Site Servicing & Stormwater Management Report
Embassy and Consulate of the State of Qatar

Client:
GRC Architects Inc.

Project Number:
OTT-00261664-A0

Prepared By: Aaditya Jariwala, M.Eng., EIT.

Reviewed By: Alam Ansari, M.Sc., P. Eng.

EXP Services Inc.
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Date Submitted:
March 1, 2022
Revised: August 26, 2022
Revised: August 1, 2023

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Legal Notification

This report was prepared by **EXP** Services Inc. for the account of the GRC Architects Inc. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **EXP** Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

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1 Introduction

EXP Services Inc. (EXP) was retained by GRC Architects Inc. to provide Site Servicing and Stormwater Management report for the embassy and consulate of the State of Qatar in Ottawa, Canada.

The site is 0.75 hectares in area and is bound by Macdonald Cartier Bridge approach to the north, King Edward Avenue to the east, Boteler Street to the south and the Embassy of United Arab Emirates to the west.

This servicing design report will address SWM, the quality and quantity control requirements for the proposed drainage areas of the three-storey + mezzanine institutional building, determine how the proposed building will be serviced with sanitary, storm and water services, determine the size of the proposed services and identify the locations of the connections to the existing services. Servicing, Grading and Drainage and SWM plans for the development of the proposed building at 187 Boteler Street are included with this report.

Refer to Figure 1 in Appendix A for the site location.

2 Existing Conditions

The subject property is currently vacant, with some vegetation and construction debris on it. The topography of the site is fairly flat, gradually sloping to the south towards Boteler Street. The McDonald-Cartier bridge approach to the north is about 2.2m – 1.0m higher than the grades on the property along the north property line, with the grassed embankment sloping towards the property.

The existing municipal infrastructure present within the property and along Boteler Street are noted below:

- ±2.0m x 1.3m Stone storm sewer running from south to north in the middle of the property
- 375mm Ø PVC sanitary sewer running north to south in the middle of the property
- 375mm Ø PVC Storm sewer on Boteler Street running east to west
- 300mm Ø PVC Storm sewer on Boteler Street running west to east
- 250mm Ø PVC Sanitary sewers on Boteler discharging in to 375mm Ø PVC Sanitary sewer
- 203mm Ø PVC Watermain on Boteler Street
- Fire hydrants 366032H096 and 366032H097 along Boteler Street and Cumberland Street, respectively

3 References

Various documents were referred to in preparing the current report including:

- Sewer Design Guidelines, Second Edition, Document SDG002, October 2012, City of Ottawa (Guidelines) including:
  - Technical Bulletin ISDTB-2012-4 (20 June 2012)

  - Technical Bulletin ISDTB-2014-01 (05 February 2014)
  - Technical Bulletin PIEDTB-2016-01 (September 6, 2016)
  - Technical Bulletin ISDTB-2018-01 (21 March 2018)
  - Technical Bulletin ISDTB-2018-04 (27 June 2018)
  - Technical Bulletin ISDTB-2019-02 (08 July 2019)
- Ottawa Design Guidelines – Water Distribution, July 2010 (WDG001), including:
  - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
  - Technical Bulletin ISTB-2018-02 (21 March 2018)
- Ontario Ministry of Transportation (MTO) Drainage Manual, 1995-1997
- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment and Climate Change, March 2003 (SMPDM).
- Design Guidelines for Drinking-Water Systems, Ontario Ministry of the Environment and Climate Change, 2008 (GDWS).
- Fire Underwriters Survey, Water Supply for Public Fire Protection (FUS), 2020
- Ontario Building Code 2012, Ministry of Municipal Affairs and Housing

4 Watermain Design

4.1 Required Fire Flow

The fire flow demand calculations were prepared based on the Fire Underwriters Survey (FUS, 2020) criteria. The proposed building's type of construction is classified as non-combustible. The building will have a fully supervised sprinkler system and limited combustible contents. The required fire flow was determined to be 83.3 L/s (5000 L/min). Refer to Appendix B for detailed fire flow demand calculations and the architect's confirmation email regarding type of construction.

4.2 Watermain Design

There is an existing municipal 203mm diameter watermain on Boteler Street. The proposed building will be serviced by a new 150mm diameter water service lateral connected to the municipal 203mm diameter watermain on Boteler Street.

The domestic water demands for the proposed building were calculated as per the City of Ottawa Water Design Guidelines (July 2010). The institutional average consumption rate of 28,000 L/gross ha/day was used. The institutional peak factors were 1.5 and 1.8 for the max. day and peak hour demands respectively. Refer to Appendix B for detailed calculations. The proposed building's domestic demands were as follows:

Institutional Water Demand

Average daily demand = 0.24 L/s

Maximum daily demand = 0.36 L/s

Maximum hourly daily demand = 0.66 L/s

4.3 Pressure Check

The boundary conditions provided by the City of Ottawa indicates that the minimum and maximum pressure in the existing municipal 200mm diameter watermain at the connection point on Boteler Street is 71.2 psi (491.9 kPa) and 83.3 psi (574.3 kPa), respectively. In addition, the residual pressure of 71.9 psi (495.9 kPa) was indicated by the city during max day + fire flow demand of 83.7 L/s. Based on the existing watermain pressure and 150mm diameter water service connection, the residual pressure at the proposed building basement was estimated to range from 73.6 psi to 85.8 psi. The residual water pressures in the proposed watermain are greater than the minimum requirement of 20psi (140kPa). However, the residual pressure may exceed the maximum allowable limit of 80 psi. therefore, the pressure reducing measures will be required within the building. Further details to be provided by the mechanical consultant. During the max day + fire flow demand of 83.7 L/s, a residual pressure of 69.5 psi was estimated at the building basement. Therefore, the existing water supply system will have adequate capacity to meet the domestic and fire demands for the proposed building. Refer to Appendix B for detailed calculations.

4.4 Review of Hydrant Spacing

A review of the hydrant spacing was completed to ensure compliance with Appendix I of Technical Bulletin ISTB-2018-02. As per Section 3 of Appendix I all hydrants within 150 meters were reviewed to assess the total possible contribution of flow from these contributing hydrants. For each hydrant, the distance to the proposed building was determined to arrive at the contribution of fire flow. A review of the available fire hydrant within 150m distance along the fire route from the building was carried out which is summarized in the table below.

Table 4-1: Summary of SWM Storage Requirements

Hydrant #	Location	City / Private	Color Code	Distance from the Building (m)	Fire Flow Contribution for Class AA Hydrant (L/min)
366032H052	Boteler Street	City	BLUE	87	3800
366032H096	Boteler Street	City	BLUE	1	5700
366032H097	Cumberland Street	City	BLUE	98	3800
366032H053	Cumberland Street	City	BLUE	110	3800
				Total:	***17,100***

As noted in the table above, total available fire flow is 17,100 L/min, which is well above the required fire flow of 5,000 L/min.

5 Sanitary Sewer Design

5.1 Peak Design Flow

There is an existing municipal 250mm diameter sanitary sewer on Boteler Street flowing from west to east, eventually discharging into 375mm diameter sanitary sewer on Cumberland Street. The anticipated peak sanitary flows from the proposed institutional site have been calculated as per the City of Ottawa Sewer Design Guidelines (October 2012). The anticipated peak sanitary flows are calculated as follows:

Design Flows

Institutional Design Flow:	28,000 L/gross ha/day
Development Area:	0.75 hectares
Peak Factor:	1.5
Extraneous Flow:	0.33 L/s/ha
Peak Design Flow:	=(28000L/ha/day)(0.75 ha)(1.5)(1/86400)+(0.75ha)(0.33L/s/ha)
	=**0.61 L/s**

The proposed building at 187 Boteler Street will be serviced by a new 200mm diameter sanitary service that will ultimately convey the sanitary flow to the municipal 250mm diameter sanitary sewer via sanitary manholes SANMH 101. The 135mm diameter sanitary service will be installed at a minimum slope of 2.0%. An additional 200mm diameter sanitary service at a minimum slope of 2.0%, will be connected to SANMH 101 within the property to convey the sanitary flows from Guard House. At this slope, the 200mm diameter sanitary services will have a capacity of 47.1 L/s and a full flow velocity of 1.72 m/s, which will be sufficient to service proposed development. Refer to the sanitary sewer design sheet in Appendix C and the Site Servicing plan (dwg #C100) in Appendix F for further details.

6 Stormwater Management

6.1 Storm Design Criteria

The storm sewer system was designed in conformance with the City of Ottawa Sewer Design Guidelines (October 2012). The stormwater servicing design criteria for the proposed development are as follows:

- The proposed on-site storm sewer network / minor system is designed using Rational Method and Manning's Equation to convey runoff under free flow conditions for the 2-year return period.
- Post-development discharge rate for up to 100-year storm event to be controlled to 2-year pre-development discharge rates.
- Maximum allowable ponding depth is 300 mm.
- Flows from storm events greater than the 100-year return period will be directed overland towards the front of the property on Boteler Street.
- Average runoff coefficients were calculated for each inlet drainage area using a runoff coefficient of 0.20 for pervious surfaces and 0.90 for impervious surfaces.
- Estimated storage volumes are based on the Modified Rational Method.
- Minimum freeboard of 300mm between the 100-year overland spill elevation and finished floor elevation.

6.2 Pre-Development Conditions

The 0.75-hectare site at 187 Boteler Street is currently a vacant land covered with trees and bushes. Surface runoff from the property flows southerly towards Boteler Street. In addition, the existing site receives additional stormwater flows from approximately 0.06 ha of external drainage areas. These areas include the landscape buffer of the Macdonald Cartier Bridge Approach on the north side of the property and landscape area on the northeast side of the property. Run-off from the property and external drainage areas as explained above, flow towards Boteler Street where it gets divided into flows going towards west

into the existing 375mm storm sewer and flows going towards east into the existing 300mm and 675mm storm sewers.

In the post development conditions, the proposed SWM infrastructure will be connected to the 375mm dia. storm sewer with exception of the exterior drainage areas to the north and north-east of the property line. The external drainage areas will be re-directed by a drainage ditch running along the north and north-east property line to discharge into the existing 300mm and 675mm storm sewers towards east.

6.3 Allowable Release Rate

The allowable release rate for the site is calculated based on area E1 (0.75 ha), runoff coefficient of 0.22 and a time of concentration of 10 minutes. Refer to drawing # C400 SWM1 for the pre-existing drainage conditions of the site.

Table D2 in Appendix D provides the pre-development discharge rates from the site during 2-year, 5-year and 100-year storm events as 35.2 L/s, 47.8 L/s and 102.4 L/s, respectively. These estimated pre-development discharge rates do not include the external drainage from 0.06 ha of City's land.

The allowable release rate for the 0.75-hectare drainage area is calculated as 35.2 L/s.

6.4 Post-Development Conditions

Stormwater from the 0.75ha drainage area will be controlled and released at a rate less than the allowable release rate for storms up to and including the 100-year storm event. An overland flow route is provided for storms greater than the 100-year event.

6.4.1 Storage Requirements and Allocation

Post development runoff will be detained on-site for storms up to and including the 100-year storm. The required SWM storage volumes will be achieved using the surface ponding in the landscaped areas, ponding on the roof of the new building, a cistern under basement floor and stormtech chambers under the parking lot for up to 100-year storm event.

Surface ponding volumes over catch basins and catch basin manholes were determined by applying the pyramid volume equation of one-third of the depth multiplied by the surface area of the pond. Ponding depths for the subject site must be equal to or less than 300 mm for the 100-year storm event.

Refer to Stormwater Management Plan drawing #C500 for the drainage areas in Appendix F and refer to Appendix D for the detailed stormwater management spreadsheet calculations. The following table 6-1 summarizes the release rates and storage requirements for the 0.75ha drainage area, which includes the proposed embassy building at 187 Boteler Street.

The 100-year controlled release rate from 0.75ha area is 34.2 L/s, which is less than the total allowable release rate of 35.2 L/s. The available storage volume of 254.3 m^3 is more than the required volume of 158.8 m^3. An additional 7.7 L/s uncontrolled discharge rate is proposed during 100-year storm event from 0.06ha external City lands north and northeast of the subject property. A swale is proposed just outside the property line to run along the north and northeast property line and discharge towards Boteler Street and King Edward Ave. Refer to the site grading plan dwg #C200 for details.

Table 6-1: Summary of SWM Storage Requirements

Area ID	Outlet Location	Area (ha)	Runoff Coefficient 'C'	100 Year Release (L/s)	100 Year storage required (m^3)	100 Year surface storage provided (m^3)	Control Method
A1	Roof Drain	0.07	0.90	**3.7**	28.2	34.3	WATTS Flow Controlled Drains
A2	Roof Drain	0.03	0.90	**2.6**	11.7	16.6	
A3	Roof Drain	0.03	0.90	**1.8**	10.7	14.0	
A4	Courtyard	0.07	0.59	**4.0**	37.2	50.0	Controlled Pump Discharge
A5	Trench Drain	0.02	0.90				
A6	Transformer Area	0.02	0.90				
A7	CBMH201	0.08	0.76	**6.0**	37.4	49.4	Hydrovex 100VHV-1
	CBMG202						
A8	Landscaped	0.01	0.44				
A9	CBMH203	0.19	0.20	**6.0**	34.8	90.0	Hydrovex 75VHV-1
A10	CB101	0.20	0.20				
A11	Uncontrolled	0.01	0.90	2.9	-	-	
A12	Uncontrolled	0.01	0.90	7.4	-	-	
A13	Exterior Drainage	0.06	0.20	7.7	-	-	
	TOTAL	**0.75**		34.4	160.0	254.3	
	Total Allowable Release L/s:			35.2			

*__Bold__ flows are controlled.

6.4.2 Flow Control Device Sizing

Stormwater runoff from the 0.75ha area will be detained using inlet control devices (ICDs) within the storm system and flow control roof drains. The roof flow control drains will be Watts Accutrol flow weir. There are two (2) proposed ICDs. Refer to the Site Servicing Plan drawing #C100 for the ICD locations and Appendix D for Hydrovex flow regulator selections. Refer to table D5 in Appendix D for flow-controlled roof drains design and Drawing #C500 for 2-year and 100-year ponding limit and depth.

The stormwater runoff from the courtyard, trench drain at the basement parking entry ramp and hydro transformer area will be attained by controlled pump discharge from cistern under the basement garage. Further details on cistern and pump type will be provided by structural and mechanical consultants.

6.4.3 Quality Control

Rideau Valley Conservation Authority (RVCA) was contacted for the applicable quality control criteria for the proposed site. RVCA had noted that no quality control is required for this site. Please refer to the email correspondence included in Appendix E.

7 Erosion and Sediment Control

During all construction activities, erosion and sedimentation shall be controlled by the following techniques:

- Extent of exposed soils shall be limited at any given time;
- Exposed areas shall be re-vegetated as soon as possible;
- Minimize the area to be cleared and disruption of adjacent areas;
- Siltsack or approved equivalent shall be installed inside all catch basins, catch basin manholes, and storm manholes as identified on the erosion and sediment control plan;
- Visual inspection shall be completed daily on sediment control barriers and any damage repaired immediately. Care will be taken to prevent damage during construction operations;
- In some cases, barriers may be removed temporarily to accommodate the construction operations. The affected barriers will be reinstated at night when construction is completed;
- Sediment control devices will be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract;
- During construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer; and,
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) 805.

8 Conclusions

This report addresses the adequacy of the existing municipal services to service the proposed development at 187 Boteler Street. Based on the analysis provided in this report, the conclusions are as follows:

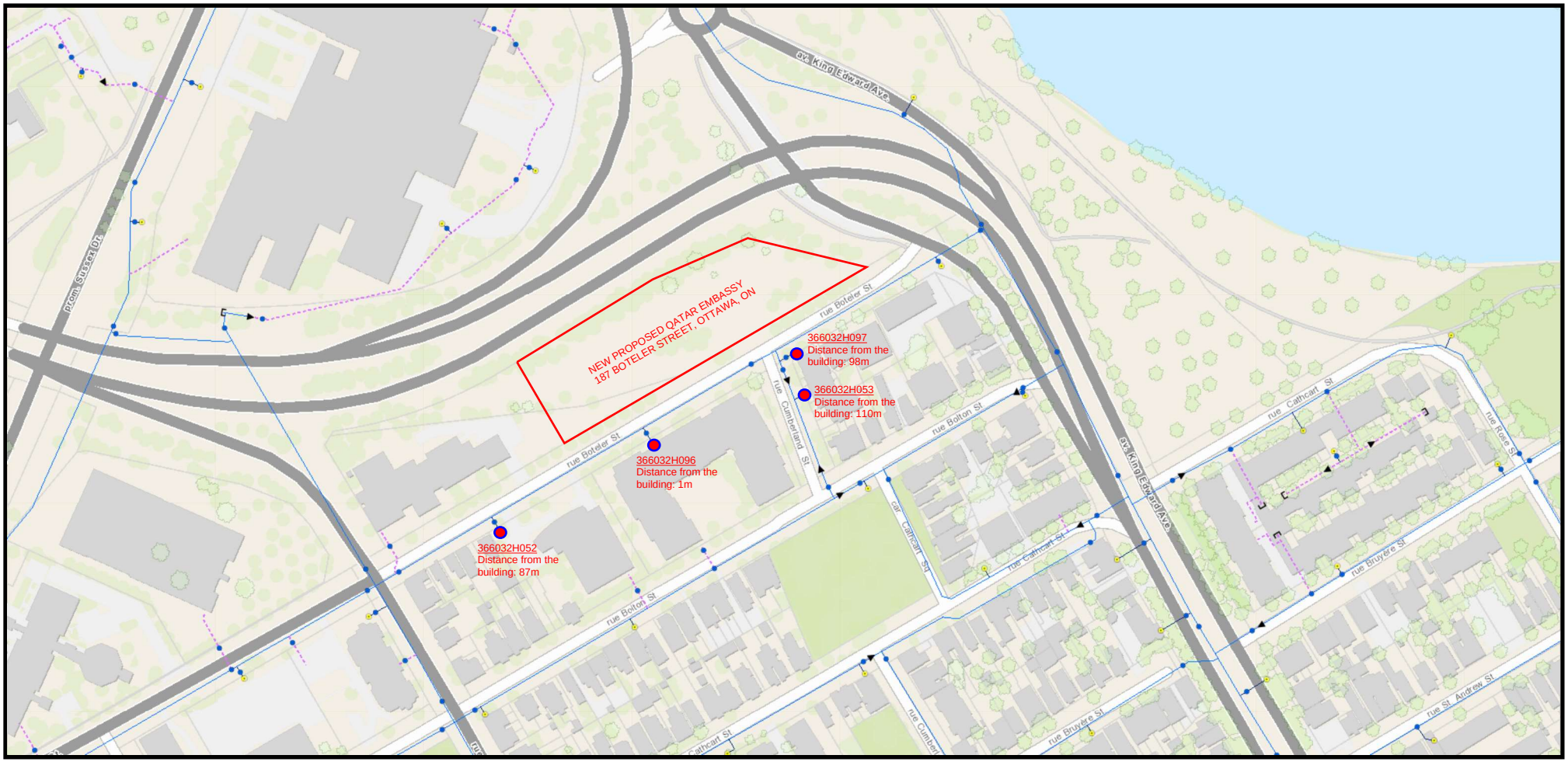
- The proposed three storey + mezzanine embassy building will be serviced by a 150mm diameter watermain, which will adequately service the proposed development for the domestic and fire flow demands.
- The proposed building will be serviced by a 200mm diameter sanitary sewer, which will adequately service the proposed development.
- SWM for the proposed development will be achieved by restricting all stormwater discharge rates up to the 100-year post development flow to the allowable release rate. The quantity control criteria for the site is to restrict the 100-year post-development release rate to the 2-year pre-development flow using the calculated runoff coefficients and a time of concentration of 10 minutes.

- Required on-site SWM storage volumes will be achieved using the surface storage in the landscaped areas, roof storage, a cistern under the basement floor and stormtech chambers for up to 100-year storm event.
- Temporary erosion and sediment control measures for the subject site have been identified.
- Overland flow routes have been provided for the subject site.

Appendix A – Figures

exp Services Inc. 100-2650 Queensview Drive Ottawa, ON K2B 8H6 www.exp.com	DESIGN --- DRAWN --- DATE --- FILE NO ---	QATAR EMBASSY SITE LOCATION PLAN	SCALE N.T.S SKETCH NO FIG A1

FIGURE A2: HYDRANT LOCATION PLAN



EXP Services Inc.
Embassy and Consulate of the State of Qatar
187 Boteler Street, Ottawa, ON
OTT-00261664-A0
August 1, 2023

Appendix B – Water Servicing

TABLE B1: Water Demand Chart

Location: Qatar Embassy - 187 Boteler St.
Project No: OTT-00261664-A0
Designed by: A. Elgayar
Checked By: A. Ansari
Date Revised: January 2021

Water Consumption
Institutional = **28,000** L/gross ha/day

	No. of Residential Units											Residential Demands in (L/sec)					Institutional						Total Demands (L/sec)		
	Singles/Semis/Towns				Apartments								Peaking Factors (x Avg Day)					Peaking Factors (x Avg Day)							
Proposed	Single Family	Semi-Detached	Duplexz	Townhome	Bachelor	1 Bedroom	2 Bedroom	3 Bedroom	4 Bedroom	Avg Apt.	Total Persons (pop)	Avg. Day Demand (L/day)	Max Day	Peak Hour	Max Day Demand (L/day)	Peak Hour Demand (L/day)	Area (m^2)	Avg Demand (L/day)	Max Day	Peak Hour	Max Day Demand (L/day)	Peak Hour Demand (L/day)	Avg Day (L/s)	Max Day (L/s)	Max Hour (L/s)
Qatar Embassy																	7,495	20,986	1.50	1.80	31,479	56,662	0.24	0.36	0.66

TABLE B2: FIRE FLOW REQURIEMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020
PROJECT: Qatar Embassy
Building No: **Embassy Building**

An estimate of the Fire Flow required for a given fire area may be estimated by:

F = 220 * C * SQRT(A)

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input	Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Non-combustible Construction	0.8	
	Ordinary Construction	1			
	Non-combustible Construction	0.8			
	Fire Resistive Construction	0.6			
Input Building Floor Areas (A)	Third Floor		730	3103.0 m²	
	Second Floor+Mezzanine		1078		
	First Floor		1295		
	Basement (At least 50% below grade, not included)		1126		
Fire Flow (F)	F = 220 * C * SQRT(A)				9,804
Fire Flow (F)	Rounded to nearest 1,000				**10,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-1,500	8,500
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-2,550	5,950
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-850	5,100
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-850	4,250
	Not Fully Supervised or N/A	0%				

Choose Structure Exposure Distance	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length: Length (m)	No of Storeys	Length-Height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
	Side 1 (West)	37.2	5	30.1 to 45	Type V	12.1	2	24.2	6	0%	10%	850	5,100
	Side 2 (East)	50	5	30.1 to 45	Type V	0	0	0	6	0%			
	Front (South)	25.4	4	20.1 to 30	Type V	76	4	304	4F	10%			
	Back (North)	84.12	5	30.1 to 45	Type V	86.5	8	692	6	0%			
Obtain Required Fire Flow										Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =			**5,000**
										Total Required Fire Flow, L/s =			**83.3**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type V	Wood Frame
Type IV-III (U)	Mass Timber or Ordinary with Unprotected Openings
Type IV-III (P)	Mass Timber or Ordinary with Protected Openings
Type II-I (U)	Noncombustible or Fire Resistive with Unprotected Openings
Type II-I (P)	Noncombustible or Fire Resistive with Protected Openings

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
> 30.1m	5

TABLE B3

ESTIMATED WATER PRESSURE AT PROPOSED BUILDING

Description	From	To	Demand (L/sec)	Pipe Length (m)	Pipe Dia (mm)	Dia (m)	Q (m3/sec)	Area (m2)	C	Vel (m/s)	Slope of HGL (m/m)	Head Loss (m)	Elev From (m)	Elev To (m)	*Elev Diff (m)	Pressure From kPa	(psi)	Pressure To kPa	(psi)	Pressure Drop (psi)
Avg Day Conditons																				
Single 150mm water service	Main	Building	0.24	17 m	150	0.150	0.0002	0.017671	110	0.0137	3.7E-06	6E-05	56.45	54.70	1.8	574.4	(83.3)	591.5	(85.8)	-2.5
Max Day Conditons																				
Single 150mm watermain	Main	Building	0.36	17 m	150	0.150	0.0004	0.017671	110	0.0206	7.8E-06	0.0001	56.45	54.70	1.8	492.0	(71.4)	509.1	(73.8)	-2.5
Peak Hour Conditons																				
Single 150mm watermain	Main	Building	0.66	17 m	150	0.150	0.0007	0.017671	110	0.0371	2.3E-05	0.0004	56.45	54.70	1.8	492.0	(71.4)	509.1	(73.8)	-2.5
Max Day + Fire Flow Conditons																				
Single 150mm watermain	Main	Building	83.70	17 m	150	0.150	0.0837	0.017671	110	4.7363	0.18394	3.0405	56.45	54.70	1.8	492.0	(71.4)	479.3	(69.5)	1.8

Water Demand Info

Average Demand =	0.24	L/sec
Max Day Demand =	0.36	L/sec
Peak Hr Deamand =	0.66	L/sec
Fireflow Requriement =	83.3	L/sec
Max Day Plus FF Demand =	83.7	L/sec

Pipe Lengths

From watermain to building =	17 m
Hazen Williams C Factor for Friction Loss in Pipe, C=	110

Boundary Conditon

	Min HGL	Max HGL	Max Day + Fireflow
HGL (m)	106.6	115	107.0
Approx Ground Elev (m) =	56.45	56.45	56.45
Approx Bldg FF Elev (m) =	54.70	54.70	54.70
Pressure (m) =	50.15	58.55	50.55
Pressure (Pa) =	491,972	574,376	495,896
Pressure (psi) =	71.4	83.3	71.9

(From City of Ottawa)

Aly Elgayar

From: Carolyn Jones <cjones@grcarchitects.com>
Sent: Monday, January 11, 2021 1:40 PM
To: Aly Elgayar
Subject: FW: Qatar Embassy - Confirmations Required for Fire Flow Calcs

Hi Aly,
Please see email from Pat below. We would be Class 3 Non-Combustible.

Thanks

Carolyn Jones
Senior Associate | Employée-associée senior
OAA OAQ MRAIC LEED-AP BD + C

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From: Patrick Dubuc <PDubuc@grcarchitects.com>
Sent: Monday, January 11, 2021 12:42 PM
To: Carolyn Jones <cjones@grcarchitects.com>
Subject: RE: Qatar Embassy - Confirmations Required for Fire Flow Calcs

Carolyn,

Qatar will be a mixed of non-combustible (class 3) for the walls and fire resistive (class 6) for the floor slabs and roof if built of solid concrete. Based on a combination; I believe Qatar would fall under Class 3 Non-Combustible.

Patrick Dubuc
Senior Associate | Employé-associé senior

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From: Aly Elgayar <Aly.ElGayar@exp.com>
Sent: Thursday, January 7, 2021 4:52 PM
To: Carolyn Jones <cjones@grcarchitects.com>
Cc: Alam Ansari <alam.ansari@exp.com>; Patrick Dubuc <PDubuc@grcarchitects.com>
Subject: RE: Qatar Embassy - Confirmations Required for Fire Flow Calcs

Hi Carolyn,

Thanks for the confirmations. Regarding the construction type, non-combustible or fire resistive construction are classified as two different types of construction for calculating the required fire flow. Please refer to the below definitions extracted the guidelines and confirm which one is applicable for the proposed building.

c. **Non-combustible (Construction class 3):** Buildings with exterior walls, floors, and roof of noncombustible or slow-burning materials supported by noncombustible or slow-burning supports (including noncombustible or slow-burning roof decks on noncombustible or slow-burning supports, regardless of the type of insulation on the roof surface).

d. **Masonry non-combustible (Construction class 4):** Buildings with exterior walls of fire resistive construction (not less than one hour), or of masonry, not less than 4 inches in thickness and with noncombustible or slow-burning floors and roof (including noncombustible or slow burning roof decks on noncombustible or slow-burning supports, regardless of the type of insulation on the roof surface).

e. **Modified fire resistive (Construction class 5):** Buildings with exterior walls, floors, and roof constructed of masonry materials described in f. below, deficient in thickness, but not less than 4 inches; or fire-resistive materials described in f. below, with a fire-resistance rating of less than two hours, but not less than one hour.

f. **Fire resistive (Construction class 6):** Buildings constructed of any combination of the following materials:

Exterior walls or exterior structural frame:
- Solid masonry, including reinforced concrete, not less than 4 inches in thickness
- Hollow masonry not less than 12 inches in thickness
- Hollow masonry less than 12 inches, but not less than 8 inches in thickness, with a listed fire-resistance rating of not less than two hours
- Assemblies with a fire-resistance rating of not less than two hours

Note: Panel or curtain sections of masonry may be of any thickness.

Floors and roof:
- Monolithic floors and roof of reinforced concrete with slabs not less than 4 inches in thickness
- Construction known as "joist systems" (or pan-type construction) with slabs supported by concrete joists spaced not more than 36 inches on centers with a slab thickness not less than 2 ¾ inches
- Floor and roof assemblies with a fire-resistance rating of not less than two hours

Structural metal supports:
- Horizontal and vertical load-bearing protected metal supports (including pre-stressed concrete units) with a fire-resistance rating of not less than two hours

Note: Wherever in the SCOPES reference is made to "pre-stressed," this term shall also include "post-tensioned."

Thank you,

Aly Elgayar, M.A.Sc.
EXP | Engineering Designer
t : +1.613.688.1899, 3225 | m : +1.613.282.0561 | e : aly.elgayar@exp.com

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From: Carolyn Jones <cjones@grcarchitects.com>
Sent: Thursday, January 7, 2021 4:40 PM
To: Aly Elgayar <Aly.ElGayar@exp.com>
Cc: Alam Ansari <alam.ansari@exp.com>; Patrick Dubuc <PDubuc@grcarchitects.com>
Subject: RE: Qatar Embassy - Confirmations Required for Fire Flow Calcs

Hi Aly,

Please see responses below in red.

Carolyn Jones
Senior Associate | Employée-associée senior
OAA OAQ MRAIC LEED-AP BD + C

grc architects
47 Clarence Street, Suite 401
Ottawa, Ontario K1N 9K1
T: 613-241-8203 x288
C: 613-371-8146
www.grcarchitects.com

From: Aly Elgayar <Aly.ElGayar@exp.com>
Sent: Thursday, January 7, 2021 1:27 PM
To: Carolyn Jones <cjones@grcarchitects.com>
Cc: Alam Ansari <alam.ansari@exp.com>
Subject: Qatar Embassy - Confirmations Required for Fire Flow Calcs

Hi Carolyn,

Can you please provide confirmation for the following questions in regards to the fire flow calculations:

- Is the construction type (frame) going to be non-combustible or fire resistive construction? yes
- Will a sprinkler system be installed throughout the entire building? yes
- Also if a sprinkler system will be installed, will it be fully supervised? yes

Thank you,

Aly Elgayar, M.A.Sc.
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2650 Queensview Drive
Suite 100
Ottawa, ON K2B 8H6
CANADA

Aly Elgayar

From: Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>
Sent: Wednesday, January 20, 2021 3:22 PM
To: Aly Elgayar
Cc: Mottalib, Abdul; Deiaco, Simon
Subject: FW: 187 Boteler St. Qatar Embassy - Water Boundary Request
Attachments: 187 Boteler Street January 2021.pdf

Hello Aly,

Please see the water boundary conditions below as requested.

--

Thanks,

Abdul
Mohammad Abdul Mottalib, P. Eng.
Extension: 27798

From: .....
Sent: January 19, 2021 6:59 AM
To: Whelan, Amy <amy.whelan@ottawa.ca>
Subject: RE: 187 Boteler St. Qatar Embassy - Water Boundary Request

Hi Amy,

Please review and ensure demand submissions are correct prior to sending them to Water Resources for boundary conditions.

Thank you,

The following are boundary conditions, HGL, for hydraulic analysis 187 Boteler (zone 1W) assumed to be connected to the 203mm on Boteler Street (see attached PDF for location).

Minimum HGL = 106.6m

Maximum HGL = 115.0m

Max Day + Fire Flow (83 L/s) = 107.0m

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.

From: Aly Elgayar <Aly.ElGayar@exp.com>
Sent: 2021/01/18 12:53 PM
To: Whelan, Amy <amy.whelan@ottawa.ca>
Cc: Steele, Matt <Matt.Steele@ottawa.ca>
Subject: RE: 187 Boteler St. Qatar Embassy - Water Boundary Request

My apologies, there was indeed a calculation error in one of the cells that I should have caught. Please find attached the corrected domestic water demand calculations.

Domestic Water Demands

- Average Day = 0.24 L/sec
- Max Day = 0.36 L/sec
- Max Hour = 0.66 L/sec

Thank you,

Aly Elgayar, M.A.Sc.
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t : +1.613.688.1899, 3225 | m : +1.613.282.0561 | e : aly.elgayar@exp.com

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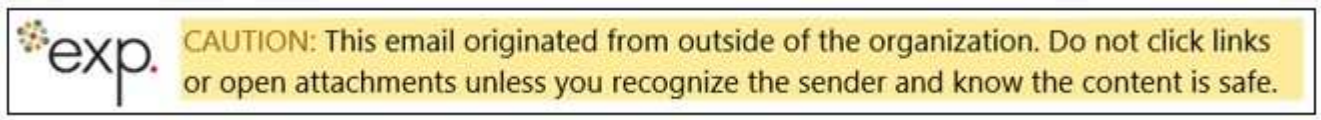
From: Whelan, Amy <amy.whelan@ottawa.ca>
Sent: Monday, January 18, 2021 12:08 PM
To: Aly Elgayar <Aly.ElGayar@exp.com>
Cc: Steele, Matt <Matt.Steele@ottawa.ca>
Subject: FW: 187 Boteler St. Qatar Embassy - Water Boundary Request



Hi Aly,

Can you please read the email thread below and verify the demands provided?

Kind regards,

Amy

From: Steele, Matt <Matt.Steele@ottawa.ca>
Sent: January 18, 2021 11:39 AM
To: Whelan, Amy <amy.whelan@ottawa.ca>
Subject: RE: 187 Boteler St. Qatar Embassy - Water Boundary Request

Good Morning Amy,

I think there are errors in the demands provided (Max Day & Peak Hour Demand seem to be low compared to the Average Day Demand).

Matt

Matt Steele, P.Eng.
Senior Water Resources Engineer
Planning, Infrastructure and Economic Development Department
City of Ottawa
P: 613-580-2424 Ext. 16024

From: Whelan, Amy <amy.whelan@ottawa.ca>
Sent: 2021/01/13 9:41 AM
To: Steele, Matt <Matt.Steele@ottawa.ca>
Subject: 187 Boteler St. Qatar Embassy - Water Boundary Request

Hi Matt,

Can you please provide the water boundary conditions for 187 Boteler street (proposed Qatar Embassy) given the attached water and fire flow demand calculations, sketch indicating the approximate proposed water service location, and the below information:

Domestic Water Demands

- Average Day = 0.24 L/sec
- Max Day = 0.13 L/sec
- Max Hour = 0.23 L/sec

Required Fire Flow

- RFF = 83 L/sec

Thanks,

Amy Whelan, E.I.T
Engineering Intern
Planning, Infrastructure and Economic Development – Service de la planification, de l'infrastructure et du développement économique
Development Review – Central 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 26642, amy.whelan@ottawa.ca

'

'
'

This e-mail originates from the City of Ottawa e-mail system. Any distribution, use or copying of this e-mail or the information it contains by other than the intended recipient(s) is unauthorized. Thank you.

