2760-2770 Sheffield Road

Site Servicing and Stormwater Management Report

Prepared for:
Richcraft Homes Ltd.

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1 Introduction

Stantec Consulting Ltd. has been commissioned by Richcraft Homes Ltd. to prepare the following Servicing and Stormwater Management Report in support of the proposed development located at 2760-2770 Sheffield Road in the City of Ottawa.

The 8.4ha site is located between Lancaster Road to the west and Sheffield Road to the east. The site is currently zoned IL and IH, and consists of several warehouses and an office building with surface parking and private driveways. The portion of the development's intended for redevelopment measures approximately 3.7ha and sits on a former Canadian National Railway rail corridor. It is bound by the existing warehouses on site and Sheffield Road to the east, existing industrial development to the north and south, and Lancaster Road to the west, as shown in **Figure 1.1** below.

Figure 1.1: Key Plan

The proposed development will see a new warehouse constructed on the former rail corridor, in addition to expanded parking spaces and private driveways servicing the proposed warehouse and the surrounding existing warehouses on site outside the project limit area.

1.1 Objective

This site servicing and stormwater management (SWM) report presents a servicing scheme that is free of conflicts, provides on-site servicing in accordance with City of Ottawa Design Guidelines, and uses the existing municipal infrastructure in accordance with any limitations communicated during prior consultation with the City of Ottawa staff. Details of the existing infrastructure located within the Sheffield Road and Lancaster Road rights of way (ROWs) were obtained from available as-built drawings and site topographic survey.

Criteria and constraints provided by the City of Ottawa have been used as a basis for the detailed servicing design of the proposed development. Specific and potential development constraints to be addressed are as follows:

- Potable Water Servicing
  - Estimated water demands to characterize the proposed feed(s) for the proposed development which will be serviced from the existing 300 mm diameter watermain within the Lancaster Road ROW.
  - Watermain servicing for the development is to be able to provide average day and maximum day (including peak hour) demands (i.e., non-emergency conditions) at pressures within the acceptable range of 345 to 552 kPa (50 to 80 psi)
  - Under fire flow (emergency) conditions, the water distribution system is to maintain a minimum pressure greater than 140 kPa (20 psi)
- Wastewater (Sanitary) Servicing
  - Define and size the sanitary service lateral which will be connected to the existing 375 mm diameter sanitary sewer within the Lancaster Road ROW.
- Storm Sewer Servicing
  - Define major and minor conveyance systems in conjunction with the proposed grading plan.
  - Determine the stormwater management storage requirements to meet the allowable release rate for the site.
  - Define and size the proposed storm sewers that will collect discharge from the site to the existing 1350 mm diameter storm sewer within the Lancaster Road ROW.
- Prepare a grading plan in accordance with the proposed site plan and existing grades.

The accompanying drawings illustrate the proposed stormwater servicing for the expanded parking lot and driveways on site.

2 Background

Documents referenced in preparing this stormwater and servicing report for 2760-2770 Sheffield Road include:

- *City of Ottawa Sewer Design Guidelines* (SDG), City of Ottawa, October 2012, including all subsequent technical bulletins
- *City of Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010, including all subsequent technical bulletins
- *Design Guidelines for Drinking Water Systems*, Ministry of the Environment, Conservation, and Parks (MECP), 2008
- *Fire Protection Water Supply Guideline* for Part 3 in the Ontario Building Code, Office of the Fire Marshal (OFM), October 2020
- *Water Supply for Public Fire Protection*, Fire Underwriters Survey (FUS), 2020
- *Geotechnical Investigation – Proposed Industrial Building 2760-2770 Sheffield Road,* Paterson Group, January 2023

3 Water Servicing

3.1 Background

The proposed building is in Pressure Zone 1E of the City of Ottawa's Water Distribution System. The existing watermains along the boundaries of the site consist of the 300mm diameter DI watermain within Lancaster Road, and the 300mm CI watermain within Sheffield Road. Furthermore, the existing warehouses within the site area are serviced by a private 200 mm diameter watermain. There are existing fire hydrants on both watermains.

3.2 Water Demands

3.2.1 Potable (Domestic) Water Demands

The City of Ottawa Water Distribution Guidelines (July 2010) and ISTB 2021-03 Technical Bulletin were used to determine water demands based on the project limit area for the proposed warehouse and associated peaking factors.

A daily rate of 28,000 L/ha/day has been used to estimate average daily (AVDY) potable water demand for the proposed warehouse. Maximum day (MXDY) demands were determined by multiplying the AVDY demands by a factor of 1.5 for industrial areas. Peak hourly (PKHR) demands were determined by multiplying the MXDY by a factor of 1.8 for industrial areas. The estimated demand for the proposed warehouse is summarized in **Table 3.1** below and detailed in **Appendix A.1**.

Table 3.1: Estimated Water Demands

Project Limit Area (ha)	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
3.72	1.51	2.26	4.07

3.2.2 Fire Flow Demands

Based on the site plan, the fire flow requirement was calculated in accordance with Fire Underwriters Survey (FUS) methodology. Through confirmation from the architect (see **Appendix A.2**), the fire flow demands were estimated based on a building of non-combustible construction type with two-hour fire rated structural members, and the final sprinkler design to conform to the NFPA 13 standard, though not fully supervised. The warehouse building footprint was used as the effective floor area, as per Page 22 of the *Fire Underwriters Survey's Water Supply for Public Fire Protection* (2020).

Based on the construction type, the building's required fire flow was determined to be 116.7 L/s (7,000 L/min). Detailed fire flow calculations per the FUS methodology is provided in **Appendix A.3**.

3.3 Level of Servicing

3.3.1 Boundary Conditions

The estimated domestic potable water demands, and fire flow demands, were used to define the level of servicing required for the proposed development from the municipal watermain and hydrants within the Lancaster Road ROW. **Table 3.2** below outlines the boundary conditions for the proposed connections servicing the site, detailed in correspondence from the City of Ottawa (see **Appendix A.4**).

Table 3.2: Boundary Conditions

Connection	Lancaster Road
Min. HGL (m)	109.8
Max. HGL (m)	118.0
MXDY+FF (116.7 L/s) (m)	106.3

3.3.2 Allowable Domestic Pressures

The desired normal operating pressure range in occupied areas as per the City of Ottawa 2010 Water Distribution Design Guidelines is 345 kPa to 552 kPa (50 psi to 80 psi) under a condition of maximum daily flow and no less than 276 kPa (40 psi) under a condition of maximum hourly demand. Furthermore, the maximum pressure at any point in the water distribution should not exceed 689 kPa (100 psi) as per the Ontario Building/Plumbing Code; pressure reducing measures are required to service areas where pressures greater than 552 kPa (80 psi) are anticipated in occupied areas.

The proposed finished floor elevation at the ground floor of 68.2 m will serve as the floor elevation for the calculation of residual pressures at ground level. As per the boundary conditions, the on-site pressures are expected to range from 408 kPa to 488 kPa (59.1 psi to 70.8 psi) under normal operating conditions, which are within the normal operating pressure range defined by the City of Ottawa design guidelines as within 276 kPa to 552 kPa (40 psi to 80 psi).

3.3.3 Allowable Fire Flow Pressures

The boundary conditions provided by the City of Ottawa indicate that the watermain in Lancaster Road is expected to maintain a residual pressure of 38.1 m equivalent to 374 kPa (54.2 psi) under the worst-case fire flow conditions. This demonstrates that the watermains can provide the required fire flows while maintaining a residual pressure of 20 psi.

3.4 Proposed Water Servicing

The development will be serviced by a single 200 mm private watermain within the project limit area, which will connect to the 300 mm diameter watermain on Lancaster Road, complete with a 200 mm diameter water service lateral at the proposed building and dual connections at Lancaster Road separated by a 300 mm main isolation valve. The sizing of the service connection is to be confirmed by the mechanical consultant.

A new fire hydrant is proposed on site, and it will be located near where the service lateral servicing the proposed building will connect to the proposed private watermain, which is within 45 m from the fire department connection per the requirements of Section 3.2.5.16 of the Ontario Building Code.

The proposed water servicing is shown on **Drawing SSP-1**. Based on the City of Ottawa Water Design Guidelines and the provided boundary conditions, the existing 300 mm diameter watermain on Lancaster Road can provide adequate fire and domestic flows for the subject site. The mechanical consultant or plumbing contractor will ultimately be responsible to confirm building pressures are adequate to meet building code requirements.

4 Wastewater Servicing

4.1 Background

The existing sewers adjacent to the development site consist of the 375 mm diameter sanitary sewers on Lancaster Road, and 250mm sanitary sewers within Sheffield Road.

4.2 Design Criteria

As outlined in the City of Ottawa Sewer Design Guidelines and the MECP Design Guidelines for Sewage Works, the following criteria were used to calculate the estimated wastewater flow rates and to determine the size and location of the sanitary service lateral:

- 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 of sanitary sewer service = 135 mm
- Minimum grade of sanitary sewer service = 1.0 % (2.0 % preferred)
- Peak Factor = 1.5 (residential)
- Infiltration allowance = 0.33 L/s/ha (per City Design Guidelines)
- Minimum cover for sewer service connections – 2.0 m
- Average light industrial wastewater generation – 35,000 L/ha/day of building space

4.3 Wastewater Generation and Servicing Design

The estimated peak wastewater flow generated are based on the current site plan and the warehouse footprint area. The anticipated wastewater peak flow generated from the proposed development is summarized in **Table 4.1** below.

Table 4.1 - Estimated Total Wastewater Peak Flow

<table>
<tr><th colspan="3">Light Industrial Areas</th><th rowspan="2">Infiltration Flow (L/s)</th><th rowspan="2">Total Peak Flow (L/s)</th></tr>
<tr><th>Area (ha)</th><th>Peaking Factor</th><th>Peak Flow (L/s)</th></tr>
<tr><td>0.78</td><td>1.50</td><td>0.8</td><td>1.2</td><td>2.0</td></tr>
<tr><td colspan="4">Total Estimated Wastewater Peak Flow (L/s):</td><td>2.0</td></tr>
</table>

1. Design light industrial flow based on 35,000 L/ha/day.

2. Peak factor taken as 1.50 for light industrial areas.
3. Infiltration design flow equals 0.33 L/s/ha.

Detailed sanitary sewage calculations are included in **Appendix B.1**. The anticipated peak wastewater flows for the proposed development were provided to the City of Ottawa staff to evaluate the adequacy of the receiving municipal sanitary sewer system in the vicinity of the site and downstream network, and the City has confirmed that the receiving sanitary sewer in Lancaster Road has adequate capacity to receive the proposed sanitary peak flow from the development (see **Appendix B.2**).

4.4 Proposed Servicing

A 250 mm diameter sanitary sewer is proposed to service the warehouse and will direct wastewater peak flows to the existing 375 mm diameter PVC sanitary sewer in Lancaster Road, complete with full port backwater valve in the service lateral as per City standard S14.1 to prevent any surcharge from the downstream sewer mains from impacting the proposed site. Final sizing of the lateral is to be confirmed by the mechanical consultant. The proposed sanitary servicing is shown on **Drawing SSP-1**.

5 Stormwater Management and Servicing

5.1 Objectives

The goal of this stormwater servicing and management plan is to determine the measures necessary to control the quantity and quality of stormwater released from the proposed design to meet the criteria established during the consultation process with City of Ottawa staff, and to provide sufficient details required for approval.

5.2 Stormwater Management (SWM) Criteria

The Stormwater Management (SWM) criteria were established by combining current design practices outlined by the City of Ottawa Sewer Design Guidelines (SDG) (October 2012), and through prior consultation with City of Ottawa staff by the proponent. The following summarizes the criteria, with the source of each criterion indicated in brackets:

General

- Use of the dual drainage principle (City of Ottawa SDG)
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff (City of Ottawa SDG)
- Assess impact of 100-year event outlined in the City of Ottawa Sewer Design Guidelines on the major and minor drainage systems (City of Ottawa SDG)
- The post-development discharge under design storm events (2-100 year storms) from the site are to be restricted to the 5-year pre-development discharge rate.
- Pre-development discharge rates to be determined through assessment of on-site time of concentration (minimum Tc of 10 minutes), and a runoff coefficient considering the lesser of either pre-development conditions or 0.50.
- Provide on-site water quality control with a minimum of 80 % TSS removal

5.3 Existing Conditions

The site is delineated into several subcatchment areas plus the existing building, as shown in the Storm Drainage Plan (see **Drawing SD-1**).

Historically, the development site was bisected north-south by a Canadian National Railway corridor, which has since been decommissioned and the land parcel agglomerated into the overall development plan. Developments along Sheffield and Lancaster Road previously discharged into ditches along the east and west sides of the railway corridor respectively, with a culvert crossing and surface swale between 2780 and 2810 Sheffield Road, and being directed to a ditch inlet to the Sheffield Road storm sewer. The Sheffield Road sewer contributes directly to a 1500mm trunk sewer on Walkley Road, and ultimately to Ramsey

Creek / Green's Creek. The 1500mm sewer runs parallel to an additional 2400mm trunk storm sewer on Walkley at roughly similar elevations, and with a direct hydraulic connection at the intersection of Lancaster and Walkley. Both sewers interact hydraulically once the 1500mm trunk begins to flow at roughly 1m in depth. As a result, inflows to either the Lancaster Road or Walkley Road sewers will likely impact both trunks within Walkley Road.

On-site drainage has since been modified with the removal of the CNR corridor and railway tracks. A significant gravel area has been placed over the historical drainage ditches, leading to the site being in a poorly drained state, and without a defined major overland outlet. The majority of surface runoff eventually routes to an on-site catch basin and storm sewer between 2760 and 2770 Sheffield Road, and discharging to an undersized portion (300mm diameter) of the Sheffield Road storm sewer. The Sheffield Road sewer has a known history of surcharge.

Runoff from the existing catchment area within areas intended for redevelopment (approximately 3.8ha) was determined via the Rational Method. Areas not included for redevelopment (areas on **Drawing SD-1** with prefix EX-, UNC-2, UNC-4, and UNC-E) are to retain their current drainage paths and have not been considered in development of the site pre-development release rate.

An overall pre-development runoff coefficient of 0.48 was established based on existing conditions considering coefficients for gravel, asphalt, and grassed surfaces per the Ministry of Transportation (MTO) Design Chart 1.07 in the MTO Drainage Management Manual. Pre-development time of concentration was then determined via Bransby Williams methodology to be approximately 11.4 minutes (see calculations within **Appendix C1**). Using the above, along with City of Ottawa's IDF parameters for the 5-year storm as noted within Ottawa's Sewer Design Guidelines (SDG), pre-development runoff was determined via Rational Method to be **489 L/s**.

$$Q = 2.78\,(C)(I)(A)$$

Where:

$Q = peak\ flow\ rate, L/s$

$C = site\ runoff\ coefficient$

$I = rainfall\ intensity, mm/hr\ (per\ City\ of\ Ottawa\ IDF\ curves)$

$A = drainage\ area, ha$

In addition to the above, an off-site area composed of predominantly asphalt parking drains through the subject lands (area EXT1). This area measures approximately 0.29ha. Being lands owned by others, area EXT1 is not subject to the required site predevelopment controls. Runoff from EXT1 is proposed to be captured in its entirety and conveyed to the site storm drainage outlet uncontrolled. Based on the minimum time of concentration of 10 minutes, runoff from EXT1 is estimated in **Table 5-1** below:

Table 5-1: Runoff From External Tributary Area EXT1

Storm Event	A (ha)	C	Runoff (L/s)
2-Year	0.29	0.90	56

5-Year	0.29	0.90	76
100-Year	0.29	0.90	130

An allowable release rate for the development has been determined based on the site pre-development release rate in addition to that captured via external contributing areas:

Table 5-2: Peak Pre-Development Discharge Rate

Design Storm	Pre-Development Rate (L/s)
2-year	**545**
5-year	**565**
100-year	**619**

5.4 Proposed Stormwater Management Plan

The Modified Rational Method was employed to assess the rate and volume of runoff anticipated during post-development rainfall events. The site assumes seven subcatchment areas as defined by the proposed grades and the location and nature of inlet control devices (ICDs) following the expansion of the parking lot. A summary of subdrainage areas and runoff coefficients is provided in **Table 5-3** below. Further details can be found in **Appendix C.1**, while **Drawing SD-1** illustrates the drainage areas.

Table 5-3: Drainage Areas with Post-Development Runoff Coefficient C

Subcatchments	C	A (ha)	
EX-1	0.57	1.29	
EX-2	0.69	0.63	
EX-3	0.67	0.80	
EX-4	0.83	0.30	
EX-5	0.90	0.27	
Total Parking Area	**0.67**	**3.28**	

5.4.1 Quantity Control

The intent of the stormwater management plan presented herein is to mitigate negative impacts that the proposed development might have on the receiving sewers, while providing adequate capacity to service the proposed buildings, parking and access areas. The proposed stormwater management plan is designed to detain runoff on available flat rooftops, surface storage within parking regions, and in a subsurface storage unit to ensure that peak flows after construction will not exceed the target discharge rates.

Runoff from the site is captured via catchbasins and roof drains and conveyed to either an on-site storm sewer or entering an underground storage unit for further quantity control, followed by a hydrodynamic separator for water quality treatment. The storage unit is restricted by ICDs at the downstream end while the roof runoff is controlled via roof drains discharging through the internal building plumbing. An ADS StormTech SC-310 system (or equivalent) is proposed to provide subsurface storage. The StormTech unit is required to store up to 384m^3 of runoff inclusive of a clear stone bedding layer which is situated below the storage chambers (modeled at 40% porosity). Roof areas are available to capture and store water up to 150mm in depth during the 100-year storm event. Each cell of the StormTech unit is interconnected to prevent blockage of a cell from impacting the overall unit, and each cell is open to infiltration to soils below. The unit itself is to be equipped with a sewer underdrain (included in overall stormwater management model calculations demonstrated in sections below), to ensure groundwater conditions do not impact the proposed storage requirements.

The proposed hydrodynamic separator maintains an internal overflow weir for large storm events for protection of building internal plumbing, and will not impede inflow to the downstream sewer. The proposed hydrodynamic separator is to be a custom sized Stormceptor MAX (or equivalent) to meet quality control requirements identified in sections below and operate under surcharged conditions assumed for the Lancaster/Sheffield Road sewers.

Site discharge will be conveyed to the existing Lancaster Road storm sewer tributary to the storm trunk on Walkley Road. Due to the shallow depth of existing sewers, an invert matching connection to the Lancaster Road sewer is proposed to permit sufficient cover for sewers on-site.

Based on pre-consultation feedback provided by City of Ottawa staff, City internal stormwater modeling anticipated a 100yr hydraulic grade line elevation of 67.9m in the receiving Lancaster Road storm sewer. A meeting was held October 23rd, 2024 between Stantec, City Development Review staff and the City Infrastructure and Water Services Department to discuss development options for the site given the elevated tailwater in the receiving sewer. A consensus was established in the meeting to provide backwater protection for the 2760-2770 Sheffield Road development by constructing a new chamber on the outgoing storm sewer incorporating a backwater valve or flap gate which would prevent stormwater inflows to the site in the event of an elevated HGL in the receiving sewer. The site would utilize emergency overland flow routes via existing swales and commercial site entrances outletting to Sheffield Road in the event that the backwater flap gate remains closed due to flooding in the Lancaster Road sewer. Stormwater modeling was to proceed without consideration to backwater within the Lancaster sewer to be conservative with respect to allowable site discharge rate. Stormwater modeling has also been prepared in consideration HGL in the receiving Lancaster Road sewer equivalent to the pipe obvert elevation.

5.4.2 Modeling Rationale

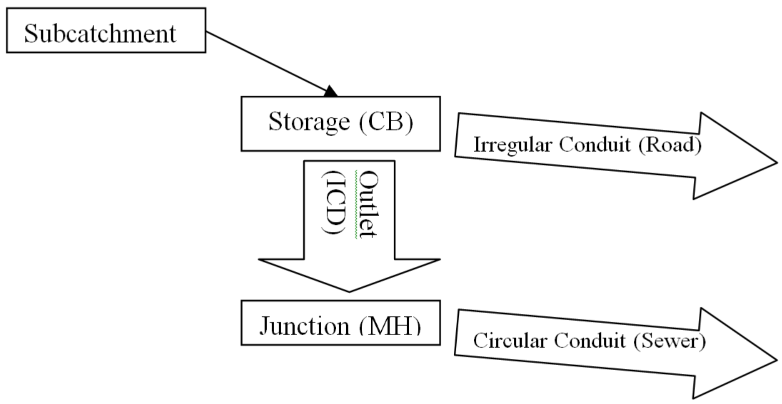
A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated major and minor systems to evaluate the storm sewer infrastructure. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems response during various storm 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.
- 12-hour SCS Storm distribution for the 100-year analysis to model 'worst-case' scenario in regards to on-site storage volume.
- 3-hour Chicago storm distributions (2 and 100-year events) with free-flowing boundary condition to model 'worst-case' scenario in regards to site discharge rates to meet the target rate. An additional model run is provided to simulate a boundary condition equivalent to tailwater at the obvert of the site sewer connection to Lancaster.
- 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 (length of overland flow path measured from high-point to high-point).
- Number of catch basins based on servicing plan (**Drawing SSP-1**)

5.4.2.1 SWMM Dual Drainage Methodology

The proposed site is modeled in one modeling program as a dual conduit system (see **Figure 5.1**), 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 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 5.1: 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 the maximum above ground storage depth (all catch basins on top of the underground structure will not have any surface storage). An 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.

Inlet control devices, as represented by orifice links, use a user-specified discharge coefficient to approximate manufacturer's specifications for the chosen ICD model, or are set to 0.61 where the catch basin lead diameter acts as an orifice control. Discharge rates from the rooftops are based on the quantity of roof drains provided in the site plan per roof level. The roof drains are modelled using outlets with rating curves which specifies the outflows per roof level.

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

5.4.2.2 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. The worst case 100-year storm has been run under two scenarios; the first considers a free-flowing condition of the outlet sewer downstream of STM 100, whereas the second considers tailwater in the outlet sewer up to the obvert elevation of the site storm sewer as it connects to STM 100.

5.4.3 Input Parameters

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

Appendices C3 and C4 summarize the modeling input parameters and results for the subject area; an example input and output file are provided for the 2-year and 100-year 3hr Chicago storm. For all other input files and results of storm scenarios, please examine the electronic model files provided with this report. 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.

5.4.3.1 Hydrologic Parameters

Table 5-4 presents the general subcatchment parameters used:

Table 5-4: 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
N Pervious	0.25
Dstore Imperv. (mm)	1.57
Dstore perv. (mm)	4.67
Zero Imperv. (%)	0

Table 5-5 presents the individual parameters that vary for each of the proposed subcatchments.

Table 5-5: Subcatchment Parameters

Name	Outlet	Area (ha)	Width (m)	Slope (%)	Imperv. (%)
C101A	500	0.192	80	2	95.7
C103A	503	0.065	33	2	100.0
C103B	502	0.098	60	3	88.6
C103C	501	0.235	105	3	85.7
C105A	105	0.637	118	2	84.3
C107A	517	0.025	58	33	0.0
C108A	507	0.099	49	2	100.0
C505A	505	0.139	44	2	100.0
C506A	506	0.444	126	2	100.0
C508A	508A	0.194	53	2	100.0
C508B	514	0.177	60	2	0.0
C508C	510	0.193	53	2	100.0
C509A	509	0.365	126	2	100.0
EXT1	501	0.288	186	3	100.0

R101A	BLDG	0.781	176	2	100.0
UNC-1	UNC-1-O	0.055	147	33	22.9
UNC-2	UNC-2-O	0.028	81	3	0.0
UNC-3	UNC-3-O	0.049	164	3	100.0

Table 5-6 summarizes the storage node parameters used in the model. Storage curves for each node have been created based on available volumes within each roof top or subsurface storage as applicable. Rim elevations for each node correspond to the rim elevation of the associated area's roof top drain or catch basin plus maximum depth of storage.

Required storage volumes and release rates for the underground storage unit were obtained through PCSWMM hydrologic/hydraulic modeling:

Table 5-6: Storage Node Parameters

Name	Invert El. (m)	Rim Elev. (m)	Depth (m)	Curve Name	Storage Curve
101	64.65	67.77	3.12	*	FUNCTIONAL
102	64.91	67.66	2.75	*	FUNCTIONAL
103	65.05	67.46	2.41	*	FUNCTIONAL
104	65.20	67.10	1.90	STECH	TABULAR
105	65.39	67.33	1.94	105-V	TABULAR
106	65.38	66.66	1.28	*	FUNCTIONAL
107	65.05	68.63	3.58	*	FUNCTIONAL
108	65.15	67.73	2.58	*	FUNCTIONAL
109	65.26	68.02	2.77	*	FUNCTIONAL
110	65.38	67.05	1.67	*	FUNCTIONAL
500	66.17	67.95	1.78	500-V	TABULAR
501	66.05	67.83	1.78	501-V	TABULAR
502	66.07	67.85	1.78	502-V	TABULAR
503	65.42	66.91	1.49	*	FUNCTIONAL
505	65.91	67.33	1.42	505-V	TABULAR
506	65.44	66.65	1.21	506-V	TABULAR
507	66.12	67.90	1.78	507-V	TABULAR
508	65.40	67.65	2.25	*	FUNCTIONAL
508A	65.40	68.05	2.65	508-V	TABULAR
509	65.64	67.04	1.40	509-V	TABULAR
510	66.22	67.90	1.68	510-V	TABULAR
511	65.99	66.99	1.00	*	FUNCTIONAL

512	66.06	67.08	1.02	*	FUNCTIONAL
513	66.20	67.20	1.00	*	FUNCTIONAL
514	66.35	67.35	1.00	*	FUNCTIONAL
517	66.57	67.07	0.50	*	FUNCTIONAL
BLDG	100.00	100.15	0.15	BLDG-V	TABULAR

5.4.3.2 Hydraulic Parameters

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

Storm sewers were modeled to confirm flow capacities and hydraulic grade lines (HGLs) in the proposed condition. The detailed storm sewer design sheet is included in **Appendix C2**.

