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1104 Halton Terrace

Site Servicing and Stormwater Management Report

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MAPLE LEAF HOMES

1104 HALTON TERRACE

SITE SERVICING AND STORMWATER MANAGEMENT REPORT

Prepared for:

Maple Leaf Homes

Prepared By:

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Issued: October 19, 2021
Revised: November 3, 2023
Revised: September 18, 2024
Revised: April 25, 2025
Revised: July 11, 2025

Novatech File: 119024
Report Ref: R-2021-114

July 11, 2025

City of Ottawa
Planning, Infrastructure and Economic Development Department
Planning Services Branch
110 Laurier Ave. West, 4th Floor
Ottawa, Ontario
K1P 1J1

Attention: **Abi Dieme, Project Manager - Infrastructure Approvals**

Reference: **1104 Halton Terrace**
Site Servicing and Stormwater Management Report
Novatech File No.: 119024

Novatech has prepared this Site Servicing and Stormwater Management Report on behalf of Maple Leaf Homes for 1104 Halton Terrace.

The report provides an analysis of sewer capacity (sanitary, storm), water distribution, and stormwater management for the proposed development site.

Contact the undersigned with any questions or comments.

Sincerely,

NOVATECH

Lucas Wilson, P.Eng.
Project Engineer

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1.0 INTRODUCTION

Novatech has been retained by Maple Leaf Homes to prepare a Site Servicing and Stormwater Management Report for 1104 Halton Terrace in North Kanata, Ottawa.

This report outlines the servicing and proposed storm drainage and stormwater management strategy for the site.

1.1 Background

The proposed development is located within the Kanata North Community west of the intersection of Halton Terrace and Old Carp Road. The development is approximately 0.70 ha and is bounded by Halton Terrace to the south and east, Old Carp Road to the north, and existing residential to the west. Refer to **Figure 1** – Site Location and **Figure 2** – Site Plan.

Figure 1 – Site Location

The proposed development will consist of one 4/5-storey apartment building with underground parking consisting of 103 units. The proposed site plan is shown in **Figure 2**.

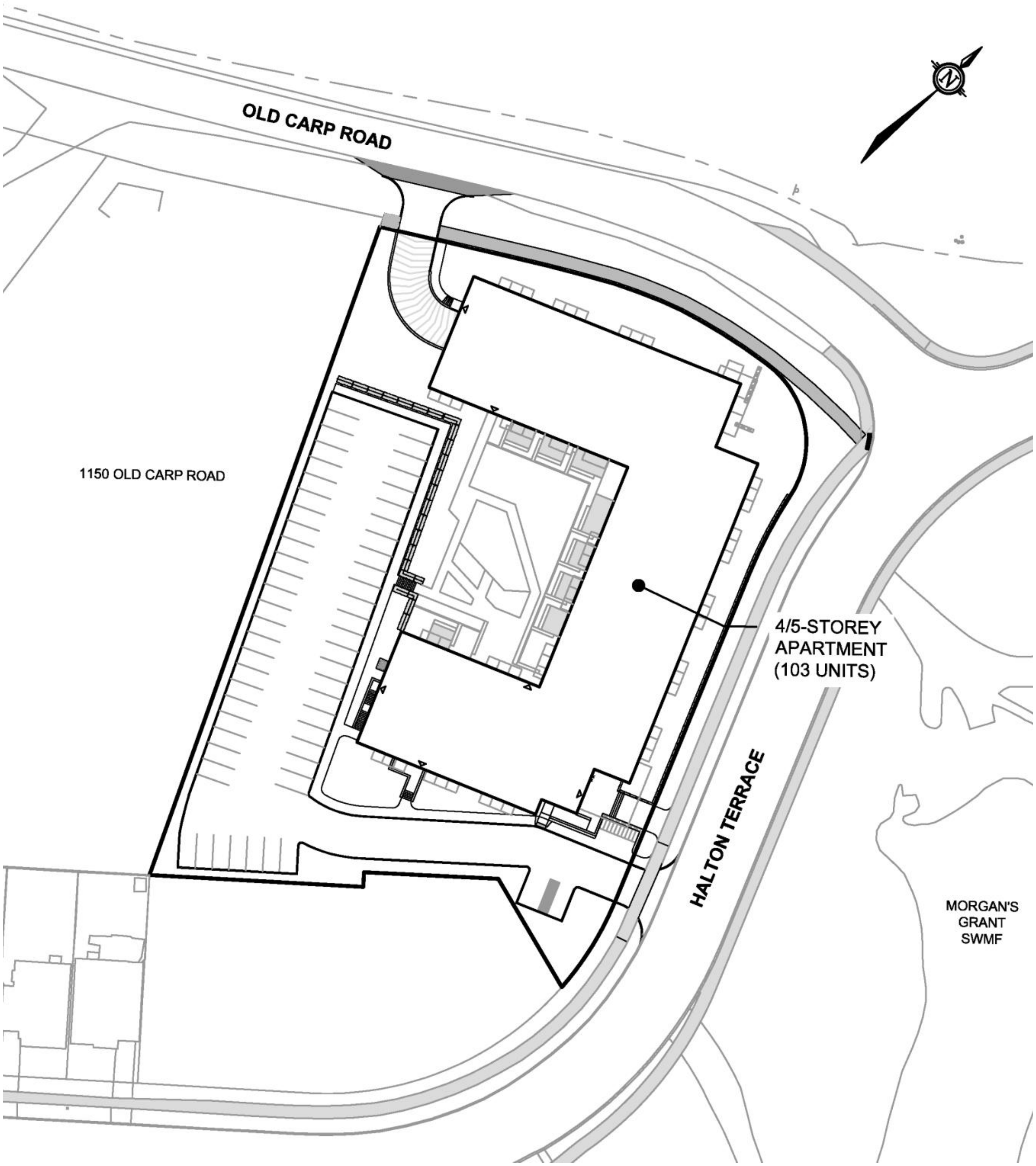

Figure 2 Site Plan

1.2 Additional Reports

This report provides information on the considerations and approach by which Novatech has designed and evaluated the proposed servicing for the Maple Leaf Homes Lands. This report should be read in conjunction with the following:

- *Geotechnical Investigation, Proposed Development, 1104 & 1150 Halton Terrace, completed by Paterson, Report: PG4872-1, dated May 3, 2019.*
- *Master Servicing Study Update for Morgan's Grant Subdivision, completed by J.L. Richards & Associates Limited, Ref. JLR 17730 dated September 2003.*
- *Morgan's Grant Stormwater Management Facility Operation, Maintenance and Monitoring Manual, completed by IBI Group, Ref. 3350-RS dated March 2014*

2.0 EXISTING CONDITIONS

2.1 Topography & Drainage

The proposed site is currently undeveloped and consists of agricultural lands with scattered mature trees. Access to the site is currently provided off Old Carp Road via a private gravel entrance.

The site generally slopes northerly towards an existing ditch line within the Halton Terrace and Old Carp Road rights-of-way. The existing ditch is routed through a 500mm diameter culvert crossing Old Carp Road.

2.2 Subsurface Conditions

Paterson completed a geotechnical investigation in support of the development, consisting of 1104 Halton Terrace and 1150 Old Carp Road properties.

The principal findings of the geotechnical investigation are as follows:

- The existing soil profile consists of having a layer of topsoil ranging from 0.05m to 0.35m thick. Silty sand to clayey silt was generally encountered underlying the topsoil ranging from 0.6 to 0.9m thick. Glacial till consisting of light brown clayey silt with some sand, gravel, cobbles, and boulders was encountered underlying the silty sand to clayey silt layer ranging from 0.15m to 0.65m thick.
- Practical refusal was encountered at all test hole locations ranging from 0.45m to 2.15m below grade.
- Based on field observations, groundwater level is expected to be within the bedrock. Besides spring melt being encountered at TP 1-19 and TP 5-19, there was no groundwater encountered at all remaining test pits upon completion of excavation.

The report provides engineering guidelines based on Paterson's interpretation of the borehole information and project requirements. Refer to the above-noted report for complete details.

3.0 WATERMAIN

3.1 Existing Conditions

The proposed development is located inside the 2W2C Pressure Zone. An existing 300mm watermain is located along Halton Terrace.

3.2 Proposed Watermain System

The site will be serviced by two 200mm water services, separated by an isolation valve, connecting to the existing 300mm watermain in Halton Terrace. **Figure 3** highlights the proposed works and connection point for the proposed watermains and hydrants. All existing watermain boundary conditions were provided by the City of Ottawa and are included in **Appendix B**.

3.3 Design Criteria

A fire flow demand of 150 L/s has been calculated, as per the Fire Underwriter's Survey (FUS) and calculations are included in **Appendix B**. Watermain analysis was completed based on the following criteria:

<u>Demands:</u>

- Apartment Density 1.8 persons/unit
- Average Daily Demand 280 L/capita/day
- Max. Daily Demand 2.5 x Average Daily Demand
- Peak Hour Demand 2.2 x Maximum Daily Demand
- Fire Flow Demand Fire Underwriters Survey

<u>System Requirements:</u>

- Max. Pressure (Unoccupied Areas) 690 kPa (100 psi)
- Max. Pressure (Occupied Areas) 552 kPa (80 psi)
- Min. Pressure 276 kPa (40 psi) excluding fire flows
- Min. Pressure (Fire) 138 kPa (20 psi) including fire flows
- Max. Age (Quality) 192 hours (onsite)

<u>Friction Factors:</u>

- Watermain Size C-Factor
- 200mm 100
- 300mm 120

Hydraulic modelling of the development was completed using EPANET 2.0. EPANET is public domain software capable of modelling municipal water distribution systems by performing simulations of the water movement within a pressurized system. EPANET uses the Hazen-Williams equation to analyze the performance of the proposed watermain and considered the following input parameters: water demand, pipe length, pipe diameter, pipe roughness, and pipe elevation.

3.4 Hydraulic Analysis

A summary of the model results are shown below in **Table 3-1**, **Table 3-2** and **Table 3-3**. Full model results are included in **Appendix B**. Refer to **Figure 3** below for details about the node and pipe network. The analysis also includes demand from the existing and proposed single family homes along Halton Terrace.

Table 3-1: Summary of Hydraulic Model Results - Maximum Day + Fire Flow

Operating Condition	Minimum Pressure
150 L/s	367.19 kPa (EXHYD1)

Table 3-2: Summary of Hydraulic Model Results - Peak Hour Demand

Operating Condition	Maximum Pressure	Minimum Pressure
3.305 L/s through system	460.00 kPa (EXHYD2)	386.02 kPa (EXHYD1)

The hydraulic modelling summarized above highlights the maximum and minimum system pressures during Peak Hour conditions, and the minimum system pressures during the Maximum Day + Fire condition. Since the Maximum Day + Fire Flow pressures are above the minimum 140 kPa, and the Peak Hour Pressures onsite fall within the normal operating pressure range (345 kPa to 552 kPa) the proposed development can be adequately serviced.

Table 3-3: Summary of Hydraulic Model Results – Maximum Pressure Check

Operating Condition	Maximum Pressure	Minimum Pressure	Maximum Age
0.601 L/s through system	468.43 kPa (T1)	434.09 kPa (EXHYD1)	11.14 Hours (B1)

The average day pressures throughout the system are below 552 kPa, therefore pressure reducing valves are not required.

Water retention was analyzed at each node during average day demand. The maximum age throughout the system is within City standards.

A copy of the boundary conditions provided by the City of Ottawa, fire flow calculations, and detailed hydraulic analysis results are included in **Appendix B**.

There are no deviations from the City of Ottawa Design Guidelines – Water Distribution (2010).

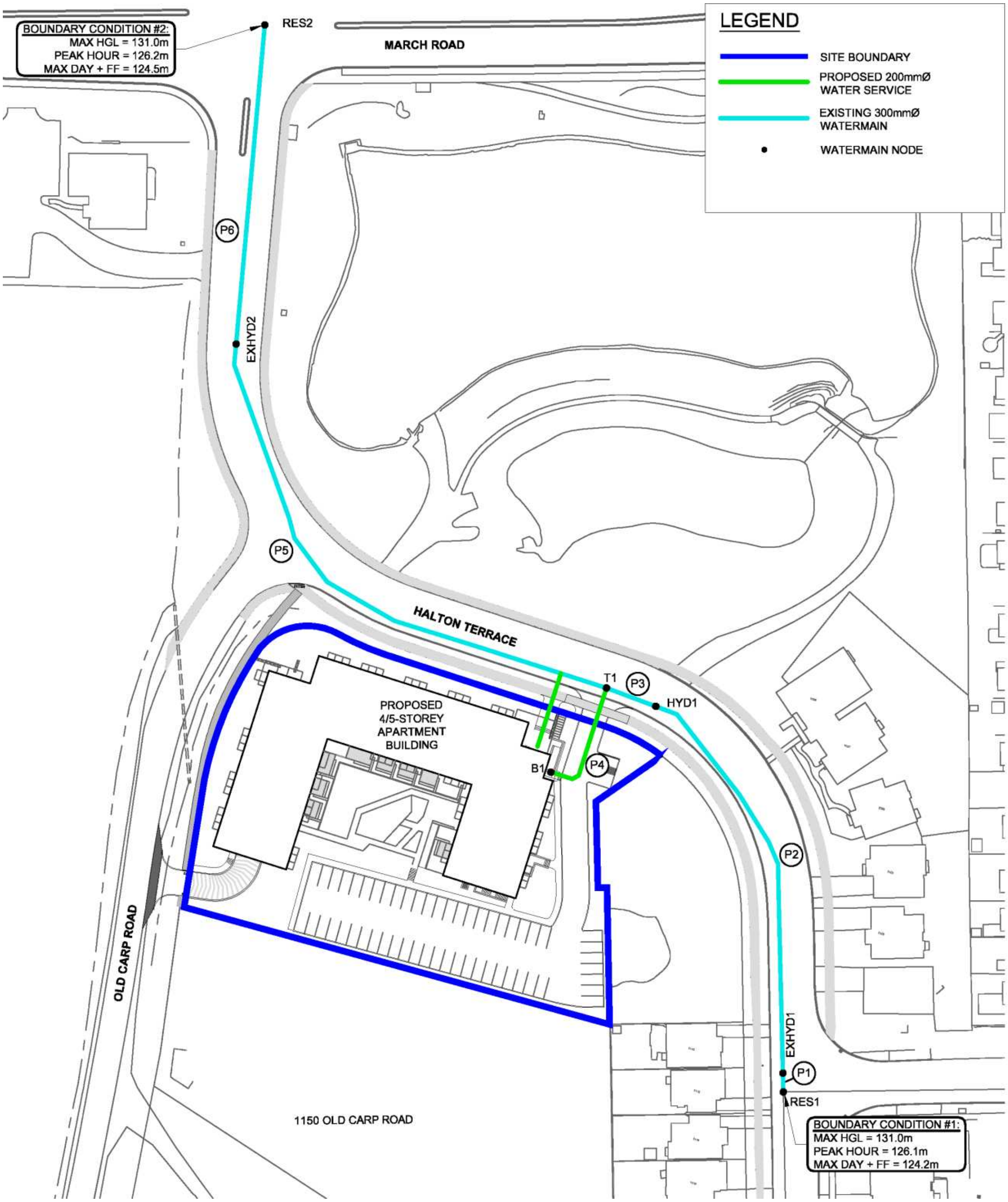

Figure 3 Watermain Distribution

4.0 SANITARY SERVICING

4.1 Existing Conditions

There is an existing 250mm sanitary sewer along Halton Terrace with an existing manhole adjacent to the proposed site. Flows from the site will be routed through the Morgan's Grant Subdivision sanitary sewers, which eventually outlets into the East March Trunk sewer.

4.2 Proposed Sanitary Sewer Outlet

A 200mm sanitary sewer and service will be installed connecting into the existing 250mm sanitary sewer network in Halton Terrace. The proposed outlet is consistent with the approved Morgan's Grant Master Servicing Study Update (J.L. Richards). The proposed sanitary layout can be seen on **Figure 4** below.

4.3 Design Criteria

Sanitary sewers, for the proposed development, are designed based on criteria established by the City of Ottawa in the following documents:

- Section 4.0 of the City of Ottawa Sewer Design Guidelines (October 2012).
- Technical Bulletin ISTB-2018-01 from the City of Ottawa regarding new sanitary design parameters. Design parameters from this technical bulletin will supersede values within the Sewer Design Guidelines (2012).

The resulting design parameters are summarized as follows:

Population Flow = 280 L/capita/day
Infiltration = 0.33 L/s/ha
Apartment = 1.8 persons per unit
Maximum Residential Peak Factor = 4.0
Harmon Correction Factor = 0.8
Minimum velocity = 0.6m/s
Manning's n = 0.013

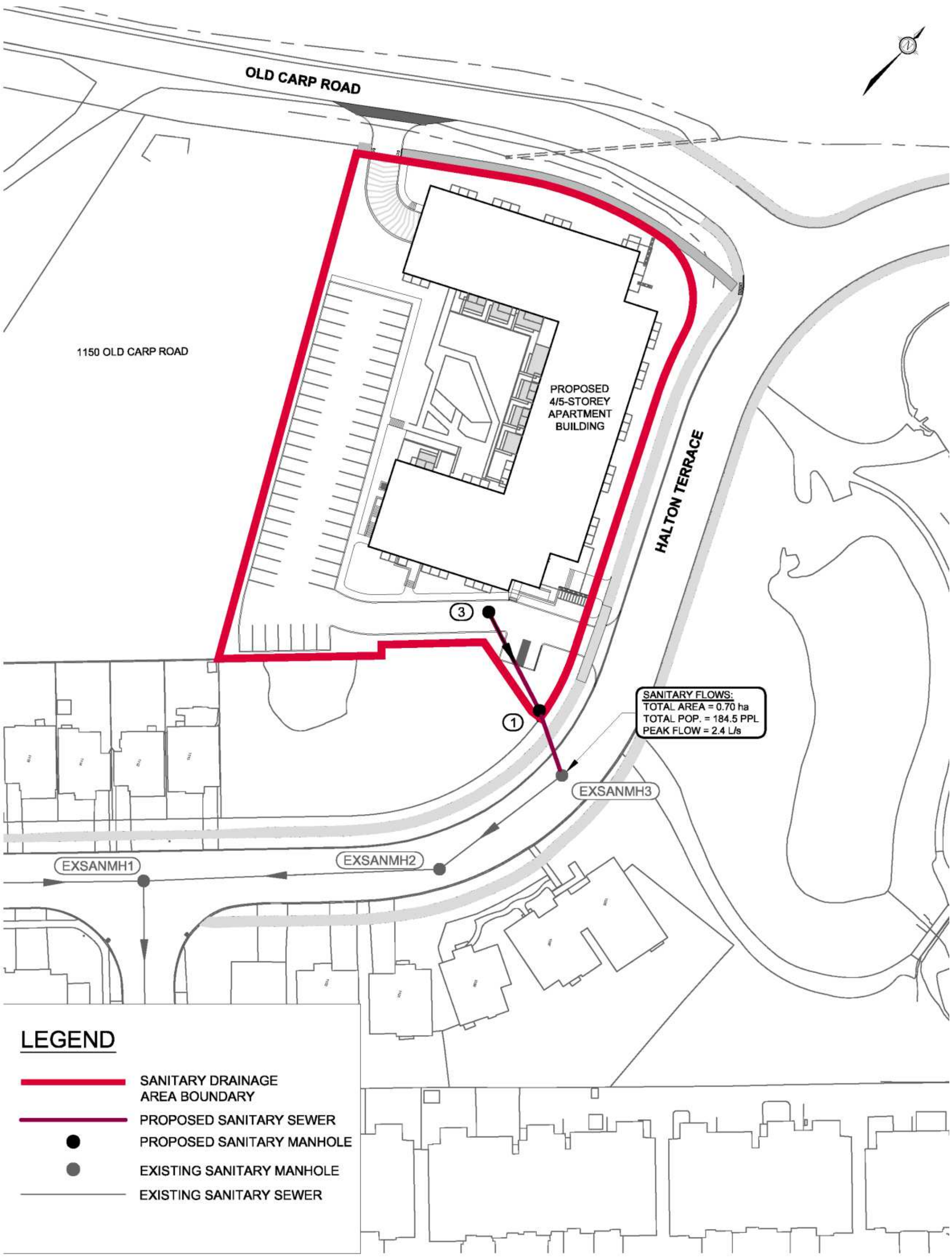

Figure 4 Sanitary Collection

4.4 Proposed Sanitary Sewer System

The calculated peak sanitary design flow for the development is 2.4 L/s. The total flow being directing to the 250mm sanitary sewer in Halton Terrace, consisting of the proposed site, future single-family homes and existing single-family homes is 3.1 L/s. The Morgan's Grant Master Servicing Study Update accounted for a total flow of 5.6 L/s through the existing 250mm sanitary sewers, exceeding the current calculated peak design flow of 3.1 L/s. For detailed calculations refer to the Sanitary Sewer Design Sheet located in **Appendix C**.

All residential units will have a gravity connection to the sanitary sewers.

The building USF is at an elevation of 80.97m and is too low to provide a gravity connection for the underground parking floor drains. A pump will be required to connect the underground parking floor drains to the 200mm diameter sanitary service.

The downstream sanitary sewers within Halton Terrace have adequate capacity to accommodate the proposed development as shown in the sanitary design sheet provided in **Appendix C**.

5.0 STORM SEWER SYSTEM AND STORMWATER MANAGEMENT

5.1 Stormwater Management Criteria

The following stormwater management criteria for the proposed development was prepared in accordance with the City of Ottawa Sewer Design Guidelines (October 2012) and the Master Servicing Study Update for Morgan's Grant Subdivision (J.L. Richards, September 2003).

- Provide a dual drainage system (i.e. minor and major system flows);
- Maximize the use of surface storage available on site;
- Control runoff to the allowable release rates for flows directed to Morgan's Grant SWMF and to the Old Carp Road ditch and specified in **Section 5.1.1** using on-site storage;
- Ensure that no surface ponding will occur on the paved surfaces (i.e. private drive aisles or parking areas) during the 2-year storm event; and,
- Ensure that ponding is confined within the parking areas at a maximum depth of 0.35m for both static ponding and dynamic flow.

5.1.1 Allowable Release Rate

<u>Flows to Morgan's Grant SWMF</u>

The allowable release rate was established based on the Morgan's Grant SWM Facility design report, which specifies a minor system release rate of 339 L/s for the 6.4 ha area directed to the SWM facility (represented as Area 11 in the Master Storm Drainage Plan for Morgan's Grant). This corresponds to an allowable release rate of 53 L/s/ha. The development has a total area of 0.70 ha and corresponds to an allowable release rate of 37.1 L/s for all storms up-to and including the 100-year storm event.

<u>Flows to Old Carp Road 500mm Culvert</u>

The allowable (pre-development) release rate has been calculated using the Rational Method with the following parameters:

- Drainage Area
    - 0.194 ha (Site boundary)
- Runoff Coefficient
    - 0.21 (Runoff coefficient increased by 25%, up to a maximum value of 1.00, for the 100-yr event.
- Rainfall Intensity
    - Based on City of Ottawa IDF data (Ottawa Sewer Design Guidelines) with a time-of-concentration of 10 minutes (derived using Uplands Method).

The allowable (pre-development) release rates are as follows. Refer to **Appendix D** for supporting calculations:

2-year	8.7 L/s
5-year	11.8 L/s
100-year	25.9 L/s

5.2 Existing and Proposed Storm Infrastructure

Existing Conditions

Under existing conditions, storm runoff from the site generally flows north to an existing ditch within the Halton Terrace and Old Carp Road rights-of-way. A portion of the site (0.42 ha) is directed to the storm sewer in Halton Terrace while the remainder of the site (0.28 ha) is routed through a 500mm diameter culvert crossing Old Carp Road, ultimately outletting to Shirley's Brook.

There are existing 375mm and 1500mm diameter storm sewers on Halton Terrace, outletting to the adjacent Morgan's Grant SWMF.

Proposed Conditions

An area of 0.42 ha will be routed to the 1500mm diameter storm sewer located at the main entrance on Halton Terrace. The remaining 0.28 ha, consisting of rooftop, underground parking ramp, and landscaped areas, will be routed to the 500mm diameter culvert crossing Old Carp Road. Refer to **Figure 5** for the storm servicing layout.

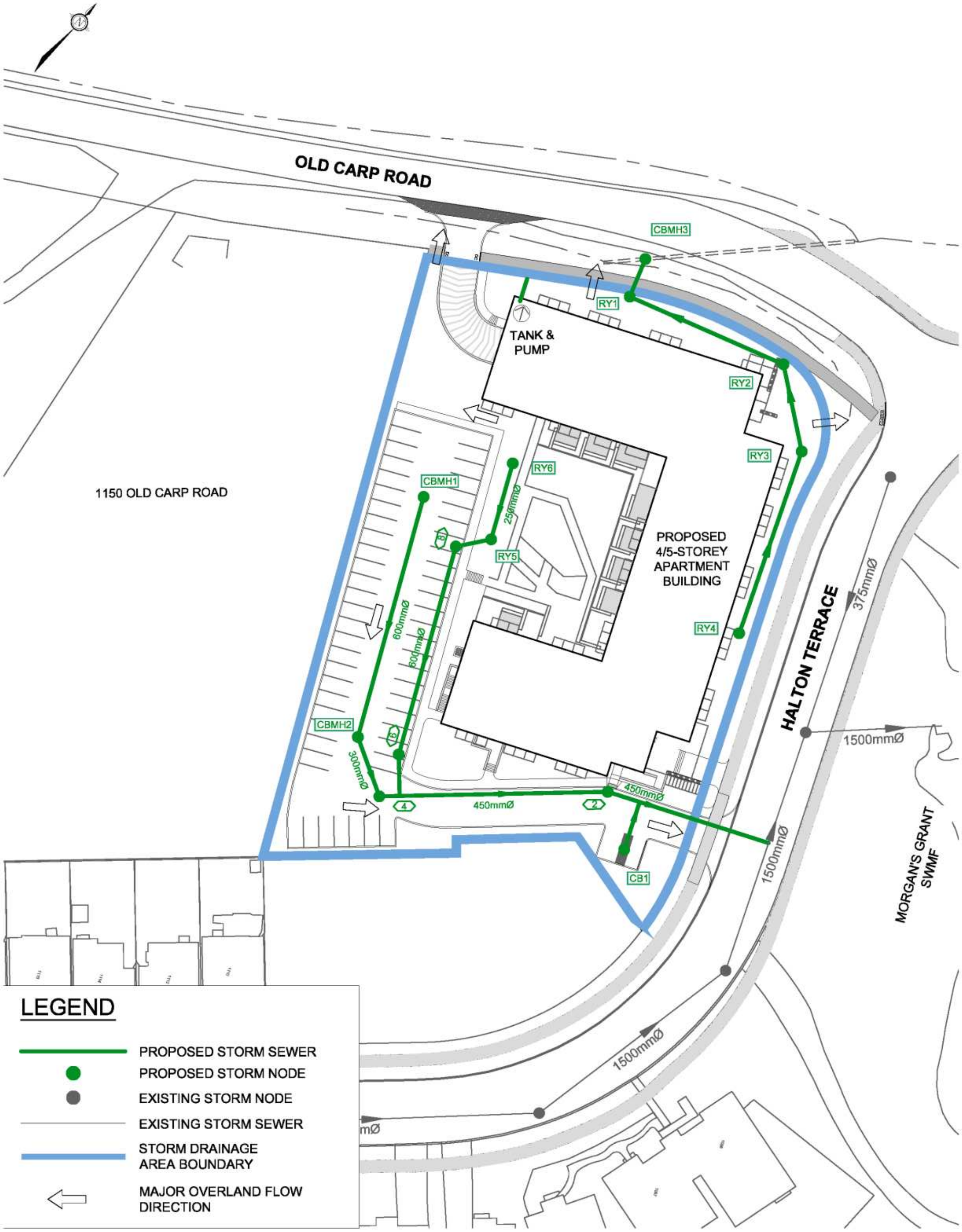

Figure 3 Storm Drainage

5.2.1 Minor System (Storm Sewers)

Storm servicing has been provided using a dual-drainage system. Runoff from frequent events will be conveyed by the proposed storm sewers (minor system), while flows from large storm events that exceed the capacity of the minor system will be stored underground using a series of Stormtech SC-800 storage chambers and 600mm diameter HDPE storage pipes, on the surface in road sags, and/or conveyed overland along defined overland flow routes (major system).

Storm Sewer Design Criteria

The following is the storm sewer design criteria [Ottawa Sewer Design Guidelines (Oct. 2012)]:

- Rational Method (Q) = 2.78CIA, where
  - Q = peak flow (L/s)
  - C = runoff coefficient
    - C = (0.70 * %Imp.) + 0.20
  - I = rainfall intensity for a 2-year return period (mm/hr)
    - $I_{2yr} = 732.951 / [(Tc(min) + 6.199)]^{0.810}$
  - A = site area (ha)
- Minimum Pipe Size = 250 mm; Minimum / Maximum Full Flow Velocity = 0.8 m/s / 3.0 m/s

The on-site storm sewers are sized to convey peak flows corresponding to a 2-year return period storm event based on the Rational Method. Refer to the storm sewer design sheets provided in **Appendix D**.

Underground Storage

Underground storage will be required to attenuate runoff from the site. Underground storage will be provided using Stormtech SC-800 storage chambers and 600 mm diameter HDPE storage pipes, providing 105.6 m^3 of storage. Refer to **Appendix D** for further details. The proposed layout of underground storage pipes are shown on the General Plan of Services (drawing 119024-GP).

Inlet Control Devices

Inlet control devices (ICDs) are to be installed within the selected roadway structures and rear-yard catchbasins. The ICDs have been sized to control minor system peak flows to the Halton Terrace storm sewer and Old Carp Road ditch to the allowable release rates and to ensure that no ponding occurs during the 2-year storm event.

Hydraulic Grade Line

The building USF is at an elevation of 80.97m and is too low to provide a gravity connection for the building foundation drain. A storage tank and pump are proposed to direct flows from the foundation drain and underground parking access ramp to the Old Carp Road ditch.

5.2.2 Major System Design

The site has been designed to convey private roadway and parking area runoff from storms that exceed the minor system capacity to Halton Terrace through the private entrance. The landscaped areas adjacent Halton Terrace and Old Carp Road have been designed to convey runoff that exceed the minor system capacity to the existing ditch along Old Carp Road. A third major overland flow route is provided for the shared amenity area, which is directed adjacent the underground parking ramp and outlets to the existing ditch along Old Carp Road. The site has been graded to ensure the 100-year peak overland flows are confined within the parking and landscaped areas.

Areas flowing uncontrolled to Halton Terrace and the existing Old Carp Road ditch are included as part of the minor system release rate.

Surface/Underground Storage

The stage-storage curves for each inlet were calculated based on the proposed Grading Plan (drawing 119024-GR) and the proposed underground storage locations. The total storage shown in the stage-storage curves at each inlet is provided in **Appendix D**. Approximately 105.6 m^3 of underground storage and 85.6 m^3 of surface storage is available on-site.

