

Functional Servicing Report

273-275 Sunview Street

Waterloo, Ontario

January 20, 2025

Revised August 11, 2025

Project Reference Number 24-239



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Revision Tracking

Revision	Date	Description
1	February 19, 2025	Updated Storm Sewer Design Sheet IDF Parameters
2	April 16, 2025	Updated SWM based on updated Site Plan
3	June 4, 2025	Updated SWM based on changes in grading plan
4	August 11, 2025	Sanitary Capacity Analysis Assessment Added

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1.0 Introduction

This Functional Servicing Report has been prepared for a proposed residential development located at 273-275 Sunview Street in Waterloo, Ontario. The site is 0.174 hectares and is currently developed with two detached residential homes. The proposed development is an 18-unit townhouse block with a total of 43 bedrooms.

The site is located on the west side of Sunview Street and south of Hickory Street West. The site location is shown in Figure 1.

This report reviews the functionality of the potable water supply, sanitary sewer servicing, and stormwater management.



Figure 1: Location of Subject Property (City of Waterloo GIS Mapping)

2.0 Overview of Proposed Development

The total site area is 0.174 ha. The existing single detached houses will be removed to be replaced by the proposed townhouses. Vehicle access to the site will be provided off Sunview Street.

The development will be serviced by municipal watermain, sanitary sewers and storm sewers. The water service will be brought to the site from the existing 150mm dia watermain in Sunview Street. The existing 200mm diameter sanitary sewer in Sunview Street will be used to provide sanitary service to the site.

The proposed development will include a storm sewer connection to Sunview Street. The storm sewer outlet will include an oil grit separator for quality control. Quantity control of stormwater runoff will be provided with parking lot storage and underground storage.

3.0 Environmental Features

The proposed development is not in close proximity to environmental features such as wetlands, woodlots, creeks or other water bodies. The site is not within GRCA regulated and Source Protection areas.

4.0 Water Servicing

The water demand for the residential development has been calculated in accordance with the Region of Waterloo Design Guidelines 2024, the Ministry of the Environment Drinking Water Systems Design Guidelines (2008) and the City of Waterloo Development Charges Background Study dated Jan. 6, 2020.

In accordance with the DGSSMS, the average residential daily demand is 225 L/person/day. The population density is 2.30 persons per unit for row housing based on the Development Charges Background Study.

Townhouse Development = 18 townhouse units x 2.30 persons per unit = 41.4 people

Total Population = 42 people

The peaking factors used to calculate the maximum daily demand, and the peak hourly demand are based on the Ministry of the Environment's drinking water systems design guidelines. The peaking factor used to determine the maximum daily demand is 2.75, while the peak hourly demand factor is 4.13.

Average Daily Demand: $225 \text{ L/day/person} \times 42 \text{ people} = 0.108 \text{ L/s}$

Maximum Daily Demand: $0.054 \text{ L/s} \times 2.75 = 0.296 \text{ L/s}$

Peak Hourly Demand: $0.054 \text{ L/s} \times 4.13 = 0.445 \text{ L/s}$

Water demand calculations are included in Appendix A.

The required fire flow is 8000 L/min or 133.3 L/s, as per the Fire Underwriter's Survey, 1999, for contiguous residential housing.

A 50mm diameter watermain will be brought into the site from Sunview Street. Each Townhouse unit will be serviced by a 25mm diameter water service off the 50mm watermain.

5.0 Sanitary Servicing

A 150mm diameter sanitary sewer will be brought into the site from the existing 200mm sanitary sewer in Sunview Street. Each townhouse unit will be serviced by 100mm diameter sanitary service.

The sanitary flow calculations are based on the Region of Waterloo's Design Guidelines which stipulate an average flow of 275 L/c/d for residential areas plus an allowance for inflow and infiltration of 0.25 L/s/ha.

The peak sewage flow from the proposed townhouse development to Sunview Street is 0.761 L/s.

The sanitary sewer design sheets have been included in Appendix B.

The City has completed sanitary capacity modeling analysis and the results of the model are included in Appendix B. The modeling indicates that there is sufficient capacity in the municipal sewer.

6.0 Stormwater Management

6.1 Geotechnical and Hydrogeological Conditions

Site specific geotechnical information was not available at the time this report was prepared. However, based on soils mapping soils are generally clayey silt till with low-medium permeability.

6.2 Existing Drainage Patterns

The site is located west of Sunview Street and south of Hickory Street W. There are no external lands draining to the site. Under existing conditions, the front of the lots drain overland towards Sunview Street. The existing 250mm diameter storm sewer along Sunview Street conveys the runoff north towards Hickory Street W. The back of the lots drains overland towards the backyard property line which drains north across the adjacent lot towards the existing storm sewer in Hickory Street W. All stormwater runoff from the property is ultimately directed to Hickory Street W. Therefore, the site has been considered as two catchments ultimately discharging to one outlet.

6.3 Proposed Drainage Patterns

The site will be graded to capture parking lot runoff, rooftop runoff and landscape runoff from the back of the units into catchbasins. Discharge will be controlled by a vortex valve and an orifice restriction at CBMH2. The restrictions installed on the structure will cause stormwater to back up into the underground chambers. The chambers, storm sewers and storm structures will provide stormwater retention volume. The on site storm sewers will connect to the storm sewer in Sunview Street, which outlets to the Hickory Street storm sewer outlet. Peak flows from the proposed development are controlled to match existing flows. It is presumed that the municipal system has the capacity to manage existing flows.

An oil grit separator will be installed to provide quality control of runoff prior to discharge to the Sunview Street storm sewer.

Due to the existing grades at the property line, a small landscaped area at the west property line will continue to drain overland toward the north. The proposed grading will result in a significant reduction in area that will contribute overland flow northward, resulting in a much improved drainage condition with reduced flows directed to the adjacent property.

The major overflow route will direct runoff to Sunview Street from where it will flow overland to the Hickory Street West outlet.

6.4 Stormwater Management Design Criteria

The stormwater management design criteria are in accordance with the City of Waterloo's Development Engineering Manual.

The design criteria are:

1. Control the 2 year, 5 year to 100 year post development peak discharge rates to the existing discharge rates.
2. Provide quality control of runoff to an enhanced level, 80% removal of suspended solids.

The storm sewers upstream of the outlet control orifice and vortex valve function as a component of the stormwater retention volume, and as such, they are not sized for conveyance. The storm sewers downstream of the outlet controls have been sized to convey the controlled discharge during the 5 year storm event. The storm design sheet is included in Appendix F.

6.5 Stormwater Modeling

MIDUSS Modeling was used to determine the volume of runoff generated from the design storm events.

The design storm hyetographs were based on the “Chicago” rainfall distribution, with the A, B, and C parameters fitted to the following IDF curve for the City of Waterloo.

Table 1: City of Waterloo IDF Parameters

Return Period	A	B	C
2 Year	1101	9.258	0.882
5 Year	1755	12.347	0.895
100 Year	4692	17.437	0.956

The site was divided into the drainage catchment areas for the existing and proposed conditions as shown in the tables below.

Table 2: Existing Drainage Catchment Areas For MIDUSS Modeling

Catchment ID	Description	Area (ha)	Percent Impervious (%)	Flow Length (m)	Slope (%)
101	Existing Area to Sunview	0.069 ha	51%	15m	0.5%
102	Existing Area North toward Hickory	0.105 ha	13%	30m	2.0%

Table 3: Proposed Drainage Catchment Areas For MIDUSS Modeling

Catchment ID	Description	Area (ha)	Percent Impervious (%)	Flow Length (m)	Slope (%)
201	Proposed Site (Uncontrolled)	0.036 ha	17%	15m	3.0%
202	Proposed Site (Controlled)	0.115 ha	78%	20m	2.5%
203	Northwest Landscaped Area	0.004 ha	0%	2m	20.0%
204	East Amenity Areas	0.007 ha	13%	3m	2.0%
205	East Driveway to CB1	0.012 ha	80%	10m	3.0%

Stormwater storage will be provided through the use of underground storage chambers (ADS Stormtech SC-800 or equivalent). The discharge rate from the underground storage will be controlled using a two stage outlet control system. A vortex valve will provide control of the 2 year and 5 year storm events, while a second outlet pipe installed at a higher elevation will provide additional outlet capacity during the 100 year storm event.

The stage storage discharge calculations for the storage chambers, pipe storage and structure storage are included in Appendix C. The Hydro International design tool was used to calculate the flows for the vortex valve. The vortex valve design information is included in Appendix G.

The results from the MIDUSS modelling are summarized below and the output files are included in Appendix D.

Table 4: MIDUSS Model Results – Peak Discharge Under Existing and Proposed Conditions to Hickory Street West Outlet

Storm Event	Existing Peak Flow (m ³ /s)	Proposed Peak Flow (m ³ /s)
2 Year Storm	0.010 m ³ /s	0.010 m ³ /s
5 Year Storm	0.015 m ³ /s	0.013 m ³ /s
100 Year Storm	0.039 m ³ /s	0.039 m ³ /s

The peak flow from the site under proposed conditions is less than or equal to the existing flow from the site for the 2 year, 5 year and 100 year storm events.

The performance of the stormwater management areas is summarized in the table below.

Table 5: Performance of Stormwater Quantity Control Components

Underground Storage Chambers, Pipe Storage, Structure Storage (Area 202)			
Vortex Valve Location	CBMH 2		
Invert	343.64		
Base of Storage	343.64		
Top of Storage	344.78		
Total Chamber Storage Vol. Provided	29.05 m ³		
Total Pipe Storage Vol. Provided	9.67m ³		
Total Structure Vol. Provided	4.14 m ³		
Orifice Location	CBMH2		
Orifice Diameter	130 mm		
Orifice Invert	344.17		
Overflow Elevation	345.58 (CBMH2)		
	2 Year Storm	5 Year Storm	100 Year Storm
Peak Inflow	0.020 m ³ /s	0.028 m ³ /s	0.054 m ³ /s
Peak Discharge	0.006 m ³ /s	0.010 m ³ /s	0.024 m ³ /s
Maximum Water Elevation	343.83 m	344.19 m	344.41 m
Maximum Storage Volume	4.33 m ³	16.80 m ³	29.57 m ³

6.6 Stormwater Quality Control

Stormwater quality control will be provided using an oil grit separator installed on storm sewer outlet prior to discharge to Sunview St.

The Stormceptor sizing program was used to select the appropriate OGS model as summarized in the table below. The sizing summary is included in Appendix E.

Table 6: Oil Grit Separator Performance Summary

Catchment ID	Area (ha)	Stormceptor Model	Quality Control Level (TSS Load Reduction)	Runoff Volume Capture
201	0.162 ha 74% Impervious	EFO4	95%	>90%

7.0 Erosion and Sediment Control

Erosion and sediment control measures will be implemented to minimize any impact to the adjacent properties during construction. The use of a mudmat at the property entrance will be used to eliminate material from entering the roadway. Catch basin sediment traps will be used to eliminate and sediment from entering the storm system during construction. The site will be surrounded by silt fencing during construction. Erosion and sediment control measures shall be inspected daily to be maintained and repaired as necessary.

8.0 Maintenance and Monitoring

The proposed stormwater management plan consists of several components. Each component, its primary function, and required maintenance is summarized in the table below.

SWM Component	Function	Maintenance Activity	Maintenance Frequency
Vegetated Swale	Convey runoff to catchbasin and provide removal of TSS	• Maintain vegetation by mowing and weeding • Inspect side slopes for erosion and slumping	• Bi-weekly or as required • Annually and after major rain events
Underground Chambers	Provide underground storage of runoff	• Maintain chamber system by cleaning the isolator row with jet-vac equipment	• Annually and after major rain events
Orifice at CBMH2	Restrict high flow discharge rates	• Inspect for debris and dirt clogging orifice	• Annually and after major rain events
Vortex valve at CBMH2	Restrict low flow discharge rates	• Inspect for debris and dirt clogging vortex valve	• Annually and after major rain events

9.0 Conclusions

The site will be serviced with municipal watermain, sanitary sewers, and storm sewers. The watermain on Sunview Street will be extended to provide water supply to the townhouses. The sanitary sewer will discharge to the existing sanitary sewer in Sunview Street and a storm sewer connection will be provided to Sunview Street.

Stormwater management will be achieved through the use of underground storage with controlled discharge. The total stormwater discharge from the subject property will be controlled to the existing discharge rates.

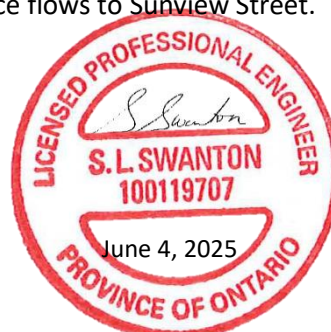
An oil grit separator unit will be installed the storm outlet to provide quality control to an enhanced, 80% removal, level.

The major overland flow route will direct surface flows to Sunview Street.

All of which is respectfully submitted,



Sandra Swanton, P.Eng.
K. Smart Associates Limited



APPENDIX A

Water Demand Calculations and Fire Flow Analysis

WATER SERVICING CALCULATIONS

273-275 Sunview St, Waterloo, Ontario

K. Smart Associates Limited
Project Number: 24-239
Date: 16-Apr-25

DESIGN CRITERIA

Residential Design Criteria (City of Waterloo Design Guidelines)

Residential Water Demand	225 L/cap/day
Density- Single Family	3.49 c/unit
Density - Row Housing	2.3 c/unit
Density - Apartment	1.76 c/unit

Peaking Factors

Maximum Day	2.75
Peak Hour	4.13

(Ministry of the Environment Design Guidelines for Drinking Water System)

PROPOSED DEVELOPMENT - BUILDING USAGE

Residential Occupancy		Density (persons/unit)
Single Family Units	0	3.49
Townhouse Units	18	2.3
Apartment Units	0	2.07
TOTAL	18 units	41.4 persons

(From Waterloo Development Charges Background Study (Hemson, 2020))

WATER DEMAND CALCULATIONS

<u>Residential</u>	
Average Day	9,315 L/day
Average Day	0.108 L/s
Maximum Day	0.296 L/s
Peak Hour	0.445 L/s

<u>TOTAL WATER DEMAND</u>	
Average Day	0.108 L/s
Maximum Day	0.296 L/s
Peak Hour	0.445 L/s

APPENDIX B

Sanitary Sewer Design Sheet
Sanitary Capacity Analysis

273-275 Sunview Street, City of Waterloo
SANITARY SEWER DESIGN SHEETS

K. Smart Associates Limited
Ref. Number 24-239
Date 16-Apr-25

City of Waterloo Design Criteria

City of Waterloo Design Criteria		
Residential Sewage Flow	0.004 L/s/c	(275 L/d/c)
Density- Single Family	3.49 c/unit	
Density - Row Housing	2.3 c/unit	
Residential Peaking Factor	1+(14/4+P ^{0.5}), P = Pop/1000	
Infiltration	0.25 L/s/ha	

LOCATION			POPULATION					SEWAGE FLOWS					SEWER DESIGN						
Street and Area	From MH	To MH	Individual Area (ha)	Total Area (ha)	Number of Units	Individual Pop.	Total Pop.	Res. Peaking Factor	Average Res. Flow (L/s)	Peak Res. Flow (L/s)	Total Infiltration (L/s)	Total Peak Flow (L/s)	Mannings 'n'	Pipe Size (mm)	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Q/Qcap (%)
Sunview St OUTLET	Townhouse Site	New MH1A	0.174	0.174	18	41.4	41.4	4.331	0.166	0.717	0.044	0.761	0.013	150	1	50	15.229	0.862	4.7%



MEMORANDUM - INTERNAL

DATE: August 6, 2025
TO: Alastair Duncan, Development Engineering
FROM: Veronica Kroess, Engineering Infrastructure
SUBJECT: 273-275 Sunview Street

I have conducted a preliminary assessment of the sanitary capacity in relation to SP-25-02 for 273-275 Sunview Street.