Table 5-8 below presents the parameters for the orifice and outlet link objects in the model, which represent ICDs and restricted roof release drains respectively. ICDs representing IPEX Tempest HF controls were assigned a discharge coefficient of 0.572 to match manufacturer discharge curves. The subsurface storage unit is designed with a lower 150mm circular orifice to restrict flows during lesser storm events and to permit the system to be entirely underdrained, as well as a higher elevation 200mm circular orifice to allow additional flows to be directed towards the outlet during larger storm events.

The roof release discharge curves assume the use of standard Zurn controlled flow roof drains equipped with Accuflow weirs as noted in the calculation sheets in **Appendix C2**. The number of roof notches for each roof level was confirmed with the building mechanical engineer. Controlled flow roof drains discharge downstream of the subsurface storage unit per City of Ottawa guidelines. Details for the IPEX ICDs and roof drains are included as part of **Appendix C5**.

Table 5-7: Schedule of Roof Release Rates

Roof Area ID	Storage Depth (mm)	Discharge (L/s)	Required Volume (m3)	Available Volume (m3)
R101A	150	36.4	342	356

Table 5-8: Outlet/Orifice Parameters

Name	Inlet	Outlet	Inlet Elev.	Type	Diameter (m)
105-O	105	104	65.39	CIRCULAR	0.250
500-O	500	101	66.17	CIRCULAR	0.127
501-O	501	102	66.05	CIRCULAR	0.178

502-O	502	103	66.07	CIRCULAR	0.127
503-O	503	103	65.42	CIRCULAR	0.300
506-O	506	106	65.44	CIRCULAR	0.250
507-O	507	108	66.12	CIRCULAR	0.095
508-O	508A	508	65.40	CIRCULAR	0.127
509-O	509	110	65.64	CIRCULAR	0.200
510-O	510	508	66.22	CIRCULAR	0.127
TANK1	104	103	65.20	CIRCULAR	0.150
TANK2	104	103	65.80	CIRCULAR	0.200
BLDG-O	BLDG	101	100.00	ROOF CONTROL	*

5.4.4 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 C3 and C4,** and the electronic model files provided.

5.4.4.1 Surface Storage

The following table outlines each proposed catch basin equipped with an inlet control, their proposed ICDs, as well as modeled surface water elevations and discharge rates for the 2 year and 100 year storm events.

Table 5-9: Surface Storage – ICD Table

Catchbasin ID	ICD Type	2 Year Head (m)	100 Year Head (m)	2 Year Flow (L/s)	100 Year Flow (L/s)
CB 500	127mm Orifice	1.41	1.58	37.2	39.5
CB 501	178mm Orifice	1.34	1.62	70.5	77.9
CB 502	127mm Orifice	0.40	1.58	18.7	39.5
CB 506	250mm Orifice	0.80	1.10	94.2	103.0
CB 507	95mm Orifice	1.38	1.55	20.7	22.0
CB 508	127mm Orifice	1.87	2.36	40.8	46.0
CB 509	200mm Orifice	0.94	1.17	77.9	87.7
CB 510	127mm Orifice	1.41	1.52	37.2	38.8
CBMH 105	250mm Orifice	1.32	1.77	134.7	155.7

5.4.4.2 Subsurface Storage

Operating conditions for the StormTech storage unit during the design storm events (2 – 100 year storms) are summarized in the following table.

Table 5-10: Subsurface Storage

Storm Event	HGL (m)	Volume Stored (m3)	Total Release Rate (L/s)
2-Year, 3 Hour Chicago	65.85	176.5	38.9
5-Year, 3 Hour Chicago	65.98	245.1	61.9
100-Year, 3 Hour Chicago	66.44	384.1	112.8
100-Year, 3 Hour Chicago (Elevated Tailwater)	66.49	384.1	113.5
100-Year, 12 Hour SCS	66.38	384.1	108.3
100-Year, 3 Hour Chicago +20%	66.53	384.1	119.6
100-Year, 12 Hour SCS +20%	66.	384.1	118.9

5.4.4.3 Hydrologic Results

The following tables demonstrate the peak outflow from each modeled outfall during the design storm (2-100yr storm) events. Outfalls UNC-1-O to UNC-3-O denote uncontrolled flows from the perimeter of the site that, due to grading restrictions, are captured by the existing Lancaster Street ROW or adjacent properties. Uncontrolled runoff from these areas continues as per existing conditions, and no increase in runoff to adjacent properties is proposed. Uncontrolled runoff has been considered in development of overall site discharge in relation to allowable site release rates. The required subsurface storage unit volume was determined through iteration of each event and sized to meet the site release rate target.

Table 5-11: Site Peak Discharge Rates

Event	Location	Peak Discharge Rate (L/s)	Target (L/s)
2-Year, 3 Hour Chicago	STM 100	353	-
	Uncontrolled*	15	-
	Total	**368**	**545**
5-Year, 3 Hour Chicago	STM 100	398	-
	Uncontrolled*	31	-
	Total	**429**	**565**
100-Year, 3 Hour Chicago	STM 100	495	-

	Uncontrolled*	61	-
	Total	**556**	**619**
100-Year, 3 Hour Chicago	STM 100	500	-
(Elevated Tailwater)	Uncontrolled*	61	-
	Total	**561**	**619**
100-Year, 12 Hour SCS	STM 100	507	-
	Uncontrolled*	43	-
	Total	**550**	**619**
100-Year, 3 Hour Chicago +20%	STM 100	519	-
	Uncontrolled*	110	-
	Total	**629**	**-**
100-Year, 12 Hour SCS +20%	STM 100	536	-
	Uncontrolled*	69	-
	Total	**605**	**-**

*Note: Uncontrolled area discharge rate is the sum of runoff to Outfalls UNC-1-O through UNC-3-O

5.4.4.4 Hydraulic Results

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. The USFs elevations have been considered at 1.5m below the lowest terrace grade. It is assumed the proposed building will have a stepped foundation to accommodate lower terrace grades at the rear (northeast) side of the building. The proposed building storm service is proposed to be located downstream of and independent to the subsurface storage unit. The maximum hydraulic grade line (HGL) at STM 101 immediately downstream of the building storm service (and without consideration to HGLs within the receiving sewer in Lancaster Road) is 65.30 during the 100 year storm event, and 65.51 in consideration of the 100 year storm event with a downstream water elevation in the receiving sewer at pipe obvert. The HGL elevations in both scenarios remain at least 0.30m below the proposed surface elevations of connected ramp drains CB 503/504, as well as the proposed building USF elevation.

Table 5-12 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of catch basins for the worst case 100-year design storm (higher of the 3hr Chicago or 12hr SCS distribution) and climate change storms.

Table 5-12: Maximum Surface Water Depths

Storage node ID	Structure ID	T/G Elevation (m)	100 year		100 year +20%	
			Max HGL (m)	Total Surface Water Depth (m)	Max HGL (m)	Total Surface Water Depth (m)
105	CBMH 105	66.93	67.16	0.23	67.23	0.30
500	CB 500	67.55	67.75	0.20	67.77	0.22
501	CB 501	67.43	67.67	0.24	67.70	0.27
502	CB 502	67.45	67.65	0.20	67.68	0.23
503	CB 503/504	66.91	65.59	0.00	65.61	0.00
505	CB 505	66.93	67.17	0.24	67.23	0.30
506	CB 506	66.25	66.51	0.26	66.56	0.31
507	CB 507	67.50	67.67	0.17	67.70	0.20
508A	CBMH 508	67.65	67.76	0.11	67.78	0.13
509	CB 509	66.64	66.91	0.27	66.84	0.20
510	CB 510	67.60	67.74	0.14	67.77	0.17

5.4.5 Water Quality Control

On-site water quality control is required to provide 80% TSS removal prior to discharging to downstream sewers. A Stormceptor MAX hydrodynamic oil/grit separator is proposed immediately prior to discharge to the Lancaster Road sewer, and will act as the monitoring manhole for the site. The selected model is to be custom sized for the development in consideration of an overall contributing impervious area of 3.58ha. The Stormceptor MAX unit was selected for its applicability to industrial sites, and ability to function under surcharged conditions to which the unit is likely to be subject. Design calculations for the MAX unit are to indicate that the selected model will provide greater than 80% TSS removal on an annual basis. The MAX unit will be privately maintained. The location and general arrangement of the MAX unit is indicated on **Drawing SD-1**. Specifications for the Stormceptor MAX unit are included in **Appendix C5.**

6 Site Grading

The project limit area of the site measures approximately 3.7 ha in area. A detailed site servicing and grading plan (see **Drawing GP-1**) has been prepared to satisfy the stormwater management requirements described in **Section** 5 and to allow for positive drainage away from the face of the building.

The topographic survey plan indicates that the existing terrain within the project limit area is relatively flat and slopes towards an existing ditch, which runs along the west side of the former rail corridor.

The site servicing and grading plan satisfies the grading and drainage objectives for the proposed development site. The proposed grading respects the existing grades at the property lines and provides adequate overland flow routes. The site grading has been designed to maintain the existing drainage patterns for the non-surface storage areas.

7 Utilities

Overhead (OH) hydro-wires run parallel to the east side of the former railroad right of way, within the project limit area. All utilities within the work area will require relocation during construction. The existing utility poles within the public right of way are to be protected during construction.

As the site is surrounded by existing commercial and residential development, Hydro Ottawa, Bell, Rogers, and Enbridge servicing is readily available through existing infrastructure to service this site. The exact size, location, and routing of utilities will be finalized after design circulation. Existing overhead wires and utility plants may need to be temporarily moved/reconfigured to allow sufficient clearance for the movement of heavy machinery required for construction. The relocation of existing utilities will be coordinated with the individual utility providers upon design circulation.

8 Approvals

The proposed development lies on a private site under singular ownership and drains to an approved separated sewer outlet. However, as the proposed sewers are intended to service industrial land or land uses, the site is subject to the Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Application (ECA) process under O.Reg. 525/98. Consultation will be initiated with City of Ottawa and MECP to determine if the ECA will be obtained through direct submission to MECP or through the City of Ottawa Transfer of Review process.

For ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). It is possible that groundwater may be encountered during the foundation excavation on this site. A minimum of two to four weeks should be allotted for completion of the EASR registration and the preparation of the Water Taking and Discharge Plan by a Qualified Person as stipulated under O.Reg. 63/16. An MECP Permit to Take Water (PTTW), which is required for dewatering volumes exceeding 400,000L/day, is not anticipated for the site.

9 Erosion and Sediment Control During Construction

To protect downstream water quality and prevent sediment build-up in catch basins and storm sewers, erosion and sediment control measures must be implemented during construction. The following recommendations will be included in the contract documents and communicated to the Contractor.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit the extent of the exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with geotextiles, geogrid, or synthetic mulches.
6. Install silt barriers/fencing around the perimeter of the site as indicated in **Drawing ECDS-1** to prevent the migration of sediment offsite.
7. Install trackout control mats (mud mats) at the entrance/egress to prevent migration of sediment into the public ROW.
8. Provide sediment traps and basins during dewatering works.
9. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
10. Schedule the construction works at times which avoid flooding due to seasonal rains.

The Contractor will also be required to complete inspections and guarantee the proper performance of their erosion and sediment control measures at least after every rainfall. The inspections are to include:

- Verification that water is not flowing under silt barriers.
- Cleaning and changing the sediment traps placed on catch basins.

Refer to **Drawing ECDS-1** for the proposed location of silt fences, sediment traps, and other erosion control measures.

10 Geotechnical Investigation

A geotechnical investigation report was prepared by Paterson Group on January 23, 2023, to provide an assessment of the subsurface conditions for the proposed warehouse. The subsurface profile generally consists of approximately 0.2 m to 1.8 m thickness of fill, comprising of silty sand with varying amounts of gravel, cobbles, and organics. From available geological mapping, the bedrock consists of shale with a drift thickness of about 10 m to 15 m.

Based on Paterson's recommendations, the site is suitable for the proposed development. The proposed industrial building is recommended to be founded on conventional spread footings placed on an undisturbed, very to hard silty clay bearing surface. Due to presence of a silty clay deposit, the site is subject to a permissible grade raise restriction of 2 m.

The recommended rigid pavement structure is further presented in

Table 10-1 below.

Table 10-1: Recommended Pavement Structure

Material	Car Only Parking Areas (mm)	Access Lanes/Local Roadways, Loading Areas, and Heavy Truck Parking Areas (mm)
Wear Course – Superpave 12.5 Asphaltic Concrete	50	40
Binder Course – Superpave 19.0 Asphaltic Concrete	-	50
BASE – OPSS Granular A Crushed Stone	150	150
SUBBASE – OPSS Granular B Type II	300	450

Refer to the geotechnical report excerpts attached in **Appendix D** and the full report part of the submission package for further details.

11 Conclusions

11.1 Water Servicing

Based on the supplied boundary conditions for existing watermains and calculated domestic and fire flow demands for the subject site, the adjacent watermain on Lancaster Road has sufficient capacity to sustain both the required domestic and emergency fire flow demands for the development. The proposed development requires a 200 mm diameter water service lateral and private 200 mm diameter on-site watermain, which will be connected to the existing 300 mm diameter watermain in Lancaster Road, and a new fire hydrant to be located along the new private watermain. Sizing of the water service are to be confirmed by the mechanical consultant.

11.2 Sanitary Servicing

The proposed sanitary sewer service will consist of a 250 mm diameter sanitary service lateral and a monitor manhole directing wastewater, through a proposed private 250 mm diameter on-site sanitary sewer, to the existing 375 mm diameter sanitary sewer on Lancaster Road. Full port backwater valves installed on the proposed sanitary service within the site to prevent any surcharge from the downstream sewer main from impacting the proposed property. Sizing of the service lateral, sump pit, and sump pump (if any) are to be confirmed by the mechanical consultant.

11.3 Stormwater Servicing and Management

Surface storage at catch basin manholes (CBMHs) equipped with inlet control devices (ICDs) have been proposed to limit the stormwater discharge rate to the 5-year storm event peak pre-development release rate as identified in prior City consultation. The remaining site area not identified for redevelopment drains uncontrolled as per existing conditions and ultimately to the existing ditch inlet catch basin to the east. A hydrodynamic oil/grit separator is to be provided to meet the 80% TSS removal water quality requirement for redeveloped site areas.

11.4 Grading

Site grading has been designed to provide an adequate emergency overland flow route and adhere to the permissible grade raise restrictions outlined in the geotechnical investigation.

11.5 Geotechnical Investigation

Based on the geotechnical investigation, the site is considered suitable for the proposed development. The proposed industrial building is recommended to be founded on conventional spread footings placed on an undisturbed, very to hard silty clay bearing surface. Due to presence of a silty clay deposit, the site is subject to a permissible grade raise restriction of 2 m.

Appendices

Appendix A Water Servicing

A.1 Water Demand Calculation Sheet

2760 Sheffield Road, Ottawa, ON - Domestic Water Demand Estimates
Site Plan provided by Ware Malcomb. (2024-05-01)
Project No.: 160401916 Designed by: MW
Date 2024-05-06 Checked by:
Revision: 01

Demand conversion factors per Table 4.2 of the City of Ottawa Water Design Guidelines and Technical Bulletin ISTB-2021-03:		
Light Industrial	35000	L/cap/day

Building	Area (m²)	Avg Day Demand		Max Day Demand [1]		Peak Hour Demand [1]	
		(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Industrial Warehouse [2]	37191	90.4	1.51	135.6	2.26	244.1	4.07
Total Site :	**37191**	**90.4**	**1.51**	**135.6**	**2.26**	**244.1**	**4.07**

Notes:
1 The City of Ottawa water demand criteria used to estimate peak demand rates for industrial areas are as follows:
maximum day 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)
2 Site area taken from the Project Limit Area per the Ware Malcomb site plan provided 2024-05-01

A.2 FUS Classification Declaration

FUS CLASSIFICATION DECLARATION

Project Name and Civic Address: Sheffield Road Number of Floors: ____

Development Review PM: ____ City File No. D07-XX-XX-XXXX

The building's FUS calculation has been determined using the following criteria: (check one of the following).

C = 1.5 ☐	**Type V Wood Frame Construction** A building is considered to be of Wood Frame construction (Type V) when structural elements, walls, arches, floors, and roofs are constructed entirely or partially of wood or other material. Note: Includes buildings with exterior wall assemblies that are constructed with any materials that do not have a fire resistance rating that meets the acceptance criteria of CAN/ULC-S114. May include exterior surface brick, stone, or other masonry materials where they do not meet the acceptance criteria. Total Effective Area (A) = 100% of all Floor Areas
C = 0.8 ☐ C = 0.9 ☐ C = 1.0 ☐ C = 1.5 ☐	**Type IV Mass Timber** Mass timber construction, including Encapsulated Mass Timber, Heavy Timber and other forms of Mass Timber are considered as one of the following sub-types relating to the fire resistance ratings of assemblies as follows: • Type IV-A Mass Timber Construction (Encapsulated Mass Timber) • Type IV-B Mass Timber Construction (Rated Mass Timber) • Type IV-C Mass Timber Construction (Ordinary Mass Timber) • Type IV-D Mass Timber Construction (Un-Rated Mass Timber) *Refer to Water Supply for Public Fire Protection, latest revision, for further Mass Timber Construction definitions and how to calculate Total Effective Area (A).
C = 1.0 ☐	**Type III Ordinary Construction** A building is considered to be of Ordinary construction (Type III) when exterior walls are of masonry construction (or other approved material) with a minimum

	1-hour fire resistance rating, but where other elements such as interior walls, arches, floors and/or roof do not have a minimum 1 hour fire resistance rating. Total Effective Area (A) = 100% of all Floor Areas
C = 0.8 ☒	**Type II Noncombustible Construction** A building is considered to be of Noncombustible construction (Type II) when all structural elements, walls, arches, floors, and roofs are constructed with a minimum 1-hour fire resistance rating and are constructed with noncombustible materials. Total Effective Area (A) = ☐ if any vertical openings in the building (ex. interconnected floor spaces, atria, elevators, escalators, etc.) are unprotected**, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight; or ☐ if all vertical openings and exterior vertical communications are properly protected* in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.
C = 0.6 ☐	**Type I Fire Resistive Construction** A building is considered to be of Fire-resistive construction (Type I) when all structural elements, walls, arches, floors, and roofs are constructed with a minimum 2-hour fire resistance rating, and all materials used in the construction of the structural elements, walls, arches, floors, and roofs are constructed with noncombustible materials. Total Effective Area (A) = ☐ if any vertical openings in the building (ex. interconnected floor spaces, atria, elevators, escalators, etc.) are unprotected**, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight; or ☐ if all vertical openings and exterior vertical communications are properly protected* in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.

Note: If a building cannot be defined within a single Construction Coefficient, the Construction Coefficient is determined by the predominate Construction Coefficient that makes up more than 66% of the Total Floor Area.

*Protected openings:

a) Enclosures shall have walls of masonry or other limited or non-combustible construction with a fire resistance rating of not less than one hour.
b) Openings including doors shall be provided with automatic closing devices
c) Elevator doors shall be of metal or metal-covered construction, so arranged that the doors must normally be closed for operation of the elevator.

**Unprotected openings:

a) Any opening through horizonal separations that are unprotected or otherwise have closures that do not meet the minimum requirements for protected openings, above.

The building's FUS calculation has been determined using the following criteria: (check all that apply)

30%	☒	**Automatic sprinkler protection designed and installed in accordance with NFPA 13** The initial credit for Automatic Sprinkler Protection is a maximum of 30% based on the system being designed and installed in accordance with the applicable criteria of NFPA 13, Standard for Installation of Sprinkler Systems, NFPA 13R, Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies, or NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes and being maintained in accordance with the applicable criteria of NFPA 25, Standard for the Inspections, Testing and Maintenance of Water-Based Fire (see Recognition of Automatic Sprinkler Protection).
10%	☐	**Water supply is standard for both the system and Fire Department hose lines** a) Sprinkler system is supplied by a pressurized water supply system (public or private) that is designed and built with no major non-conformance issues (i.e. water supply system is designed in accordance with Part 1 of the Water Supply for Public Fire Protection to qualify for fire insurance grading recognition). b) Calculated demand for maximum sprinkler design area operation in addition to hose stream requirements are below the available water supply curve (at the corresponding flow rate and pressure). An appropriate safety margin is used to take into account the difference between the available water supply curve at the time of hydrant flow testing as compared to the available water supply curve during Maximum Day Demand. c) Volume of water available is adequate for the total flow rate including the maximum sprinkler design area operation plus required hose streams plus Maximum Day Demand for the full duration of the design fire event. d) Residual pressure at all points in the water supply system can be maintained at not less than 150 kPa during the flowing of the sprinkler and required hose streams (plus Maximum Day Demand).
10%	☐	**Fully supervised system** a) a distinctive supervisory signal to indicate conditions that could impair the satisfactory operation of the sprinkler system (a fault alarm), that is to sound and be displayed, either at a location within the building that is constantly attended by qualified personnel (such as a security room), or at an approved remotely located receiving facility (such as a monitoring facility of the sprinkler system manufacturer); and

	b) a water flow alarm to indicate that the sprinkler system has been activated, which is to be transmitted to an approved, proprietary alarm-receiving facility, a remote station, a central station, or the fire department.

Note: Where only part of a building is protected by Automatic Sprinkler Protection, credit should be interpolated by determining the percentage of the Total Floor Area being protected by the automatic sprinkler system.

☐ Fully Supervised sprinkler system (per above description)

PROFESSIONAL SEAL APPLIED BY:

Civil Consultant:	Stantec Consulting Ltd.
Consultancy:	Community Development (Civil Engineering)
Phone Number:	(613) 722-4420
Address:	1331 Clyde Avenue, Suite 300, Ottawa, ON, K2C 3G4

______ (initial)	The FUS design parameters will be carried into the building's design

PROFESSIONAL SEAL APPLIED BY:

Architect or Building Engineer:	
Consultancy:	Architecture
Phone Number:	
Address:	

Architect's or Building
Engineer's Seal

______ (initial)	The FUS design parameters will be carried into the building's design

A.3 FUS Fire Flow Demand Sheet

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160401916
Project Name: 2760-2770 Sheffield Road
Date: 2024-05-06
Fire Flow Calculation #: 1
Description: Light Industrial

Notes: Proposed industrial warehouse with 7805 m^2 floor area. Site Plan provided by Ware Malcomb on 2024-05-01.

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	Please Select if Vertical Openings are Protected					Vertical Openings Protected?					-	-
		7805										7805	-
3	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min										-	16000
4	Determine Occupancy Charge	Non-Combustible										-25%	12000
5	Determine Sprinkler Reduction	Conforms to NFPA 13										-30%	-4800
		Standard Water Supply										-10%	
		Not Fully Supervised or N/A										0%	
		% 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	20.1 to 30	4.5	1	0-20	Type III-IV - Unprotected Openings		NO			0%	0
		East	20.1 to 30	14.5	1	0-20	Type III-IV - Unprotected Openings		NO			0%	
		South	> 30	0	0	0-20	Type III-IV - Unprotected Openings		NO			0%	
		West	> 30	0	0	0-20	Type III-IV - Unprotected Openings		NO			0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											7000
		Total Required Fire Flow in L/s											116.7
		Required Duration of Fire Flow (hrs)											2.00
		Required Volume of Fire Flow (m^3)											840

A.4 Boundary Conditions

Wu, Michael

From: Bramah, Bruce <bruce.bramah@ottawa.ca>
Sent: June 7, 2024 10:35
To: Wu, Michael
Cc: Gillis, Sheridan
Subject: RE: 2760 Sheffield Road Updated Boundary Condition Request
Attachments: 2760 Sheffield Road June 2024.pdf

Good morning,

Please see the BC results below:

The following are boundary conditions, HGL, for hydraulic analysis at 2760 Sheffield Road (zone 1E) assumed connected via two connections to the 305 mm watermain on Sheffield Road and the 305mm watermain on Lancaster Road (see attached PDF for location).

Both Connections:

Minimum HGL: 109.8 m

Maximum HGL: 118.0 m

Max Day+ Fire Flow (116.7 L/s): 107.2 m (connection 1), 106.3 m (Connection 2)

These are for current conditions and are based on computer model simulation.

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.

Thanks,

--
Bruce Bramah, P.Eng
Project Manager
Planning, Development, and Building Services Department | Direction générale des services de la planification, de l'aménagement et du bâtiment
Development Review - South Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 29686, Bruce.Bramah@ottawa.ca

From: Wu, Michael <Michael.Wu@stantec.com>
Sent: May 17, 2024 12:07 PM
To: Bramah, Bruce <bruce.bramah@ottawa.ca>
Cc: Gillis, Sheridan <Sheridan.Gillis@stantec.com>
Subject: 2760 Sheffield Road Updated Boundary Condition Request

Good afternoon, Bruce:

We are requesting updated boundary conditions for the proposed warehouse at 2760 Sheffield Road to account for the site plan updates and the handover. The revised warehouse will have a floor area of 7805 m2 while the domestic demands are based on the project limit area of 3.72 ha.

The site is projected to be serviced from the 300 mm diameter watermain on Lancaster Road, though we would also like boundary conditions at the 300 mm diameter watermain on Sheffield Road.

