

198-200 & 206 Plains Road East Functional Servicing and Stormwater Management Design Report

Burlington, ON

Submitted to:
City of Burlington
426 Brant Street
Burlington, ON L7R 3Z6

Submitted by:
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Project No. 2500052



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1. Introduction

This report has been prepared by GEI Consultants Canada Ltd. to document the functi nal servicing and stormwater management design in support of the Site Plan Approval for the proposed development at 198, 200 and 206 Plains Road East in the City of Burlington. This report has been updated following changes to the proposed site plan (dated October 24, 2025).

The Owner is required to have a Professional Engineer design a stormwater management system and have the said Engineer supervise and certify that the stormwater management system was installed in accordance with the approvals given under Secti n 41 of the Planning Act.

2. Site Information

The 0.29-hectare site is bound by Plains Road East to the north, and existi g residenti l development to the east, south and west. The site will be serviced by the existi g sanitary sewer, storm sewer and watermain on Plains Road East.

The legal boundary and topographic survey of the site was completed by J.H. Gelbloom Surveying Limited (dated April 4, 2023). The Site Plan was prepared by Hatem Nassif Architects Inc. (dated October 24, 2025). The existi g and proposed site details and the servicing are shown on the Existi g Condi ons and Removals Plan, Site Grading and Servicing Plans (GEI Consultants Canada Ltd., Drawings 1, No. 2, and No. 3).

2.1. Existing Site Conditions

Under existi g condi ons, the site is comprised of two residenti l buildings, one single family and one mul -family building, including the required asphalt driving and parking areas. Under existi g condi ons, drainage from the site shee lows overland to the south to the rear yard of the residenti l proper es fronti g on Filman Place.

2.2. Proposed Development

The intent of the Owner at this ti e is to construct a 1,100 m^2 six storey commercial and residenti l building, along with the associated asphalt driving and parking areas including an underground parking garage. Following development, runoff generated by the site will be directed to the proposed on-site storm sewers, and ul mately discharge to the existi g 525mm storm sewer on Plains Road East.

The site is proposed to be composed of the following surface types:

Table 1: Site Surface Types

	Area (% of Site)
Rooftop	41.4%
Asphalt	44.0%
Soft Landscaping	14.6%

2.2.1. Site Grading

Site grading is constrained by the existi g elevations along the property lines, as well as the centre line road elevation of Plains Road East at the proposed driveway entrance. The site will be graded to match existi g grades along property line, and to match existi g drainage pa erns. Local low points will ensure minimal slopes of 0.5% in paved areas and 2% in landscaped areas are achieved on site.

Access to the development is proposed via a driveway entrance from Plains Road East. Pedestrian access is provided by one (1) proposed connecti n to the sidewalk on Plains Road East. As per the comments received during the pre-consultation meeti g, the existi g sidewalk on Plains Road East, fronti g the side, will be replaced with a 2.5m sidewalk.

3. Site Servicing

3.1. Water Supply

The proposed development will be serviced via the extension of a 150mm diameter water service from the existi g 300mm diameter cast iron watermain on Plains Road East. The watermain will be installed to a minimum depth of 1.7 meters below nished grade.

Antic pated water demands are summarized in the table below. Both medium density residenti l population and commercial employee population were included for the proposed 6-story residenti l building with the rst oor to be allocated to commercial use.

Table 2: Anticipated Water Demands

	Anticipated Water Demand
Average Day Demand Total	***48.48 m^3/day***
2.431 P.P.U./66 medium density units[1] - Residential 265 L/cap/d[2]	42.52 m^3/day
370sq.ft employee @ 9308.8 sq.ft or commercial[1] -Employment: 225/emp/d[2]	5.96 m^3/day
Maximum Day Demand 2.25 x Average Day Demand	***109.08 m^3/day***
Peak Hour Demand 4.00 x Average Day Demand	***193.92 m^3/day (2.24 L/s)***
Required Fire Flow (per FUS) – **See Appendix A for detailed calculations**	150 L/s

[1] 2024 Development Charges Background Study (City of Burlington, 2024)
[2] 2022 Development Charges Background Study for Water, Wastewater, Roads & General Services (Region of Halton, 2021)

3.2. Sanitary Servicing

The proposed development will be serviced via the extension of a 200mm diameter sanitary service from the existi g 250mm diameter sanitary sewer on Plains Road East. Expected sanitary ows are as follows:

Table 3: Anticipated Sanitary Flows

	Anticipated Water Demand
Dry Weather Flow Total	65.56 m^3/day = 0.76 L/s
2.431 P.P.U./66 medium density units - Residential 360 L/cap/d	57.76 m^3/day
370sq.ft employee @ 9308.8 sq.ft or commercial -Employment: 310 L/emp/d	7.80 m^3/day
Peaking Factor (based on Harmon Equation)	4.16
Infiltration and Inflow (0.286 x 10^{-3} m^3/ha/s)	0.08 L/s
Total Sanitary Flow	3.32 L/s

Therefore, the peak sanitary ows from the site are projected to be 3.32 L/s. As the existi g 250 mm diameter sanitary sewer on Plains Road East (SMH13384 to SMH13393) has capacity for 37.1 L/s (250mm diameter sewer at 0.46%), the ows from the proposed development at 198 Plains Road East represents 8.9% of this. According to the Region's wastewater modelling, the existi g wet weather (10-year design storm) peak ow from SMH13384 to SMH13393 is 1.0L/s. Please see the table below for a summary of the existi g, and post-development ows in the sanitary sewer from SMH13384 to SMH13393.

Table 4: Anticipated Change in Peak Flows in the Existing Sanitary Sewer on Plains Road

Location	**Existing Conditions**	**Post-Development Conditions**
198, 200 & 206 Plains Road East Existing: -4 Units @ 3.378 P.P.U. x 360 L/cap/day Proposed: -2.431 P.P.U./66 medium density units -370sq.ft employee @ 9308.8 sq.ft or commercial -1 Unit @ 3.378 P.P.U. x 360 L/cap/day	0.25 L/s	3.46 l/S
Difference from post-development to existing conditions at 198, 200 & 206 Plains Road East	---	+ 3.21 L/s
SMH13384 to SMH13393	1.0 L/s	4.21 L/s
Existing Sewer Capacity	37.10 L/s	37.10 L/s
% of Capacity	2.7%	11.3%

Therefore, as shown in the above table, the post-development ows at 198, 200 and 206 Plains Road East are antic pated to increase by 3.21 L/s from the existi g condi on. This change results in an increase in the overall peak ow in the sewer (from 198, 200 and 206 Plains Road East) from 1.0 L/s to 4.21 L/s. As the capacity of the existi g sewer (250mm at 0.46%) is 37.10 L/s, the existi g sewer has capacity for the proposed development.

Sanitary design sheets for the proposed development and upstream and downstream sanitary sewers have been provided in Appendix A.

3.3. Storm Servicing

Storm servicing for the proposed development will be provided via the extension of a 300mm diameter storm sewer from the existi g 525mm storm sewer on Plains Road East. As per the stormwater management criteria from the City of Burlington, storage will be provided in order to control the post development ows generated during the 100-year design storm event to the level of the 5-year design storm event for an imperviousness of 36%.

To meet the City's criteria for quality control (80% total suspended solids [TSS] removal), an ETV cer ed membrane ltratio device (Jelly sh Filter) will be proposed.

The proposed on-site storm sewers have been designed for the 5-year design storm event. Storm Sewer design sheets can be found in Appendix A.

4. Stormwater Management Design

4.1. Stormwater Management Design Criteria

The stormwater management criteria established for this site are as follows:

1. Runoff generated during either the 100-year post development or Regional Storm, whichever is greater, is to be controlled to the 5-year pre-development level.
2. A max. pre-development imperviousness of 36.0% (C = 0.50) for re-development is to be used for the pre-development calculations
3. If there is a foundation drainage collecti n system, ows must be accommodated in the quantit control for the site, and discharge must meet the Storm Sewer Discharge Bylaw 59-2022 Table 1 criteria, as amended.
4. Enhanced 80.0% TSS removal achieved with a treatment train approach. An OGS will only be credited with 50.0% TSS removal. OGS CA-ETV certi ed units only.
5. OGS to be sized to capture and treat a min. 90.0% of the runo volume.
6. Roo op areas may be considered clean if the ows are separated from non-roof areas.
7. Strongly recommend the rst 5mm of rainfall be retained and infi trated or reused onsite.
8. Provide the emergency overland ow route on the plans and direct it towards Plains Road East. Include the neighbouring proper es to ensure existi g drainage pa erns are being maintained.

The City of Burlington IDF Curve (Standard Drawing S-IDF) from the Stormwater Management Design Guidelines was used to model the 2,5,10,25, 50, and 100-year design storm events in Visual OTTHYMO and the Horton in ltra on method was applied as soil infil ra on parameters in the runo calculation.

Hurricane Hazel rainfall me series data was used to simulate the Regional Storm Event. The rainfall intensity equation, DF parameters for the analysis are as follows:

Table 5: City of Burlington Chicago Rainfall Distribution Parameters

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
a =	681.580	802.040	918.280	1065.950	1172.340	1281.340
b =	6.000	5.000	5.000	5.000	5.000	5.000
c =	0.780	0.764	0.763	0.762	0.761	0.761
r =	0.400	0.400	0.400	0.400	0.400	0.400
Duration (min) =	360	360	360	360	360	360

The in ltration pa ameters used in V.O are shown in Table No. 6.

Table 6: Horton Infiltration Parameters on Visual Otthymo

	Parameter Value
Maximum Infiltration	125.0 mm/hr
Minimum Infiltration	3.0 mm/hr
Decay Coefficient	2.0 hr

4.2. Existing Conditions

The 0.29-hectare site was modeled as one (1) drainage catchment containing 54% imperviousness area, as shown in Figure No.1. The existi g condi ons of Visual OTTHYMO modeling results are included in Appendix B. The following table summarizes the exis ng condi ons ow rates from the site.

Table 7: Existing Condition Flow Rates

	2-Year	5-Year	10-year	25-Year	50-Year	100-Year	Regional
Catchment 10	0.045 m^3/s	0.059 m^3/s	0.068 m^3/s	0.080 m^3/s	0.088m^3/s	0.096 m^3/s	0.038 m^3/s
Total	**0.045 m^3/s**	**0.059 m^3/s**	**0.068 m^3/s**	**0.080 m^3/s**	**0.088 m^3/s**	**0.096 m^3/s**	**0.038 m^3/s**

4.3. Allowable Release Rates

The post-development runoff ows generated during the 2, 5, 10, 25, 50 and 100-year design storm events are to be a enuated to an allowable release rate equal to the pre-development runoff ow generated during the 5-year design storm event. As per the City of Burlington stormwater management design criteria, a maximum imperviousness value of 36% was used to model the existi g condi on runo peak ow.

The allowable release rate from the site for all design storm events is 0.040 m^3/s. The Visual Ott ymo modeling results are included in Appendix B.

4.4. Post-Development Drainage Areas

For the post-development condi on analysis, the site was modelled as ve (5) drainage catchments (see Figure 2).

Catchment 100 (0.03-hectares, 100% Impervious) represents the roo op of the proposed building, excluding roo op terrace and 6th oor terrace areas. The roo op of the proposed building is at and will be used to store and a enuate stormwater runo . Runoff from Catchment 100 will be a enuated through the use of one (1) roof drain with two (2) weirs per drain, and the average depth of water stored on the roo op will not exceed the design criteria of 150mm based on the Ontario Building Code (OBC; 2024). Please note that six (6) notches represent a fully open drain. Runoff generated from Catchment 100 is directed to the proposed on-site storm sewers, and ul mately the existi g storm sewer in the Plains Road East right-of-way.

Catchment 200 (0.09-hectares, 100% Impervious) represents the roo op terrace and 6th oor terrace areas of the building. This por on of the roo op is at and will be used to store and a enuate stormwater runoff with minimal storage (i.e. maximum depth of 3.6cm during the 100-year storm) as it is proposed to be outdoor amenity area. Runoff from Catchment 200 will be a enuated through the use of four (4) roof drains with three (3) weirs per drain and the average depth of water stored on the roo op will not exceed the design criteria of 150mm based on the Ontario Building Code (OBC; 2024). Please note that six (6) notches represent a fully open drain. Runoff generated from Catchment 200 is

directed to the proposed on-site storm sewers, and ulti ately the existi g storm sewer in the Plains Road East right-of-way.

Catchment 300 (0.11-hectares, 97% Impervious) represents the proposed parking lot. Runo generated from Catchment 300 discharges to the existi g storm sewer on Plains Road East via the proposed on-site storm sewers.

Quantity control for runoff generated by Catchment 300 will be provided by a 90mm diameter ori ce plate installed on the outlet of MH.4. Storage volume for runoff during ow a enuation ill be provided via parking lot ponding from an elevation of 99.55masl to 99.77masl. Approximately 46m^3 of storage has been provided in the proposed parking area in Catchment 200.

Quality control for runoff generated by Catchment 300 will be provided via a membrane ltration d vice (Jelly sh unit JF4-1-1), sized by Imbrium Systems. Further details of the membrane ltra on device can be found in Appendix C. The Jelly sh unit can provide up to 85% TSS removal.

Catchment 400 (0.03-hectares, 52% Impervious) represents a por on of the landscaped and sidewalk areas of the site. Runoff generated from Catchment 400 will conti ue to discharge, uncontrolled, to the adjacent proper es to the northeast.

Catchment 500 (0.03-hectares, 25% Impervious) represents a por on of the landscape, sidewalk, and asphalted driveway areas of the site. Runoff generated from Catchment 500 will conti ue to discharge, uncontrolled, to the adjacent proper es to the southwest.

4.5. Stormwater Quality Control

Enhanced level treatment will be provided for the parking lot area (0.11 ha) of the site via an o ine JF4-1-1 Jelly sh membrane ltration reatment device which can treat 85% TSS from runoff generated from the catchment. The sizing report and speci cations ave been provided in Appendix C.

4.6. Routing

The hydrologic model Visual OTTHYMO was used to create the 2-100-year design storm runoff hydrographs and to route the hydrographs. A copy of the nal printout of the hydrologic modelling is appended in Appendix A.

The results of the routi g analysis are as follows:

Table 8: Catchment 100 Rooftop Stage/Storage/Discharge Capacities

	Available Capacity			**Actual Capacity Used**		
	Peak Flow m^3/s	**Storage Volume m^3**	**Storage Elevation m**	**Peak Flow m^3/s**	**Storage Volume m^3**	**Storage Elevation m**
Roo op	0.000	0	0.000	---	---	---
2-Year	---	---	---	0.001	7	0.023
5-Year	---	---	---	0.001	9	0.030
10-Year	---	---	---	0.002	10	0.033
25-Year	---	---	---	0.002	11	0.037
50-Year	---	---	---	0.002	12	0.040
100-Year	---	---	---	0.003	13	0.043
Regional	---	---	---	0.003	16	0.053
Overfl w	0.015	25	0.100	---	---	---

Table 9: Catchment 200 Rooftop Stage/Storage/Discharge Capacities

	Available Capacity			**Actual Capacity Used**		
	Peak Flow m^3/s	**Storage Volume m^3**	**Storage Elevation m**	**Peak Flow m^3/s**	**Storage Volume m^3**	**Storage Elevation m**
Roo op	0.000	0	0.000	---	---	---
2-Year	---	---	---	0.005	15	0.017
5-Year	---	---	---	0.007	20	0.022
10-Year	---	---	---	0.008	23	0.026
25-Year	---	---	---	0.009	27	0.030
50-Year	---	---	---	0.010	30	0.033
Regional	---	---	---	0.010	30	0.033
100-Year	---	---	---	0.011	32	0.036
Overfl w	0.030	90	0.100	---	---	---

Table 10: Catchment 300 Surface Ponding Stage/Storage/Discharge Capacities

	Available Capacity			Actual Capacity Used		
	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m
Orific Invert	0.000	0	98.770	---	---	---
CB T/G	0.015	0	99.550	---	---	---
Regional	---	---	---	0.016	3	99.633
2-Year	---	---	---	0.016	5	99.654
5-Year	---	---	---	0.016	8	99.668
10-Year	---	---	---	0.016	11	99.682
25-Year	---	---	---	0.016	15	99.700
50-Year	---	---	---	0.016	18	99.708
100-Year	---	---	---	0.016	21	99.715
Weir	0.017	35	99.750	---	---	---
Overfl w	0.036	46	99.770	---	---	---

A summary of the post-development peak ows from the site for all design storm events is provided in the table below.

Table 11: Summary of Post-Development Peak Flow Rates

	2-Year	5-Year	10-year	25-Year	50-Year	100-Year	Regional
Catchment 100 (Roo op Storage)	0.001 m^3/s	0.001 m^3/s	0.002 m^3/s	0.002 m^3/s	0.002 m^3/s	0.003 m^3/s	0.003 m^3/s
Catchment 200 (Roo op Storage-Terrace Area)	0.005 m^3/s	0.007 m^3/s	0.008 m^3/s	0.009 m^3/s	0.010 m^3/s	0.011 m^3/s	0.010 m^3/s
Catchment 300 (Parking Lot - Surface Ponding)	0.016 m^3/s	0.016 m^3/s	0.016 m^3/s	0.016 m^3/s	0.016 m^3/s	0.016 m^3/s	0.016 m^3/s
Catchment 400 (Uncontrolled)	0.005 m^3/s	0.006 m^3/s	0.008 m^3/s	0.010 m^3/s	0.012 m^3/s	0.013 m^3/s	0.004 m^3/s
Catchment 500 (Uncontrolled)	0.001 m^3/s	0.001 m^3/s	0.002 m^3/s	0.002 m^3/s	0.003 m^3/s	0.003 m^3/s	0.004 m^3/s
Total	**0.025 m^3/s**	**0.028 m^3/s**	**0.031 m^3/s**	**0.034 m^3/s**	**0.037 m^3/s**	**0.040 m^3/s**	**0.037 m^3/s**

Table 12. Comparison of Allowable Release Rates and Post-Development Flow Rates

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	Regional
Allowable Release Rate	0.040 m^3/s	0.040 m^3/s	0.040 m^3/s	0.040 m^3/s	0.040 m^3/s	0.040 m^3/s	0.040 m^3/s
Post-Development Flow Rate	0.025 m^3/s	0.028m^3/s	0.031 m^3/s	0.034 m^3/s	0.037 m^3/s	0.040 m^3/s	0.037 m^3/s

As shown on Table 12, the post-development peak ow rates are a enuated to allowable release rates for the 2-year to 100-year design storm events, and the regional storm event.

4.7. Water Budget

As part of the City's stormwater management criteria, it is strongly recommended to retain the rst 5mm of rainfall across the enti e site area. Given the layout of the site, and distance constraints from the building and property line, in ltra on is not recommended for this site.

5. Sediment and Erosion Control

A silt fence will be installed along the property boundary. The silt fence will serve to minimize the opportunity for water borne sediments to be transported from the site to the adjacent proper es.

Upon completio of the grading, any area not subject to acti e construc on within 30 days will be topsoiled and seeded as per OPSS 572.

Inspection an maintenance of all fencing will start a er installa on is complete. The silt fence will be inspected on a weekly basis during acti e constructi n or a er a rainfall event of 13 mm or greater. Maintenance will be carried out, within 48 hours, on any part of the features found to need repair.

Once construc on and landscaping have been substanti lly completed, the silt fence will be removed, any accumulated sediment within the limits of the subdivision will be collected and removed and the landscaping will be completed.

6. Maintenance Plan

To ensure that the stormwater management system conti ues to functi n as designed and constructed, we recommend that the following inspecti ns and maintenance ac vi es be completed on an annual basis:

1. Is there any noticea le damage to the asphalt? If yes, complete any necessary repairs.
2. Is there any indication of a spill (i.e. frothy water, oily sheen on the water)? If yes, inves gate, inform the appropriate agencies and complete the necessary clean-up and restoration
3. Inspect all roof drains and associated piping. Remove and dispose of any accumulated sediment, trash/li er debris (i.e. leaves).
4. Inspect the oil/grit structure and complete any necessary maintenance/repair activities identified y the manufacturer.
5. Inspect all inlet structures and manholes. Remove and dispose of any accumulated sediment, trash/li er, debris (i.e. sediment, garbage, leaves, etc.).
6. Inspect all ori ce plates, and ow control devices. Remove and dispose of any accumulated sediment, trash/li er, debris (i.e. sediment, garbage, leaves, etc.).

Please note that any structures identi ed during the annual inspection o be worn, missing or damaged are to be repaired or replaced within 48 hours.

7. Conclusions

In summary, the features of the design for the proposed development are as follows:

1. The proposed development will be serviced via the extension of a 150mm diameter water service from the existi g 300mm diameter watermain on Plains Road East.
2. The proposed development will be serviced via the extension of a 200mm diameter sanitary service from the existi g 250mm diameter sanitary sewer on Plains Road East.
3. Storm servicing for the proposed development will be provided via the extension of a 300mm storm sewer to the existi g 525mm storm sewer on Plains Road East.
4. The runoff generated from the site during the 2, 5, 10, 25, 50 and 100-year design storm events has been a enuated to less than the allowable release rate of 0.040 m^3/s.
5. Enhanced water quality control is achieved by an ETV certi d Jelly sh JF4-1-1 membrane ltration d vice.
6. Prior to construc on, a silt fence will be installed along the property boundary in all loca ons where runo will discharge from the site to adjacent lands. This will minimize the transport of sediment o -site during the construc on period.