The total storage provided underground and on the surface is as follows:

Table 5-1: Total Available Storage

Structure ID	Underground Storage (m^3)	Surface Storage (m^3)	Total Storage (m^3)
	Provided	Provided	Provided
CB01*	-	5.2	5.2
TOTAL	-	**5.2**	**5.2**
CBMH01	-	45.3	45.3
CBMH02*	12.0	30.3	42.3
TOTAL	**12.0**	**75.6**	**87.6**
RY05	-	2.4	2.4
RY06	-	2.4	2.4
MH06*	10.4	-	10.4
TOTAL	**10.4**	**4.8**	**15.2**
RY01*	83.2	-	83.2
TOTAL	**83.2**	-	**83.2**
TOTAL OVERALL	**105.6**	**85.6**	**191.2**

*Structure with ICD.

5.3 Stormwater Quality Control

Flows directed to Morgan's Grant SWMF

Subcatchments A-01 to A-04, A-07 and B-01 are directed to the Morgan's Grant Stormwater Management Facility which will provide water quality control. The Morgan's Grant Stormwater Management Facility Operation, Maintenance and Monitoring Manual, prepared by IBI, specified the required and provided water quality volumes. The report specifies an overall tributary drainage area of 85.7 ha with an imperviousness of 32% and does not include the lands associated with our proposed development at 1104 Halton Terrace. The original water quality volumes are provided in the table below for reference.

Table 5-2 Original Water Quality Volumes – 1994 MOEE Manual vs Design

Level 2 Protection (70% TSS)*						
Drainage Tributary to Facility (ha)	Type of SWM Facility	Imperviousness Ratio	Permanent Storage (m^3)		Extended Detention (m^3)	
			Required	Provided	Required	Provided
85.7	Wet Pond	32 % (90 m^3/ha)	4,285	11,000	3,428	13,000

Table 5-3 Updated Water Quality Volumes – Includes 1104 Halton Terrace

Level 2 Protection (70% TSS)*						
Drainage Tributary to Facility (ha)	Type of SWM Facility	Imperviousness Ratio	Permanent Storage (m^3)		Extended Detention (m^3)	
			Required	Provided	Required	Provided
86.131	Wet Pond	32 % (90 m^3/ha)	4,307	11,000	3,445	13,000

As shown above in **Table 5-3**, even with the inclusion of our development, Morgan's Grant SWMF has sufficient volume to provide water quality control.

Flows directed to Old Carp Road Culvert

Most of the land being directed to Old Carp Road consists of rooftop and landscaped areas which do not require water quality control. Subcatchment A-09, with an area of 0.017 ha and an imperviousness of 79.4%, consists of landscaped area and an underground parking access ramp. Due to the underground access ramp, this area will require water quality control prior to being released to the existing Old Carp Road ditch system. The access ramp will be captured by a trench drain and directed to an internal storage tank, designed by others, which will be outfitted with a pump to discharge flow to a bioswale. The bioswale will consist of a grassed surface with landscape planting, 200 mm topsoil (filter media) and 200 mm of clear stone to promote infiltration.

Under appropriate conditions, bioswales permit significant amounts of total suspended solid (TSS) removal and the proposed bioswale has been designed based on the following publications:

- Young et. al., "Evaluation and Management of Highway Runoff Water Quality (FHWA, 1996)
- Stormwater Best Management Practices in an Urban Setting: Selection and Monitoring (FHWA, 1996)
- Stormwater Management Planning and Design Manual (MOE, 2003)

Case studies on the effectiveness of bioswales for water quality control have provided variable results, which precludes the ability to precisely calculate pollutant efficiencies. However, the above referenced publications indicate that properly designed swales can provide in excess of 80% long-term TSS removal.

Both dry and wet swales demonstrate good pollutant removal, with dry swales providing significantly better performance for metals and nitrate. Dry swales typically remove 65 percent of total phosphorous (TP), 50 percent of total nitrogen (TN), and between 80 and 90 percent of metals. The total suspended solids removal is typically between 80 and 90 percent (FHWA, 1996).

The proposed bioswale has been designed to meet MECP standards for water quality treatment. The recommended MECP & FHWA criteria for water quality are summarized in **Table 5-4**.

Table 5-4: Bioswale Design (Based on MECP & FHWA Guidelines)

Criteria	Recommended	Bioswale
Channel Slope	< 4.0% (MOE)	1.50%
Bottom Width	> 0.75m (MOE)	0.15 m
Side Slopes (H:V)	> 2.5:1 (MOE)	15:1
25mm Event (Water Quality)		
Peak Flow		2.1 L/s
Flow Depth	± 0.1 (FHWA)	0.02 m
Velocity	< 0.5m/s (MOE)	0.20 m/s
100-year Event (SCS 100-12hr)		
Peak Flow		3.7 L/s
Flow Depth	< 0.5m (MOE)	0.03 m
Velocity	< 0.5m/s (MOE)	0.24 m/s

5.4 Hydrologic & Hydraulic Modelling

The City of Ottawa Sewer Design Guidelines (October 2012) require hydrologic modelling for all dual drainage systems. The performance of the proposed storm drainage system for 1104 Halton Terrace was evaluated using the PCSWMM hydrologic/hydraulic modelling software.

<u>Design Storms</u>

The PCSWMM model includes the following design storms based on the City of Ottawa IDF data presented in the City of Ottawa Sewer Design Guidelines (October 2012):

- 3-hour Chicago Storm Distribution (10-minute time step)
- 12-hour SCS Storm Distribution (30-minute time step)

The 3-hour Chicago storm distribution includes the 2-year, 5-year, 100-year, and 100-year (+20%) return periods while the 12-hour SCS storm distribution includes only the 100-year return period.

The 3-hour Chicago storm distribution was determined to be the critical design storm for the proposed development.

PCSWMM Model Schematics, Output Data and Modelling Files

PCSWMM model schematics and output data for the 100-year 3-hour Chicago storm distribution are provided in **Appendix D**.

Table 5-5 provides a summary of the hydrologic modelling parameters (subcatchments).

Table 5-5: Hydrologic Modelling Parameters (subcatchments)

Area ID	Catchment Area (ha)	Runoff Coefficient (%)	Percent Imperviousness (%)	Zero Imperviousness (%)	Equivalent Width (m)	Average Slope (%)
Controlled Areas						
A-01	0.086	0.78	82.4	0	29	1
A-02	0.093	0.52	45.7	0	37	1
A-03	0.088	0.76	80.5	0	44	1
A-04	0.090	0.60	57.1	0	23	4
A-05	0.014	0.25	7	0	7	1
A-06	0.031	0.25	7	0	21	1
A-07	0.053	0.90	100	95	11	1
A-08	0.028	0.25	7	0	11	1
A-09	0.017	0.76	79.4	0	9	5
A-10	0.077	0.90	100	95	15	1
A-11	0.093	0.90	100	95	19	1
Uncontrolled Areas						
B-01	0.005	0.32	16.7	0	3	3
B-02	0.024	0.25	7	0	7	2
Site	**0.700**	**0.68**	**68.7**	**-**	**-**	**-**

Subcatchment Areas / Runoff Coefficients

- The proposed site has been divided into subcatchments based on the tributary drainage areas to each inlet of the proposed storm sewer system, as shown on the Storm Drainage Area Plan (Drawing 119024-STM).
- Weighted runoff coefficients were assigned based on the percent impervious values used in the PCSWMM model. As per the City of Ottawa Sewer Design Guidelines (October 2012), the runoff coefficient is based on the following equation:

$$C = (\% \text{ Imp.} * 0.7) - 0.2$$

Infiltration

Infiltration losses for all catchment areas were modeled using Horton's infiltration equation, which defines the infiltration capacity of the soil over the duration of a precipitation event using a decay function that ranges from an initial maximum infiltration rate to a minimum rate as the storm progresses. The default values for the Sewer Design Guidelines were used for all catchments.

Horton's Equation:
$f(t) = f_c + (f_o - f_c)e^{-k(t)}$

Initial infiltration rate: f_o = 76.2 mm/hr
Final infiltration rate: f_c = 13.2 mm/hr
Decay Coefficient: k = 4.14/hr

Depression Storage

- The default values for depression storage (1.57 mm impervious / 4.67 mm pervious) have been applied to all catchments.

Subarea Routing

- Subarea routing for all subcatchments has been set to 'direct to outlet'.

Equivalent Width

- The equivalent width parameter for all subcatchments is based on the measured flow length.

Minor System Conduits (Bend / Exit Losses)

- The minor system network was created in Civil3D and imported into PCSWMM.
- The following exit losses have been inputted into the model. They represent the loss coefficient based on the bend angle, as per the Appendix 6-B in the City of Ottawa Sewer Design Guidelines (October 2012).

Bend Angle	Loss Coefficient
0	0.00
15	0.09
30	0.21
45	0.39
60	0.64
75	0.96
90	1.32

Downstream Boundary Condition (Minor System)

- The storm sewer outlets for the proposed development are the existing 500mm culvert crossing Old Carp Road and the 1500mm diameter storm sewer in Halton Terrace.
- The Master Servicing Study Update for Morgan's Grant Subdivision estimated a 100-year HGL elevation of 82.65m at the proposed connection (See **Appendix D** for MSS excerpts).
- A 100-yr boundary condition of 81.23m at the 500mm culvert was used, representing the obvert of the culvert. The culvert analysis included in **Appendix D** indicates that under existing conditions, the 500mm culvert will be flowing full during the 100-year storm event.

An additional PCSWMM model has been provided for comparison purposes and includes the upstream existing drainage area routed to the Old Carp Road 500mm diameter culvert. The model includes the proposed 500mm diameter culvert extending from CBMH3 to the western edge of the property. The additional analysis was used to determine the upstream water levels and compare with the boundary condition assumption of 81.23m mentioned above. The 100-year boundary condition of 81.23m at CBMH3 produced higher upstream water levels within RY1 to RY4. The difference in upstream water levels during the 100-year storm event was approximately 3cm. The analysis results provided in this report are based on the conservative approach that uses a 100-year boundary condition of 81.23m at the 500mm culvert as this produced the highest water levels upstream of the existing culvert.

5.4.1 PCSWMM Model Results

Inlet Control Devices (ICDs)

ICDs are provided for specified structures within the roadway and catchbasins in the landscaped areas. The ICD sizes and design flows are provided in **Table 5-6**. The ICDs have been sized to maximize surface storage, limit the outlet peak flows to the allowable release rates and ensure no surface ponding during a 2-year storm event.

Table 5-6: Inlet Control Devices and Design Flows

Structure ID	ICD Size & Inlet Rate						
	ICD Type	T/G (m)	Orifice Invert (m)	100-year Head on Orifice (m)	2-year Orifice Peak Flow* (L/s)	5-year Orifice Peak Flow* (L/s)	100-year Orifice Peak Flow* (L/s)
CB01	106mm	83.32	82.32	1.13	11.1	17.1	21.2
CBMH02	Tempest LMF	85.55	82.88	2.96	6.8	7.2	7.4
RY01	Tempest LMF	82.75	81.06	1.63	8.3	9.5	12.2
MH06	Tempest LMF	85.82	82.70	1.12	3.0	4.3	8.0

**From PCSWMM model, 3-hour Chicago storm distribution.*

Both IPEX Tempest LMF and MHF ICDs are proposed for the site.

Overland Flow (Major System)

The major system network was evaluated using the PCSWMM model to ensure that the ponding depths conform to the City of Ottawa Sewer Design Guidelines (Oct. 2012). A summary of ponding depths at each inlet for the 2-year, 5-year, 100-year and 100-year (+20%) events are provided in the table below (See **Appendix C** for a more detailed ponding table). The maximum static and dynamic ponding depths are less than 0.35m during all events up to and including the 100-year + 20%, thereby meeting the major system criteria. In addition, there is no cascading flow over the highpoints during the 100-year storm event.

Table 5-7: Overland Flow Results

Structure	T/G (m)	Max. Static Ponding		HGL Elev. (m)				Ponding Depth (m)			
		Elev. (m)	Spill Depth (m)	2-yr	5-yr	100-yr	100-yr (+20%)	2-yr	5-yr	100-yr	100-yr (+20%)
CB01	83.32	83.45	0.13	82.59	82.89	83.45	83.46	0.00	0.00	0.13	0.14
CBMH01	85.55	85.90	0.35	85.43	85.68	85.84	85.86	0.00	0.13	0.29	0.31
CBMH02	85.55	85.85	0.30	85.43	85.68	85.84	85.86	0.00	0.13	0.29	0.31
RY01	82.78	82.86	0.08	81.77	81.98	82.69	82.92	0.00	0.00	0.00	0.14
RY02	83.07	83.07	0.00	81.77	81.98	82.69	82.92	0.00	0.00	0.00	0.00
RY03	82.90	82.95	0.05	81.77	81.97	82.70	82.92	0.00	0.00	0.00	0.02

Structure	T/G	Max. Static Ponding		HGL Elev. (m)				Ponding Depth (m)			
	(m)	Elev. (m)	Spill Depth (m)	2-yr	5-yr	100-yr	100-yr (+20%)	2-yr	5-yr	100-yr	100-yr (+20%)
RY04	83.16	83.26	0.10	81.77	81.98	82.70	82.92	0.00	0.00	0.00	0.00
RY05	83.80	83.90	0.10	82.89	83.04	83.83	83.91	0.00	0.00	0.03	0.11
RY06	83.80	83.90	0.10	82.89	83.05	83.83	83.91	0.00	0.00	0.03	0.11

**From PCSWMM model, 3-hour Chicago storm distribution.*

An expanded table of the ponding depths at low points in the roadway and landscaped areas (including the stress-test event) is provided in **Appendix D**. Based on these results, the proposed storm drainage system will not experience any adverse flooding even with a 20% increase to the 100-year event.

Hydraulic Grade Line

Table 5-8 provides a summary of the 100-year HGL elevations at each storm manhole.

Table 5-8: 100-year HGL Elevations

Manhole ID	MH Obvert Elevation (m)	T/G Elevation (m)	HGL Elevation (100yr) (m)	Design USF (m)
MH02	81.80	83.79	82.67	80.97
MH04	82.62	85.74	82.68	-
Connection to Ex.	81.66	83.22	82.65	-

**From PCSWMM model, 3-hour Chicago storm distribution.*

As shown above in **Table 5-8**, the USF is at an elevation of 80.97m and is too low to provide a gravity connection for the foundation drain to the proposed storm sewer system or to the existing ditch along Old Carp Road. A storage tank and pump (by others) will be required within the underground parking area to discharge flows from the foundation drain and the ramp trench drain to surface within a proposed bioswale adjacent to Old Carp Road.

Comparison of Peak Flows

Table 5-9 provides a comparison of the minor/major system flows from the proposed development to Klondike Road and the 500mm culvert crossing Old Carp Road.

Table 5-9: Comparison of Peak Flows

Outlet	Design Event	Allowable Release Rate (L/s)	Controlled Minor System Release Rate (L/s)	Uncontrolled Minor System Release Rate (L/s)	Total Minor System Release Rate (L/s)	Major System Release Rate (L/s)
1500m STM Sewer	2-yr	37.1	17.0	0.2	17.2	0
	5-yr		25.8	0.4	26.2	0
	100-yr		35.6	1.5	37.1	0
Old Carp Road Ditch	2-yr	8.7	8.3	0.4	8.7	0
	5-yr	11.8	9.5	1.2	10.7	0
	100-yr	25.9	12.2	5.0	17.2	0

(1) PCSWMM model results for the 3-hour Chicago storm distribution.

The 100-year minor system peak flow to Halton Terrace is controlled to the allowable release rate of 37.1 L/s for the proposed site. The peak flows to the Old Carp Road ditch are controlled to the allowable release rates for all storm events. The total 100-year major system peak flow is contained on-site through a combination of underground and surface storage.

6.0 ROADWAYS

6.1 Proposed Road Infrastructure

Paterson has prepared a Geotechnical Investigation report for 1104 Halton Terrace (May 2019) that provides recommendations for roadway structure, servicing and foundations. The site consists of a private roadway and at-grade parking; the recommended roadway structure is as follows:

Table 6-1: Roadway Structure

Roadway Material Description	Pavement Structure Layer Thickness (mm) Private Road
Asphalt Wear Course: Superpave 12.5 (Class B)	40
Asphalt Binder Course: Superpave 19.0 (Class B)	50
Base: Granular A	150
Sub-Base: Granular B – Type II	400
Total	**640**

7.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment control measures will be implemented during construction in accordance with the “Guidelines on Erosion and Sediment Control for Urban Construction Sites” (Government of Ontario, May 1987). An Erosion and Sediment Control Plan will be prepared as part of the detailed design.

Typical erosion and sediment control measures recommended include, but are not limited to, the use of silt fences around perimeter of site (OPSD 219.110), catch basin inserts under catch basin/maintenance hole lids, heavy duty silt fence barrier (OPSD 219.130), straw bale check dams (OPSD 219.180), rock check dams (219.210 or OPSD 219.211), riprap (OPSS 511), mud mats, silt bags for dewatering operations, topsoil and sod to disturbed areas and natural grassed waterways. Dewatering and sediment control techniques will be developed for the individual situations based on the above guidelines and utilizing typical measures to ensure erosion and sediment control is controlled in an acceptable manner and there is no negative impact to adjacent Lands, water bodies or water treatment/conveyance facilities.

It will be the responsibility of the Contractor to submit a detailed construction schedule and appropriate staging, dewatering and erosion and sediment control plans to the Contract Administrator for review and approval prior to the commencement of work.

General Erosion and Sediment Control Measures

- All erosion and sediment control measures are to be installed to the satisfaction of the engineer, the municipality and the conservation authority prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and remain present during all phases of site preparation and construction.
- A qualified inspector, provided by the owner, should conduct daily visits during construction to ensure that the contractor is working in accordance with the design drawings and that mitigation measures are being implemented as specified.
    - A light duty silt fence barrier is to be installed in the locations shown on the Erosion and Sediment Control Plan.
    - Rock check dams and/or straw bales are to be installed in drainage ditches.
    - Catch basin inserts are to be placed under the grates of all existing and proposed catchbasins and structures.
    - After complete build-out, all sewers are to be inspected and cleaned and all sediment and construction fencing is to be removed.
- The contractor shall ensure that proper dust control is provided with the application of water (and if required, calcium chloride) during dry periods.
- The contractor shall immediately report to the engineer or inspector any accidental discharges of sediment material into any ditch or sewer system. Appropriate response measures shall be carried out by the contractor without delay.

The contractor acknowledges that failure to implement erosion and sediment control measures may result in penalties imposed by any applicable regulatory agency.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Sanitary Servicing

- Wastewater will discharge to a 250mm sanitary sewer in Halton Terrace consistent with the approved Morgan's Grant Master Servicing Study.
- The peak design flow from the development is 2.4 L/s, which is less than the flows identified in the Master Servicing Study (5.6 L/s).
- All residential units can be serviced by gravity sewer.
- A pump is required to discharge the underground parking floor drains to the 200mm sanitary sewer.

Watermain

- Two 200mm service connections are proposed to service the development with connections to the 300mm watermain in Halton Terrace.
- The proposed water distribution network provides fire protection and domestic supply under all operating conditions.

Stormwater Management

- Drainage is conveyed to the Halton Terrace storm sewer and the Old Carp Road ditch in accordance with flow control limits.
  - Storm sewers (minor system) have been designed to convey the uncontrolled 2-year peak flow using the Rational Method.
  - Inflows to the minor system will be controlled using inlet control devices to the allowable release rates identified in Section 5.1.1.
  - The proposed building requires a storage tank and sump pump for collection of drainage from the foundation weeper and ramp trench drain, all of which shall discharge to a bioswale prior to outletting to the existing roadside ditch along Old Carp Road.
  - Roof drains shall discharge to surface within parking areas or landscaped areas as shown on the General Plan of Services (119024-GP).
- Rainfall in excess of the allowable minor system release rate is stored underground and/or on the surface (parking lot, swale depressions).
  - Major overland flow is routed to Halton Terrace and Old Carp Road for emergency purposes when rainfall exceeds the 100-year design storm.
  - Maximum ponding depth does not exceed 0.35m during the 100-year design storm.
  - No surface ponding occurs during the 2-year design storm.
  - Underground storage is provided within underground storage chambers, pipes and structures upstream of the flow control devices.

Erosion and Sediment control

- Erosion and sediment control measures (i.e. filter fabric, silt fences, etc.) will be implemented prior to construction and remain in place until vegetation is established.
- The Erosion and Sediment Control Plan outlines recommended measures to mitigate negative impact to adjacent lands, water bodies and water treatment/conveyance facilities.

9.0 CLOSURE

The preceding report is respectfully submitted for review and approval. Please contact the undersigned should you have questions or require additional information.

NOVATECH

Prepared by:

Lucas Wilson, P.Eng.
Project Engineer

Mark Bissett, P.Eng.
Senior Project Manager

FOR REVIEW

Appendix A

Correspondence

Lucas Wilson

From: Christine McCuaig <christine@q9planning.com>
Sent: Friday, November 20, 2020 8:30 AM
To: Brian Saumure; Mark Bissett; Jennifer Luong
Subject: Fwd: Pre-Consultation Follow-Up: 1104 Halton Terrace
Attachments: AODA Checklist.docx; 1104 Halton Terrace_design_brief_submission requirements.pdf; Plans & Study List (2020).pdf

From: "McCreight, Laurel" <Laurel.McCreight@ottawa.ca>
Date: November 20, 2020 at 7:55:06 AM EST
To: Christine McCuaig <christine@q9planning.com>
Subject: Pre-Consultation Follow-Up: 1104 Halton Terrace

Hi Christine,

Please refer to the below regarding the Pre-Application for 1104 Halton Terrace for a Site Plan Control Application and Zoning By-law Amendment for a residential development. I have also attached the required Plans & Study List for application submission.

An email was sent providing instructions on how to pay the fee for the pre-application consultation.

Below are staff's preliminary comments based on the information available at the time of the pre-consultation meeting:

Planning / Urban Design

- Grading of the site at the intersection of Old Carp Road and Halton Terrace will be an important consideration. Please ensure that the basement level is not exposed at this corner, and the principal entrance to the building is not significantly higher than the existing sidewalk/right of way.
- Will the Old Carp Road frontage be urbanized? If not please consider how this can be designed to work with the proposal.
- Please ensure the setback to the proposed low-rise residential is adequate and considers light and privacy.
- Please ensure that the TIA scoping includes all units, not just the apartment units, but also the detached dwellings.

- Please ensure adequate room for tree planting on-site.
- A design brief is required. Please see the attached terms of reference.
- Cash-in-lieu of Parkland will be required.
- You are encouraged to contact the Ward Councillor, Councillor Jenna Sudds, regarding the proposal.

Engineering

- The Servicing Study Guidelines for Development Applications are available here.
- Servicing and site works shall be in accordance with the following documents:
    - Ottawa Sewer Design Guidelines (October 2012)
    - Ottawa Design Guidelines – Water Distribution (2010)
    - Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
    - City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
    - City of Ottawa Environmental Noise Control Guidelines (January, 2016)
    - City of Ottawa Park and Pathway Development Manual (2012)
    - City of Ottawa Accessibility Design Standards (2012)
    - Ottawa Standard Tender Documents (latest version)
    - Ontario Provincial Standards for Roads & Public Works (2013)
- Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).
- The Stormwater Management Criteria for the subject site is to be based on the following:
    - The allowable storm release rate for the subject site is limited to 70 L/s/ha as per the Master Servicing Study Update for Morgan's Grant Subdivision.
    - Onsite storm runoff, in excess of the allowable release rate, must be detained on site.
    - The hydraulic grade line in the storm sewer must remain at least 0.3 m below the underside of adjacent building footings during the 100-year storm event.
    - Quantity control to be provided by the adjacent stormwater management facility and/or as determined by the Mississippi Valley Conservation Authority (MVCA). Please include correspondence from the MVCA in the stormwater management report.
- Additional studies pertaining to discharge to Shirley's Creek sub-watershed will not be required if out letting to existing stormwater management pond to the east. Stormwater charges will not be imposed to connect to the existing stormwater management pond to the east.
- No sanitary sewer capacity constraints were identified on Halton Terrace during the initial review of the concept plan.

- As per Section 4.3.1 of the Water Design Guidelines, two watermain connections will be required to provide a looped connection if the basic day demand is greater than 50 m3/day (approx. 50 homes).

- Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information:

    - Location of service

    - Type of development and the amount of fire flow required (as per FUS, 1999).

    - Average daily demand: ___ l/s.

    - Maximum daily demand: ___l/s.

    - Maximum hourly daily demand: ___ l/s.

- An MECP Environmental Compliance Approval in not anticipated to be required for the subject site.

- Phase 1 ESAs and Phase 2 ESAs must conform to clause 4.8.4 of the Official Plan that requires that development applications conform to Ontario Regulation 153/04

Please contact Infrastructure Project Manager Ahmed Elsayed for follow-up questions.

Transportation

- Follow Traffic Impact Assessment Guidelines
    - Traffic Impact Assessment will be required.
    - Start this process asap.
    - Applicant advised that their application will not be deemed complete until the submission of the draft step 1-4, including the functional draft RMA package (if applicable) and/or monitoring report (if applicable).
    - Reduced scope with regards to the study area will be considered.
- To allow for a reduction of the ROW from 26 m, the development proponent should demonstrate that the 24 m ROW can accommodate the road requirements, services, trees and pedestrian and cycling facilities. This can be done by showing the recommended cross section based on the Designing Neighbourhood Collector Guidelines (2019).
- Corner triangles as per OP Annex 1 - Road Classification and Rights-of-Way at the following locations on the final plan will be required:
    - Collector Road to Collector Road: 5 metre x 5 metres
- Noise Impact Studies required for the following:
    - Road
    - Stationary (if there will be any exposed mechanical equipment due to the proximity to neighbouring noise sensitive land uses)
- It is recommended that the access is located only on Halton Terrace to minimize accesses on Old Carp. The realignment of Old Carp is going to add more traffic to this road and the road currently does not have many accesses. The location of the accesses will be further reviewed in the TIA. Sight line analysis for the accesses on Halton Terrace and Carp (if proposed) will be required.
- On site plan:
    - Show all details of the roads abutting the site up to and including the opposite curb; include such items as pavement markings, accesses and/or sidewalks.

  - Turning templates will be required for all accesses showing the largest vehicle to access the site; required for internal movements and at all access (entering and exiting and going in both directions). Show on separate drawings.
  - Show all curb radii measurements; ensure that all curb radii are reduced as much as possible
  - Show lane/aisle widths.
  - Sidewalks are to be continuous across access as per City Specification 7.1.
- It is recommended that the accessibility requirements are implemented (checklist is attached.)

Please contact Transportation Project Manager, Neeti Paudel for follow-up questions.

Forestry

- A Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City; an approved TCR is a requirement of Site Plan approval.
- Any removal of privately-owned trees 10cm or larger in diameter requires a tree permit issued under the Urban Tree Conservation Bylaw; the permit is based on the approved TCR.
- Any removal of City-owned trees will require the permission of Forestry Services who will also review the submitted TCR.
- The TCR must list all trees on site by species, diameter and health condition.
- The TCR must list all trees on adjacent sites if they have a critical root zone that extends onto the development site.
- If trees are to be removed, the TCR must clearly show where they are, and document the reason they cannot be retained.
- The City encourages the retention of healthy trees; if possible, please seek opportunities for retention of trees that will contribute to the design/function of the site.
- Please ensure newly planted trees have an adequate soil volume for their size at maturity. Here are the recommended soil volumes:

Tree Type/Size	Single Tree Soil Volume (m3)	Multiple Tree Soil Volume (m3/tree)
Ornamental	15	9
Columnar	15	9
Small	20	12
Medium	25	15
Large	30	18
Conifer	25	15

- For more information on the process or help with tree retention options, contact Mark Richardson

Other

Please refer to the links to "Guide to preparing studies and plans" and fees for general information. Additional information is available related to building permits, development charges, and the Accessibility Design Standards. Be aware that other fees and permits may be required, outside of the development review process. You may obtain background drawings by contacting informationcentre@ottawa.ca.

These pre-consultation comments are valid for one year. If you submit a development application(s) after this time, you may be required to meet for another pre-consultation meeting and/or the submission requirements may change. You are as well encouraged to contact us for a follow-up meeting if the plan/concept will be further refined.

Please do not hesitate to contact me if you have any questions.