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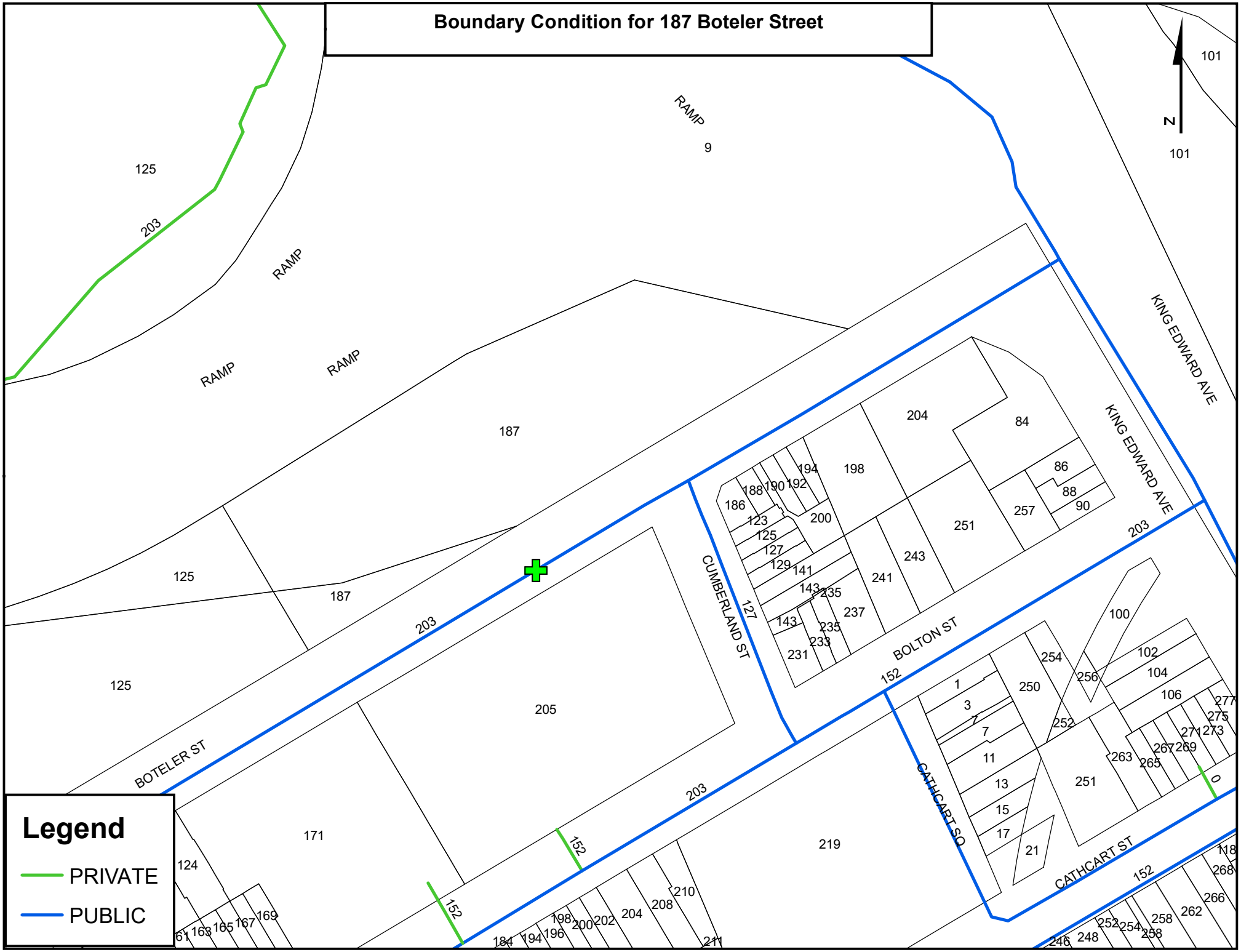
'


Boundary Condition for 187 Boteler Street
N
Legend
PRIVATE
PUBLIC
BOTELER ST
CUMBERLAND ST
BOLTON ST
CATHCART SQ
CATHCART ST
KING EDWARD AVE
KING EDWARD AVE
RAMP
RAMP
RAMP
RAMP
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101
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203
187
125
187
203
125
205
171
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Appendix C – Sanitary Sewer Design Sheet

TABLE C1 - SANITARY SEWER CALCULATION SHEET

LOCATION				RESEDENTIAL AREAS AND POPULAITONS											COMMERCIAL			INDUSTRIAL			INSTITUTIONAL			INFILTRATION			TOTAL	SEWER DATA						
					NUMBER OF UNITS							POPULATION				AREA (ha)			AREA (ha)						AREA (ha)									
Street	U/S MH	D/S MH	Desc	Area (ha)	Singles	Semis	Towns	1-Bed Apt.	2-Bed Apt.	3-Bed Apt.	4-Bed Apt.	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	Peak Flow (L/sec)	INDIV	ACCU	Peak Factor (per	AREA (Ha)	ACCU AREA (Ha)	Peak Flow (L/sec)	INDIV	ACCU	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q_{CAP} (%)	Full Velocity (m/s)
Site	BLDG	SANMH 101		0.75																		0.75	0.7495	0.36434	0.750	0.750	0.25	0.61	200	201.16	2.00	0.600	47.1	1%	1.72
	Guard House	SANMH 101																					0.7495	0.36434		0.750	0.25	0.61	135	133.02	2.00	20.090	15.6	4%	1.72
Boteler Street	SANMH 101	SAN Main																					0.75	0.36434		0.750	0.25	0.61	200	201.16	2.00	12.000	47.1	1%	1.72
				0.750																					0.750			0.61							

Residential Avg. Daily Flow, q (L/p/day) =	280	Commercial Peak Factor =	1.5	(when area >20%)	Peak Population Flow, (L/sec) =	P*q*M/86.4	Unti Type / Persons/Unit
Commercial Avg. Daily Flow (L/gross ha/day) =	28,000		1.0	(when area <20%)	Peak Extraneous Flow, (L/sec) =	I*Ac	Singles 3.0
or L/gross ha/sec =	0.324				Residential Peaking Factor, M =	1 + (14/(4+P^0.5)) * K	Semi-Detached 2.7
Institutianal Avg. Daily Flow (L/s/ha) =	28,000	Institutional Peak Factor =	1.5	(when area >20%)	A_c = Cumulative Area (hectares)		Townhomes 2.7
or L/gross ha/sec =	0.324		1.0	(when area <20%)	P = Population (thousands)		Single Apt. Unit 1.4
Light Industrial Flow (L/gross ha/day) =	35,000						2-bed Apt. Unit 2.1
or L/gross ha/sec =	0.40509	Residential Correction Factor, K =	0.80		Sewer Capacity, Qcap (L/sec) =	1/N S^1/2 R^2/3 A_c	3-bed Apt. Unit 3.1
Light Industrial Flow (L/gross ha/day) =	55,000	Manning N =	0.013		(Manning's Equation)		4-bed Apt. Unit 3.8
or L/gross ha/sec =	0.637	Peak extraneous flow, I (L/s/ha) =	0.33	(Total I/I)			

Designed:	Project:
A. Jariwala, M.Eng.	Qatar Embassy
Checked:	Location:
A. Ansari, M.Sc., P.Eng.	187 Boteler Street, Ottawa, ON
File Reference:	Page No:
261664 - SAN Design Sheet.xlsx	**1 of 1**

Appendix D – Stormwater Management Design Sheet

Table D1
Stormwater Management Summary

Area ID	Outlet Location	Area (ha)	Runoff Coefficient 'C'	100 Year Release (L/s)	100 Year storage required (m^3)	100 Year surface storage provided (m^3)	Control Method
A1	Roof Drain	0.07	0.90	**3.7**	28.2	34.3	WATTS Flow Controlled Drains
A2	Roof Drain	0.03	0.90	**2.6**	11.7	16.6	
A3	Roof Drain	0.03	0.90	**1.8**	10.7	14.0	
A4	Courtyard	0.07	0.59	**4.0**	37.2	50.0	Controlled Pump Discharge
A5	Trench Drain	0.02	0.90				
A6	Transformer Area	0.02	0.90				
A7	CBMH201	0.08	0.76	**6.0**	37.4	49.4	Hydrovex 100VHV-1
	CBMH202						
A8	Landscaped	0.01	0.44				
A9	CBMH203	0.19	0.20	**6.0**	34.8	90.0	Hydrovex 75VHV-1
A10	CB101	0.20	0.20				
A11	Uncontrolled	0.01	0.90	2.9	-	-	
A12	Uncontrolled	0.01	0.90	7.4	-	-	
A13	*Exterior Drainage*	*0.06*	*0.20*	*7.7*	*-*	*-*	
	TOTAL	**0.75**					
			Totals:	**34.4**	**160.0**	**254.3**	
			Total Allowable Release L/s:	**35.2**			

Table D2
SWM PRE-DEVELOPMENT RUNOFF

Area No	Outlet Location	Area (ha)	Time of Conc. T_c (min)	Storm = 2-year			Storm = 5-year			Storm = 100-year		
				C_{AVG}	I_2 (mm/hr)	Q (L/sec)	C_{AVG}	I_5 (mm/hr)	Q (L/sec)	$C_{AVG-100Yr}$	I_{100} (mm/hr)	Q (L/sec)
E1	Boteler Street	0.75	10	0.22	76.81	35.2	0.22	104.19	47.8	0.28	178.56	102.4
Total		0.75				35.2			47.8			102.4

Allowable Release rate for up to 100-year post-development storm events

Notes
1) Intensity, $I_2 = 732.951/(Tc+6.199)^{0.810}$ (2-year, City of Ottawa)
2) Intensity, $I_5 = 998.071/(Tc+6.035)^{0.814}$ (5-year, City of Ottawa)
3) Intensity, $I_{100} = 1735.688/(Tc+6.014)^{0.820}$ (100-year, City of Ottawa)
4) Time of Concentration: T_c=10min
4) Flows under column Q_{CAP} which are **bold**, denotes flows that are controlled.

Table D3 - CALCULATION OF AVERAGE RUNOFF COEFFICIENTS (POST-DEVELOPMENT)

Area No.	Outlet Location	Asphalt/Concrete Areas		Roof Areas		Pavers/Gravel Areas		Grassed Areas		Sum AC	Total Area (m^2)	C_{AVG}
		Area (m^2)	A * C	Area (m^2)	A * C	Area (m^2)	A * C	Area (m^2)	A * C			
		C=0.90		C=0.90		C=0.90		C=0.20				
A1	Roof Drain		0.0	730.11	657.1		0.0		0.00	657.1	730.11	0.90
A2	Roof Drain		0.0	342.26	308.0		0.0		0.00	308.0	342.26	0.90
A3	Roof Drain		0.0	290.35	261.3		0.0		0.00	261.3	290.35	0.90
A4	Courtyard		0.0		0.0	369.33	332.4	293.50	58.70	391.1	662.83	0.59
A5	Trench Drain	219.79	197.8		0.0		0.0		0.00	197.8	219.79	0.90
A6	Transformer Area	165.44	148.9		0.0		0.0		0.00	148.9	165.44	0.90
A7	CBMH201	338.10	304.3		0.0		0.0	83.47	16.69	642.0	843.12	0.76
	CBMH202	338.10	304.3		0.0		0.0	83.47	16.69			
A8	Landscaped		0.0		0.0	36.22	32.6	69.23	13.85	46.4	105.45	0.44
A9	CBMH203		0.0		0.0		0.0	1949.64	389.93	389.9	1949.64	0.20
A10	CB101		0.0		0.0		0.0	1975.77	395.15	395.2	1975.77	0.20
A11	Uncontrolled	57.94	52.1		0.0		0.0		0.00	52.1	57.94	0.90
A12	Uncontrolled	115.48	103.9	34.02	30.6		0.0		0.00	134.6	149.50	0.90
A13	*Exterior Drainage*		*0.0*		*0.0*		*0.0*	*623.63*	*124.73*	*124.7*	*623.63*	*0.20*
								Average Runoff Coeff =		C_{AVG} =	$\frac{3,624}{7,492}$	= 0.48

Table D4

SWM POST-DEVELOPMENT RUNOFF (UNCONTROLLED AND CONTROLLED)

Area No	Outlet Location	Area (ha)	Time of Conc. T_c (min)	Storm = 2-year				Storm = 5-year				Storm = 100-year			
				C_{AVG}	I_2 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}		Q (L/sec)	Q_{CAP} (L/sec)	$C_{AVG-100Yr}$	I_{100} (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)
A1	Roof Drain	0.0730	10	0.90	76.81	14.0	**3.0**	0.90	104.19	19.0	**3.3**	1.00	178.56	36.2	**3.7**
A2	Roof Drain	0.0342	10	0.90	76.81	6.6	**2.2**	0.90	104.19	8.9	**2.4**	1.00	178.56	17.0	**2.6**
A3	Roof Drain	0.0290	10	0.90	76.81	5.6	**1.5**	0.90	104.19	7.6	**1.6**	1.00	178.56	14.4	**1.8**
A4	Courtyard	0.0663	10	0.59	76.81	8.4	**1.5**	0.59	104.19	11.3	**2.0**	0.74	178.56	24.3	**4.0**
A5	Trench Drain	0.0220	10	0.90	76.81	4.2		0.90	104.19	5.7		1.00	178.56	10.9	
A6	Transformer Area	0.0165	10	0.90	76.81	3.2		0.90	104.19	4.3		1.00	178.56	8.2	
A7	CBMH201	0.0843	10	0.76	76.81	13.7	**2.1**	0.76	104.19	18.6	**2.8**	0.95	178.56	39.8	**6.0**
	CBMH202														
A8	Landscaped	0.0105	10	0.44	76.81	1.0		0.44	104.19	1.3		0.55	178.56	2.9	
A9	CBMH203	0.1950	10	0.20	76.81	8.3	**2.1**	0.20	104.19	11.3	**2.8**	0.25	178.56	24.2	**6.0**
A10	CB101	0.1976	10	0.20	76.81	8.4		0.20	104.19	11.4		0.25	178.56	24.5	
A11	Uncontrolled	0.0058	10	0.90	76.81	1.1	1.1	0.90	104.19	1.5	1.5	1.00	178.56	2.9	2.9
A12	Uncontrolled	0.0150	10	0.90	76.81	2.9	2.9	0.90	104.19	3.9	3.9	1.00	178.56	7.4	7.4
A13	*Exterior Drainage*	*0.0624*	*10*	*0.20*	*76.81*	*2.7*	*2.7*	*0.20*	*104.19*	*3.6*	*3.6*	*0.25*	*178.56*	*7.7*	*7.7*
Total		0.749				77.4	**16.3**			105.0	**20.2**			212.8	**34.4**

Notes

1) Intensity, $I_2 = 732.951/(Tc+6.199)^{0.810}$ (2-year, City of Ottawa)

2) Intensity, $I_5 = 998.071/(Tc+6.035)^{0.814}$ (5-year, City of Ottawa)

3) Intensity, $I_{100} = 1735.688/(Tc+6.014)^{0.820}$ (100-year, City of Ottawa)

4) Time of Concentration: T_c=10min

4) Flows under column Q_{CAP} which are **bold**, denotes flows that are controlled.

Table D5: 2-year, 5-year & 100-year Roof Drains Design Sheet - Using Flow Controlled Roof Drains

Project: Qatar Embassy
Location: City of Ottawa
Date: August 2022

Area #	Roof Drain Type	No Drains per Area	No of Weirs per Drain	Weir Position	Runoff Coeff (Cavg)		Drainage Area		2-year Event						5-year Event						100-year Event						Storage Required *(MRM)*			Maximium Storage Provided at Spill Elevation					
					2-year & 5-year	100-year	m^2	ha	Runoff Rate (L/sec)	2yr Ponding Depth (mm)	Roof Drain Capacity Per Weir (gpm)	Roof Drain Capacity Per Drain per weir (gpm)	Roof Drain Capacity Per Drain (L/sec)	Total Flow From Roof Drains (L/sec)	Runoff Rate (L/sec)	5yr Ponding Depth (mm)	Roof Drain Capacity Per Weir (gpm)	Roof Drain Capacity Per Drain per weir (gpm)	Roof Drain Capacity Per Drain (L/sec)	Total Flow From Roof Drains (L/sec)	Runoff Rate (L/sec)	100yr Ponding Depth (mm)	Roof Drain Capacity Per Weir (gpm)	Roof Drain Capacity Per Drain per weir (gpm)	Roof Drain Capacity Per Drain (L/sec)	Total Flow From Roof Drains (L/sec)	2-year (m^3)	5-year (m^3)	100-year (m^3)	Area Available for Storage (m^2)	Max Prism Depth (mm)	Max Prisim Volume (m^3)	% Volume Used for Ponding		
																																	2-year	5-year	100-year
R1-1	RD1	1	1	3-1/4 open	0.90	1.00	199.64	0.0200	3.837	94	12.2	12.2	0.770	0.770	5.204	114	13.2	13.2	0.833	0.833	9.910	144	14.7	14.7	0.927	0.927	2.23	3.91	7.87	179.7	150	9.0	25%	43%	88%
R1-2	RD1	1	1	3-1/4 open	0.90	1.00	186.49	0.0186	3.584	92	12.1	12.1	0.763	0.763	4.862	111	13.1	13.1	0.823	0.823	9.257	140	14.5	14.5	0.915	0.915	2.02	3.55	7.20	177.2	150	8.9	23%	40%	81%
R1-3	RD1	1	1	3-1/4 open	0.90	1.00	204.01	0.0204	3.921	93	12.2	12.2	0.767	0.767	5.318	112	13.1	13.1	0.826	0.826	10.127	141	14.6	14.6	0.918	0.918	2.31	4.04	8.13	193.8	150	9.7	24%	42%	84%
R1-4	RD1	1	1	3-1/4 open	0.90	1.00	141.80	0.0142	2.725	87	11.9	11.9	0.748	0.748	3.697	106	12.8	12.8	0.808	0.808	7.039	135	14.3	14.3	0.899	0.899	1.32	2.39	4.95	134.7	150	6.7	20%	35%	74%
R2-1	RD1	1	1	3-1/4 open	0.90	1.00	149.11	0.0149	2.866	88	11.9	11.9	0.751	0.751	3.887	107	12.9	12.9	0.811	0.811	7.402	136	14.3	14.3	0.902	0.902	1.43	2.57	5.31	141.7	150	7.1	20%	36%	75%
R2-2	RD1	1	1	3-1/4 open	0.90	1.00	52.99	0.0053	1.018	65	10.8	10.8	0.678	0.678	1.381	86	11.8	11.8	0.744	0.744	2.630	115	13.3	13.3	0.836	0.836	0.21	0.47	1.14	50.3	150	2.5	8%	19%	45%
R2-3	RD1	1	1	3-1/4 open	0.90	1.00	147.07	0.0147	2.826	88	11.9	11.9	0.751	0.751	3.834	107	12.9	12.9	0.811	0.811	7.300	136	14.3	14.3	0.902	0.902	1.40	2.52	5.21	139.7	150	7.0	20%	36%	75%
R3-1	RD1	1	1	3-1/4 open	0.90	1.00	194.20	0.0194	3.732	92	12.1	12.1	0.763	0.763	5.063	111	13.1	13.1	0.823	0.823	9.640	141	14.6	14.6	0.918	0.918	2.15	3.77	7.60	184.5	150	9.2	23%	41%	82%
R3-2	RD1	1	1	3-1/4 open	0.90	1.00	101.25	0.0101	1.946	81	11.6	11.6	0.729	0.729	2.639	100	12.5	12.5	0.789	0.789	5.026	129	14.0	14.0	0.880	0.880	0.75	1.43	3.07	96.2	150	4.8	16%	30%	64%
Totals					0.9	0.9	**1,377**	**0.1377**	**26.45**		**106.50**		**6.72**	**6.72**	**35.89**		**115.20**		**7.27**	**7.27**	**68.33**		**128.35**		**8.10**	**8.10**	**13.80**	**24.65**	**50.49**	**1298**		**64.9**			
Min										**65**						**86**						**115**														
Max										**94**						**114**						**144**														

Runoff Based on the Following:

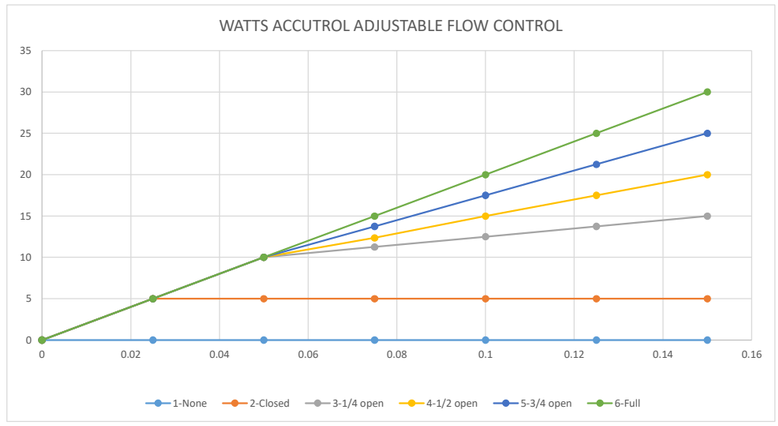
Storm Frequency (years) =	2	5	100
Time of Conc (mins) =	10	10	10
Storm Intensity (mm/hr) =	76.8	104.2	178.6

Roof Drains have Following Flow Rates: WATTS Flow Controlled Drain

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	@150mm
1-None	0	0	0	0	0	0	0	0.000
2-Closed	0	5	5	5	5	5	5	0.315
3-1/4 open	0	5	10	11	13	14	15	0.946
4-1/2 open	0	5	10	12	15	18	20	1.262
5-3/4 open	0	5	10	14	18	21	25	1.577
6-Full	0	5	10	15	20	25	30	1.893

Roof Drain Types

Drain Type =	RD1
Max Overflow Depth	150 mm
Flow Controlled (Yes/	Yes
Ponding	Yes
Weir Desc	Accutrol
No. Weirs	1



Storage Volumes Roof Area #R1-1 (2 Year, 5 Year and 100 Year Storms)

C_{AVG} = 0.90 (dimmensionless)
C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.01996 (hectares)

	Release Rate = 0.770 (L/sec)					Release Rate = 0.8328 (L/sec)					Release Rate = 0.9274 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.95			, B = 0.810		IDF Parameters, A = 998.07			, B = 0.814		DF Parameters, A = 1735.7			, B = 0.820	
	(I = A/(T_c+C			, C = 6.199		(I = A/(T_c+C)			, C = 6.053		(I = A/(T_c+C)			, C = 6.014	
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	8.4	0.77	7.6	0.00	230.5	12.8	0.833	12.0	0.00	398.6	22.1	0.9	21.2	0.00
5	103.6	5.2	0.77	4.4	1.32	141.2	7.8	0.833	7.0	2.10	242.7	13.5	0.9	12.5	3.76
10	76.8	3.8	0.77	3.1	1.84	104.2	5.8	0.833	4.9	2.97	178.6	9.9	0.9	9.0	5.39
15	61.8	3.1	0.77	2.3	2.08	83.6	4.6	0.833	3.8	3.42	142.9	7.9	0.9	7.0	6.30
20	52.0	2.6	0.77	1.8	2.20	70.3	3.9	0.833	3.1	3.68	120.0	6.7	0.9	5.7	6.88
25	45.2	2.3	0.77	1.5	2.23	60.9	3.4	0.833	2.5	3.82	103.8	5.8	0.9	4.8	7.25
30	40.0	2.0	0.77	1.2	2.21	53.9	3.0	0.833	2.2	3.89	91.9	5.1	0.9	4.2	7.51
35	36.1	1.8	0.77	1.0	2.17	48.5	2.7	0.833	1.9	3.91	82.6	4.6	0.9	3.7	7.68
40	32.9	1.6	0.77	0.9	2.09	44.2	2.5	0.833	1.6	3.89	75.1	4.2	0.9	3.2	7.78
45	30.2	1.5	0.77	0.7	2.00	40.6	2.3	0.833	1.4	3.84	69.1	3.8	0.9	2.9	7.84
50	28.0	1.4	0.77	0.6	1.89	37.7	2.1	0.833	1.3	3.77	64.0	3.5	0.9	2.6	7.87
55	26.2	1.3	0.77	0.5	1.77	35.1	1.9	0.833	1.1	3.68	59.6	3.3	0.9	2.4	7.86
60	24.6	1.2	0.77	0.5	1.65	32.9	1.8	0.833	1.0	3.58	55.9	3.1	0.9	2.2	7.83
65	23.2	1.2	0.77	0.4	1.51	31.0	1.7	0.833	0.9	3.47	52.6	2.9	0.9	2.0	7.78
70	21.9	1.1	0.77	0.3	1.36	29.4	1.6	0.833	0.8	3.35	49.8	2.8	0.9	1.8	7.71
75	20.8	1.0	0.77	0.3	1.21	27.9	1.5	0.833	0.7	3.22	47.3	2.6	0.9	1.7	7.63
80	19.8	1.0	0.77	0.2	1.06	26.6	1.5	0.833	0.6	3.08	45.0	2.5	0.9	1.6	7.53
85	18.9	0.9	0.77	0.2	0.90	25.4	1.4	0.833	0.6	2.93	43.0	2.4	0.9	1.5	7.43
90	18.1	0.9	0.77	0.1	0.74	24.3	1.3	0.833	0.5	2.78	41.1	2.3	0.9	1.4	7.31
95	17.4	0.9	0.77	0.1	0.57	23.3	1.3	0.833	0.5	2.63	39.4	2.2	0.9	1.3	7.19
100	16.7	0.8	0.77	0.1	0.40	22.4	1.2	0.833	0.4	2.46	37.9	2.1	0.9	1.2	7.06
105	16.1	0.8	0.77	0.0	0.23	21.6	1.2	0.833	0.4	2.30	36.5	2.0	0.9	1.1	6.92
110	15.6	0.8	0.77	0.0	0.05	20.8	1.2	0.833	0.3	2.13	35.2	2.0	0.9	1.0	6.77
115	15.0	0.8	0.77	0.0	-0.13	20.1	1.1	0.833	0.3	1.96	34.0	1.9	0.9	1.0	6.62
120	14.6	0.7	0.77	0.0	-0.30	19.5	1.1	0.833	0.2	1.78	32.9	1.8	0.9	0.9	6.47
Max =					**2.23**					**3.91**					**7.87**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, I = $A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximum Storage = Max Storage Over Duration

Storage Volumes Roof Area #R1-2 (2 Year, 5 Year and 100 Year Storms)

C_{AVG} = 0.90 (dimmensionless)
C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.01865 (hectares)

	Release Rate = 0.763 (L/sec)					Release Rate = 0.8233 (L/sec)					Release Rate = 0.9148 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.95 , B = 0.810					IDF Parameters, A = 998.07 , B = 0.814					IDF Parameters, A = 1735.7 , B = 0.820				
	($I = A/(T_c+C$, C = 6.199					($I = A/(T_c+C)$, C = 6.053					($I = A/(T_c+C)$, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	7.8	0.76	7.0	0.00	230.5	11.9	0.823	11.1	0.00	398.6	20.7	0.9	19.8	0.00
5	103.6	4.8	0.76	4.1	1.22	141.2	7.3	0.823	6.5	1.95	242.7	12.6	0.9	11.7	3.50
10	76.8	3.6	0.76	2.8	1.69	104.2	5.4	0.823	4.6	2.75	178.6	9.3	0.9	8.3	5.01
15	61.8	2.9	0.76	2.1	1.91	83.6	4.3	0.823	3.5	3.16	142.9	7.4	0.9	6.5	5.84
20	52.0	2.4	0.76	1.7	2.00	70.3	3.6	0.823	2.8	3.38	120.0	6.2	0.9	5.3	6.36
25	45.2	2.1	0.76	1.3	2.02	60.9	3.2	0.823	2.3	3.50	103.8	5.4	0.9	4.5	6.70
30	40.0	1.9	0.76	1.1	1.99	53.9	2.8	0.823	2.0	3.55	91.9	4.8	0.9	3.8	6.93
35	36.1	1.7	0.76	0.9	1.93	48.5	2.5	0.823	1.7	3.55	82.6	4.3	0.9	3.4	7.07
40	32.9	1.5	0.76	0.8	1.85	44.2	2.3	0.823	1.5	3.52	75.1	3.9	0.9	3.0	7.15
45	30.2	1.4	0.76	0.6	1.75	40.6	2.1	0.823	1.3	3.46	69.1	3.6	0.9	2.7	7.20
50	28.0	1.3	0.76	0.5	1.63	37.7	2.0	0.823	1.1	3.39	64.0	3.3	0.9	2.4	7.20
55	26.2	1.2	0.76	0.5	1.51	35.1	1.8	0.823	1.0	3.29	59.6	3.1	0.9	2.2	7.18
60	24.6	1.1	0.76	0.4	1.38	32.9	1.7	0.823	0.9	3.18	55.9	2.9	0.9	2.0	7.14
65	23.2	1.1	0.76	0.3	1.24	31.0	1.6	0.823	0.8	3.07	52.6	2.7	0.9	1.8	7.08
70	21.9	1.0	0.76	0.3	1.09	29.4	1.5	0.823	0.7	2.94	49.8	2.6	0.9	1.7	7.00
75	20.8	1.0	0.76	0.2	0.93	27.9	1.4	0.823	0.6	2.80	47.3	2.4	0.9	1.5	6.91
80	19.8	0.9	0.76	0.2	0.78	26.6	1.4	0.823	0.6	2.66	45.0	2.3	0.9	1.4	6.81
85	18.9	0.9	0.76	0.1	0.61	25.4	1.3	0.823	0.5	2.51	43.0	2.2	0.9	1.3	6.69
90	18.1	0.8	0.76	0.1	0.45	24.3	1.3	0.823	0.4	2.35	41.1	2.1	0.9	1.2	6.57
95	17.4	0.8	0.76	0.0	0.28	23.3	1.2	0.823	0.4	2.19	39.4	2.0	0.9	1.1	6.44
100	16.7	0.8	0.76	0.0	0.11	22.4	1.2	0.823	0.3	2.03	37.9	2.0	0.9	1.1	6.30
105	16.1	0.8	0.76	0.0	-0.07	21.6	1.1	0.823	0.3	1.86	36.5	1.9	0.9	1.0	6.16
110	15.6	0.7	0.76	0.0	-0.24	20.8	1.1	0.823	0.3	1.69	35.2	1.8	0.9	0.9	6.01
115	15.0	0.7	0.76	-0.1	-0.42	20.1	1.0	0.823	0.2	1.52	34.0	1.8	0.9	0.8	5.85
120	14.6	0.7	0.76	-0.1	-0.60	19.5	1.0	0.823	0.2	1.34	32.9	1.7	0.9	0.8	5.69
Max =					**2.02**					**3.55**					**7.20**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Storage Volumes Roof Area #R1-3 (2 Year, 5 Year and 100 Year Storms)

C_{AVG} = 0.90 (dimmensionless)
C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.02040 (hectares)

	Release Rate = 0.767 (L/sec)					Release Rate = 0.8265 (L/sec)					Release Rate = 0.9180 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.95, B = 0.810					IDF Parameters, A = 998.07, B = 0.814					IDF Parameters, A = 1735.7, B = 0.820				
	(I = A/(T_c+C C = 6.199					(I = A/(T_c+C) C = 6.053					(I = A/(T_c+C) C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	8.5	0.77	7.8	0.00	230.5	13.1	0.826	12.2	0.00	398.6	22.6	0.9	21.7	0.00
5	103.6	5.3	0.77	4.5	1.36	141.2	8.0	0.826	7.2	2.15	242.7	13.8	0.9	12.8	3.85
10	76.8	3.9	0.77	3.2	1.89	104.2	5.9	0.826	5.1	3.05	178.6	10.1	0.9	9.2	5.53
15	61.8	3.2	0.77	2.4	2.15	83.6	4.7	0.826	3.9	3.52	142.9	8.1	0.9	7.2	6.47
20	52.0	2.7	0.77	1.9	2.27	70.3	4.0	0.826	3.2	3.79	120.0	6.8	0.9	5.9	7.06
25	45.2	2.3	0.77	1.5	2.31	60.9	3.5	0.826	2.6	3.94	103.8	5.9	0.9	5.0	7.46
30	40.0	2.0	0.77	1.3	2.30	53.9	3.1	0.826	2.2	4.02	91.9	5.2	0.9	4.3	7.73
35	36.1	1.8	0.77	1.1	2.26	48.5	2.8	0.826	1.9	4.04	82.6	4.7	0.9	3.8	7.91
40	32.9	1.7	0.77	0.9	2.19	44.2	2.5	0.826	1.7	4.03	75.1	4.3	0.9	3.3	8.03
45	30.2	1.5	0.77	0.8	2.10	40.6	2.3	0.826	1.5	3.99	69.1	3.9	0.9	3.0	8.10
50	28.0	1.4	0.77	0.7	1.99	37.7	2.1	0.826	1.3	3.93	64.0	3.6	0.9	2.7	8.13
55	26.2	1.3	0.77	0.6	1.88	35.1	2.0	0.826	1.2	3.85	59.6	3.4	0.9	2.5	8.13
60	24.6	1.3	0.77	0.5	1.75	32.9	1.9	0.826	1.0	3.75	55.9	3.2	0.9	2.3	8.11
65	23.2	1.2	0.77	0.4	1.62	31.0	1.8	0.826	0.9	3.64	52.6	3.0	0.9	2.1	8.06
70	21.9	1.1	0.77	0.4	1.48	29.4	1.7	0.826	0.8	3.53	49.8	2.8	0.9	1.9	8.00
75	20.8	1.1	0.77	0.3	1.33	27.9	1.6	0.826	0.8	3.40	47.3	2.7	0.9	1.8	7.93
80	19.8	1.0	0.77	0.2	1.18	26.6	1.5	0.826	0.7	3.26	45.0	2.6	0.9	1.6	7.84
85	18.9	1.0	0.77	0.2	1.02	25.4	1.4	0.826	0.6	3.12	43.0	2.4	0.9	1.5	7.74
90	18.1	0.9	0.77	0.2	0.86	24.3	1.4	0.826	0.6	2.98	41.1	2.3	0.9	1.4	7.63
95	17.4	0.9	0.77	0.1	0.70	23.3	1.3	0.826	0.5	2.82	39.4	2.2	0.9	1.3	7.52
100	16.7	0.9	0.77	0.1	0.53	22.4	1.3	0.826	0.4	2.67	37.9	2.1	0.9	1.2	7.39
105	16.1	0.8	0.77	0.1	0.36	21.6	1.2	0.826	0.4	2.50	36.5	2.1	0.9	1.2	7.26
110	15.6	0.8	0.77	0.0	0.19	20.8	1.2	0.826	0.4	2.34	35.2	2.0	0.9	1.1	7.12
115	15.0	0.8	0.77	0.0	0.01	20.1	1.1	0.826	0.3	2.17	34.0	1.9	0.9	1.0	6.97
120	14.6	0.7	0.77	0.0	-0.17	19.5	1.1	0.826	0.3	2.00	32.9	1.9	0.9	0.9	6.82
Max =					**2.31**					**4.04**					**8.13**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Storage Volumes Roof Area #R1-4 (2 Year, 5 Year and 100 Year Storms)

C_{AVG} = 0.90 (dimmensionless)
C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.01418 (hectares)

	Release Rate = 0.748 (L/sec) Return Period = 2 (years) IDF Parameters, A = 732.95, B = 0.810, (I = A/(T_c+C, C = 6.199					Release Rate = 0.8076 (L/sec) Return Period = 5 (years) DF Parameters, A = 998.07, B = 0.814, (I = A/(T_c+C), C = 6.053					Release Rate = 0.8990 (L/sec) Return Period = 100 (years) IDF Parameters, A = 1735.7, B = 0.820, (I = A/(T_c+C), C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	5.9	0.75	5.2	0.00	230.5	9.1	0.808	8.3	0.00	398.6	15.7	0.9	14.8	0.00
5	103.6	3.7	0.75	2.9	0.88	141.2	5.6	0.808	4.8	1.43	242.7	9.6	0.9	8.7	2.60
10	76.8	2.7	0.75	2.0	1.19	104.2	4.1	0.808	3.3	1.98	178.6	7.0	0.9	6.1	3.68
15	61.8	2.2	0.75	1.4	1.30	83.6	3.3	0.808	2.5	2.24	142.9	5.6	0.9	4.7	4.26
20	52.0	1.8	0.75	1.1	1.32	70.3	2.8	0.808	2.0	2.35	120.0	4.7	0.9	3.8	4.60
25	45.2	1.6	0.75	0.9	1.28	60.9	2.4	0.808	1.6	2.39	103.8	4.1	0.9	3.2	4.79
30	40.0	1.4	0.75	0.7	1.21	53.9	2.1	0.808	1.3	2.37	91.9	3.6	0.9	2.7	4.90
35	36.1	1.3	0.75	0.5	1.12	48.5	1.9	0.808	1.1	2.32	82.6	3.3	0.9	2.4	4.95
40	32.9	1.2	0.75	0.4	1.00	44.2	1.7	0.808	0.9	2.24	75.1	3.0	0.9	2.1	4.95
45	30.2	1.1	0.75	0.3	0.88	40.6	1.6	0.808	0.8	2.14	69.1	2.7	0.9	1.8	4.92
50	28.0	1.0	0.75	0.2	0.74	37.7	1.5	0.808	0.7	2.03	64.0	2.5	0.9	1.6	4.87
55	26.2	0.9	0.75	0.2	0.60	35.1	1.4	0.808	0.6	1.90	59.6	2.4	0.9	1.5	4.79
60	24.6	0.9	0.75	0.1	0.45	32.9	1.3	0.808	0.5	1.77	55.9	2.2	0.9	1.3	4.70
65	23.2	0.8	0.75	0.1	0.29	31.0	1.2	0.808	0.4	1.62	52.6	2.1	0.9	1.2	4.59
70	21.9	0.8	0.75	0.0	0.13	29.4	1.2	0.808	0.4	1.47	49.8	2.0	0.9	1.1	4.47
75	20.8	0.7	0.75	0.0	-0.04	27.9	1.1	0.808	0.3	1.31	47.3	1.9	0.9	1.0	4.34
80	19.8	0.7	0.75	0.0	-0.21	26.6	1.0	0.808	0.2	1.15	45.0	1.8	0.9	0.9	4.20
85	18.9	0.7	0.75	-0.1	-0.39	25.4	1.0	0.808	0.2	0.98	43.0	1.7	0.9	0.8	4.05
90	18.1	0.6	0.75	-0.1	-0.56	24.3	1.0	0.808	0.1	0.81	41.1	1.6	0.9	0.7	3.90
95	17.4	0.6	0.75	-0.1	-0.74	23.3	0.9	0.808	0.1	0.63	39.4	1.6	0.9	0.7	3.74
100	16.7	0.6	0.75	-0.2	-0.92	22.4	0.9	0.808	0.1	0.45	37.9	1.5	0.9	0.6	3.57
105	16.1	0.6	0.75	-0.2	-1.10	21.6	0.9	0.808	0.0	0.27	36.5	1.4	0.9	0.5	3.40
110	15.6	0.6	0.75	-0.2	-1.29	20.8	0.8	0.808	0.0	0.09	35.2	1.4	0.9	0.5	3.23
115	15.0	0.5	0.75	-0.2	-1.48	20.1	0.8	0.808	0.0	-0.10	34.0	1.3	0.9	0.4	3.05
120	14.6	0.5	0.75	-0.2	-1.66	19.5	0.8	0.808	0.0	-0.29	32.9	1.3	0.9	0.4	2.86
Max =					**1.32**					**2.39**					**4.95**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Storage Volumes Roof Area #R2-1 (2 Year, 5 Year and 100 Year Storms)