The revised water and fire flow demands are as follows:

- Average Day Demand: 1.51 L/s
- Maximum Day Demand: 2.26 L/s
- Peak Hour Demand: 4.07 L/s
- Fire Flow Demand (2020 FUS): 116.7 L/s (7000 L/min)

Attached are the boundary condition request map, the domestic and fire flow demand calculation sheets for your reference.

Please reach out to us if you have any questions or require additional information.

Thank you,

Michael Wu EIT
Civil Engineering Intern, Community Development

Direct: 1 (613) 738-6033
Michael.Wu@stantec.com

Stantec
300-1331 Clyde Avenue
Ottawa ON K2C 3G4

Appendix B Wastewater Servicing

B.1 Sanitary Sewer Design Sheet

Stantec

SUBDIVISION:

2760 - 2770 SHEFFIELD ROAD

DATE: 2024-11-26
REVISION: 1
DESIGNED BY: MJS
CHECKED BY: DT

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401916

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	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 (ICI >20%):	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	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION										COMMERCIAL		INDUSTRIAL (L)	
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)	AREA (ha)	ACCU. AREA (ha)
	BLDG SAN	3	0.00	0	0	0	0	0.00	0	3.80	0.0		0.00	0.00	0.78	0.78
G2A, I2A	3	2	0.00	0	0	0	0	0.00	0	3.80	0.0		0.00	0.00	0.00	0.78
	2	1	0.00	0	0	0	0	0.00	0	3.80	0.0		0.00	0.00	0.00	0.78

LOCATION			INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	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)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)
	BLDG SAN	3	0.00	0.00	0.00	0.00	0.00	0.00	0.8	0.78	0.78	0.3	1.0	11.7	250	PVC	SDR 35	1.00	60.6	**1.68%**	1.22
G2A, I2A	3	2	0.00	0.00	0.00	0.00	3.09	3.09	0.8	3.09	3.87	1.3	2.0	86.6	250	PVC	SDR 35	1.65	77.9	**2.62%**	1.57
	2	1	0.00	0.00	0.00	0.00	0.00	3.09	0.8	0.00	3.87	1.3	2.0	10.8	250	PVC	SDR 35	1.00	60.6	**3.36%**	1.22
															250						

B.2 Confirmation on Sanitary Sewer Capacity

Wu, Michael

From:	Bramah, Bruce <bruce.bramah@ottawa.ca>
Sent:	May 27, 2024 09:25
To:	Wu, Michael
Cc:	Gillis, Sheridan
Subject:	RE: 2760 Sheffield Road Sanitary Sewer Capacity Confirmation

Good morning,

We can accept the proposed flows to Lancaster Rd if redevelopment is not fronting Sheffield. If redevelopment is occurring fronting on Sheffield, it would be preferred to split the sanitary flows to both Lancaster and Sheffield.
Thanks,
--
Bruce Bramah, P.Eng
Project Manager
Planning, Development, and Building Services Department | Direction générale des services de la planification, de l'aménagement et du bâtiment
Development Review - South Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 29686, Bruce.Bramah@ottawa.ca

From: Wu, Michael <Michael.Wu@stantec.com>
Sent: May 24, 2024 1:43 PM
To: Bramah, Bruce <bruce.bramah@ottawa.ca>
Cc: Gillis, Sheridan <Sheridan.Gillis@stantec.com>
Subject: RE: 2760 Sheffield Road Sanitary Sewer Capacity Confirmation

My apologies, here you go, Bruce.

Michael Wu EIT
Civil Engineering Intern, Community Development

Direct: 1 (613) 738-6033
Michael.Wu@stantec.com

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300-1331 Clyde Avenue
Ottawa ON K2C 3G4

Stantec

From: Bramah, Bruce <bruce.bramah@ottawa.ca>
Sent: Friday, May 24, 2024 1:07 PM
To: Wu, Michael <Michael.Wu@stantec.com>

Cc: Gillis, Sheridan <Sheridan.Gillis@stantec.com>
Subject: RE: 2760 Sheffield Road Sanitary Sewer Capacity Confirmation

Hi Michael,

I do not see any attachment. Please provide.
Thanks,
--
Bruce Bramah, P.Eng
Project Manager
Planning, Development, and Building Services Department | Direction générale des services de la planification, de l'aménagement et du bâtiment
Development Review - South Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 29686, Bruce.Bramah@ottawa.ca

From: Wu, Michael <Michael.Wu@stantec.com>
Sent: May 24, 2024 10:40 AM
To: Bramah, Bruce <bruce.bramah@ottawa.ca>
Cc: Gillis, Sheridan <Sheridan.Gillis@stantec.com>
Subject: 2760 Sheffield Road Sanitary Sewer Capacity Confirmation

Good morning, Bruce:

We are looking to confirm whether the downstream sanitary sewers on Lanchester Road will have capacity to receive an additional 2.0 L/s of sanitary peak flow from the proposed light industrial warehouse at 2760 Sheffield Road.

Attached is the sanitary calculation sheet for your reference.

Please reach out to us if you have any questions or require additional information.

Thank you,

Michael Wu EIT
Civil Engineering Intern, Community Development

Direct: 1 (613) 738-6033
Michael.Wu@stantec.com

Stantec
300-1331 Clyde Avenue
Ottawa ON K2C 3G4

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Appendix C Stormwater Servicing and Management

C.1 Pre-Development Runoff Calculations

Sheffield Road Industrial Building

2760-2770 Sheffield Road
160401916
Runoff Coefficient Calculation

Area (ha)	C	Description	A x C
2.10	0.60	Gravel	1.26
0.30	0.90	Building/Asphalt	0.2691
1.38	0.20	Grass	0.2756
3.7770			1.8047

Composite C-Factor: 0.48

C- factor from MTO Design Chart 1.07: Runoff Coefficients

Time of Concentration

Bransby Williams (C>0.40)
$tc = 0.057 \times L / (S_w^{0.2} \times A^{0.1})$

L	190	m (longest flow path)
S_w	0.4%	
A	3.7770	ha
t_c	11.4	min
	0.19	hrs

Therefore, T_c =	11.4	min
	0.19	hrs

Rational Method Calculation of Catchment Flow Rate

5 Year Storm IDF Parameters

a	b	c
998.071	6.053	0.814

160401916

Parameters

A	=	3.777	ha
C	=	0.48	
Tc	=	11.4	min
i	=	97.52	mm/hr
Q	**=**	**0.489**	**m^3/s**

C.2 Storm Sewer Design Sheet and Modified Rational Method Roof Storage Calculations

Stantec

2760-2770 Sheffield Road	
DATE:	2024-11-26
REVISION:	1
DESIGNED BY:	MW
CHECKED BY:	DT

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: **160401916**

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	MANNING'S n =	0.013	BEDDING CLASS = B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00	m
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10	min

LOCATION: AREA ID NUMBER	FROM M.H.	TO M.H.	DRAINAGE AREA: 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)	PIPE SELECTION: 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)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
C505A	505	105	0.00	0.14	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.000	0.000	0.125	0.125	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	36.2	60.0	300	300	CIRCULAR	PVC	-	0.50	68.0	**53.30%**	0.97	0.84	1.19
C105A	105	104	0.00	0.64	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.000	0.000	0.503	0.629	0.000	0.000	0.000	0.000	11.19	72.52	98.31	115.21	168.38	0.0	0.0	171.7	18.3	525	525	CIRCULAR	CONCRETE	-	0.20	200.6	**85.56%**	0.90	0.90	0.34
																				11.53																			
C506A	506	106	0.00	0.44	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.000	0.000	0.400	0.400	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	115.7	27.6	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**87.00%**	0.81	0.82	0.56
	106	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.400	0.000	0.000	0.000	0.000	10.56	74.72	101.32	118.76	173.59	0.0	0.0	112.5	62.3	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**84.60%**	0.81	0.81	1.28
																				11.84																			
	103A	103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	1.028	0.000	0.000	0.000	0.000	11.84	70.39	95.38	111.76	163.31	0.0	0.0	272.5	36.4	675	675	CIRCULAR	CONCRETE	-	0.15	339.6	**80.23%**	0.92	0.91	0.67
C103C, C103A, C103B	103	102	0.00	0.13	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.000	0.000	0.114	1.143	0.000	0.000	0.000	0.000	12.51	68.34	92.57	108.45	158.46	0.0	0.0	293.8	47.0	750	750	CIRCULAR	CONCRETE	-	0.15	449.8	**65.31%**	0.99	0.92	0.85
C102A, C102C, C102B, EXT1	102	101	0.00	0.55	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.000	0.000	0.468	1.611	0.000	0.000	0.000	0.000	13.37	65.91	89.24	104.53	152.70	0.0	0.0	399.3	120.5	825	825	CIRCULAR	CONCRETE	-	0.15	580.0	**68.85%**	1.05	0.99	2.03
																				15.39																			
C508B	514	513	0.00	0.18	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.000	0.000	0.035	0.035	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	10.2	30.0	250	250	CIRCULAR	HDPE	-	0.50	42.7	**23.97%**	0.86	0.58	0.86
	513	512	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.000	10.86	73.67	99.88	117.06	171.09	0.0	0.0	9.8	27.0	250	250	CIRCULAR	HDPE	-	0.50	42.9	**22.87%**	0.86	0.58	0.78
	512	511	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.000	11.63	71.05	96.29	112.83	164.88	0.0	0.0	9.5	18.5	250	250	CIRCULAR	HDPE	-	0.50	42.7	**22.13%**	0.86	0.58	0.53
	511	508	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.035	0.000	0.000	0.000	0.000	12.17	69.37	93.98	110.11	160.89	0.0	0.0	9.2	29.8	250	250	CIRCULAR	HDPE	-	0.50	42.7	**21.60%**	0.86	0.57	0.88
C508C, C508A	508	108	0.00	0.39	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.000	0.000	0.348	0.383	0.000	0.000	0.000	0.000	13.05	66.80	90.45	105.96	154.80	0.0	0.0	96.3	65.2	450	450	CIRCULAR	CONCRETE	-	0.30	162.9	**59.11%**	0.99	0.89	1.22
C509A	509	110	0.00	0.37	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.000	0.000	0.329	0.329	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	95.1	36.6	375	375	CIRCULAR	CONCRETE	-	0.50	116.6	**81.62%**	1.11	1.10	0.56
	110	109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.329	0.000	0.000	0.000	0.000	10.56	74.73	101.34	118.78	173.62	0.0	0.0	92.5	45.6	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**69.56%**	0.81	0.76	0.99
	109	108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.329	0.000	0.000	0.000	0.000	11.55	71.32	96.65	113.26	165.51	0.0	0.0	88.2	26.4	450	450	CIRCULAR	CONCRETE	-	0.20	133.0	**66.34%**	0.81	0.75	0.59
																				12.14																			
C108A	108	107	0.00	0.10	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.000	0.000	0.089	0.801	0.000	0.000	0.000	0.000	12.14	69.47	94.11	110.27	161.12	0.0	0.0	209.4	22.0	600	600	CIRCULAR	CONCRETE	-	0.20	286.5	**73.09%**	0.98	0.94	0.39
																				12.53																			
C107A	517	107	0.00	0.02	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.000	0.000	0.005	0.005	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	1.4	8.2	250	250	CIRCULAR	HDPE	-	1.00	60.4	**2.37%**	1.22	0.42	0.32
																				10.32																			
	107	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.806	0.000	0.000	0.000	0.000	12.53	68.30	92.50	108.38	158.35	0.0	0.0	207.1	38.7	600	600	CIRCULAR	CONCRETE	-	0.20	286.5	**72.28%**	0.98	0.94	0.69
																				13.21																			
	BLDG STOR	101	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	36.4	36.4	36.4	9.3	300	300	CIRCULAR	PVC	-	1.00	96.2	**37.86%**	1.37	1.07	0.14
																				10.14																			
R101A, C101A	101	STC IN	0.00	0.19	0.00	0.00	0.78	0.00	0.87	0.00	0.00	0.000	0.000	0.167	2.584	0.000	0.000	0.000	0.000	15.39	60.86	82.31	96.38	140.74	0.0	36.4	627.2	81.3	900	900	CIRCULAR	CONCRETE	-	0.15	731.4	**85.75%**	1.11	1.12	1.21
	STC IN	STC 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	2.584	0.000	0.000	0.000	0.000	16.60	58.23	78.72	92.16	134.54	0.0	36.4	601.4	4.0	900	900	CIRCULAR	CONCRETE	-	0.15	731.4	**82.22%**	1.11	1.10	0.06
	STC OUT	STM BWC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	2.584	0.000	0.000	0.000	0.000	16.66	58.10	78.54	91.96	134.25	0.0	36.4	600.2	3.5	900	900	CIRCULAR	CONCRETE	-	0.15	731.4	**82.06%**	1.11	1.10	0.05
	106	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	2.584	0.000	0.000	0.000	0.000	16.72	57.99	78.40	91.78	133.99	0.0	36.4	599.1	12.8	900	900	CIRCULAR	CONCRETE	-	0.15	731.4	**81.91%**	1.11	1.10	0.19
																				16.91																			
																													1350	1350									

Stormwater Management Calculations

Project #160401916, 2760-2770 Sheffield Road
Modified Rational Method Calculations for Storage

2 yr Intensity	I = a/(t + b)^c	a =	732.951	**t (min)**	**I (mm/hr)**
City of Ottawa		b =	6.199	10	76.81
		c =	0.81	20	52.03
				30	40.04
				40	32.86
				50	28.04
				60	24.56
				70	21.91
				80	19.83
				90	18.14
				100	16.75
				110	15.57
				120	14.56

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: BLDG — Roof
Area (ha): 0.78 — 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	76.81	150.1	21.8	128.3	77.0	89	0.00
20	52.03	101.7	23.5	78.2	93.8	96	0.00
30	40.04	78.2	23.9	54.3	**97.8**	97	0.00
40	32.86	64.2	23.8	40.4	96.9	97	0.00
50	28.04	54.8	23.5	31.3	93.8	96	0.00
60	24.56	48.0	23.1	24.9	89.6	94	0.00
70	21.91	42.8	22.6	20.2	84.9	92	0.00
80	19.83	38.7	22.1	16.6	79.9	90	0.00
90	18.14	35.5	21.6	13.9	74.9	88	0.00
100	16.75	32.7	21.1	11.6	69.9	86	0.00
110	15.57	30.4	20.6	9.8	65.0	84	0.00
120	14.56	28.5	20.1	8.4	60.2	82	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	97	0.10	23.9	97.8	351.5	0.00

Project #160401916, 2760-2770 Sheffield Road
Modified Rational Method Calculations for Storage

100 yr Intensity	I = a/(t + b)^c	a =	1735.688	**t (min)**	**I (mm/hr)**
City of Ottawa		b =	6.014	10	178.56
		c =	0.820	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 Modified Rational Method for Entire Site

Subdrainage Area: BLDG — Roof
Area (ha): 0.78 — 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	387.7	31.2	356.5	213.9	127	0.00
20	119.95	260.4	33.6	226.9	272.2	137	0.00
30	91.87	199.5	34.6	164.9	296.8	141	0.00
40	75.15	163.2	35.0	128.1	307.5	143	0.00
50	63.95	138.9	35.2	103.7	**311.0**	143	0.00
60	55.89	121.4	35.2	86.2	310.3	143	0.00
70	49.79	108.1	35.0	73.1	307.0	142	0.00
80	44.99	97.7	34.8	62.9	301.8	142	0.00
90	41.11	89.3	34.5	54.7	295.5	141	0.00
100	37.90	82.3	34.2	48.1	288.3	139	0.00
110	35.20	76.4	33.9	42.5	280.6	138	0.00
120	32.89	71.4	33.6	37.8	272.4	137	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	143	0.14	35.2	311.0	351.5	0.00

Project #160401916, 2760-2770 Sheffield Road
Roof Drain Design Sheet, Area BLDG
Standard Zurn Model Z-105-5 Control-Flo 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	0.0004	0.0061	2	0.025	195	2	2	0.025
0.050	0.0008	0.0123	13	0.050	781	11	13	0.050
0.075	0.0012	0.0184	44	0.075	1757	31	44	0.075
0.100	0.0015	0.0246	104	0.100	3124	60	104	0.100
0.125	0.0019	0.0307	203	0.125	4881	99	203	0.125
0.150	0.0023	0.0369	351	0.150	7029	148	351	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
11.4	926.9	11.4	0.25747
42.3	1677.2	30.9	0.72336
102.5	2449.6	60.2	1.40382
201.8	3230.9	99.3	2.30128
349.8	4016.5	148.1	3.41698

Rooftop Storage Summary

Total Building Area (sq.m)		7810
Assume Available Roof Area (sq.	90%	7029
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		16
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		351
Estimated 100 Year Drawdown Time (h)		3.1

* 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.

From Zurn Drain Catalogue

Head (m)	L/min	L/s	Notch Rating
0.051	45.5	0.00076	232

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.024	0.035	-
Depth (m)	0.097	0.143	0.150
Volume (cu.m)	97.8	311.0	351.5
Draintime (hrs)	1.4	3.1	

C.3 PCSWMM Model Input File (100-Year, 3-Hour Chicago Storm)

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    NO

START_DATE           06/18/2024
START_TIME           00:00:00
REPORT_START_DATE    06/18/2024
REPORT_START_TIME    00:00:00
END_DATE             06/19/2024
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:05:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
```



```
MINIMUM_STEP         0.5
THREADS              8

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES 100C

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack

;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
----------------
;0.87
C101A            RG1              500              0.192455 95.714   80       2        0

;0.90
C103A            RG1              503              0.065012 100      33       2        0

;0.82
C103B            RG1              502              0.098356 88.571   60       3        0

;0.80
C103C            RG1              501              0.234921 85.714   105      3        0

;0.79
C105A            RG1              105              0.637211 84.286   118      2        0

;0.20
C107A            RG1              517              0.024692 0        58       33       0

;0.90
```

```
C108A            RG1              507              0.098819 100      49       2        0

;0.90
C505A            RG1              505              0.139133 100      44       2        0

;0.90
C506A            RG1              506              0.444275 100      126      2        0

;0.90
C508A            RG1              508A             0.193818 100      53       2        0

;0.20
C508B            RG1              514              0.176718 0        60       2        0

;0.90
C508C            RG1              510              0.192761 100      53       2        0

;0.90
C509A            RG1              509              0.365219 100      126      2        0

;0.90
EXT1             RG1              501              0.288138 100      186      3        0

;0.90
R101A            RG1              BLDG             0.780524 100      175.6    2        0

;0.36
UNC-1            RG1              UNC-1-O          0.054912 22.857   147      33       0

;0.20
UNC-2            RG1              UNC-2-O          0.027979 0        81       3        0

;0.90
UNC-3            RG1              UNC-3-O          0.049157 100      164      3        0


[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
```



```
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
C101A            0.013      0.25       1.57       4.67       0          OUTLET
C103A            0.013      0.25       1.57       4.67       0          OUTLET
C103B            0.013      0.25       1.57       4.67       0          OUTLET
C103C            0.013      0.25       1.57       4.67       0          OUTLET
C105A            0.013      0.25       1.57       4.67       0          OUTLET
C107A            0.013      0.25       1.57       4.67       0          OUTLET
C108A            0.013      0.25       1.57       4.67       0          OUTLET
C505A            0.013      0.25       1.57       4.67       0          OUTLET
C506A            0.013      0.25       1.57       4.67       0          OUTLET
C508A            0.013      0.25       1.57       4.67       0          OUTLET
C508B            0.013      0.25       1.57       4.67       0          OUTLET
C508C            0.013      0.25       1.57       4.67       0          OUTLET
C509A            0.013      0.25       1.57       4.67       0          OUTLET
EXT1             0.013      0.25       1.57       4.67       0          OUTLET
R101A            0.013      0.25       1.57       4.67       0          OUTLET
UNC-1            0.013      0.25       1.57       4.67       0          OUTLET
UNC-2            0.013      0.25       1.57       4.67       0          OUTLET
UNC-3            0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
C101A            76.2       13.2       4.14       7          0
C103A            76.2       13.2       4.14       7          0
C103B            76.2       13.2       4.14       7          0
C103C            76.2       13.2       4.14       7          0
C105A            76.2       13.2       4.14       7          0
C107A            76.2       13.2       4.14       7          0
C108A            76.2       13.2       4.14       7          0
C505A            76.2       13.2       4.14       7          0
C506A            76.2       13.2       4.14       7          0
C508A            76.2       13.2       4.14       7          0
C508B            76.2       13.2       4.14       7          0
C508C            76.2       13.2       4.14       7          0
C509A            76.2       13.2       4.14       7          0
EXT1             76.2       13.2       4.14       7          0
R101A            76.2       13.2       4.14       7          0
```

```
UNC-1            76.2       13.2       4.14       7          0
UNC-2            76.2       13.2       4.14       7          0
UNC-3            76.2       13.2       4.14       7          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
100              64.5       FREE                        NO
UNC-1-O          0          FREE                        NO
UNC-2-O          0          FREE                        NO
UNC-3-O          0          FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            SurDepth Fevap
Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- ---------- ---------------------------- -------- --------
-------- -------- --------
101              64.652   3.122      0          FUNCTIONAL 0         0        1.13     0        0
102              64.91    2.752      0          FUNCTIONAL 0         0        1.13     0        0
103              65.05    2.411      0          FUNCTIONAL 0         0        1.13     0        0
104              65.2     1.903      0          TABULAR    STECH                       0        0
105              65.39    1.94       0          TABULAR    105-V                       0        0
106              65.382   1.278      0          FUNCTIONAL 0         0        1.13     0        0
107              65.047   3.578      0          FUNCTIONAL 0         0        1.13     0        0
108              65.154   2.58       0          FUNCTIONAL 0         0        1.13     0        0
109              65.257   2.765      0          FUNCTIONAL 0         0        1.13     0        0
110              65.378   1.671      0          FUNCTIONAL 0         0        1.13     0        0
500              66.17    1.78       0          TABULAR    500-V                       0        0
501              66.05    1.78       0          TABULAR    501-V                       0        0
502              66.07    1.78       0          TABULAR    502-V                       0        0
503              65.42    1.49       0          FUNCTIONAL 0         0        0.36     0        0
505              65.91    1.42       0          TABULAR    505-V                       0        0
506              65.44    1.21       0          TABULAR    506-V                       0        0
507              66.12    1.78       0          TABULAR    507-V                       0        0
508              65.4     2.25       0          FUNCTIONAL 0         0        1.13     0        0
508A             65.4     2.65       0          TABULAR    508-V                       0        0
509              65.64    1.4        0          TABULAR    509-V                       0        0
510              66.22    1.68       0          TABULAR    510-V                       0        0
```



```
511              65.988   0.998      0          FUNCTIONAL 0         0        0        0        0
512              66.064   1.015      0          FUNCTIONAL 0         0        0        0        0
513              66.2     1.003      0          FUNCTIONAL 0         0        0        0        0
514              66.35    1.003      0          FUNCTIONAL 0         0        0        0        0
517              66.57    0.504      0          FUNCTIONAL 0         0        0        0        0
BLDG             100      0.15       0          TABULAR    BLDG-V                      0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow
MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ----------
----------
Pipe_10          107              101              38.655     0.013      65.047     64.97      0          0

Pipe_11          108              107              22.033     0.013      65.154     65.11      0          0

Pipe_13          508              108              65.248     0.013      65.401     65.204     0          0

Pipe_14          109              108              26.435     0.013      65.257     65.204     0          0

Pipe_15          110              109              45.598     0.013      65.378     65.287     0          0

Pipe_2           101              100              101.606    0.013      64.652     64.5       0          0

Pipe_26          511              508              29.708     0.013      65.988     65.75      0          0

Pipe_27          512              511              18.49      0.013      66.064     65.99      0          0

Pipe_28          513              512              26.995     0.013      66.2       66.064     0          0

Pipe_29          514              513              30.042     0.013      66.35      66.2       0          0

Pipe_3           102              101              120.5      0.013      64.91      64.73      0          0

Pipe_35          517              107              8.171      0.013      66.57      66.488     0          0

Pipe_4           103              102              47.018     0.013      65.05      64.98      0          0
```

```
Pipe_7          505             105             60         0.013      65.91      65.61      0          0

Pipe_8          106             104             62.34      0.013      65.382     65.26      0          0


[ORIFICES]
;;Name          From Node       To Node         Type         Offset     Qcoeff     Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- ----------
105-O           105             104             SIDE         65.39      0.61       NO       0
500-O           500             101             SIDE         66.17      0.572      NO       0
501-O           501             102             SIDE         66.05      0.572      NO       0
502-O           502             103             SIDE         66.07      0.572      NO       0
503-O           503             103             SIDE         65.42      0.61       NO       0
506-O           506             106             SIDE         65.44      0.61       NO       0
507-O           507             108             SIDE         66.12      0.572      NO       0
508-O           508A            508             SIDE         65.4       0.572      NO       0
509-O           509             110             SIDE         65.64      0.61       NO       0
510-O           510             508             SIDE         66.22      0.572      NO       0
TANK1           104             103             SIDE         65.2       0.61       NO       0
TANK2           104             103             SIDE         65.8       0.61       NO       0

[WEIRS]
;;Name          From Node       To Node         Type         CrestHt    Qcoeff     Gated    EndCon
EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- --------
---------- ---------- ---------- ---------- ----------------
W1              501             502             TRANSVERSE   67.6       1.67       NO       0        0
       YES
W2              502             105             TRANSVERSE   67.6       1.67       NO       0        0
       YES
W3              500             501             TRANSVERSE   67.75      1.67       NO       0        0
       YES

[OUTLETS]
;;Name          From Node       To Node         Offset     Type             QTable/Qcoeff    Qexpon
Gated
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ----------
--------
```



