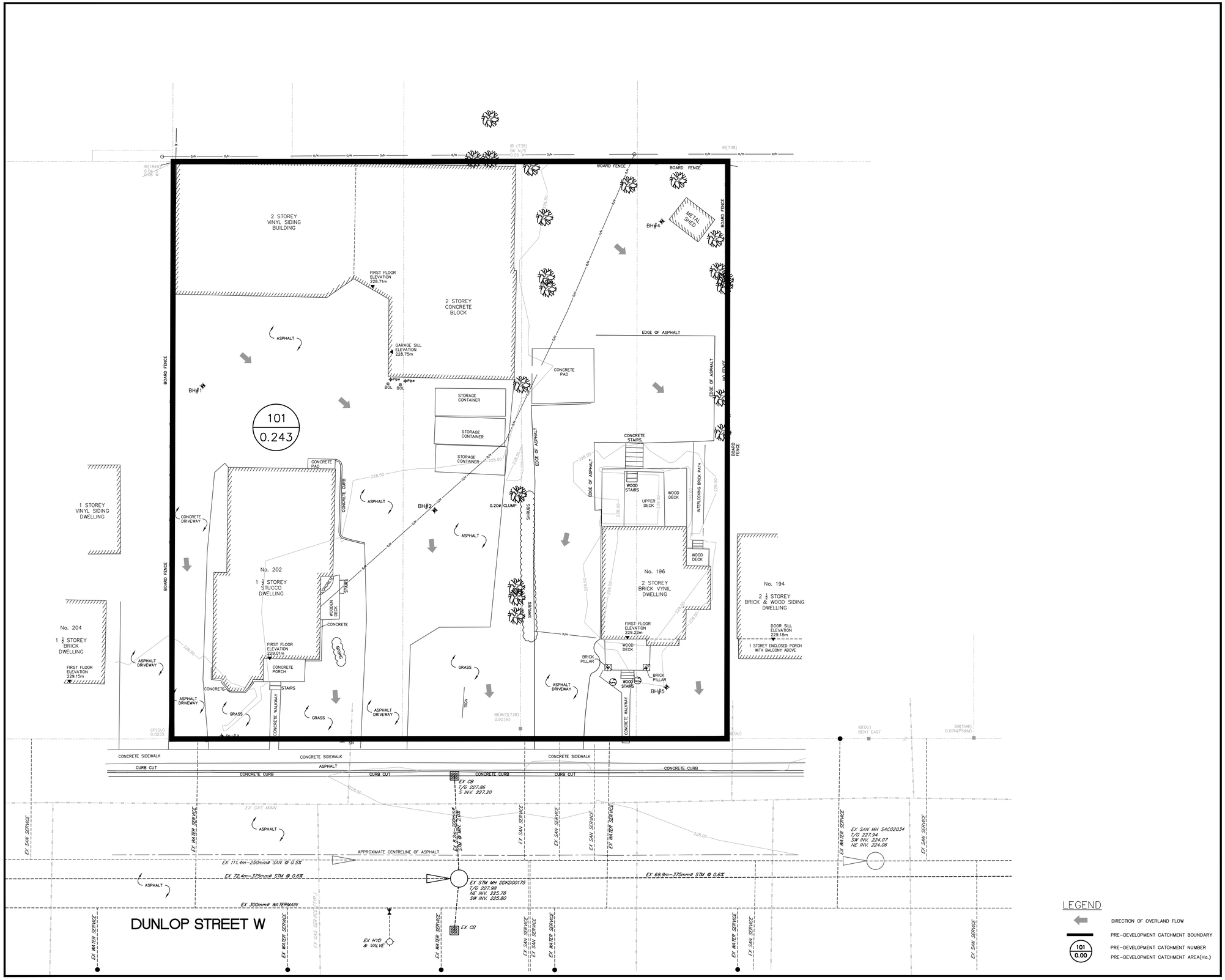
CLIENT/PROJECT

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT

DRAWING TITLE

PAVEMENT MARKING AND SIGNAGE PLAN

PROJECT NO.	DRAWING NO.	REVISION
22-11713-B	PM-1	1



PEL
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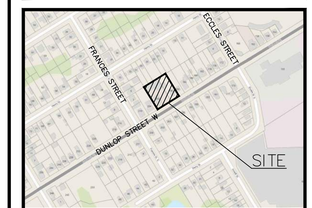

KEY MAP

NOTES

1. TOPOGRAPHIC SURVEY COMPLETED BY KRCMAR SURVEYORS LTD., DATED JUNE 10 2022.
2. SITE PLAN INFORMATION PROVIDED BY PATRICK MARKUS LUCKIE, ARCHITECT, DATED APRIL 25, 2024.

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SEAL

LICENSED PROFESSIONAL ENGINEER
D. P. HORDYK
100330228
2024-07-19
PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED:	J.V.
DATE:	SEPT 2023
SCALE:	1:150

