S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing and Stormwater Management Report

800 BURLOAK DRIVE

CITY OF BURLINGTON

EMSHIH DEVELOPMENTS INC.

April 2024

SLA File: 24012

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1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S.Llewellyn & Associates Limited has been retained by Emshih Developments Inc. to provide Consulting Engineering services in support of the proposed development located at 800 Burloak Drive in the City of Burlington (see Figure 1.0 for location plan). This report will outline the functional servicing and stormwater management strategy for the proposed development.

The proponent proposes to develop a mixed-use building with commercial ground floor areas, a three-storey above ground parking podium, two six-storey residential towers, and associated driveways, concrete curb/sidewalk, parking and landscaped areas.

This report will provide detailed information of the proposed functional servicing and stormwater management scheme for this development. Please refer to the site engineering prepared by S. Llewellyn and Associates Limited and the site plan prepared by ZO1 Architects for additional information.

1.2 BACKGROUND INFORMATION

The following documents were referenced in the preparation of this report:

Ref. 1: MOE Stormwater Management Practices Planning and Design Manual (Ministry of Environment, March 2003)

Ref. 2: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref. 3: Low Impact Development Stormwater Management Planning and Design Guide, Version 1 (CVC and TRCA, 2010)

Ref. 4: City of Burlington Standard Drawings (City of Burlington, March 2014)

Ref. 5: Halton Region Water and Wastewater Linear Design Manual (Halton Region, May 2014)



Figure 1.0 - Location Plan

2.0 STORMWATER MANAGEMENT CRITERIA

The following stormwater management (SWM) criteria will be applied to the site, in accordance with the City of Burlington requirements:

Quantity Control
The stormwater discharge from the subject site shall be controlled to the 5-year pre-development discharge rate for all storm events (2 to 100-year storm events).

Quality Control
The stormwater runoff from the post-development condition site must meet Level 1 (Enhanced) stormwater quality control (80% TSS removal, 90% average annual runoff treatment).

Water Balance
It is strongly recommended that the first 5mm of rainfall be retained and infiltrated or reused onsite.

2.1 PRE-DEVELOPMENT CONDITIONS

In the pre-development condition, the 2.02ha site is vacant land. The site is bound by Burloak Drive to the east, Canadian Pacific Railway tracks to the north, Hydro One lands to the south, and Sherwood Forest Park to the west. There is an existing 825mmø storm sewer flowing south at a slope of 0.73% within Fothergill Boulevard with an existing 600mmø storm lateral at a slope of 0.6% to the subject lands west of the site.

The topography of the site sheet drains south towards an existing swale along the south property line. The swale conveys drainage west through Sherwood Forest Park to Fothergill Boulevard. The remainder of runoff collected on-site sheet drains east to Burloak Drive.

A Storm Key Plan prepared by Urban Engineering Consultants for the Sheldon Creek Community indicates the subject lands were included in Block 72 catchment area discharging to the existing 825mmø storm sewer along Fothergill Boulevard. The existing 825mmø storm sewer has been designed to accommodate the subject site with a runoff co-efficient of 0.45. Refer to Appendix A for the Storm Key Plan for details.

Two (2) catchment areas, Catchments 101 and 102, have been identified in the pre-development condition. Catchment 101 represents the discharge which is captured by the existing swale along the south property line. Catchment 102 represents the external drainage which is captured by the existing swale along the south property line. For additional information regarding the pre-development catchment areas mentioned above, see Table 2.1 below and the Pre-Development Storm Drainage Area Plan in Appendix A.

Table 2.1 – Pre-Development Catchment Areas

Catchment ID	Description	Area (ha)	% Impervious	Runoff Coefficient (C)
101	Runoff to existing swale along south property line	2.02	28	0.45
102	External drainage to swale along property line	0.32	11	0.32

An analysis was performed on the above-mentioned catchment areas using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2-year to 100-year City of Burlington Design Storms. A summary of the results can be found in Table 2.2 and the detailed SWMHYMO input/output information in Appendix A for details.

Table 2.2 – Pre-Development Condition Site Discharge

Storm Event	Total Discharge from Site (m^3/s) [A]
2-Yr Event	0.133
5-Yr Event	**0.188**
10-Yr Event	0.229
25-Yr Event	0.295
50-Yr Event	0.349
100-Yr Event	0.410

[A] Total Discharge from Site = Discharge from Catchment 101 + Discharge from Catchment 102

2.2 POST-DEVELOPMENT CONDITIONS

It is proposed to construct a mixed-use building with commercial ground floor areas, a three-storey above ground parking podium, two six-storey residential towers, and associated driveways, concrete curb/sidewalk, parking and landscaped areas. It is proposed to connect to the existing 600mmø storm lateral within Fothergill Boulevard through an existing servicing easement at the property boundary in the southwest corner of the site. It is also proposed to service the development with a private storm sewer system designed and constructed in accordance with the standards and specifications of the City of Burlington.

Quantity Control

Three (3) catchment areas, Catchments 201, 202, and 102 have been identified in the post-development condition. Catchment 201 represents the drainage area for the portion of the site which will be captured via the on-site storm network and controlled by the proposed stormwater management tank which will ultimately discharge to the existing 825mmø storm sewer along Fothergill Boulevard. Catchment 202 represents the drainage area for the portion of the site which will sheet drain uncontrolled to Fothergill Boulevard. Catchment 102 represents the external drainage which will be captured via the on-site storm network and controlled by the proposed stormwater management tank which will ultimately discharge to the existing 825mmø storm sewer along Fothergill Boulevard. Table 2.3 below and the Post-Development Storm Drainage Area Plan in Appendix A distinguish the proposed characteristics for the subject lands.

Table 2.3 – Post-Development Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious	Run-off Coefficient
201	Controlled drainage to Fothergill Boulevard	1.96	79	0.79
202	Uncontrolled drainage to Fothergill Boulevard	0.06	0	0.25
102	External Drainage to Fothergill Boulevard	0.32	11	0.32

Water Quantity Control

It is proposed to apply quantity control measures to the runoff from Catchment 201 by means of a 250mmø orifice pipe installed between the SWM tank and MH4, to restrict discharge from the site to the 5-year pre-development allowable discharge rate.

With the installation of on-site quantity control measures for Catchment 201, it will be required to provide stormwater storage during storm events up to and including the 100-year event. To provide the required storage, an MC-3500 storage tank is proposed with approximately 627m^3 of storage. See Table 2.4 and Appendix A for the stage-storage-discharge relationship of the orifice control and on-site storage.

Table 2.4 – Proposed Condition Stage-Storage-Discharge			
Elevation (m)	**Storage (m^3)**	**Discharge (m^3/s)**	**Comments**
101.33	0	0.0000	Orifice Invert
101.40	0	0.000	Bottom of Tank
101.70	174	0.0861	0.30 Dee
102.00	336	0.1284	0.60 Deep
102.30	447	0.1599	0.90m Deep
102.49	540	0.1770	Top of Tank
102.79	627	0.2010	Top of Stone

An analysis was performed on Catchments 201, 202 and 102 using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2-year to 100-year City of Burlington Design Storms. A summary of the results can be found in Table 2.5 and the detailed SWMHYMO input/output information in Appendix A for details.

Table 2.5 – Proposed Condition Stormwater Discharge and Storage Volumes						
Storm Event	**201 + 102 (Controlled) (m^3/s) [A]**	**202 (Uncontrolled) (m^3/s) [A]**	**Total Discharge (m^3/s) [A]**	**Allowable Discharge (m^3/s) [B]**	**Required Storage (m^3) [A]**	**Storage Provided (m^3)**
2-Year	0.100	0.002	0.102	0.185	229.0	627
5-Year	0.121	0.004	0.124		308.6	
10-Year	0.141	0.005	0.141		365.4	
25-Year	0.163	0.007	0.163		439.0	
50-Year	0.165	0.009	0.172		496.1	
100-Year	0.177	0.010	0.183		558.3	
[A] From SWMHYMO Output. Refer to Appendix A for details. [B] Refer to Table 3.2 (5-Yr Event)						

This analysis determined the following:

- The proposed condition discharge rates will not exceed the allowable 5-year pre-development flow rate from the site.
- Catchment 201 and 102 will require 558.3m^3 of stormwater storage during the 100-year event, which can be accommodated within the proposed storage tank, having a volume of 627m^3.

Water Quality Control

The proposed development is required to achieve an “Enhanced” (80% TSS removal) level of water quality protection. To achieve this criterion, discharge from Catchment 201 will be subject to treatment from an Isolator Row Plus and a HydroStorm or similar ETV approved oil/grit separator before ultimately discharging to the 825mmø storm sewer along Fothergill Boulevard.

The Isolator Row Plus sizing chart was used to determine the TSS removal efficiency, and it was determined that 19 chambers of the Isolator Row Plus in the MC-3500 tank will provide 82% TSS removal based on the treated flow rate per chamber. Refer to Appendix B for the Isolator Row Plus ETV verification documentation and sizing chart.

The HydroStorm sizing software was used to determine the required size of oil/grit separator unit for the site. It was determined that a HydroStorm HS6 will provide 61% TSS removal and 91% average annual runoff treatment. See HydroStorm unit sizing procedures in Appendix B for details. However, HydroStorm units have been certified under the NJDEP for a 50% removal credit. Therefore, the HydroStorm unit has been assigned a TSS removal of 50% in the treatment train calculation in Table 2.6.

The treatment train mechanisms have been summarized in Table 2.6 below. In order to calculate the total TSS removal of the proposed development, the weighted average has been taken to calculate the cumulative TSS removal. Runoff from rooftop and landscaped areas are not included in the calculation because runoff from those surfaces is considered clean.

Table 2.6 – Post-Development Condition Stormwater Treatment Train

Surface Type	Drainage Area (m^2)	Treatment Train Mechanism #1 (% TSS Removal)	Treatment Train Mechanism #2 (% TSS Removal)	Total TSS Removal (%)
Asphalt & Concrete Surfaces	5,048	Isolator Row Plus (82%)	HydroStorm HS6 (50%)	91%

As such, the weighted average of TSS Removal from the proposed development reveals that the treatment train approach will provide 91% TSS removal and meet the 'Enhanced' (80% TSS removal) level of water quality protection.

HydroStorm units and the Isolator Row Plus require regular inspection and maintenance as per the manufacturer's specifications to ensure the units operate properly. See HydroStorm and Isolator Row Plus maintenance manuals in Appendix B for details.

2.3 SEDIMENT AND EROSION CONTROL

In order to minimize erosion during the grading and site servicing period of construction, the following measures will be implemented:

- Install silt fencing along the outer boundary of the site to ensure that sediment does not migrate to the adjacent properties;
- Install sediment control (silt sacks) in the proposed catchbasins as well as the nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system; and
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion.

To ensure and document the effectiveness of the erosion and sediment control structures, an appropriate inspection and maintenance program is necessary. The program will include the following activities:

- Inspection of the erosion and sediment controls (e.g. silt fences, sediment traps, outlets, vegetation, etc.) with follow up reports to the governing municipality; and
- The developer and/or his contractor shall be responsible for any costs incurred during the remediation of problem areas.

For details on the proposed erosion and sediment control for the proposed site, see the Grading & Erosion Control Plan included in the engineering drawings.

3.0 SANITARY SEWER SERVICING

3.1 EXSTING CONDITIONS

The site is located on the west side of Burloak Drive, south of CN Rail tracks. There is an existing 300mmø sanitary sewer flowing south at a slope of 0.9% within Fothergill Boulevard with an existing 200mmø sanitary lateral at a slope of 2.0% to the subject lands west of the site. There exists a servicing easement parallel to the south property line which connects the west property line of the subject site to Fothergill Boulevard.

3.2 SANITARY DEMAND

The proposed development consists of constructing two 6-storey mixed-use building containing 358 residential units, 700m^2 of daycare floor area and 1,500m^2 of commercial floor area. Wastewater generation for the site was calculated based on Tables 3-1 Residential Dry Weather Flow and 3-2 Commercial, Industrial, and Community Dry Weather Flow of the 2019 Regional Municipality of Halton Water and Wastewater Linear Design Manual.

Table 3.1 summarizes the population and Table 3.2 summarizes the sanitary sewer discharge rates from the proposed site.

Table 3.1 – Proposed Population

Occupancy Type	No. of Units [A]	Gross Floor Area (m^2) [A]	Population Density [B]	Population
Residential	358	---	3 per/unit	1,074
Commercial	---	2,200	90 per/ha	25
			Total Population [C]:	**1,099**

[A] Information from site plan prepared by Emshih Developments Inc., dated February 13, 2024.
[B] Residential population density assumed 3per/unit; commercial population density as per Table 2-1 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual for light commercial.
[C] Total population = Residential Population + Commercial Population

Table 3.2 – Proposed Sanitary Sewer Discharge

Site Area (ha)	Population [A]	Avg. Demand [B] (l/s)	Peak Factor [C]	Infiltration [D] (l/s)	Peak Flow [E] (l/s)
2.04	1,099	3.50	3.77	0.58	**13.78**

[A] From Table 3.1.
[B] Based on a unit sewage flow of 0.275m^{3}pcd (as per Table 3-1 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
[C] Based on the modified Harmon Formula (as per section 3.2.3 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
Peak Factor, $M = 1 + [14 / (4+P^{0.5})]$, where P is in thousands
[D] Based on an infiltration rate of 0.286 l/ha/s (as per Section 3.2.4 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
[E] Peak Flow = (Avg. Demand x Peak Factor) + Infiltration

Based on the above, the estimate of sanitary demand for the retirement building is:

13.78 L/s

3.3 PROPOSED SANITARY SERVICING

The proposed mix-use buildings will be serviced by a 200mmø sanitary sewer, designed and constructed in accordance with the Region of Halton standards. Drainage from this sewer will discharge to the existing 300mmø sanitary sewer along Fothergill Boulevard. Furthermore, it is proposed to connect the proposed 200mmø to the existing 200mmø sanitary lateral on Fothergill Drive through the servicing easement.

The minimum grade of the proposed 200mmø sanitary sewer will be 2.0%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.019 m^3/s (19 l/s). Therefore, the proposed 200mmø sanitary sewer at 2.0% grade is adequately sized to service the proposed development.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 EXISTING CONDITIONS

The existing municipal water distribution system consists of a 300mmø watermain located on Fothergill Boulevard. There is a 200mmø stub teed off the existing 300mmø on Fothergill Boulevard located just south of the servicing easement extending from Fothergill Boulevard to the proposed site. An existing fire hydrant is located within the Fothergill Boulevard cul-de-sac.

4.2 DOMESTIC WATER DEMAND

Water demand for the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual. Tables 4.1 summarizes the domestic water demand requirements for the Average Daily, Maximum Daily and Maximum Hourly demand scenarios.

Table 4.1 – Proposed Domestic Water Demand

Occupancy Type	Population / Gross Floor Area [A]	Avg. Daily Demand [B] (l/s)	Max. Daily Peaking Factor [C]	Max. Hourly Peaking Factor [D]	Max. Daily Demand [E] (l/s)	Max. Hourly Demand [F] (l/s)
Residential	1,074 per	3.42	2.25	4.00	**7.70**	13.68
Commercial	2,200 m^2	0.06	2.25	2.25	**0.14**	0.14
				Total:	**7.84**	13.82

[A] From Table 3.1.
[B] Based on a unit sewage flow of 0.275m^3pcd for residential and 24.75m^3/ha/day (as per Tables 3-1 and 3-2 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
[C] From Section 2.4.1 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual.
[D] From Table 2-2 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual.
[E] Max. Daily Demand = Avg. Daily Demand x Max. Daily Peaking Factor
[F] Max. Hourly Demand = Avg. Daily Demand x Max. Hourly Peaking Factor

4.3 FIRE FLOW DEMAND

Fire flow demands for the development are governed by a number of guidelines and criteria, such as the Public Fire Protection (Fire Underwriters Survey, 2020), the Ontario Building Code (OBC), and various codes and standards published by the National Fire Protection Association (NFPA). Since FUS criteria provides adjustments for sprinklered buildings (OBC does not), the FUS method was used to determine the fire flow demand for the proposed development.

The proposed building is fire-resistive construction (C=0.6), with limited combustible occupancy (-15% correction) and a fully supervised sprinkler system (-50% correction).

Exposure components are based on the worst-case scenario (Block B) following:

North Face: 0-3m (25% correction)
South Face: >30m (0% correction)
East Face: >30m (0% correction)
West Face: 10.1-20m (15% correction)

It is estimated that the required fire flow for the proposed development will be **517 l/s**. See the Fire Flow Demand Requirements in Appendix C for details.

At the time of this report, no hydrant flow information was available. A hydrant flow test will be completed at the detailed design stage to confirm the existing system has adequate pressure to service the proposed development.

4.4 PROPOSED WATER SERVICING AND ANALYSIS

The proposed water servicing for the site consists of connecting a 200mmø water service to the existing 200mmø water stub along Fothergill Boulevard through the existing servicing easement. The proposed 200mmø water service will be split within the site to provide a 150mmø domestic line and 200mmø fire service line for the proposed building and the proposed on-site fire hydrant. Water services for the site are to be designed and constructed in accordance with Region of Halton standards.

The proposed hydrant is located within 45m of the proposed Fire Department Connection. Also, the hydrant provides the minimum OBC required coverage of 90m to any portion of a building perimeter which is required to face a fire route. See the Site Servicing Plan for details and the location of hydrant.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that the proposed development at 800 Burloak Drive can be constructed to meet the requirements of the City of Burlington and Region of Halton. Therefore, it is recommended that:

- The development be graded and serviced in accordance with the Preliminary Grading and Erosion Control Plan and the Preliminary Site Servicing Plan prepared by S. Llewellyn & Associates Limited;

- A 250mmø orifice pipe be installed as per the Preliminary Site Servicing Plan and this report to provide adequate quantity control;

- StormTech MC-3500 underground storage tank be installed as per the Primary Site Servicing Plan and this report to provide 627m^3 of effective stormwater storage during storm events;

- A HydroStorm HS6 oil/grit separator and Isolator Row Plus be installed as per the Preliminary Site Servicing Plan and this report to provide effective stormwater quality control;

- Erosion and sediment controls be installed as described in this report to meet City of Burlington requirements; and

- The proposed sanitary and water servicing system be installed as per the Preliminary Site Servicing Plan and this report to adequately service the proposed development.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

Prepared by:

S. LLEWELLYN & ASSOCIATES LIMITED



A. Porco, P.Eng.

APPENDIX A

STORMWATER MANAGEMENT INFORMATION

PART A — PART B

BURLOAK DRIVE

BLOCK 72 INDUSTRIAL

BLK. 66 COMMERCIAL

BLK. 65 MEDIUM DENSITY RESIDENTIAL

BLK. 70 HIGH DENSITY RESIDENTIAL

BLK. 107 MEDIUM DENSITY RESIDENTIAL

BLK. 105 PARK

BLK. 106

SYSCON CT.

1-52 m x 2-44m CULVERT

600mm STM. @ 0.58 %

HEADWALL

DITCH SECTION W.L. - 50yr. SLOPE 0.60 %

STORM INTERCEPTOR DITCH

SERVICE CONN.

EX. CONN. TO

19m-375mm-1.00%

EX. STM. TO BE ABANDONED

INTERCEPTOR DITCH

PLUG TO BE INSTALLED

EX. 78m-600mm-0.45%

EX. 109.0m-825mm-1.05%

EX. 110.0m-675mm-0.99%

EX. 109.4m-750mm-1.05%

EX. 132.9m-900mm-0.63%

EX. 10.2m-300mm-1.03%

70.4m-450mm-1.09%

EX. 102.3m-450mm-0.89%

EX. 98m-450mm-0.78%

EX. 84m-525mm-0.93%

EX. 98m-600mm-0.98%

EX. 112.0m-450mm-0.62%

EX. 42m-1050mm-0.35%

EX. 94m-675mm-0.35%

EX. 34.9m-525mm-0.73%

EX. 27.2m-600mm-2.9%

EX. 78m-1500mm-1.17%

EX. 143.75m-900mm-1.20%

EX. 154m-1050mm-0.91%

EX. 123.70m-1050mm-1.32%

EX. 124.6m-1050mm-1.35%

EX. 124.65m-1200mm-0.83%

EX. 18m-825mm-0.30%

EX. 183.7m-1650mm-0.21%

EX. 73m-1050mm-0.35%

EX. 49.2m-675mm-0.22%

EX. 39.5m-675mm-0.38%

EX. 60.5m-675mm-0.38%

EX. 68.5m-750mm-0.51%

AMELIA CRES.

ELIZA CRES.

FOTHERGILL BLVD.

FOTHERGILL PHASE I

FOTHERGILL PHASE II

PHOEBE CRESCENT

AMANDA CRESCENT

HANNAH ST.

PRINCE WILLIAM WAY

BLVD.

82m-450mm-0.70%

75m-525mm-0.70%

73m-525mm-0.80%

73m-300mm-1.20%

73m-375mm-1.30%

87m-450mm-1.00%

98m-600mm-0.50%

28m-675mm-0.40% H.G.

40m-675mm-0.40% H.G.

65m-450mm-0.50% H.G.

84m-600mm-0.50% H.G.

20m-375mm-0.80%

30m-450mm-1.00%

250 STM CONN. @ 2.00%

300mm CONN @ 0.80%

450 STM CONN @ 1.00%

1200mm STM

1800mm STM

HIGH DENSITY RESIDENTIAL

T.H.

BLK.

EX. 6m EASEMENT

0.6m

DITCH SECTION

MIN. SLOPE=1.0%; CAP. = 2.7m³/sec.; VEL. = 1.5m/sec.

AREA = 34ha
PEAK FLOW = 7.08m³/sec.
SEWER CAP. = 4.37 m³/sec.
OVERLAND FLOW = 2.71m³/sec.

SHELDON CREEK DIVERSION CHANNEL

4.6m x 2.4m TWIN BOX CULVERT

SCHUELER CRES.

NEW STREET

FAIRVIEW

SHELDON CT.

RAILROAD

CANADIAN NATIONAL

BASEBALL DIAMOND

PARK

H.R.C.

R.O.W.

Sheldon Creek

RIVERSIDE DRIVE

MEADOW LANE

CAPE AVE.

3.3 — AREA (ha.)
RUN-OFF COEFFICIENT (0.45 UNLESS OTHERWISE NOTED)

OVERLAND OVERFLOW ROUTE

NOTE:
1) EXISTING SEWERS WERE DESIGNED FOR 2 YEAR STORM WITH A RUNOFF COEFFICIENT OF 0.85 (INDUSTRIAL).
2) WITH THE CHANGE IN LAND USE TO RESIDENTIAL, ALL EXISTING SEWERS HAVE ENOUGH CAPACITY FOR STORMS UP TO 5 YEARS.
3) ALL PROPOSED SEWERS ARE DESIGNED FOR FIVE YEAR STORM.
4) WEEPING TILES TO BE CONNECTED TO STORM SEWERS VIA SUMP PUMPS & BACK FLOW CHECK VALVES.