The sanitary calculations provided for the application notes that the proposed development will have a sanitary discharge of 0.761 L/s, as summarized in Table 1.

Table 1 – Sanitary Servicing anticipated maximum peak flow rates:

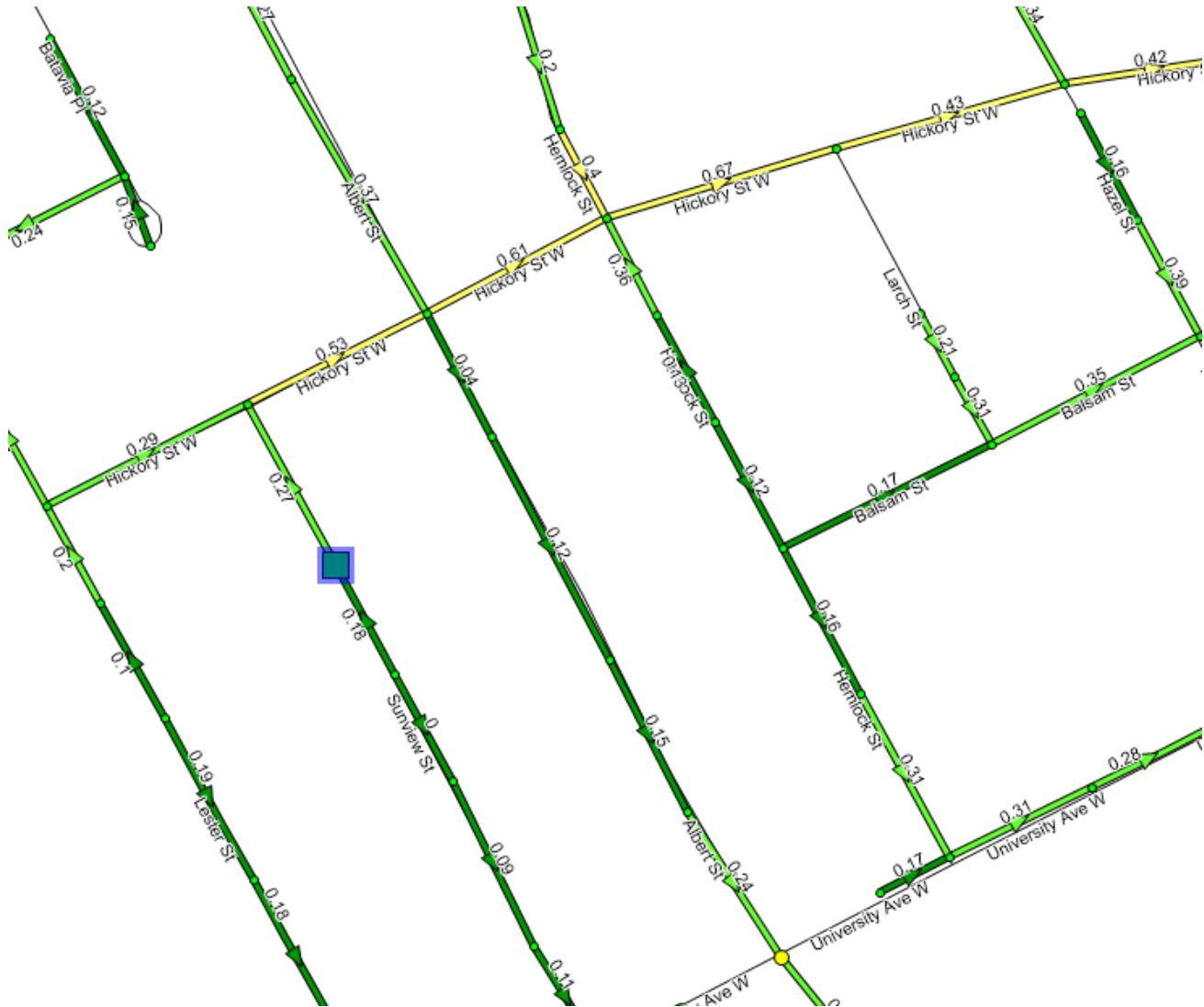
Source	Peak Flow (L/s)
Proposed Site	0.761

2051 Modelling Scenario

The future conditions PCSWMM sanitary sewer model includes loading rates that are projected to reflect 2051 conditions. The projected 2051 model estimated flows do not account for flows from the proposed development. To be conservative, the flows resulting from the proposed development were added to the sanitary sewer model flows to determine the effects of the proposed development on the sanitary sewer system. The analysis was conducted for the wet weather modelling scenario as it is more conservative, using the Sanitary Hydraulic model developed for the 2024 Sanitary Master Plan update.

University Trunk System

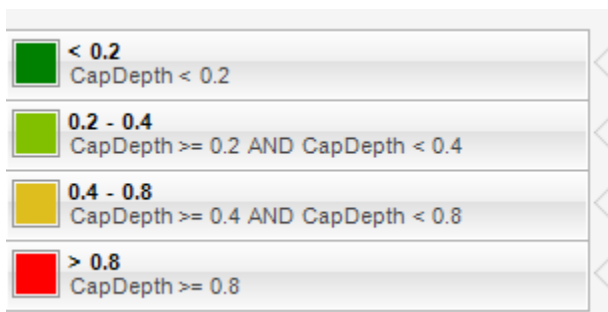
The proposed flow of 0.761 L/s was accounted for in the MH U7-96 flows, the closest downstream manhole. The 2051 projected ‘post-development’ modelling results indicate that the sanitary sewer on Sunview Street downstream of the proposed development appears to have available capacity under wet weather modelling scenarios, reaching a depth of 27 percent full, as shown on the figure below.



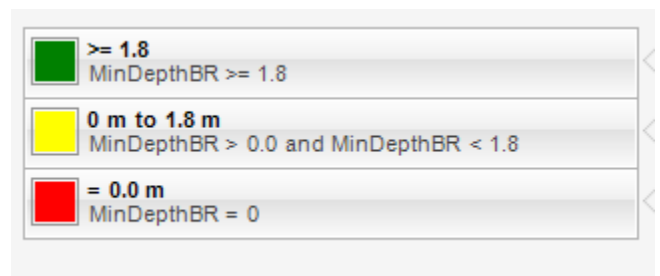
Projected 2051 Wet Weather modelling results

Legend:

Sanitary Sewers (fraction full):



Maintenance Holes (depth to rim):



APPENDIX C

Underground Storage Stage Storage Discharge Calculations

273-275 Sunview , City of Waterloo
STORMTECH CHAMBERS STORAGE CALCULATIONS

K. Smart Associates Limited
Project Number 24-239
Date June 4, 2025

Chamber Model -	SC800	
Units -	Metric	
Number of Chambers -	10	
Number of End Caps -	4	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	343.64	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm
Area of system -	44.21	sq.meters

FROM ADS STORMTECH STORAGE CALCULATIONS									StormStructure Storage						
Height of System	Incremental Single Chamber	Incremental Single End Cap	Incremental Chambers	Incremental End Cap	Incremental Stone	Incremental Ch, EC and Stone	Stormtech System Storage Volume	Elevation	Pipe Storage	CBMH 2	CBMH 3	CBMH 4	CB2	Total Storage	Head
(mm)	(cubic meters)	(cubic meters)	(cubic meters)	(cubic meters)	(cubic meters)	(cubic meters)	(cubic meters)	(meters)	(cubic meters)	(cubic meters)	(cubic meters)	(cubic meters)	(cubic meters)	(cubic meters)	(meters)
25	0.000	0.000	0.00	0.00	0.45	0.45	0.45	343.67		0.029				0.478	0.03
51	0.000	0.000	0.00	0.00	0.45	0.45	0.90	343.69		0.057				0.956	0.05
76	0.000	0.000	0.00	0.00	0.45	0.45	1.35	343.72		0.086				1.434	0.08
102	0.000	0.000	0.00	0.00	0.45	0.45	1.80	343.74		0.115				1.912	0.10
127	0.000	0.000	0.00	0.00	0.45	0.45	2.25	343.77		0.144		0.019		2.409	0.13
152	0.000	0.000	0.00	0.00	0.45	0.45	2.70	343.79		0.172		0.048		2.915	0.15
178	0.063	0.004	0.63	0.01	0.19	0.84	3.53	343.82		0.201		0.077		3.809	0.18
203	0.062	0.005	0.62	0.02	0.19	0.84	4.37	343.84		0.230	0.015	0.105		4.717	0.20
229	0.062	0.005	0.62	0.02	0.19	0.83	5.20	343.87		0.259	0.044	0.134		5.635	0.23
254	0.061	0.005	0.61	0.02	0.20	0.83	6.03	343.89		0.287	0.072	0.163		6.549	0.25
279	0.060	0.005	0.60	0.02	0.20	0.82	6.85	343.92		0.316	0.101	0.192		7.459	0.28
305	0.060	0.005	0.60	0.02	0.20	0.82	7.67	343.94		0.345	0.130	0.220		8.365	0.30
330	0.059	0.005	0.59	0.02	0.21	0.81	8.48	343.97		0.373	0.159	0.249		9.265	0.33
356	0.058	0.005	0.58	0.02	0.21	0.81	9.29	344.00		0.402	0.187	0.278		10.162	0.36
381	0.057	0.005	0.57	0.02	0.21	0.80	10.10	344.02		0.431	0.216	0.306		11.052	0.38
406	0.057	0.004	0.57	0.02	0.22	0.80	10.90	344.05		0.460	0.245	0.335		11.937	0.41
432	0.056	0.004	0.56	0.02	0.22	0.79	11.69	344.07		0.488	0.273	0.364		12.816	0.43
457	0.055	0.004	0.55	0.02	0.22	0.79	12.48	344.10		0.517	0.302	0.393		13.689	0.46
483	0.054	0.004	0.54	0.02	0.23	0.78	13.26	344.12		0.546	0.331	0.421		14.556	0.48
508	0.052	0.004	0.52	0.02	0.23	0.77	14.03	344.15		0.575	0.360	0.450		15.415	0.51
533	0.051	0.004	0.51	0.01	0.24	0.77	14.80	344.17		0.603	0.388	0.479		16.267	0.53
559	0.050	0.004	0.50	0.01	0.24	0.76	15.55	344.20		0.632	0.417	0.508		17.111	0.56
584	0.049	0.003	0.49	0.01	0.25	0.75	16.30	344.22		0.661	0.446	0.536		17.947	0.58
610	0.047	0.003	0.47	0.01	0.25	0.74	17.05	344.25		0.689	0.475	0.565		18.774	0.61
635	0.046	0.003	0.46	0.01	0.26	0.73	17.78	344.28		0.718	0.503	0.594		19.592	0.63
660	0.044	0.003	0.44	0.01	0.27	0.72	18.50	344.30		0.747	0.532	0.622		20.400	0.66
686	0.043	0.002	0.43	0.01	0.27	0.71	19.21	344.33		0.776	0.561	0.651		21.197	0.69
711	0.041	0.002	0.41	0.01	0.28	0.70	19.91	344.35	2.43	0.804	0.589	0.680		24.414	0.71
737	0.039	0.002	0.39	0.01	0.29	0.69	20.60	344.38	2.43	0.833	0.618	0.709		25.187	0.74
762	0.037	0.002	0.37	0.01	0.30	0.67	21.27	344.40	5.69	0.862	0.647	0.737		29.208	0.76
787	0.034	0.001	0.34	0.01	0.31	0.66	21.93	344.43	5.69	0.891	0.676	0.766		29.953	0.79
813	0.032	0.001	0.32	0.00	0.32	0.64	22.57	344.45	5.69	0.919	0.704	0.795	0.001	30.682	0.81
838	0.029	0.001	0.29	0.00	0.33	0.62	23.19	344.48	5.69	0.948	0.733	0.824	0.010	31.401	0.84
864	0.025	0.001	0.25	0.00	0.35	0.60	23.80	344.50	5.69	0.977	0.762	0.852	0.019	32.099	0.86
889	0.021	0.000	0.21	0.00	0.36	0.58	24.37	344.53	5.69	1.005	0.791	0.881	0.028	32.770	0.89
914	0.014	0.000	0.14	0.00	0.39	0.54	24.91	344.55	5.69	1.034	0.819	0.910	0.038	33.401	0.91
940	0.008	0.000	0.08	0.00	0.42	0.50	25.41	344.58	5.69	1.063	0.848	0.938	0.047	33.995	0.94
965	0.006	0.000	0.06	0.00	0.43	0.48	25.89	344.61	5.69	1.092	0.877	0.967	0.056	34.573	0.97
991	0.002	0.000	0.02	0.00	0.44	0.46	26.35	344.63	5.69	1.120	0.905	0.996	0.065	35.130	0.99
1016	0.000	0.000	0.00	0.00	0.45	0.45	26.80	344.66	5.69	1.149	0.934	1.025	0.074	35.675	1.02
1041	0.000	0.000	0.00	0.00	0.45	0.45	27.25	344.68	5.69	1.178	0.963	1.053	0.083	36.219	1.04
1067	0.000	0.000	0.00	0.00	0.45	0.45	27.70	344.71	5.69	1.207	0.992	1.082	0.092	36.764	1.07
1092	0.000	0.000	0.00	0.00	0.45	0.45	28.15	344.73	5.69	1.235	1.020	1.111	0.102	37.308	1.09
1118	0.000	0.000	0.00	0.00	0.45	0.45	28.60	344.76	6.97	1.264	1.049	1.140	0.111	39.129	1.12
1143	0.000	0.000	0.00	0.00	0.45	0.45	29.05	344.78	6.97	1.293	1.078	1.168	0.120	39.673	1.14

Orifice Control	High Flow orifice	HYDRO-BRAKE Vortex Valve
Orifice Flow	Q=CA(2gh)^0.5	6 L/s @ 1.14m HEAD
Orifice Size	0.13	
Orifice Invert	344.17	
Orifice Location	CBMH2	
Coefficient	0.65	