All of which is respectf lly submi ed.

Sincerely,

GEI Consultants Canada Ltd.



Patrick Grier, P.Eng.
Senior Project Engineer

PG/SJ
\\geiconsultants.com\data\Data_Storage\Working\LANDWISE\2500052 198-200 & 206 Plains Road East\Design Phase\Reports - SWM, FSR, Design Brief, etc\2500052 198 200 and 206 Plains Rd E FSR and SWM Report - Revised - 2025-11-14.docx

Figures

Figure 1. Pre-development Drainage Area Figure

Figure 2. Post-Development Drainage Area Figure

198-200 & 206 PLAINS RD. EAST
CITY OF BURLINGTON

EX. 99.5m - 250Ø SAN @ -0.24%

EX. 183.6m - 250Ø SAN @ 0.48%

EX. 91.4m - 250Ø SAN @ 0.39%

EX. 88.8m - 250Ø SAN @ 0.46%

10
0.29 | 54

LEGEND

- EX. STORM SEWER
- DRAINAGE AREA BOUNDARY
- 201 — CATCHMENT NUMBER
- 0.30 | 50 — PERCENT IMPERVIOUS
- CATCHMENT AREA IN HECTARES

5 0 5 10 20
1:500 (m)

PRE-DEVELOPMENT DRAINAGE AREA FIGURE

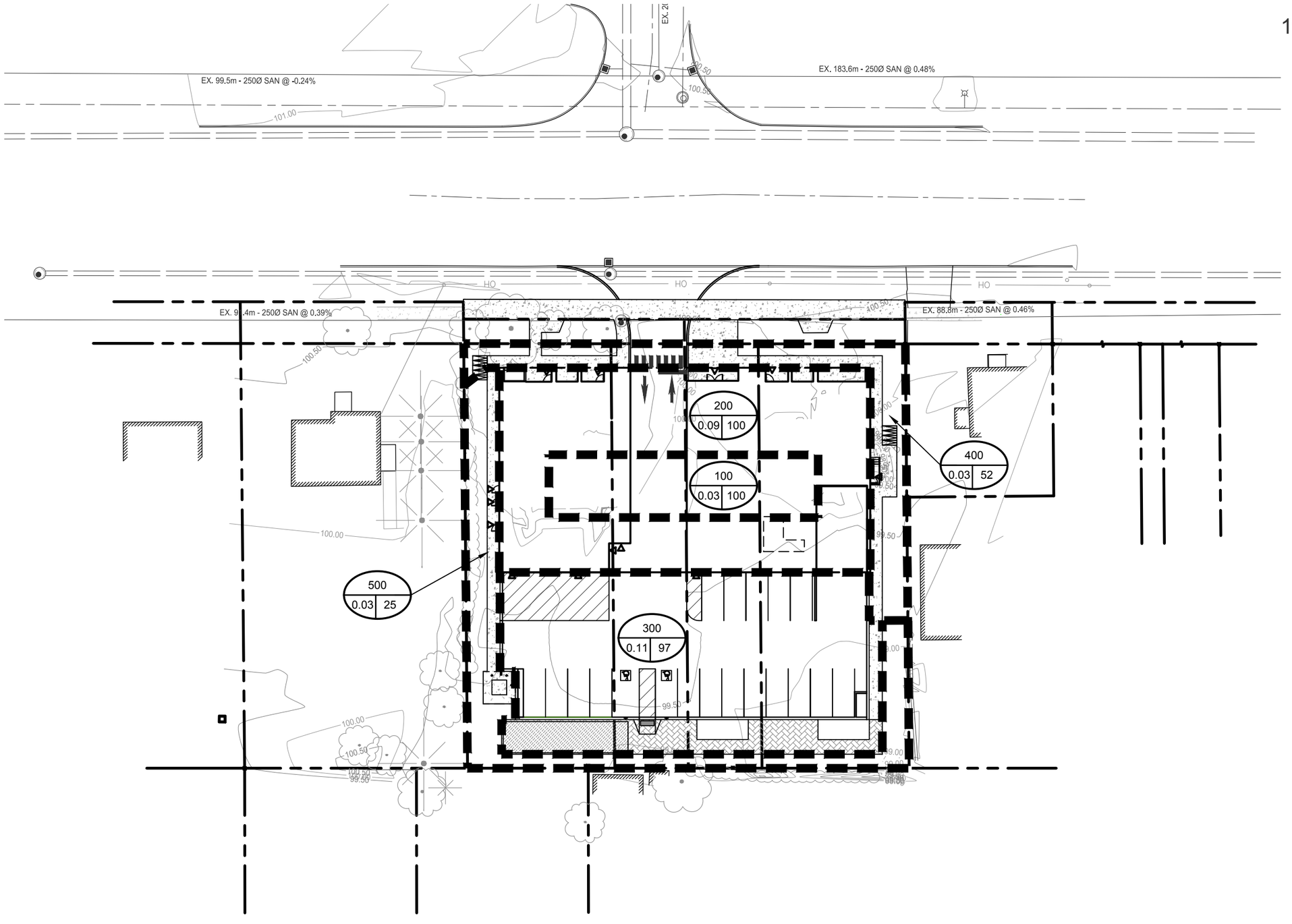
Figure No. 1

GEI Consultants
GEI CONSULTANTS, INC.
330 TRILLIUM DRIVE
UNIT D
KITCHENER, ONTARIO N2E 3J2
519.748.1440

2500052
JAN. 2025
Scale: 1:500 | NAD 1983 UTM Zone 17N

FILE:B:\Working\LANDWISE\2500052 198-200 & 206 Plains Road East\Design Phase\Drawings\2500052 SWM FIGS.dwg LAYOUT:PRE-DEVELOPMENT
LAST SAVED BY:Robmac4063, 5/7/2025 4:45:38 PM PLOTTED BY:MacDonald, Robert 5/8/2025 10:07:39 AM

198-200 & 206 PLAINS RD. EAST
CITY OF BURLINGTON



LEGEND

- PROP. STORM SEWER
- DRAINAGE AREA BOUNDARY
- 201 / 0.30 | 50 — CATCHMENT NUMBER; PERCENT IMPERVIOUS; CATCHMENT AREA IN HECTARES

5 0 5 10 20
1:500 (m)

POST DEVELOPMENT DRAINAGE AREA FIGURE

Figure No. 2

GEI Consultants
GEI CONSULTANTS, INC.
330 TRILLIUM DRIVE
UNIT D
KITCHENER, ONTARIO N2E 3J2
519.748.1440

2500052
JAN. 2025
Scale: 1:500 | NAD 1983 UTM Zone 17N

FILE:B:\Working\LANDWISE\2500052 198-200 & 206 Plains Road East\Design Phase\Drawings\2500052 SWM FIGS.dwg LAYOUT:POST DEVELOPMENT
LAST SAVED BY:Robmac4063, 11/11/2025 10:09:53 AM PLOTTED BY:MacDonald, Robert 11/11/2025 10:10:18 AM

Appendix A Sewer Design Sheets

A.1. Storm Sewer Design Sheet

A.2. Sanitary Sewer Design Sheet

A.3. FUS Fire Flow Calculations

City of Burlington

STORM SEWER DESIGN

198-200 & 206 Plains Road East

City of Burlington

5 -Year Design Storm Event

A = 802.04

B = 5

C = 0.764

Intensity = $A / (t + B)^C$

									Proposed Sewer						
From	To	Area (ha)	Runoff Coefficient	A x C	Cumulative A x C	Time of Conc. (min.)	Intensity (mm/hr)	Flow (m^3/s)	Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Time of Flow (min.)
CB11*	MH5	0.110	0.51	0.0561	0.06	10.00	101.31	**0.016**	3.1	150	0.013	0.50	0.011	0.61	0.08
MH5	MH4	0.000	0.95	0.0000	0.06	10.08	100.88	**0.016**	37.6	300	0.013	0.27	0.050	0.71	0.88
MH4	JF4-1-1	0.000	0.95	0.0000	0.06	10.97	96.59	**0.015**	2.7	300	0.013	0.50	0.068	0.97	0.05
JF4-1-1	CBMH.3	0.000	0.95	0.0000	0.06	11.01	96.38	**0.015**	1.8	300	0.013	0.50	0.068	0.97	0.03
CBMH.3	MH1	0.020	0.95	0.0190	0.08	11.04	96.24	**0.020**	12.7	300	0.013	0.50	0.068	0.97	0.22
Building	MH2	0.120	0.95	0.1140	0.11	10.00	101.31	**0.032**	1.5	300	0.013	2.00	0.137	1.93	0.01
MH2	MH1	0.000	0.95	0.0000	0.11	10.01	101.25	**0.032**	20.0	300	0.013	0.50	0.068	0.97	0.34
MH1	EX HS35A	0.000	0.95	0.0000	0.19	11.26	95.25	**0.050**	7.9	300	0.013	0.50	0.068	0.97	0.14

*Runoff coefficient reduced to reflect flows controlled by 90mm orifice

Date: November 14, 2025

Designed By: SJ

Checked by: PFG

Project 198, 200 & 206 Plains Road East

File 250052

PROJECT: 198, 200 & 206 Plains Road East

SANITARY SEWER DESIGN

198, 200 & 206 Plains Road East

City of Burlington

DATE: November 14, 2025
DESIGNED BY: S.J.
CHECKED BY: P.F.G

Commercial Flow= 310 L/c/day
0.0036 L/c/s
Residential Flow = 360 L/c/day
0.0042 L/c/s
n = 0.013

Q(i) = Cumm. Area (ha) * Infiltration Rate / 1000

Infiltration Rate: 0.286 L/ha/s

Peaking Factor : $F = 1 + \frac{14}{4 + \sqrt{P}}$ (P = Population/1,000)

Manning Equation: Full Cap.= (D/2/1000)^2*Pi*(D/4/1000)^0.667*(1/n)*(S/100)^0.5

D = Diameter (mm)

S = Slope (%)

Minimum Full Velocity= 0.6 m/s

n = 0.013 (PVC & Concrete), 0.016 (Vitrified Clay)

Catchment No.	Street	From M.H.	To M.H.	Community Services		Commercial		Low/Mid Rise Apartment		Single Family		Semi-detached Duplex		Townhouse Area		Cumulative		Peak Factor	Peak Flow	Peak Extraneous Flow	Total Flow	Distance	Diameter	Slope	Capacity (Full)	Velocity	
				Area (ha)	Population (40 ppl/ha)	Area (ha)	Population (370 sq.ft / employee)	Area (ha)	Population (420 ppl/ha OR MED DEN: 2.431PPU)	Area (ha)	Population (95 ppl/ha)	Area (ha)	Population (165 ppl/ha)	Area (ha)	Population (260 ppl/ha)	Area (ha)	Population		(m^3/s)	Q(i) = (m^3/s)	(m^3/s)	(m)	(mm)	(%)	(m^3/s)	Full (m/s)	Actual (m/s)
Existing	Plains Road East	SMH13375	SMH13384							0.23	22	0.28	46.20	0.00	0.00	0.51	68	4.286	0.00122	0.00015	0.0014	87.3	250	0.43	0.0390	0.795	0.022
	Plains Road East	SMH13384	SMH13393							0.19	18	0.36	59.40	0.15	39.00	1.21	185	4.161	0.00320	0.00035	**0.0035**	91.4	250	0.39	0.0371	0.756	0.055
Proposed (Upstream)	Plains Road East	SMH13375	SMH13384							0.23	22	0.14	23.10			0.37	45	4.324	0.00081	0.00011	0.0009	87.3	250	0.43	0.0390	0.795	0.000
Proposed (Site)	196-206 Plains Road East	Building	MH.B			0.09	26	0.20	161							0.29	187	4.159	0.00318	0.00008	0.0033	2.5	200	2.00	0.0464	1.477	0.153
	-	MH.B	MH.A													0.29	187	4.159	0.00324	0.00008	0.0033	20.2	200	0.50	0.0232	0.738	0.078
	Plains Road East	MH.A	SMH13384													0.29	187	4.159	0.00324	0.00008	0.0033	1.3	200	0.50	0.0232	0.738	0.078
	Plains Road East	SMH13384	SMH13393							0.04	4	0.36	59.40	0.15	39.00	1.21	334	4.058	0.00565	0.00035	**0.0060**	91.4	250	0.39	0.0371	0.756	0.092
	Plains Road East	SMH13393	SMH133402							0.15	14					1.36	348	4.050	0.00588	0.00039	0.0063	88.8	250	0.46	0.0403	0.821	0.105
	Plains Road East and Shadeland Avenue	Upstream + SMH133402	SMH13404	2.2600	90					1.35	128					4.97	567	3.945	0.00932	0.00142	**0.0107**	23.2	450	0.68	0.2351	1.478	0.100
	Shadeland Avenue	SMH13404	SMH13415							0.54	51					5.51	618	3.925	0.01011	0.00157	0.0117	23.2	450	0.88	0.2675	1.682	0.124
	Shadeland Avenue	SMH13415	SMH13426							2.07	197					7.58	815	3.856	0.01309	0.00217	0.0153	89.0	450	0.43	0.1870	1.176	0.113
	Shadeland Avenue	SMH13426	SMH19239							0.62	59					8.20	874	3.837	0.01397	0.00234	**0.0163**	91.1	450	0.31	0.1587	0.998	0.102

Date: November 14, 2025
Designed By: S.J.
Checked By: P.F.G

Project: 198, 200 & 206 Plains Road East
File: 2500052

Project No: 2500052
Designed By: SJ
Checked By: PFG

FIRE UNDERWRITERS SURVEY CALCULATIONS

198, 200 & 206 Plains Road East

City of Burlington

Date: November 14, 2025

Parameters from Water Supply for Public Fire Protection, Fire Underwriters Survey (2020)

Type of Construction	
Wood	1.5
Ordinary	1.0
Non-Combustible	0.8
Fire-Resistive	0.6

Fire Hazard	
Non-Combustible	-0.25
Limited Combustibility	-0.15
Combustible	0
Free Burning	0.15
Rapid Burning	0.25

Sprinklers	
System	-30%
Standard Water Supply	-40%
Fully Supervised	-50%

Proximity to closest structure (m)	
0 to 3	25%
3 to 10	20%
10 to 20	15%
20 to 30	10%
30 to 40	5%
None	0%
Fire Wall	10%

Building	Total Effective Floor Area (m2)	Construction Coefficient	NFF 220*C*(A)**0.5	Rounded NFF (to nearest 1000L/min)	Occupancy Factor	NFF adjusted for occupancy	Sprinkler Adjustment	Sprinkler Credit	Exposure Coefficient					Exposure Flow Debit	RFF	Rounded RFF (to nearest 1000L/min)	Required Fire Flow (L/s)
									N	S	E	W	Total (max 0.75)				
Proposed Bldg	2732.575	0.8	9,200	9,000	-0.15	7,650	-0.4	-3,060	0.00	0.15	0.20	0.20	0.55	4,208	8,798	9,000	150

Appendix B Stormwater Management Analysis

B.1. Existing Conditions Modelling

B.2. Existing Conditions Modelling – Allowable Release Rate

B.3. Post-development Conditions Modelling

B.4. Rooftop and Parking Lot Storage Details

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        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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DATE: 02/10/2025                          TIME: 08:38:46

USER:


COMMENTS: Pre-Development
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  ********************************************
  ** SIMULATION : 1-Burlington-2yr           **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 681.000
| Ptotal= 40.91 mm |                          B=   6.000
--------------------                          C=   0.780
```

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

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.63	1.50	3.92	3.00	6.77	4.50	2.41
0.08	1.68	1.58	4.31	3.08	6.08	4.58	2.34
0.17	1.73	1.67	4.79	3.17	5.53	4.67	2.27
0.25	1.79	1.75	5.42	3.25	5.08	4.75	2.20
0.33	1.85	1.83	6.25	3.33	4.70	4.83	2.14
0.42	1.92	1.92	7.43	3.42	4.38	4.92	2.08
0.50	1.99	2.00	9.21	3.50	4.10	5.00	2.03
0.58	2.07	2.08	12.26	3.58	3.86	5.08	1.98
0.67	2.16	2.17	18.62	3.67	3.65	5.17	1.93
0.75	2.25	2.25	39.29	3.75	3.47	5.25	1.88
0.83	2.36	2.33	104.92	3.83	3.30	5.33	1.84
0.92	2.47	2.42	45.18	3.92	3.15	5.42	1.80
1.00	2.61	2.50	24.73	4.00	3.01	5.50	1.76
1.08	2.75	2.58	16.95	4.08	2.89	5.58	1.72
1.17	2.92	2.67	12.92	4.17	2.78	5.67	1.69
1.25	3.12	2.75	10.47	4.25	2.68	5.75	1.65
1.33	3.34	2.83	8.83	4.33	2.58	5.83	1.62
1.42	3.61	2.92	7.66	4.42	2.49	5.92	1.59

CALIB STANDHYD (0010) ID= 1 DT= 5.0 min	Area (ha)= 0.29 Total Imp(%)= 54.00 Dir. Conn.(%)= 54.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.16	0.13	
Dep. Storage	(mm)=	1.50	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	50.00	50.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.	(mm/hr)=	104.92	0.00	
over	(min)	5.00	225.00	
Storage Coeff.	(min)=	1.34 (ii)	222.59 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	225.00	
Unit Hyd. peak	(cms)=	0.33	0.01	
				TOTALS
PEAK FLOW	(cms)=	0.04	0.00	0.045 (iii)
TIME TO PEAK	(hrs)=	2.42	0.00	2.42
RUNOFF VOLUME	(mm)=	39.41	0.00	21.28

```
     TOTAL RAINFALL   (mm)=      40.91        40.91          40.91
     RUNOFF COEFFICIENT   =       0.96         0.00           0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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DATE: 02/10/2025                          TIME: 08:38:46

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COMMENTS: _____

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  ********************************************
  ** SIMULATION : 2-Burlington-5yr            **
  ********************************************
```

CHICAGO STORM	Ptotal= 53.06 mm

IDF curve parameters: A= 802.040
B= 5.000
C= 0.764

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

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.24	1.50	5.21	3.00	8.79	4.50	3.27
0.08	2.30	1.58	5.70	3.08	7.93	4.58	3.17
0.17	2.37	1.67	6.31	3.17	7.24	4.67	3.08
0.25	2.45	1.75	7.10	3.25	6.68	4.75	2.99
0.33	2.53	1.83	8.14	3.33	6.20	4.83	2.91
0.42	2.62	1.92	9.59	3.42	5.79	4.92	2.84
0.50	2.71	2.00	11.79	3.50	5.44	5.00	2.76
0.58	2.82	2.08	15.51	3.58	5.14	5.08	2.70
0.67	2.93	2.17	23.22	3.67	4.87	5.17	2.63
0.75	3.06	2.25	48.81	3.75	4.63	5.25	2.57
0.83	3.19	2.33	138.10	3.83	4.41	5.33	2.52
0.92	3.35	2.42	56.20	3.92	4.22	5.42	2.46
1.00	3.52	2.50	30.66	4.00	4.05	5.50	2.41
1.08	3.71	2.58	21.19	4.08	3.89	5.58	2.36
1.17	3.93	2.67	16.30	4.17	3.74	5.67	2.31
1.25	4.18	2.75	13.33	4.25	3.61	5.75	2.27
1.33	4.47	2.83	11.32	4.33	3.49	5.83	2.22
1.42	4.81	2.92	9.88	4.42	3.37	5.92	2.18

CALIB STANDHYD (0010) ID= 1 DT= 5.0 min	Area (ha)= 0.29 Total Imp(%)= 54.00 Dir. Conn.(%)= 54.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.16	0.13

```
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      50.00        50.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     138.10         0.00
               over (min)         5.00       225.00
     Storage Coeff.  (min)=       1.20 (ii)  222.45 (ii)
     Unit Hyd. Tpeak (min)=       5.00       225.00
     Unit Hyd. peak  (cms)=       0.33         0.01
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.00          0.059 (iii)
     TIME TO PEAK    (hrs)=       2.42         0.00           2.42
     RUNOFF VOLUME    (mm)=      51.56         0.00          27.84
     TOTAL RAINFALL   (mm)=      53.06        53.06          53.06
     RUNOFF COEFFICIENT   =       0.97         0.00           0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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       O   O    T      T    H   H    Y    M   M  O   O
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USER:

COMMENTS: _____

****
** SIMULATION : 3-Burlington-10yr **
****

| CHICAGO STORM |
| Ptotal= 61.11 mm |

IDF curve parameters: A= 918.280
B= 5.000
C= 0.763
used in: INTENSITY = A / (t + B)^C