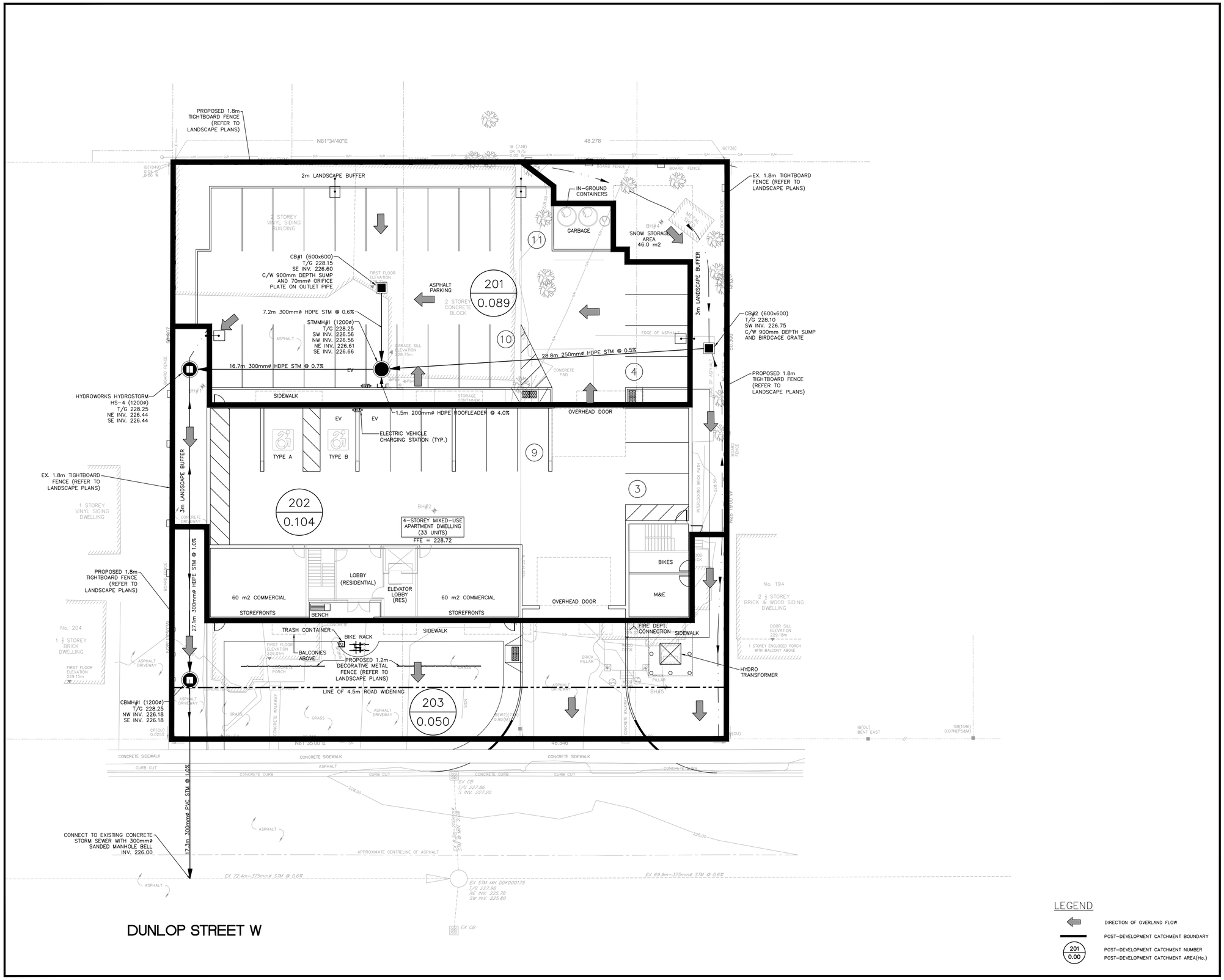
CLIENT/PROJECT

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT

DRAWING TITLE

PRE-DEVELOPMENT CATCHMENT PLAN

PROJECT NO.	DRAWING NO.	REVISION
22-11713-B	PRE-1	1



LEGEND

- DIRECTION OF OVERLAND FLOW
- POST-DEVELOPMENT CATCHMENT BOUNDARY
- 201 / 0.00 — POST-DEVELOPMENT CATCHMENT NUMBER / POST-DEVELOPMENT CATCHMENT AREA(Ha.)

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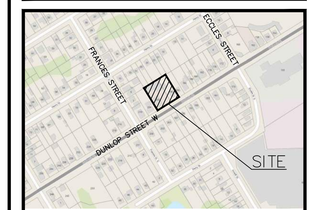

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1	24.03.21	REVISED PER AGENCY COMMENTS	C.A.

SEAL

LICENSED PROFESSIONAL ENGINEER
D. P. HORDYK
100330228
2024-07-16
PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED:	J.V.
DATE:	SEPT 2023
SCALE:	1:150

CLIENT/PROJECT

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT

DRAWING TITLE

POST-DEVELOPMENT CATCHMENT PLAN

PROJECT NO.	DRAWING NO.	REVISION
22-11713-B	POST-1	1

PARKING LOT/DRIVEWAY NOTES

1) EXISTING SOILS AND GRANULAR MATERIALS TO BE REMOVED TO THE LIMITS SHOWN ON THE DRAWINGS AND ANY SURPLUS IS TO BE DISPOSED OFF-SITE AT A LOCATION CHOSEN BY, AND PAID FOR, BY THE CONTRACTOR.
2) PROPOSED SUB-GRADE TO BE INSPECTED AND PROOF-ROLLED IN THE PRESENCE OF THE GEOTECHNICAL ENGINEER AND APPROVED PRIOR TO PLACEMENT OF GRANULAR "B". DEFICIENT AREAS ARE TO BE SUB-EXCAVATED AND REPLACED WITH GRANULAR "B" AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
3) THE GRANULAR SUB-BASE IS TO BE INSPECTED AND PROOF-ROLLED IN THE PRESENCE OF THE GEOTECHNICAL ENGINEER AND APPROVED PRIOR TO PLACEMENT OF THE GRANULAR "A".
4) THE GRANULAR BASE IS TO BE INSPECTED AND PROOF-ROLLED IN THE PRESENCE OF THE GEOTECHNICAL ENGINEER AND APPROVED PRIOR TO PLACEMENT OF THE ASPHALT.
5) CONTRACTOR TO PROVIDE SAMPLES OF GRANULAR MATERIALS AND THE ASPHALT MIX DESIGNS TO THE GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION.
6) GRANULAR MATERIALS TO BE UNIFORMLY COMPACTED TO MINIMUM 100% STANDARD PROCTOR MAXIMUM DRY DENSITY. HOT LAID ASPHALT TO BE ROLLED UNIFORMLY TO A MINIMUM OF 97% MARSHALL BULK DENSITY.
7) GRASSED AREAS DISTURBED DURING CONSTRUCTION TO BE RESTORED WITH MINIMUM 200mm TOPSOIL AND SOD.
8) TOPSOIL SHALL CONFORM TO OPSS 570, EXCEPT THAT TOPSOIL SHALL CONTAIN NOT LESS THAN 4% ORGANIC MATTER FOR CLAY LOAMS AND NOT LESS THAN 2% FOR SANDY LOAMS, WITH AN ACIDITY VALUE RANGING FROM P.H. 6.0 TO P.H. 7.5 AND CAPABLE OF SUSTAINING VIGOROUS PLANT GROWTH. IT SHALL BE FREE FROM ANY ADMIXTURE OF SUBSOIL, CLAY LUMPS, STONES GREATER THAN 25MM IN DIAMETER AND ANY OTHER EXTRANEOUS MATTER.
9) SOD SHALL CONFORM TO OPSS 571.

RESTORATION NOTES

A. REINSTATE ROADS TO PREVIOUS CONDITION OR BETTER. MINIMUM 40mm HL3, 100mm HL4, 150mm GRANULAR 'A' AND 500mm GRANULAR 'B'

B. CONTRACTOR TO RESTORE DRIVEWAYS AND BOULEVARD IN AREAS DISTURBED BY CONSTRUCTION TO EQUAL OR BETTER CONDITIONS.

C. MINIMUM GRAVEL DRIVEWAY RESTORATION TO BE 150mm, GRANULAR 'A'. ASPHALT DRIVEWAY RESTORATION TO BE 50mm OF HL3. AND 200mm GRANULAR 'A'

D. ALL GRASSED AREAS DISTURBED DURING CONSTRUCTION SHALL BE RESTORED WITH 200mm DEPTH TOPSOIL AND SOD. MAINTAIN UNTIL ESTABLISHED.

E. ALL RESTORATION WORK TO BE COMPLETED TO THE SATISFACTION OF THE ENGINEER.

GENERAL NOTES

1. DRAWINGS

A. ALL DRAWINGS SHALL BE PRODUCED IN ACCORDANCE WITH CURRENT CITY OF BARRIE STANDARDS & SYMBOLS FOR PLAN & PROFILE DRAWINGS, GENERAL SERVICE PLANS AND LOT GRADING PLANS.