MIDUSS STAGE STORAGE DISCHARGE CURVE		
Stage	Discharge	Storage
(meters)	(cubic meters per second)	(cubic meters)
343.64	0.000	0.0000
343.67	0.000	0.478
343.69	0.001	0.956
343.72	0.002	1.434
343.74	0.004	1.912
343.77	0.005	2.409
343.79	0.005	2.915
343.82	0.006	3.809
343.84	0.006	4.717
343.87	0.006	5.635
343.89	0.006	6.549
343.92	0.006	7.459
343.94	0.006	8.365
343.97	0.006	9.265
344.00	0.006	10.162
344.02	0.006	11.052
344.05	0.006	11.937
344.07	0.006	12.816
344.10	0.006	13.689
344.12	0.006	14.556
344.15	0.006	15.415
344.17	0.006	16.267
344.20	0.012	17.111
344.22	0.015	17.947
344.25	0.017	18.774
344.28	0.018	19.592
344.30	0.020	20.400
344.33	0.021	21.197
344.35	0.022	24.414
344.38	0.023	25.187
344.40	0.024	29.208
344.43	0.025	29.953
344.45	0.026	30.682
344.48	0.027	31.401
344.50	0.028	32.099
344.53	0.029	32.770
344.55	0.029	33.401
344.58	0.030	33.995
344.61	0.031	34.573
344.63	0.032	35.130
344.66	0.032	35.675
344.68	0.033	36.219
344.71	0.034	36.764
344.73	0.034	37.308
344.76	0.035	39.129
344.78	0.036	39.673

Structure Storage Information				
Structure ID	CBMH4	CBMH3	CBMH2	CB2
Diameter/Length	1.2	1.2	1.2	0.6
T/G Elevation	345.8	345.72	345.58	345.95
Invert	343.75	343.83	343.64	344.45
Storage	2.318	2.138	2.194	0.540

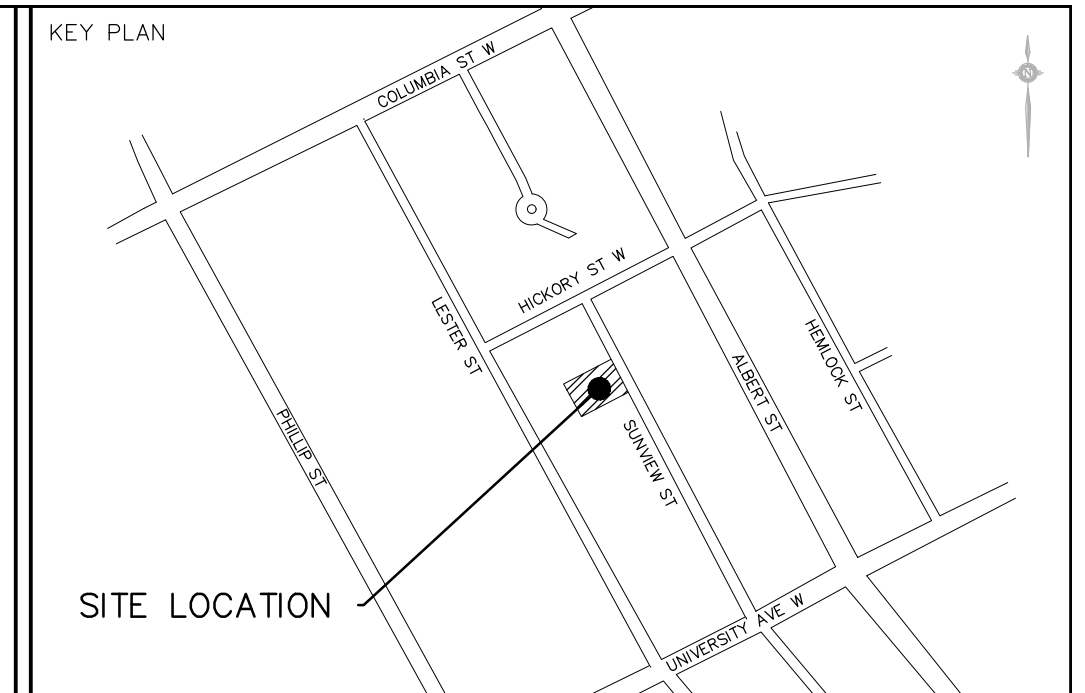
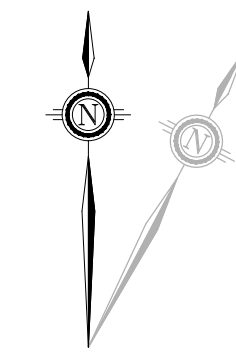
Storage Volume in Pipes					
Diameter (mm)	D/S Invert	U/S Invert	U/S Obvert	Length (m)	Volume (m³)
600	343.72	343.75	344.35	8.6	2.43
450	343.67	343.95	344.4	20.5	3.26
250	343.81	344.45	344.7	26	1.28
					6.97

APPENDIX D

MIDUSS Modeling Output

Existing Conditions

2 Year Storm
5 Year Storm
100 Year Storm



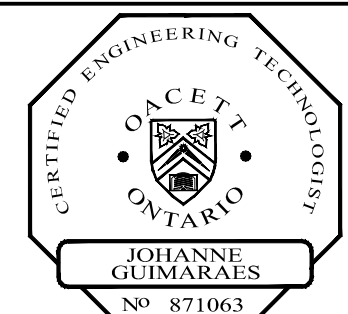
101
0.000ha

■ ■ ■ ■ ■ CATCHMENT AREA BOUNDARY

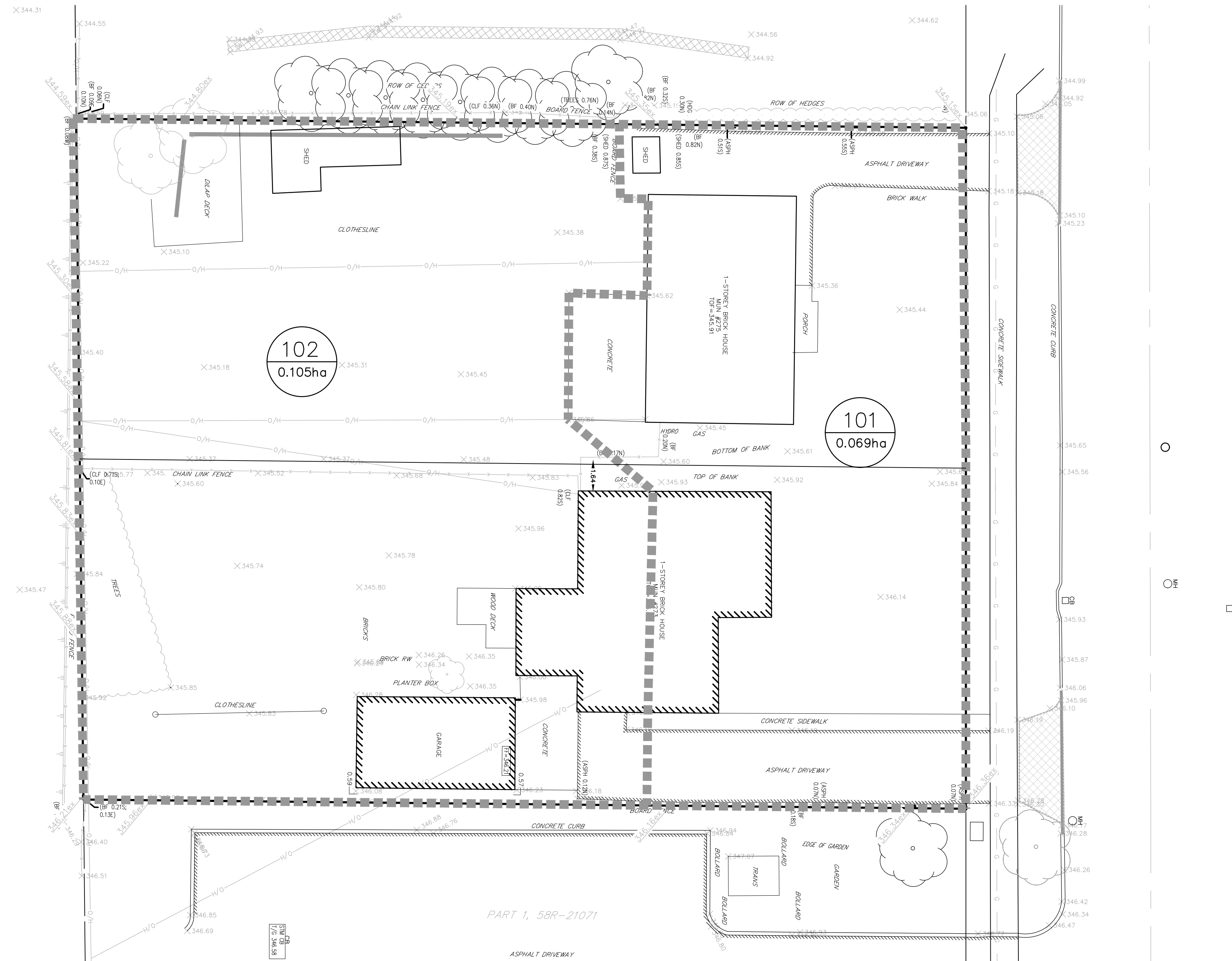
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1	REVISIONS PER CITY COMMENTS	AP	APR 2/25
No.	REVISIONS	BY	DATE
	CONSTRUCTION		
	TENDER		
	ISSUE FOR APPROVALS		
	ISSUE BLOCK		

SUNVIEW DEVELOPMENT
273-275 SUNVIEW STREET
REGION OF WATERLOO CITY OF WATERLOO

EXISTING CATCHMENT AREA PLAN



DESIGNED BY: J.G.	0 3 6	DATE: JAN 2025
CHECKED BY: S.S.		SHEET PRE
DRAWN BY: A.P.	SCALE: 1:150	
CHECKED BY: J.G.		
FILE No. 24-239	REVISION No. 2	



```

"          MIDUSS Output ----->"
"          MIDUSS version                Version 2.25 rev. 473"
"          MIDUSS created                February 7, 2010"
"          10 Units used:                ie METRIC"
"          Job folder:                  \\KSFS03\Data\2024\24-239\Engineering\
"                                     MIDUSS\Final"
"          Output filename:              Existing 2 Year Run 1.out"
"          Licensee name:                Gretchen Capuyan"
"          Company                      K. Smart Associates"
"          Date & Time last used:        2025-01-15 at 7:50:05 AM"
" 31      TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1 Chicago storm"
"          1101.000 Coefficient A"
"          9.254 Constant B"
"          0.882 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity            105.685 mm/hr"
"          Total depth                  32.401 mm"
" 33      CATCHMENT 101"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          101 Existing Area to Sunview"
"          51.000 % Impervious"
"          0.069 Total Area"
"          15.000 Flow length"
"          0.500 Overland Slope"
"          0.034 Pervious Area"
"          15.000 Pervious length"
"          0.500 Pervious slope"
"          0.035 Impervious Area"
"          15.000 Impervious length"
"          0.500 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.163 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.833 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.007 0.000 0.000 0.000 c.m/sec"

```

```

"          Catchment 101                Pervious Impervious Total Area "
"          Surface Area                0.034 0.035 0.069 hectare"
"          Time of concentration        28.006 2.247 6.314 minutes"
"          Time to Centroid            132.895 89.658 96.486 minutes"
"          Rainfall depth              32.401 32.401 32.401 mm"
"          Rainfall volume             10.95 11.40 22.36 c.m"
"          Rainfall losses             27.132 5.407 16.052 mm"
"          Runoff depth                5.269 26.994 16.349 mm"
"          Runoff volume               1.78 9.50 11.28 c.m"
"          Runoff coefficient           0.163 0.833 0.505 "
"          Maximum flow                0.000 0.007 0.007 c.m/sec"
"          6 002hyd Hydrograph extension used in this file"
" 40      HYDROGRAPH Add Runoff "
"          4 Add Runoff "
"          0.007 0.007 0.000 0.000"
" 40      HYDROGRAPH Copy to Outflow"
"          8 Copy to Outflow"
"          0.007 0.007 0.007 0.000"
" 40      HYDROGRAPH Combine 1"
"          6 Combine "
"          1 Node #"
"          Discharge from Site"
"          Maximum flow                0.007 c.m/sec"
"          Hydrograph volume           11.281 c.m"
"          0.007 0.007 0.007 0.007"
" 40      HYDROGRAPH Start - New Tributary"
"          2 Start - New Tributary"
"          0.007 0.000 0.007 0.007"
" 33      CATCHMENT 102"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          102 Existing Area North toward Hickory"
"          13.000 % Impervious"
"          0.105 Total Area"
"          30.000 Flow length"
"          2.000 Overland Slope"
"          0.091 Pervious Area"
"          30.000 Pervious length"
"          2.000 Pervious slope"
"          0.014 Impervious Area"
"          30.000 Impervious length"
"          2.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.163 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."

```

```

"      0.833  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"              0.003      0.000      0.007      0.007 c.m/sec"
"      Catchment 102      Pervious  Impervious Total Area "
"      Surface Area      0.091      0.014      0.105      hectare"
"      Time of concentration 28.006      2.247      16.836      minutes"
"      Time to Centroid      132.895      89.658      114.147      minutes"
"      Rainfall depth      32.401      32.401      32.401      mm"
"      Rainfall volume      29.60      4.42      34.02      c.m"
"      Rainfall losses      27.132      5.407      24.308      mm"
"      Runoff depth      5.269      26.994      8.093      mm"
"      Runoff volume      4.81      3.68      8.50      c.m"
"      Runoff coefficient      0.163      0.833      0.250      "
"      Maximum flow      0.001      0.003      0.003      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"              0.003      0.003      0.007      0.007"
" 40      HYDROGRAPH Copy to Outflow"
"      8      Copy to Outflow"
"              0.003      0.003      0.003      0.007"
" 40      HYDROGRAPH Combine 1"
"      6      Combine "
"      1      Node #"
"      Discharge from Site"
"      Maximum flow      0.010      c.m/sec"
"      Hydrograph volume      19.778      c.m"
"              0.003      0.003      0.003      0.010"
" 38      START/RE-START TOTALS 102"
"      3      Runoff Totals on EXIT"
"      Total Catchment area      0.174      hectare"
"      Total Impervious area      0.049      hectare"
"      Total % impervious      28.069"
" 19      EXIT"

```

```

"          MIDUSS Output ----->"
"          MIDUSS version              Version 2.25 rev. 473"
"          MIDUSS created              February 7, 2010"
"          10  Units used:              ie METRIC"
"          Job folder:                 \\KSFS03\Data\2024\24-239\Engineering\
"                                     MIDUSS\Final"
"          Output filename:            Existing 5 Year Run 1.out"
"          Licensee name:              Gretchen Capuyan"
"          Company                     K. Smart Associates"
"          Date & Time last used:      2025-01-15 at 8:00:30 AM"
" 31    TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32    STORM Chicago storm"
"          1      Chicago storm"
"          1755.000 Coefficient A"
"          12.347  Constant B"
"          0.895   Exponent C"
"          0.400   Fraction R"
"          180.000 Duration"
"          1.000   Time step multiplier"
"          Maximum intensity            136.512  mm/hr"
"          Total depth                  47.549  mm"
"          6  005hyd Hydrograph extension used in this file"
" 33    CATCHMENT 101"
"          1      Triangular SCS"
"          1      Equal length"
"          1      SCS method"
"          101    Existing Area to Sunview"
"          51.000 % Impervious"
"          0.069  Total Area"
"          15.000 Flow length"
"          0.500  Overland Slope"
"          0.034  Pervious Area"
"          15.000 Pervious length"
"          0.500  Pervious slope"
"          0.035  Impervious Area"
"          15.000 Impervious length"
"          0.500  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.259  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.879  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"