24.39m DITCH BLOCK

0.3 FREE-BOARD (WL 100yr FLOW)
0.45 FREE-BOARD (WL 50yr FLOW)

DITCH CROSS SECTION (LOOKING UPSTREAM) (SHELDON CREEK)

DRY WEATHER FLOW CHANNEL
AREA = 0.27m²
W.P. = 1.64 m
Y = 0.165m
y/b = 0.30
S = 0.002
S^½ = 0.0447
V = 1/0.032 x 0.03 x 0.0447 = 0.42 m/sec

FULL CHANNEL (0.45m FB)
AREA = 25.32m²
W.P. = 20.16m
Y = 1.256m
y/b = 1.164
S = 0.002
S^½ = 0.0447
V = 1/0.032 x 1.164 x 0.0447 = 1.626 m/sec
Q = 25.32 x 1.626 = 41.17 m³
50yr ACTUAL FLOW = 39.5m³/sec (PROVIDED BY HALTON REGION CONSERVATION AUTHORITY)

FULL CHANNEL (0.3m FB)
AREA = 28.3 m²
W.P. = 21.11 m
Y = 1.34 m
y/b = 1.216
S = 0.002
S^½ = 0.0447
V = 1/0.032 x 1.216 x 0.0447 = 1.7m/sec
Q = 28.3 x 1.7 = 48.1 m³/sec
100yr ACTUAL FLOW = 48.3 m³/sec (PROVIDED BY H.R.C.A.)

Nº	Date	By	REVISIONS
	MAR/93		AS CONSTRUCTED (PHASE I)
5	DEC./90		REVISED TO RESIDENTIAL SUBDIVISION.
4	MAR/83		BLOCK 27 LINEN FINALIZED.
3	NOV./82		BLOCK 27 SUBDIVIDED & SEWERS ON EASEMENT ADDED.
2	OCT/82		LINEN FINALIZED.
1	AUG 4/82		MANHOLES ON LOTS 12 & 16 EASEMENTS REMOVED.

Design J.R. | Checked | Date MARCH 19, 1982
Drawn G.B. | Checked

Scale 1:2000 (0 20 40 80)

REGISTERED PROFESSIONAL ENGINEER — CIVIL — BORIS IVANOFF — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — CIVIL — J. R. Bull — PROVINCE OF ONTARIO

APPROVALS

CITY OF BURLINGTON

EXEC. DIRECTOR OF PUBLIC WORKS

DATE Sept 3/82

REGION OF HALTON

CONSULTANT
URBAN ENGINEERING CONSULTANTS
CONSULTING ENGINEERS — TORONTO
239-3051

MUNICIPALITY
REGION OF HALTON
CITY OF BURLINGTON

TITLE
SHELDON CREEK COMMUNITY
STORM KEY PLAN
PHASE I PART A & B & PHASE II PART A & B

MUNICIPAL DRAWING Nº MDR-35-D

REGIONAL DRAWING Nº E-235-14

CONTRACT Nº

SHEET 1 OF 2

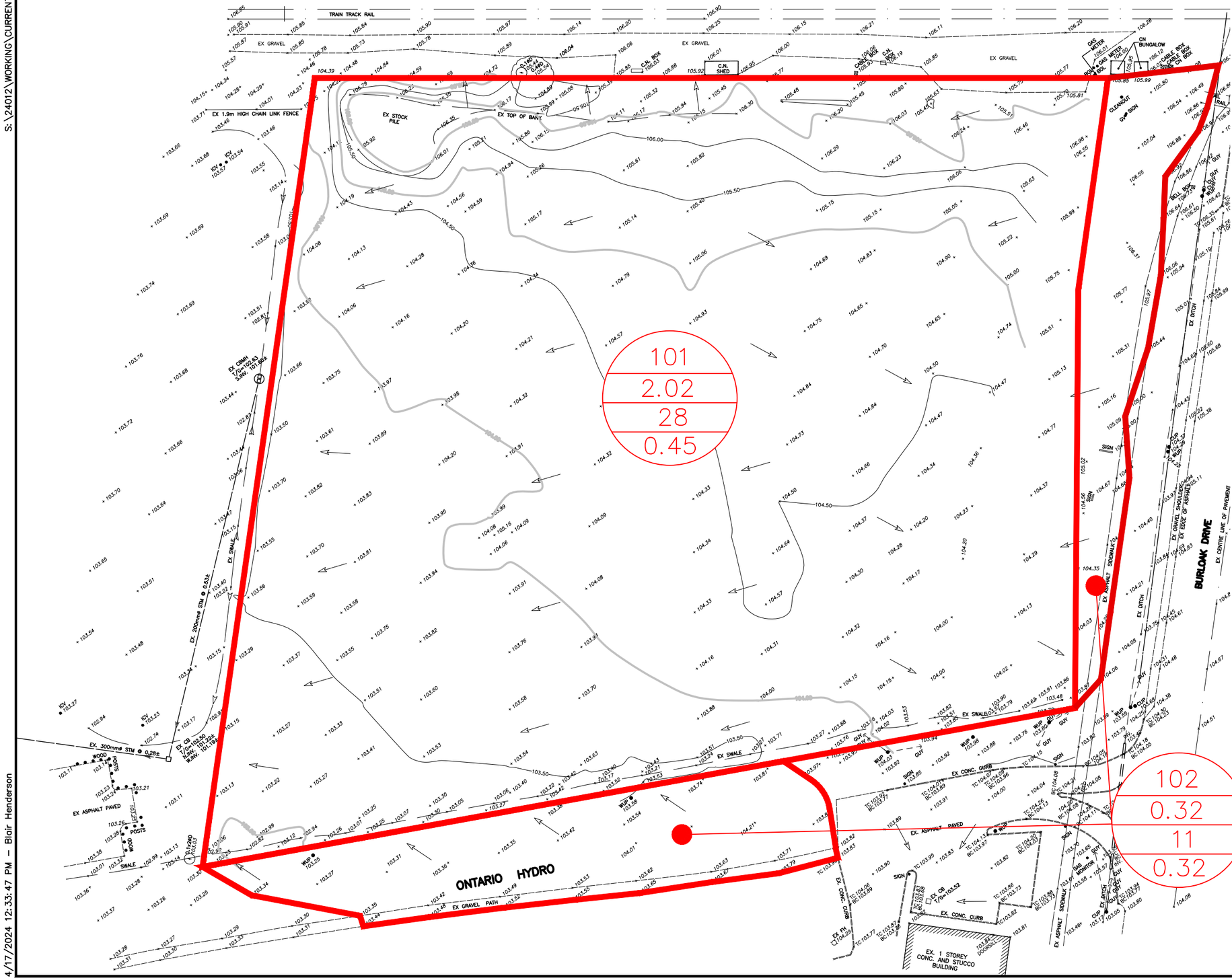
DB-340 / DB-400

DB-458 / DB-459

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4/17/2024 12:33:47 PM - Blair Henderson

CANADIAN NATIONAL RAILWAY



LEGEND

201
0.39
11
0.32

DRAINAGE AREA I.D.
DRAINAGE AREA (ha)
PERCENT IMPERVIOUS
RUNOFF COEFFICENT

EXISTING DIRECTION OF SHEET FLOW

FIGURE 1.0
PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:750

PROJECT: 800 BURLOAK DRIVE
PROJECT No.: 24012

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

S:\24012\WORKING\CURRENT\24012-DAP.dwg

CANADIAN NATIONAL RAILWAY

TRAIN TRACK RAIL

202
0.06
0
0.25

201
1.96
79
0.79

102
0.32
11
0.32

LEGEND

201
0.39
11
0.32

DRAINAGE AREA I.D.
DRAINAGE AREA (ha)
PERCENT IMPERVIOUS
RUNOFF COEFFICENT

DIRECTION OF SHEET FLOW

EMERGENCY OVERLAND FLOW ROUTE

FIGURE 2.0
POST-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:750

PROJECT: 800 BURLOAK DRIVE
PROJECT No.: 24012

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4/17/2024 12:33:49 PM - Blair Henderson

800 Burloak Drive
Burlington, Ontario

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

STAGE-STORAGE-DISCHARGE CALCULATIONS

Catchment 201
Outlet Device No. 1 (Quantity)

Type:	Orifice Pipe
Diameter (mm)	**250**
Area (m^2)	0.04909
Invert Elev. (m)	101.33
C/L Elev. (m)	101.46
Disch. Coeff. (C_d)	0.8
Discharge (Q) =	$C_d A (2 g H)^{0.5}$
Number of Orifices:	1