Regards,
Laurel

Laurel McCreight MCIP, RPP
Planner
Development Review West
Urbaniste
Examen des demandes d'aménagement ouest

City of Ottawa | Ville d'Ottawa

613.580.2424 ext./poste 16587
ottawa.ca/planning / ottawa.ca/urbanisme

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Appendix B

Watermain Boundary Conditions,
FUS Calculations, &
Modelling Results

Boundary Conditions
1104 Halton Terrace

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	36	0.60
Maximum Daily Demand	90	1.50
Peak Hour	198	3.31
Fire Flow Demand #1	9,000	150.00

Location

Results

Connection 1 – Flamborough Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	131.0	63.1
Peak Hour	126.1	56.2
Max Day plus Fire Flow #1	124.2	53.5

[1] Ground Elevation = 86.6 m

Connection 2 – March Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	131.0	74.1
Peak Hour	126.2	67.2
Max Day plus Fire Flow #1	124.5	64.8

[1] Ground Elevation = 78.9 m

Notes

1. *As per OWDG Technical Bulleting ISTB-2021-03 Section 4.3.1:*

   Industrial, commercial, institutional service areas with a basic day demand greater than 50 m^3/day (0.58 L/s) and residential areas serving 50 or more dwellings shall be connected with a minimum of two watermains, separated by an isolation valve, to avoid the creation of a vulnerable service area.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

FUS - Fire Flow Calculations

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Engineers, Planners & Landscape Architects

Novatech Project #: 119024
Project Name: 1104 Halton Terrace
Date: 9/12/2024
Input By: Lucas Wilson
Reviewed By: Mark Bissett
Drawing Reference: 119024-GP

Legend: Input by User
No Input Required
Reference: Fire Underwriter's Survey Guideline (2020)
Formula Method

Building Description: 4/5 Storey Residential Building
Type II - Non-combustible construction

Step			Choose		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction **C**	Type V - Wood frame		1.5	0.8	
		Type IV - Mass Timber		Varies		
		Type III - Ordinary construction		1		
		Type II - Non-combustible construction	Yes	0.8		
		Type I - Fire resistive construction (2 hrs)		0.6		
2	**Floor Area**					
	A	Podium Level Footprint (m^2)	2238			
		Total Floors/Storeys (Podium)	4			
		Tower Footprint (m^2)	1705			
		Total Floors/Storeys (Tower)	1			
		Protected Openings (1 hr)	No			
		A, Total Effective Floor Area (m^2)			**7,567**	
	F	**Base fire flow without reductions**				**15,000**
		$F = 220\,C\,(A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**		**FUS Table 3**	**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**12,750**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**		**FUS Table 4**	**Reduction**		
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-5,100**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System	No	-10%		
				Cumulative Sub-Total	**-40%**	
		Area of Sprinklered Coverage (m²)	10658	100%		
				Cumulative Total	**-40%**	
5	**Exposure Surcharge per**		**FUS Table 5**		**Surcharge**	
	(3)	North Side	>30m		0%	**1,275**
		East Side	>30m		0%	
		South Side	20.1 - 30 m		10%	
		West Side	>30m		0%	
				Cumulative Total	**10%**	
Results						
6	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**9,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**150**
				or	USGPM	2,378

1104 Halton Terrace
Water Demand

	Area (ha)	Units	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Apartment Unit	N/A	103	185	0.601	1.502	3.305
Total	**0.00**	**103**	**185**	**0.601**	**1.502**	**3.305**

Water Demand Parameters

Apartment Unit	1.8	ppl/unit
Residential Demand	280	L/c/day
Residential Max Day	2.5	x Avg Day
Residential Peak Hour	2.2	x Max Day
Residential Fire Flow	150	L/s

1104 Halton Terrace: Watermain Demand

Node	Existing Singles	Apartment Unit	Total Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Fire Flow (L/s)
B1		103	185	0.601	1.502	3.305	N/A
EXHYD1	6		20	0.066	0.165	0.364	N/A
EXHYD2			0	0.000	0.000	0.000	N/A
HYD1			0	0.000	0.000	0.000	150
T1			0	0.000	0.000	0.000	N/A
Total	**6**	**103**	**206**	**0.667**	**1.667**	**3.668**	

Water Demand Parameters

Apartment Unit	1.8	ppl/unit	Residential Max Day	2.5	x Avg Day
Existing Singles	3.4	ppl/unit	Residential Peak Hour	2.2	x Max Day
Residential Demand	280	L/c/day	Apartment Fire Flow	150	L/s

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1104 Halton Terrace: Watermain Analysis

Network Table - Nodes - (Peak Hour)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc B1	83.6	3.31	126.12	42.52	417.12	60.50
Junc EXHYD1	86.75	0.36	126.1	39.35	386.02	55.99
Junc EXHYD2	80.05	0	126.17	46.12	460.00	66.72
Junc HYD1	83.73	0	126.12	42.39	450.00	65.27
Junc T1	83.25	0	126.13	42.88	420.65	61.01
Resvr RES1	126.1	15.25	126.1	0	0.00	0.00
Resvr RES2	126.2	-18.92	126.2	0	0.00	0.00

Network Table - Links - (Peak Hour)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	5	300	120	-15.25	0.22	0.23	0.029
Pipe P2	100	300	120	-15.61	0.22	0.24	0.029
Pipe P3	13	300	120	-15.61	0.22	0.24	0.029
Pipe P4	31	200	100	3.31	0.11	0.14	0.048
Pipe P5	135	300	120	-18.92	0.27	0.34	0.028
Pipe P6	77	300	120	-18.92	0.27	0.34	0.028

1104 Halton Terrace: Watermain Analysis

Network Table - Nodes - (Max Pressure Check)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi	Age Hours
Junc B1	83.6	0.6	131	47.4	464.99	67.44	11.14
Junc EXHYD1	86.75	0.07	131	44.25	434.09	62.96	0.21
Junc EXHYD2	80.05	0	131	50.95	460.00	66.72	5.92
Junc HYD1	83.73	0	131	47.27	450.00	65.27	5.84
Junc T1	83.25	0	131	47.75	468.43	67.94	10.7
Resvr RES1	131	-0.41	131	0	0.00	0.00	0
Resvr RES2	131	-0.25	131	0	0.00	0.00	0

Network Table - Links - (Max Pressure Check)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	5	300	120	0.41	0.01	0.00	0.356
Pipe P2	100	300	120	0.35	0.00	0.00	0.046
Pipe P3	13	300	120	0.35	0.00	0.00	0.000
Pipe P4	31	200	100	0.60	0.02	0.01	0.062
Pipe P5	135	300	120	-0.25	0.00	0.00	0.063
Pipe P6	77	300	120	-0.25	0.00	0.00	0.055

1104 Halton Terrace: Watermain Analysis

Network Table - Nodes - (Max Day + FF)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc B1	83.6	1.5	123.7	40.1	393.38	57.06
Junc EXHYD1	86.75	0.17	124.18	37.43	367.19	53.26
Junc EXHYD2	80.05	0	124.21	44.16	460.00	66.72
Junc HYD1	83.73	150	123.66	39.93	450.00	65.27
Junc T1	83.25	0	123.7	40.45	396.81	57.55
Resvr RES1	124.2	-82.53	124.2	0	0.00	0.00
Resvr RES2	124.5	-69.14	124.5	0	0.00	0.00

Network Table - Links - (Max Day + FF)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	5	300	120	82.53	1.17	5.22	0.023
Pipe P2	100	300	120	82.37	1.17	5.20	0.023
Pipe P3	13	300	120	-67.63	0.96	3.61	0.023
Pipe P4	31	200	100	1.50	0.05	0.03	0.054
Pipe P5	135	300	120	-69.14	0.98	3.76	0.023
Pipe P6	77	300	120	-69.14	0.98	3.76	0.023

Appendix C
Sanitary Design Sheets

SANITARY SEWER DESIGN SHEET

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 119024
Project Name: 1104 Halton Terrace
Date: 4/24/2025
Input By: Lucas Wilson
Reviewed By: Mark Bissett
Drawing Reference: 119024-GP

Legend:
- Design Input by User
- As-Built Input by User
- Cumulative Cell
- Calculated Design Cell Output
- Calculated Annual Cell Output
- Calculated Rare Cell Output

Reference: City of Ottawa - Sewer Design Guidelines (2012 and TBs)
MOE - Design Guidelines for Sewage Works (2008)

Location				Demand												Design Capacity							
				Residential Flow									Extraneous Flow Area Method		Total Design Flow	Proposed Sewer Pipe Sizing / Design							
Street	Area ID	From MH	To MH	Singles	Apts	Population (in 1000's)	Cumulative Population (in 1000's)	Average Pop. Flow Q(q) (L/s)	Design Peaking Factor M	Peak Design Pop. Flow Q(p) (L/s)	Res. Drainage Area (ha.)	Cumulative Res. Drainage Area (ha.)	Cumulative Extraneous Drainage Area (ha.)	Design Extraneous Flow Q(e) (L/s)	Total Peak Design Flow Q(D) (L/s)	Pipe Length (m)	Pipe Size (mm) and Material	Pipe ID Actual (m)	Roughness n	Design Grade So (%)	Capacity Qfull (L/s)	Full Flow Velocity Vfull (m/s)	Q(D) / Qfull
Site	-	MH1	EXMH3		103	0.185	0.185	0.60	3.53	2.12	0.700	0.700	0.700	0.23	2.4	13.9	200 PVC	0.203	0.013	0.35	20.2	0.62	11.6%
Halton Terrace	-	EXMH3	EXMH2	3		0.010	0.196	0.63	3.52	2.23	0.220	0.920	0.920	0.30	2.5	31.2	250 PVC	0.254	0.013	0.38	38.2	0.75	6.6%
Halton Terrace	-	EXMH2	EXMH1	10		0.034	0.230	0.74	3.50	2.60	0.420	1.340	1.340	0.44	3.0	59.9	250 PVC	0.254	0.013	0.27	32.2	0.64	9.5%

Demand Equation / Parameters

1. **Q(D), Q(A), Q(R) =** Q(p) + Q(fd) + Q(ici) + Q(e)
2. **Q(p) =** (P x q x M x K / 86,400)
3. **q =** 280 L/per person/day (design); 200 L/per person/day (annual and rare)
4. **M = Harmon Formula (maximum of 4.0)**
5. **K =** 0.8 (design); 0.6 (annual and rare)
6. **Park flow is considered equivalent to a single unit / ha**
   Park Demand = 4 single unit equivalent / park ha (~ 3,600 L/ha/day)
7. **Q(fd) =** 0.45 L/s/unit
8. **Q(ici) =** ICI Area x ICI Flow x ICI Peak
9. **Q(e) =** 0.33 L/s/ha (design); 0.30 L/s/ha (annual); 0.55 L/s/ha (rare)

Definitions

Q(D) = Peak Design Flow (L/s)
Q(A) = Peak Annual Flow (L/s)
Q(R) = Peak Rare Flow (L/s)
Q(p) = Peak Design Population Flow (L/s)
Q(q) = Average Population Flow (L/s)

	Singles	Semis / Towns	Apts
P = Residential Population =	3.4	2.7	1.8

q = Average Capita Flow
M = Harmon Formula
K = Harmon Correction Factor
Typ. Service Diameter (mm) = 135
Typ. Service Length (m) = 15 15
I/I Pipe Rate (L/mm dia/m/hr) = 0.007
Q(fd) = Foundation Flow (L/s)
Q(ici) = Industrial / Commercial / Institutional Flow (L/s)
Q(e) = Extraneous Flow (L/s)

Institutional / Commercial / Industrial	Industrial	Commercial / Institutional	
Design =	35000	28000	L/gross ha/day
Annual / Rare =	10000	17000	L/gross ha/day
ICI Peak *			
Design =	1.0	1.5	* ICI Peak = 1.0 Default, 1.5 if ICI in contributing area is >20% (design only)
Annual / Rare =		1.0	

Capacity Equation

Q full = (1/n) Ap R^(2/3) So^(1/2)

Definitions

Q full = Capacity (L/s)
n = Manning coefficient of roughness (0.013)
Ap = Pipe flow area (m^2)
R = Wetted perimeter (m)
So = Pipe slope/gradient

J.L. Richards & Associates Limited
Consulting Engineers, Architects & Planners

CITY OF OTTAWA

MINTO DEVELOPMENT INC.

MORGAN'S GRANT SUBDIVISION - PHASE 10A & 10B
JLR NO. 17730

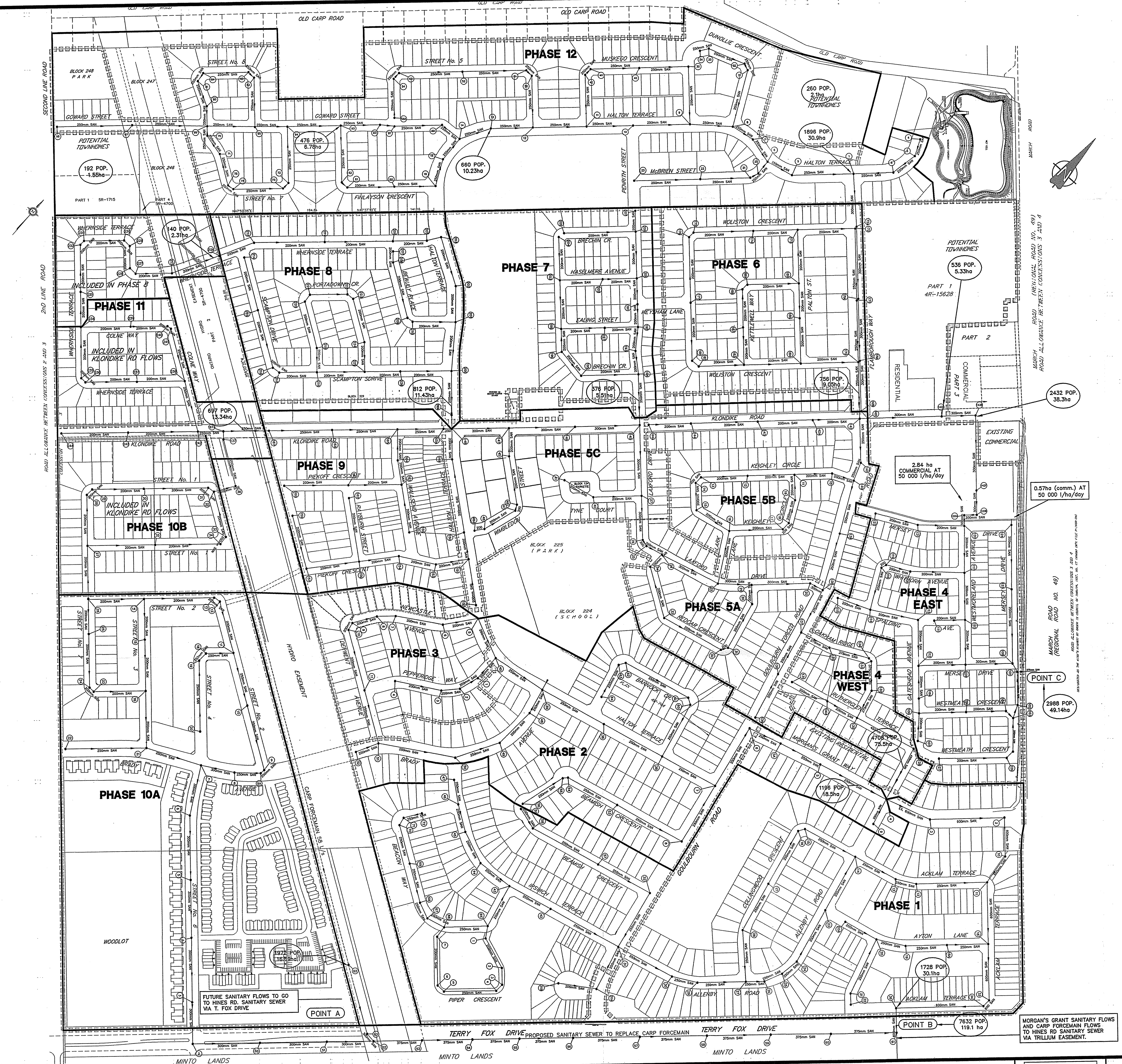
SANITARY SEWER DESIGN SHEET
Revised September 16, 2003

Designed by: J.B.
Checked by: L.J.

DESIGN PARAMETERS

I =	0.280	l/s/ha	q (res) =	350	l/cap/day
Singles =	4.0	pers / unit	q (com) =	50,000	l/ha/day
Townhouses =	4.0	pers / unit	q (inst) =	50,000	l/ha/day

STREET	M.H. #		NO. of UNITS	RESIDENTIAL INDIVIDUAL		RESIDENTIAL CUMMULATIVE		Peaking Factor	POPUL. FLOW	NON-RESIDENTIAL AREA	CUMM. AREA	Peaking Factor	NON-RES. FLOW	INFIL. FLOW	PEAK FLOW	SEWER DATA DIA.	Slope	CAPAC.	VEL.	LENGTH	RESIDUAL CAP.	Obvert Drop	UPSTREAM Obvert	UPSTREAM Invert	DOWNSTREAM Obvert	DOWNSTREAM Invert	COMMENTS
	FROM	TO		POPUL. people	AREA ha	POPUL. people	AREA ha		l/s	ha	ha		(l/s)	l/s	l/s	mm	%	l/s	m/s	m	(l/s)						
Street No. 1		5	4	16	0.15	1500	26.93	3.68	22.36	0.00	2.93	1.50	2.54	7.54	32.44	250	0.40	39.23	0.77	41.20	6.79	0.078	82.850	82.596	82.685	82.431	Phase 12
	5	Ex. 1	25	100	0.81	1600	27.74	3.66	23.72	0.00	2.93	1.50	2.54	7.77	34.03	250	0.40	39.23	0.77	90.60	5.21	0.063	82.622	82.368	82.260	82.006	Phase 12
STREET No. 1 Phase 12	4	3	2	8	0.21	8	0.21	4.00	0.13	0.00	0.00	1.50	0.00	0.06	0.19	250	0.40	39.23	0.77	24.00	39.04		82.140	81.890	82.044	81.794	PHASE 12
	3	2	3	12	0.33	20	0.54	4.00	0.32	0.00	0.00	1.50	0.00	0.15	0.48	250	0.40	39.23	0.77	24.70	38.76		82.024	81.774	81.925	81.675	PHASE 12
BIDGOOD LANDS	-	2	65	260	2.10	260	2.10	4.00	4.21	0.00	0.00	1.50	0.00	0.59	4.80	250	0.40	39.23	0.77	95.00	34.43						Assumed Future Townhomes
	2	Ex. 1	4	16	0.34	296	2.98	4.00	4.80	0.00	0.00	1.50	0.00	0.83	5.63	250	0.40	39.23	0.77	37.50	33.60		81.905	81.655	81.755	81.505	PHASE 12
FLAMBOROUGH WAY	Ex. 1	Ex. 172A		0	0.17	1896	30.89	3.60	27.68	0.00	2.93	1.50	2.54	8.65	38.87	300	0.18	42.21	0.58	81.10	3.34		81.726	81.426	81.584	81.284	PHASE 6 (as-built info. added)
	Ex. 172A	Ex. 171A		0	0.77	1896	31.66	3.60	27.68	0.00	2.93	1.50	2.54	8.86	39.09	300	0.19	44.07	0.60	104.80	4.98		81.584	81.284	81.384	81.084	PHASE 6 (as-built info. added)
	Ex. 171A	Ex. 170A		0	0.68	1896	32.34	3.60	27.68	0.00	2.93	1.50	2.54	9.06	39.28	300	0.20	44.98	0.62	88.50	5.71		81.344	81.044	81.168	80.868	PHASE 6 (as-built info. added)
	Ex. 170A	Ex. 142B		0	0.41	1896	32.75	3.60	27.68	0.00	2.93	1.50	2.54	9.17	39.39	300	0.18	42.24	0.58	77.00	2.85		81.165	80.865	81.035	80.730	PHASE 6 (as-built info. added)
	Ex. 142B	Ex. 142C		0	0.00	1896	32.75	3.60	27.68	0.00	2.93	1.50	2.54	9.17	39.39	300	0.21	46.28	0.63	17.10	6.89		80.954	80.649	80.918	80.613	PHASE 6 (as-built info. added)
KLONDIKE ROAD	Ex. 142C	142D		0	0.22	1896	32.97	3.60	27.68	0.00	2.93	1.50	2.54	9.23	39.45	300	3.30	183.25	2.51	110.00	143.79	0.04	80.878	80.573	77.248	76.943	
KLONDIKE ROAD	142D	142E	134	536	5.33	2432	38.30	3.52	34.66	0.37	3.30	1.50	2.86	10.72	48.25	300	0.30	55.25	0.76	50.50	7.00	1.07	76.178	75.873	76.026	75.722	Flow from Future Townhouse Complex
COMMERCIAL SITE	142E	142F		0	2.84	2432	41.14	3.52	34.66	2.84	6.14	1.50	5.33	11.52	51.51	300	0.30	55.25	0.76	110.00	3.74		76.026	75.722	75.696	75.392	
	142F	120B		0	0.00	2432	41.14	3.52	34.66	0.00	6.14	1.50	5.33	11.52	51.51	300	0.30	55.25	0.76	36.15	3.74		75.696	75.392	75.588	75.283	Commercial Property
	120B	120A		0	0.00	2432	41.14	3.52	34.66	0.00	6.14	1.50	5.33	11.52	51.51	300	0.30	55.25	0.76	18.69	3.74		75.588	75.283	75.532	75.227	Commercial Property
	120A	Ex. 120		0	0.00	2432	41.14	3.52	34.66	0.00	6.14	1.50	5.33	11.52	51.51	300	0.38	62.18	0.85	15.84	10.67		75.532	75.227	[illegible]	75.167	
Mersey Drive	122	121		24	0.38	24	0.38	4.00	0.39	0.00	0.00	1.50	0.00	0.11	0.50	200	3.78	66.52	2.05	63.5	66.02		80.400	80.200	78.000	77.800	
	121	120		24	0.28	48	0.66	4.00	0.78	0.00	0.00	1.50	0.00	0.18	0.96	200	2.53	54.43	1.68	68.0	53.47		77.900	77.700	76.179	75.979	
Westmoreland Avenue	120	[illegible]		20	0.33	2500	42.13	3.51	35.53	0.00	6.14	1.50	5.33	11.80	52.66	300	0.42	65.32	0.90	70.6	12.66		75.467	75.167	75.171	74.871	Phase IV (as-built info. Added)
Whithorn Avenue	116	119		8	0.14	8	0.14	4.00	0.13	0.00	0.00	1.50	0.00	0.04	0.17	200	2.00	48.38	1.49	8.1	48.22		79.262	79.062	79.100	78.900	
	119	118		24	0.22	32	0.36	4.00	0.52	0.00	0.00	1.50	0.00	0.10	0.62	200	2.69	56.10	1.73	37.2	55.48		79.000	78.800	78.000	77.800	
	118	[illegible]		44	0.50	76	0.86	4.00	1.23	0.00	0.00	1.50	0.00	0.24	1.47	200	2.21	50.86	1.57	81.1	49.39		77.700	77.500	75.908	75.708	
Westmoreland Avenue		[illegible]		24	0.31	2600	43.30	3.49	36.81	0.00	6.14	1.50	5.33	12.12	54.26	300	0.42	65.49	0.90	68.8	11.23		75.160	74.860	74.870	74.570	Phase IV (as-built info. Added)
	111	[illegible]		12	0.33	12	0.33	4.00	0.19	0.00	0.00	1.50	0.00	0.09	0.29	200	1.91	47.28	1.46	46.0	47.00		76.500	76.300	75.620	75.420	
Westmoreland Avenue	[illegible]	109		16	0.30	2628	43.93	3.49	37.16	0.00	6.14	1.50	5.33	12.30	54.79	300	0.36	60.31	0.83	66.3	5.52		74.840	74.540	74.603	74.303	Phase IV (as-built info. Added)
	115	114		20	0.32	20	0.32	4.00	0.32	0.00	0.00	1.50	0.00	0.09	0.41	200	4.49	72.51	2.24	51.2	72.10		81.500	81.300	79.200	79.000	
	116	114		20	0.30	20	0.30	4.00	0.32	0.00	0.00	1.50	0.00	0.08	0.41	200	0.58	26.06	0.80	64.5	25.65		79.374	79.174	79.000	78.800	
	114	113		32	0.40	72	1.02	4.00	1.17	0.00	0.00	1.50	0.00	0.29	1.45	200	0.62	26.94	0.83	72.8	25.49		78.750	78.550	78.300	78.100	
	113	112		16	0.32	88	1.34	4.00	1.43	0.00	0.00	1.50	0.00	0.38	1.80	200	0.50	24.24	0.75	67.7	22.44		78.200	78.000	77.860	77.660	
	112A	112		16	0.35	16	0.35	4.00	0.26	0.00	0.00	1.50	0.00	0.10	0.36	200	1.00	34.21	1.06	48.0	33.86		77.680	77.480	77.200	77.000	
	112	109		16	0.32	120	2.01	4.00	1.94	0.00	0.00	1.50	0.00	0.56	2.51	200	1.71	44.74	1.38	70.0	42.23		77.097	76.897	75.900	75.700	
Mersey Drive	109	[illegible]		24	0.33	2772	46.27	3.47	38.98	0.00	6.14	1.50	5.33	12.96	57.27	300	0.46	68.74	0.94	68.7	11.47		74.580	74.280	74.261	73.961	Phase IV (as-built info. Added)
Mersey Drive	124	123		28	0.44	28	0.44	4.00	0.45	0.00	0.00	1.50	0.00	0.12	0.58	200	0.55	25.38	0.78	96.3	24.80		75.600	75.400	75.070	74.870	Phase IV (as-built info. Added)
	123	[illegible]		32	0.42	60	0.86	4.00	0.97	0.00	0.00	1.50	0.00	0.24	1.21	200	0.59	26.27	0.81	109.2	25.06		75.065	74.865	74.421	74.221	Phase IV (as-built info. Added)
Easement	[illegible]	[illegible]		0	0.00	2832	47.13	3.46	39.73	0.00	6.14	1.50	5.33	13.20	58.26	375	0.32	103.88	0.91	12.4	45.62		74.245	73.870	74.205	73.830	Phase IV (as-built info. Added)
	127	126		56	0.78	56	0.78	4.00	0.91	0.00	0.00	1.50	0.00	0.22	1.13	200	1.00	34.21	1.06	100.7	33.09		78.155	77.955	77.148	76.948	
	126	126A		16	0.19	72	0.97	4.00	1.17	0.00	0.00	1.50	0.00	0.27	1.44	200	0.58	26.06	0.80	13.1	24.62		77.118	76.918	77.042	76.842	
	126A	103		0	0.00	72	0.97	4.00	1.17	0.00	0.00	1.50	0.00	0.27	1.44	200	2.83	57.56	1.77	49.8	56.12		77.012	76.812	75.600	75.400	
	107	106		12	0.19	12	0.19	4.00	0.19	0.00	0.00	1.50	0.00	0.05	0.25	200	1.00	34.21	1.06	41.0	33.97		77.470	77.270	77.060	76.860	
	106	105		36	0.36	48	0.55	4.00	0.78	0.00	0.00	1.50	0.00	0.15	0.93	200	0.58	26.06	0.80	69.9	25.12		77.000	76.800	76.595	76.395	
	105	104		32	0.39	80	0.94	4.00	1.30	0.00	0.00	1.50	0.00	0.26	1.56	200	0.58	26.06	0.80	59.2	24.50		75.860	75.660	75.516	75.316	
	104	103		4	0.01	84	0.95	4.00	1.36	0.00	0.00	1.50	0.00	0.27	1.63	200	1.00	34.21	1.06	14.9	32.59		75.049	74.849	74.900	74.700	



1	17/09/03	REVISED PHASE 10 AND 12	L.J.

LICENSED PROFESSIONAL ENGINEER L.J.A. JABLONSKI 16/09/03 PROVINCE OF ONTARIO

SCALE
25m 50m 75m 100m
HORIZONTAL 1:3000

J.L.Richards & Associates Limited
Consulting Engineers, Architect & Planners
OTTAWA,KINGSTON,SUDBURY,CANADA.

DESIGN	
CHECKED	L.J.
DRAWN	M.Z.
CHECKED	
APPROVED	

Ottawa

minto

MORGAN'S GRANT SUBDIVISION
MASTER DRAINAGE PLAN (SANITARY)

DATED SEPT. 2003
DWG. No. 17730-SA

Appendix D

STM Design Sheets, SWM Excerpts &
PCSWMM Modelling Info

1104 Halton Terrace (119024)
PCSWMM Model Results (Ponding)

NOVATECH
Engineers, Planners & Landscape Architects

CB / CBMH ID	Invert Elev. (m)	Rim Elev. (m)	Spill Elev. (m)	Ponding Depth (m)	HGL Elev. (m)[1]				Ponding Depth (m)				Spill Depth (m)			
					2-yr	5-yr	100-yr	100-yr (+20%)	2-yr	5-yr	100-yr	100-yr (+20%)	2-yr	5-yr	100-yr	100-yr (+20%)
CB01	82.32	83.32	83.45	0.13	82.59	82.89	83.45	83.46	0.00	0.00	0.13	0.14	0.00	0.00	0.00	0.01
CBMH01	83.69	85.55	85.90	0.35	85.43	85.68	85.84	85.86	0.00	0.13	0.29	0.31	0.00	0.00	0.00	0.00
CBMH02	82.88	85.55	85.85	0.30	85.43	85.68	85.84	85.86	0.00	0.13	0.29	0.31	0.00	0.00	0.00	0.01
RY01	81.06	82.78	82.86	0.08	81.77	81.98	82.69	82.92	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.06
RY02	81.29	83.07	83.07	0.00	81.77	81.98	82.69	82.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RY03	81.51	82.90	82.95	0.05	81.77	81.97	82.70	82.92	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
RY04	81.73	83.16	83.26	0.10	81.77	81.98	82.70	82.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RY05	82.80	83.80	83.90	0.10	82.89	83.04	83.83	83.91	0.00	0.00	0.03	0.11	0.00	0.00	0.00	0.01
RY06	82.87	83.80	83.90	0.10	82.89	83.05	83.83	83.91	0.00	0.00	0.03	0.11	0.00	0.00	0.00	0.01

[1] *3-hour Chicago Storm.*

Date: 4/24/2025
M:\2019\119024\DATA\Calculations\SWM\119024-Model Results_Ph1.xlsx

1104 Halton Terrace (119024)
PCSWMM Storage Curves (underground/surface storage)

Engineers, Planners & Landscape Architects

CB01-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	0.36	0.00
1.00	0.36	0.36
1.13	80.00	5.58
1.14	0.00	5.98
2.00	0.00	5.98

CBMH01-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	1.17	0.00
1.86	1.17	2.18
2.21	257.70	47.48
2.21	0.00	47.61
2.86	0.00	47.61

CBMH02-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	1.17	0.00
2.67	1.17	3.12
2.97	200.80	33.42
2.97	0.00	33.52
3.67	0.00	33.52

RY05-Storage		
Depth (m)	Area (m^2)	Volume (m^3)
0.00	0.36	0.00
1.00	0.36	0.36
1.10	48	2.76
1.10	0.00	2.78
2.00	0.00	2.78

RY06-Storage		
Depth (m)	Area (m2)	Volume (m3)
0.00	0.36	0.00
0.93	0.36	0.33
1.03	48	2.73
1.03	0.00	2.76
1.93	0.00	2.76

Date: 4/24/2025
M:\2019\119024\DATA\Calculations\SWM\119024-Storage Curves_Ph1.xlsx

1104 Halton Terrace (119024)
Summary of Hydraulic Grade Line (HGL) Elevations

Engineers, Planners & Landscape Architects

MH ID	Obvert Elevation (m)	T/G Elevation (m)	HGL Elevation[1] (m)	Surcharge (m)	Clearance from T/G (m)	HGL in Stress Test[1] (m)
MH02	81.80	83.79	82.67	0.87	1.12	82.67
MH04	82.62	85.74	82.68	0.06	3.06	82.68
Connection to Ex.	81.66	83.22	82.65	0.99	0.57	82.65

[1] *3-hour Chicago Storm; Fixed outfall (100yr HGL @ connections to existing = 82.65).*

Date: 4/24/2025
M:\2019\119024\DATA\Calculations\SWM\119024-Model Results_Ph1.xlsx

1104 Halton Terrace
Maple Leaf Homes
Project No.: 119024

STORM SEWER DESIGN SHEET
(Maple Leaf Homes)
FLOW RATES BASED ON RATIONAL METHOD

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION				AREA (ha)			FLOW							TOTAL FLOW	SEWER DATA								
Street	Catchment ID	From Manhole	To Manhole	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
	A-01, A-03, A-07	CBMH2	MH04	0.227	0.80	0.18	0.505	0.505	10.00	76.81			38.8	38.8	0.305	300	PVC	1.00	10.8	100.8	1.38	0.13	38%
						0.00	0.000	0.000	10.00														
						0.00	0.000	0.000	10.00														
	A-02	MH04	MH02	0.093	0.52	0.05	0.134	0.639	10.13	76.31			48.8	48.8	0.457	450	Conc	1.00	39.0	297.2	1.81	0.36	16%
						0.00	0.000	0.000	10.13														
						0.00	0.000	0.000	10.13														
	A-04	MH02	EX 1500mm	0.090	0.60	0.05	0.150	0.789	10.49	74.98			59.2	59.2	0.457	450	Conc	0.50	28.8	210.2	1.28	0.37	28%
						0.00	0.000	0.000	10.49														
						0.00	0.000	0.000	10.49														

Q = 2.78 AIC, where	**Consultant:**	**Novatech**
Q = Peak Flow in Litres per Second (L/s)	**Date:**	April 24, 2025
A = Area in hectares (ha)	**Design By:**	Lucas Wilson
I = Rainfall Intensity (mm/hr), 5 year storm	**Client:**	**Dwg. Reference:** / **Checked By:**
C = Runoff Coefficient	Maple Leaf Homes	119024-STM / MAB

Legend:

*	Indicates 100 Year intensity for storm sewers
10.00	Storm sewers designed to the 2 year event (without ponding) for local roads
10.00	Storm sewers designed to the 5 year event (without ponding) for collector roads
10.00	Storm sewers designed to the 10 year event (without ponding) for arterial roads

LICENSED PROFESSIONAL ENGINEER
L. R. WILSON
100160065
2025.07.11
PROVINCE OF ONTARIO

1104 Halton Terrace (119024)
Pre-Development Peak Flow Calculations (EXT-02)
On-Site Area Draining to Old Carp Road

NOVATECH
Engineers, Planners & Landscape Architects

EXISTING CONDITIONS

Time-of-Concentration (Uplands Method)

Flow Classification (Land Use)	Length (m)	Elevation U/S (m)	Elevation D/S (m)	Slope (%)	Velocity[1] (m/s)	Time-of-Concentration (min)
EXT-02 Overland Flow (Pasture)	100	86.5	80.7	5.8%	0.45	3.7
TOTAL	**100**	**86.5**	**80.7**	**5.8%**	**0.45**	**10.0**

[1] Refer to Uplands Velocity Chart. **Min 10-minutes.*

Existing Catchment Parameters

Catchment ID	Areas (ha) Total	Areas (ha) Hard Surfaces (C=0.70)	Areas (ha) Soft Surfaces (C=0.20)	Runoff Coefficient C_{avg}	Runoff Coefficient C_{100yr}[1]	%Imperv.
TOTAL	**0.194**	**0.005**	**0.189**	**0.21**	**0.27**	**1.4%**

[1] Runoff coefficient increases by 25%, up to a maximum value of 1.00, for the 100-year event.