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.58	1.50	6.02	3.00	10.14	4.50	3.78
0.08	2.66	1.58	6.58	3.08	9.15	4.58	3.66
0.17	2.74	1.67	7.29	3.17	8.36	4.67	3.56
0.25	2.83	1.75	8.19	3.25	7.70	4.75	3.46
0.33	2.92	1.83	9.39	3.33	7.16	4.83	3.36
0.42	3.03	1.92	11.06	3.42	6.69	4.92	3.28
0.50	3.14	2.00	13.59	3.50	6.28	5.00	3.20
0.58	3.26	2.08	17.87	3.58	5.93	5.08	3.12
0.67	3.39	2.17	26.73	3.67	5.62	5.17	3.04
0.75	3.53	2.25	56.11	3.75	5.35	5.25	2.97
0.83	3.69	2.33	158.48	3.83	5.10	5.33	2.91
0.92	3.87	2.42	64.59	3.92	4.88	5.42	2.85
1.00	4.06	2.50	35.28	4.00	4.68	5.50	2.79
1.08	4.29	2.58	24.40	4.08	4.49	5.58	2.73

```
                1.17    4.54 |  2.67   18.78 |  4.17    4.33 |  5.67    2.67
                1.25    4.83 |  2.75   15.36 |  4.25    4.17 |  5.75    2.62
                1.33    5.16 |  2.83   13.05 |  4.33    4.03 |  5.83    2.57
                1.42    5.55 |  2.92   11.39 |  4.42    3.90 |  5.92    2.52


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0010)|   Area    (ha)=   0.29
|ID= 1 DT= 5.0 min |   Total Imp(%)=  54.00   Dir. Conn.(%)=  54.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.16         0.13
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      50.00        50.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     158.48         2.05
               over (min)        5.00        40.00
     Storage Coeff.  (min)=       1.14 (ii)   39.32 (ii)
     Unit Hyd. Tpeak (min)=       5.00        40.00
     Unit Hyd. peak  (cms)=       0.34         0.03
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.00          0.068 (iii)
     TIME TO PEAK    (hrs)=       2.42         3.00           2.42
     RUNOFF VOLUME    (mm)=      59.61         1.37          32.81
     TOTAL RAINFALL   (mm)=      61.11        61.11          61.11
     RUNOFF COEFFICIENT   =       0.98         0.02           0.54

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL
```

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        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

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

Output filename:
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Summary filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\a9769fce-c28e-430b-aeb9-df15be0ee336\s

DATE: 02/10/2025 TIME: 08:38:46

USER:

COMMENTS: _____

****
** SIMULATION : 4-Burlington-25yr **
****

| CHICAGO STORM |
| Ptotal= 71.35 mm |

IDF curve parameters: A=1065.950
B= 5.000
C= 0.762
used in: INTENSITY = A / (t + B)^C

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.03	1.50	7.04	3.00	11.85	4.50	4.42

0.08	3.12	1.58	7.71	3.08	10.70	4.58	4.29
0.17	3.21	1.67	8.53	3.17	9.78	4.67	4.17
0.25	3.32	1.75	9.58	3.25	9.01	4.75	4.05
0.33	3.43	1.83	10.98	3.33	8.37	4.83	3.94
0.42	3.55	1.92	12.94	3.42	7.83	4.92	3.84
0.50	3.68	2.00	15.89	3.50	7.36	5.00	3.74
0.58	3.82	2.08	20.88	3.58	6.94	5.08	3.65
0.67	3.97	2.17	31.20	3.67	6.58	5.17	3.57
0.75	4.14	2.25	65.40	3.75	6.26	5.25	3.49
0.83	4.32	2.33	184.39	3.83	5.97	5.33	3.41
0.92	4.53	2.42	75.26	3.92	5.71	5.42	3.33
1.00	4.76	2.50	41.16	4.00	5.48	5.50	3.26
1.08	5.02	2.58	28.49	4.08	5.26	5.58	3.20
1.17	5.31	2.67	21.94	4.17	5.07	5.67	3.13
1.25	5.65	2.75	17.95	4.25	4.89	5.75	3.07
1.33	6.04	2.83	15.26	4.33	4.72	5.83	3.02
1.42	6.50	2.92	13.32	4.42	4.57	5.92	2.96

CALIB STANDHYD (0010) ID= 1 DT= 5.0 min	Area (ha)= 0.29 Total Imp(%)= 54.00 Dir. Conn.(%)= 54.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.16	0.13	
Dep. Storage	(mm)=	1.50	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	50.00	50.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		184.39	14.42	
over (min)		5.00	20.00	
Storage Coeff.	(min)=	1.07 (ii)	18.58 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	20.00	
Unit Hyd. peak	(cms)=	0.34	0.06	
				TOTALS
PEAK FLOW	(cms)=	0.08	0.00	0.080 (iii)
TIME TO PEAK	(hrs)=	2.42	2.67	2.42
RUNOFF VOLUME	(mm)=	69.85	4.81	39.93
TOTAL RAINFALL	(mm)=	71.35	71.35	71.35
RUNOFF COEFFICIENT	=	0.98	0.07	0.56

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

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

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

Output filename:
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Summary filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\dae0f8ca-70a4-4d4c-967c-33980be4ec51\s

DATE: 02/10/2025 TIME: 08:38:46

USER:

COMMENTS: _____

****
** SIMULATION : 5-Burlington-50yr **
****

```
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1172.340
| Ptotal= 78.94 mm |                          B=   5.000
--------------------                          C=   0.761
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  6.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.40
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.37	1.50	7.81	3.00	13.13	4.50	4.91
0.08	3.46	1.58	8.55	3.08	11.86	4.58	4.76
0.17	3.57	1.67	9.46	3.17	10.84	4.67	4.63
0.25	3.68	1.75	10.62	3.25	9.99	4.75	4.50
0.33	3.81	1.83	12.17	3.33	9.28	4.83	4.38
0.42	3.94	1.92	14.33	3.42	8.68	4.92	4.26
0.50	4.08	2.00	17.60	3.50	8.16	5.00	4.16
0.58	4.24	2.08	23.11	3.58	7.70	5.08	4.06
0.67	4.41	2.17	34.51	3.67	7.30	5.17	3.96
0.75	4.59	2.25	72.22	3.75	6.94	5.25	3.87
0.83	4.80	2.33	203.26	3.83	6.62	5.33	3.78
0.92	5.03	2.42	83.09	3.92	6.34	5.42	3.70
1.00	5.28	2.50	45.49	4.00	6.08	5.50	3.63
1.08	5.57	2.58	31.51	4.08	5.84	5.58	3.55
1.17	5.90	2.67	24.28	4.17	5.62	5.67	3.48
1.25	6.27	2.75	19.87	4.25	5.42	5.75	3.41
1.33	6.70	2.83	16.90	4.33	5.24	5.83	3.35
1.42	7.21	2.92	14.76	4.42	5.07	5.92	3.29

```
--------------------
| CALIB            |
| STANDHYD (  0010)|   Area    (ha)=   0.29
|ID= 1 DT= 5.0 min |   Total Imp(%)=  54.00   Dir. Conn.(%)=  54.00
--------------------
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.16	0.13
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	50.00	50.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.	(mm/hr)=	203.26	30.67
	over (min)	5.00	15.00
Storage Coeff.	(min)=	1.03 (ii)	13.98 (ii)
Unit Hyd. Tpeak	(min)=	5.00	15.00
Unit Hyd. peak	(cms)=	0.34	0.08

```
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.01          0.090 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.58           2.42
     RUNOFF VOLUME    (mm)=      77.44         7.67          45.34
     TOTAL RAINFALL   (mm)=      78.94        78.94          78.94
     RUNOFF COEFFICIENT   =       0.98         0.10           0.57

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


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

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9100a9-ff49-419f-8fec-bd133f5a658a\s
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C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\e1
9100a9-ff49-419f-8fec-bd133f5a658a\s


DATE: 02/10/2025                          TIME: 08:38:47
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USER:

COMMENTS: _____

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  ********************************************
  ** SIMULATION : 6-Burlington-100yr           **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1281.340
| Ptotal= 86.28 mm |                          B=   5.000
--------------------                          C=   0.761
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  6.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.40

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    3.68 |  1.50    8.54 |  3.00   14.36 |  4.50    5.37
                0.08    3.79 |  1.58    9.34 |  3.08   12.97 |  4.58    5.21
                0.17    3.90 |  1.67   10.34 |  3.17   11.85 |  4.67    5.06
                0.25    4.03 |  1.75   11.61 |  3.25   10.92 |  4.75    4.92
                0.33    4.16 |  1.83   13.30 |  3.33   10.15 |  4.83    4.78
                0.42    4.30 |  1.92   15.67 |  3.42    9.49 |  4.92    4.66
                0.50    4.46 |  2.00   19.23 |  3.50    8.92 |  5.00    4.54
                0.58    4.63 |  2.08   25.26 |  3.58    8.42 |  5.08    4.43
                0.67    4.82 |  2.17   37.72 |  3.67    7.98 |  5.17    4.33
                0.75    5.02 |  2.25   78.93 |  3.75    7.59 |  5.25    4.23
                0.83    5.25 |  2.33  222.16 |  3.83    7.24 |  5.33    4.14
                0.92    5.50 |  2.42   90.81 |  3.92    6.93 |  5.42    4.05
                1.00    5.78 |  2.50   49.72 |  4.00    6.64 |  5.50    3.96
                1.08    6.09 |  2.58   34.44 |  4.08    6.38 |  5.58    3.88
                1.17    6.45 |  2.67   26.54 |  4.17    6.15 |  5.67    3.81
                1.25    6.85 |  2.75   21.72 |  4.25    5.93 |  5.75    3.73
                1.33    7.33 |  2.83   18.47 |  4.33    5.73 |  5.83    3.66
                1.42    7.88 |  2.92   16.13 |  4.42    5.54 |  5.92    3.59


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0010)|   Area    (ha)=   0.29
|ID= 1 DT= 5.0 min |   Total Imp(%)=  54.00   Dir. Conn.(%)=  54.00
```

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--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.16         0.13
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      50.00        50.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     222.16        62.97
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       0.99 (ii)   10.70 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.10         0.01          0.099 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.58           2.42
     RUNOFF VOLUME    (mm)=      84.78        10.50          50.61
     TOTAL RAINFALL   (mm)=      86.28        86.28          86.28
     RUNOFF COEFFICIENT   =       0.98         0.12           0.59

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


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

  Output  filename:
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  Summary filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\2a
e34202-14ab-49c9-abc0-aa37ecb4bd18\s


DATE: 02/10/2025                          TIME: 08:41:24

USER:


COMMENTS: Allowable
_____________________________________________________________

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  ********************************************
  ** SIMULATION : 2-Burlington-5yr           **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 802.040
| Ptotal= 53.06 mm |                          B=   5.000
--------------------                          C=   0.764
```

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

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.24	1.50	5.21	3.00	8.79	4.50	3.27
0.08	2.30	1.58	5.70	3.08	7.93	4.58	3.17
0.17	2.37	1.67	6.31	3.17	7.24	4.67	3.08
0.25	2.45	1.75	7.10	3.25	6.68	4.75	2.99
0.33	2.53	1.83	8.14	3.33	6.20	4.83	2.91
0.42	2.62	1.92	9.59	3.42	5.79	4.92	2.84
0.50	2.71	2.00	11.79	3.50	5.44	5.00	2.76
0.58	2.82	2.08	15.51	3.58	5.14	5.08	2.70
0.67	2.93	2.17	23.22	3.67	4.87	5.17	2.63
0.75	3.06	2.25	48.81	3.75	4.63	5.25	2.57
0.83	3.19	2.33	138.10	3.83	4.41	5.33	2.52
0.92	3.35	2.42	56.20	3.92	4.22	5.42	2.46
1.00	3.52	2.50	30.66	4.00	4.05	5.50	2.41
1.08	3.71	2.58	21.19	4.08	3.89	5.58	2.36
1.17	3.93	2.67	16.30	4.17	3.74	5.67	2.31
1.25	4.18	2.75	13.33	4.25	3.61	5.75	2.27
1.33	4.47	2.83	11.32	4.33	3.49	5.83	2.22
1.42	4.81	2.92	9.88	4.42	3.37	5.92	2.18

CALIB STANDHYD (0010) ID= 1 DT= 5.0 min	Area (ha)= 0.29 Total Imp(%)= 36.00 Dir. Conn.(%)= 36.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.10	0.19	
Dep. Storage	(mm)=	1.50	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	50.00	50.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.	(mm/hr)=	138.10	0.00	
over	(min)	5.00	225.00	
Storage Coeff.	(min)=	1.20 (ii)	222.45 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	225.00	
Unit Hyd. peak	(cms)=	0.33	0.01	
				TOTALS
PEAK FLOW	(cms)=	0.04	0.00	0.040 (iii)
TIME TO PEAK	(hrs)=	2.42	0.00	2.42
RUNOFF VOLUME	(mm)=	51.56	0.00	18.56

```
     TOTAL RAINFALL   (mm)=      53.06        53.06          53.06
     RUNOFF COEFFICIENT   =       0.97         0.00           0.35

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 FINISH
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


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

  Output  filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\00
6b5b36-6718-40a2-85ea-a310ae9bf14e\s
  Summary filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\00
6b5b36-6718-40a2-85ea-a310ae9bf14e\s


DATE: 11/11/2025                          TIME: 11:37:29

USER:


COMMENTS: Post-Development
          _____________________________________________________

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  ********************************************
  ** SIMULATION : 1-Burlington-2yr           **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 681.000
| Ptotal= 40.91 mm |                          B=   6.000
--------------------                          C=   0.780
```

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

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.63	1.50	3.92	3.00	6.77	4.50	2.41
0.08	1.68	1.58	4.31	3.08	6.08	4.58	2.34
0.17	1.73	1.67	4.79	3.17	5.53	4.67	2.27
0.25	1.79	1.75	5.42	3.25	5.08	4.75	2.20
0.33	1.85	1.83	6.25	3.33	4.70	4.83	2.14
0.42	1.92	1.92	7.43	3.42	4.38	4.92	2.08
0.50	1.99	2.00	9.21	3.50	4.10	5.00	2.03
0.58	2.07	2.08	12.26	3.58	3.86	5.08	1.98
0.67	2.16	2.17	18.62	3.67	3.65	5.17	1.93
0.75	2.25	2.25	39.29	3.75	3.47	5.25	1.88
0.83	2.36	2.33	104.92	3.83	3.30	5.33	1.84
0.92	2.47	2.42	45.18	3.92	3.15	5.42	1.80
1.00	2.61	2.50	24.73	4.00	3.01	5.50	1.76
1.08	2.75	2.58	16.95	4.08	2.89	5.58	1.72
1.17	2.92	2.67	12.92	4.17	2.78	5.67	1.69
1.25	3.12	2.75	10.47	4.25	2.68	5.75	1.65
1.33	3.34	2.83	8.83	4.33	2.58	5.83	1.62
1.42	3.61	2.92	7.66	4.42	2.49	5.92	1.59

CALIB	
NASHYD (0500)	Area (ha)= 0.03 Curve Number (CN)= 74.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.20

Unit Hyd Qpeak (cms)= 0.006

PEAK FLOW (cms)= 0.001 (i)
TIME TO PEAK (hrs)= 2.667
RUNOFF VOLUME (mm)= 10.264
TOTAL RAINFALL (mm)= 40.905
RUNOFF COEFFICIENT = 0.251

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

CALIB	
STANDHYD (0100)	Area (ha)= 0.03
ID= 1 DT= 5.0 min	Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

```
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.03         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     104.92         0.00
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.71 (ii)    1.32 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.33
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.009 (iii)
     TIME TO PEAK    (hrs)=       2.42         0.00           2.42
     RUNOFF VOLUME    (mm)=      39.41         0.00          39.01
     TOTAL RAINFALL   (mm)=      40.91        40.91          40.91
     RUNOFF COEFFICIENT   =       0.96         0.00           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0002)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |    0.0040      0.0022
                          0.0010      0.0008   |    0.0050      0.0030
                          0.0030      0.0015   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      0.030      0.009      2.42      39.01
   OUTFLOW: ID= 1 (  0002)      0.030      0.001      2.83      32.92

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.34
                  TIME SHIFT OF PEAK FLOW         (min)= 25.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0007

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--------------------
| CALIB            |
| STANDHYD (  0300)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  97.00   Dir. Conn.(%)=  97.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       4.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     104.92         0.00
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.69 (ii)    1.82 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.32
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.031 (iii)
     TIME TO PEAK    (hrs)=       2.42         0.00           2.42
     RUNOFF VOLUME    (mm)=      39.41         0.00          38.22
     TOTAL RAINFALL   (mm)=      40.91        40.91          40.91
     RUNOFF COEFFICIENT   =       0.96         0.00           0.93

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                          0.0149      0.0000   |    0.0163      0.0015
                          0.0154      0.0001   |    0.0167      0.0035
                          0.0159      0.0004   |    0.0362      0.0046

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0300)      0.110      0.031      2.42      38.22
   OUTFLOW: ID= 1 (  0003)      0.110      0.016      2.50      39.48
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00
```

```
                    TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                    CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                    PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 51.18
                    TIME SHIFT OF PEAK FLOW         (min)=  5.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0005

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0400)|   Area    (ha)=   0.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  52.00   Dir. Conn.(%)=  52.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.01
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       5.00         5.00
     Length            (m)=       3.00         3.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     104.92         0.00
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.21 (ii)    1.28 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.33
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00          0.005 (iii)
     TIME TO PEAK    (hrs)=       2.42         0.00           2.42
     RUNOFF VOLUME    (mm)=      39.41         0.00          19.18
     TOTAL RAINFALL   (mm)=      40.91        40.91          40.91
     RUNOFF COEFFICIENT   =       0.96         0.00           0.47

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     104.92         0.00
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.71 (ii)    1.32 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.33
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.026 (iii)
     TIME TO PEAK    (hrs)=       2.42         0.00           2.42
     RUNOFF VOLUME    (mm)=      39.41         0.00          39.01
     TOTAL RAINFALL   (mm)=      40.91        40.91          40.91
     RUNOFF COEFFICIENT   =       0.96         0.00           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0013)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |    0.0230      0.0067
                           0.0080      0.0022   |    0.0300      0.0090
                           0.0150      0.0045   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      0.090      0.026      2.42      39.01
   OUTFLOW: ID= 1 (  0013)      0.090      0.005      2.58      38.32

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.06
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0015

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--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0013):     0.09   0.005     2.58    38.32
      + ID2= 2 (  0002):     0.03   0.001     2.83    32.92
        ================================================
        ID = 3 (  0004):     0.12   0.006     2.67    36.97

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.12   0.006     2.67    36.97
      + ID2= 2 (  0003):     0.11   0.016     2.50    39.48
        ================================================
        ID = 1 (  0004):     0.23   0.022     2.58    38.17

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     0.23   0.022     2.58    38.17
      + ID2= 2 (  0400):     0.03   0.005     2.42    19.18
        ================================================
        ID = 3 (  0004):     0.26   0.024     2.42    35.98

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.26   0.024     2.42    35.98
      + ID2= 2 (  0500):     0.03   0.001     2.67    10.26
        ================================================
        ID = 1 (  0004):     0.29   0.025     2.42    33.32

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

```
       V    V   I    SSSSS  U   U    A    L             (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

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

Output filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\31e75b8f-31a4-4c1b-8024-e1bfd93c4b81\s
Summary filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\31e75b8f-31a4-4c1b-8024-e1bfd93c4b81\s

DATE: 11/11/2025 TIME: 11:37:29

USER:

COMMENTS: _____

****
** SIMULATION : 2-Burlington-5yr **
****

| CHICAGO STORM | Ptotal= 53.06 mm |

IDF curve parameters: A= 802.040
B= 5.000
C= 0.764
used in: INTENSITY = A / (t + B)^C

Duration of storm = 6.00 hrs

Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.24	1.50	5.21	3.00	8.79	4.50	3.27
0.08	2.30	1.58	5.70	3.08	7.93	4.58	3.17
0.17	2.37	1.67	6.31	3.17	7.24	4.67	3.08
0.25	2.45	1.75	7.10	3.25	6.68	4.75	2.99
0.33	2.53	1.83	8.14	3.33	6.20	4.83	2.91
0.42	2.62	1.92	9.59	3.42	5.79	4.92	2.84
0.50	2.71	2.00	11.79	3.50	5.44	5.00	2.76
0.58	2.82	2.08	15.51	3.58	5.14	5.08	2.70
0.67	2.93	2.17	23.22	3.67	4.87	5.17	2.63
0.75	3.06	2.25	48.81	3.75	4.63	5.25	2.57
0.83	3.19	2.33	138.10	3.83	4.41	5.33	2.52
0.92	3.35	2.42	56.20	3.92	4.22	5.42	2.46
1.00	3.52	2.50	30.66	4.00	4.05	5.50	2.41
1.08	3.71	2.58	21.19	4.08	3.89	5.58	2.36
1.17	3.93	2.67	16.30	4.17	3.74	5.67	2.31
1.25	4.18	2.75	13.33	4.25	3.61	5.75	2.27
1.33	4.47	2.83	11.32	4.33	3.49	5.83	2.22
1.42	4.81	2.92	9.88	4.42	3.37	5.92	2.18

CALIB			
NASHYD (0500)	Area (ha)=	0.03	Curve Number (CN)= 74.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.20	

Unit Hyd Qpeak (cms)= 0.006

PEAK FLOW (cms)= 0.001 (i)
TIME TO PEAK (hrs)= 2.583
RUNOFF VOLUME (mm)= 16.760
TOTAL RAINFALL (mm)= 53.058
RUNOFF COEFFICIENT = 0.316

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

CALIB			
STANDHYD (0100)	Area (ha)=	0.03	
ID= 1 DT= 5.0 min	Total Imp(%)=	99.00	Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.03	0.00