```

```

"          0.011  0.000  0.000  0.000 c.m/sec"
"          Catchment 101      Pervious  Impervious Total Area "
"          Surface Area      0.034    0.035    0.069  hectare"
"          Time of concentration 19.232    1.996    5.800  minutes"
"          Time to Centroid    121.355    88.629    95.851  minutes"
"          Rainfall depth     47.549    47.549    47.549  mm"
"          Rainfall volume     16.08     16.73    32.81   c.m"
"          Rainfall losses     35.233    5.764    20.204  mm"
"          Runoff depth        12.316    41.785    27.345  mm"
"          Runoff volume       4.16     14.70    18.87   c.m"
"          Runoff coefficient   0.259    0.879    0.575   "
"          Maximum flow        0.001    0.010    0.011   c.m/sec"
" 40    HYDROGRAPH Add Runoff "
"          4  Add Runoff "
"          0.011  0.011  0.000  0.000"
" 40    HYDROGRAPH Copy to Outflow"
"          8  Copy to Outflow"
"          0.011  0.011  0.011  0.000"
" 40    HYDROGRAPH Combine 1"
"          6  Combine "
"          1  Node #"
"          Discharge from Site"
"          Maximum flow              0.011  c.m/sec"
"          Hydrograph volume         18.868  c.m"
"          0.011  0.011  0.011  0.011"
" 40    HYDROGRAPH Start - New Tributary"
"          2  Start - New Tributary"
"          0.011  0.000  0.011  0.011"
" 33    CATCHMENT 102"
"          1      Triangular SCS"
"          1      Equal length"
"          1      SCS method"
"          102    Existing Area North toward Hickory"
"          13.000 % Impervious"
"          0.105  Total Area"
"          30.000 Flow length"
"          2.000  Overland Slope"
"          0.091  Pervious Area"
"          30.000 Pervious length"
"          2.000  Pervious slope"
"          0.014  Impervious Area"
"          30.000 Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.259  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."

```

```

"      0.879 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"            0.005      0.000      0.011      0.011 c.m/sec"
"      Catchment 102      Pervious Impervious Total Area "
"      Surface Area      0.091      0.014      0.105      hectare"
"      Time of concentration 19.232      1.996      13.433      minutes"
"      Time to Centroid      121.355      88.629      110.346      minutes"
"      Rainfall depth      47.549      47.549      47.549      mm"
"      Rainfall volume      43.44      6.49      49.93      c.m"
"      Rainfall losses      35.233      5.764      31.402      mm"
"      Runoff depth      12.316      41.785      16.147      mm"
"      Runoff volume      11.25      5.70      16.95      c.m"
"      Runoff coefficient      0.259      0.879      0.340      "
"      Maximum flow      0.004      0.004      0.005      c.m/sec"
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"      4 Add Runoff "
"            0.005      0.005      0.011      0.011"
" 40      HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"            0.005      0.005      0.005      0.011"
" 40      HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Discharge from Site"
"      Maximum flow      0.015      c.m/sec"
"      Hydrograph volume      35.823      c.m"
"            0.005      0.005      0.005      0.015"
" 38      START/RE-START TOTALS 102"
"      3 Runoff Totals on EXIT"
"      Total Catchment area      0.174      hectare"
"      Total Impervious area      0.049      hectare"
"      Total % impervious      28.069"
" 19      EXIT"

```

```

"          MIDUSS Output ----->"
"          MIDUSS version              Version 2.25 rev. 473"
"          MIDUSS created              February 7, 2010"
"          10 Units used:              ie METRIC"
"          Job folder:                \\KSFS03\Data\2024\24-239\Engineering\
"                                     MIDUSS\Final"
"          Output filename:            Existing 100 Year Run 1.out"
"          Licensee name:              Gretchen Capuyan"
"          Company                    K. Smart Associates"
"          Date & Time last used:      2025-01-15 at 8:01:48 AM"
" 31      TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1 Chicago storm"
"          4692.000 Coefficient A"
"          17.437 Constant B"
"          0.956 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity          239.793 mm/hr"
"          Total depth                89.960 mm"
"          6 100hyd Hydrograph extension used in this file"
" 33      CATCHMENT 101"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          101 Existing Area to Sunview"
"          51.000 % Impervious"
"          0.069 Total Area"
"          15.000 Flow length"
"          0.500 Overland Slope"
"          0.034 Pervious Area"
"          15.000 Pervious length"
"          0.500 Pervious slope"
"          0.035 Impervious Area"
"          15.000 Impervious length"
"          0.500 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.443 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.927 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"

```

```

"          0.022 0.000 0.000 0.000 c.m/sec"
"          Catchment 101 Pervious Impervious Total Area "
"          Surface Area 0.034 0.035 0.069 hectare"
"          Time of concentration 11.682 1.573 4.753 minutes"
"          Time to Centroid 107.779 86.185 92.977 minutes"
"          Rainfall depth 89.960 89.960 89.960 mm"
"          Rainfall volume 30.42 31.66 62.07 c.m"
"          Rainfall losses 50.120 6.542 27.895 mm"
"          Runoff depth 39.840 83.418 62.065 mm"
"          Runoff volume 13.47 29.35 42.82 c.m"
"          Runoff coefficient 0.443 0.927 0.690 "
"          Maximum flow 0.006 0.020 0.022 c.m/sec"
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"          4 Add Runoff "
"          0.022 0.022 0.000 0.000"
" 40      HYDROGRAPH Copy to Outflow"
"          8 Copy to Outflow"
"          0.022 0.022 0.022 0.000"
" 40      HYDROGRAPH Combine 1"
"          6 Combine "
"          1 Node #"
"          Discharge from Site"
"          Maximum flow 0.022 c.m/sec"
"          Hydrograph volume 42.825 c.m"
"          0.022 0.022 0.022 0.022"
" 40      HYDROGRAPH Start - New Tributary"
"          2 Start - New Tributary"
"          0.022 0.000 0.022 0.022"
" 33      CATCHMENT 102"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          102 Existing Area North toward Hickory"
"          13.000 % Impervious"
"          0.105 Total Area"
"          30.000 Flow length"
"          2.000 Overland Slope"
"          0.091 Pervious Area"
"          30.000 Pervious length"
"          2.000 Pervious slope"
"          0.014 Impervious Area"
"          30.000 Impervious length"
"          2.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.443 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."

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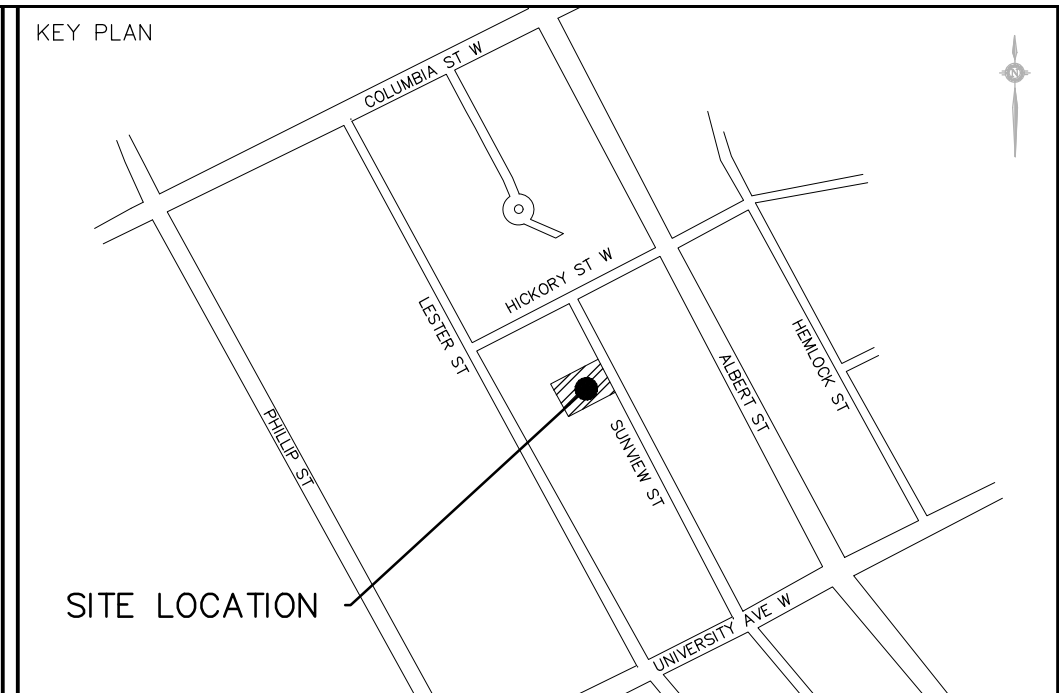
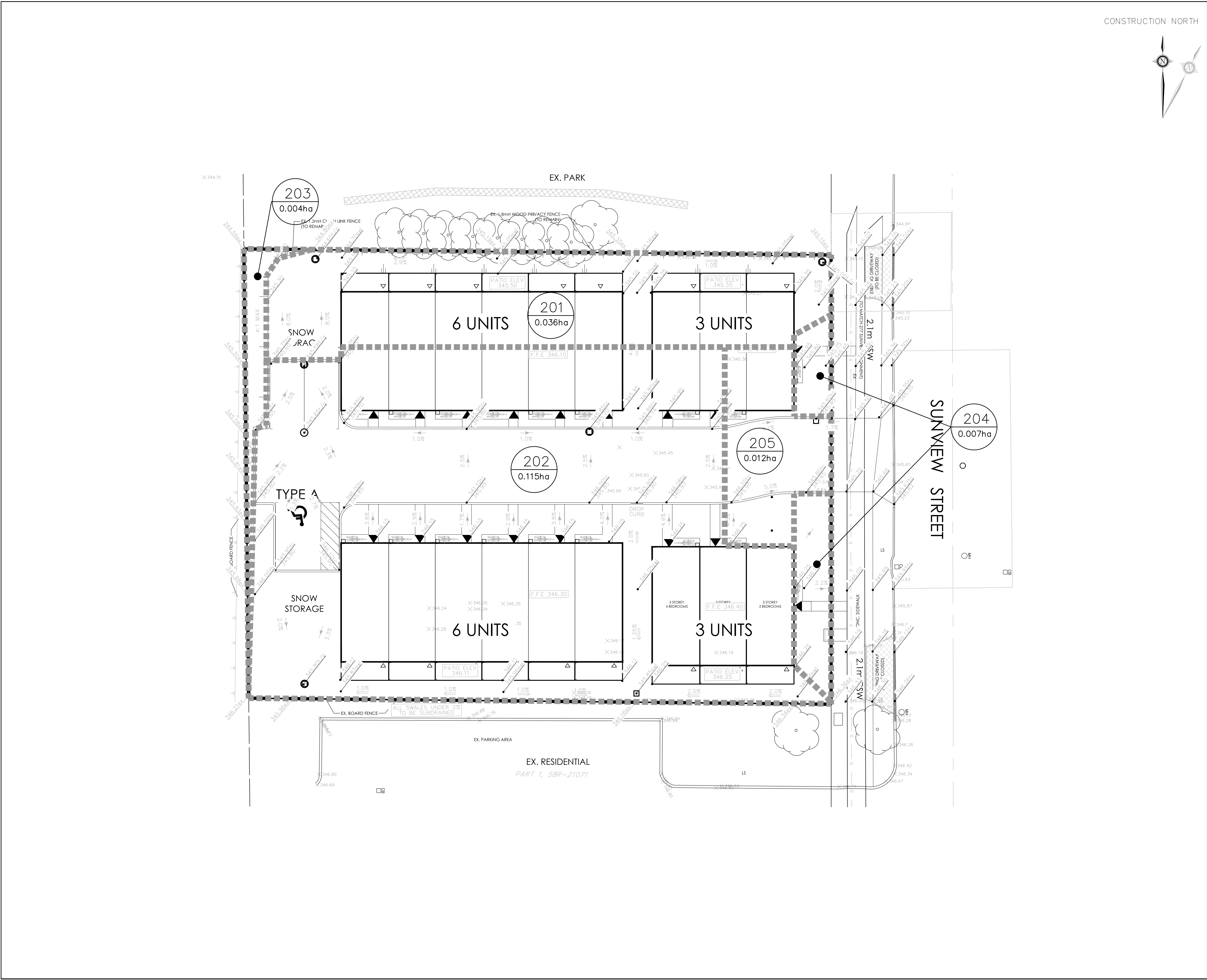
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"      0.927  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"              0.021      0.000      0.022      0.022 c.m/sec"
"      Catchment 102      Pervious  Impervious Total Area "
"      Surface Area      0.091      0.014      0.105      hectare"
"      Time of concentration 11.682      1.573      9.273      minutes"
"      Time to Centroid      107.779      86.185      102.633      minutes"
"      Rainfall depth      89.960      89.960      89.960      mm"
"      Rainfall volume      82.18      12.28      94.46      c.m"
"      Rainfall losses      50.120      6.542      44.455      mm"
"      Runoff depth      39.840      83.418      45.505      mm"
"      Runoff volume      36.39      11.39      47.78      c.m"
"      Runoff coefficient      0.443      0.927      0.506      "
"      Maximum flow      0.017      0.008      0.021      c.m/sec"
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"      4      Add Runoff "
"              0.021      0.021      0.022      0.022"
" 40      HYDROGRAPH Copy to Outflow"
"      8      Copy to Outflow"
"              0.021      0.021      0.021      0.022"
" 40      HYDROGRAPH Combine 1"
"      6      Combine "
"      1      Node #"
"      Discharge from Site"
"      Maximum flow      0.039      c.m/sec"
"      Hydrograph volume      90.605      c.m"
"              0.021      0.021      0.021      0.039"
" 38      START/RE-START TOTALS 102"
"      3      Runoff Totals on EXIT"
"      Total Catchment area      0.174      hectare"
"      Total Impervious area      0.049      hectare"
"      Total % impervious      28.069"
" 19      EXIT"

```

Proposed Conditions

2 Year Storm
5 Year Storm
100 Year Storm



NOTES:

101
0.000ha

PROPOSED CATCHMENT AREA I.D.
CATCHMENT AREA

CATCHMENT AREA BOUNDARY

2	REVISIONS PER CITY COMMENTS	JG	JUN 4/25
1	REVISIONS PER CITY COMMENTS	AP	APR 2/25
No.	REVISIONS	BY	DATE
	CONSTRUCTION		
	TENDER		
	ISSUE FOR APPROVALS		
	ISSUE BLOCK		