Pre-Development Peak Flows

Catchment ID	Rainfall Intensity (mm/hr)[1] 2-year	Rainfall Intensity (mm/hr)[1] 5-year	Rainfall Intensity (mm/hr)[1] 100-year	Peak Flows (L/s) 2-year	Peak Flows (L/s) 5-year	Peak Flows (L/s) 100-year
EXT-02 (existing conditions)	76.81	104.19	178.56	8.7	11.8	25.9

[1] Tc is based on Uplands Method.

Notes:

Rainfall Intensity from City of Ottawa Sewer Design Guidelines (Oct. 2012)
- 100 year Intensity = $1735.688 / (Tc + 6.014)^{0.820}$
- 5 year Intensity = $998.071 / (Tc + 6.053)^{0.814}$
- 2 year Intensity = $732.951 / (Tc + 6.199)^{0.810}$

Q(peak flow) = 2.78 x C x I x A
- C is the runoff coefficient
- I is the rainfall intensity
- A is the total drainage area

Date: 10/11/2023
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1104 Halton Terrace (119204)
Pre-Development Peak Flow Calculations (EXT-01 EXT-02)
Upstream Area Draining to 500mm Culvert

NOVATECH
Engineers, Planners & Landscape Architects

EXISTING CONDITIONS

Time-of-Concentration (Uplands Method)

Flow Classification (Land Use)	Length (m)	Elevation U/S (m)	Elevation D/S (m)	Slope (%)	Velocity[1] (m/s)	Time-of-Concentration (min)
EXT-01/EXT-04 Overland Flow (Pasture)	210	87.0	80.7	3.0%	0.37	9.5
TOTAL	**210**	**87.0**	**80.7**	**3.0%**	**0.37**	**10.0**

[1] *Refer to Uplands Velocity Chart.*

**Min 10-minutes.*

Existing Catchment Parameters

Catchment ID	Areas (ha) Total	Areas (ha) Hard Surfaces (C=0.90)	Areas (ha) Soft Surfaces (C=0.20)	Runoff Coefficient C_{avg}	Runoff Coefficient C_{100yr}[1]	%Imperv.
TOTAL	**1.550**	**0.120**	**1.430**	**0.25**	**0.31**	**7.7%**

[1] *Runoff coefficient increases by 25%, up to a maximum value of 1.00, for the 100-year event.*

Pre-Development Peak Flows

Catchment ID	Rainfall Intensity (mm/hr)[1] 2-year	5-year	100-year	Peak Flows (L/s) 2-year	5-year	100-year
Site Boundary (existing conditions)	76.81	104.19	178.56	84.1	114.1	237.0

[1] *Tc is based on Uplands Method.*

Notes:

Rainfall Intensity from City of Ottawa Sewer Design Guidelines (Oct. 2012)

- 100 year Intensity = $1735.688 / (Tc + 6.014)^{0.820}$
- 5 year Intensity = $998.071 / (Tc + 6.053)^{0.814}$
- 2 year Intensity = $732.951 / (Tc + 6.199)^{0.810}$

Q(peak flow) = 2.78 x C x I x A
- C is the runoff coefficient
- I is the rainfall intensity
- A is the total drainage area

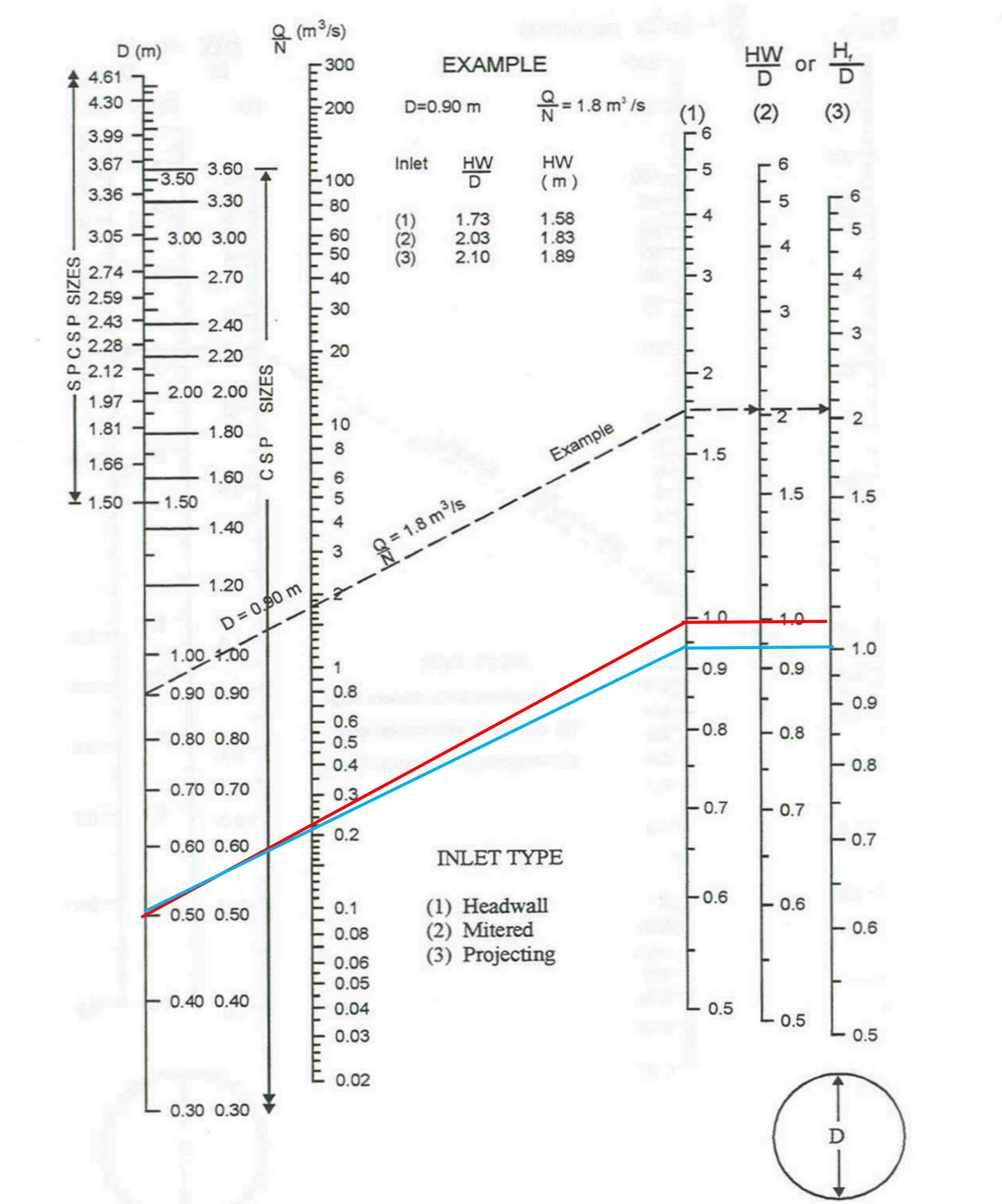
MTO Drainage Management Manual
Design Chart 2.32: Inlet Control: Circular Culverts
Source: Herr (1977)

PROJECT NAME: 1104 Halton Terrace
PROJECT #: 119024

500mm CSP Culvert
Crosses Old Carp Road

Drainage Area to Culvert = 1.55 ha (approx.)
Runoff Coefficient = 0.25 (approx.)

100-year Peak Flow = 0.237 m^3/s
Capacity (HW/D=1) = 0.21 m^3/s



1104 Halton Terrace (119024)
PCSWMM Model Output
100yr 3-hour Chicago Storm

NOVATECH
Engineers, Planners & Landscape Architects

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

****
Element Count
****

Number of rain gages 1
Number of subcatchments ... 13
Number of nodes 27
Number of links 30
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
RG-1	C3h-100yr	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A-01	0.09	28.67	82.40	1.0000	RG-1	CBMH02
A-02	0.09	37.20	45.70	1.0000	RG-1	RY05
A-03	0.09	44.00	80.50	1.0000	RG-1	CBMH01
A-04	0.09	22.50	57.10	4.0000	RG-1	CB01
A-05	0.01	7.00	7.00	1.0000	RG-1	RY04
A-06	0.03	20.67	7.00	1.0000	RG-1	RY03
A-07	0.05	10.60	100.00	1.0000	RG-1	CBMH01
A-08	0.03	11.20	7.00	1.0000	RG-1	RY01
a-09	0.02	8.50	79.40	5.0000	RG-1	HP02
A-10	0.08	15.40	100.00	1.0000	RG-1	RY01
A-11	0.09	18.60	100.00	1.0000	RG-1	RY03
B-01	0.01	3.33	16.70	3.0000	RG-1	OF1
B-02	0.02	6.86	7.00	2.0000	RG-1	Ex_Ditch3

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
HP01	JUNCTION	83.66	1.00	0.0	
HP02	JUNCTION	83.06	1.00	0.0	
HP-CBMH02	JUNCTION	85.85	1.00	0.0	
HP-CBMH03	JUNCTION	85.90	1.00	0.0	
HP-RY05	JUNCTION	83.90	1.00	0.0	
HP-RY06	JUNCTION	83.90	1.00	0.0	
HP-RY08	JUNCTION	83.26	1.00	0.0	
CBMH03	OUTFALL	80.71	0.00	0.0	
Ex_1500	OUTFALL	80.11	1.55	0.0	
Ex_Ditch3	OUTFALL	83.22	1.00	0.0	
HP-CB01	OUTFALL	83.45	1.00	0.0	
HP-RY01	OUTFALL	82.86	1.00	0.0	
HP-RY02	OUTFALL	82.95	1.00	0.0	
OF1	OUTFALL	83.30	0.00	0.0	
CB01	STORAGE	82.32	2.00	0.0	
CBMH01	STORAGE	83.69	2.86	0.0	
CBMH02	STORAGE	82.88	3.67	0.0	
MH02	STORAGE	81.35	2.44	0.0	
MH04	STORAGE	82.17	3.57	0.0	
MH06	STORAGE	82.70	3.12	0.0	
MH08	STORAGE	82.77	3.11	0.0	
RY01	STORAGE	81.06	2.72	0.0	
RY02	STORAGE	81.29	2.78	0.0	
RY03	STORAGE	81.51	2.39	0.0	
RY04	STORAGE	81.73	2.43	0.0	
RY05	STORAGE	82.80	2.00	0.0	
RY06	STORAGE	82.87	1.93	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
CBMH01-CBMH02	CBMH01	CBMH02	CONDUIT	42.5	0.4941	0.0130
MH02-Ex_1500	MH02	Ex_1500	CONDUIT	28.8	0.4861	0.0130
MH04-MH02	MH04	MH02	CONDUIT	39.0	1.0001	0.0130
MH08-MH06	MH08	MH06	CONDUIT	36.8	0.1902	0.0130
MS-CB01	CB01	HP-CB01	CONDUIT	3.0	-4.3374	0.0150
MS-CBMH01(1)	CBMH01	HP-CBMH03	CONDUIT	3.0	-11.7469	0.0150
MS-CBMH01(2)	HP-CBMH03	CBMH02	CONDUIT	3.0	11.7469	0.0150
MS-CBMH02(1)	CBMH02	HP-CBMH02	CONDUIT	3.0	-10.0504	0.0150
MS-CBMH02(2)	HP-CBMH02	CB01	CONDUIT	3.0	156.9311	0.0150
MS-HP01	HP01	RY04	CONDUIT	22.0	2.2733	0.0350
MS-HP02	HP02	RY01	CONDUIT	18.7	1.4975	0.0350
MS-RY01	RY01	HP-RY01	CONDUIT	3.0	-2.6676	0.0350
MS-RY02(1)	RY02	RY01	CONDUIT	27.6	1.0145	0.0350
MS-RY02(2)	RY02	RY03	CONDUIT	21.5	0.7907	0.0350
MS-RY03	RY03	HP-RY02	CONDUIT	3.0	-1.6669	0.0350
MS-RY04(1)	RY04	HP-RY08	CONDUIT	6.6	-1.5153	0.0350
MS-RY04(2)	HP-RY08	RY03	CONDUIT	20.0	1.8003	0.0350
MS-RY05(1)	RY05	HP-RY05	CONDUIT	3.0	-3.3352	0.0350
MS-RY05(2)	HP-RY05	RY06	CONDUIT	3.0	3.3352	0.0350
MS-RY06(1)	RY06	HP-RY06	CONDUIT	3.0	-3.3352	0.0350
MS-RY06(2)	HP-RY06	Ex_Ditch3	CONDUIT	30.3	2.2448	0.0350
RY03-RY02	RY03	RY02	CONDUIT	6.9	3.1854	0.0130
RY05-MH08	RY05	MH08	CONDUIT	6.2	0.4839	0.0130
RY05-RY06	RY06	RY05	CONDUIT	13.5	0.5185	0.0130
RY08-RY03	RY04	RY03	CONDUIT	17.1	1.2859	0.0130
SC740	RY02	RY01	CONDUIT	14.6	1.5112	0.0130
O-CB01	CB01	MH02	ORIFICE			
O-CBMH02	CBMH02	MH04	ORIFICE			
O-MH06	MH06	MH04	ORIFICE			
O-RY01	RY01	CBMH03	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
CBMH01-CBMH02	CIRCULAR	0.61	0.29	0.15	0.61	1	451.09
MH02-Ex_1500	CIRCULAR	0.45	0.16	0.11	0.45	1	198.79
MH04-MH02	CIRCULAR	0.45	0.16	0.11	0.45	1	285.13
MH08-MH06	CIRCULAR	0.61	0.29	0.15	0.61	1	279.88
MS-CB01	RECT_OPEN	1.00	3.00	0.60	3.00	1	29632.76
MS-CBMH01(1)	RECT_OPEN	1.00	3.00	0.60	3.00	1	48766.13
MS-CBMH01(2)	RECT_OPEN	1.00	3.00	0.60	3.00	1	48766.13
MS-CBMH02(1)	RECT_OPEN	1.00	3.00	0.60	3.00	1	45107.44
MS-CBMH02(2)	RECT_OPEN	1.00	3.00	0.60	3.00	1	178242.59
MS-HP01	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	8394.58
MS-HP02	TRAPEZOIDAL	1.00	15.15	0.50	30.15	1	33432.18
MS-RY01	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	9093.49
MS-RY02(1)	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	5607.96
MS-RY02(2)	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	4950.86
MS-RY03	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	7188.26
MS-RY04(1)	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	6853.65
MS-RY04(2)	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	7470.34
MS-RY05(1)	RECT_OPEN	1.00	3.00	0.60	3.00	1	11136.28
MS-RY05(2)	RECT_OPEN	1.00	3.00	0.60	3.00	1	11136.28
MS-RY06(1)	RECT_OPEN	1.00	3.00	0.60	3.00	1	11136.28
MS-RY06(2)	RECT_OPEN	1.00	2.50	0.56	2.50	1	7232.76
RY03-RY02	RECT_CLOSED	1.14	2.16	0.36	1.90	1	14858.77
RY05-MH08	CIRCULAR	0.25	0.05	0.06	0.25	1	41.37
RY05-RY06	CIRCULAR	0.25	0.05	0.06	0.25	1	42.82
RY08-RY03	RECT_CLOSED	1.14	2.16	0.36	1.90	1	9440.71
SC740	RECT_CLOSED	1.14	2.16	0.36	1.90	1	10234.24

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****

Flow Units .... LPS
Process Models:
  Rainfall/Runoff .... YES
  RDII .... NO

```
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 07/21/2021 00:00:00
Ending Date .............. 07/22/2021 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 6.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m
```

****
Runoff Quantity Continuity
****

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.050	71.667
Evaporation Loss	0.000	0.000
Infiltration Loss	0.010	14.800
Surface Runoff	0.040	56.956
Final Storage	0.000	0.602
Continuity Error (%)	-0.965	

****
Flow Routing Continuity
****

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.040	0.399
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.002
External Outflow	0.040	0.400
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.002	0.015
Final Stored Volume	0.002	0.015
Continuity Error (%)	0.042	

****
Highest Continuity Errors
****

Node RY03 (25.75%)
Node RY04 (15.53%)
Node RY02 (-14.12%)
Node RY01 (-11.24%)
Node RY06 (1.16%)

****
Time-Step Critical Elements
****

Link RY05-MH08 (3.28%)
Link RY03-RY02 (1.68%)

****
Highest Flow Instability Indexes
****

Link O-CB01 (125)
Link MH02-Ex_1500 (19)
Link MH04-MH02 (16)
Link SC740 (11)
Link RY03-RY02 (9)

****
Routing Time Step Summary
****

```
Minimum Time Step           :     0.50 sec
Average Time Step           :     5.89 sec
Maximum Time Step           :     6.00 sec
Percent in Steady State     :    -0.00
Average Iterations per Step :     2.42
Percent Not Converging      :     3.25
Time Step Frequencies       :
    6.000 -  3.650 sec      :    97.63 %
    3.650 -  2.221 sec      :     2.14 %
    2.221 -  1.351 sec      :     0.16 %
    1.351 -  0.822 sec      :     0.03 %
    0.822 -  0.500 sec      :     0.04 %
```

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
A-01	71.67	0.00	0.00	7.82	58.11	5.13	63.24	0.05	40.77	0.882
A-02	71.67	0.00	0.00	28.72	32.12	43.09	43.09	0.04	31.90	0.601
A-03	71.67	0.00	0.00	8.63	56.66	5.80	62.46	0.05	41.90	0.871
A-04	71.67	0.00	0.00	19.25	40.14	12.07	52.21	0.05	37.84	0.729
A-05	71.67	0.00	0.00	42.90	4.91	24.46	29.37	0.00	3.28	0.410
A-06	71.67	0.00	0.00	42.38	4.92	25.15	30.07	0.01	8.41	0.420
A-07	71.67	0.00	0.00	0.00	72.18	0.00	72.18	0.04	26.17	1.007
A-08	71.67	0.00	0.00	43.38	4.91	23.86	28.77	0.01	5.79	0.401
a-09	71.67	0.00	0.00	9.05	55.75	6.43	62.18	0.01	8.16	0.868
A-10	71.67	0.00	0.00	0.00	72.18	0.00	72.18	0.06	38.03	1.007
A-11	71.67	0.00	0.00	0.00	72.18	0.00	72.18	0.07	45.93	1.007
B-01	71.67	0.00	0.00	37.24	35.46	23.74	35.46	0.00	1.54	0.495
B-02	71.67	0.00	0.00	43.36	4.91	23.89	28.80	0.01	5.00	0.402

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Meters
HP01	JUNCTION	0.00	0.00	83.66	0	00:00	0.00
HP02	JUNCTION	0.00	0.04	83.10	0	01:10	0.04
HP-CBMH02	JUNCTION	0.00	0.00	85.85	0	00:00	0.00
HP-CBMH03	JUNCTION	0.00	0.00	85.90	0	00:00	0.00
HP-RY05	JUNCTION	0.00	0.00	83.90	0	00:00	0.00
HP-RY06	JUNCTION	0.00	0.00	83.90	0	00:00	0.00
HP-RY08	JUNCTION	0.00	0.00	83.26	0	00:00	0.00
CBMH03	OUTFALL	0.52	0.52	81.23	0	00:00	0.52
Ex_1500	OUTFALL	2.54	2.54	82.65	0	00:00	2.54
Ex_Ditch3	OUTFALL	0.00	0.00	83.22	0	00:00	0.00
HP-CB01	OUTFALL	0.00	0.00	83.45	0	00:00	0.00
HP-RY01	OUTFALL	0.00	0.00	82.86	0	00:00	0.00
HP-RY02	OUTFALL	0.00	0.00	82.95	0	00:00	0.00
OF1	OUTFALL	0.00	0.00	83.30	0	00:00	0.00
CB01	STORAGE	0.35	1.13	83.45	0	01:13	1.13
CBMH01	STORAGE	0.43	2.15	85.84	0	01:52	2.15
CBMH02	STORAGE	0.66	2.96	85.84	0	01:51	2.96
MH02	STORAGE	1.30	1.31	82.66	0	01:21	1.31
MH04	STORAGE	0.48	0.49	82.66	0	01:21	0.49
MH06	STORAGE	0.05	1.12	83.82	0	01:29	1.12

MH08	STORAGE	0.05	1.05	83.82	0	01:29	1.05
RY01	STORAGE	0.35	1.63	82.69	0	01:40	1.63
RY02	STORAGE	0.16	1.40	82.69	0	01:40	1.40
RY03	STORAGE	0.12	1.19	82.70	0	01:40	1.19
RY04	STORAGE	0.09	0.97	82.70	0	01:40	0.97
RY05	STORAGE	0.04	1.03	83.83	0	01:29	1.03
RY06	STORAGE	0.04	0.96	83.83	0	01:30	0.96

****
Node Inflow Summary
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Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
HP01	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP02	JUNCTION	8.16	8.16	0	01:10	0.0106	0.0106	-0.004
HP-CBMH02	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-CBMH03	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY05	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY06	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY08	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
CBMH03	OUTFALL	0.00	12.21	0	01:40	0	0.155	0.000
Ex_1500	OUTFALL	0.00	35.63	0	01:21	0	0.239	0.000
Ex_Ditch3	OUTFALL	5.00	5.00	0	01:10	0.00693	0.00693	0.000
HP-CB01	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY01	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY02	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
OF1	OUTFALL	1.54	1.54	0	01:15	0.00178	0.00178	0.000
CB01	STORAGE	37.84	37.84	0	01:10	0.0471	0.0483	0.535
CBMH01	STORAGE	68.08	68.08	0	01:10	0.0933	0.0933	0.078
CBMH02	STORAGE	40.77	58.44	0	01:09	0.0544	0.148	0.002
MH02	STORAGE	0.00	35.63	0	01:21	0	0.24	-0.045
MH04	STORAGE	0.00	15.35	0	01:30	0	0.189	0.003
MH06	STORAGE	0.00	17.78	0	01:11	0	0.0403	0.243
MH08	STORAGE	0.00	28.96	0	01:11	0	0.0402	-0.305
RY01	STORAGE	43.82	54.36	0	02:54	0.0637	0.154	-10.107
RY02	STORAGE	0.00	179.32	0	01:13	0	0.0736	-12.370
RY03	STORAGE	54.34	76.46	0	01:13	0.0765	0.0964	34.679
RY04	STORAGE	3.28	46.50	0	01:09	0.00412	0.018	18.389
RY05	STORAGE	31.90	31.90	0	01:10	0.0402	0.0418	-0.014
RY06	STORAGE	0.00	3.47	0	01:24	0	0.00165	1.178

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Node Surcharge Summary
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No nodes were surcharged.

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Node Flooding Summary
****

No nodes were flooded.

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Storage Volume Summary
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Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	hr:min	Maximum Outflow LPS
CB01	0.000	3	0	0	0.006	92	0	01:13	21.23
CBMH01	0.004	8	0	0	0.033	70	0	01:52	20.80
CBMH02	0.004	12	0	0	0.031	94	0	01:51	7.37
MH02	0.001	53	0	0	0.001	54	0	01:21	35.63
MH04	0.001	13	0	0	0.001	14	0	01:21	16.42
MH06	0.000	2	0	0	0.001	36	0	01:29	7.99
MH08	0.000	1	0	0	0.001	34	0	01:29	17.78
RY01	0.000	13	0	0	0.001	60	0	01:40	81.95
RY02	0.000	6	0	0	0.001	50	0	01:40	67.64
RY03	0.000	5	0	0	0.000	50	0	01:40	141.63
RY04	0.000	4	0	0	0.000	40	0	01:40	21.83
RY05	0.000	1	0	0	0.001	19	0	01:29	30.37
RY06	0.000	1	0	0	0.000	18	0	01:30	1.26

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
CBMH03	25.63	7.53	12.21	0.155
Ex_1500	97.01	3.13	35.63	0.239
Ex_Ditch3	10.38	0.98	5.00	0.007
HP-CB01	0.00	0.00	0.00	0.000
HP-RY01	0.00	0.00	0.00	0.000
HP-RY02	0.00	0.00	0.00	0.000
OF1	6.61	0.36	1.54	0.002
System	19.95	12.00	51.11	0.402

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Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
CBMH01-CBMH02	CONDUIT	20.80	0	01:05	0.47	0.05	1.00
MH02-Ex_1500	CONDUIT	35.63	0	01:21	0.22	0.18	1.00
MH04-MH02	CONDUIT	16.42	0	01:26	0.10	0.06	1.00
MH08-MH06	CONDUIT	17.78	0	01:11	0.49	0.06	1.00
MS-CB01	CONDUIT	0.00	0	00:00	0.00	0.00	0.06
MS-CBMH01(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.14
MS-CBMH01(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.14
MS-CBMH02(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.14
MS-CBMH02(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.06
MS-HP01	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-HP02	CONDUIT	8.09	0	01:10	0.29	0.00	0.04
MS-RY01	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY02(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY02(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY03	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY04(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY04(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY05(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.01
MS-RY05(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.01
MS-RY06(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.01
MS-RY06(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
RY03-RY02	CONDUIT	108.20	0	01:13	0.28	0.01	1.00
RY05-MH08	CONDUIT	28.96	0	01:11	0.82	0.70	1.00
RY05-RY06	CONDUIT	3.47	0	01:24	0.07	0.08	1.00
RY08-RY03	CONDUIT	43.36	0	01:09	0.11	0.00	0.92
SC740	CONDUIT	71.12	0	01:13	0.03	0.01	1.00
O-CB01	ORIFICE	21.23	0	01:13			1.00
O-CBMH02	ORIFICE	7.37	0	01:51			1.00
O-MH06	ORIFICE	7.99	0	01:30			1.00
O-RY01	ORIFICE	12.21	0	01:40			1.00

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Flow Classification Summary
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Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
CBMH01-CBMH02	1.00	0.01	0.00	0.00	0.28	0.00	0.00	0.72	0.02	0.00
MH02-Ex_1500	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH04-MH02	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH08-MH06	1.00	0.82	0.04	0.00	0.14	0.00	0.00	0.00	0.87	0.00
MS-CB01	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-CBMH01(1)	1.00	0.82	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-CBMH01(2)	1.00	0.82	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-CBMH02(1)	1.00	0.82	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MS-CBMH02(2)	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-HP01	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-HP02	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MS-RY01	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY02(1)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY02(2)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY03	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY04(1)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY04(2)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY05(1)	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY05(2)	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY06(1)	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY06(2)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RY03-RY02	1.00	0.25	0.33	0.00	0.41	0.02	0.00	0.00	0.25	0.00
RY05-MH08	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.87	0.00
RY05-RY06	1.00	0.04	0.00	0.00	0.95	0.00	0.00	0.00	0.88	0.00
RY08-RY03	1.00	0.57	0.23	0.00	0.20	0.00	0.00	0.00	0.32	0.00
SC740	1.00	0.00	0.25	0.00	0.75	0.00	0.00	0.00	0.79	0.00

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Conduit Surcharge Summary
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Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
CBMH01-CBMH02	4.87	4.87	5.10	0.01	0.01
MH02-Ex_1500	24.00	24.00	24.00	0.01	0.01
MH04-MH02	24.00	24.00	24.00	0.01	0.01
MH08-MH06	0.78	0.78	0.85	0.01	0.01
RY03-RY02	0.57	0.57	1.39	0.01	0.01
RY05-MH08	1.34	1.34	1.41	0.01	0.01
RY05-RY06	1.19	1.19	1.34	0.01	0.01
RY08-RY03	0.01	0.01	0.57	0.01	0.01
SC740	1.39	1.39	2.06	0.01	0.01

Analysis begun on: Thu Apr 24 13:50:26 2025
Analysis ended on: Thu Apr 24 13:50:27 2025
Total elapsed time: 00:00:01

1104 Halton Terrace (119024)
PCSWMM Model Output (Upstream WL Comparison Model)
100yr 3-hour Chicago Storm

ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM VERSION 7.6.3665

Simulation start time:	07/21/2021 00:00:00
Simulation end time:	07/22/2021 00:00:00
Runoff wet weather time steps:	300 seconds
Report time steps:	60 seconds
Number of data points:	1441

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Unit Hydrographs Runoff Method
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Subcatchment	Runoff Method	Raingage	Area (ha)	Time of Concentration (min)	Time to Peak (min)	Time after Peak (min)	Peak UH Flow (m³/s/mm)	UH Depth (mm)
EXT-01	Nash IUH	RG-1	1.352	10	6.67	43.33	0.0183	0.982

****
ARM Runoff Summary
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Subcatchment	Total Precip (mm)	Total Losses (mm)	Total Runoff (mm)	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff (fraction)
EXT-01	71.667	37.794	33.269	0.45	211.699	0.464

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

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Element Count
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Number of rain gages 1
Number of subcatchments ... 13
Number of nodes 29
Number of links 32
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
RG-1	C3h-100yr	INTENSITY	10 min.