```
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     138.10         0.00
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.64 (ii)    1.18 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.33
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.011 (iii)
     TIME TO PEAK    (hrs)=       2.42         0.00           2.42
     RUNOFF VOLUME    (mm)=      51.56         0.00          51.04
     TOTAL RAINFALL   (mm)=      53.06        53.06          53.06
     RUNOFF COEFFICIENT   =       0.97         0.00           0.96

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0002)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |    0.0040      0.0022
                           0.0010      0.0008   |    0.0050      0.0030
                           0.0030      0.0015   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      0.030      0.011      2.42      51.04
   OUTFLOW: ID= 1 (  0002)      0.030      0.001      2.75      44.86

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.20
                  TIME SHIFT OF PEAK FLOW         (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0009

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0300)|   Area    (ha)=   0.11
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  97.00   Dir. Conn.(%)=  97.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       4.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     138.10         0.00
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.61 (ii)    1.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.32
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.041 (iii)
     TIME TO PEAK    (hrs)=       2.42         0.00           2.42
     RUNOFF VOLUME    (mm)=      51.56         0.00          50.01
     TOTAL RAINFALL   (mm)=      53.06        53.06          53.06
     RUNOFF COEFFICIENT   =       0.97         0.00           0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                          0.0149      0.0000   |    0.0163      0.0015
                          0.0154      0.0001   |    0.0167      0.0035
                          0.0159      0.0004   |    0.0362      0.0046

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0300)      0.110      0.041      2.42      50.01
   OUTFLOW: ID= 1 (  0003)      0.110      0.016      2.50      50.40
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
```

```
                    PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 39.17
                    TIME SHIFT OF PEAK FLOW         (min)=  5.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0008

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0400)|   Area    (ha)=   0.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  52.00   Dir. Conn.(%)=  52.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.01
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       5.00         5.00
     Length            (m)=       3.00         3.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     138.10         0.00
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.18 (ii)    1.15 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.006 (iii)
     TIME TO PEAK    (hrs)=       2.42         0.00           2.42
     RUNOFF VOLUME    (mm)=      51.56         0.00          26.52
     TOTAL RAINFALL   (mm)=      53.06        53.06          53.06
     RUNOFF COEFFICIENT   =       0.97         0.00           0.50

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.00
     Dep. Storage     (mm)=       1.50         5.00
```

```
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n             =    0.015        0.250

     Max.Eff.Inten.(mm/hr)=     138.10         0.00
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.64 (ii)    1.18 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.33
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.00          0.034 (iii)
     TIME TO PEAK    (hrs)=       2.42         0.00           2.42
     RUNOFF VOLUME    (mm)=      51.56         0.00          51.04
     TOTAL RAINFALL   (mm)=      53.06        53.06          53.06
     RUNOFF COEFFICIENT   =       0.97         0.00           0.96

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0013)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |    0.0230      0.0067
                           0.0080      0.0022   |    0.0300      0.0090
                           0.0150      0.0045   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      0.090      0.034      2.42      51.04
   OUTFLOW: ID= 1 (  0013)      0.090      0.007      2.58      50.36

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.53
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0020

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0013):     0.09   0.007     2.58    50.36
      + ID2= 2 (  0002):     0.03   0.001     2.75    44.86
        ================================================
        ID = 3 (  0004):     0.12   0.008     2.67    48.99

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.12   0.008     2.67    48.99
      + ID2= 2 (  0003):     0.11   0.016     2.50    50.40
        ================================================
        ID = 1 (  0004):     0.23   0.024     2.58    49.66

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     0.23   0.024     2.58    49.66
      + ID2= 2 (  0400):     0.03   0.006     2.42    26.52
        ================================================
        ID = 3 (  0004):     0.26   0.027     2.42    46.99

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.26   0.027     2.42    46.99
      + ID2= 2 (  0500):     0.03   0.001     2.58    16.76
        ================================================
        ID = 1 (  0004):     0.29   0.028     2.42    43.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
```

```
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

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

Output filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\3ab0733d-a92a-48e3-a513-e8827916f482\s
Summary filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\3ab0733d-a92a-48e3-a513-e8827916f482\s

DATE: 11/11/2025 TIME: 11:37:30

USER:

COMMENTS: _____

****
** SIMULATION : 3-Burlington-10yr **
****

| CHICAGO STORM |
| Ptotal= 61.11 mm |

IDF curve parameters: A= 918.280
B= 5.000
C= 0.763
used in: INTENSITY = A / (t + B)^C

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	2.58	1.50	6.02	3.00	10.14	4.50	3.78
0.08	2.66	1.58	6.58	3.08	9.15	4.58	3.66
0.17	2.74	1.67	7.29	3.17	8.36	4.67	3.56
0.25	2.83	1.75	8.19	3.25	7.70	4.75	3.46
0.33	2.92	1.83	9.39	3.33	7.16	4.83	3.36
0.42	3.03	1.92	11.06	3.42	6.69	4.92	3.28
0.50	3.14	2.00	13.59	3.50	6.28	5.00	3.20
0.58	3.26	2.08	17.87	3.58	5.93	5.08	3.12
0.67	3.39	2.17	26.73	3.67	5.62	5.17	3.04
0.75	3.53	2.25	56.11	3.75	5.35	5.25	2.97
0.83	3.69	2.33	158.48	3.83	5.10	5.33	2.91
0.92	3.87	2.42	64.59	3.92	4.88	5.42	2.85
1.00	4.06	2.50	35.28	4.00	4.68	5.50	2.79
1.08	4.29	2.58	24.40	4.08	4.49	5.58	2.73
1.17	4.54	2.67	18.78	4.17	4.33	5.67	2.67
1.25	4.83	2.75	15.36	4.25	4.17	5.75	2.62
1.33	5.16	2.83	13.05	4.33	4.03	5.83	2.57
1.42	5.55	2.92	11.39	4.42	3.90	5.92	2.52

CALIB			
NASHYD (0500)	Area (ha)= 0.03	Curve Number (CN)= 74.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.20		

Unit Hyd Qpeak (cms)= 0.006

PEAK FLOW (cms)= 0.002 (i)
TIME TO PEAK (hrs)= 2.583
RUNOFF VOLUME (mm)= 21.598
TOTAL RAINFALL (mm)= 61.107
RUNOFF COEFFICIENT = 0.353

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

CALIB			
STANDHYD (0100)	Area (ha)= 0.03		
ID= 1 DT= 5.0 min	Total Imp(%)= 99.00	Dir. Conn.(%)= 99.00	

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.03	0.00
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	15.00	15.00

```
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     158.48         8.21
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.60 (ii)    1.12 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.013 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      59.61         1.37          59.02
     TOTAL RAINFALL   (mm)=      61.11        61.11          61.11
     RUNOFF COEFFICIENT   =       0.98         0.02           0.97

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0002)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |    0.0040      0.0022
                           0.0010      0.0008   |    0.0050      0.0030
                           0.0030      0.0015   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      0.030      0.013      2.42      59.02
   OUTFLOW: ID= 1 (  0002)      0.030      0.002      2.75      52.89

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.13
                  TIME SHIFT OF PEAK FLOW         (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0010

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0300)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  97.00   Dir. Conn.(%)=  97.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11         0.00
```

```
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       4.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     158.48         8.21
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.58 (ii)    1.55 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.33
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.047 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      59.61         1.37          57.86
     TOTAL RAINFALL   (mm)=      61.11        61.11          61.11
     RUNOFF COEFFICIENT   =       0.98         0.02           0.95

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                          0.0149      0.0000   |    0.0163      0.0015
                          0.0154      0.0001   |    0.0167      0.0035
                          0.0159      0.0004   |    0.0362      0.0046

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0300)      0.110      0.047      2.42      57.86
   OUTFLOW: ID= 1 (  0003)      0.110      0.016      2.50      57.87
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                  PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 34.24
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0011
```

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0400)|   Area    (ha)=   0.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  52.00   Dir. Conn.(%)=  52.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.01
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       5.00         5.00
     Length            (m)=       3.00         3.00
     Mannings n            =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     158.48         8.21
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.17 (ii)    1.09 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.008 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      59.61         1.37          31.65
     TOTAL RAINFALL   (mm)=      61.11        61.11          61.11
     RUNOFF COEFFICIENT   =       0.98         0.02           0.52

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n            =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     158.48         8.21
               over (min)         5.00         5.00
```

```
     Storage Coeff.  (min)=       0.60 (ii)    1.12 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.00          0.039 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      59.61         1.37          59.02
     TOTAL RAINFALL   (mm)=      61.11        61.11          61.11
     RUNOFF COEFFICIENT   =       0.98         0.02           0.97

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0013)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |    0.0230      0.0067
                           0.0080      0.0022   |    0.0300      0.0090
                           0.0150      0.0045   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      0.090      0.039      2.42      59.02
   OUTFLOW: ID= 1 (  0013)      0.090      0.008      2.58      58.32

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.55
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0023

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0013):     0.09   0.008     2.58    58.32
      + ID2= 2 (  0002):     0.03   0.002     2.75    52.89
        ================================================
        ID = 3 (  0004):     0.12   0.010     2.67    56.96

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

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.12   0.010     2.67    56.96
      + ID2= 2 (  0003):     0.11   0.016     2.50    57.87
        ================================================
        ID = 1 (  0004):     0.23   0.026     2.58    57.40

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     0.23   0.026     2.58    57.40
      + ID2= 2 (  0400):     0.03   0.008     2.42    31.65
        ================================================
        ID = 3 (  0004):     0.26   0.030     2.42    54.43

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.26   0.030     2.42    54.43
      + ID2= 2 (  0500):     0.03   0.002     2.58    21.60
        ================================================
        ID = 1 (  0004):     0.29   0.031     2.42    51.03

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

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

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

Output filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\7e3061a1-feb1-4646-ba13-c61f94e91e9b\s
Summary filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\7e3061a1-feb1-4646-ba13-c61f94e91e9b\s

DATE: 11/11/2025 TIME: 11:37:30

USER:

COMMENTS: _____

****
** SIMULATION : 4-Burlington-25yr **
****

| CHICAGO STORM |
| Ptotal= 71.35 mm |

IDF curve parameters: A=1065.950
B= 5.000
C= 0.762
used in: INTENSITY = A / (t + B)^C

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.03	1.50	7.04	3.00	11.85	4.50	4.42
0.08	3.12	1.58	7.71	3.08	10.70	4.58	4.29
0.17	3.21	1.67	8.53	3.17	9.78	4.67	4.17
0.25	3.32	1.75	9.58	3.25	9.01	4.75	4.05
0.33	3.43	1.83	10.98	3.33	8.37	4.83	3.94

0.42	3.55	1.92	12.94	3.42	7.83	4.92	3.84
0.50	3.68	2.00	15.89	3.50	7.36	5.00	3.74
0.58	3.82	2.08	20.88	3.58	6.94	5.08	3.65
0.67	3.97	2.17	31.20	3.67	6.58	5.17	3.57
0.75	4.14	2.25	65.40	3.75	6.26	5.25	3.49
0.83	4.32	2.33	184.39	3.83	5.97	5.33	3.41
0.92	4.53	2.42	75.26	3.92	5.71	5.42	3.33
1.00	4.76	2.50	41.16	4.00	5.48	5.50	3.26
1.08	5.02	2.58	28.49	4.08	5.26	5.58	3.20
1.17	5.31	2.67	21.94	4.17	5.07	5.67	3.13
1.25	5.65	2.75	17.95	4.25	4.89	5.75	3.07
1.33	6.04	2.83	15.26	4.33	4.72	5.83	3.02
1.42	6.50	2.92	13.32	4.42	4.57	5.92	2.96

CALIB			
NASHYD (0500)	Area (ha)= 0.03	Curve Number (CN)= 74.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.20		

Unit Hyd Qpeak (cms)= 0.006

PEAK FLOW (cms)= 0.002 (i)
TIME TO PEAK (hrs)= 2.583
RUNOFF VOLUME (mm)= 28.218
TOTAL RAINFALL (mm)= 71.354
RUNOFF COEFFICIENT = 0.395

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

CALIB			
STANDHYD (0100)	Area (ha)= 0.03		
ID= 1 DT= 5.0 min	Total Imp(%)= 99.00	Dir. Conn.(%)= 99.00	

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.03	0.00
Dep. Storage (mm)=	1.50	5.00
Average Slope (%)=	2.00	2.00
Length (m)=	15.00	15.00
Mannings n =	0.015	0.250
Max.Eff.Inten.(mm/hr)=	184.39	28.84
over (min)	5.00	5.00
Storage Coeff. (min)=	0.57 (ii)	1.06 (ii)
Unit Hyd. Tpeak (min)=	5.00	5.00
Unit Hyd. peak (cms)=	0.34	0.34

```
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.015 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      69.85         4.81          69.20
     TOTAL RAINFALL   (mm)=      71.35        71.35          71.35
     RUNOFF COEFFICIENT   =       0.98         0.07           0.97

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0002)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |    0.0040      0.0022
                           0.0010      0.0008   |    0.0050      0.0030
                           0.0030      0.0015   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      0.030      0.015      2.42      69.20
   OUTFLOW: ID= 1 (  0002)      0.030      0.002      2.75      63.10

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 13.01
                  TIME SHIFT OF PEAK FLOW         (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0011

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0300)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  97.00   Dir. Conn.(%)=  97.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       4.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n             =     0.015        0.250

     Max.Eff.Inten.(mm/hr)=     184.39        28.84
               over (min)        5.00         5.00
```

```
     Storage Coeff.  (min)=       0.55 (ii)    1.46 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.33
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.055 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      69.85         4.81          67.90
     TOTAL RAINFALL   (mm)=      71.35        71.35          71.35
     RUNOFF COEFFICIENT   =       0.98         0.07           0.95

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                          0.0149      0.0000   |    0.0163      0.0015
                          0.0154      0.0001   |    0.0167      0.0035
                          0.0159      0.0004   |    0.0362      0.0046

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0300)     0.110      0.055      2.42      67.90
   OUTFLOW: ID= 1 (  0003)     0.110      0.016      2.58      69.28
   OVERFLOW:ID= 3 (  0003)     0.000      0.000      0.00       0.00

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                  PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 29.54
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0015

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0400)|   Area    (ha)=   0.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  52.00   Dir. Conn.(%)=  52.00
--------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.01
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       5.00         5.00
     Length            (m)=       3.00         3.00
     Mannings n             =     0.015        0.250

     Max.Eff.Inten.(mm/hr)=     184.39        28.84
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.16 (ii)    1.02 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.010 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      69.85         4.81          38.63
     TOTAL RAINFALL   (mm)=      71.35        71.35          71.35
     RUNOFF COEFFICIENT   =       0.98         0.07           0.54

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n             =     0.015        0.250

     Max.Eff.Inten.(mm/hr)=     184.39        28.84
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.57 (ii)    1.06 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.046 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      69.85         4.81          69.20
```

```
     TOTAL RAINFALL   (mm)=      71.35        71.35          71.35
     RUNOFF COEFFICIENT   =       0.98         0.07           0.97

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0013)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |    0.0230      0.0067
                           0.0080      0.0022   |    0.0300      0.0090
                           0.0150      0.0045   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      0.090      0.046      2.42      69.20
   OUTFLOW: ID= 1 (  0013)      0.090      0.009      2.58      68.46

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.25
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0027

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0013):     0.09   0.009     2.58    68.46
     + ID2= 2 (  0002):     0.03   0.002     2.75    63.10
       ================================================
       ID = 3 (  0004):     0.12   0.011     2.67    67.12

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 3 (  0004):     0.12   0.011     2.67    67.12
```

```
      + ID2= 2 (  0003):     0.11   0.016     2.58    69.28
        ================================================
        ID = 1 (  0004):     0.23   0.027     2.58    68.15

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     0.23   0.027     2.58    68.15
      + ID2= 2 (  0400):     0.03   0.010     2.42    38.63
        ================================================
        ID = 3 (  0004):     0.26   0.033     2.42    64.75

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.26   0.033     2.42    64.75
      + ID2= 2 (  0500):     0.03   0.002     2.58    28.22
        ================================================
        ID = 1 (  0004):     0.29   0.034     2.42    60.97

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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

Output filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\8ed4dcc3-84d6-4439-9b12-787ba9203948\s
Summary filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\8ed4dcc3-84d6-4439-9b12-787ba9203948\s

DATE: 11/11/2025 TIME: 11:37:30

USER:

COMMENTS: _____

****
** SIMULATION : 5-Burlington-50yr **
****

| CHICAGO STORM |
| Ptotal= 78.94 mm |

IDF curve parameters: A=1172.340
B= 5.000
C= 0.761
used in: INTENSITY = A / (t + B)^C

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.37	1.50	7.81	3.00	13.13	4.50	4.91
0.08	3.46	1.58	8.55	3.08	11.86	4.58	4.76
0.17	3.57	1.67	9.46	3.17	10.84	4.67	4.63
0.25	3.68	1.75	10.62	3.25	9.99	4.75	4.50
0.33	3.81	1.83	12.17	3.33	9.28	4.83	4.38
0.42	3.94	1.92	14.33	3.42	8.68	4.92	4.26
0.50	4.08	2.00	17.60	3.50	8.16	5.00	4.16
0.58	4.24	2.08	23.11	3.58	7.70	5.08	4.06
0.67	4.41	2.17	34.51	3.67	7.30	5.17	3.96
0.75	4.59	2.25	72.22	3.75	6.94	5.25	3.87
0.83	4.80	2.33	203.26	3.83	6.62	5.33	3.78
0.92	5.03	2.42	83.09	3.92	6.34	5.42	3.70

1.00	5.28	2.50	45.49	4.00	6.08	5.50	3.63
1.08	5.57	2.58	31.51	4.08	5.84	5.58	3.55
1.17	5.90	2.67	24.28	4.17	5.62	5.67	3.48
1.25	6.27	2.75	19.87	4.25	5.42	5.75	3.41
1.33	6.70	2.83	16.90	4.33	5.24	5.83	3.35
1.42	7.21	2.92	14.76	4.42	5.07	5.92	3.29

CALIB			
NASHYD (0500)	Area (ha)= 0.03	Curve Number (CN)= 74.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.20		

Unit Hyd Qpeak (cms)= 0.006

PEAK FLOW (cms)= 0.003 (i)
TIME TO PEAK (hrs)= 2.583
RUNOFF VOLUME (mm)= 33.410
TOTAL RAINFALL (mm)= 78.940
RUNOFF COEFFICIENT = 0.423

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

CALIB			
STANDHYD (0100)	Area (ha)= 0.03		
ID= 1 DT= 5.0 min	Total Imp(%)= 99.00	Dir. Conn.(%)= 99.00	

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.03	0.00	
Dep. Storage (mm)=	1.50	5.00	
Average Slope (%)=	2.00	2.00	
Length (m)=	15.00	15.00	
Mannings n =	0.015	0.250	
Max.Eff.Inten.(mm/hr)=	203.26	46.01	
over (min)	5.00	5.00	
Storage Coeff. (min)=	0.55 (ii)	1.01 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.34	
			TOTALS
PEAK FLOW (cms)=	0.02	0.00	0.017 (iii)
TIME TO PEAK (hrs)=	2.42	2.42	2.42
RUNOFF VOLUME (mm)=	77.44	7.67	76.74
TOTAL RAINFALL (mm)=	78.94	78.94	78.94
RUNOFF COEFFICIENT =	0.98	0.10	0.97

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

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| RESERVOIR(0002)| IN= 2---> OUT= 1 | DT= 5.0 min |

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0040	0.0022
0.0010	0.0008	0.0050	0.0030
0.0030	0.0015	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0100)	0.030	0.017	2.42	76.74
OUTFLOW: ID= 1 (0002)	0.030	0.002	2.75	70.68

PEAK FLOW REDUCTION [Qout/Qin](%)= 13.51
TIME SHIFT OF PEAK FLOW (min)= 20.00
MAXIMUM STORAGE USED (ha.m.)= 0.0012

| CALIB | STANDHYD (0300)| ID= 1 DT= 5.0 min |

Area (ha)= 0.11
Total Imp(%)= 97.00 Dir. Conn.(%)= 97.00

	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	0.11	0.00	
Dep. Storage (mm)=	1.50	5.00	
Average Slope (%)=	4.00	2.00	
Length (m)=	20.00	20.00	
Mannings n =	0.015	0.250	
Max.Eff.Inten.(mm/hr)=	203.26	46.01	
over (min)	5.00	5.00	
Storage Coeff. (min)=	0.53 (ii)	1.40 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.33	
			TOTALS
PEAK FLOW (cms)=	0.06	0.00	0.061 (iii)
TIME TO PEAK (hrs)=	2.42	2.42	2.42
RUNOFF VOLUME (mm)=	77.44	7.67	75.35