2. MEASUREMENTS

A. ALL DIMENSIONS ARE IN METRES, EXCEPT PIPE DIAMETERS, WHICH ARE IN MILLIMETRES, UNLESS SPECIFIED OTHERWISE.

3. GENERAL

A. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT CITY OF BARRIE STANDARD DRAWINGS (BSD) AND ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

B. ORDER OF PRECEDENCE OF STANDARD DRAWINGS IS FIRSTLY CITY OF BARRIE STANDARD DRAWINGS (BSD) AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

C. LOCATION OF EXISTING SERVICES ARE NOT GUARANTEED. THE CONTRACTOR IS REQUIRED TO NOTIFY THE VARIOUS UTILITY COMPANIES 48 HOURS PRIOR TO THE COMMENCEMENT OF ANY WORK.

D. A ROAD OCCUPANCY PERMIT IS REQUIRED FROM THE ROADS AND PARKS OPERATIONS BRANCH PRIOR TO THE COMMENCEMENT OF WORK WITHIN ANY CITY RIGHT-OF-WAY.

E. A SITE ALTERATION PERMIT IS REQUIRED FROM THE ENGINEERING DEPARTMENT PRIOR TO THE COMMENCEMENT OF ANY EARTH WORKS ON THE SITE.

F. NATIVE MATERIAL, SUITABLE FOR BACKFILL, SHALL BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.

G. GRANULAR MATERIAL , USED FOR BACKFILL , SHALL BE PLACED IN LAYERS 150mm IN DEPTH MAXIMUM AND COMPACTED TO 100% STANDARD PROCTOR MAXIMUM DRY DENSITY.

H. ALL DISTURBED AREAS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION OR BETTER, AS DETERMINED BY THE CITY ENGINEERING DEPARTMENT.

I. ALL SILT CONTROL AND EROSION PROTECTION DEVICES ARE TO BE IN PLACE PRIOR TO THE COMMENCEMENT OF CONSTRUCTION AND SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL CONSTRUCTION IS COMPLETE AND THE GRASS HAS ESTABLISHED GROWTH, SUBJECT TO APPROVAL BY THE CITY ENGINEERING DEPARTMENT.

Barrie	Development General Notes	REV No. 5	DATE: APR 2023	SCALE: N.T.S	G200B

STORM SEWER

A. STORM SEWER TO BE PROVIDED ON ALL ROADS WITH CURB AND GUTTER.

B. PLACE ALL CATCH BASIN LATERALS AT 2% GRADE UNLESS OTHERWISE NOTED. PIPE SIZE MINIMUM 250mm DIA. SINGLE , 300mm DIA. DOUBLE.

C. STORM SEWERS SHALL BE CONSTRUCTED WITH BEDDING AS PER OPSD-802.010 (GRAN. 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD-802.030 OR 802.031 CLASS B (GRAN. 'A' BEDDING MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING.

D. MAINTENANCE HOLE TOPS (FRAMES) AND CATCH BASIN (FRAMES) ARE TO BE SET TO BASE COURSE ASPHALT GRADE AND THEN ADJUSTED TO FINAL GRADE WHEN THE TOP LIFT OF ASPHALT IS PLACED. ALL ADJUSTMENT WILL BE ACCORDANCE WITH BSD-N2.

E. STORM SEWER TO BE LOCATED OFFSET 3.0m SOUTH OR EAST OF CENTRELINE UNLESS OTHERWISE SPECIFIED.

F. ALL CONNECTIONS TO THE STORM MAIN SHALL BE MADE WITH A STORM MANHOLE OR APPROVED FACTORY TEE CONNECTION AS PER OPSD-708.01 OR 708.03.

G. PIPE MATERIAL TO BE REINFORCED CONCRETE WITH A MINIMUM STRENGTH OF 50 N/m/mm CERTIFIED TO C.S.A. STANDARD A247.2-1982, CLASS 50-D (PREVIOUSLY C.S.A. STANDARD A257.2-1974, CLASS II) OR PVC CERTIFIED TO C.S.A. STANDARDS 182.2 AND 182.4.

H. STORM SEWER TO BE MINIMUM 300mm DIAMETER WITH JOINTS CONFORMING TO C.S.A. STANDARD A257.3.

I. ALL PIPE BEDDING MUST CONFORM TO OPSD, MAXIMUM COVER TABLE. NO FLEXIBLE PIPE SEWERS WILL BE INSTALLED WITH A DEPTH OF COVER GREATER THAN 6 METRES UNLESS SPECIFICALLY APPROVED BY THE DIRECTOR OF ENGINEERING.

J. ALL PIPE HANDLING INSTALLATIONS MUST BE IN STRICT COMPLIANCE WITH MANUFACTURES INSTALLATION GUIDES AND THE O.C.P.A. OR UNIBELL GUIDELINES.

K. SUMP PUMP DISCHARGE PIPING IN BOULEVARD:
IN THE EVENT OF OVERACTIVE SUMP PUMP ACTIVITY, A 150mm DIAMETER PVC DR-28 SEWER MAY BE INSTALLED, WHEN SO DIRECTED BY THE DIRECTOR OF ENGINEERING, ALONG THE FRONTAGES OF DESIGNATED LOTS, WITH AN OFFSET OF 0.6m FROM BACK OF CURB. THIS SEWER IS TO BE CAPPED AT THE UPSTREAM END AND IS TO OUTLET INTO THE NEAREST CATCHBASIN DOWNSTREAM. DEPTH OF SEWER IS TO BE EQUAL TO SUBDRAIN DEPTH. NOT TO BE DIRECTLY CONNECTED TO FOUNDATION DRAINS.

Barrie	Storm Sewers General Notes	REV No. 5	DATE: APR 2023	SCALE: N.T.S.	D788

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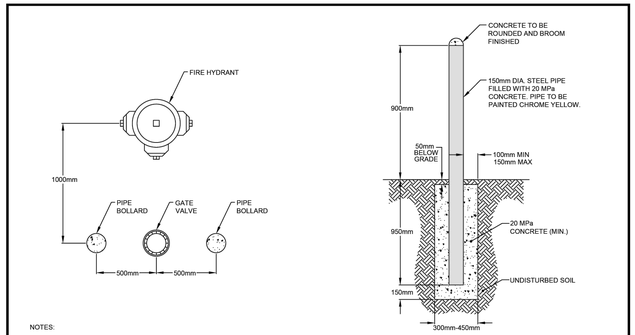


NOTES:

1. DIMENSION MAY BE REDUCED TO SUIT AVAILABLE SPACE IN BOULEVARD AREA.
   * DIMENSION - PROVIDED SPACE IS AVAILABLE
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. REQUIRED NUMBER OF BOLLARDS AND LOCATIONS MAY VARY WITH DIRECTION OF HAZARD(S).

Barrie	Hydrant Bollard	REV No. 2	DATE: APR 2023	SCALE: N.T.S	W509

GENERAL NOTES

SANITARY SEWERS

A. SANITARY SEWER TO BE LOCATED AT THE CENTRELINE OF THE ROAD.

B. SEWERS SHALL BE CONSTRUCTED WITH BEDDINGS AS PER OPSD-1005.02, (GRAN. 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD-1005.01 CLASS B (GRAN. 'A') FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF MUNICIPAL WORKS.