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Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A-01	0.09	28.67	82.40	1.0000	RG-1	CBMH02
A-02	0.09	37.20	45.70	1.0000	RG-1	RY05
A-03	0.09	44.00	80.50	1.0000	RG-1	CBMH01
A-04	0.09	22.50	57.10	4.0000	RG-1	CB01
A-05	0.01	7.00	7.00	1.0000	RG-1	RY04
A-06	0.03	20.67	7.00	1.0000	RG-1	RY03
A-07	0.05	10.60	100.00	1.0000	RG-1	CBMH01
A-08	0.03	11.20	7.00	1.0000	RG-1	RY01
a-09	0.02	8.50	79.40	5.0000	RG-1	HP02
A-10	0.08	15.40	100.00	1.0000	RG-1	RY01
A-11	0.09	18.60	100.00	1.0000	RG-1	RY03
B-01	0.01	3.33	16.70	3.0000	RG-1	OF1
B-02	0.02	6.86	7.00	2.0000	RG-1	Ex_Ditch3

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Node Summary
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Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
HP01	JUNCTION	83.66	1.00	0.0	
HP02	JUNCTION	83.06	1.00	0.0	
HP-CBMH02	JUNCTION	85.85	1.00	0.0	
HP-CBMH03	JUNCTION	85.90	1.00	0.0	
HP-RY05	JUNCTION	83.90	1.00	0.0	
HP-RY06	JUNCTION	83.90	1.00	0.0	
HP-RY08	JUNCTION	83.26	1.00	0.0	
J1	JUNCTION	82.25	2.00	0.0	
Ex_1500	OUTFALL	80.11	1.55	0.0	
Ex_Ditch3	OUTFALL	83.22	1.00	0.0	
HP-CB01	OUTFALL	83.45	1.00	0.0	
HP-RY01	OUTFALL	82.86	1.00	0.0	
HP-RY02	OUTFALL	82.95	1.00	0.0	
OF1	OUTFALL	83.30	0.00	0.0	
OF2	OUTFALL	80.47	0.50	0.0	
CB01	STORAGE	82.32	2.00	0.0	
CBMH01	STORAGE	83.69	2.86	0.0	
CBMH02	STORAGE	82.88	3.67	0.0	
CBMH03	STORAGE	80.71	1.96	0.0	
MH02	STORAGE	81.35	2.44	0.0	
MH04	STORAGE	82.17	3.57	0.0	
MH06	STORAGE	82.70	3.12	0.0	
MH08	STORAGE	82.77	3.11	0.0	
RY01	STORAGE	81.06	2.72	0.0	
RY02	STORAGE	81.29	2.78	0.0	
RY03	STORAGE	81.51	2.39	0.0	
RY04	STORAGE	81.73	2.43	0.0	
RY05	STORAGE	82.80	2.00	0.0	
RY06	STORAGE	82.87	1.93	0.0	

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Link Summary
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Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J1	CBMH03	CONDUIT	38.2	3.9297	0.0240
C2	CBMH03	OF2	CONDUIT	35.8	0.6704	0.0240
CBMH01-CBMH02	CBMH01	CBMH02	CONDUIT	42.5	0.4941	0.0130
MH02-Ex_1500	MH02	Ex_1500	CONDUIT	28.8	0.4861	0.0130
MH04-MH02	MH04	MH02	CONDUIT	39.0	1.0001	0.0130
MH08-MH06	MH08	MH06	CONDUIT	36.8	0.1902	0.0130
MS-CB01	CB01	HP-CB01	CONDUIT	3.0	-4.3374	0.0150
MS-CBMH01(1)	CBMH01	HP-CBMH03	CONDUIT	3.0	-11.7469	0.0150
MS-CBMH01(2)	HP-CBMH03	CBMH02	CONDUIT	3.0	11.7469	0.0150
MS-CBMH02(1)	CBMH02	HP-CBMH02	CONDUIT	3.0	-10.0504	0.0150
MS-CBMH02(2)	HP-CBMH02	CB01	CONDUIT	3.0	156.9311	0.0150
MS-HP01	HP01	RY04	CONDUIT	22.0	2.2733	0.0350
MS-HP02	HP02	RY01	CONDUIT	18.7	1.4975	0.0350
MS-RY01	RY01	HP-RY01	CONDUIT	3.0	-2.6676	0.0350
MS-RY02(1)	RY02	RY01	CONDUIT	27.6	1.0145	0.0350
MS-RY02(2)	RY02	RY03	CONDUIT	21.5	0.7907	0.0350
MS-RY03	RY03	HP-RY02	CONDUIT	3.0	-1.6669	0.0350
MS-RY04(1)	RY04	HP-RY08	CONDUIT	6.6	-1.5153	0.0350
MS-RY04(2)	HP-RY08	RY03	CONDUIT	20.0	1.8003	0.0350
MS-RY05(1)	RY05	HP-RY05	CONDUIT	3.0	-3.3352	0.0350
MS-RY05(2)	HP-RY05	RY06	CONDUIT	3.0	3.3352	0.0350
MS-RY06(1)	RY06	HP-RY06	CONDUIT	3.0	-3.3352	0.0350
MS-RY06(2)	HP-RY06	Ex_Ditch3	CONDUIT	30.3	2.2448	0.0350
RY03-RY02	RY03	RY02	CONDUIT	6.9	3.1854	0.0130
RY05-MH08	RY05	MH08	CONDUIT	6.2	0.4839	0.0130
RY05-RY06	RY06	RY05	CONDUIT	13.5	0.5185	0.0130
RY08-RY03	RY04	RY03	CONDUIT	17.1	1.2859	0.0130
SC740	RY02	RY01	CONDUIT	14.6	1.5112	0.0130
O-CB01	CB01	MH02	ORIFICE			
O-CBMH02	CBMH02	MH04	ORIFICE			
O-MH06	MH06	MH04	ORIFICE			
O-RY01	RY01	CBMH03	ORIFICE			

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Cross Section Summary
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Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

