Orleans II Frontage Phase 3 - Site Servicing and Stormwater Management Report

2025 Mer Bleue Road

Stantec

Prepared for:
SmartREIT (Orleans II) Inc. & Mer Bleue Shopping Centres Limited

Prepared by:
Stantec Consulting

April 21, 2025

Project/File:
160402122

Stantec Consulting Ltd.

Revision Schedule

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
0	Site Plan Control Application	MW/ZW	2025-04-16	KS	2025-04-17	DT	2025-04-21

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Prepared by:

Michael Wu / Ziyi Wang

Reviewed by:

Dustin Thiffault, P.Eng

Approved by:

Karin Smadella, P.Eng

LICENSED PROFESSIONAL ENGINEER
K.L. SMADELLA
2025-04-21
PROVINCE OF ONTARIO

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1 Introduction

Stantec Consulting Ltd. has been retained by SmartREIT (Orleans II) Inc. & Mer Bleue Shopping Centres Limited to prepare a servicing study to support the Site Plan Control application for Phase 3 of the Orleans II Frontage Lands commercial development located at 2025 Mer Bleue Road. The commercial site is situated in the southeast corner of the intersection of Innes Road and Mer Bleue Road within the City of Ottawa and is bound on the east and south by Roger Pharand Street and Noella Leclair Way are indicated in **Figure 1** below. The area of the commercial development site is 5.33 ha and it is being developed in phases. Phases 1 and 2 of the development were previously approved and are largely constructed. Phase 3 has an area of 1.83 ha and is the final Phase of the commercial block development. The development of this phase will include a commercial building, space for a future commercial building and completion of the parking area and servicing for the development block.

This Site Servicing and Stormwater Management report has been prepared to support Phase 3 of the development. The intent of this report is to provide a servicing scenario for the site that is free of conflicts, provides on-site servicing in accordance with City of Ottawa design guidelines, and utilizes the existing local infrastructure in accordance with the background studies noted in **Section 2.0**, and as outlined in consultation with City of Ottawa staff.

Figure 1: Location Plan

2 Background

Documents referenced in preparation of the design for Phase 3 of the Orleans II Frontage Lands commercial development include:

- Geotechnical Investigation – Proposed Commercial Development – 2025 Mer Bleue Road – Phase 2, Paterson Group, September 6, 2024
- Phase 1 - Environmental Site Assessment, Part of 2025 Mer Bleue Road, Paterson Group, September 18, 2024
- City of Ottawa Sewer Design Guidelines, City of Ottawa, October 2012, and all subsequent Technical Bulletins
- City of Ottawa Design Guidelines – Water Distribution, City of Ottawa, July 2010, and all subsequent Technical Bulletins
- Gloucester and Cumberland East Urban Community Expansion Area and Bilberry Creek Industrial Park Master Servicing Update, Stantec Consulting Ltd., July 2006
- Pharand Lands, Innes Shopping Centres Limited – City of Ottawa, Stantec Consulting Ltd., February 22, 2012
- Site Servicing and Stormwater Management Report – Orleans II Development – 2025 Mer Bleue Road – Phase 1, Stantec Consulting Ltd., March 7, 2017
- Site Servicing and Stormwater Management Report – Orleans II Development – 2025 Mer Bleue Road – Phase 2, Stantec Consulting Ltd., March 8, 2018

3 Water Supply Servicing

3.1 Background

The proposed development is the final phase of the commercial site plan development at 2025 Mer Bleue Road. The site location is outlined in **Figure 1**. The ultimate development of this phase will include two commercial buildings, above ground parking areas and associated servicing. The commercial buildings will be serviced by a watermain connection to the existing 305mm watermain within Roger Pharand Street. A 150mm watermain will also be extended from the existing private watermain servicing to allow for installation of a fire hydrant on the north side of the proposed buildings. The full development site is fed by a the 305mm watermain in Roger Pharand which is fed from distribution mains and feedermains in Innes Road, Mer Bleue Road and Noella Leclair Way.

The site is located within the City's Pressure Zone 2E. Proposed ground elevations of the site vary from approximately 89.79m to 88.24m. Under normal operating conditions, hydraulic gradelines vary from approximately 126.8m to 130.3m based on boundary conditions provided by the City of Ottawa (see **Appendix A.3**).

3.2 Water Demands

Water demands for the development were estimated using the Ministry of Environment's Design Guidelines for Drinking Water Systems (2008) and the City of Ottawa's Water Distribution Design Guidelines (2010).

A demand of 2,500 L/1,000m^2/day for commercial shopping space was used to estimate water demands for the development site. See **Appendix A.1** for detailed domestic water demand estimates.

The average day demand (AVDY) for Phase 3 of the development was determined to be 0.2 L/s. The maximum daily demand (MXDY) is 1.5 times the AVDY (commercial property), which totals 0.3 L/s. The peak hour demand (PKHR) is 1.8 times the MXDY, totaling 0.5 L/s.

To discover the ultimate serviceability of this site, ordinary construction for buildings S2 and the future building are considered in the assessment for fire flow requirements according to the FUS Guidelines. The buildings have been considered as one area for a conservative analysis. Both building S2 and future building will be equipped with an automatic sprinkler system conforming to NFPA 13. Based on calculations per the FUS Guidelines (**Appendix iv**), the maximum required fire flow is 6000L/min (100L/s) for this conservative scenario.

3.3 Boundary Conditions

A boundary condition request was made to the City of Ottawa based on the above domestic demands and fire flow. Results from the City of Ottawa simulation of the water distribution system demonstrate that adequate flows are available for the subject site, with on-site pressures ranging from **54.3 psi** to **61.6 psi** under normal operating conditions. These values are within the normal operating pressure range as defined by MECP and City of Ottawa design guidelines (50 to 70 psi and not less than 40 psi). Boundary conditions provided by the City of Ottawa are included in **Appendix A.3**.

Boundary conditions provided by the City of Ottawa indicate that fire flows of 6,000L/min (100 l/sec) can be delivered while maintaining an operating pressure of 56.6 psi, which is well above the minimum 20 psi required.

3.4 Summary of Findings

Given the boundary conditions and the design analysis, the proposed water servicing for this development will adequately meet the domestic demands, operating pressures and emergency fire flow requirements for the site.

4 Wastewater Servicing

4.1 Background

The proposed development is the final phase of the commercial development at 2025 Mer Bleue Road. The site is located on the east side of Mer Bleue Road and south of the intersection with Innes Road as identified in **Figure 1**. Wastewater servicing for this phase of the development will be extended from the existing 250mm diameter private sewer connected to Roger Pharand Street within the private access (**Drawing SSP-1**). A new 250 mm sewer will extend along the south side of the proposed and future buildings and sewer stubs will be dropped off for the building connections.

The private collection system for the site discharges to the municipal system in Roger Pharand Street and is ultimately serviced by to the Tenth Line Road pumping station.

4.2 Design Criteria

As outlined in the City of Ottawa Sewer Design Guidelines and the Ministry of Environment Conservation and Parks Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Velocity – 0.6 m/s (0.8 m/s for upstream sections)
- Maximum Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Minimum size – 200mm dia. for residential areas, 250mm for commercial areas
- Average Wastewater Generation – 28000L/ha/day
- Peak Factor – 1.5 (Harmon's) (Commercial)
- Extraneous Flow Allowance – 0.28 l/s/ha
- Manhole Spacing – 120 m
- Minimum Cover – 2.5m

4.3 Proposed Servicing

The proposed site will be serviced by gravity sewers which will direct the wastewater flows from the entire development site (approx. 2.4 L/s with allowance for infiltration) to the existing 250mm diameter sanitary sewer. The proposed collection system is detailed on **Drawing SA-1**. A sanitary sewer design sheet is included in **Appendix B.1**. Full port backwater valves are to be installed on all sanitary services within the site to prevent any potential surcharge from the downstream sanitary sewer from impacting the proposed property.

5 Stormwater Management

5.1 Objectives

The objective of this stormwater management plan is to determine the measures necessary to control the quantity/quality of stormwater released from the proposed development to criteria established by the *Pharand Lands – Innes Shopping Centres Limited – Serviceability Study* Stantec, February 2012) for the region, and to provide sufficient detail for approval and construction.

The proposed development is Phase 3 of the commercial development at 2025 Mer Bleue Road depicted in **Figure 1**.

5.2 SWM Criteria and Constraints

Criteria were established by combining current design practices outlined by the City of Ottawa Design Guidelines (2012), and through consultation with City of Ottawa staff. The following summarizes the criteria, with the source of each criterion indicated in brackets:

General

- Use of the dual drainage principle (City of Ottawa).
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff. (City of Ottawa).
- Assess impact of 100 year event outlined in the City of Ottawa Sewer Design Guidelines on major & minor drainage system (City of Ottawa).
- Enhanced quality control (80% TSS removal) to be provided on-site for the development.

Storm Sewer & Inlet Controls

- Stormwater discharge from the commercial development to be directed to the existing 1350mm diameter storm sewer on Noella Leclair Way (City of Ottawa).
- Minor system inflow to be restricted for all contributing areas to 50L/s/ha (Pharand Lands Serviceability Study).
- 100-year HGL boundary condition at the site outlet sewer of 81.342m (BCIP Report, Appendix I for node W19).
- 100-year Storm HGL to be a minimum of 0.30 m below building foundation footing (City of Ottawa).

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.30m above the 100-year water level (City of Ottawa).
- Site to provide minimum storage of 200 m^3/ha or sufficient storage to contain 100-year storm event on-site, whichever is greater (Pharand Lands Serviceability Study).
- Public Road storage to be maximized where possible to provide 130 m^3/ha of storage (Pharand Lands Serviceability Study).
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35m (City of Ottawa)
- Provide adequate emergency overflow conveyance off-site (City of Ottawa)

5.3 Stormwater Management

5.3.1 Allowable Release Rate

Based on background information, the peak post-development discharge from the entirety of the development area to the minor system is to be limited to 50L/s/ha of contributing area. Peak post-development discharge from municipal Rights-of-Way within the development area are to be limited to 100L/s/ha. Peak release rates for the current phase, existing tributary areas and future developments are summarized in **Table 1** below and are depicted on **Drawing SD-1**:

Table 1: Target Release Rates

Development Site	Area (ha)	Target Flow Rate (L/s)
Phase 1 - Private	2.718	135.9
Phase 1 – Public	1.294	129.4
Phase 2 & 3	2.508	125.4
Future Block E of Noella Leclair	1.826	91.3
Existing Car Dealership (EX104A)	4.205	214.235 (Per CIMA Stormwater Management Report)
Private Site Plan Blocks S of Roger Pharand	11.189	559.5
Subdivision Public Roadways	1.434	143.4
Future External (South of Vanguard Road)	16.830	841.5
Total	**41.464**	**2240.6**

5.3.2 Proposed Stormwater Management Plan

The proposed storm sewer collection system for Phase 3 of the development comprises of a network of 675 mm to 900 mm diameter storm sewers that will convey discharge from the full site into the municipal storm sewer collection system within the adjacent public roadways, as shown in **Drawings SSP-1** and **SD-1**.

Quality control of stormwater runoff for the commercial development is being provided by a Model STC 750 Stormceptor, designed to provide “Enhanced” level of treatment (80 % TSS Removal) prior to discharging into the 1350 mm diameter storm sewer on Noella Leclair Way.

As part of Phases 1 and 2 of the development, flows were temporarily stored on a drainage ditch within the Phase 3 parcel. For the Phase 3 development, a new underground storage tank will be constructed, complete with an orifice, for restricting discharge from the site into the Noella Leclair Way storm sewers.

At the south side of the Phase 3 site, roof drains, foundation drains and catch basins will direct drainage to a network of 900 mm diameter storm sewers sized to provide in-pipe storage, before discharge into the municipal 900 mm diameter storm sewer in Roger Pharand Street. The Roger Pharand Street storm sewer ultimately contributes to the 1350 mm storm sewer on Noella Leclair Way.

5.3.3 Modeling Rationale

A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems response during various storm events. Surface storage estimates were based on the final grading plan design (see **Drawing GP-1**). The following assumptions were applied to the detailed model:

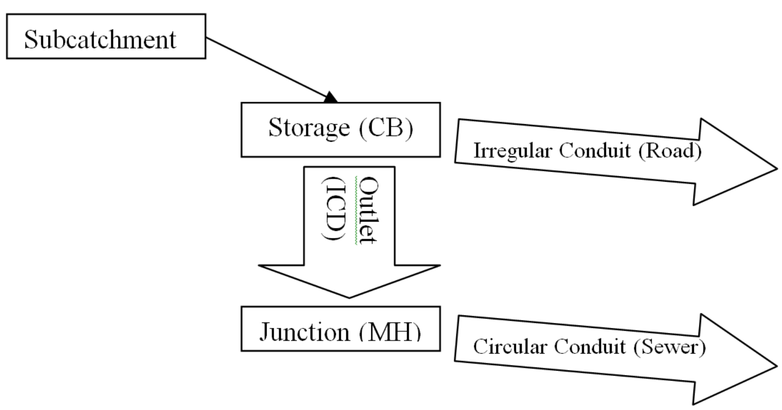
- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning’s ‘n’, and depression storage values
- 3-hour Chicago Storm distribution for the 2, 5, and 100-year analysis with static boundary condition at the site outlet to model ‘worst-case’ scenario in regard to on-site HGLs.
- To ‘stress test’ the system a ‘climate change’ scenario was created by adding 20% of the individual intensity values of the 100-year Chicago storm event at their specified time step.
- Percent imperviousness calculated based on actual soft and hard surfaces on each subcatchment, converted to equivalent Runoff Coefficient using the relationship C = (Imp. x 0.7) + 0.2
- Subcatchment areas are defined from high-point to high-point where sags occur. Subcatchment width (average length of overland sheet flow) determined by dividing subcatchment area by subcatchment length x 2 (length of overland flow path measured from high-point to high-point) for street (double-sided) catchments, and by 225 x the subcatchment area otherwise.

- Number of catchbasins based on servicing plan (**Drawing SSP-1**)
- Catchbasin inflow restricted with inlet-control devices (ICDs) as necessary to maintain inflow target rate and maximize use of surface storage.
- Surface ponding in sag storage where no well-defined road cross section exists calculated based on grading plans (**Drawing GP-1**). For storage on roads with defined cross-sections, active storage was modeled based on actual conduit flow using a cross-section as detailed on **Drawing DS-1**.
- The proposed buildings are assumed to have ten roof drains each and equipped with roof drain controls with scuppers at 0.15 m above the roof drains for emergency overflow to restrict discharge into the storm sewers.

5.3.3.1 SWMM Dual Drainage Methodology

The proposed subdivision is modeled in one modeling program as a dual conduit system (see Figure 2), with: 1) circular conduits representing the sewers & junction nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the sawtoothed overland road network from high-point to low-point and storage nodes representing catchbasins. The dual drainage systems are connected via orifice link objects (or outlets) from storage node (i.e. CB) to junction (i.e. MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there firstly.

Figure 2: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins as well as major system junctions. For storage nodes representing catchbasins (CBs), the invert of the storage node represents the invert of the CB and the rim of the storage node is the top of the CB plus an additional constant depth of 0.45m represent depth of surface water over the storage node (to be limited to a maximum of 0.35m during the 100-year event). The additional depth has been added to rim elevations to allow routing from one surface storage to the next, and is unused where no spillage occurs between ponding areas. Ponding at low points is represented via storage area-depth curves for each individual storage node to match ponding volumes demonstrated on the grading plan **Drawing GP-1**. Storage volumes exceeding the sag storage available in the node will route through the connected irregular conduit to the next storage node and continue routing through the system until, ultimately, flows either re-enter the minor system or reach the outfall of the major system.

Inlet control devices, as represented by orifice links, use a user-specified diameter and discharge coefficient taken from manufacturer's specifications for the chosen ICD model.

Subcatchment imperviousness was calculated via impervious area measured from **Drawing SSP-1**.

5.3.3.2 Boundary Conditions

The detailed PCSWMM hydrology and the proposed storm sewers were used to assess the peak inflows and hydraulic grade line (HGL) for the site. All storm events used to demonstrate adherence to SWM target outflow rates for the site were run with a free-flowing outlet condition to be conservative with respect to the maximum expected release rate from the site. Within previous reports for the region, a fixed backwater condition was used at the obvert of the receiving 1800mm diameter sewer within Wildflower Drive. As this elevation is below the invert of the 1350mm sewer outgoing from the subject site, the 1350mm sewer was considered as free flowing for the purposes of this model.

5.3.4 Input Parameters

Drawing SD-1 summarizes the discretized subcatchments used in the analysis of the proposed development and outlines the major overland flow paths. The grading plans are also enclosed for review.

Appendices C2-C3 summarize the modeling input parameters and results for the subject area; an example input and output file are provided for the 100-year 3hr Chicago storm. For all other input files and results of storm scenarios, please examine the electronic model files provided as part of the submission package. This analysis was performed using PCSWMM, which is a front-end GUI to the EPA-SWMM engine. Model files can be examined in any program which can read EPA-SWMM files version 5.2.4.

5.3.4.1 Hydrologic Parameters

Table 2 presents the general subcatchment parameters used:

Table 2: General Subcatchment Parameters

Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Impervious	0.013

Parameter	Value
N Pervious	0.25
Dstore Imperv. (mm)	1.57
Dstore perv. (mm)	4.67
Zero Imperv. (%)	0

Table 3 presents the individual parameters that vary for each of the proposed subcatchments.

Table 3: Subcatchment Parameters

Name	Outlet	Area (ha)	Width (m)	Slope (%)	Imperv. (%)
C101A	CB101A-S	0.557	125.492	2.0	94.3
C102A	CB102A-S	0.421	94.929	2.0	98.6
C102B	CB102B-S	0.248	55.969	2.0	95.7
C103A	CB103A-S	0.031	7.126	2.0	100.0
C103B	CB103B-S	0.026	5.872	2.0	100.0
C105A	CB105A-S	0.048	10.817	2.0	100.0
C105B	CB105B-S	0.019	4.454	2.0	100.0
R104A	R104A-S	0.360	81.076	1.5	100.0
R104B	R104A-S	0.004	0.987	1.5	100.0
R106A	R106A-S	0.262	59.019	1.5	100.0
UNC-1	100A	0.013	2.947	2.0	100.0
UNC-2	101A-1	0.038	8.528	2.0	68.6
UNC-3	103A-1	0.113	25.427	2.0	48.6
UNC-4	203B	0.039	8.691	2.0	70.0
TOTAL		**2.183**			**94.0**

Table 4 summarizes the storage node parameters used in the model. Storage curves for each node have been created based on volumes presented for each individual ponding area within **Drawing GP-**1. Rim elevations for each node correspond to the rim elevation of the associated area's catchbasin plus maximum depth of storage plus an additional buffer depth to allow for demonstration of overland flow in the climate change event scenario. The buffer is unused during other modeled events. Storage curves noted as 'functional' are set not to provide any additional storage for the node, as storage will occur within the major system conduit (transect) connecting the storage nodes within the model. Storage curves for roof areas are based on roof design spreadsheets included as **Appendix C1**.