C. MAXIMUM DEFLECTION FROM COMBINED LIVE AND DEAD LOADING SHALL NOT EXCEED ANY C.S.A., O.P.S. OR MANUFACTURES RECOMMENDED SPECIFICATIONS.

D. PVC, CONCRETE AND PROFILE WALL PVC SEWERS SHALL HAVE RUBBER GASKET TYPE JOINTS AND SHALL BE CERTIFIED TO CONFORM TO ALL APPLICABLE CURRENT C.S.A. SPECIFICATIONS.

E. CONCRETE SANITARY SEWERS SHALL HAVE A MINIMUM STRENGTH OF 50 N/m/mm CONFORMING TO CSA STANDARD A257.2-1982, CLASS 50-D (PREVIOUSLY C.S.A. STANDARD A257.2-1974, CLASS II).

F. MAINTENANCE HOLE TOPS (FRAMES) ARE TO BE SET TO BASE COURSE ASPHALT GRADE AND THEN ADJUSTED TO FINAL GRADE WHEN THE TOP LIFT OF ASPHALT IS PLACE. ALL ADJUSTMENT WILL BE ACCORDANCE WITH BSD-N2.

G. ALL CONNECTIONS TO NEW SANITARY MAINS SHALL BE PRE-MANUFACTURED, FABRICATED TEES CONNECTIONS TO EXISTING SANITARY SEWER SHALL BE MADE WITH APPROVED FACTORY MADE TEES OR INSERTA-TEES IN STRICT ACCORDANCE TO MANUFACTURES GUIDELINES.

Barrie	Sanitary Sewers General Notes	REV No. 3	DATE: APR 2023	SCALE: N.T.S	S607

GENERAL NOTES - WATERMAIN

1. CONTRACTORS SHALL INFORM THE CITY OF BARRIE WATER OPERATIONS DEPARTMENT A MINIMUM OF 48 HOURS IN ADVANCE OF THEIR INTENTIONS TO PERFORM WORK ON WATER INFRASTRUCTURE.

2. OPERATION OF HYDRANTS AND VALVES ON THE POTABLE WATER SYSTEM BY OTHER THAN QUALIFIED WATER OPERATIONS STAFF IS PROHIBITED BY CURRENT BY-LAW. CITY SERVICE FEES ARE PER THE CURRENT FEES BY-LAW. THE CITY'S WATER OPERATIONS STAFF WILL SWAB, PRESSURE TEST, CHLORINATE AND FLUSH ALL NEW WATERMAINS.

3. MINIMUM COVER OVER WATERMAIN SHALL BE 1.7m. THE MINIMUM HORIZONTAL SEPARATION BETWEEN WATERMAIN AND SEWERS SHALL BE 2.5m. WHERE WATERMAIN CONFLICTS WITH SEWER PIPES, DEFLECT WATERMAIN HORIZONTALLY OR VERTICALLY WHILE PROVIDING A MINIMUM OF 0.5m CLEARANCE BETWEEN WATERMAIN AND SEWERS. MAINTAIN MINIMUM DEPTH OF COVER AT ALL TIMES.

4. WATERMAIN SHALL BE INSTALLED IN BEDDING AS PER OPSD 802.010 (GRANULAR 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD 802.030 OR 802.031 CLASS 'B' (GRANULAR 'A' BEDDING MATERIAL, GRANULAR 'A' OR SELECT NATIVE COVER MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF WATER OPERATIONS. ALTERNATIVE EMBEDMENT MATERIAL - SAND MEETING GRADATION REQUIREMENTS OF OPSS.MUNI 1004.05.07 COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY IS PERMISSIBLE WHERE NOTED IN STANDARD DETAILS. GEOTECHNICAL CERTIFICATION OF MATERIAL AND COMPACTION TESTING MUST BE PROVIDED EVERY 150 METRES. THE COMPACTION TESTING MUST INCLUDE THE ENTIRE EMBEDMENT ENVELOPE (HAUNCHES, BEDDING, TOP OF PIPE AND COVER).

5. COPPER WATER MAINS AND SERVICES 25mm TO 50mm IN DIAMETER SHALL BE EMBEDDED IN SAND 100mm ABOVE AND BELOW TO CONFORM TO OPSS.MUNI 1004.05.07.

6. RESTRAINING WILL BE REQUIRED ON ALL HYDRANTS. THRUST BLOCKS, AS PER OPSD 1103.010 AND 1103.020. RESTRAINING DEVICES MAY BE REQUIRED IN ADDITION TO STANDARD CONCRETE THRUST BLOCKING WHERE SOIL CONDITIONS WARRANT AT THE CITY'S DISCRETION.

7. NEW WATERMAINS TO BE PVC DR18 CL150 MINIMUM; DUCTILE IRON CL52 AS PER THE APPROVED MANUFACTURERS PRODUCTS FOR LINEAR WATER SYSTEMS LIST.

8. TRACING WIRE SHALL BE #12 AWG HIGH STRENGTH COPPER CLAD (HS-CSS) AND SHALL BE INSTALLED ON THE TOTAL LENGTH OF ALL WATERMAIN AND BROUGHT UP AT EACH HYDRANT AND TERMINATED INSIDE A HYDRANT TEST STATION. ALL SPLICES TO UTILIZE CONNECTORS AS PER THE APPROVED MANUFACTURERS PRODUCTS FOR LINEAR WATER SYSTEMS LIST.

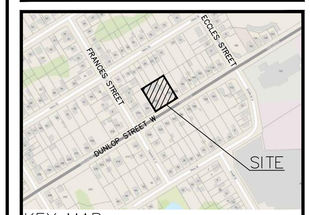
9. ALL WATER SERVICES SHALL BE MINIMUM 25mm TYPE 'K' COPPER OR 25mm CROSS-LINKED POLYETHYLENE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF WATER OPERATIONS. WATER SERVICE SADDLES SHALL BE USED WHEN TAPPING INTO PVC WATERMAIN.

10. SERVICE TAPPINGS SHALL BE PLACED AT A MINIMUM SEPARATION OF 1.0m AND A MINIMUM OF 0.6m FROM JOINTS. (ENDS OF PIPE)

11. RISER PIPES ARE TO BE INSTALLED AS PER BSD-510, AND REMOVED AS DIRECTED. SWABBING SCHEDULE TO BE SUPPLIED BY A WATER OPERATIONS FIELD REPRESENTATIVE. ALL RISERS ARE TO BE RESTRAINED OR THRUST BLOCKED.