C1	CIRCULAR	0.50	0.20	0.12	0.50	1	405.48
C2	CIRCULAR	0.50	0.20	0.12	0.50	1	167.48
CBMH01-CBMH02	CIRCULAR	0.61	0.29	0.15	0.61	1	451.09
MH02-Ex_1500	CIRCULAR	0.45	0.16	0.11	0.45	1	198.79
MH04-MH02	CIRCULAR	0.45	0.16	0.11	0.45	1	285.13
MH08-MH06	CIRCULAR	0.61	0.29	0.15	0.61	1	279.88
MS-CB01	RECT_OPEN	1.00	3.00	0.60	3.00	1	29632.76
MS-CBMH01(1)	RECT_OPEN	1.00	3.00	0.60	3.00	1	48766.13
MS-CBMH01(2)	RECT_OPEN	1.00	3.00	0.60	3.00	1	48766.13
MS-CBMH02(1)	RECT_OPEN	1.00	3.00	0.60	3.00	1	45107.44
MS-CBMH02(2)	RECT_OPEN	1.00	3.00	0.60	3.00	1	178242.59
MS-HP01	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	8394.58
MS-HP02	TRAPEZOIDAL	1.00	15.15	0.50	30.15	1	33432.18
MS-RY01	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	9093.49
MS-RY02(1)	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	5607.96
MS-RY02(2)	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	4950.86
MS-RY03	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	7188.26
MS-RY04(1)	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	6853.65
MS-RY04(2)	TRAPEZOIDAL	1.00	3.15	0.49	6.15	1	7470.34
MS-RY05(1)	RECT_OPEN	1.00	3.00	0.60	3.00	1	11136.28
MS-RY05(2)	RECT_OPEN	1.00	3.00	0.60	3.00	1	11136.28
MS-RY06(1)	RECT_OPEN	1.00	3.00	0.60	3.00	1	11136.28
MS-RY06(2)	RECT_OPEN	1.00	2.50	0.56	2.50	1	7232.76
RY03-RY02	RECT_CLOSED	1.14	2.16	0.36	1.90	1	14858.77
RY05-MH08	CIRCULAR	0.25	0.05	0.06	0.25	1	41.37
RY05-RY06	CIRCULAR	0.25	0.05	0.06	0.25	1	42.82
RY08-RY03	RECT_CLOSED	1.14	2.16	0.36	1.90	1	9440.71
SC740	RECT_CLOSED	1.14	2.16	0.36	1.90	1	10234.24

```
*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 07/21/2021 00:00:00
Ending Date .............. 07/22/2021 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 6.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.050        71.667
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.010        14.800
Surface Runoff ...........         0.040        56.956
Final Storage ............         0.000         0.602
Continuity Error (%) .....        -0.965


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.040         0.398
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.045         0.452
External Outflow .........         0.085         0.851
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.001         0.013
Final Stored Volume ......         0.001         0.013
Continuity Error (%) .....        -0.063


*************************
Highest Continuity Errors
*************************
Node RY03 (13.55%)
Node RY04 (11.20%)
Node RY02 (-8.00%)
Node RY01 (-5.30%)


***************************
Time-Step Critical Elements
***************************
Link RY05-MH08 (3.31%)
Link RY03-RY02 (1.27%)


********************************
Highest Flow Instability Indexes
********************************
Link O-CB01 (126)
Link MH02-Ex_1500 (19)
Link MH04-MH02 (16)
Link SC740 (11)
Link RY03-RY02 (9)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     5.87 sec
Maximum Time Step           :     6.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.34
Percent Not Converging      :     1.66
Time Step Frequencies       :
    6.000 -  3.650 sec      :    97.15 %
    3.650 -  2.221 sec      :     2.47 %
    2.221 -  1.351 sec      :     0.27 %
    1.351 -  0.822 sec      :     0.07 %
    0.822 -  0.500 sec      :     0.04 %


***************************
Subcatchment Runoff Summary
***************************
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
A-01	71.67	0.00	0.00	7.82	58.11	5.13	63.24	0.05	40.77	0.882
A-02	71.67	0.00	0.00	28.72	32.12	43.09	43.09	0.04	31.90	0.601
A-03	71.67	0.00	0.00	8.63	56.66	5.80	62.46	0.05	41.90	0.871
A-04	71.67	0.00	0.00	19.25	40.14	12.07	52.21	0.05	37.84	0.729
A-05	71.67	0.00	0.00	42.90	4.91	24.46	29.37	0.00	3.28	0.410
A-06	71.67	0.00	0.00	42.38	4.92	25.15	30.07	0.01	8.41	0.420
A-07	71.67	0.00	0.00	0.00	72.18	0.00	72.18	0.04	26.17	1.007

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A-08	71.67	0.00	0.00	43.38	4.91	23.86	28.77
0.01	5.79	0.401					
a-09	71.67	0.00	0.00	9.05	55.75	6.43	62.18
0.01	8.16	0.868					
A-10	71.67	0.00	0.00	0.00	72.18	0.00	72.18
0.06	38.03	1.007					
A-11	71.67	0.00	0.00	0.00	72.18	0.00	72.18
0.07	45.93	1.007					
B-01	71.67	0.00	0.00	37.24	35.46	23.74	35.46
0.00	1.54	0.495					
B-02	71.67	0.00	0.00	43.36	4.91	23.89	28.80
0.01	5.00	0.402					

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	hr:min	Reported Max Depth Meters
HP01	JUNCTION	0.00	0.00	83.66	0	00:00	0.00
HP02	JUNCTION	0.00	0.04	83.10	0	01:10	0.04
HP-CBMH02	JUNCTION	0.00	0.00	85.85	0	00:00	0.00
HP-CBMH03	JUNCTION	0.00	0.00	85.90	0	00:00	0.00
HP-RY05	JUNCTION	0.00	0.00	83.90	0	00:00	0.00
HP-RY06	JUNCTION	0.00	0.00	83.90	0	00:00	0.00
HP-RY08	JUNCTION	0.00	0.00	83.26	0	00:00	0.00
J1	JUNCTION	0.02	0.50	82.75	0	01:13	0.50
Ex_1500	OUTFALL	2.54	2.54	82.65	0	00:00	2.54
Ex_Ditch3	OUTFALL	0.00	0.00	83.22	0	00:00	0.00
HP-CB01	OUTFALL	0.00	0.00	83.45	0	00:00	0.00
HP-RY01	OUTFALL	0.00	0.00	82.86	0	00:00	0.00
HP-RY02	OUTFALL	0.00	0.00	82.95	0	00:00	0.00
OF1	OUTFALL	0.00	0.00	83.30	0	00:00	0.00
OF2	OUTFALL	0.03	0.50	80.97	0	01:10	0.50
CB01	STORAGE	0.35	1.13	83.45	0	01:13	1.13
CBMH01	STORAGE	0.44	2.15	85.84	0	01:52	2.15
CBMH02	STORAGE	0.66	2.96	85.84	0	01:50	2.96
CBMH03	STORAGE	0.04	0.74	81.45	0	01:15	0.71
MH02	STORAGE	1.30	1.31	82.66	0	01:21	1.31
MH04	STORAGE	0.48	0.49	82.66	0	01:21	0.49
MH06	STORAGE	0.05	1.12	83.82	0	01:30	1.12
MH08	STORAGE	0.05	1.05	83.82	0	01:30	1.05
RY01	STORAGE	0.20	1.60	82.66	0	01:38	1.59
RY02	STORAGE	0.15	1.37	82.66	0	01:37	1.36
RY03	STORAGE	0.11	1.15	82.66	0	01:41	1.15
RY04	STORAGE	0.08	0.93	82.66	0	01:41	0.93
RY05	STORAGE	0.05	1.02	83.82	0	01:29	1.02
RY06	STORAGE	0.04	0.95	83.82	0	01:30	0.95

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
HP01	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP02	JUNCTION	8.16	8.16	0	01:10	0.0106	0.0106	-0.011
HP-CBMH02	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-CBMH03	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY05	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY06	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY08	JUNCTION	0.00	0.00	0	00:00	0	0	0.000 ltr
J1	JUNCTION	211.58	211.58	0	01:15	0.45	0.45	-0.028
Ex_1500	OUTFALL	0.00	35.62	0	01:21	0	0.239	0.000
Ex_Ditch3	OUTFALL	5.00	5.00	0	01:10	0.00692	0.00692	0.000
HP-CB01	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY01	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
HP-RY02	OUTFALL	0.00	0.00	0	00:00	0	0	0.000 ltr
OF1	OUTFALL	1.54	1.54	0	01:15	0.00178	0.00178	0.000
OF2	OUTFALL	0.00	225.12	0	01:15	0	0.606	0.000
CB01	STORAGE	37.84	37.84	0	01:10	0.047	0.0483	0.500
CBMH01	STORAGE	68.08	68.08	0	01:10	0.0933	0.0933	0.067
CBMH02	STORAGE	40.77	59.43	0	01:06	0.0544	0.148	0.056
CBMH03	STORAGE	0.00	300.97	0	01:14	0	0.605	-0.107
MH02	STORAGE	0.00	35.62	0	01:21	0	0.24	-0.049
MH04	STORAGE	0.00	15.34	0	01:30	0	0.189	0.003
MH06	STORAGE	0.00	17.82	0	01:11	0	0.0403	0.259
MH08	STORAGE	0.00	28.98	0	01:11	0	0.0401	-0.290
RY01	STORAGE	43.82	54.32	0	01:10	0.0637	0.162	-5.029
RY02	STORAGE	0.00	103.24	0	02:02	0	0.0858	-7.406
RY03	STORAGE	54.34	80.98	0	01:09	0.0765	0.0982	15.677
RY04	STORAGE	3.28	52.02	0	01:09	0.00412	0.0185	12.611
RY05	STORAGE	31.90	31.90	0	01:10	0.0401	0.0418	-0.023
RY06	STORAGE	0.00	3.25	0	01:24	0	0.00164	0.853

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
J1	JUNCTION	0.01	0.001	1.499

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	hr:min	Maximum Outflow LPS
CB01	0.000	3	0	0	0.006	93	0	01:13	21.23
CBMH01	0.004	8	0	0	0.033	70	0	01:52	21.40
CBMH02	0.004	12	0	0	0.031	94	0	01:50	7.37
CBMH03	0.000	2	0	0	0.001	38	0	01:15	225.12
MH02	0.001	53	0	0	0.001	54	0	01:21	35.62
MH04	0.001	13	0	0	0.001	14	0	01:21	16.43
MH06	0.000	2	0	0	0.001	36	0	01:30	7.99
MH08	0.000	2	0	0	0.001	34	0	01:30	17.82
RY01	0.000	7	0	0	0.001	59	0	01:38	55.48
RY02	0.000	5	0	0	0.000	49	0	01:37	70.55
RY03	0.000	5	0	0	0.000	48	0	01:41	103.24
RY04	0.000	3	0	0	0.000	38	0	01:41	22.67
RY05	0.000	1	0	0	0.001	18	0	01:29	30.36
RY06	0.000	1	0	0	0.000	18	0	01:30	1.24

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
Ex_1500	97.05	3.23	35.62	0.239
Ex_Ditch3	10.61	1.05	5.00	0.007
HP-CB01	0.00	0.00	0.00	0.000
HP-RY01	0.00	0.00	0.00	0.000
HP-RY02	0.00	0.00	0.00	0.000
OF1	6.85	0.41	1.54	0.002
OF2	25.27	33.56	225.12	0.606
System	19.97	38.24	264.68	0.853

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	290.94	0	01:14	1.48	0.72	1.00
C2	CONDUIT	225.12	0	01:15	1.15	1.34	1.00
CBMH01-CBMH02	CONDUIT	21.40	0	01:05	0.47	0.05	1.00
MH02-Ex_1500	CONDUIT	35.62	0	01:21	0.22	0.18	1.00
MH04-MH02	CONDUIT	16.43	0	01:26	0.10	0.06	1.00
MH08-MH06	CONDUIT	17.82	0	01:11	0.49	0.06	1.00
MS-CB01	CONDUIT	0.00	0	00:00	0.00	0.00	0.06
MS-CBMH01(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.14
MS-CBMH01(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.14
MS-CBMH02(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.14
MS-CBMH02(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.06
MS-HP01	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-HP02	CONDUIT	8.09	0	01:10	0.29	0.00	0.04
MS-RY01	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY02(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY02(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY03	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY04(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY04(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MS-RY05(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.01
MS-RY05(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.01
MS-RY06(1)	CONDUIT	0.00	0	00:00	0.00	0.00	0.01
MS-RY06(2)	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
RY03-RY02	CONDUIT	103.24	0	02:02	0.36	0.01	1.00
RY05-MH08	CONDUIT	28.98	0	01:11	0.82	0.70	1.00
RY05-RY06	CONDUIT	3.25	0	01:24	0.07	0.08	1.00
RY08-RY03	CONDUIT	48.86	0	01:09	0.14	0.01	0.91
SC740	CONDUIT	45.65	0	01:09	0.06	0.00	1.00
O-CB01	ORIFICE	21.23	0	01:13			1.00
O-CBMH02	ORIFICE	7.37	0	01:50			1.00
O-MH06	ORIFICE	7.99	0	01:30			1.00
O-RY01	ORIFICE	12.63	0	01:39			1.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		Fraction of Time in Flow Class								
C1	1.00	0.77	0.05	0.00	0.16	0.00	0.00	0.01	0.00	0.99
C2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.84
CBMH01-CBMH02	1.00	0.01	0.00	0.00	0.28	0.00	0.00	0.72	0.02	0.00
MH02-Ex_1500	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH04-MH02	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH08-MH06	1.00	0.82	0.04	0.00	0.14	0.00	0.00	0.00	0.87	0.00
MS-CB01	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-CBMH01(1)	1.00	0.81	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-CBMH01(2)	1.00	0.81	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-CBMH02(1)	1.00	0.81	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-CBMH02(2)	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-HP01	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-HP02	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MS-RY01	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY02(1)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY02(2)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY03	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY04(1)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY04(2)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY05(1)	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY05(2)	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY06(1)	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MS-RY06(2)	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RY03-RY02	1.00	0.19	0.37	0.00	0.42	0.03	0.00	0.00	0.29	0.00
RY05-MH08	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.87	0.00
RY05-RY06	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.88	0.00
RY08-RY03	1.00	0.56	0.25	0.00	0.19	0.00	0.00	0.00	0.36	0.00
SC740	1.00	0.19	0.00	0.00	0.25	0.00	0.00	0.56	0.05	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1	0.01	0.01	0.19	0.01	0.01
C2	0.21	0.21	0.23	0.24	0.21
CBMH01-CBMH02	4.87	4.87	5.09	0.01	0.01
MH02-Ex_1500	24.00	24.00	24.00	0.01	0.01
MH04-MH02	24.00	24.00	24.00	0.01	0.01
MH08-MH06	0.78	0.78	0.85	0.01	0.01
RY03-RY02	0.24	0.24	1.21	0.01	0.01
RY05-MH08	1.34	1.34	1.41	0.01	0.01
RY05-RY06	1.19	1.19	1.34	0.01	0.01
RY08-RY03	0.01	0.01	0.24	0.01	0.01
SC740	1.21	1.21	1.87	0.01	0.01

Analysis begun on: Fri Jul 11 13:56:27 2025
Analysis ended on: Fri Jul 11 13:56:27 2025
Total elapsed time: < 1 sec

1104 Halton Terrace – Maple Leaf Homes (119024)
PCSWMM Model Schematic

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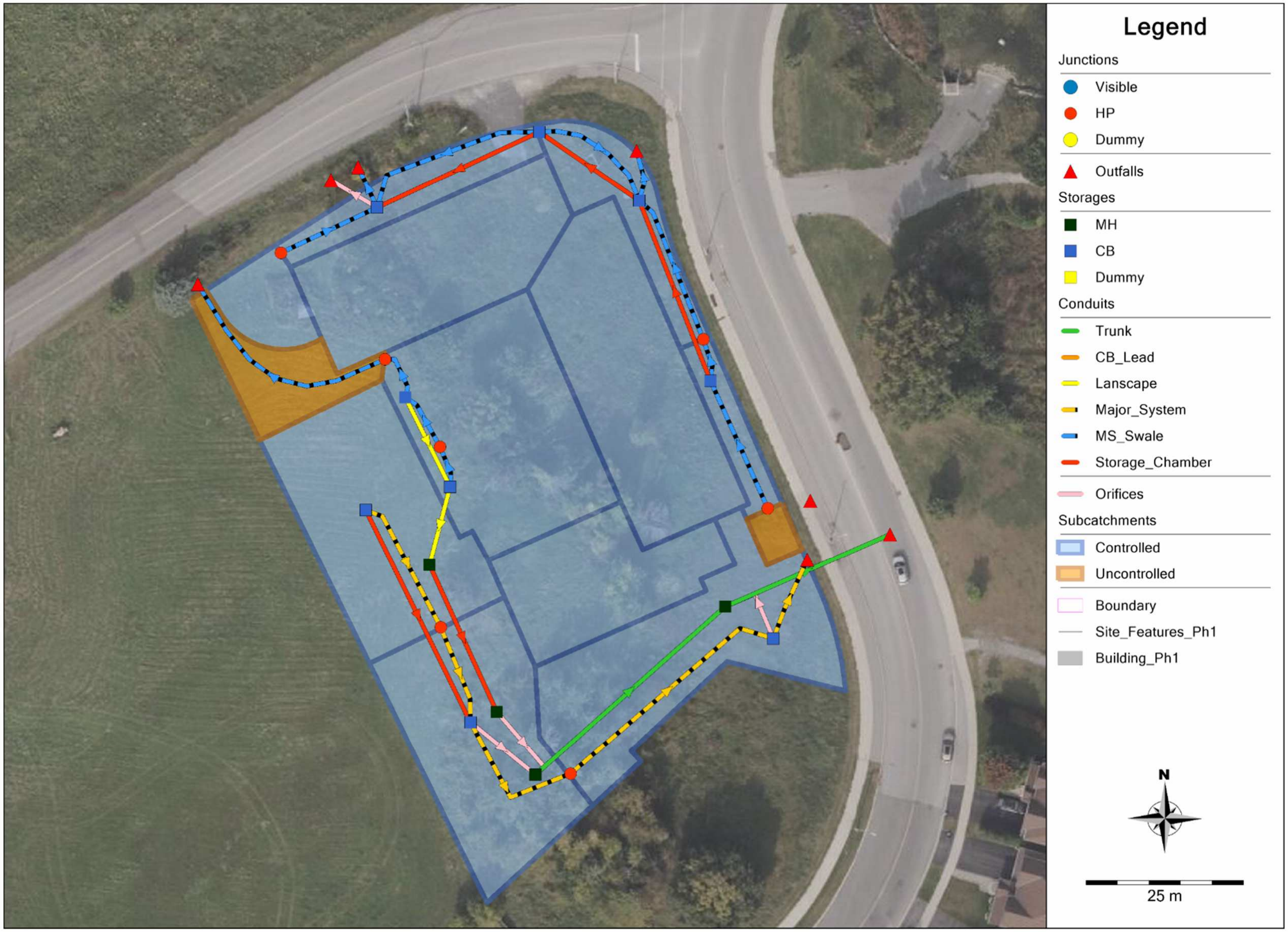
Engineers, Planners & Landscape Architects

Overall Model Schematic



Date: 2025-04-24
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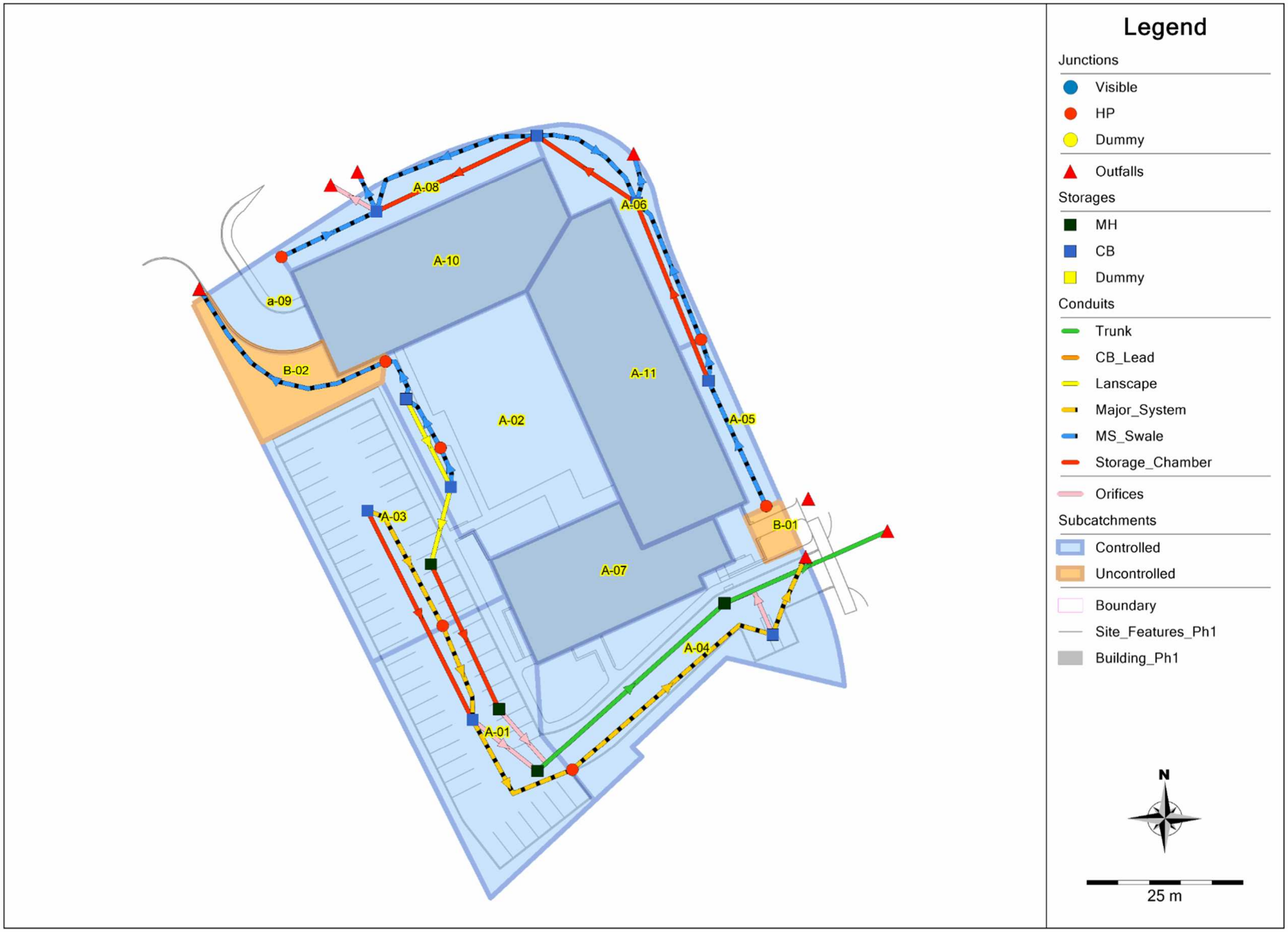
1104 Halton Terrace – Maple Leaf Homes (119024)
PCSWMM Model Schematic

NOVATECH
Engineers, Planners & Landscape Architects

Subcatchments (ID's)



Date: 2025-04-24
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1104 Halton Terrace – Maple Leaf Homes (119024)
PCSWMM Model Schematic

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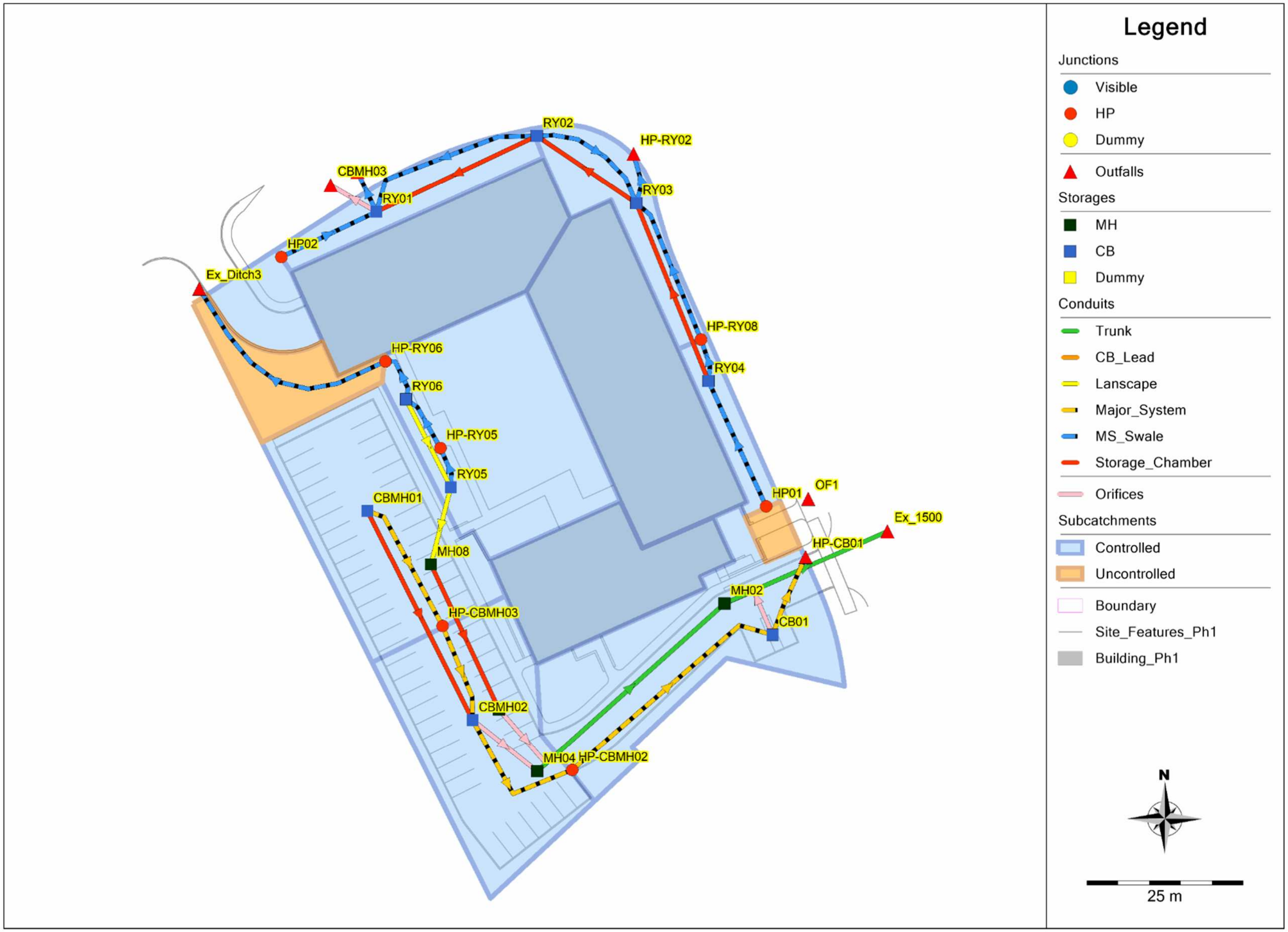
Engineers, Planners & Landscape Architects

Nodes ID's



Date: 2025-04-24
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User Inputs

Chamber Model: SC-800
Outlet Control Structure: No
Project Name: 1104 Halton Terrace Phase 1
Engineer: Lucas Wilson
Project Location: Ontario
Measurement Type: Metric
Required Storage Volume: 14.01 cubic meters.
Stone Porosity: 40%
Stone Foundation Depth: 153 mm.
Stone Above Chambers: 153 mm.
Design Constraint Dimensions: (2.00 m. x 12.00 m.)

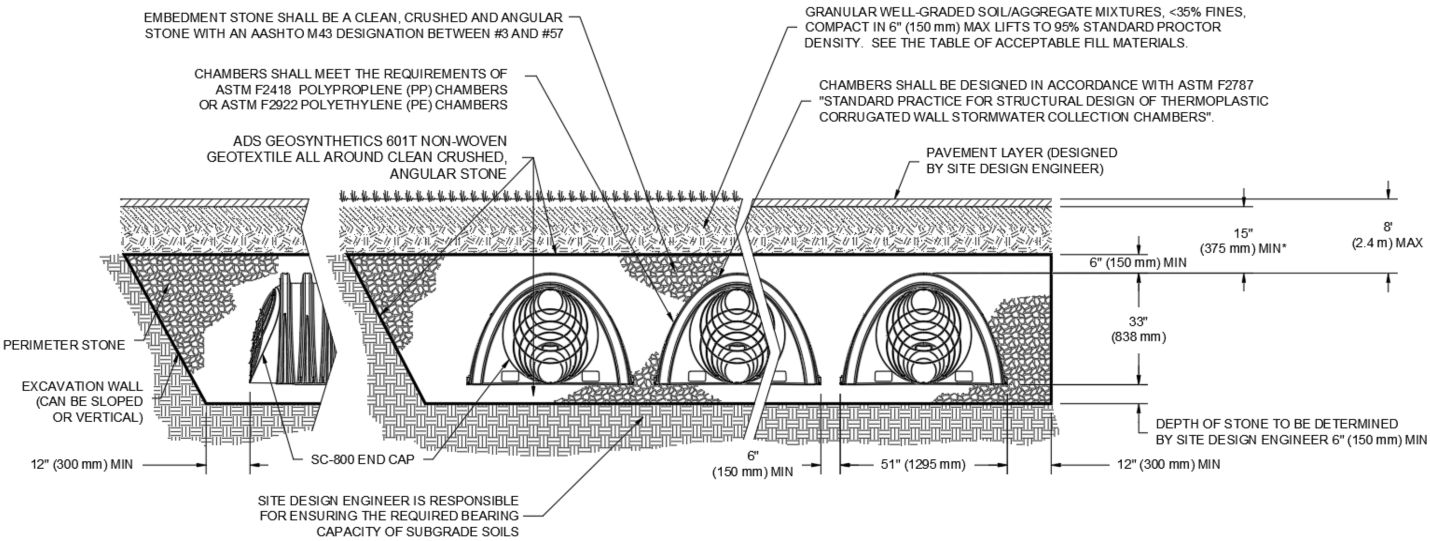
Results

System Volume and Bed Size

Installed Storage Volume: 14.86 cubic meters.
Storage Volume Per Chamber: 1.44 cubic meters.
Number Of Chambers Required: 5
Number Of End Caps Required: 2
Chamber Rows: 1
Maximum Length: 11.99 m.
Maximum Width: 1.91 m.
Approx. Bed Size Required: 22.84 square meters.
Average Cover Over Chambers: N/A .

System Components

Amount Of Stone Required: 19 cubic meters
Volume Of Excavation (Not Including Fill): 27 cubic meters
Total Non-woven Geotextile Required: 93 square meters
Woven Geotextile Required (excluding Isolator Row): 0 square meters
Woven Geotextile Required (Isolator Row): 21 square meters
Total Woven Geotextile Required: 21 square meters
Impervious Liner Required: 0 square meters



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

User Inputs

Chamber Model:	SC-800
Outlet Control Structure:	No
Project Name:	1104 Halton Terrace Phase 1
Engineer:	Lucas Wilson
Project Location:	Ontario
Measurement Type:	Metric
Required Storage Volume:	31.00 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	153 mm.
Stone Above Chambers:	153 mm.
Design Constraint Dimensions:	(2.00 m. x 26.00 m.)

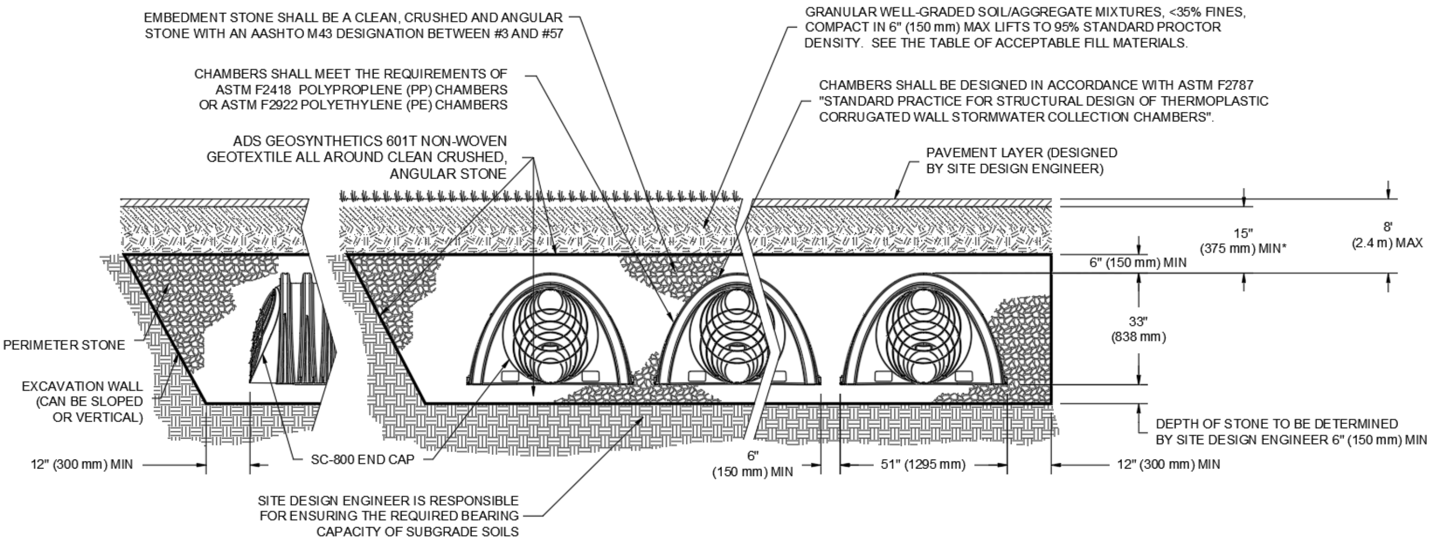
Results

System Volume and Bed Size

Installed Storage Volume:	31.36 cubic meters.
Storage Volume Per Chamber:	1.44 cubic meters.
Number Of Chambers Required:	11
Number Of End Caps Required:	2
Chamber Rows:	1
Maximum Length:	25.01 m.
Maximum Width:	1.91 m.
Approx. Bed Size Required:	47.64 square meters.
Average Cover Over Chambers:	N/A .

System Components

Amount Of Stone Required:	39 cubic meters
Volume Of Excavation (Not Including Fill):	55 cubic meters
Total Non-woven Geotextile Required:	189 square meters
Woven Geotextile Required (excluding Isolator Row):	0 square meters
Woven Geotextile Required (Isolator Row):	45 square meters
Total Woven Geotextile Required:	45 square meters
Impervious Liner Required:	0 square meters



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

User Inputs

Chamber Model:	SC-800
Outlet Control Structure:	No
Project Name:	1104 Halton Terrace Phase 1
Engineer:	Lucas Wilson
Project Location:	Ontario
Measurement Type:	Metric
Required Storage Volume:	36.00 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	153 mm.
Stone Above Chambers:	153 mm.
Design Constraint Dimensions:	(2.00 m. x 30.01 m.)

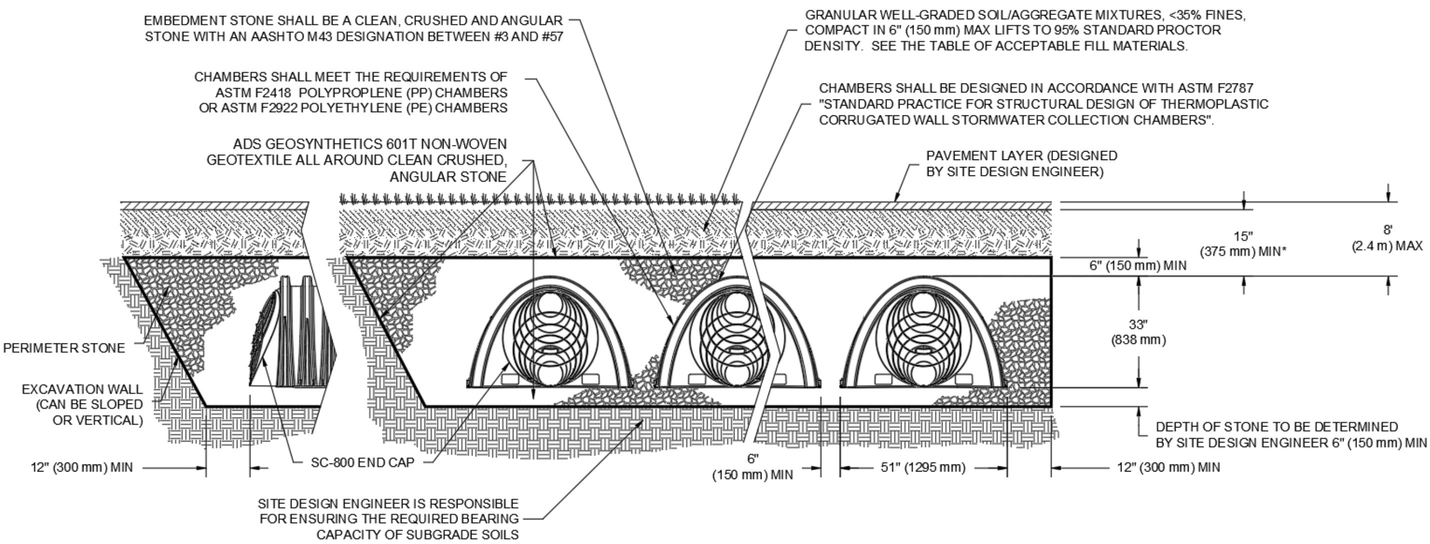
Results

System Volume and Bed Size

Installed Storage Volume:	36.86 cubic meters.
Storage Volume Per Chamber:	1.44 cubic meters.
Number Of Chambers Required:	13
Number Of End Caps Required:	2
Chamber Rows:	1
Maximum Length:	29.35 m.
Maximum Width:	1.91 m.
Approx. Bed Size Required:	55.90 square meters.
Average Cover Over Chambers:	N/A .

System Components

Amount Of Stone Required:	46 cubic meters
Volume Of Excavation (Not Including Fill):	64 cubic meters
Total Non-woven Geotextile Required:	220 square meters
Woven Geotextile Required (excluding Isolator Row):	0 square meters
Woven Geotextile Required (Isolator Row):	53 square meters
Total Woven Geotextile Required:	53 square meters
Impervious Liner Required:	0 square meters



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

Project: **1104 HALTON TERRACE**

Chamber Model -	SC-800	
Units -	**Metric**	
Number of Chambers -	5	
Number of End Caps -	2	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	81.07	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

Area of System- 22.83866401 sq.meters Min. Area - 17.36 sq.meters

☑ Include Perimeter Stone in Calculations

☐ Click for Stage Area Data

☐ Click to Invert Stage Area Data

Click Here for Imperial

StormTech SC-800 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)*
1143	0.000	0.000	0.00	0.00	0.23	0.23	14.86	82.21
1118	0.000	0.000	0.00	0.00	0.23	0.23	14.63	82.19
1092	0.000	0.000	0.00	0.00	0.23	0.23	14.39	82.16
1067	0.000	0.000	0.00	0.00	0.23	0.23	14.16	82.14
1041	0.000	0.000	0.00	0.00	0.23	0.23	13.93	82.11
1016	0.000	0.000	0.00	0.00	0.23	0.23	13.70	82.09
991	0.002	0.000	0.01	0.00	0.23	0.24	13.47	82.06
965	0.006	0.000	0.03	0.00	0.22	0.25	13.23	82.04
940	0.008	0.000	0.04	0.00	0.22	0.26	12.98	82.01
914	0.014	0.000	0.07	0.00	0.20	0.28	12.72	81.98
889	0.021	0.000	0.10	0.00	0.19	0.30	12.45	81.96
864	0.025	0.001	0.13	0.00	0.18	0.31	12.15	81.93
838	0.029	0.001	0.14	0.00	0.17	0.32	11.84	81.91
813	0.032	0.001	0.16	0.00	0.17	0.33	11.52	81.88
787	0.034	0.001	0.17	0.00	0.16	0.34	11.20	81.86
762	0.037	0.002	0.18	0.00	0.16	0.34	10.86	81.83
737	0.039	0.002	0.19	0.00	0.15	0.35	10.51	81.81
711	0.041	0.002	0.20	0.00	0.15	0.36	10.16	81.78
686	0.043	0.002	0.21	0.00	0.14	0.36	9.81	81.76
660	0.044	0.003	0.22	0.01	0.14	0.37	9.44	81.73
635	0.046	0.003	0.23	0.01	0.14	0.37	9.07	81.71
610	0.047	0.003	0.24	0.01	0.13	0.38	8.70	81.68
584	0.049	0.003	0.24	0.01	0.13	0.38	8.32	81.65
559	0.050	0.004	0.25	0.01	0.13	0.39	7.94	81.63
533	0.051	0.004	0.26	0.01	0.13	0.39	7.55	81.60
508	0.052	0.004	0.26	0.01	0.12	0.39	7.16	81.58
483	0.054	0.004	0.27	0.01	0.12	0.40	6.77	81.55
457	0.055	0.004	0.27	0.01	0.12	0.40	6.37	81.53
432	0.056	0.004	0.28	0.01	0.12	0.40	5.97	81.50
406	0.057	0.004	0.28	0.01	0.12	0.41	5.57	81.48
381	0.057	0.005	0.29	0.01	0.11	0.41	5.16	81.45
356	0.058	0.005	0.29	0.01	0.11	0.41	4.75	81.43
330	0.059	0.005	0.29	0.01	0.11	0.41	4.34	81.40
305	0.060	0.005	0.30	0.01	0.11	0.42	3.92	81.37
279	0.060	0.005	0.30	0.01	0.11	0.42	3.51	81.35
254	0.061	0.005	0.31	0.01	0.11	0.42	3.09	81.32
229	0.062	0.005	0.31	0.01	0.10	0.42	2.67	81.30
203	0.062	0.005	0.31	0.01	0.10	0.43	2.24	81.27
178	0.063	0.004	0.31	0.01	0.10	0.43	1.82	81.25
152	0.000	0.000	0.00	0.00	0.23	0.23	1.39	81.22
127	0.000	0.000	0.00	0.00	0.23	0.23	1.16	81.20
102	0.000	0.000	0.00	0.00	0.23	0.23	0.93	81.17
76	0.000	0.000	0.00	0.00	0.23	0.23	0.70	81.15
51	0.000	0.000	0.00	0.00	0.23	0.23	0.46	81.12
25	0.000	0.000	0.00	0.00	0.23	0.23	0.23	81.10

Project: **1104 HALTON TERRACE**

Chamber Model -	SC-800	
Units -	**Metric**	
Number of Chambers -	11	
Number of End Caps -	2	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	81.29	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm
Area of System-	47.64	sq.meters

Min. Area - 36.2 sq.meters

☑ Include Perimeter Stone in Calculations

☐ Click for Stage Area Data

☐ Click to Invert Stage Area Data

Click Here for Imperial

StormTech SC-800 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)*
1143	0.000	0.000	0.00	0.00	0.48	0.48	31.36	82.43
1118	0.000	0.000	0.00	0.00	0.48	0.48	30.87	82.41
1092	0.000	0.000	0.00	0.00	0.48	0.48	30.39	82.38
1067	0.000	0.000	0.00	0.00	0.48	0.48	29.91	82.36
1041	0.000	0.000	0.00	0.00	0.48	0.48	29.42	82.33
1016	0.000	0.000	0.00	0.00	0.48	0.48	28.94	82.31
991	0.002	0.000	0.02	0.00	0.47	0.50	28.45	82.28
965	0.006	0.000	0.06	0.00	0.46	0.52	27.96	82.26
940	0.008	0.000	0.09	0.00	0.45	0.54	27.44	82.23
914	0.014	0.000	0.16	0.00	0.42	0.58	26.90	82.20
889	0.021	0.000	0.23	0.00	0.39	0.62	26.32	82.18
864	0.025	0.001	0.28	0.00	0.37	0.65	25.70	82.15
838	0.029	0.001	0.32	0.00	0.36	0.67	25.04	82.13
813	0.032	0.001	0.35	0.00	0.34	0.69	24.37	82.10
787	0.034	0.001	0.38	0.00	0.33	0.71	23.67	82.08
762	0.037	0.002	0.40	0.00	0.32	0.73	22.96	82.05
737	0.039	0.002	0.43	0.00	0.31	0.74	22.23	82.03
711	0.041	0.002	0.45	0.00	0.30	0.76	21.49	82.00
686	0.043	0.002	0.47	0.00	0.29	0.77	20.74	81.98
660	0.044	0.003	0.49	0.01	0.29	0.78	19.97	81.95
635	0.046	0.003	0.50	0.01	0.28	0.79	19.19	81.93
610	0.047	0.003	0.52	0.01	0.27	0.80	18.40	81.90
584	0.049	0.003	0.54	0.01	0.27	0.81	17.60	81.87
559	0.050	0.004	0.55	0.01	0.26	0.82	16.79	81.85
533	0.051	0.004	0.56	0.01	0.26	0.83	15.97	81.82
508	0.052	0.004	0.58	0.01	0.25	0.83	15.14	81.80
483	0.054	0.004	0.59	0.01	0.25	0.84	14.31	81.77
457	0.055	0.004	0.60	0.01	0.24	0.85	13.46	81.75
432	0.056	0.004	0.61	0.01	0.24	0.86	12.61	81.72
406	0.057	0.004	0.62	0.01	0.23	0.86	11.76	81.70
381	0.057	0.005	0.63	0.01	0.23	0.87	10.90	81.67
356	0.058	0.005	0.64	0.01	0.22	0.87	10.03	81.65
330	0.059	0.005	0.65	0.01	0.22	0.88	9.15	81.62
305	0.060	0.005	0.66	0.01	0.22	0.88	8.27	81.59
279	0.060	0.005	0.66	0.01	0.21	0.89	7.39	81.57
254	0.061	0.005	0.67	0.01	0.21	0.89	6.50	81.54
229	0.062	0.005	0.68	0.01	0.21	0.90	5.61	81.52
203	0.062	0.005	0.69	0.01	0.21	0.90	4.71	81.49
178	0.063	0.004	0.69	0.01	0.20	0.90	3.81	81.47
152	0.000	0.000	0.00	0.00	0.48	0.48	2.90	81.44
127	0.000	0.000	0.00	0.00	0.48	0.48	2.42	81.42
102	0.000	0.000	0.00	0.00	0.48	0.48	1.94	81.39
76	0.000	0.000	0.00	0.00	0.48	0.48	1.45	81.37
51	0.000	0.000	0.00	0.00	0.48	0.48	0.97	81.34
25	0.000	0.000	0.00	0.00	0.48	0.48	0.48	81.32

Project: 1104 HALTON TERRACE

Chamber Model -	SC-800	
Units -	**Metric**	
Number of Chambers -	13	
Number of End Caps -	2	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	81.51	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm

Area of System- 55.9 sq.meters Min. Area - 42.48 sq.meters

☑ Include Perimeter Stone in Calculations

☐ Click for Stage Area Data

☐ Click to Invert Stage Area Data

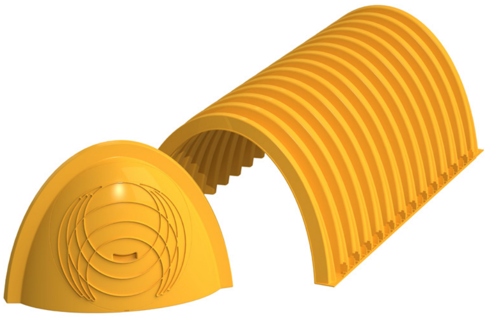
Click Here for Imperial

StormTech SC-800 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)*
1143	0.000	0.000	0.00	0.00	0.57	0.57	36.86	82.65
1118	0.000	0.000	0.00	0.00	0.57	0.57	36.29	82.63
1092	0.000	0.000	0.00	0.00	0.57	0.57	35.72	82.60
1067	0.000	0.000	0.00	0.00	0.57	0.57	35.15	82.58
1041	0.000	0.000	0.00	0.00	0.57	0.57	34.58	82.55
1016	0.000	0.000	0.00	0.00	0.57	0.57	34.02	82.53
991	0.002	0.000	0.03	0.00	0.56	0.58	33.45	82.50
965	0.006	0.000	0.07	0.00	0.54	0.61	32.86	82.48
940	0.008	0.000	0.11	0.00	0.53	0.63	32.25	82.45
914	0.014	0.000	0.19	0.00	0.49	0.68	31.62	82.42
889	0.021	0.000	0.27	0.00	0.46	0.73	30.94	82.40
864	0.025	0.001	0.33	0.00	0.44	0.77	30.21	82.37
838	0.029	0.001	0.37	0.00	0.42	0.79	29.44	82.35
813	0.032	0.001	0.41	0.00	0.40	0.82	28.65	82.32
787	0.034	0.001	0.45	0.00	0.39	0.84	27.83	82.30
762	0.037	0.002	0.48	0.00	0.38	0.86	26.99	82.27
737	0.039	0.002	0.51	0.00	0.36	0.87	26.14	82.25
711	0.041	0.002	0.53	0.00	0.35	0.89	25.27	82.22
686	0.043	0.002	0.55	0.00	0.34	0.90	24.38	82.20
660	0.044	0.003	0.58	0.01	0.34	0.92	23.47	82.17
635	0.046	0.003	0.60	0.01	0.33	0.93	22.56	82.15
610	0.047	0.003	0.62	0.01	0.32	0.94	21.63	82.12
584	0.049	0.003	0.63	0.01	0.31	0.95	20.69	82.09
559	0.050	0.004	0.65	0.01	0.30	0.96	19.73	82.07
533	0.051	0.004	0.67	0.01	0.30	0.97	18.77	82.04
508	0.052	0.004	0.68	0.01	0.29	0.98	17.80	82.02
483	0.054	0.004	0.70	0.01	0.29	0.99	16.82	81.99
457	0.055	0.004	0.71	0.01	0.28	1.00	15.82	81.97
432	0.056	0.004	0.72	0.01	0.28	1.01	14.83	81.94