Table 4: Storage Node Parameters

Name	Invert	Rim	Depth	Storage Curve	Curve Name
CB101A-S	87.27	89	1.73	TABULAR	CB101A-V
CB102A-S	86.93	88.66	1.73	TABULAR	CB102A-V

Name	Invert	Rim	Depth	Storage Curve	Curve Name
CB102B-S	86.82	88.55	1.73	TABULAR	CB102B-V
CB103A-S	84.8	88.58	3.78	TABULAR	CB103A-V
CB103B-S	87.38	88.76	1.38	TABULAR	CB103B-V
CB105A-S	87.52	88.9	1.38	TABULAR	CB105A-V
CB105B-S	84.9	88.38	3.48	TABULAR	CB103B-V
R104A-S	103	103.3	0.3	TABULAR	R104A-V
R106A-S	103	103.3	0.3	TABULAR	R106A-V
SU7	84.72	88	3.28	TABULAR	STORMTECH

5.3.4.2 Hydraulic Parameters

As per the Ottawa Sewer Design Guidelines (OSDG 2012), Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways.

Storm sewers were modeled to confirm flow capacities and hydraulic grade lines (HGLs) in the ultimate condition with consideration of flow contributions from future areas. The detailed storm sewer design sheet is included in **Appendix C1**.

Tables 5 and 6 below present the parameters for the outlet and orifice link objects in the model, which represent ICDs and flow-controlled roof drains. All IPEX tempest orifices were assigned a discharge coefficient of 0.572. Roof release discharge curves assume a standard Watts Model R1100 Accuflow controlled release roof drain as noted in the calculation sheets in **Appendix C1**. The number of roof notches are to be confirmed with the building mechanical engineer. Inflows from future undeveloped areas have been modeled as direct constant inflows to the minor system at the given 50L/s/ha or 100L/s/ha inflow rate as applicable. It is assumed that no major system spillage will occur from external areas to those within the commercial development site during design storm events.

Table 5: Orifice Parameters

Name	Inlet	Outlet	Inlet Elev.	Type	Diameter
201-O	SU7	STC	84.72	CIRCULAR	0.2
C29	MH103	EXSTM	84.69	IPEX Tempest	0.127
OR1	CB101A-S	202	87.11	CIRCULAR	0.2
OR2	CB102A-S	102	86.82	IPEX Tempest	0.178
OR3	CB102B-S	201	86.82	IPEX Tempest	0.152
OR6	CB105A-S	MH105	87.52	IPEX Tempest	0.127
OR7	CB103B-S	CB103A-S	87.72	IPEX Tempest	0.127

Table 6: Outlet Parameters

Name	Inlet	Outlet	Inlet Elev.	Curve Name
OR4	R104A-S	MH103	103	R104A-O
OR5	R106A-S	MH105	103	R106A-O

5.3.5 Model Results

The following section summarizes the key hydrologic and hydraulic model results. For detailed model results or inputs please refer to the example input file in **Appendix C.2**.

5.3.5.1 Hydrologic Results

The following tables demonstrate the peak outflow from each modeled outfall during the design storm (3hr Chicago 2-100yr) events. A free-flowing outfall condition has been modeled for these events to be conservative with respect to site peak release rates.

Table 7: 3 Hour Chicago Event Peak Discharge Rates

Event	Location	Discharge Rate (L/s)
3 Hr Chicago 2-Year	Outlet Sewer (OF-MJ, OF-MN)	2126
3 Hr Chicago 5-Year	Outlet Sewer (OF-MJ, OF-MN)	2162
3 Hr Chicago 100-Year	Outlet Sewer (OF-MJ, OF-MN)	2227
3 Hr Chicago 100-Year + 20%	Outlet Sewer (OF-MJ, OF-MN)	2322

5.3.5.2 Hydraulic Results

Table 8 summarizes the HGL results within the site for the 100 year, 3 hour Chicago storm event and the ‘climate change’ scenario storm required by the City of Ottawa Sewer Design Guidelines (2012), where intensities are increased by 20%.

The City of Ottawa requires that during major storm events, the maximum hydraulic grade line be kept at least 0.30 m below the underside-of-footing (USF) of any adjacent units connected to the storm sewer during design storm events. HGLs during the climate change event are not to exceed adjacent USF elevations (Freeboard of 0.00m). USF elevations are detailed on **Drawing GP-1**.

Table 8: Modeled Hydraulic Grade Line (HGL) Results

STM MH	Adjacent USF (m)	100-year 3hr Chicago		100-year 3hr Chicago + 20%	
		HGL (m)	USF-HGL Clearance (m)	HGL (m)	USF-HGL Clearance (m)
102	-	86.30	-	86.42	-
201	-	86.29	-	86.42	-

STM MH	Adjacent USF (m)	100-year 3hr Chicago		100-year 3hr Chicago + 20%	
		HGL (m)	USF-HGL Clearance (m)	HGL (m)	USF-HGL Clearance (m)
201CB	88.15	86.60	1.55	86.60	1.55
202	-	86.30	-	86.42	-
EXSTM	-	84.66	-	84.67	-
MH103	88.3	86.05	2.25	86.43	1.87
MH105	88.3	86.05	2.25	86.43	1.87
STC	-	84.98	-	85.11	-

As is demonstrated in the table above, the worst-case scenario results in HGL elevations remain at least 0.30 m below the proposed underside of footings, and HGL elevations remain below the proposed underside of footing elevations during the 20% increased intensity ‘climate change’ scenario.

Table 9 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of catchbasins for the 2-year and 100-year design storms and climate change storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed the required 0.35m maximum during the 100-year event. Total ponding depths during the climate change scenario are below adjacent building openings and should not impact the proposed buildings. No ponding was present in the 2-year storm event.

Table 9: Maximum Surface Water Depths

Storage node ID	Structure ID	Rim Elevation (m)	2-year, 3-hour Chicago		100-year, 3-hour Chicago		100-year, 3-hour Chicago+20%	
			Max Surface HGL (m)	Total Surface Water Depth (m)	Max Surface HGL (m)	Total Surface Water Depth (m)	Max Surface HGL (m)	Total Surface Water Depth (m)
CB101A-S	CB 101A	88.65	88.58	0.00	88.81	0.16	88.81	0.16
CB102A-S	CB 102A	88.31	88.30	0.00	88.54	0.23	88.54	0.23
CB102B-S	CB 102B	88.20	88.10	0.00	88.50	0.30	88.52	0.32
CB103A-S	CBMH 103A	88.58	85.37	0.00	86.05	0.00	86.44	0.00
CB103B-S	CB 103B	88.76	87.82	0.00	87.95	0.00	88.02	0.00
CB105A-S	CB 105A	88.90	87.68	0.00	88.13	0.00	88.38	0.00
CB105B-S	CBMH 105B	88.58	85.75	0.00	86.05	0.00	86.44	0.00

5.3.6 Results

Table 10 demonstrates that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflow rates for the site.

Table 10: Summary of Release Rates

Storm Event	Site Peak Discharge (L/s)*	Target Discharge Rate (L/s)*
3 Hour Chicago 2-Year	2126.3	2240.6
3 Hour Chicago 5-Year	2162.3	2240.6
3 Hour Chicago 100-Year	2226.7	2240.6
3 Hour Chicago 100-Year+20%	2321.8	-

*Includes discharge from uncontrolled and external drainage areas.

Furthermore, the table below presents the HGLs and associated storage volume and release rate in the underground storage under the 100-year storm and climate change events. Based on the model results, stormwater flows will bypass the storage tank and use the emergency overflow pipe to the Noella Leclair Way storm sewer under the climate change event.

Table 11: Storage HGL and Volume

Storage node ID	Model	100-year, 3-hour Chicago			100-year, 3-hour Chicago+20%		
		Max HGL (m)	Storage Volume (m^3)	Release Rate (L/s)	Max HGL (m)	Storage Volume (m^3)	Release Rate (L/s)
SU7	StormTech MC-7200	86.29	1048	91.4	86.44	1048	95.9

A StormTech system was sized based on the minimum required storage size under the 100-year storm event. Based on the model results, a StormTech Model MC-7200 was preliminarily sized to provide around 1042.2 m^3 of storage. The sizing report is attached in **Appendix C.5**.

5.4 Water Quality Control

On-site quality control measures are required for the development per section 3.1.2.5.2 of the Gloucester Cumberland EUC & BCIP Servicing Update. Enhanced protection (80% removal of suspended solids) is required for the site similar to existing areas of the BCIP. An oil grit separator (OGS) was sized to service the entire commercial site to treat runoff from impervious areas directed to catchbasins on-site. The design of the OGS was undertaken as part of Phase 1 of the development and the approved unit was subsequently installed. The oil-grit separator unit is privately maintained and is located immediately upstream of the connection to the sewer in Noella Leclair Way as shown on **Drawing SSP-1**. The OGS unit was modeled in the PCSWMM for Stormceptor model provided by the manufacturer (Imbrium Systems) to validate suitability for the site. The detailed design of Phase 3 of the development does not result in an increase in imperviousness over the original design assumptions.

Treated runoff from the commercial site is directed to the 1350mm storm sewer within Noella Leclair Way. The stormwater is then directed to the downstream SWMF at Des Epinettes Avenue (designed to provide 70% TSS removal) prior to discharge to Bilberry Creek. The majority of impervious surfaces from the overall site plan development are directed to the on-site OGS unit and suspended solids within runoff are not anticipated to have a deleterious impact on downstream watercourses.

6 Grading and Drainage

This phase of the commercial development measures approximately 1.83 ha in area. The topography across the site is relatively flat and currently drains from west to east. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements, adhere to permissible grade raise restrictions (see **Section 10.0**) for the site, and provide for minimum cover requirements for storm and sanitary sewers where possible. Site grading has been established to provide emergency overland flow routes required for stormwater management in accordance with City of Ottawa requirements.

The subject site maintains emergency overland flow routes for flows from storm events in excess of the maximum design event to the proposed municipal rights-of-way at the southern and eastern boundaries of the development, and ultimately to Innes Road as depicted in **Drawing GP-1.**

7 Utilities

As the subject site is bound to the east and west by an existing commercial business park, and by a municipal right-of-way to the north, Hydro, Bell, Gas and Cable servicing for the proposed development are readily available. Pole mounted Hydro infrastructure and a gas main exist along Mer Bleue Road. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site. Exact size, location and routing of utilities will be finalized after design circulation.

8 Approvals

Environmental Compliance Approval (ECAs, formerly Certificates of Approval (CofA)) under the Ontario Water Resources Act are not expected to be a requirement for Phase 3 of the development as approval was obtained for storm and sanitary sewers within the adjacent municipal roadways as a part of Phase 1 of the development. The commercial site is of a single parcel of non-industrial use, and discharges to existing sewers designed to accommodate the current phase.

9 Erosion Control During Construction

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

- Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
- Limit extent of exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with plastic or synthetic mulches.
- Provide sediment traps and basins during dewatering.
- Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
- Plan construction at proper time to avoid flooding.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

- Verification that water is not flowing under silt barriers.
- Clean and change silt traps at catch basins.

Refer to **Drawing EC-1** for the proposed location of silt fences, straw bales and other erosion control structures.

10 Geotechnical Investigation

A geotechnical Investigation Report was prepared by Paterson Group entitled Geotechnical investigation Proposed Commercial Development, 2025 Mer Bleue Road – Phase 2, dated September 6, 2024. The report summarizes the existing soil conditions within the development and provides construction recommendations. For details which are not summarized below, please see the Paterson Group Geotechnical Report which accompanies the Site Plan Control application.

Subsurface soil conditions within the subject area were determined from 12 boreholes and 8 test pits distributed across Phase 3 of the site. In general soil stratigraphy consisted of fill material over silty clay and glacial till. Bedrock elevations are expected to be encountered at 5m to 15m in depth. Groundwater Levels were measured in August 2024 and vary in elevation from 1.8m to 3.6m below ground surface. Long term groundwater levels table is expected at approximately 2.5 to 3.5m below ground surface.

A permissible grade raise of 1.8m above existing ground surface is recommended for grading within 6m of the building footprint. A grade raise restriction of 2.2m raise is recommended for parking areas and access lanes.

The required pavement structure for proposed hard surfaced areas are outlined in **Table 11** and **12** below:

Table 12: Pavement Structure – Car-Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course – HL 3 or Superpave 12.5 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
300	Subbase - OPSS Granular B Type II
Subgrade – Either in situ soil, fill or engineered fill placed over in situ soil	

Table 13: Pavement Structure – Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
50	Binder Course – HL-8 or Superpave 19.0 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
450	Subbase - OPSS Granular B Type II
Subgrade – Either in situ soil, fill or engineered fill placed over in situ soil	

11 Conclusions

11.1 Water Servicing

Based on the supplied boundary conditions for existing watermains and estimated domestic and fire flow demands for the subject site, it is anticipated that the proposed servicing in this development will provide sufficient capacity to sustain the required domestic demands and emergency fire flow demands of the proposed site. Fire flows greater than those required are available for this development.

11.2 Sanitary Servicing

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage of the site. The proposed development will be serviced by a network of gravity sewers which will direct wastewater flows to the existing 250mm dia. sanitary sewer constructed as part of Phase 1. The proposed drainage outlet to the east has sufficient capacity to receive sanitary discharge from the site based on the findings of the Gloucester and Cumberland EUC Master Servicing Update.

11.3 Stormwater Servicing

The proposed stormwater management plan is in compliance with the goals specified through consultation with the City of Ottawa. On-site stormwater management controls have been proposed to limit peak storm sewer inflows to downstream storm sewers to 50L/s/ha. The downstream receiving sewer has sufficient capacity to receive runoff volumes from the site based on the findings of the Gloucester and Cumberland EUC Master Servicing Update.

11.4 Grading

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the recommendations made in the Geotechnical Investigation Report prepared by Paterson Group. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing facilities.

11.5 Utilities

Utility infrastructure exists within the surrounding roadways. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the entirety of the development. Exact size, location and routing of utilities will be finalized after design circulation.

11.6 Approvals/Permits

An MECP Environmental Compliance Approval is not expected to be required. No other approval requirements from other regulatory agencies are anticipated.

Appendix A Water Supply Servicing

A.1 Domestic Water Demand Estimate

Orleans II Phase 3, Ottawa, ON - Domestic Water Demand Estimates

Site Plan provided by Petroff Partnership Architects. (2025-03-14)

Project No. 160402122 | Designed by: ZW
Revision: | Revised by:
Date: 31-Mar-2025 | Checked by: KS
Date Checked: 11-Apr-2025
City File No.

Demand conversion factors per Table 4.2 of the City of Ottawa Water Design Guidelines 2500 L/(1000m²/day) for Shopping Centre:		
Commercial	2500	L/(1000m²/d)

Unit Type	Commercial (m²)	No. of Units	Population	Avg Day Demand		Max Day Demand [1 2]		Peak Hour Demand [1 2]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Commercial									
Future Building									
Commercial	2995	N/A	N/A	5.2	0.09	7.8	0.13	14.0	0.23
Building S2									
Commercial	3970	N/A	N/A	6.9	0.11	10.3	0.17	18.6	0.31
Total Site :				**12.1**	**0.2**	**18.1**	**0.3**	**32.6**	**0.5**

Notes:

1 The City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:
 maximum day demand rate = 2.5 x average day demand rate
 peak hour demand rate = 2.2 x maximum day demand rate (as per Technical Bulletin ISD-2010-02)

2 Water demand criteria used to estimate peak demand rates for gross commercial area are as follows:
 maximum daily demand rate = 1.5 x average day demand rate
 peak hour demand rate = 1.8 x maximum day demand rate (as per Technical Bulletin ISD-2010-02)

A.2 Fire Flow Requirements Per FUS

Stantec

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160402122
Project Name: Smartcentres Orlean Phase 3 - Farmboy
Date: 4/11/2025
Fire Flow Calculation #: 1
Description: Building S2 (Proposed New Farm Boy Building)
Notes: Non-combustible structure 1-storey commerical building has estimated GFA 3969.6 sqm with fully supervised sprinkler system per site plan provided by Pertroff Partnership Architects dated March 14, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type II - Noncombustible Construction / Type IV-A - Mass Timber Construction										0.8	-
2	Determine Effective Floor Area	Sum of Two Largest Floors + 50% of Eight Additional Floors					Vertical Openings Protected?					NO	-
		3970										3970	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min										-	11000
4	Determine Occupancy Charge	Non-Combustible										-25%	8250
5	Determine Sprinkler Reduction	Conforms to NFPA 13										-30%	-4125
		Standard Water Supply										-10%	
		Fully Supervised										-10%	
		% Coverage of Sprinkler System										100%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall		Firewall / Sprinklered ?			-	-
		North	> 30	74	1	61-80	Type I-II - Unprotected Openings		NO			0%	0
		East	> 30	47	1	41-60	Type I-II - Unprotected Openings		NO			0%	
		South	> 30	74	1	61-80	Type I-II - Unprotected Openings		NO			0%	
		West	> 30	47	1	41-60	Type I-II - Unprotected Openings		NO			0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											4000
		Total Required Fire Flow in L/s											66.7
		Required Duration of Fire Flow (hrs)											1.50
		Required Volume of Fire Flow (m^3)											360

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec

Stantec Project #: 160402122
Project Name: Smartcentres Orlean Phase 3
Date: 4/11/2025
Fire Flow Calculation #: 2
Description: Building S2 together with future building TBD without using firewall
Notes: Non-combustible structure 1-storey commerical building has total estimated GFA 6593 sqm and 372 sqm mezzanine with fully supervised sprinkler system per site plan provided by Pertroff Partnership Architects dated March 14, 2025

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type II - Noncombustible Construction / Type IV-A - Mass Timber Construction										0.8	-
2	Determine Effective Floor Area	Sum of Two Largest Floors + 50% of Eight Additional Floors					Vertical Openings Protected?					NO	-
		6965										6965	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min										-	15000
4	Determine Occupancy Charge	Non-Combustible										-25%	11250
5	Determine Sprinkler Reduction	Conforms to NFPA 13										-30%	-5625
		Standard Water Supply										-10%	
		Fully Supervised										-10%	
		% Coverage of Sprinkler System										100%	
6	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall		Firewall / Sprinklered ?			-	-
		North	> 30	74	1	61-80	Type I-II - Unprotected Openings		NO			0%	0
		East	> 30	47	1	41-60	Type I-II - Unprotected Openings		NO			0%	
		South	> 30	74	1	61-80	Type I-II - Unprotected Openings		NO			0%	
		West	> 30	47	1	41-60	Type I-II - Unprotected Openings		NO			0%	
7	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**											**6000**
		Total Required Fire Flow in L/s											**100.0**
		Required Duration of Fire Flow (hrs)											**2.00**
		Required Volume of Fire Flow (m^3)											**720**