```
BLDG-O          BLDG            101             100        TABULAR/HEAD     BLDG-Q
NO

[XSECTIONS]
;;Link          Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
Pipe_10         CIRCULAR     0.6              0          0          0          1
Pipe_11         CIRCULAR     0.6              0          0          0          1
Pipe_13         CIRCULAR     0.45             0          0          0          1
Pipe_14         CIRCULAR     0.45             0          0          0          1
Pipe_15         CIRCULAR     0.45             0          0          0          1
Pipe_2          CIRCULAR     0.9              0          0          0          1
Pipe_26         CIRCULAR     0.2              0          0          0          1
Pipe_27         CIRCULAR     0.25             0          0          0          1
Pipe_28         CIRCULAR     0.25             0          0          0          1
Pipe_29         CIRCULAR     0.25             0          0          0          1
Pipe_3          CIRCULAR     0.825            0          0          0          1
Pipe_35         CIRCULAR     0.25             0          0          0          1
Pipe_4          CIRCULAR     0.75             0          0          0          1
Pipe_7          CIRCULAR     0.3              0          0          0          1
Pipe_8          CIRCULAR     0.45             0          0          0          1
105-O           CIRCULAR     0.25             0          0          0
500-O           CIRCULAR     0.127            0          0          0
501-O           CIRCULAR     0.178            0          0          0
502-O           CIRCULAR     0.127            0          0          0
503-O           CIRCULAR     0.3              0          0          0
506-O           CIRCULAR     0.25             0          0          0
507-O           CIRCULAR     0.095            0          0          0
508-O           CIRCULAR     0.127            0          0          0
509-O           CIRCULAR     0.2              0          0          0
510-O           CIRCULAR     0.127            0          0          0
TANK1           CIRCULAR     0.15             0          0          0
TANK2           CIRCULAR     0.2              0          0          0
W1              RECT_OPEN    0.1              6          0          0
W2              RECT_OPEN    0.1              6          0          0
W3              RECT_OPEN    0.1              6          0          0

[LOSSES]
```

```
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
Pipe_10          0          1.344      0          NO         0
Pipe_11          0          1.344      0          NO         0
Pipe_13          0          1.344      0          NO         0
Pipe_14          0          0.072      0          NO         0
Pipe_15          0          0.072      0          NO         0
Pipe_2           0          1.344      0          NO         0
Pipe_26          0          1.344      0          NO         0
Pipe_27          0          1.344      0          NO         0
Pipe_28          0          0.246      0          NO         0
Pipe_29          0          0.636      0          NO         0
Pipe_3           0          1.344      0          NO         0
Pipe_35          0          1.344      0          NO         0
Pipe_4           0          0.022      0          NO         0
Pipe_7           0          0.034      0          NO         0
Pipe_8           0          1.344      0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
BLDG-Q           Rating     0          0
BLDG-Q                      0.025      6.1
BLDG-Q                      0.05       12.3
BLDG-Q                      0.075      18.4
BLDG-Q                      0.1        24.6
BLDG-Q                      0.125      30.7
BLDG-Q                      0.15       36.9

105-V            Storage    0          1.13
105-V                       1.6        1.13
105-V                       1.600001   0
105-V                       1.84       1255.7
105-V                       1.94       1255.7

500-V            Storage    0          0.36
500-V                       1.38       0.36
500-V                       1.3800001  0
```



```
500-V                       1.58       307.6
500-V                       1.78       307.6

501-V            Storage    0          0.36
501-V                       1.11       0.36
501-V                       1.1100001  0
501-V                       1.55       306.1
501-V                       1.78       306.1

502-V            Storage    0          0.36
502-V                       1.38       0.36
502-V                       1.380001   0
502-V                       1.53       74.5
502-V                       1.78       74.5

505-V            Storage    0          0.36
505-V                       1.02       0.36
505-V                       1.020001   0
505-V                       1.32       625.9
505-V                       1.42       625.9

506-V            Storage    0          0.36
506-V                       0.81       0.36
506-V                       0.810001   0
506-V                       1.1        553.8
506-V                       1.21       553.8

507-V            Storage    0          0.36
507-V                       1.38       0.36
507-V                       1.380001   0
507-V                       1.68       297.1
507-V                       1.78       297.1

508-V            Storage    0          1.13
508-V                       2.25       1.13
508-V                       2.250001   0
508-V                       2.55       1280.1
508-V                       2.65       1280.1
```

509-V	Storage	0	0.36
509-V		1	0.36
509-V		1.00001	0
509-V		1.18	671.6
509-V		1.4	671.6
510-V	Storage	0	0.36
510-V		1.38	0.36
510-V		1.380001	0
510-V		1.68	935.1
510-V		1.78	935.1
BLDG-V	Storage	0	0
BLDG-V		0.025	195
BLDG-V		0.05	781
BLDG-V		0.075	1758
BLDG-V		0.1	3124
BLDG-V		0.125	4881
BLDG-V		0.15	7030
STECH	Storage	0	264.57
STECH		0.05	264.57
STECH		0.08	264.57
STECH		0.1	264.57
STECH		0.13	264.57
STECH		0.15	264.57
STECH		0.18	264.57
STECH		0.2	264.57
STECH		0.23	264.57
STECH		0.25	264.57
STECH		0.28	264.57
STECH		0.3	264.57
STECH		0.33	264.57
STECH		0.36	264.57
STECH		0.38	264.57
STECH		0.41	264.57
STECH		0.43	264.57

STECH		0.46	264.57
STECH		0.48	264.57
STECH		0.51	264.57
STECH		0.53	264.57
STECH		0.56	264.57
STECH		0.58	264.57
STECH		0.61	264.57
STECH		0.64	552.45
STECH		0.66	546.51
STECH		0.69	538.48
STECH		0.71	530.37
STECH		0.74	520.4
STECH		0.76	508.37
STECH		0.79	496.2
STECH		0.81	484.21
STECH		0.84	468.25
STECH		0.86	450.1
STECH		0.89	430.03
STECH		0.91	405.85
STECH		0.94	373.89
STECH		0.97	317.92
STECH		0.99	295.61
STECH		1.02	276.37
STECH		1.04	264.57
STECH		1.07	264.57
STECH		1.09	264.57
STECH		1.12	264.57
STECH		1.14	264.57
STECH		1.17	264.57
STECH		1.170001	0
STECH		2	0

[TIMESERIES]

;;Name	Date	Time	Value
;;--------------	----------	----------	----------
002C		0:00	0
002C		0:10	2.81
002C		0:20	3.5

POST-DEVELOPMENT MODEL

002C	0:30	4.69
002C	0:40	7.3
002C	0:50	18.21
002C	1:00	76.81
002C	1:10	24.08
002C	1:20	12.36
002C	1:30	8.32
002C	1:40	6.3
002C	1:50	5.09
002C	2:00	4.29
002C	2:10	3.72
002C	2:20	3.29
002C	2:30	2.95
002C	2:40	2.68
002C	2:50	2.46
002C	3:00	2.28
005C	0:00	0
005C	0:10	3.68
005C	0:20	4.58
005C	0:30	6.15
005C	0:40	9.61
005C	0:50	24.17
005C	1:00	104.19
005C	1:10	32.04
005C	1:20	16.34
005C	1:30	10.96
005C	1:40	8.29
005C	1:50	6.69
005C	2:00	5.63
005C	2:10	4.87
005C	2:20	4.3
005C	2:30	3.86
005C	2:40	3.51
005C	2:50	3.22
005C	3:00	2.98
100C	0:00	0

POST-DEVELOPMENT MODEL

100C	0:10	6.05
100C	0:20	7.54
100C	0:30	10.16
100C	0:40	15.97
100C	0:50	40.65
100C	1:00	178.56
100C	1:10	54.05
100C	1:20	27.32
100C	1:30	18.24
100C	1:40	13.74
100C	1:50	11.06
100C	2:00	9.29
100C	2:10	8.02
100C	2:20	7.08
100C	2:30	6.35
100C	2:40	5.76
100C	2:50	5.28
100C	3:00	4.88
100S	0:00	2.35
100S	0:15	2.35
100S	0:30	2.35
100S	0:45	2.35
100S	1:00	2.35
100S	1:15	2.35
100S	1:30	2.35
100S	1:45	2.35
100S	2:00	2.82
100S	2:15	2.82
100S	2:30	2.82
100S	2:45	2.82
100S	3:00	3.76
100S	3:15	3.76
100S	3:30	3.76
100S	3:45	3.76
100S	4:00	5.63
100S	4:15	5.63
100S	4:30	7.51

POST-DEVELOPMENT MODEL

100S	4:45	7.51
100S	5:00	11.27
100S	5:15	11.27
100S	5:30	45.07
100S	5:45	123.95
100S	6:00	16.90
100S	6:15	16.90
100S	6:30	7.51
100S	6:45	7.51
100S	7:00	5.63
100S	7:15	5.63
100S	7:30	5.63
100S	7:45	5.63
100S	8:00	3.29
100S	8:15	3.29
100S	8:30	3.29
100S	8:45	3.29
100S	9:00	3.29
100S	9:15	3.29
100S	9:30	3.29
100S	9:45	3.29
100S	10:00	1.88
100S	10:15	1.88
100S	10:30	1.88
100S	10:45	1.88
100S	11:00	1.88
100S	11:15	1.88
100S	11:30	1.88
100S	11:45	1.88
100S	12:00	0
120C	0:00	0
120C	0:10	7.26
120C	0:20	9.048
120C	0:30	12.192
120C	0:40	19.164
120C	0:50	48.78
120C	1:00	214.272

120C	1:10	64.86
120C	1:20	32.784
120C	1:30	21.888
120C	1:40	16.488
120C	1:50	13.272
120C	2:00	11.148
120C	2:10	9.624
120C	2:20	8.496
120C	2:30	7.62
120C	2:40	6.912
120C	2:50	6.336
120C	3:00	5.856
120S	0:00	2.82
120S	0:15	2.82
120S	0:30	2.82
120S	0:45	2.82
120S	1:00	2.82
120S	1:15	2.82
120S	1:30	2.82
120S	1:45	2.82
120S	2:00	3.38
120S	2:15	3.38
120S	2:30	3.38
120S	2:45	3.38
120S	3:00	4.51
120S	3:15	4.51
120S	3:30	4.51
120S	3:45	4.51
120S	4:00	6.76
120S	4:15	6.76
120S	4:30	9.01
120S	4:45	9.01
120S	5:00	13.52
120S	5:15	13.52
120S	5:30	54.09
120S	5:45	148.74
120S	6:00	20.28

```
120S                        6:15       20.28
120S                        6:30       9.01
120S                        6:45       9.01
120S                        7:00       6.76
120S                        7:15       6.76
120S                        7:30       6.76
120S                        7:45       6.76
120S                        8:00       3.94
120S                        8:15       3.94
120S                        8:30       3.94
120S                        8:45       3.94
120S                        9:00       3.94
120S                        9:15       3.94
120S                        9:30       3.94
120S                        9:45       3.94
120S                        10:00      2.25
120S                        10:15      2.25
120S                        10:30      2.25
120S                        10:45      2.25
120S                        11:00      2.25
120S                        11:15      2.25
120S                        11:30      2.25
120S                        11:45      2.25
120S                        12:00      0

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       374517.9473      5028962.7404     374947.7327      5029269.8956
UNITS            Meters
```



```
[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
100              374590.8           5029044
UNC-1-O          374909.18          5029032.583
UNC-2-O          374579.279         5029052.173
UNC-3-O          374659.571         5029201.12
101              374656.6           5029121
102              374747.7           5029042
103              374783.3           5029012
104              374827.6           5029030
105              374844.5           5029038
106              374803.2           5029088
107              374627.1           5029146
108              374641.4           5029163
109              374662.2           5029179
110              374704             5029198
500              374655.614         5029108.261
501              374691.546         5029083.406
502              374754.588         5029032.242
503              374787.106         5029044.028
505              374899.5           5029062
506              374799.1           5029115
507              374628.385         5029159.927
508              374591.3           5029205
508A             374594.065         5029211.221
509              374731.9           5029174
510              374623.693         5029186.53
511              374572.1           5029182
512              374558             5029194
513              374549.5           5029220
514              374568.9           5029243
517              374621.9           5029140
BLDG             374662.6           5029128

[VERTICES]
;;Link           X-Coord            Y-Coord
```

```
;;-------------- ------------------ ------------------
501-O            374737.152         5029042.703
502-O            374777.324         5029011.971
503-O            374790.597         5029022.617
510-O            374599.759         5029206.938
TANK1            374805.045         5029026.353
W1               374698.459         5029071.617
W1               374742.08          5029034.228
W2               374758.563         5029023.574
W2               374779.67          5029005.08
W2               374823.292         5029021.765

[POLYGONS]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------


;;Storage Node   X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

C.4 PCSWMM Model Output File (100-Year, 3-Hour Chicago Storm)

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

****
Element Count
****

Number of rain gages 1
Number of subcatchments ... 18
Number of nodes 31
Number of links 31
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
RG1	100C	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
C101A	0.19	80.00	95.71	2.0000	RG1	500
C103A	0.07	33.00	100.00	2.0000	RG1	503
C103B	0.10	60.00	88.57	3.0000	RG1	502
C103C	0.23	105.00	85.71	3.0000	RG1	501
C105A	0.64	118.00	84.29	2.0000	RG1	105
C107A	0.02	58.00	0.00	33.0000	RG1	517
C108A	0.10	49.00	100.00	2.0000	RG1	507
C505A	0.14	44.00	100.00	2.0000	RG1	505
C506A	0.44	126.00	100.00	2.0000	RG1	506
C508A	0.19	53.00	100.00	2.0000	RG1	508A
C508B	0.18	60.00	0.00	2.0000	RG1	514
C508C	0.19	53.00	100.00	2.0000	RG1	510
C509A	0.37	126.00	100.00	2.0000	RG1	509
EXT1	0.29	186.00	100.00	3.0000	RG1	501
R101A	0.78	175.60	100.00	2.0000	RG1	BLDG
UNC-1	0.05	147.00	22.86	33.0000	RG1	UNC-1-O
UNC-2	0.03	81.00	0.00	3.0000	RG1	UNC-2-O
UNC-3	0.05	164.00	100.00	3.0000	RG1	UNC-3-O

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
100	OUTFALL	64.50	0.90	0.0	
UNC-1-O	OUTFALL	0.00	0.00	0.0	
UNC-2-O	OUTFALL	0.00	0.00	0.0	
UNC-3-O	OUTFALL	0.00	0.00	0.0	
101	STORAGE	64.65	3.12	0.0	
102	STORAGE	64.91	2.75	0.0	
103	STORAGE	65.05	2.41	0.0	
104	STORAGE	65.20	1.90	0.0	
105	STORAGE	65.39	1.94	0.0	
106	STORAGE	65.38	1.28	0.0	
107	STORAGE	65.05	3.58	0.0	
108	STORAGE	65.15	2.58	0.0	
109	STORAGE	65.26	2.77	0.0	
110	STORAGE	65.38	1.67	0.0	
500	STORAGE	66.17	1.78	0.0	
501	STORAGE	66.05	1.78	0.0	
502	STORAGE	66.07	1.78	0.0	
503	STORAGE	65.42	1.49	0.0	
505	STORAGE	65.91	1.42	0.0	

506	STORAGE	65.44	1.21	0.0
507	STORAGE	66.12	1.78	0.0
508	STORAGE	65.40	2.25	0.0
508A	STORAGE	65.40	2.65	0.0
509	STORAGE	65.64	1.40	0.0
510	STORAGE	66.22	1.68	0.0
511	STORAGE	65.99	1.00	0.0
512	STORAGE	66.06	1.01	0.0
513	STORAGE	66.20	1.00	0.0
514	STORAGE	66.35	1.00	0.0
517	STORAGE	66.57	0.50	0.0
BLDG	STORAGE	100.00	0.15	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
Pipe_10	107	101	CONDUIT	38.7	0.1992	0.0130
Pipe_11	108	107	CONDUIT	22.0	0.1997	0.0130
Pipe_13	508	108	CONDUIT	65.2	0.3019	0.0130
Pipe_14	109	108	CONDUIT	26.4	0.2005	0.0130
Pipe_15	110	109	CONDUIT	45.6	0.1996	0.0130
Pipe_2	101	100	CONDUIT	101.6	0.1496	0.0130
Pipe_26	511	508	CONDUIT	29.7	0.8012	0.0130
Pipe_27	512	511	CONDUIT	18.5	0.4002	0.0130
Pipe_28	513	512	CONDUIT	27.0	0.5038	0.0130
Pipe_29	514	513	CONDUIT	30.0	0.4993	0.0130
Pipe_3	102	101	CONDUIT	120.5	0.1494	0.0130
Pipe_35	517	107	CONDUIT	8.2	1.0036	0.0130
Pipe_4	103	102	CONDUIT	47.0	0.1489	0.0130
Pipe_7	505	105	CONDUIT	60.0	0.5000	0.0130
Pipe_8	106	104	CONDUIT	62.3	0.1957	0.0130
105-O	105	104	ORIFICE			
500-O	500	101	ORIFICE			
501-O	501	102	ORIFICE			
502-O	502	103	ORIFICE			

503-O	503	103	ORIFICE
506-O	506	106	ORIFICE
507-O	507	108	ORIFICE
508-O	508A	508	ORIFICE
509-O	509	110	ORIFICE
510-O	510	508	ORIFICE
TANK1	104	103	ORIFICE
TANK2	104	103	ORIFICE
W1	501	502	WEIR
W2	502	105	WEIR
W3	500	501	WEIR
BLDG-O	BLDG	101	OUTLET

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
Pipe_10	CIRCULAR	0.60	0.28	0.15	0.60	1	274.06
Pipe_11	CIRCULAR	0.60	0.28	0.15	0.60	1	274.41
Pipe_13	CIRCULAR	0.45	0.16	0.11	0.45	1	156.67
Pipe_14	CIRCULAR	0.45	0.16	0.11	0.45	1	127.67
Pipe_15	CIRCULAR	0.45	0.16	0.11	0.45	1	127.37
Pipe_2	CIRCULAR	0.90	0.64	0.23	0.90	1	700.23
Pipe_26	CIRCULAR	0.20	0.03	0.05	0.20	1	29.36
Pipe_27	CIRCULAR	0.25	0.05	0.06	0.25	1	37.62
Pipe_28	CIRCULAR	0.25	0.05	0.06	0.25	1	42.21
Pipe_29	CIRCULAR	0.25	0.05	0.06	0.25	1	42.02
Pipe_3	CIRCULAR	0.82	0.53	0.21	0.82	1	554.82
Pipe_35	CIRCULAR	0.25	0.05	0.06	0.25	1	59.58
Pipe_4	CIRCULAR	0.75	0.44	0.19	0.75	1	429.58
Pipe_7	CIRCULAR	0.30	0.07	0.07	0.30	1	68.38
Pipe_8	CIRCULAR	0.45	0.16	0.11	0.45	1	126.13