12. ALL NEW CURB STOPS AND BOXES TO BE LOCATED AT PROPERTY LINE AND OUT OF DRIVEWAYS AND SIDEWALKS.

Barrie	Watermain General Notes	REV No. 4	DATE: APR 2023	SCALE: N.T.S.	W539



KEY MAP

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SEAL: LICENSED PROFESSIONAL ENGINEER D. P. HORDYK 100530228 2024-07-19 PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED	J.V.
DATE:	SEPT 2023
SCALE:	

CLIENT/PROJECT

202 DUNLOP STREET WEST APARTMENT DEVELOPMENT

DRAWING TITLE

GENERAL NOTES PLAN

PROJECT NO.	DRAWING NO.	REVISION
22-11713-B	GN-1	1

202 DUNLOP STREET W APARTMENT DEVELOPMENT
City of Barrie

Project Number: 22-11713B
Date: July 17, 2024
Design By: DH
Checked By: JHV
File:

SANITARY SEWER DESIGN SHEET
ENGINEERING AND PUBLIC WORKS

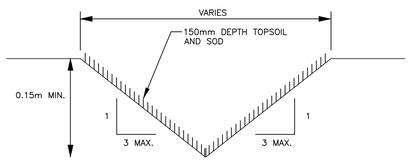
Drainage Area Plan No: N/A

Design Parameters

Average Daily Flow			
Residential	0.0026 L/s/c	Mannings "n"	0.0130
		Min. Velocity	0.60 m/sec
		Max. Velocity	3.0 m/sec
		Residential Harmon Peaking Factor (F)	
Commercial	0.324 L/s/ha	Infiltration	0.10 L/s/ha

PINESTONE ENGINEERING LTD.

LOCATION				RESIDENTIAL AREAS and POPULATION						SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL			TOTALS- C.I FLOW	INFILTRATION			DESIGN							
										HECTARES AND FLOW OF EACH ZONING																				
										0.00 L/s/ha			0.324 L/s/ha			0.00 L/s/ha														
STREET	AREA NO.	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA	UNITS	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	TOTALS- C.I FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY
				ha		1000s	1000s		L/sec	ha	ha	L/sec	ha	ha	L/sec	ha	ha	L/sec	L/sec	ha	ha	L/sec	L/sec	m	%	mm	L/sec.	m/s	m/s
Proposed Apartment Building (33 Residential Units, 2 Commercial Units)		SANMH1	SANMH2	0.26	33.00	0.055	0.055	4.305976	0.6180				0.012	0.012	0.0039				0.6219	0.26	0.26	0.0255	0.6474	7.4	2.00	150	21.5267	1.219	0.543
		SANMH2	SANMH3				0.055	4.305976	0.6180					0.012	0.0039				0.6219	0.00	0.26	0.0255	0.6474	15.8	7.50	150	41.6863	2.360	0.857
																Capacity of Immediate Downstream Reach of 250mm dia. Sanitary Sewer =								111.4	0.50	250	42.0285	0.857	



BLADE CUT SWALE
NTS

202 DUNLOP STREET APARTMENT DEVELOPMENT
City of Barrie

Project Number: 22-11713B
Date: July 17, 2024
Design By: DPH
Checked By: JHV
File:

STORM SEWER DESIGN SHEET
ENGINEERING AND PUBLIC WORKS

Drainage Area Plan No: POST-1

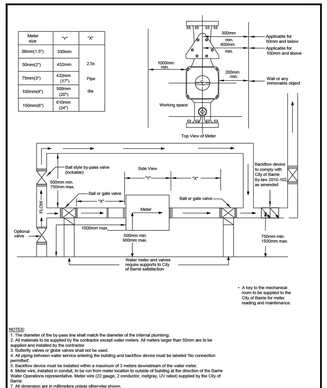
Design Parameters

100 YEAR STORM

Q=kAIR, k=0.00278		Manning's "n"	0.013
Intensity (I) = a/(tc+b)^c		Min. Velocity	0.750 m/s
a =	1383.628	Max. Velocity	4.000 m/s
b =	4.905		
c =	0.754		

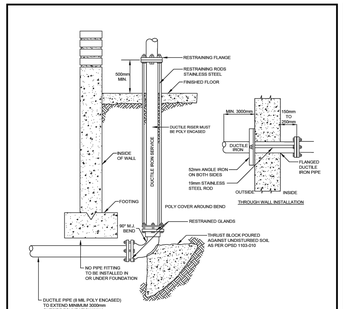
PINESTONE ENGINEERING LTD.

LOCATION				STORMWATER FLOW									DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME TOTAL	CONCENTRATION TIME IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY
				ha		ha	ha	min	min	mm/hr	L/s	mm	m	%	L/s	m/s	m/s
	201	CB#1	STMMH#1	100 YEAR CONTROLLED DESIGN FLOW FROM VO MODELLING							14.00000	300	7.2	0.60	74.90409	1.0597	0.8111
		CB#2	STMMH#1	0.020	0.13	0.0025	0.0025	10.0000	1.2616	180.43759	1.24953	250	28.8	0.50	42.04989	0.8566	0.3805
	202	BLDG	STMMH#1	100 YEAR CONTROLLED DESIGN FLOW FROM VO MODELLING							57.00000	200	1.5	4.00	65.59688	2.0880	2.3515
	201 & 202	STMMH#1	HS-4	100 YEAR CONTROLLED DESIGN FLOW FROM VO MODELLING							71.00000	300	16.7	0.70	80.90566	1.1446	1.2909
	201 & 202	HS-4	CBMH#1	100 YEAR CONTROLLED DESIGN FLOW FROM VO MODELLING							71.00000	300	27.1	1.00	96.70076	1.3680	1.4947
		CBMH#1	EXSTMSR	0.005	0.13	0.0006	0.0006	10.0000	0.1927	180.43759	71.31238	300	17.3	1.00	96.70076	1.3680	1.4961



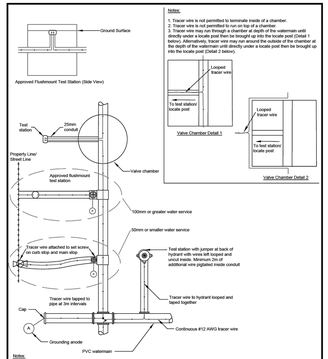
NOTES:
1. The diameter of the by pass line shall match the diameter of the internal plumbing.
2. All materials to be supplied by the contractor except water meters. All meters larger than 50mm are to be supplied and installed by the contractor.
3. Butterfly valves or globe valves shall not be used.
4. The piping between water service entering the building and backflow device must be labeled "No connection permitted".
5. Backflow device must be installed within a maximum of 3 meters downstream of the water meter.
6. Backflow device must be tested by a City of Barrie approved tester to outside of building at the direction of the Barrie Water Operations representative. Meter wire (22 gauge, 2 conductor, melights, UV rated) supplied by the City of Barrie.
7. All dimension are in millimeters unless otherwise shown.
8. Contractor to provide flat secure (vertical) surface for the smart point to be mounted on.

Barrie	Water Meter Installation with By-Pass Assembly	REV No. 4	DATE: APR 2023 SCALE: N.T.S	W533



NOTES:
1. INSTALLATION MUST MEET THE CURRENT NATIONAL FIRE PROTECTION ACT.
2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN.