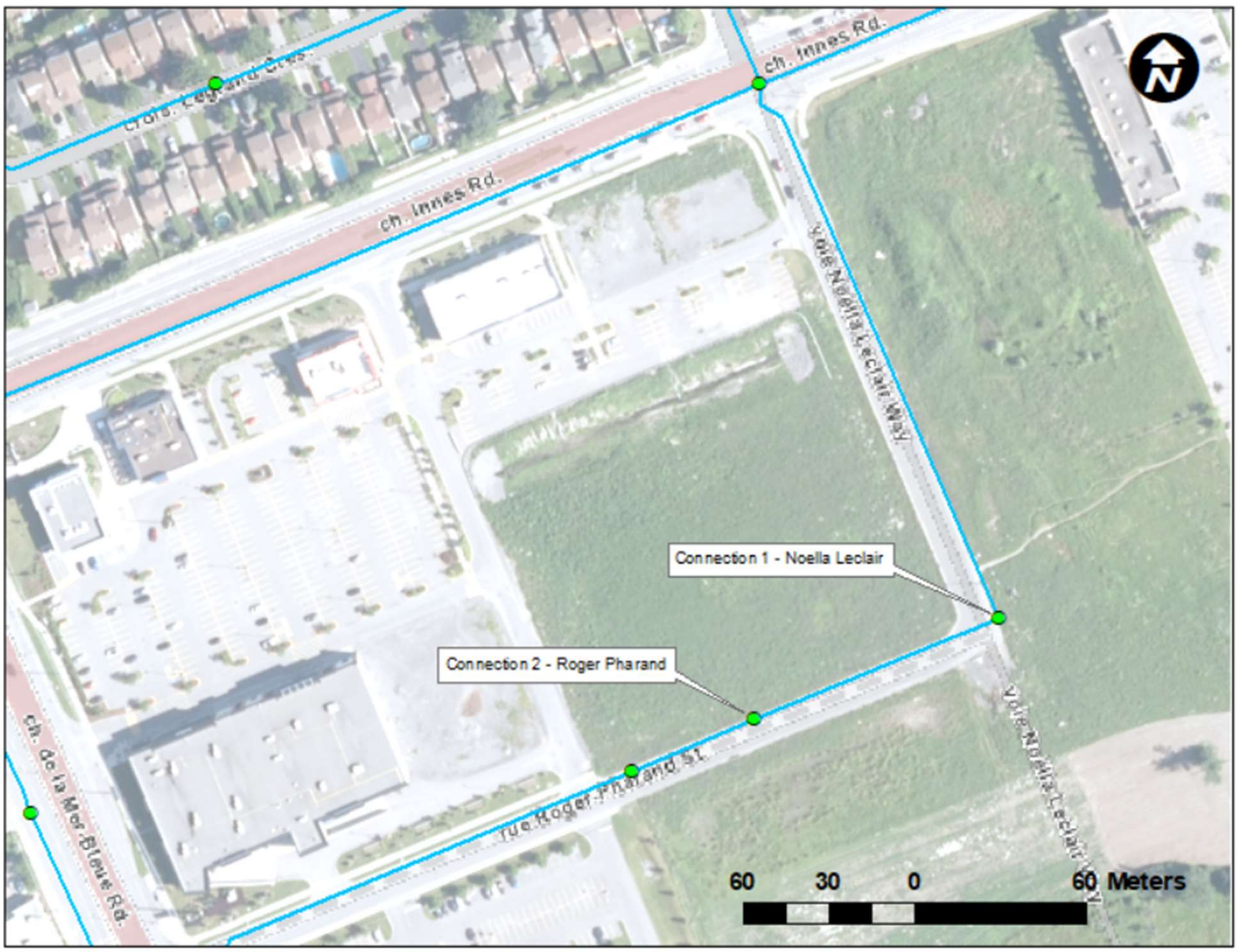
A.3 Boundary Conditions

Boundary Conditions
Smart Centre Orléans – Phase 3

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	12.1	0.20
Maximum Daily Demand	18.1	0.30
Peak Hour	32.6	0.54
Fire Flow Demand #1	6,000.0	100.00

Location



Results

Connection 1 – Noella Leclair

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.3	59.3
Peak Hour	126.8	54.3
Max Day plus Fire Flow #1	126.8	54.3

[1] Ground Elevation = 88.6 m

Connection 2 – Roger-Pharand

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.3	61.6
Peak Hour	126.8	56.6
Max Day plus Fire Flow #1	126.8	56.6

[1] Ground Elevation = 87.0 m

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.

Appendix B Wastewater Servicing

B.1 Sanitary Sewer Design Sheet

Stantec

SUBDIVISION:

Orleans II Smart Centres
Phase 3 Development

DATE: 4/14/2025
REVISION: 1
DESIGNED BY: ZW
CHECKED BY: KS

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160402122

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON[2]	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (COMM., INST.):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 l/s/Ha		
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)
C6L	L	6	0.00	0	0	0	0	0.00	0	4.00	0.0	0.07	0.07
C6M	M	6	0.00	0	0	0	0	0.00	0	4.00	0.0	0.10	0.10
G6A	6	3	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.17
C4J	J	4	0.00	0	0	0	0	0.00	0	4.00	0.0	0.05	0.05
C4K	K	4	0.00	0	0	0	0	0.00	0	4.00	0.0	0.06	0.06
G4A, C4N	4	3	0.00	0	0	0	0	0.00	0	4.00	0.0	0.04	0.15
	3	2	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.32
	2	1A	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.32
C5H	H	5	0.00	0	0	0	0	0.00	0	4.00	0.0	0.66	0.66
G5A	5	1A	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.66
	1A	1B	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.98
C10A	BLDG S2	8	0.00	0	0	0	0	0.00	0	4.00	0.0	0.36	0.36
G8A	8	7	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.36
C9A	STUB 9	7	0.00	0	0	0	0	0.00	0	4.00	0.0	0.26	0.26
G7A	7	1B	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.62
	1B	1	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	1.60

LOCATION			INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)
C6L	L	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.07	0.07	0.0	0.1
C6M	M	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.10	0.10	0.0	0.1
G6A	6	3	0.00	0.00	0.00	0.00	0.00	0.00	1.40	1.40	0.1	1.40	1.57	0.4	0.5
C4J	J	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.05	0.05	0.0	0.0
C4K	K	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	0.06	0.0	0.0
G4A, C4N	4	3	0.00	0.00	0.00	0.00	0.00	0.00	1.72	1.72	0.1	1.76	1.87	0.5	0.6
	3	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.12	0.2	0.00	3.44	1.0	1.1
	2	1A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.12	0.2	0.00	3.44	1.0	1.1
C5H	H	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	0.66	0.66	0.2	0.5
G5A	5	1A	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.71	0.3	0.71	1.37	0.4	0.7
	1A	1B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.83	0.5	0.00	4.81	1.3	1.8
C10A	BLDG S2	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	0.36	0.36	0.1	0.3
G8A	8	7	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.2	0.15	0.51	0.1	0.3
C9A	STUB 9	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.26	0.26	0.1	0.2
G7A	7	1B	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.27	0.3	0.12	0.89	0.2	0.6
	1B	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10	0.8	0.00	5.70	1.6	2.4

LOCATION			PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
C6L	L	6	4.1	150	PVC	DR 28	1.0	15.3	**0.3%**	0.9	0.2
C6M	M	6	9.3	150	PVC	DR 28	1.0	15.3	**0.5%**	0.9	0.2
G6A	6	3	102.4	250	PVC	SDR 35	0.3	30.3	**1.7%**	0.6	0.2
C4J	J	4	31.4	135	PVC	DR 28	1.0	11.5	**0.3%**	0.8	0.2
C4K	K	4	3.1	135	PVC	DR 28	1.0	11.5	**0.4%**	0.8	0.2
G4A, C4N	4	3	87.8	250	PVC	SDR 35	0.6	47.0	**1.3%**	0.9	0.3
	3	2	80.0	250	PVC	SDR 35	0.3	30.3	3.7%	0.6	0.2
	2	1A	55.9	250	PVC	SDR 35	0.3	30.3	**3.7%**	0.6	0.2
C5H	H	5	9.9	150	PVC	DR 28	1.0	15.3	**3.3%**	0.9	0.3
G5A	5	1A	55.3	250	PVC	SDR 35	0.5	42.9	1.6%	0.9	0.3
	1A	1B	2.2	250	PVC	SDR 35	0.3	30.3	6.0%	0.6	0.3
C10A	BLDG S2	8	10.2	150	PVC	DR 28	1.0	15.3	1.8%	0.9	0.3
G8A	8	7	38.8	250	PVC	SDR 35	0.4	38.3	**0.8%**	0.8	0.2
C9A	STUB 9	7	10.2	150	PVC	DR 28	1.0	15.3	**1.3%**	0.9	0.2
G7A	7	1B	47.8	250	PVC	SDR 35	0.4	38.3	1.4%	0.8	0.2
	1B	1	19.9	250	PVC	SDR 35	0.3	30.3	7.8%	0.6	0.3
				250							

B.2 Background Report Excerpts (Sanitary Drainage)

5.0 Sanitary Drainage

For the purposes of this serviceability study the sanitary drainage sewers have been designed to service the proposed commercial development. Detailed design of the sanitary sewer network will be completed during the detailed design phase. Sanitary sewer connection is available at the existing 525mm diameter municipal main at the intersection of Lanthier Drive and Vanguard Drive. Sewage will be directed along Vanguard Drive to Tenth Line Road and south along Tenth Line Road to the Tenth Line Road pumping station. The development will include extension of the sanitary trunk sewer from Lanthier Drive along future Vanguard extension at the south property line of the proposed site. A sanitary stub will be provided to service the development to the south of the proposed site (see **Drawing SAN-1**).

For detailed information regarding the wastewater servicing and pump station improvements please refer to the appended excerpts of the Stantec Consulting Ltd. "*Gloucester and Cumberland East Urban Community Expansion Area and Bilberry Creek Industrial Park Master Servicing Update*", dated July, 2006

5.1 SANITARY SEWER

A 375mm dia. extension is proposed for the Vanguard Drive sanitary trunk in order to connect to the existing 525mm diameter sanitary main at the intersection of Lanthier Drive and Vanguard Drive. The proposed sanitary sewer network for the site consists of 200mm and 250mm diameter sewers with gravity feed to sanitary manhole SAN 6 in Vanguard Drive; roughly 90m northeast of the site access road off Vanguard Drive. See the attached **Drawing SAN-1** for details.

Design flows for the proposed site were developed in accordance with the City of Ottawa Sewer Design Criteria using standard commercial flow estimates and total land area of 24.0ha. Total peak flow estimates were based on a commercial peaking factor of 1.5 and an infiltration rate of 0.28L/s/ha. Flow estimates of a nearby 16.83ha industrial land draining to the site sanitary sewer network were also included in the flow estimate using a peaking factor of 2.4. Building footprint areas were not included in the total area used for infiltration flows. The proposed site falls within drainage boundaries as presented in the 2006 Master Servicing Update.

The total flow through the proposed Pharand Lands development site was estimated to be approximately 49.6L/s. This flow estimate includes flows of approximately 21 L/s from the nearby industrial area and offsite flows generated along Vanguard Drive between the site sanitary service network connection at sanitary manhole SAN6 and the connection to the existing sewer at Lanthier Drive. The capacity of the Tenth Line Rd pumping station is sufficient to handle the flows generated by the proposed development as the pumping station was designed to accommodate the entire 85ha of the BCIP. The sanitary sewer design sheets for the proposed site are included in **Appendix C.2**.

Appendix C Stormwater Management

C.1 Storm Sewer Design Sheet

Stantec

Orleans II Phase 3	
DATE:	2025-04-21
REVISION:	1
DESIGNED BY:	MJS
CHECKED BY:	MW

FILE NUMBER: **160402122**

STORM SEWER DESIGN SHEET (City of Ottawa)

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013 BEDDING CLASS = B

MINIMUM COVER: 2.00 m

TIME OF ENTRY 10 min

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
PHASE 1, C101A	101	102	1.63	0.56	0.00	0.00	0.14	0.83	0.86	0.00	0.00	1.343	1.343	0.480	0.480	0.000	0.000	0.000	0.000	13.13	66.56	90.13	105.58	154.24	6.5	6.5	374.9
PHASE 2, C102A, C102B	102	100	0.06	0.67	0.00	0.00	0.17	0.90	0.88	0.00	0.00	0.050	1.392	0.592	1.072	0.000	0.000	0.000	0.000	14.41	63.21	85.53	100.17	146.30	8.7	15.2	514.3
																				15.03							
	100	TANK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15.03	61.70	83.47	97.75	142.74	0.0	15.2	15.2
																				15.10							
	100	TANK OUT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.392	0.000	1.072	0.000	0.000	0.000	0.000	15.10	61.54	83.25	97.49	142.37	0.0	0.0	485.8
																				15.12							
	TANK	TANK OUT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	0.0
																				10.00							
	TANK OUT	STC 750	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	1.392	0.000	1.072	0.000	0.000	0.000	0.000	15.12	61.48	83.16	97.39	142.21	91.4	91.4	576.7
																				15.19							
C103A, C103B	103A	103	0.00	0.06	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.000	0.000	0.056	0.056	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	16.2
																				12.09							
R104A, R104B	104	103	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	18.6	18.6	18.6
																				10.10							
C105B	105B	105	0.00	0.02	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.000	0.000	0.018	0.018	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	5.2
																				11.37							
R106A	106	105	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	12.5	12.5	12.5
																				10.11							
C105A	105	103	0.00	0.05	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.000	0.000	0.043	0.061	0.000	0.000	0.000	0.000	11.37	71.90	97.45	114.20	166.90	0.0	12.5	29.0
																				11.90							
	103	EXMH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.117	0.000	0.000	0.000	0.000	12.09	69.60	94.30	110.49	161.44	0.0	31.1	61.8
																				12.26							

PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)
PHASE 1, C101A	101	102	70.4	675	675	CIRCULAR	CONCRETE	-	0.15	339.6	**110.38%**	0.92
PHASE 2, C102A, C102B	102	100	39.4	900	900	CIRCULAR	CONCRETE	-	0.15	731.4	**70.31%**	1.11
	100	TANK	2.4	900	900	CIRCULAR	CONCRETE	-	0.50	1335.4	**1.14%**	2.03
	100	TANK OUT	5.2	450	450	CIRCULAR	CONCRETE	-	2.85	502.1	**96.76%**	3.06
	TANK	TANK OUT	2.4	200	200	CIRCULAR	PVC	-	1.00	33.3	**0.00%**	1.05
	TANK OUT	STC 750	6.5	900	900	CIRCULAR	PVC	-	0.48	1308.4	**44.08%**	1.99
				900	900							
C103A, C103B	103A	103	52.9	900	900	CIRCULAR	CONCRETE	-	0.20	844.6	**1.92%**	1.29
R104A, R104B	104	103	5.5	200	200	CIRCULAR	PVC	-	1.00	33.3	**55.84%**	1.05
C105B	105B	105	30.6	900	900	CIRCULAR	CONCRETE	-	0.35	1117.3	**0.46%**	1.70
R106A	106	105	5.5	200	200	CIRCULAR	PVC	-	1.00	33.3	**37.53%**	1.05
C105A	105	103	21.0	900	900	CIRCULAR	CONCRETE	-	0.45	1266.9	**2.29%**	1.93
	103	EXMH	12.1	450	450	CIRCULAR	CONCRETE	-	1.00	297.4	**20.77%**	1.81
				450	450							

C.2 Roof Storage Calculations

Project #160402122, Orleans II Phase 3
Roof Drain Design Sheet, Area R104A
Standard Watts Accutrol Weir - Single Notch Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0032	1	0.025	81	1	1	0.025
0.050	0.0006	0.0063	5	0.050	324	5	5	0.050
0.075	0.0009	0.0095	18	0.075	729	13	18	0.075
0.100	0.0013	0.0126	43	0.100	1297	25	43	0.100
0.125	0.0016	0.0158	84	0.125	2026	41	84	0.125
0.150	0.0019	0.0189	146	0.150	2918	61	146	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
4.7	749.5	4.7	0.20819
17.6	1356.2	12.8	0.58491
42.6	1980.8	25.0	1.13512
83.8	2612.5	41.2	1.8608
145.2	3247.7	61.5	2.76294

Rooftop Storage Summary

Total Building Area (sq.m)		3647.26
Assume Available Roof Area (sq.	80%	2917.808
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		10
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		146
Estimated 100 Year Drawdown Time (h)		2.7

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

Adjustable Accutrol Weir Flow Rate Settings From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	25%	Closed
0.025	**0.3154**	0.3154	0.3154	0.3154	0.3154
0.05	**0.6308**	0.6308	0.6308	0.6308	0.3154
0.075	**0.9462**	0.8674	0.7885	0.7097	0.3154
0.1	**1.2617**	1.104	0.9462	0.7885	0.3154
0.125	**1.5771**	1.3405	1.104	0.8674	0.3154
0.15	**1.8925**	1.5771	1.2617	0.9462	0.3154

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.014	0.019	-
Depth (m)	0.112	0.147	0.150
Volume (cu.m)	63.1	138.8	145.9
Draintime (hrs)	1.5	2.7	

Project #160402122, Orleans II Phase 3
Roof Drain Design Sheet, Area R106A
Standard Watts Accutrol Weir - Single Notch Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0032	0	0.025	58	0	0	0.025
0.050	0.0006	0.0063	4	0.050	233	3	4	0.050
0.075	0.0008	0.0079	13	0.075	525	9	13	0.075
0.100	0.0009	0.0095	31	0.100	933	18	31	0.100
0.125	0.0011	0.0110	61	0.125	1457	30	61	0.125
0.150	0.0013	0.0126	105	0.150	2098	44	105	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
3.4	539.0	3.4	0.14973
12.6	1170.4	9.2	0.47484
30.6	1899.4	18.0	1.00245
60.2	2684.1	29.6	1.74802
104.4	3503.6	44.2	2.72123

Rooftop Storage Summary

Total Building Area (sq.m)		2623.06
Assume Available Roof Area (sq.	80%	2098.448
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		10
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		105
Estimated 100 Year Drawdown Time (h)		2.7

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

Adjustable Accutrol Weir Flow Rate Settings From Watts Drain Catalogue

Head (m)	L/s Open	75%	**50%**	25%	Closed
0.025	0.3154	0.3154	**0.3154**	0.3154	0.3154
0.05	0.6308	0.6308	**0.6308**	0.6308	0.3154
0.075	0.9462	0.8674	**0.7885**	0.7097	0.3154
0.1	1.2617	1.104	**0.9462**	0.7885	0.3154
0.125	1.5771	1.3405	**1.104**	0.8674	0.3154
0.15	1.8925	1.5771	**1.2617**	0.9462	0.3154

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.010	0.013	-
Depth (m)	0.112	0.149	0.150
Volume (cu.m)	45.3	102.3	104.9
Draintime (hrs)	1.4	2.7	

Stormwater Management Calculations

File No: **160402122**
Project: **Orleans II Phase 3**
Date: **09-Apr-25**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table								
Catchment Type	**Sub-catchment Area ID / Description**		**Area (ha) "A"**		**Runoff Coefficient "C"**	**"A x C"**		**Overall Runoff Coefficient**
Roof	R106A	Hard	0.262		0.9	0.236		
		Soft	0.000		0.2	0.000		
		Subtotal		0.262306			0.2360754	0.900
Roof	R104A	Hard	0.365		0.9	0.328		
		Soft	0.000		0.2	0.000		
		Subtotal		0.364726			0.3282534	0.900
Total				**0.627**			**0.564**	
Overall Runoff Coefficient= C:								**0.90**

Total Roof Areas	**0.627 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.000 ha**
Total Tributary Area to Outlet	**0.627 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.000 ha**
Total Site	**0.627 ha**

Stormwater Management Calculations

Project #160402122, Orleans II Phase 3
Modified Rational Method Calculations for Storage

5 yr Intensity | $I = a/(t + b)^c$
City of Ottawa

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
10	104.19
20	70.25
30	53.93
40	44.18
50	37.65
60	32.94
70	29.37
80	26.56
90	24.29
100	22.41
110	20.82
120	19.47