```
     TOTAL RAINFALL   (mm)=      78.94        78.94          78.94
     RUNOFF COEFFICIENT   =       0.98         0.10           0.95

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                          0.0149      0.0000   |    0.0163      0.0015
                          0.0154      0.0001   |    0.0167      0.0035
                          0.0159      0.0004   |    0.0362      0.0046

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0300)     0.110      0.061      2.42      75.35
   OUTFLOW: ID= 1 (  0003)     0.110      0.016      2.58      76.33
   OVERFLOW:ID= 3 (  0003)     0.000      0.000      0.00       0.00

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                  PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.85
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0018

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0400)|   Area    (ha)=   0.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  52.00   Dir. Conn.(%)=  52.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.01
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       5.00         5.00
     Length            (m)=       3.00         3.00
     Mannings n           =      0.015        0.250
```

```
     Max.Eff.Inten.(mm/hr)=     203.26        46.01
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.16 (ii)    0.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.012 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      77.44         7.67          43.95
     TOTAL RAINFALL   (mm)=      78.94        78.94          78.94
     RUNOFF COEFFICIENT   =       0.98         0.10           0.56

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     203.26        46.01
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.55 (ii)    1.01 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.050 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      77.44         7.67          76.74
     TOTAL RAINFALL   (mm)=      78.94        78.94          78.94
     RUNOFF COEFFICIENT   =       0.98         0.10           0.97

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
```

```
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0013)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |    0.0230      0.0067
                           0.0080      0.0022   |    0.0300      0.0090
                           0.0150      0.0045   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      0.090      0.050      2.42      76.74
   OUTFLOW: ID= 1 (  0013)      0.090      0.010      2.58      76.00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.10
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0030

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0013):     0.09   0.010     2.58    76.00
     + ID2= 2 (  0002):     0.03   0.002     2.75    70.68
       ================================================
       ID = 3 (  0004):     0.12   0.012     2.67    74.67

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 3 (  0004):     0.12   0.012     2.67    74.67
     + ID2= 2 (  0003):     0.11   0.016     2.58    76.33
       ================================================
       ID = 1 (  0004):     0.23   0.029     2.58    75.47

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

```
--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     0.23   0.029     2.58    75.47
      + ID2= 2 (  0400):     0.03   0.012     2.42    43.95
        ====================================================
        ID = 3 (  0004):     0.26   0.036     2.42    71.83

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


--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.26   0.036     2.42    71.83
      + ID2= 2 (  0500):     0.03   0.003     2.58    33.41
        ====================================================
        ID = 1 (  0004):     0.29   0.037     2.42    67.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


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

  Output  filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\16
e3c056-362e-4f49-85ba-60aec1e30640\s
  Summary filename:
```

C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\16e3c056-362e-4f49-85ba-60aec1e30640\s

DATE: 11/11/2025 TIME: 11:37:30

USER:

COMMENTS: _____

****
** SIMULATION : 6-Burlington-100yr **
****

CHICAGO STORM
Ptotal= 86.28 mm

IDF curve parameters: A=1281.340
B= 5.000
C= 0.761
used in: INTENSITY = A / (t + B)^C

Duration of storm = 6.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.40

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.68	1.50	8.54	3.00	14.36	4.50	5.37
0.08	3.79	1.58	9.34	3.08	12.97	4.58	5.21
0.17	3.90	1.67	10.34	3.17	11.85	4.67	5.06
0.25	4.03	1.75	11.61	3.25	10.92	4.75	4.92
0.33	4.16	1.83	13.30	3.33	10.15	4.83	4.78
0.42	4.30	1.92	15.67	3.42	9.49	4.92	4.66
0.50	4.46	2.00	19.23	3.50	8.92	5.00	4.54
0.58	4.63	2.08	25.26	3.58	8.42	5.08	4.43
0.67	4.82	2.17	37.72	3.67	7.98	5.17	4.33
0.75	5.02	2.25	78.93	3.75	7.59	5.25	4.23
0.83	5.25	2.33	222.16	3.83	7.24	5.33	4.14
0.92	5.50	2.42	90.81	3.92	6.93	5.42	4.05
1.00	5.78	2.50	49.72	4.00	6.64	5.50	3.96
1.08	6.09	2.58	34.44	4.08	6.38	5.58	3.88
1.17	6.45	2.67	26.54	4.17	6.15	5.67	3.81
1.25	6.85	2.75	21.72	4.25	5.93	5.75	3.73
1.33	7.33	2.83	18.47	4.33	5.73	5.83	3.66
1.42	7.88	2.92	16.13	4.42	5.54	5.92	3.59

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0500)|   Area    (ha)=   0.03   Curve Number   (CN)= 74.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

     Unit Hyd Qpeak  (cms)=   0.006

     PEAK FLOW       (cms)=   0.003 (i)
     TIME TO PEAK    (hrs)=   2.583
     RUNOFF VOLUME    (mm)=  38.651
     TOTAL RAINFALL   (mm)=  86.279
     RUNOFF COEFFICIENT   =   0.448

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0100)|   Area    (ha)=   0.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------

                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.03         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     222.16        62.97
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.53 (ii)    0.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.00          0.018 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      84.78        10.50          84.04
     TOTAL RAINFALL   (mm)=      86.28        86.28          86.28
     RUNOFF COEFFICIENT   =       0.98         0.12           0.97

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

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

RESERVOIR(0002) | IN= 2---> OUT= 1 | DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0040	0.0022
	0.0010	0.0008	0.0050	0.0030
	0.0030	0.0015	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0100)	0.030	0.018	2.42	84.04
OUTFLOW: ID= 1 (0002)	0.030	0.003	2.67	77.85

PEAK FLOW REDUCTION [Qout/Qin](%)= 13.89
TIME SHIFT OF PEAK FLOW (min)= 15.00
MAXIMUM STORAGE USED (ha.m.)= 0.0013

CALIB STANDHYD (0300) | ID= 1 DT= 5.0 min	Area (ha)= 0.11 Total Imp(%)= 97.00 Dir. Conn.(%)= 97.00			
		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.11	0.00	
Dep. Storage	(mm)=	1.50	5.00	
Average Slope	(%)=	4.00	2.00	
Length	(m)=	20.00	20.00	
Mannings n	=	0.015	0.250	
Max.Eff.Inten.(mm/hr)	=	222.16	62.97	
over	(min)	5.00	5.00	
Storage Coeff.	(min)=	0.51 (ii)	1.35 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	5.00	
Unit Hyd. peak	(cms)=	0.34	0.33	
				TOTALS
PEAK FLOW	(cms)=	0.07	0.00	0.067 (iii)
TIME TO PEAK	(hrs)=	2.42	2.42	2.42
RUNOFF VOLUME	(mm)=	84.78	10.50	82.55
TOTAL RAINFALL	(mm)=	86.28	86.28	86.28
RUNOFF COEFFICIENT	=	0.98	0.12	0.96

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

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00

```
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                          0.0149      0.0000   |    0.0163      0.0015
                          0.0154      0.0001   |    0.0167      0.0035
                          0.0159      0.0004   |    0.0362      0.0046

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0300)      0.110      0.067      2.42      82.55
   OUTFLOW: ID= 1 (  0003)      0.110      0.016      2.58      83.10
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                  PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 24.61
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0021

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0400)|   Area    (ha)=   0.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  52.00   Dir. Conn.(%)=  52.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.01
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       5.00         5.00
     Length            (m)=       3.00         3.00
     Mannings n           =      0.015        0.250

     Max.Eff.Inten.(mm/hr)=     222.16        62.97
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       0.15 (ii)    0.95 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.013 (iii)
```

```
     TIME TO PEAK    (hrs)=       2.42         2.42          2.42
     RUNOFF VOLUME    (mm)=      84.78        10.50         49.12
     TOTAL RAINFALL   (mm)=      86.28        86.28         86.28
     RUNOFF COEFFICIENT   =       0.98         0.12          0.57

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n             =     0.015        0.250

     Max.Eff.Inten.(mm/hr)=     222.16        62.97
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.53 (ii)    0.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.34
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.055 (iii)
     TIME TO PEAK    (hrs)=       2.42         2.42           2.42
     RUNOFF VOLUME    (mm)=      84.78        10.50          84.04
     TOTAL RAINFALL   (mm)=      86.28        86.28          86.28
     RUNOFF COEFFICIENT   =       0.98         0.12           0.97

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

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

```
| RESERVOIR(  0013)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |    0.0230      0.0067
                          0.0080      0.0022   |    0.0300      0.0090
                          0.0150      0.0045   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      0.090      0.055      2.42      84.04
   OUTFLOW: ID= 1 (  0013)      0.090      0.011      2.58      83.31

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 19.95
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0032

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0013):     0.09   0.011     2.58    83.31
      + ID2= 2 (  0002):     0.03   0.003     2.67    77.85
        ================================================
        ID = 3 (  0004):     0.12   0.014     2.67    81.94

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.12   0.014     2.67    81.94
      + ID2= 2 (  0003):     0.11   0.016     2.58    83.10
        ================================================
        ID = 1 (  0004):     0.23   0.030     2.58    82.49

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     0.23   0.030     2.58    82.49
      + ID2= 2 (  0400):     0.03   0.013     2.42    49.12
        ================================================
```

```
        ID = 3 (  0004):     0.26   0.038     2.42    78.64

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.26   0.038     2.42    78.64
      + ID2= 2 (  0500):     0.03   0.003     2.58    38.65
        ================================================
        ID = 1 (  0004):     0.29   0.040     2.42    74.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2017)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


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

  Output  filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\19
9a5a84-6d65-458a-b5d0-3c3b82d239a9\s
  Summary filename:
C:\Users\sabjiv4671\AppData\Local\Civica\VH5\cbc13465-eafc-453b-a7bd-4df21529b211\19
9a5a84-6d65-458a-b5d0-3c3b82d239a9\s


DATE: 11/11/2025                          TIME: 11:37:30

USER:
```

COMMENTS: _____

```
  **********************************************
  ** SIMULATION : 7-Regional-Hazel              **
  **********************************************
```

READ STORM	Filename: C:\Users\sabjiv4671\AppData\Local\Temp\2c451590-41ae-4bdd-a9cb-5d2549cbc1d3\0adfb70c
Ptotal=285.00 mm	Comments: 7-Regional-Hazel

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.00	13.00	2.03	26.00	2.03	39.00	6.00
1.00	2.03	14.00	2.03	27.00	2.03	40.00	13.00
2.00	2.03	15.00	2.03	28.00	2.03	41.00	17.00
3.00	2.03	16.00	2.03	29.00	2.03	42.00	13.00
4.00	2.03	17.00	2.03	30.00	2.03	43.00	23.00
5.00	2.03	18.00	2.03	31.00	2.03	44.00	13.00
6.00	2.03	19.00	2.03	32.00	2.03	45.00	13.00
7.00	2.03	20.00	2.03	33.00	2.03	46.00	53.00
8.00	2.03	21.00	2.03	34.00	2.03	47.00	38.00
9.00	2.03	22.00	2.03	35.00	2.03	48.00	13.00
10.00	2.03	23.00	2.03	36.00	2.03		
11.00	2.03	24.00	2.03	37.00	6.00		
12.00	2.03	25.00	2.03	38.00	4.00		

CALIB			
NASHYD (0500)	Area (ha)=	0.03	Curve Number (CN)= 74.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.20	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	12.333	2.03	24.583	2.03	36.83	2.03

0.167	0.00	12.417	2.03	24.667	2.03	36.92	2.03
0.250	0.00	12.500	2.03	24.750	2.03	37.00	2.03
0.333	0.00	12.583	2.03	24.833	2.03	37.08	6.00
0.417	0.00	12.667	2.03	24.917	2.03	37.17	6.00
0.500	0.00	12.750	2.03	25.000	2.03	37.25	6.00
0.583	0.00	12.833	2.03	25.083	2.03	37.33	6.00
0.667	0.00	12.917	2.03	25.167	2.03	37.42	6.00
0.750	0.00	13.000	2.03	25.250	2.03	37.50	6.00
0.833	0.00	13.083	2.03	25.333	2.03	37.58	6.00
0.917	0.00	13.167	2.03	25.417	2.03	37.67	6.00
1.000	0.00	13.250	2.03	25.500	2.03	37.75	6.00
1.083	2.03	13.333	2.03	25.583	2.03	37.83	6.00
1.167	2.03	13.417	2.03	25.667	2.03	37.92	6.00
1.250	2.03	13.500	2.03	25.750	2.03	38.00	6.00
1.333	2.03	13.583	2.03	25.833	2.03	38.08	4.00
1.417	2.03	13.667	2.03	25.917	2.03	38.17	4.00
1.500	2.03	13.750	2.03	26.000	2.03	38.25	4.00
1.583	2.03	13.833	2.03	26.083	2.03	38.33	4.00
1.667	2.03	13.917	2.03	26.167	2.03	38.42	4.00
1.750	2.03	14.000	2.03	26.250	2.03	38.50	4.00
1.833	2.03	14.083	2.03	26.333	2.03	38.58	4.00
1.917	2.03	14.167	2.03	26.417	2.03	38.67	4.00
2.000	2.03	14.250	2.03	26.500	2.03	38.75	4.00
2.083	2.03	14.333	2.03	26.583	2.03	38.83	4.00
2.167	2.03	14.417	2.03	26.667	2.03	38.92	4.00
2.250	2.03	14.500	2.03	26.750	2.03	39.00	4.00
2.333	2.03	14.583	2.03	26.833	2.03	39.08	6.00
2.417	2.03	14.667	2.03	26.917	2.03	39.17	6.00
2.500	2.03	14.750	2.03	27.000	2.03	39.25	6.00
2.583	2.03	14.833	2.03	27.083	2.03	39.33	6.00
2.667	2.03	14.917	2.03	27.167	2.03	39.42	6.00
2.750	2.03	15.000	2.03	27.250	2.03	39.50	6.00
2.833	2.03	15.083	2.03	27.333	2.03	39.58	6.00
2.917	2.03	15.167	2.03	27.417	2.03	39.67	6.00
3.000	2.03	15.250	2.03	27.500	2.03	39.75	6.00
3.083	2.03	15.333	2.03	27.583	2.03	39.83	6.00
3.167	2.03	15.417	2.03	27.667	2.03	39.92	6.00
3.250	2.03	15.500	2.03	27.750	2.03	40.00	6.00
3.333	2.03	15.583	2.03	27.833	2.03	40.08	13.00
3.417	2.03	15.667	2.03	27.917	2.03	40.17	13.00
3.500	2.03	15.750	2.03	28.000	2.03	40.25	13.00
3.583	2.03	15.833	2.03	28.083	2.03	40.33	13.00
3.667	2.03	15.917	2.03	28.167	2.03	40.42	13.00
3.750	2.03	16.000	2.03	28.250	2.03	40.50	13.00
3.833	2.03	16.083	2.03	28.333	2.03	40.58	13.00
3.917	2.03	16.167	2.03	28.417	2.03	40.67	13.00
4.000	2.03	16.250	2.03	28.500	2.03	40.75	13.00
4.083	2.03	16.333	2.03	28.583	2.03	40.83	13.00
4.167	2.03	16.417	2.03	28.667	2.03	40.92	13.00
4.250	2.03	16.500	2.03	28.750	2.03	41.00	13.00

4.333	2.03	16.583	2.03	28.833	2.03	41.08	17.00
4.417	2.03	16.667	2.03	28.917	2.03	41.17	17.00
4.500	2.03	16.750	2.03	29.000	2.03	41.25	17.00
4.583	2.03	16.833	2.03	29.083	2.03	41.33	17.00
4.667	2.03	16.917	2.03	29.167	2.03	41.42	17.00
4.750	2.03	17.000	2.03	29.250	2.03	41.50	17.00
4.833	2.03	17.083	2.03	29.333	2.03	41.58	17.00
4.917	2.03	17.167	2.03	29.417	2.03	41.67	17.00
5.000	2.03	17.250	2.03	29.500	2.03	41.75	17.00
5.083	2.03	17.333	2.03	29.583	2.03	41.83	17.00
5.167	2.03	17.417	2.03	29.667	2.03	41.92	17.00
5.250	2.03	17.500	2.03	29.750	2.03	42.00	17.00
5.333	2.03	17.583	2.03	29.833	2.03	42.08	13.00
5.417	2.03	17.667	2.03	29.917	2.03	42.17	13.00
5.500	2.03	17.750	2.03	30.000	2.03	42.25	13.00
5.583	2.03	17.833	2.03	30.083	2.03	42.33	13.00
5.667	2.03	17.917	2.03	30.167	2.03	42.42	13.00
5.750	2.03	18.000	2.03	30.250	2.03	42.50	13.00
5.833	2.03	18.083	2.03	30.333	2.03	42.58	13.00
5.917	2.03	18.167	2.03	30.417	2.03	42.67	13.00
6.000	2.03	18.250	2.03	30.500	2.03	42.75	13.00
6.083	2.03	18.333	2.03	30.583	2.03	42.83	13.00
6.167	2.03	18.417	2.03	30.667	2.03	42.92	13.00
6.250	2.03	18.500	2.03	30.750	2.03	43.00	13.00
6.333	2.03	18.583	2.03	30.833	2.03	43.08	22.99
6.417	2.03	18.667	2.03	30.917	2.03	43.17	23.00
6.500	2.03	18.750	2.03	31.000	2.03	43.25	23.00
6.583	2.03	18.833	2.03	31.083	2.03	43.33	23.00
6.667	2.03	18.917	2.03	31.167	2.03	43.42	23.00
6.750	2.03	19.000	2.03	31.250	2.03	43.50	23.00
6.833	2.03	19.083	2.03	31.333	2.03	43.58	23.00
6.917	2.03	19.167	2.03	31.417	2.03	43.67	23.00
7.000	2.03	19.250	2.03	31.500	2.03	43.75	23.00
7.083	2.03	19.333	2.03	31.583	2.03	43.83	23.00
7.167	2.03	19.417	2.03	31.667	2.03	43.92	23.00
7.250	2.03	19.500	2.03	31.750	2.03	44.00	23.00
7.333	2.03	19.583	2.03	31.833	2.03	44.08	13.01
7.417	2.03	19.667	2.03	31.917	2.03	44.17	13.00
7.500	2.03	19.750	2.03	32.000	2.03	44.25	13.00
7.583	2.03	19.833	2.03	32.083	2.03	44.33	13.00
7.667	2.03	19.917	2.03	32.167	2.03	44.42	13.00
7.750	2.03	20.000	2.03	32.250	2.03	44.50	13.00
7.833	2.03	20.083	2.03	32.333	2.03	44.58	13.00
7.917	2.03	20.167	2.03	32.417	2.03	44.67	13.00
8.000	2.03	20.250	2.03	32.500	2.03	44.75	13.00
8.083	2.03	20.333	2.03	32.583	2.03	44.83	13.00
8.167	2.03	20.417	2.03	32.667	2.03	44.92	13.00
8.250	2.03	20.500	2.03	32.750	2.03	45.00	13.00
8.333	2.03	20.583	2.03	32.833	2.03	45.08	13.00
8.417	2.03	20.667	2.03	32.917	2.03	45.17	13.00

8.500	2.03	20.750	2.03	33.000	2.03	45.25	13.00
8.583	2.03	20.833	2.03	33.083	2.03	45.33	13.00
8.667	2.03	20.917	2.03	33.167	2.03	45.42	13.00
8.750	2.03	21.000	2.03	33.250	2.03	45.50	13.00
8.833	2.03	21.083	2.03	33.333	2.03	45.58	13.00
8.917	2.03	21.167	2.03	33.417	2.03	45.67	13.00
9.000	2.03	21.250	2.03	33.500	2.03	45.75	13.00
9.083	2.03	21.333	2.03	33.583	2.03	45.83	13.00
9.167	2.03	21.417	2.03	33.667	2.03	45.92	13.00
9.250	2.03	21.500	2.03	33.750	2.03	46.00	13.00
9.333	2.03	21.583	2.03	33.833	2.03	46.08	52.94
9.417	2.03	21.667	2.03	33.917	2.03	46.17	53.00
9.500	2.03	21.750	2.03	34.000	2.03	46.25	53.00
9.583	2.03	21.833	2.03	34.083	2.03	46.33	53.00
9.667	2.03	21.917	2.03	34.167	2.03	46.42	53.00
9.750	2.03	22.000	2.03	34.250	2.03	46.50	53.00
9.833	2.03	22.083	2.03	34.333	2.03	46.58	53.00
9.917	2.03	22.167	2.03	34.417	2.03	46.67	53.00
10.000	2.03	22.250	2.03	34.500	2.03	46.75	53.00
10.083	2.03	22.333	2.03	34.583	2.03	46.83	53.00
10.167	2.03	22.417	2.03	34.667	2.03	46.92	53.00
10.250	2.03	22.500	2.03	34.750	2.03	47.00	53.00
10.333	2.03	22.583	2.03	34.833	2.03	47.08	38.02
10.417	2.03	22.667	2.03	34.917	2.03	47.17	38.00
10.500	2.03	22.750	2.03	35.000	2.03	47.25	38.00
10.583	2.03	22.833	2.03	35.083	2.03	47.33	38.00
10.667	2.03	22.917	2.03	35.167	2.03	47.42	38.00
10.750	2.03	23.000	2.03	35.250	2.03	47.50	38.00
10.833	2.03	23.083	2.03	35.333	2.03	47.58	38.00
10.917	2.03	23.167	2.03	35.417	2.03	47.67	38.00
11.000	2.03	23.250	2.03	35.500	2.03	47.75	38.00
11.083	2.03	23.333	2.03	35.583	2.03	47.83	38.00
11.167	2.03	23.417	2.03	35.667	2.03	47.92	38.00
11.250	2.03	23.500	2.03	35.750	2.03	48.00	38.00
11.333	2.03	23.583	2.03	35.833	2.03	48.08	13.04
11.417	2.03	23.667	2.03	35.917	2.03	48.17	13.00
11.500	2.03	23.750	2.03	36.000	2.03	48.25	13.00
11.583	2.03	23.833	2.03	36.083	2.03	48.33	13.00
11.667	2.03	23.917	2.03	36.167	2.03	48.42	13.00
11.750	2.03	24.000	2.03	36.250	2.03	48.50	13.00
11.833	2.03	24.083	2.03	36.333	2.03	48.58	13.00
11.917	2.03	24.167	2.03	36.417	2.03	48.67	13.00
12.000	2.03	24.250	2.03	36.500	2.03	48.75	13.00
12.083	2.03	24.333	2.03	36.583	2.03	48.83	13.00
12.167	2.03	24.417	2.03	36.667	2.03	48.92	13.00
12.250	2.03	24.500	2.03	36.750	2.03	49.00	13.00

Unit Hyd Qpeak (cms)= 0.006

PEAK FLOW (cms)= 0.004 (i)

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     TIME TO PEAK    (hrs)=  47.000
     RUNOFF VOLUME    (mm)= 211.902
     TOTAL RAINFALL   (mm)= 285.001
     RUNOFF COEFFICIENT   =   0.744

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

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0100)|   Area    (ha)=   0.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.03         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      15.00        15.00
     Mannings n           =      0.015        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                         ---- TRANSFORMED HYETOGRAPH ----
  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
 0.083    0.00 |12.333    2.03 |24.583    2.03 | 36.83    2.03
 0.167    0.00 |12.417    2.03 |24.667    2.03 | 36.92    2.03
 0.250    0.00 |12.500    2.03 |24.750    2.03 | 37.00    2.03
 0.333    0.00 |12.583    2.03 |24.833    2.03 | 37.08    6.00
 0.417    0.00 |12.667    2.03 |24.917    2.03 | 37.17    6.00
 0.500    0.00 |12.750    2.03 |25.000    2.03 | 37.25    6.00
 0.583    0.00 |12.833    2.03 |25.083    2.03 | 37.33    6.00
 0.667    0.00 |12.917    2.03 |25.167    2.03 | 37.42    6.00
 0.750    0.00 |13.000    2.03 |25.250    2.03 | 37.50    6.00
 0.833    0.00 |13.083    2.03 |25.333    2.03 | 37.58    6.00
 0.917    0.00 |13.167    2.03 |25.417    2.03 | 37.67    6.00
 1.000    0.00 |13.250    2.03 |25.500    2.03 | 37.75    6.00
 1.083    2.03 |13.333    2.03 |25.583    2.03 | 37.83    6.00
 1.167    2.03 |13.417    2.03 |25.667    2.03 | 37.92    6.00
 1.250    2.03 |13.500    2.03 |25.750    2.03 | 38.00    6.00
 1.333    2.03 |13.583    2.03 |25.833    2.03 | 38.08    4.00
 1.417    2.03 |13.667    2.03 |25.917    2.03 | 38.17    4.00
 1.500    2.03 |13.750    2.03 |26.000    2.03 | 38.25    4.00
 1.583    2.03 |13.833    2.03 |26.083    2.03 | 38.33    4.00
 1.667    2.03 |13.917    2.03 |26.167    2.03 | 38.42    4.00
 1.750    2.03 |14.000    2.03 |26.250    2.03 | 38.50    4.00
 1.833    2.03 |14.083    2.03 |26.333    2.03 | 38.58    4.00
 1.917    2.03 |14.167    2.03 |26.417    2.03 | 38.67    4.00
 2.000    2.03 |14.250    2.03 |26.500    2.03 | 38.75    4.00
```