SUNVIEW DEVELOPMENT
273-275 SUNVIEW STREET
REGION OF WATERLOO CITY OF WATERLOO

**PROPOSED CATCHMENT AREA
PLAN**

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

DESIGNED BY: J.G. 0 3 6 DATE: JAN 2025
CHECKED BY: S.S. SCALE: 1:150
DRAWN BY: A.P. SHEET
CHECKED BY: J.G. POST
FILE No. 24-239 REVISION No. 2

```

"          MIDUSS Output ----->"
"          MIDUSS version              Version 2.25 rev. 473"
"          MIDUSS created              February 7, 2010"
"          10 Units used:              ie METRIC"
"          Job folder:                \\KSF503\Data\2024\24-239\Engineering\
"                                     Rev. June 2025\MIDUSS\June 2"
"          Output filename:          Proposed 2 Year Run 5.out"
"          Licensee name:            Gretchen Capuyan"
"          Company                    K. Smart Associates"
"          Date & Time last used:    2025-06-02 at 2:54:25 PM"
" 31      TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1 Chicago storm"
"          1101.000 Coefficient A"
"          9.258 Constant B"
"          0.882 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity          105.659 mm/hr"
"          Total depth                32.400 mm"
"          6 002hyd Hydrograph extension used in this file"
" 33      CATCHMENT 201"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          201 Proposed Site (Uncontrolled)"
"          17.000 % Impervious"
"          0.036 Total Area"
"          15.000 Flow length"
"          3.000 Overland Slope"
"          0.030 Pervious Area"
"          15.000 Pervious length"
"          3.000 Pervious slope"
"          0.006 Impervious Area"
"          15.000 Impervious length"
"          3.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.162 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.831 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"

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"          0.001 0.000 0.000 0.000 c.m/sec"
"          Catchment 201 Pervious Impervious Total Area "
"          Surface Area 0.030 0.006 0.036 hectare"
"          Time of concentration 16.363 1.313 8.662 minutes"
"          Time to Centroid 119.294 88.274 103.422 minutes"
"          Rainfall depth 32.400 32.400 32.400 mm"
"          Rainfall volume 9.68 1.98 11.66 c.m"
"          Rainfall losses 27.140 5.491 23.460 mm"
"          Runoff depth 5.260 26.909 8.940 mm"
"          Runoff volume 1.57 1.65 3.22 c.m"
"          Runoff coefficient 0.162 0.831 0.276 "
"          Maximum flow 0.001 0.001 0.001 c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4 Add Runoff "
"          0.001 0.001 0.000 0.000"
" 40      HYDROGRAPH Copy to Outflow"
"          8 Copy to Outflow"
"          0.001 0.001 0.001 0.000"
" 40      HYDROGRAPH Combine 1"
"          6 Combine "
"          1 Node #"
"          Total Discharge From Site"
"          Maximum flow 0.001 c.m/sec"
"          Hydrograph volume 3.219 c.m"
"          0.001 0.001 0.001 0.001"
" 40      HYDROGRAPH Start - New Tributary"
"          2 Start - New Tributary"
"          0.001 0.000 0.001 0.001"
" 33      CATCHMENT 202"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          202 Proposed Site (Controlled)"
"          78.000 % Impervious"
"          0.115 Total Area"
"          20.000 Flow length"
"          2.500 Overland Slope"
"          0.025 Pervious Area"
"          20.000 Pervious length"
"          2.500 Pervious slope"
"          0.090 Impervious Area"
"          20.000 Impervious length"
"          2.500 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.163 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."

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"      0.835 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"          0.020      0.000      0.001      0.001 c.m/sec"
"      Catchment 202      Pervious      Impervious Total Area "
"      Surface Area      0.025      0.090      0.115      hectare"
"      Time of concentration      20.539      1.648      2.632      minutes"
"      Time to Centroid      124.137      88.749      90.593      minutes"
"      Rainfall depth      32.400      32.400      32.400      mm"
"      Rainfall volume      8.20      29.06      37.26      c.m"
"      Rainfall losses      27.131      5.358      10.148      mm"
"      Runoff depth      5.270      27.042      22.252      mm"
"      Runoff volume      1.33      24.26      25.59      c.m"
"      Runoff coefficient      0.163      0.835      0.687      "
"      Maximum flow      0.000      0.020      0.020      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.020      0.020      0.001      0.001"
" 54      POND DESIGN"
"      0.020      Current peak flow      c.m/sec"
"      0.011      Target outflow      c.m/sec"
"      25.6      Hydrograph volume      c.m"
"      46.      Number of stages"
"      343.640      Minimum water level      metre"
"      344.780      Maximum water level      metre"
"      343.640      Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"          Level Discharge      Volume"
"      343.640      0.000      0.000"
"      343.670      1.01E-05      0.4780"
"      343.690      0.00100      0.9560"
"      343.720      0.00200      1.434"
"      343.740      0.00400      1.912"
"      343.770      0.00500      2.409"
"      343.790      0.00500      2.915"
"      343.820      0.00600      3.809"
"      343.840      0.00600      4.717"
"      343.870      0.00600      5.635"
"      343.890      0.00600      6.549"
"      343.920      0.00600      7.459"
"      343.940      0.00600      8.365"
"      343.970      0.00600      9.265"
"      344.000      0.00600      10.162"
"      344.020      0.00600      11.052"
"      344.050      0.00600      11.937"
"      344.070      0.00600      12.816"
"      344.100      0.00600      13.689"
"      344.120      0.00600      14.556"
"      344.150      0.00600      15.415"
"      344.170      0.00600      16.267"

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"      344.200      0.01200      17.111"
"      344.220      0.01500      17.947"
"      344.250      0.01700      18.774"
"      344.280      0.01800      19.592"
"      344.300      0.02000      20.400"
"      344.330      0.02100      21.197"
"      344.350      0.02200      24.414"
"      344.380      0.02300      25.187"
"      344.400      0.02400      29.208"
"      344.430      0.02500      29.953"
"      344.450      0.02600      30.682"
"      344.480      0.02700      31.401"
"      344.500      0.02800      32.099"
"      344.530      0.02900      32.770"
"      344.550      0.02900      33.401"
"      344.580      0.03000      33.995"
"      344.610      0.03100      34.573"
"      344.630      0.03200      35.130"
"      344.660      0.03200      35.675"
"      344.680      0.03300      36.219"
"      344.710      0.03400      36.764"
"      344.730      0.03400      37.308"
"      344.760      0.03500      39.129"
"      344.780      0.03600      39.673"
"      Peak outflow      0.006      c.m/sec"
"      Maximum level      343.831      metre"
"      Maximum storage      4.330      c.m"
"      Centroidal lag      1.930      hours"
"          0.020      0.020      0.006      0.001 c.m/sec"
" 40      HYDROGRAPH      Combine      1"
"      6      Combine "
"      1      Node #"
"          Total Discharge From Site"
"      Maximum flow      0.007      c.m/sec"
"      Hydrograph volume      28.816      c.m"
"          0.020      0.020      0.006      0.007"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"
"          0.020      0.000      0.006      0.007"
" 33      CATCHMENT 203"
"      1      Triangular SCS"
"      1      Equal length"
"      1      SCS method"
"      203      Northwest Landscaped Area "
"      0.000      % Impervious"
"      0.004      Total Area"
"      2.000      Flow length"
"      20.000      Overland Slope"
"      0.004      Pervious Area"
"      2.000      Pervious length"

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"      20.000 Pervious slope"
"      0.000 Impervious Area"
"      2.000 Impervious length"
"      20.000 Pervious slope"
"      0.250 Pervious Manning 'n'"
"      75.000 Pervious SCS Curve No."
"      0.160 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      8.467 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.000 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.000 0.000 0.006 0.007 c.m/sec"
"      Catchment 203 Pervious Impervious Total Area "
"      Surface Area 0.004 0.000 0.004 hectare"
"      Time of concentration 2.765 0.222 2.765 minutes"
"      Time to Centroid 103.387 86.410 103.387 minutes"
"      Rainfall depth 32.400 32.400 32.400 mm"
"      Rainfall volume 1.30 0.00 1.30 c.m"
"      Rainfall losses 27.227 8.741 27.227 mm"
"      Runoff depth 5.173 23.659 5.173 mm"
"      Runoff volume 0.21 0.00 0.21 c.m"
"      Runoff coefficient 0.160 0.000 0.160 "
"      Maximum flow 0.000 0.000 0.000 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.000 0.000 0.006 0.007"
" 40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"      0.000 0.000 0.000 0.007"
" 40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Discharge From Site"
"      Maximum flow 0.008 c.m/sec"
"      Hydrograph volume 29.023 c.m"
"      0.000 0.000 0.000 0.008"
" 40 HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
"      0.000 0.000 0.000 0.008"
" 33 CATCHMENT 204"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      204 East Amenity Areas"
"      13.000 % Impervious"
"      0.007 Total Area"
"      3.000 Flow length"

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"      2.000 Overland Slope"
"      0.006 Pervious Area"
"      3.000 Pervious length"
"      2.000 Pervious slope"
"      0.001 Impervious Area"
"      3.000 Impervious length"
"      2.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      75.000 Pervious SCS Curve No."
"      0.161 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      8.467 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.771 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.000 0.000 0.000 0.008 c.m/sec"
"      Catchment 204 Pervious Impervious Total Area "
"      Surface Area 0.006 0.001 0.007 hectare"
"      Time of concentration 7.036 0.564 4.338 minutes"
"      Time to Centroid 108.491 87.736 99.837 minutes"
"      Rainfall depth 32.400 32.400 32.400 mm"
"      Rainfall volume 1.97 0.29 2.27 c.m"
"      Rainfall losses 27.178 7.412 24.609 mm"
"      Runoff depth 5.222 24.988 7.791 mm"
"      Runoff volume 0.32 0.23 0.55 c.m"
"      Runoff coefficient 0.161 0.771 0.240 "
"      Maximum flow 0.000 0.000 0.000 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.000 0.000 0.000 0.008"
" 40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"      0.000 0.000 0.000 0.008"
" 40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Discharge From Site"
"      Maximum flow 0.008 c.m/sec"
"      Hydrograph volume 29.568 c.m"
"      0.000 0.000 0.000 0.008"
" 40 HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
"      0.000 0.000 0.000 0.008"
" 33 CATCHMENT 205"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      205 East Driveway to CB1"

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"      80.000  % Impervious"
"      0.012  Total Area"
"     10.000  Flow length"
"      3.000  Overland Slope"
"      0.002  Pervious Area"
"     10.000  Pervious length"
"      3.000  Pervious slope"
"      0.010  Impervious Area"
"     10.000  Impervious length"
"      3.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"     75.000  Pervious SCS Curve No."
"      0.162  Pervious Runoff coefficient"
"      0.100  Pervious Ia/S coefficient"
"      8.467  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"     98.000  Impervious SCS Curve No."
"      0.819  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"          0.002  0.000  0.000  0.008 c.m/sec"
"      Catchment 205      Pervious      Impervious Total Area "
"      Surface Area      0.002  0.010  0.012  hectare"
"      Time of concentration 12.829  1.029  1.585  minutes"
"      Time to Centroid 115.167  87.915  89.199  minutes"
"      Rainfall depth 32.400  32.400  32.400  mm"
"      Rainfall volume 0.78  3.11  3.89  c.m"
"      Rainfall losses 27.153  5.849  10.110  mm"
"      Runoff depth 5.247  26.551  22.290  mm"
"      Runoff volume 0.13  2.55  2.67  c.m"
"      Runoff coefficient 0.162  0.819  0.688  "
"      Maximum flow 0.000  0.002  0.002  c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"          0.002  0.002  0.000  0.008"
" 40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"          0.002  0.002  0.002  0.008"
" 40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Discharge From Site"
"      Maximum flow 0.010  c.m/sec"
"      Hydrograph volume 32.243  c.m"
"          0.002  0.002  0.002  0.010"
" 38 START/RE-START TOTALS 205"
"      3 Runoff Totals on EXIT"
"      Total Catchment area 0.174  hectare"
"      Total Impervious area 0.106  hectare"
"      Total % impervious 61.109"

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" 19 EXIT"

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"          MIDUSS Output ----->"
"          MIDUSS version              Version 2.25 rev. 473"
"          MIDUSS created              February 7, 2010"
"          10 Units used:              ie METRIC"
"          Job folder:                \\KSFS03\Data\2024\24-239\Engineering\
"                                     Rev. June 2025\MIDUSS\June 2"
"          Output filename:           Proposed 5 Year Run 5.out"
"          Licensee name:             Gretchen Capuyan"
"          Company                    K. Smart Associates"
"          Date & Time last used:     2025-06-02 at 2:53:07 PM"
" 31      TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1 Chicago storm"
"          1755.000 Coefficient A"
"          12.347 Constant B"
"          0.895 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity          136.512 mm/hr"
"          Total depth                47.549 mm"
"          6 005hyd Hydrograph extension used in this file"
" 33      CATCHMENT 201"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          201 Proposed Site (Uncontrolled)"
"          17.000 % Impervious"
"          0.036 Total Area"
"          15.000 Flow length"
"          3.000 Overland Slope"
"          0.030 Pervious Area"
"          15.000 Pervious length"
"          3.000 Pervious slope"
"          0.006 Impervious Area"
"          15.000 Impervious length"
"          3.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.259 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.870 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"

```

```

"          0.002 0.000 0.000 0.000 c.m/sec"
"          Catchment 201 Pervious Impervious Total Area "
"          Surface Area 0.030 0.006 0.036 hectare"
"          Time of concentration 11.235 1.166 7.132 minutes"
"          Time to Centroid 111.586 87.475 101.761 minutes"
"          Rainfall depth 47.549 47.549 47.549 mm"
"          Rainfall volume 14.21 2.91 17.12 c.m"
"          Rainfall losses 35.225 6.164 30.284 mm"
"          Runoff depth 12.324 41.385 17.265 mm"
"          Runoff volume 3.68 2.53 6.22 c.m"
"          Runoff coefficient 0.259 0.870 0.363 "
"          Maximum flow 0.002 0.002 0.002 c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4 Add Runoff "
"          0.002 0.002 0.000 0.000"
" 40      HYDROGRAPH Copy to Outflow"
"          8 Copy to Outflow"
"          0.002 0.002 0.002 0.000"
" 40      HYDROGRAPH Combine 1"
"          6 Combine "
"          1 Node #"
"          Total Discharge From Site"
"          Maximum flow 0.002 c.m/sec"
"          Hydrograph volume 6.215 c.m"
"          0.002 0.002 0.002 0.002"
" 40      HYDROGRAPH Start - New Tributary"
"          2 Start - New Tributary"
"          0.002 0.000 0.002 0.002"
" 33      CATCHMENT 202"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          202 Proposed Site (Controlled)"
"          78.000 % Impervious"
"          0.115 Total Area"
"          20.000 Flow length"
"          2.500 Overland Slope"
"          0.025 Pervious Area"
"          20.000 Pervious length"
"          2.500 Pervious slope"
"          0.090 Impervious Area"
"          20.000 Impervious length"
"          2.500 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.259 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."

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"      0.877 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"          0.028      0.000      0.002      0.002 c.m/sec"
"      Catchment 202      Pervious      Impervious      Total Area "
"      Surface Area      0.025      0.090      0.115      hectare"
"      Time of concentration      14.102      1.464      2.436      minutes"
"      Time to Centroid      115.099      87.827      89.925      minutes"
"      Rainfall depth      47.549      47.549      47.549      mm"
"      Rainfall volume      12.03      42.65      54.68      c.m"
"      Rainfall losses      35.220      5.834      12.299      mm"
"      Runoff depth      12.329      41.715      35.250      mm"
"      Runoff volume      3.12      37.42      40.54      c.m"
"      Runoff coefficient      0.259      0.877      0.741      "
"      Maximum flow      0.001      0.028      0.028      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.028      0.028      0.002      0.002"
" 54      POND DESIGN"
"      0.028      Current peak flow      c.m/sec"
"      0.011      Target outflow      c.m/sec"
"      40.5      Hydrograph volume      c.m"
"      46.      Number of stages"
"      343.640      Minimum water level      metre"
"      344.780      Maximum water level      metre"
"      343.640      Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"          Level Discharge      Volume"
"      343.640      0.000      0.000"
"      343.670      1.01E-05      0.4780"
"      343.690      0.00100      0.9560"
"      343.720      0.00200      1.434"
"      343.740      0.00400      1.912"
"      343.770      0.00500      2.409"
"      343.790      0.00500      2.915"
"      343.820      0.00600      3.809"
"      343.840      0.00600      4.717"
"      343.870      0.00600      5.635"
"      343.890      0.00600      6.549"
"      343.920      0.00600      7.459"
"      343.940      0.00600      8.365"
"      343.970      0.00600      9.265"
"      344.000      0.00600      10.162"
"      344.020      0.00600      11.052"
"      344.050      0.00600      11.937"
"      344.070      0.00600      12.816"
"      344.100      0.00600      13.689"
"      344.120      0.00600      14.556"
"      344.150      0.00600      15.415"
"      344.170      0.00600      16.267"