C_{AVG} = 0.90 (dimmensionless)
C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.01491 (hectares)

	Release Rate = 0.751 (L/sec)					Release Rate = 0.8107 (L/sec)					Release Rate = 0.9022 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.95 , B = 0.810					IDF Parameters, A = 998.07 , B = 0.814					IDF Parameters, A = 1735.7 , B = 0.820				
	(I = A/(T_c+C , C = 6.199					(I = A/(T_c+C) , C = 6.053					(I = A/(T_c+C) , C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	6.2	0.75	5.5	0.00	230.5	9.6	0.811	8.7	0.00	398.6	16.5	0.9	15.6	0.00
5	103.6	3.9	0.75	3.1	0.93	141.2	5.9	0.811	5.0	1.51	242.7	10.1	0.9	9.2	2.75
10	76.8	2.9	0.75	2.1	1.27	104.2	4.3	0.811	3.5	2.11	178.6	7.4	0.9	6.5	3.90
15	61.8	2.3	0.75	1.6	1.40	83.6	3.5	0.811	2.7	2.39	142.9	5.9	0.9	5.0	4.52
20	52.0	1.9	0.75	1.2	1.43	70.3	2.9	0.811	2.1	2.52	120.0	5.0	0.9	4.1	4.88
25	45.2	1.7	0.75	0.9	1.40	60.9	2.5	0.811	1.7	2.57	103.8	4.3	0.9	3.4	5.10
30	40.0	1.5	0.75	0.7	1.34	53.9	2.2	0.811	1.4	2.56	91.9	3.8	0.9	2.9	5.23
35	36.1	1.3	0.75	0.6	1.25	48.5	2.0	0.811	1.2	2.52	82.6	3.4	0.9	2.5	5.29
40	32.9	1.2	0.75	0.5	1.14	44.2	1.8	0.811	1.0	2.45	75.1	3.1	0.9	2.2	5.31
45	30.2	1.1	0.75	0.4	1.02	40.6	1.7	0.811	0.9	2.36	69.1	2.9	0.9	2.0	5.29
50	28.0	1.0	0.75	0.3	0.89	37.7	1.6	0.811	0.8	2.25	64.0	2.7	0.9	1.7	5.25
55	26.2	1.0	0.75	0.2	0.74	35.1	1.5	0.811	0.6	2.13	59.6	2.5	0.9	1.6	5.18
60	24.6	0.9	0.75	0.2	0.60	32.9	1.4	0.811	0.6	2.00	55.9	2.3	0.9	1.4	5.09
65	23.2	0.9	0.75	0.1	0.44	31.0	1.3	0.811	0.5	1.86	52.6	2.2	0.9	1.3	4.99
70	21.9	0.8	0.75	0.1	0.28	29.4	1.2	0.811	0.4	1.71	49.8	2.1	0.9	1.2	4.88
75	20.8	0.8	0.75	0.0	0.12	27.9	1.2	0.811	0.3	1.55	47.3	2.0	0.9	1.1	4.76
80	19.8	0.7	0.75	0.0	-0.05	26.6	1.1	0.811	0.3	1.39	45.0	1.9	0.9	1.0	4.62
85	18.9	0.7	0.75	0.0	-0.22	25.4	1.1	0.811	0.2	1.23	43.0	1.8	0.9	0.9	4.48
90	18.1	0.7	0.75	-0.1	-0.40	24.3	1.0	0.811	0.2	1.06	41.1	1.7	0.9	0.8	4.33
95	17.4	0.6	0.75	-0.1	-0.58	23.3	1.0	0.811	0.2	0.89	39.4	1.6	0.9	0.7	4.18
100	16.7	0.6	0.75	-0.1	-0.76	22.4	0.9	0.811	0.1	0.71	37.9	1.6	0.9	0.7	4.01
105	16.1	0.6	0.75	-0.1	-0.94	21.6	0.9	0.811	0.1	0.53	36.5	1.5	0.9	0.6	3.85
110	15.6	0.6	0.75	-0.2	-1.12	20.8	0.9	0.811	0.1	0.35	35.2	1.5	0.9	0.6	3.68
115	15.0	0.6	0.75	-0.2	-1.31	20.1	0.8	0.811	0.0	0.16	34.0	1.4	0.9	0.5	3.50
120	14.6	0.5	0.75	-0.2	-1.49	19.5	0.8	0.811	0.0	-0.03	32.9	1.4	0.9	0.5	3.32
Max =					**1.43**					**2.57**					**5.31**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, I = $A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Storage Volumes Roof Area #R2-2 (2 Year, 5 Year and 100 Year Storms)

C_{AVG} = 0.90 (dimmensionless)
C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.00530 (hectares)

	Release Rate = 0.678 (L/sec)					Release Rate = 0.7445 (L/sec)					Release Rate = 0.8359 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.95, B = 0.810					IDF Parameters, A = 998.07, B = 0.814					IDF Parameters, A = 1735.7, B = 0.820				
	($I = A/(T_c+C$, C = 6.199					($I = A/(T_c+C)$, C = 6.053					($I = A/(T_c+C)$, C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	2.2	0.68	1.5	0.00	230.5	3.4	0.744	2.7	0.00	398.6	5.9	0.8	5.0	0.00
5	103.6	1.4	0.68	0.7	0.21	141.2	2.1	0.744	1.3	0.40	242.7	3.6	0.8	2.7	0.82
10	76.8	1.0	0.68	0.3	0.20	104.2	1.5	0.744	0.8	0.47	178.6	2.6	0.8	1.8	1.08
15	61.8	0.8	0.68	0.1	0.13	83.6	1.2	0.744	0.5	0.44	142.9	2.1	0.8	1.3	1.14
20	52.0	0.7	0.68	0.0	0.01	70.3	1.0	0.744	0.3	0.35	120.0	1.8	0.8	0.9	1.12
25	45.2	0.6	0.68	-0.1	-0.12	60.9	0.9	0.744	0.2	0.23	103.8	1.5	0.8	0.7	1.04
30	40.0	0.5	0.68	-0.1	-0.27	53.9	0.8	0.744	0.0	0.09	91.9	1.4	0.8	0.5	0.93
35	36.1	0.5	0.68	-0.2	-0.42	48.5	0.7	0.744	0.0	-0.06	82.6	1.2	0.8	0.4	0.80
40	32.9	0.4	0.68	-0.2	-0.58	44.2	0.7	0.744	-0.1	-0.22	75.1	1.1	0.8	0.3	0.65
45	30.2	0.4	0.68	-0.3	-0.75	40.6	0.6	0.744	-0.1	-0.39	69.1	1.0	0.8	0.2	0.49
50	28.0	0.4	0.68	-0.3	-0.92	37.7	0.6	0.744	-0.2	-0.57	64.0	0.9	0.8	0.1	0.32
55	26.2	0.3	0.68	-0.3	-1.09	35.1	0.5	0.744	-0.2	-0.75	59.6	0.9	0.8	0.0	0.14
60	24.6	0.3	0.68	-0.4	-1.27	32.9	0.5	0.744	-0.3	-0.93	55.9	0.8	0.8	0.0	-0.05
65	23.2	0.3	0.68	-0.4	-1.45	31.0	0.5	0.744	-0.3	-1.12	52.6	0.8	0.8	-0.1	-0.24
70	21.9	0.3	0.68	-0.4	-1.63	29.4	0.4	0.744	-0.3	-1.31	49.8	0.7	0.8	-0.1	-0.43
75	20.8	0.3	0.68	-0.4	-1.81	27.9	0.4	0.744	-0.3	-1.50	47.3	0.7	0.8	-0.1	-0.63
80	19.8	0.3	0.68	-0.4	-1.99	26.6	0.4	0.744	-0.4	-1.70	45.0	0.7	0.8	-0.2	-0.83
85	18.9	0.3	0.68	-0.4	-2.18	25.4	0.4	0.744	-0.4	-1.89	43.0	0.6	0.8	-0.2	-1.04
90	18.1	0.2	0.68	-0.4	-2.36	24.3	0.4	0.744	-0.4	-2.09	41.1	0.6	0.8	-0.2	-1.24
95	17.4	0.2	0.68	-0.4	-2.55	23.3	0.3	0.744	-0.4	-2.29	39.4	0.6	0.8	-0.3	-1.45
100	16.7	0.2	0.68	-0.5	-2.74	22.4	0.3	0.744	-0.4	-2.49	37.9	0.6	0.8	-0.3	-1.67
105	16.1	0.2	0.68	-0.5	-2.93	21.6	0.3	0.744	-0.4	-2.69	36.5	0.5	0.8	-0.3	-1.88
110	15.6	0.2	0.68	-0.5	-3.11	20.8	0.3	0.744	-0.4	-2.89	35.2	0.5	0.8	-0.3	-2.09
115	15.0	0.2	0.68	-0.5	-3.30	20.1	0.3	0.744	-0.4	-3.09	34.0	0.5	0.8	-0.3	-2.31
120	14.6	0.2	0.68	-0.5	-3.49	19.5	0.3	0.744	-0.5	-3.30	32.9	0.5	0.8	-0.4	-2.53
Max =					**0.21**					**0.47**					**1.14**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Storage Volumes Roof Area #R2-3 (2 Year, 5 Year and 100 Year Storms)

C_{AVG} = 0.90 (dimmensionless)
C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.01471 (hectares)

	Release Rate = 0.751 (L/sec)					Release Rate = 0.8107 (L/sec)					Release Rate = 0.9022 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.95 , B = 0.810					IDF Parameters, A = 998.07 , B = 0.814					IDF Parameters, A = 1735.7 , B = 0.820				
	(I = A/(T_c+C , C = 6.199					(I = A/(T_c+C) , C = 6.053					(I = A/(T_c+C) , C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	6.2	0.75	5.4	0.00	230.5	9.4	0.811	8.6	0.00	398.6	16.3	0.9	15.4	0.00
5	103.6	3.8	0.75	3.1	0.92	141.2	5.8	0.811	5.0	1.49	242.7	9.9	0.9	9.0	2.71
10	76.8	2.8	0.75	2.1	1.25	104.2	4.3	0.811	3.4	2.07	178.6	7.3	0.9	6.4	3.84
15	61.8	2.3	0.75	1.5	1.37	83.6	3.4	0.811	2.6	2.35	142.9	5.8	0.9	4.9	4.45
20	52.0	1.9	0.75	1.2	1.40	70.3	2.9	0.811	2.1	2.47	120.0	4.9	0.9	4.0	4.80
25	45.2	1.7	0.75	0.9	1.37	60.9	2.5	0.811	1.7	2.52	103.8	4.2	0.9	3.3	5.02
30	40.0	1.5	0.75	0.7	1.30	53.9	2.2	0.811	1.4	2.51	91.9	3.8	0.9	2.9	5.14
35	36.1	1.3	0.75	0.6	1.21	48.5	2.0	0.811	1.2	2.46	82.6	3.4	0.9	2.5	5.20
40	32.9	1.2	0.75	0.5	1.10	44.2	1.8	0.811	1.0	2.39	75.1	3.1	0.9	2.2	5.21
45	30.2	1.1	0.75	0.4	0.98	40.6	1.7	0.811	0.9	2.30	69.1	2.8	0.9	1.9	5.19
50	28.0	1.0	0.75	0.3	0.84	37.7	1.5	0.811	0.7	2.19	64.0	2.6	0.9	1.7	5.14
55	26.2	1.0	0.75	0.2	0.70	35.1	1.4	0.811	0.6	2.06	59.6	2.4	0.9	1.5	5.07
60	24.6	0.9	0.75	0.2	0.55	32.9	1.3	0.811	0.5	1.93	55.9	2.3	0.9	1.4	4.98
65	23.2	0.9	0.75	0.1	0.39	31.0	1.3	0.811	0.5	1.79	52.6	2.2	0.9	1.3	4.88
70	21.9	0.8	0.75	0.1	0.23	29.4	1.2	0.811	0.4	1.64	49.8	2.0	0.9	1.1	4.76
75	20.8	0.8	0.75	0.0	0.07	27.9	1.1	0.811	0.3	1.48	47.3	1.9	0.9	1.0	4.63
80	19.8	0.7	0.75	0.0	-0.10	26.6	1.1	0.811	0.3	1.32	45.0	1.8	0.9	0.9	4.50
85	18.9	0.7	0.75	-0.1	-0.27	25.4	1.0	0.811	0.2	1.16	43.0	1.8	0.9	0.9	4.36
90	18.1	0.7	0.75	-0.1	-0.45	24.3	1.0	0.811	0.2	0.98	41.1	1.7	0.9	0.8	4.20
95	17.4	0.6	0.75	-0.1	-0.63	23.3	1.0	0.811	0.1	0.81	39.4	1.6	0.9	0.7	4.05
100	16.7	0.6	0.75	-0.1	-0.81	22.4	0.9	0.811	0.1	0.63	37.9	1.5	0.9	0.6	3.88
105	16.1	0.6	0.75	-0.2	-0.99	21.6	0.9	0.811	0.1	0.45	36.5	1.5	0.9	0.6	3.72
110	15.6	0.6	0.75	-0.2	-1.17	20.8	0.9	0.811	0.0	0.27	35.2	1.4	0.9	0.5	3.54
115	15.0	0.6	0.75	-0.2	-1.36	20.1	0.8	0.811	0.0	0.08	34.0	1.4	0.9	0.5	3.37
120	14.6	0.5	0.75	-0.2	-1.55	19.5	0.8	0.811	0.0	-0.11	32.9	1.3	0.9	0.4	3.19
Max =					**1.40**					**2.52**					**5.21**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, I = $A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Storage Volumes Roof Area #R3-1 (2 Year, 5 Year and 100 Year Storms)

C_{AVG} = 0.90 (dimmensionless)
C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.01942 (hectares)

	Release Rate = 0.763 (L/sec)					Release Rate = 0.8233 (L/sec)					Release Rate = 0.9180 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	DF Parameters, A = 732.95 , B = 0.810					DF Parameters, A = 998.07 , B = 0.814					DF Parameters, A = 1735.7 , B = 0.820				
	(I = A/(T_c+C , C = 6.199					(I = A/(T_c+C) , C = 6.053					(I = A/(T_c+C) , C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	8.1	0.76	7.4	0.00	230.5	12.4	0.823	11.6	0.00	398.6	21.5	0.9	20.6	0.00
5	103.6	5.0	0.76	4.3	1.28	141.2	7.6	0.823	6.8	2.04	242.7	13.1	0.9	12.2	3.66
10	76.8	3.7	0.76	3.0	1.78	104.2	5.6	0.823	4.8	2.88	178.6	9.6	0.9	8.7	5.23
15	61.8	3.0	0.76	2.2	2.01	83.6	4.5	0.823	3.7	3.32	142.9	7.7	0.9	6.8	6.12
20	52.0	2.5	0.76	1.8	2.12	70.3	3.8	0.823	3.0	3.56	120.0	6.5	0.9	5.6	6.67
25	45.2	2.2	0.76	1.4	2.15	60.9	3.3	0.823	2.5	3.70	103.8	5.6	0.9	4.7	7.03
30	40.0	1.9	0.76	1.2	2.13	53.9	2.9	0.823	2.1	3.76	91.9	5.0	0.9	4.0	7.28
35	36.1	1.8	0.76	1.0	2.08	48.5	2.6	0.823	1.8	3.77	82.6	4.5	0.9	3.5	7.43
40	32.9	1.6	0.76	0.8	2.00	44.2	2.4	0.823	1.6	3.75	75.1	4.1	0.9	3.1	7.53
45	30.2	1.5	0.76	0.7	1.91	40.6	2.2	0.823	1.4	3.70	69.1	3.7	0.9	2.8	7.59
50	28.0	1.4	0.76	0.6	1.80	37.7	2.0	0.823	1.2	3.63	64.0	3.5	0.9	2.5	7.60
55	26.2	1.3	0.76	0.5	1.68	35.1	1.9	0.823	1.1	3.54	59.6	3.2	0.9	2.3	7.59
60	24.6	1.2	0.76	0.4	1.55	32.9	1.8	0.823	1.0	3.44	55.9	3.0	0.9	2.1	7.56
65	23.2	1.1	0.76	0.4	1.41	31.0	1.7	0.823	0.9	3.33	52.6	2.8	0.9	1.9	7.50
70	21.9	1.1	0.76	0.3	1.27	29.4	1.6	0.823	0.8	3.20	49.8	2.7	0.9	1.8	7.43
75	20.8	1.0	0.76	0.2	1.12	27.9	1.5	0.823	0.7	3.07	47.3	2.6	0.9	1.6	7.35
80	19.8	1.0	0.76	0.2	0.96	26.6	1.4	0.823	0.6	2.93	45.0	2.4	0.9	1.5	7.25
85	18.9	0.9	0.76	0.2	0.80	25.4	1.4	0.823	0.5	2.79	43.0	2.3	0.9	1.4	7.15
90	18.1	0.9	0.76	0.1	0.64	24.3	1.3	0.823	0.5	2.63	41.1	2.2	0.9	1.3	7.03
95	17.4	0.8	0.76	0.1	0.47	23.3	1.3	0.823	0.4	2.48	39.4	2.1	0.9	1.2	6.90
100	16.7	0.8	0.76	0.1	0.30	22.4	1.2	0.823	0.4	2.32	37.9	2.0	0.9	1.1	6.77
105	16.1	0.8	0.76	0.0	0.13	21.6	1.2	0.823	0.3	2.15	36.5	2.0	0.9	1.1	6.63
110	15.6	0.8	0.76	0.0	-0.05	20.8	1.1	0.823	0.3	1.99	35.2	1.9	0.9	1.0	6.48
115	15.0	0.7	0.76	0.0	-0.22	20.1	1.1	0.823	0.3	1.81	34.0	1.8	0.9	0.9	6.33
120	14.6	0.7	0.76	-0.1	-0.40	19.5	1.1	0.823	0.2	1.64	32.9	1.8	0.9	0.9	6.18
Max =					**2.15**					**3.77**					**7.60**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, I = $A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Storage Volumes Roof Area #R3-2 (2 Year, 5 Year and 100 Year Storms)

C_{AVG} = 0.90 (dimmensionless)
C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.01013 (hectares)

	Release Rate = 0.729 (L/sec)					Release Rate = 0.7886 (L/sec)					Release Rate = 0.8801 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.95 , B = 0.810					DF Parameters, A = 998.07 , B = 0.814					DF Parameters, A = 1735.7 , B = 0.820				
	(I = A/(T_c+C , C = 6.199					(I = A/(T_c+C) , C = 6.053					(I = A/(T_c+C) , C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	4.2	0.73	3.5	0.00	230.5	6.5	0.789	5.7	0.00	398.6	11.2	0.9	10.3	0.00
5	103.6	2.6	0.73	1.9	0.57	141.2	4.0	0.789	3.2	0.96	242.7	6.8	0.9	6.0	1.79
10	76.8	1.9	0.73	1.2	0.73	104.2	2.9	0.789	2.1	1.29	178.6	5.0	0.9	4.1	2.49
15	61.8	1.6	0.73	0.8	0.75	83.6	2.4	0.789	1.6	1.41	142.9	4.0	0.9	3.1	2.83
20	52.0	1.3	0.73	0.6	0.71	70.3	2.0	0.789	1.2	1.43	120.0	3.4	0.9	2.5	3.00
25	45.2	1.1	0.73	0.4	0.62	60.9	1.7	0.789	0.9	1.39	103.8	2.9	0.9	2.0	3.06
30	40.0	1.0	0.73	0.3	0.51	53.9	1.5	0.789	0.7	1.31	91.9	2.6	0.9	1.7	3.07
35	36.1	0.9	0.73	0.2	0.39	48.5	1.4	0.789	0.6	1.21	82.6	2.3	0.9	1.4	3.03
40	32.9	0.8	0.73	0.1	0.25	44.2	1.2	0.789	0.5	1.09	75.1	2.1	0.9	1.2	2.96
45	30.2	0.8	0.73	0.0	0.10	40.6	1.1	0.789	0.4	0.96	69.1	1.9	0.9	1.1	2.87
50	28.0	0.7	0.73	0.0	-0.06	37.7	1.1	0.789	0.3	0.81	64.0	1.8	0.9	0.9	2.76
55	26.2	0.7	0.73	-0.1	-0.22	35.1	1.0	0.789	0.2	0.66	59.6	1.7	0.9	0.8	2.63
60	24.6	0.6	0.73	-0.1	-0.38	32.9	0.9	0.789	0.1	0.50	55.9	1.6	0.9	0.7	2.50
65	23.2	0.6	0.73	-0.1	-0.55	31.0	0.9	0.789	0.1	0.33	52.6	1.5	0.9	0.6	2.35
70	21.9	0.6	0.73	-0.2	-0.73	29.4	0.8	0.789	0.0	0.16	49.8	1.4	0.9	0.5	2.19
75	20.8	0.5	0.73	-0.2	-0.91	27.9	0.8	0.789	0.0	-0.02	47.3	1.3	0.9	0.5	2.03
80	19.8	0.5	0.73	-0.2	-1.09	26.6	0.7	0.789	0.0	-0.20	45.0	1.3	0.9	0.4	1.85
85	18.9	0.5	0.73	-0.2	-1.27	25.4	0.7	0.789	-0.1	-0.38	43.0	1.2	0.9	0.3	1.68
90	18.1	0.5	0.73	-0.3	-1.45	24.3	0.7	0.789	-0.1	-0.57	41.1	1.2	0.9	0.3	1.50
95	17.4	0.4	0.73	-0.3	-1.64	23.3	0.7	0.789	-0.1	-0.76	39.4	1.1	0.9	0.2	1.31
100	16.7	0.4	0.73	-0.3	-1.83	22.4	0.6	0.789	-0.2	-0.95	37.9	1.1	0.9	0.2	1.12
105	16.1	0.4	0.73	-0.3	-2.02	21.6	0.6	0.789	-0.2	-1.14	36.5	1.0	0.9	0.1	0.93
110	15.6	0.4	0.73	-0.3	-2.21	20.8	0.6	0.789	-0.2	-1.34	35.2	1.0	0.9	0.1	0.73
115	15.0	0.4	0.73	-0.3	-2.40	20.1	0.6	0.789	-0.2	-1.53	34.0	1.0	0.9	0.1	0.53
120	14.6	0.4	0.73	-0.4	-2.59	19.5	0.5	0.789	-0.2	-1.73	32.9	0.9	0.9	0.0	0.33
Max =					**0.75**					**1.43**					**3.07**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Table D6 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: **A4, A5, A6**

C_{AVG} = 0.70 (2-yr)

C_{AVG} = 0.70 (5-yr)

C_{AVG} = 0.88 (100-yr, Max 1.0)

Time Interval = 5.00 (mins)

Drainage Area = 0.1048 (hectares)

Actual Release Rate (L/sec) = 4.00

Percentage of Actual Rate (City of Ottawa requirement) = 100% (Set to 50% when U/G storage used

Release Rate Used for Estimation of 100-year Storage (L/sec) = 4.00

Duration (mins)	Release Rate = 1.45 (L/sec), Return Period = 2 (years), IDF Parameters, A = 733.0, B = 0.810, (I = A/(Tc+C)), C = 6.199					Release Rate = 1.97 (L/sec), Return Period = 5 (years), IDF Parameters, A = 998.1, B = 0.814, (I = A/(Tc+C)), C = 6.053					Release Rate = 4.00 (L/sec), Return Period = 100 (years), IDF Parameters, A = 1735.7, B = 0.820, (I = A/(Tc+C)), C = 6.014				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	34.3	1.5	32.8	0.0	230.5	47.3	2.0	45.3	0.0	398.6	102.2	4.0	98.2	0.0
5	103.6	21.2	1.5	19.8	5.9	141.2	29.0	2.0	27.0	8.1	242.7	62.2	4.0	58.2	17.5
10	76.8	15.8	1.5	14.3	8.6	104.2	21.4	2.0	19.4	11.6	178.6	45.8	4.0	41.8	25.1
15	61.8	12.7	1.5	11.2	10.1	83.6	17.1	2.0	15.2	13.7	142.9	36.6	4.0	32.6	29.4
20	52.0	10.7	1.5	9.2	11.1	70.3	14.4	2.0	12.4	14.9	120.0	30.8	4.0	26.8	32.1
25	45.2	9.3	1.5	7.8	11.7	60.9	12.5	2.0	10.5	15.8	103.8	26.6	4.0	22.6	33.9
30	40.0	8.2	1.5	6.8	12.2	53.9	11.1	2.0	9.1	16.4	91.9	23.6	4.0	19.6	35.2
35	36.1	7.4	1.5	5.9	12.5	48.5	10.0	2.0	8.0	16.8	82.6	21.2	4.0	17.2	36.1
40	32.9	6.7	1.5	5.3	12.7	44.2	9.1	2.0	7.1	17.0	75.1	19.3	4.0	15.3	36.6
45	30.2	6.2	1.5	4.8	12.8	40.6	8.3	2.0	6.4	17.2	69.1	17.7	4.0	13.7	37.0
50	28.0	5.8	1.5	4.3	12.9	37.7	7.7	2.0	5.8	17.3	64.0	16.4	4.0	12.4	37.2
55	26.2	5.4	1.5	3.9	12.9	35.1	7.2	2.0	5.2	17.3	59.6	15.3	4.0	11.3	37.2
60	24.6	5.0	1.5	3.6	12.9	32.9	6.8	2.0	4.8	17.2	55.9	14.3	4.0	10.3	37.2
65	23.2	4.7	1.5	3.3	12.9	31.0	6.4	2.0	4.4	17.1	52.6	13.5	4.0	9.5	37.0
70	21.9	4.5	1.5	3.0	12.8	29.4	6.0	2.0	4.1	17.0	49.8	12.8	4.0	8.8	36.8
75	20.8	4.3	1.5	2.8	12.7	27.9	5.7	2.0	3.8	16.9	47.3	12.1	4.0	8.1	36.5
80	19.8	4.1	1.5	2.6	12.6	26.6	5.4	2.0	3.5	16.7	45.0	11.5	4.0	7.5	36.2
85	18.9	3.9	1.5	2.4	12.4	25.4	5.2	2.0	3.2	16.5	43.0	11.0	4.0	7.0	35.8
90	18.1	3.7	1.5	2.3	12.3	24.3	5.0	2.0	3.0	16.3	41.1	10.5	4.0	6.5	35.3
95	17.4	3.6	1.5	2.1	12.1	23.3	4.8	2.0	2.8	16.0	39.4	10.1	4.0	6.1	34.8
100	16.7	3.4	1.5	2.0	11.9	22.4	4.6	2.0	2.6	15.8	37.9	9.7	4.0	5.7	34.3
Max =					**12.9**					**17.3**					**37.2**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, I = $A/(Tc+C)^B$

3) Release Rate = Min (Release Rate, Peak Flow)

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximum Storage = Max Storage Over Duration

7) Parameters a,b,c are for City of Ottawa

City of Ottawa IDF Data (from SDG002)

IDF curve equations (Intensity in mm/hr)

100 year Intensity = $1735.688 / (\text{Time in min} + 6.014)^{0.820}$

50 year Intensity = $1569.580 / (\text{Time in min} + 6.014)^{0.820}$

25 year Intensity = $1402.884 / (\text{Time in min} + 6.018)^{0.819}$

10 year Intensity = $1174.184 / (\text{Time in min} + 6.014)^{0.816}$

5 year Intensity = $998.071 / (\text{Time in min} + 6.053)^{0.814}$

2 year Intensity = $732.951 / (\text{Time in min} + 6.199)^{0.810}$

Table D7 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A7, A8
C_{AVG} = 0.73 (2-yr)
C_{AVG} = 0.73 (5-yr)
C_{AVG} = 0.91 (100-yr, Max 1.0)
Time Interval = 5.00 (mins)
Drainage Area = 0.0949 (hectares)

Actual Release Rate (L/sec) = 6.00
Percentage of Actual Rate (City of Ottawa requirement) = 50% (Set to 50% when U/G storage used)
Release Rate Used for Estimation of 100-year Storage (L/sec) = 3.00

Duration (mins)	Release Rate = 2.06 (L/sec); Return Period = 2 (years); IDF Parameters, A = 733.0, B = 0.810, C = 6.199 (I = A/(T_c+C))					Release Rate = 2.80 (L/sec); Return Period = 5 (years); IDF Parameters, A = 998.1, B = 0.814, C = 6.053 (I = A/(T_c+C))					Release Rate = 3.00 (L/sec); Return Period = 100 (years); IDF Parameters, A = 1735.7, B = 0.820, C = 6.014 (I = A/(T_c+C))				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	32.0	2.1	29.9	0.0	230.5	44.1	2.8	41.3	0.0	398.6	95.4	3.0	92.4	0.0
5	103.6	19.8	2.1	17.8	5.3	141.2	27.0	2.8	24.2	7.3	242.7	58.1	3.0	55.1	16.5
10	76.8	14.7	2.1	12.6	7.6	104.2	19.9	2.8	17.1	10.3	178.6	42.7	3.0	39.7	23.8
15	61.8	11.8	2.1	9.8	8.8	83.6	16.0	2.8	13.2	11.9	142.9	34.2	3.0	31.2	28.1
20	52.0	10.0	2.1	7.9	9.5	70.3	13.4	2.8	10.6	12.8	120.0	28.7	3.0	25.7	30.8
25	45.2	8.6	2.1	6.6	9.9	60.9	11.7	2.8	8.9	13.3	103.8	24.8	3.0	21.8	32.8
30	40.0	7.7	2.1	5.6	10.1	53.9	10.3	2.8	7.5	13.5	91.9	22.0	3.0	19.0	34.2
35	36.1	6.9	2.1	4.8	10.2	48.5	9.3	2.8	6.5	13.6	82.6	19.8	3.0	16.8	35.2
40	32.9	6.3	2.1	4.2	10.1	44.2	8.5	2.8	5.7	13.6	75.1	18.0	3.0	15.0	35.9
45	30.2	5.8	2.1	3.7	10.1	40.6	7.8	2.8	5.0	13.4	69.1	16.5	3.0	13.5	36.5
50	28.0	5.4	2.1	3.3	9.9	37.7	7.2	2.8	4.4	13.2	64.0	15.3	3.0	12.3	36.9
55	26.2	5.0	2.1	2.9	9.7	35.1	6.7	2.8	3.9	12.9	59.6	14.3	3.0	11.3	37.2
60	24.6	4.7	2.1	2.6	9.5	32.9	6.3	2.8	3.5	12.6	55.9	13.4	3.0	10.4	37.3
65	23.2	4.4	2.1	2.4	9.2	31.0	5.9	2.8	3.1	12.2	52.6	12.6	3.0	9.6	37.4
70	21.9	4.2	2.1	2.1	8.9	29.4	5.6	2.8	2.8	11.8	49.8	11.9	3.0	8.9	37.4
75	20.8	4.0	2.1	1.9	8.6	27.9	5.3	2.8	2.5	11.4	47.3	11.3	3.0	8.3	37.4
80	19.8	3.8	2.1	1.7	8.3	26.6	5.1	2.8	2.3	11.0	45.0	10.8	3.0	7.8	37.3
85	18.9	3.6	2.1	1.6	8.0	25.4	4.9	2.8	2.1	10.5	43.0	10.3	3.0	7.3	37.1
90	18.1	3.5	2.1	1.4	7.6	24.3	4.6	2.8	1.8	10.0	41.1	9.8	3.0	6.8	36.9
95	17.4	3.3	2.1	1.3	7.2	23.3	4.5	2.8	1.7	9.5	39.4	9.4	3.0	6.4	36.7
100	16.7	3.2	2.1	1.1	6.8	22.4	4.3	2.8	1.5	8.9	37.9	9.1	3.0	6.1	36.4
Max =					**10.2**					**13.6**					**37.4**

Notes
1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration
7) Parameters a,b,c are for City of Ottawa

City of Ottawa IDF Data (from SDG002)

IDF curve equations (Intensity in mm/hr)

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
50 year Intensity = 1569.580 / (Time in min + 6.014) $^{0.820}$
25 year Intensity = 1402.884 / (Time in min + 6.018) $^{0.819}$
10 year Intensity = 1174.184 / (Time in min + 6.014) $^{0.816}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

Table D8 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: **A9, A10**

C_{AVG} = 0.20 (2-yr)

C_{AVG} = 0.20 (5-yr)

C_{AVG} = 0.25 (100-yr, Max 1.0)

Time Interval = 5.00 (mins)

Drainage Area = 0.3925 (hectares)

Actual Release Rate (L/sec) = 6.00

Percentage of Actual Rate (City of Ottawa requirement) = 100% (Set to 50% when U/G storage used)

Release Rate Used for Estimation of 100-year Storage (L/sec) = 6.00

Duration (mins)	Release Rate = 2.06 (L/sec), Return Period = 2 (years), IDF Parameters, A = 733.0, B = 0.810, (I = A/(T_c+C), C = 6.199					Release Rate = 2.80 (L/sec), Return Period = 5 (years), IDF Parameters, A = 998.1, B = 0.814, (I = A/(T_c+C), C = 6.053					Release Rate = 6.00 (L/sec), Return Period = 100 (years), IDF Parameters, A = 1735.7, B = 0.820, (I = A/(T_c+C), C = 6.014				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	36.5	2.1	34.4	0.0	230.5	50.3	2.8	47.5	0.0	398.6	108.7	6.0	102.7	0.0
5	103.6	22.6	2.1	20.5	6.2	141.2	30.8	2.8	28.0	8.4	242.7	66.2	6.0	60.2	18.1
10	76.8	16.8	2.1	14.7	8.8	104.2	22.7	2.8	19.9	12.0	178.6	48.7	6.0	42.7	25.6
15	61.8	13.5	2.1	11.4	10.3	83.6	18.2	2.8	15.4	13.9	142.9	39.0	6.0	33.0	29.7
20	52.0	11.4	2.1	9.3	11.1	70.3	15.3	2.8	12.5	15.0	120.0	32.7	6.0	26.7	32.1
25	45.2	9.9	2.1	7.8	11.7	60.9	13.3	2.8	10.5	15.7	103.8	28.3	6.0	22.3	33.5
30	40.0	8.7	2.1	6.7	12.0	53.9	11.8	2.8	9.0	16.1	91.9	25.1	6.0	19.1	34.3
35	36.1	7.9	2.1	5.8	12.2	48.5	10.6	2.8	7.8	16.4	82.6	22.5	6.0	16.5	34.7
40	32.9	7.2	2.1	5.1	12.3	44.2	9.6	2.8	6.8	16.4	75.1	20.5	6.0	14.5	34.8
45	30.2	6.6	2.1	4.5	12.2	40.6	8.9	2.8	6.1	16.4	69.1	18.8	6.0	12.8	34.7
50	28.0	6.1	2.1	4.1	12.2	37.7	8.2	2.8	5.4	16.3	64.0	17.4	6.0	11.4	34.3
55	26.2	5.7	2.1	3.6	12.0	35.1	7.7	2.8	4.9	16.1	59.6	16.3	6.0	10.3	33.9
60	24.6	5.4	2.1	3.3	11.9	32.9	7.2	2.8	4.4	15.8	55.9	15.2	6.0	9.2	33.3
65	23.2	5.1	2.1	3.0	11.7	31.0	6.8	2.8	4.0	15.5	52.6	14.4	6.0	8.4	32.6
70	21.9	4.8	2.1	2.7	11.4	29.4	6.4	2.8	3.6	15.2	49.8	13.6	6.0	7.6	31.9
75	20.8	4.5	2.1	2.5	11.2	27.9	6.1	2.8	3.3	14.8	47.3	12.9	6.0	6.9	31.0
80	19.8	4.3	2.1	2.3	10.9	26.6	5.8	2.8	3.0	14.4	45.0	12.3	6.0	6.3	30.1
85	18.9	4.1	2.1	2.1	10.6	25.4	5.5	2.8	2.7	14.0	43.0	11.7	6.0	5.7	29.2
90	18.1	4.0	2.1	1.9	10.2	24.3	5.3	2.8	2.5	13.5	41.1	11.2	6.0	5.2	28.2
95	17.4	3.8	2.1	1.7	9.9	23.3	5.1	2.8	2.3	13.0	39.4	10.8	6.0	4.8	27.1
100	16.7	3.7	2.1	1.6	9.5	22.4	4.9	2.8	2.1	12.5	37.9	10.3	6.0	4.3	26.0
Max =					**12.3**					**16.4**					**34.8**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, I = A/(Tc+C)^B

3) Release Rate = Min (Release Rate, Peak Flow)

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

7) Parameters a,b,c are for City of Ottawa

City of Ottawa IDF Data (from SDG002)

IDF curve equations (Intensity in mm/hr)

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$

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25 year Intensity = 1402.884 / (Time in min + 6.018) $^{0.819}$

10 year Intensity = 1174.184 / (Time in min + 6.014) $^{0.816}$

5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$

2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

TABLE D9: 2-YEAR STORM SEWER CALCULATION SHEET

Return Period Storm =	**2**	(2-years, 100-years)
Default Inlet Time=	10	(minutes)
Manning Coefficient =	0.013	(dimensionless)

LOCATION			AREA (hectares)				FLOW (UNRESTRICTED)							SEWER DATA									
Location	From Node	To Node	Area No.	Area (ha)	∑ Area (ha)	Average R	Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow (L/sec)	Return Period	Q (L/sec)	Dia (mm) Actual	Dia (mm) Nominal	Type	Slope (%)	Length (m)	Capacity (L/sec)	Velocity (m/s)		Time in Pipe, Tt (min)	Hydraulic Ratios	
																				Vf	Va		Qa/Qf	Va/Vf
187 BOTELER STREET	CB 101	CBMH 203	A10	0.1976	0.198	0.20	0.11	0.11	10.00	76.81	8.44	2.00	8.4	251.46	250	PVC	0.50	40.62	42.7	0.86	0.57	1.18	0.20	0.67
	CBMH 203	STMMH 302	A9	0.1950	0.393	0.20	0.11	0.22	11.18	72.55	7.86	2.00	15.8	251.46	250	PVC	0.50	35.68	42.7	0.86	0.61	0.98	0.37	0.71
	CB 102	Storm Sewer	A6	0.0165	0.017	0.90	0.04	0.04	10.00	76.81	3.18	2.00	3.2	251.46	250	PVC	1.00	14.53	60.4	1.21	0.56	0.43	0.05	0.46
	CB 103	Cistern	A4	0.066	0.083	0.59	0.11	0.15	10.43	75.18	8.17	2.00	11.3	251.46	250	PVC	1.00	23.87	60.4	1.21	0.78	0.51	0.19	0.64
	Building	STMMH 301	A1-A6	0.241	0.241	0.81	0.55	0.55	10.00	76.81	41.94	2.00	41.9	251.46	250	PVC	2.00	4.13	85.4	1.71	1.21	0.06	0.49	0.71
	STMMH 301	STMMH 302			0.241			0.55	10.06	76.59		2.00	41.8	299.36	300	PVC	0.60	7.12	74.5	1.06	0.75	0.16	0.56	0.71
	CBMH 202	STMMH 302	A7, A8	0.095	0.095	0.73	0.19	0.19	10.00	76.81	14.70	2.00	14.7	251.46	250	PVC	0.50	2.06	42.7	0.86	0.60	0.06	0.34	0.70
	STMMH 302	STMMH 303			0.728			0.96	12.16	69.40		2.00	66.3	366.42	375	PVC	0.30	22.51	90.3	0.87	0.85	0.44	0.73	0.98
TOTALS =							**1.11**											**150.52**						

Definitions:
Q = 2.78*AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Watershed Area (hectares)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficients (dimensionless)

Notes:
Ottawa Rainfall Intensity Values:
From Sewer Desing Guidelines, 2004

	2yr	100yr
a =	732.951	1735.688
b=	0.810	0.820
c =	6.199	6.014

Designed:
A. Jariwala, M.Eng.