10.417	2.03	22.667	2.03	34.917	2.03	47.17	38.00
10.500	2.03	22.750	2.03	35.000	2.03	47.25	38.00
10.583	2.03	22.833	2.03	35.083	2.03	47.33	38.00
10.667	2.03	22.917	2.03	35.167	2.03	47.42	38.00
10.750	2.03	23.000	2.03	35.250	2.03	47.50	38.00
10.833	2.03	23.083	2.03	35.333	2.03	47.58	38.00
10.917	2.03	23.167	2.03	35.417	2.03	47.67	38.00
11.000	2.03	23.250	2.03	35.500	2.03	47.75	38.00
11.083	2.03	23.333	2.03	35.583	2.03	47.83	38.00
11.167	2.03	23.417	2.03	35.667	2.03	47.92	38.00
11.250	2.03	23.500	2.03	35.750	2.03	48.00	38.00
11.333	2.03	23.583	2.03	35.833	2.03	48.08	13.04
11.417	2.03	23.667	2.03	35.917	2.03	48.17	13.00
11.500	2.03	23.750	2.03	36.000	2.03	48.25	13.00
11.583	2.03	23.833	2.03	36.083	2.03	48.33	13.00
11.667	2.03	23.917	2.03	36.167	2.03	48.42	13.00
11.750	2.03	24.000	2.03	36.250	2.03	48.50	13.00
11.833	2.03	24.083	2.03	36.333	2.03	48.58	13.00
11.917	2.03	24.167	2.03	36.417	2.03	48.67	13.00
12.000	2.03	24.250	2.03	36.500	2.03	48.75	13.00
12.083	2.03	24.333	2.03	36.583	2.03	48.83	13.00
12.167	2.03	24.417	2.03	36.667	2.03	48.92	13.00
12.250	2.03	24.500	2.03	36.750	2.03	49.00	13.00

Max.Eff.Inten.(mm/hr)=	53.00	48.00	
over (min)	5.00	5.00	
Storage Coeff. (min)=	0.93 (ii)	1.74 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.32	
			TOTALS
PEAK FLOW (cms)=	0.00	0.00	0.004 (iii)
TIME TO PEAK (hrs)=	46.33	46.33	47.00
RUNOFF VOLUME (mm)=	283.50	146.99	282.13
TOTAL RAINFALL (mm)=	285.00	285.00	285.00
RUNOFF COEFFICIENT =	0.99	0.52	0.99

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

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0002)	OVERFLOW IS OFF				
IN= 2---> OUT= 1					
DT= 5.0 min	OUTFLOW	STORAGE	OUTFLOW	STORAGE	

```
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000  |    0.0040      0.0022
                          0.0010      0.0008  |    0.0050      0.0030
                          0.0030      0.0015  |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      0.030      0.004     47.00     282.13
   OUTFLOW: ID= 1 (  0002)      0.030      0.003     48.00     275.95

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 70.55
                  TIME SHIFT OF PEAK FLOW         (min)= 60.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0016

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| CALIB            |
| STANDHYD (  0300)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  97.00   Dir. Conn.(%)=  97.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.11         0.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       4.00         2.00
     Length            (m)=      20.00        20.00
     Mannings n             =     0.015        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.00 |12.333    2.03 |24.583    2.03 | 36.83    2.03
              0.167    0.00 |12.417    2.03 |24.667    2.03 | 36.92    2.03
              0.250    0.00 |12.500    2.03 |24.750    2.03 | 37.00    2.03
              0.333    0.00 |12.583    2.03 |24.833    2.03 | 37.08    6.00
              0.417    0.00 |12.667    2.03 |24.917    2.03 | 37.17    6.00
              0.500    0.00 |12.750    2.03 |25.000    2.03 | 37.25    6.00
              0.583    0.00 |12.833    2.03 |25.083    2.03 | 37.33    6.00
              0.667    0.00 |12.917    2.03 |25.167    2.03 | 37.42    6.00
              0.750    0.00 |13.000    2.03 |25.250    2.03 | 37.50    6.00
              0.833    0.00 |13.083    2.03 |25.333    2.03 | 37.58    6.00
              0.917    0.00 |13.167    2.03 |25.417    2.03 | 37.67    6.00
              1.000    0.00 |13.250    2.03 |25.500    2.03 | 37.75    6.00
              1.083    2.03 |13.333    2.03 |25.583    2.03 | 37.83    6.00
              1.167    2.03 |13.417    2.03 |25.667    2.03 | 37.92    6.00
              1.250    2.03 |13.500    2.03 |25.750    2.03 | 38.00    6.00
              1.333    2.03 |13.583    2.03 |25.833    2.03 | 38.08    4.00
              1.417    2.03 |13.667    2.03 |25.917    2.03 | 38.17    4.00
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9.833	2.03	22.083	2.03	34.333	2.03	46.58	53.00
9.917	2.03	22.167	2.03	34.417	2.03	46.67	53.00
10.000	2.03	22.250	2.03	34.500	2.03	46.75	53.00
10.083	2.03	22.333	2.03	34.583	2.03	46.83	53.00
10.167	2.03	22.417	2.03	34.667	2.03	46.92	53.00
10.250	2.03	22.500	2.03	34.750	2.03	47.00	53.00
10.333	2.03	22.583	2.03	34.833	2.03	47.08	38.02
10.417	2.03	22.667	2.03	34.917	2.03	47.17	38.00
10.500	2.03	22.750	2.03	35.000	2.03	47.25	38.00
10.583	2.03	22.833	2.03	35.083	2.03	47.33	38.00
10.667	2.03	22.917	2.03	35.167	2.03	47.42	38.00
10.750	2.03	23.000	2.03	35.250	2.03	47.50	38.00
10.833	2.03	23.083	2.03	35.333	2.03	47.58	38.00
10.917	2.03	23.167	2.03	35.417	2.03	47.67	38.00
11.000	2.03	23.250	2.03	35.500	2.03	47.75	38.00
11.083	2.03	23.333	2.03	35.583	2.03	47.83	38.00
11.167	2.03	23.417	2.03	35.667	2.03	47.92	38.00
11.250	2.03	23.500	2.03	35.750	2.03	48.00	38.00
11.333	2.03	23.583	2.03	35.833	2.03	48.08	13.04
11.417	2.03	23.667	2.03	35.917	2.03	48.17	13.00
11.500	2.03	23.750	2.03	36.000	2.03	48.25	13.00
11.583	2.03	23.833	2.03	36.083	2.03	48.33	13.00
11.667	2.03	23.917	2.03	36.167	2.03	48.42	13.00
11.750	2.03	24.000	2.03	36.250	2.03	48.50	13.00
11.833	2.03	24.083	2.03	36.333	2.03	48.58	13.00
11.917	2.03	24.167	2.03	36.417	2.03	48.67	13.00
12.000	2.03	24.250	2.03	36.500	2.03	48.75	13.00
12.083	2.03	24.333	2.03	36.583	2.03	48.83	13.00
12.167	2.03	24.417	2.03	36.667	2.03	48.92	13.00
12.250	2.03	24.500	2.03	36.750	2.03	49.00	13.00

Max.Eff.Inten.(mm/hr)=	53.00	48.00	
over (min)	5.00	5.00	
Storage Coeff. (min)=	0.90 (ii)	2.40 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.30	
			TOTALS
PEAK FLOW (cms)=	0.02	0.00	0.016 (iii)
TIME TO PEAK (hrs)=	46.33	46.50	47.00
RUNOFF VOLUME (mm)=	283.50	146.99	279.40
TOTAL RAINFALL (mm)=	285.00	285.00	285.00
RUNOFF COEFFICIENT =	0.99	0.52	0.98

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

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

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

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| RESERVOIR(  0003)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                        0.0149      0.0000   |    0.0163      0.0015
                        0.0154      0.0001   |    0.0167      0.0035
                        0.0159      0.0004   |    0.0362      0.0046

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0300)    0.110      0.016     47.00     279.40
   OUTFLOW: ID= 1 (  0003)    0.110      0.016     47.00     279.62
   OVERFLOW:ID= 3 (  0003)    0.000      0.000      0.00       0.00

                  TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                  CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                  PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 96.89
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0003

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| CALIB            |
| STANDHYD (  0400)|   Area    (ha)=   0.03
|ID= 1 DT= 5.0 min |   Total Imp(%)=  52.00   Dir. Conn.(%)=  52.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.01
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       5.00         5.00
     Length            (m)=       3.00         3.00
     Mannings n             =     0.015        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.00 |12.333    2.03 |24.583    2.03 | 36.83    2.03
              0.167    0.00 |12.417    2.03 |24.667    2.03 | 36.92    2.03
              0.250    0.00 |12.500    2.03 |24.750    2.03 | 37.00    2.03
              0.333    0.00 |12.583    2.03 |24.833    2.03 | 37.08    6.00
```

8.750	2.03	21.000	2.03	33.250	2.03	45.50	13.00
8.833	2.03	21.083	2.03	33.333	2.03	45.58	13.00
8.917	2.03	21.167	2.03	33.417	2.03	45.67	13.00
9.000	2.03	21.250	2.03	33.500	2.03	45.75	13.00
9.083	2.03	21.333	2.03	33.583	2.03	45.83	13.00
9.167	2.03	21.417	2.03	33.667	2.03	45.92	13.00
9.250	2.03	21.500	2.03	33.750	2.03	46.00	13.00
9.333	2.03	21.583	2.03	33.833	2.03	46.08	52.94
9.417	2.03	21.667	2.03	33.917	2.03	46.17	53.00
9.500	2.03	21.750	2.03	34.000	2.03	46.25	53.00
9.583	2.03	21.833	2.03	34.083	2.03	46.33	53.00
9.667	2.03	21.917	2.03	34.167	2.03	46.42	53.00
9.750	2.03	22.000	2.03	34.250	2.03	46.50	53.00
9.833	2.03	22.083	2.03	34.333	2.03	46.58	53.00
9.917	2.03	22.167	2.03	34.417	2.03	46.67	53.00
10.000	2.03	22.250	2.03	34.500	2.03	46.75	53.00
10.083	2.03	22.333	2.03	34.583	2.03	46.83	53.00
10.167	2.03	22.417	2.03	34.667	2.03	46.92	53.00
10.250	2.03	22.500	2.03	34.750	2.03	47.00	53.00
10.333	2.03	22.583	2.03	34.833	2.03	47.08	38.02
10.417	2.03	22.667	2.03	34.917	2.03	47.17	38.00
10.500	2.03	22.750	2.03	35.000	2.03	47.25	38.00
10.583	2.03	22.833	2.03	35.083	2.03	47.33	38.00
10.667	2.03	22.917	2.03	35.167	2.03	47.42	38.00
10.750	2.03	23.000	2.03	35.250	2.03	47.50	38.00
10.833	2.03	23.083	2.03	35.333	2.03	47.58	38.00
10.917	2.03	23.167	2.03	35.417	2.03	47.67	38.00
11.000	2.03	23.250	2.03	35.500	2.03	47.75	38.00
11.083	2.03	23.333	2.03	35.583	2.03	47.83	38.00
11.167	2.03	23.417	2.03	35.667	2.03	47.92	38.00
11.250	2.03	23.500	2.03	35.750	2.03	48.00	38.00
11.333	2.03	23.583	2.03	35.833	2.03	48.08	13.04
11.417	2.03	23.667	2.03	35.917	2.03	48.17	13.00
11.500	2.03	23.750	2.03	36.000	2.03	48.25	13.00
11.583	2.03	23.833	2.03	36.083	2.03	48.33	13.00
11.667	2.03	23.917	2.03	36.167	2.03	48.42	13.00
11.750	2.03	24.000	2.03	36.250	2.03	48.50	13.00
11.833	2.03	24.083	2.03	36.333	2.03	48.58	13.00
11.917	2.03	24.167	2.03	36.417	2.03	48.67	13.00
12.000	2.03	24.250	2.03	36.500	2.03	48.75	13.00
12.083	2.03	24.333	2.03	36.583	2.03	48.83	13.00
12.167	2.03	24.417	2.03	36.667	2.03	48.92	13.00
12.250	2.03	24.500	2.03	36.750	2.03	49.00	13.00

Max.Eff.Inten.(mm/hr)=	53.00	48.00	
over (min)	5.00	5.00	
Storage Coeff. (min)=	0.27 (ii)	1.68 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.34	0.32	
			TOTALS

PEAK FLOW (cms)=	0.00	0.00	0.004 (iii)
TIME TO PEAK (hrs)=	46.17	46.42	47.00
RUNOFF VOLUME (mm)=	283.50	146.99	217.96
TOTAL RAINFALL (mm)=	285.00	285.00	285.00
RUNOFF COEFFICIENT =	0.99	0.52	0.76

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

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0200) ID= 1 DT= 5.0 min	Area (ha)= 0.09 Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.09	0.00
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	15.00	15.00
Mannings n	=	0.015	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.00	12.333	2.03	24.583	2.03	36.83	2.03
0.167	0.00	12.417	2.03	24.667	2.03	36.92	2.03
0.250	0.00	12.500	2.03	24.750	2.03	37.00	2.03
0.333	0.00	12.583	2.03	24.833	2.03	37.08	6.00
0.417	0.00	12.667	2.03	24.917	2.03	37.17	6.00
0.500	0.00	12.750	2.03	25.000	2.03	37.25	6.00
0.583	0.00	12.833	2.03	25.083	2.03	37.33	6.00
0.667	0.00	12.917	2.03	25.167	2.03	37.42	6.00
0.750	0.00	13.000	2.03	25.250	2.03	37.50	6.00
0.833	0.00	13.083	2.03	25.333	2.03	37.58	6.00
0.917	0.00	13.167	2.03	25.417	2.03	37.67	6.00
1.000	0.00	13.250	2.03	25.500	2.03	37.75	6.00
1.083	2.03	13.333	2.03	25.583	2.03	37.83	6.00
1.167	2.03	13.417	2.03	25.667	2.03	37.92	6.00
1.250	2.03	13.500	2.03	25.750	2.03	38.00	6.00
1.333	2.03	13.583	2.03	25.833	2.03	38.08	4.00

9.750	2.03	22.000	2.03	34.250	2.03	46.50	53.00
9.833	2.03	22.083	2.03	34.333	2.03	46.58	53.00
9.917	2.03	22.167	2.03	34.417	2.03	46.67	53.00
10.000	2.03	22.250	2.03	34.500	2.03	46.75	53.00
10.083	2.03	22.333	2.03	34.583	2.03	46.83	53.00
10.167	2.03	22.417	2.03	34.667	2.03	46.92	53.00
10.250	2.03	22.500	2.03	34.750	2.03	47.00	53.00
10.333	2.03	22.583	2.03	34.833	2.03	47.08	38.02
10.417	2.03	22.667	2.03	34.917	2.03	47.17	38.00
10.500	2.03	22.750	2.03	35.000	2.03	47.25	38.00
10.583	2.03	22.833	2.03	35.083	2.03	47.33	38.00
10.667	2.03	22.917	2.03	35.167	2.03	47.42	38.00
10.750	2.03	23.000	2.03	35.250	2.03	47.50	38.00
10.833	2.03	23.083	2.03	35.333	2.03	47.58	38.00
10.917	2.03	23.167	2.03	35.417	2.03	47.67	38.00
11.000	2.03	23.250	2.03	35.500	2.03	47.75	38.00
11.083	2.03	23.333	2.03	35.583	2.03	47.83	38.00
11.167	2.03	23.417	2.03	35.667	2.03	47.92	38.00
11.250	2.03	23.500	2.03	35.750	2.03	48.00	38.00
11.333	2.03	23.583	2.03	35.833	2.03	48.08	13.04
11.417	2.03	23.667	2.03	35.917	2.03	48.17	13.00
11.500	2.03	23.750	2.03	36.000	2.03	48.25	13.00
11.583	2.03	23.833	2.03	36.083	2.03	48.33	13.00
11.667	2.03	23.917	2.03	36.167	2.03	48.42	13.00
11.750	2.03	24.000	2.03	36.250	2.03	48.50	13.00
11.833	2.03	24.083	2.03	36.333	2.03	48.58	13.00
11.917	2.03	24.167	2.03	36.417	2.03	48.67	13.00
12.000	2.03	24.250	2.03	36.500	2.03	48.75	13.00
12.083	2.03	24.333	2.03	36.583	2.03	48.83	13.00
12.167	2.03	24.417	2.03	36.667	2.03	48.92	13.00
12.250	2.03	24.500	2.03	36.750	2.03	49.00	13.00