```

```

"      344.200      0.01200      17.111"
"      344.220      0.01500      17.947"
"      344.250      0.01700      18.774"
"      344.280      0.01800      19.592"
"      344.300      0.02000      20.400"
"      344.330      0.02100      21.197"
"      344.350      0.02200      24.414"
"      344.380      0.02300      25.187"
"      344.400      0.02400      29.208"
"      344.430      0.02500      29.953"
"      344.450      0.02600      30.682"
"      344.480      0.02700      31.401"
"      344.500      0.02800      32.099"
"      344.530      0.02900      32.770"
"      344.550      0.02900      33.401"
"      344.580      0.03000      33.995"
"      344.610      0.03100      34.573"
"      344.630      0.03200      35.130"
"      344.660      0.03200      35.675"
"      344.680      0.03300      36.219"
"      344.710      0.03400      36.764"
"      344.730      0.03400      37.308"
"      344.760      0.03500      39.129"
"      344.780      0.03600      39.673"
"      Peak outflow      0.010      c.m/sec"
"      Maximum level      344.189      metre"
"      Maximum storage      16.804      c.m"
"      Centroidal lag      2.025      hours"
"          0.028      0.028      0.010      0.002 c.m/sec"
" 40      HYDROGRAPH      Combine      1"
"      6      Combine "
"      1      Node #"
"          Total Discharge From Site"
"      Maximum flow      0.012      c.m/sec"
"      Hydrograph volume      46.434      c.m"
"          0.028      0.028      0.010      0.012"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"
"          0.028      0.000      0.010      0.012"
" 33      CATCHMENT 203"
"      1      Triangular SCS"
"      1      Equal length"
"      1      SCS method"
"      203      Northwest Landscaped Area "
"      0.000      % Impervious"
"      0.004      Total Area"
"      2.000      Flow length"
"      20.000      Overland Slope"
"      0.004      Pervious Area"
"      2.000      Pervious length"

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"      20.000 Pervious slope"
"      0.000 Impervious Area"
"      2.000 Impervious length"
"      20.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      75.000 Pervious SCS Curve No."
"      0.256 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      8.467 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.000 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.000 0.000 0.010 0.012 c.m/sec"
"      Catchment 203 Pervious Impervious Total Area "
"      Surface Area 0.004 0.000 0.004 hectare"
"      Time of concentration 1.898 0.197 1.898 minutes"
"      Time to Centroid 99.986 85.544 99.986 minutes"
"      Rainfall depth 47.549 47.549 47.549 mm"
"      Rainfall volume 1.90 0.00 1.90 c.m"
"      Rainfall losses 35.367 11.099 35.367 mm"
"      Runoff depth 12.182 36.450 12.182 mm"
"      Runoff volume 0.49 0.00 0.49 c.m"
"      Runoff coefficient 0.256 0.000 0.256 "
"      Maximum flow 0.000 0.000 0.000 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.000 0.000 0.010 0.012"
" 40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"      0.000 0.000 0.000 0.012"
" 40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Discharge From Site"
"      Maximum flow 0.012 c.m/sec"
"      Hydrograph volume 46.921 c.m"
"      0.000 0.000 0.000 0.012"
" 40 HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
"      0.000 0.000 0.000 0.012"
" 33 CATCHMENT 204"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      204 East Amenity Areas"
"      13.000 % Impervious"
"      0.007 Total Area"
"      3.000 Flow length"

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"      2.000 Overland Slope"
"      0.006 Pervious Area"
"      3.000 Pervious length"
"      2.000 Pervious slope"
"      0.001 Impervious Area"
"      3.000 Impervious length"
"      2.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      75.000 Pervious SCS Curve No."
"      0.258 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      8.467 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.800 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.001 0.000 0.000 0.012 c.m/sec"
"      Catchment 204 Pervious Impervious Total Area "
"      Surface Area 0.006 0.001 0.007 hectare"
"      Time of concentration 4.831 0.501 3.460 minutes"
"      Time to Centroid 103.796 87.047 98.494 minutes"
"      Rainfall depth 47.549 47.549 47.549 mm"
"      Rainfall volume 2.90 0.43 3.33 c.m"
"      Rainfall losses 35.279 9.513 31.930 mm"
"      Runoff depth 12.270 38.036 15.619 mm"
"      Runoff volume 0.75 0.35 1.09 c.m"
"      Runoff coefficient 0.258 0.800 0.328 "
"      Maximum flow 0.000 0.000 0.001 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.001 0.001 0.000 0.012"
" 40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"      0.001 0.001 0.001 0.012"
" 40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Discharge From Site"
"      Maximum flow 0.012 c.m/sec"
"      Hydrograph volume 48.014 c.m"
"      0.001 0.001 0.001 0.012"
" 40 HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
"      0.001 0.000 0.001 0.012"
" 33 CATCHMENT 205"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      205 East Driveway to CB1"

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"      80.000  % Impervious"
"      0.012  Total Area"
"     10.000  Flow length"
"      3.000  Overland Slope"
"      0.002  Pervious Area"
"     10.000  Pervious length"
"      3.000  Pervious slope"
"      0.010  Impervious Area"
"     10.000  Impervious length"
"      3.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"     75.000  Pervious SCS Curve No."
"      0.258  Pervious Runoff coefficient"
"      0.100  Pervious Ia/S coefficient"
"      8.467  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"     98.000  Impervious SCS Curve No."
"      0.855  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"      0.003  0.000  0.001  0.012 c.m/sec"
"      Catchment 205      Pervious      Impervious Total Area "
"      Surface Area      0.002  0.010  0.012  hectare"
"      Time of concentration 8.809  0.914  1.469  minutes"
"      Time to Centroid 108.618  87.124  88.633  minutes"
"      Rainfall depth 47.549  47.549  47.549  mm"
"      Rainfall volume 1.14  4.56  5.71  c.m"
"      Rainfall losses 35.262  6.883  12.558  mm"
"      Runoff depth 12.287  40.666  34.991  mm"
"      Runoff volume 0.29  3.90  4.20  c.m"
"      Runoff coefficient 0.258  0.855  0.736  "
"      Maximum flow 0.000  0.003  0.003  c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.003  0.003  0.001  0.012"
" 40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"      0.003  0.003  0.003  0.012"
" 40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Discharge From Site"
"      Maximum flow 0.013  c.m/sec"
"      Hydrograph volume 52.213  c.m"
"      0.003  0.003  0.003  0.013"
" 38 START/RE-START TOTALS 205"
"      3 Runoff Totals on EXIT"
"      Total Catchment area 0.174  hectare"
"      Total Impervious area 0.106  hectare"
"      Total % impervious 61.109"

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" 19 EXIT"

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"          MIDUSS Output ----->"
"          MIDUSS version              Version 2.25 rev. 473"
"          MIDUSS created              February 7, 2010"
"          10 Units used:              ie METRIC"
"          Job folder:                 \\KSFS03\Data\2024\24-239\Engineering\
"                                     Rev. June 2025\MIDUSS\June 2"
"          Output filename:            Proposed 100 Year Run 5.out"
"          Licensee name:              Gretchen Capuyan"
"          Company                     K. Smart Associates"
"          Date & Time last used:      2025-06-02 at 2:52:14 PM"
" 31      TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1 Chicago storm"
"          4692.000 Coefficient A"
"          17.437 Constant B"
"          0.956 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity           239.793 mm/hr"
"          Total depth                 89.960 mm"
"          6 100hyd Hydrograph extension used in this file"
" 33      CATCHMENT 201"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          201 Proposed Site (Uncontrolled)"
"          17.000 % Impervious"
"          0.036 Total Area"
"          15.000 Flow length"
"          3.000 Overland Slope"
"          0.030 Pervious Area"
"          15.000 Pervious length"
"          3.000 Pervious slope"
"          0.006 Impervious Area"
"          15.000 Impervious length"
"          3.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.440 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.903 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"

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"          0.009 0.000 0.000 0.000 c.m/sec"
"          Catchment 201 Pervious Impervious Total Area "
"          Surface Area 0.030 0.006 0.036 hectare"
"          Time of concentration 6.824 0.919 5.077 minutes"
"          Time to Centroid 101.837 85.375 96.965 minutes"
"          Rainfall depth 89.960 89.960 89.960 mm"
"          Rainfall volume 26.88 5.51 32.39 c.m"
"          Rainfall losses 50.389 8.749 43.310 mm"
"          Runoff depth 39.571 81.211 46.650 mm"
"          Runoff volume 11.82 4.97 16.79 c.m"
"          Runoff coefficient 0.440 0.903 0.519 "
"          Maximum flow 0.007 0.004 0.009 c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4 Add Runoff "
"          0.009 0.009 0.000 0.000"
" 40      HYDROGRAPH Copy to Outflow"
"          8 Copy to Outflow"
"          0.009 0.009 0.009 0.000"
" 40      HYDROGRAPH Combine 1"
"          6 Combine "
"          1 Node #"
"          Total Discharge From Site"
"          Maximum flow 0.009 c.m/sec"
"          Hydrograph volume 16.794 c.m"
"          0.009 0.009 0.009 0.009"
" 40      HYDROGRAPH Start - New Tributary"
"          2 Start - New Tributary"
"          0.009 0.000 0.009 0.009"
" 33      CATCHMENT 202"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          202 Proposed Site (Controlled)"
"          78.000 % Impervious"
"          0.115 Total Area"
"          20.000 Flow length"
"          2.500 Overland Slope"
"          0.025 Pervious Area"
"          20.000 Pervious length"
"          2.500 Pervious slope"
"          0.090 Impervious Area"
"          20.000 Impervious length"
"          2.500 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.442 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."

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"      0.918 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"          0.054      0.000      0.009      0.009 c.m/sec"
"      Catchment 202 Pervious Impervious Total Area "
"      Surface Area      0.025      0.090      0.115      hectare"
"      Time of concentration      8.566      1.154      2.041      minutes"
"      Time to Centroid      103.863      85.669      87.846      minutes"
"      Rainfall depth      89.960      89.960      89.960      mm"
"      Rainfall volume      22.76      80.69      103.45      c.m"
"      Rainfall losses      50.158      7.372      16.785      mm"
"      Runoff depth      39.802      82.588      73.175      mm"
"      Runoff volume      10.07      74.08      84.15      c.m"
"      Runoff coefficient      0.442      0.918      0.813      "
"      Maximum flow      0.005      0.052      0.054      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"          0.054      0.054      0.009      0.009"
" 54      POND DESIGN"
"      0.054 Current peak flow      c.m/sec"
"      0.011 Target outflow      c.m/sec"
"      84.2 Hydrograph volume      c.m"
"      46. Number of stages"
"      343.640 Minimum water level      metre"
"      344.780 Maximum water level      metre"
"      343.640 Starting water level      metre"
"      0 Keep Design Data: 1 = True; 0 = False"
"          Level Discharge      Volume"
"      343.640      0.000      0.000"
"      343.670      1.00E-07      0.4780"
"      343.690      0.00100      0.9560"
"      343.720      0.00200      1.434"
"      343.740      0.00400      1.912"
"      343.770      0.00500      2.409"
"      343.790      0.00500      2.915"
"      343.820      0.00600      3.809"
"      343.840      0.00600      4.717"
"      343.870      0.00600      5.635"
"      343.890      0.00600      6.549"
"      343.920      0.00600      7.459"
"      343.940      0.00600      8.365"
"      343.970      0.00600      9.265"
"      344.000      0.00600      10.162"
"      344.020      0.00600      11.052"
"      344.050      0.00600      11.937"
"      344.070      0.00600      12.816"
"      344.100      0.00600      13.689"
"      344.120      0.00600      14.556"
"      344.150      0.00600      15.415"
"      344.170      0.00600      16.267"

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"      344.200      0.01200      17.111"
"      344.220      0.01500      17.947"
"      344.250      0.01700      18.774"
"      344.280      0.01800      19.592"
"      344.300      0.02000      20.400"
"      344.330      0.02100      21.197"
"      344.350      0.02200      24.414"
"      344.380      0.02300      25.187"
"      344.400      0.02400      29.208"
"      344.430      0.02500      29.953"
"      344.450      0.02600      30.682"
"      344.480      0.02700      31.401"
"      344.500      0.02800      32.099"
"      344.530      0.02900      32.770"
"      344.550      0.02900      33.401"
"      344.580      0.03000      33.995"
"      344.610      0.03100      34.573"
"      344.630      0.03200      35.130"
"      344.660      0.03200      35.675"
"      344.680      0.03300      36.219"
"      344.710      0.03400      36.764"
"      344.730      0.03400      37.308"
"      344.760      0.03500      39.129"
"      344.780      0.03600      39.673"
"      Peak outflow      0.024      c.m/sec"
"      Maximum level      344.414      metre"
"      Maximum storage      29.565      c.m"
"      Centroidal lag      1.816      hours"
"          0.054      0.054      0.024      0.009 c.m/sec"
" 40      HYDROGRAPH Combine      1"
"      6 Combine "
"      1 Node #"
"          Total Discharge From Site"
"      Maximum flow      0.033      c.m/sec"
"      Hydrograph volume      100.387      c.m"
"          0.054      0.054      0.024      0.033"
" 40      HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
"          0.054      0.000      0.024      0.033"
" 33      CATCHMENT 203"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      203 Northwest Landscaped Area "
"      0.000 % Impervious"
"      0.004 Total Area"
"      2.000 Flow length"
"      20.000 Overland Slope"
"      0.004 Pervious Area"
"      2.000 Pervious length"

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"      20.000 Pervious slope"
"      0.000 Impervious Area"
"      2.000 Impervious length"
"      20.000 Pervious slope"
"      0.250 Pervious Manning 'n'"
"      75.000 Pervious SCS Curve No."
"      0.433 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      8.467 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.000 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.001 0.000 0.024 0.033 c.m/sec"
"      Catchment 203 Pervious Impervious Total Area "
"      Surface Area 0.004 0.000 0.004 hectare"
"      Time of concentration 1.153 0.155 1.153 minutes"
"      Time to Centroid 94.499 83.539 94.499 minutes"
"      Rainfall depth 89.960 89.960 89.960 mm"
"      Rainfall volume 3.60 0.00 3.60 c.m"
"      Rainfall losses 50.992 16.985 50.992 mm"
"      Runoff depth 38.968 72.976 38.968 mm"
"      Runoff volume 1.56 0.00 1.56 c.m"
"      Runoff coefficient 0.433 0.000 0.433 "
"      Maximum flow 0.001 0.000 0.001 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.001 0.001 0.024 0.033"
" 40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"      0.001 0.001 0.001 0.033"
" 40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Discharge From Site"
"      Maximum flow 0.033 c.m/sec"
"      Hydrograph volume 101.946 c.m"
"      0.001 0.001 0.001 0.033"
" 40 HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
"      0.001 0.000 0.001 0.033"
" 33 CATCHMENT 204"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      204 East Amenity Areas"
"      13.000 % Impervious"
"      0.007 Total Area"
"      3.000 Flow length"