406	0.057	0.004	0.73	0.01	0.27	1.01	13.82	81.92
381	0.057	0.005	0.75	0.01	0.27	1.02	12.81	81.89
356	0.058	0.005	0.76	0.01	0.26	1.03	11.78	81.87
330	0.059	0.005	0.77	0.01	0.26	1.03	10.76	81.84
305	0.060	0.005	0.78	0.01	0.25	1.04	9.72	81.81
279	0.060	0.005	0.79	0.01	0.25	1.05	8.68	81.79
254	0.061	0.005	0.79	0.01	0.25	1.05	7.64	81.76
229	0.062	0.005	0.80	0.01	0.24	1.06	6.59	81.74
203	0.062	0.005	0.81	0.01	0.24	1.06	5.53	81.71
178	0.063	0.004	0.82	0.01	0.24	1.06	4.47	81.69
152	0.000	0.000	0.00	0.00	0.57	0.57	3.41	81.66
127	0.000	0.000	0.00	0.00	0.57	0.57	2.84	81.64
102	0.000	0.000	0.00	0.00	0.57	0.57	2.27	81.61
76	0.000	0.000	0.00	0.00	0.57	0.57	1.70	81.59
51	0.000	0.000	0.00	0.00	0.57	0.57	1.14	81.56
25	0.000	0.000	0.00	0.00	0.57	0.57	0.57	81.54

StormTech® SC-800 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



Nominal Chamber Specifications
(not to scale)

Size (L x W x H)
85.4" x 51" x 33"
2169 mm x 1295 mm x 838 mm

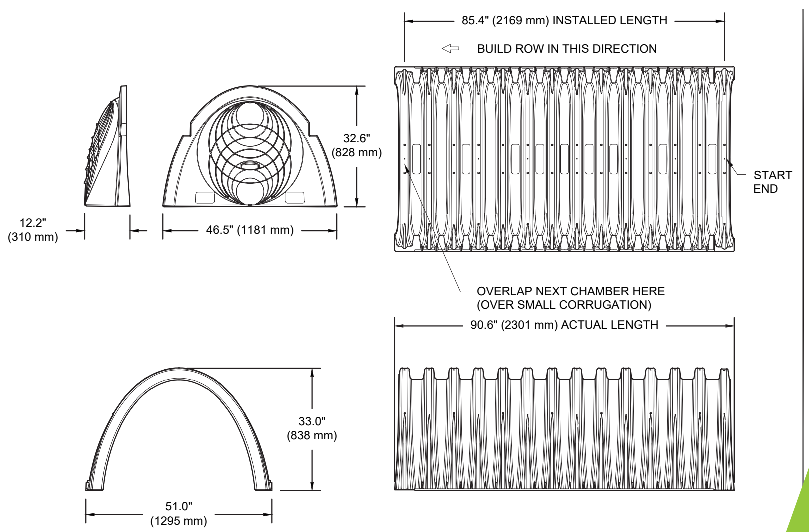
Chamber Storage
50.6 ft^3 (1.43 m^3)

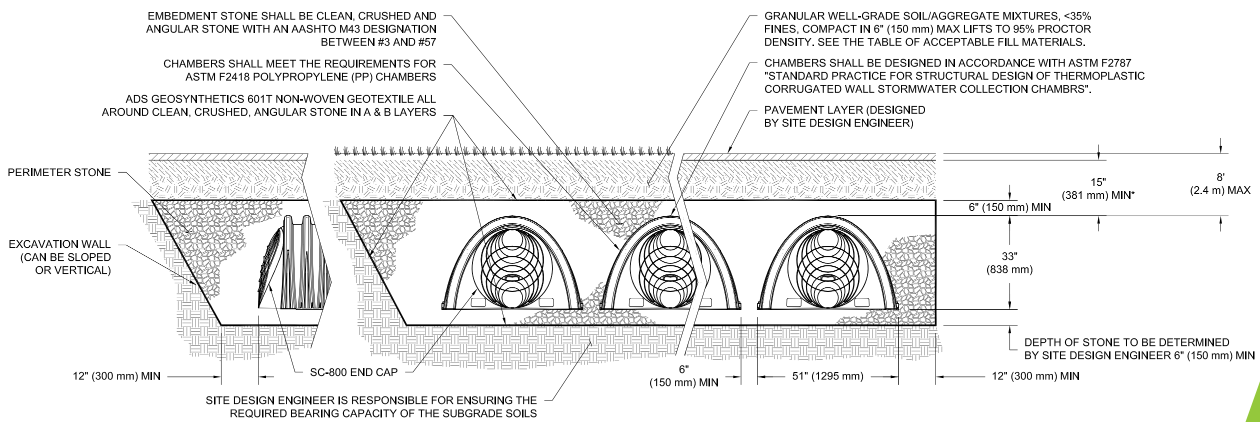
Min. Installed Storage*
81.0 ft^3 (2.29 m^3)

Weight
81.8 lbs (37.1 kg)

Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck

*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 21" (533 mm).

ADS StormTech™

StormTech SC-800 Specifications

Cumulative Storage Volumes Per Chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)		Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
45 (1143)	↑	50.62 (1.433)	81.08 (2.296)
44 (1118)		50.62 (1.433)	79.96 (2.264)
43 (1092)	Stone	50.62 (1.433)	78.83 (2.232)
42 (1067)	Cover	50.62 (1.433)	77.70 (2.200)
41 (1041)		50.62 (1.433)	76.57 (2.168)
40 (1016)	↓	50.62 (1.433)	75.44 (2.136)
39 (991)		50.62 (1.433)	74.31 (2.104)
38 (965)		50.55 (1.431)	73.14 (2.071)
37 (940)		50.35 (1.426)	71.90 (2.036)
36 (914)		50.07 (1.418)	70.60 (1.999)
35 (889)		49.56 (1.403)	69.17 (1.959)
34 (864)		48.82 (1.382)	67.60 (1.914)
33 (838)		47.93 (1.357)	65.94 (1.867)
32 (813)		46.91 (1.328)	64.20 (1.818)
31 (787)		45.79 (1.297)	62.40 (1.767)
30 (762)		44.58 (1.262)	60.55 (1.715)
29 (737)		43.28 (1.226)	58.65 (1.661)
28 (711)		41.91 (1.187)	56.70 (1.606)
27 (686)		40.47 (1.146)	54.71 (1.549)
26 (660)		38.96 (1.103)	52.68 (1.492)
25 (635)		37.40 (1.059)	50.61 (1.433)
24 (610)		35.78 (1.013)	48.51 (1.374)
23 (584)		34.10 (0.966)	46.38 (1.313)
22 (559)		32.38 (0.917)	44.22 (1.252)
21 (533)		30.61 (0.867)	42.03 (1.190)
20 (508)		28.80 (0.816)	39.82 (1.128)
19 (483)		26.95 (0.763)	37.58 (1.064)
18 (457)		25.06 (0.710)	35.32 (1.000)
17 (432)		23.13 (0.655)	33.04 (0.936)
16 (406)		21.17 (0.599)	30.74 (0.870)
15 (381)		19.17 (0.543)	28.42 (0.805)
14 (356)		17.14 (0.485)	26.08 (0.739)
13 (330)		15.09 (0.427)	23.72 (0.672)
12 (305)		13.00 (0.368)	21.34 (0.604)
11 (279)		10.89 (0.308)	18.95 (0.537)
10 (254)		8.76 (0.248)	16.54 (0.468)
9 (229)		6.60 (0.187)	14.12 (0.400)
8 (203)		4.42 (0.125)	11.69 (0.331)
7 (178)		2.22 (0.063)	9.24 (0.262)
6 (152)	↑	0 (0)	6.78 (0.192)
5 (127)		0 (0)	5.65 (0.160)
4 (102)	Stone	0 (0)	4.52 (0.128)
3 (76)	Foundation	0 (0)	3.39 (0.096)
2 (51)		0 (0)	2.26 (0.064)
1 (25)	↓	0 (0)	1.13 (0.032)

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber ft³ (m³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-800 Chamber	50.6 (1.43)	81.0 (2.29)	87.8 (2.48)	94.6 (2.6)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

Amount of Stone Per Chamber

English Tons (yds³)	Stone Foundation Depth		
	6"	12"	18"
SC-800	3.9 (2.8)	4.8 (3.4)	5.7 (4.1)
Metric Kilograms (m³)	**150 mm**	**300 mm**	**450 mm**
SC-800	3580 (2.2)	4380 (2.6)	5170 (3.1)

Note: Assumes 6" (150 mm) of stone above and between chambers.

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth		
	6" (150 mm)	12" (300 mm)	18" (450 mm)
SC-800	5.6 (4.3)	6.3 (4.8)	6.9 (5.3)

Note: Assumes 6" (150 mm) of row separation and 15" (375 mm) of cover. The volume of excavation will vary as depth of cover increases.

ADS StormTech products, manufactured in accordance with ASTM F2418 or ASTMF2922, comply with all requirements in the Build America, Buy America (BABA) Act.

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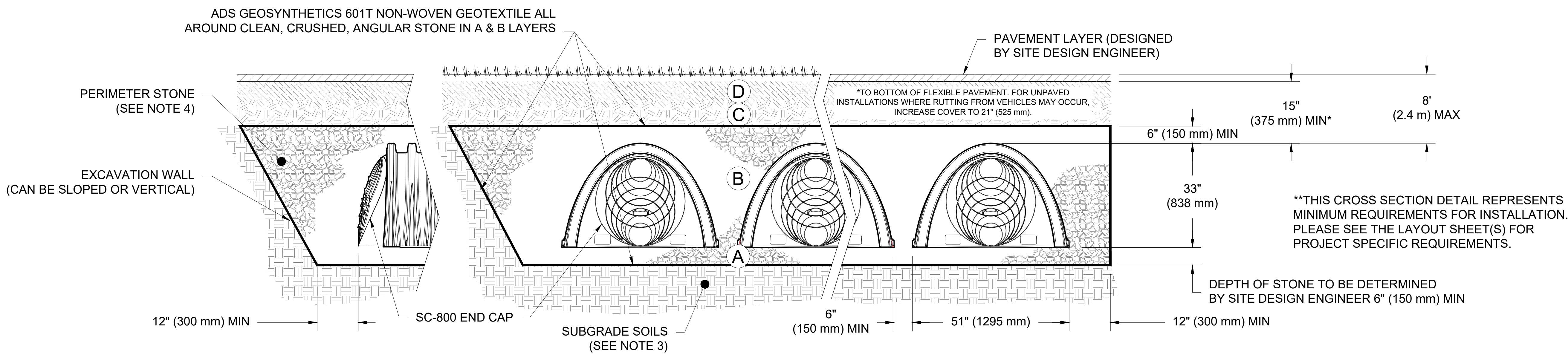
ACCEPTABLE FILL MATERIALS: STORMTECH SC-800 CHAMBER SYSTEMS

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 15" (375 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 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	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 6" (150 mm) (MAX) 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.
5. WHERE RECYCLED CONCRETE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-800 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 2".
   - 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 550 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.

STANDARD CROSS SECTION
SC-800 CHAMBER

DATE: 01/10/24
DRAWN: JLM
PROJECT #:
CHECKED: JLM

DATE	DRWN	CHKD	DESCRIPTION

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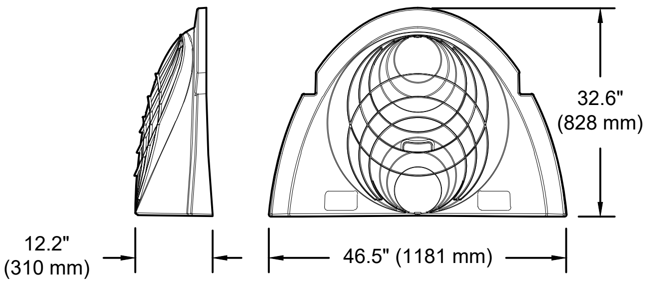
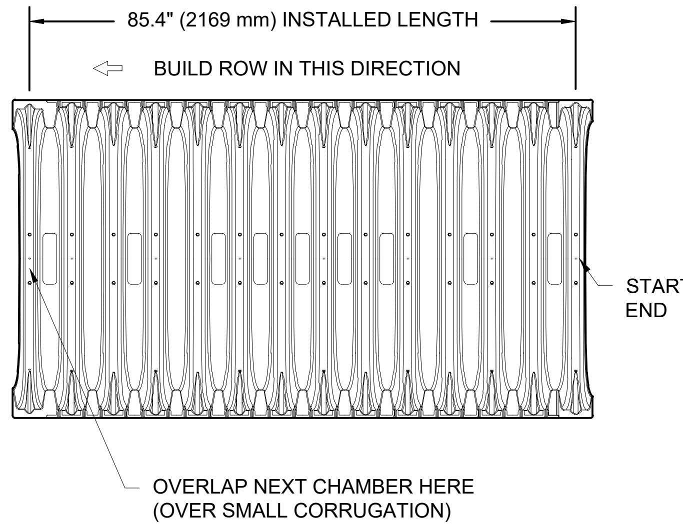
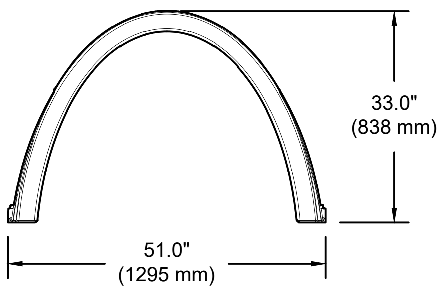
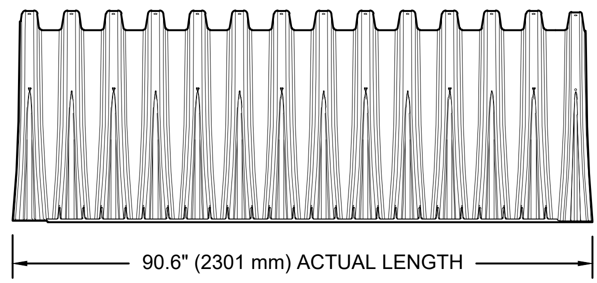
SC-800 TECHNICAL SPECIFICATION

NTS









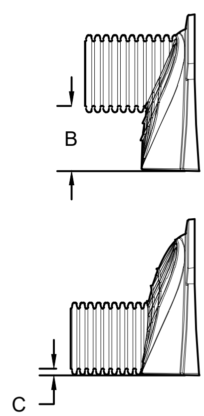
NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 33.0" X 85.4"	(1295 mm X 838 mm X 2169 mm)
CHAMBER STORAGE	50.6 CUBIC FEET	(1.43 m³)
MINIMUM INSTALLED STORAGE*	81.0 CUBIC FEET	(2.29 m³)
WEIGHT	81.8 lbs.	(37.1 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS

PRE-CORED HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-CORED HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	B	C
SC800EPE06TPC	6" (150 mm)	21.4" (544 mm)	---
SC800EPE06BPC		---	0.9" (23 mm)
SC800EPE08TPC	8" (200 mm)	19.2" (488 mm)	---
SC800EPE08BPC		---	1.0" (25 mm)
SC800EPE10TPC	10" (250 mm)	17.0" (432 mm)	---
SC800EPE10BPC		---	1.2" (30 mm)
SC800EPE12TPC	12" (300 mm)	14.4" (366 mm)	---
SC800EPE12BPC		---	1.6" (41 mm)
SC800EPE15TPC	15" (375 mm)	11.3" (287 mm)	---
SC800EPE15BPC		---	1.7" (43 mm)
SC800EPE18TPC	18" (450 mm)	8.0" (203 mm)	---
SC800EPE18BPC		---	2.0" (51 mm)
SC800EPE24BPC	24" (600 mm)	---	2.3" (58 mm)
SC800EPE	NONE	SOLID END CAP	



NOTE: ALL DIMENSIONS ARE NOMINAL

TECHNICAL SPECIFICATIONS
SC-800 CHAMBER

DATE: 01/12/24
DRAWN: JLM
PROJECT #:
CHECKED: JLM

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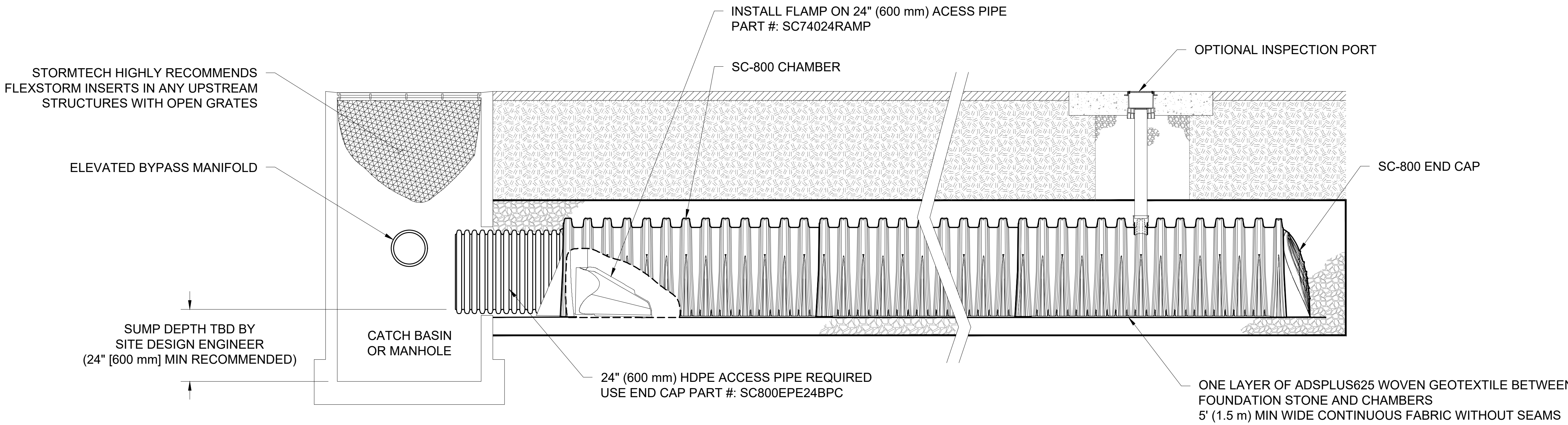
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

1



SC-800 ISOLATOR ROW PLUS DETAIL

NTS

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

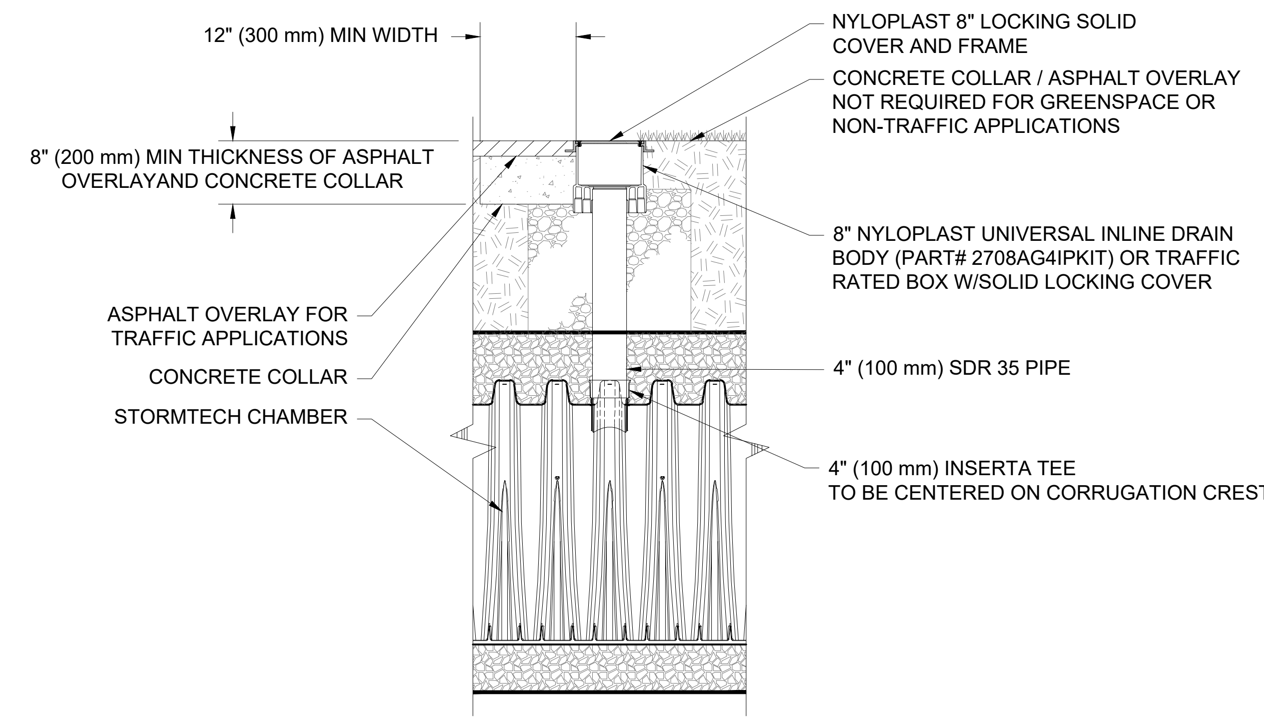
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

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.



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

4" PVC INSPECTION PORT DETAIL (SC SERIES CHAMBER)

NTS

ISOLATOR ROW PLUS
SC-800 CHAMBER

DATE: 11/14/23 | DRAWN: JLM
PROJECT #: | CHECKED: CJD

DATE	DRWN	CHKD	DESCRIPTION
01/12/24	JLM	JLM	UPDATE END CAP CALLOUT

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SHEET 1 OF 1

Isolator® Row Plus

O&M Manual

ADS StormTech™

The Isolator® Row Plus

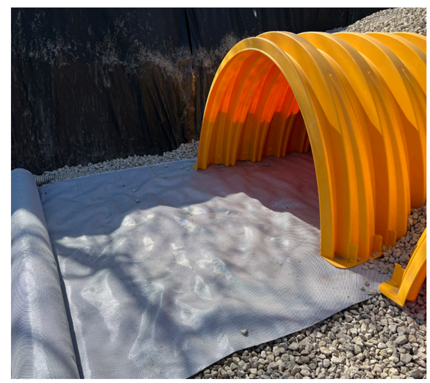
Introduction

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), Total Phosphorus (TP), Total Petroluem Hydrocarbons (TPH) and Total Nitrogen (TN) removal with easy access for inspection and maintenance.

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

The Isolator Row Plus

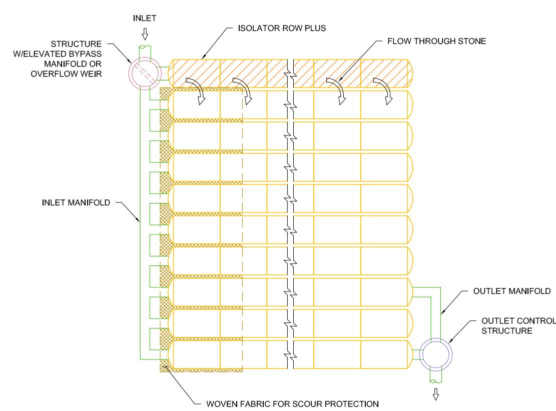
The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, SC-800, MC-3500, MC-4500 or MC-7200 models, are lined with filter fabric and connected to a closely located manhole for easy access. The fabric lined chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers allow stormwater to flow vertically out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.



ADS Isolator Row and Plus fabric are 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.

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 provides access to the Isolator Row Plus and 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 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 chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

StormTech Isolator Row Plus with Overflow Structure (not to scale)



The Isolator Row Plus Flamp™ is a flared end ramp apparatus 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 by enhancing outflow of solid debris that would otherwise collect at the chamber's end, or more difficult to remove and require confined space entry into the chamber area. 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 treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus 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.*

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.

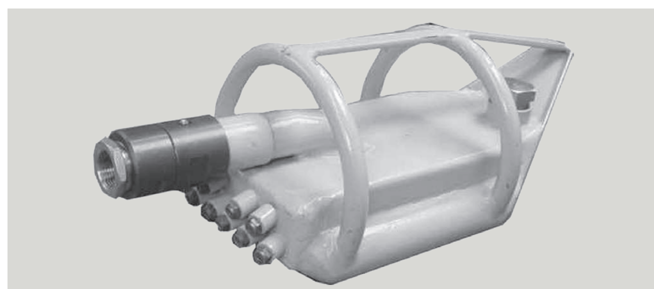
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

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" (75 mm) throughout the length of the Isolator Row Plus, clean-out should be performed.

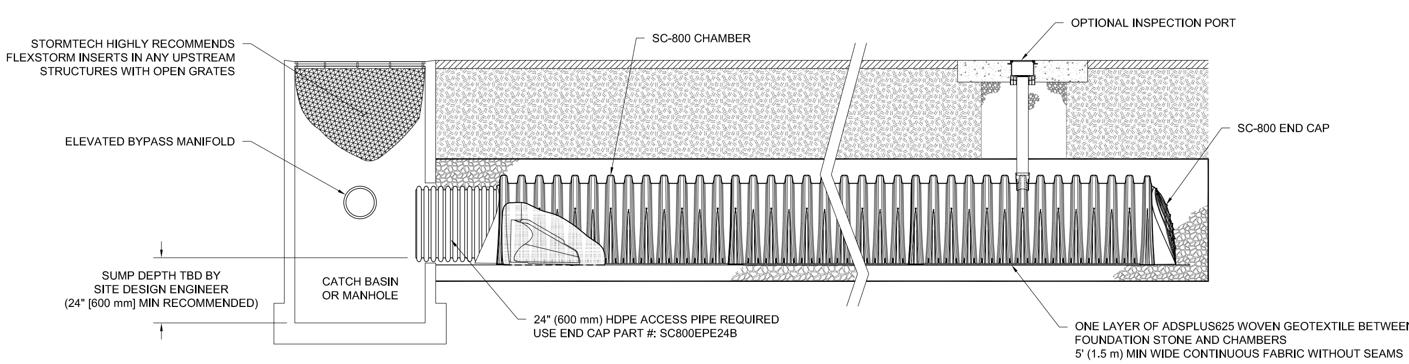
Maintenance

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 entry.

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. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **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*)



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.

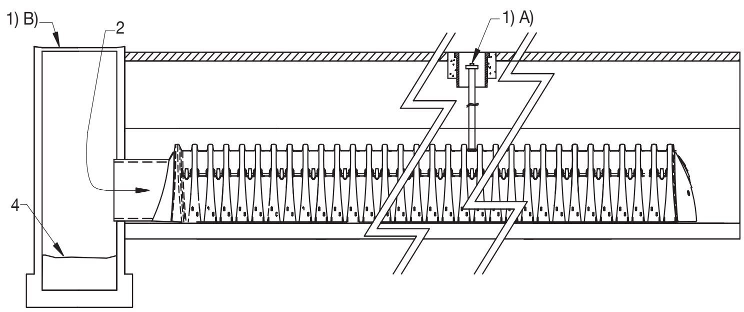
Step 2

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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StormTech® Installation Guide
SC-310/SC-740/DC-780/SC-800

StormTech
Installation Video

Required Materials and Equipment List

- Acceptable fill materials per Table 1
- ADS Plus and non-woven geotextile fabrics
- StormTech solid end caps and pre-cored end caps
- StormTech chambers
- StormTech manifolds and fittings

Important Notes:

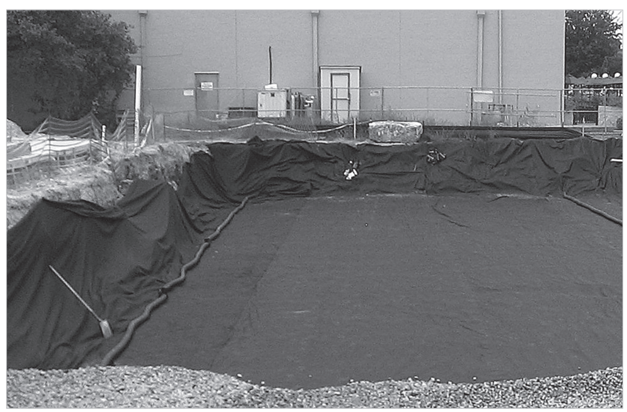
A. This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.

B. 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.

C. Care should be taken in the handling of chambers and end caps. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation

Excavate bed and prepare subgrade per engineer’s plans.

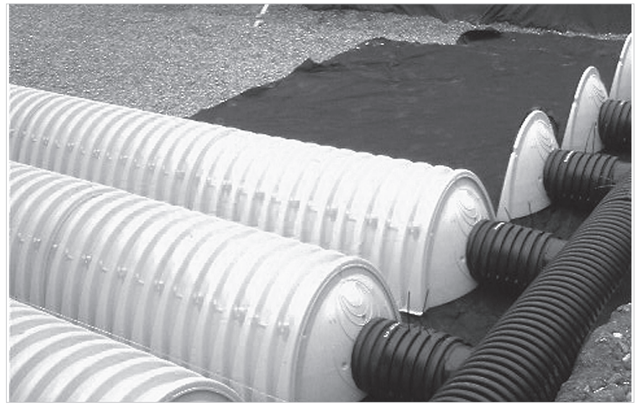


Place non-woven geotextile over prepared soils and up excavation walls. Install underdrains if required.

Place clean, crushed, angular stone foundation 6” (150 mm) min. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly

Install manifolds and lay out ADS Plus fabric at inlet rows (min. 12.5 ft (3.8 m)) at each inlet end cap. Place a continuous piece along entire length of Isolator® Plus Row(s).



Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled “Lower Joint – Overlap Here” and “Build this direction – Upper Joint” Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 6” (150 mm) spacing between rows.

Attaching the End Caps

Lift the end of the chamber a few inches off the ground. With the curved face of the end cap facing outward, place the end cap into the chamber’s end corrugation.

Prefabricated End Caps

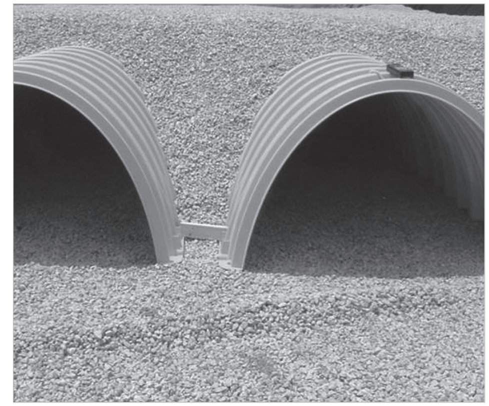
24” (600 mm) inlets are the maximum size that can fit into a SC-740/DC-780/SC-800 end cap and must be prefabricated with a 24” (600 mm) pipe stub. SC-310 chambers with a 12” (300 mm) inlet pipe must use a prefabricated end cap with a 12” (300 mm) pipe stub. When used on an Isolator Row Plus, these end caps will contain a welded Flamp (flared end ramp) that will lay on top of the ADS Plus fabric (shown above)

Isolator Row Plus

Place a continuous layer of ADS Plus fabric between the foundation stone and the Isolator Row Plus chambers, making sure the fabric lays flat and extends the entire width of the chamber feet.

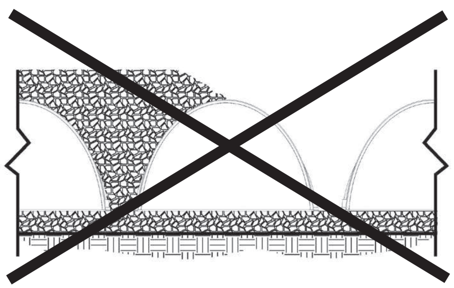
Initial Anchoring of Chambers – Embedment Stone

Initial embedment shall be spotted along the center line of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

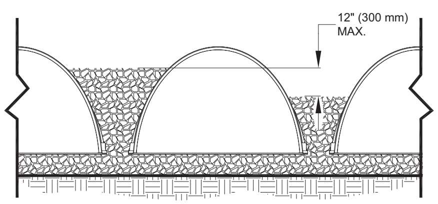


No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

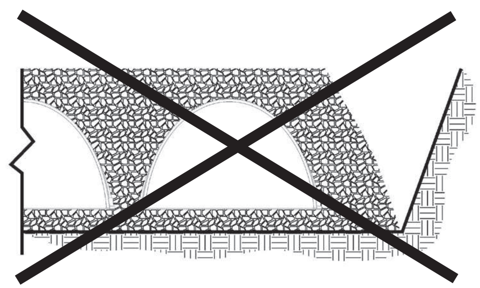


Uneven Backfill

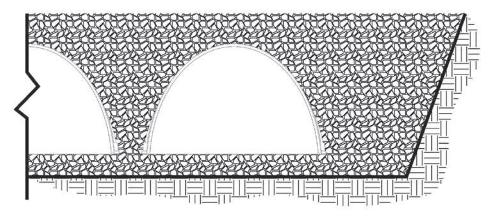


Even Backfill

Backfill chambers evenly. Stone column height should never differ by more than 12” (300 mm) between adjacent chamber rows or between chamber rows and perimeter.



Perimeter Not Backfilled



Perimeter Fully Backfilled

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.

Backfill - Embedment Stone & Cover Stone

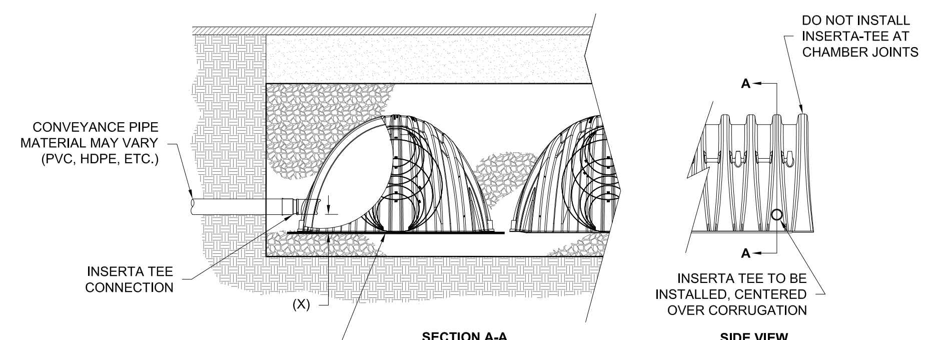
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. **Only after chambers have been backfilled to top of chamber and with a minimum 6" (150 mm) of cover stone on top of chambers can small dozers be used over the chambers for backfilling remaining cover stone.**

Small dozers and skid loaders may be used to finish grading stone backfill in accordance with ground pressure limits in Table 2. They must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends that the contractor inspect chambers before placing final backfill. Any chambers damaged by construction shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24" (600 mm) min. where edges meet. Compact each lift of backfill as specified in the site design engineer's drawings. Roller travel parallel with rows.

Inserta Tee Detail



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.

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)
SC-800	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 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		

StormTech Isolator Row Plus Detail

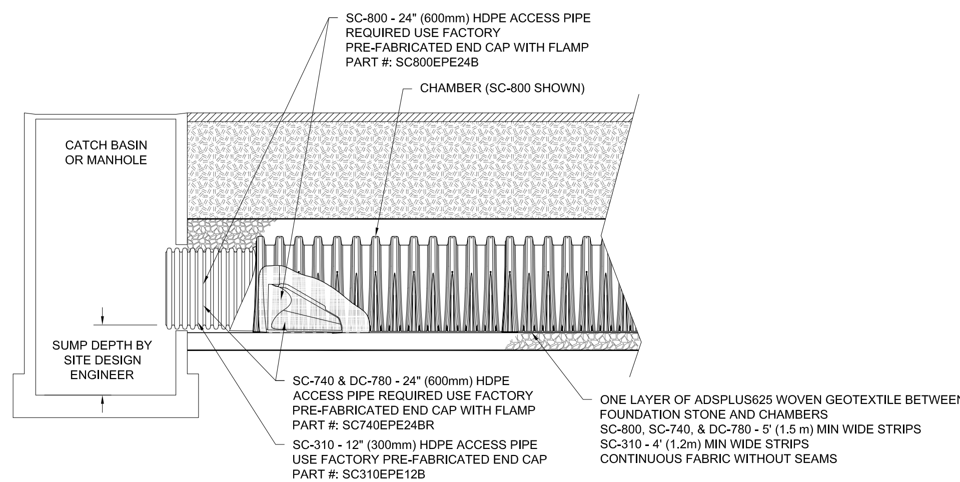


Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
Ⓓ **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 the 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.
Ⓒ **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 18" (450 mm) above the top of the chamber. Note that pavement subbase may be 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 M45 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 compaction after min. 12" (300 mm) of material over the chambers is reached. Compact additional layers in 6" (150 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials. Roller gross vehicle weight not to exceed 12,000 lbs (53 kN). Dynamic force not to exceed 20,000 lbs (89 kN)
Ⓑ **Embedment Stone:** Embedment Stone surrounding chambers from the foundation stone to the 'C' layer above.	Clean, crushed, angular stone or Recycled Concrete[4]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	No compaction required.
Ⓐ **Foundation Stone:** Foundation Stone below the chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone or Recycled Concrete[4]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	Place and compact in 6" (150 mm) lifts using two full coverages with a vibratory compactor.[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 6" (150 mm) (max) lifts using two full coverages with a vibratory compactor.
3. Where infiltration surfaces may be comprised by compaction, for standard installations and 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. Where recycled concrete aggregate is used in layers 'A' or 'B' the material should also meet the acceptable criteria outlined in ADS Technical Note 6.20 "Recycled Concrete Structural Backfill".

Figure 1- Inspection Port Detail

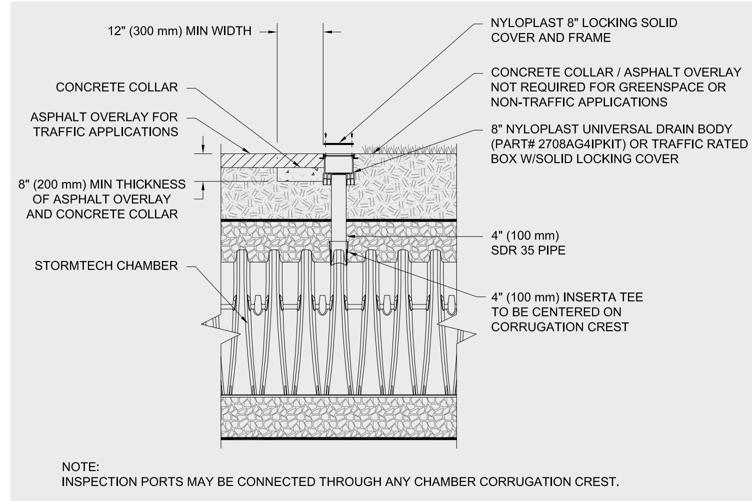
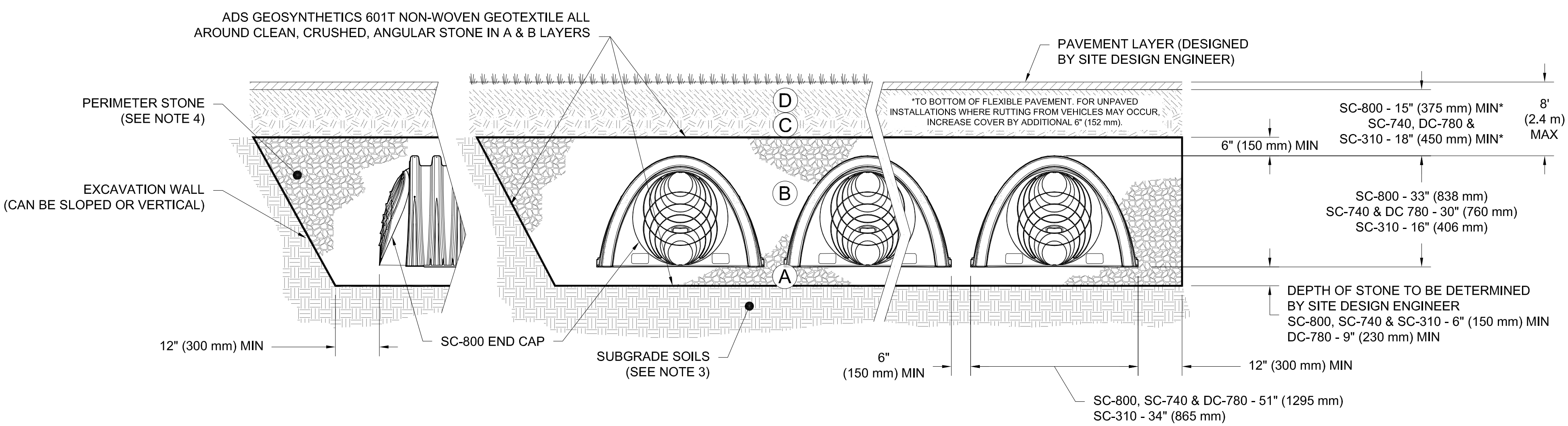


Figure 2 - Fill Material Locations



Notes:

1. 36" (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.
2. During paving operations, dump truck axle loads on 18" (450 mm) of cover may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18" (450 mm) of cover exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
3. Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
4. Mini-excavators (< 8,000 lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
5. Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.
6. Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Table 2 - Maximum Allowable Construction Vehicle Loads[6]

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	Max Drum Weight or Dynamic Force lbs (kN)
Ⓓ Final Fill Material	36" (900) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	3880 (186) 2640 (126) 2040 (97) 1690 (81) 1470 (70)	38,000 (169)
Ⓒ Initial Fill Material	24" (600) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2690 (128) 1880 (90) 1490 (71) 1280 (61) 1150 (55)	20,000 (89)
	24" (600) Loose/ Dumped	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2390 (114) 1700 (81) 1370 (65) 1190 (57) 1080 (51)	20,000 (89) Roller gross vehicle weight not toexceed 12,000 lbs. (53 kN)
	18" (450)	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2110 (101) 1510 (72) 1250 (59) 1100 (52) 1020 (48)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
Ⓑ Embedment Stone	12" (300)	16,000 (71)	NOT ALLOWED	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	1540 (74) 1190 (57) 1010 (48) 910 (43) 840 (40)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
	6" (150)	8,000 (35)	NOT ALLOWED	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	1070 (51) 900 (43) 800 (38) 760 (36) 720 (34)	NOT ALLOWED

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows until 36" (900mm) compacted cover is reached.[4]	Roller travel parallel to rows only until 36" (900 mm) compacted cover is reached.
Ⓒ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 18" (450 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 6" (150 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 12" (300 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 6" (150 mm) cover stone is in place.	No rollers allowed.
Ⓐ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

ADS StormTech™

StormTech® Standard Limited Warranty

STANDARD LIMITED WARRANTY OF STORMTECH LLC ("STORMTECH"): PRODUCTS

(A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and end plates are collectively referred to as the "Products."

(B) The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech's liability specifically excludes the cost of removal and/or installation of the Products.

(C) THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

(D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.

(E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.

(F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.

(G) THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLECT; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.

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Drainage Filtration Separation

ADS 0601T/O NONWOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 0601T/O nonwoven geotextile.

Filter Fabric Requirements

ADS 0601T/O is an orange nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. ADS 0601T/O is inert to biological degradation and resists naturally encountered chemicals, alkali and acids. ADS 0601T/O conforms to the physical property values listed below:

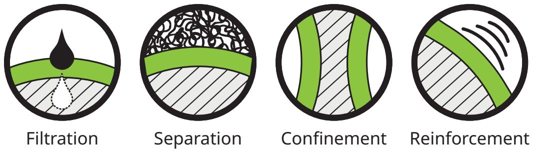
Filter Fabric Properties

Property	Test Method	Unit	Typical Value[1] MD	Typical Value[1] CD
Grab Tensile Strength	ASTM D4632	lbs (N)	175 (779)	175 (779)
Grab Tensile Elongation	ASTM D4632	%	75	75
Trapezoid Tear Strength	ASTM D4533	lbs (N)	85 (378)	85 (378)
CBR Puncture Strength	ASTM D6241	lbs (N)	480 (2136)	480 (2136)
Permittivity	ASTM D4491	sec^{-1}	1.5	1.5
Flow Rate	ASTM D4491	gal/min/ft^2 (l/min/m^2)	105 (4278)	105 (4278)
UV Resistance (at 500 hours)[1]	ASTM D4355	% strength retained	80	80

Physical Properties

Property	Test Method	Unit	Typical Value[2]
Weight	ASTM D5161	oz/yd^2 (g/m^2)	6.5 (220)
Thickness	ASTM D5199	mils (mm)	65 (1.7)
Roll Dimensions (W x L)	-	ft (m)	15 x 300 (4.5 x 91)
Roll Area	-	yd^2 (m^2)	500 (418)
Estimated Roll Weight	-	lb (kg)	220 (100)

1 Modified, Minimum Test Value
2 ASTM D4439 Standard Terminology for Geosynthetics: typical value, n-*for geosynthetics*, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.



ADS PLUS WOVEN GEOTEXTILE SPECIFICATION

For use with StormTech® Isolator® Row Plus

Scope

This specification describes ADS Plus woven geotextile.

ADS Plus woven geotextile fabrics are woven polypropylene materials offering optimum performance when used in stabilization applications. Produced from first quality raw materials, they provide the perfect balance of strength and separation in styles capable of functioning exceptionally well in a wide range of performance requirements.

Filter Fabric Properties

Property[1]	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value)[2]
Weight	ASTM D5261	oz/yd^2 (g/m^2)	8.0 (271.25)
Grab Tensile Strength	ASTM D4632	lbs (kN)	325 (1.45)
Grab Elongation	ASTM D4632	%	15
Trapezoidal Tear Strength	ASTM D4533	lbs (kN)	125 (0.89)
CBR Puncture Resistance	ASTM D6241	lbs (kN)	1,124 (5.0)

1. The property values listed above are subject to change without notice.
2. Minimum Average Roll Values (MARV) is calculated as the average minus two standard deviations. Statistically, it yields approximately 97.5% degree of confidence that any samples taken from quality assurance testing will meet or exceed the values described above.

Dimensions

ADS Plus shall be delivered to the jobsite in roll form with each roll individually identified and nominally measuring 12.5’ (3.8 m) width x 360’ (110 m) length for Plus125 and 6.25’ (1.9 m) width x 360’ (110 m) length for Plus625.

MASTER SERVICING STUDY UPDATE FOR MORGAN'S GRANT SUBDIVISION

CITY OF OTTAWA

September 2003

Prepared for:

MINTO DEVELOPMENTS INC.
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Ottawa, Ontario
K1R 7Y2

Prepared by:

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Consulting Engineers, Architects & Planners
864 Lady Ellen Place
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JLR 17730

Table 5 - Results of HGL Analysis (2003)

Manhole Junction Number	1:100 Year HGL Elevation (m)	HGL-Centreline Road Elev. (M)
101	83.927	3.073
102	83.392	1.908
103	83.017	1.733
104	82.322	1.068
Chamber	82.000	1.200

2.5 On-Site Storage Requirements

To minimize land requirements for stormwater management facilities, ICDs, combined with on-site storage, have been utilized in all recent Phases of the Subdivision. As such, local storm sewers are to be designed to limit the capture rate to 70 L/s/ha, approximately equivalent to a 1:5 year storm event. Storm runoff in excess of the 1:5 year recurrence is to be detained, tentatively, on site by means of road-sag storage, park storage, hydro easement storage or, ultimately, by the stormwater management facility. To maintain the integrity of the design of the stormwater management facilities (existing and future), specific on-site storage requirements have been calculated and are presented in Table 6.

NOTE :

1. UPON COMPLETION OF THE STORMWATER DETENTION POND NORTH EAST OF PHASE 6 AND FOLLOWING CONSTRUCTION OF STORM SEWERS IN PHASE 6 AND 7 ALL STORM WATER WEST OF MH 645 WILL BE REROUTED THROUGH PHASES 7 AND 6 TO THE NEW STORMWATER DETENTION POND.
2. MAJOR OVERLAND FLOW FOR THESE AREAS WILL ALSO BE DIRECTED TO THE DETENTION POND WITH PROVISIONS FOR SURFACE STORAGE WHEREVER POSSIBLE (i.e. ROAD SAGS, PARKS, etc....)

1	17/09/03	REVISED PHASE 10 AND 12	L.J.

LICENSED PROFESSIONAL ENGINEER — L.A. JABLONSKI — 16/09/03 — PROVINCE OF ONTARIO

SCALE
0 25m 50m 75m 100m
HORIZONTAL 1:3000

J.L.Richards & Associates Limited
Consulting Engineers, Architect & Planners
OTTAWA,KINGSTON,SUDBURY,CANADA.

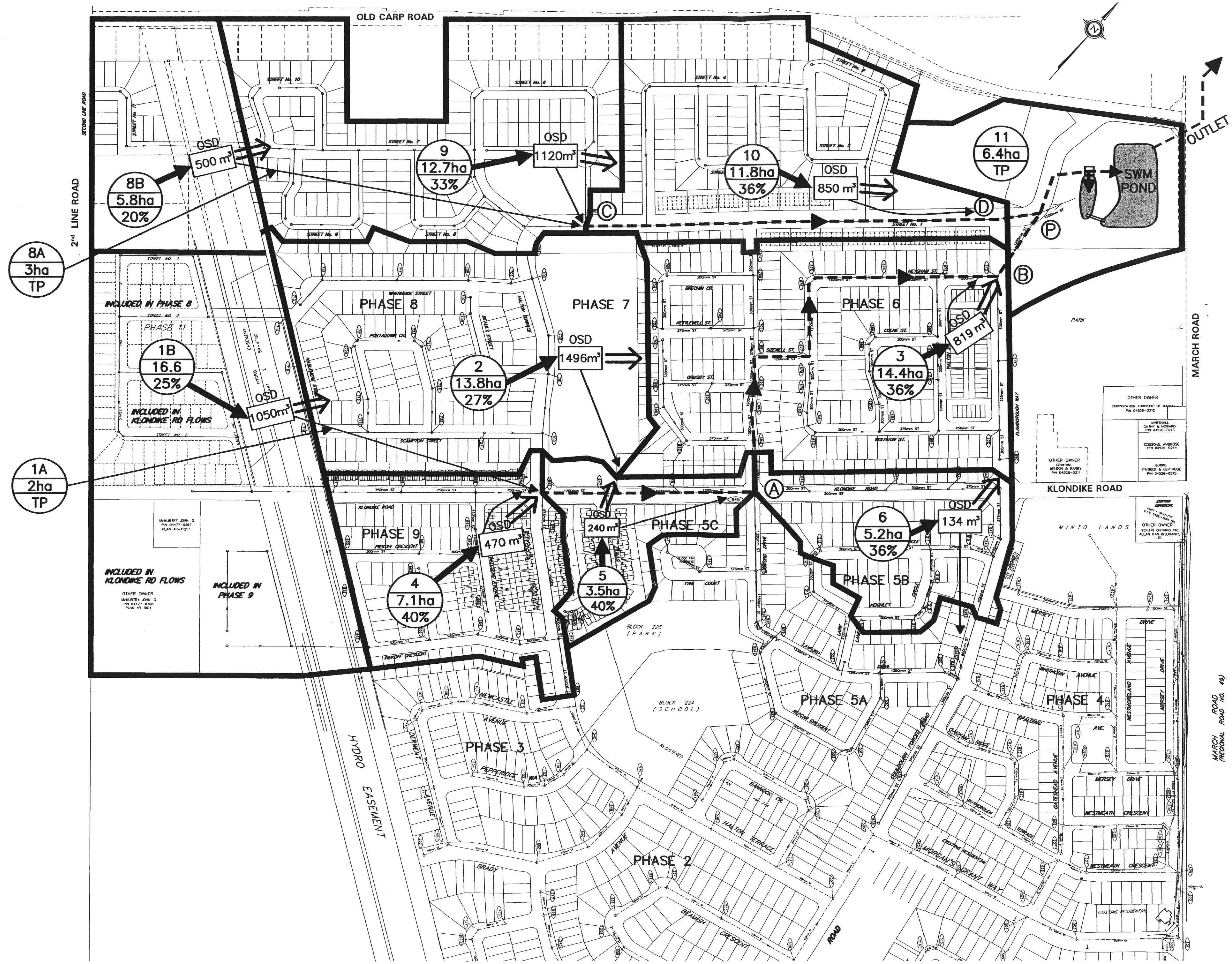
DESIGN
CHECKED L.J.
DRAWN M.Z.
CHECKED
APPROVED

Ottawa

minto

MORGAN'S GRANT SUBDIVISION
MASTER DRAINAGE PLAN (STORM)

DATED SEPT. 2003
DWG. No. 17730-ST



NOTES:

OTTHYMO MODEL CONNECTIVITY

- MAIN SEWER
- MAJOR OVERFLOW
- TOTAL FLOW
- MINOR FLOW
- ID No. — 0
- AREA — 0.0 ha
- COMPOSITE IMP OR TP — 0%

Ottawa

CCL Cumming Cockburn Limited
Consulting Engineers and Planners
Ottawa, Kingston, Toronto, Waterloo, London

MORGAN'S GRANT SUBDIVISION

MASTER STORM DRAINAGE PLAN

DATE	SCALE	DWG. NO.
JULY 2001	1:5000	FIGURE 2