		SWM Pond Volumes						Outlet No. 1	
	Elevation m	Area m^2	Tank Incremental Volume	Additional Incremental Underground	Additional Incremental Surface m^3	Cumulative Volume m^3	Active Storage Volume m^3	H m	Discharge m^3/s
Orifice Invert	101.33	0	0	0.0	0	0	0	0.000	0.0000
Tank Invert	101.40	479	0	0.0	0	0	0	0.000	0.0000
0.30 Deep	101.70	479	174	0.0	0	174	174	0.245	0.0861
0.60m Deep	102.00	479	162	0.0	0	336	336	0.545	0.1284
0.90m Deep	102.30	479	111	0.0	0	447	447	0.845	0.1599
Top of Tank	102.49	479	93	0.0	0	540	540	1.035	0.1770
Top of Stone	102.79	479	87	0.0	0	627	627	1.335	0.2010

```
00001> 2     Metric units
00002> *#*************************************************************************|
00003> *#  Project Name: 800 BURLOAK DRIVE
00004> *#                BURLINGTON, ONTARIO
00005> *#  JOB NUMBER  : 24012
00006> *#       Date   : APRIL 2024
00007> *#    Revised   :
00008> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00009> *#       File   : 24012.DAT
00010> *#*************************************************************************|
00011> *
00012> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
00013>                     BUR6_002.stm
00014> *
00015> READ STORM          STORM_FILENAME "STORM.001"
00016> *
00017> *#*************************************************************************|
00018> *#
00019> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING (PHASE 1)
00020> *#        ========================================================
00021> *#
00022> *#*************************************************************************|
00023> *# CATCHMENT 101 -  EXISTING DRAINAGE TO FOTHERGILL BOULEVARD
00024> *
00025> CALIB STANDHYD      ID=[1], NHYD=["101"], DT=[1](min), AREA=[2.02](ha),
00026>                     XIMP=[0.28], TIMP=[0.28], DWF=[0](cms), LOSS=[2],
00027>                     SCS curve number CN=[79],
00028>                     Pervious   surfaces: IAper=[6.75](mm), SLPP=[2.5](%),
00029>                                          LGP=[50](m), MNP=[0.250], SCP=[0](min),
00030>                     Impervious surfaces: IAimp=[1](mm), SLPI=[2.5](%),
00031>                                          LGI=[50](m), MNI=[0.013], SCI=[0](min),
00032>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00033> *%-----------------|-------------------------------------------------------|
00034> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
00035> *
00036> CALIB NASHYD        ID=[2], NHYD=["102"], DT=[1]min, AREA=[0.32](ha),
00037>                     DWF=[0](cms),  CN/C=[79], IA=[6.75](mm),
00038>                     N=[3], TP=[0.20]hrs,
00039>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00040> *%-----------------|-------------------------------------------------------|
00041> ADD HYD             IDsum=[3], NHYD=["101+102"], IDs to add=[1,2]
00042> *%-----------------|-------------------------------------------------------|
00043>
00044> *#
00045> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00046> *#        ==============================================
00047> *#
00048> **#************************************************************************|
00049> *# CATCHMENT 201 - Proposed Condition (Controlled to FOTHERGILL BOULEVARD)
00050> *
00051> CALIB STANDHYD      ID=[1], NHYD=["201"], DT=[1](min), AREA=[2.02](ha),
00052>                     XIMP=[0.715], TIMP=[0.715], DWF=[0](cms), LOSS=[2],
00053>                     SCS curve number CN=[55],
00054>                     Pervious   surfaces: IAper=[2.50](mm), SLPP=[5.0](%),
00055>                                          LGP=[20.0](m), MNP=[0.25], SCP=[0](min)
00056>                     Impervious surfaces: IAimp=[1.00](mm), SLPI=[5.0](%),
00057>                                          LGI=[10](m), MNI=[0.015], SCI=[0](min),
00058>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00059> *%-----------------|-------------------------------------------------------|
00060> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
00061> *
00062> CALIB NASHYD        ID=[2], NHYD=["102"], DT=[1]min, AREA=[0.32](ha),
00063>                     DWF=[0](cms),  CN/C=[79], IA=[6.75](mm),
00064>                     N=[3], TP=[0.20]hrs,
00065>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
```

```
00066> *%-----------------|-------------------------------------------------------|
00067> ADD HYD             IDsum=[3], NHYD=["201+102"], IDs to add=[1,2]
00068> *%-----------------|-------------------------------------------------------|
00069> *#
00070> *
00071> ROUTE RESERVOIR     IDout=[4],   NHYD=["CTRL"],  IDin=[3],
00072>                     RDT=[1](min),
00073>                           TABLE of ( OUTFLOW-STORAGE ) values
00074>                                    (cms) - (ha-m)
00075>                                     0.0    , 0.0
00076>                                     0.0861 , 0.0174
00077>                                     0.1284 , 0.0336
00078>                                     0.1599 , 0.0447
00079>                                     0.1700 , 0.0540
00080>                                     0.2010 , 0.0627
00081>                                        -1  ,  -1    (max twenty pts)
00082>                           IDovf=[5], NHYDovf=["OVF"]
00083> *%-----------------|-------------------------------------------------------|
00084> *# CATCHMENT 102 -  UNCONTROLLED DRAINAGE TO FOTHERGILL BOULEVARD
00085> *
00086> CALIB NASHYD        ID=[6], NHYD=["202"], DT=[1]min, AREA=[0.06](ha),
00087>                     DWF=[0](cms),  CN/C=[79], IA=[6.75](mm),
00088>                     N=[3], TP=[0.10]hrs,
00089>                     RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
00090> *%-----------------|-------------------------------------------------------|
00091> ADD HYD             IDsum=[7], NHYD=["CTRL+202"], IDs to add=[4,5,6]
00092> *%-----------------|-------------------------------------------------------|
00093> **#*****************************************************************|
00094> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
00095> *
00096> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
00097>                     BUR6_005.stm
00098> *
00099> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
00100>                     BUR6_010.stm
00101> *
00102> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
00103>                     BUR6_025.stm
00104> *
00105> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
00106>                     BUR6_050.stm
00107> *
00108> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
00109>                     BUR6_100.stm
00110> *
00111> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[300]
00112>                     MTHP25MM.stm
00113> *%-----------------|-------------------------------------------------------|
00114> FINISH
00115>
00116>
00117>
00118>
00119>
00120>
00121>
00122>
00123>
00124>
00125>
00126>
00127>
00128>
00129>
00130>
```

```
00001> ================================================================================
00002>
00003>   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>       S  W W  M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
00008>                                                        9   9  9   9   # 3902680
00009>         StormWater Management HYdrologic Model          999    999    =========
00010>
00011> ********************************************************************************
00012> ************************** SWMHYMO Ver/4.05  ***************************
00013> *********  A single event and continuous hydrologic simulation model  *********
00014> *********     based on the principles of HYMO and its successors      *********
00015> *********                  OTTHYMO-83 and OTTHYMO-89.                  *********
00016> ********************************************************************************
00017> ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
00018> *********                  Ottawa,  Ontario: (613) 836-3884           *********
00019> *********                  Gatineau, Quebec: (819) 243-6858           *********
00020> *********                  E-Mail: swmhymo@jfsa.Com                   *********
00021> ********************************************************************************
00022>
00023> +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024> +++++++++ Licensed user: S. Llewellyn & Associates Ltd                +++++++++
00025> +++++++++                Burlington          SERIAL#:3902680        +++++++++
00026> +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028> ********************************************************************************
00029> *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
00030> *********           Maximum value for ID numbers  :     10            *********
00031> *********           Max. number of rainfall points: 105408            *********
00032> *********           Max. number of flow points    : 105408            *********
00033> ********************************************************************************
00034>
00035>
00036> **********************   D E T A I L E D   O U T P U T   **********************
00037> ********************************************************************************
00038> *         DATE: 2024-04-25     TIME: 16:55:27     RUN COUNTER: 000794          *
00039> ********************************************************************************
00040> * Input   filename: T:\PROJECTS\24012\SWMHYMO\24012.dat                        *
00041> * Output  filename: T:\PROJECTS\24012\SWMHYMO\24012.out                       *
00042> * Summary filename: T:\PROJECTS\24012\SWMHYMO\24012.sum                       *
00043> * User comments:                                                             *
00044> * 1:_____________________________________________________________________    *
00045> * 2:_____________________________________________________________________    *
00046> * 3:_____________________________________________________________________    *
00047> ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*************************************************************************|
00052> *#  Project Name: 800 BURLOAK DRIVE
00053> *#               BURLINGTON, ONTARIO
00054> *#  JOB NUMBER  : 24012
00055> *#       Date   : APRIL 2024
00056> *#    Revised   :
00057> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00058> *#       File   : 24012.DAT
00059> *#*************************************************************************|
00060> *
00061>   ** END OF RUN :   1
00062>
00063> ********************************************************************************
00064>
00065>
00066>
00067>
00068>
00069> --------------------
00070> | START            |  Project  dir.: T:\PROJECTS\24012\SWMHYMO\
00071> --------------------  Rainfall dir.: T:\PROJECTS\24012\SWMHYMO\
00072>     TZERO =   .00 hrs on       0
00073>     METOUT=   2 (output = METRIC)
00074>     NRUN  = 002
00075>     NSTORM=   1
00076>               #  1=BUR6_002.stm
00077> --------------------------------------------------------------------------------
00078> 002:0002--------------------------------------------------------------------------
00079> *#*************************************************************************|
00080> *#  Project Name: 800 BURLOAK DRIVE
00081> *#               BURLINGTON, ONTARIO
00082> *#  JOB NUMBER  : 24012
00083> *#       Date   : APRIL 2024
00084> *#    Revised   :
00085> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00086> *#       File   : 24012.DAT
00087> *#*************************************************************************|
00088> *
00089> --------------------------------------------------------------------------------
00090> 002:0002--------------------------------------------------------------------------
00091> *
00092> --------------------
00093> | READ STORM       |     Filename: Burlington 2-yr 6hr CHICAGO  (A=681.52,
00094> | Ptotal=  40.93 mm|     Comments: Burlington 2-yr 6hr CHICAGO  (A=681.52,
00095> --------------------
00096>                TIME    RAIN  |  TIME    RAIN  |  TIME    RAIN  |  TIME    RAIN
00097>                hrs   mm/hr   |  hrs   mm/hr   |  hrs   mm/hr   |  hrs   mm/hr
00098>                 .17   1.715  |  1.67   8.325  |  3.17   4.467  |  4.67   2.213
00099>                 .33   1.858  |  1.83  19.646  |  3.33   3.978  |  4.83   2.105
00100>                 .50   2.032  |  2.00  78.391  |  3.50   3.595  |  5.00   2.008
00101>                 .67   2.247  |  2.17  25.776  |  3.67   3.286  |  5.17   1.920
00102>                 .83   2.522  |  2.33  13.777  |  3.83   3.030  |  5.33   1.841
00103>                1.00   2.888  |  2.50   9.511  |  4.00   2.815  |  5.50   1.769
00104>                1.17   3.399  |  2.67   7.331  |  4.17   2.632  |  5.67   1.703
00105>                1.33   4.172  |  2.83   6.005  |  4.33   2.474  |  5.83   1.642
00106>                1.50   5.492  |  3.00   5.111  |  4.50   2.335  |  6.00   1.586
00107>
00108> --------------------------------------------------------------------------------
00109> 002:0003--------------------------------------------------------------------------
00110> *
00111> *#*************************************************************************|
00112> *#
00113> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING (PHASE 1)
00114> *#        ============================================================
00115> *#
00116> *#*************************************************************************|
00117> *# CATCHMENT 101 -  EXISTING DRAINAGE TO FOTHERGILL BOULEVARD
00118> *
00119> ----------------------
00120> | CALIB STANDHYD     |   Area    (ha)=    2.02
00121> | 01:101    DT= 1.00 |   Total Imp(%)=   28.00   Dir. Conn.(%)=   28.00
00122> ----------------------
00123>                                IMPERVIOUS    PERVIOUS (i)
00124>      Surface Area     (ha)=        .57          1.45
00125>      Dep. Storage     (mm)=       1.00          6.75
00126>      Average Slope     (%)=       2.50          2.50
00127>      Length            (m)=      50.00         50.00
00128>      Mannings n             =       .013          .250
00129>
00130>      Max.eff.Inten.(mm/hr)=      78.39         13.67
00131>                over (min)        1.00         18.00
00132>      Storage Coeff.  (min)=       1.41 (ii)    18.14 (ii)
00133>      Unit Hyd. Tpeak (min)=       1.00         18.00
00134>      Unit Hyd. peak  (cms)=        .86           .06
00135>                                                          *TOTALS*
00136>      PEAK FLOW       (cms)=        .12           .03          .130 (iii)
00137>      TIME TO PEAK    (hrs)=       2.00          2.32         2.000
00138>      RUNOFF VOLUME    (mm)=      39.93         11.49        19.453
00139>      TOTAL RAINFALL   (mm)=      40.93         40.93        40.933
00140>      RUNOFF COEFFICIENT   =        .98           .28          .475
00141>
00142>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00143>            CN* =  79.0    Ia = Dep. Storage  (Above)
00144>         (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00145>              THAN THE STORAGE COEFFICIENT.
00146>        (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00147>
00148> --------------------------------------------------------------------------------
00149> 002:0004--------------------------------------------------------------------------
00150> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
00151> *
00152> ----------------------
00153> | CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
00154> | 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
00155> ----------------------   U.H. Tp(hrs)=    .200
00156>
00157>      Unit Hyd Qpeak  (cms)=     .061
00158>
00159>      PEAK FLOW       (cms)=     .009 (i)
00160>      TIME TO PEAK    (hrs)=    2.233
00161>      RUNOFF VOLUME    (mm)=   11.488
00162>      TOTAL RAINFALL   (mm)=   40.933
00163>      RUNOFF COEFFICIENT   =     .281
00164>
00165>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00166>
00167> --------------------------------------------------------------------------------
00168> 002:0005--------------------------------------------------------------------------
00169> ------------------------
00170> | ADD HYD (101+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00171> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00172>                        ID1 01:101          2.02     .130    2.00  19.45    .000
00173>                      +ID2 02:102            .32     .009    2.23  11.49    .000
00174>                        ========================================================
00175>                        SUM 03:101+102      2.34     .133    2.00  18.36    .000
00176>
00177>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00178>
00179> --------------------------------------------------------------------------------
00180> 002:0006--------------------------------------------------------------------------
00181> *#
00182> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00183> *#        ==============================================
00184> *#
00185> **#************************************************************************|
00186> *# CATCHMENT 201 - Proposed Condition (Controlled to FOTHERGILL BOULEVARD)
00187> *
00188> ----------------------
00189> | CALIB STANDHYD     |   Area    (ha)=    2.02
00190> | 01:201    DT= 1.00 |   Total Imp(%)=   71.50   Dir. Conn.(%)=   71.50
00191> ----------------------
00192>                                IMPERVIOUS    PERVIOUS (i)
00193>      Surface Area     (ha)=       1.44          .58
00194>      Dep. Storage     (mm)=       1.00         2.50
00195>      Average Slope     (%)=       5.00         5.00
00196>      Length            (m)=      10.00        20.00
00197>      Mannings n             =       .015         .250
00198>
00199>      Max.eff.Inten.(mm/hr)=      78.39         8.95
00200>                over (min)        1.00        10.00
00201>      Storage Coeff.  (min)=        .48 (ii)    9.76 (ii)
00202>      Unit Hyd. Tpeak (min)=       1.00        10.00
00203>      Unit Hyd. peak  (cms)=       1.49          .12
00204>                                                          *TOTALS*
00205>      PEAK FLOW       (cms)=        .31          .01          .320 (iii)
00206>      TIME TO PEAK    (hrs)=       1.97         2.13         2.000
00207>      RUNOFF VOLUME    (mm)=      39.93         6.00        30.261
00208>      TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
00209>      RUNOFF COEFFICIENT   =        .98          .15          .739
00210>
00211>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00212>            CN* =  55.0    Ia = Dep. Storage  (Above)
00213>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00214>            THAN THE STORAGE COEFFICIENT.
00215>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00216>
00217> --------------------------------------------------------------------------------
00218> 002:0007--------------------------------------------------------------------------
00219> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
00220> *
00221> ----------------------
00222> | CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
00223> | 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
00224> ----------------------   U.H. Tp(hrs)=    .200
00225>
00226>      Unit Hyd Qpeak  (cms)=     .061
00227>
00228>      PEAK FLOW       (cms)=     .009 (i)
00229>      TIME TO PEAK    (hrs)=    2.233
00230>      RUNOFF VOLUME    (mm)=   11.488
00231>      TOTAL RAINFALL   (mm)=   40.933
00232>      RUNOFF COEFFICIENT   =     .281
00233>
00234>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00235>
00236> --------------------------------------------------------------------------------
00237> 002:0008--------------------------------------------------------------------------
00238> ------------------------
00239> | ADD HYD (201+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00240> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00241>                        ID1 01:201          2.02     .320    2.00  30.26    .000
00242>                      +ID2 02:102            .32     .009    2.23  11.49    .000
00243>                        ========================================================
00244>                        SUM 03:201+102      2.34     .323    2.00  27.69    .000
00245>
00246>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00247>
00248> --------------------------------------------------------------------------------
00249> 002:0009--------------------------------------------------------------------------
00250> *#
00251> *
00252> ----------------------
00253> | ROUTE RESERVOIR    |     Requested routing time step =  1.0 min.
00254> |  IN>03:(201+10)    |
00255> | OUT<04:(CTRL  )    |     =========  OUTFLOW STORAGE TABLE  =========
00256> ----------------------   OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
00257>                            (cms)     (ha.m.)  |    (cms)    (ha.m.)
00258>                             .000  .0000E+00   |     .160  .4470E-01
00259>                             .086  .1740E-01   |     .170  .5400E-01
00260>                             .128  .3360E-01   |     .201  .6270E-01
00261>
00262>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00263>      ---------------           (ha)     (cms)     (hrs)       (mm)
00264>      INFLOW >03: (201+10)       2.34     .323     2.000     27.694
00265>      OUTFLOW<04: (CTRL  )       2.34     .100     2.167     27.694
00266>     OVERFLOW<05: (OVF   )        .00     .000      .000      .000
00267>
00268>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00269>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00270>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
```

```
00271>
00272>
00273>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   31.053
00274>                    TIME SHIFT OF PEAK FLOW          (min)=    10.00
00275>                    MAXIMUM  STORAGE   USED       (ha.m.)=.2290E-01
00276>
00277> ------------------------------------------------------------------------------
00278> 002:0010------------------------------------------------------------------------
00279> *# CATCHMENT 102 -  UNCONTROLLED DRAINAGE TO FOTHERGILL BOULEVARD
00280> *
00281> ----------------------
00282> | CALIB NASHYD       |   Area    (ha)=     .06   Curve Number   (CN)=79.00
00283> | 06:202    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
00284> ----------------------   U.H. Tp(hrs)=    .100
00285>
00286>      Unit Hyd Qpeak  (cms)=     .023
00287>
00288>      PEAK FLOW       (cms)=     .002 (i)
00289>      TIME TO PEAK    (hrs)=    2.067
00290>      RUNOFF VOLUME    (mm)=   11.486
00291>      TOTAL RAINFALL   (mm)=   40.933
00292>      RUNOFF COEFFICIENT   =     .281
00293>
00294>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00295>
00296> ------------------------------------------------------------------------------
00297> 002:0011------------------------------------------------------------------------
00298> ------------------------
00299> | ADD HYD (CTRL+202  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00300> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00301>                      ID1 04:CTRL          2.34      .100    2.17  27.69    .000
00302>                     +ID2 05:OVF            .00      .000     .00    .00    .000
00303>                     +ID3 06:202            .06      .002    2.07  11.49    .000
00304>                      ========================================================
00305>                      SUM 07:CTRL+202      2.40      .102    2.17  27.29    .000
00306>
00307>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00308>
00309> ------------------------------------------------------------------------------
00310> 002:0012------------------------------------------------------------------------
00311> **#*****************************************************************************|
00312> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
00313> *
00314>   ** END OF RUN :   4
00315>
00316> ******************************************************************************
00317>
00318>
00319>
00320>
00321>
00322> ---------------------
00323> | START             |  Project  dir.: T:\PROJECTS\24012\SWMHYMO\
00324> ---------------------  Rainfall dir.: T:\PROJECTS\24012\SWMHYMO\
00325>     TZERO =   .00 hrs on       0
00326>     METOUT=   2 (output = METRIC)
00327>     NRUN  = 005
00328>     NSTORM=   1
00329>               #  1=BUR6_005.stm
00330> ------------------------------------------------------------------------------
00331> 005:0002------------------------------------------------------------------------
00332> *#*****************************************************************************|
00333> *#  Project Name: 800 BURLOAK DRIVE
00334> *#               BURLINGTON, ONTARIO
00335> *#  JOB NUMBER  : 24012
00336> *#       Date   : APRIL 2024
00337> *#    Revised   :
00338> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00339> *#       File   : 24012.DAT
00340> *#*****************************************************************************|
00341> *
00342> ------------------------------------------------------------------------------
00343> 005:0002------------------------------------------------------------------------
00344> *
00345> ---------------------
00346> | READ STORM        |    Filename: Burlington 5-yr 6hr CHICAGO    (A=802.04
00347> | Ptotal=  53.05 mm |    Comments: Burlington 5-yr 6hr CHICAGO    (A=802.04
00348> ---------------------
00349>               TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
00350>               hrs    mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
00351>                .17   2.348 |  1.67  10.690 |  3.17   5.897 |  4.67   3.004
00352>                .33   2.537 |  1.83  24.479 |  3.33   5.279 |  4.83   2.862
00353>                .50   2.766 |  2.00 101.312 |  3.50   4.790 |  5.00   2.734
00354>                .67   3.048 |  2.17  31.941 |  3.67   4.394 |  5.17   2.619
00355>                .83   3.407 |  2.33  17.333 |  3.83   4.065 |  5.33   2.514
00356>               1.00   3.881 |  2.50  12.145 |  4.00   3.788 |  5.50   2.419
00357>               1.17   4.539 |  2.67   9.469 |  4.17   3.550 |  5.67   2.331
00358>               1.33   5.523 |  2.83   7.826 |  4.33   3.344 |  5.83   2.251
00359>               1.50   7.185 |  3.00   6.709 |  4.50   3.164 |  6.00   2.176
00360>
00361> ------------------------------------------------------------------------------
00362> 005:0003------------------------------------------------------------------------
00363> *
00364> *#*****************************************************************************|
00365> *#
00366> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING (PHASE 1)
00367> *#        ============================================================
00368> *#
00369> *#*****************************************************************************|
00370> *# CATCHMENT 101 -  EXISTING DRAINAGE TO FOTHERGILL BOULEVARD
00371> *
00372> ----------------------
00373> | CALIB STANDHYD     |   Area    (ha)=    2.02
00374> | 01:101    DT= 1.00 |   Total Imp(%)=   28.00   Dir. Conn.(%)=   28.00
00375> ----------------------
00376>                              IMPERVIOUS    PERVIOUS (i)
00377>      Surface Area     (ha)=       .57         1.45
00378>      Dep. Storage     (mm)=      1.00         6.75
00379>      Average Slope     (%)=      2.50         2.50
00380>      Length            (m)=     50.00        50.00
00381>      Mannings n             =     .013         .250
00382>
00383>      Max.eff.Inten.(mm/hr)=    101.31        25.50
00384>                  over (min)      1.00        14.00
00385>      Storage Coeff.  (min)=      1.27 (ii)   14.31 (ii)
00386>      Unit Hyd. Tpeak (min)=      1.00        14.00
00387>      Unit Hyd. peak  (cms)=       .92          .08
00388>                                                          *TOTALS*
00389>      PEAK FLOW       (cms)=       .16          .06          .181 (iii)
00390>      TIME TO PEAK    (hrs)=      2.00         2.22         2.000
00391>      RUNOFF VOLUME    (mm)=     52.05        18.83        28.137
00392>      TOTAL RAINFALL   (mm)=     53.05        53.05        53.053
00393>      RUNOFF COEFFICIENT   =       .98          .36          .530
00394>
00395>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00396>            CN* =  79.0    Ia = Dep. Storage  (Above)
00397>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00398>            THAN THE STORAGE COEFFICIENT.
00399>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00400>
00401> ------------------------------------------------------------------------------
00402> 005:0004------------------------------------------------------------------------
00403> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
00404> *
00405> ----------------------
00406> | CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
00407> | 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
00408> ----------------------   U.H. Tp(hrs)=    .200
00409>
00410>      Unit Hyd Qpeak  (cms)=     .061
00411>
00412>      PEAK FLOW       (cms)=     .015 (i)
00413>      TIME TO PEAK    (hrs)=    2.217
00414>      RUNOFF VOLUME    (mm)=   18.835
00415>      TOTAL RAINFALL   (mm)=   53.053
00416>      RUNOFF COEFFICIENT   =     .355
00417>
00418>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00419>
00420> ------------------------------------------------------------------------------
00421> 005:0005------------------------------------------------------------------------
00422> ------------------------
00423> | ADD HYD (101+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00424> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00425>                      ID1 01:101           2.02      .181    2.00  28.14    .000
00426>                     +ID2 02:102            .32      .015    2.22  18.84    .000
00427>                      ========================================================
00428>                      SUM 03:101+102       2.34      .188    2.00  26.86    .000
00429>
00430>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00431>
00432> ------------------------------------------------------------------------------
00433> 005:0006------------------------------------------------------------------------
00434> *#
00435> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00436> *#        ==============================================
00437> *#
00438> **#*****************************************************************************|
00439> *# CATCHMENT 201 - Proposed Condition (Controlled to FOTHERGILL BOULEVARD)
00440> *
00441> ----------------------
00442> | CALIB STANDHYD     |   Area    (ha)=    2.02
00443> | 01:201    DT= 1.00 |   Total Imp(%)=   71.50   Dir. Conn.(%)=   71.50
00444> ----------------------
00445>                              IMPERVIOUS    PERVIOUS (i)
00446>      Surface Area     (ha)=      1.44         .58
00447>      Dep. Storage     (mm)=      1.00        2.50
00448>      Average Slope     (%)=      5.00        5.00
00449>      Length            (m)=     10.00       20.00
00450>      Mannings n             =     .015         .250
00451>
00452>      Max.eff.Inten.(mm/hr)=    101.31       16.46
00453>                  over (min)      1.00        8.00
00454>      Storage Coeff.  (min)=       .43 (ii)    7.71 (ii)
00455>      Unit Hyd. Tpeak (min)=      1.00        8.00
00456>      Unit Hyd. peak  (cms)=      1.53         .14
00457>                                                          *TOTALS*
00458>      PEAK FLOW       (cms)=       .41         .02          .419 (iii)
00459>      TIME TO PEAK    (hrs)=      1.95        2.10         2.000
00460>      RUNOFF VOLUME    (mm)=     52.05        9.89        40.037
00461>      TOTAL RAINFALL   (mm)=     53.05       53.05        53.053
00462>      RUNOFF COEFFICIENT   =       .98         .19          .755
00463>
00464>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00465>            CN* =  55.0    Ia = Dep. Storage  (Above)
00466>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00467>            THAN THE STORAGE COEFFICIENT.
00468>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00469>
00470> ------------------------------------------------------------------------------
00471> 005:0007------------------------------------------------------------------------
00472> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
00473> *
00474> ----------------------
00475> | CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
00476> | 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
00477> ----------------------   U.H. Tp(hrs)=    .200
00478>
00479>      Unit Hyd Qpeak  (cms)=     .061
00480>
00481>      PEAK FLOW       (cms)=     .015 (i)
00482>      TIME TO PEAK    (hrs)=    2.217
00483>      RUNOFF VOLUME    (mm)=   18.835
00484>      TOTAL RAINFALL   (mm)=   53.053
00485>      RUNOFF COEFFICIENT   =     .355
00486>
00487>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00488>
00489> ------------------------------------------------------------------------------
00490> 005:0008------------------------------------------------------------------------
00491> ------------------------
00492> | ADD HYD (201+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00493> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00494>                      ID1 01:201           2.02      .419    2.00  40.04    .000
00495>                     +ID2 02:102            .32      .015    2.22  18.84    .000
00496>                      ========================================================
00497>                      SUM 03:201+102       2.34      .425    2.00  37.14    .000
00498>
00499>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00500>
00501> ------------------------------------------------------------------------------
00502> 005:0009------------------------------------------------------------------------
00503> *#
00504> *
00505> ----------------------
00506> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00507> |  IN>03:(201+10)    |
00508> | OUT<04:(CTRL  )    |    =========  OUTFLOW STORAGE TABLE  =========
00509> ----------------------    OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
00510>                             (cms)    (ha.m.)  |   (cms)    (ha.m.)
00511>                              .000  .0000E+00   |    .160  .4470E-01
00512>                              .086  .1740E-01   |    .170  .5400E-01
00513>                              .128  .3360E-01   |    .201  .6270E-01
00514>
00515>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00516>      ---------------            (ha)     (cms)     (hrs)       (mm)
00517>      INFLOW >03: (201+10)       2.34      .425     2.000     37.137
00518>      OUTFLOW<04: (CTRL  )       2.34      .121     2.183     37.137
00519>     OVERFLOW<05: (OVF   )        .00      .000      .000       .000
00520>
00521>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00522>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00523>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00524>
00525>
00526>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   28.471
00527>                     TIME SHIFT OF PEAK FLOW          (min)=    11.00
00528>                     MAXIMUM  STORAGE   USED       (ha.m.)=.3086E-01
00529>
00530> ------------------------------------------------------------------------------
00531> 005:0010------------------------------------------------------------------------
00532> *# CATCHMENT 102 -  UNCONTROLLED DRAINAGE TO FOTHERGILL BOULEVARD
00533> *
00534> ----------------------
00535> | CALIB NASHYD       |   Area    (ha)=     .06   Curve Number   (CN)=79.00
00536> | 06:202    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
00537> ----------------------   U.H. Tp(hrs)=    .100
00538>
00539>      Unit Hyd Qpeak  (cms)=     .023
00540>
```

```
      PEAK FLOW       (cms)=     .004 (i)
      TIME TO PEAK    (hrs)=    2.067
      RUNOFF VOLUME    (mm)=   18.832
      TOTAL RAINFALL   (mm)=   53.053
      RUNOFF COEFFICIENT   =     .355

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

------------------------------------------------------------------------------
005:0011----------------------------------------------------------------------
 ----------------------
| ADD HYD (CTRL+202  ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
 ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 04:CTRL          2.34     .121    2.18  37.14    .000
                      +ID2 05:OVF           .00      .000     .00    .00    .000
                      +ID3 06:202           .06      .004    2.07  18.83    .000
                       ========================================================
                       SUM 07:CTRL+202      2.40     .124    2.18  36.68    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
005:0012----------------------------------------------------------------------
**#*************************************************************************|
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
------------------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*
  ** END OF RUN :   9

**************************************************************************
 ---------------------
| START               |  Project  dir.: T:\PROJECTS\24012\SWMHYMO\
 ---------------------  Rainfall dir.: T:\PROJECTS\24012\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
             #  1=BUR6_010.stm
------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 800 BURLOAK DRIVE
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 24012
*#       Date   : APRIL 2024
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 24012.DAT
*#*************************************************************************|
*
------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*
 ---------------------
| READ STORM          |    Filename: Burlington 10-yr 6hr CHICAGO     (A=918.
| Ptotal=  61.10 mm   |    Comments: Burlington 10-yr 6hr CHICAGO     (A=918.
 ---------------------
               TIME    RAIN  |  TIME    RAIN  |  TIME    RAIN  |  TIME    RAIN
               hrs   mm/hr   |  hrs   mm/hr   |  hrs   mm/hr   |  hrs   mm/hr
               .17   2.714   |  1.67  12.326  |  3.17   6.808  |  4.67   3.472
               .33   2.933   |  1.83  28.176  |  3.33   6.095  |  4.83   3.308
               .50   3.197   |  2.00 116.310  |  3.50   5.532  |  5.00   3.161
               .67   3.523   |  2.17  36.748  |  3.67   5.075  |  5.17   3.027
               .83   3.937   |  2.33  19.967  |  3.83   4.696  |  5.33   2.907
              1.00   4.483   |  2.50  14.001  |  4.00   4.376  |  5.50   2.796
              1.17   5.242   |  2.67  10.921  |  4.17   4.102  |  5.67   2.695
              1.33   6.377   |  2.83   9.030  |  4.33   3.864  |  5.83   2.602
              1.50   8.291   |  3.00   7.743  |  4.50   3.656  |  6.00   2.516

------------------------------------------------------------------------------
010:0003----------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING (PHASE 1)
*#        ======================================================
*#
*#*************************************************************************|
*# CATCHMENT 101 -  EXISTING DRAINAGE TO FOTHERGILL BOULEVARD
*
 ----------------------
| CALIB STANDHYD      |   Area    (ha)=    2.02
| 01:101    DT= 1.00  |   Total Imp(%)=   28.00   Dir. Conn.(%)=   28.00
 ----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      .57         1.45
     Dep. Storage     (mm)=     1.00         6.75
     Average Slope     (%)=     2.50         2.50
     Length            (m)=    50.00        50.00
     Mannings n            =     .013         .250

     Max.eff.Inten.(mm/hr)=   116.31        35.04
                   over (min)      1.00        13.00
     Storage Coeff.  (min)=     1.21 (ii)   12.68 (ii)
     Unit Hyd. Tpeak (min)=     1.00        13.00
     Unit Hyd. peak  (cms)=      .96          .09
                                                      *TOTALS*
     PEAK FLOW       (cms)=      .18          .09          .220 (iii)
     TIME TO PEAK    (hrs)=     2.00         2.18         2.000
     RUNOFF VOLUME    (mm)=    60.10        24.24        34.281
     TOTAL RAINFALL   (mm)=    61.10        61.10        61.101
     RUNOFF COEFFICIENT   =      .98          .40          .561

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  79.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
010:0004----------------------------------------------------------------------
*# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
*
 ----------------------
| CALIB NASHYD        |   Area    (ha)=     .32   Curve Number   (CN)=79.00
| 02:102    DT= 1.00  |   Ia      (mm)=    6.750  # of Linear Res.(N)= 3.00
 ----------------------  U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .061

     PEAK FLOW       (cms)=     .020 (i)
     TIME TO PEAK    (hrs)=    2.217
     RUNOFF VOLUME    (mm)=   24.239
     TOTAL RAINFALL   (mm)=   61.101
     RUNOFF COEFFICIENT   =     .397

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

------------------------------------------------------------------------------
010:0005----------------------------------------------------------------------
 ----------------------
| ADD HYD (101+102   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
 ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 01:101           2.02     .220    2.00  34.28    .000
                      +ID2 02:102            .32     .020    2.22  24.24    .000
                       ========================================================
                       SUM 03:101+102       2.34     .229    2.00  32.91    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
010:0006----------------------------------------------------------------------
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#*************************************************************************|
*# CATCHMENT 201 - Proposed Condition (Controlled to FOTHERGILL BOULEVARD)
*
 ----------------------
| CALIB STANDHYD      |   Area    (ha)=    2.02
| 01:201    DT= 1.00  |   Total Imp(%)=   71.50   Dir. Conn.(%)=   71.50
 ----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     1.44         .58
     Dep. Storage     (mm)=     1.00        2.50
     Average Slope     (%)=     5.00        5.00
     Length            (m)=    10.00       20.00
     Mannings n            =     .015        .250

     Max.eff.Inten.(mm/hr)=   116.31       22.46
                   over (min)     1.00        7.00
     Storage Coeff.  (min)=      .41 (ii)    6.83 (ii)
     Unit Hyd. Tpeak (min)=     1.00        7.00
     Unit Hyd. peak  (cms)=     1.55         .16
                                                      *TOTALS*
     PEAK FLOW       (cms)=      .47          .02          .486 (iii)
     TIME TO PEAK    (hrs)=     1.97         2.07         2.000
     RUNOFF VOLUME    (mm)=    60.10        12.89        46.646
     TOTAL RAINFALL   (mm)=    61.10        61.10        61.101
     RUNOFF COEFFICIENT   =      .98          .21          .763

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
010:0007----------------------------------------------------------------------
*# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
*
 ----------------------
| CALIB NASHYD        |   Area    (ha)=     .32   Curve Number   (CN)=79.00
| 02:102    DT= 1.00  |   Ia      (mm)=    6.750  # of Linear Res.(N)= 3.00
 ----------------------  U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .061

     PEAK FLOW       (cms)=     .020 (i)
     TIME TO PEAK    (hrs)=    2.217
     RUNOFF VOLUME    (mm)=   24.239
     TOTAL RAINFALL   (mm)=   61.101
     RUNOFF COEFFICIENT   =     .397

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

------------------------------------------------------------------------------
010:0008----------------------------------------------------------------------
 ----------------------
| ADD HYD (201+102   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
 ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 01:201           2.02     .486    2.00  46.65    .000
                      +ID2 02:102            .32     .020    2.22  24.24    .000
                       ========================================================
                       SUM 03:201+102       2.34     .495    2.00  43.58    .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
010:0009----------------------------------------------------------------------
*#
*
 ----------------------
| ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
|  IN>03:(201+10)     |
| OUT<04:(CTRL  )     |    =========  OUTLFOW STORAGE TABLE  =========
 ----------------------    OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                             (cms)     (ha.m.)  |    (cms)    (ha.m.)
                             .000  .0000E+00    |     .160  .4470E-01
                             .086  .1740E-01    |     .170  .5400E-01
                             .128  .3360E-01    |     .201  .6270E-01

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------             (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (201+10)        2.34     .495     2.000      43.582
     OUTFLOW<04: (CTRL  )        2.34     .137     2.183      43.582
    OVERFLOW<05: (OVF   )         .00     .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   27.607
                   TIME SHIFT OF PEAK FLOW         (min)=    11.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.3654E-01

------------------------------------------------------------------------------
010:0010----------------------------------------------------------------------
*# CATCHMENT 102 -  UNCONTROLLED DRAINAGE TO FOTHERGILL BOULEVARD
*
 ----------------------
| CALIB NASHYD        |   Area    (ha)=     .06   Curve Number   (CN)=79.00
| 06:202    DT= 1.00  |   Ia      (mm)=    6.750  # of Linear Res.(N)= 3.00
 ----------------------  U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   24.236
     TOTAL RAINFALL   (mm)=   61.101
     RUNOFF COEFFICIENT   =     .397

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

------------------------------------------------------------------------------
010:0011----------------------------------------------------------------------
 ----------------------
| ADD HYD (CTRL+202  ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
 ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 04:CTRL          2.34     .137    2.18  43.58    .000
```

```
00811>                    +ID2 05:OVF            .00     .000     .00    .00    .000
00812>                    +ID3 06:202            .06     .005    2.05  24.24    .000
00813>                     ==========================================================
00814>                     SUM 07:CTRL+202       2.40     .141    2.18  43.10    .000
00815>
00816>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00817>
00818> ---------------------------------------------------------------------------------
00819> 010:0012-----------------------------------------------------------------------
00820> **#*********************************************************************************|
00821> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
00822> *
00823> ---------------------------------------------------------------------------------
00824> 010:0002-----------------------------------------------------------------------
00825> *
00826> ---------------------------------------------------------------------------------
00827> 010:0002-----------------------------------------------------------------------
00828> *
00829>   ** END OF RUN :  24
00830>
00831> ********************************************************************************
00832>
00833>
00834>
00835>
00836>
00837> --------------------
00838> | START            |  Project  dir.: T:\PROJECTS\24012\SWMHYMO\
00839> --------------------  Rainfall dir.: T:\PROJECTS\24012\SWMHYMO\
00840>     TZERO =   .00 hrs on        0
00841>     METOUT=   2 (output = METRIC)
00842>     NRUN  = 025
00843>     NSTORM=   1
00844>              #  1=BUR6_025.stm
00845> ---------------------------------------------------------------------------------
00846> 025:0002-----------------------------------------------------------------------
00847> *#*********************************************************************************|
00848> *#  Project Name: 800 BURLOAK DRIVE
00849> *#                BURLINGTON, ONTARIO
00850> *#  JOB NUMBER  : 24012
00851> *#       Date   : APRIL 2024
00852> *#    Revised   :
00853> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00854> *#       File   : 24012.DAT
00855> *#*********************************************************************************|
00856> *
00857> ---------------------------------------------------------------------------------
00858> 025:0002-----------------------------------------------------------------------
00859> *
00860> --------------------
00861> | READ STORM        |    Filename: Burlington 25-yr 6hr CHICAGO      (A=106
00862> | Ptotal=  71.35 mm |    Comments: Burlington 25-yr 6hr CHICAGO      (A=106
00863> --------------------
00864>                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
00865>                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
00866>                 .17   3.182 |  1.67  14.410 |  3.17   7.968 |  4.67   4.068
00867>                 .33   3.437 |  1.83  32.881 |  3.33   7.135 |  4.83   3.876
00868>                 .50   3.746 |  2.00 135.380 |  3.50   6.477 |  5.00   3.704
00869>                 .67   4.128 |  2.17  42.866 |  3.67   5.943 |  5.17   3.548
00870>                 .83   4.612 |  2.33  23.321 |  3.83   5.499 |  5.33   3.407
00871>                1.00   5.251 |  2.50  16.365 |  4.00   5.125 |  5.50   3.278
00872>                1.17   6.138 |  2.67  12.771 |  4.17   4.805 |  5.67   3.160
00873>                1.33   7.465 |  2.83  10.563 |  4.33   4.527 |  5.83   3.051
00874>                1.50   9.700 |  3.00   9.061 |  4.50   4.284 |  6.00   2.950
00875>
00876> ---------------------------------------------------------------------------------