****

```
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 ............ 06/18/2024 00:00:00
Ending Date .............. 06/19/2024 00:00:00
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 ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.291        71.667
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.019         4.710
Surface Runoff ...........         0.267        65.630
Final Storage ............         0.006         1.406
Continuity Error (%) .....        -0.112
```



```
**************************        Volume        Volume
Flow Routing Continuity        hectare-m     10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.267         2.667
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.266         2.663
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 ......         0.000         0.000
Continuity Error (%) .....         0.141


********************************
Highest Flow Instability Indexes
********************************
Link 508-O (6)
Link 506-O (5)
Link 105-O (3)


*********************************
Most Frequent Nonconverging Nodes
*********************************
Convergence obtained at all time steps.


*************************
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 : 2.00
% of Steps Not Converging : 0.00

****
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
C101A	71.67	0.00	0.00	1.88	67.18	1.20	68.38	0.13	94.88	0.954
C103A	71.67	0.00	0.00	0.00	70.19	0.00	70.19	0.05	32.25	0.979
C103B	71.67	0.00	0.00	5.01	62.19	3.20	65.38	0.06	48.00	0.912
C103C	71.67	0.00	0.00	6.28	60.17	3.98	64.15	0.15	114.03	0.895
C105A	71.67	0.00	0.00	7.00	59.14	4.27	63.41	0.40	302.51	0.885
C107A	71.67	0.00	0.00	43.77	0.00	28.07	28.07	0.01	10.53	0.392
C108A	71.67	0.00	0.00	0.00	70.19	0.00	70.19	0.07	49.01	0.979
C505A	71.67	0.00	0.00	0.00	70.18	0.00	70.18	0.10	69.01	0.979
C506A	71.67	0.00	0.00	0.00	70.17	0.00	70.17	0.31	220.34	0.979

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
C508A	71.67	0.00	0.00	0.00	70.17	0.00	70.17	0.14	96.12	0.979
C508B	71.67	0.00	0.00	46.36	0.00	25.33	25.33	0.04	35.37	0.353
C508C	71.67	0.00	0.00	0.00	70.17	0.00	70.17	0.14	95.60	0.979
C509A	71.67	0.00	0.00	0.00	70.18	0.00	70.18	0.26	181.14	0.979
EXT1	71.67	0.00	0.00	0.00	70.21	0.00	70.21	0.20	142.92	0.980
R101A	71.67	0.00	0.00	0.00	70.16	0.00	70.16	0.55	387.01	0.979
UNC-1	71.67	0.00	0.00	33.74	16.04	21.71	37.75	0.02	24.31	0.527
UNC-2	71.67	0.00	0.00	43.96	0.00	27.81	27.81	0.01	11.77	0.388
UNC-3	71.67	0.00	0.00	0.00	70.17	0.00	70.17	0.03	24.38	0.979

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	hr:min	Reported Max Depth Meters
100	OUTFALL	0.04	0.41	64.91	0	01:22	0.41
UNC-1-O	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
UNC-2-O	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
UNC-3-O	OUTFALL	0.00	0.00	0.00	0	00:00	0.00
101	STORAGE	0.08	0.64	65.29	0	01:21	0.64
102	STORAGE	0.05	0.44	65.35	0	01:22	0.44
103	STORAGE	0.05	0.33	65.38	0	01:22	0.33
104	STORAGE	0.12	1.25	66.45	0	01:37	1.24
105	STORAGE	0.12	1.77	67.16	0	01:13	1.77

106	STORAGE	0.09	1.06	66.44	0	01:41	1.06
107	STORAGE	0.03	0.48	65.52	0	01:15	0.48
108	STORAGE	0.03	0.49	65.65	0	01:15	0.49
109	STORAGE	0.02	0.41	65.67	0	01:15	0.41
110	STORAGE	0.02	0.33	65.71	0	01:15	0.33
500	STORAGE	0.05	1.58	67.75	0	01:11	1.58
501	STORAGE	0.06	1.62	67.67	0	01:10	1.61
502	STORAGE	0.03	1.58	67.65	0	01:10	1.58
503	STORAGE	0.00	0.17	65.59	0	01:10	0.17
505	STORAGE	0.06	1.26	67.17	0	01:20	1.26
506	STORAGE	0.09	1.07	66.51	0	01:12	1.07
507	STORAGE	0.04	1.55	67.67	0	01:11	1.55
508	STORAGE	0.02	0.37	65.77	0	01:14	0.37
508A	STORAGE	0.07	2.36	67.76	0	01:11	2.36
509	STORAGE	0.04	1.17	66.81	0	01:11	1.17
510	STORAGE	0.05	1.52	67.74	0	01:12	1.52
511	STORAGE	0.01	0.25	66.24	0	01:13	0.25
512	STORAGE	0.01	0.25	66.32	0	01:12	0.25
513	STORAGE	0.00	0.18	66.38	0	01:10	0.18
514	STORAGE	0.00	0.19	66.54	0	01:10	0.19
517	STORAGE	0.00	0.08	66.65	0	01:10	0.08
BLDG	STORAGE	0.03	0.15	100.15	0	01:41	0.15

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
100	OUTFALL	0.00	495.01	0	01:22	0	2.6	0.000
UNC-1-O	OUTFALL	24.31	24.31	0	01:10	0.0207	0.0207	0.000
UNC-2-O	OUTFALL	11.77	11.77	0	01:10	0.00778	0.00778	0.000
UNC-3-O	OUTFALL	24.38	24.38	0	01:04	0.0345	0.0345	0.000

101	STORAGE	0.00	495.87	0	01:20	0	2.6	-0.015
102	STORAGE	0.00	202.02	0	01:20	0	1.28	0.135
103	STORAGE	0.00	125.81	0	01:20	0	0.96	-0.181
104	STORAGE	0.00	258.24	0	01:02	0	0.835	-0.249
105	STORAGE	302.51	403.88	0	01:10	0.404	0.539	0.076
106	STORAGE	0.00	104.20	0	01:03	0	0.311	0.319
107	STORAGE	0.00	225.73	0	01:14	0	0.649	0.520
108	STORAGE	0.00	223.40	0	01:14	0	0.642	0.042
109	STORAGE	0.00	87.36	0	01:14	0	0.256	-0.347
110	STORAGE	0.00	87.66	0	01:11	0	0.256	0.164
500	STORAGE	94.88	94.88	0	01:10	0.132	0.132	0.029
501	STORAGE	256.95	256.95	0	01:10	0.353	0.353	0.019
502	STORAGE	48.00	156.34	0	01:10	0.0643	0.102	0.009
503	STORAGE	32.25	32.25	0	01:10	0.0456	0.0456	0.000
505	STORAGE	69.01	88.16	0	01:04	0.0976	0.111	0.347
506	STORAGE	220.34	220.34	0	01:10	0.312	0.312	0.324
507	STORAGE	49.01	49.01	0	01:10	0.0694	0.0694	0.021
508	STORAGE	0.00	114.45	0	01:12	0	0.316	0.008
508A	STORAGE	96.12	96.12	0	01:10	0.136	0.136	0.035
509	STORAGE	181.14	181.14	0	01:10	0.256	0.256	0.006
510	STORAGE	95.60	95.60	0	01:10	0.135	0.135	0.007
511	STORAGE	0.00	32.83	0	01:10	0	0.0445	-0.318
512	STORAGE	0.00	34.19	0	01:10	0	0.0448	0.573
513	STORAGE	0.00	35.02	0	01:10	0	0.0448	0.003
514	STORAGE	35.37	35.37	0	01:10	0.0448	0.0448	-0.024
517	STORAGE	10.53	10.53	0	01:10	0.00693	0.00693	0.004
BLDG	STORAGE	387.01	387.01	0	01:10	0.548	0.548	-0.001

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary

****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
101	0.000	2.4	0.0	0.0	0.001	20.3	0 01:21	495.01
102	0.000	2.0	0.0	0.0	0.000	16.0	0 01:22	201.65
103	0.000	2.0	0.0	0.0	0.000	13.5	0 01:22	125.67
104	0.038	9.8	0.0	0.0	0.384	100.0	0 01:37	113.06
105	0.001	0.4	0.0	0.0	0.078	28.0	0 01:13	175.38
106	0.000	6.9	0.0	0.0	0.001	83.0	0 01:41	100.99
107	0.000	0.7	0.0	0.0	0.001	13.3	0 01:15	225.67
108	0.000	1.0	0.0	0.0	0.001	19.1	0 01:15	223.35
109	0.000	0.7	0.0	0.0	0.000	14.9	0 01:15	87.54
110	0.000	1.0	0.0	0.0	0.000	19.8	0 01:15	87.36
500	0.000	0.5	0.0	0.0	0.031	33.3	0 01:11	39.52
501	0.002	1.1	0.0	0.0	0.088	63.8	0 01:10	193.40
502	0.000	0.3	0.0	0.0	0.010	39.6	0 01:10	150.81
503	0.000	0.3	0.0	0.0	0.000	11.6	0 01:10	32.25
505	0.001	0.9	0.0	0.0	0.059	37.3	0 01:20	62.66
506	0.002	1.3	0.0	0.0	0.065	46.2	0 01:12	104.20
507	0.000	0.3	0.0	0.0	0.015	20.2	0 01:11	22.03
508	0.000	0.8	0.0	0.0	0.000	16.4	0 01:14	114.17
508A	0.000	0.1	0.0	0.0	0.028	8.7	0 01:11	45.95
509	0.001	0.3	0.0	0.0	0.052	24.8	0 01:11	87.66
510	0.001	0.4	0.0	0.0	0.032	22.4	0 01:12	38.76
511	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	30.37
512	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	32.83
513	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	34.19

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
514	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	35.02
517	0.000	0.0	0.0	0.0	0.000	0.0	0 00:00	10.52
BLDG	0.041	11.5	0.0	0.0	0.342	96.1	0 01:41	36.41

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
100	72.16	41.70	495.01	2.600
UNC-1-O	11.58	2.07	24.31	0.021
UNC-2-O	3.55	2.53	11.77	0.008
UNC-3-O	11.92	3.35	24.38	0.034
System	24.80	49.66	511.53	2.663

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
Pipe_10	CONDUIT	225.67	0 01:15	1.16	0.82	0.66
Pipe_11	CONDUIT	223.35	0 01:15	0.99	0.81	0.75
Pipe_13	CONDUIT	114.17	0 01:13	0.79	0.73	0.90
Pipe_14	CONDUIT	87.54	0 01:17	0.71	0.69	0.95
Pipe_15	CONDUIT	87.36	0 01:14	0.90	0.69	0.79
Pipe_2	CONDUIT	495.01	0 01:22	1.29	0.71	0.58
Pipe_26	CONDUIT	30.37	0 01:13	1.04	1.03	0.88

Pipe_27	CONDUIT	32.83	0	01:10	0.75	0.87	1.00
Pipe_28	CONDUIT	34.19	0	01:10	0.82	0.81	0.85
Pipe_29	CONDUIT	35.02	0	01:10	0.92	0.83	0.72
Pipe_3	CONDUIT	201.65	0	01:22	0.82	0.36	0.60
Pipe_35	CONDUIT	10.52	0	01:10	0.82	0.18	0.31
Pipe_4	CONDUIT	125.67	0	01:22	0.95	0.29	0.46
Pipe_7	CONDUIT	62.66	0	01:43	0.89	0.92	1.00
Pipe_8	CONDUIT	100.99	0	01:02	0.80	0.80	1.00
105-O	ORIFICE	157.25	0	01:02			1.00
500-O	ORIFICE	39.52	0	01:11			1.00
501-O	ORIFICE	77.94	0	01:10			1.00
502-O	ORIFICE	39.53	0	01:10			1.00
503-O	ORIFICE	32.25	0	01:10			0.57
506-O	ORIFICE	104.20	0	01:03			1.00
507-O	ORIFICE	22.03	0	01:11			1.00
508-O	ORIFICE	45.95	0	01:05			1.00
509-O	ORIFICE	87.66	0	01:11			1.00
510-O	ORIFICE	38.76	0	01:12			1.00
TANK1	ORIFICE	50.33	0	01:42			1.00
TANK2	ORIFICE	62.78	0	01:37			1.00
W1	WEIR	115.45	0	01:10			0.67
W2	WEIR	111.28	0	01:10			0.50
W3	WEIR	0.00	0	00:00			0.00
BLDG-O	DUMMY	36.41	0	01:41			

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
Pipe_10	1.00	0.02	0.00	0.00	0.02	0.00	0.00	0.96	0.00	0.00
Pipe_11	1.00	0.02	0.00	0.00	0.03	0.00	0.00	0.95	0.00	0.00
Pipe_13	1.00	0.02	0.00	0.00	0.10	0.00	0.00	0.88	0.02	0.00

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
Pipe_14	1.00	0.02	0.00	0.00	0.10	0.00	0.00	0.88	0.02	0.00
Pipe_15	1.00	0.02	0.00	0.00	0.04	0.00	0.00	0.95	0.00	0.00
Pipe_2	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
Pipe_26	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
Pipe_27	1.00	0.04	0.00	0.00	0.07	0.00	0.00	0.89	0.00	0.00
Pipe_28	1.00	0.04	0.00	0.00	0.95	0.00	0.00	0.00	0.95	0.00
Pipe_29	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.91	0.00
Pipe_3	1.00	0.02	0.00	0.00	0.22	0.00	0.00	0.76	0.01	0.00
Pipe_35	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
Pipe_4	1.00	0.02	0.00	0.00	0.07	0.00	0.00	0.91	0.00	0.00
Pipe_7	1.00	0.02	0.00	0.00	0.13	0.00	0.00	0.85	0.05	0.00
Pipe_8	1.00	0.02	0.00	0.00	0.21	0.00	0.00	0.77	0.05	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
Pipe_26	0.01	0.12	0.01	0.08	0.01
Pipe_27	0.03	0.03	0.04	0.01	0.02
Pipe_28	0.01	0.01	0.03	0.01	0.01
Pipe_7	1.22	1.22	2.03	0.01	0.01
Pipe_8	2.29	2.29	2.63	0.01	0.01

Analysis begun on: Tue Jun 25 12:49:10 2024
Analysis ended on: Tue Jun 25 12:49:12 2024
Total elapsed time: 00:00:02

C.5 Manufacturer Product Information

PATERSON GROUP

Geotechnical Investigation

Proposed Industrial Building

2760-2770 Sheffield Road
Ottawa, Ontario

Prepared for Richcraft

Report PG6530 -1 dated January 23, 2023

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The current geotechnical investigation was carried out on January 10th and 11th, 2023, and consisted of a total of nine (9) boreholes (BH 1-23 through BH 9-23) advanced to a maximum depth of 7.3 m below the existing grade. The borehole locations were distributed in a manner to provide general coverage of the subject site, taking into consideration underground services and available access. The approximate locations of the boreholes are shown on Drawing PG6530-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a low-clearance track-mounted drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer.

Sampling and In Situ Testing

The soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler or from the drill auger and hand auger flights. The samples were initially classified on site, placed in sealed plastic bags, and transported to our laboratory. The depths at which the drill auger, and split-spoon samples were recovered from the boreholes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

A Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing was carried out in cohesive soils using a field vane apparatus.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed at boreholes BH 1-23 and BH 4-23. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. It is recommended that the proposed industrial building be founded on conventional spread footings placed on an undisturbed, very to hard silty clay bearing surface.

Due to the presence of a silty clay deposit, a grade raise restriction will apply to the subject site. Permissible grade raise recommendations are discussed in Section 5.3.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, such as those containing organic or deleterious materials, should be stripped from under any buildings and other settlement sensitive structures. It is anticipated that the existing fill within the future building footprint, free of deleterious material and significant amounts of organics, can be left in place below the proposed building footprints outside of lateral support zones for the footings. However, it is recommended that the existing fill layer be proof-rolled several times under dry conditions and above freezing temperatures and approved by Paterson personnel at the time of construction. Any poor performing areas noted during the proof-rolling operation should be removed and replaced with an approved fill.

Fill Placement

Engineered fill placed for grading beneath the proposed buildings, where required, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings and paved areas should be compacted to at least 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material's SPMDD.

5.3 Foundation Design

Bearing Resistance Values – Conventional Spread Footings

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, very stiff to hard silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**. A geotechnical resistance factor of 0.5 is applied to the above noted bearing resistance value at ULS.

The above-noted bearing resistance values at SLS for soil bearing surfaces will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a silty clay bearing medium when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V, passes only through in situ soil or engineered fill of the same or higher capacity as the bearing soil.

Permissible Grade Raise

Due to the presence of the silty clay deposit, a permissible grade raise restriction of **2 m** is recommended. A post-development groundwater lowering of 0.5 m was considered in our permissible grade raise calculations.

If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D**. If a higher seismic site class is required (Class C), a site-specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed buildings, as presented in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012.

Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2012 for a full discussion of the earthquake design requirements.

5.5 Slab on Grade Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the existing fill subgrade or native soil subgrade approved by the geotechnical consultant at the time of excavation will be considered an acceptable subgrade surface on which to commence backfilling for slab-on-grade construction. Where the subgrade consists of the existing fill, a vibratory drum roller should complete several passes over the subgrade surface as a proof-rolling program. Any poor performing areas should be removed and reinstated with an engineered fill, such as OPSS Granular B Type II.

It is recommended that the upper 200 mm of sub-floor fill consists of OPSS Granular A crushed stone. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Design

Car only parking, heavy truck parking areas and access lanes are proposed at this site. The proposed pavement structures are presented in Tables 3 and 4 on the next page.

Table 3 – Recommended 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 fill, in-situ soil, or OPSS Granular B Type I or II material placed over fill or in-situ soil.	

Table 4 - Recommended Pavement Structure - Access Lanes/Local Roadways, Loading Areas and Heavy Truck Parking

Thickness (mm)	Material Description
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placedover fill or in situ soil.	

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or II material. Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable compaction equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity. For areas where silty clay is encountered at subgrade level, it is recommended that subdrains be installed during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

7.0 Recommendations

It is a requirement for the foundation data provided herein to be applicable that the following material testing, and observation program be performed by the geotechnical consultant.

- Review of the grading plan, from a geotechnical perspective.
- Observation of all bearing surfaces prior to the placement of concrete.
- Sampling and testing of the concrete and fill materials.
- Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- Observation of all subgrades prior to backfilling.
- Field density tests to determine the level of compaction achieved.
- Sampling and testing of the bituminous concrete including mix design reviews.

All excess soils, with the exception of engineered crushed stone fill, generated by construction activities that will be transported on-site or off-site should be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management*.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon request, following the completion of a satisfactory material testing and observation program by Paterson

8.0 Statement of Limitations

The recommendations provided are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Richcraft, or their agents, is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

Puneet Bandi, M.Eng.

Scott S. Dennis, P.Eng.

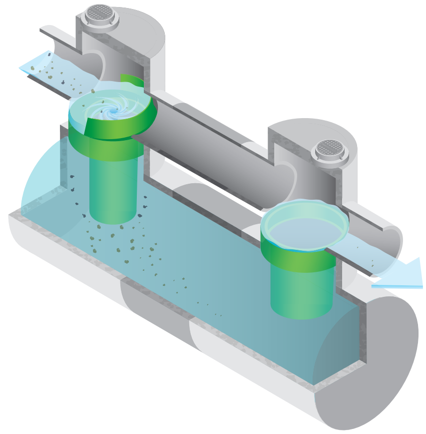
Report Distribution:

- ❑ Richcraft (e-mail copy)
- ❑ Paterson Group (1 copy)

Appendix D External Report Excerpts

Stormceptor® MAX

One system for your large stormwater capacity needs



The Stormceptor MAX responds to the needs of large-scale industrial, urban and residential areas which may require a single stormwater management device. It provides stormwater quality treatment for areas 20 to 100+ acres and industrial spill volume capture of 15,000+ gallons.

One Stormceptor MAX can provide protection for an entire neighbourhood, a full-scale industrial plant, urban redevelopments or other large developments.

Unique, comprehensive site coverage

- Increased sedimentation chamber extends horizontally rather than vertically
- Non-turbulent treatment environment allows oil to rise and sediment to settle
- Spill protection in dry and wet conditions
- Patented scour prevention technology contains captured pollutants for secure storage and easy removal
- Ideal for industrial, urban or residential sites with established infrastructure

Design flexibility

- Modular and expandable, depending on the site's size and water quality objective
- System can be constructed of different materials
- May be used as part of a stormwater treatment train, complimenting BMPs such as ponds or swales

Unit sizing based on PCSWMM for Stormceptor

- Industry-leading continuous simulation modeling software uses site conditions to project the frequency and intensity of runoff to determine the best system for your

It's still a Stormceptor

- Continuous positive treatment of total suspended solids (TSS) in stormwater runoff year-round, regardless of flow rate
- Industry-leading reputation for efficiency and reliability

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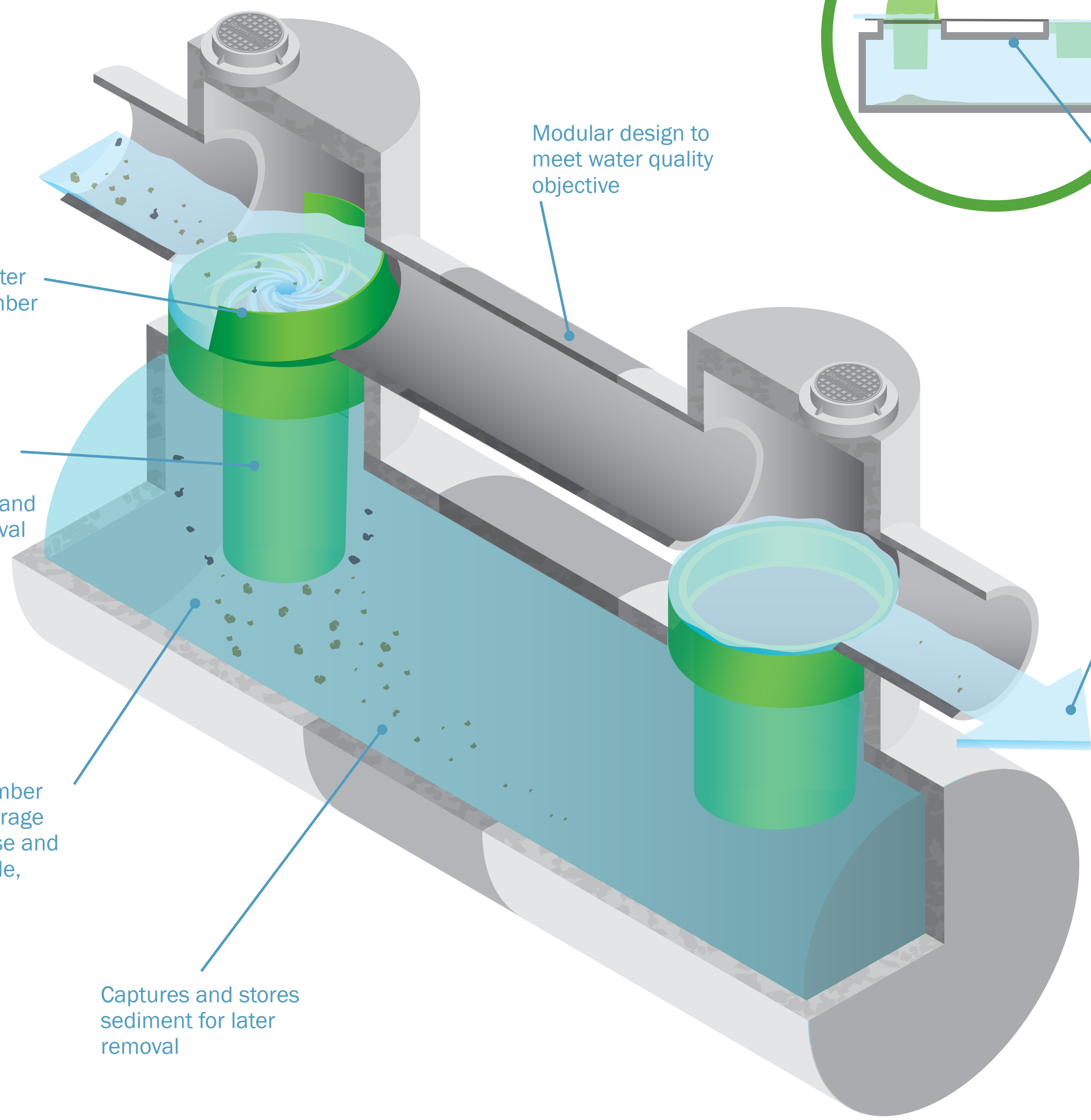
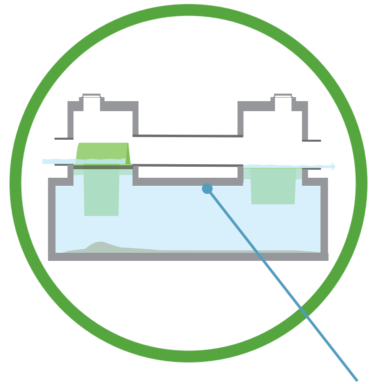
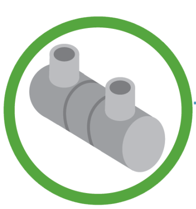
Large Capacity System

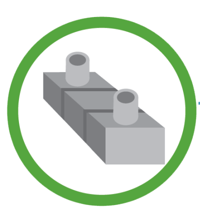






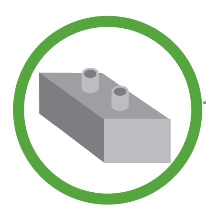
Pre-Cast Pipe Construction

Reliable and easy to install



Pre-Cast Box Construction

Larger volume-to-length ratio allows for treatment in a smaller footprint



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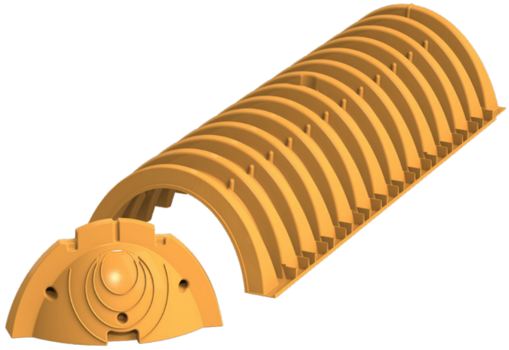
StormTech® SC-310 Chamber

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



Nominal Chamber Specifications
(not to scale)

Size (L x W x H)
85.4" x 34" x 16"