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.6270
C: 0.20

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
20	70.25	**24.49**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: R106A — Roof
Area (ha): 0.26 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	68.38	9.68	58.70	35.22	103.5	0.00
20	70.25	46.11	10.11	36.00	43.20	110.2	0.00
30	53.93	35.39	10.22	25.17	**45.31**	112.0	0.00
40	44.18	29.00	10.21	18.79	45.10	111.8	0.00
50	37.65	24.71	10.14	14.58	43.73	110.7	0.00
60	32.94	21.62	10.03	11.59	41.73	109.0	0.00
70	29.37	19.28	9.90	9.37	39.37	107.0	0.00
80	26.56	17.43	9.77	7.67	36.80	104.8	0.00
90	24.29	15.94	9.62	6.32	34.11	102.6	0.00
100	22.41	14.71	9.48	5.23	31.37	100.2	0.00
110	20.82	13.67	9.28	4.39	28.97	97.1	0.00
120	19.47	12.78	9.07	3.70	26.66	93.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	112.00	0.11	10.22	45.31	104.92	0.00

Subdrainage Area: R104A — Roof
Area (ha): 0.36 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	95.08	13.07	82.01	49.20	103.6	0.00
20	70.25	64.11	13.92	50.19	60.23	110.3	0.00
30	53.93	49.21	14.14	35.07	**63.13**	112.1	0.00
40	44.18	40.32	14.12	26.20	62.88	111.9	0.00
50	37.65	34.36	13.99	20.37	61.12	110.9	0.00
60	32.94	30.06	13.79	16.27	58.57	109.3	0.00
70	29.37	26.80	13.56	13.24	55.60	107.5	0.00
80	26.56	24.24	13.32	10.92	52.41	105.6	0.00
90	24.29	22.16	13.07	9.10	49.12	103.6	0.00
100	22.41	20.45	12.81	7.63	45.80	101.6	0.00
110	20.82	19.00	12.54	6.46	42.63	99.4	0.00
120	19.47	17.76	12.21	5.56	40.00	96.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	112.08	0.11	14.14	63.13	145.89	0.00

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	0.627	ha			
Total 5yr Flow to Sewer	28	L/s	0	0 m^3	Ok
Non-Tributary Area	0.000	ha			
Total 5yr Flow Uncontrolled	0	L/s			
Total Area	0.627	ha			
Total 5yr Flow	28	L/s			
Target	24	L/s			

Project #160402122, Orleans II Phase 3
Modified Rational Method Calculations for Storage

100 yr Intensity | $I = a/(t + b)^c$
City of Ottawa

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.6270
C: 0.20

Estimated Time of Concentration after Development

tc (min)	I (100 yr) (mm/hr)	Q100yr (L/s)
20	119.95	**41.82**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: R106A — Roof
Area (ha): 0.26 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	130.21	11.42	118.79	71.27	131.0	0.00
20	119.95	87.47	12.10	75.37	90.44	141.8	0.00
30	91.87	66.99	12.38	54.61	98.30	146.3	0.00
40	75.15	54.80	12.50	42.30	101.52	148.1	0.00
50	63.95	46.64	12.52	34.11	**102.33**	148.5	0.00
60	55.89	40.76	12.50	28.26	101.72	148.2	0.00
70	49.79	36.31	12.45	23.86	100.21	147.3	0.00
80	44.99	32.81	12.37	20.44	98.09	146.1	0.00
90	41.11	29.98	12.28	17.70	95.56	144.7	0.00
100	37.90	27.64	12.18	15.46	92.74	143.1	0.00
110	35.20	25.67	12.07	13.60	89.73	141.4	0.00
120	32.89	23.99	11.96	12.03	86.58	139.6	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	148.54	0.15	12.52	102.33	104.92	0.00

Subdrainage Area: R104A — Roof
Area (ha): 0.36 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	181.05	16.50	164.54	98.73	130.8	0.00
20	119.95	121.62	17.83	103.79	124.55	141.3	0.00
30	91.87	93.15	18.35	74.80	134.64	145.4	0.00
40	75.15	76.19	18.54	57.65	138.37	146.9	0.00
50	63.95	64.85	18.56	46.28	**138.85**	147.1	0.00
60	55.89	56.67	18.49	38.18	137.45	146.6	0.00
70	49.79	50.48	18.36	32.12	134.91	145.5	0.00
80	44.99	45.62	18.19	27.42	131.64	144.2	0.00
90	41.11	41.68	18.00	23.68	127.89	142.7	0.00
100	37.90	38.43	17.79	20.64	123.83	141.0	0.00
110	35.20	35.69	17.57	18.12	119.58	139.3	0.00
120	32.89	33.35	17.35	16.00	115.22	137.5	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	147.13	0.15	18.56	138.85	145.89	0.00

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	0.627	ha			
Total 100yr Flow to Sewer	28	L/s	0	0 m^3	Ok
Non-Tributary Area	0.000	ha			
Total 100yr Flow Uncontrolled	0	L/s			
Total Area	0.627	ha			
Total 100yr Flow	28	L/s			
Target	42	L/s			

C.3 Sample PCSWMM Model Output (100 yr 3hr Chicago)

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

WARNING 04: minimum elevation drop used for Conduit C11
WARNING 03: negative offset ignored for Link C13
WARNING 04: minimum elevation drop used for Conduit C23
WARNING 04: minimum elevation drop used for Conduit C24
WARNING 04: minimum elevation drop used for Conduit C7
WARNING 04: minimum elevation drop used for Conduit C8
WARNING 04: minimum elevation drop used for Conduit C9
WARNING 03: negative offset ignored for Link OR1
WARNING 03: negative offset ignored for Link OR2

****
Element Count
****
Number of rain gages 4
Number of subcatchments ... 40
Number of nodes 62
Number of links 81
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
002	002yr_3hr_10m_CHI	INTENSITY	10 min.
005	005yr_3hr_10m_CHI	INTENSITY	60 min.
100	100yr_3h_10m_CHI	INTENSITY	10 min.
120	100yr_3hr_10m_CHI+20%	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
BLDG_H	0.65	146.70	100.00	1.5000	100	BLDG_H-S
BLDG_J	0.06	16.70	100.00	1.5000	100	BLDG_J-S
BLDG_K	0.06	13.60	100.00	1.5000	100	

```
BLDG_K-S
 BLDG_L                        0.07      34.90     100.00     1.5000 100
BLDG_L-S
 BLDG_M                        0.09      45.70     100.00     1.5000 100
BLDG_M-S
 BLDG_N                        0.04      15.10     100.00     1.5000 100
BLDG_N-S
 C101A                         0.56     125.49      94.29     2.0000 100
CB101A-S
 C102A                         0.42      94.93      98.57     2.0000 100
CB102A-S
 C102B                         0.25      55.97      95.71     2.0000 100
CB102B-S
 C103A                         0.03       7.13     100.00     2.0000 100
CB103A-S
 C103B                         0.03       5.87     100.00     2.0000 100
CB103B-S
 C105A                         0.05      10.82     100.00     2.0000 100
CB105A-S
 C105B                         0.02       4.45     100.00     2.0000 100
CB105B-S
 EX.C100A                      0.13     102.50      75.71     2.0000 100
100A
 EX.C101A                      0.17     141.60      77.14     1.3000 100
101A
 EX.C102A                      0.17     146.20      77.14     1.1000 100
102A
 EX.C103A                      0.16     133.80      77.14     1.2000 100
103A
 EX.C104A                      0.21     166.00      75.71     1.0000 100
104A
 EX.C105A                      0.45     288.70      62.86     1.2000 100
105A
 L106A                         0.03      24.00     100.00     3.0000 100
106A
 L106B                         0.02      27.00     100.00     3.0000 100
106A
 L107A                         0.02      27.00     100.00     3.0000 100
107
 L107B                         0.14     142.10     100.00     2.0000 100
107A
 L203A                         0.30      68.60     100.00     1.5000 100
203A
 L203B                         0.07      70.70     100.00     2.0000 100
203B
 L203C                         0.05      32.10     100.00     1.5000 100
203C
 L204A                         0.32      70.20     100.00     1.5000 100
204A
 L204B                         0.37      85.00     100.00     1.5000 100
```

						204B
L205A	0.37	81.80	87.14	1.5000	100	205
L207A	0.16	30.90	42.86	3.5000	100	207A
R104A	0.36	81.08	100.00	1.5000	100	R104A-S
R104B	0.00	0.99	100.00	1.5000	100	R104A-S
R106A	0.26	59.02	100.00	1.5000	100	R106A-S
U100A	0.03	5.90	32.86	3.0000	100	U100A-OF
U100B	0.08	13.60	31.43	3.0000	100	U100B-OF
U100C	0.12	25.60	31.42	2.0000	100	U100C-OF
UNC-1	0.01	2.95	100.00	2.0000	100	100A
UNC-2	0.04	8.53	68.57	2.0000	100	101A-1
UNC-3	0.11	25.43	48.57	2.0000	100	103A-1
UNC-4	0.04	8.69	70.00	2.0000	100	203B

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
100	JUNCTION	81.73	5.78	0.0	
101	JUNCTION	81.94	6.44	0.0	Yes
102	JUNCTION	84.85	3.85	0.0	
103	JUNCTION	82.65	6.15	0.0	Yes
104	JUNCTION	82.34	9.33	0.0	Yes
105	JUNCTION	84.45	4.58	0.0	
106	JUNCTION	85.19	4.04	0.0	
106A	JUNCTION	86.39	2.34	0.0	
107	JUNCTION	86.43	2.63	0.0	
201	JUNCTION	84.74	3.76	0.0	
201CB	JUNCTION	85.90	2.93	0.0	
202	JUNCTION	85.20	3.02	0.0	
203	JUNCTION	84.95	4.19	0.0	
204	JUNCTION	85.96	3.23	0.0	
206	JUNCTION	86.70	3.23	0.0	
207	JUNCTION	87.00	3.14	0.0	
207A	JUNCTION	86.89	3.29	0.0	

208	JUNCTION	86.97	2.65	0.0	
EX102	JUNCTION	82.24	6.61	0.0	Yes
EXSTM	JUNCTION	84.54	4.23	0.0	
MH103	JUNCTION	84.69	4.55	0.0	
MH105	JUNCTION	84.75	4.43	0.0	
STC	JUNCTION	84.42	4.06	0.0	
OF-MJ	OUTFALL	87.87	0.35	0.0	
OF-MN	OUTFALL	81.99	1.35	0.0	
U100A-OF	OUTFALL	0.00	0.00	0.0	
U100B-OF	OUTFALL	0.00	0.00	0.0	
U100C-OF	OUTFALL	0.00	0.00	0.0	
100A	STORAGE	86.25	2.15	0.0	
100A-1	STORAGE	88.56	0.10	0.0	
101A	STORAGE	86.48	2.25	0.0	
101A-1	STORAGE	88.67	0.10	0.0	
102A	STORAGE	86.56	2.25	0.0	
102A-1	STORAGE	88.69	0.10	0.0	
103A	STORAGE	86.66	2.25	0.0	
103A-1	STORAGE	88.84	0.10	0.0	
104A	STORAGE	86.81	2.25	0.0	
104A-1	STORAGE	88.92	0.10	0.0	
105A	STORAGE	86.44	2.68	0.0	
107A	STORAGE	87.25	2.15	0.0	
203A	STORAGE	87.30	2.15	0.0	
203B	STORAGE	87.30	2.15	0.0	
203C	STORAGE	86.50	2.68	0.0	
204A	STORAGE	87.30	2.15	0.0	
204B	STORAGE	87.30	2.15	0.0	
205	STORAGE	86.49	2.96	0.0	
BLDG_H-S	STORAGE	103.00	0.30	0.0	
BLDG_J-S	STORAGE	103.00	0.30	0.0	
BLDG_K-S	STORAGE	103.00	0.30	0.0	
BLDG_L-S	STORAGE	103.00	0.30	0.0	
BLDG_M-S	STORAGE	103.00	0.30	0.0	
BLDG_N-S	STORAGE	103.00	0.30	0.0	
CB101A-S	STORAGE	87.27	1.73	0.0	
CB102A-S	STORAGE	86.93	1.73	0.0	
CB102B-S	STORAGE	86.82	1.73	0.0	
CB103A-S	STORAGE	84.80	3.78	0.0	
CB103B-S	STORAGE	87.38	1.38	0.0	
CB105A-S	STORAGE	87.52	1.38	0.0	
CB105B-S	STORAGE	84.90	3.48	0.0	
R104A-S	STORAGE	103.00	0.30	0.0	
R106A-S	STORAGE	103.00	0.30	0.0	
SU7	STORAGE	84.72	3.28	0.0	

****
Link Summary
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Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	203C	CB102A-S	CONDUIT	48.4	0.2687	0.0130
C10	203B	CB101A-S	CONDUIT	56.0	1.0887	0.0250
C11	204B	203A	CONDUIT	34.2	0.0009	0.0130
C12	100A-1	100A	CONDUIT	52.2	0.9771	0.0130
C13	100A	OF-MJ	CONDUIT	5.0	3.6023	0.0130
C14	105A	104A-1	CONDUIT	25.5	-0.5882	0.0130
C15	104A	103A-1	CONDUIT	30.0	-0.7667	0.0130
C16	103A	102A-1	CONDUIT	37.7	-0.6101	0.0130
C17	102A	101A-1	CONDUIT	26.1	-1.1878	0.0130
C18	101A	100A-1	CONDUIT	22.8	-1.2282	0.0130
C19	202	102	CONDUIT	71.0	0.1409	0.0130
C2	104A-1	104A	CONDUIT	52.8	0.5874	0.0130
C20	102	201	CONDUIT	39.2	0.2910	0.0130
C21	201	SU7	CONDUIT	10.3	0.1553	0.0130
C22	CB101A-S	CB102A-S	CONDUIT	58.0	0.4998	0.0130
C23	CB102A-S	CB102B-S	CONDUIT	34.3	0.0009	0.0130
C24	CB102B-S	100A	CONDUIT	15.0	0.0020	0.0130
C25	201	STC	CONDUIT	5.2	2.8649	0.0130
C26	CB103A-S	MH103	CONDUIT	52.9	0.2079	0.0130
C27	MH105	MH103	CONDUIT	21.0	0.4762	0.0130
C28	CB105B-S	MH105	CONDUIT	30.6	0.3595	0.0130
C3	107A	104A-1	CONDUIT	15.0	1.8670	0.0130
C30	EXSTM	103	CONDUIT	16.5		

1.0910	0.0130			
C31	CB105A-S	103A-1	CONDUIT	37.7
0.1592	0.0130			
C32	CB103B-S	103A-1	CONDUIT	15.0
1.7388	0.0130			
C4	103A-1	103A	CONDUIT	30.0
1.2668	0.0130			
C5	102A-1	102A	CONDUIT	47.6
0.6933	0.0130			
C6	101A-1	101A	CONDUIT	48.0
0.8125	0.0130			
C7	205	204A	CONDUIT	35.1
0.0009	0.0130			
C8	204A	204B	CONDUIT	34.2
0.0009	0.0130			
C9	203A	203B	CONDUIT	23.8
0.0013	0.0130			
Pipe_1	100	OF-MN	CONDUIT	9.8
0.4071	0.0130			
Pipe_10	103	EX102	CONDUIT	78.6
0.3300	0.0130			
Pipe_11	104	103	CONDUIT	59.2
0.1500	0.0130			
Pipe_12	203	202	CONDUIT	32.7
0.1498	0.0130			
Pipe_13	204	203	CONDUIT	68.4
0.2000	0.0130			
Pipe_14	206	204	CONDUIT	38.9
1.0001	0.0130			
Pipe_16	207	206	CONDUIT	24.2
1.0000	0.0130			
Pipe_19	208	203	CONDUIT	38.9
1.0000	0.0130			
Pipe_23	106A	106	CONDUIT	74.5
1.0001	0.0130			
Pipe_25	107	106	CONDUIT	33.9
1.0001	0.0130			
Pipe_41	207A	207	CONDUIT	14.2
1.0000	0.0130			
Pipe_49	105	104	CONDUIT	70.1
0.5849	0.0130			
Pipe_50	106	105	CONDUIT	18.7
0.4200	0.0130			
Pipe_53	STC	101	CONDUIT	15.2
0.1500	0.0130			
Pipe_76	201CB	102	CONDUIT	56.3
1.1724	0.0130			
Pipe_8	101	100	CONDUIT	73.8
0.2614	0.0130			
Pipe_9	EX102	101	CONDUIT	119.1

0.2500 0.0130

105A-O	105A	105	ORIFICE
107-O	107A	107	ORIFICE
201-O	SU7	STC	ORIFICE
203A-O	203A	203	ORIFICE
203B-O	203B	203	ORIFICE
204A-O	204A	204	ORIFICE
204B-O	204B	204	ORIFICE
205-O	205	204	ORIFICE
C29	MH103	EXSTM	ORIFICE
OL1	203C	201CB	ORIFICE
OR1	CB101A-S	202	ORIFICE
OR2	CB102A-S	102	ORIFICE
OR3	CB102B-S	201	ORIFICE
OR6	CB105A-S	MH105	ORIFICE
OR7	CB103B-S	CB103A-S	ORIFICE
100A-O	100A	100	OUTLET
100A-O1	100A	100	OUTLET
101A-O	101A	101	OUTLET
101A-O1	101A	101	OUTLET
102A-O	102A	EX102	OUTLET
102A-O1	102A	EX102	OUTLET
103A-O	103A	103	OUTLET
103A-O1	103A	103	OUTLET
104A-O	104A	104	OUTLET
104A-O1	104A	104	OUTLET
BLDG_H_OUT	BLDG_H-S	106	OUTLET
BLDG_J_OUT	BLDG_J-S	207	OUTLET
BLDG_K_OUT	BLDG_K-S	206	OUTLET
BLDG_L_OUT	BLDG_L-S	201CB	OUTLET
BLDG_M_OUT	BLDG_M-S	201CB	OUTLET
BLDG_N_OUT	BLDG_N-S	208	OUTLET
OR4	R104A-S	MH103	OUTLET
OR5	R106A-S	MH105	OUTLET

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	550.90
C10	TRAPEZOIDAL	0.10	0.40	0.07	6.00	1	274.35

C11	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	31.73
C12	24mROW	0.35	4.20	0.18	24.00	1	10287.69
C13	24mROW	0.35	4.20	0.18	24.00	1	19753.76
C14	24mROW	0.35	4.20	0.18	24.00	1	7982.47
C15	24mROW	0.35	4.20	0.18	24.00	1	9113.13
C16	24mROW	0.35	4.20	0.18	24.00	1	8129.34
C17	24mROW	0.35	4.20	0.18	24.00	1	11343.15
C18	24mROW	0.35	4.20	0.18	24.00	1	11534.15
C19	CIRCULAR	0.68	0.36	0.17	0.68	1	315.55
C2	24mROW	0.35	4.20	0.18	24.00	1	7976.41
C20	CIRCULAR	0.90	0.64	0.23	0.90	1	976.65
C21	CIRCULAR	0.90	0.64	0.23	0.90	1	713.48
C22	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	751.31
C23	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	31.69
C24	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	47.90
C25	CIRCULAR	0.45	0.16	0.11	0.45	1	482.60
C26	CIRCULAR	0.90	0.64	0.23	0.90	1	825.56
C27	CIRCULAR	0.90	0.64	0.23	0.90	1	1249.32
C28	CIRCULAR	0.90	0.64	0.23	0.90	1	1085.47
C3	24mROW_OS	0.35	2.12	0.18	12.00	1	7156.89
C30	CIRCULAR	0.45	0.16	0.11	0.45	1	297.81
C31	24mROW_OS	0.35	2.12	0.18	12.00	1	2090.10
C32	24mROW_OS	0.35	2.12	0.18	12.00	1	6906.84
C4	24mROW	0.35	4.20	0.18	24.00	1	11714.03
C5	24mROW	0.35	4.20	0.18	24.00	1	8665.96