00877> 025:0003-----------------------------------------------------------------------
00878> *
00879> *#*********************************************************************************|
00880> *#
00881> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING (PHASE 1)
00882> *#        ============================================================
00883> *#
00884> *#*********************************************************************************|
00885> *# CATCHMENT 101 -  EXISTING DRAINAGE TO FOTHERGILL BOULEVARD
00886> *
00887> ----------------------
00888> | CALIB STANDHYD     |   Area    (ha)=    2.02
00889> | 01:101    DT= 1.00 |   Total Imp(%)=   28.00   Dir. Conn.(%)=   28.00
00890> ----------------------
00891>                              IMPERVIOUS    PERVIOUS (i)
00892>      Surface Area     (ha)=       .57         1.45
00893>      Dep. Storage     (mm)=      1.00         6.75
00894>      Average Slope     (%)=      2.50         2.50
00895>      Length            (m)=     50.00        50.00
00896>      Mannings n             =      .013         .250
00897>
00898>      Max.eff.Inten.(mm/hr)=     135.38        51.30
00899>                    over (min)        1.00        11.00
00900>      Storage Coeff.  (min)=      1.13 (ii)   10.99 (ii)
00901>      Unit Hyd. Tpeak (min)=      1.00        11.00
00902>      Unit Hyd. peak  (cms)=      1.00          .10
00903>                                                      *TOTALS*
00904>      PEAK FLOW       (cms)=       .21          .13          .282 (iii)
00905>      TIME TO PEAK    (hrs)=      2.00         2.15         2.000
00906>      RUNOFF VOLUME    (mm)=     70.35        31.58        42.438
00907>      TOTAL RAINFALL   (mm)=     71.35        71.35        71.347
00908>      RUNOFF COEFFICIENT   =       .99          .44          .595
00909>
00910>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00911>            CN* =  79.0    Ia = Dep. Storage  (Above)
00912>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00913>            THAN THE STORAGE COEFFICIENT.
00914>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00915>
00916> ---------------------------------------------------------------------------------
00917> 025:0004-----------------------------------------------------------------------
00918> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
00919> *
00920> ----------------------
00921> | CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
00922> | 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
00923> ----------------------  U.H. Tp(hrs)=    .200
00924>
00925>      Unit Hyd Qpeak  (cms)=     .061
00926>
00927>      PEAK FLOW       (cms)=     .027 (i)
00928>      TIME TO PEAK    (hrs)=    2.200
00929>      RUNOFF VOLUME    (mm)=   31.583
00930>      TOTAL RAINFALL   (mm)=   71.347
00931>      RUNOFF COEFFICIENT   =     .443
00932>
00933>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00934>
00935> ---------------------------------------------------------------------------------
00936> 025:0005-----------------------------------------------------------------------
00937> ------------------------
00938> | ADD HYD (101+102   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00939> ------------------------                   (ha)     (cms)   (hrs)    (mm)   (cms)
00940>                       ID1 01:101           2.02     .282    2.00  42.44    .000
00941>                      +ID2 02:102            .32     .027    2.20  31.58    .000
00942>                       ==========================================================
00943>                       SUM 03:101+102       2.34     .295    2.00  40.95    .000
00944>
00945>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00946>
00947> ---------------------------------------------------------------------------------
00948> 025:0006-----------------------------------------------------------------------
00949> *#
00950> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00951> *#        ==============================================
00952> *#
00953> **#*********************************************************************************|
00954> *# CATCHMENT 201 - Proposed Condition (Controlled to FOTHERGILL BOULEVARD)
00955> *
00956> ----------------------
00957> | CALIB STANDHYD     |   Area    (ha)=    2.02
00958> | 01:201    DT= 1.00 |   Total Imp(%)=   71.50   Dir. Conn.(%)=   71.50
00959> ----------------------
00960>                              IMPERVIOUS    PERVIOUS (i)
00961>      Surface Area     (ha)=      1.44          .58
00962>      Dep. Storage     (mm)=      1.00         2.50
00963>      Average Slope     (%)=      5.00         5.00
00964>      Length            (m)=     10.00        20.00
00965>      Mannings n             =      .015         .250
00966>
00967>      Max.eff.Inten.(mm/hr)=     135.38        31.15
00968>                    over (min)        1.00         6.00
00969>      Storage Coeff.  (min)=       .38 (ii)    6.02 (ii)
00970>      Unit Hyd. Tpeak (min)=      1.00         6.00
00971>      Unit Hyd. peak  (cms)=      1.57          .19
00972>                                                      *TOTALS*
00973>      PEAK FLOW       (cms)=       .54          .03          .573 (iii)
00974>      TIME TO PEAK    (hrs)=      1.95         2.05         2.000
00975>      RUNOFF VOLUME    (mm)=     70.35        17.13        55.181
00976>      TOTAL RAINFALL   (mm)=     71.35        71.35        71.347
00977>      RUNOFF COEFFICIENT   =       .99          .24          .773
00978>
00979>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00980>            CN* =  55.0    Ia = Dep. Storage  (Above)
00981>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00982>            THAN THE STORAGE COEFFICIENT.
00983>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00984>
00985> ---------------------------------------------------------------------------------
00986> 025:0007-----------------------------------------------------------------------
00987> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
00988> *
00989> ----------------------
00990> | CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
00991> | 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
00992> ----------------------  U.H. Tp(hrs)=    .200
00993>
00994>      Unit Hyd Qpeak  (cms)=     .061
00995>
00996>      PEAK FLOW       (cms)=     .027 (i)
00997>      TIME TO PEAK    (hrs)=    2.200
00998>      RUNOFF VOLUME    (mm)=   31.583
00999>      TOTAL RAINFALL   (mm)=   71.347
01000>      RUNOFF COEFFICIENT   =     .443
01001>
01002>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01003>
01004> ---------------------------------------------------------------------------------
01005> 025:0008-----------------------------------------------------------------------
01006> ------------------------
01007> | ADD HYD (201+102   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01008> ------------------------                   (ha)     (cms)   (hrs)    (mm)   (cms)
01009>                       ID1 01:201           2.02     .573    2.00  55.18    .000
01010>                      +ID2 02:102            .32     .027    2.20  31.58    .000
01011>                       ==========================================================
01012>                       SUM 03:201+102       2.34     .586    2.00  51.95    .000
01013>
01014>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01015>
01016> ---------------------------------------------------------------------------------
01017> 025:0009-----------------------------------------------------------------------
01018> *#
01019> *
01020> ----------------------
01021> | ROUTE RESERVOIR    |     Requested routing time step =  1.0 min.
01022> |  IN>03:(201+10)    |
01023> | OUT<04:(CTRL  )    |     =========  OUTFLOW STORAGE TABLE  =========
01024> ----------------------   OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
01025>                            (cms)    (ha.m.)  |    (cms)    (ha.m.)
01026>                             .000  .0000E+00  |     .160  .4470E-01
01027>                             .086  .1740E-01  |     .170  .5400E-01
01028>                             .128  .3360E-01  |     .201  .6270E-01
01029>
01030>      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
01031>      --------------------        (ha)     (cms)     (hrs)       (mm)
01032>      INFLOW >03: (201+10)        2.34      .586     2.000     51.953
01033>      OUTFLOW<04: (CTRL  )        2.34      .158     2.183     51.953
01034>     OVERFLOW<05: (OVF   )         .00      .000      .000       .000
01035>
01036>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01037>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
01038>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
01039>
01040>
01041>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   26.895
01042>                     TIME SHIFT OF PEAK FLOW          (min)=    11.00
01043>                     MAXIMUM  STORAGE   USED       (ha.m.)=.4390E-01
01044>
01045> ---------------------------------------------------------------------------------
01046> 025:0010-----------------------------------------------------------------------
01047> *# CATCHMENT 102 -  UNCONTROLLED DRAINAGE TO FOTHERGILL BOULEVARD
01048> *
01049> ----------------------
01050> | CALIB NASHYD       |   Area    (ha)=     .06   Curve Number   (CN)=79.00
01051> | 06:202    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
01052> ----------------------  U.H. Tp(hrs)=    .100
01053>
01054>      Unit Hyd Qpeak  (cms)=     .023
01055>
01056>      PEAK FLOW       (cms)=     .007 (i)
01057>      TIME TO PEAK    (hrs)=    2.050
01058>      RUNOFF VOLUME    (mm)=   31.580
01059>      TOTAL RAINFALL   (mm)=   71.347
01060>      RUNOFF COEFFICIENT   =     .443
01061>
01062>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01063>
01064> ---------------------------------------------------------------------------------
01065> 025:0011-----------------------------------------------------------------------
01066> ------------------------
01067> | ADD HYD (CTRL+202  ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01068> ------------------------                   (ha)     (cms)   (hrs)    (mm)   (cms)
01069>                       ID1 04:CTRL          2.34     .158    2.18  51.95    .000
01070>                      +ID2 05:OVF            .00     .000     .00    .00    .000
01071>                      +ID3 06:202            .06     .007    2.05  31.58    .000
01072>                       ==========================================================
01073>                       SUM 07:CTRL+202      2.40     .163    2.18  51.44    .000
01074>
01075>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01076>
01077> ---------------------------------------------------------------------------------
01078> 025:0012-----------------------------------------------------------------------
01079> **#*********************************************************************************|
01080> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
```

```
*
------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
 ** END OF RUN :  49

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



--------------------
| START            |  Project  dir.: T:\PROJECTS\24012\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\24012\SWMHYMO\
   TZERO =   .00 hrs on      0
   METOUT=  2 (output = METRIC)
   NRUN  = 050
   NSTORM=   1
           #  1=BUR6_050.stm
------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 800 BURLOAK DRIVE
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 24012
*#      Date    : APRIL 2024
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 24012.DAT
*#*****************************************************************************|
*
------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
--------------------
| READ STORM       |     Filename: Burlington 50-yr 6hr CHICAGO     (A=1172
| Ptotal=  78.93 mm|    Comments: Burlington 50-yr 6hr CHICAGO     (A=1172
--------------------
              TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
              .17   3.533 |  1.67  15.961 |  3.17   8.836 |  4.67   4.516
              .33   3.817 |  1.83  36.356 |  3.33   7.913 |  4.83   4.304
              .50   4.160 |  2.00 149.296 |  3.50   7.185 |  5.00   4.113
              .67   4.582 |  2.17  47.374 |  3.67   6.593 |  5.17   3.940
              .83   5.119 |  2.33  25.806 |  3.83   6.102 |  5.33   3.783
             1.00   5.827 |  2.50  18.121 |  4.00   5.688 |  5.50   3.640
             1.17   6.809 |  2.67  14.149 |  4.17   5.333 |  5.67   3.509
             1.33   8.278 |  2.83  11.707 |  4.33   5.025 |  5.83   3.388
             1.50  10.753 |  3.00  10.045 |  4.50   4.755 |  6.00   3.277
------------------------------------------------------------------------------
050:0003------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING (PHASE 1)
*#        ===============================================
*#
*#*****************************************************************************|
*# CATCHMENT 101 -  EXISTING DRAINAGE TO FOTHERGILL BOULEVARD
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=    2.02
| 01:101    DT= 1.00 |   Total Imp(%)=   28.00   Dir. Conn.(%)=   28.00
----------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .57          1.45
     Dep. Storage     (mm)=      1.00          6.75
     Average Slope     (%)=      2.50          2.50
     Length            (m)=     50.00         50.00
     Mannings n             =    .013          .250

     Max.eff.Inten.(mm/hr)=    149.30         65.06
                   over (min)      1.00         10.00
     Storage Coeff.  (min)=     1.09 (ii)    10.05 (ii)
     Unit Hyd. Tpeak (min)=      1.00         10.00
     Unit Hyd. peak  (cms)=      1.02          .11
                                                        *TOTALS*
     PEAK FLOW       (cms)=       .23          .16          .333 (iii)
     TIME TO PEAK    (hrs)=      2.00         2.13         2.000
     RUNOFF VOLUME    (mm)=     77.93        37.29        48.674
     TOTAL RAINFALL   (mm)=     78.93        78.93        78.932
     RUNOFF COEFFICIENT   =       .99          .47          .617

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  79.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
050:0004------------------------------------------------------------------------
*# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
*
----------------------
| CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
| 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .061

     PEAK FLOW       (cms)=     .032 (i)
     TIME TO PEAK    (hrs)=    2.200
     RUNOFF VOLUME    (mm)=   37.295
     TOTAL RAINFALL   (mm)=   78.932
     RUNOFF COEFFICIENT   =     .472

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

------------------------------------------------------------------------------
050:0005------------------------------------------------------------------------
----------------------
| ADD HYD (101+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:101           2.02     .333    2.00  48.67    .000
                     +ID2 02:102            .32     .032    2.20  37.29    .000
                      ========================================================
                      SUM 03:101+102       2.34     .349    2.00  47.12    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
050:0006------------------------------------------------------------------------
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#*****************************************************************************|
*# CATCHMENT 201 - Proposed Condition (Controlled to FOTHERGILL BOULEVARD)
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=    2.02
| 01:201    DT= 1.00 |   Total Imp(%)=   71.50   Dir. Conn.(%)=   71.50
----------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      1.44          .58
     Dep. Storage     (mm)=      1.00         2.50
     Average Slope     (%)=      5.00         5.00
     Length            (m)=     10.00        20.00
     Mannings n             =    .015          .250

     Max.eff.Inten.(mm/hr)=    149.30        37.50
                   over (min)      1.00         6.00
     Storage Coeff.  (min)=      .37 (ii)     5.60 (ii)
     Unit Hyd. Tpeak (min)=      1.00         6.00
     Unit Hyd. peak  (cms)=      1.59          .20
                                                        *TOTALS*
     PEAK FLOW       (cms)=       .60          .04          .636 (iii)
     TIME TO PEAK    (hrs)=      1.95         2.05         2.000
     RUNOFF VOLUME    (mm)=     77.93        20.55        61.579
     TOTAL RAINFALL   (mm)=     78.93        78.93        78.932
     RUNOFF COEFFICIENT   =       .99          .26          .780

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  55.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
050:0007------------------------------------------------------------------------
*# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
*
----------------------
| CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
| 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     .061

     PEAK FLOW       (cms)=     .032 (i)
     TIME TO PEAK    (hrs)=    2.200
     RUNOFF VOLUME    (mm)=   37.295
     TOTAL RAINFALL   (mm)=   78.932
     RUNOFF COEFFICIENT   =     .472

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

------------------------------------------------------------------------------
050:0008------------------------------------------------------------------------
----------------------
| ADD HYD (201+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 01:201           2.02     .636    2.00  61.58    .000
                     +ID2 02:102            .32     .032    2.20  37.29    .000
                      ========================================================
                      SUM 03:201+102       2.34     .652    2.00  58.26    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
050:0009------------------------------------------------------------------------
*#
*
----------------------
| ROUTE RESERVOIR    |     Requested routing time step =  1.0 min.
|  IN>03:(201+102)   |
|  OUT<04:(CTRL  )   |     =========  OUTLFOW STORAGE TABLE  =========
----------------------   OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)  |    (cms)    (ha.m.)
                           .000  .0000E+00    |     .160  .4470E-01
                           .086  .1740E-01    |     .170  .5400E-01
                           .128  .3360E-01    |     .201  .6270E-01

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------             (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (201+102)       2.34      .652     2.000     58.258
     OUTFLOW<04: (CTRL  )        2.34      .165     2.200     58.258
    OVERFLOW<05: (OVF   )         .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   25.332
                   TIME SHIFT OF PEAK FLOW          (min)=    12.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.4961E-01

------------------------------------------------------------------------------
050:0010------------------------------------------------------------------------
*# CATCHMENT 102 -  UNCONTROLLED DRAINAGE TO FOTHERGILL BOULEVARD
*
----------------------
| CALIB NASHYD       |   Area    (ha)=     .06   Curve Number   (CN)=79.00
| 06:202    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
----------------------  U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .009 (i)
     TIME TO PEAK    (hrs)=    2.050
     RUNOFF VOLUME    (mm)=   37.293
     TOTAL RAINFALL   (mm)=   78.932
     RUNOFF COEFFICIENT   =     .472

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

------------------------------------------------------------------------------
050:0011------------------------------------------------------------------------
----------------------
| ADD HYD (CTRL+202  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 04:CTRL          2.34     .165    2.20  58.26    .000
                     +ID2 05:OVF            .00     .000     .00    .00    .000
                     +ID3 06:202            .06     .009    2.05  37.29    .000
                      ========================================================
                      SUM 07:CTRL+202      2.40     .172    2.17  57.73    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
050:0012------------------------------------------------------------------------
**#****************************************************************************|
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
------------------------------------------------------------------------------
```

```
01351> 050:0002-----------------------------------------------------------------------------
01352> *
01353> -----------------------------------------------------------------------------
01354> 050:0002-----------------------------------------------------------------------------
01355> *
01356>   ** END OF RUN :  99
01357>
01358> ****************************************************************************
01359>
01360>
01361>
01362>
01363>
01364> --------------------
01365> | START            |  Project  dir.: T:\PROJECTS\24012\SWMHYMO\
01366> --------------------  Rainfall dir.: T:\PROJECTS\24012\SWMHYMO\
01367>     TZERO =   .00 hrs on        0
01368>     METOUT=   2 (output = METRIC)
01369>     NRUN  = 100
01370>     NSTORM=   1
01371>              #  1=BUR6_100.stm
01372> -----------------------------------------------------------------------------
01373> 100:0002-----------------------------------------------------------------------------
01374> *#*************************************************************************|
01375> *#  Project Name: 800 BURLOAK DRIVE
01376> *#               BURLINGTON, ONTARIO
01377> *#  JOB NUMBER  : 24012
01378> *#       Date   : APRIL 2024
01379> *#    Revised   :
01380> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
01381> *#       File   : 24012.DAT
01382> *#*************************************************************************|
01383> *
01384> -----------------------------------------------------------------------------
01385> 100:0002-----------------------------------------------------------------------------
01386> *
01387> --------------------
01388> | READ STORM       |    Filename: Burlington 100-yr 6hr CHICAGO        (A=
01389> | Ptotal=  86.27 mm|    Comments: Burlington 100-yr 6hr CHICAGO        (A=
01390> --------------------
01391>               TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
01392>                hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
01393>                .17   3.862 |  1.67  17.445 |  3.17   9.657 |  4.67   4.936
01394>                .33   4.172 |  1.83  39.736 |  3.33   8.649 |  4.83   4.704
01395>                .50   4.546 |  2.00 163.177 |  3.50   7.853 |  5.00   4.495
01396>                .67   5.008 |  2.17  51.779 |  3.67   7.206 |  5.17   4.306
01397>                .83   5.595 |  2.33  28.205 |  3.83   6.670 |  5.33   4.135
01398>               1.00   6.369 |  2.50  19.806 |  4.00   6.217 |  5.50   3.979
01399>               1.17   7.443 |  2.67  15.465 |  4.17   5.829 |  5.67   3.835
01400>               1.33   9.048 |  2.83  12.795 |  4.33   5.492 |  5.83   3.703
01401>               1.50  11.752 |  3.00  10.979 |  4.50   5.197 |  6.00   3.581
01402>
01403> -----------------------------------------------------------------------------
01404> 100:0003-----------------------------------------------------------------------------
01405> *
01406> *#*************************************************************************|
01407> *#
01408> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING (PHASE 1)
01409> *#        ======================================================
01410> *#
01411> *#*************************************************************************|
01412> *# CATCHMENT 101 -  EXISTING DRAINAGE TO FOTHERGILL BOULEVARD
01413> *
01414> ----------------------
01415> | CALIB STANDHYD       |   Area    (ha)=    2.02
01416> | 01:101    DT= 1.00   |   Total Imp(%)=   28.00   Dir. Conn.(%)=   28.00
01417> ----------------------
01418>                          IMPERVIOUS    PERVIOUS (i)
01419>      Surface Area     (ha)=      .57         1.45
01420>      Dep. Storage     (mm)=     1.00         6.75
01421>      Average Slope     (%)=     2.50         2.50
01422>      Length            (m)=    50.00        50.00
01423>      Mannings n            =     .013         .250
01424>
01425>      Max.eff.Inten.(mm/hr)=    163.18        79.16
01426>                    over (min)     1.00         9.00
01427>      Storage Coeff.  (min)=     1.05 (ii)    9.34 (ii)
01428>      Unit Hyd. Tpeak (min)=     1.00         9.00
01429>      Unit Hyd. peak  (cms)=     1.04          .12
01430>                                                      *TOTALS*
01431>      PEAK FLOW       (cms)=      .26          .20          .391 (iii)
01432>      TIME TO PEAK    (hrs)=     2.00         2.12         2.000
01433>      RUNOFF VOLUME    (mm)=    85.27        43.00        54.840
01434>      TOTAL RAINFALL   (mm)=    86.27        86.27        86.271
01435>      RUNOFF COEFFICIENT   =      .99          .50          .636
01436>
01437>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01438>            CN* =  79.0    Ia = Dep. Storage  (Above)
01439>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01440>            THAN THE STORAGE COEFFICIENT.
01441>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01442>
01443> -----------------------------------------------------------------------------
01444> 100:0004-----------------------------------------------------------------------------
01445> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
01446> *
01447> ----------------------
01448> | CALIB NASHYD         |   Area    (ha)=     .32   Curve Number   (CN)=79.00
01449> | 02:102    DT= 1.00   |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
01450> ----------------------  U.H. Tp(hrs)=    .200
01451>
01452>      Unit Hyd Qpeak  (cms)=     .061
01453>
01454>      PEAK FLOW       (cms)=     .038 (i)
01455>      TIME TO PEAK    (hrs)=    2.200
01456>      RUNOFF VOLUME    (mm)=   43.005
01457>      TOTAL RAINFALL   (mm)=   86.271
01458>      RUNOFF COEFFICIENT   =     .498
01459>
01460>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01461>
01462> -----------------------------------------------------------------------------
01463> 100:0005-----------------------------------------------------------------------------
01464> ----------------------
01465> | ADD HYD (101+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01466> ----------------------  (ha)     (cms)   (hrs)    (mm)    (cms)
01467>                       ID1 01:101          2.02     .391    2.00  54.84    .000
01468>                      +ID2 02:102           .32     .038    2.20  43.01    .000
01469>                       ========================================================
01470>                       SUM 03:101+102      2.34     .410    2.00  53.22    .000
01471>
01472>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01473>
01474> -----------------------------------------------------------------------------
01475> 100:0006-----------------------------------------------------------------------------
01476> *#
01477> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01478> *#        ==============================================
01479> *#
01480> **#************************************************************************|
01481> *# CATCHMENT 201 - Proposed Condition (Controlled to FOTHERGILL BOULEVARD)
01482> *
01483> ----------------------
01484> | CALIB STANDHYD       |   Area    (ha)=    2.02
01485> | 01:201    DT= 1.00   |   Total Imp(%)=   71.50   Dir. Conn.(%)=   71.50
01486> ----------------------
01487>                          IMPERVIOUS    PERVIOUS (i)
01488>      Surface Area     (ha)=     1.44          .58
01489>      Dep. Storage     (mm)=     1.00         2.50
01490>      Average Slope     (%)=     5.00         5.00
01491>      Length            (m)=    10.00        20.00
01492>      Mannings n            =     .015         .250
01493>
01494>      Max.eff.Inten.(mm/hr)=    163.18        45.56
01495>                    over (min)     1.00         5.00
01496>      Storage Coeff.  (min)=      .35 (ii)    5.20 (ii)
01497>      Unit Hyd. Tpeak (min)=     1.00         5.00
01498>      Unit Hyd. peak  (cms)=     1.60          .22
01499>                                                      *TOTALS*
01500>      PEAK FLOW       (cms)=      .65          .05          .703 (iii)
01501>      TIME TO PEAK    (hrs)=     1.93         2.03         2.000
01502>      RUNOFF VOLUME    (mm)=    85.27        24.07        67.828
01503>      TOTAL RAINFALL   (mm)=    86.27        86.27        86.271
01504>      RUNOFF COEFFICIENT   =      .99          .28          .786
01505>
01506>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01507>            CN* =  55.0    Ia = Dep. Storage  (Above)
01508>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01509>            THAN THE STORAGE COEFFICIENT.
01510>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01511>
01512> -----------------------------------------------------------------------------
01513> 100:0007-----------------------------------------------------------------------------
01514> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
01515> *
01516> ----------------------
01517> | CALIB NASHYD         |   Area    (ha)=     .32   Curve Number   (CN)=79.00
01518> | 02:102    DT= 1.00   |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
01519> ----------------------  U.H. Tp(hrs)=    .200
01520>
01521>      Unit Hyd Qpeak  (cms)=     .061
01522>
01523>      PEAK FLOW       (cms)=     .038 (i)
01524>      TIME TO PEAK    (hrs)=    2.200
01525>      RUNOFF VOLUME    (mm)=   43.005
01526>      TOTAL RAINFALL   (mm)=   86.271
01527>      RUNOFF COEFFICIENT   =     .498
01528>
01529>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01530>
01531> -----------------------------------------------------------------------------
01532> 100:0008-----------------------------------------------------------------------------
01533> -------------------------
01534> | ADD HYD (201+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01535> -------------------------  (ha)     (cms)   (hrs)    (mm)    (cms)
01536>                       ID1 01:201          2.02     .703    2.00  67.83    .000
01537>                      +ID2 02:102           .32     .038    2.20  43.01    .000
01538>                       ========================================================
01539>                       SUM 03:201+102      2.34     .722    2.00  64.43    .000
01540>
01541>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01542>
01543> -----------------------------------------------------------------------------
01544> 100:0009-----------------------------------------------------------------------------
01545> *#
01546> *
01547> ----------------------
01548> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
01549> |  IN>03:(201+10)    |
01550> | OUT<04:(CTRL  )    |    =========  OUTLFOW STORAGE TABLE  =========
01551> ----------------------    OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
01552>                             (cms)     (ha.m.)  |    (cms)    (ha.m.)
01553>                              .000  .0000E+00   |     .160  .4470E-01
01554>                              .086  .1740E-01   |     .170  .5400E-01
01555>                              .128  .3360E-01   |     .201  .6270E-01
01556>
01557>      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
01558>      ---------------------        (ha)     (cms)     (hrs)       (mm)
01559>      INFLOW >03: (201+10)        2.34      .722     2.000     64.433
01560>      OUTFLOW<04: (CTRL  )        2.34      .177     2.250     64.433
01561>     OVERFLOW<05: (OVF   )         .00      .000      .000       .000
01562>
01563>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01564>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
01565>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
01566>
01567>
01568>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   24.431
01569>                     TIME SHIFT OF PEAK FLOW          (min)=    15.00
01570>                     MAXIMUM  STORAGE   USED       (ha.m.)=.5583E-01
01571>
01572> -----------------------------------------------------------------------------
01573> 100:0010-----------------------------------------------------------------------------
01574> *# CATCHMENT 102 -  UNCONTROLLED DRAINAGE TO FOTHERGILL BOULEVARD
01575> *
01576> ----------------------
01577> | CALIB NASHYD         |   Area    (ha)=     .06   Curve Number   (CN)=79.00
01578> | 06:202    DT= 1.00   |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
01579> ----------------------  U.H. Tp(hrs)=    .100
01580>
01581>      Unit Hyd Qpeak  (cms)=     .023
01582>
01583>      PEAK FLOW       (cms)=     .010 (i)
01584>      TIME TO PEAK    (hrs)=    2.050
01585>      RUNOFF VOLUME    (mm)=   43.002
01586>      TOTAL RAINFALL   (mm)=   86.271
01587>      RUNOFF COEFFICIENT   =     .498
01588>
01589>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01590>
01591> -----------------------------------------------------------------------------
01592> 100:0011-----------------------------------------------------------------------------
01593> -------------------------
01594> | ADD HYD (CTRL+202  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01595> -------------------------  (ha)     (cms)   (hrs)    (mm)    (cms)
01596>                       ID1 04:CTRL         2.34     .177    2.25  64.43    .000
01597>                      +ID2 05:OVF           .00     .000     .00    .00    .000
01598>                      +ID3 06:202           .06     .010    2.05  43.00    .000
01599>                       ========================================================
01600>                       SUM 07:CTRL+202     2.40     .183    2.18  63.90    .000
01601>
01602>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01603>
01604> -----------------------------------------------------------------------------
01605> 100:0012-----------------------------------------------------------------------------
01606> **#************************************************************************|
01607> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
01608> *
01609> -----------------------------------------------------------------------------
01610> 100:0002-----------------------------------------------------------------------------
01611> *
01612> -----------------------------------------------------------------------------
01613> 100:0002-----------------------------------------------------------------------------
01614> *
01615> -----------------------------------------------------------------------------
01616> 100:0002-----------------------------------------------------------------------------
01617> *
01618> -----------------------------------------------------------------------------
01619> 100:0002-----------------------------------------------------------------------------
01620> *
```

```
01621> ----------------------------------------------------------------------------
01622> 100:0002----------------------------------------------------------------------
01623> *
01624>   ** END OF RUN : 299
01625>
01626> ****************************************************************************
01627>
01628>
01629>
01630>
01631>
01632> --------------------
01633> | START            |  Project  dir.: T:\PROJECTS\24012\SWMHYMO\
01634> --------------------  Rainfall dir.: T:\PROJECTS\24012\SWMHYMO\
01635>     TZERO =   .00 hrs on        0
01636>     METOUT=   2 (output = METRIC)
01637>     NRUN  = 300
01638>     NSTORM=   1
01639>              #  1=MTHP25MM.stm
01640> ----------------------------------------------------------------------------
01641> 300:0002----------------------------------------------------------------------
01642> *#*************************************************************************|
01643> *#  Project Name: 800 BURLOAK DRIVE
01644> *#               BURLINGTON, ONTARIO
01645> *#  JOB NUMBER  : 24012
01646> *#       Date   : APRIL 2024
01647> *#    Revised   :
01648> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
01649> *#       File   : 24012.DAT
01650> *#*************************************************************************|
01651> *
01652> ----------------------------------------------------------------------------
01653> 300:0002----------------------------------------------------------------------
01654> *
01655> --------------------
01656> | READ STORM       |    Filename: 25mm 4-HOUR (A=555 B=5.89 C=0.813)
01657> | Ptotal=  25.27 mm|    Comments: 25mm 4-HOUR (A=555 B=5.89 C=0.813)
01658> --------------------
01659>               TIME    RAIN  |  TIME    RAIN  |  TIME    RAIN  |  TIME    RAIN
01660>               hrs   mm/hr   |  hrs   mm/hr   |  hrs   mm/hr   |  hrs   mm/hr
01661>               .17   1.491   |  1.17  13.390  |  2.17   3.748  |  3.17   1.810
01662>               .33   1.720   |  1.33  58.584  |  2.33   3.156  |  3.33   1.675
01663>               .50   2.045   |  1.50  17.849  |  2.50   2.734  |  3.50   1.560
01664>               .67   2.542   |  1.67   9.118  |  2.67   2.417  |  3.67   1.460
01665>               .83   3.408   |  1.83   6.129  |  2.83   2.170  |  3.83   1.374
01666>              1.00   5.319   |  2.00   4.638  |  3.00   1.973  |  4.00   1.299
01667>
01668> ----------------------------------------------------------------------------
01669> 300:0003----------------------------------------------------------------------
01670> *
01671> *#*************************************************************************|
01672> *#
01673> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING (PHASE 1)
01674> *#        ============================================================
01675> *#
01676> *#*************************************************************************|
01677> *# CATCHMENT 101 -  EXISTING DRAINAGE TO FOTHERGILL BOULEVARD
01678> *
01679> ----------------------
01680> | CALIB STANDHYD     |   Area    (ha)=    2.02
01681> | 01:101    DT= 1.00 |   Total Imp(%)=   28.00   Dir. Conn.(%)=   28.00
01682> ----------------------
01683>                              IMPERVIOUS    PERVIOUS (i)
01684>      Surface Area     (ha)=        .57         1.45
01685>      Dep. Storage     (mm)=       1.00         6.75
01686>      Average Slope     (%)=       2.50         2.50
01687>      Length            (m)=      50.00        50.00
01688>      Mannings n            =       .013         .250
01689>
01690>      Max.eff.Inten.(mm/hr)=      58.58         4.12
01691>                 over (min)       2.00        29.00
01692>      Storage Coeff.  (min)=       1.59 (ii)   28.62 (ii)
01693>      Unit Hyd. Tpeak (min)=       2.00        29.00
01694>      Unit Hyd. peak  (cms)=        .64          .04
01695>                                                          *TOTALS*
01696>      PEAK FLOW       (cms)=        .09          .01          .092 (iii)
01697>      TIME TO PEAK    (hrs)=       1.33         1.93         1.333
01698>      RUNOFF VOLUME    (mm)=      24.27         3.99         9.665
01699>      TOTAL RAINFALL   (mm)=      25.27         25.27        25.268
01700>      RUNOFF COEFFICIENT   =        .96          .16          .382
01701>
01702>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01703>            CN* =  79.0    Ia = Dep. Storage  (Above)
01704>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01705>            THAN THE STORAGE COEFFICIENT.
01706>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01707>
01708> ----------------------------------------------------------------------------
01709> 300:0004----------------------------------------------------------------------
01710> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
01711> *
01712> ----------------------
01713> | CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
01714> | 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
01715> ----------------------  U.H. Tp(hrs)=    .200
01716>
01717>      Unit Hyd Qpeak  (cms)=     .061
01718>
01719>      PEAK FLOW       (cms)=     .003 (i)
01720>      TIME TO PEAK    (hrs)=    1.617
01721>      RUNOFF VOLUME    (mm)=    3.984
01722>      TOTAL RAINFALL   (mm)=   25.268
01723>      RUNOFF COEFFICIENT   =     .158
01724>
01725>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01726>
01727> ----------------------------------------------------------------------------
01728> 300:0005----------------------------------------------------------------------
01729> ------------------------
01730> | ADD HYD (101+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01731> ------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
01732>                      ID1 01:101           2.02     .092    1.33   9.66    .000
01733>                     +ID2 02:102            .32     .003    1.62   3.98    .000
01734>                      ========================================================
01735>                      SUM 03:101+102       2.34     .093    1.33   8.89    .000
01736>
01737>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01738>
01739> ----------------------------------------------------------------------------
01740> 300:0006----------------------------------------------------------------------
01741> *#
01742> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01743> *#        ==============================================
01744> *#
01745> **************************************************************************|
01746> *# CATCHMENT 201 - Proposed Condition (Controlled to FOTHERGILL BOULEVARD)
01747> *
01748> ----------------------
01749> | CALIB STANDHYD     |   Area    (ha)=    2.02
01750> | 01:201    DT= 1.00 |   Total Imp(%)=   71.50   Dir. Conn.(%)=   71.50
01751> ----------------------
01752>                              IMPERVIOUS    PERVIOUS (i)
01753>      Surface Area     (ha)=       1.44          .58
01754>      Dep. Storage     (mm)=       1.00         2.50
01755>      Average Slope     (%)=       5.00         5.00
01756>      Length            (m)=      10.00        20.00
01757>      Mannings n            =       .015         .250
01758>
01759>      Max.eff.Inten.(mm/hr)=      58.58         3.41
01760>                 over (min)       1.00        14.00
01761>      Storage Coeff.  (min)=        .53 (ii)   14.20 (ii)
01762>      Unit Hyd. Tpeak (min)=       1.00        14.00
01763>      Unit Hyd. peak  (cms)=       1.44          .08
01764>                                                          *TOTALS*
01765>      PEAK FLOW       (cms)=        .24          .00          .236 (iii)
01766>      TIME TO PEAK    (hrs)=       1.30         1.55         1.333
01767>      RUNOFF VOLUME    (mm)=      24.27         2.25        17.992
01768>      TOTAL RAINFALL   (mm)=      25.27        25.27        25.268
01769>      RUNOFF COEFFICIENT   =        .96          .09          .712
01770>
01771>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01772>            CN* =  55.0    Ia = Dep. Storage  (Above)
01773>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01774>            THAN THE STORAGE COEFFICIENT.
01775>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01776>
01777> ----------------------------------------------------------------------------
01778> 300:0007----------------------------------------------------------------------
01779> *# CATCHMENT 102 -  EXTERNAL DRAINAGE THROUGH SITE TO FOTHERGILL BOULEVARD
01780> *
01781> ----------------------
01782> | CALIB NASHYD       |   Area    (ha)=     .32   Curve Number   (CN)=79.00
01783> | 02:102    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
01784> ----------------------  U.H. Tp(hrs)=    .200
01785>
01786>      Unit Hyd Qpeak  (cms)=     .061
01787>
01788>      PEAK FLOW       (cms)=     .003 (i)
01789>      TIME TO PEAK    (hrs)=    1.617
01790>      RUNOFF VOLUME    (mm)=    3.984
01791>      TOTAL RAINFALL   (mm)=   25.268
01792>      RUNOFF COEFFICIENT   =     .158
01793>
01794>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01795>
01796> ----------------------------------------------------------------------------
01797> 300:0008----------------------------------------------------------------------
01798> -------------------------
01799> | ADD HYD (201+102   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01800> -------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
01801>                      ID1 01:201           2.02     .236    1.33  17.99    .000
01802>                     +ID2 02:102            .32     .003    1.62   3.98    .000
01803>                      ========================================================
01804>                      SUM 03:201+102       2.34     .237    1.33  16.08    .000
01805>
01806>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01807>
01808> ----------------------------------------------------------------------------
01809> 300:0009----------------------------------------------------------------------
01810> *#
01811> *
01812> ----------------------
01813> | ROUTE RESERVOIR    |     Requested routing time step =  1.0 min.
01814> |  IN>03:(201+10)    |
01815> | OUT<04:(CTRL  )    |     =========  OUTLFOW STORAGE TABLE  =========
01816> ----------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
01817>                              (cms)     (ha.m.)  |    (cms)    (ha.m.)
01818>                              .000  .0000E+00    |     .160  .4470E-01
01819>                              .086  .1740E-01     |     .170  .5400E-01
01820>                              .128  .3360E-01     |     .201  .6270E-01
01821>
01822>      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
01823>      -----------------------      (ha)     (cms)     (hrs)        (mm)
01824>      INFLOW >03: (201+10)        2.34      .237     1.333      16.077
01825>      OUTFLOW<04: (CTRL  )        2.34      .076     1.500      16.077
01826>     OVERFLOW<05: (OVF   )         .00      .000      .000       .000
01827>
01828>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
01829>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
01830>                     PERCENTAGE OF TIME OVERFLOWING    (%)=       .00
01831>
01832>
01833>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   32.053
01834>                     TIME SHIFT OF PEAK FLOW          (min)=    10.00
01835>                     MAXIMUM  STORAGE   USED       (ha.m.)=.1534E-01
01836>
01837> ----------------------------------------------------------------------------
01838> 300:0010----------------------------------------------------------------------
01839> *# CATCHMENT 102 -  UNCONTROLLED DRAINAGE TO FOTHERGILL BOULEVARD
01840> *
01841> ----------------------
01842> | CALIB NASHYD       |   Area    (ha)=     .06   Curve Number   (CN)=79.00
01843> | 06:202    DT= 1.00 |   Ia      (mm)=   6.750   # of Linear Res.(N)= 3.00
01844> ----------------------  U.H. Tp(hrs)=    .100
01845>
01846>      Unit Hyd Qpeak  (cms)=     .023
01847>
01848>      PEAK FLOW       (cms)=     .001 (i)
01849>      TIME TO PEAK    (hrs)=    1.433
01850>      RUNOFF VOLUME    (mm)=    3.982
01851>      TOTAL RAINFALL   (mm)=   25.268
01852>      RUNOFF COEFFICIENT   =     .158
01853>
01854>      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01855>
01856> ----------------------------------------------------------------------------
01857> 300:0011----------------------------------------------------------------------
01858> ------------------------
01859> | ADD HYD (CTRL+202  ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01860> ------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
01861>                      ID1 04:CTRL          2.34      .076    1.50  16.08    .000
01862>                     +ID2 05:OVF            .00      .000     .00    .00    .000
01863>                     +ID3 06:202            .06      .001    1.43   3.98    .000
01864>                      ========================================================
01865>                      SUM 07:CTRL+202      2.40      .077    1.50  15.77    .000
01866>
01867>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01868>
01869> ----------------------------------------------------------------------------
01870> 300:0012----------------------------------------------------------------------
01871> **#************************************************************************|
01872> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
01873> *
01874> ----------------------------------------------------------------------------
01875> 300:0002----------------------------------------------------------------------
01876> *
01877> ----------------------------------------------------------------------------
01878> 300:0002----------------------------------------------------------------------
01879> *
01880> ----------------------------------------------------------------------------
01881> 300:0002----------------------------------------------------------------------
01882> *
01883> ----------------------------------------------------------------------------
01884> 300:0002----------------------------------------------------------------------
01885> *
01886> ----------------------------------------------------------------------------
01887> 300:0002----------------------------------------------------------------------
01888> *
01889> ----------------------------------------------------------------------------
01890> 300:0002----------------------------------------------------------------------
```

```
01891>       FINISH
01892> -------------------------------------------------------------------------------
01893> *******************************************************************************
01894>      WARNINGS / ERRORS / NOTES
01895>      -------------------------
01896>    Simulation ended on 2024-04-25     at 16:55:29
01897> ===============================================================================
01898>
01899>
```