Max.Eff.Inten.(mm/hr)=	53.00	48.00		
over (min)	5.00	5.00		
Storage Coeff. (min)=	0.93 (ii)	1.74 (ii)		
Unit Hyd. Tpeak (min)=	5.00	5.00		
Unit Hyd. peak (cms)=	0.34	0.32		
			TOTALS	
PEAK FLOW (cms)=	0.01	0.00	0.013 (iii)	
TIME TO PEAK (hrs)=	46.33	46.42	47.00	
RUNOFF VOLUME (mm)=	283.50	146.99	282.13	
TOTAL RAINFALL (mm)=	285.00	285.00	285.00	
RUNOFF COEFFICIENT =	0.99	0.52	0.99	

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

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

```
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0013)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |    0.0230      0.0067
                          0.0080      0.0022   |    0.0300      0.0090
                          0.0150      0.0045   |    0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      0.090      0.013     47.00     282.13
   OUTFLOW: ID= 1 (  0013)      0.090      0.010     47.08     281.41

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 77.30
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0030

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--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0013):     0.09   0.010    47.08   281.41
     + ID2= 2 (  0002):     0.03   0.003    48.00   275.95
       ================================================
       ID = 3 (  0004):     0.12   0.013    47.08   280.04

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 3 (  0004):     0.12   0.013    47.08   280.04
     + ID2= 2 (  0003):     0.11   0.016    47.00   279.62
       ================================================
       ID = 1 (  0004):     0.23   0.029    47.08   279.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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| ADD HYD  (  0004)|
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```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0004):     0.23   0.029    47.08   279.84
      + ID2= 2 (  0400):     0.03   0.004    47.00   217.96
        ================================================
        ID = 3 (  0004):     0.26   0.033    47.00   272.70

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

--------------------
| ADD HYD  (  0004)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0004):     0.26   0.033    47.00   272.70
      + ID2= 2 (  0500):     0.03   0.004    47.00   211.90
        ================================================
        ID = 1 (  0004):     0.29   0.037    47.00   266.41

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

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

198-200 & 206 Plains Road East
Burlington
Our File: 2500052
November 11, 2025

Catchment 100: Proposed Rooftop Storage

Design Discharge Rate =	1.50	l/min/mm/weir	2.50E-05	m^3/s/mm/weir
Max. Average Storage Depth =	100	mm		
Design Discharge =	150.0	l/min/weir	0.0025	m^3/s/weir
No. of Drains =	1			
No. Weirs/Drain =	2			
Allowable Release Rate =	300.0	l/min	0.005	m^3/s
Rooftop Area =	300	m^2	(flat rooftop area that is available for storage)	

Therefore: 464.5 sq m/Roof Drain or 5000 sq ft/Roof Drain as per OBC

STAGE-STORAGE-DISCHARGE TABLE

Stage (m)	Storage (m^3)	Discharge (m^3/s)
0.000	0.0	0.000
0.025	7.5	0.001
0.050	15.0	0.003
0.075	22.5	0.004
0.100	30.0	0.005

198-200 & 206 Plains Road East
Burlington
Our File: 2500052
November 11, 2025

Catchment 200: Proposed Rooftop Storage

Design Discharge Rate =	1.50	l/min/mm/weir	2.50E-05	m^3/s/mm/weir
Max. Average Storage Depth =	100	mm		
Design Discharge =	150.0	l/min/weir	0.0025	m^3/s/weir
No. of Drains =	4			
No. Weirs/Drain =	3			
Allowable Release Rate =	1800.0	l/min	0.030	m^3/s
Rooftop Area =	900	m^2	(flat rooftop area that is available for storage)	

Therefore: 464.5 sq m/Roof Drain or 5000 sq ft/Roof Drain as per OBC

STAGE-STORAGE-DISCHARGE TABLE

Stage (m)	Storage (m^3)	Discharge (m^3/s)
0.000	0.0	0.000
0.025	22.5	0.008
0.050	45.0	0.015
0.075	67.5	0.023
0.100	90.0	0.030

198-200 & 206 Plains Road East
Burlington, ON
Our File: 2500052
November 11, 2025

Catchment 300: Surface Ponding

ELEV (m)	INC. DEPTH (m)	SURFACE AREA (m^2)	INCREASE ACTIVE VOLUME (m^3)	ACCUM STORAGE VOL (m^3)	
98.77	0.00	0.00	0.00	0.00	Orifice
99.55	0.00	0.00	0.00	0.00	T/G CB.13
99.60	0.05	27.00	0.67	0.67	
99.65	0.10	116.00	3.58	4.25	
99.70	0.15	310.00	10.65	14.90	
99.75	0.20	503.00	20.32	35.22	Weir
99.77	0.22	600.00	11.03	46.25	Overflow

ORIFICE OUTLET

Invert =	98.77	m
Q =	0.017	m^3/s
Cd =	0.6	
H =	1.00	m
2g =	19.62	
A =	0.006	m^2
D=	0.090	m

OVERFLOW WEIR

Q =	0.019	cu m/s
d1 =	1.000	m
h =	0.980	m
H =	0.020	m
2g =	19.620	
L =	5.000	m

ELEVATION	STAGE (m)	STORAGE (cu m)	OUTLET CONTROL (cu m/s)	WEIR DISCHARGE (cu m/s)	TOTAL DISCHARGE (cu m/s)	
99.55	0.000	0.00	0.0149	0.000	0.0149	T/G CB.13
99.60	0.050	0.67	0.0154	0.000	0.0154	
99.65	0.100	4.25	0.0159	0.000	0.0159	
99.70	0.150	14.90	0.0163	0.000	0.0163	
99.75	0.200	35.22	0.0167	0.000	0.0167	Weir
99.77	0.220	46.25	0.0169	0.019	0.0362	Overflow

Appendix C Water Quality Control

C.1. Jellyfish JF4-1-1 Sizing Report and Details

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	May 20, 2025
Project Name	198-200 and 206 Plains Rd. E
Project Number	2500052
Location	Burlington

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.

Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF4-1-1 is recommended to meet the water quality objective by treating a flow of 7.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 34 years of HAMILTON A rainfall data for this site. This model has a sediment capacity of 85 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	7.6	85

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

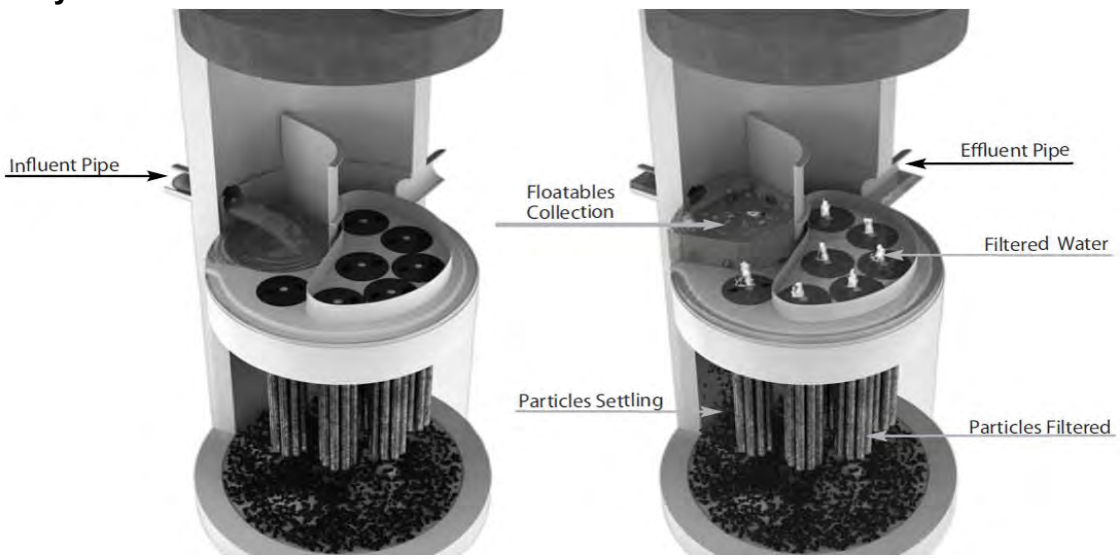
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TAPE qualifying rain events and field monitored according to the TAPE field test protocol, demonstrating:

- A median TSS removal efficiency of 90%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 77%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Project Information

Date:	May 20, 2025
Project Name:	198-200 and 206 Plains Rd. E
Project Number:	2500052
Location:	Burlington

Designer Information

Company:	GEI Consultants Inc.
Contact:	Sabrina Jivani
Phone #:	

Notes

Rainfall

Name:	HAMILTON A
State:	ON
ID:	3194
Record:	1970 to 2003
Co-ords:	43°10.N'N, 79°56.W'N

Drainage Area

Total Area:	0.11 ha
Imperviousness:	100%

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 34 years of HAMILTON A rainfall data:	**3.4 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 561 m³, with a suspended sediment concentration of 60 mg/L.	**34 kg**

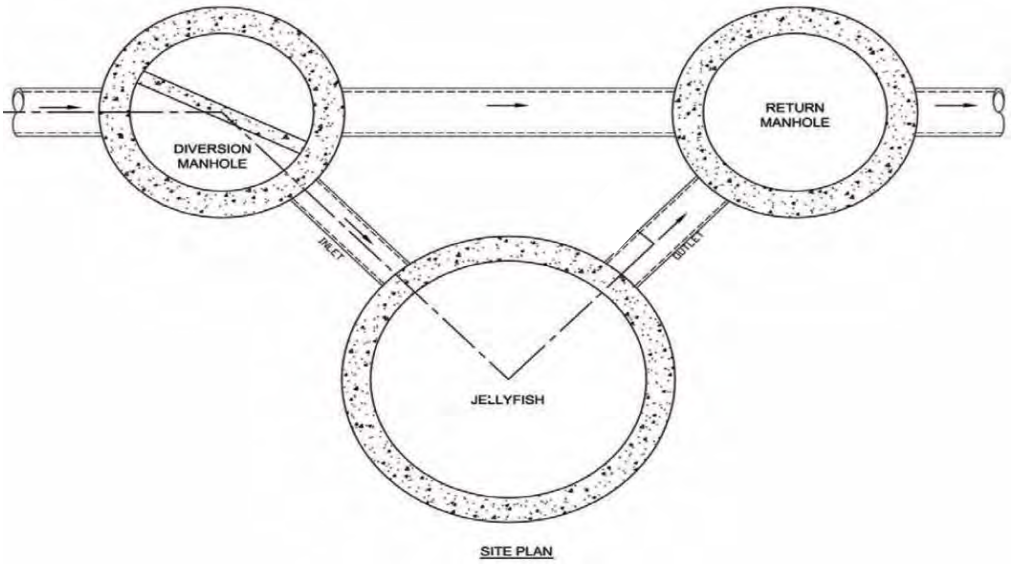
Recommendation

The Jellyfish Filter model JF4-1-1 is recommended to meet the water quality objective by treating a flow of 7.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 34 years of HAMILTON A rainfall data for this site. This model has a sediment capacity of 85 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	**1**	**1**	**1.2**	**2313**	**0.34**	**379**	**7.6**	**85**
JF4-2-1	2	1	1.2	2313	0.34	379	12.6	142
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	**62º**	**150**	**200**
1.8	59º	200	250
2.4	52º	250	300
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

DRAWING NOT TO BE USED FOR CONSTRUCTION

GENERAL NOTES:

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

JELLYFISH STRUCTURE & DESIGN NOTES:

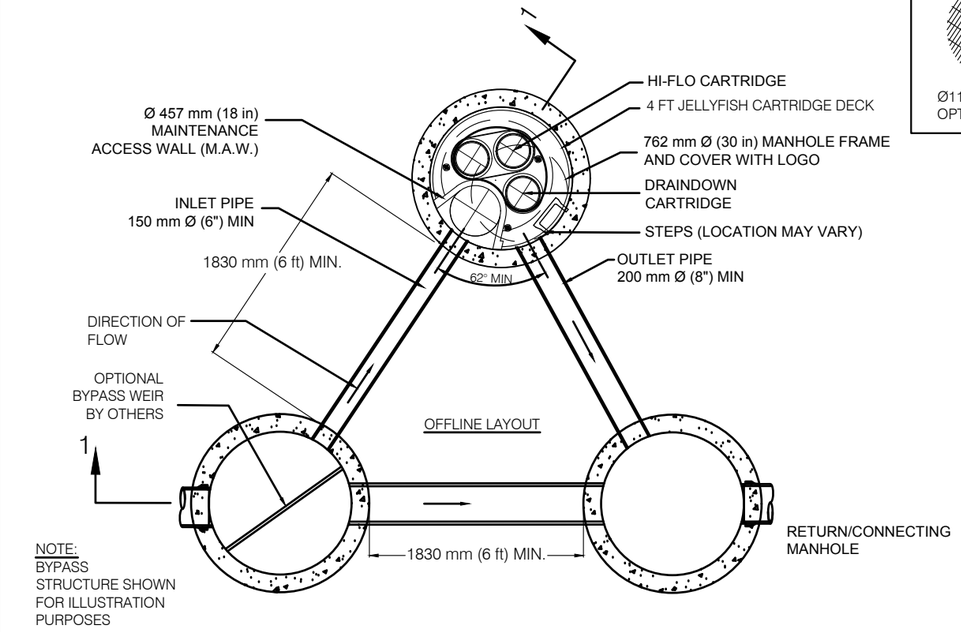
1. 457 MM Ø (18") MAINTENANCE ACCESS WALL TO BE USED FOR CLEANOUT AND ACCESS BELOW CARTRIDGE DECK.
2. CASTINGS OR DOORS OF THE JELLYFISH MANHOLE STRUCTURE TO EXTEND TO DESIGN FINISH GRADE. DEPTHS IN EXCESS OF 3.65 M (12') MAY REQUIRE THE DESIGN AND INSTALLATION OF INTERMEDIATE SAFETY GRATES OR OTHER STRUCTURAL ELEMENTS.
3. CASTINGS AND GRADE RINGS, OR DOORS AND DOOR RISERS, OR BOTH, SHALL BE GROUTED FOR WATERTIGHTNESS.
   STRUCTURE SHALL MEET AASHTO HS-20, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
4. ALL STRUCTURAL SECTIONS AND PARTS TO MEET OR EXCEED ASTM C-478, ASTM C-443, AND ASTM D-4097 CORRESPONDING TO AASHTO SPECIFICATIONS, AND ANY OTHER SITE OR LOCAL STANDARDS.
5. CONCRETE RISER SECTIONS FROM BOTTOM TO TOP WILL BE ADDED AS REQUIRED INCLUDING TRANSITION PIECES TO SMALLER DIAMETER RISERS FOR SURFACE ACCESSES WHERE WARRANTED BY SERVICING DEPTH.
6. IF MINIMUM DEPTH FROM TOP OF CARTRIDGE DECK TO BOTTOM OF STRUCTURAL TOP SLAB CANNOT BE ACHIEVED DUE TO PIPING INVERT ELEVATIONS OR OTHER SITE CONSTRAINTS. ALTERNATIVE HATCH CONFIGURATIONS MAY BE AVAILABLE. HATCH DOORS SHOULD BE SIZED TO PROVIDE FULL ACCESS ABOVE THE CARTRIDGES TO ACCOMMODATE MAINTENANCE.
7. STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
8. CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
9. IT IS THE RESPONSIBILITY OF OTHERS TO PROPERLY PROTECT THE TREATMENT DEVICE, AND KEEP THE DEVICE OFFLINE DURING CONSTRUCTION. FILTER CARTRIDGES SHALL NOT BE INSTALLED UNTIL THE PROJECT SITE IS CLEAN AND FREE OF DEBRIS, BY OTHERS. THE PROJECT SITE INCLUDES ANY SURFACE THAT CONTRIBUTES STORM DRAINAGE TO THE TREATMENT DEVICE. CARTRIDGES SHALL BE FURNISHED NEW, AT THE TIME OF FINAL ACCEPTANCE.
10. THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

INSTALLATION NOTES

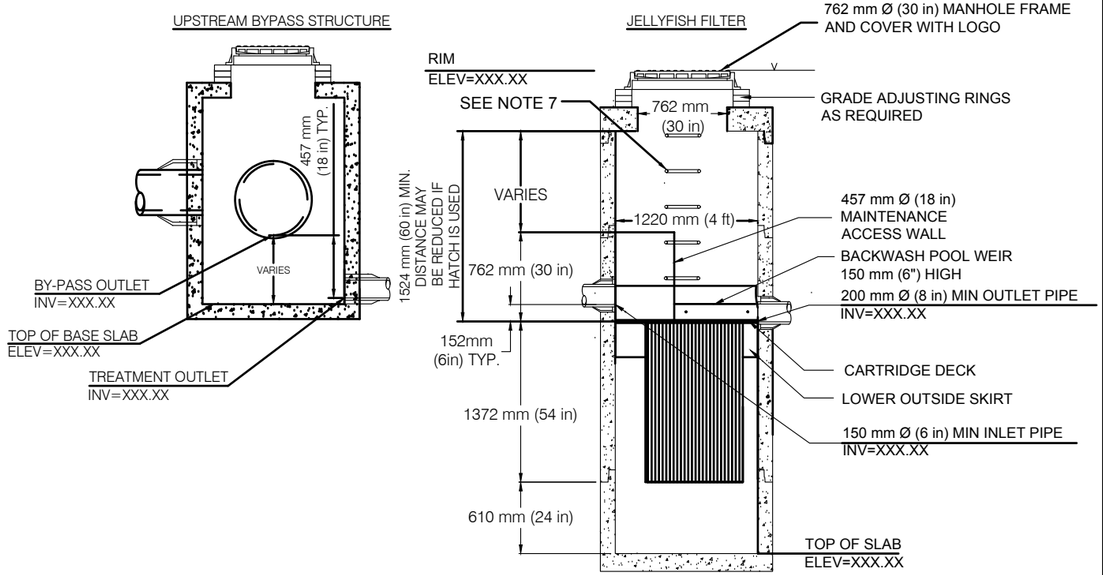
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. CARTRIDGE INSTALLATION, BY IMBRIUM, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.

STANDARD OFFLINE JELLYFISH RECOMMENDED PIPE DIAMETERS			
MODEL DIAMETER (m)	MINIMUM ANGLE INLET/OUTLET PIPES	MINIMUM INLET PIPE DIAMETER (mm)	MINIMUM OULTET PIPE DIAMETER (mm)
1.2	62	150	200
1.8	59	200	250
2.4	52	250	300
3.0	48	300	450
3.6	40	300	450
CONTACT IMBRIUM SYSTEMS FOR ALTERNATE PIPE DIAMETERS			

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE.



XXX.XX INFORMATION TO BE SUPPLIED BY ENGINEER OF RECORD



CROSS SECTION 1-1

JELLYFISH DESIGN NOTES

JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN. Ø1220 mm (48") MANHOLE JELLYFISH PEAK TREATMENT CAPACITY IS 12.7 L/s (0.54 CFS). TREATMENT FLOW RATE IS BASED ON 457 mm (18") OF HEAD PRESSURE.

CARTRIDGE SELECTION		54"	40"		27"		15"				
CARTRIDGE DEPTH		90"	76"		63"		51"				
OUTLET INVERT TO STRUCTURE BASE SLAB		5.09 / 2.55	3.68 / 1.84		2.55 / 1.27		1.41 / 0.71				
FLOW RATE HIGH-FLO / DRAINDOWN (L/s) (per cart)		57 / 28	42 / 21		28 / 14		16 / 8				
SEDIMENT CAPACITY HIGH-FLO / DRAINDOWN (kg) (per cart)				2 / 1							
MAX. CARTS HIGH-FLO/DRAINDOWN								142	105	70	40
MAX. SEDIMENT CAPACITY (kg)								12.7	9.3	6.2	3.4
MAX. TREATMENT (L/s)											

SITE SPECIFIC DATA REQUIREMENTS

JELLYFISH MODEL	*
STRUCTURE ID	*
WATER QUALITY FLOW RATE (L/s)	*
PEAK FLOW RATE (L/s)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
# OF CARTRIDGES REQUIRED (HF / DD)	*
CARTRIDGE SIZE (inches)	*

PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
1	08/01/2015	NOTES	BSF
0	10/01/2014	INTIAL RELEASE	BSF

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Jellyfish
JF4 STANDARD
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THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS: U.S. 6,641,720 B2; 7,425,262 B2; 7,470,366 B2; 7,905,367 B2; CA 2,366,482; CA 2,634,542; CA 2,466,480; KR 10-1307519; NZ 583481; NZ 604427; ZL 200580050866; OTHER INTERNATIONAL PATENTS PENDING

DATE: #####
DESIGNED: | DRAWN: BSF
CHECKED: BSF | APPROVED: SP
PROJECT #: ##### | PROJECT NAME: #####
SHEET: 1 OF 2

\\AD.CONTECH-CPI.COM\ROOT\CORPORATE\MARKETING\IMBRIUM\CAD & PDF\JELLYFISH\JELLYFISH FILTER JF4 - OFFLINE.DWG 8/5/2016 9:14 AM

JELLYFISH® FILTER - SPECIFICATIONS

GENERAL

A. WORK INCLUDED: SPECIFIES REQUIREMENTS FOR CONSTRUCTION AND PERFORMANCE OF AN UNDERGROUND STORMWATER QUALITY, MEMBRANE FILTRATION, AND TREATMENT DEVICE THAT REMOVES POLLUTANTS FROM STORMWATER RUNOFF THROUGH THE UNIT OPERATIONS OF SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. REFERENCE STANDARDS:
ASTM C 891: SPECIFICATION FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES
ASTM C 478: SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS
ASTM C 990: SPECIFICATION FOR JOINTS FOR CONCRETE MANHOLES USING PREFORMED FLEXIBLE JOINT SEALANTS
ASTM D 4101: SPECIFICATION FOR COPOLYMER STEPS CONSTRUCTION

C. SHOP DRAWINGS: SHOP DRAWINGS FOR THE STRUCTURE AND PERFORMANCE ARE TO BE SUBMITTED WITH EACH ORDER TO THE CONTRACTOR. CONTRACTOR SHALL FORWARD SHOP DRAWING SUBMITTAL TO THE CONSULTING ENGINEER FOR APPROVAL. SHOP DRAWINGS ARE TO DETAIL THE STRUCTURE PRECAST CONCRETE AND CALL OUT OR NOTE THE FIBERGLASS (FRP) INTERNALS/COMPONENTS.

D. PRODUCT SUBSTITUTIONS: NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD. SUBMISSIONS FOR SUBSTITUTIONS REQUIRE REVIEW AND APPROVAL BY THE ENGINEER OF RECORD, FOR HYDRAULIC PERFORMANCE, IMPACT TO PROJECT DESIGNS, EQUIVALENT TREATMENT PERFORMANCE, AND ANY REQUIRED PROJECT PLAN AND REPORT (HYDROLOGY/HYDRAULIC, WATER QUALITY, STORMWATER POLLUTION) MODIFICATIONS THAT WOULD BE REQUIRED BY THE APPROVING JURISDICTIONS/AGENCIES. CONTRACTOR TO COORDINATE WITH THE ENGINEER OF RECORD ANY APPLICABLE MODIFICATIONS TO THE PROJECT ESTIMATES OF COST, BONDING AMOUNT DETERMINATIONS, PLAN CHECK FEES FOR CHANGES TO APPROVED DOCUMENTS, AND/OR ANY OTHER REGULATORY REQUIREMENTS RESULTING FROM THE PRODUCT SUBSTITUTION.

E. HANDLING AND STORAGE: PREVENT DAMAGE TO MATERIALS DURING STORAGE AND HANDLING.

PRODUCTS

A. THE DEVICE SHALL BE A CYLINDRICAL OR RECTANGULAR, ALL CONCRETE STRUCTURE (INCLUDING RISERS), CONSTRUCTED FROM PRECAST CONCRETE RISER AND SLAB COMPONENTS OR MONOLITHIC PRECAST STRUCTURE(S), INSTALLED TO CONFORM TO ASTM C 891 AND TO ANY REQUIRED STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS; WHICHEVER IS MORE STRINGENT. THE DEVICE SHALL BE WATERTIGHT.