2170 mm x 864 mm x 406 mm

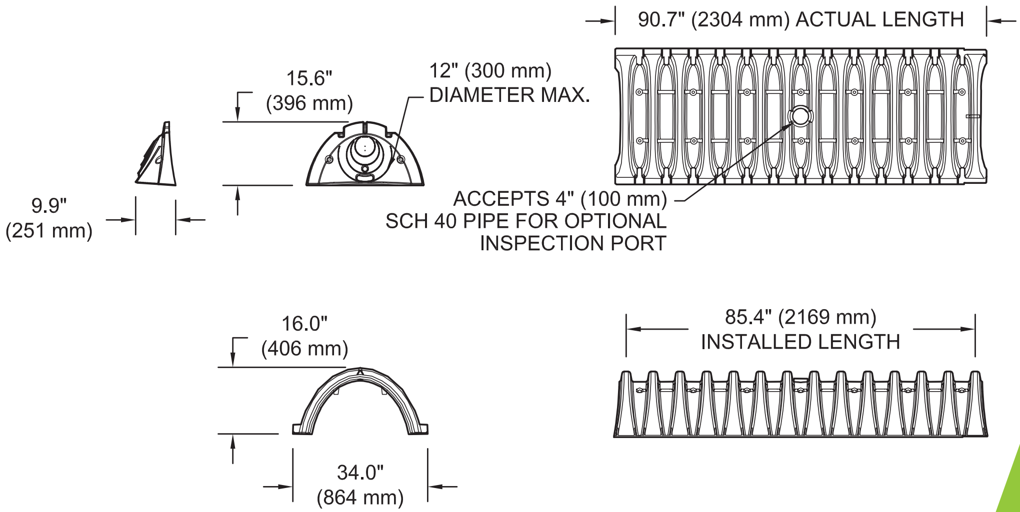
Chamber Storage
14.7 ft^3 (0.42 m^3)

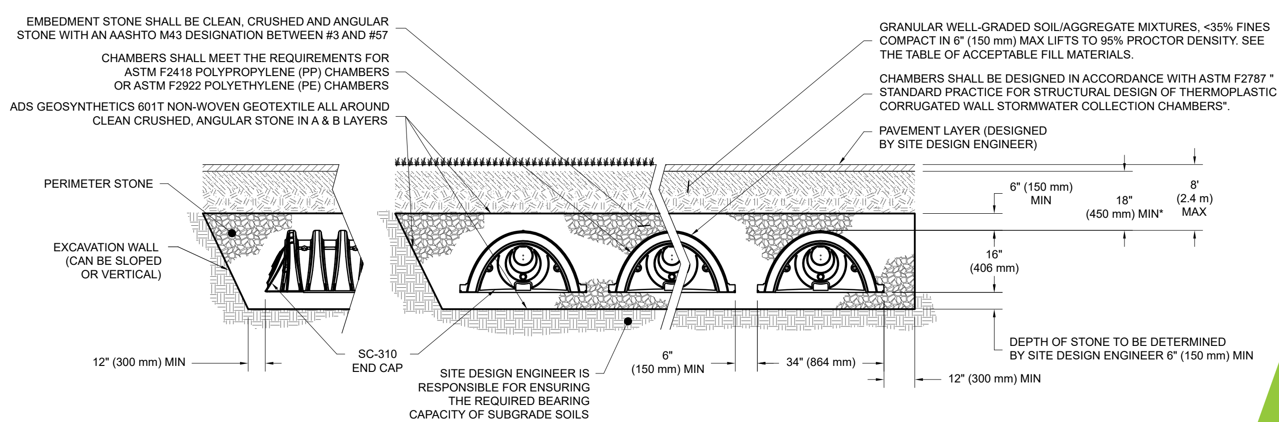
Min. Installed Storage*
31.0 ft^3 (0.88 m^3)

Weight
37.0 lbs (16.8 kg)

Shipping
55 chambers/pallet
108 end caps/pallet
18 pallets/truck

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





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

ADS StormTech™

StormTech SC-310 Specifications

Cumulative Storage Volumes Per Chamber

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

Depth of Water in System Inches (mm)		Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
28 (711)	Stone Cover	14.70 (0.416)	31.00 (0.878)
27 (686)		14.70 (0.416)	30.21 (0.855)
26 (660)		14.70 (0.416)	29.42 (0.833)
25 (635)		14.70 (0.416)	28.63 (0.811)
24 (610)		14.70 (0.416)	27.84 (0.788)
23 (584)		14.70 (0.416)	27.05 (0.766)
22 (559)		14.70 (0.416)	26.26 (0.748)
21 (533)		14.64 (0.415)	25.43 (0.720)
20 (508)		14.49 (0.410)	24.54 (0.695)
19 (483)		14.22 (0.403)	23.58 (0.668)
18 (457)		13.68 (0.387)	22.47 (0.636)
17 (432)		12.99 (0.368)	21.25 (0.602)
16 (406)		12.17 (0.345)	19.97 (0.566)
15 (381)		11.25 (0.319)	18.62 (0.528)
14 (356)		10.23 (0.290)	17.22 (0.488)
13 (330)		9.15 (0.260)	15.78 (0.447)
12 (305)		7.99 (0.227)	14.29 (0.425)
11 (279)		6.78 (0.192)	12.77 (0.362)
10 (254)		5.51 (0.156)	11.22 (0.318)
9 (229)		4.19 (0.119)	9.64 (0.278)
8 (203)		2.83 (0.081)	8.03 (0.227)
7 (178)		1.43 (0.041)	6.40 (0.181)
6 (152)	Stone Foundation	0	4.74 (0.134)
5 (127)		0	3.95 (0.112)
4 (102)		0	3.16 (0.090)
3 (76)		0	2.37 (0.067)
2 (51)		0	1.58 (0.046)
1 (25)		0	0.79 (0.022)

Note: Add 0.79 ft³ (0.022 m³) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber ft³ (m³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-310 Chamber	14.7 (0.4)	31.0 (0.9)	35.7 (1.0)	40.4 (1.1)

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

Amount of Stone Per Chamber

English Tons (yds³)	Stone Foundation Depth		
	6"	12"	18"
SC-310	2.1 (1.5)	2.7 (1.9)	3.4 (2.4)
Metric Kilograms (m³)	**150 mm**	**300 mm**	**450 mm**
SC-310	1830 (1.1)	2490 (1.5)	2990 (1.8)

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

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-310	2.9 (2.2)	3.4 (2.6)	3.8 (2.9)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as the depth of the cover increases.

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

Working on a project?
Visit us at adspipe.com/stormtech and utilize the Design Tool

ADS StormTech

adspipe.com
800-821-6710

SPECIFICATION DRAINAGE

Control-Flo

Roof Drainage System

www.zurn.com

THE ZURN "CONTROL-FLO CONCEPT"

Originally, Zurn introduced the scientifically-advanced "Control-Flo" drainage principle for dead-level roofs. Today, after thousands of successful applications in modern, large dead-level roof areas, Zurn engineers have adapted the comprehensive "Control-Flo" data to **sloped roof** areas.

WHAT IS "CONTROL-FLO"?

It is an advanced method of removing rain water off dead-level or sloped roofs. As contrasted with conventional drainage practices, which attempt to drain off storm water as quickly as it falls on the roof's surface, "Control-Flo" drains the roof at a controlled rate. Excess water accumulates on the roof under controlled conditions...then drains off at a lower rate after a storm abates.

CUTS DRAINAGE COSTS

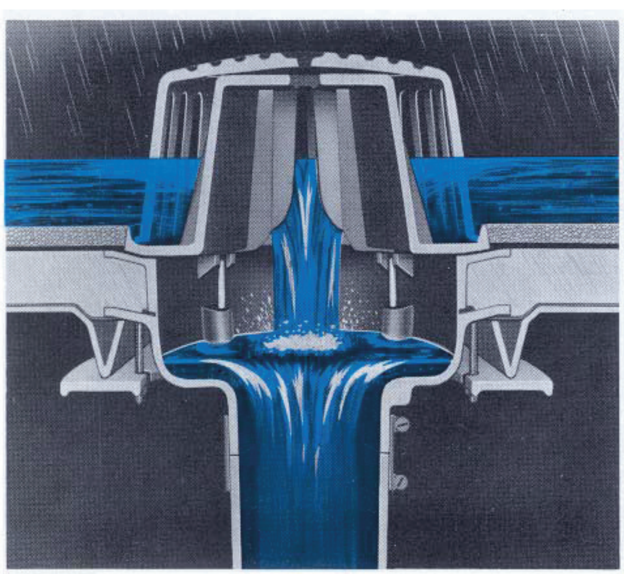
Fewer roof drains, smaller diameter piping, smaller sewer sizes, and lower installation costs are possible with a "Control-Flo" drainage system because roof areas are utilized as temporary storage reservoirs.

REDUCES PROBABILITY OF STORM DAMAGE

Lightens load on combination sewers by reducing rate of water drained from roof tops during severe storms thereby reducing probability of flooded sewers, and consequent backflow into basements and other low areas.

THANKS TO EXCLUSIVE ZURN "AQUA-WEIR" ACTION

Key to successful "Control-Flo" drainage is a unique scientifically-designed weir containing accurately calibrated notches with sides formed by parabolic curves which provide flow rates directly proportional to the head. Shape and size of notches are based on predetermined flow rates, and all factors involved in roof drainage to assure permanent regulation of drainage flow rates for specific geographic locations and rainfall intensities.

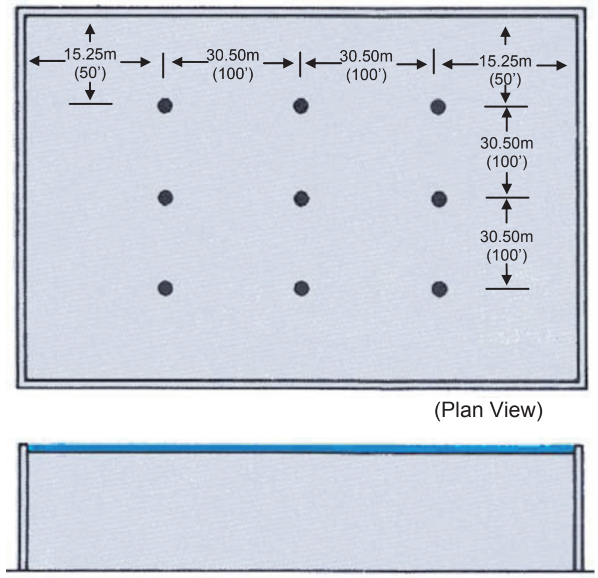


DEFINITION

DEAD LEVEL ROOFS

DIAGRAM "A"

A dead-level roof for purposes of applying the Zurn "Control-Flo" drainage principle is one which has been designed for zero slope across its entire surface. Measurements shown are for maximum distances.



(Plan View)

(Section View)

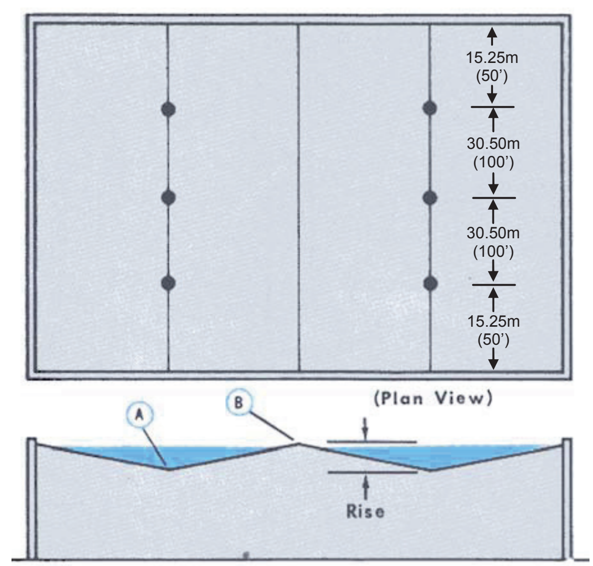
SLOPED ROOFS

DIAGRAM "B"

A sloped roof is one designed commonly with a shallow slope. The Zurn "Control-Flo" drainage system can be applied to any slope which results in a total rise up to 152mm (6").

The total rise of a roof as calculated for "Control-Flo" application is defined as the vertical increase in height in inches, from the low point or valley of a sloping roof (A) to the top of the sloping section (B). (Example: a roof that slopes 3mm (1/8") per foot having a 7.25m (24') span would have a rise of 7.25m x 3mm or 76mm (24' x 1/8" or 3")).

Measurements shown are for maximum distances.

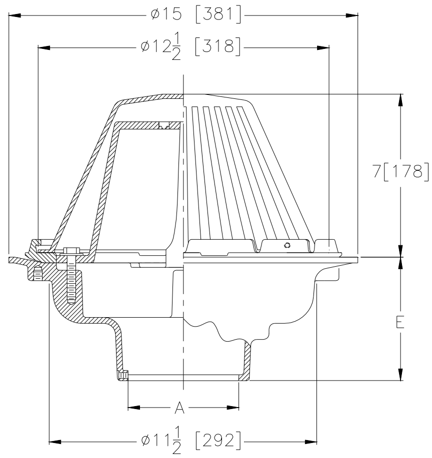


(Plan View)

(Section View)

Dimensions and other measurements given in metric and imperial forms.

SPECIFICATION DATA



ENGINEERING SPECIFICATION: ZURN Z-105 "Control-Flo" roof drain for dead -level or sloped roof construction, Dura-Coated cast iron body. "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/ gravel guard and Poly-Dome. All data shall be verified proportional to flow rates.

ROOF DESIGN RECOMMENDATIONS

Basic roofing design should incorporate protection that will prevent roof overloading by installing adequate over-flow scuppers in parapet walls.

GENERAL INFORMATION

The “Control-Flo” roof drainage data is tabulated for four areas (232.25m^2 (2500 sq. ft.), 464.502m^2 (5000 sq. ft.), 696.75m^2 (7500 sq. ft.), 929m^2 (10,000 sq. ft.) notch areas ratings) for each locality. For each notch area rating the maximum discharge in L.P.M. (G.P.M.) - draindown in hours, and maximum water depth at the drain in inches for a dead level roof — 51mm (2 inch) rise — 102mm (4 inch) rise and 152mm (6 inch) rise—are tabulated. The rise is the total change in elevation from the valley to the peak. Values for areas, rise or combination thereof other than those listed, can be arrived at by extrapolation. All data listed is based on the fifty-year return frequency storm. In other words the maximum conditions as listed will occur on the average of once every fifty years.

NOTE: The tabulated “Control-Flo” data enables the individual engineer to select his own design limiting condition. The limiting condition can be draindown time, roof load factor, or maximum water depth at the drain. If draindown time is the limiting factor because of possible freezing conditions, it must be recognized that the maximum time listed will occur on the average of once every 50 years and would most likely be during a heavy summer thunder storm. Average winter draindown times would be much shorter in duration than those listed.

GENERAL RECOMMENDATIONS

On sloping roofs, we recommend a design depth referred to as an equivalent depth. An equivalent depth is the depth of water attained at the drains that results in the same roof stresses as those realized on a dead-level roof. In all cases this equivalent depth is almost equal to that attained by using the same notch area rating for the different rises to 152mm (6”). With the same depth of water at the drain the roof stresses will decrease with increasing total rise. Therefore, it would be possible to have a depth in excess of 152mm (6”) at the drain on a sloping roof without exceeding stresses normally encountered in a 152mm (6”) depth on a dead-level roof. However, it is recommended that scuppers be placed to limit the maximum water depth on any roof to 152mm (6”) to prevent the overflow of the weirs on the drains and consequent overloading of drain piping. In the few cases where the data shows a flow rate in excess of 136 L.P.M. (30 G.P.M.) if all drains and drain lines are sized according to recommendations, and the one storm in fifty years occurs, the only consequence will be a brief flow through the scuppers or over-flow drains.

NOTE: An equivalent depth is that depth of water attained at the drains at the lowest line or valley of the roof with all other conditions such as notch area and rainfall intensity being equal. For Toronto, Ontario a notch area rating of 464.50m^2 (5,000 sq. ft.) results in a 74mm (2.9 inch) depth on a dead level roof for a 50-year storm. For the same notch area and conditions, equivalent depths for a 51mm (2”), 102mm (4”) and 152mm (6”) rise respectively on a sloped roof would be 86mm (3.4”), 104mm (4.1”) and 124mm (4.9”). Roof stresses will be approximately equal in all cases.

The exclusive Zurn "Selecta-Drain" Chart (pages 8—11) tabulates selection data for 34 localities in Canada. Proper use of this chart constitutes your best assurance of sure, safe, economical application of Zurn "Control-Flo" systems for your specific geographical area. If the "Selecta-Drain Chart does not cover your specific design criteria, contact Zurn Industries Limited, Mississauga, Ontario, for additional data for your locality. Listed below is additional information pertinent to proper engineering of the "Control-Flo" system.

ROOF USED AS TEMPORARY RETENTION

The key to economical "Control-Flo" is the utilization of large roof areas to temporarily store the maximum amount of water without overloading average roofs or creating excessive draindown time during periods of heavy rainfall. The data shown in the "Selecta-Drain" Chart enables the engineer to select notch area ratings from 232.25 m^2 (2,500 $ft.^2$) to 929m^2 (10,000 $ft.^2$) and to accurately predict all other design factors such as maximum roof load, L.P.M. (G.P.M.) discharge, draindown time and water depth at the drain. Obviously, as design factors permit the notch area rating to increase the resulting money saved in being able to use small leaders and drain lines will also increase.

ROOF LOADING AND RUN-OFF RATES

The four values listed in the "Selecta-Drain" Chart for notch area ratings for different localities will normally span the range of good design. If areas per notch below 232.25m^2 (2,500 $ft.^2$) are used considerable economy of the "Control-Flo" concept is being lost. The area per notch is limited to 929m^2 (10,000 $ft.^2$) to keep the draindown time within reasonable limits. Extensive studies show that stresses due to water load on a sloping roof for any fixed set of conditions are very nearly the same as those on a dead-level roof. A sloping roof tends to concentrate more water in the valleys and increase the water depth at this point. The greater depth around the drain leads to a faster run-off rate, particularly a faster early run -off rate. As a result, the total volume of water stored on the roof is less, and the total load on the sloping roof is less. By using the same area on the sloping roof as on the dead-level roof the increase in roof stresses due to increased water depth in the valleys is offset by the decrease in the total load due to less water stored. The net result of the maximum roof stress is approximately the same for any single span rise and fixed set of conditions. A fixed set of conditions, would be the same notch area, the same frequency store, and the same locality.

SPECIAL CONSIDERATIONS FOR STRUCTURAL SAFETY: Normal practice of roof design is based on 18kg (40 lbs.) per 929 cm^2 (sq ft.). (Subject to local codes and by-laws.) Thus it is extremely important that design is in accordance with normal load factors so deflection will be slight enough in any bay to prevent progressive deflection which could cause water depths to load the roof beyond its design limits.

ADDITIONAL NOTCH RATINGS

The 'Selecta-Drain" Chart along with Tables I and II enables the engineer to select "Control-Flo" Drains and drain pipe sizes for most Canadian applications. These calculations are computed for a proportional flow weir that is sized to give a flow of 23 L.P.M. (5 G.P.M.) per inch of head. The 23 L.P.M. (5 G.P.M.) per inch of head notch opening is selected as the bases of design as it offers the most economical installation as applied to actual rainfall experienced in Canada.
Should you require design criteria for locations outside of Canada or for special project applications please contact Zurn Industries Limited, Mississauga, Ontario.

LEADER AND DRAIN PIPE SIZING

Since all data in the "Selecta-Drain" Chart is based on the 50-year-storm it is possible to exceed the water depth listed in these charts if a 100-year or 1000-year storm would occur. Therefore, for good design it is recommended that scuppers or other methods be used to limit water depth to the design depth and tables I and II be used to size the leaders and drain pipes. If the roof is capable of supporting more water than the design depth it is permissible to locate the scuppers or other overflow means at a height that will allow a greater water depth on the roof. However, in this case the leader and drain pipes should be sized to handle the higher flow rates possible based on a flow rate of 23 L.P.M. (5 G.P.M.) per inch of depth at the drain.

PROPER DRAIN LOCATION

The following good design practice is recommended for selecting the proper number of "Control-Flo" drains for a given area. **On dead-level roofs**, drains should be located no further than 15.25m (50 feet) from edge of roof and no further than 30.50m (100 feet) between drains. See diagram "A" page 2. **On sloping roofs**, drains should be located in the valleys at a distance no greater than 15.25m (50 feet) from each end of the valleys and no further than 30.50m (100 feet) between drains. See diagram "B" page 2. Compliance with these recommendations will assure good run off regardless of wind direction.

Saves Specification Time, Assures Proper Application

QUICK, EASY SELECTION

Using the “Selecta-Drain” Chart (pages 9—13) in combination with the steps and examples appearing below, should save you countless hours in engineering specification time. This vast compilation of data is related to the proper selection of drains for 34 cities. All cities in alphabetical order by province. If a specific city does not appear in the tabulation, chooses the city nearest your area and select the proper drain using these factors.

3 EASY STEPS…

AND 3 TYPICAL EXAMPLES FOR APPLICATION OF SURE, SCIENTIFIC CONTROL OF DRAINAGE FROM DEAD-LEVEL AND SLOPING ROOFS WITH THE ZURN CONCEPT.

NOTE: Where roof area to be drained is adjacent to one or more vertical walls projecting above the roof, then a percentage of the of the wall(s) must be added to the roof area in determining total roof area to be drained.

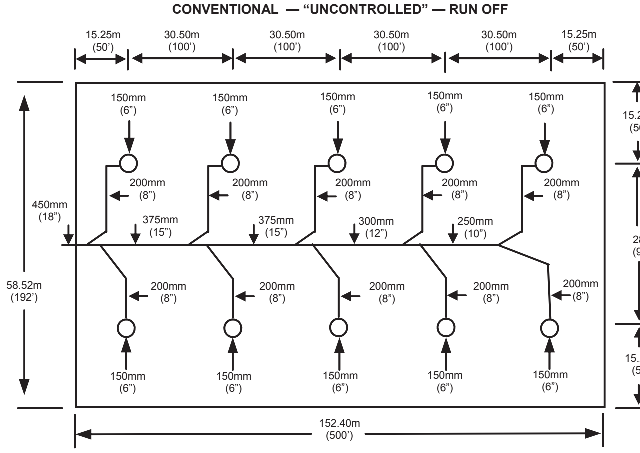
	TORONTO, ONTARIO	DEAD-LEVEL ROOF	102mm (4 INCH) SLOPE	152mm (6 INCH) SLOPE
1	Determine total roof area or individual areas when roof is divided by expansion joints or peaks in the case of sloping roof.	Roof Area: 56.52m x 152.40m = 8918.40m^2 (192ft x 500ft = 96,000 sq. ft.) (See Z105 layout bottom of this page.)	3 Individual Roof Areas: 19.50m x 152.40m = 2972.80m^2 (64ft x 500ft = 32,000 sq. ft.) Valleys 152.40m (500ft) long 3 x 2972.80 = 8918.40m^2 (3 x 32,000 = 96,000 sq. ft.)	2 Individual Roof Areas: 29.87m x 152.40m = 4552m^2 (98ft x 500ft = 49,000 sq. ft.) Valleys 152.40m (500ft) long 2 x 4552 = 9104m^2 (2 x 49,000 = 98,000 sq. ft.)
2	Divide roof area or individual areas by Zurn Notch Area Rating selected to obtain the total number of notches required.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from “Selecta-Drain Chart, page 11. Total Roof Area = 8918.40m^2 (96,000 sq. ft.) Entire roof. 464.50m^2 (5,000 sq. ft.) notch area = 19.2 notches—USE 20.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from “Selecta-Drain Chart, page 11. Total Roof Area = 2972.80m^2 (32,000 sq. ft.) Each area. 464.50m^2 (5,000 sq. ft.) notch area = 6.4 notches—USE 7 PER AREA.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from “Selecta-Drain Chart, page 11. Total Roof Area = 4552m^2 (49,000 sq. ft.) Each area. 464.50m^2 (5,000 sq. ft.) notch area = 9.8 notches—USE 10 PER AREA.
3	Determine total number of drains required by not exceeding maximum spacing dimensions in the preceding instructions. See Diagrams “A” or “B”, page 2. Divide total number of notches required to determine the number of notches per drain. Note maximum water depth at drain and use this dimension to determine scupper height. Maximum scupper height to be used is 152mm (6”). *Use this flow rate to size leaders and drain lines.*	*10 drains required. All drains must have two notches each for a total of 20 notches. Flow rate is 66 L.P.M. (14.5 G.P.M.) per notch. Size leaders for 2 notch weirs for a flow rate of 66 L.P.M. (14.5 G.P.M.) 50 mm (two inch) pipe size leaders required. Maximum water depth and scupper height is 74mm (2.9“). Requires 19 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.	**5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacings. Two drains on ends with two notches—3 drains in middle on notch each for a total of 7 notches. Maximum flow rate 93 L.P.M. (20.5 G.P.M.) per notch. Leader size 50mm (2”) for single notch weirs—75mm (3”) notch weirs. Maximum water depth and scupper height is 104mm (4.1”). Requires 11 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.	**5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacing in the middle. 10 notches are required therefore all drains must have two notches. Flow rate is 111 L.P.M. (24.5 G.P.M.) per notch. Size all leaders for 2 notch weirs. 75mm (3”) pipe size required. Maximum water depth and scupper height is 124mm (4.9”). Requires 9 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.

*See Diagram “A” page 2 for recommended drain placement.
**See Diagram “B” page 2 for recommended drain placement.

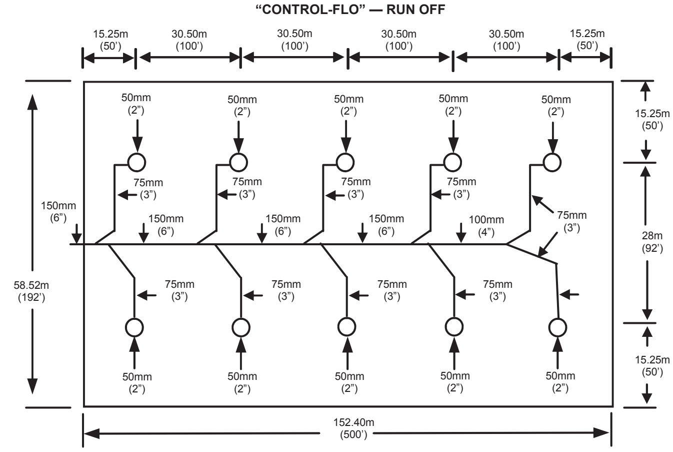
DEAD LEVEL ROOF

6mm (1/4”) PER FT. SLOPE STORM DRAIN

CONVENTIONAL — “UNCONTROLLED” — RUN OFF



“CONTROL-FLO” — RUN OFF



Select The Proper Vertical Drain Leaders

ROOF DRAINAGE DATA

The flow rate for any design condition can be easily read from the data contained on the following pages; the tabulations shown below (and on the opposite page) can be used to simplify selection of drain line sizes.

TABLE 1 - SUGGESTED RELATION OF DRAIN OUTLET AND VERTICAL LEADER SIZE TO ZURN CONTROL-FLO ROOF DRAINS (BASED ON NATIONAL PLUMBING CODE ASA -A40.8 DATA ON VERTICAL LEADERS).

No. of Notches in Drain	Max. Flow per Notch in L.P.M. (G.P.M.)		
	Pipe Size		
	50mm (2”)	75mm (3”)	100mm (4”)
1	136* (30*)	—	—
2	68 (15)	136* (30*)	—
3	45 (10)	136* (30*)	—
4	—	105 (23)	136* (30*)
5	—	82 (18)	136* (30*)
6	—	68 (15)	136* (30*)

*Maximum flow obtainable from 1 notch with 152mm (6”) water depth at drain.

Table 1 should be used to select **vertical drain** leaders which at the same time establishes the drain outlet size. This table illustrates the minimum flow per notch in L.P.M. (G.P.M.) Since the Z-105 drain is available with a minimum of one and a maximum of six notches, calculations have already been a made and are listed in this table for any quantity of weir notch openings established in your design. It was determined ten drains with two notches each weir would be required in the Dead-Level Roof example on page 5. A 66 L.P.M. (14.5 G.P.M.) discharge per notch flow rate was also established.