```

```

"      2.000 Overland Slope"
"      0.006 Pervious Area"
"      3.000 Pervious length"
"      2.000 Pervious slope"
"      0.001 Impervious Area"
"      3.000 Impervious length"
"      2.000 Impervious slope"
"      0.250 Pervious Manning 'n'"
"      75.000 Pervious SCS Curve No."
"      0.435 Pervious Runoff coefficient"
"      0.100 Pervious Ia/S coefficient"
"      8.467 Pervious Initial abstraction"
"      0.015 Impervious Manning 'n'"
"      98.000 Impervious SCS Curve No."
"      0.822 Impervious Runoff coefficient"
"      0.100 Impervious Ia/S coefficient"
"      0.518 Impervious Initial abstraction"
"      0.002 0.000 0.001 0.033 c.m/sec"
"      Catchment 204 Pervious Impervious Total Area "
"      Surface Area 0.006 0.001 0.007 hectare"
"      Time of concentration 2.934 0.395 2.376 minutes"
"      Time to Centroid 96.866 84.863 94.225 minutes"
"      Rainfall depth 89.960 89.960 89.960 mm"
"      Rainfall volume 5.48 0.82 6.30 c.m"
"      Rainfall losses 50.809 16.050 46.290 mm"
"      Runoff depth 39.151 73.910 43.670 mm"
"      Runoff volume 2.38 0.67 3.06 c.m"
"      Runoff coefficient 0.435 0.822 0.485 "
"      Maximum flow 0.002 0.001 0.002 c.m/sec"
" 40 HYDROGRAPH Add Runoff "
"      4 Add Runoff "
"      0.002 0.002 0.001 0.033"
" 40 HYDROGRAPH Copy to Outflow"
"      8 Copy to Outflow"
"      0.002 0.002 0.002 0.033"
" 40 HYDROGRAPH Combine 1"
"      6 Combine "
"      1 Node #"
"      Total Discharge From Site"
"      Maximum flow 0.035 c.m/sec"
"      Hydrograph volume 105.003 c.m"
"      0.002 0.002 0.002 0.035"
" 40 HYDROGRAPH Start - New Tributary"
"      2 Start - New Tributary"
"      0.002 0.000 0.002 0.035"
" 33 CATCHMENT 205"
"      1 Triangular SCS"
"      1 Equal length"
"      1 SCS method"
"      205 East Driveway to CB1"

```

```

"      80.000  % Impervious"
"      0.012  Total Area"
"     10.000  Flow length"
"      3.000  Overland Slope"
"      0.002  Pervious Area"
"     10.000  Pervious length"
"      3.000  Pervious slope"
"      0.010  Impervious Area"
"     10.000  Impervious length"
"      3.000  Impervious slope"
"      0.250  Pervious Manning 'n'"
"     75.000  Pervious SCS Curve No."
"      0.442  Pervious Runoff coefficient"
"      0.100  Pervious Ia/S coefficient"
"      8.467  Pervious Initial abstraction"
"      0.015  Impervious Manning 'n'"
"     98.000  Impervious SCS Curve No."
"      0.880  Impervious Runoff coefficient"
"      0.100  Impervious Ia/S coefficient"
"      0.518  Impervious Initial abstraction"
"      0.006  0.000  0.002  0.035 c.m/sec"
"      Catchment 205      Pervious      Impervious Total Area "
"      Surface Area      0.002      0.010      0.012      hectare"
"      Time of concentration 5.351      0.721      1.237      minutes"
"      Time to Centroid 99.893      85.204      86.842      minutes"
"      Rainfall depth      89.960      89.960      89.960      mm"
"      Rainfall volume      2.16      8.64      10.80      c.m"
"      Rainfall losses      50.209      10.752      18.643      mm"
"      Runoff depth      39.751      79.208      71.317      mm"
"      Runoff volume      0.95      7.60      8.56      c.m"
"      Runoff coefficient      0.442      0.880      0.793      "
"      Maximum flow      0.001      0.006      0.006      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"      0.006      0.006      0.002      0.035"
" 40      HYDROGRAPH Copy to Outflow"
"      8      Copy to Outflow"
"      0.006      0.006      0.006      0.035"
" 40      HYDROGRAPH Combine 1"
"      6      Combine "
"      1      Node #"
"      Total Discharge From Site"
"      Maximum flow      0.039      c.m/sec"
"      Hydrograph volume      113.561      c.m"
"      0.006      0.006      0.006      0.039"
" 38      START/RE-START TOTALS 205"
"      3      Runoff Totals on EXIT"
"      Total Catchment area      0.174      hectare"
"      Total Impervious area      0.106      hectare"
"      Total % impervious      61.109"

```

" 19 EXIT"

APPENDIX E

Quality Control – Oil Grit Separator Sizing Report

Stormceptor®EF Sizing Report

Imbrium® Systems

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

04/16/2025

Province:	Ontario	Project Name:	273-275 Sunview Street
City:	Waterloo	Project Number:	24-239
Nearest Rainfall Station:	WATERLOO WELLINGTON AP	Designer Name:	Gretchen Capuyan
Climate Station Id:	6149387	Designer Company:	K.Smart Associates Ltd.
Years of Rainfall Data:	34	Designer Email:	gcapuyan@ksmart.ca
		Designer Phone:	519-748-1199
Site Name:	201	EOR Name:	
		EOR Company:	
Drainage Area (ha):	0.16	EOR Email:	
% Imperviousness:	74.00	EOR Phone:	
Runoff Coefficient 'c': 0.74			

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	4.51
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	157
Estimated Average Annual Sediment Volume (L/yr):	128

**Net Annual Sediment
(TSS) Load Reduction
Sizing Summary**

Stormceptor Model	TSS Removal Provided (%)
EFO4	95
EFO5	98
EFO6	99
EFO8	100
EFO10	100
EFO12	100

Recommended Stormceptor EFO Model: **EFO4**
Estimated Net Annual Sediment (TSS) Load Reduction (%): **95**
Water Quality Runoff Volume Capture (%): **> 90**

Stormceptor® EF Sizing Report

THIRD-PARTY TESTING AND VERIFICATION

► **Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

► **Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

► The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

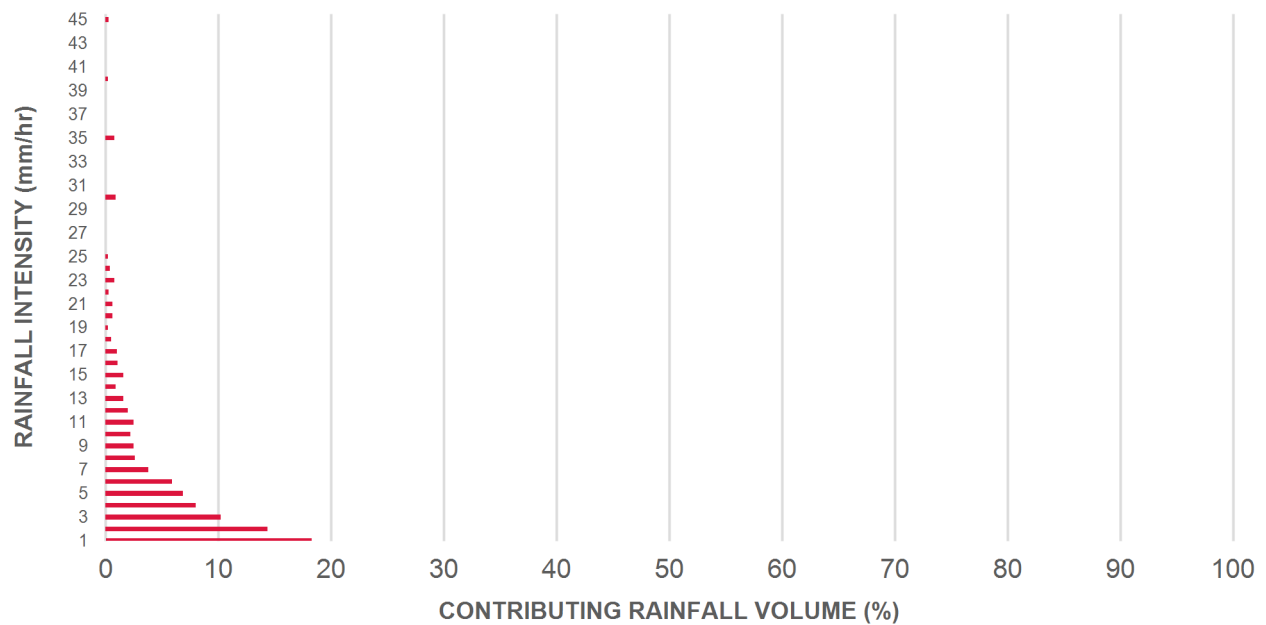
Stormceptor®EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.5	8.5	0.17	10.0	8.0	100	8.5	8.5
1.00	18.3	26.8	0.33	20.0	17.0	100	18.3	26.8
2.00	14.4	41.3	0.66	40.0	33.0	100	14.4	41.3
3.00	10.2	51.5	0.99	60.0	50.0	100	10.2	51.5
4.00	8.0	59.5	1.32	79.0	66.0	100	8.0	59.5
5.00	6.9	66.4	1.65	99.0	83.0	98	6.8	66.3
6.00	5.9	72.3	1.99	119.0	99.0	96	5.6	71.9
7.00	3.8	76.1	2.32	139.0	116.0	95	3.6	75.5
8.00	2.6	78.7	2.65	159.0	132.0	92	2.4	77.9
9.00	2.5	81.1	2.98	179.0	149.0	91	2.2	80.1
10.00	2.2	83.3	3.31	199.0	165.0	88	1.9	82.1
11.00	2.5	85.8	3.64	218.0	182.0	86	2.1	84.2
12.00	2.0	87.8	3.97	238.0	199.0	84	1.7	85.9
13.00	1.6	89.4	4.30	258.0	215.0	83	1.3	87.2
14.00	0.9	90.4	4.63	278.0	232.0	82	0.8	88.0
15.00	1.6	91.9	4.96	298.0	248.0	81	1.3	89.3
16.00	1.1	93.0	5.29	318.0	265.0	80	0.9	90.1
17.00	1.0	94.0	5.63	338.0	281.0	79	0.8	91.0
18.00	0.5	94.6	5.96	357.0	298.0	79	0.4	91.4
19.00	0.2	94.8	6.29	377.0	314.0	78	0.2	91.6
20.00	0.6	95.4	6.62	397.0	331.0	77	0.5	92.0
21.00	0.6	96.1	6.95	417.0	347.0	77	0.5	92.5
22.00	0.3	96.4	7.28	437.0	364.0	76	0.2	92.7
23.00	0.8	97.2	7.61	457.0	381.0	75	0.6	93.4
24.00	0.4	97.6	7.94	477.0	397.0	74	0.3	93.7
25.00	0.2	97.8	8.27	496.0	414.0	73	0.1	93.8
30.00	0.9	98.7	9.93	596.0	496.0	70	0.6	94.4
35.00	0.8	99.5	11.58	695.0	579.0	66	0.5	95.0
40.00	0.2	99.7	13.24	794.0	662.0	64	0.2	95.1
45.00	0.3	100.0	14.89	894.0	745.0	64	0.2	95.3
Estimated Net Annual Sediment (TSS) Load Reduction =								95 %

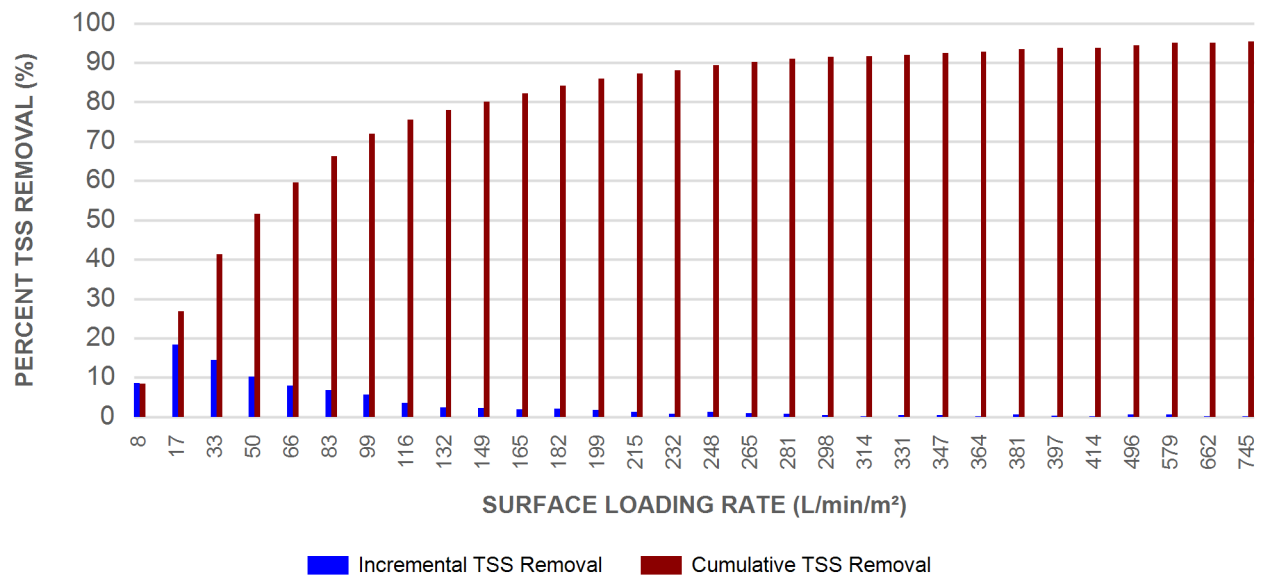
Climate Station ID: 6149387 Years of Rainfall Data: 34

Stormceptor®EF Sizing Report

RAINFALL DATA FROM WATERLOO WELLINGTON AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Stormceptor® EF Sizing Report

Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

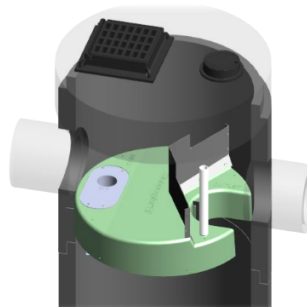
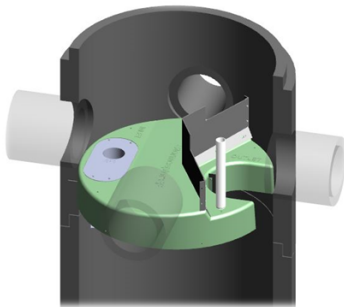
► **Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

DESIGN FLEXIBILITY

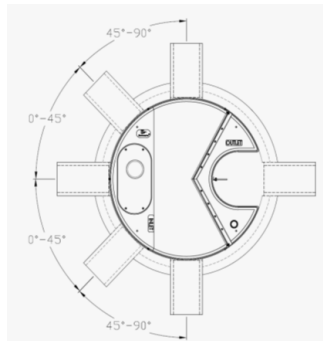
► **Stormceptor® EF and EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

► While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.