B. THE CYLINDRICAL CONCRETE DEVICE SHALL INCLUDE A FIBERGLASS CARTRIDGE DECK INSERT. THE RECTANGULAR CONCRETE DEVICE SHALL INCLUDE A COATED ALUMINUM INSERT. IN EITHER INSTANCE, THE INSERT SHALL BE BOLTED AND SEALED WATERTIGHT INSIDE THE PRECAST CONCRETE CHAMBER. THE INSERT SHALL SERVE AS: (A) A HORIZONTAL DIVIDER BETWEEN THE LOWER TREATMENT ZONE AND THE UPPER TREATED EFFLUENT ZONE; (B) A DECK FOR ATTACHMENT OF FILTER CARTRIDGES SUCH THAT THE MEMBRANE FILTER ELEMENTS OF EACH CARTRIDGE EXTEND INTO THE LOWER TREATMENT ZONE; (C) A PLATFORM FOR MAINTENANCE WORKERS TO SERVICE THE FILTER CARTRIDGES (MAXIMUM MANNED WEIGHT = 450 POUNDS); (D) A CONDUIT FOR CONVEYANCE OF TREATED WATER TO THE EFFLUENT PIPE.

C. MEMBRANE FILTER CARTRIDGES SHALL BE COMPRISED OF REUSABLE CYLINDRICAL MEMBRANE FILTER ELEMENTS CONNECTED TO A PERFORATED HEAD PLATE. THE NUMBER OF MEMBRANE FILTER ELEMENTS PER CARTRIDGE SHALL BE A MINIMUM OF ELEVEN 2.75-INCH (70-MM) OR GREATER DIAMETER ELEMENTS. THE LENGTH OF EACH FILTER ELEMENT SHALL BE A MINIMUM 15 INCHES (381 MM). EACH CARTRIDGE SHALL BE FITTED INTO THE CARTRIDGE DECK BY INSERTION INTO A CARTRIDGE RECEPTACLE THAT IS PERMANENTLY MOUNTED INTO THE CARTRIDGE DECK. EACH CARTRIDGE SHALL BE SECURED BY A CARTRIDGE LID THAT IS THREADED ONTO THE RECEPTACLE, OR SIMILAR MECHANISM TO SECURE THE CARTRIDGE INTO THE DECK. THE MAXIMUM TREATMENT FLOW RATE OF A FILTER CARTRIDGE SHALL BE CONTROLLED BY AN ORIFICE IN THE CARTRIDGE LID, OR ON THE INDIVIDUAL CARTRIDGE ITSELF, AND BASED ON A DESIGN FLUX RATE (SURFACE LOADING RATE) DETERMINED BY THE MAXIMUM TREATMENT FLOW RATE PER UNIT OF FILTRATION MEMBRANE SURFACE AREA. THE MAXIMUM FLUX RATE SHALL BE 0.21 GPM/FT2 (0.142 LPS/M2). EACH MEMBRANE FILTER CARTRIDGE SHALL ALLOW FOR MANUAL INSTALLATION AND REMOVAL.

D. ALL FILTER CARTRIDGES AND MEMBRANES SHALL BE REUSABLE AND ALLOW FOR THE USE OF FILTRATION MEMBRANE RINSING PROCEDURES TO RESTORE FLOW CAPACITY AND SEDIMENT CAPACITY; EXTENDING CARTRIDGE SERVICE LIFE.

E. ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. THE DEVICE SHALL INCLUDE A MINIMUM 24 INCHES (610 MM) OF SUMP BELOW THE BOTTOM OF THE CARTRIDGES FOR SEDIMENT ACCUMULATION, UNLESS OTHERWISE SPECIFIED BY THE DESIGN ENGINEER. DEPTHS LESS THAN 24" MAY HAVE AN IMPACT ON THE TOTAL PERFORMANCE AND/OR LONGEVITY BETWEEN CARTRIDGE MAINTENANCE/REPLACEMENT OF THE DEVICE.

G. ALL PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED TO A MINIMUM LIVE LOAD OF HS-20 TRUCK LOADING OR GREATER BASED ON LOCAL REGULATORY SPECIFICATIONS, UNLESS OTHERWISE MODIFIED OR SPECIFIED BY THE DESIGN ENGINEER, AND SHALL BE WATERTIGHT.

H. GASKETS AND/OR SEALANTS TO PROVIDE WATER TIGHT SEAL BETWEEN CONCRETE JOINTS. JOINTS SHALL BE SEALED WITH PREFORMED JOINT SEALING COMPOUND CONFORMING TO ASTM C 990.

I. FRAME AND COVERS MUST BE MANUFACTURED FROM CAST-IRON OR OTHER COMPOSITE MATERIAL TESTED TO WITHSTAND H-20 OR GREATER DESIGN LOADS, AND AS APPROVED BY THE LOCAL REGULATORY BODY. FRAMES AND COVERS MUST BE EMBOSSED WITH THE NAME OF THE DEVICE MANUFACTURER OR THE DEVICE BRAND NAME.

J. DOOR AND HATCHES, IF PROVIDED SHALL MEET DESIGNATED LOADING REQUIREMENTS OR AT A MINIMUM FOR INCIDENTAL VEHICULAR TRAFFIC.

K. ALL CONCRETE COMPONENTS SHALL BE MANUFACTURED ACCORDING TO LOCAL SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS OF ASTM C 478.

L. THE FIBERGLASS PORTION OF THE FILTER DEVICE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING STANDARD: ASTM D-4097: CONTACT MOLDED GLASS FIBER REINFORCED CHEMICAL RESISTANT TANKS.

M. STEPS SHALL BE CONSTRUCTED ACCORDING TO ASTM D4101 OF COPOLYMER POLYPROPYLENE, AND BE DRIVEN INTO PREFORMED OR PRE-DRILLED HOLES AFTER THE CONCRETE HAS CURED, INSTALLED TO CONFORM TO APPLICABLE SECTIONS OF STATE, PROVINCIAL AND MUNICIPAL BUILDING CODES, HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF SUCH DEVICES.

N. ALL PRECAST CONCRETE SECTIONS SHALL BE INSPECTED TO ENSURE THAT DIMENSIONS, APPEARANCE AND QUALITY OF THE PRODUCT MEET LOCAL MUNICIPAL SPECIFICATIONS AND ASTM C 478.

PERFORMANCE

A. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL FUNCTION TO REMOVE POLLUTANTS BY THE FOLLOWING UNIT TREATMENT PROCESSES; SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL REMOVE OIL, DEBRIS, TRASH, COARSE AND FINE PARTICULATES, PARTICULATE-BOUND POLLUTANTS, METALS AND NUTRIENTS FROM STORMWATER DURING RUNOFF EVENTS.

C. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TYPICALLY UTILIZE AN EXTERNAL BYPASS TO DIVERT EXCESSIVE FLOWS. INTERNAL BYPASS SYSTEMS SHALL BE EQUIPPED WITH A FLOATABLES BAFFLE, AND MUST PASS WATER OVER THE CARTRIDGE DECK, AND AVOID PASSAGE THROUGH THE SUMP AND/OR CARTRIDGE FILTRATION ZONE.

D. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TREAT 100% OF THE REQUIRED WATER QUALITY TREATMENT FLOW BASED ON A MAXIMUM TREATMENT FLUX RATE (SURFACE LOADING RATE) ACROSS THE MEMBRANE FILTER CARTRIDGES NOT TO EXCEED 0.21 GPM/FT2 (0.142 LPS/M2).

E. AT A MINIMUM, THE STORMWATER QUALITY FILTER DEVICE SHALL HAVE BEEN FIELD TESTED AND VERIFIED WITH A MINIMUM 25 QUALIFYING STORM EVENTS AND FIELD MONITORING CONDUCTED ACCORDING TO THE TARP TIER II OR TAPE FIELD TEST PROTOCOL, AND HAVE RECEIVED NJCAT VERIFICATION.

F. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TSS REMOVAL EFFICIENCY OF 85% AND A MINIMUM MEDIAN SSC REMOVAL EFFICIENCY OF 95%.

G. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED THE ABILITY TO CAPTURE FINE PARTICLES AS INDICATED BY A MINIMUM MEDIAN REMOVAL EFFICIENCY OF 75% FOR THE PARTICLE FRACTION LESS THAN 25 MICRONS, AN EFFLUENT D50 OF 15 MICRONS OR LOWER FOR ALL MONITORED STORM EVENTS, AND AN EFFLUENT TURBIDITY OF 15 NTUS OR LOWER.

H. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL PHOSPHORUS REMOVAL OF 55%, AND A MINIMUM MEDIAN TOTAL NITROGEN REMOVAL OF 50%.

I. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL ZINC REMOVAL OF 50%, AND A MINIMUM MEDIAN TOTAL COPPER REMOVAL OF 75%.

INSPECTION AND MAINTENANCE

A. DURABILITY OF MEMBRANES ARE SUBJECT TO GOOD HANDLING PRACTICES DURING INSPECTION AND MAINTENANCE (REMOVAL, RINSING, AND REINSERTION) EVENTS, AND SITE SPECIFIC CONDITIONS THAT MAY HAVE HEAVIER OR LIGHTER LOADING ONTO THE CARTRIDGES, AND POLLUTANT VARIABILITY THAT MAY IMPACT THE MEMBRANE STRUCTURAL INTEGRITY. MEMBRANE MAINTENANCE AND REPLACEMENT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

B. INSPECTION WHICH INCLUDES TRASH AND FLOATABLES COLLECTION, SEDIMENT DEPTH DETERMINATION, AND VISIBLE DETERMINATION OF BACKWASH POOL DEPTH SHALL BE EASILY CONDUCTED FROM GRADE (OUTSIDE THE STRUCTURE).

C. MANUAL RINSING OF THE REUSABLE FILTER CARTRIDGES SHALL PROMOTE RESTORATION OF THE FLOW CAPACITY AND SEDIMENT CAPACITY OF THE FILTER CARTRIDGES, EXTENDING CARTRIDGE SERVICE LIFE.

D. SEDIMENT REMOVAL FROM THE FILTER TREATMENT DEVICE SHALL BE ABLE TO BE CONDUCTED USING A STANDARD MAINTENANCE TRUCK AND VACUUM APPARATUS, AND A MINIMUM ONE POINT OF ENTRY TO THE SUMP THAT IS UNOBSTRUCTED BY FILTER CARTRIDGES.

E. MAINTENANCE ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. FILTER CARTRIDGES SHALL BE ABLE TO BE MAINTAINED WITHOUT THE USE OF ADDITIONAL LIFTING EQUIPMENT.

EXECUTION

A. THE INSTALLATION OF A WATERTIGHT PRECAST CONCRETE DEVICE SHOULD CONFORM TO ASTM C 891 AND TO ANY STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF MANHOLES, WHICHEVER IS MORE STRINGENT. SELECTED SECTIONS OF A GENERAL SPECIFICATION THAT ARE APPLICABLE ARE SUMMARIZED BELOW.

B. THE WATERTIGHT PRECAST CONCRETE DEVICE IS INSTALLED IN SECTIONS IN THE FOLLOWING SEQUENCE:
- AGGREGATE BASE
- BASE SLAB
- TREATMENT CHAMBER AND CARTRIDGE DECK RISER SECTION(S)
- BYPASS SECTION
- CONNECT INLET AND OUTLET PIPES
- CONCRETE RISER SECTION(S) AND/OR TRANSITION SLAB (IF REQUIRED)
- MAINTENANCE RISER SECTION(S) (IF REQUIRED)
- FRAME AND ACCESS COVER

C. INLET AND OUTLET PIPES SHOULD BE SECURELY SET INTO THE DEVICE USING APPROVED PIPE SEALS (FLEXIBLE BOOT CONNECTIONS, WHERE APPLICABLE) SO THAT THE STRUCTURE IS WATERTIGHT, AND SUCH THAT ANY PIPE INTRUSION INTO THE DEVICE DOES NOT IMPACT THE DEVICE FUNCTIONALITY.

D. ADJUSTMENT UNITS (E.G. GRADE RINGS) SHOULD BE INSTALLED TO SET THE FRAME AND COVER AT THE REQUIRED ELEVATION. THE ADJUSTMENT UNITS SHOULD BE LAID IN A FULL BED OF MORTAR WITH SUCCESSIVE UNITS BEING JOINED USING SEALANT RECOMMENDED BY THE MANUFACTURER. FRAMES FOR THE COVER SHOULD BE SET IN A FULL BED OF MORTAR AT THE ELEVATION SPECIFIED.

E. IN SOME INSTANCES THE MAINTENANCE ACCESS WALL, IF PROVIDED, SHALL REQUIRE AN EXTENSION ATTACHMENT AND SEALING TO THE PRECAST WALL AND CARTRIDGE DECK AT THE JOB SITE, RATHER THAN AT THE PRECAST FACILITY. IN THIS INSTANCE, INSTALLATION OF THESE COMPONENTS SHALL BE PERFORMED ACCORDING TO INSTRUCTIONS PROVIDED BY THE MANUFACTURER.

F. FILTER CARTRIDGES SHALL BE INSTALLED IN THE CARTRIDGE DECK AFTER THE CONSTRUCTION SITE IS FULLY STABILIZED AND IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES AND RECOMMENDATIONS. CONTRACTOR TO CONTACT THE MANUFACTURER TO SCHEDULE CARTRIDGE DELIVERY AND REVIEW PROCEDURES/REQUIREMENTS TO BE COMPLETED TO THE DEVICE PRIOR TO INSTALLATION OF THE CARTRIDGES AND ACTIVATION OF THE SYSTEM.

G. MANUFACTURER SHALL COORDINATE DELIVERY OF FILTER CARTRIDGES AND OTHER INTERNAL COMPONENTS WITH CONTRACTOR. FILTER CARTRIDGES SHALL BE DELIVERED AND INSTALLED COMPLETE AFTER SITE IS STABILIZED AND UNIT IS READY TO ACCEPT CARTRIDGES. UNIT IS READY TO ACCEPT CARTRIDGES AFTER IS HAS BEEN CLEANED OUT AND ANY STANDING WATER, DEBRIS, AND OTHER MATERIALS HAVE BEEN REMOVED. CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO PROTECT THE FILTER CARTRIDGE RECEPTACLES AND FILTER CARTRIDGES FROM DAMAGE DURING CONSTRUCTION, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND GUIDANCE. FOR SYSTEMS WITH CARTRIDGES INSTALLED PRIOR TO FULL SITE STABILIZATION AND PRIOR TO SYSTEM ACTIVATION, THE CONTRACTOR CAN PLUG INLET AND OUTLET PIPES TO PREVENT STORMWATER AND OTHER INFLUENT FROM ENTERING THE DEVICE. PLUGS MUST BE REMOVED DURING THE ACTIVATION PROCESS.

H. THE MANUFACTURER SHALL PROVIDE AN OWNER'S MANUAL UPON REQUEST.

I. AFTER CONSTRUCTION AND INSTALLATION, AND DURING OPERATION, THE DEVICE SHALL BE INSPECTED AND CLEANED AS NECESSARY BASED ON THE MANUFACTURER'S RECOMMENDED INSPECTION AND MAINTENANCE GUIDELINES AND THE LOCAL REGULATORY AGENCY/BODY.

J. WHEN REPLACEMENT MEMBRANE FILTER ELEMENTS AND/OR OTHER PARTS ARE REQUIRED, ONLY MEMBRANE FILTER ELEMENTS AND PARTS APPROVED BY THE MANUFACTURER FOR USE WITH THE STORMWATER QUALITY FILTER DEVICE SHALL BE INSTALLED.

END OF SECTION

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MARK	DATE	REVISION DESCRIPTION		BY

JELLYFISH FILTER SPECIFICATIONS

Jellyfish

JF4 STANDARD

Scale = 1:50

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Jellyfish Filter

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS: US 6,511,595 B1, US 7,425,262 B2, US 7,470,366 B2, US 8,431,011 B2, CA 2, 399,462, CA 2,634,842,CA 2,856,466, KR 10-1287578, NZ 593461, NZ 606427, AU 2001281084, OTHER PATENTS PENDING.

DATE: #####	
DESIGNED:	DRAWN:
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 2 OF 2	

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STANDARD PERFORMANCE SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV)

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: filtration surface area, 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, filtration treatment device 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 GENERAL

2.1.1 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the internal components. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of their installed placement for the entire length of the cartridge.

2.1.2 Pollutant Storage: The Filter device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter treatment device shall have been field tested in accordance with either TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements – Amendments to TARP Tier II Protocol (NJDEP, 2009) or Washington State Technology Assessment Protocol – Ecology (TAPE), 2011 or later version. The field test shall have been verified in accordance with ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV). See Section 3.2 of this specification for field test performance requirements.

3.2 FIELD TEST PERFORMANCE

The field test (as specified in section 3.1.1)shall have monitored a minimum of twenty (20) TARP or TAPE qualifying storm events, and report at **minimum** the following results:

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median TSS removal efficiency of at least 85% and load based median SSC removal efficiency of at least 98%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, and an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce turbidity such that effluent turbidity is 15 NTU or lower.

3.2.5 Nutrients & Metals – The stormwater quality filter treatment device shall have ISO 14034 ETV Verified minimum load based removal efficiencies for the following:

3.2.5.1 Total Phosphorus (TP) Removal - Median TP removal efficiency of at least 49%.

3.2.5.2 Total Nitrogen (TN) Removal - Median TN removal efficiency of at least 39%.

3.2.5.3 Total Zinc (Zn) Removal - Median Zn removal efficiency of at least 69%.

3.2.5.4 Total Copper (Cu) Removal - Median Cu removal efficiency of at least 91%.

END OF SECTION