Project: **800 Burloak Drive**

Chamber Model -	MC-3500	
Units -	**Metric**	
Number of Chambers -	134	
Number of End Caps -	16	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	101.12	m
Amount of Stone Above Chambers -	307	mm
Amount of Stone Below Chambers -	229	mm

693.67 sq.meters Min. Area - 641.07 sq.meters

StormTech MC-3500 Cumulative Storage Volumes

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Single End Cap (cubic meters)	Incremental Chambers (cubic meters)	Incremental End Cap (cubic meters)	Incremental Stone (cubic meters)	Incremental Ch, EC and Stone (cubic meters)	Cumulative System (cubic meters)	Elevation (meters)
1676	0.00	0.00	0.00	0.00	7.044	7.04	719.30	102.80
1651	0.00	0.00	0.00	0.00	7.044	7.04	712.25	102.77
1626	0.00	0.00	0.00	0.00	7.044	7.04	705.21	102.75
1600	0.00	0.00	0.00	0.00	7.044	7.04	698.16	102.72
1575	0.00	0.00	0.00	0.00	7.044	7.04	691.12	102.70
1549	0.00	0.00	0.00	0.00	7.044	7.04	684.07	102.67
1524	0.00	0.00	0.00	0.00	7.044	7.04	677.03	102.65
1499	0.00	0.00	0.00	0.00	7.044	7.04	669.99	102.62
1473	0.00	0.00	0.00	0.00	7.044	7.04	662.94	102.59
1448	0.00	0.00	0.00	0.00	7.044	7.04	655.90	102.57
1422	0.00	0.00	0.00	0.00	7.044	7.04	648.85	102.54
1397	0.00	0.00	0.00	0.00	7.044	7.04	641.81	102.52
1372	0.00	0.00	0.22	0.00	6.956	7.18	634.77	102.49
1346	0.01	0.00	0.74	0.01	6.745	7.49	627.59	102.47
1321	0.01	0.00	1.12	0.02	6.591	7.72	620.10	102.44
1295	0.01	0.00	1.53	0.02	6.422	7.98	612.37	102.42
1270	0.02	0.00	2.61	0.03	5.989	8.63	604.40	102.39
1245	0.03	0.00	3.90	0.04	5.467	9.41	595.77	102.37
1219	0.04	0.00	4.74	0.05	5.128	9.92	586.36	102.34
1194	0.04	0.00	5.40	0.06	4.863	10.32	576.44	102.31
1168	0.04	0.00	5.97	0.07	4.630	10.66	566.13	102.29
1143	0.05	0.00	6.48	0.07	4.424	10.98	555.46	102.26
1118	0.05	0.01	6.94	0.08	4.236	11.26	544.49	102.24
1092	0.05	0.01	7.35	0.09	4.067	11.51	533.23	102.21
1067	0.06	0.01	7.74	0.10	3.907	11.75	521.72	102.19
1041	0.06	0.01	8.10	0.11	3.762	11.97	509.97	102.16
1016	0.06	0.01	8.44	0.11	3.623	12.18	498.00	102.14
991	0.07	0.01	8.75	0.12	3.495	12.37	485.82	102.11
965	0.07	0.01	9.05	0.13	3.374	12.55	473.46	102.09
940	0.07	0.01	9.33	0.13	3.258	12.72	460.91	102.06
914	0.07	0.01	9.59	0.14	3.151	12.88	448.18	102.04
889	0.07	0.01	9.84	0.15	3.049	13.04	435.30	102.01
864	0.08	0.01	10.08	0.15	2.952	13.18	422.26	101.98
838	0.08	0.01	10.30	0.16	2.860	13.32	409.08	101.96
813	0.08	0.01	10.52	0.16	2.773	13.45	395.76	101.93
787	0.08	0.01	10.72	0.17	2.689	13.58	382.31	101.91
762	0.08	0.01	10.91	0.17	2.610	13.70	368.73	101.88
737	0.08	0.01	11.10	0.18	2.534	13.81	355.04	101.86
711	0.08	0.01	11.27	0.18	2.463	13.92	341.23	101.83
686	0.09	0.01	11.43	0.19	2.396	14.02	327.31	101.81
660	0.09	0.01	11.59	0.19	2.332	14.11	313.30	101.78
635	0.09	0.01	11.74	0.20	2.268	14.21	299.18	101.76
610	0.09	0.01	11.88	0.20	2.211	14.29	284.98	101.73
584	0.09	0.01	12.01	0.21	2.156	14.38	270.68	101.71
559	0.09	0.01	12.14	0.21	2.103	14.46	256.31	101.68
533	0.09	0.01	12.26	0.22	2.053	14.53	241.85	101.65
508	0.09	0.01	12.38	0.22	2.005	14.60	227.32	101.63
483	0.09	0.01	12.48	0.23	1.960	14.67	212.72	101.60
457	0.09	0.01	12.59	0.23	1.916	14.74	198.05	101.58
432	0.09	0.01	12.69	0.23	1.875	14.80	183.31	101.55
406	0.10	0.01	12.78	0.24	1.837	14.86	168.51	101.53
381	0.10	0.01	12.87	0.24	1.799	14.91	153.66	101.50
356	0.10	0.02	12.96	0.24	1.764	14.96	138.74	101.48
330	0.10	0.02	13.04	0.25	1.729	15.02	123.78	101.45
305	0.10	0.02	13.12	0.25	1.696	15.07	108.76	101.43
279	0.10	0.02	13.20	0.25	1.664	15.12	93.70	101.40
254	0.10	0.02	13.30	0.27	1.616	15.19	78.58	101.38
229	0.00	0.00	0.00	0.00	7.044	7.04	63.40	101.35
203	0.00	0.00	0.00	0.00	7.044	7.04	56.35	101.32
178	0.00	0.00	0.00	0.00	7.044	7.04	49.31	101.30
152	0.00	0.00	0.00	0.00	7.044	7.04	42.26	101.27
127	0.00	0.00	0.00	0.00	7.044	7.04	35.22	101.25
102	0.00	0.00	0.00	0.00	7.044	7.04	28.18	101.22
76	0.00	0.00	0.00	0.00	7.044	7.04	21.13	101.20
51	0.00	0.00	0.00	0.00	7.044	7.04	14.09	101.17
25	0.00	0.00	0.00	0.00	7.044	7.04	7.04	101.15

APPENDIX B

QUALITY CONTROL INFORMATION

Hydroworks Sizing Summary

04-16-2024

Recommended Size: HydroStorm HS 6

A HydroStorm HS 6 is recommended to provide 60 % annual TSS removal based on a drainage area of 1.96 (ha) with an imperviousness of 79 % and Hamilton RBG, Ontario rainfall for the ETV Canada particle size distribution.