C6	24mROW	0.35	4.20	0.18	24.00	1	9381.59
C7	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	31.32
C8	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	31.73
C9	TRAPEZOIDAL	0.05	1.05	0.05	22.00	1	38.03
Pipe_1	CIRCULAR	1.35	1.43	0.34	1.35	1	3405.65
Pipe_10	CIRCULAR	0.90	0.64	0.23	0.90	1	1040.01
Pipe_11	CIRCULAR	0.90	0.64	0.23	0.90	1	701.19
Pipe_12	CIRCULAR	0.68	0.36	0.17	0.68	1	325.35
Pipe_13	CIRCULAR	0.60	0.28	0.15	0.60	1	274.61
Pipe_14	CIRCULAR	0.25	0.05	0.06	0.25	1	59.47
Pipe_16	CIRCULAR	0.25	0.05	0.06	0.25	1	59.47
Pipe_19	CIRCULAR	0.25	0.05	0.06	0.25	1	59.47
Pipe_23	CIRCULAR	0.20	0.03	0.05	0.20	1	32.80
Pipe_25	CIRCULAR	0.30	0.07	0.07	0.30	1	96.71
Pipe_41	CIRCULAR	0.20	0.03	0.05	0.20	1	32.80
Pipe_49	CIRCULAR	0.90	0.64	0.23	0.90	1	1384.54
Pipe_50	CIRCULAR	0.90	0.64	0.23	0.90	1	1173.25
Pipe_53	CIRCULAR	0.90	0.64	0.23	0.90	1	701.13
Pipe_76	CIRCULAR	0.30	0.07	0.07	0.30	1	104.71
Pipe_8	CIRCULAR	1.35	1.43	0.34	1.35	1	2729.02
Pipe_9	CIRCULAR	1.35	1.43	0.34	1.35	1	2668.87

****
Transect Summary
****

Transect 24mROW
Area:

0.0004	0.0016	0.0035	0.0062	0.0097
0.0140	0.0191	0.0250	0.0316	0.0390
0.0472	0.0561	0.0659	0.0764	0.0877
0.0998	0.1127	0.1263	0.1407	0.1560
0.1719	0.1888	0.2067	0.2258	0.2457
0.2664	0.2879	0.3102	0.3333	0.3572
0.3818	0.4072	0.4335	0.4605	0.4883
0.5169	0.5463	0.5764	0.6074	0.6392
0.6717	0.7050	0.7391	0.7740	0.8097
0.8462	0.8835	0.9215	0.9604	1.0000

Hrad:

0.0190	0.0380	0.0570	0.0760	0.0949
0.1139	0.1329	0.1519	0.1709	0.1899
0.2089	0.2279	0.2469	0.2659	0.2848
0.3038	0.3228	0.3418	0.3608	0.3798
0.3988	0.4176	0.4354	0.4604	0.4943
0.5264	0.5568	0.5857	0.6131	0.6393
0.6642	0.6881	0.7109	0.7329	0.7539
0.7742	0.7937	0.8126	0.8308	0.8485
0.8656	0.8821	0.8982	0.9139	0.9291
0.9440	0.9585	0.9726	0.9865	1.0000

Width:

0.0195	0.0390	0.0584	0.0779	0.0974
0.1169	0.1364	0.1559	0.1753	0.1948
0.2143	0.2338	0.2533	0.2727	0.2922
0.3117	0.3312	0.3507	0.3701	0.3896
0.4091	0.4340	0.4629	0.4879	0.5076
0.5273	0.5470	0.5667	0.5864	0.6061
0.6258	0.6455	0.6652	0.6849	0.7046
0.7242	0.7439	0.7636	0.7833	0.8030
0.8227	0.8424	0.8621	0.8818	0.9015
0.9212	0.9409	0.9606	0.9803	1.0000

Transect 24mROW_OS

Area:

0.0004	0.0015	0.0035	0.0062	0.0096
0.0139	0.0189	0.0247	0.0312	0.0385
0.0466	0.0555	0.0651	0.0755	0.0867
0.0987	0.1114	0.1249	0.1391	0.1542
0.1700	0.1867	0.2048	0.2244	0.2449
0.2661	0.2881	0.3108	0.3342	0.3585
0.3834	0.4091	0.4356	0.4628	0.4908
0.5195	0.5489	0.5791	0.6101	0.6418
0.6742	0.7074	0.7414	0.7761	0.8115
0.8477	0.8847	0.9224	0.9608	1.0000

Hrad:

0.0191	0.0383	0.0574	0.0765	0.0957
0.1148	0.1339	0.1531	0.1722	0.1913
0.2104	0.2296	0.2487	0.2678	0.2870
0.3061	0.3252	0.3444	0.3635	0.3826

```
            0.4018     0.4205     0.4373     0.4605     0.4929
            0.5237     0.5530     0.5810     0.6077     0.6334
            0.6580     0.6816     0.7043     0.7262     0.7474
            0.7678     0.7875     0.8067     0.8252     0.8432
            0.8607     0.8778     0.8944     0.9105     0.9263
            0.9417     0.9567     0.9715     0.9859     1.0000
Width:
            0.0195     0.0390     0.0584     0.0779     0.0974
            0.1169     0.1364     0.1559     0.1753     0.1948
            0.2143     0.2338     0.2533     0.2728     0.2922
            0.3117     0.3312     0.3507     0.3702     0.3897
            0.4091     0.4394     0.4778     0.5078     0.5268
            0.5457     0.5646     0.5836     0.6025     0.6214
            0.6403     0.6593     0.6782     0.6971     0.7161
            0.7350     0.7539     0.7729     0.7918     0.8107
            0.8296     0.8486     0.8675     0.8864     0.9054
            0.9243     0.9432     0.9621     0.9811     1.0000


****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 11/23/2016 00:00:00
Ending Date .............. 11/23/2016 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... NO
Maximum Trials ........... 8
Number of Threads ........ 8
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
```

```
  Total Precipitation ......         0.468        71.665
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.035         5.433
  Surface Runoff ...........         0.424        64.918
  Final Storage ............         0.009         1.389
  Continuity Error (%) .....        -0.106


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.424         4.238
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         3.996        39.958
  External Outflow .........         4.329        43.289
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.090         0.902
  Continuity Error (%) .....         0.011


  *************************
  Highest Continuity Errors
  *************************
  Node 203B (-9.16%)
  Node 104A-1 (-6.00%)
  Node 104A (2.95%)
  Node 103A-1 (-2.34%)
  Node CB102A-S (-1.60%)


  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link OL1 (56)
  Link C21 (5)
  Link C20 (3)


  *********************************
  Most Frequent Nonconverging Nodes
  *********************************
  Node OF-MJ (0.05%)
  Node OF-MN (0.05%)
  Node U100A-OF (0.05%)
  Node U100B-OF (0.05%)
```

Node U100C-OF (0.05%)

```
*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     1.00 sec
Average Time Step           :     1.00 sec
Maximum Time Step           :     1.00 sec
% of Time in Steady State   :     0.00
Average Iterations per Step :     2.01
% of Steps Not Converging   :     0.05
```

```
***************************
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
BLDG_H	71.66	0.00	0.00	0.00	70.14	0.00	70.14	0.46	323.24	0.979
BLDG_J	71.66	0.00	0.00	0.00	70.16	0.00	70.16	0.04	27.64	0.979
BLDG_K	71.66	0.00	0.00	0.00	70.15	0.00	70.15	0.04	28.47	0.979
BLDG_L	71.66	0.00	0.00	0.00	70.18	0.00	70.18	0.05	37.10	0.979
BLDG_M	71.66	0.00	0.00	0.00	70.18	0.00	70.18	0.06	43.77	0.979
BLDG_N	71.66	0.00	0.00	0.00	70.17	0.00	70.17	0.03	18.68	0.979
C101A	71.66	0.00	0.00	2.51	66.14	1.59	67.74	0.38	274.22	0.945
C102A	71.66	0.00	0.00	0.62	69.15	0.40	69.55	0.29	208.78	0.970
C102B	71.66	0.00	0.00	1.88	67.15	1.20	68.34	0.17	122.59	0.954
C103A	71.66	0.00	0.00	0.00	70.15	0.00	70.15	0.02	15.70	0.979

C103B	71.66	0.00	0.00	0.00	70.15	0.00	70.15	0.02	12.94	0.979
C105A	71.66	0.00	0.00	0.00	70.15	0.00	70.15	0.03	23.84	0.979
C105B	71.66	0.00	0.00	0.00	70.15	0.00	70.15	0.01	9.82	0.979
EX.C100A	71.66	0.00	0.00	10.68	53.16	6.75	59.91	0.08	61.04	0.836
EX.C101A	71.66	0.00	0.00	10.06	54.16	6.34	60.50	0.10	81.21	0.844
EX.C102A	71.66	0.00	0.00	10.07	54.16	6.33	60.49	0.11	83.24	0.844
EX.C103A	71.66	0.00	0.00	10.07	54.16	6.34	60.49	0.10	78.37	0.844
EX.C104A	71.66	0.00	0.00	10.71	53.15	6.71	59.86	0.13	99.20	0.835
EX.C105A	71.66	0.00	0.00	16.50	44.13	10.14	54.27	0.24	202.38	0.757
L106A	71.66	0.00	0.00	0.00	70.21	0.00	70.21	0.02	14.06	0.980
L106B	71.66	0.00	0.00	0.00	70.21	0.00	70.21	0.02	11.37	0.980
L107A	71.66	0.00	0.00	0.00	70.21	0.00	70.21	0.02	11.38	0.980
L107B	71.66	0.00	0.00	0.00	70.21	0.00	70.21	0.10	71.49	0.980
L203A	71.66	0.00	0.00	0.00	70.14	0.00	70.14	0.21	148.30	0.979
L203B	71.66	0.00	0.00	0.00	70.21	0.00	70.21	0.05	32.68	0.980
L203C	71.66	0.00	0.00	0.00	70.19	0.00	70.19	0.04	24.93	0.979
L204A	71.66	0.00	0.00	0.00	70.14	0.00	70.14	0.22	158.04	0.979
L204B	71.66	0.00	0.00	0.00	70.14	0.00	70.14	0.26	184.34	0.979
L205A	71.66	0.00	0.00	5.70	61.13	3.52	64.65	0.24	180.16	0.902
L207A	71.66	0.00	0.00	26.17	30.08	14.80	44.88	0.07	56.27	0.626
R104A	71.66	0.00	0.00	0.00	70.14	0.00	70.14	0.25	178.60	0.979
R104B	71.66	0.00	0.00	0.00	70.14	0.00	70.14	0.00	2.17	0.979
R106A	71.66	0.00	0.00	0.00	70.14	0.00	70.14	0.18	130.01	0.979
U100A	71.66	0.00	0.00	30.85	23.07	17.28	40.35	0.01	8.26	0.563
U100B	71.66	0.00	0.00	31.93	22.06	17.22	39.29	0.03	22.27	0.548

U100C	71.66	0.00	0.00	31.93	22.06	17.24	39.29	0.05	34.09	0.548
UNC-1	71.66	0.00	0.00	0.00	70.15	0.00	70.15	0.01	6.49	0.979
UNC-2	71.66	0.00	0.00	14.15	48.12	8.38	56.50	0.02	16.50	0.788
UNC-3	71.66	0.00	0.00	23.56	34.09	13.31	47.40	0.05	40.87	0.661
UNC-4	71.66	0.00	0.00	13.49	49.12	8.02	57.14	0.02	16.99	0.797

****

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
100	JUNCTION	1.04	1.08	82.81	0	01:02	1.08
101	JUNCTION	1.11	1.15	83.09	0	01:02	1.15
102	JUNCTION	0.96	1.45	86.30	0	03:00	1.44
103	JUNCTION	1.64	1.72	84.37	0	01:01	1.72
104	JUNCTION	2.07	2.16	84.50	0	01:00	2.16
105	JUNCTION	0.38	0.50	84.95	0	01:00	0.50
106	JUNCTION	0.37	0.47	85.66	0	01:00	0.47
106A	JUNCTION	0.53	0.67	87.06	0	01:00	0.67
107	JUNCTION	0.31	0.44	86.87	0	00:53	0.44
201	JUNCTION	1.06	1.56	86.29	0	03:00	1.56
201CB	JUNCTION	0.61	0.70	86.60	0	01:03	0.70
202	JUNCTION	0.68	1.10	86.30	0	02:59	1.10
203	JUNCTION	0.93	1.36	86.30	0	02:59	1.36
204	JUNCTION	0.43	0.56	86.52	0	01:00	0.56
206	JUNCTION	0.33	0.51	87.21	0	01:00	0.51
207	JUNCTION	0.32	0.50	87.50	0	01:00	0.50
207A	JUNCTION	0.59	1.06	87.95	0	01:00	1.05
208	JUNCTION	0.30	0.33	87.31	0	01:22	0.33
EX102	JUNCTION	1.13	1.17	83.41	0	01:01	1.17
EXSTM	JUNCTION	0.09	0.12	84.66	0	01:38	0.12
MH103	JUNCTION	0.74	1.36	86.05	0	01:38	1.36
MH105	JUNCTION	0.69	1.30	86.05	0	01:38	1.30
STC	JUNCTION	0.47	0.56	84.98	0	03:00	0.56
OF-MJ	OUTFALL	0.00	0.04	87.91	0	01:00	0.04
OF-MN	OUTFALL	0.74	0.78	82.77	0	01:02	0.78
U100A-OF	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
U100B-OF	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
U100C-OF	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
100A	STORAGE	0.16	1.84	88.09	0	01:00	1.84

100A-1	STORAGE	0.00	0.00	88.56	0	00:00	0.00
101A	STORAGE	0.44	2.01	88.49	0	01:10	2.01
101A-1	STORAGE	0.01	0.02	88.69	0	01:00	0.02
102A	STORAGE	0.71	2.09	88.65	0	01:27	2.09
102A-1	STORAGE	0.01	0.05	88.74	0	01:11	0.05
103A	STORAGE	0.62	2.08	88.74	0	01:11	2.08
103A-1	STORAGE	0.01	0.06	88.90	0	01:03	0.06
104A	STORAGE	0.68	2.09	88.90	0	01:03	2.09
104A-1	STORAGE	0.01	0.08	89.00	0	01:00	0.08
105A	STORAGE	0.27	2.57	89.01	0	01:00	2.57
107A	STORAGE	0.15	2.01	89.26	0	00:52	2.01
203A	STORAGE	1.22	2.07	89.37	0	01:25	2.07
203B	STORAGE	0.28	2.12	89.42	0	01:00	2.12
203C	STORAGE	0.15	2.13	88.63	0	01:00	2.13
204A	STORAGE	1.31	2.12	89.42	0	01:20	2.12
204B	STORAGE	1.59	2.08	89.38	0	01:41	2.08
205	STORAGE	1.60	2.93	89.42	0	01:10	2.93
BLDG_H-S	STORAGE	0.10	0.15	103.15	0	01:32	0.15
BLDG_J-S	STORAGE	0.06	0.13	103.13	0	01:21	0.13
BLDG_K-S	STORAGE	0.08	0.15	103.15	0	01:30	0.15
BLDG_L-S	STORAGE	0.12	0.16	103.16	0	01:40	0.16
BLDG_M-S	STORAGE	0.08	0.15	103.15	0	01:22	0.15
BLDG_N-S	STORAGE	0.07	0.14	103.14	0	01:21	0.14
CB101A-S	STORAGE	0.19	1.54	88.81	0	01:00	1.54
CB102A-S	STORAGE	0.24	1.61	88.54	0	01:02	1.61
CB102B-S	STORAGE	0.30	1.68	88.50	0	01:12	1.68
CB103A-S	STORAGE	0.64	1.25	86.05	0	01:37	1.25
CB103B-S	STORAGE	0.34	0.57	87.95	0	01:00	0.57
CB105A-S	STORAGE	0.04	0.61	88.13	0	01:00	0.61
CB105B-S	STORAGE	0.55	1.15	86.05	0	01:38	1.15
R104A-S	STORAGE	0.09	0.15	103.15	0	01:29	0.15
R106A-S	STORAGE	0.09	0.15	103.15	0	01:31	0.15
SU7	STORAGE	1.06	1.57	86.29	0	03:00	1.57