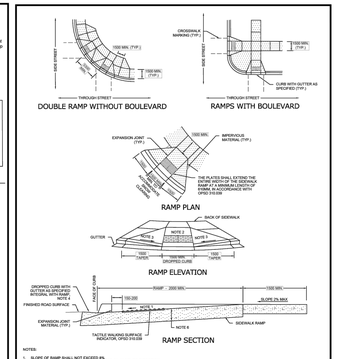
Barrie	Water Service 100mm to 300mm	REV No. 2	DATE: APR 2023 SCALE: N.T.S	W505



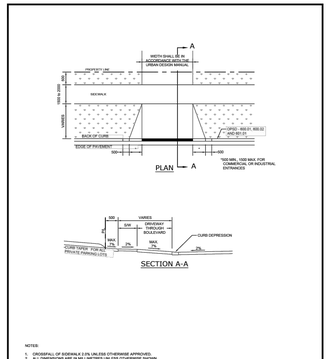
Notes:
1. Tracer wire is not permitted to terminate inside of a chamber.
2. Tracer wire is not permitted to run on top of a chamber.
3. Tracer wire may run through a chamber at depth of the watermain until directly under a locate post then be brought up into the locate post (Detail 1 below). Alternatively, tracer wire may run around the outside of the chamber at depth of the watermain until directly under a locate post then be brought up into the locate post (Detail 2 below).

Notes:
1. To be interpreted in conjunction with the current Drinking Water Infrastructure Standards and the Approved Manufacturers' Products for Linear Water Systems list. Tracer wire to be installed as per the City's Tracer Wire Infrastructure Standards.
2. Tracer wire shall be installed at a minimum of 25mm installed to a depth of 600mm below grade.
3. All connections must be watertightcoded.
4. Splicing of tracer wire is not allowed unless specified or approved.
5. Heat shrink is to be completed by a heat gun and not using an open flame.
6. SnakePits are to be placed inside of a SSL road leader with lid.

Barrie	Water Infrastructure Tracer Wire	REV No. 5	DATE: APR 2023 SCALE: N.T.S	W515

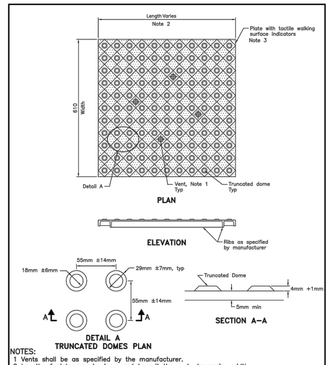

DOUBLE RAMP WITHOUT BOULEVARD
RAMPS WITH BOULEVARD
CROSSWALK MARKING (TYP.)
1500 MIN. (TYP.)
CURB WITH GUTTER AS SPECIFIED (TYP.)
THROUGH STREET
SIDE STREET
RAMP PLAN
RAMP ELEVATION
RAMP SECTION
EXPANSION JOINT (TYP.)
APPROVOUS MATERIAL (TYP.)
THE PLATES SHALL EXTEND THE FULL WIDTH OF THE CONCRETE RAMP AT A MINIMUM SLOPE OF 1:50 IN ACCORDANCE WITH AODA 4.8.2
BACK OF SIDEWALK
GUTTER
DROPPED CURB
DROPPED CURB WITH GUTTER AS SPECIFIED INTERNAL WITH RAMP
FINISHED ROAD SURFACE
EXPANSION JOINT MATERIAL (TYP.)
TACTILE WALKING SURFACE INDICATOR, OPSD 310.030
SIDEWALK RAMP
SLOPE 2% MAX
NOTES:
1. SLOPE OF RAMP SHALL NOT EXCEED 8%.
2. CROSS SLOPE OF RAMP SHALL NOT EXCEED 2% IN EITHER DIRECTION.
3. CROSS SLOPE OF FLARED SIDE OF RAMP SHALL NOT EXCEED 8%.
4. PROVIDE 1500 MIN. DIAMETER LEVEL LANDING AT TOP OF STEP AT GUTTER LINE.
5. ACCESSIBLE PEDESTRIAN SIGNAL TO HAVE TACTILE ARROW THAT ALIGNS WITH DIRECTION OF CROSSWALK.
6. MINIMUM THICKNESS OF RAMP IS 200mm. MINIMUM THICKNESS OF SIDEWALK AND FLARED SIDES ADJACENT TO RAMP IS 150mm.
7. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
8. FOR CROSSWALK MARKINGS AND DRAINAGE REFER TO OTM BOOK 12.

Barrie	SIDEWALK RAMPS UNSIGNALIZED INTERSECTIONS	REV No. 2	DATE: APR 2023 SCALE: N.T.S	R318



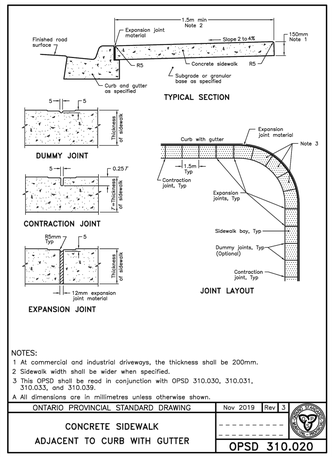
NOTES:
1. CROSSFALL OF SIDEWALK 2.0% UNLESS OTHERWISE APPROVED.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
3. DRIVEWAYS ON HOME TURNS OVER PRIVATE PARKING SLOPES MAY BE CONSIDERED WHEN THE BOULEVARD WIDTH IS LESS THAN 2.4M OR DURING ROAD RECONSTRUCTION.
4. REVISED SINGES ARE NOT APPROVED.

Barrie	DRIVEWAY AND ENTRANCE DETAIL	REV No. 2	DATE: APR 2023 SCALE: N.T.S	R319



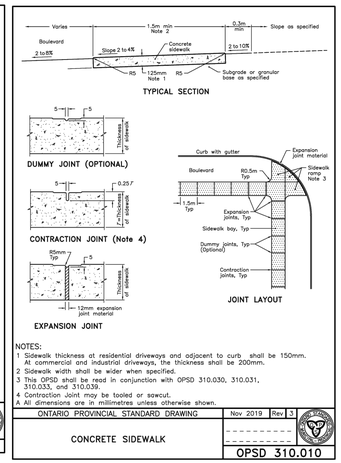
NOTES:
1 Vents shall be as specified by the manufacturer.
2 Length of plate may be increased to suit the curb depression width.
3 Material of plate shall be as specified in Contract Documents.
A Adjacent cast iron plates shall be permanently connected using a locking mechanism and any hardware shall be hot dipped galvanized.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2019	Rev 1
CONCRETE SIDEWALK RAMPS TACTILE WALKING SURFACE INDICATORS COMPONENT	OPSD 310.039	



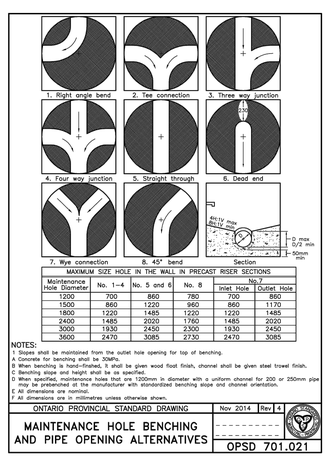
NOTES:
1 At commercial and industrial driveways, the thickness shall be 200mm.
2 Sidewalk width shall be wider when specified.
3 This OPSD shall be read in conjunction with OPSD 310.030, 310.031, 310.033, and 310.039.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2019	Rev 3
CONCRETE SIDEWALK ADJACENT TO CURB WITH GUTTER	OPSD 310.020	



NOTES:
1 Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways, the thickness shall be 200mm.
2 Sidewalk width shall be wider when specified.
3 This OPSD shall be read in conjunction with OPSD 310.030, 310.031, 310.033, and 310.039.
4 Contraction Joint may be tooled or sawcut.
A All dimensions are in millimetres unless otherwise shown.