Checked:
A. Ansari, PEng.

Dwg Reference:
C100

Project:
187 BOTELER STREET

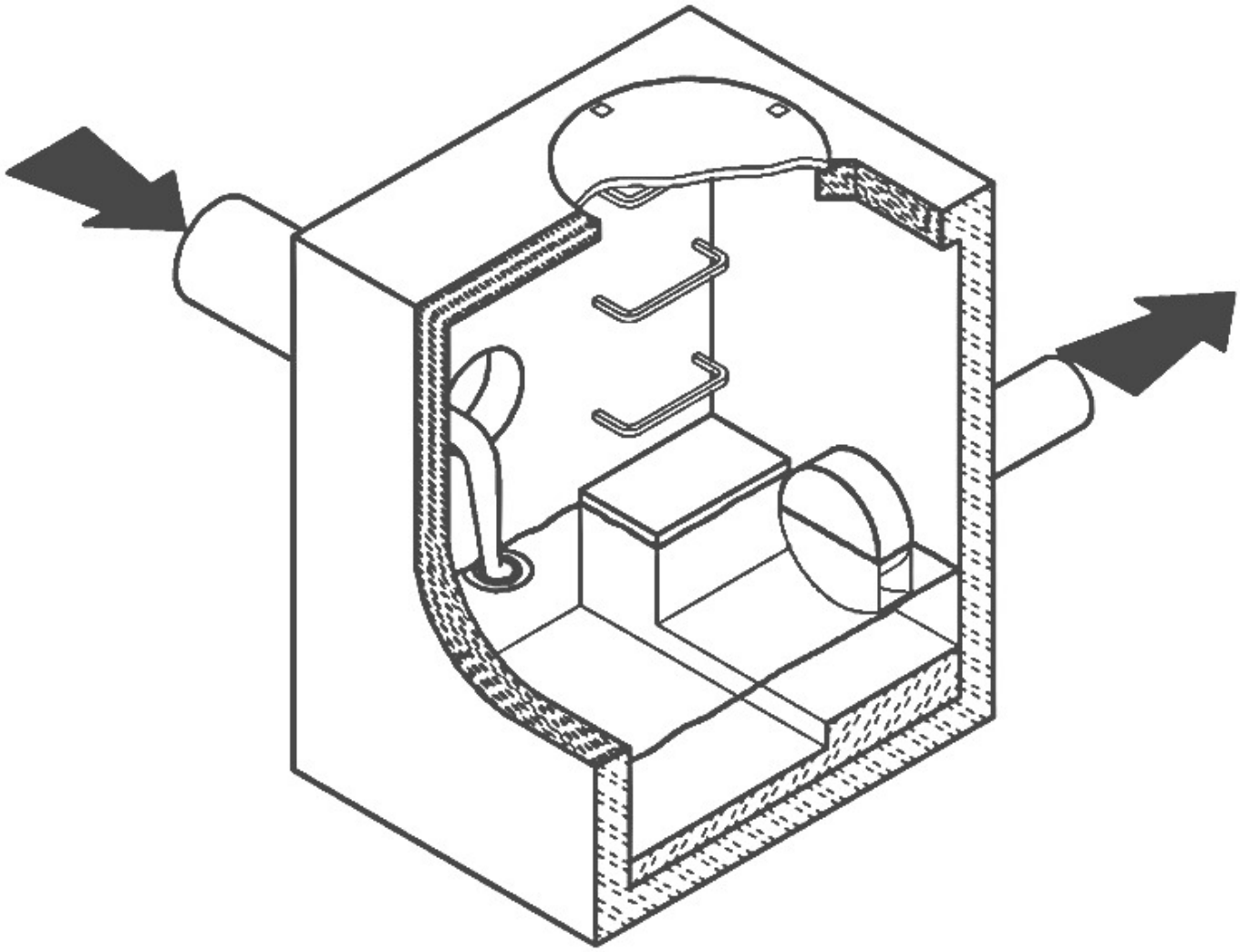
Location:
Ottawa, Ontario

File Ref:
261664 2-Year Storm Design Sheets

Sheet No:
1 of 1

CSO/STORMWATER MANAGEMENT

HYDROVEX® VHV / SVHV
Vertical Vortex Flow Regulator



JOHN MEUNIER

APPLICATIONS

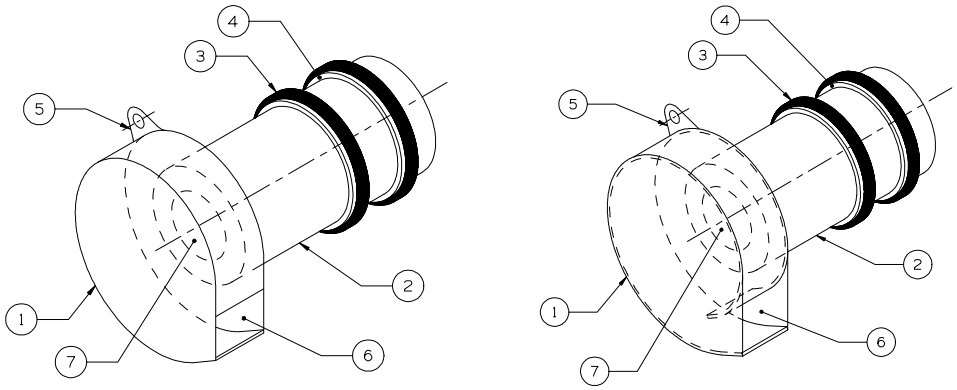
One of the major problems of urban wet weather flow management is the runoff generated after a heavy rainfall. During a storm, uncontrolled flows may overload the drainage system and cause flooding. Due to increased velocities, sewer pipe wear is increased dramatically and results in network deterioration. In a combined sewer system, the wastewater treatment plant may also experience significant increases in flows during storms, thereby losing its treatment efficiency.

A simple means of controlling excessive water runoff is by controlling excessive flows at their origin (manholes). **John Meunier Inc.** manufactures the **HYDROVEX® VHV / SVHV** line of vortex flow regulators to control stormwater flows in sewer networks, as well as manholes.

The vortex flow regulator design is based on the fluid mechanics principle of the forced vortex. This grants flow regulation without any moving parts, thus reducing maintenance. The operation of the regulator, depending on the upstream head and discharge, switches between orifice flow (gravity flow) and vortex flow. Although the concept is quite simple, over 12 years of research have been carried out in order to get a high performance.

The **HYDROVEX® VHV / SVHV** Vertical Vortex Flow Regulators **(refer to Figure 1)** are manufactured entirely of stainless steel, and consist of a hollow body (**1**) (in which flow control takes place) and an outlet orifice (**7**). Two rubber "O" rings (**3**) seal and retain the unit inside the outlet pipe. Two stainless steel retaining rings (**4**) are welded on the outlet sleeve to ensure that there is no shifting of the "O" rings during installation and use.

1. BODY
2. SLEEVE
3. O-RING
4. RETAINING RINGS (SQUARE BAR)
5. ANCHOR PLATE
6. INLET
7. OUTLET ORIFICE



VHV *SVHV*

FIGURE 1: HYDROVEX® VHV-SVHV VERTICAL VORTREX FLOW REGULATORS

ADVANTAGES

- The **HYDROVEX® VHV / SVHV** line of flow regulators are manufactured entirely of stainless steel, making them durable and corrosion resistant.
- Having no moving parts, they require minimal maintenance.
- The geometry of the **HYDROVEX® VHV / SVHV** flow regulators allows a control equal to an orifice plate, having a cross section area 4 to 6 times smaller. This decreases the chance of blockage of the regulator, due to sediments and debris found in stormwater flows. **Figure 2** illustrates the comparison between a regulator model 100 SVHV-2 and an equivalent orifice plate. One can see that for the same height of water, the regulator controls a flow approximately four times smaller than an equivalent orifice plate.
- Installation of the **HYDROVEX® VHV / SVHV** flow regulators is quick and straightforward and is performed after all civil works are completed.
- Installation requires no special tools or equipment and may be carried out by any contractor.
- Installation may be carried out in existing structures.

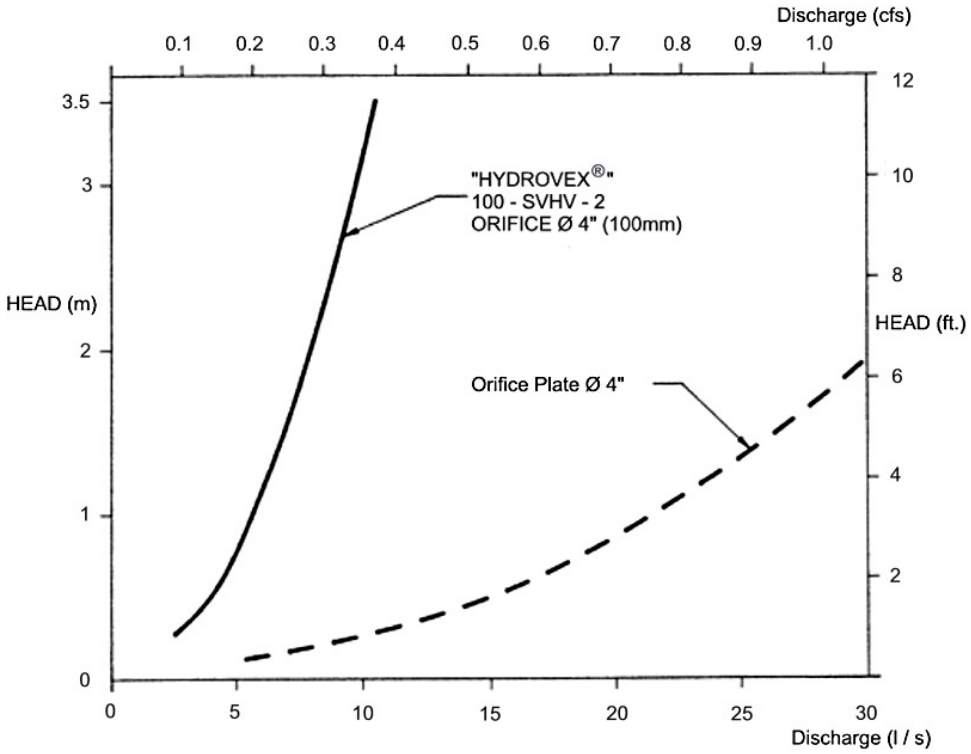


FIGURE 2: DISCHARGE CURVE SHOWING A HYDROVEX® FLOW REGULATOR VS AN ORIFICE PLATE

SELECTION

Selection of a **VHV or SVHV** regulator can be easily made using the selection charts found at the back of this brochure (see **Figure 3**). These charts are a graphical representation of the maximum upstream water pressure (head) and the maximum discharge at the manhole outlet. The maximum design head is the difference between the maximum upstream water level and the invert of the outlet pipe. All selections should be verified by John Meunier Inc. personnel prior to fabrication.

Example:

✓ Maximum design head	2m (6.56 ft.)
✓ Maximum discharge	6 L/s (0.2 cfs)
✓ Using **Figure 3** - VHV	model required is a **75 VHV-1**

INSTALLATION REQUIREMENTS

All **HYDROVEX® VHV / SVHV** flow regulators can be installed in circular or square manholes. **Figure 4** gives the various minimum dimensions required for a given regulator. ***It is imperative to respect the minimum clearances shown to ensure easy installation and proper functioning of the regulator.***

SPECIFICATIONS

In order to specify a **HYDROVEX®** regulator, the following parameters must be defined:

- The model number (ex: 75-VHV-1)
- The diameter and type of outlet pipe (ex: 6" diam. SDR 35)
- The desired discharge (ex: 6 l/s or 0.21 CFS)
- The upstream head (ex: 2 m or 6.56 ft.) *
- The manhole diameter (ex: 36" diam.)
- The minimum clearance "H" (ex: 10 inches)
- The material type (ex: 304 s/s, 11 Ga. standard)

* ***Upstream head is defined as the difference in elevation between the maximum upstream water level and the invert of the outlet pipe where the HYDROVEX® flow regulator is to be installed.***

PLEASE NOTE THAT WHEN REQUESTING A PROPOSAL, WE SIMPLY REQUIRE THAT YOU PROVIDE US WITH THE FOLLOWING:

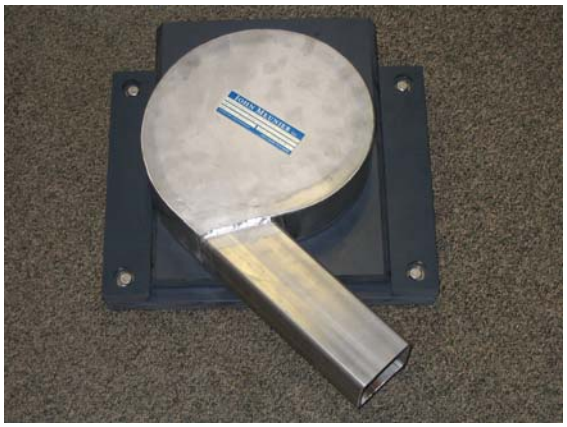
- ***project design flow rate***
- ***pressure head***
- ***chamber's outlet pipe diameter and type***

Typical VHV model in factory

OPTIONS

FV – SVHV (mounted on sliding plate)

VHV-1-O (standard model with odour control inlet)



FV – VHV-O (mounted on sliding plate with odour control inlet)

VHV with Gooseneck assembly in existing chamber without minimum release at the bottom

VHV with air vent for minimal slopes

HYDROVEX®

VHV Vertical Vortex Flow Regulator

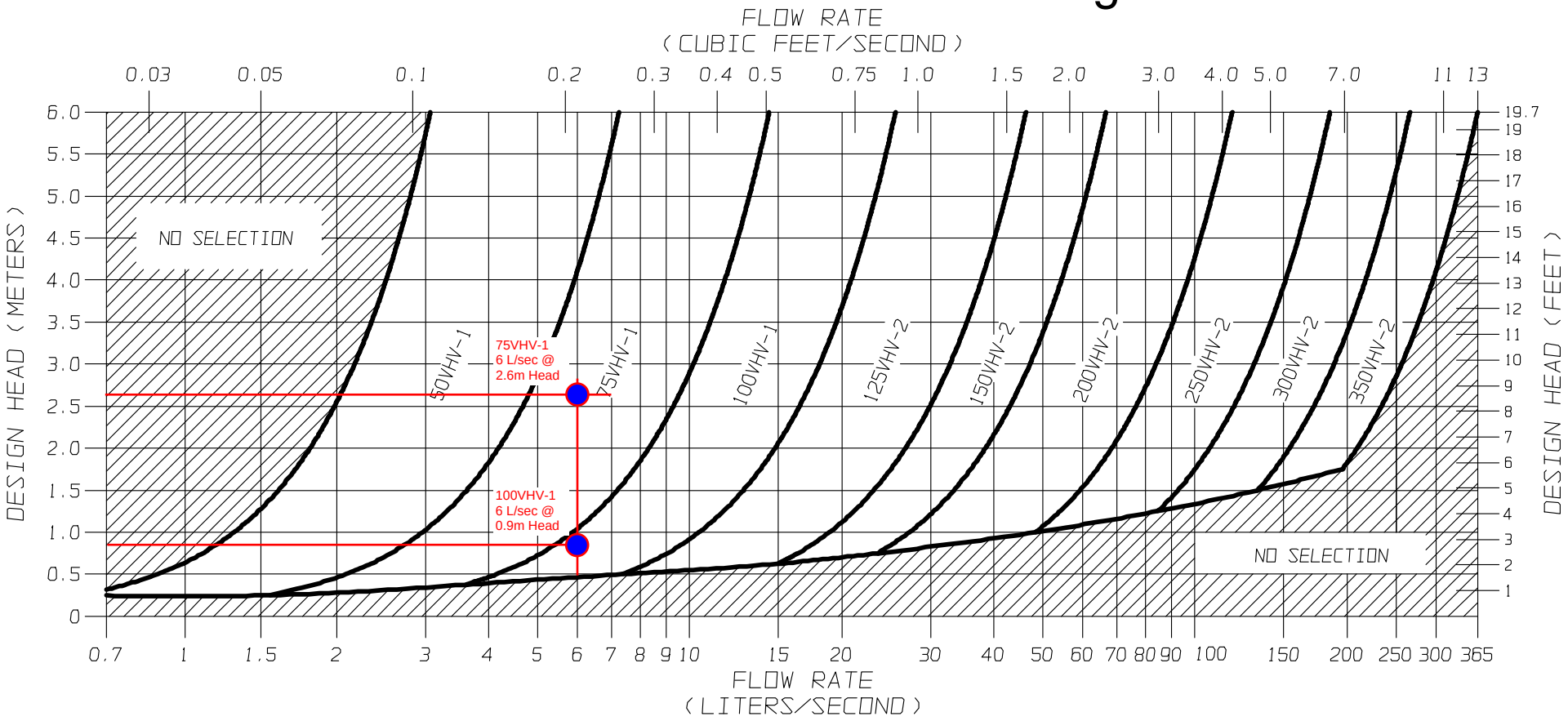


FIGURE 3 - VHV

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HYDROVEX®

SVHV Vertical Vortex Flow Regulator

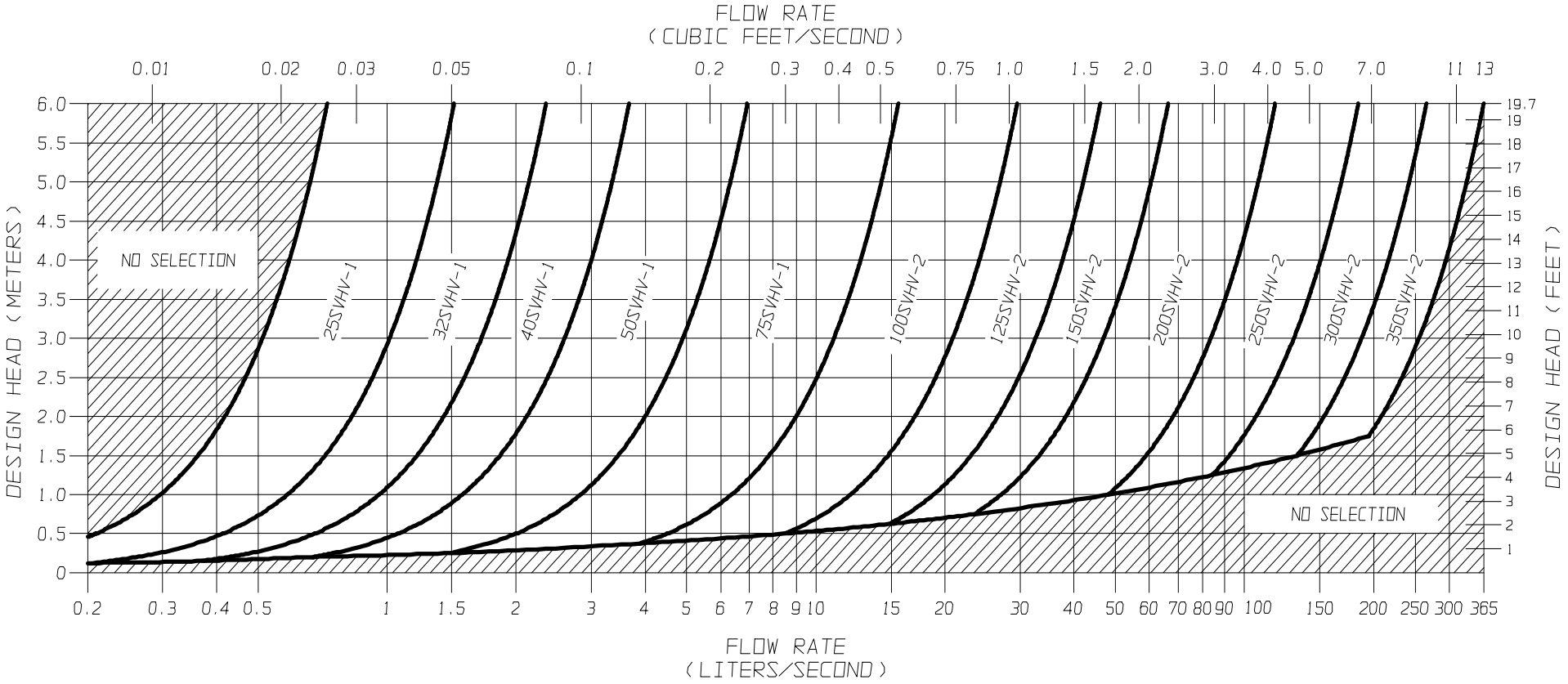

FIGURE 3 - SVHV

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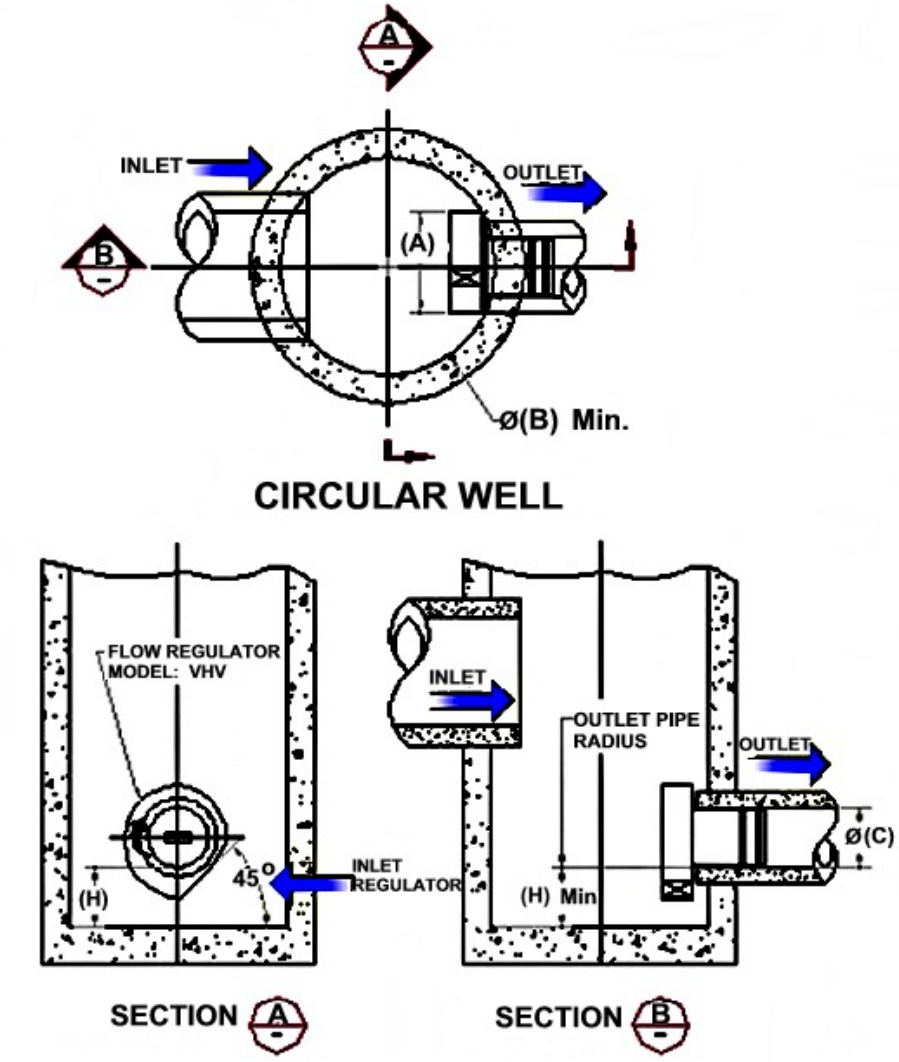
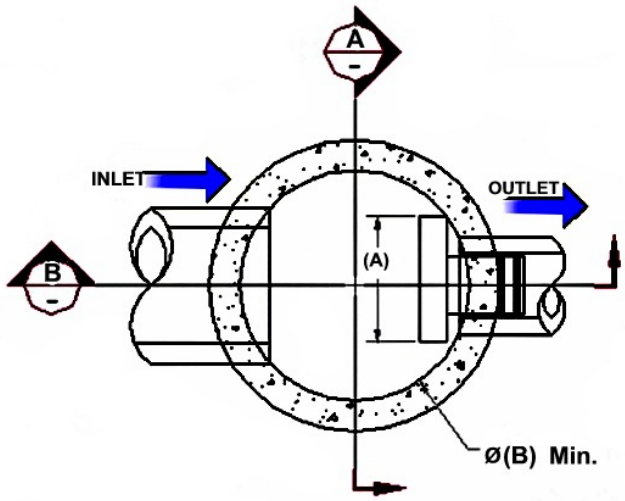
FLOW REGULATOR TYPICAL INSTALLATION IN CIRCULAR MANHOLE
FIGURE 4 (MODEL VHV)

Model Number	Regulator Diameter		Minimum Manhole Diameter		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	**A** (in.)	**B** (mm)	**B** (in.)	**C** (mm)	**C** (in.)	**H** (mm)	**H** (in.)
50VHV-1	150	6	600	24	150	6	150	6
75VHV-1	250	10	600	24	150	6	150	6
100VHV-1	325	13	900	36	150	6	200	8
125VHV-2	275	11	900	36	150	6	200	8
150VHV-2	350	14	900	36	150	6	225	9
200VHV-2	450	18	1200	48	200	8	300	12
250VHV-2	575	23	1200	48	250	10	350	14
300VHV-2	675	27	1600	64	250	10	400	16
350VHV-2	800	32	1800	72	300	12	500	20

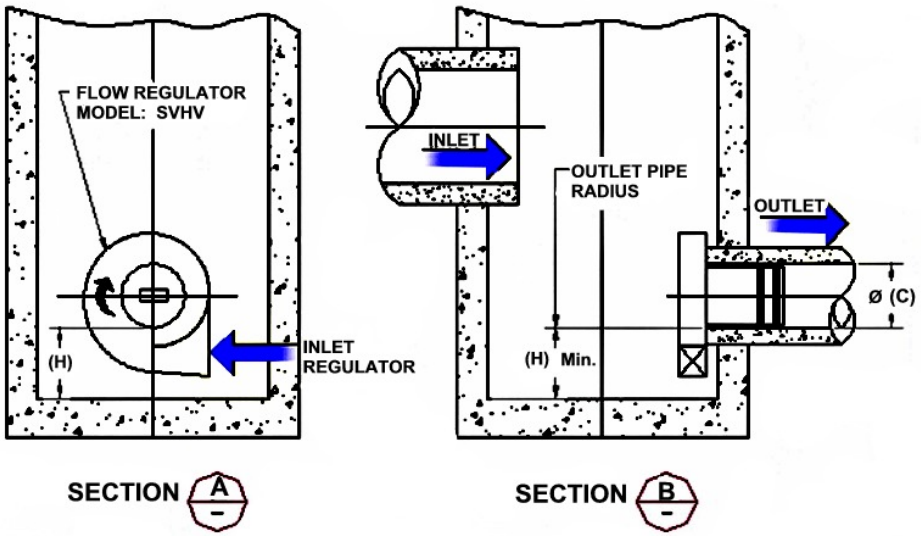


FLOW REGULATOR TYPICAL INSTALLATION IN CIRCULAR MANHOLE
FIGURE 4 (MODEL SVHV)

Model Number	Regulator Diameter		Minimum Manhole Diameter		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	**A** (in.)	**B** (mm)	**B** (in.)	**C** (mm)	**C** (in.)	**H** (mm)	**H** (in.)
25 SVHV-1	125	5	600	24	150	6	150	6
32 SVHV-1	150	6	600	24	150	6	150	6
40 SVHV-1	200	8	600	24	150	6	150	6
50 SVHV-1	250	10	600	24	150	6	150	6
75 SVHV-1	375	15	900	36	150	6	275	11
100 SVHV-2	275	11	900	36	150	6	250	10
125 SVHV-2	350	14	900	36	150	6	300	12
150 SVHV-2	425	17	1200	48	150	6	350	14
200 SVHV-2	575	23	1600	64	200	8	450	18
250 SVHV-2	700	28	1800	72	250	10	550	22
300 SVHV-2	850	34	2400	96	250	10	650	26
350 SVHV-2	1000	40	2400	96	250	10	700	28



CIRCULAR WELL

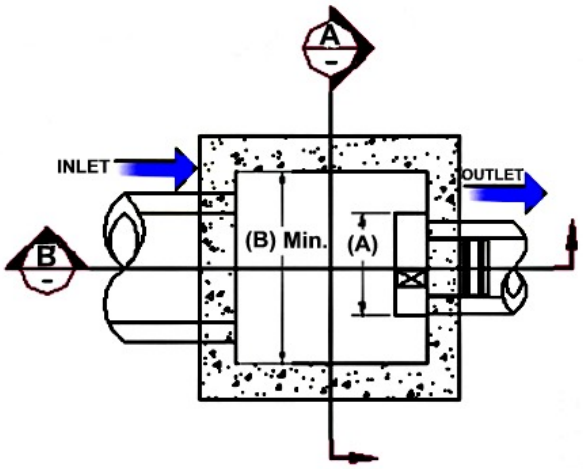


SECTION A **SECTION B**

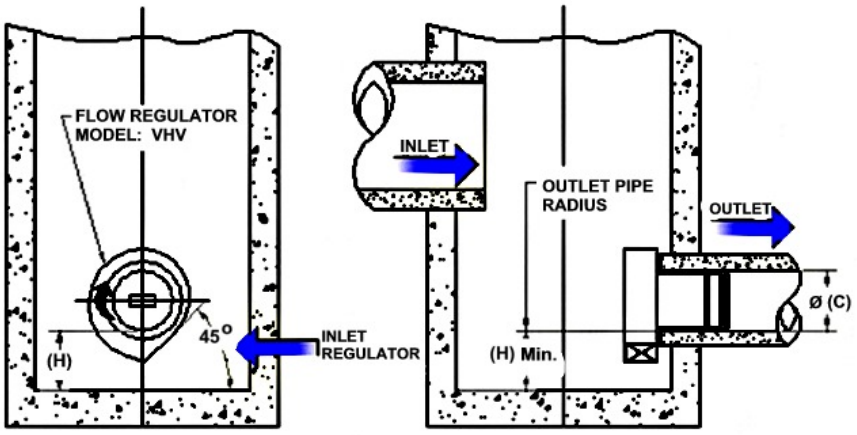
FLOW REGULATOR TYPICAL INSTALLATION IN SQUARE MANHOLE
FIGURE 4 (MODEL VHV)

Model Number	Regulator Diameter		Minimum Chamber Width		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	**A** (in.)	**B** (mm)	**B** (in.)	**C** (mm)	**C** (in.)	**H** (mm)	**H** (in.)
50VHV-1	150	6	600	24	150	6	150	6
75VHV-1	250	10	600	24	150	6	150	6
100VHV-1	325	13	600	24	150	6	200	8
125VHV-2	275	11	600	24	150	6	200	8
150VHV-2	350	14	600	24	150	6	225	9
200VHV-2	450	18	900	36	200	8	300	12
250VHV-2	575	23	900	36	250	10	350	14
300VHV-2	675	27	1200	48	250	10	400	16
350VHV-2	800	32	1200	48	300	12	500	20

NOTE: ***In the case of a square manhole, the outlet flow pipe must be centered on the wall to ensure enough clearance for the unit.***



SQUARE / RECTANGULAR WELL

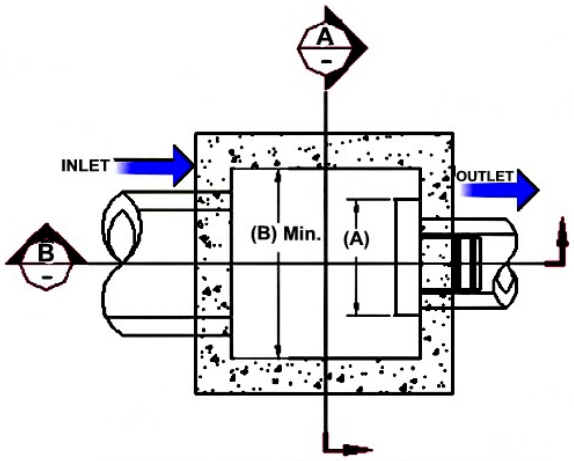


SECTION A **SECTION B**

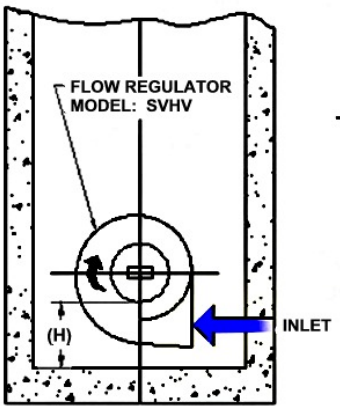
FLOW REGULATOR TYPICAL INSTALLATION IN SQUARE MANHOLE
FIGURE 4 (MODEL SVHV)

Model Number	Regulator Diameter		Minimum Chamber Width		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	**A** (in.)	**B** (mm)	**B** (in.)	**C** (mm)	**C** (in.)	**H** (mm)	**H** (in.)
25 SVHV-1	125	5	600	24	150	6	150	6
32 SVHV-1	150	6	600	24	150	6	150	6
40 SVHV-1	200	8	600	24	150	6	150	6
50 SVHV-1	250	10	600	24	150	6	150	6
75 SVHV-1	375	15	600	24	150	6	275	11
100 SVHV-2	275	11	600	24	150	6	250	10
125 SVHV-2	350	14	600	24	150	6	300	12
150 SVHV-2	425	17	600	24	150	6	350	14
200 SVHV-2	575	23	900	36	200	8	450	18
250 SVHV-2	700	28	900	36	250	10	550	22
300 SVHV-2	850	34	1200	48	250	10	650	26
350 SVHV-2	1000	40	1200	48	250	10	700	28

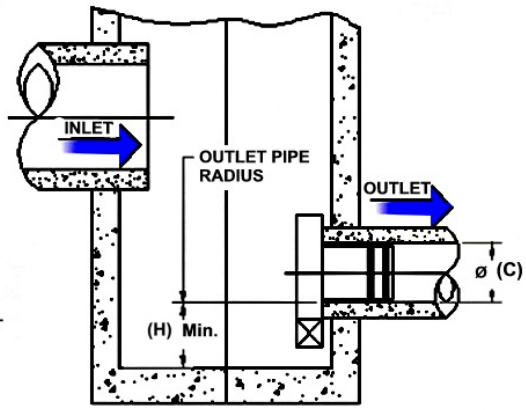
NOTE: ***In the case of a square manhole, the outlet flow pipe must be centered on the wall to ensure enough clearance for the unit.***



SQUARE / RECTANGULAR WELL



SECTION A



SECTION B

INSTALLATION

The installation of a **HYDROVEX®** regulator may be undertaken once the manhole and piping is in place. Installation consists of simply fitting the regulator into the outlet pipe of the manhole. **John Meunier Inc.** recommends the use of a lubricant on the outlet pipe, in order to facilitate the insertion and orientation of the flow controller.

MAINTENANCE

HYDROVEX® regulators are manufactured in such a way as to be maintenance free; however, a periodic inspection (every 3-6 months) is suggested in order to ensure that neither the inlet nor the outlet has become blocked with debris. The manhole should undergo periodically, particularly after major storms, inspection and cleaning as established by the municipality

GUARANTY

The **HYDROVEX®** line of **VHV / SVHV** regulators are guaranteed against both design and manufacturing defects for a period of 5 years. Should a unit be defective, **John Meunier Inc.** is solely responsible for either modification or replacement of the unit.