```
  ******************
  Node Inflow Summary
  ******************


---------------------------------------------------------------------------------------------------
--------------
                                 Maximum  Maximum                 Lateral
Total        Flow
                                 Lateral    Total  Time of Max      Inflow
Inflow     Balance
                                  Inflow   Inflow   Occurrence      Volume
Volume       Error
  Node                   Type         LPS      LPS  days hr:min    10^6 ltr    10^6
ltr     Percent
```

100	JUNCTION	0.00	2178.58	0	01:02	0	43.2	0.010
101	JUNCTION	91.30	2159.26	0	01:02	1.97	43.2	0.170
102	JUNCTION	0.00	341.48	0	01:01	0	1.9	0.675
103	JUNCTION	43.50	481.95	0	01:00	0.94	7.16	0.240
104	JUNCTION	214.24	392.37	0	01:00	4.63	5.56	0.261
105	JUNCTION	0.00	157.68	0	01:00	0	0.778	0.045
106	JUNCTION	0.00	96.02	0	01:00	0	0.59	0.059
106A	JUNCTION	25.44	25.44	0	01:00	0.036	0.036	1.778
107	JUNCTION	11.38	43.83	0	00:53	0.0161	0.098	0.355
201	JUNCTION	0.00	396.24	0	01:01	0	2.14	0.721
201CB	JUNCTION	0.00	24.06	0	01:03	0	0.147	0.699
202	JUNCTION	0.00	240.81	0	01:01	0	1.48	1.144
203	JUNCTION	0.00	145.40	0	01:00	0	1.18	0.246
204	JUNCTION	0.00	111.70	0	01:00	0	0.872	0.045
206	JUNCTION	0.00	61.56	0	01:00	0	0.151	0.233
207	JUNCTION	0.00	59.49	0	01:00	0	0.111	0.316
207A	JUNCTION	56.27	56.27	0	01:00	0.0727	0.0727	0.979
208	JUNCTION	0.00	2.35	0	01:21	0	0.0264	1.342
EX102	JUNCTION	1500.90	2002.73	0	01:01	32.4	39.7	0.226
EXSTM	JUNCTION	0.00	36.50	0	01:38	0	0.526	0.011
MH103	JUNCTION	0.00	48.56	0	00:59	0	0.527	0.098
MH105	JUNCTION	0.00	35.97	0	00:58	0	0.233	0.014
STC	JUNCTION	0.00	100.54	0	03:00	0	1.47	0.170
OF-MJ	OUTFALL	0.00	48.08	0	01:00	0		

							0.0255	0.000	
OF-MN	OUTFALL	0.00	2178.59	0	01:02	0	43.2	0.000	
U100A-OF	OUTFALL	8.26	8.26	0	01:00	0.0106	0.0106	0.000	
U100B-OF	OUTFALL	22.27	22.27	0	01:00	0.0307	0.0307	0.000	
U100C-OF	OUTFALL	34.09	34.09	0	01:00	0.0469	0.0469	0.000	
100A	STORAGE	67.54	67.54	0	01:00	0.0858	0.0861	-0.001	
100A-1	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
101A	STORAGE	81.21	88.40	0	01:00	0.103	0.113	0.687	
101A-1	STORAGE	16.50	16.50	0	01:00	0.0214	0.0214	-6.319	
102A	STORAGE	83.24	91.93	0	01:00	0.105	0.167	1.046	
102A-1	STORAGE	0.00	54.63	0	01:10	0	0.0499	-1.160	
103A	STORAGE	78.37	131.36	0	01:03	0.0993	0.198	0.575	
103A-1	STORAGE	40.87	133.58	0	01:00	0.0536	0.108	-2.286	
104A	STORAGE	99.20	277.57	0	00:59	0.125	0.22	3.035	
104A-1	STORAGE	0.00	174.69	0	01:00	0	0.0785	-5.663	
105A	STORAGE	202.38	202.38	0	01:00	0.244	0.246	-0.197	
107A	STORAGE	71.49	71.49	0	01:00	0.101	0.101	-0.211	
203A	STORAGE	148.30	165.34	0	01:00	0.21	0.218	0.006	
203B	STORAGE	49.67	49.67	0	01:00	0.0683	0.0683	-8.393	
203C	STORAGE	24.93	24.93	0	01:00	0.0353	0.0354	-0.609	
204A	STORAGE	158.04	158.04	0	01:00	0.224	0.249	-1.406	
204B	STORAGE	184.34	184.34	0	01:00	0.261	0.281	0.004	
205	STORAGE	180.16	180.16	0	01:00	0.242	0.244	3.892	
BLDG_H-S	STORAGE	323.24	323.24	0	01:00	0.457	0.457	0.001	
BLDG_J-S	STORAGE	27.64	27.64	0	01:00	0.0391	0.0391	0.002	
BLDG_K-S	STORAGE	28.47	28.47	0	01:00	0.0403			

							0.0403	0.002
BLDG_L-S	STORAGE	37.10	37.10	0	01:00	0.0525	0.0525	0.004
BLDG_M-S	STORAGE	43.77	43.77	0	01:00	0.0619	0.0619	0.002
BLDG_N-S	STORAGE	18.68	18.68	0	01:00	0.0264	0.0264	0.002
CB101A-S	STORAGE	274.22	284.07	0	01:00	0.378	0.383	1.372
CB102A-S	STORAGE	208.78	395.88	0	01:00	0.293	0.364	-1.576
CB102B-S	STORAGE	122.59	206.08	0	01:00	0.17	0.248	0.007
CB103A-S	STORAGE	15.70	28.64	0	01:00	0.0222	0.0405	0.008
CB103B-S	STORAGE	12.94	12.94	0	01:00	0.0183	0.0183	1.524
CB105A-S	STORAGE	23.84	23.84	0	01:00	0.0337	0.0337	0.005
CB105B-S	STORAGE	9.82	11.25	0	00:58	0.0139	0.016	-0.142
R104A-S	STORAGE	180.78	180.78	0	01:00	0.256	0.256	0.001
R106A-S	STORAGE	130.01	130.01	0	01:00	0.184	0.184	0.001
SU7	STORAGE	0.00	448.82	0	00:55	0	2.12	0.148

****
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
102	JUNCTION	1.76	0.155	2.405
202	JUNCTION	3.38	0.427	1.918
207A	JUNCTION	0.12	0.256	2.235
MH103	JUNCTION	2.31	0.456	3.194
MH105	JUNCTION	1.87	0.356	3.134

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
100A	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	67.48
100A-1	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	0.00
101A	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	20.28
101A-1	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	15.90
102A	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	20.67
102A-1	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	50.35
103A	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	75.27
103A-1	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	106.41
104A	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	126.96
104A-1	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	166.39
105A	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	197.51
107A	0.000	3.4	0.0	0.0	0.002	100.0	0 00:52	72.69
203A	0.042	26.7	0.0	0.0	0.118	75.6	0 01:25	16.37
203B	0.001	8.6	0.0	0.0	0.007	100.0	0 00:55	43.80
203C	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	23.66
204A	0.046	39.3	0.0	0.0	0.117	100.0	0	

```
01:11      33.31
  204B                      0.076   39.3    0.0    0.0       0.168   86.4       0
01:41      16.44
  205                       0.029   32.1    0.0    0.0       0.092  100.0       0
01:01      53.45
  BLDG_H-S                  0.133    7.6    0.0    0.0       0.282   16.0       0
01:32      29.02
  BLDG_J-S                  0.007    3.6    0.0    0.0       0.022   10.8       0
01:21       3.49
  BLDG_K-S                  0.010    6.0    0.0    0.0       0.024   14.5       0
01:30       2.82
  BLDG_L-S                  0.017   10.3    0.0    0.0       0.033   19.7       0
01:40       2.84
  BLDG_M-S                  0.013    5.5    0.0    0.0       0.035   14.8       0
01:22       5.03
  BLDG_N-S                  0.005    3.8    0.0    0.0       0.015   11.3       0
01:21       2.35
  CB101A-S                  0.002    1.7    0.0    0.0       0.034   30.5       0
01:00     275.75
  CB102A-S                  0.003    4.8    0.0    0.0       0.032   55.2       0
01:02     200.06
  CB102B-S                  0.008    7.2    0.0    0.0       0.091   77.6       0
01:12      59.65
  CB103A-S                  0.000   16.9    0.0    0.0       0.000   33.0       0
01:37      12.78
  CB103B-S                  0.000   24.3    0.0    0.0       0.000   41.0       0
01:00      12.94
  CB105A-S                  0.000    2.7    0.0    0.0       0.000   44.5       0
01:00      23.82
  CB105B-S                  0.000    0.2    0.0    0.0       0.000    0.4       0
01:38       1.92
  R104A-S                   0.066    6.6    0.0    0.0       0.154   15.6       0
01:29      18.93
  R106A-S                   0.049    6.8    0.0    0.0       0.111   15.6       0
01:31      12.62
  SU7                       0.765   73.1    0.0    0.0       1.048  100.0       0
02:56      91.39
```

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  ***********************
  Outfall Loading Summary
  ***********************
```

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF-MJ	5.39	21.88	48.08	0.025
OF-MN	99.85	2001.95	2178.59	43.175

U100A-OF	46.93	1.04	8.26	0.011
U100B-OF	48.91	2.90	22.27	0.031
U100C-OF	49.86	4.35	34.09	0.047
System	50.19	2032.13	2283.15	43.289

****
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
C1	CONDUIT	7.27	0	01:00	0.03	0.01	0.47
C10	CONDUIT	9.94	0	01:00	0.22	0.04	0.19
C11	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
C12	CHANNEL	0.00	0	00:00	0.00	0.00	0.05
C13	CHANNEL	48.08	0	01:00	1.02	0.00	0.11
C14	CHANNEL	135.81	0	01:00	0.21	0.02	0.46
C15	CHANNEL	106.30	0	01:01	0.28	0.01	0.51
C16	CHANNEL	54.63	0	01:10	0.11	0.01	0.48
C17	CHANNEL	8.70	0	01:00	0.31	0.00	0.43
C18	CHANNEL	0.00	0	00:00	0.00	0.00	0.30
C19	CONDUIT	239.61	0	01:01	1.26	0.76	1.00
C2	CHANNEL	166.39	0	01:00	0.21	0.02	0.52
C20	CONDUIT	339.21	0	01:01	1.23	0.35	1.00
C21	CONDUIT	448.82	0	00:55	2.33	0.63	1.00
C22	CONDUIT	180.17	0	01:00	0.36	0.24	0.63
C23	CONDUIT	122.17	0	01:02	0.20	3.85	0.60
C24	CONDUIT	1.32	0	01:12	0.00	0.03	0.05
C25	CONDUIT	9.17	0	03:00	1.18	0.02	0.10
C26	CONDUIT	12.78	0	00:59	0.07	0.02	1.00
C27	CONDUIT	19.80	0	00:59	0.26	0.02	1.00
C28	CONDUIT	6.05	0	01:13	0.11	0.01	1.00
C3	CHANNEL	40.26	0	00:53	1.99	0.01	0.19
C30	CONDUIT	36.50	0	01:38	1.13	0.12	0.26
C31	CHANNEL	7.08	0	01:04	0.19	0.00	0.13
C32	CHANNEL	0.00	0	00:00	0.00	0.00	0.09
C4	CHANNEL	106.41	0	01:03	0.38	0.01	0.48
C5	CHANNEL	50.35	0	01:11	0.07	0.01	0.46
C6	CHANNEL	7.20	0	01:00	0.26	0.00	0.32
C7	CONDUIT	34.93	0	01:10	0.10	1.12	0.37
C8	CONDUIT	16.73	0	01:21	0.08	0.53	0.22
C9	CONDUIT	17.28	0	01:00	0.08	0.45	0.21
Pipe_1	CONDUIT	2178.59	0	01:02	2.52	0.64	0.58
Pipe_10	CONDUIT	481.60	0	01:01	1.68	0.46	0.46
Pipe_11	CONDUIT	392.27	0	01:00	1.27	0.56	0.49

Pipe_12	CONDUIT	145.30	0	01:01	0.68	0.45	1.00
Pipe_13	CONDUIT	110.43	0	01:00	1.06	0.40	0.40
Pipe_14	CONDUIT	60.74	0	01:00	1.41	1.02	0.82
Pipe_16	CONDUIT	58.90	0	01:00	1.41	0.99	0.80
Pipe_19	CONDUIT	2.35	0	01:22	0.59	0.04	0.14
Pipe_23	CONDUIT	25.44	0	01:00	1.16	0.78	0.66
Pipe_25	CONDUIT	43.84	0	00:53	1.34	0.45	0.47
Pipe_41	CONDUIT	56.26	0	01:00	1.81	1.72	0.97
Pipe_49	CONDUIT	157.49	0	01:00	1.45	0.11	0.23
Pipe_50	CONDUIT	95.98	0	01:00	1.11	0.08	0.19
Pipe_53	CONDUIT	100.40	0	03:00	0.83	0.14	0.24
Pipe_76	CONDUIT	24.05	0	01:03	1.16	0.23	0.60
Pipe_8	CONDUIT	2159.29	0	01:02	2.40	0.79	0.60
Pipe_9	CONDUIT	2002.61	0	01:01	2.11	0.75	0.63
105A-O	ORIFICE	61.70	0	01:00			1.00
107-O	ORIFICE	32.48	0	00:52			1.00
201-O	ORIFICE	91.39	0	03:00			1.00
203A-O	ORIFICE	16.37	0	01:25			1.00
203B-O	ORIFICE	16.58	0	01:00			1.00
204A-O	ORIFICE	16.58	0	01:20			1.00
204B-O	ORIFICE	16.44	0	01:41			1.00
205-O	ORIFICE	18.52	0	01:10			1.00
C29	ORIFICE	36.50	0	01:38			1.00
OL1	ORIFICE	16.40	0	00:54			1.00
OR1	ORIFICE	95.58	0	01:00			1.00
OR2	ORIFICE	77.89	0	01:02			1.00
OR3	ORIFICE	58.33	0	01:12			1.00
OR6	ORIFICE	23.82	0	01:00			1.00
OR7	ORIFICE	12.94	0	01:00			1.00
100A-O	DUMMY	9.70	0	01:00			
100A-O1	DUMMY	9.70	0	01:00			
101A-O	DUMMY	10.14	0	01:10			
101A-O1	DUMMY	10.14	0	01:10			
102A-O	DUMMY	10.33	0	01:27			
102A-O1	DUMMY	10.33	0	01:27			
103A-O	DUMMY	10.32	0	01:11			
103A-O1	DUMMY	10.32	0	01:11			
104A-O	DUMMY	10.35	0	01:03			
104A-O1	DUMMY	10.35	0	01:03			
BLDG_H_OUT	DUMMY	29.02	0	01:12			
BLDG_J_OUT	DUMMY	3.49	0	01:21			
BLDG_K_OUT	DUMMY	2.82	0	01:30			
BLDG_L_OUT	DUMMY	2.84	0	01:01			
BLDG_M_OUT	DUMMY	5.03	0	01:22			
BLDG_N_OUT	DUMMY	2.35	0	01:21			
OR4	DUMMY	18.93	0	01:13			
OR5	DUMMY	12.62	0	01:14			

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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
C1	1.00	0.91	0.06	0.00	0.03	0.00	0.00	0.00	0.85	0.00
C10	1.00	0.93	0.00	0.00	0.03	0.00	0.00	0.03	0.02	0.00
C11	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C12	1.00	0.95	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C13	1.00	0.95	0.00	0.00	0.00	0.05	0.00	0.00	0.01	0.00
C14	1.00	0.14	0.00	0.00	0.07	0.00	0.00	0.78	0.02	0.00
C15	1.00	0.04	0.00	0.00	0.31	0.00	0.00	0.65	0.22	0.00
C16	1.00	0.14	0.03	0.00	0.26	0.00	0.00	0.57	0.16	0.00
C17	1.00	0.04	0.00	0.00	0.33	0.00	0.00	0.63	0.33	0.00
C18	1.00	0.80	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C19	1.00	0.04	0.00	0.00	0.81	0.00	0.00	0.15	0.00	0.00
C2	1.00	0.14	0.01	0.00	0.31	0.00	0.00	0.55	0.31	0.00
C20	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.01	0.00
C21	1.00	0.04	0.00	0.00	0.86	0.10	0.00	0.00	0.01	0.00
C22	1.00	0.91	0.04	0.00	0.04	0.00	0.00	0.00	0.84	0.00
C23	1.00	0.91	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00
C24	1.00	0.98	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
C25	1.00	0.97	0.00	0.00	0.00	0.00	0.00	0.03	0.00	

										0.00
C26	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.07	0.00
C27	1.00	0.04	0.01	0.00	0.95	0.00	0.00	0.00	0.07	0.00
C28	1.00	0.04	0.00	0.00	0.95	0.00	0.00	0.01	0.12	0.00
C3	1.00	0.15	0.83	0.00	0.01	0.02	0.00	0.00	0.85	0.00
C30	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C31	1.00	0.04	0.95	0.00	0.00	0.00	0.01	0.00	0.00	0.00
C32	1.00	0.04	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	1.00	0.04	0.00	0.00	0.29	0.00	0.00	0.67	0.29	0.00
C5	1.00	0.14	0.03	0.00	0.30	0.00	0.00	0.52	0.30	0.00
C6	1.00	0.04	0.00	0.00	0.20	0.00	0.00	0.76	0.20	0.00
C7	1.00	0.82	0.00	0.00	0.12	0.00	0.03	0.03	0.00	0.00
C8	1.00	0.84	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00
C9	1.00	0.94	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
Pipe_1	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.01	0.00
Pipe_10	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_11	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.00	0.00
Pipe_12	1.00	0.04	0.01	0.00	0.95	0.00	0.00	0.00	0.00	0.00
Pipe_13	1.00	0.05	0.00	0.00	0.03	0.00	0.00	0.92	0.00	0.00
Pipe_14	1.00	0.07	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00
Pipe_16	1.00	0.07	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00
Pipe_19	1.00	0.08	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00
Pipe_23	1.00	0.07	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00
Pipe_25	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00
Pipe_41	1.00	0.07	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00
Pipe_49	1.00	0.00	0.05	0.00	0.03	0.00	0.00	0.91	0.03	

										0.00
Pipe_50	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00
Pipe_53	1.00	0.09	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00
Pipe_76	1.00	0.06	0.00	0.00	0.54	0.01	0.00	0.38	0.55	0.00
Pipe_8	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Pipe_9	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

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Conduit Surcharge Summary
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Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C19	3.38	3.38	3.80	0.01	0.01
C20	3.91	3.91	4.37	0.01	0.01
C21	4.37	4.37	4.44	0.01	0.01
C23	0.01	0.01	0.01	0.24	0.01
C26	1.83	1.83	2.31	0.01	0.01
C27	1.87	1.87	2.31	0.01	0.01
C28	1.38	1.38	1.87	0.01	0.01
C7	0.01	0.01	0.01	0.06	0.01
Pipe_12	3.16	3.16	3.38	0.01	0.01
Pipe_14	0.01	0.01	0.01	0.01	0.01
Pipe_41	0.01	0.12	0.01	0.16	0.01
Pipe_76	0.01	0.01	1.76	0.01	0.01

Analysis begun on: Mon Apr 21 12:04:26 2025
Analysis ended on: Mon Apr 21 12:04:29 2025
Total elapsed time: 00:00:03

C.4 Background Report Excepts (Storm Drainage)

Line/Vanguard Intersection (that controls the flow from the N2 pond and the Tenth Line road interconnect).

The release rate from the BCIP was determined by providing a 5 year level of service for the road corridors and controlling the flow from the development parcels. Accounting for the 10 year flow contribution from the Innes and Mer Bleue road corridors and flow contributions from the remainder of the tributary area, it was found that new developments within the BCIP would have to be controlled to 50L/s/ha.

Tributary areas and peak flow contributions to the Wildflower Drive trunk sewer at Innes Road are summarized in **Table 3-1**.

TABLE 3-1
Tributary Areas and Peak Flow Contributions to the Wildflower Trunk Sewer at Innes Road – Major Flows

Tributary Area	Area (ha)	Controlled Flow Rate	
		L/s/ha	Total (L/s)
The BCIP development: • Future Lots (Phases 1 & 2) • Roads (Exist & Future)	 63.8 5.19	 50 100	 3190 519
Innes Road	3.7	235*	869.5
Mer Bleue Road	0.86	111	95.5
Existing Urban Block (south west corner of Innes and Mer Bleue Roads)	1.20	111	133.2
Existing Urban area north of Innes Road west of Prestwick Drive	2.14	150	321
The outflow from N2 SWM pond and Tenth Line Road storm sewer at Vanguard Drive	N/A	N/A	820
Total	76.89		5948

The total peak flow contribution to the Wildflower storm trunk at Innes Road of 5948L/s, shown in **Table 3-1**, represents the 100 year storm condition. For a 5 year storm, the peak flow contribution as shown in the Rational Method calculation provided in **Appendix G** is 5663L/s, which is less than the allowable flow of 5948L/s.

Areas and flow contributions to the BCIP – Innes Road trunk sewer between Tenth Line Road and Wildflower Drive are summarized in **Table 3-2**.

The required BCIP/Innes Road storm trunk size is a 1200mm diameter at Tenth Line Road and increases to a 1650mm on Innes Road at the outlet to Wildflower Drive trunk sewer. The sewer depth varies from 6.0m at Tenth Line Road to 7.2m at Wildflower Drive. The routing of the storm sewers through the BCIP for the preferred concept plan is shown on **Figure 3-3**.

TABLE 3-2
Tributary Areas and Peak Flow Contributions to the BCIP

Tributary Area	Area (ha)	Controlled Flow Rate	
		L/s/ha	Total (L/s)
The BCIP development:			
• Future Lots (Phase 1) Including Loblaws Site	25.7	50	1285
• Roads (Exist & Future Phase 1)	1.74	100	174
Innes Road Prestwick Dr. to Wildflower Dr.	1.88	235	441.8
Existing Urban area north of Innes Road west of Prestwick Drive	2.14	150	321
The outflow from N2 SWM pond and Tenth Line Road storm sewer at Vanguard Drive	N/A	N/A	820
Total	**31.46**		**3042**

3.1.2.4 Major System

The developments within the BCIP are required to provide onsite storage to reduce the 100 year storm flow to 50L/s/ha. The onsite storage volume requirement for the 100 year storm is 310m^3/ha based on the release rate of 50L/s/ha and an imperviousness ratio of 0.7.