Once this design criteria has been determined it will be the key to the proper selection of all drain outlet sizes, vertical and horizontal storm drain sizes in Table I and II. Enter the column “Number of Notches in Drain”, Table I, read down the column to the figure 2 which indicates two notches in weir, then read across until you reach a figure equal to or closest figure in excess of 66 L.P.M. (14.5 G.P.M.) You will find fifteen in the column under 50mm (2”) which represents the pipe size. Therefore all drain outlets and vertical leaders are 50mm (2”) size.

Let us digress for a moment assuming a specific structure requires a total of six drains each containing a weir with a different number of notches. One with 1, one with 2, etc. Table 1 discloses the pipe size for one notch is 50mm (2”), two notch is 50mm (2”), three notch is 75mm (3”), four notch is 75mm (3”), five notch is 75mm (3”) and six notch is 75mm (3”) as they all equal or closely exceed the 66 L.P.M. (14.5 G.P.M.) design.

NOTE: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

TABLE II should be used to select **horizontal** storm drain piping. Use the same flow rate 66 L.P.M. (14.5 G.P.M.) used to establish the vertical leaders to size the storm drainage system and main storm drain. Let us assume the ten drains each with two notch weirs were actually on the roof in two separate lines of five drains each and joined at a common point before leaving the building. Since Table II includes 3mm (1/8”), 6mm (1/4”) and 13mm (1/2”) per foot slope, let **us use 6mm (1/4”) as our basis for selection** which will take us to the centre section. Starting with the first of five drains we enter the extreme left column in Table II and read down to the figure 2 since this drain has two notches in weir, read across horizontally and the size of first section of horizontal storm drain is 75mm (3”) between 1st and 2nd drain, return to left hand column proceed reading down until you reach figure 4 then read across horizontally and the pipe size will be 100mm (4”) between 2nd and 3rd drain, 100mm (4”) between 3rd and 4th and 125mm (5”) (if available) between 4th and 5th. If not available use 150mm (6”). (You may be tempted to use 100mm (4”) since the capacity is close. We recommend you go to the larger size.) Pipe size leaving 5th drain would be 150mm (6”). The same sizing would hold true for the second line of five drains. Since both columns of five drains each are being joined together before leaving the building there will be total of twenty notches discharging into the main building storm sewer. Enter left hand column Table II, read down until you reach the figure twenty, then read across horizontally to the 6mm (1/4”) per 305mm (1’) slope column and you will see a 150mm (6”) storm drain will handle the job adequately. The same procedure should be followed for sloped roof installations. The above method of sizing was done to better acquaint you with Table II and its use. The more economical and practical way of laying out and installing this same job is illustrated in the control-flo layout shown on bottom of page 5.

NOTE: Although pipe size calculations should be based on accumulated flow rates, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

Select Proper Horizontal Storm Drain Piping

Table II — SUGGESTED RELATION OF HORIZONTAL STORM DRAIN SIZE TO ZURN CONTROL-FLO ROOF DRAINAGE

Total No. of Notches Discharging to Storm Drain	MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.)								MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.)							MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.)						
	Storm Drain Size 3mm (1/8") per 305mm (1') Slope								Storm Drain Size 6mm (1/4") per 305mm (1') Slope							Storm Drain Size 13mm (1/2") per 305mm (1') Slope						
	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")	375 (15")	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")
1	136* (30*)	—	—	—	—	—	—	—	136* (30*)	—	—	—	—	—	—	136* (30*)	—	—	—	—	—	—
2	77 (17)	136* (30*)	—	—	—	—	—	—	109 (24)	136* (30*)	—	—	—	—	—	136* (30*)	—	—	—	—	—	—
3	50 (11)	118 (26)	136* (30*)	—	—	—	—	—	73 (16)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	—
4	36 (8)	86 (19)	136* (30*)	—	—	—	—	—	55 (12)	127 (28)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	—
5	—	65 (15)	127* (28*)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	59 (13)	136* (30*)	—	—	—	—	—
6	—	59 (13)	105 (23)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	50 (11)	118 (26)	136* (30*)	—	—	—	—
7	—	50 (11)	91 (20)	136* (30*)	—	—	—	—	—	73 (16)	127 (28)	136* (30*)	—	—	—	—	100 (22)	136* (30*)	—	—	—	—
8	—	—	77 (17)	127 (28)	136* (30*)	—	—	—	—	64 (14)	114 (25)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—	—	—	—
9	—	—	68 (15)	114 (25)	136* (30*)	—	—	—	—	55 (12)	100 (22)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—	—	—
10	—	—	64 (14)	100 (22)	136* (30*)	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	68 (15)	123 (27)	136* (30*)	—	—	—
11	—	—	55 (12)	91 (20)	136* (30*)	—	—	—	—	—	82 (18)	132 (29)	136* (30*)	—	—	—	64 (14)	114 (25)	136* (30*)	—	—	—
12	—	—	—	82 (18)	136* (30*)	—	—	—	—	—	73 (16)	118 (26)	136* (30*)	—	—	—	59 (13)	105 (23)	136* (30*)	—	—	—
13	—	—	—	77 (17)	136* (30*)	—	—	—	—	—	68 (15)	109 (24)	136* (30*)	—	—	—	55 (12)	95 (21)	136* (30*)	—	—	—
14	—	—	—	73 (16)	136* (30*)	—	—	—	—	—	64 (14)	100 (22)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—	—	—
15	—	—	—	68 (15)	136* (30*)	—	—	—	—	—	59 (13)	95 (21)	136* (30*)	—	—	—	—	82 (18)	132 (29)	136* (30*)	—	—
16	—	—	—	64 (14)	136* (30*)	—	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	77 (17)	123 (27)	136* (30*)	—	—
17	—	—	—	59 (13)	127 (28)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	73 (16)	118 (26)	136* (30*)	—	—
18	—	—	—	55 (12)	118 (26)	136* (30*)	—	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	68 (15)	109 (24)	136* (30*)	—	—
19	—	—	—	—	114 (25)	136* (30*)	—	—	—	—	—	73 (16)	136* (30*)	—	—	—	—	64 (14)	105 (23)	136* (30*)	—	—
20	—	—	—	—	109 (24)	136* (30*)	—	—	—	—	—	68 (15)	136* (30*)	—	—	—	—	59 (13)	100 (22)	136* (30*)	—	—
23	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	—	64 (14)	132 (29)	136* (30*)	—	—	—	55 (12)	86 (19)	136* (30*)	—	—
25	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	—	59 (13)	123 (27)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—
30	—	—	—	—	73 (16)	127 (28)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	64 (14)	136* (30*)	—	—
35	—	—	—	—	59 (13)	109 (24)	136* (30*)	—	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	55 (12)	123 (27)	136* (30*)	—
40	—	—	—	—	55 (12)	95 (21)	136* (30*)	—	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	—	105 (23)	136* (30*)	—
45	—	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	—	68 (15)	123 (27)	136* (30*)	—	—	—	—	95 (21)	136* (30*)	—
50	—	—	—	—	—	77 (17)	123 (27)	136* (30*)	—	—	—	—	59 (13)	109 (24)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—
55	—	—	—	—	—	68 (15)	114 (25)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—
60	—	—	—	—	—	64 (14)	105 (23)	136* (30*)	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	68 (15)	127 (28)	136* (30*)
65	—	—	—	—	—	59 (13)	95 (21)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	64 (14)	118 (26)	136* (30*)
70	—	—	—	—	—	55 (12)	91 (20)	136* (30*)	—	—	—	—	—	77 (17)	127 (28)	—	—	—	—	59 (13)	109 (24)	136* (30*)

*Maximum flow obtainable from 1 notch with 152mm (6") water depth at drain.

TABLE III - TO BE USED WHEN ROOF STORM WATER RUN OFF AND OTHER SURFACE WATER RUN OFF IS BEING CONSOLIDATED INTO ONE COMMON MAIN HORIZONTAL STORM SEWER.

Flow capacity of vertical leaders litres per minute (gallons per minute)

Pipe Size	Maximum Capacity L.P.M. (G.P.M.)
50mm (2”)	136 (30)
75mm (3”)	409 (90)
100mm (4”)	864 (190)
†125mm (5”)	1582 (348)
150mm (6”)	2550 (561)

†In some areas 125mm (5”) drainage pipe may not be available.

Flow capacity of horizontal storm sewers litres per minute (gallons per minute).

Pipe Size	Slope per 305mm (1’0”)		
	3mm (1/8”)	6mm (1/4”)	13mm (1/2”)
75mm (3”)	163 (36)	232 (51)	327 (72)
100mm (4”)	355 (78)	505 (111)	714 (157)
†125mm (5”)	646 (142)	914 (201)	1291 (284)
150mm (6”)	1050 (231)	1487 (327)	2100 (462)
200mm (8”)	2264 (498)	3205 (705)	4528 (996)
250mm (10”)	4100 (902)	5796 (1275)	8201 (1804)
300mm (12”)	6669 (1467)	9437 (2076)	13338 (2934)
375mm (15”)	12120 (2666)	17157 (3774)	24239 (5332)

Note: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

SCUPPER AND OVERFLOW DRAINS

Roofing members and understructures, weakened by seepage and rot resulting from improper drainage and roof construction can give away under the weight of rapidly accumulated water during flash storms. Thus, it is recommended, and often required by building codes, to install scuppers and overflow drains in parapet-type roofs. Properly selected and sized scuppers and overflow drains are vital to a well-engineered drainage system to prevent excessive loading, erosion, seepage and rotting.

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT)	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2”) RISE			102mm (4”) RISE			152mm (6”) RISE		
	NOTCH AREA RATING		L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Calgary, Alberta	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	66 (14.5)	**14**	73.5 (2.9)	82 (18)	**9**	91.5 (3.6)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**28**	68.5 (2.7)	72.5 (16)	**22**	81.5 (3.2)	88.5 (19.5)	**15**	99 (3.9)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	6.8 (15.1)	66 (14.5)	**38**	73.5 (2.9)	77.5 (17)	**31**	86.5 (3.4)	93 (20.5)	**22**	104 (4.1)	109 (24)	**17**	122 (4.8)
Edmonton, Alberta	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	82 (18)	**3**	91.5 (3.6)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14.5**	76 (3)	84 (18.5)	**9.5**	94 (3.7)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.6 (14.5)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	97.5 (21.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3.0)	79.5 (17.5)	**32**	89 (3.5)	100 (22)	**22**	112 (4.4)	113.5 (25)	**18**	127 (5.0)
Penticton, British Columbia	232 (2,500)	3.8 (8.3)	36.5 (8)	**6**	40.5 (1.6)	38.5 (8.5)	**4**	43 (1.7)	52.5 (11.5)	**3**	58.5 (2.3)	61.5 (13.5)	**2.3**	68.5 (2.7)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	**13**	43 (1.7)	41 (9)	**9**	45.5 (1.8)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**5**	76 (3)
	697 (7,500)	4.2 (9.3)	41 (9)	**21**	45.5 (1.8)	43 (9.5)	**14.5**	48.5 (1.9)	61.5 (13.5)	**10.5**	68.5 (2.7)	72.5 (16)	**8**	81.5 (3.2)
	929 (10,000)	4.2 (9.3)	41 (9)	**27**	45.5 (1.8)	45.5 (10)	**20**	51 (2)	63.5 (14)	**14**	71 (2.8)	75 (16.5)	**11**	84 (3.3)
Vancouver, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	**5.5**	35.5 (1.4)	38.5 (8.5)	**4**	43 (1.7)	47.5 (10.5)	**2.8**	53.5 (2.1)	57 (12.5)	**2**	63.5 (2.5)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	**13**	43 (1.7)	45.5 (10)	**10**	51 (2)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**5**	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	**22**	48.5 (1.9)	50 (11)	**17**	56 (2.2)	63.5 (14)	**11**	71 (2.8)	75 (16.5)	**8.5**	84 (3.3)
	929 (10,000)	4.9 (10.9)	47.5 (10.5)	**30**	53.5 (2.1)	54.5 (12)	**24**	61 (2.4)	68 (15)	**15**	76 (3)	79.5 (17.5)	**12**	89 (3.5)
Victoria, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	**5.5**	35.5 (1.4)	38.5 (8.5)	**4**	43 (1.7)	43 (9.5)	**2.5**	48.5 (1.9)	54.5 (12)	**2**	61 (2.4)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	**13**	43 (1.7)	45.5 (10)	**10**	51 (2)	54.5 (12)	**6**	61 (2.4)	68 (15)	**5**	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	**22**	48.5 (1.9)	50 (11)	**16**	56 (2.2)	59 (13)	**10**	66 (2.6)	75 (16.5)	**8**	84 (3.3)
	929 (10,000)	4.7 (10.4)	45.5 (10)	**30**	51 (2)	54.5 (12)	**23**	61 (2.4)	63.5 (14)	**14**	71 (2.8)	79.5 (17.5)	**12**	89 (3.5)
Brandon, Manitoba	232 (2,500)	5.9 (13)	57 (12.5)	**8**	63.5 (2.5)	68 (15)	**7**	76 (3)	82 (18)	**4.5**	91.5 (3.6)	92.5 (21)	**3.5**	106.5 (4.2)
	465 (5,000)	7.3 (16.1)	73 (16)	**20**	81.5 (3.2)	84 (18.5)	**17**	94 (3.7)	97.5 (21.5)	**11**	109 (4.3)	113.5 (25)	**8.5**	127 (5)
	697 (7,500)	8.3 (18.2)	79.5 (17.5)	**32**	89 (3.5)	93 (20.5)	**27**	104 (4.1)	107 (23.5)	**19**	119.5 (4.7)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	9.0 (19.8)	86.5 (19)	**43**	96.5 (3.8)	100 (22)	**38**	112 (4.4)	113.5 (25)	**26**	127 (5.0)	132 (29)	**21**	147.5 (5.8)
Winnipeg, Manitoba	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	57 (12.5)	**6**	63.5 (2.5)	75 (16.5)	**4**	84 (3.3)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**15**	76 (3)	84 (18.5)	**10**	94 (3.7)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	6.6 (14.5)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	93 (20.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**39**	76 (3)	82 (18)	**32**	91.5 (3.6)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**17**	127 (5.0)
Campbellton, New Brunswick	232 (2,500)	6.4 (14)	62 (13.5)	**9**	68.5 (2.7)	70.5 (15.5)	**7**	78.5 (3.1)	79.5 (17.5)	**4.5**	89 (3.5)	91 (20)	**3.5**	101.5 (4.0)
	465 (5,000)	9.0 (19.8)	86.5 (19)	**22**	96.5 (3.8)	91 (20)	**18**	101.5 (4)	102.5 (22.5)	**12**	115 (4.5)	113.5 (25)	**9**	127 (5.0)
	697 (7,500)	10.4 (22.9)	100 (22)	**35**	112 (4.4)	102.5 (22.5)	**28**	114.5 (4.5)	118 (26)	**20**	132 (5.2)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	11.3 (25)	109 (24)	**47**	122 (4.8)	111.5 (24.5)	**40**	124.5 (4.9)	127.5 (28)	**29**	142 (5.6)	141 (31)	**22**	157.5 (6.2)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Chatham, New Brunswick	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	52.5 (11.5)	**5.5**	58.5 (2.3)	63.5 (14)	**3.5**	71 (2.8)	77.5 (17)	**2.9**	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	63.5 (14)	**13**	71 (2.8)	77.5 (17)	**9**	86.5 (3.4)	91 (20)	**7**	101.5 (4.0)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	68 (15)	**22**	76 (3)	84 (18.5)	**14**	94 (3.7)	102.5 (22.5)	**12**	114.5 (4.5)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**37**	71 (2.8)	75 (16.5)	**30**	84 (3.3)	91 (20)	**20**	101.5 (4.0)	107 (23.5)	**16**	119.5 (4.7)
Moncton, New Brunswick	232 (2,500)	4.3 (9.4)	41 (9)	**7**	45.5 (1.8)	54.5 (12)	**6**	61 (2.4)	63.5 (14)	**3.5**	71 (2.8)	72.5 (16)	**2.7**	81.5 (3.2)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14**	76 (3)	82 (18)	**9**	91.5 (3.6)	93 (20.5)	**7**	104 (4.1)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	79.5 (17.5)	**24**	89 (3.5)	93 (20.5)	**16**	104 (4.1)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	7.5 (16.6)	73.5 (16)	**39**	81.5 (3.2)	84 (18.5)	**34**	94 (3.7)	100 (22)	**23**	112 (4.4)	113.5 (25)	**17**	127 (5.0)
Saint John, New Brunswick	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	57 (12.5)	**6**	63.5 (2.5)	75 (16.5)	**4**	84 (3.3)	86.5 (19)	**3**	96.5 (3.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	**20**	81.5 (3.2)	79.5 (17.5)	**16**	89 (3.5)	95.5 (21)	**11**	106.5 (4.2)	104.5 (23)	**8**	117 (4.6)
	697 (7,500)	8.7 (19.2)	84 (18.5)	**32**	94 (3.7)	93 (20.5)	**27**	104 (4.1)	107 (23.5)	**19**	119.5 (4.7)	118 (26)	**13.5**	132 (5.2)
	929 (10,000)	9.7 (21.3)	93 (20.5)	**44**	104 (4.1)	104.5 (23)	**38**	117 (4.6)	113.5 (25)	**27**	127 (5.0)	127.5 (28)	**20**	142 (5.6)
Gander, Newfound-land	232 (2,500)	3.5 (7.8)	34 (7.5)	**5.5**	38 (1.5)	45.5 (10)	**5**	51 (2.0)	57 (12.5)	**3.5**	63.5 (2.5)	68 (15)	**2.5**	76 (3.0)
	465 (5,000)	4.7 (10.4)	45.5 (10)	**15**	51 (2.0)	57 (12.5)	**12**	63.5 (2.5)	72.5 (16)	**8**	81.5 (3.2)	82 (18)	**6.5**	91.5 (3.6)
	697 (7,500)	5.7 (12.5)	54.5 (12)	**25**	61 (2.4)	63.5 (14)	**21**	71 (2.8)	79.5 (17.5)	**13.5**	89 (3.5)	93 (20.5)	**11**	104 (4.1)
	929 (10,000)	6.1 (13.5)	59 (13)	**35**	66 (2.6)	70.5 (15.5)	**29**	78.5 (3.1)	84 (18.5)	**19**	94 (3.7)	100 (22)	**15**	112 (4.4)
St. Andrews, Newfound-land	232 (2,500)	3.5 (7.8)	34 (7.5)	**5.5**	38 (1.5)	45.5 (10)	**5**	51 (2.0)	59 (13)	**3.5**	66 (2.6)	63.5 (14)	**2.5**	71 (2.8)
	465 (5,000)	5.2 (11.4)	47.5 (10.5)	**15**	53.5 (2.1)	59 (13)	**13**	66 (2.6)	72.5 (16)	**8**	81.5 (3.2)	79.5 (17.5)	**6**	89 (3.5)
	697 (7,500)	5.9 (13)	57 (12.5)	**26**	63.5 (2.5)	66 (14.5)	**21**	73.5 (2.9)	82 (18)	**14**	91.5 (3.6)	88.5 (19.5)	**10**	99 (3.9)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	72.5 (16)	**30**	81.5 (3.2)	86.5 (19)	**20**	96.5 (3.8)	95.5 (21)	**14.5**	106.5 (4.2)
St. John's, Newfound-land	232 (2,500)	5.9 (13)	57 (12.5)	**8**	63.5 (2.6)	68 (15)	**7**	76 (3.0)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	**21**	91.5 (3.6)	91 (20)	**18**	101 (4.0)	100 (22)	**11**	112 (4.4)	113.5 (25)	**9**	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	**34**	114.5 (4.5)	109 (24)	**29**	122 (4.8)	122.5 (27)	**21**	137 (5.4)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	**48**	127 (5.0)	129.5 (28.5)	**43**	145 (5.7)	143 (31.5)	**33**	160 (6.3)	150 (33)	**24**	167.5 (6.6)
Torbay, Newfound-land	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	61.5 (13.5)	**6.5**	68.5 (2.7)	75 (16.5)	**4**	84 (3.3)	84 (18.5)	**3**	94 (3.7)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	75 (16.5)	**15.5**	84 (3.3)	88.5 (19.5)	**10**	99 (3.9)	102.5 (22.5)	**8**	114.5 (4.5)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	84 (18.5)	**25**	94 (3.7)	100 (22)	**17.5**	112 (4.4)	113.5 (25)	**13**	127 (5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	**40**	86.5 (3.4)	88.5 (19.5)	**34**	99 (3.9)	107 (23.5)	**24**	119.5 (4.7)	122.5 (27)	**19**	137 (5.4)
Halifax, Nova Scotia	232 (2,500)	5.9 (13)	57 (12.5)	**8**	63.5 (2.5)	68 (15)	**7**	76 (3.0)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	**21**	91.5 (3.6)	91 (20)	**18**	101.5 (4.0)	100 (22)	**11**	112 (4.4)	113.5 (25)	**9**	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	**34**	114.5 (4.5)	109 (24)	**29**	122 (4.8)	122.5 (27)	**21**	137 (5.4)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	**48**	127 (5.0)	129.5 (28.5)	**43**	145 (5.7)	143 (31.5)	**33**	160 (6.3)	150 (33)	**24**	167.5 (6.6)

Selecta-Drain Chart

ZURN®

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Sydney, Nova Scotia	232 (2,500)	4.3 (9.4)	41 (9)	**6.5**	45.5 (1.8)	45.5 (10)	**5**	51 (2.0)	57 (12.5)	**3.5**	6.5 (2.5)	68 (15)	**2.5**	76 (3)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	59 (13)	**13**	66 (2.6)	75 (16.5)	**8**	84 (3.3)	84 (18.5)	**6.5**	94 (3.7)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**28**	68.5 (2.7)	68 (15)	**22**	76 (3)	84 (18.5)	**14**	94 (3.7)	97.5 (21.5)	**11**	109 (4.3)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3)	75 (16.5)	**30**	84 (3.3)	91 (20)	**20**	101.5 (4)	104.5 (23)	**16**	117 (4.6)
Yarmouth, Nova Scotia	232 (2,500)	6.4 (14)	61.5 (13.5)	**9**	68.5 (2.7)	70.5 (15.5)	**7.5**	78.5 (3.1)	82 (18)	**4.5**	91.5 (3.6)	91 (20)	**3.5**	101.5 (4)
	465 (5,000)	8.3 (18.2)	79.5 (17.5)	**21**	89 (3.5)	88.5 (19.5)	**18**	99 (3.9)	104.5 (23)	**12**	117 (4.6)	116 (25.5)	**9**	129.5 (5.1)
	697 (7,500)	9.4 (20.8)	91 (20)	**34**	101.5 (4)	102.5 (22.5)	**29**	114.5 (4.5)	118 (26)	**21**	132 (5.2)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	10.4 (22.9)	100 (22)	**45**	112 (4.4)	109 (24)	**41**	122 (4.8)	129.5 (28.5)	**29**	145 (5.7)	141 (31)	**22**	157.5 (6.2)
Thunder Bay, Ontario	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	61.5 (13.5)	**6.5**	68.5 (2.7)	75 (16.5)	**4**	84 (3.3)	88.5 (19.5)	**3.5**	91.5 (3.6)