John Meunier Inc.
ISO 9001 : 2008

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Revised: 2011-05-03

Stormtech chamber sizing report and supporting documents

User Inputs

Chamber Model:	SC-740
Outlet Control Structure:	Yes
Project Name:	Qatar Embassy
Engineer:	Aaditya Jariwala
Project Location:	
Measurement Type:	Metric
Required Storage Volume:	37.21 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	153 mm.
Stone Above Chambers:	153 mm.
Average Cover Over Chambers:	458 mm.
Design Constraint Dimensions:	(10.01 m. x 16.00 m.)

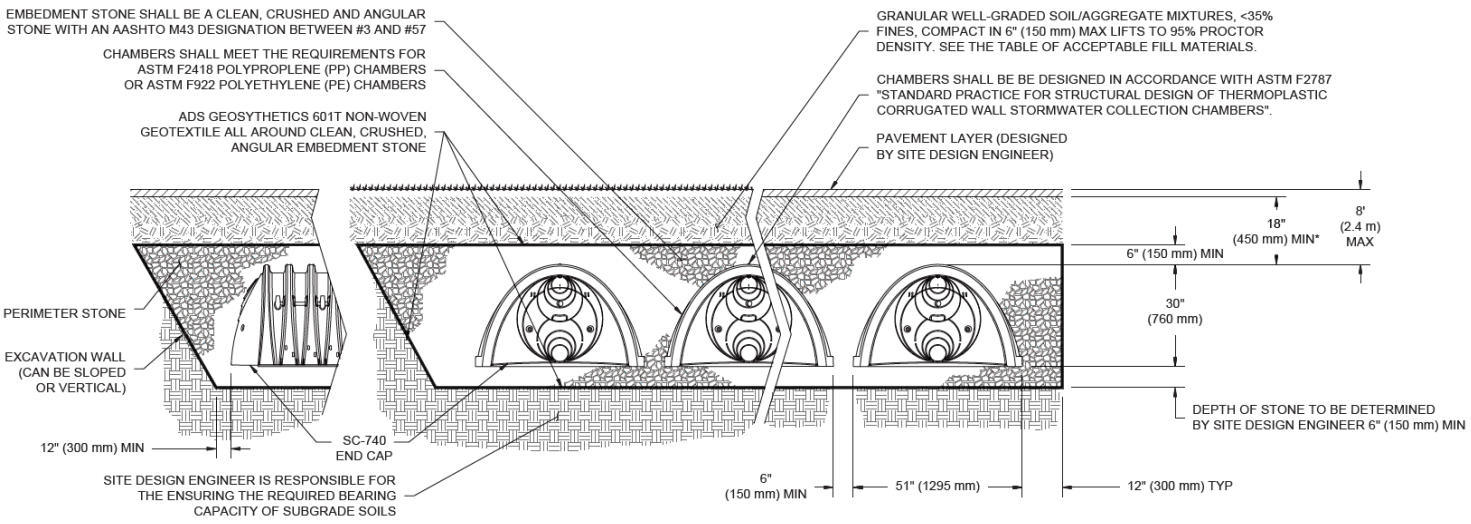
Results

System Volume and Bed Size

Installed Storage Volume:	39.65 cubic meters.
Storage Volume Per Chamber:	1.30 cubic meters.
Number Of Chambers Required:	15
Number Of End Caps Required:	6
Chamber Rows:	3
Maximum Length:	13.15 m.
Maximum Width:	4.99 m.
Approx. Bed Size Required:	65.49 square meters.

System Components

Amount Of Stone Required:	51 cubic meters
Volume Of Excavation (Not Including Fill):	92 cubic meters
Total Non-woven Geotextile Required:	244 square meters
Woven Geotextile Required (excluding Isolator Row):	14 square meters
Woven Geotextile Required (Isolator Row):	21 square meters
Total Woven Geotextile Required:	41 square meters



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

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
VISIT OUR APP

QATAR EMBASSY

OTTAWA, ONTARIO

SC-740 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-740 SYSTEM

1. STORMTECH SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 20-50 mm (3/4-2").
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

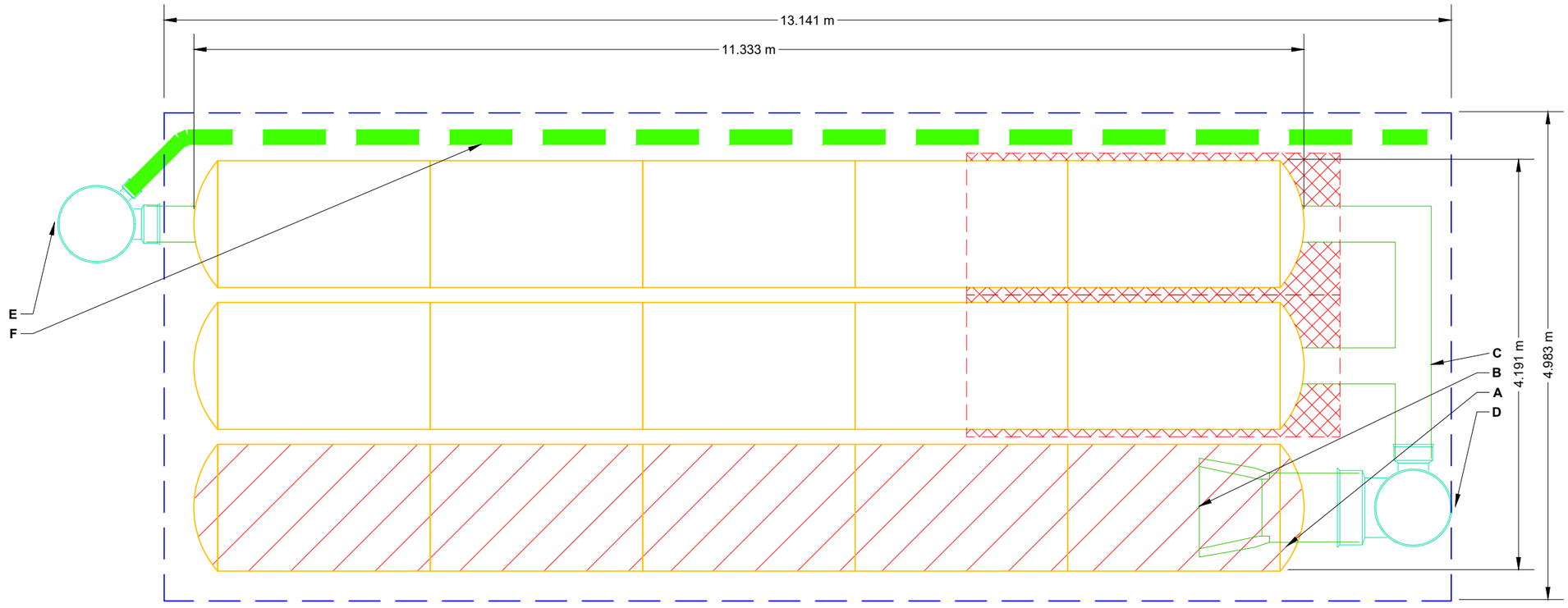
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

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

PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS	
15	STORMTECH SC-740 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	3.353
6	STORMTECH SC-740 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	1.524
152	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	1.372
152	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	1.372
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	1.372
39.7	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	1.067
		TOP OF SC-740 CHAMBER:	0.914
		300 mm x 300 mm TOP MANIFOLD INVERT:	0.470
		300 mm BOTTOM CONNECTION INVERT:	0.183
65.5	SYSTEM AREA (m^2)	600 mm ISOLATOR ROW PLUS INVERT:	0.155
36.2	SYSTEM PERIMETER (m)	BOTTOM OF SC-740 CHAMBER:	0.152
		UNDERDRAIN INVERT:	0.000
		BOTTOM OF STONE:	0.000

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED EZ END CAP	A	600 mm BOTTOM PREFABRICATED EZ END CAP, PART#: SC740ECEZ / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	3 mm	
FLAMP	B	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: SC74024RAMP		
MANIFOLD	C	300 mm x 300 mm TOP MANIFOLD, ADS N-12	318 mm	
NYLOPLAST (INLET W/ ISO PLUS ROW)	D	750 mm DIAMETER (610 mm SUMP MIN)		130 L/s IN
NYLOPLAST (OUTLET)	E	750 mm DIAMETER (DESIGN BY ENGINEER)		57 L/s OUT
UNDERDRAIN	F	150 mm ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 3.810 m OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

QATAR EMBASSY
OTTAWA, ONTARIO
DRAWN: AJ
CHECKED: N/A
DATE:
PROJECT #:

DESCRIPTION	CHK	DRW	DATE

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

SCALE = 1 : 50

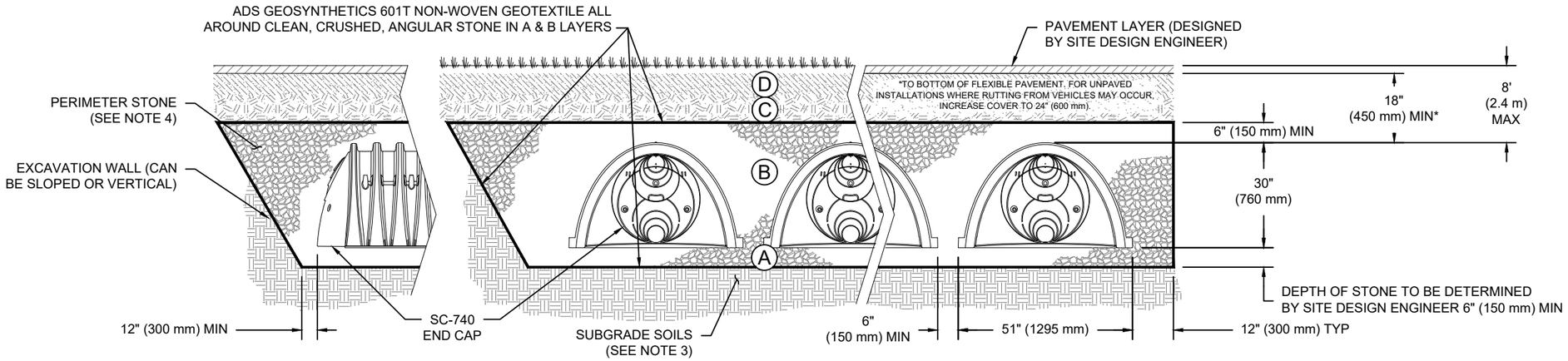
StormTech® Chamber System

888-892-2694 | WWW.STORMTECH.COM

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

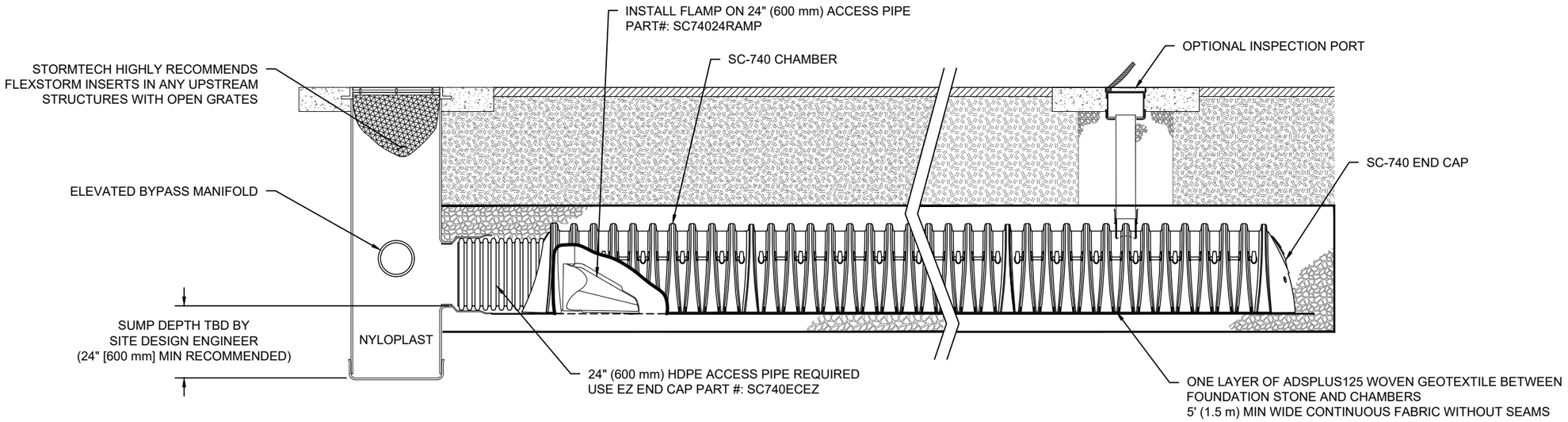
1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 550 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

QATAR EMBASSY
OTTAWA, ONTARIO
DRAWN: AJ
CHECKED: N/A
DATE:
PROJECT #:

DATE	DRW	CHK	DESCRIPTION

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

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



SC-740 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

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

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

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

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

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

QATAR EMBASSY
OTTAWA, ONTARIO
DATE: DRAWN: AJ
PROJECT #: CHECKED: N/A

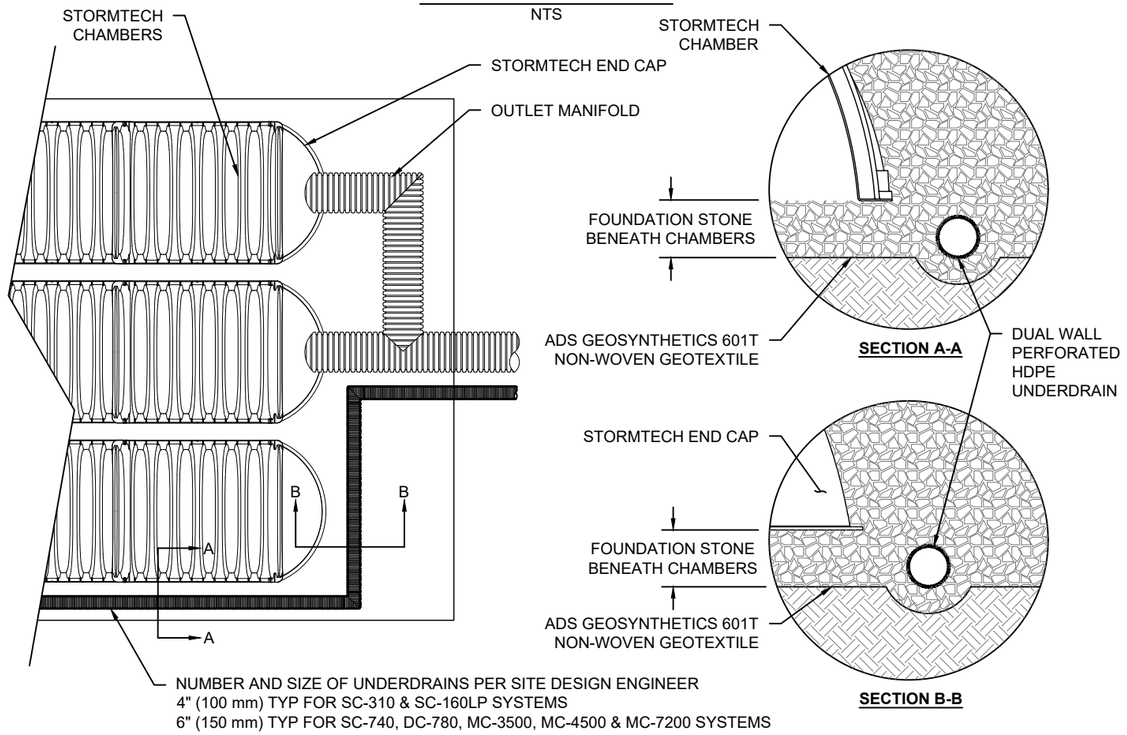
DATE	DRW	CHK	DESCRIPTION

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

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

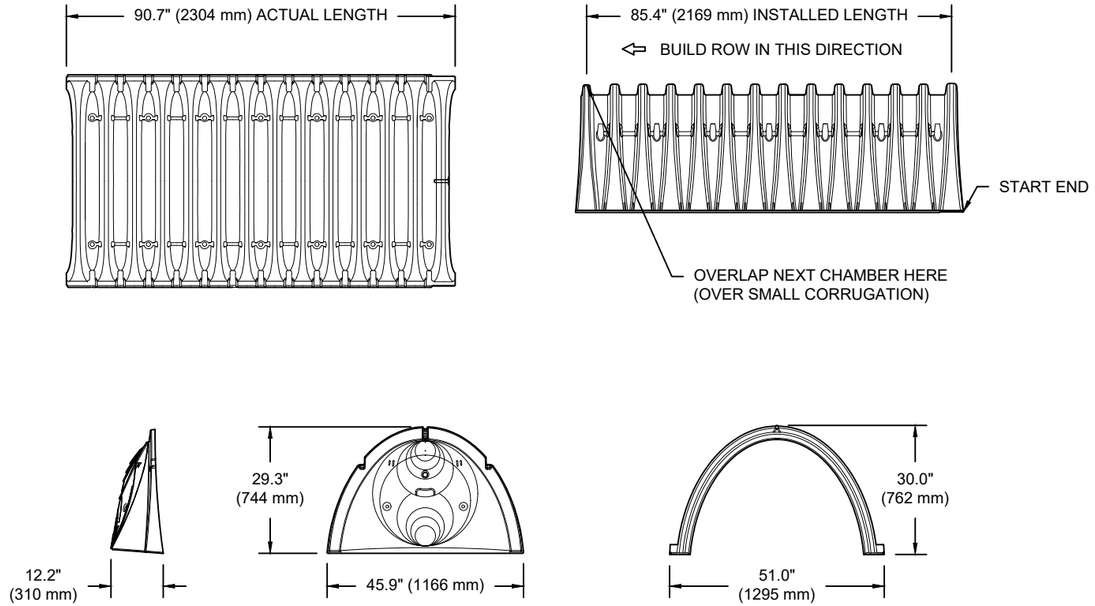
UNDERDRAIN DETAIL

NTS



SC-740 TECHNICAL SPECIFICATION

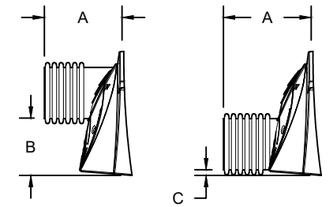
NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

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



PRE-FAB STUB AT BOTTOM OF END CAP WITH FLAMP END WITH "BR"
PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE-CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740ECEZ*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740ECEZ ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740ECEZ THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

QATAR EMBASSY
OTTAWA, ONTARIO
DATE:
DRAWN: AJ
PROJECT #:
CHECKED: N/A

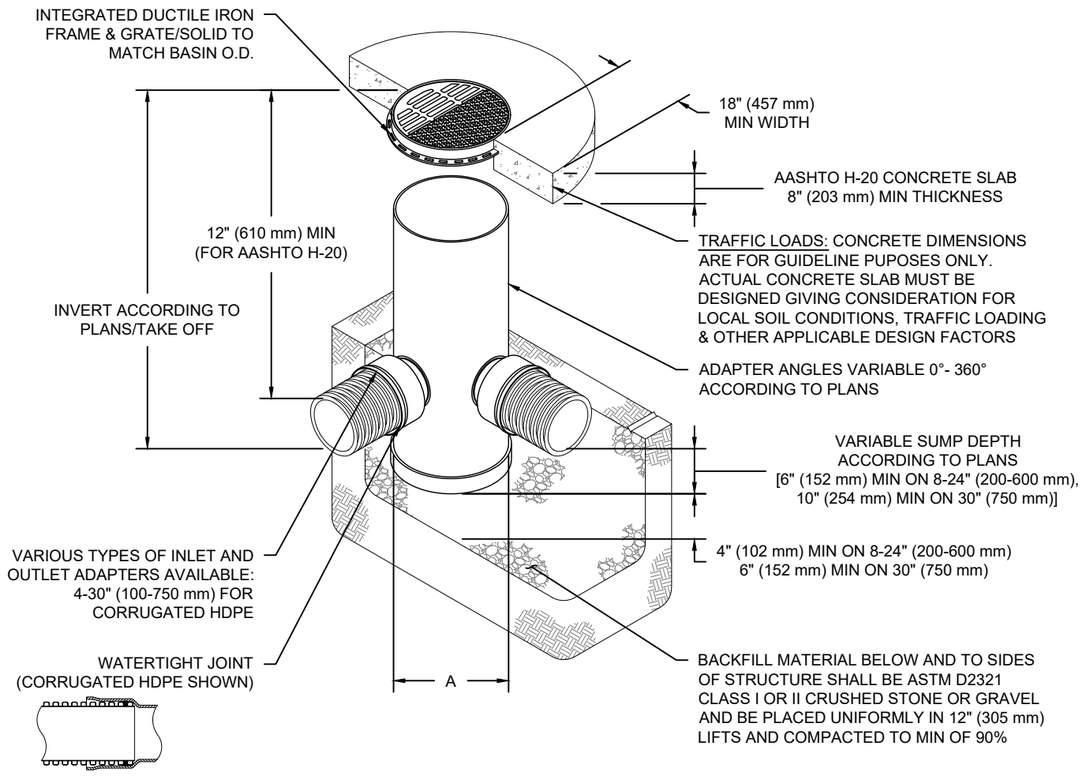
DATE	DRW	CHK	DESCRIPTION

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

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

NYLOPLAST DRAIN BASIN

NTS



NOTES

1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

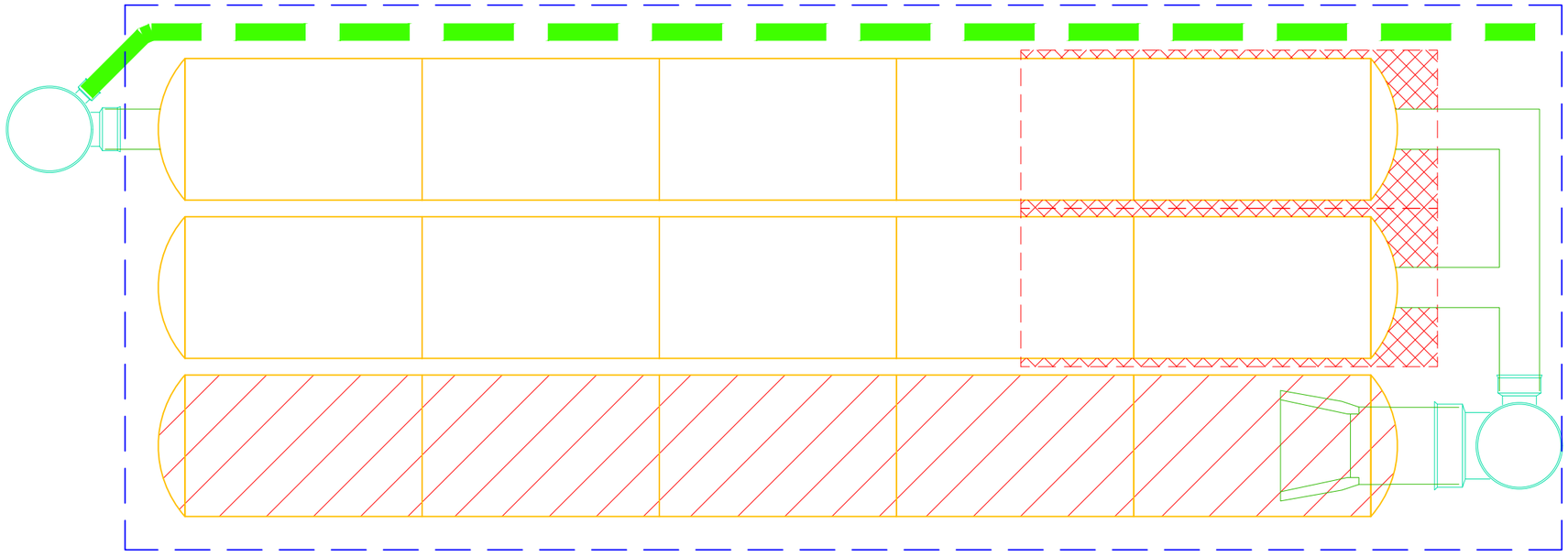
A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

QATAR EMBASSY
OTTAWA, ONTARIO

DATE: | DRAWN: AJ
PROJECT #: | CHECKED: N/A

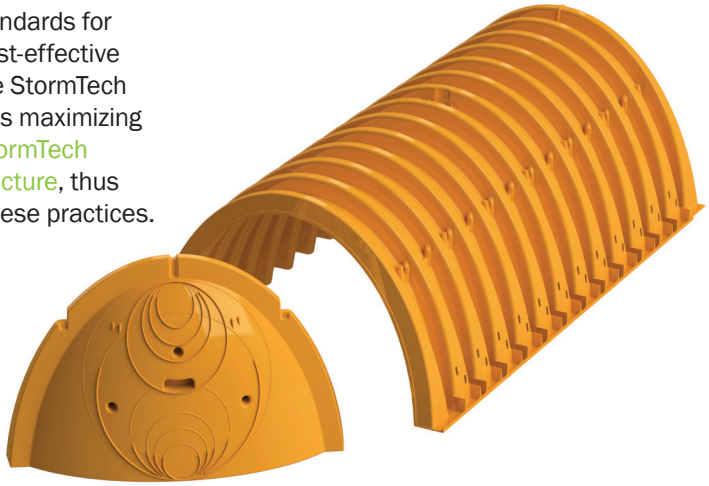
DATE	DRW	CHK	DESCRIPTION

Nyloplast®
770-932-2443 | WWW.NYLOPLAST-US.COM
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473



STORMTECH SC-740 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.



STORMTECH SC-740 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
85.4" x 51" x 30"
2,170 mm x 1,295 mm x 762 mm

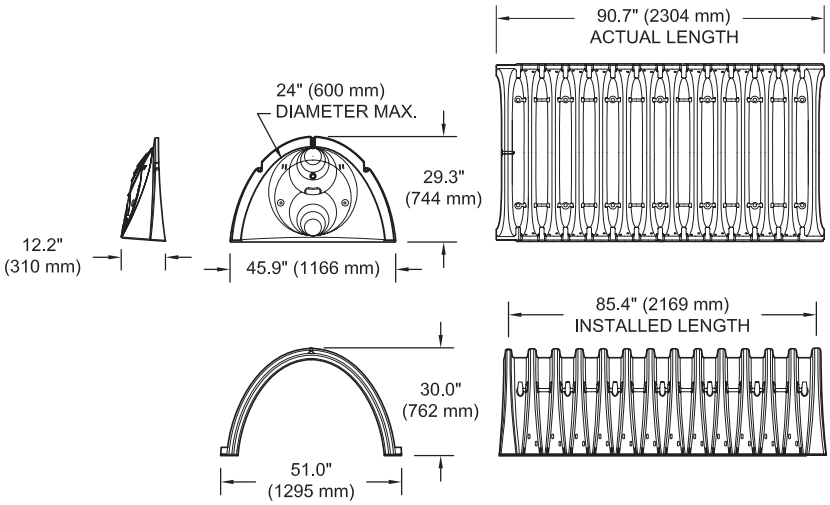
Chamber Storage
45.9 ft³ (1.30 m³)

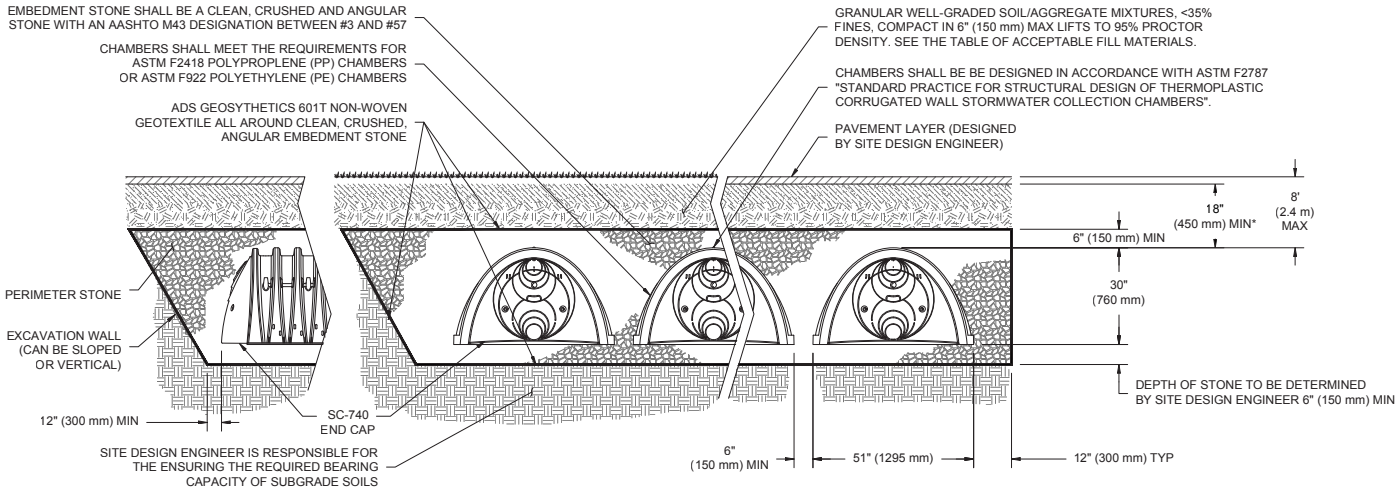
Min. Installed Storage*
74.9 ft³ (2.12 m³)

Weight
74.0 lbs (33.6 kg)

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

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





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

SC-740 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)
42 (1067)		45.90 (1.300)	74.90 (2.121)
41 (1041)		45.90 (1.300)	73.77 (2.089)
40 (1016)	Stone	45.90 (1.300)	72.64 (2.057)
39 (991)	Cover	45.90 (1.300)	71.52 (2.025)
38 (965)		45.90 (1.300)	70.39 (1.993)
37 (940)		45.90 (1.300)	69.26 (1.961)
36 (914)		45.90 (1.300)	68.14 (1.929)
35 (889)		45.85 (1.298)	66.98 (1.897)
34 (864)		45.69 (1.294)	65.75 (1.862)
33 (838)		45.41 (1.286)	64.46 (1.825)
32 (813)		44.81 (1.269)	62.97 (1.783)
31 (787)		44.01 (1.246)	61.36 (1.737)
30 (762)		43.06 (1.219)	59.66 (1.689)
29 (737)		41.98 (1.189)	57.89 (1.639)
28 (711)		40.80 (1.155)	56.05 (1.587)
27 (686)		39.54 (1.120)	54.17 (1.534)
26 (660)		38.18 (1.081)	52.23 (1.479)
25 (635)		36.74 (1.040)	50.23 (1.422)
24 (610)		35.22 (0.977)	48.19 (1.365)
23 (584)		33.64 (0.953)	46.11 (1.306)
22 (559)		31.99 (0.906)	44.00 (1.246)
21 (533)		30.29 (0.858)	1.85 (1.185)
20 (508)		28.54 (0.808)	39.67 (1.123)
19 (483)		26.74 (0.757)	37.47 (1.061)
18 (457)		24.89 (0.705)	35.23 (0.997)
17 (432)		23.00 (0.651)	32.96 (0.939)
16 (406)		21.06 (0.596)	30.68 (0.869)
15 (381)		19.09 (0.541)	28.36 (0.803)
14 (356)		17.08 (0.484)	26.03 (0.737)
13 (330)		15.04 (0.426)	23.68 (0.670)
12 (305)		12.97 (0.367)	21.31 (0.608)
11 (279)		10.87 (0.309)	18.92 (0.535)
10 (254)		8.74 (0.247)	16.51 (0.468)
9 (229)		6.58 (0.186)	14.09 (0.399)
8 (203)		4.41 (0.125)	11.66 (0.330)
7 (178)		2.21 (0.063)	9.21 (0.264)
6 (152)		0 (0)	6.76 (0.191)
5 (127)		0 (0)	5.63 (0.160)
4 (102)	Stone	0 (0)	4.51 (0.128)
3 (76)	Foundation	0 (0)	3.38 (0.096)
2 (51)		0 (0)	2.25 (0.064)
1 (25)		0 (0)	1.13 (0.032)

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

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

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

AMOUNT OF STONE PER CHAMBER

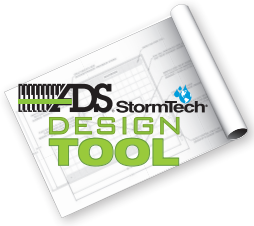
ENGLISH TONS (yds³)	Stone Foundation Depth		
	6"	12"	16"
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

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-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

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



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

For more information on the StormTech SC-740 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

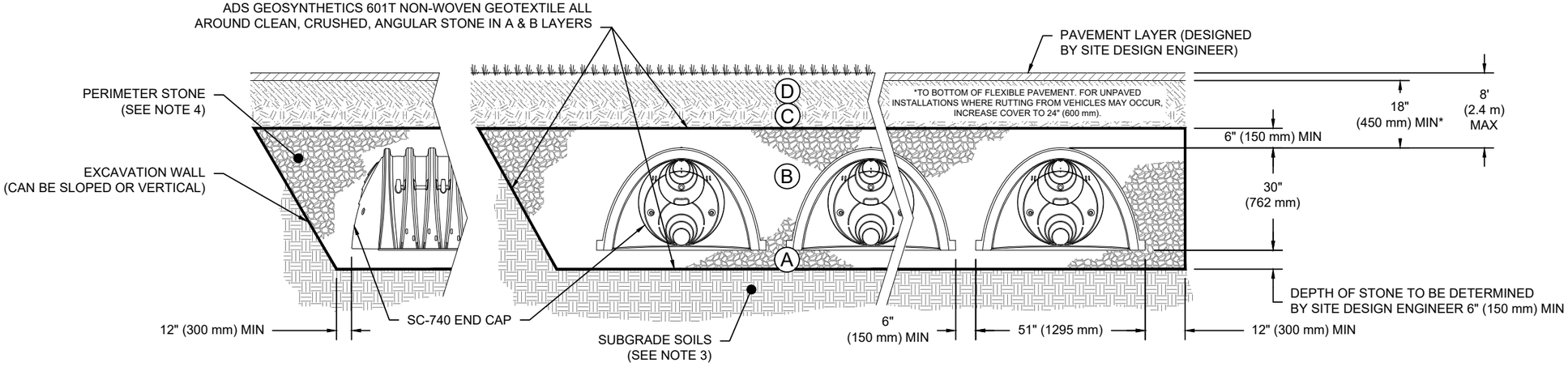
*THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™*

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SC-740
STANDARD CROSS SECTION
DATE: 05-10-19 | DRAWN: KR | CHECKED: KR
PROJECT #:

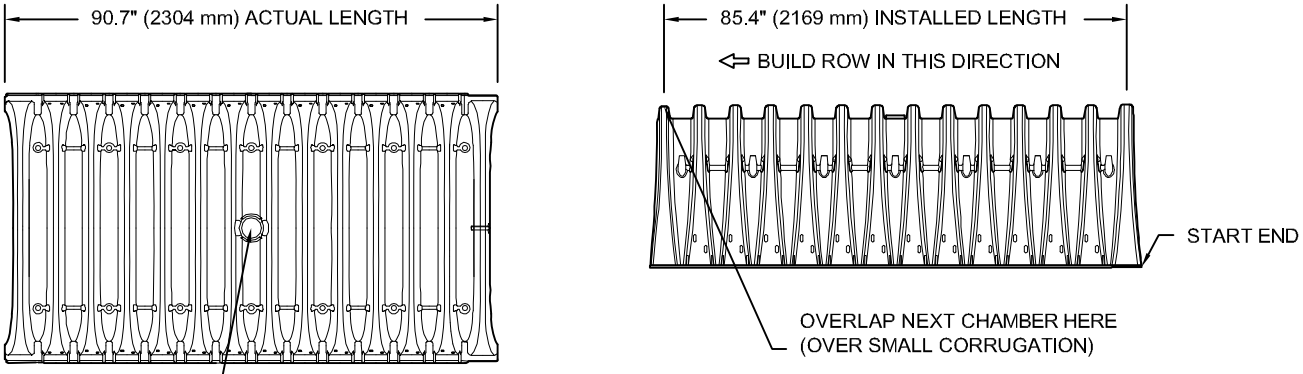
DATE	DRWN	CHKD	DESCRIPTION

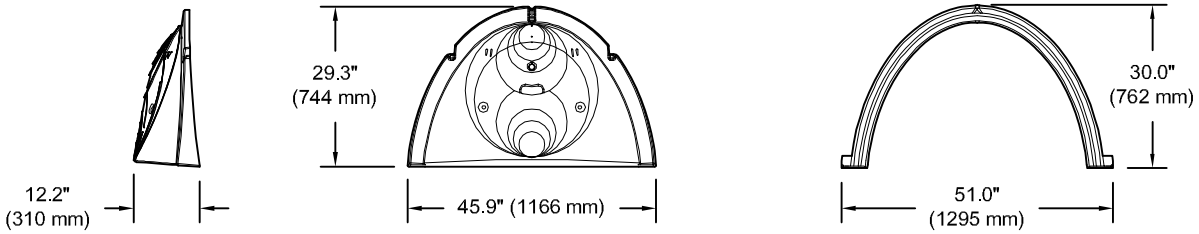
StormTech
Detention • Retention • Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SC-740 TECHNICAL SPECIFICATION

NTS





NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
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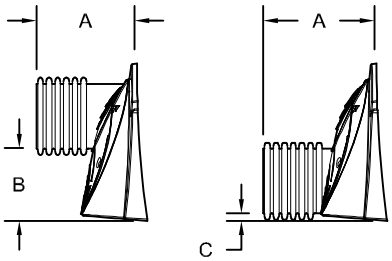
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