```
                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=    99.602
                 TIME SHIFT OF PEAK FLOW        (min)=      3.00
                 MAXIMUM  STORAGE   USED      (ha.m.)=.4825E-02
 
 ------------------------------------------------------------------------------
 001:0063----------------------------------------------------------------------
 *
 --------------------
 | ROUTE RESERVOIR    |    Requested routing time step =  3.0 min.
 |  IN>07:(000100)    |
 | OUT<08:(000100)    |    =========  OUTLFOW STORAGE TABLE  =========
 --------------------        OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                              (cms)     (ha.m.)  |   (cms)     (ha.m.)
                               .000  .0000E+00   |    .042  .4300E-01
       *** WARNING: Inflow hydrograph is dry.

     ROUTING RESULTS            AREA     QPEAK     TPEAK          R.V.
     -------------------        (ha)     (cms)     (hrs)          (mm)
     INFLOW >07:  (000100)       .00      .000      .000          .000
     OUTFLOW<08:  (000100)       .00      .000      .000          .000

 *** WARNING: Inflow and ouflow hydrographs are dry.

 ------------------------------------------------------------------------------
 001:0064----------------------------------------------------------------------
 *
 *#=====================
 *#  FLOW POINT "D"    ||
 *#=====================
 *
 --------------------
 | ADD HYD (000132) | ID: NHYD        AREA     QPEAK    TPEAK    R.V.      DWF
 --------------------                 (ha)     (cms)    (hrs)    (mm)     (cms)
                  ID1 03:000100      11.80      .481    12.30   28.69      .000
                 +ID2 02:000100      21.50      .893    12.40   26.35      .000
                 ==================================================
                  SUM 01:000132      33.30     1.356    12.40   27.18      .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 001:0065----------------------------------------------------------------------
 *
 *#===========================
 *#  SWM FACILITY Minor Flow ||
 *#===========================
 *
 --------------------
 | ADD HYD (000214) | ID: NHYD        AREA     QPEAK    TPEAK    R.V.      DWF
 --------------------                 (ha)     (cms)    (hrs)    (mm)     (cms)
                  ID1 01:000132      33.30     1.356    12.40   27.18      .000
                 +ID2 04:000100      57.40     2.194    12.50   27.41      .000
                 ==================================================
                  SUM 02:000214      90.70     3.487    12.45   27.33      .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 001:0066----------------------------------------------------------------------
 *
 --------------------
 | ROUTE RESERVOIR    |    Requested routing time step =  3.0 min.
 |  IN>02:(000214)    |
 | OUT<04:(000100)    |    =========  OUTLFOW STORAGE TABLE  =========
 --------------------        OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                              (cms)     (ha.m.)  |   (cms)     (ha.m.)
                               .000  .0000E+00   |   3.500  .1890E+00
                              1.100  .1165E+00   |   7.000  .2500E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK          R.V.
     -------------------        (ha)     (cms)     (hrs)          (mm)
     INFLOW >02:  (000214)     90.70     3.487    12.450        27.326
     OUTFLOW<04:  (000100)     90.70     3.386    12.550        27.326
   OVERFLOW<01:  (000100)        .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](%)=    97.085
                 TIME SHIFT OF PEAK FLOW        (min)=      6.00
                 MAXIMUM  STORAGE   USED      (ha.m.)=.1856E+00

 ------------------------------------------------------------------------------
 001:0067----------------------------------------------------------------------
 *
 --------------------
 | ADD HYD (000389) | ID: NHYD        AREA     QPEAK    TPEAK    R.V.      DWF
 --------------------                 (ha)     (cms)    (hrs)    (mm)     (cms)
                  ID1 01:000100        .00      .000      .00     .00      .000 **DRY**
                 +ID2 04:000100      90.70     3.386    12.55   27.33      .000
                 ==================================================
                  SUM 05:000389      90.70     3.386    12.55   27.33      .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 001:0068----------------------------------------------------------------------
 *
 *#===========================================
 *# AREA 11  (Park Adjacent to SWM Facility  ||
 *#===========================================
 *
 ---------------------
 | CALIB NASHYD       |   Area    (ha)=    6.40   Curve Number   (CN)=85.00
 | 01:000100 DT= 3.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
 ---------------------    U.H. Tp(hrs)=    .200

     Unit Hyd Qpeak  (cms)=     1.222

     PEAK FLOW       (cms)=      .339 (i)
     TIME TO PEAK    (hrs)=    12.100
     RUNOFF VOLUME    (mm)=    21.796
     TOTAL RAINFALL   (mm)=    45.500
     RUNOFF COEFFICIENT   =      .479

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

 ------------------------------------------------------------------------------
 001:0069----------------------------------------------------------------------
 *
 *#===========================
 *#  SWM FACILITY Major Flow ||
 *#===========================
 *
 --------------------
 | ADD HYD (000389) | ID: NHYD        AREA     QPEAK    TPEAK    R.V.      DWF
 --------------------                 (ha)     (cms)    (hrs)    (mm)     (cms)
                  ID1 08:000100        .00      .000      .00     .00      .000 **DRY**
                 +ID2 09:000100        .00      .000      .00     .00      .000 **DRY**
                 ==================================================
                  SUM 03:000389        .00      .000      .00     .00      .000 **DRY**
 ------------------------------------------------------------------------------
 001:0070----------------------------------------------------------------------
 *
 --------------------
 | ADD HYD (000461) | ID: NHYD        AREA     QPEAK    TPEAK    R.V.      DWF
 --------------------                 (ha)     (cms)    (hrs)    (mm)     (cms)
                  ID1 06:000798        .00      .000      .00     .00      .000 **DRY**
                 +ID2 01:000100       6.40      .339    12.10   21.80      .000
                 ==================================================
                  SUM 04:000461       6.40      .339    12.10   21.80      .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 ------------------------------------------------------------------------------
 001:0071----------------------------------------------------------------------
 *
 *
 --------------------
 | ADD HYD (000643) | ID: NHYD        AREA     QPEAK    TPEAK    R.V.      DWF
 --------------------                 (ha)     (cms)    (hrs)    (mm)     (cms)
                  ID1 04:000461       6.40      .339    12.10   21.80      .000
                 +ID2 03:000389        .00      .000      .00     .00      .000 **DRY**
                 ==================================================
                  SUM 06:000643       6.40      .339    12.10   21.80      .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 001:0072----------------------------------------------------------------------
 *
 *#============================
 *#  SWM FACILITY Total Flow ||
 *#============================
 *
 --------------------
 | ADD HYD (000162) | ID: NHYD        AREA     QPEAK    TPEAK    R.V.      DWF
 --------------------                 (ha)     (cms)    (hrs)    (mm)     (cms)
                  ID1 06:000643       6.40      .339    12.10   21.80      .000
                 +ID2 05:000389      90.70     3.386    12.55   27.33      .000
                 ==================================================
                  SUM 01:000162      97.10     3.483    12.55   26.96      .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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 001:0073----------------------------------------------------------------------
 *
 --------------------
 | ROUTE RESERVOIR    |    Requested routing time step =  3.0 min.
 |  IN>01:(000162)    |
 | OUT<02:(000100)    |    =========  OUTLFOW STORAGE TABLE  =========
 --------------------        OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                              (cms)     (ha.m.)  |   (cms)     (ha.m.)
                               .000  .0000E+00   |   3.000  .8600E+00
                              1.800  .6100E+00   |   5.500  .1320E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK          R.V.
     -------------------        (ha)     (cms)     (hrs)          (mm)
     INFLOW >01:  (000162)     97.10     3.483    12.550        26.962
     OUTFLOW<02:  (000100)     97.10     1.959    13.100        26.962

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=    56.242
                 TIME SHIFT OF PEAK FLOW        (min)=     33.00
                 MAXIMUM  STORAGE   USED      (ha.m.)=.6436E+00

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 001:0074----------------------------------------------------------------------
 *#
 *#
 *#
 *#
 *#
 *#
 *#
 *#
 *#
 *#
 *#==========================================================
 *#                  5 YEAR STM SCS II 24 HRS 12 MIN
 *#==========================================================
 *
 --------------------
 | MASS STORM       |     Filename: c:\PROGRA~1\SWMHYMO\PROJECTS\SCS12.24H
 | Ptotal= 57.10 mm |     Comments: SCS TYPE II - 24 HOURS DURATION, 12 MIN.
 --------------------
                          Duration of storm          =   24.00 hrs
                          Mass curve time step       =   12.00 min
                          Selected storm time step   =   12.00 min
                          Volume of derived storm    =   57.10 mm

                TIME    RAIN |    TIME    RAIN |    TIME    RAIN |    TIME    RAIN
                 hrs   mm/hr |     hrs   mm/hr |     hrs   mm/hr |     hrs   mm/hr
                 .20    .571 |    6.20   1.142 |   12.20  11.420 |   18.20   1.142
                 .40    .571 |    6.40   1.142 |   12.40   7.137 |   18.40   1.142
                 .60    .571 |    6.60   1.142 |   12.60   5.139 |   18.60   1.142
                 .80    .571 |    6.80   1.142 |   12.80   4.854 |   18.80   1.142
                1.00    .571 |    7.00   1.142 |   13.00   3.426 |   19.00   1.142
                1.20    .571 |    7.20   1.142 |   13.20   2.855 |   19.20    .857
                1.40    .571 |    7.40   1.142 |   13.40   2.855 |   19.40    .856
                1.60    .571 |    7.60   1.142 |   13.60   2.855 |   19.60    .857
                1.80    .571 |    7.80   1.142 |   13.80   2.855 |   19.80    .856
                2.00    .571 |    8.00   1.142 |   14.00   2.855 |   20.00    .857
                2.20    .571 |    8.20   1.713 |   14.20   1.713 |   20.20    .857
                2.40    .571 |    8.40   1.713 |   14.40   1.713 |   20.40    .856
                2.60    .571 |    8.60   1.713 |   14.60   1.713 |   20.60    .857
                2.80    .571 |    8.80   1.713 |   14.80   1.713 |   20.80    .857
                3.00    .571 |    9.00   1.713 |   15.00   1.713 |   21.00    .856
                3.20    .571 |    9.20   1.713 |   15.20   1.713 |   21.20    .571
                3.40    .571 |    9.40   1.713 |   15.40   1.713 |   21.40    .571
                3.60    .571 |    9.60   1.713 |   15.60   1.713 |   21.60    .571
                3.80    .571 |    9.80   1.713 |   15.80   1.713 |   21.80    .571
                4.00    .571 |   10.00   1.713 |   16.00   1.713 |   22.00    .571
                4.20   1.142 |   10.20   3.140 |   16.20   1.142 |   22.20    .571
                4.40   1.142 |   10.40   3.141 |   16.40   1.142 |   22.40    .571
                4.60   1.142 |   10.60   3.140 |   16.60   1.142 |   22.60    .571
                4.80   1.142 |   10.80   3.141 |   16.80   1.142 |   22.80    .571
                5.00   1.142 |   11.00   3.140 |   17.00   1.142 |   23.00    .571
                5.20   1.142 |   11.20   4.282 |   17.20   1.142 |   23.20    .571
                5.40   1.142 |   11.40   6.281 |   17.40   1.142 |   23.40    .571
                5.60   1.142 |   11.60  14.275 |   17.60   1.142 |   23.60    .200
                5.80   1.142 |   11.80  31.405 |   17.80   1.142 |   23.80    .200
                6.00   1.142 |   12.00  65.665 |   18.00   1.142 |   24.00    .171

 ------------------------------------------------------------------------------
 001:0075----------------------------------------------------------------------
 *#===================================
 *# AREA 1A  (External Area)         ||
 *#===================================
 *
 ---------------------
 | CALIB NASHYD       |   Area    (ha)=    2.00   Curve Number   (CN)=85.00
 | 02:000100 DT= 3.00 |   Ia      (mm)=   1.500   # of Linear Res.(N)= 3.00
 ---------------------    U.H. Tp(hrs)=    .250

     Unit Hyd Qpeak  (cms)=      .306

     PEAK FLOW       (cms)=      .132 (i)
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City of Ottawa
SWF-1227

Minto Communities Inc.

MORGAN'S GRANT STORMWATER MANAGEMENT FACILITY
OPERATION, MAINTENANCE AND MONITORING MANUAL

3350-RS
REVISION
MARCH 2014

3. WATER QUALITY AND HYDRAULIC CHARACTERISTICS

3.1 Water Quality Control

The Morgan's Grant SWF is an off-line facility providing Level 2 Protection or 70% long term suspended solids (TSS) removal for the residential area of 105.2 ha. The following table summarizes the water quality storage volumes provided by the facility, which are in excess of the objectives outlined in the Ontario Ministry of Environment and Energy (MOEE) *Stormwater Management Practices Planning and Design Manual* (June 1994).

Table 3.1 Water Quality Volumes – 1994 MOEE Manual versus Design

Level 2 Protection (70% TSS)*						
Drainage Tributary to Facility (ha)	Type of SWM Facility	Imperviousness Ratio	Permanent Storage (m^3)		Extended Detention (m^3)	
			Required	Provided	Required	Provided
85.7†	Wet Pond	32% (90 m^3/ha)	4,285	11,000	3,428	13,000

Notes: * Level 2 Protection is equivalent to Normal Protection Level in the MOE *Stormwater Management Planning and Design Manual* (March 2003) where the storage values presented are the same.

† Urban drainage 85.7 ha is exclusive of the external areas (5 ha) and sub-basin 6, 11 and 13 (5.2 ha, 5.44 ha and 3.83 ha) and was calculated as follows: 105.2 ha – 5.0 ha – 5.2 ha – 5.44 ha – 3.83 ha = 85.7 ha.

The permanent storage was significantly oversized to accommodate a volume 11,000 m^3. The facility was oversized to enhance dilution of the first flush, and to construct a more visually pleasing facility.

The performance of the proposed facility including proper function of the extended detention storage was further evaluated in more detail by continuous simulation QUALHYMO (A.C. Rowney 1992(8)). This model has the ability to generate flow and pollutant series in a continuous hydrological mode. The analysis conducted as part of the design is restricted to the generation of a flow series and suspended solids (SS) concentration for future conditions.

The QUALHYMO model was simplified to one drainage basin and the treatment facility. The results of the continuous simulations are summarized in **Table 3.2**.

Table 3.2 Removal Efficiency – QUALHYMO Continuous Simulation

Year Designation	Removal Efficiency (%)		
(Simulation Code)	Forebay	Wet Cell	Overall
1986 (W-06)	47	41	70
1967 (WI-02)	50	42	71
1971 (AVE(1)-03)	49	41	70
1968 (AVE(2)-01)	52	45	74
1983 (01-05)	55	48	77
1974 (0-04)	55	45	75