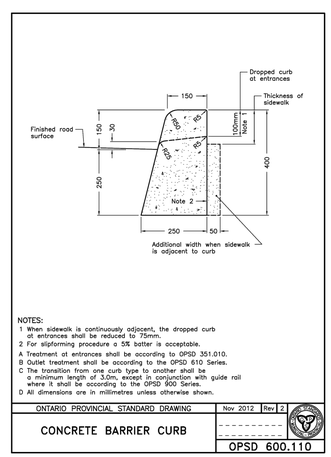
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2019	Rev 3
CONCRETE SIDEWALK	OPSD 310.010	



MAXIMUM SIZE HOLE IN THE WALL IN PRECAST RISER SECTIONS					
Maintenance Hole Diameter	No. 1–4	No. 5 and 6	No. 8	No. 9	
				Inlet Hole	Outlet Hole
1200	700	860	780	700	860
1500	860	1220	960	860	1170
1800	1220	1485	1220	1220	1485
2400	1485	2020	1760	1485	2020
3000	1930	2450	2300	1930	2450
3600	2470	3085	2730	2470	3085

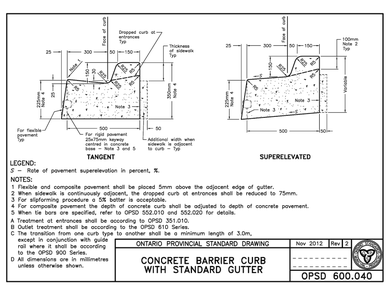
NOTES:
1 Slopes shall be maintained from the outlet hole opening for top of benching.
A Concrete for benching shall be 30MPa.
B When benching is hand-finished, it shall be given wood float finish, channel shall be given steel trowel finish.
C Benching slope and height shall be as specified.
D When specified, maintenance holes that are 1200mm in diameter with a uniform channel for 200 or 250mm pipe may be prebenched at the manufacturer with standardized benching slope and channel orientation.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 4
MAINTENANCE HOLE BENCHING AND PIPE OPENING ALTERNATIVES	OPSD 701.021	



NOTES:
1 When sidewalk is continuously adjacent, the dropped curb at entrances shall be reduced to 75mm.
2 For slipforming procedure a 5% batter is acceptable.
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

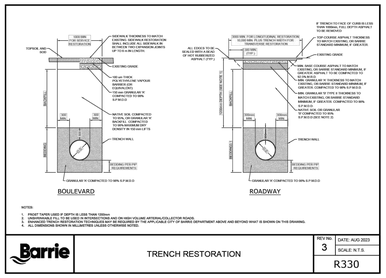
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
CONCRETE BARRIER CURB	OPSD 600.110	



LEGEND:
S = Rate of pavement superelevation in percent, %.

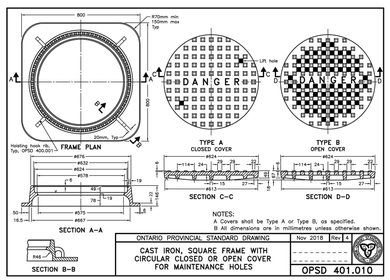
NOTES:
1 Flexible and composite pavement shall be placed 5mm above the adjacent edge of gutter.
2 When sidewalk is continuously adjacent, the dropped curb at entrances shall be reduced to 75mm.
3 For slipforming procedure a 5% batter is acceptable.
4 For composite pavement the depth of concrete curb shall be adjusted to depth of concrete pavement.
5 When tie bars are specified, refer to OPSD 552.010 and 552.020 for details.
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
CONCRETE BARRIER CURB WITH STANDARD GUTTER	OPSD 600.040	



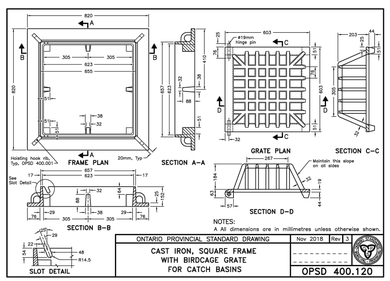
NOTES:
1. FRONT TAPERS USED IF DEPTH IS LESS THAN 100mm
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
3. DRAWING TRENCH RESTORATION TECHNIQUES MAY BE REQUIRED ON HIGH VOLUME ARTERIAL/COLLECTOR ROADS.
4. ALL DIMENSIONS MUST BE VERIFIED BY THE APPLICABLE CITY OF BARRIE DEPARTMENT ABOVE AND BEYOND WHAT IS SHOWN ON THIS DRAWING.
5. ALL DIMENSIONS MUST BE VERIFIED BY THE APPLICABLE CITY OF BARRIE DEPARTMENT.

Barrie	TRENCH RESTORATION	REV No. 3	DATE: AUG 2023 SCALE: N.T.S	R330



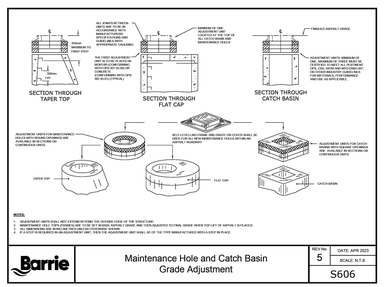
NOTES:
A Covers shall be Type A or Type B, as specified.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2018	Rev 1
CAST IRON, SQUARE FRAME WITH CIRCULAR CLOSED OR OPEN COVER FOR MAINTENANCE HOLES	OPSD 401.010	

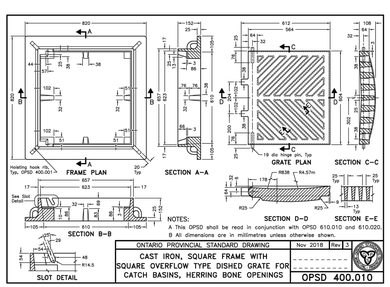


NOTES:
A The separator must be watertight.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2018	Rev 1
CAST IRON, SQUARE FRAME WITH BIRDCAGE GRATE FOR CATCH BASINS	OPSD 400.120	

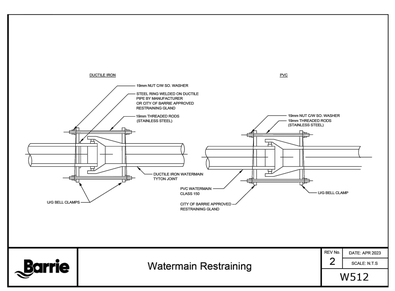


Barrie	Maintenance Hole and Catch Basin Grade Adjustment	REV No. 5	DATE: APR 2023 SCALE: N.T.S	S606