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



STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	—
SC740EPE06B / SC740EPE06BPC			—	0.5" (13 mm)
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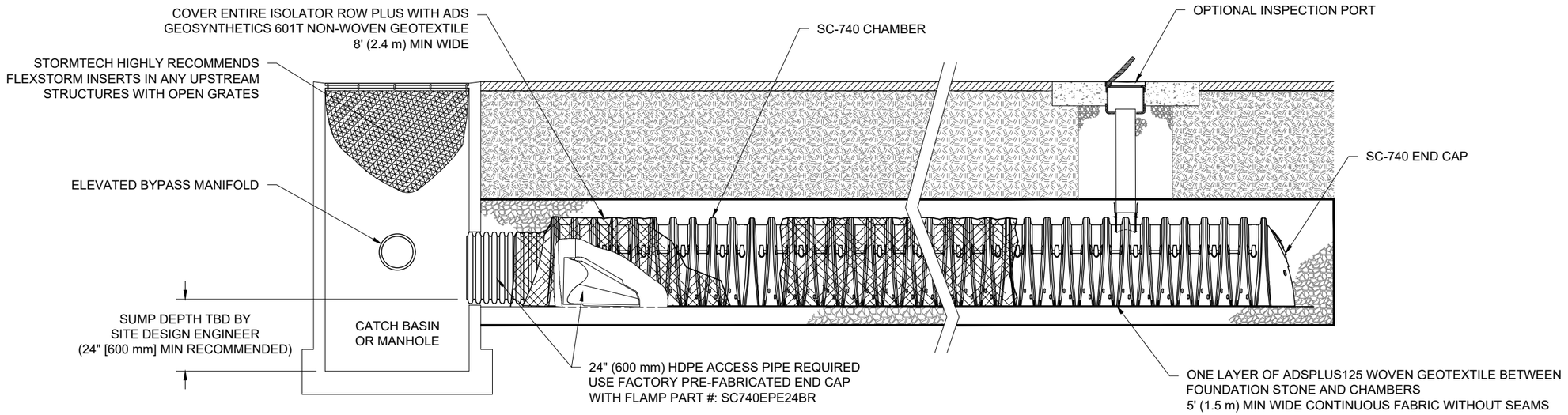
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	—
SC740EPE10B / SC740EPE10BPC			—	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	—
SC740EPE12B / SC740EPE12BPC			—	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	—
SC740EPE15B / SC740EPE15BPC			—	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	—
SC740EPE18B / SC740EPE18BPC			—	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	—	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL



SC-740 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

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

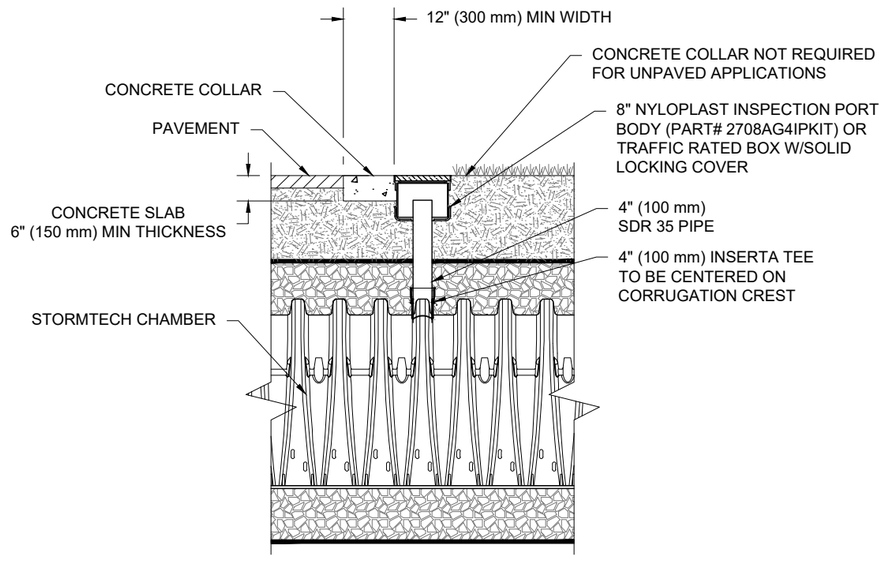
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

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

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

NOTES

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



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

4" PVC INSPECTION PORT DETAIL (SC SERIES CHAMBER)
NTS

SC-740
ISOLATOR ROW PLUS DETAILS
DATE: 08/26/20 DRAWN: ALI
PROJECT #: --- CHECKED: ALI

DATE	DRWN	CHKD	DESCRIPTION

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Isolator® Row PLUS O&M Manual

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

ADS®

THE ISOLATOR® ROW PLUS

INTRODUCTION

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

THE ISOLATOR ROW PLUS

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

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

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

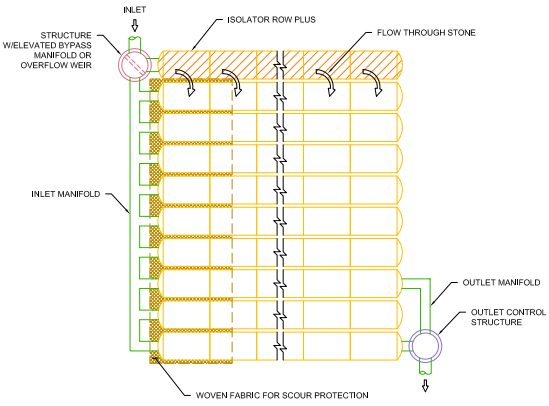
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus that is attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by enhancing outflow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

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

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

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

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



ISOLATOR ROW PLUS INSPECTION/MAINTENANCE

INSPECTION

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

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

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

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

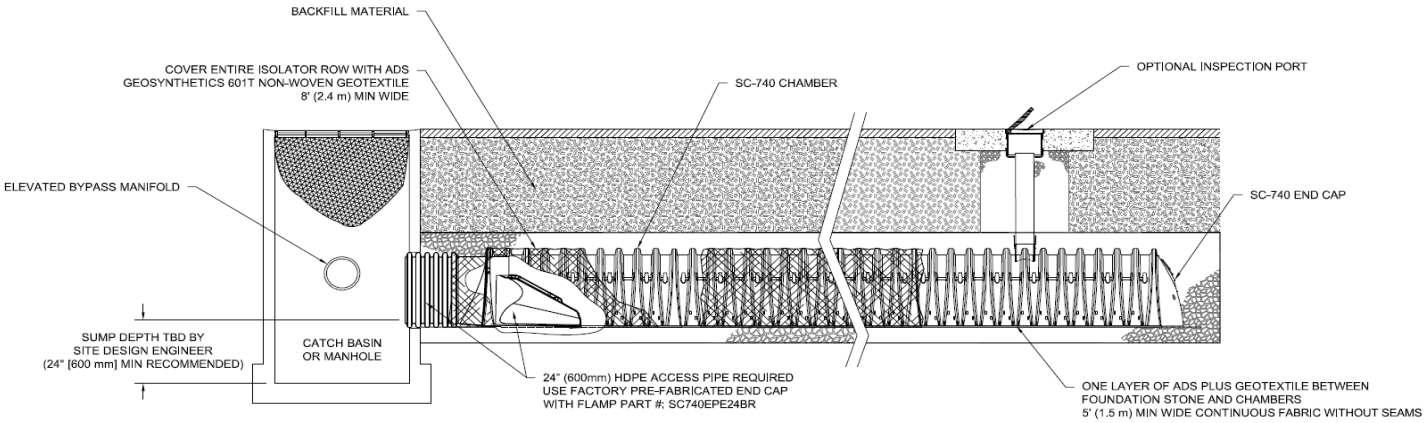
MAINTENANCE

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

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

StormTech Isolator Row PLUS (not to scale)

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



ISOLATOR ROW PLUS STEP BY STEP MAINTENANCE PROCEDURES

STEP 1

Inspect Isolator Row PLUS for sediment.

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

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

STEP 2

Clean out Isolator Row PLUS using the JetVac process.

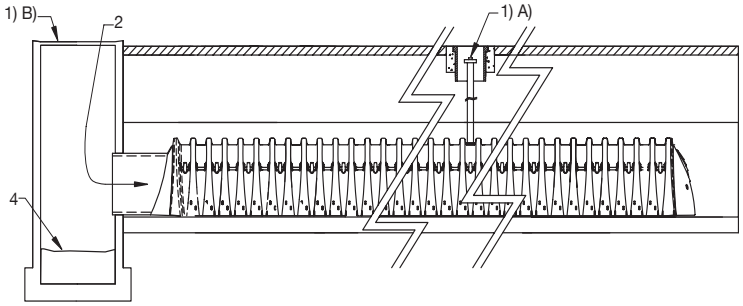
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

STEP 3

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

STEP 4

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



SAMPLE MAINTENANCE LOG

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

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SC-310/SC-740/DC-780

StormTech Construction Guide

REQUIRED MATERIALS AND EQUIPMENT LIST

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

IMPORTANT NOTES:

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

B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

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

Requirements for System Installation

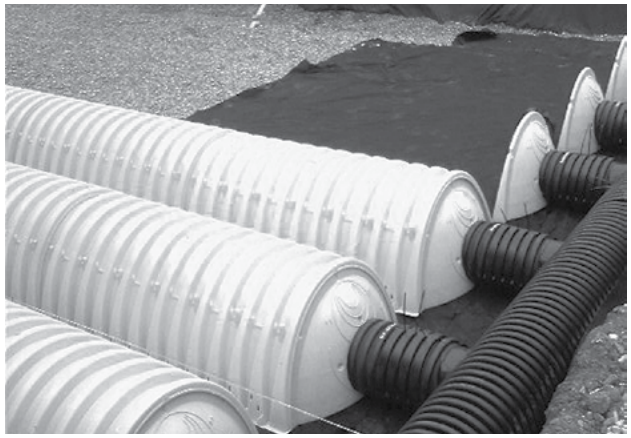
Excavate bed and prepare subgrade per engineer's plans.

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

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

Manifold, Scour Fabric and Chamber Assembly

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



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

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

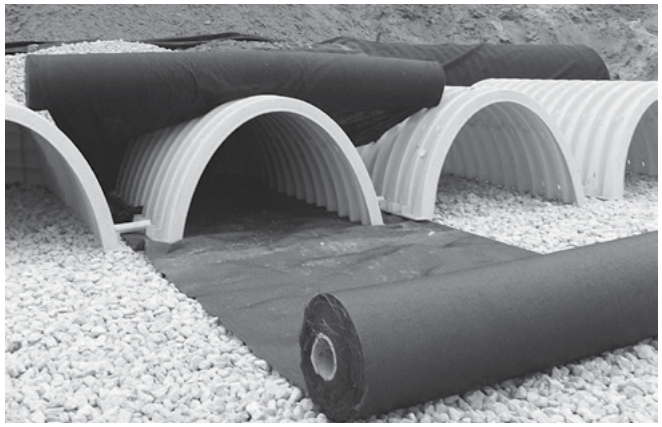
Attaching the End Caps

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

Prefabricated End Caps

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

Isolator Row PLUS



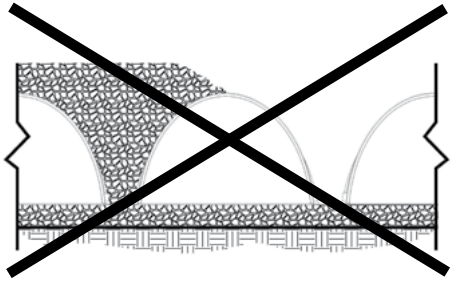
Place a continuous layer of ADS PLUS fabric between the foundation stone and the Isolator Row PLUS chambers, making sure the fabric lays flat and extends the entire width of the chamber feet. Drape a strip of ADS non-woven geotextile over the row of chambers (not required over DC-780). This is the same type of non-woven geotextile used as a separation layer around the angular stone of the StormTech system.

Initial Anchoring of Chambers – Embedment Stone

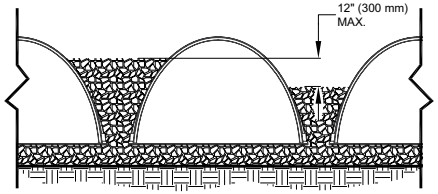
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

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

Backfill of Chambers – Embedment Stone

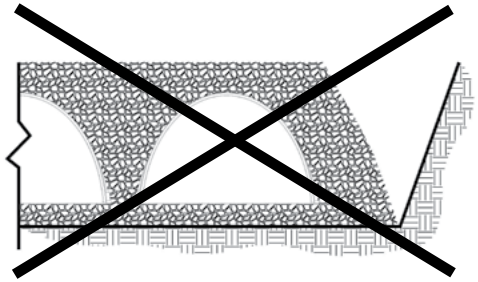


UNEVEN BACKFILL

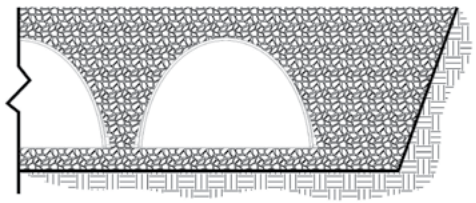


EVEN BACKFILL

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



PERIMETER NOT BACKFILLED



PERIMETER FULLY BACKFILLED

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

Backfill - Embedment Stone & Cover Stone

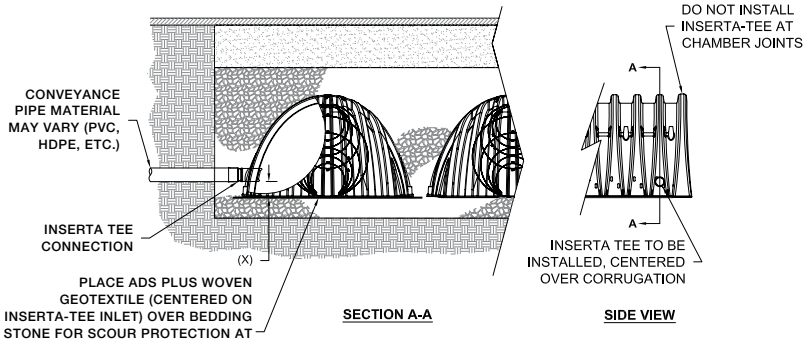
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. **Only after chambers have been backfilled to top of chamber and with a minimum 6" (150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

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

Final Backfill of Chambers – Fill Material

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

Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 36, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON.		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

StormTech Isolator Row PLUS Detail

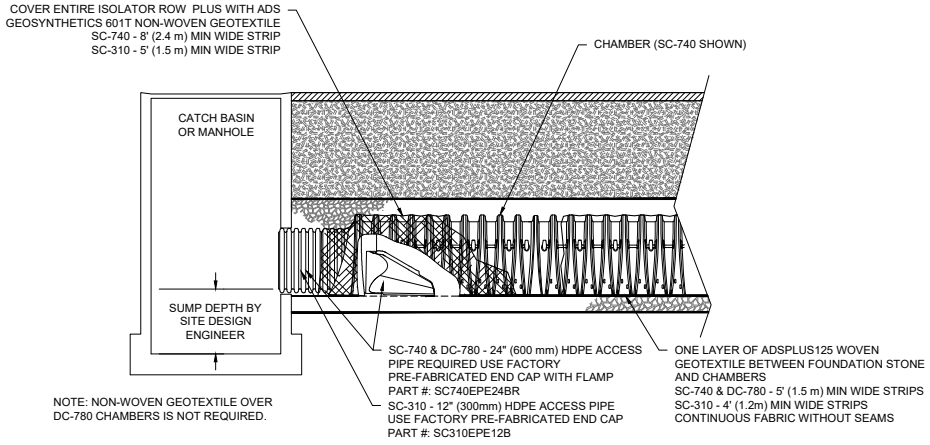


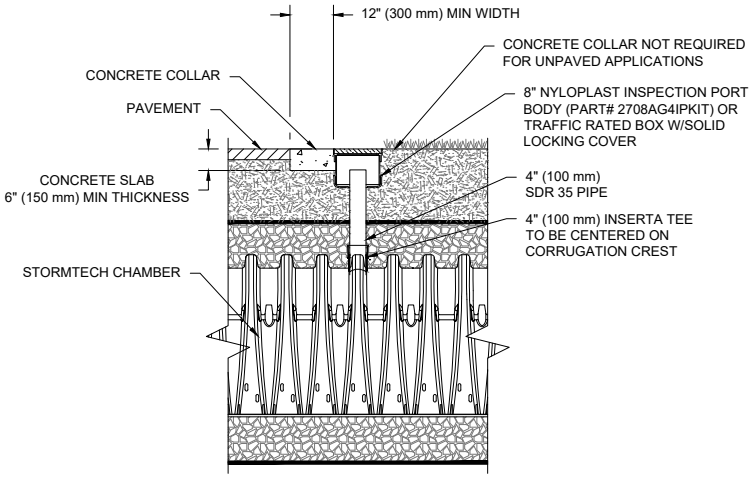
Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
(D) **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
(C) **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 18" (450 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/ aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M45 A-1, A-2-4, A-3 or AASHTO M431 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 12" (300 mm) of material over the chambers is reached. Compact additional layers in 6" (150 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials. Roller gross vehicle weight not to exceed 12,000 lbs (53 kN). Dynamic force not to exceed 20,000 lbs (89 kN)
(B) **Embedment Stone:** Embedment Stone surrounding chambers from the foundation stone to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	No compaction required.
(A) **Foundation Stone:** Foundation Stone below the chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	Place and compact in 6" (150 mm) lifts using two full coverages with a vibratory compactor.[2,3]

PLEASE NOTE:

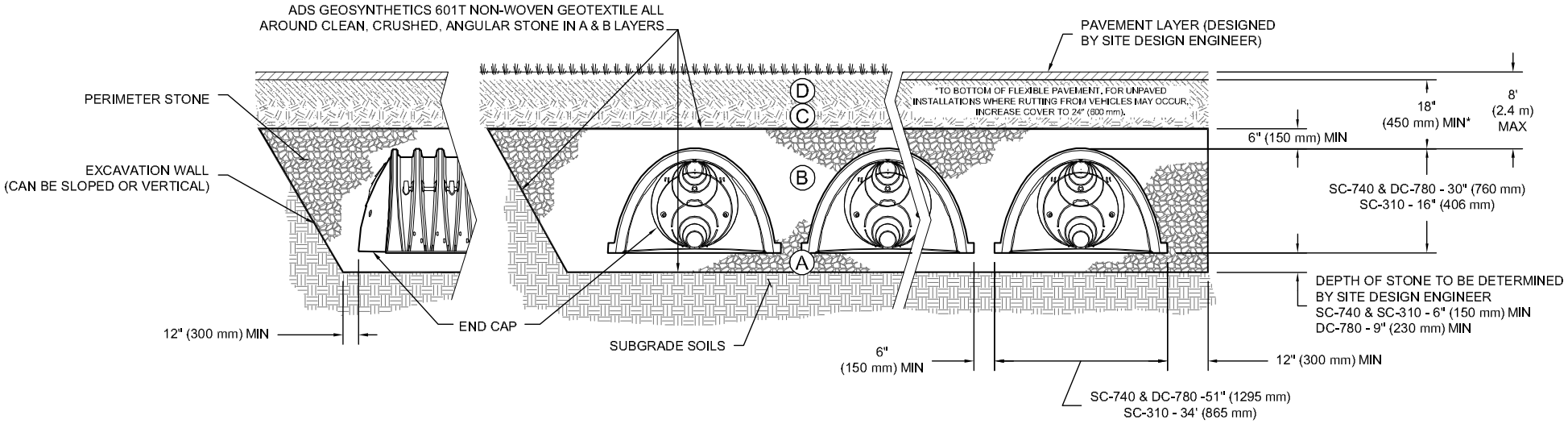
1. ***The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".***
2. ***StormTech compaction requirements are met for 'A' location materials when placed and compacted in 6" (150 mm) (max) lifts using two full coverages with a vibratory compactor.***
3. ***Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.***

Figure 1- Inspection Port Detail



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

Figure 2 - Fill Material Locations



NOTES:

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

Table 2 - Maximum Allowable Construction Vehicle Loads[5]

Material Location	Fill Depth over Chambers in. [mm]	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs [kN]	Max Wheel Load for Loaders lbs [kN]	Track Width in. [mm]	Max Ground Pressure psf [kPa]	Max Drum Weight or Dynamic Force lbs [kN]
Ⓓ Final Fill Material	36" [900] Compacted	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	3420 [164] 2350 [113] 1850 [89] 1510 [72] 1310 [63]	38,000 [169]
Ⓒ Initial Fill Material	24" [600] Compacted	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	2480 [119] 1770 [85] 1430 [68] 1210 [58] 1070 [51]	20,000 [89]
	24" [600] Loose/Dumped	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	2245 [107] 1625 [78] 1325 [63] 1135 [54] 1010 [48]	20,000 [89] Roller gross vehicle weight not to exceed 12,000 lbs. [53 kN]
	18" [450]	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	2010 [96] 1480 [71] 1220 [58] 1060 [51] 950 [45]	20,000 [89] Roller gross vehicle weight not to exceed 12,000 lbs. [53 kN]
Ⓑ Embedment Stone	12" [300]	16,000 [71]	NOT ALLOWED	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	1540 [74] 1190 [57] 1010 [48] 910 [43] 840 [40]	20,000 [89] Roller gross vehicle weight not to exceed 12,000 lbs. [53 kN]
	6" [150]	8,000 [35]	NOT ALLOWED	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	1070 [51] 900 [43] 800 [38] 760 [36] 720 [34]	NOT ALLOWED

Table 3 - Placement Methods and Descriptions

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

17.0 Standard Limited Warranty

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

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

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

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

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

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

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

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

StormTech®
Detention • Retention • Water Quality
An ADS company
20 Beaver Road, Suite 104 | Wethersfield | Connecticut | 06109
888.892.2694 fax 866.328.8401
www.stormtech.com

ADS GEOSYNTHETICS 0601T NONWOVEN GEOTEXTILE

Scope

This specification describes ADS Geosynthetics 6.0 oz (0601T) nonwoven geotextile.

Filter Fabric Requirements

ADS Geosynthetics 6.0 oz (0601T) is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. ADS Geosynthetics 6.0 oz (0601T) resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. ADS Geosynthetics 6.0 oz (0601T) conforms to the physical property values listed below:

Filter Fabric Properties

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Weight (Typical)	ASTM D 5261	oz/yd^2 (g/m^2)	6.0 (203)
Grab Tensile	ASTM D 4632	lbs (kN)	160 (0.711)
Grab Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs (kN)	60 (0.267)
CBR Puncture Resistance	ASTM D 6241	lbs (kN)	410 (1.82)
Permittivity*	ASTM D 4491	sec^{-1}	1.5
Water Flow*	ASTM D 4491	gpm/ft^2 ($l/min/m^2$)	110 (4480)
AOS*	ASTM D 4751	US Sieve (mm)	70 (0.212)
UV Resistance	ASTM D 4355	%/hrs	70/500

PACKAGING	
Roll Dimensions (W x L) – ft	12.5 x 360 / 15 x 300
Square Yards Per Roll	500
Estimated Roll Weight – lbs	195

* At the time of manufacturing. Handling may change these properties.

ADS GEOSYNTHETICS 315W WOVEN GEOTEXTILE

Scope

This specification describes ADS Geosynthetics 315W woven geotextile.

Filter Fabric Requirements

ADS Geosynthetics 315W is manufactured using high tenacity polypropylene yarns that are woven to form a dimensionally stable network, which allows the yarns to maintain their relative position. ADS Geosynthetics 315W resists ultraviolet deterioration, rotting and biological degradation and is inert to commonly encountered soil chemicals. ADS Geosynthetics 315W conforms to the physical property values listed below:

Filter Fabric Properties

PROPERTY	TEST METHOD	ENGLISH M.A.R.V. (Minimum Average Roll Value)	METRIC M.A.R.V. (Minimum Average Roll Value)
Tensile Strength (Grab)	ASTM D-4632	315 lbs	1400 N
Elongation	ASTM D-4632	15%	15%
CBR Puncture	ASTM D-6241	900 lbs	4005 N
Puncture	ASTM D-4833	150 lbs	667 N
Mullen Burst	ASTM D-3786	600 psi	4134 kPa
Trapezoidal Tear	ASTM D-4533	120 lbs	533 N
UV Resistance (at 500 hrs)	ASTM D-4355	70%	70%
Apparent Opening Size (AOS)*	ASTM D-4751	40 US Std. Sieve	0.425 mm
Permittivity	ASTM D-4491	.05 sec^{-1}	.05 sec^{-1}
Water Flow Rate	ASTM D-4491	4 gpm/ft^2	163 $l/min/m^2$
Roll Sizes		12.5' x 360' 15.0' x 300' 17.5' x 258'	3.81 m x 109.8 m 4.57 m x 91.5 m 5.33 m x 78.6 m

*Maximum average roll value.

Appendix E – Additional Information

Pre-Application Consultation Meeting Notes

187 Boteler Street (Embassy of the State of Qatar)
[Pre-Application Consultation File Number PC2020-0028]
Thursday January 23, 2020, Room 4106E

Attendees:

City of Ottawa:
Simon Deiaco, File Lead
Margot Linker, Student Planner
Christopher Moise, Urban Design
Mike Giampa, Transportation

Public:
Robert Tritt, Lowertown Community Association

Applicant Team:
Alam Ansari, EXP, Civil Engineer
Carolyn Jones, GRC Architects
Martin Tite, GRC Architects
M. Rashed, Embassy of the State of Qatar

Regrets:
A. Mottlib (comments to be forwarded)

Subject: 187 Boteler Street (Qatar Embassy)

Meeting Notes:

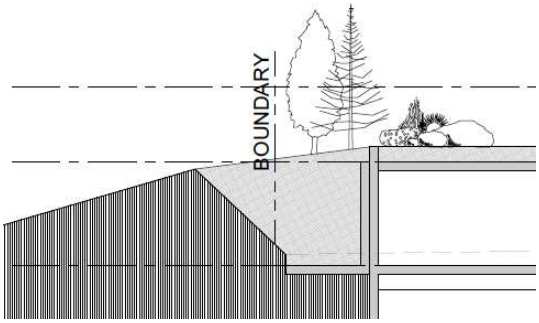
Opening & attendee introduction

- Introduction of meeting attendees

Proposal Overview

- Caroline explained that there were three design options developed, and the preferred design was option two. This design concept has evolved since the start of January.
- Development of the Qatar Embassy will be built west of the easement on the property. East side will be maintained for future development.
- Propose to build a 5-storey, 50,000 square foot building.
- Ground floor: public space, large lobby, art gallery, multi-purpose hall, access to internal court yard space and support spaces.
- 3-storey volume of office spaces. Offices are located on the perimeter of this building to maximize views. Top floor for is programmed for the Ambassador's office.
- Roof would contain green elements.

- Below grade - underground parking, mechanical spaces, archive storage space.
- Design inspired by: Qatar landscapes – "Curved angulating volume space, curvilinear forms".
    - Considering daylight and views while maintaining security
    - Several tiered roofs
    - Planters built into the design, windows above. Concrete structure, steel structure, intensive green roof on parts, lighter green roof above the multipurpose hall
    - Security guard house
- Access to surface parking, ramp to underground parking.
- Only one vehicular entrance to the site.
- Tree lined along Boteler Street.
- Martin explained that currently, the highway has crash barriers and a small hill between highway and property.



- They want the perspective from the highway to the property to be more landscape. This would be by filling in the side of the hill, so it meets the back side of the building (building face not exposed).
    - This could avoid the issue of water coming from the City's property onto this property
    - Potential concerns with stormwater management and engineering that would need to be addressed with raising the grade.
    - Martin suggested creating a swale to solve some of these issues.
    - Will return to this idea, Simon to follow up with internal staff with respect to who may comment on this proposal.
- The building will have a high security focus, but there are some restrictions on fencing height.
    - Simon - The site plan control by-law can allow for additional fence height if approved through an application, Christopher suggested to look to surrounding properties that have the same conditions as precedents

Preliminary Comments from Related Disciplines

<u>Mike Giampa, Transportation</u>

- Mike was surprised at the vehicle generation conducted from the traffic study, but actual trips will be low as this is not an actual office building. The numbers will be reviewed as process moves forward.

    - Simon questioned if in the morning if there is an opening of the Embassy which will generate lots of traffic for that time. What are the operating hours of the Embassy?
- Need preliminary scope to determine which intersections will need to be considered in the study.
    - Should look at Sussex Drive
- Access from Boteler – avoid offset entrance lanes.
- Caroline – asked for clarification on the four screening steps of the TIA. The first step has been completed and the consulting team will be moving onto Step 2.

Bob Tritt:

- Concerns about the view lines of the neighbourhood of condominiums.
- Potential issues with the fence.
- Likes the appearance of the building.

Christopher Moise: Urban Design

- Suggests including the surrounding context into their design.
    - Very close to the road, strong face-to-face relationship
    - The condominiums are close, need to consider the relationship between the 3-storey condominiums and this development
- Show it from the street from a pedestrian view.
    - Need to be sensitive to the community they're building in
    - Trees used to protect views from street to the north
- Christopher - Incorporate mechanical room in the design itself.
- Given the high level of effort, one formal session with the UDRP would suffice. There is always the ability to pre-consult, informally with the panel should the design team wish to do so.

Simon Deiaco: Planning

- The project will be subject to site plan control (public consultation) and potentially applications to the Committee of Adjustment if relief is required. This has not been confirmed. Submission requirements are included.
- The parcel is split zoned, and the use of office is permitted, subject to FSI limitations.
- Staff have worked with the team early on to discuss the limitations on the design concept in relation to significant municipal infrastructure that crosses (bisects) the site.
- The subject site is located within a design priority area.
    - Staff can work with the design team to organize a session with UDRP (potential to make the March meeting informally if they wish to do so as noted above)
        - Staff will provide links to the UDRP
- The building shows more of a hardscape from the front in the public boulevard, which is not in keeping with the abutting condition on the north side of Boteler.
- Reconsider the curb-boulevard relationship.
- What to do between sidewalk and fence line.
    - Precedent: Condominium has done coniferous planting

- Need continuation of the sidewalk on Boteler as part of the site plan drawings.
- Issues with the slope of the ramp that leads to the underground parking.
    - The ramp may need reconsideration as portions of the retaining walls appear to be within the easement area. Permanent elements in the easement are a concern.
- Issues with the overhang of the building on the upper storeys.
    - Simon will confirm the clear span required for the overhang (distance from grade)
- Process question:
    - Are there any restrictive covenants on title in favor of the NCC or design review requirements? – no covenants on title or requirement to have Federal approvals on the design (Matrin)
- Staff note that the security gate is within the site. This is an appreciated design element as stacking would be avoided on the local street.
- Has the design team considered what the site looks like at night? Have you considered a lighting scheme or the potential impacts?
- Look at the guidelines for this area, including the NCCs illumination plan.
- Question regarding the general timelines?
    - Uncertain currently. More information would be forwarded as it became available.

<u>Next Steps</u>

- Meeting minutes and submission requirements to follow.
- Staff to look into issue of clearance of the building overhang and the treatment of the north. property limit abutting City lands…..can this be altered?
- Preconsultation fees will be refunded if an application is made within 12 months of the preconsultation meeting.
- When the design is more advanced, staff strongly suggest meeting with the Ward Councillor prior to making a formal submission.

Site: Qatar Embassy -187 Boteler Street
Date of Pre-consultation meeting: January 23, 2019

It is the consultant /designer's responsibility to verify all the information related to the infrastructures.

Sanitary: 250 mm PVC on Botteler Street
Storm: 375mm and 300 mm PVC storm sewer on Botteler
Water: 203 mm PVC watermain on Botteler

Capacity issues for sewers

Please find the Servicing Report Template & Study Guidelines" in the attachment and prepare the servicing study accordingly. For capacity issue, please see section 3.2.1 page 3-3 and follow this section. A completed checklist with corresponding references from the servicing study is mandatory for the completeness of the study. Please add a completed checklist in the report.

ServicingGuideli nes_ final_Dec...

Servicing Report Template Final Versi

The allowable sewer release rate should be based on the existing Zoning Designation using the City's Sewer Guidelines. If the proposal requires a greater flow than the allowable, then please do an analysis of the City's sewers system as per servicing guidelines to determine available capacity in the City's sewers system.

Please calculate the sewers demand for the proposed development and send it to us ASAP, if you want to verify whether or not there is enough capacity in the city system. Normally, it takes 10 business days to get response back from the internal circulation.

Required information for Water boundary conditions (not required if you're using existing service)

Boundary conditions are required to confirm that the require fire flows can be achieved as well as availability of the domestic water pressure on the city street in front of the development. Please use Table 3-3 of the MOE Design Guidelines for Drinking-Water System to determine Maximum Day and Maximum Hour peaking factors for 0 to 500 persons and use Table 4.2 of the Ottawa Design Guidelines, Water Distribution for 501 to 3,000 persons.

1. Location of Service
2. A sketch of the proposed water service to the city watermain
3. Street Number & Name
4. Type of development and units
5. Amount of fire flow required ___l/s (Calculation as per the FUS Method).
6. Average daily demand: -l/s
7. Maximum daily demand: -l/s
8. Maximum hourly daily demand: -l/s

Please note proposed development will require 2 separate service connections from the city watermains if the basic day demand is greater than 50m^3/day to avoid the creation of a vulnerable service area. Two water meters will be required for two service connections and the service connections will have to be looped.

Utility conflict with the proposed servicing

It is the consultant's sole responsibility to investigate the existing utilities in the proposed servicing area while preparing the Servicing and Grading Plans to avoid any conflict with the proposed services and will require a note stating this on the servicing plan.

Underground and above ground building footprints
All underground and above ground building footprints and permanent walls need to be shown on the plan to confirm that any of the permanent structures does not extend beyond the property line either above or below ground or does not encroach into sight triangles and future road widening protection limits.

Grade limitations for underground ramps (Wally)
Underground ramps should be limited to a 12% grade and must contain a subsurface melting device when exceeds 6%. If the ramp's break over slope exceeds 8%, a vertical transition curve or a transition slope should be used in the midway of the ramp.

SWM Criteria for the Catchment Area of the site being redeveloped: (Quantity control criteria)

- Allowable release rate will be 2-year pre-development rate for Local Street.
- C Coefficient of runoff will need to be determined **as per existing conditions** but in no case more than 0.5
- TC =20 minutes or can be calculated,
- TC should not be less than 10 minutes, since the IDF curves become unrealistic less than 10min.
- Any storm events greater than 2 year, up to 100 year, and including 100-year storm event must be detained on site.

TECHNICAL BULLETIN PIEDTB-2016-01

Section 5.4.9.2,Page 5.31,

While rear yard grading will create low points and storage at each catch basin, the storage will not be considered in the available storage requirements. It will be assumed that all backyard flows in excess of the 2-year will flow towards the roads. Effective available storage will only be considered on streets and open space/park storage. Furthermore, there must be at least 30 cm of vertical clearance between the rear yard spill elevation and the ground elevation at the adjacent building envelope.

Major system storage in backyards is not to be included/accounted for in design computations, however the effect of flow attenuation can now be accounted for by assuming a constant slope ditch/swale draining to the street with the following geometry: a minimum slope of 1.5% and a minimum depth of 150 mm. The maximum allowable depth of a swale/ditch shall be 600 mm. The maximum side slope of swales/ditches shall be 3 horizontal to 1 vertical.

Section 8.3.11.6, Page 8.20:

Rear Yard storage cannot be accounted for in the water storage calculation. It should be assumed that all water in excess of the 2-year event will flow to the street. The maximum depth of flow depth in rear yards is 300 mm. Furthermore, there must be at least 30 cm of vertical clearance between the rear yard spill elevation and the ground elevation at the adjacent building envelope. See Section 5.4.9 for further information. Major system storage in backyards is not to be included/accounted for in design computations, however the effect of flow attenuation can now be accounted for by assuming a constant slope ditch/swale draining to the street.

Stormwater management criteria (Quality Control Issues)

Please note there will a section in the SWM report that will discuss about the quality control requirements for this site. It is consultant's responsibility to check with the Rideau Valley Conservation Authority (RVCA) for quality control issues and include this information in the SWM report under Quality Control Section. Please contact RVCA for further information.

Implementation considerations

- Accounting for external overland drainage
- Use of standard ICDs
- Requirement for ICD plans
- Requirement for plans showing 100-year and stress-test ponding limits
- Provide a foundation drain backwater valve installed as per Std Dwg S14.
- Provide a full port backwater valve, in the sanitary building drain, installed as per Std Dwg S14.1.

Monitoring MHs

Onsite Monitoring MHs are required for sewers (sanitary and storm) as this is a commercial development.

Sight Triangle and Road widening requirement (By Transportation Project Manager Mr. Wally Dubyk)

Sidewalk Condition/Requirement: if there is no sidewalk, damaged one or asphalt sidewalk which needs to be changed to concrete.

City needs minimum 2.0 m monolithic concrete sidewalk for more information please contact with Wally Dubyk at 613-580-2424 ext. 13783

Transportation Comments from Transportation Project Manager, Wally Dubyk

Studies required for Site Plan application

- Serviceability Study
- Erosion and sediment Control Plan, it can be combined with grading plan
- Stormwater Management Report
- Geotechnical Study
- Slope Stability Report
- Transportation -Wally Dubyk.
- Phase 2 Noise Control Detailed Study- Please add stationary noise concerns if the usages are considered as Industrial, car dealerships, moto vehicle maintenance and commercial activities and equipped with is generator, fans or commercial air conditioners.
- ESA-Phase 1 Study, needs to be prepared as per current MOE regulation not as per CSA standards
- ESA-Phase 2, Depend on the Phase I recommendation if required needs to be prepared as per current MOE regulation not as per CSA standard
- RSC is needed for more sensitive land usage; - RSC is required before ZA approval.

Plans required;

a. Site Servicing Plan
b. Grade Control and Drainage Plan
c. Erosion and Sediment Control Plan

Building over City easement Requirement

The information below you provided to the client earlier just for ready reference I have added the information here.