The recommended HydroStorm HS 6 treats 91 % of the annual runoff and provides 61 % annual TSS removal for the Hamilton RBG rainfall records and ETV Canada particle size distribution.

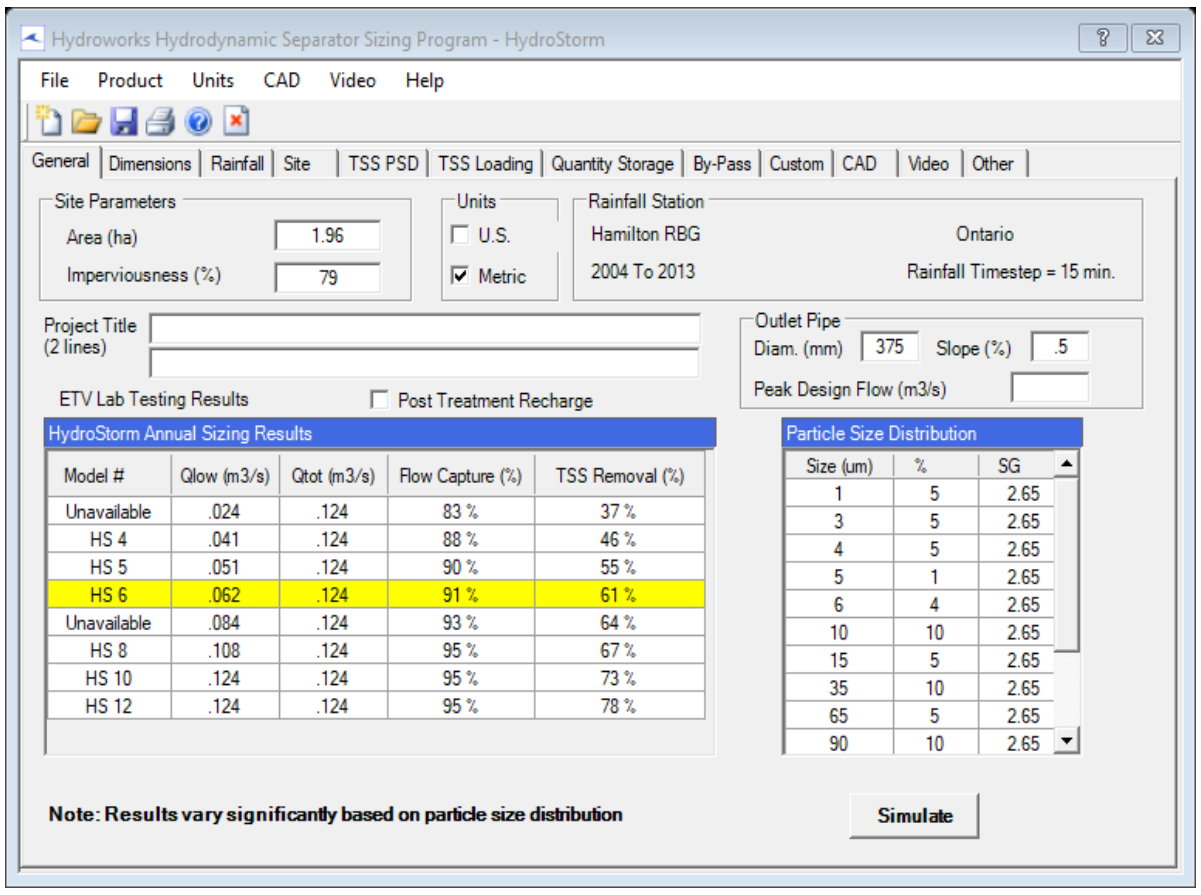
The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .12 (m3/s) for the given 375 (mm) pipe diameter at .5% slope. The headloss was calculated to be 67 (mm) based on a flow depth of 375 (mm) (full pipe flow).

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

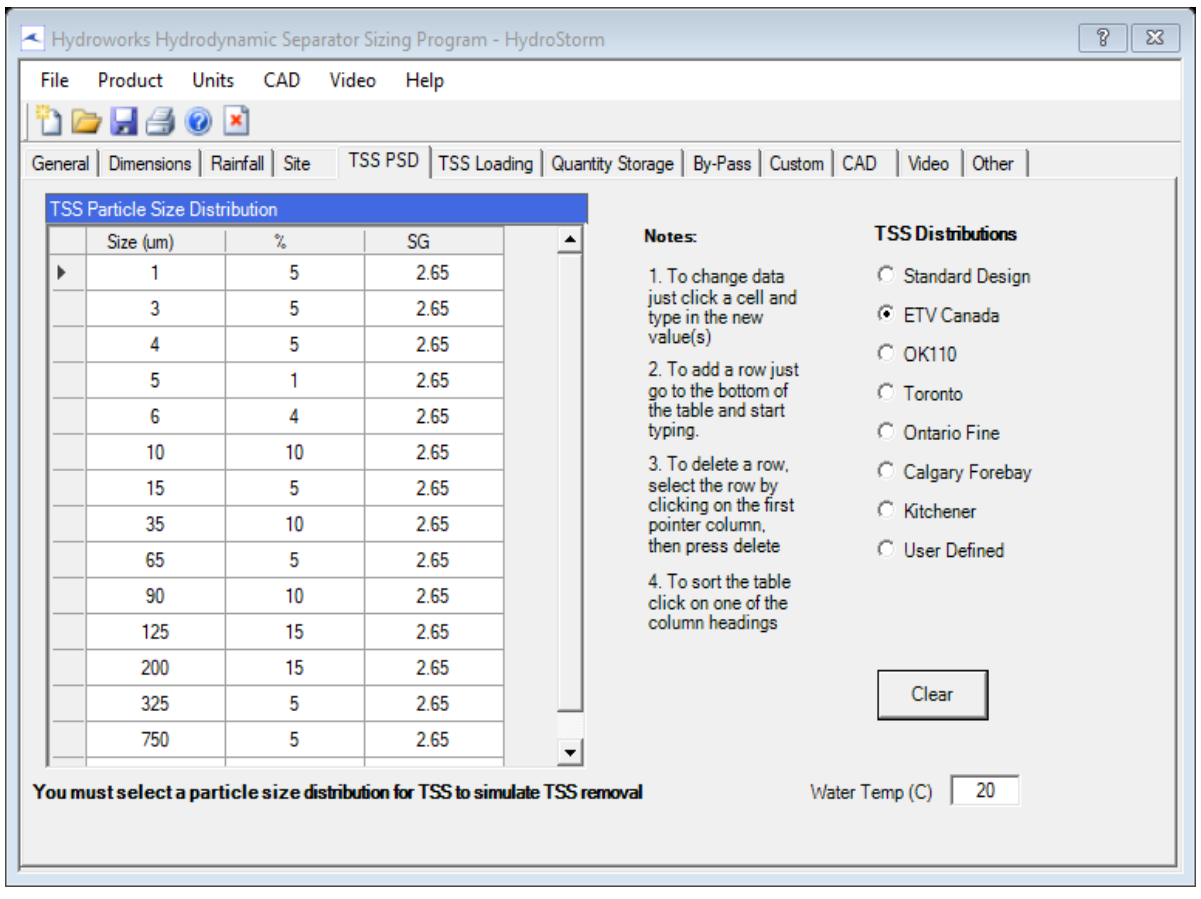
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroStorm .

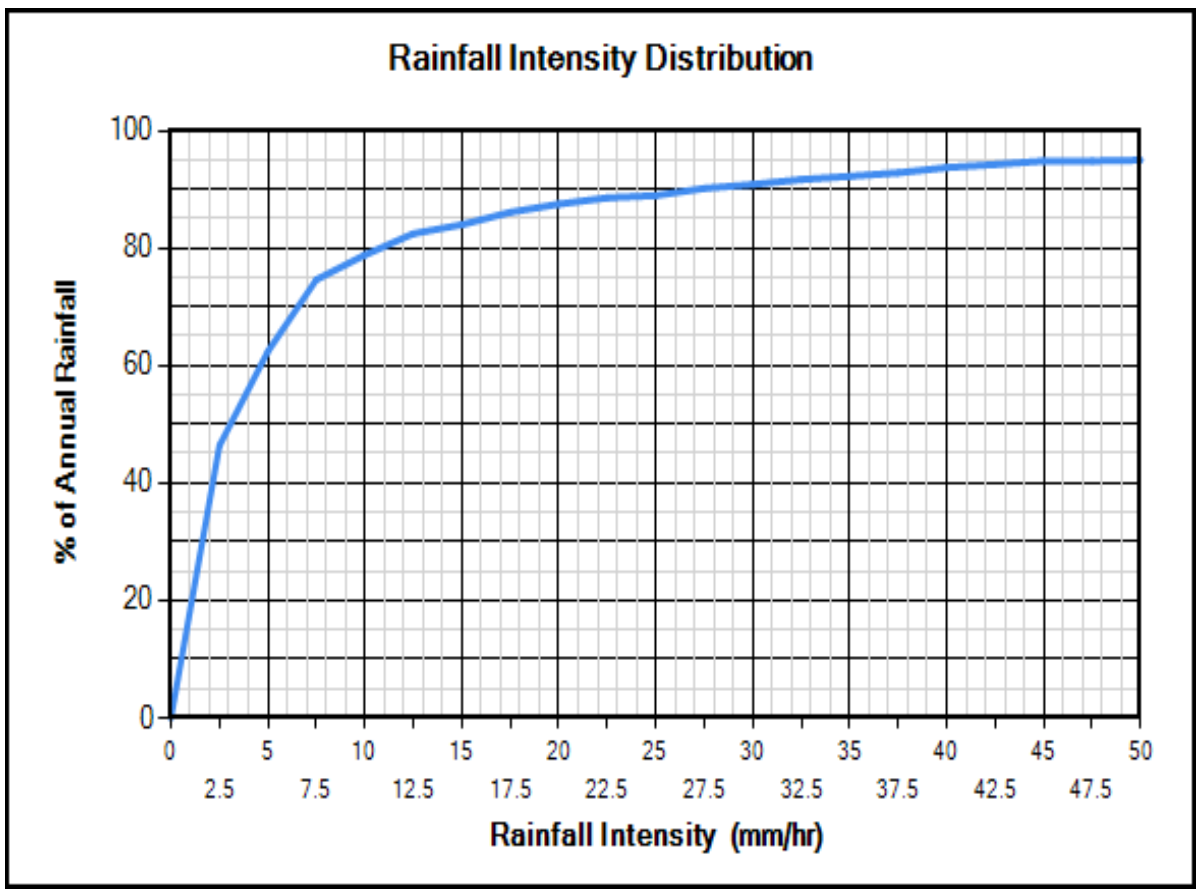
TSS Removal Sizing Summary



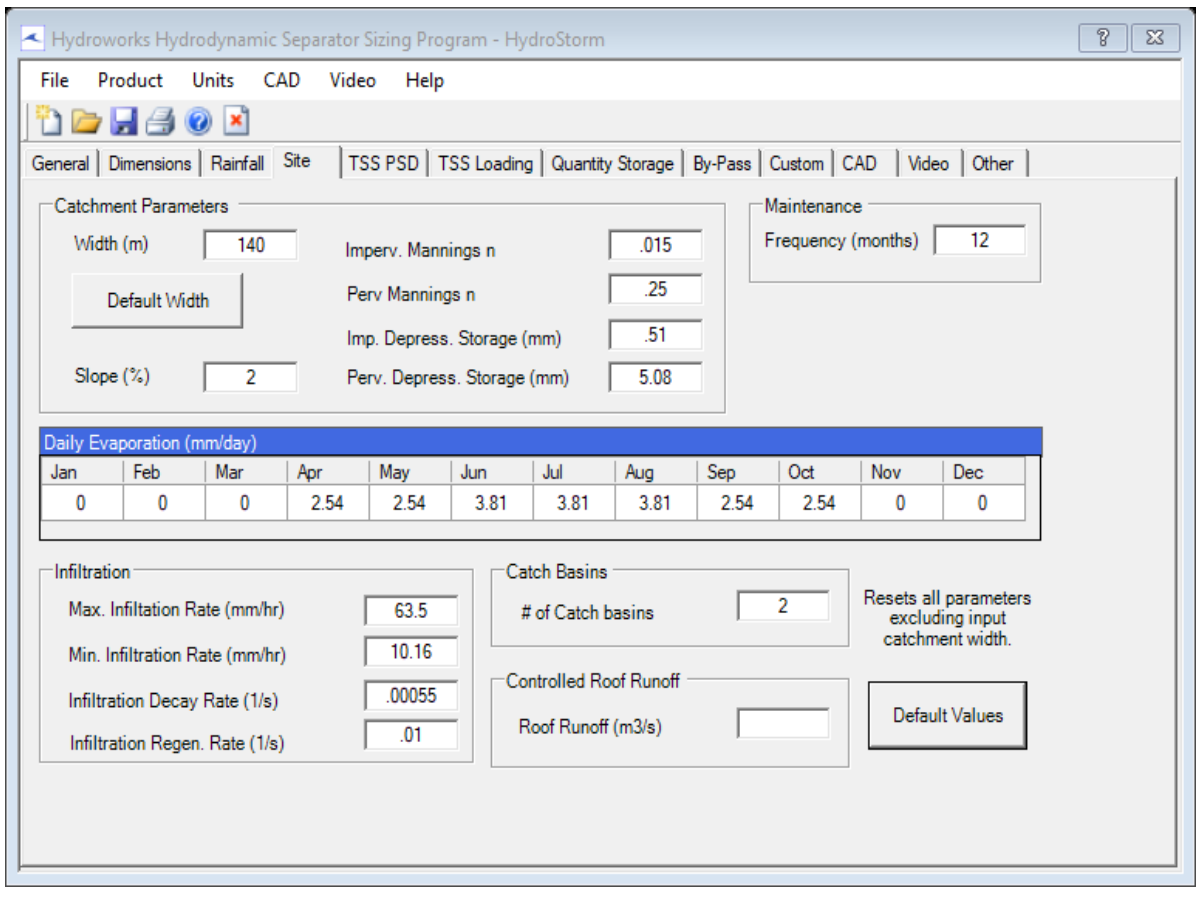
TSS Particle Size Distribution



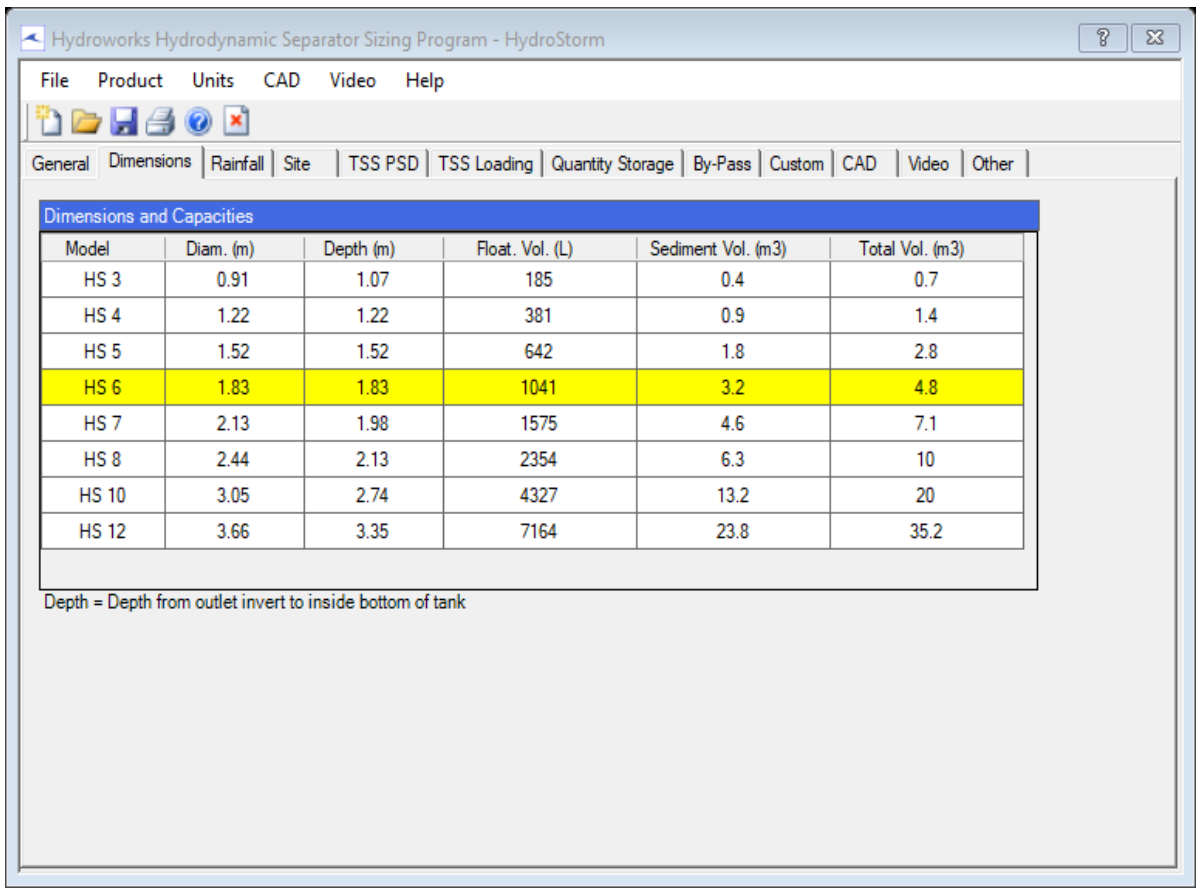
Rainfall Station - Hamilton RBG, Ontario(2004 To 2013)