The roads within the BCIP are to be designed to maximize the amount of storage that can be provided at sag points to a maximum of 130m^3/ha. The effective road slopes should be designed to allow major system flow to overflow towards Innes Road or Mer Bleue Road. Inlet control devices are required on catch basins to control sewer flows to the 5 year level of 100L/s/ha. Given that the major system flow from the BCIP area cannot flow across Innes Road, it is proposed to store excess volume in the ditches south of Innes Road and east of Mer Bleue Road. A DDSWMM assessment of the BCIP roadway drainage system was undertaken and it was found that approximately 1330m^3 of excess runoff would be generated during the July 1st, 1979 storm event. If 130m^3/ha of storage is provided in the sag points, 900m^3 of storage will be provided along the 6.93ha of internal roads. The remaining 430m^3 will therefore need to be stored in the ditches south of Innes Road.

The City's current design guidelines, published in November 2004, dictate that the minor system within arterial roads be designed to handle the 10 year peak flow and the flow from residential developments to the minor system be restricted to 85L/s/ha. (Refer to **Appendix H** for a copy of the technical memo explaining the basis for the 85L/s/ha.) As the BCIP storm flows were approved prior to the release of the November 2004 guidelines, the criteria used in sizing the collection system do not match the current guidelines. In addition, as it is intended to upgrade

Mer Bleue Road in 2008, the detailed design of the minor system along Mer Bleue must account for the proposed upgrade.

3.1.2.5 Downstream Impacts

3.1.2.5.1 Cardinal Farm Developments

The Hydraulic Gradeline (HGL) elevations in the Wildflower Drive trunk, which services the Cardinal Farm development, were calculated to determine the impact of major storm flow contributions from the sewershed south of and including Innes Road. The allowable release rates in **Table 3-1** were applied in calculating the flows and HGL elevations in XPSWMM. Peak flows from the Cardinal Farm development, which is tributary to the sewer system, were increased by 20 % for the 5 year event to account for the increased catch basin capture rates during the 100 year storm.

The results of the HGL analysis indicated there is no significant sewer surcharge during the 100 year storm. The maximum flow contribution to the Wildflower trunk from the catchment area south of and including Innes Road is 5.9m^3/s (major storm), which is close to the 5 year allowable flow of 6.16m^3/s. (Refer to **Appendix I** for modeling details.)

3.1.2.5.2 Bilberry Creek

The existing SWM pond at Avenue Des Epinettes, constructed in 1986 was sized to control the flows from the BCIP and the Cardinal Farm development, as well as address erosion and flooding concerns in Bilberry Creek. Therefore, no negative impacts to Bilberry Creek are expected.

Similar to the existing properties within Phase 1 of the BCIP, water quality control measures are to be implemented as part of the City's development site plan control process. It is also of note that the N2 SWM pond provides additional treatment to allow areas downstream of the pond to be released untreated. Therefore, water quality control measures for the section of Innes Road draining to Wildflower and Prestwick trunks are not required.

3.1.2.6 Cost Apportionment – BCIP/Innes Road Storm Trunk

The cost sharing analysis for the BCIP / Innes Road trunk sewer was completed to delineate the costs associated between both the Innes Road and BCIP drainage catchments. The cost sharing considers not only the areas draining directly to the BCIP / Innes Road trunk but also the lands that were allocated capacity in the Prestwick Drive trunk, with the construction of the BCIP / Innes Road trunk. The cost sharing is assessed based on the peak flow contribution from the tributary areas considering the allowable flow to the Prestwick Drive trunk and the total flow from the areas directly tributary to the BCIP – Innes Road trunk sewer. The allowable flow to the Prestwick Drive trunk sewer is 2.6 m^3/s and the total flow contribution to the BCIP – Innes Road trunk sewer is 3.65 m^3/s. Flow contributions from the Innes Road (including Tenth Line Road) and the existing and proposed developments are summarized in **Table 3-3**.

4.0 Storm Drainage

4.1 STORM SEWER CRITERIA

Criteria were established by combining current design practices outlined by the City of Ottawa guidelines (2004) and the supporting servicing studies for the Pharand Lands and Bilberry Creek industrial Park (BCIP). Where the criteria conflicted, the BCIP & Pharand Lands report criteria were given precedence. The following summarizes the criteria, with the source of each criterion indicated in italics:

General

- Use of the dual drainage principle *(City of Ottawa)*
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff *(City of Ottawa)*
- Assess impact of 5 and 100 year storm (using 3-hour Chicago Storm distribution and City of Ottawa IDF parameters) (*City of Ottawa, Pharand/BCIP Reports*)

Storm Sewer & Inlet Controls

- Size storm sewers to convey 5 year storm event under free-flow conditions using 2004 City of Ottawa I-D-F parameters *(City of Ottawa)*
- 100 year Hydraulic Grade Line (HGL) analysis to be conducted using the boundary condition at outlet of 81.342 m (from BCIP report, Appendix I for node W19) *(Pharand/BCIP Reports)*
- Overall inlet rate to sewer to be restricted to 50 L/s/ha *(Pharand/BCIP Reports)*
- Sewer inlet rate for roads within the BCIP to be restricted to 100 L/s/ha *(Pharand/BCIP Reports)*

Surface Storage & Overland Flow

- No overland flow is allowed from internal sites, however overland flow is expected to occur along roadways
- Maximum 100 year ponding depth of 0.30 m *(City of Ottawa)*
- Sites to provide minimum storage of 200 m^3/ha or sufficient storage to contain 100 year storm on-site, whichever of the two is greater (*Pharand/BCIP Reports*)
- Road storage to be maximized where possible to provide up to 130 m^3/ha of storage (*Pharand/BCIP Reports*)

- Standing water depths at road sags not to cause surface flooding in any building or structure *(City of Ottawa)*
- Maximum ponding spill point elevation to be at least 0.30m below adjacent at-units grades *(City of Ottawa)*
- Subdrains required in swales where longitudinal gradient is less than 1.5% *(City of Ottawa)*
- Provide adequate emergency overflow conveyance off-site (*City of Ottawa*)

4.2 STORMWATER MANAGEMENT

The following sections describe the stormwater management (SWM) design for the Pharand Lands Development in the context of the background documents and governing criteria.

4.2.1 Proposed Conditions

The proposed development will consist of commercial buildings complete with associated transportation and servicing infrastructure. The various commercial blocks are bisected by the proposed internal roadways which connect to the intersection of Wildflower Drive and Innes Road.

The overall drainage area to the proposed outlet sewer is 41.2 ha: Future Development Lands (16.8 ha), Area Tributary to Proposed Dry Pond (9.6 ha), Development block STOR168 (4.3 ha), Remaining Site Area (10.4 ha). At the required rate of 50 L/s/ha, the peak allowable rate at the outlet is 2,060 L/s.

Future development areas (future blocks) have been considered for the purposes of this stormwater management analysis. The previous Stantec Pharand Lands report quantified this future area to the South as 15.2 ha, however using more detailed CAD areas it has been found that this area is actually 16.83 ha in size. For location and extent of this future development block, refer to excerpts of the previous Stantec report in **Appendix D.1**. The future development block will be serviced through the storm sewer trunk at upstream manhole MH200.

It is expected that development designs for these future blocks will be submitted to the City of Ottawa under separate applications. Stormwater Management criteria for the future blocks remain the same as in the BCIP and Pharand lands reports: sites are to provide minimum 200 m^3/ha of active storage in the 100 year event or sufficient storage to contain the 100 year storm on-site, whichever of the two criteria is greater. Inflow rates to the minor system are not to exceed 50 L/s/ha. Precise ponding volumes and final ICD sizes should be determined at the detailed design stage.

It is proposed that a portion of the proposed site drain unrestricted to a storm sewer, which is connected by reverse sloped pipe to a dry pond. An orifice will be placed on the sewer at MH110, causing water to back-up into the proposed dry pond. The orifice will not be in-line with the main trunk that runs from the Future Development Lands in the south to the intersection of Innes Road and Wildflower Drive. See **Figure 4.1** below, showing the proposed site subcatchments, with the proposed area which is tributary to the dry pond highlighted in blue.

The previous storm sewer design included conveying a portion of the Vanguard Road stormwater (drainage areas 132 and 139) through the site. At the City's request this design has been modified to convey these flows to the existing manhole in Vanguard Road. Analysis of the existing storm sewer design indicated that the downstream system (existing nodes 15 to 13) has capacity for 1671L/s and the proposed design would result in an actual flow rate of 1591 L/s. Therefore, there is sufficient capacity within the existing system to accommodate the additional flows from Vanguard Road.

Figure 4.1: PCSWMM Model Subcatchments in light green (area in blue is tributary to the proposed dry pond, area = 9.6 ha)

4.2.2 Design Methodology

The design methodology for the SWM component of the development is as follows:

- Restrict inflows to the sewer to a rate of 50 L/s/ha or less for sites via orifices
- Road CBs to be interconnected and controlled with a 100 mm circular diameter orifice per catchbasin pair, except in areas upstream of MH110 (these areas are tributary to the dry pond and should not have inlet restrictors)
- Produce a combined hydrologic/hydraulic model to provide minor system hydrographs and to model the storm sewer system
- Provide a preliminary volume total for the proposed dry pond based on the proposed outline
- Identify criteria and constraints for development blocks

The roadways are designed using the "dual drainage" principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 5 year design storm and runoff from larger events is to be conveyed by both minor (pipe) and major (overland) channels, such as roadways and walkways, safely off site without impacting proposed or existing downstream properties. A separate DDSWMM model was prepared as part of the BCIP report, dealing with major system flows from the internal roadways in the BCIP. Inlet and storage rates in the roadways should meet BCIP criteria; overflows should be directed to Innes Road, where they are to be stored in roadside ditches. See the BCIP report excerpts included in **Appendix D** for more information. Since the inlet rates for roadways are being met (and exceeded) in this analysis, and that an overland flow model for the roadways has been dealt with by others, the overland routes and downstream off-site storage have not been modeled in this analysis.

Solid covers should be installed on all manholes located in ponding areas to limit inflows to the minor system to that of the ICD.

Drawing SD-1 outlines the proposed storm sewer alignment, ICD locations, drainage divides and labels. The major flow from most of the site is contained within each block; right-of-ways are allowed to have major system flow beyond the five year event. Regardless, all areas will be graded to safely convey extreme flows off-site via engineered (overland) channels such as roadways and walkways. The majority of the site is graded to overflow to Innes Road, however some portions in the east will be directed to Vanguard Extension.

4.2.3 Building Storm Service Surcharging

Because the proposed buildings are slab-on-grade and will not have any basements, flooding will not be an issue. However, the City has expressed concerns regarding building storm services that are attached to the sewer which surcharges into the proposed dry pond. We have agreed to perform SWM modeling using several different storms to determine the maximum HGL (excluding the initial wave pulse). The pipe surcharge is due to water accumulating in the dry pond and is not permanent – the dry pond drains down over several hours. Six storm distributions were run at the 100 year return period: 3, 6, and 12 hour Chicago storms, and 6, 12, and 24 hour SCS storms. The HGLs from the 6 hour SCS storm were used to set the minimum storm service inverts for buildings S and A. HGL for the services to buildings S and A were 86.94 m and 87.14 m for building S and building A, respectively. It is therefore proposed that the storm services to these buildings have inverts not lower than these values and that a similar approach be taken for any future buildings proposed at the detailed design stage, unless these buildings are to have underground parking, in which case they will need to be sump pumped. Any parking garages will be fitted with backflow preventers and pumps, as is standard practice in the City of Ottawa. See **Appendix B.4** for the results of the SWM analysis, or the SWM modeling files that have been included on the CD attached to this report.

4.3 HYDROLOGY / HYDRAULICS

A preliminary integrated hydrologic/hydraulic modeling exercise was completed with PCSWMM, accounting for the sites area and future lands to the south.

Surface storage amounts based on the Pharand and BCIP reports were originally 200 m^3/ha for sites, 130 m^3/ha for right-of-ways. Because the criteria in this report is to provide either these above rates or sufficient storage to contain the 100 year storm on-site, these rates were multiplied by three (an arbitrary number). It is intended that if storage greater than 200 m^3/ha occurs, this preliminary overestimate of storage will allow the total quantity of stored volume to be identified. Actual per hectare rates of required storage are reported later in this report.

The following assumptions were applied to the preliminary PCSWMM model:

- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values
- 3-hour Chicago Storm distribution for 5 & 100 Year Analysis; July 1, 1979 City of Ottawa Historical Storm used to assess impact of major storm
- Imperviousness assumed as 100% for all site areas excluding the proposed pond and vacant strip of land to its north (these areas were assumed to have 0% imperviousness)
- Subcatchment areas and segment lengths defined from conceptual grading.
- Subcatchment width equal to catchment area divided by subcatchment flow length. Site inflows restricted with inlet-control devices (ICDs) as necessary to meet inlet rate criterion.
- Storage amounts over-predicted to ensure capture of total 'actual storage' volume

Drawing SD-1 presents the proposed subcatchments used in the analysis of the proposed development. The preliminary grading plans are also enclosed for review.

For the purposes of this analysis, the Future Development Lands to the south and the development block in storm area ST168 are considered to be self contained. Hydrographs for area ST168 were generated and routed through that site's storage, with a flow restriction at 50 L/s/ha. The Future Development Land to the south was represented by a static constant inflow of 841.6 L/s at node 200 (i.e. 16.833 ha at 50 L/s/ha).

Zurn Flo-Control Roof Drains are proposed for the flat roofs of the buildings on-site. A brief modified rational method analysis was used to calculate the number of drains required for the buildings, see **Appendix B** for the results. The stage versus flow and storage curves calculated in this analysis were input into the PCSWMM model. Water depths on roofs during the 100 year storm do not exceed 75 mm.

The BCIP proposed inlet restriction rate for the roadways is 100 L/s/ha. It was found that for most road catchments, this could be achieved using a 100 mm circular orifice. In order to meet the criterion for some smaller catchments however, an orifice smaller than the minimum allowable City size would be required; this was not considered to be a viable option. For simplification of construction installation, it is proposed to use this ICD size in all interconnected roadway CBs. Any over-contribution of flow has been offset by reducing the flow from the dry pond tributary area.

The list of proposed inlet control devices is presented below in **Table 4.1**.

Table 4.1: Preliminary Inlet Control Device Schedule

Tributary Area IDs	Located in Structure:	Install Type	Orifice Size, Circular Diameter (mm)	Peak Flow Rate (L/s)
Control for areas to pond	110	PLUG	200	216
ST170, ST174, RF181, RF179, RF176, RF177	167 (on u/s inv. to STM170)	FRAME	175	125
ST199	206	PLUG	100	39
ST167	184	PLUG	100	34
ST197	208	PLUG	100	39
ST188	193	PLUG	100	31
ST190	191	PLUG	100	45
ST106B	228	PLUG	100	37
ST106	226	PLUG	100	35
ST165	212	PLUG	100	34
CB203	201	PLUG	95	36
CB215	214	PLUG	95	33

Tributary Area IDs	Located in Structure:	Install Type	Orifice Size, Circular Diameter (mm)	Peak Flow Rate (L/s)
ST230	230	PLUG	75	32
ST109	217	PLUG	75	30
ST106A	225	PLUG	75	18
CB223, CB224, ST219, CB222, RF220	218	PLUG	150	102

Table 4.2 summarizes the subcatchment areas, node outlets, and peak runoff rates for the proposed development during the 100 year, 3-hour Chicago storm, as well as maximum required storage rates. **Appendix B** summarizes the modeling results for the subject area for the 100 year storm.

Table 4.2: PCSWMM Results (100 Year Storm)

Area Group	Name	Area (ha)	Peak Runoff (L/s)	Outlet	Storage Node	Maximum Storage (cu.m)	Orifice Size, Circular Diameter (mm)	Peak Flow Rate (L/s)
ROW	ST106B	0.088	43	228	228	3	100	37
	ST106	0.324	156	226	226	84	100	35
	ST199	0.369	169	206	206	89	100	39
	ST197	0.385	175	208	208	99	100	39
	ST190	0.108	53	191	191	2	100	45
	ST188	0.383	174	193	193	110	100	31
	ST167	0.341	150	184	184	88	100	34
	ST165	0.483	225	212	212	157	100	34
To_Pond	ST154	0.783	366	154	143	2635	0	0
	CB156	0.479	234	156				
	ST151	0.148	73	151				
	ST135A	0.932	441	136				
	ST132	1.912	907	140				
	ST128A	1.793	849	146				
	ST128	0.137	62	128				
	ST123	0.604	272	123				

Area Group	Name	Area (ha)	Peak Runoff (L/s)	Outlet	Storage Node	Maximum Storage (cu.m)	Orifice Size, Circular Diameter (mm)	Peak Flow Rate (L/s)
	ST118	0.375	173	118				
	CB160	0.076	37	160				
	POND	0.549	68	143				
	FREE_1	0.175	47	POND				
	RF150A	0.271	133	STOR150	STOR150	559		
	RF150	0.886	430	STOR150				
	RF114	0.178	88	STOR114	STOR114	87		
Parcels	ST109	0.419	206	217	217	138	75	30
	ST230	0.401	190	230	230	122	75	32
	ST106A	0.325	156	225	225	116	75	18
	RF231	0.030	15	STOR231	STOR231	15	Zurn	1
	RF211	0.419	208	STOR211	STOR211	204	Zurn	16
	RF210	0.046	23	STOR210	STOR210	23	Zurn	2
	RF195	0.289	143	STOR195	STOR195	141	Zurn	11
	CB215	0.782	350	214	214	309	95	33
	CB203	0.996	414	201	201	406	95	36
Future	ST168	4.328	1700	STOR1	STOR1	1546	TBD	216
NW corner of site, controlled at MH174	ST174	1.159	558	172	169	771	0	0
	ST170	0.983	472	170				
	RF181	0.310	154	STOR181	STOR181	151		
	RF179	0.035	17	STOR179	STOR179	17		
	RF177	0.046	23	STOR177	STOR177	23		
	RF176	0.067	33	STOR176	STOR176	33		
NE corner of site, controlled at MH218	RF220	0.237	117	STOR220	STOR220	115	0	0
	ST219	0.234	114	219	218	454		
	CB224	0.198	98	224				
	CB223	0.338	166	223				
	CB222	0.614	301	222				

Tot. Area: **24.035** **ha**

Max Storage: **8497.52** **cu.m**
Max. Storage per ha: **353.5** **cu.m/ha**

Total Peak Runoff: **10785** **L/s**

Maximum Inflow (L/s): **841.6**

Total peak runoff per hectare: **448.7** **L/s/ha**

Maximum Inflow per ha (L/s/ha): **35.0**

Maximum ICD Inflow from Site (L/s):	**936**	**L/s**
External Flow From Industrial Lands to South (L/s):	**842**	**L/s**
Peak Maximum Inflow with ICDs & External:	**1777**	**L/s**
Actual Peak Flow at outlet from model:	**1946**	**L/s**
Allowable flow:	**2060**	**L/s**
Amount that actual peak flow is below allowable flow:	**114**	**L/s**

As can be seen from the table, the expected required storage rate per hectare for the proposed site is higher than previously estimated (310 m^3/ha from BCIP report versus 354 cu.m/ha). This is mostly due to the change in imperviousness: the subject sites were previously anticipated to be 70% impervious, but now are effectively 100% impervious. Some sites may not be able to contain all of the proposed runoff in surface storage. In these cases, either underground storage or volume reduction methods would be required to meet the criterion.

The proposed dry pond peaks at 0.76 m in depth during the 100 year 3 hour Chicago storm event (2,635 cu.m). This is below the 2.0 m allowable maximum depth the Ministry of the Environment specifies. A detailed pond design should be prepared at the detailed design stage. A preliminary area and depth has been shown on **Drawing GP-1**, which was used in this analysis.