- Staff have looked at the infrastructure we have along the easement in question: a storm trunk (1980x1320mm – egg inverted shape with flat bottom, tunneled in bedrock) and a pull-back sanitary sewer (375mm encased in concrete inside the storm trunk).

- The cover over the storm trunk is approximately 4m (the bedrock is shallow in that area), thus construction over the trunk may be acceptable as long as no additional loads are added to the pipe when compared to existing configuration.

- As part of the Site Plan Control application, the consultant will have to provide drawings showing the type of support for the construction going over the easement. Footing designs should avoid, to the highest degree possible, being located within the existing easement and will be reviewed on a case-by-case basis. Concept drawings could be forwarded in advance for comment by staff given the complexity of the project.

- Record drawings and utility plans can be purchased from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455)

Relevant information

1. Servicing & site works shall be in accordance with the following documents:

   - ⇨ Ottawa Sewer Design Guidelines (2012)
   - ⇨ Ottawa Design Guidelines – Water Distribution (2010)
   - ⇨ Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
   - ⇨ City of Ottawa Slope Stability Guidelines for Development Applications (2004)
   - ⇨ City of Ottawa Environmental Noise Control Guidelines (2006)
   - ⇨ City of Ottawa Park and Pathway Development Manual (2012)
   - ⇨ City of Ottawa Accessibility Design Standards (2012)
   - ⇨ Ottawa Standard Tender Documents (2015)
   - ⇨ Ontario Provincial Standards for Roads & Public Works (2015)

2. Record drawings and utility plans can be purchased from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).

Regards,

Mohammad

Mohammad Abdul Mottalib, M. Sc., M. Eng., P. Eng.
Sr. Engineer Infrastructure Applications
Development Review , Central Group
Planning, Infrastructure and Economic Development Department
Services de la planification, de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Ave. West / 110, avenue Laurier Ouest, Ottawa K1P 1J1
Tel. 613-580-2424 ext. 27798 , Fax. 613-560-6006 ,E-mail: Abdul.Mottalib@ottawa.ca

From: Eric Lalande <eric.lalande@rvca.ca>
Sent: Friday, May 13, 2022 3:45 PM
To: Jamie Batchelor; Aaditya Jariwala
Cc: Alam Ansari
Subject: RE: Quality Control Criteria for 187 Boteler Street, Ottawa, ON

Hello Aaditya,

Based on the site plan provided, the RVCA has no quality control requirements for the project. Best Management practices are encourage where possible to be integrated into the site design.

Thank you,

Eric Lalande, MCIP, RPP
Planner, RVCA
613-692-3571 x1137

From: Jamie Batchelor <jamie.batchelor@rvca.ca>
Sent: Friday, May 13, 2022 3:37 PM
To: Aaditya Jariwala <Aaditya.Jariwala@exp.com>
Cc: Alam Ansari <alam.ansari@exp.com>; Eric Lalande <eric.lalande@rvca.ca>
Subject: RE: Quality Control Criteria for 187 Boteler Street, Ottawa, ON

Good Afternoon Aaditya,

I am forwarding your inquiry to Eric Lalande as he would be the RVCA Planner for that area.

Jamie Batchelor, MCIP, RPP
Planner, ext. 1191
Jamie.batchelor@rvca.ca

Rideau Valley Conservation Authority
3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
T 613-692-3571 | 1-800-267-3504 **F** 613-692-0831 | www.rvca.ca

From: Aaditya Jariwala <Aaditya.Jariwala@exp.com>
Sent: Friday, May 13, 2022 9:16 AM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Cc: Alam Ansari <alam.ansari@exp.com>
Subject: Quality Control Criteria for 187 Boteler Street, Ottawa, ON

Good Morning Jamie,

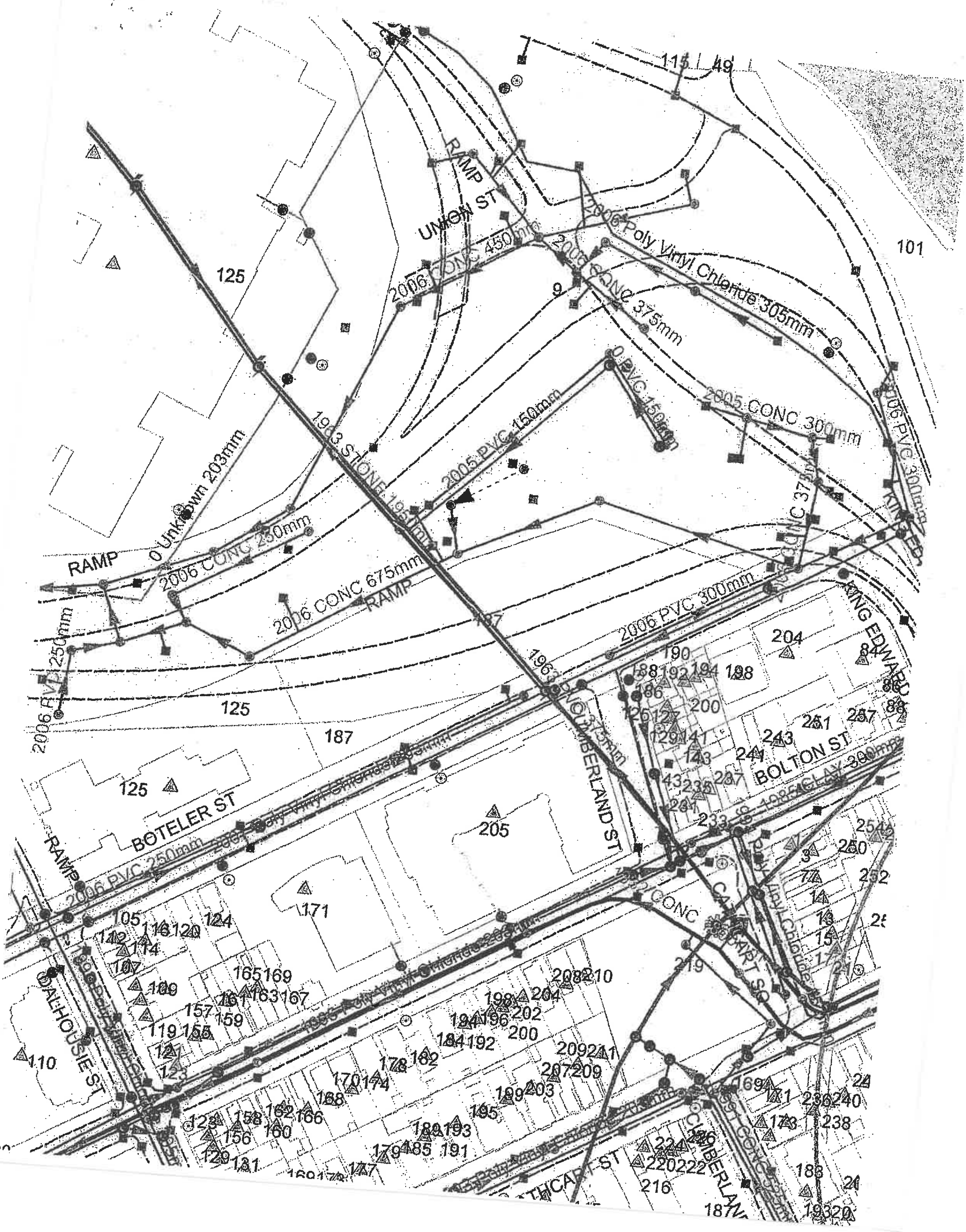
Can you please provide quality control criteria for development at 187 Boteler Street, Ottawa, ON (City application number: D07-12-22-0041). I have attached Site Location Plan and Site Servicing Plan for your reference.

Please let me know if you need further information.

Regards,

Aaditya Jariwala, M.Eng
EXP | Engineering Designer
t : +1.613.688.1899, 63240 | m : +1.613.816.5961 | e : aaditya.jariwala@exp.com
2650 Queensview Drive
Suite 100
Ottawa, ON K2B 8H6
CANADA

City of Ottawa Water and Sewer Utilities locate Report


UNION ST
RAMP
2006 CONC 450mm
2006 Poly Vinyl Chloride 305mm
2006 CONC 375mm
2005 CONC 300mm
2006 PVC 300mm
2005 PVC 150mm
0 Unknown 203mm
2006 CONC 250mm
2006 CONC 675mm
2006 PVC 250mm
2006 PVC 300mm
1963 STONE
KING EDWARD
BOLTON ST
BOTELER ST
CUMBERLAND ST
DALHOUSIE ST
CATHCART ST
101
125
187
204
205
171
110

City of Ottawa Locate Report – Water and Sewer Utilities
Rapport de localisation des conduites d'eau et d'égout d'Ottawa

For more information / Pour de plus amples renseignements : 3-1-1 or/ou (613) 580-2424, ext. (poste) 22336.

Date : May 24, 2019	Work Order # / No d'ordre de travail : 1272097
Location of Work / Lieu de travail : 187 Boteler St	ON1CALL # / No d'appel ON1 : 20192027963
Type of Work / Type de travail : CONSTRUCTION	☑ ArcView attached Plan ArcView ci-joint
Contractor / Entrepreneur : U S L	Fax / Télécopieur :

Sketch Not To Scale / Le croquis n'est pas à l'échelle

Unable To Locate Storm and Sanitary on North Side of Locked Fenced off Area in work Area

1950mm Storm Runs Through Area as well as Sanitary See Attached ArcView for Reference

Contractor signature
Signature de l'entrepreneur

T. Wylie
Locator (please print)
Marqueurs [en lettres moulées]

Method of marking / Méthode de marquage

☐ Flags / Drapeaux ☐ Paint / Peinture ☐ Other (specify) / Autre [précisez] :

Remarks / Commentaires :

Office copy : White
Copie du bureau : Blanc

Contractor copy: Yellow
Copie de l'entrepreneur : Jaune

Void after 60 days.
Périmé après 60 jours.

Promark telecon

Auxiliary Locate Sheet

Union Gas Emergency # 1-877-969-0999

Fax: 613-723-9277

Toll free: 1-800-371-9866

Email

Utilities ☐ Bell ☐ Gas + HydroOttawa ☐ Street Lighting
Located: ☐ Blink ☐ Peel Fibre ☐ ☐

Date Located: mm/dd/yyyy MAY 24 2019

Request # 20192027963

Number of Services marked: (Specify building/house numbers) N/A

LOCATED AREA: EXCAVATOR SHALL NOT WORK OUTSIDE THE LOCATED AREA WITHOUT OBTAINING ANOTHER LOCATE

FROM: N.FL OF 187 BOTELER
FROM: E.FL OF 125 BOTELER
TO: S.FL OF 187 BOTELER
TO: E.FL OF 187 BOTELER

CAUTION: Hand dig within 1.5M as measured horizontally from the field markings to avoid damaging the underground utilities. If you damage the plant, you may be held liable. If you damage underground plant, contact the facility owner immediately. Depth varies and MUST be verified by hand digging or vacuum excavation.

LOCATED AREA HAS BEEN ALTERED AS PER:

Legend

- Building Line — BL —
- Fence Line — FL —
- Face of Curb — FC —
- Road Edge — RE —
- Property Line — PL —
- Driveway — DW —
- Catch Basin CB
- Sidewalk SW
- Demarcation DM
- Railway
- Pole O
- Flush to Grade Pedestal
- Pedestal X
- Buried Cable — B —
- Conduit — C —
- Buried Service Wire — BSW —
- Manhole MH
- Fibre Optic Cable — FO —
- Gas Main — GM —
- Gas Service — GS —
- Gas Valve
- Hydrant
- Transformer
- HydroOttawa — H —
- Hydro Pole X
- Street Light Cable — SL —
- Street Light
- North N.
- South S.
- East E.
- West W.

THIS FORM VALID ONLY WITH Primary Locate Form. This sketch is not to scale.
Any privately owned services within the located area have not been marked- check with service/property owner.

A copy of this Auxiliary Locate Sheet(s) and the Primary Locate Sheet must be on site and in the hands of the machine operator during work operations. If sketch and markings do not coincide, the Excavator must obtain a new locate.

Promark telecon
Locators of underground infrastructure

Auxiliary Locate Sheet

Union Gas Emergency # 1-877-969-0999

Fax: 613-723-9277 Toll free: 1-800-371-9866 Email

Utilities ☐ Bell + Gas ☐ HydroOttawa ☐ Street Lighting
Located: ☐ Blink ☐ Peel Fibre ☐ ☐

Date Located: MAY 24 2019

Request # 20192027963

Number of Services marked: (Specify building/house numbers) N/A

LOCATED AREA: EXCAVATOR SHALL NOT WORK OUTSIDE THE LOCATED AREA WITHOUT OBTAINING ANOTHER LOCATE

FROM: N.FL OF 187 BOTELER
FROM: E.FL OF 125 BOTELER
TO: S.FL OF 187 BOTELER
TO: E.FL OF 187 BOTELER

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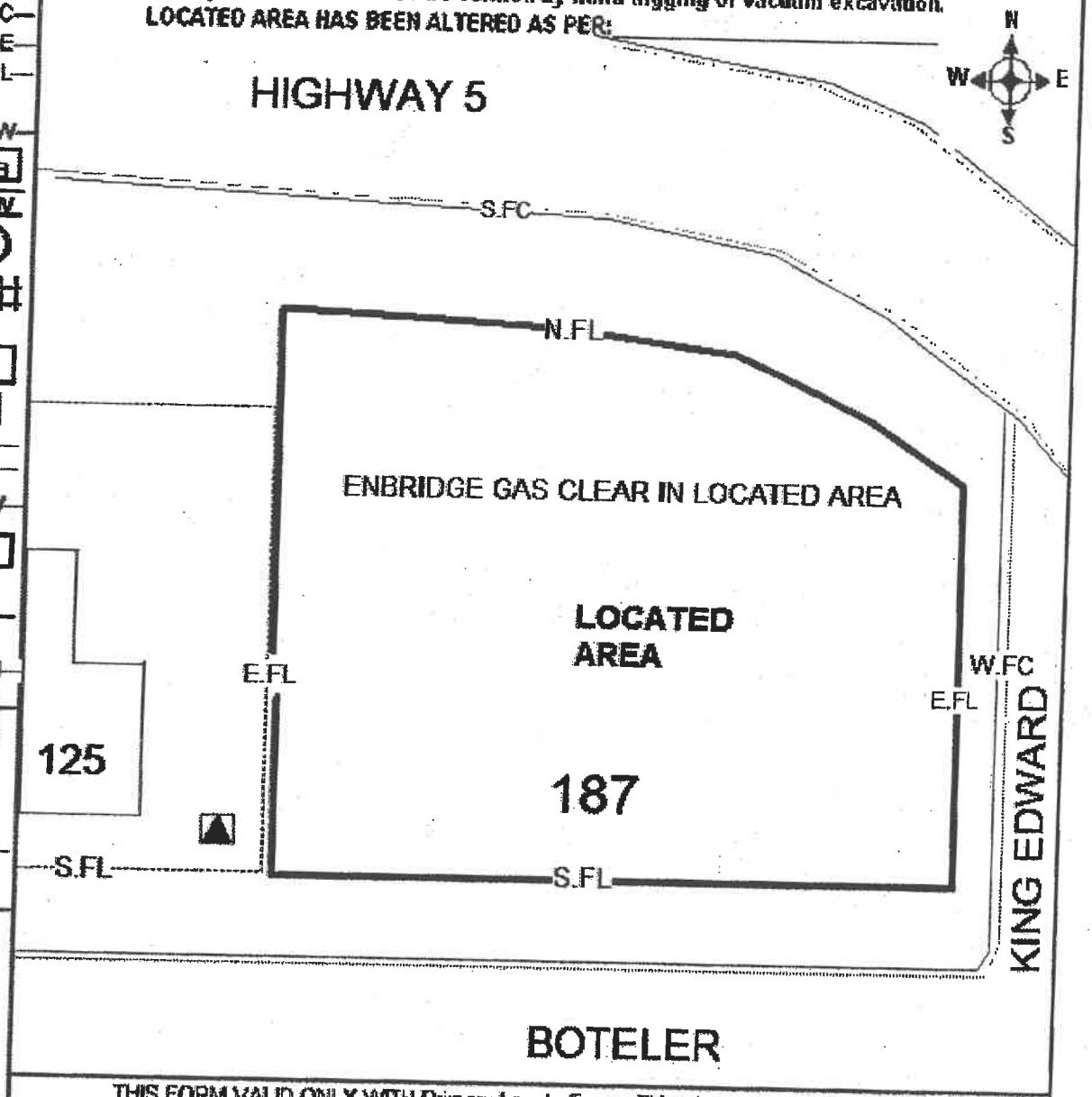
LOCATED AREA HAS BEEN ALTERED AS PER:

Legend
Building Line —BL—
Fence Line —FL—
Face of Curb —FC—
Road Edge —RE—
Property Line —PL—
Driveway —DW—
Catch Basin CB
Sidewalk SW
Demarcation DM
Railway
Pole O
Flush to Grade Pedestal
Pedestal X
Buried Cable —B—
Conduit —C—
Buried Service Wire —BSW—
Manhole MH
Fibre Optic Cable —FO—
Gas Main —GM—
Gas Service —GS—
Gas Valve
Hydrant
Transformer
HydroOttawa —H—
Hydro Pole X
Street Light Cable —SL—
Street Light
North N.
South S.
East E.
West W.



THIS FORM VALID ONLY WITH Primary Locate Form. This sketch is not to scale.
Any privately owned services within the located area have not been marked- check with service/property owner.

A copy of this Auxiliary Locate Sheet(s) and the Primary Locate Sheet must be on site and in the hands of the machine operator during work operations. If sketch and markings do not coincide, the Excavator must obtain a new locate.

Promark telecon

Auxiliary Locate Sheet

Union Gas Emergency # 1-877-969-0999

Fax: 613-723-9277 Toll free: 1-800-371-9866 Email

Utilities Located: + Bell ☐Gas ☐HydroOttawa ☐Street Lighting ☐Blink ☐Paol Fibre ☐ ☐

Date Located: MAY 24 2019

Request # 20192027963

Number of Services marked: (Specify building/house numbers) N/A

LOCATED AREA: EXCAVATOR SHALL NOT WORK OUTSIDE THE LOCATED AREA WITHOUT OBTAINING ANOTHER LOCATE

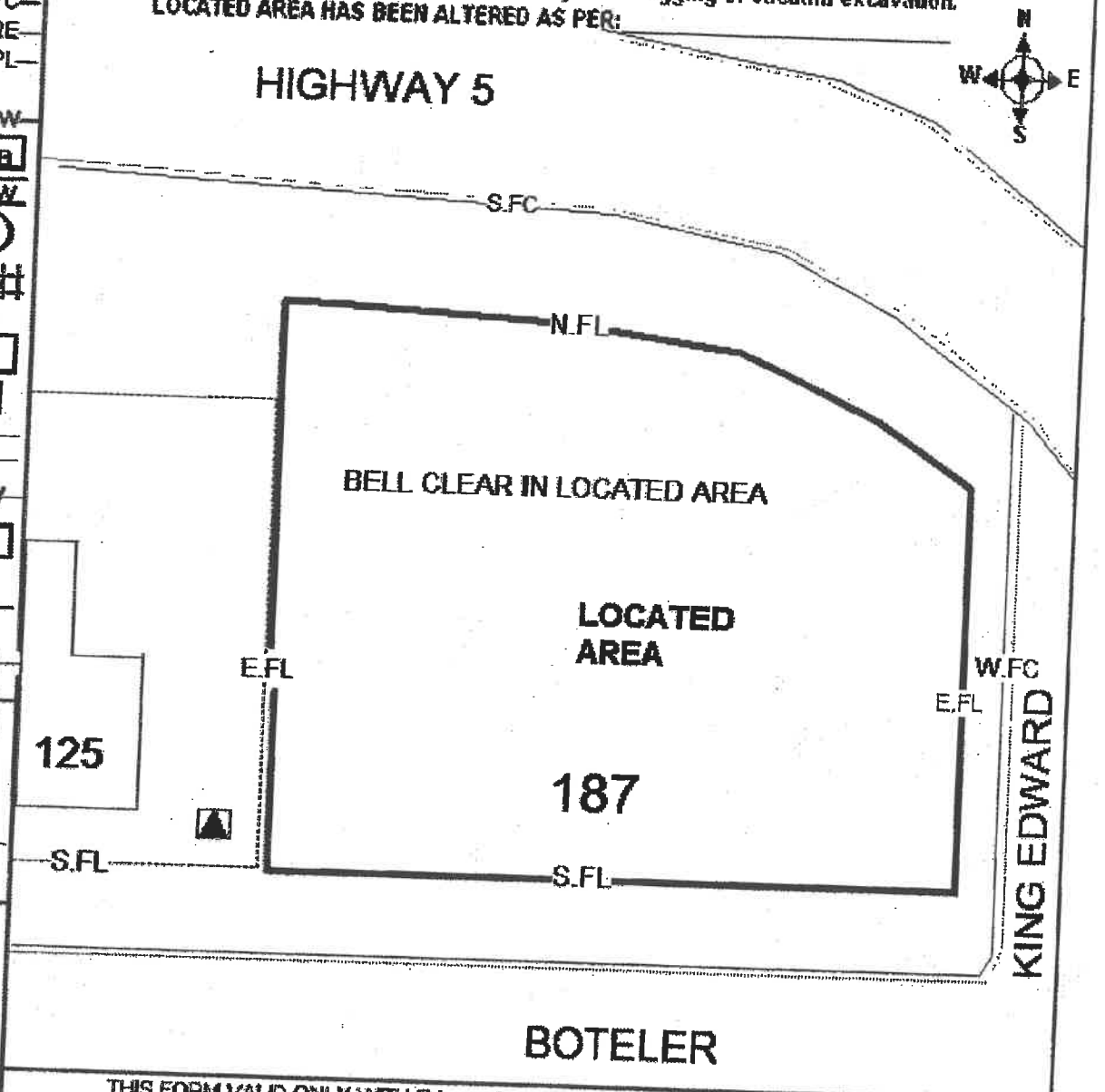
FROM: N.FL OF 187 BOTELER
FROM: E.FL OF 125 BOTELER
TO: S.FL OF 187 BOTELER
TO: E.FL OF 187 BOTELER

CAUTION: Hand dig within 1.5M as measured horizontally from the field markings to avoid damaging the underground utilities. If you damage the plant, you may be held liable. If you damage underground plant, contact the facility owner immediately. Depth varies and MUST be verified by hand digging or vacuum excavation.

LOCATED AREA HAS BEEN ALTERED AS PER:

Legend

- Building Line — BL —
- Fence Line — FL —
- Face of Curb — FC —
- Road Edge — RE —
- Property Line — PL —
- Driveway — DW —
- Catch Basin CB
- Sidewalk SW
- Demarcation DM
- Railway
- Pole O
- Flush to Grade Pedestal
- Pedestal X
- Buried Cable — B —
- Conduit — C —
- Buried Service Wire — BSW —
- Manhole MH
- Fibre Optic Cable — FO —
- Gas Main — GM —
- Gas Service — GS —
- Gas Valve
- Hydrant
- Transformer
- Hydro Ottawa — H —
- Hydro Pole X
- Street Light Cable — SL —
- Street Light
- North N.
- South S.
- East E.
- West W.



THIS FORM VALID ONLY WITH Primary Locate Form. This sketch is not to scale.

Any privately owned services within the located area have not been marked- check with service/property owner.

A copy of this Auxiliary Locate Sheet(s) and the Primary Locate Sheet must be on site and in the hands of the machine operator during work operations. If sketch and markings do not coincide, the Excavator must obtain a new locate.

This form revised April 2009 White-Excavator Yellow-Office LAC FORM

UNDERGROUND SERVICE LOCATORS - PRIVATE UTILITY REPORT DATE: May 30/2019

ONE-CALL SYSTEMS INC.
775 TAYLOR CREEK DRIVE
OTTAWA, ON, K4A 0Z9

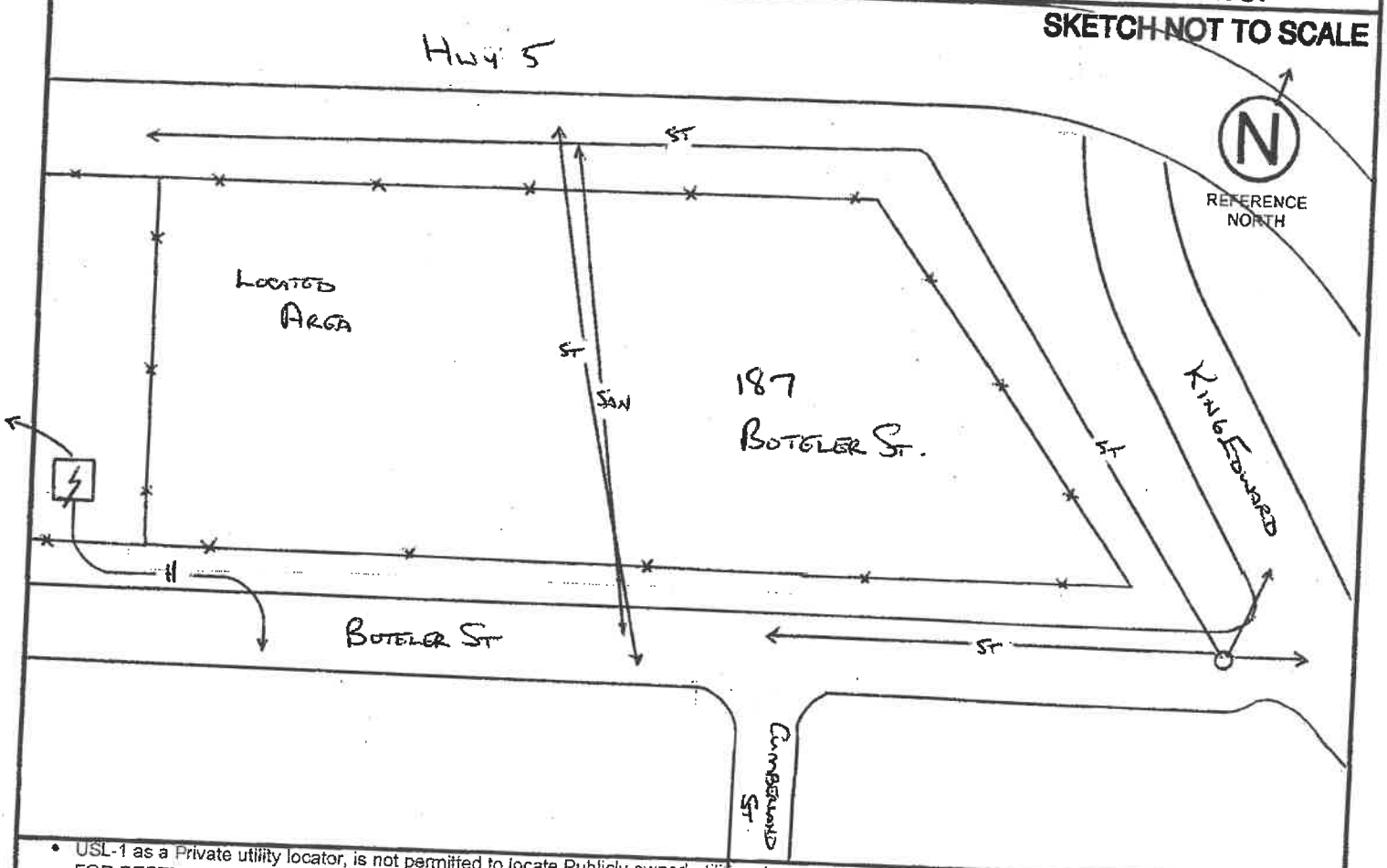
PHONE (613) 226-8750
FAX (613) 226-8677

CUSTOMER: FMW	REQUESTED BY: David Trousdale
LOCATION OF WORK: 187 Botgler St.	LIMITS OF WORK: Survey

HYDRO	-- H --	CABLE T.V.	-- T.V. --	STEAM	-- STEAM --
GAS	-- G --	SANITARY	-- SAN --	ELECTRICAL	-- E --
BELL	-- B --	STORM	-- ST --	COMMUNICATIONS	-- COM --
UNIDENTIFIED CABLE	-- UC --	FIBER OPTIC	-- FOC --	OTHER:	
WATER	-- W --				

LOCATES ONLY APPLICABLE TO INFO ABOVE - LOCATES VOID AFTER 30 DAYS!

SKETCH NOT TO SCALE



- USL-1 as a Private utility locator, is not permitted to locate Publicly owned utilities. In some cases, Public utilities may be noted on a sketch, but are FOR REFERENCE ONLY, and under no circumstances shall be used for excavation purposes. It is the contractor's responsibility to verify any Public utilities noted on the USL-1 sketch by referring to the Public utility locate sheets for physical LOCATION AND ACCURACY. USL-1 DOES NOT ASSUME LIABILITY FOR PUBLIC LOCATE INNACCURACIES.
- If the proposed work area is on Private property, it does NOT mean that all buried utilities are Private. Regardless of when you are digging, and what the proposed depth of excavation is, it is the law to notify Ontario One Call (or Info-Excavation in Quebec) to obtain Public utility locates.

COMMENTS:

THIS SKETCH IS NOT A PUBLIC UTILITY LOCATE/DOCUMENT. PUBLIC UTILITIES SHOWN ARE FOR REFERENCE ONLY. REFER TO USL-1 DISCLAIMER - FORM 101. CONTRACTOR IS RESPONSIBLE TO ENSURE THEY HAVE PUBLIC UTILITY LOCATES BEFORE COMMENCING WORK.

LOCATORS NAME: Stan Pedar 613-986-7226 | SIGNATURE:

LOCATE RECEIVED AND REVIEWED BY _____ (Print Name) _____ (Signature)

CAUTION: HAND DIG WITHIN 1.5 METERS OF MARKINGS

USL-1
UNDERGROUND SERVICE LOCATORS INC.

Stan Pedlar
Locate Technician
stanp@usl-1.com
cell 613-986-7226

775 Taylor Creek Drive,
Ottawa ON K1C 1T1
tel 613-226-8750
fax 613-226-8677
toll-free 877-248-3444
www.usl-1.com

DATE: May 30 | 2019

Client Name: FMW

Job Location: 187 Bottger St.

Nature of work: Survey

DESCRIPTION OF PUBLIC LOCATES

BELL: Utility in work area: Yes (No) - Located ☐ - Marked ☐ - See attached sketch ☑
Notes: Bell is Clear, See Promark Report.

GAS: Utility in work area: Yes (No) - Located ☐ - Marked ☐ - See attached sketch ☑
Notes: Gas is Clear, See Promark Report.

HYDRO: Utility in work area: Yes (No) - Located ☐ - Marked ☐ - See attached sketch ☑
Notes: Hydro Ottawa is Clear, See Promark Report.

WATER: + Sewer Utility in work area: (Yes) / No - Located ☑ - Marked ☑ - See attached sketch ☑
Notes: City Water is Clear, City Sewer is in Work Zone, See City Report.

CABLE: Utility in work area: Yes (No) - Located ☐ - Marked ☐ - See attached sketch ☑
Notes: Rogers is Clear, See Rogers Clearance.

TRAFFIC + STREET LIGHTS: Utility in work area: Yes (No) - Located ☐ - Marked ☐ - See attached sketch ☑
Notes: Traffic + Street Lights are Clear, See Reports

Utility in work area: Yes / No - Located ☐ - Marked ☐ - See attached sketch ☐
Notes:

Notes:

Locators Name: Stan Pedlar **Signature:** [signature]

*** IF THERE ARE ANY QUESTIONS WITH REGARDS TO THIS OR ANY OTHER CLEARANCE SHEET PLEASE CONTACT US IMMEDIATELY ***

20192027963_ENOE01

Promark telecon
Location of underground infrastructures

Primary Locate Sheet

UNION GAS EMERGENCY # 1-877-969-0999

Fax: 613-723-9277 | Toll free: 1-800-371-8866 | Email:

Request # 20192027963 NORMAL

Utilities Located: + Bell + Gas + Hydro Ottawa ☐ Hydro One ☐ Videotron ☐ Lakefront Utilities ☐ Elexicon Energy

Revised Excavation Date: mm/dd/yyyy	Excavation Date: 05/27/2019 00:00:00 mm/dd/yyyy	Status: STANDARD		
Requested by: JACQUES DESJARDINS	Company: USL	Phone: (613)-226-8750 ext.	Fax/email: (613)-226-8677 ext.	Homeowner ☐
Appt Date: mm/dd/yyyy	Received Date: 05/17/2019 mm/dd/yyyy	Locate Address: 187, BOTELER ST		Contractor +
		1st Inters.: CUMBERLAND ST	2nd Inters.: KING EDWARD AVE	Project ☐

Type of work: CONSTRUCTION

City: OTTAWA

Caller's Remarks:
MACH. DIG
CORLOT=U CLEAR ENTIRE PROPERTY AND TO ROAD EDGE ON BOTELER ST.

-75.693884, 45.435811, NB_SEGMENTS:2, NO_PLAN:613 241, BCOED1, ROGOTT01, OTWATSD1, OTWASL01, OTWAWS01, ENOED1, HOT1

Bell Mark | Clear	Enbridge Gas Mark | Clear	Hydro Ottawa Mark | Clear	Street Lighting Mark | Clear	Lakefront Mark | Clear	Hydro One Mark | Clear	Veridian Mark | Clear	Union Gas Mark | Clear	Videotron Mark | Clear
1	1	1						

LOCATED AREA: EXCAVATOR SHALL NOT WORK OUTSIDE THE LOCATED AREA WITHOUT OBTAINING ANOTHER LOCATE.

Records Reference:
— Map — Network X # 4038
— Byers — Datapak: + LAC Multiviewer
Field Notes: NE188,FN3455-1,FN3436-2
Other:
OPT Remarks:

— Third Party Notification

N/A

Apply Sticker Here if Required

Excavator shall notify & receive a clearance from Utility prior to excavation for the following:
Telecon ☐ High Priority Cable ☐ Central Office Vicinity

Method of Field Marking: + Paint ☐ Stakes + Flags ☐ Offset Flags ☐ Other (Telecom=Orange, Gas=Yellow, Hydro Ott. =Red)

Caution: Locates are VOID after 30 days. Hydro One valid for 60 days. See Disclaimer for the specific Facility Owner's Guidelines.

Caution: Any changes to location or nature of work require new locate. The Excavator must not work outside the Located Area without a new locate. Privately owned services within the located area have not been marked - check with service/property owner. For all Locate requests including remarks contact: Ontario One Call at 1-800-400-2255 or www.on1call.com.

Locator Name: BELAIR DANICK
ID #:
Date: MAY 24 2019

Start Time: 1000
End Time: 1030
Total Hours: 0.5

+ Mark & Fax — Left on Site — Emailed
Print:
Signature:

A copy of this Primary Locate Sheet and Auxiliary Locate Sheet(s) must be on site and in the hands of the machine operator during work operations. If sketch and markings do not coincide, the Excavator must obtain a new locate.

This form revised December 2016

Bell

February 9 2015

To all Excavators:

Bell locates are now valid for the life of the excavation project and will not automatically be relocated every 60 days.

Please note the following for the above to apply:

a) Construction within the located area begins within 60 days of the "locate completed" date on the original ticket.

b) The construction company named on the locate remains active on the site.

Bell expects excavators will protect and preserve the paint marks put down on the original locate ticket. If markings are removed due to weather or excavation work the excavator is expected to recreate the markings based on the tie-in measurements provided on the original locate ticket.

If an excavator would like their markings freshened up they can contact Promark (the Bell Canada Locate Service Provider in this area) directly to arrange for them to place fresh markings on the ground however this will be at the excavators expense. Promark can be reached at 613-723-9888.

The locate will be considered officially expired one day after the final day of construction.

Thank you.

Bell Canada

DISCLAIMER

Warning!

The Excavator must have a copy of this locate on the job site during excavation.

Located Area: The Excavator must not work outside the area indicated by the Located Area in the Diagram without a further locate by the Company

Locate the plant: The plant location information provided is the best we have available but constitutes only an estimate. Depth of underground plant varies and the exact location must be determined by hand digging prior to excavation with mechanical equipment.

Mechanical equipment must not be used within one metre of the estimated location of the plant.

Hydro Ottawa must be notified prior to excavation and inspector on site

Expose the plant: Once the plant has been located by hand digging, it must be exposed along its length adjacent to or in the immediate vicinity of the proposed excavation. For this purpose, mechanical equipment must not be used within 0.5 metres of the plant.

Digging around the exposed plant: When the plant has been exposed, any further excavation within 0.3 metres, must only be done by hand digging and not with mechanical equipment.

Support Requirements: If the underground plant is exposed over a distance of more than 1.25 metres, the Facility Owner must be notified. Underground plant must be supported at all times.

O. Reg. 210/01 Oil and Gas Pipeline systems EXCERPTS

9. (1) No person shall dig, bore, trench, grade, excavate or break ground with mechanical equipment or explosives without first ascertaining the location of any pipeline that may be interfered with.

10. No person shall interfere with or damage any pipeline without authority to do so.

Technical Standards & Safety Act 2000 EXCERPT

37 (1) Every person who contravenes or fails to comply with any provision of this act or the regulations; etc... is guilty of an offense and on conviction is liable to a fine of not more than $50,000 or to imprisonment for a term of not more than one year, or to both.

Caution: The markings may disappear or be misplaced. Should sketch and markings not coincide, Excavator must obtain a new locate. This is based on information given at the time. Any changes to location or nature of work require a new locate. The Excavator must not work outside the indicated Located Area without a further locate. Privately owned services within the located area have not been marked - check with service/property owner.

Locate is VOID after 30 days.