Site Physical Characteristics

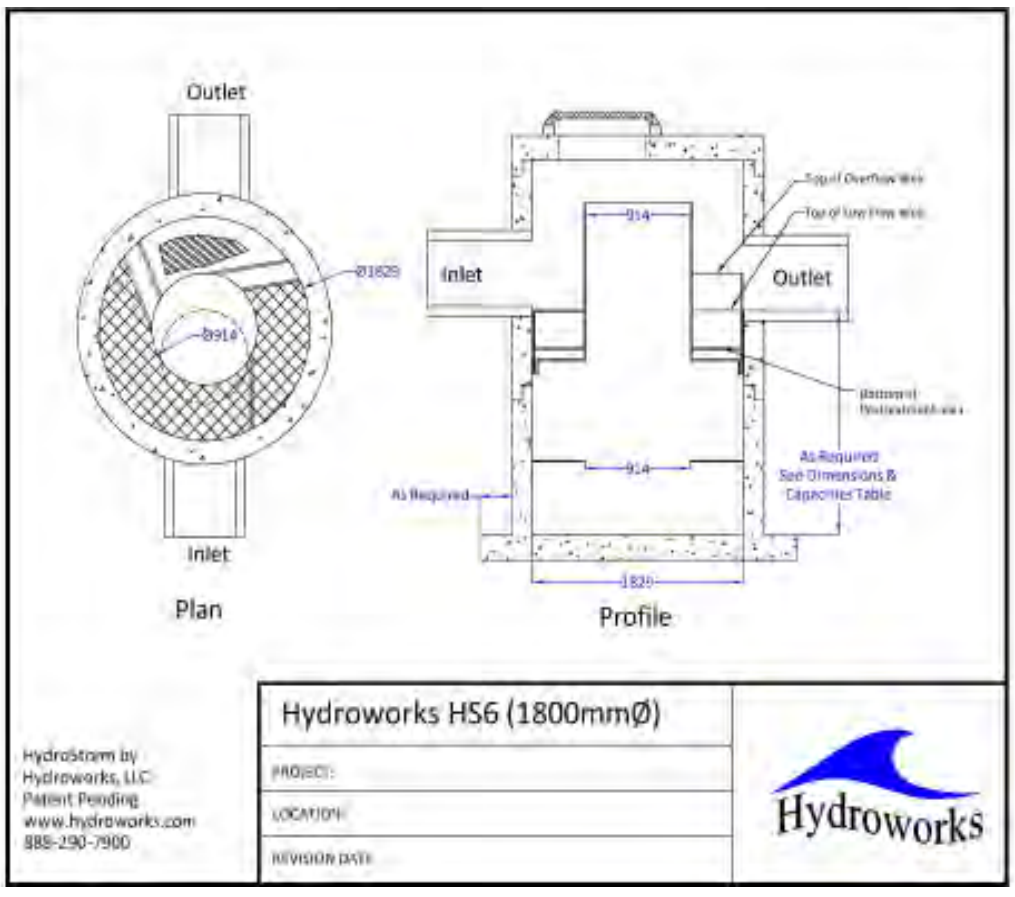


Dimensions And Capacities

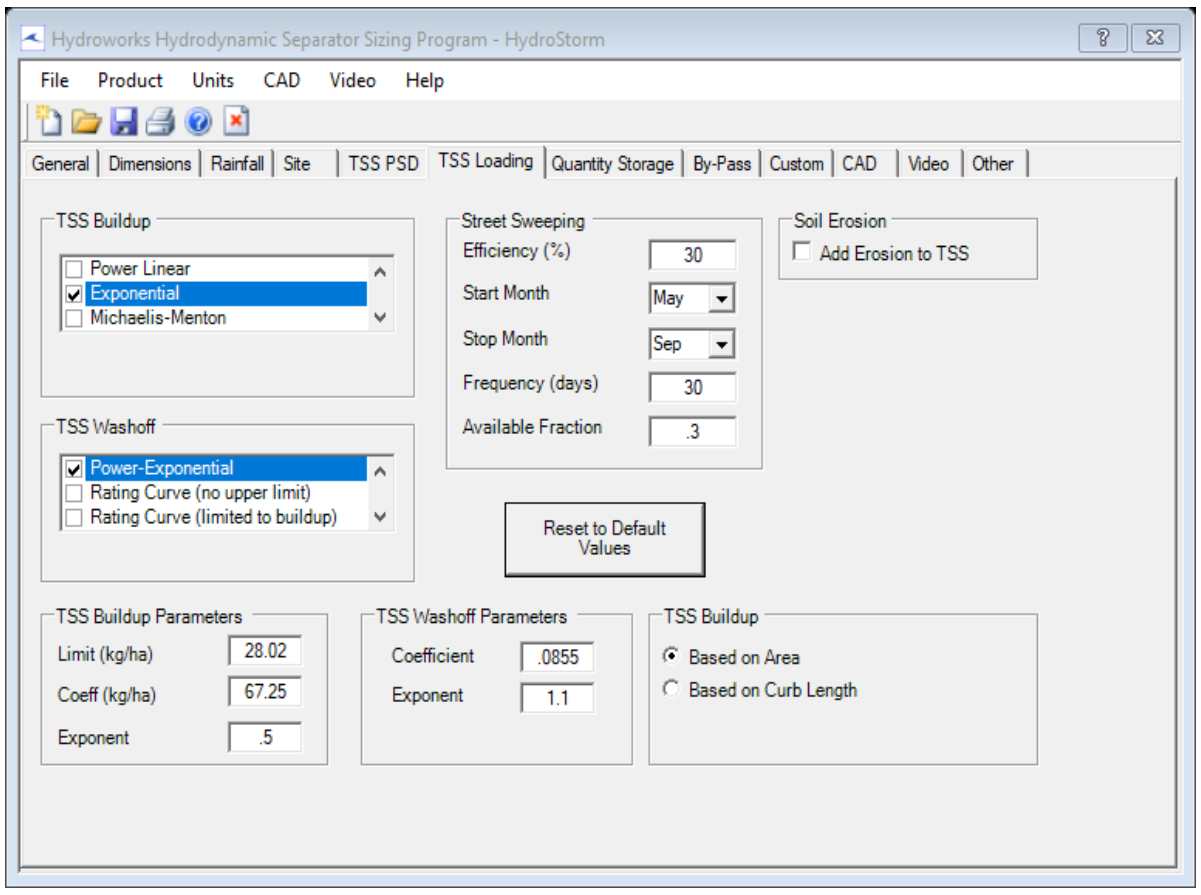


Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 3	0.91	1.07	185	0.4	0.7
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

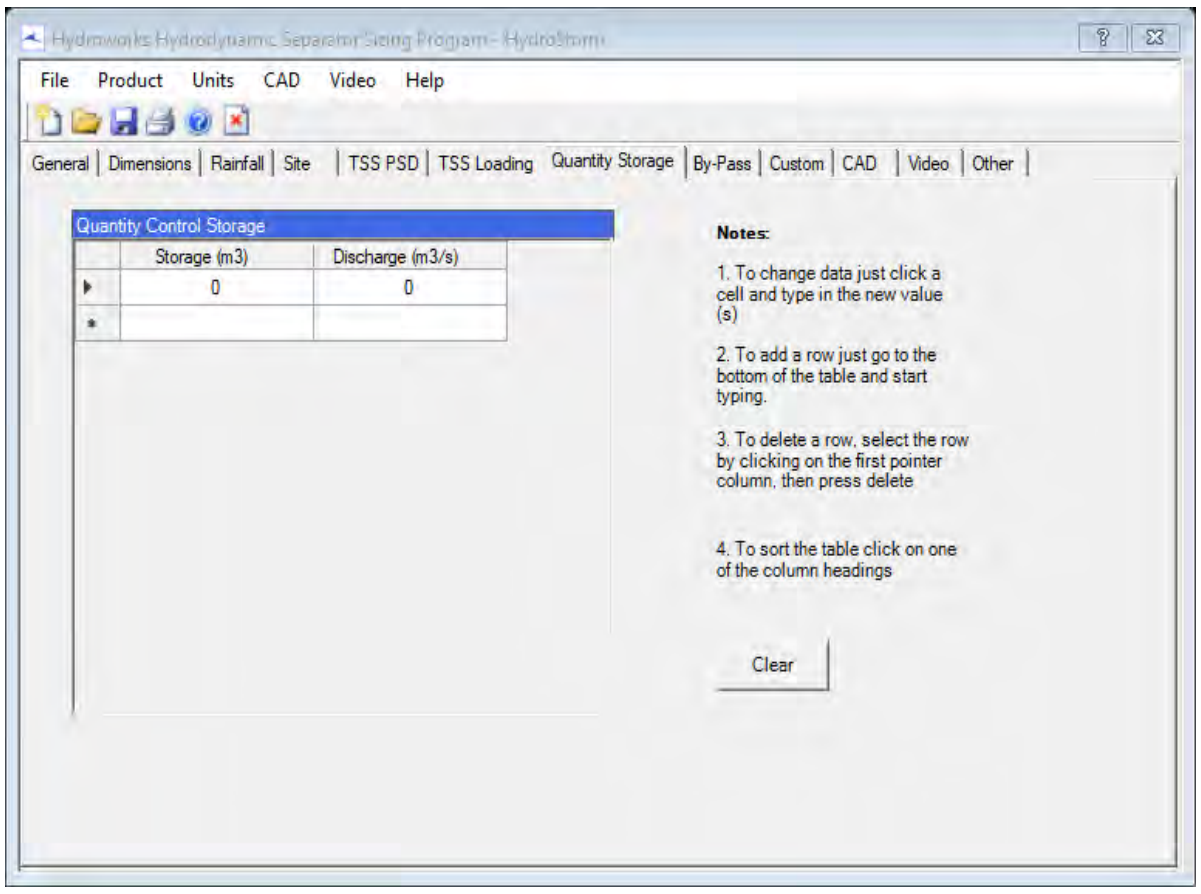
Generic HS 6 CAD Drawing



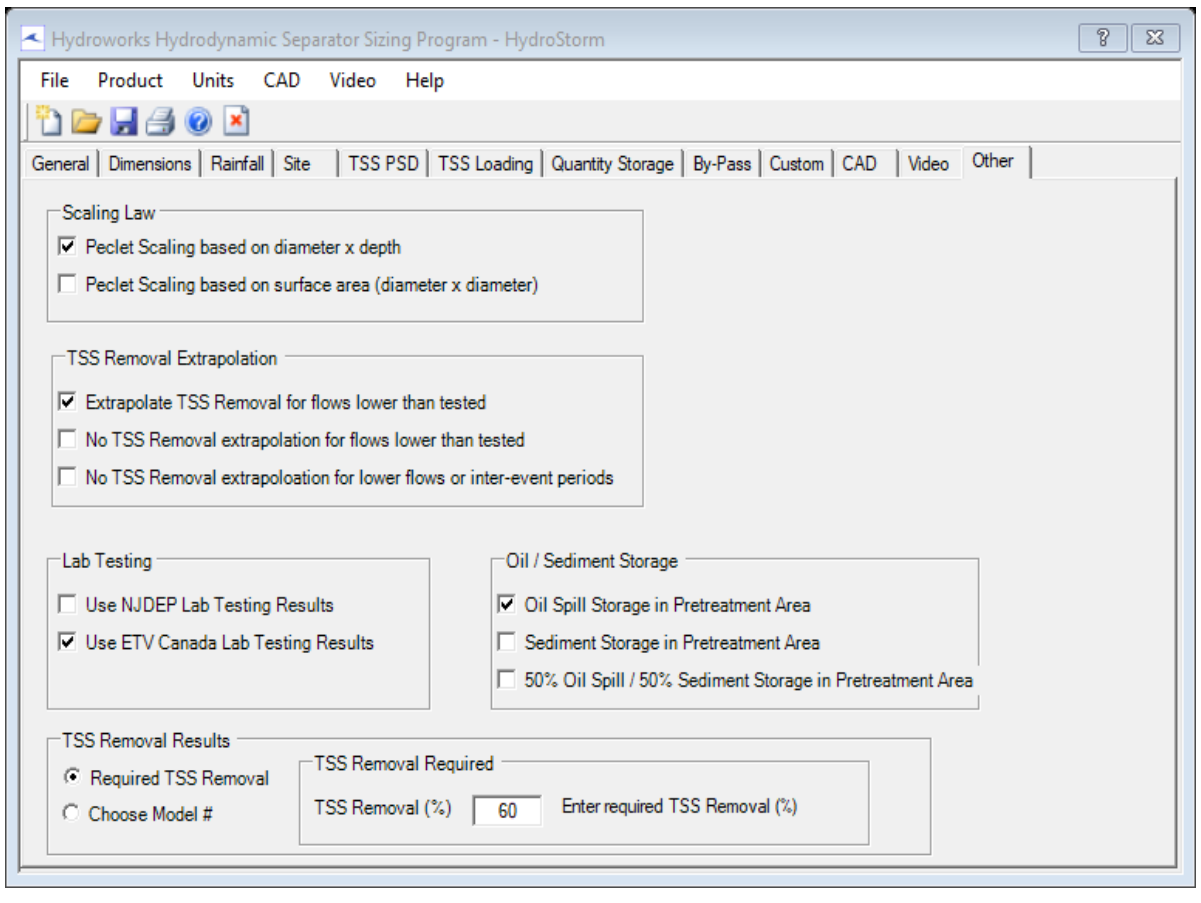
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

None

Hydroworks Sizing Program - Version 5.6
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www.hydroworks.com

Advanced Drainage Systems, Inc.

SiteAssist®
FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

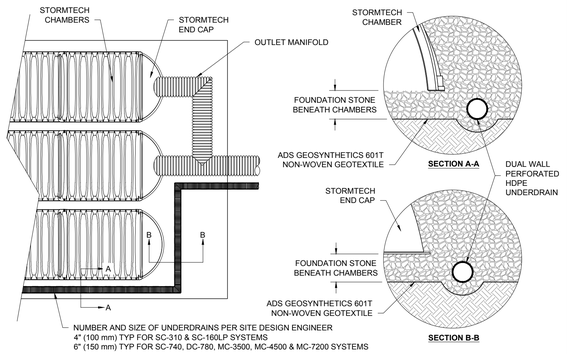
1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

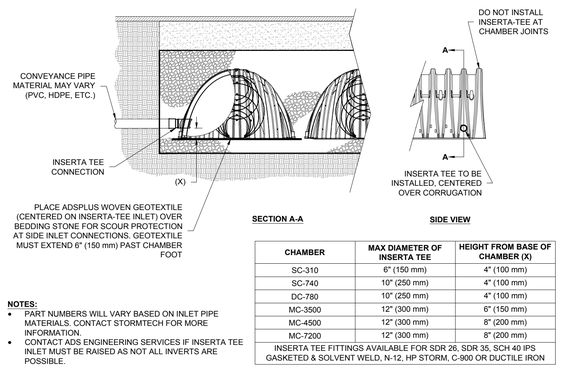
1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.



5 UNDERDRAIN DETAIL

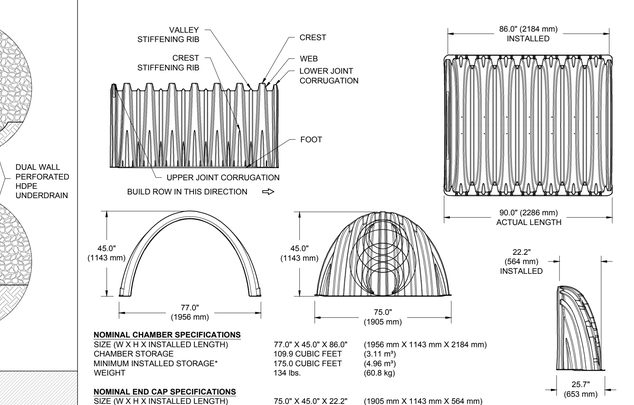


CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
MC-7200	12" (300 mm)	8" (200 mm)

INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON

NOTES:
- PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.
- CONTACT ADS ENGINEERING SERVICES IF INSERTA TEE INLET MUST BE RAISED AS NOT ALL INVERTS ARE POSSIBLE.

6 INSERTA-TEE SIDE INLET DETAIL



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" (152 mm) STONE BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL

CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

2 MC-3500 TECHNICAL SPECIFICATIONS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

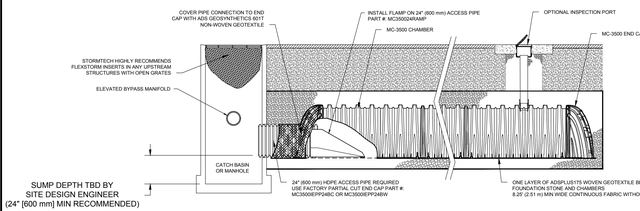
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45° (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

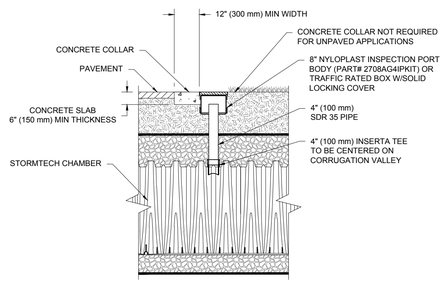
STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

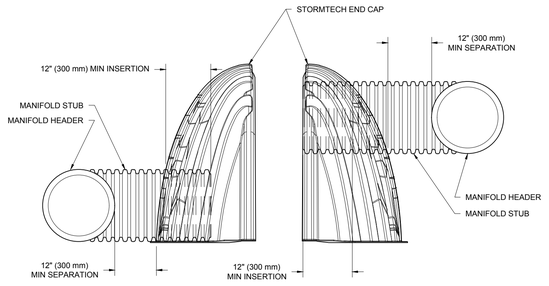


3 MC-3500 ISOLATOR ROW PLUS DETAIL



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

4 4" PVC INSPECTION PORT DETAIL (MC SERIES CHAMBER)



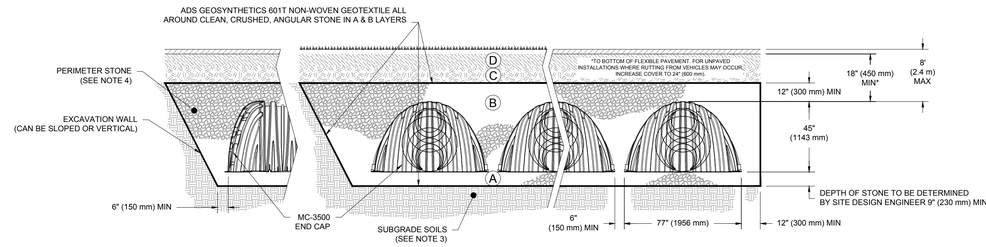
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

7 MC-SERIES END CAP INSERTION DETAIL

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) IMAX LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

1 MC-3500 CROSS SECTION DETAIL

DRAWN:
DATE:
REVIEWED:
PROJECT NO:
REV:
NOT TO SCALE

MC-3500 STANDARD DETAILS

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026

Advanced Drainage Systems, Inc.

SHEET

ADVANCED DRAINAGE SYSTEMS, INC. ("ADS") HAS PREPARED THIS DETAIL BASED ON REFERENCED STANDARDS. ADS HAS NOT PERFORMED ANY ENGINEERING OR DESIGN SERVICES FOR THIS PROJECT. NOR HAS ADS INDEPENDENTLY VERIFIED THE INFORMATION SUPPLIED. THE INSTALLATION DETAILS PROVIDED HEREIN ARE GENERAL RECOMMENDATIONS AND ARE NOT SPECIFIC FOR THIS PROJECT. UNLESS THE PLANS ARE SIGNED AND SEALED BY THE SITE DESIGN ENGINEER. THE SITE DESIGN ENGINEER SHALL REVIEW THESE DETAILS PRIOR TO CONSTRUCTION AND SEALING THE DOCUMENT. IT IS THE SITE DESIGN ENGINEER'S RESPONSIBILITY TO ENSURE THE DETAILS PROVIDED HEREIN MEETS OR EXCEEDS THE APPLICABLE NATIONAL, STATE, OR LOCAL REQUIREMENTS AND TO ENSURE THAT THE DETAILS PROVIDED HEREIN ARE ACCEPTABLE FOR THIS PROJECT.

StormTech Isolator Row Sizing Chart

StormTech Isolator Row - Water Quality Flowrate for >81% TSS Removal							
	SC-160	**SC-310**	**SC-740**	**DC-780**	**MC-3500**	**MC-4500**	**MC-7200**
Chamber Bottom Area (m²)	1.06	1.64	2.58	2.58	3.99	2.80	4.65
Treated Flowrate / Chamber (L/s)	2.97	4.62	7.25	7.25	11.19	7.84	12.74

Notes:

- Results per ETV verified results, independently verifed by VerifiGlobal: https://www.verifiglobal.com/media/knubjbej/verifiglobal-verification-statement-for-stormtech-isolator-row-plus-final-2020-10-27-for-posting.pdf
- ETV verified treated flowrate = 4.13 GPM/ft² (2.80 L/s/m²)
- Above rates based on 81.2% removal of ETV/NJDEP particle size distribution.

Verification Statement



StormTech Isolator® Row PLUS
Registration number: (V-2020-10-01)
Date of issue: (2020-October-27)

Technology type	Stormwater Filtration Device
Application	Stormwater filtration technology to remove sediments, nutrients, heavy metals, and organic contaminants from stormwater runoff
Company	StormTech, LLC.
Address	520 Cromwell Avenue, Rocky Hill, CT 06067 USA **Phone** +1-888-892-2694
Website	www.stormtech.com
E-mail	info@stormtech.com

Verified Performance Claims

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Based on the laboratory testing conducted, the verified performance claims are as follows:

Total Suspended Solids (TSS) Removal Efficiency - The StormTech Isolator® Row PLUS achieved 82% ± 1% removal efficiency of suspended sediment concentration (SCC) at a 95% confidence level.

Average Loading Rate - Based on the reported flow rate data and the effective sedimentation and filtration treatment area of the test unit, the average loading rate of the test unit was 4.15 ± 0.03 GPM/ft^2 at a 95% confidence level.

Maximum Treatment Flow Rate (MTFR) - Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 gpm/ ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.

Detention Time and Volume - The StormTech Isolator Row PLUS detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 and a detention time of 2.2 minutes.

Maximum Sediment Storage Depth and Volume - The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.

Effective Sedimentation/Filtration Treatment Areas - The Effective Sedimentation Area (ESA) and the Effective Filtration Treatment Area (EFTA) increase as the size of the system increases. For the two overlapping StormTech SC-740 chambers tested, the ESA and the ratio of ESA/EFTA were 54.5 ft^2 and 1.0, respectively.

Sediment Mass Load Capacity - The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs ± 0.8 lbs (2.91 ±0.01 lbs/ ft^2) following a total sediment loading of 195.2 lbs.

Technology Application

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers covered in a non-woven geotextile fabric with a single layer of proprietary woven fabric at the bottom that serves as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal. The following features make the Isolator® Row PLUS effective as a water quality solution:

- Enhanced infiltration Surface Area
- Runoff Volume Reduction
- Peak Flow Reduction
- Sediment/Pollutant Removal
- Internal Water Storage (IWS)
- Water Temperature Cooling (Thermal Buffer).

Technology Description

The Isolator® Row PLUS (shown in Figures 1 and 2) is the first row of StormTech chambers that is surrounded with filter fabric and connected to a closely located manhole for easy access. The Isolator® Row PLUS provides for settling and filtration of sediment as stormwater rises in the chamber and ultimately passes through the filter fabric. The open-bottom chambers allow stormwater to flow out of the chambers, while sediment is captured in the Isolator® Row PLUS.

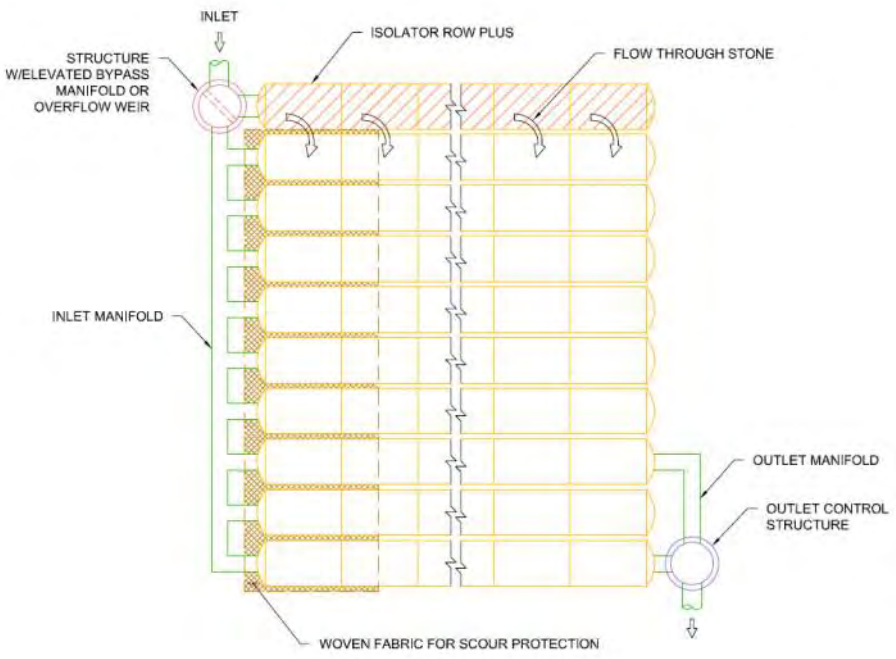


Figure 1: Schematic of the StormTech Isolator® Row PLUS System

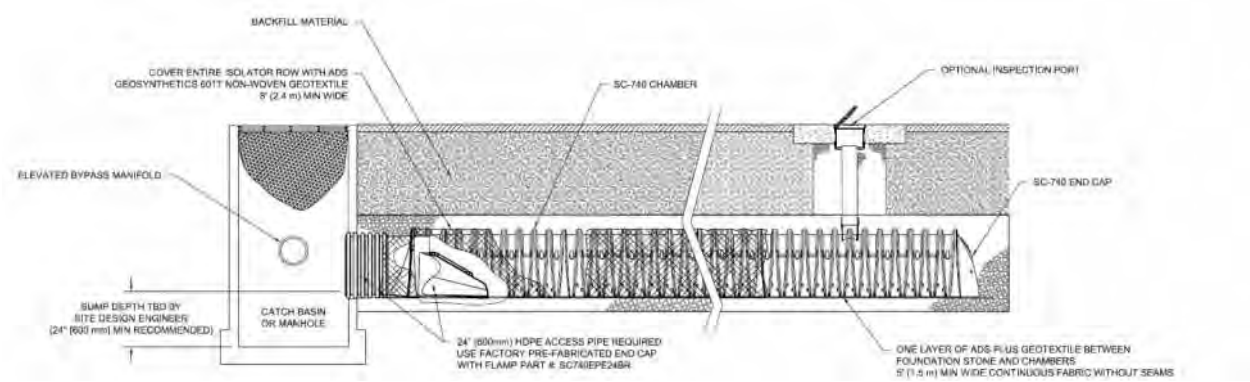


Figure 2: Isolator® Row PLUS Detail

A single layer of proprietary Advanced Drainage Systems (ADS) PLUS fabric is placed between the angular base stone and the Isolator Row PLUS chamber. The geotextile provides the means for stormwater filtration and provides a durable surface for maintenance operations. A 6 oz. non-woven fabric is placed over the chambers.