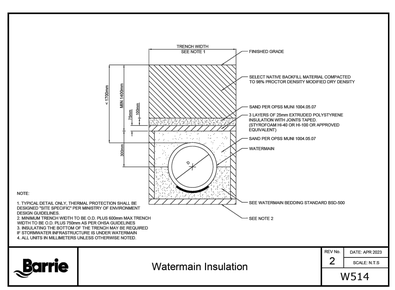


NOTES:
A This OPSD shall be read in conjunction with OPSD 610.010 and 610.020.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2018	Rev 3
CAST IRON, SQUARE FRAME WITH SQUARE OVERFLOW TYPE DISHED GRATE FOR CATCH BASINS, HERRING BONE OPENINGS	OPSD 400.010	



Barrie	Watermain Restraining	REV No. 2	DATE: APR 2023 SCALE: N.T.S	W512



NOTE:
1. TYPICAL DETAIL ONLY. THERMAL PROTECTION SHALL BE DESIGNED TO THE SPECIFIC PER MINISTRY OF ENVIRONMENT DESIGN GUIDELINES.
2. TRENCH BASE MINIMUM WIDTH TO BE O.D. PLUS 600mm MAX TRENCH WIDTH TO BE O.D. PLUS 750mm AS PER OHSA GUIDELINES
3. INSULATING THE BOTTOM OF THE TRENCH MAY BE REQUIRED
4. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
5. ALL UNITS IN MILLIMETRES UNLESS OTHERWISE NOTED.

Barrie	Watermain Insulation	REV No. 2	DATE: APR 2023 SCALE: N.T.S	W514

Specifications

1. Must be independently tested to the 2013 NJDEP Laboratory Protocol and 2013 ETV Canada protocol (ISO 14024:2016). Separator must be sized based on this data.

2. Any testing performed by the manufacturer is unacceptable to demonstrate an alternate equal.

3. Field Testing is unreliable, site and storm specific, and subject to compounding equipment and analytical errors and therefore is unacceptable as verification of an alternate equal. TARP verification as per NJDEP is testing consistent with the 2013 NJDEP laboratory protocol.

4. The separator must be designed based on the following criteria:

Flow Criteria	
Water Quality Flow Rate cfs (L/s)	
Peak Design Flow Rate cfs (L/s)	

TSS Removal Criteria	
Annual TSS Removal (%)	
NJDEP/ETV Canada TSS	
OK110 Sand	
City of Toronto	
Other	

Notes:

1. Headloss K factor of 1.04 for hydraulic gradeline calculations

2. Sump depths shown are typical. Additional depth can be added as required

3. Multiple inlet pipes allowed

4. Drops allowed

5. Inlet invert elevations should be the same or higher than the outlet invert elevation. Inlet can be up to 12" (300 mm) lower than outlet if pretreatment area is omitted but 12" (300 mm) must be added to sump depth to maintain overall treatment volume

6. Solid Cover shown. HydroStorm can be designed with an inlet grate if required.

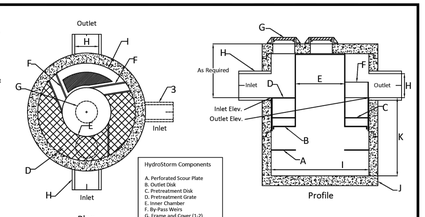
7. Oil capacities given are spill capacities.

8. Sediment depths are maximum holding capacities and not recommended capacities for regular maintenance.

9. Capacities are rounded down to nearest 5 gal or ft3 (1L or 0.1 m3 for metric units)

10. Base Extensions not provided on standard units larger than the HS 6. Extensions can be provided if required due to groundwater/buoyancy concerns at the request of the engineer of record.

11. HS4 to HS6 models require one frame and cover. HS7 to HS12 models require two covers



HydroStorm Components

A. Perforated Scour Plate
B. Outlet Disk
C. Pretreatment Disk
D. Perforated Flared Grate
E. Inner Chamber
F. By-Pass Weirs
G. Frame and Cover (1-2)
H. Inlet and Outlet Pipes
I. Structure Diameter
J. Base Extension (HS4 - HS6)
K. Sump Depth

HydroStorm by Hydroworks, LLC
US Patent No. 10,710,907
www.hydroworks.com
888-290-7900

HydroStorm Dimensions / Capacities

Model	Diameter ft (m) (B)	Sump Depth ft (m) (K)	Inner Chamber Diam. ft (m) (E)	Max. Pipe dia (mm) (H)	Oil Spill Volume gal (L)	Sediment Volume ft3 (m3)	Total Volume gal (L)
HS 3	3 (0.9)	3 (0.9)	1.5 (0.45)	18 (450)	40 (155)	10 (0.35)	155 (600)
HS 4	4 (1.2)	4 (1.2)	2 (0.6)	24 (600)	95 (375)	30 (0.85)	375 (1420)
HS 5	5 (1.5)	5 (1.5)	2.5 (0.8)	30 (750)	165 (635)	60 (1.8)	730 (2780)
HS 6	6 (1.8)	6 (1.8)	3 (0.9)	36 (900)	270 (1030)	110 (3.2)	1265 (4800)
HS 7	7 (2.1)	6.5 (2.0)	3.5 (1.0)	42 (1050)	410 (1560)	160 (4.6)	1870 (7080)
HS 8	8 (2.4)	7 (2.1)	4 (1.2)	48 (1200)	615 (2330)	220 (6.2)	2630 (9960)
HS 10	10 (3.0)	9 (2.7)	5 (1.5)	60 (1500)	1130 (4285)	465 (13.1)	5285 (20015)
HS 12	12 (3.6)	11 (3.3)	6 (1.8)	72 (1800)	1875 (7100)	835 (23.7)	9305 (35225)

Hydroworks HydroStorm	
PROJECT:	
LOCATION:	
REVISION DATE: 08/07/2020	

PEL
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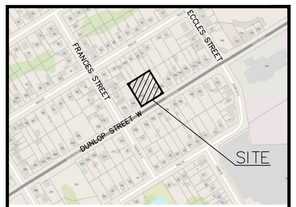
The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing 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.



KEY MAP

NOTES
1. TOPOGRAPHIC SURVEY COMPLETED BY KRCMAR SURVEYORS LTD., DATED JUNE 10 2022.
2. SITE PLAN INFORMATION PROVIDED BY PATRICK MARKUS LUCKIE, ARCHITECT, DATED APRIL 25, 2024.

NO.	YY.MM.DD	REVISION	BY
1	24.03.21	REVISED PER AGENCY COMMENTS	C.A.

SEAL
LICENSED PROFESSIONAL ENGINEER
D. P. HORDYK
100330228
2024-07-19
PROVINCE OF ONTARIO

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED:	J.V.
DATE:	SEPT 2023
SCALE:	

CLIENT/PROJECT

202 DUNLOP STREET WEST
APARTMENT DEVELOPMENT

DRAWING TITLE

STANDARD DETAILS PLAN

PROJECT NO.	DRAWING NO.	REVISION
22-11713-B	DET-1	1