	465 (5,000)	6.1 (13.5)	59 (13)	**18**	66 (2.6)	72.5 (16)	**15**	81.5 (3.2)	86.5 (19)	**9.5**	96.5 (3.8)	102.5 (22.5)	**7.5**	114.5 (4.5)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	77.5 (17)	**24**	86.5 (3.4)	93 (20.5)	**16**	104 (4.1)	109 (24)	**13**	122 (4.8)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3)	84 (18.5)	**33**	94 (3.7)	97.5 (21.5)	**22**	109 (4.3)	116 (25.5)	**18**	129.5 (5.1)
Guelph, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	63.5 (14)	**7**	71 (2.8)	86.5 (19)	**5**	96.5 (3.8)	100 (22)	**3.7**	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	75 (16.5)	**15.5**	84 (3.3)	97.5 (21.5)	**11**	109 (4.3)	116 (25.5)	**9**	129.5 (5.1)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	82 (18)	**25**	91.5 (3.6)	104.5 (23)	**18**	117 (4.6)	125 (27.5)	**14**	139.5 (5.5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	**40**	86.5 (3.4)	84 (18.5)	**34**	94 (3.7)	109 (24)	**26**	122 (4.8)	132 (29)	**20**	147.5 (5.8)
Hamilton, Ontario	232 (2,500)	5.9 (13)	57 (12.5)	**8.5**	63.5 (2.5)	72.5 (16)	**7.5**	81.5 (3.2)	93 (20.5)	**5**	104 (4.1)	109 (24)	**4**	122 (4.8)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	79.5 (17.5)	**16**	89 (3.5)	104.5 (23)	**12**	117 (4.6)	122.5 (27)	**9**	137 (5.4)
	697 (7,500)	6.8 (15.1)	66 (14.5)	**28**	73.5 (2.9)	84 (18.5)	**26**	94 (3.7)	111.5 (24.5)	**20**	124.5 (4.9)	127.5 (28)	**15**	142 (5.6)
	929 (10,000)	7.1 (15.6)	68 (15)	**39**	76 (3)	86.5 (19)	**34**	96.5 (3.8)	116 (25.5)	**27**	129.5 (5.1)	134 (29.5)	**21**	150 (5.9)
Kingston, Ontario	232 (2,500)	6.4 (14)	61.5 (13.5)	**9**	68.5 (2.7)	77.5 (17)	**8**	86.5 (3.4)	91 (20)	**5**	101.5 (4)	109 (24)	**4**	122 (4.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	**20**	81.5 (3.2)	86.5 (19)	**18**	96.5 (3.8)	104.5 (23)	**12**	117 (4.6)	122.5 (27)	**9.5**	137 (5.4)
	697 (7,500)	8.5 (18.7)	82 (18)	**31**	91.5 (3.6)	93 (20.5)	**28**	104 (4.1)	111.5 (24.5)	**20**	124.5 (4.9)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	8.7 (19.2)	86.5 (19)	**42**	96.5 (3.8)	97.5 (21.5)	**38**	109 (4.3)	116 (25.5)	**27**	129.5 (5.1)	68 (15)	**21**	152.5 (6)
London, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	**8.5**	66 (2.6)	72.5 (16)	**7.5**	81.5 (3.2)	88.5 (19.5)	**5**	99 (3.9)	107 (23.5)	**4**	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	**20**	76 (3)	84 (18.5)	**17**	94 (3.7)	102.5 (22.5)	**12**	114.5 (4.5)	122.5 (27)	**9.5**	137 (5.4)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	88.5 (19.5)	**27**	99 (3.9)	109 (24)	**19**	122 (4.8)	129.5 (28.5)	**15**	145 (5.7)
	929 (10,000)	8.5 (18.7)	82 (18)	**41**	91.5 (3.6)	91 (20)	**36**	101.5 (4)	113.5 (25)	**27**	127 (5)	134 (29.5)	**21**	150 (5.9)
North Bay, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	68 (15)	**7**	76 (3)	86.5 (19)	**5**	96.5 (3.8)	100 (22)	**3.8**	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	79.5 (17.5)	**16**	89 (3.5)	97.5 (21.5)	**11**	109 (4.3)	113.5 (25)	**9**	127 (5)
	697 (7,500)	7.5 (16.6)	72.5 (16)	**30**	81.5 (3.2)	86.5 (19)	**26**	96.5 (3.8)	107 (23.5)	**19**	119.5 (4.7)	122.5 (27)	**14**	137 (5.4)
	929 (10,000)	8.3 (18.2)	77.5 (17)	**40**	86.5 (3.4)	93 (20.5)	**36**	104 (4.1)	111.5 (24.5)	**26**	124.5 (4.9)	127.5 (28)	**20**	142 (5.6)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE: DEAD LEVEL L.P.M. (G.P.M.) Discharge	DEAD LEVEL Draindown Time Hrs.	DEAD LEVEL mm (in.) Water Depth	51mm (2") RISE L.P.M. (G.P.M.) Discharge	51mm (2") RISE Draindown Time Hrs.	51mm (2") RISE mm (in.) Water Depth	102mm (4") RISE L.P.M. (G.P.M.) Discharge	102mm (4") RISE Draindown Time Hrs.	102mm (4") RISE mm (in.) Water Depth	152mm (6") RISE L.P.M. (G.P.M.) Discharge	152mm (6") RISE Draindown Time Hrs.	152mm (6") RISE mm (in.) Water Depth
Ottawa, Ontario	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	59 (13)	**6.5**	66 (2.6)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14**	76 (3)	86.5 (19)	**10**	96.5 (3.8)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	75 (16.5)	**23**	84 (3.3)	93 (20.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	79.5 (17.5)	**32**	89 (3.5)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**18**	127 (5)
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	68 (15)	**7**	76 (3.0)	86.5 (19)	**5**	96.5 (3.8)	104.5 (23)	**4**	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	77.5 (17)	**16**	86.5 (3.4)	97.5 (21.5)	**11**	109 (4.3)	118 (26)	**9**	132 (5.2)
	697 (7,500)	7.1 (16.6)	68 (15)	**29**	76 (3.0)	82 (18)	**26**	91.5 (3.6)	102.5 (22.5)	**18**	114.5 (4.5)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	**40**	81.5 (3.2)	86.5 (19)	**34**	96.5 (3.8)	107 (23.5)	**24**	119.5 (4.7)	132 (29)	**20**	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	**7**	45.5 (1.8)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	86.5 (19)	**3.3**	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	63.5 (14)	**14**	71 (2.8)	82 (18)	**9**	91.5 (3.6)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	70.5 (15.5)	**22**	78.5 (3.1)	86.5 (19)	**15**	96.5 (3.8)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	72.5 (16)	**30**	81.5 (3.2)	91 (20)	**21**	101.5 (4.0)	109 (24)	**17**	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	66 (14.5)	**7**	73.5 (2.9)	82 (18)	**4.5**	91.5 (3.6)	97.5 (21.5)	**3.5**	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	**19**	73.5 (2.9)	77.5 (17)	**16**	86.5 (3.4)	93 (20.5)	**11**	104 (4.1)	111.5 (24.5)	**9**	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	84 (18.5)	**26**	94 (3.7)	100 (22)	**18**	112 (4.4)	120.5 (26.5)	**14**	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	**42**	91.5 (3.6)	86.5 (19)	**34**	96.5 (3.8)	104.5 (23)	**24**	117 (4.6)	127.5 (28)	**20**	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	**8.5**	66 (2.6)	70.5 (15.5)	**7.5**	78.5 (3.1)	84 (18.5)	**4.5**	94 (3.7)	107 (23.5)	**4**	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	**20**	76 (3.0)	79.5 (17.5)	**16**	89 (3.5)	97.5 (21.5)	**11**	109 (4.3)	118 (26)	**9**	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	86.5 (19)	**26**	96.5 (3.8)	107 (23.5)	**18**	119.5 (4.7)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	**42**	91.5 (3.6)	91 (20)	**36**	101.5 (4.0)	113.5 (25)	**26**	127 (5.0)	129.5 (28.5)	**20**	145 (5.7)
Charlottetown, Prince Edward Island	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**3.8**	76 (3.0)	79.5 (17.5)	**3**	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	75 (16.5)	**15.5**	84 (3.3)	88.5 (19.5)	**10**	99 (3.9)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	**31**	84 (3.3)	86.5 (19)	**26**	96.5 (3.8)	102.5 (22.5)	**18**	114.5 (4.5)	113.5 (25)	**13**	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	**42**	94 (3.7)	97.5 (21.5)	**37**	106.5 (4.2)	111.5 (24.5)	**26**	124.5 (4.9)	125 (27.5)	**20**	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	**7.5**	56 (2.2)	61.5 (13.5)	**7**	68.5 (2.7)	79.5 (17.5)	**4.5**	89 (3.5)	97.5 (21.5)	**3.5**	109 (4.36)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	70.5 (15.5)	**15**	78.5 (3.1)	88.5 (19.5)	**10**	99 (3.9)	109 (24)	**8**	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	**27**	66 (2.6)	72.5 (16)	**23**	81.5 (3.2)	93 (20.5)	**16**	104 (4.1)	113.5 (25)	**13**	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	**36**	68.5 (2.7)	77.5 (17)	**31**	86.5 (3.4)	95.5 (21)	**22**	106.5 (4.2)	120.5 (26.5)	**19**	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	**8**	58.5 (2.3)	63.5 (14)	**7**	71 (2.8)	79.5 (17.5)	**4.5**	89 (3.5)	97.5 (21.5)	**3.5**	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	70.5 (15.5)	**15**	78.5 (3.1)	84 (18.5)	**10**	94 (3.7)	104.5 (23)	**8**	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	72.5 (16)	**23**	81.5 (3.2)	86.5 (19)	**15**	96.5 (3.8)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**37**	76 (3.0)	77.5 (17)	**31**	86.5 (3.4)	88.5 (19.5)	**20**	99 (3.9)	109 (24)	**17**	122 (4.8)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) / NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE: DEAD LEVEL L.P.M. (G.P.M.) Discharge	DEAD LEVEL Draindown Time Hrs.	DEAD LEVEL mm (in.) Water Depth	51mm (2") RISE L.P.M. (G.P.M.) Discharge	51mm (2") RISE Draindown Time Hrs.	51mm (2") RISE mm (in.) Water Depth	102mm (4") RISE L.P.M. (G.P.M.) Discharge	102mm (4") RISE Draindown Time Hrs.	102mm (4") RISE mm (in.) Water Depth	152mm (6") RISE L.P.M. (G.P.M.) Discharge	152mm (6") RISE Draindown Time Hrs.	152mm (6") RISE mm (in.) Water Depth
Regina, Saskatchewan	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	54.5 (12)	**6**	61 (2.4)	72.5 (16)	**4**	81.5 (3.2)	79.5 (17.5)	**3**	89 (3.5)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	68 (15)	**14**	76 (3.0)	86.5 (19)	**10**	96.5 (3.8)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	77.5 (17)	**24**	86.5 (3.4)	100 (22)	**17**	112 (4.4)	109 (24)	**12**	122 (4.8)
	929 (10,000)	8.3 (18.2)	79.5 (17.5)	**40**	89 (3.5)	82 (18)	**32**	91.5 (3.6)	104.5 (23)	**24**	117 (4.6)	118 (26)	**18**	132 (5.2)
Saskatoon, Saskatchewan	232 (2,500)	4.0 (8.8)	38.5 (8.5)	**6**	43 (1.7)	57 (12.5)	**6**	63.5 (2.5)	66 (14.5)	**3.8**	73.5 (2.9)	77.5 (17)	**2.8**	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	68 (15)	**14.5**	76 (3.0)	82 (18)	**9**	91.5 (3.6)	95.5 (21)	**7**	106.5 (4.2)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	91 (20)	**16**	101.5 (4.0)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3.0)	82 (18)	**32**	91.5 (3.6)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**18**	127 (5.0)

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Volume III: TEMPEST INLET CONTROL DEVICES

Municipal Technical Manual Series

SECOND EDITION

LMF (Low to Medium Flow) ICD

HF (High Flow) ICD

MHF (Medium to High Flow) ICD

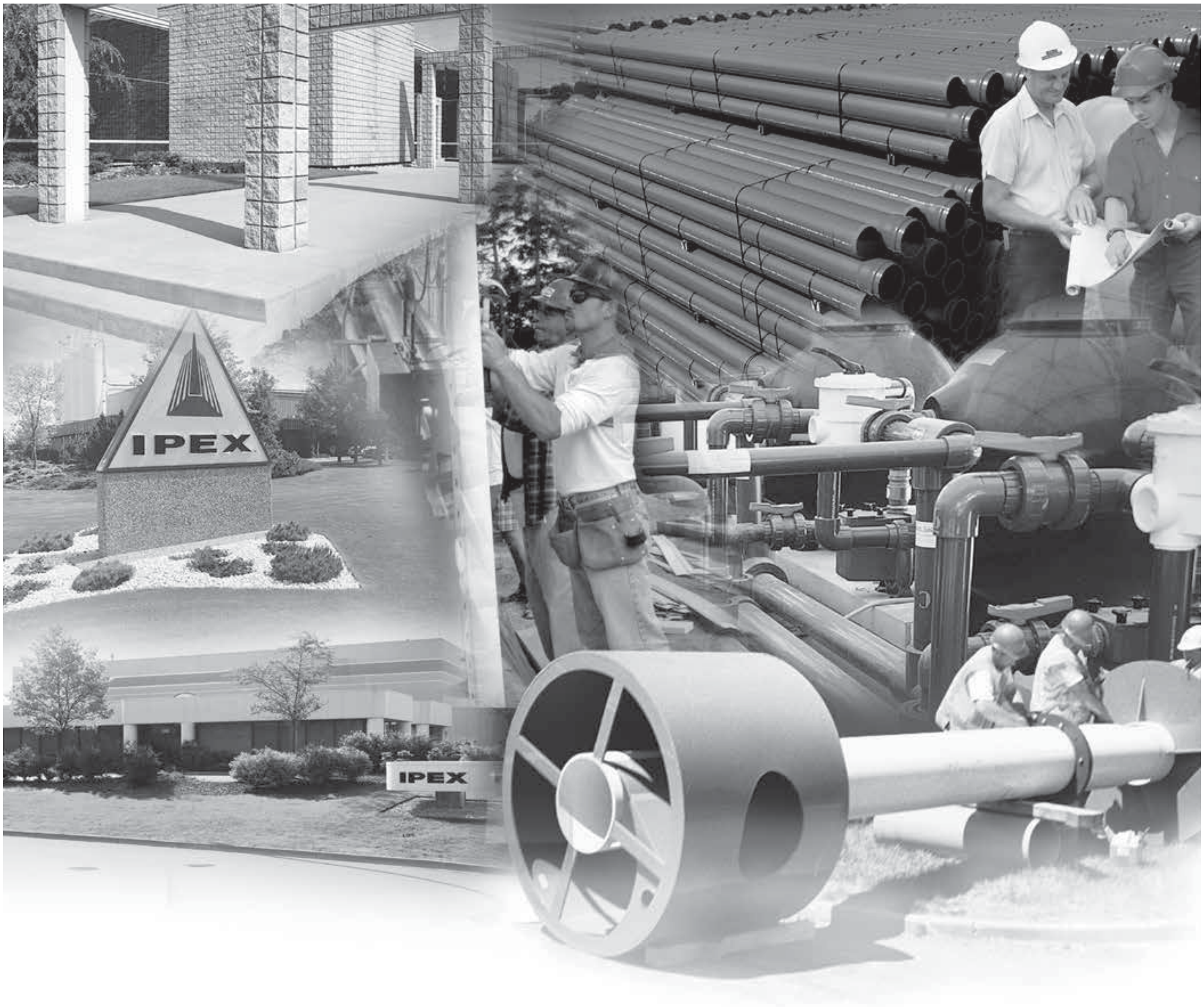
IPEX by aliaxis

IPEX Tempest™ Inlet Control Devices

Municipal Technical Manual Series

Vol. I, 2nd Edition

For information contact: IPEX, Marketing,
1425 North Service Road East, Oakville, Ontario, Canada, L6H 1A7



ABOUT IPEX

At IPEX, we have been manufacturing non-metallic pipe and fittings since 1951. We formulate our own compounds and maintain strict quality control during production. Our products are made available for customers thanks to a network of regional stocking locations throughout North America. We offer a wide variety of systems including complete lines of piping, fittings, valves and custom-fabricated items.

More importantly, we are committed to meeting our customers' needs. As a leader in the plastic piping industry, IPEX continually develops new products, modernizes manufacturing facilities and acquires innovative process technology. In addition, our staff take pride in their work, making available to customers their extensive thermoplastic knowledge and field experience. IPEX personnel are committed to improving the safety, reliability and performance of thermoplastic materials. We are involved in several standards committees and are members of and/or comply with the organizations listed on this page.

For specific details about any IPEX product, contact our customer service department.

CONTENTS

NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

PRODUCT INFORMATION: TEMPEST LOW, MEDIUM FLOW (LMF) ICD

Purpose

To control the amount of storm water runoff entering a sewer system by allowing a specified flow volume out of a catch basin or manhole at a specified head. This approach conserves pipe capacity so that catch basins downstream do not become uncontrollably surcharged, which can lead to basement floods, flash floods and combined sewer overflows.

Product Description

Our LMF ICD is designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter and larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 14 preset flow curves, the LMF ICD has the ability to provide flow rates: 2lps – 17lps (31gpm – 270gpm)

Product Function

The LMF ICD vortex flow action allows the LMF ICD to provide a narrower flow curve using a larger orifice than a conventional orifice plate ICD, making it less likely to clog. When comparing flows at the same head level, the LMF ICD has the ability to restrict more flow than a conventional ICD during a rain event, preserving greater sewer capacity.

Product Construction

Constructed from durable PVC, the LMF ICD is light weight 8.9 Kg (19.7 lbs).

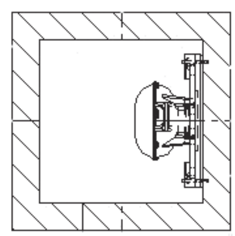
Product Applications

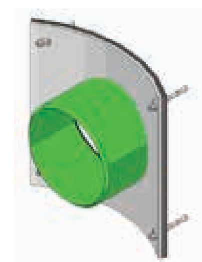
Will accommodate both square and round applications:

Square Application

Round Application

Universal Mounting Plate



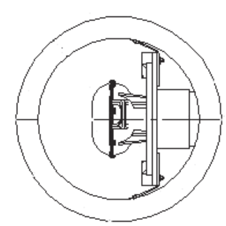


+

Spigot CB Wall Plate

=

Universal Mounting Plate Hub Adapter



NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

Chart 1: LMF 14 Preset Flow Curves

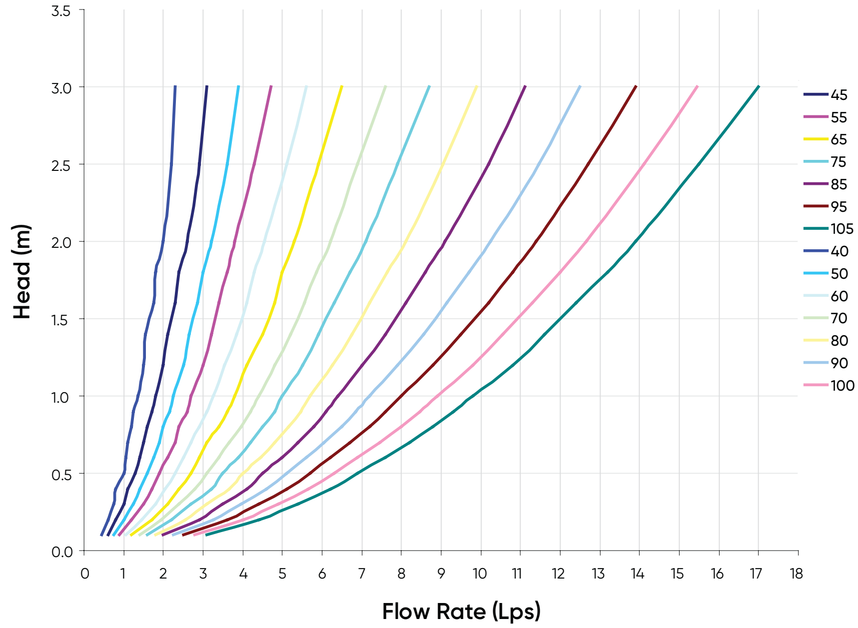
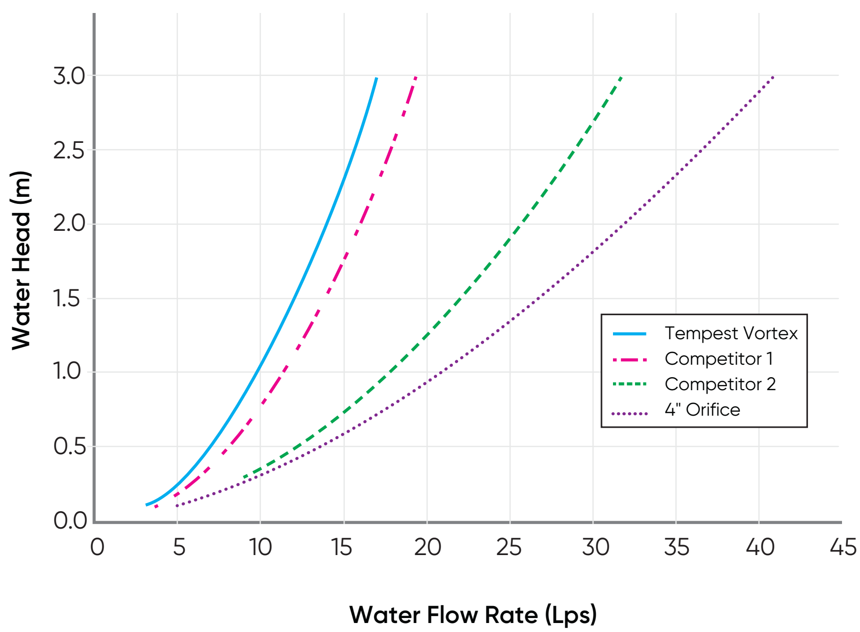


Chart 2: LMF Flow vs. ICD Alternatives



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PRODUCT INSTALLATION

Instructions to assemble a TEMPEST LMF ICD into a Square Catch Basin:

STEPS:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device.
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST LMF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the spigot catch basin wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the CB spigot wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot wall plate and the catch basin wall.
6. Apply solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the universal mounting plate hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut back the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at ipexna.com.
- Call your IPEX representative for more information or if you have any questions about our products.

NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

PRODUCT TECHNICAL SPECIFICATION

General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook will be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above must not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices will consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's shall have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

PRODUCT INFORMATION: TEMPEST HF & MHF ICD

Product Description

Our HF, HF Sump and MHF ICD's are designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter or larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 5 preset flow curves, these ICDs have the ability to provide constant flow rates: 9lps (143 gpm) and greater

Product Function

TEMPEST HF (High Flow): designed to manage moderate to higher flows 15 L/s (240 gpm) or greater and prevent the propagation of odour and floatables. With this device, the cross-sectional area of the device is larger than the orifice diameter and has been designed to limit head losses. The HF ICD can also be ordered without flow control when only odour and floatable control is required.

TEMPEST HF (High Flow) Sump: The height of a sewer outlet pipe in a catch basin is not always conveniently located. At times it may be located very close to the catch basin floor, not providing enough sump for one of the other TEMPEST ICDs with universal back plate to be installed. In these applications, the HF Sump is offered. The HF Sump offers the same features and benefits as the HF ICD; however, is designed to raise the outlet in a square or round catch basin structure. When installed, the HF sump is fixed in place and not easily removed. Any required service to the device is performed through a clean-out located in the top of the device which can be often accessed from ground level.

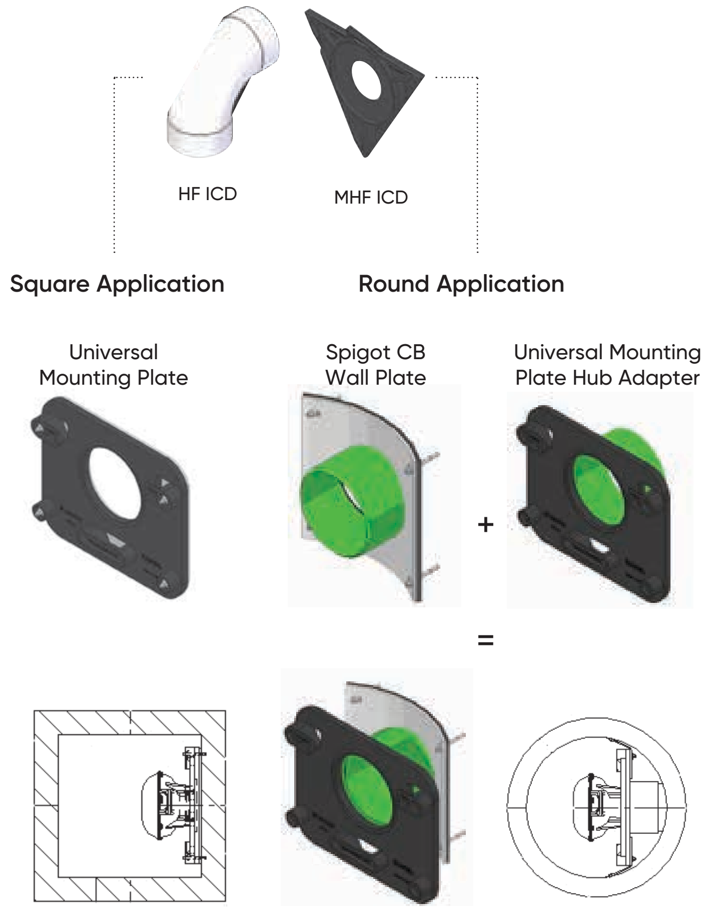
TEMPEST MHF (Medium to High Flow):
The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

Product Construction

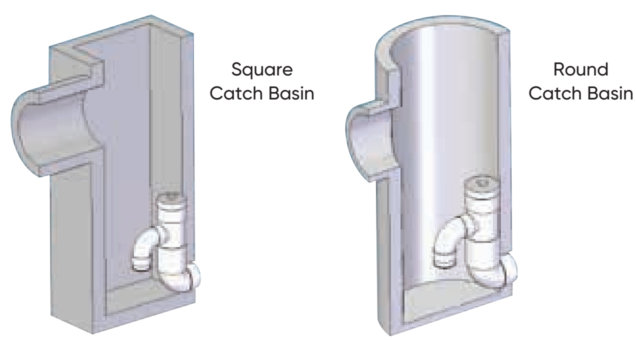
The HF, HF Sump and MHF ICDs are built to be light weight at a maximum weight of 6.8 Kg (14.6 lbs).

Product Applications

The HF and MHF ICD's are available to accommodate both square and round applications:

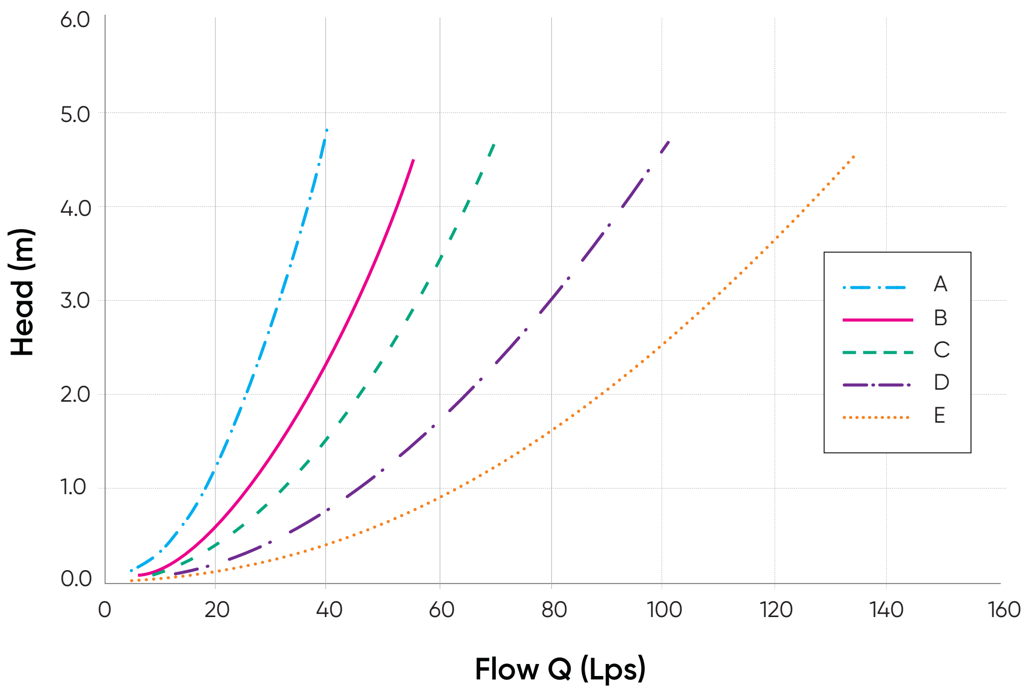


The HF Sump is available to accommodate low to no sump applications in both square and round catch basins:



NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

Chart 3: HF & MHF Preset Flow Curves



PRODUCT INSTALLATION

Instructions to assemble a TEMPEST HF or MHF ICD into a Square Catch Basin:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal wall mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal wall mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST HF or MHF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the round catch basin spigot adaptor to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the spigot CB wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot CB wall plate and the catch basin wall.
6. Put solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the wall mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST HF Sump into a Square or Round Catch Basin:

STEPS:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, mastic tape and metal strapping
   - Material: (2) concrete anchor 3/8 x 3-1/2, (2) washers, (2) nuts, HF Sump pieces (2).
2. Apply solvent cement to the spigot end of the top half of the sump. Apply solvent cement to the hub of the bottom half of the sump. Insert the spigot of the top half of the sump into the hub of the bottom half of the sump.
3. Install the 8" spigot of the device into the outlet pipe. Use the mastic tape to seal the device spigot into the outlet pipe. You should use a level to be sure that the fitting is standing at the vertical.
4. Use an impact drill with a 3/8" concrete bit to make a series of 2 holes along each side of the body throat. The depth of the hole should be between 1-1/2" to 2-1/2". Clean the concrete dust from the 2 holes.
5. Install the anchors (2) in the holes by using a hammer. Put the nuts on the top of the anchors to protect the threads when you hit the anchors. Remove the nuts from the ends of the anchors.
6. Cut the metal strapping to length and connect each end of the strapping to the anchors. Screw the nuts in place with a maximum torque of 40 N.m (30 lbf-ft). The device should be completely flush with the catch basin wall.

⚠ WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

PRODUCT TECHNICAL SPECIFICATION

General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control where specified. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook shall be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above shall not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices shall consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's shall have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

NOTES

SALES AND CUSTOMER SERVICE

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Toll Free: (866) 473-9462
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About the IPEX Group of Companies

As leading suppliers of thermoplastic piping systems, the IPEX Group of Companies provides our customers with some of the largest and most comprehensive product lines. All IPEX products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have established a reputation for product innovation, quality, end-user focus and performance.

Markets served by IPEX group products are:

- Electrical systems
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- PVC, CPVC, PP, ABS, PEX, FR-PVDF and PE pipe and fittings (1/4" to 48")
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems

IPEX by aliaxis

MNMNTPIP110817RC

With every community, we redefine what's possible.

Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.