The Isolator® Row PLUS is designed to capture the “first flush” and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator® Row PLUS but includes a high low/concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator® Row PLUS bypass through a manifold to the other chambers. This is achieved with either a high-flow weir or an elevated manifold. This creates a differential between the Isolator® Row PLUS and the manifold, thus allowing for settlement time in the Isolator® Row PLUS. After Stormwater flows through the Isolator® Row PLUS and into the rest of the StormTech chamber system it is either infiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

StormTech developed and owns the Isolator® Row PLUS technology and has filed a number of patent applications relating to the Isolator® Row PLUS system.[1]

Description of Test Procedure for the StormTech Isolator® Row PLUS

In January 2020, two overlapping StormTech SC-740 Isolator® Row PLUS commercial size chambers were installed at the Mid-Atlantic Storm Water Research Center (MASWRC, a subsidiary of BaySaver), in Mount Airy, Maryland, to evaluate the performance of the Isolator® Row PLUS system for Total Suspended Solid (TSS) removal (Figure 3) All testing and data collection procedures were supervised by Boggs Environmental Consultants, Inc. (BEC), who was hired by ADS for third party oversight, and were in accordance with the *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device (January 2013)*.

Prior to the start of testing, a Quality Assurance Project Plan (QAPP), revision dated January 09, 2020, was submitted and approved by the New Jersey Corporation for Advanced Technology (NJCAT), c/o Center for Environmental Systems, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ 07030.

[1] (U.S. Provisional Application No. 62/753,050, filed October 30, 2018; U.S. Non-Provisional Application No. 16/670,628, filed October 31, 2019; International Application No. PCT/US2019/059283, filed October 31, 2019; U.S. Application No. 16/938,482, filed July 24, 2020; U.S. Application No. 16/938,657, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043557, filed July 24, 2020.



Figure 3: StormTech "Isolator® Row PLUS" Test Set-up at MASWRC

Verification Results

The verification process for the StormTech Isolator® Row PLUS technology was conducted by GHL in accordance with the VerifiGlobal Verification Plan for the StormTech "Isolator® Row PLUS" Technology – 2020-09-09. The technology performance claims verified by GHL are summarized at the front of this Verification Statement and in Table 6 on Page 8 under the heading "Verification Summary".

Particle size distribution analysis was performed by ECS Mid-Atlantic, LLC of Frederick, MD in accordance with ASTM D422-63(2007). ECS is accredited by the American Association of State Highways and Transportation Officials (AASHTO).

ASTM D422-63(2007) is a sieve and hydrometer method where the larger particles, > 75 microns, are measured using a standard sieve stack while the smaller particles are measured based on their settling time using a hydrometer.

The PSD meets the requirements of NJDEP, which is generally accepted as representative of the type of particle sizes an OGS would be designed to treat. Actual PSD is site and rainfall event specific, so it was necessary to choose a standard PSD to make testing and comparison manageable.

Table 1 shows the NJDEP PSD specification. Table 2 and Figure 4 show the incoming material PSD as determined by ECS Mid-Atlantic and confirmed by the verifier.

Table 1: NJDEP PSD Specification

Particle Size (µm)	NJDEP Minimum Specification
1000	98
500	93
250	88
150	73
100	58
75	48
50	43
20	33
8	18
5	8
2	3
d_{50}	< 75 µm

Table 2 – Particle Size Distribution (PSD) of Test Sediment

Mesh (mm)	US Sieve Size	Sample ID		
		PSD A	PSD B	PSD C
		Percent Finer		
9.525	0.375	100.0	100.0	100.0
4.750	#4	100.0	100.0	100.0
4.000	#5	100.0	100.0	100.0
2.360	#8	100.0	100.0	100.0
2.000	#10	100.0	100.0	100.0
1.180	#16	100.0	100.0	100.0
1.000	#18	100.0	100.0	100.0
0.500	#35	100.0	100.0	100.0
0.425	#40	93.3	93.0	93.6
0.250	#60	90.3	89.8	90.2
0.150	#100	79.3	78.1	78.1
0.125	#120	73.6	71.7	71.7
0.106	#140	68.4	65.2	64.8
0.090	#170	60.2	58.3	57.5
0.075	#200	52.0	50.9	50.3
0.053	#270	48.0	48.3	47.8
0.045	Hydrometer	46.6	46.7	46.7
0.032		42.8	42.9	41.0
0.021		37.1	37.2	35.3
0.0125		25.7	25.7	25.8
0.0090		20.1	20.1	19.2
0.0064		16.3	16.4	14.5
0.0032		8.8	8.7	7.8
0.0014		3.8	3.7	3.8

The suspended sediment concentration analysis was completed by Fredericktowne Labs Inc., Meyersville, MD. Fredericktown Labs is accredited by the Maryland Department of Environment as Maryland Certified Water Quality Laboratory. The analysis procedure was ASTM D3977-97, Suspended Sediment Concentration. The sampling procedure and submission of samples to the test lab were overseen by the independent observer, Boggs Environmental Consultants, Inc.

All test data and calculations were detailed in the report “NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC”, July 2020, which was submitted to and verified by the New Jersey Corporation for Advanced Technology (NJCAT).

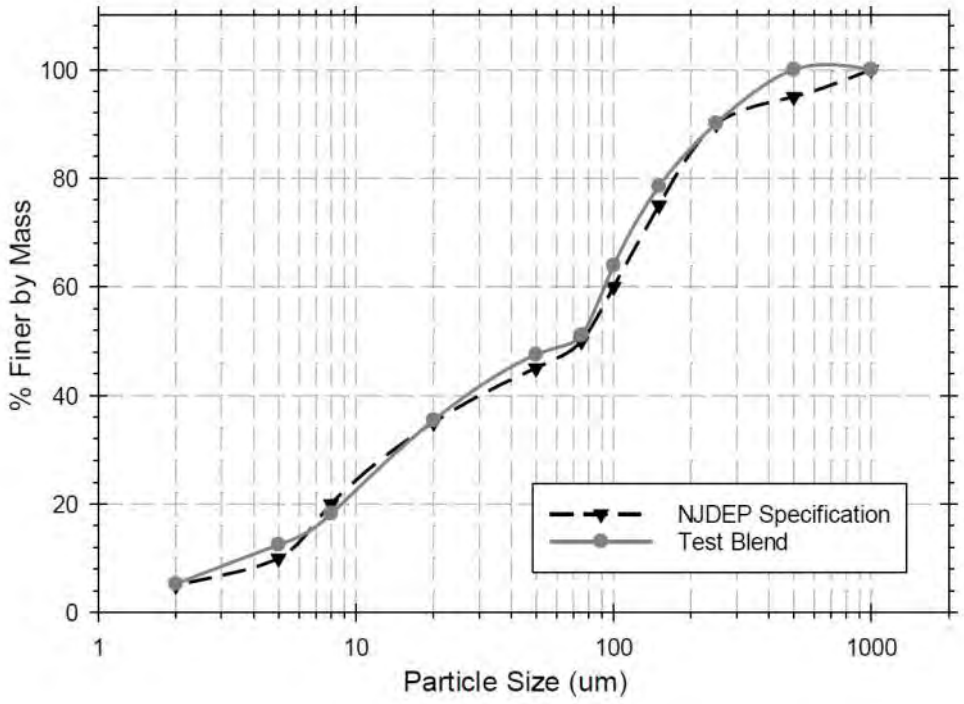


Figure 4– Particle Size Distribution (PSD)

The data in Table 3 (Flow Rate and Temperature) and Table 4 (Removal Efficiency) form the basis for the verified technology performance claim, specifically, flow rate, sediment captured and removal efficiency.

Table 3: Flow Rate and Temperature Summary

Run	Max Flow (gpm)	Min Flow (gpm)	Average Flow (gpm)	Flow COV	Flow Compliance (COV< 0.1)	Maximum Temperature (Fahrenheit)	NJDEP Temperature Compliance (< 80 F)
1	232.8	223.9	226.3	0.0078	Y	48.2	Y
2	228.9	218.6	220.8	0.0104	Y	51.5	Y
3	229.4	220.0	227.2	0.0094	Y	44.7	Y
4	230.2	218.7	223.2	0.0138	Y	40.5	Y
5	228.7	216.9	222.2	0.0103	Y	44.7	Y
6	227.6	217.0	224.2	0.0115	Y	46.7	Y
7	229.7	221.9	226.4	0.0092	Y	44.6	Y
8	230.3	222.2	226.8	0.0089	Y	43.5	Y
9	233.2	218.4	225.6	0.0136	Y	45.5	Y
10	232.2	219.7	228.4	0.0126	Y	44.7	Y
11	226.9	219.2	224.1	0.0088	Y	52.4	Y
12	232.2	222.1	226.9	0.0107	Y	48.5	Y
13	234.7	221.2	226.1	0.0109	Y	48.5	Y
14	231.9	223.4	228.7	0.0103	Y	45.6	Y
15	236.8	224.1	231.4	0.0131	Y	52.2	Y
16	232.5	221.3	229.0	0.0137	Y	47.8	Y

Table 4: Removal Efficiency Results

Run	Average Influent TSS (mg/L)	Influent Water Volume (gal)	Adjusted Average Effluent TSS (mg/L)	Effluent Water Volume (gal)	Adjusted Average Drain Down TSS (mg/L)	Drain Down Water Volume (gal)	Single Run Removal Efficiency (%)	Mass of Captured Sediment (g)	Cumulative Removal Efficiency (%)
1	203	7166	46	6881	34	285	77.8	4282	77.8
2	199	6993	32	6639	27	354	84.0	4415	80.8
3	207	7197	37	6793	27	403	82.6	4654	81.4
4	217	7068	33	6635	29	433	84.9	4923	82.3
5	215	7037	39	6593	29	444	82.2	4705	82.3
6	207	7097	40	6643	31	454	81.2	4504	82.1
7	198	7169	37	6693	30	476	81.6	4386	82.0
8	201	7184	37	6716	32	468	81.6	4473	82.0
9	205	7147	38	6675	30	472	81.8	4539	82.0
10	203	7235	38	6759	31	476	81.4	4523	81.9
11	208	7096	38	6624	30	472	81.8	4567	81.9
12	209	7185	41	6709	30	476	80.7	4584	81.8
13	198	7162	41	6680	32	482	79.7	4277	81.6
14	200	7242	43	6757	34	485	78.8	4318	81.4
15	196	7329	41	6842	32	487	79.5	4320	81.3
16	202	7254	44	6769	31	485	78.9	4384	81.2
Avg.	**204.2**	**7160**	**39**	**6713**	**31**	**447**	**81.2**	**4491**	**N/A**
Cumulative Mass Removed (g)							**71854**		
Cumulative Mass Removed (lb)							**158.4**		
Total Mass Loaded (lb)							**195.2**		
Cumulative Removal Efficiency (%)							**81.2**		

Quality Assurance

Performance verification of the StormTech Isolator® Row PLUS technology was performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. This included reviewing all data sheets and calculated values, as well as overall management of the test system, quality control and data integrity.

Additional information on quality control measures taken can be found in section 5 of the QAPP for StormTech Isolator Row New Jersey Department of Environmental Protection Testing, Rev. 1/9/2020.

Specific QA/QC measures reviewed by the verifier are summarized in Table 5 below.

Table 5. Validation of QA/QC Procedures

QC Parameter	Acceptance Criteria
Independence of observer	Confirmed in letter from Boggs Environmental Consultants, Inc. to NJCAT
Consistency of procedure	Daily logs confirm proper procedure
Existence of QAPP	Confirmed. “QAPP For StormTech Isolator Row New Jersey Department of Environmental Protection Testing”, Rev. 1/9/2020*)*
Use of appropriate sample analysis method – ASTM D3799	Confirmed by method reference on lab reports from Fredericktowne Labs Inc.
Test method appropriate for the technology	Used industry stakeholder approved protocol: *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids*

	Removal by a Filtration Manufactured Treatment Device (January 2013)
Test parameters stayed within required limits	Confirmed in report "NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC", July 2020
Third party verified data	All testing was observed and reviewed by Boggs Environmental Consultants, Inc.

Variance

Performance claims regarding structural load limitations were not verified as they are outside the scope of the performance testing that was conducted in accordance with the 'Quality Assurance Project Plan (QAPP) for StormTech Isolator Row, New Jersey Department of Environmental Protection Testing', revision dated January 09, 2020.

Verification Summary

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers wrapped in woven geotextile fabric with two layers at the bottom that serve as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal.

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Table 6 summarizes the verification results in relation to the technology performance parameters that were identified in the Verification Plan to determine the efficacy of the StormTech Isolator® Row PLUS technology.

Table 6 - Summary of Verification Results Against Performance Parameters

Parameters	Verified Claims	Accuracy
Total Suspended Solids (TSS) Removal Efficiency	Based on the laboratory testing conducted, the StormTech Isolator® Row PLUS achieved an average 82% removal efficiency of SSC	± 1% (95% confidence level)
Average Loading Rate	Based on the laboratory testing parameters, the StormTech Isolator® Row PLUS maintained a loading rate of 4.15 GPM/sf	±0.03 GPM/sf (95% confidence level)
Maximum Treatment Flow Rate (MTFR)	Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 GPM/ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.	± 1.4 GPM (95% confidence level)
Detention Time and Volume	Detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 (based on	N/A

	physical measurement) and a detention time of 2.2 minutes.	
Maximum Sediment Storage Depth and Volume	The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.	N/A
Effective Sedimentation/ Filtration Treatment Area	The effective sedimentation and filtration treatment area increases as the size of the chamber increases. Under the tested conditions using 2 overlapping chambers, the treatment area was 54.5 ft^2	The sedimentation /filtration area was determined from the actual physical dimensions of the test unit*
Sediment Mass Load Capacity	The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs (2.91 lbs/ ft^2) following a total sediment loading of 195.2 lbs	± 0.8 lbs (±0.01 lbs/ft^2) (95% confidence level)

*Note: These numbers are determined based on physical measurement or a dimensional drawing, which is standard practice. Highly accurate measurements are not practical.

In conclusion, the StormTech Isolator® Row PLUS is a viable technology that can be used to remove contaminants from stormwater runoff via filtration. This technology has proven effective at removing suspended sediment from stormwater through in-lab testing using an industry recognized laboratory protocol.

By extension of sediment removal, this technology should also remove particle bound nutrients, heavy metals, and a wide variety of organic contaminants. Performance is a function of pollutant properties, hydraulic retention time, filter media, pre-treatment, and flow rate, such that proper design of the system is critical to achieving the desired results.

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the StormTech "Isolator® Row PLUS" technology, contact:	For more information on VerifiGlobal, contact:
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Signed for StormTech: *Original signed by:* *Greg Spires* Greg Spires, P.E. General Manager	Signed for VerifiGlobal: *Original signed by:* *Thomas Bruun* Thomas Bruun, Managing Director *Original signed by:* *John Neate* John Neate, Managing Director

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined operational conditions and parameters and the appropriate quality assurance procedures. VerifiGlobal and the Verification Expert, Good Harbour Laboratories, make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable regulatory requirements. Mention of commercial product names does not imply endorsement.

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StormTech®
Detention • Retention • Water Quality
An ADS company

Isolator® Row PLUS O&M Manual







THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS®

ADS®

THE ISOLATOR® ROW PLUS

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row PLUS is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

THE ISOLATOR ROW PLUS

The Isolator Row PLUS is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row PLUS and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row PLUS protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row PLUS chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row PLUS is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator Row PLUS but includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row PLUS bypass through a manifold to the other chambers. This is achieved with either an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row PLUS row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row PLUS. After Stormwater flows through the Isolator Row PLUS and into the rest of the StormTech chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus that is attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by enhancing outflow of solid debris that would otherwise collect at an end of the chamber. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row PLUS may be part of a treatment train system. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row PLUS is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

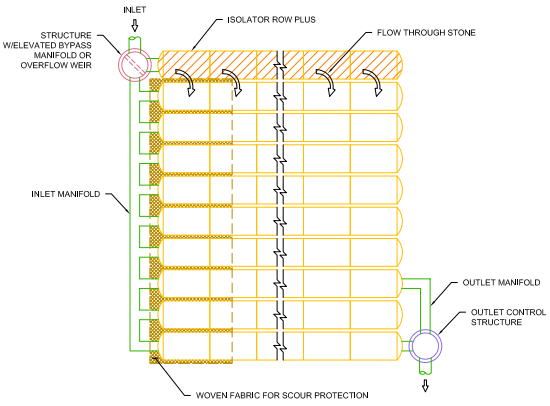
Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row PLUS.



Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.



StormTech Isolator Row PLUS with Overflow Spillway (not to scale)





ISOLATOR ROW PLUS INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row PLUS should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row PLUS incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row PLUS, clean-out should be performed.

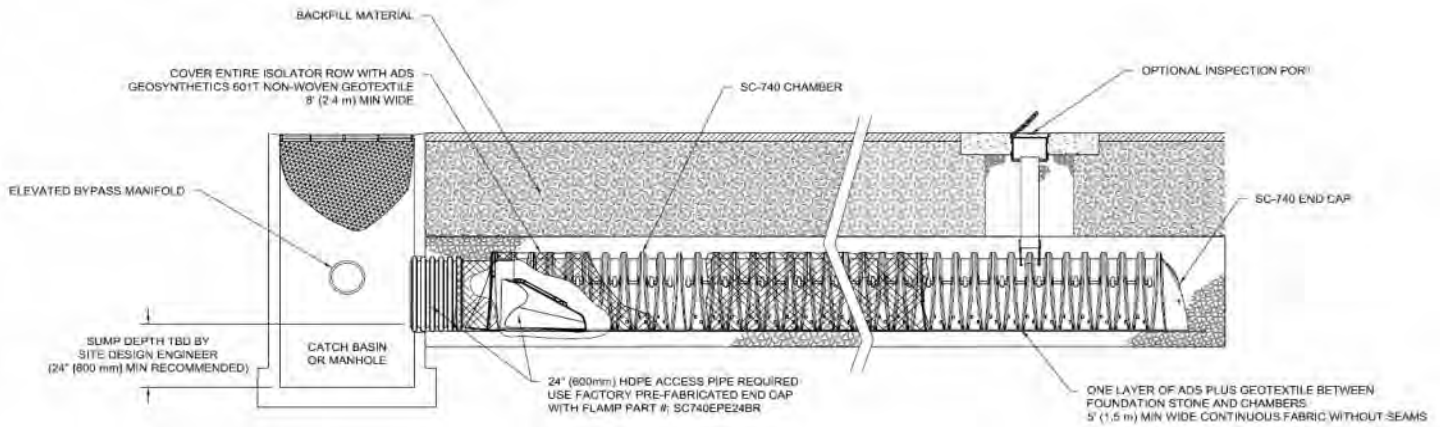
MAINTENANCE

The Isolator Row PLUS was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row PLUS while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row PLUS up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Row PLUS that have ADS PLUS Fabric (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row PLUS (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row PLUS.



ISOLATOR ROW PLUS STEP BY STEP MAINTENANCE PROCEDURES

STEP 1

Inspect Isolator Row PLUS for sediment.

A) Inspection ports (if present)
   i. Remove lid from floor box frame
   ii. Remove cap from inspection riser
   iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
   iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row PLUS
   i. Remove cover from manhole at upstream end of Isolator Row PLUS
   ii. Using a flashlight, inspect down Isolator Row PLUS through outlet pipe
      1. Mirrors on poles or cameras may be used to avoid a confined space entry
      2. Follow OSHA regulations for confined space entry if entering manhole
   iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2

Clean out Isolator Row PLUS using the JetVac process.

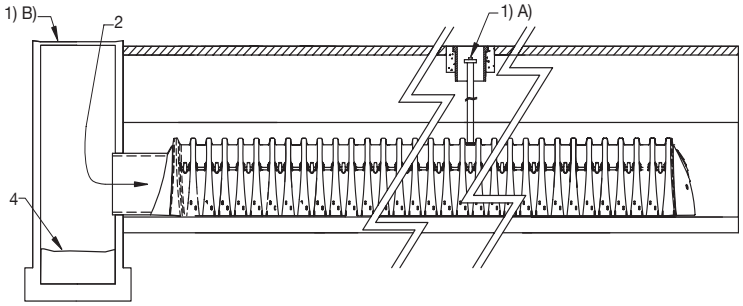
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

STEP 3

Replace all caps, lids and covers, record observations and actions.

STEP 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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APPENDIX C

FIRE FLOW ANALYSIS INFORMATION

FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Project Number: **24012**
Project Name: **800 Burloak Drive**
Date: **2024-04-17**

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 2020).

An estimate of the fire flow required is given by the following formula:

$$F = 220\,C\sqrt{A}$$

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for Type V wood frame construction (structure essentially all combustible)
= 0.8 for Type IV-A mass timber construction (encapsulated mass timber)
= 0.9 for Type IV-B mass timber construction (rated mass timber)
= 1.0 for Type IV-C mass timber construction (ordinary mass timber)
= 1.5 for Type IV-D mass timber construction (un-rated mass timber)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Total floor area in square metres

Building / Location	Building Area: Footprint Area (m^2)	Building Area: # of Storeys	Building Area: **Total GFA (m^2)**	Type of Construction	(1) *Fire Flow "F"*: (l/min)	(1) *Fire Flow "F"*: (l/s)	(2) *Occupancy*: %	(2) *Occupancy*: Adjustment (l/min)	(2) *Occupancy*: **Adjusted Fire Flow (l/min)**	(3) *Sprinkler*: %	(3) *Sprinkler*: Adjustment (l/min)	(4) *Exposure*: %	(4) *Exposure*: Adjustment (l/min)	**Final Adjusted Fire Flow**: **(l/min)**	**Final Adjusted Fire Flow**: **(l/s)**
Mixed Use Block B	**3300.0**	**6**	**13200**	**0.6**	15000	250.0	**-15**	-2250.0	**12750.0**	**-50**	-6375.0	40	5100.0	**11000**	**183**

(2) Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

Minimum credit for systems designed to NFPA 13 is 30%.

If the domestic and fire services are supplied by the same municipal water system, then take an additional 10%.

If the sprinkler system is fully supervised (ie. annunciator panel that alerts the Fire Dept., such as a school), then an additional 10% can be taken. Maximum credit = 50%.

(4) Exposure

0 to 3m	25%	
3.1 to 10m	20%	Calculate for all
10.1 to 20m	15%	sides. Maximum
20.1 to 30m	10%	charge shall not
> 30m	0%	exceed 75%

Side	Exposure (m)	Charge (%)
North =	**0 to 3m**	**25**
South =	**> 30m**	**0**
East =	**> 30m**	**0**
West =	**10.1 to 20m**	**15**
Total Expoure =		***40***