In future, further storage could be gained by placing inlet controls on sites within the dry pond tributary area. Standard practice in the City of Ottawa is to avoid inlet control devices in series such as this, however because the potential storage volumes are at different elevations, ICDs in series would be necessary to take advantage of all of the available storage. Storing more runoff on the individual sites within the dry pond tributary area would reduce the size of the dry pond.

Table 4.3 below presents the peak outflow rates to the trunk sewer on Innes Road for each of the modeled scenarios. During all scenarios, the peak flow rate is below the allowable rate of 2,060 L/s.

Table 4.3: Scenario Peak Outflow Rates

	100 Year, 3 Hour Chicago Storm	**5 Year, 3 Hour Chicago Storm**	**July 1, 1979 Historical Storm**
Peak Outflow Rate (L/s) to Innes Road	1946	1834	1905

Peak Outlet Rate per Hectare (L/s/ha)	48	45	47

The City of Ottawa normally requires that during the major storm event, the maximum hydraulic grade line (HGL) be kept at least 0.30 m below the underside-of-footing (USF) of any adjacent units connected to the storm sewer. There are no units with USFs proposed in this commercial development.

Appendix B summarizes the results of the hydraulic modeling and output files for the subject site area during the 100 year storm event. All modeling files and results are contained on the CD enclosed with this report.

C.5 StormTech Sizing Report

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADS
Advanced Drainage Systems, Inc.

ADS SiteAssist™
FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

160402122

OTTAWA, ON, CANADA

MC-7200 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-7200.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 75 mm (3").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.
10. MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE. DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
11. ADS DOES NOT DESIGN OR PROVIDE MEMBRANE LINER SYSTEMS. TO MINIMIZE THE LEAKAGE POTENTIAL OF LINER SYSTEMS, THE MEMBRANE LINER SYSTEM SHOULD BE DESIGNED BY A KNOWLEDGEABLE GEOTEXTILE PROFESSIONAL AND INSTALLED BY A QUALIFIED CONTRACTOR.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-7200 CHAMBER SYSTEM

1. STORMTECH MC-7200 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 230 mm (9") SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 300 mm (12") INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE; AASHTO M43 #3, 357, 4, 467, 5, 56, OR 57.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 300 mm (12") BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-7200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-7200 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-7200 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

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

CONTACT STORMTECH AT 1-800-821-6710 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

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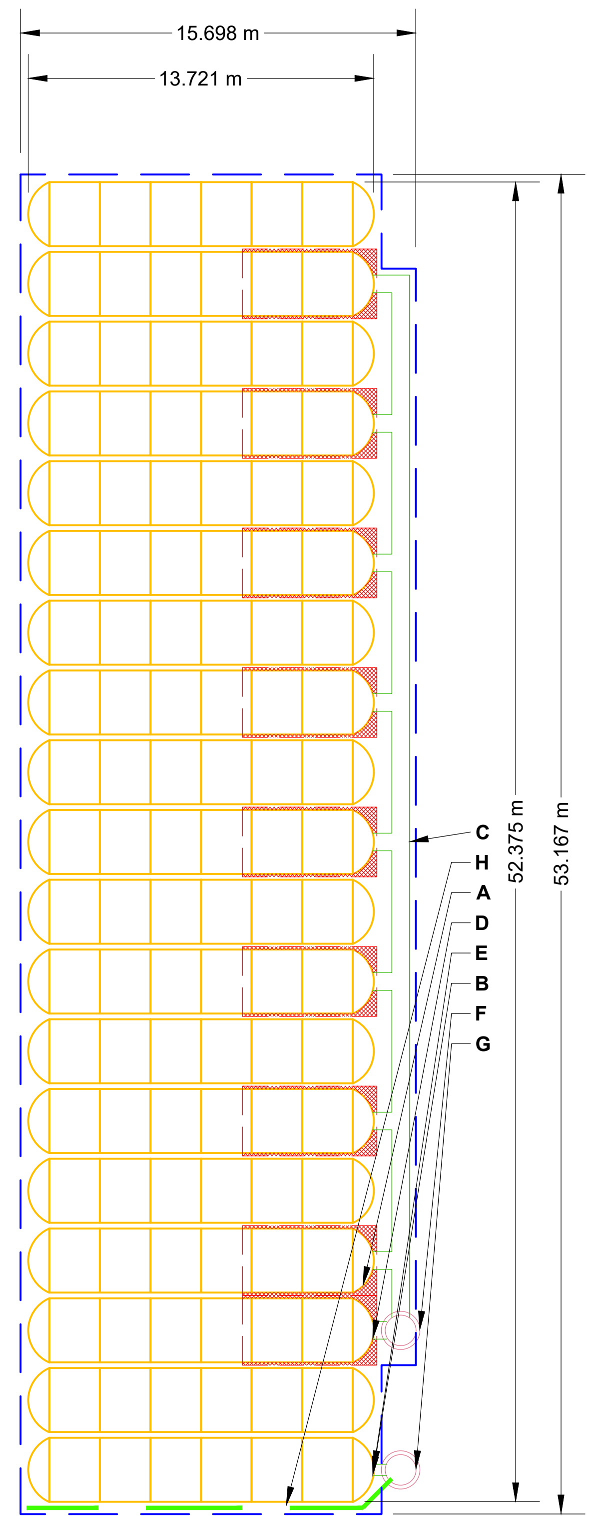
PROPOSED LAYOUT	
114	STORMTECH MC-7200 CHAMBERS
38	STORMTECH MC-7200 END CAPS
305	STONE ABOVE (mm)
229	STONE BELOW (mm)
40	STONE VOID
1042.2	INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
821.4	SYSTEM AREA (m²)
137.7	SYSTEM PERIMETER (m)

CONCEPTUAL ELEVATIONS:	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	3.886
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	2.515
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	2.362
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	2.362
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	2.362
TOP OF STONE:	2.057
TOP OF MC-7200 CHAMBER:	1.753
600 mm x 600 mm BOTTOM MANIFOLD INVERT:	0.286
600 mm ISOLATOR ROW PLUS INVERT:	0.286
375 mm BOTTOM CONNECTION INVERT:	0.272
BOTTOM OF MC-7200 CHAMBER:	0.229
UNDERDRAIN INVERT:	0.000
BOTTOM OF STONE:	0.000

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	600 mm BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP24B / TYP OF ALL 600 mm BOTTOM CONNECTIONS	57 mm	
PREFABRICATED END CAP	B	375 mm BOTTOM PARTIAL CUT END CAP, PART#: MC7200IEPP15B / TYP OF ALL 375 mm BOTTOM CONNECTIONS	43 mm	
MANIFOLD	C	600 mm x 600 mm BOTTOM MANIFOLD, ADS N-12	57 mm	
PIPE CONNECTION	D	600 mm BOTTOM CONNECTION	57 mm	
PIPE CONNECTION	E	375 mm BOTTOM CONNECTION	43 mm	
CONCRETE STRUCTURE	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		1174 L/s IN
CONCRETE STRUCTURE	G	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		76 L/s OUT
UNDERDRAIN	H	150 mm ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



NO ISOLATOR ROW PLUS

PLACE MINIMUM 5.334 m OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

160402122
OTTAWA, ON, CANADA
DATE: 04/14/2025
DRAWN: ZW
PROJECT #:
CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

StormTech® Chamber System
1-800-821-6710 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

SCALE = 1 : 300

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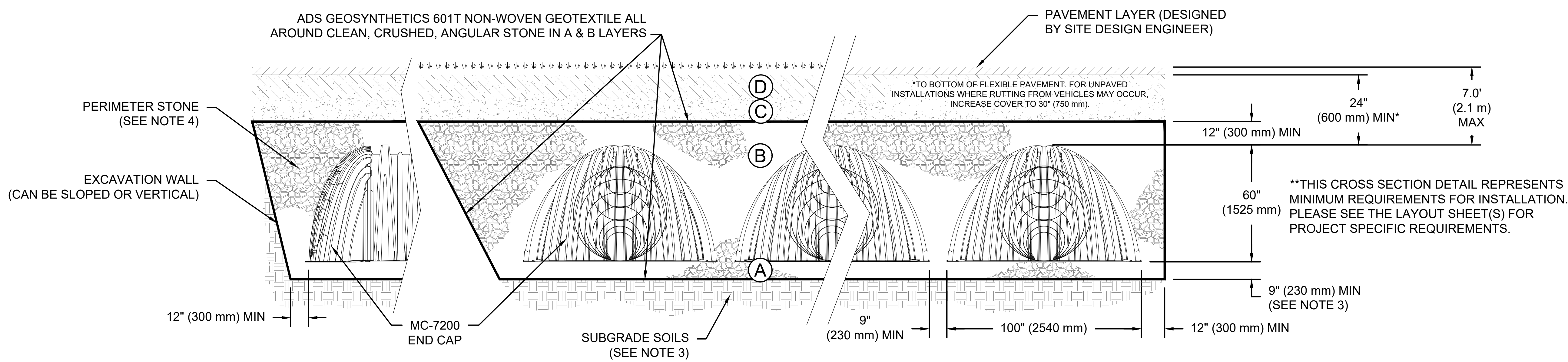
ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE 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 9" (230 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 AGGREGATE 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" CHAMBER CLASSIFICATION 60x101
2. MC-7200 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. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

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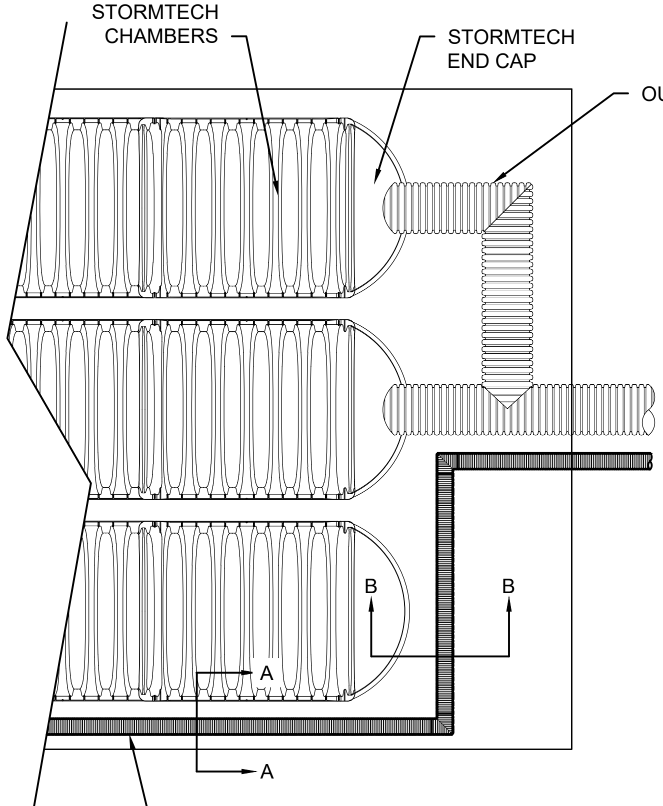
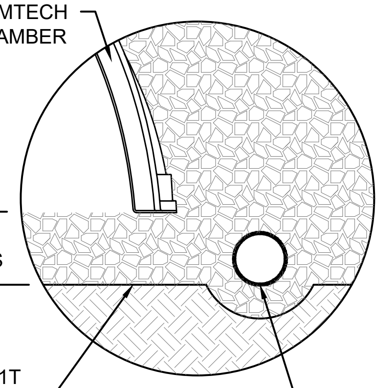
UNDERDRAIN DETAIL

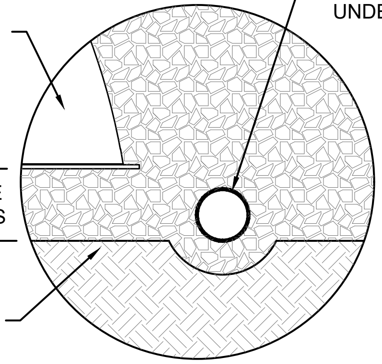
NTS



NUMBER AND SIZE OF UNDERDRAINS PER SITE DESIGN ENGINEER
4" (100 mm) TYP FOR SC-310 & SC-160LP SYSTEMS
6" (150 mm) TYP FOR SC-800, DC-780, MC-3500, MC-4500 & MC-7200 SYSTEMS



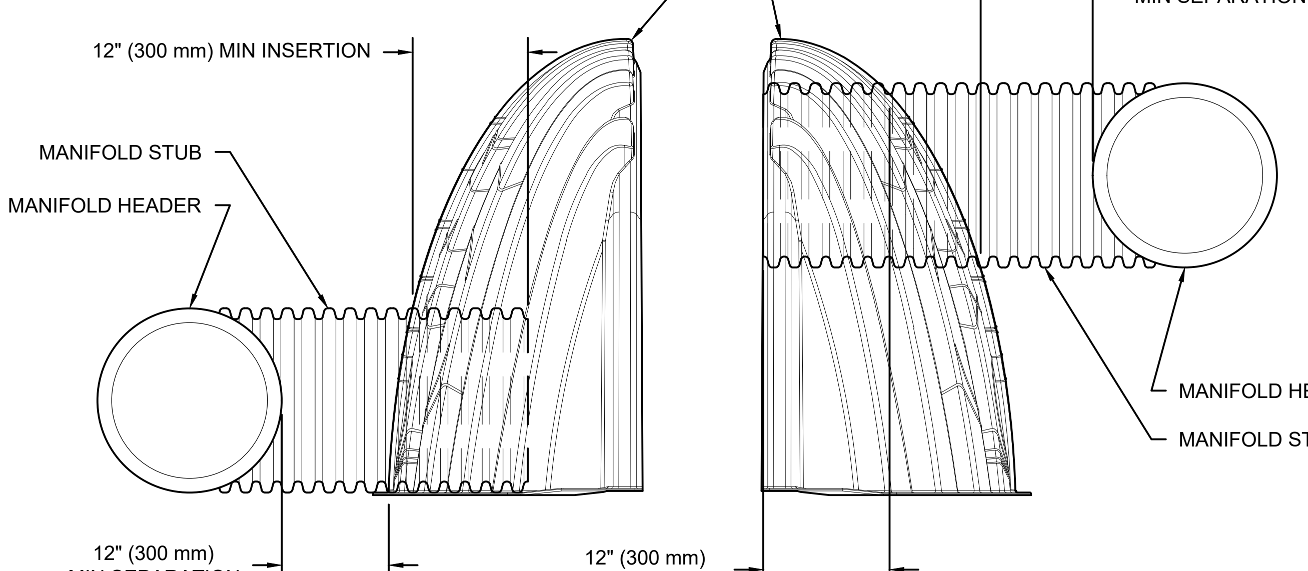
SECTION A-A



SECTION B-B

MC-SERIES END CAP INSERTION DETAIL

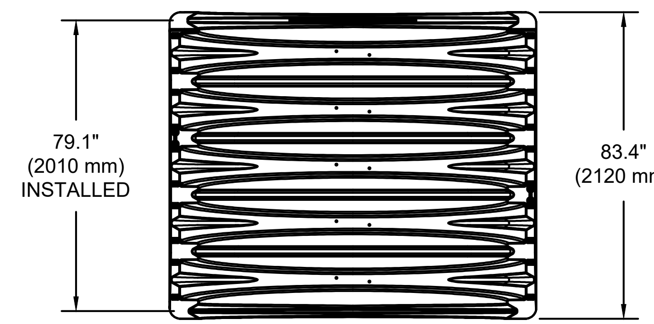
NTS

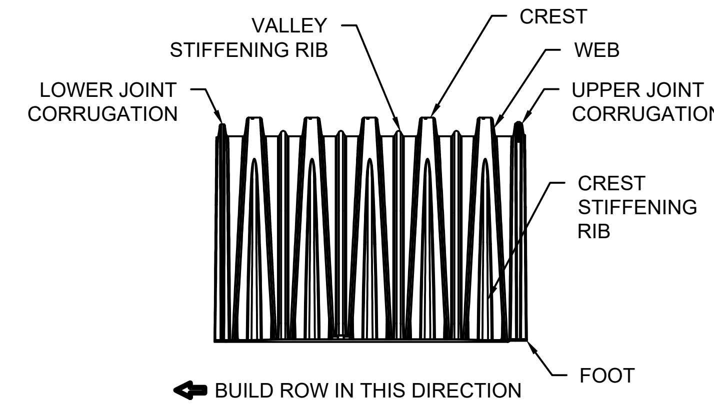


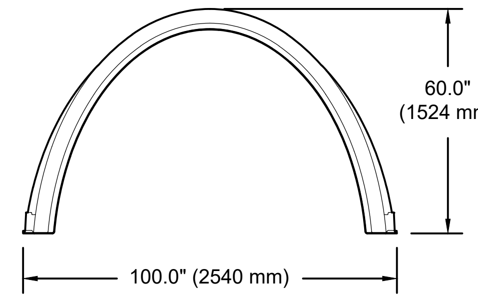
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

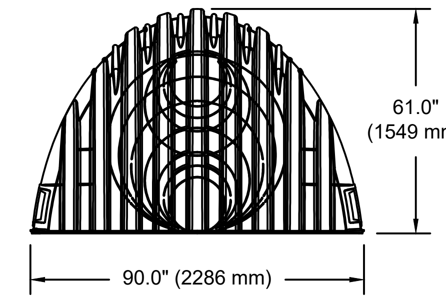
MC-7200 TECHNICAL SPECIFICATION

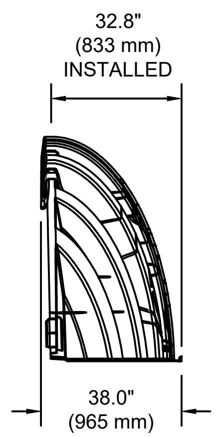
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 79.1"	(2540 mm X 1524 mm X 2010 mm)
CHAMBER STORAGE	175.9 CUBIC FEET	(4.98 m³)
MINIMUM INSTALLED STORAGE*	267.3 CUBIC FEET	(7.56 m³)
WEIGHT (NOMINAL)	205 lbs.	(92.9 kg)

NOMINAL END CAP SPECIFICATIONS

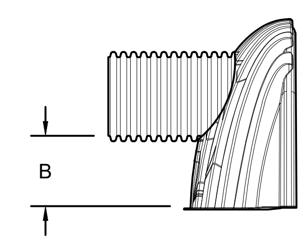
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

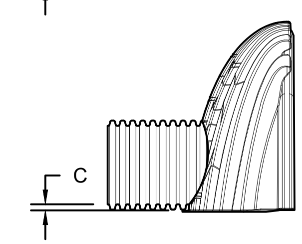
*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

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

PART #	STUB	B	C
MC7200IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC7200IEPP06B		---	0.86" (22 mm)
MC7200IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC7200IEPP08B		---	1.01" (26 mm)
MC7200IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC7200IEPP10B		---	1.33" (34 mm)
MC7200IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC7200IEPP12B		---	1.55" (39 mm)
MC7200IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC7200IEPP15B		---	1.70" (43 mm)
MC7200IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC7200IEPP18TW			
MC7200IEPP18B		---	1.97" (50 mm)
MC7200IEPP18BW			
MC7200IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC7200IEPP24TW			
MC7200IEPP24B		---	2.26" (57 mm)
MC7200IEPP24BW			
MC7200IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC7200IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC7200IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL





CUSTOM PREFABRICATED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-7200 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

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Stantec Consulting Ltd.
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4
stantec.com