Stormceptor® EF Sizing Report



INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1.

For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit <http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef>

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit <http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef>

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m ³ sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m ³ sediment / 420 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m ³ sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m ³ sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m ³ sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m ³ sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

Stormceptor®EF Sizing Report

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m² to 1400 L/min/m², and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m² and 1400 L/min/m² shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m² shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m². No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m².

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m².

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m².

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid

Stormceptor®EF Sizing Report

Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators**, with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m² to 2600 L/min/m²) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

APPENDIX F

Storm Sewer Design Sheet

SUNVIEW DEVELOPMENT, CITY OF WATERLOO
STORM SEWER DESIGN SHEETS

K. Smart Associates Limited
Ref. Number 24-239
Date 04-Jun-25

City of Waterloo IDF Parameters		
	5 Year Storm	100 Year Storm
A	1755	4692
B	12.347	17.437
C	0.895	0.956

Reach	Design Storm	From	To	Δ Area (ha)	C	AC	Total AC	Tc (minutes)	Rain (mm/hr)	Q design (cms)	Design Pipe Size	Qcap (cms)	Velocity (m/sec)	Mannings N	Pipe Slope (%)	Pipe Length (meters)	Travel Time (minutes)	Total Time (minutes)	Remaining Capacity (%)	Q/Qcap (%)
Vortex Valve	5	CMBH2	CBMH1	0.115	0.60	0.069	0.069	10.00	108.824	0.010	200	0.0194	0.618	0.013	0.35	8.5	0.229	10.229	48.5%	51.5%
Orifice	100	CBMH2	CBMH1	0.115	0.60	0.069	0.069	10.00	197.837	0.024	250	0.0352	0.717	0.013	0.35	8.5	0.198	10.198	31.8%	68.2%
	5	CBMH1	OGS	0.023	0.60	0.0138	0.0828	10.23	107.834	0.028	300	0.0572	0.809	0.013	0.35	41	0.844	11.074	50.8%	49.2%
	5	CB1	OGS	0.012	0.60	0.0072	0.0072	10.00	108.824	0.002	200	0.0232	0.738	0.013	0.5	12.5	0.282	10.282	90.6%	9.4%
	5	OGS	MH1	0.013	0.60	0.0078	0.0978	11.07	104.348	0.033	300	0.0572	0.809	0.013	0.35	6	0.124	11.197	43.1%	56.9%

- Notes:**
1. Peak Flow from CBMH2 to CBMH1 is controlled by Hydro-Brake Vortex Valve during 5 year storm and vortex valve plus high flow orifice during 100 year storm. Flows used in calculations are from Discharge Calculations/MIDUSS Modeling

APPENDIX G

Vortex Valve Design Information

Technical Specification

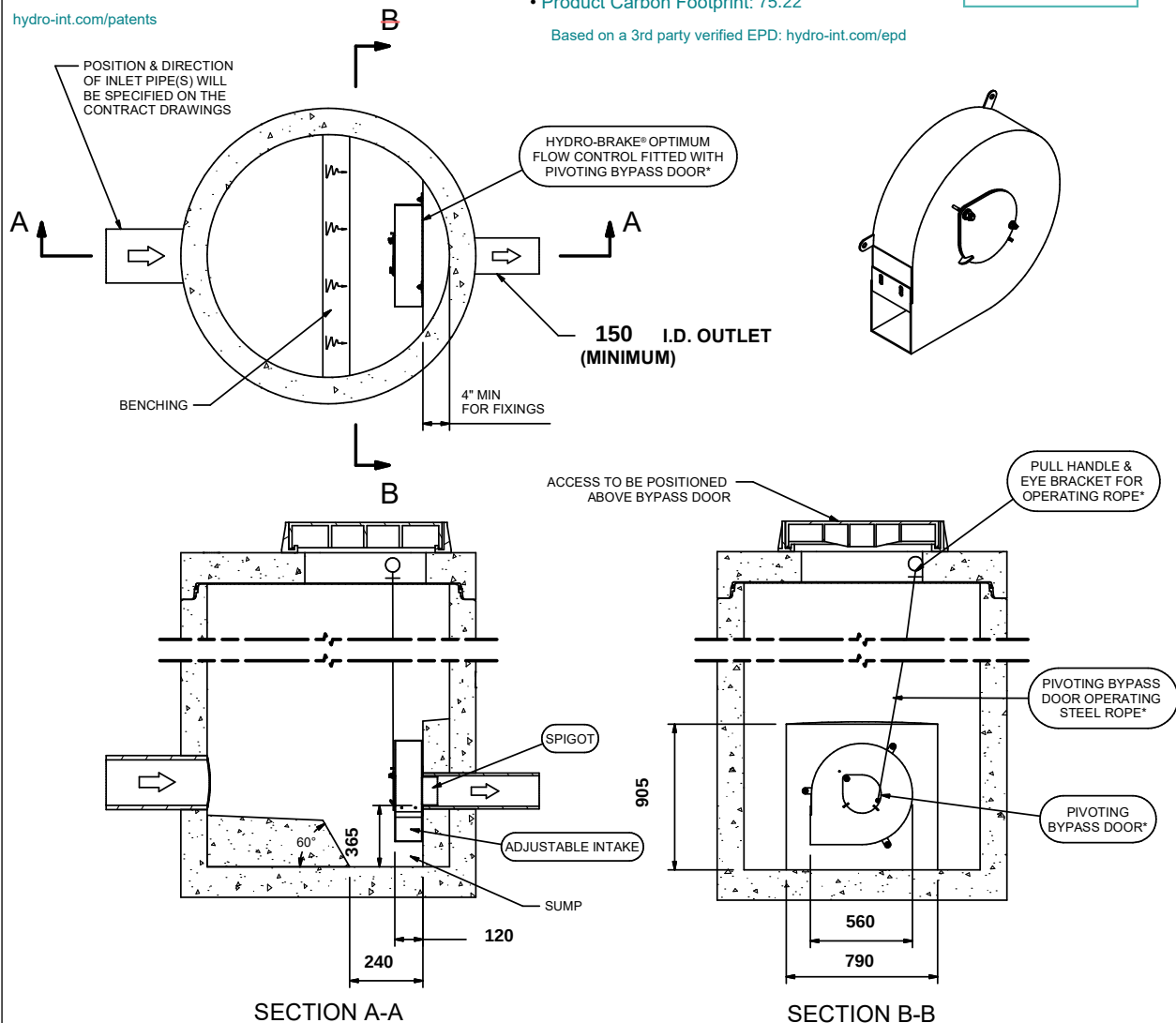
Control Point	Head (m)	Flow (l/s)
Primary Design	1.140	6.000
Flush-Flo™	0.340	5.984
Kick-Flo®	0.724	4.848
Mean Flow		5.216

hydro-int.com/patents

This Hydro-Brake® Optimum includes:

- All in 3 mm Grade 304L stainless steel
- Integral pivoting by-pass door allowing clear line of sight through to outlet, c/w operating rope
- Media blasted for corrosion resistance
- Variable flow rate post installation via adjustable inlet (if necessary)
- Indicative Weight: 20 kg
- Product Carbon Footprint: 75.22

Based on a 3rd party verified EPD: hydro-int.com/epd



IMPORTANT: ○ LIMIT OF HYDRO INTERNATIONAL SUPPLY
 THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
 FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
 ALL CIVIL AND INSTALLATION WORK BY OTHERS
 * WHERE SUPPLIED
 HYDRO-BRAKE® IS A REGISTERED TRADEMARK FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY
 HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0113-6000-1140-6000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International
 A CRH COMPANY

DATE	6/2/2025 6:51 PM	SHE-0113-6000-1140-6000 Hydro-Brake® Optimum
SITE	Sunview Development	
DESIGNER	Gretchen Capuyan	
REF	24-239	

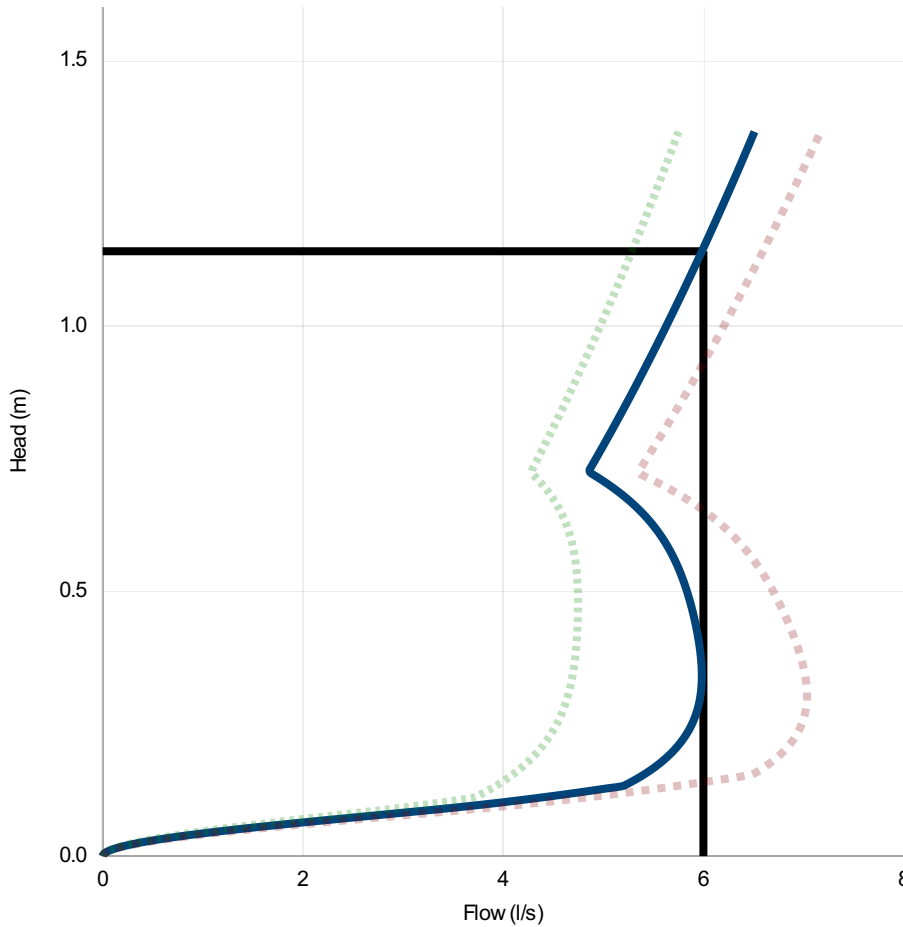
© 2025 Hydro International Ltd, 94 Hutchins Drive, Portland, Maine, 04102-1930. Tel; +1 (207) 756 6200 Fax; +1 (207) 756 6212 Website; hydro-int.com Email; enquiries@hydro-int.com

Technical Specification

	Original Setting		Minimum Setting		Maximum Setting	
Control Point	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
Primary Design	1.140	6.000	1.140	5.286	1.140	6.595
Flush-Flo™	0.340	5.984	0.473	4.748	0.303	7.034
Kick-Flo®	0.724	4.848	0.722	4.272	0.721	5.340
Mean Flow		5.216		4.356		5.909



hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.039	0.851
0.079	2.825
0.118	4.676
0.157	5.435
0.197	5.691
0.236	5.850
0.275	5.939
0.314	5.978
0.354	5.982
0.393	5.963
0.432	5.927
0.472	5.878
0.511	5.815
0.550	5.733
0.590	5.624
0.629	5.474
0.668	5.270
0.708	4.995
0.747	4.919
0.786	5.037
0.826	5.152
0.865	5.265
0.904	5.374
0.943	5.481
0.983	5.586
1.022	5.689
1.061	5.789
1.101	5.888
1.140	5.985

DESIGN ADVICE



The head/flow characteristics of this SHE-0113-6000-1140-6000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modeling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International
A CRH COMPANY

DATE	6/2/2025 6:51 PM
Site	Sunview Development
DESIGNER	Gretchen Capuyan
Ref	24-239

SHE-0113-6000-1140-6000
Hydro-Brake® Optimum

APPENDIX H

FSR and SWM Checklist

Functional Servicing Report Submission Requirements and Checklist

This checklist can be completed by the qualified Professional that prepared the Functional Servicing Report. Use of the form by the City of Waterloo is not to be construed as verification of engineering/servicing content.

Functional Servicing Report Submission Requirements and Checklist		
A. Introduction	Included in Functional Servicing Report (reference page number)	Report includes this information (City Staff Check)
Site Background (review of existing conditions, site location, historical uses etc.)	page 1	
Reference Reports and Drawings (any historical information relied upon)	n/a	
B. Existing Information	Included in Functional Servicing Report (reference page number)	Report includes this information (City Staff Check)
Existing Topography and Land Use (review existing drainage patterns, major overland flow routes, existing outlets, etc.)	page 3	
Geotechnical and Hydrogeological Conditions (provide an overview as applicable to servicing and stormwater management)	page 2	
Environmental Features (review proximity to environmental features such as wetlands, woodlots, creeks and/or other water bodies etc.)	page 2	
Existing Servicing and Utilities	page 1	
C. Proposed Phasing, Development Strategy, Construction Staging	Included in Functional Servicing Report (reference page number)	Report includes this information (City Staff Check)
Provide relevant verbiage discussing any development phasing, the overall servicing strategy, and any considerations necessary for phasing and staging of the development.	page 1	
D. Source Water Protection	Included in Functional Servicing Report (reference page number)	Report includes this information (City Staff Check)
Provide relevant verbiage discussing any water quality or water quantity source water protection that may be required. Specifically discuss the need for enhanced sewer construction, prohibition on	page 2	