For remarks contact Ontario One Call 1-800-400-2255.
or www.on1call.com

ON1CALL
CALL BEFORE YOU DIG

Fnw

ROGERS

TICKET#: 20192027963
CLEARANCE#: A4834792
DATE: 05/18/2019

8200 Dixie Rd
East Bldg, 2nd Flr
Brampton, Ontario, L6T 0C1
Tel.: (855) 232-0342
Fax.: (905) 780-7379

CLEAR TO DIG

ROGOTT01

Requested By: Company: USL
Contact name: JACQUES DESJARDINS Ph:(613)-226-8750 ext. Fax: (613)-226-8677 ext.

Dig Site Location :
Municipality : OTTAWA Call Date: 05/17/2019
Address : 187, BOTELER ST Intersection : CUMBERLAND ST

Remarks (Additional Dig Info)
-75.693984 45.435841 NB_SEGMENTS::2 BCOE01 ROGOTT01 OTWATS01 OTWASL01 OTWAWS01 ENOE01 HOT1

OTTAWA CORLOT=U CLEAR ENTIRE PROPERTY AND TO ROAD EDGE ON BOTELER ST. NO_PLAN::613 241

ALL CLEAR HAS BEEN GIVEN FOR THE WORK AREA DESCRIBED ABOVE.

YOU WILL BE LIABLE FOR ANY DAMAGES TO ROGERS FACILITIES IF EXCAVATING / DIGGING PRIOR TO RECEIVING A COMPLETED LOCATE OR CLEARANCE NUMBER FROM ROGERS OR IT'S AGENTS.

PLEASE CALL ROGERS LOCATE SERVICES AT (800) 738-7893, IF THERE ARE ANY CHANGES TO THIS LOCATE REQUEST. LOCATES AND CLEARANCES ARE VALID FOR 60 DAYS ONLY.

CAUTION: Stakes and or markings may disappear or be displaced. Should the sketches and markings not coincide, a new stake out must be obtained.

FOR ALL CUT CABLES CALL
1-800-265-9501

USL-1 DISCLAIMER - FORM 101

- It is our Clients responsibility to fully read and understand this document, prior to any ground disturbance taking place. Should any questions or clarifications be required, contact USL-1 before commencing work
- Locate is VOID after 30 days from the date the locate was completed. Contact USL-1 for remarks and/or new ticket requests, with a minimum notice of 5 business days
- If the scope of work, locate area, or site information changes, contact USL-1 before continuing work. In certain instances, a new ticket request may be required
- Any work within 1.5 metres laterally of a marked utility, must be hand dug or daylighted. Utility depths vary, as does the accuracy of the locate equipment, and therefore depths are typically not provided and should not be used for excavation purposes. Depth of utilities should also be verified by hand digging or daylighting. The best information is provided at the time of the locate, however the accuracy of field markings can vary with regard to equipment accuracy and external interference
- If the paint markings or flags on site differ from that of the sketch provided, please contact USL-1 before commencing work. If possible, the issue will be clarified by USL-1 and/or a site meet may be requested with the appropriate parties
- The "Excavator" is responsible for keeping a current copy of the locates on site, with the operators and in/on the excavation equipment AT ALL TIMES
- It is the "Excavator/Contractor's" responsibility to read ALL locate sheets, both public and private, to ensure they understand what potential hazards or buried utilities exist in their work area
- Special purpose locates such as sewer sondeing, locate surveys, tunnel identification, conduit identification, ground fault detections, ground penetrating radar, well cap location, concrete scanning, or anything else that requires use of more than Radiodetection equipment, must be identified at the time of the original locate request. Should a USL-1 locator identify any special needs services during a normal Private utility locate, the client will be notified for the appropriate course of action
- Not all buried utilities can be traced. In many instances, water and sewer lines, irrigation systems, grounding cables, fibre optic cables, heating cables, protection cables, and communication cables may not be traceable. Typically, sewer lines will be painted and lined up directionally from manhole to manhole where possible. It may not be possible to detect bends in the sewer lines between manholes. If tracer wires have been buried with the utility, they will be used to locate the buried utility where possible. If a buried utility cannot be traced, it will be noted on the USL-1 report. USL-1 is not liable for damage to untraceable utilities
- Public utility locators have maps, plans and as-built diagrams for reference to work from. Private utility locators, for the most part, do not. USL-1 will attempt to locate any Private utilities on a site, using as-built plans provided to them. Building access is mandatory and must be arranged by our client. Any conduits or utilities noted entering or exiting a building will be traced if possible, as well as any other visible utilities observed on site. It is the responsibility of the contractor to provide any and all buried utility information and site contacts that they have. There is no guarantee that USL-1 can find all buried utilities if the property owner does not have records or information regarding their own buried utilities
- USL- 1 cannot be held liable for damage to Private water and/or sewer laterals unless building access is granted, and the utility is locatable
- Thick snow and ice, frozen manhole lids, live traffic, parked cars, construction debris and activities etc, are all factors that can interfere with USL-1's ability to perform Private utility locates. USL-1 cannot guaranty location of all buried utilities when such factors impede the locate process. It is the contractor's responsibility to ensure that the work areas are safe and accessible for locates, prior to USL-1's arrival to site
- USL-1 as a Private utility locator, is not permitted to locate Publicly owned utilities. In some cases, Public utilities may be noted on a sketch, but are FOR REFERENCE ONLY, and under no circumstances shall be used for excavation purposes. It is the contractor's responsibility to verify any Public utilities noted on the USL-1 sketch by referring to the Public utility locate sheets for physical LOCATION AND ACCURACY. USL-1 DOES NOT ASSUME LIABILTY FOR PUBLIC LOCATE INNACCURACIES
- If the proposed work area is on Private property, it does NOT mean that all buried utilities are Private. Regardless of where you are digging, and what the proposed depth of excavation is, it is the law to notify Ontario One Call (or Info-Excavation in Quebec) to obtain Public utility locates
- NCC PROPERTY - assuming the contractor has been issued a Land Access Permit from the NCC, it is typically indicated within the permit that it is the contractor's responsibility to contact NCC for utility locates of their buried utilities

Black & McDonald

Disclaimer

Warning!

The Excavator must have a copy of this locate on the job site during excavation.

Located Area: The Excavator must not work outside the area indicated, by the located area in the diagram, without a further locate completed by **Black & McDonald Limited.**

Locate the Plant: The plant location information provided is the best we have available, but constitutes only an estimate. Depth of underground plant varies and the exact location must be determined by hand digging prior to excavation with mechanical equipment.

Mechanical equipment must not be used within 1.0 meter of the estimated location of the plant.

Valid Documentation: This locate is valid only for the Agency accepting it. Other parties must obtain and accept their respective underground locate from **Ontario 1 Call.**

Excavator Alterations: Under no circumstance shall an Excavator touch or move an underground power cable. Arrangements must be made to have qualified personnel relocate any such cable.

Expose the plant: Once the plant has been located by hand digging, it must be exposed along its length adjacent to or in the immediate vicinity of the proposed excavation. For this purpose, mechanical equipment must not be used within 0.5 meters of the plant.

Digging around the Exposed Plant: When the plant has been exposed, any further excavation within 0.3 meters, must only be done by hand digging and not with mechanical equipment.

Support Requirements: If the underground plant is exposed over a distance of more than 1.25 meters, the Facility Owner must be notified. Underground plant must be supported at all times.

Private Cables: Please be advised that **Black & McDonald Limited** is not responsible for and does not locate private cables

New Cables: Be aware that new cables could be installed at any time after the locate has been completed. It is the Excavator's responsibility to call for new locates if any changes are known or suspected.

Caution: The markings may disappear or be misplaced. Should sketch and markings not coincide, the Excavator must obtain a new locate. This is based on the information given at the time. Any changes to location or nature of work require a new locate. The Excavator must not work outside the indicated located area without a further locate. Privately owned services within the located area have not been marked- check with service/property owner.

Liability: Any person or Excavator who interferes with or damages any underground electrical cable without having obtained a valid locate/clearance from **Black & McDonald Limited**, shall be liable for all cost incurred during the repair of the cable as well as any resulting legal actions.

This locate has been given as accurately as possible, but no locate is guaranteed. Excavators must always dig with extreme caution to prevent the possibility of damaging electrical cables and endangering safety.

Locate is void after 60 days

For remarks contact **Ontario One Call** 1-800-400-2255 or www.on1call.com

ON1CALL
CALL BEFORE YOU DIG

Ont Call #	20192027963
Date Requested	05/17/2019 9:16:47 AM

City of Ottawa Street Light Locate

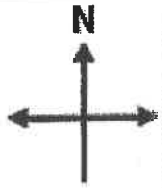
Dispatcher: Lisa Biseillon
Phone: 613-526-1226

Black&McDonald

Company	U S L
Name	JACQUES DESJARDINS
Phone	(613)-226-8750 ext.
FAX	(613)-226-8677 ext.
Site Contact	JEFF FORRESTER
Phone	

Instructions
167, BOTELER ST
CORLOT=U CLEAR ENTIRE PROPERTY AND TO ROAD EDGE ON BOTELER ST. NO_PLAN::613 241

LOCATOR SKETCH



Clear

No City of Ottawa Street Light assets in dig area

—SL— Underground Street Light Cable
Street Light
—OH— Overhead/Aerial Wires
Globe/Decorative Light
Source/Transformer
Hydro Pole

Locator Notes/Comments:

Locate is valid for 60 days. If sketch is different from markings, location or nature of work changes, a new locate must be requested. Hand dig within 1m (3.28ft) on either side of markings. Depth of buried plant varies.

Cette fiche n'est pas valide 60 jours de calendrier apres la reperage. Si les marques ne concordent pas avec celles sur le croquis, un nouveau reperage est requis. Tout changement a l'emplacement ou a la nature du travail necessite un nouveau reperage. Creuser a la main un metre (3.28 pieds) du repere. La profondeur des installation varie d'un endroit a l'autre.

Date Located	05/22/2019
Time of day	
Located by	MIKE LESPERANCE
Signature	

FMW

Ontario One Call TF

City of Ottawa
Street Light Locate

Black&McDonald

NOTICE OF INTENT TO EXCAVATE

Header Code: STANDARD

Request Type: NORMAL

Ticket No: 20192027963

Original Call Date: 05/17/2019 9:16:47 AM
Work To Begin Date: 05/27/2019

Company: U S L
Contact Name: JACQUES DESJARDINS
Contact Phone: (613)-226-8750 ext.
Fax: (613)-226-8677 ext.
Alternate Contact: JEFF FORRESTER

Pager:
Cell:
Alt. Phone:

Place: OTTAWA
Street: 187 BOTELER ST
Nearest Intersecting Street: CUMBERLAND ST
Second Intersecting Street: KING EDWARD AVE

Subdivision: OTTAWA

Additional Dig Information:
CORLOT=U CLEAR ENTIRE PROPERTY AND TO ROAD EDGE ON BOTELER ST. NO_PLAN::613 241

WO/ JOB #: ANYTIME
Type Of Work: CONSTRUCTION

Remarks:

-75.693984 45.435841 NB_SEGMENTS::2 BCOE01 ROGOTT01 OTWATS01 OTWASL01 OTWAWS01 ENOE01 HOT1

CONTRACTOR'S SKETCH: A file provided directly by the excavator, not generated by Ontario One Call:

IMPORTANT INFORMATION: Please read.

Defining "NC" - Non-Compliant
- Non-compliant members have not met their obligations under section 5 of the Ontario Underground Infrastructure Notification Act.ON1Call has notified these members to ensure they are aware of your excavation. In this circumstance, should the member not respond, the excavator should contact the member directly to obtain their locates or request a status. ON1Call will not be provided with a locate status from the member regarding this ticket and therefore, cannot provide further information at this time.For locate status contact information please refer to our website.

You have a valid locate when...
- You have reviewed your locate request information for accuracy. CONTACT Ontario One Call (ON1Call) IMMEDIATELY if changes are needed and obtain a corrected locate request confirmation.
- You have obtained locates or clearances from all ON1Call members listed in this ticket before beginning your dig.

You've met your obligations when...
- In addition to this locate request, you have DIRECTLY contacted all owners of infrastructure who ARE NOT current members of ON1Call (such as owned buried infrastructure on private property), as well as arranged for contract locates for your private lines on your private property - where applicable. For a list of locate status contacts visit www.on1call.com.
- You respect the marks and instructions provided by the locators and dig with care; the marks and locator instructions MUST MATCH.
- You have obtained any necessary permits from the municipality in whichyou are excavating.

What does "Cleared" mean in the "Initial Status" section?
1. The information that you have provided about your dig will not affect that member's underground infrastructure and they have provided you with a
clearance, if anything about your excavation changes, please ensure that you update your ticket immediately.

What are the images under "Map Selection":
1. A drawing created by an excavator directly within Ontario One Call's web ticket tool, this is expected to be an accurate rendition of the dig site, and it is the excavator's responsibility to ensure the location matches the information they provide under the 'Dig Location' section OR;

2. A drawing created by an Ontario One Call agent, this drawing is based on a verbal description by phone of the area by the excavator. Agents may create drawings that are larger than the proposed dig to minimize risk of interpretation. It is the excavator's responsibility to review these map selections for accuracy. Changes can be made by the excavator through the web ticket tool, to learn how visit www.on1call.com/contractors.

3. All drawings dictate which members are notified.

locates

From: Solutions@on1call.com
Sent: Friday, May 17, 2019 9:17 AM
To: locates@usl-1.com
Subject: Request 20192027963
Attachments: MapSelection_17052019_09154211.png; FMW.187_Boteler.png

<https://www.on1call.com/wp-content/themes/ooc/images/ooc-logo-2.png> LOCATE REQUEST CONFIRMATION

TICKET #: 20192027963 REQUEST PRIORITY: STANDARD REQUEST TYPE: REGULAR WORK TO BEGIN DATE: 05/27/2019
Update of Ticket # Project # Transmit date: 05/17/2019 09:16:26 AM

REQUESTOR'S CONTACT INFORMATION
Contractor ID#: 202 Company Phone #: (613) 226-8750
Contact Name: JACQUES DESJARDINS Cell #:
Alternate Contact Name: JEFF FORRESTER Fax #: (613) 226-8677
Company name: U S L Email: locates@usl-1.com
Address: 775 TAYLOR CREEK DR Alternate Contact #:

DIG INFORMATION
Region/County: OTTAWA Type of work: CONSTRUCTION Mark & Fax: NO
Community: Max Depth: 15.00 FT Area is not marked: NO
City: OTTAWA Machine Dig: YES Area is marked: YES
Address: 187, BOTELER ST Hand Dig: NO Site Meet Req.: NO
Directional Drilling: NO Work being done for: FMW
Intersecting Street 1: CUMBERLAND ST Public Property: YES
Intersecting Street 2: KING EDWARD AVE Private Property: YES

DETAILED DESCRIPTION OF WORK REMARKS
CORLOT=U Clear entire property and to road edge on Boteler St.

MEMBERS NOTIFIED: The following owners of underground infrastructure in the area of your excavation site have been notified.

Member name	Station Code	Initial Status
HYDRO OTTAWA (HOT1)	HOT1	Notification sent
PROMARK FOR ENBRIDGE GAS (ENOE01)	ENOE01	Notification sent
CITY OF OTTAWA WATER/SEWER (OTWAWS01)	OTWAWS01	Notification sent
BLACK AND MC DONALD FOR CITY OF OTTAWA STREET LIGHTS (OTWASL01)	OTWASL01	Notification sent
CITY OF OTTAWA TRAFFIC SIGNALS (OTWATS01)	OTWATS01	Notification sent
CLI FOR ROGERS (ROGOTT01)	ROGOTT01	Notification sent
PROMARK FOR BELL CANADA (BCOE01)	BCOE01	Notification sent

MAP SELECTION: Map Selection provided by the excavator through Ontario One Call's map tool or through agent interpretation by phone

Fnw

locates

From: Sigouin, Francois <Francois.Sigouin@ottawa.ca>
Sent: Friday, May 17, 2019 11:42 AM
To: locates@usl-1.com
Subject: 20192027963

20192027963

This Ontario One Ticket is **Clear of Underground Traffic Lights Infrastucture in Proposed Work Area **

"Locates are Valide for 60 Days"

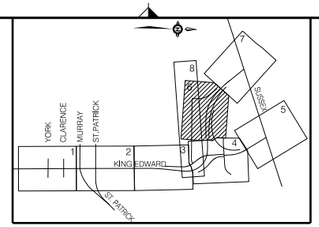
Frank Sigouin
City of Ottawa

Traffic U/G Utilities Investigator
Cell: (613)229-0580

Email: francois.sigouin@ottawa.ca <mailto:francois.sigouin@ottawa.ca>

Appendix F – Drawings

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.



DELCAN

NO.	REVISIONS	BY	DATE
	TENDER ISSUE	MDM	06/05/26
1	ADDENDUM 3	A.G.	06/06/30
2	CONSTRUCTION ISSUE	MDM	06/09/19
5	CHANGE ORDER No. 5	MDM	07/09/07
	AS BUILT	TVI	02/01/11

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage

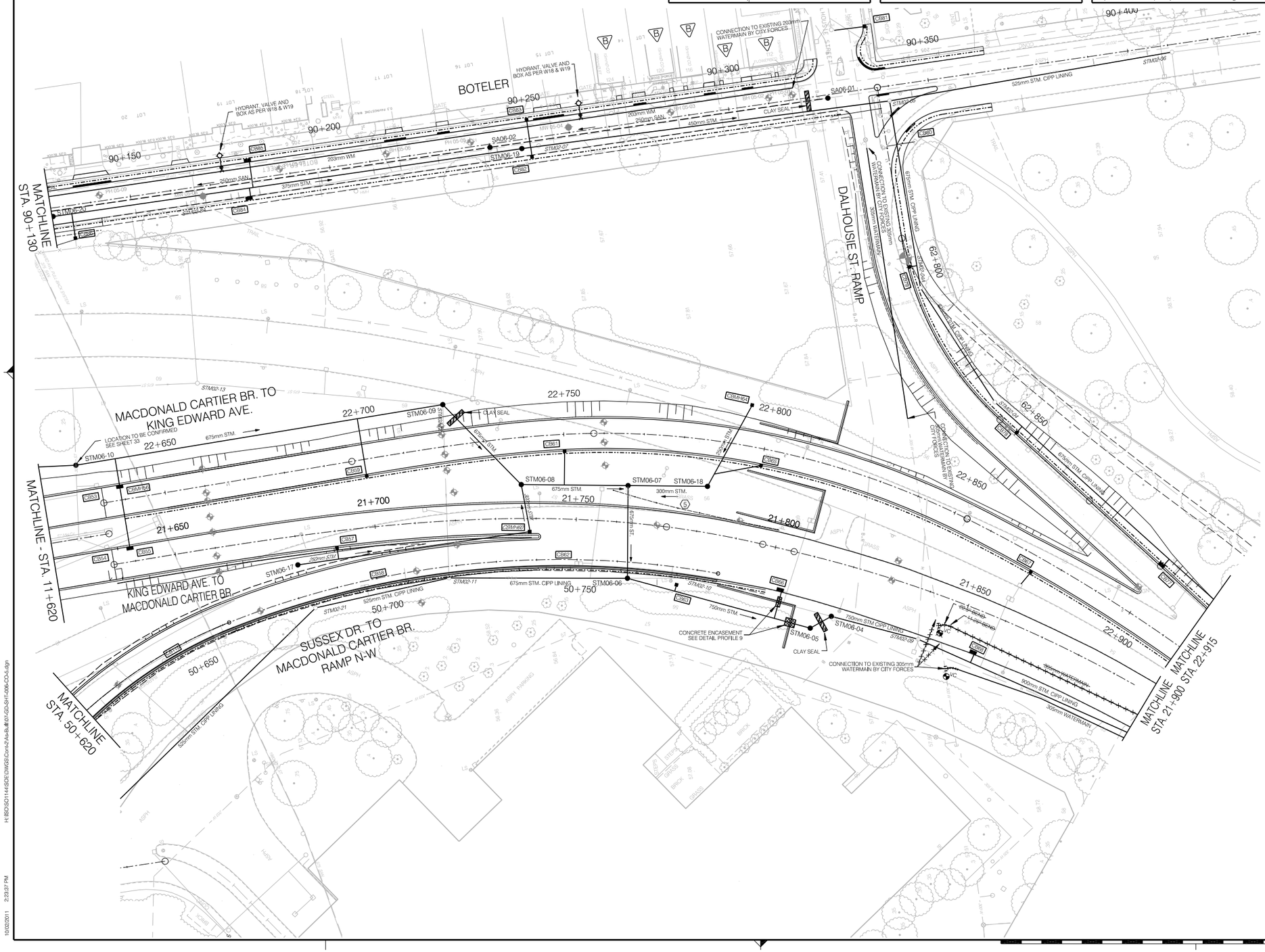
KING EDWARD AVENUE RENEWAL
YORK STREET TO MACDONALD CARTIER BRIDGE \ SUSSEX DRIVE

GRADING & DRAINAGE 6

Ottawa

CONTRACT NO.
ISB05-5270
DWG. NO.
R-ISB05-5270-024
SHEET 24 OF
Date: JANUARY 2006
Scale: 0m 5 10 20

W. NEWELL, P.ENG. Director Infrastructure Services		B. MASON, P.ENG. Manager Construction Services	
Dwn: MDM	Chkd: DAH	Des: MDM	Chkd: DAH



STORM MANHOLES, CATCH BASINS, HEADWALLS AND DITCH INLET DATA						
No.	STATION	OFFSET (m)*	TYPE OF STRUCTURE STD. No.***	FRAME & GRATE STD. No.	ELEVATION	
					TOP OF GRATE**	LOW INVERT
KING EDWARD AVE. TO MACDONALD CARTIER BR.						
1 06-04	21+818.11	13.04 RT.	701.012 C	S24/S25	54.90	51.27
06-05	21+813.68	17.30 RT.	701.012	S24/S25	56.00	51.33
06-06	21+763.99	13.75 RT.	701.012 C	S24/S25	55.80	51.62
02-09	*21+841.09*	*12.14 RT.*	*EXIST.*	S24/S25	EXIST.	*50.36*
02-10	*21+779.63*	*11.92 RT*	*EXIST.*	S24/S25	EXIST.	*51.47*
CB55	21+639.12	3.75 LT.	705.020 A	S19 (2)	59.55	58.02
CB57	21+690.00	3.75 RT.	705.010 A	S22/S23	58.16	56.70
~~CB60 (CBMH60)~~	21+738.47	3.25 RT.	~~705.010 A~~ *701.010*	S19	56.77	~~55.24~~ *55.26*
CB62	*21+751.07*	*10.82 RT.*	*EXIST.*	S19 (2)	55.95	*EXIST.*
CB63	21+777.02	13.91 RT.	705.010 A	S19	55.35	53.82
1 CB66	21+803.51	10.04 Rt.	705.020 C	S19 (2)	54.56	52.73
1 CB68	21+855.49	10.26 Rt.	705.020 C	S19 (2)	53.47	51.64
SUSSEX TO MACDOANALD CARTIER RAMP						
5 06-17	50+840.81	7.99 LT.	701.010	S24/S25	58.15	~~55.68~~ *56.17*
5 *02-21*	*50+683.37*	*3.48 RT.*	*EXIST.*	S24/S25	EXIST.	*52.39*
02-11	*50+717.83*	*2.85 RT.*	*EXIST.*	S24/S25	57.11	*52.07*
CB115	50+642.96	1.27 Rt.	*EXIST.*	S19	56.65	*EXIST.*
CB58	50+696.63	1.08 Rt.	*EXIST.*	S19 (2)	57.70	*EXIST.*
MACDONALD CARTIER BR. TO KING EDWARD AVE.						
1 ~~06-03~~	~~22+854.54~~	~~7.58 RT.~~	~~701.012 C~~	~~S24/S25~~	~~55.02~~	~~51.58~~
06-07	22+766.33	12.90 RT.	701.012 D	S24/S25	57.00	51.79
5 06-08	22+738.30	11.65 RT.	701.011 A****	S24/S25	57.10	52.16
1 06-09	22+721.28	10.39 LT.	701.011 A	S24/S25	58.86	52.33
06-18	22+787.27	11.47 RT.	701.010	S24/S25	56.25	52.57
CBMH56	22+639.14	~~3.25 LT.~~ *3.75 LT.*	701.011 E****	S19 (2)	59.54	53.22
CB59	22+700.00	3.75 RT.	705.010 A	S22/S23	57.87	56.41
CB61	22+750.00	3.75 RT.	705.010 A	S22/S23	56.61	55.08
CBMH64	22+795.15	10.17 LT.	~~705.010 A~~ *701.010*	S19	56.60	55.07
CB65	22+800.00	3.75 RT.	705.010 A	S22/S23	55.36	53.90
CB67	~~22+850.00~~ *22+852.50*	3.75 RT.	705.010 A	S22/S23	54.33	52.87
1 ~~CB69~~	~~22+910.00~~	~~3.75 RT.~~	~~705.020 C~~	~~S22/S23(2)~~	~~53.97~~	~~52.21~~
KING EDWARD AVENUE.						
1 06-10	11+629.28	~~10.11 RT.~~ *18.11 LT.*	701.011 A	S24/S25	60.98	52.76
CB53	*11+633.50*	*11.50 LT.*	705.010 A	S22/S23	59.65	*EXIST.*
CB54	*11+633.50*	*4.00 RT.*	705.010 A	S22/S23	59.65	*EXIST.*
DALHOUSIE STREET RAMP						
02-04	*62+840.81*	*2.26 LT.*	*EXIST.*	S24/S25	EXIST.	*51.88*
02-04A	*62+805.84*	*1.54 LT.*	*EXIST.*	S24/S25	EXIST.	*52.27*
02-05	*62+758.59*	*2.36 LT.*	*EXIST.*	S24/S25	EXIST.	*52.93*
1 CB77	62+898.71	0.00 RT.	705.020 C	S22/S23 (2)	54.00	52.24
CB78	62+850.00	0.00 RT.	705.010 A	S22/S23	55.00	53.54
CB79	62+800.00	0.00 RT.	705.010 A	S22/S23	56.48	55.02
CB80	62+769.50	7.08 LT.	*EXIST.*	S19	56.90	*EXIST.*
BOTELER STREET SEE GRADING AND DRAINAGE 8						

* OFFSETS FOR CURB INLET CATCH BASINS ARE TO THE FACE OF CURB AND ELEVATIONS ARE THE FINISHED GUTTER GRADE AT THE GRATE. REFER TO STD. DWG. S22 FOR DETAIL OF LOCAL DEPRESSION OF ASPHALT IN FRONT OF THE GRATE. OFFSETS FOR BOX MAINTENANCE HOLES ARE TO THE CENTER OF THE BASE SECTION. REFER TO GRADING AND DRAINAGE DETAILS 1-3 FOR DETAILS OF NEW MAINTENANCE HOLES.

** OFFSETS AND ELEVATIONS FOR FLAT GRATE CATCH BASINS ARE AT THE CENTER OF THE GRATE. REFER TO STD. DWG. S2. OFFSETS FOR O.I. (OPSD-705.030 & OPSD-705.040) ARE TO THE CENTER OF THE STRUCTURE; TOP OF GRATE ELEVATIONS ARE TO THE BOTTOM OF THE GRATE SLOPE.

*** EXISTING CORRUGATED STEEL PIPE STRUCTURE TO BE REHABILITATED. SEE GRADING AND DRAINAGE DETAILS 4.

****EXTERNAL DROP CONNECTION

WATERMAIN TABLE			
STATION	OFFSET (m)*	TYPE OF FITTING	TOP OF WM. ELEVATION
KING EDWARD AVE. TO MACDONALD CARTIER BR.			
RELOCATED 21+844.83	7.24 RT.	305x305x305mm TEE.	~~50.00~~
RELOCATED 21+846.17	6.51 RT.	~~305mm -22.5° HORIZONTAL BEND~~	50.00
RELOCATED 21+847.55	6.35 RT.	~~305mm - 11.25° HORIZONTAL BEND~~	50.00
RELOCATED 21+848.55	6.42 RT.	~~305mm - 22.5° VERTICAL BEND~~	50.00
RELOCATED 21+851.95	6.64 RT.	305mm - 22.5° VERTICAL BEND	51.40
RELOCATED ~~21+882.63~~	7.06 RT.	VERTICAL DEFLECTION	~~50.93~~
MACDONALD CARTIER BR TO DALHOUSIE RAMP.			
62+769.10	5.0 RT.	305mm COUPLING	±57.70
62+810.00	7.57 RT.	1.25° VERT. DEFLECTION	53.82
62+830.61	16.80 RT.	305mm COUPLING	±53.82

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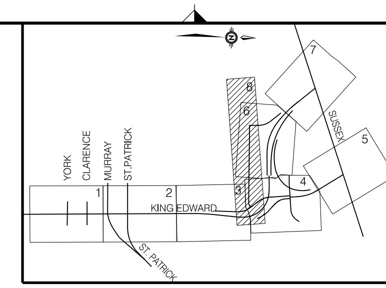
10/02/2011 2:23:37 PM

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.



DELCAN

NO.	REVISIONS	BY	DATE
	TENDER ISSUE	MDM	06/05/26
1	ADDENDUM 3	A.G.	06/06/30
2	CONSTRUCTION ISSUE	MDM	06/09/19
	AS BUILT	TVI	02/01/11

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage

KING EDWARD AVENUE RENEWAL
YORK STREET
TO
MACDONALD CARTIER BRIDGE \ SUSSEX DRIVE

GRADING & DRAINAGE 8
BOTELER STREET

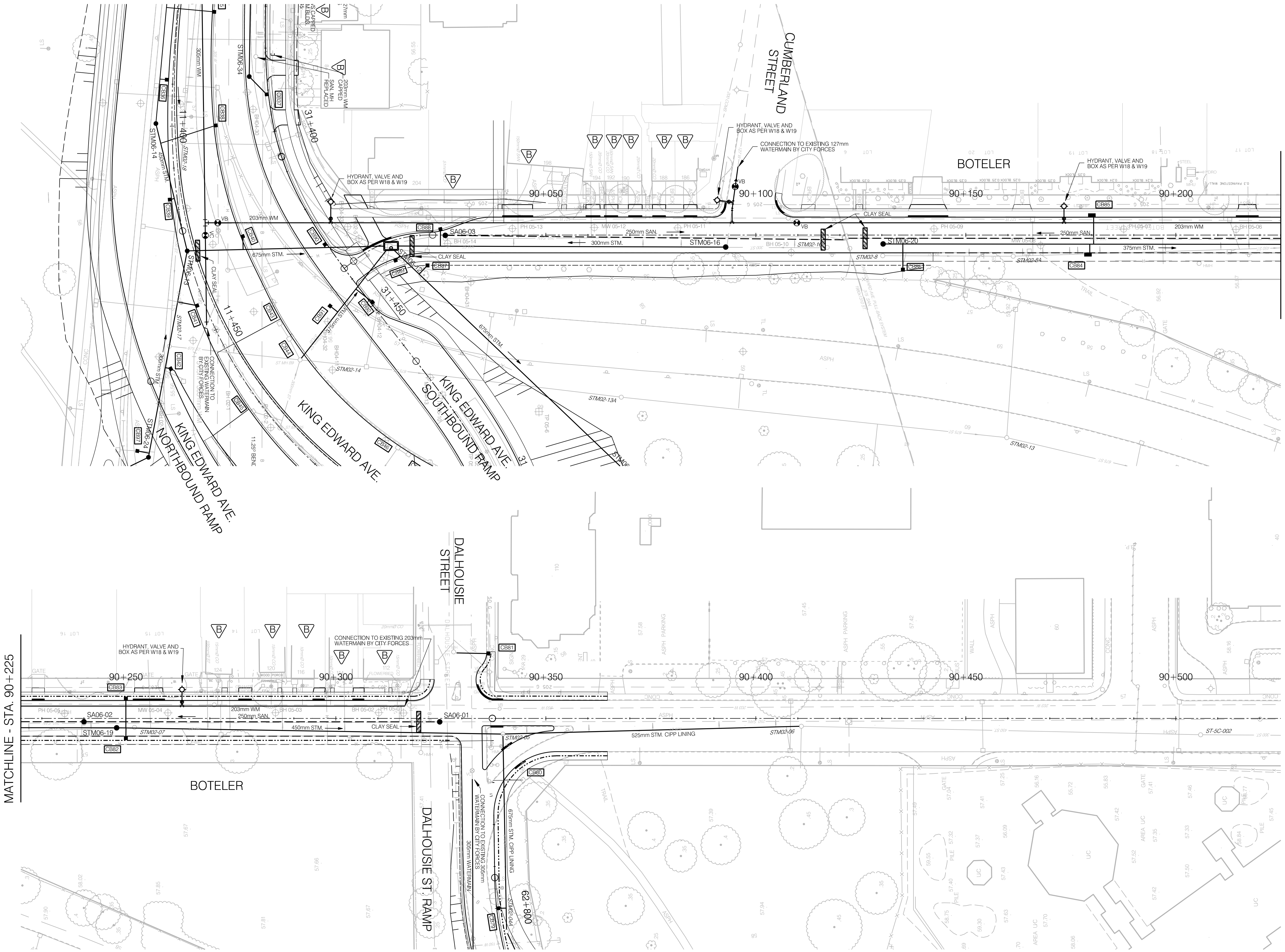
W. NEWELL, P.ENG.
Director Infrastructure Services

B. MASON, P.ENG.
Manager Construction Services

Dwn: MDM Chkd: DAH Des: MDM Chkd: DAH

Ottawa

CONTRACT NO.
ISB05-5270
DWG. NO.
R-ISB05-5270-026
SHEET 26 OF
Date: JANUARY 2006
Scale: 0m 5 10 20



STORM MANHOLES, CATCH BASINS, HEADWALLS AND DITCH INLET DATA							
	No.	STATION	OFFSET (m)*	TYPE OF STRUCTURE STD. No.***	FRAME & GRATE STD. No.	ELEVATION	
						TOP OF GRATE**	LOW INVERT
	06-12	90+012.61	1.10 RT	M-7	S24/S25	55.68	53.39
	06-16	90+092.82	2.87 RT.	701.010	S24/S25	57.35	54.97
	06-20	90+130.30	2.12 RT.	701.010	S24/S25	56.83	54.60
	06-19	90+247.80	2.42 RT.	701.010	S24/S25	56.67	53.76
	02-05	*90+339.69*	*3.83 RT.*	*EXIST.*	S24/S25	57.22	*EXIST.*
	02-06	*90+410.84*	*1.87 RT.*	*EXIST.*	S24/S25	56.79	*EXIST.*
	CB81	90+335.91	15.47 LT.	705.010 A	S22/S23	57.00	55.54
	CB82	90+250.00	4.25 RT.	705.010 A	S22/S23	56.64	55.18
	CB83	90+250.00	4.25 LT.	705.010 A	S22/S23	56.64	55.18
1	CB84	90+179.07	4.25 RT.	705.020 C	S22/S23(2)	56.36	54.60
1	CB85	90+180.00	4.25 LT.	705.020 C	S22/S23(2)	56.36	54.60
	CB86	90+135.01	7.80 Rt.	705.010 A	S19	56.61	55.08
	CB88	90+025.00	0.98 LT	705.010 A	S22/S23	55.85	54.39
	CB87	90+021.64	7.25 RT.	705.010 A	S19	55.62	54.09
	CB89	90+012.47	4.25 RT.	705.010 A	S22/S23	55.62	54.16

* OFFSETS FOR CURB INLET CATCH BASINS ARE TO THE FACE OF CURB AND ELEVATIONS ARE THE FINISHED GUTTER GRADE AT THE GRATE. REFER TO STD. DWG. S22 FOR DETAIL OF LOCAL DEPRESSION OF ASPHALT IN FRONT OF THE GRATE. OFFSETS FOR BOX MAINTENANCE HOLES ARE TO THE CENTER OF THE BASE SECTION. REFER TO GRADING AND DRAINAGE DETAILS 1-3 FOR DETAILS OF NEW MAINTENANCE HOLES.

** OFFSETS AND ELEVATIONS FOR FLAT GRATE CATCH BASINS ARE AT THE CENTER OF THE GRATE. REFER TO STD. DWG. S2. OFFSETS FOR D.I. (OPSD-705.030 & OPSD-705.040) ARE TO THE CENTER OF THE STRUCTURE; TOP OF GRATE ELEVATIONS ARE TO THE BOTTOM OF THE GRATE SLOPE.

*** EXISTING CORRUGATED STEEL PIPE STRUCTURE TO BE REHABILITATED. SEE GRADING AND DRAINAGE DETAILS 4.

SANITARY MANHOLES DATA						
No.	STATION	OFFSET (m)*	TYPE OF STRUCTURE STD. No.**	FRAME & GRATE STD. No.	ELEVATION	
					TOP OF GRATE**	LOW INVERT
06-01	90+324.73	0.82 RT.	701.010	S24/S25	57.04	53.65
06-02	90+223.27	0.72 RT.	701.010	S24/S25	57.05	52.99
06-03	90+026.05	0.08 RT.	701.010	S24/S25	55.88	54.19
EXIST.	*90+116.90*	*0.36 RT.*	*EXIST.*	S24/S25	*57.10*	*EXIST.*
EXIST.	*90+121.25*	*0.52 RT.*	*EXIST.*	S24/S25	*57.02*	*EXIST.*

* OFFSETS FOR BOX MAINTENANCE HOLES ARE TO THE CENTER OF THE BASE SECTION. REFER TO GRADING AND DRAINAGE DETAILS 1-3 FOR DETAILS OF NEW MAINTENANCE HOLES.

** EXISTING CORRUGATED STEEL PIPE STRUCTURE TO BE REHABILITATED. SEE GRADING AND DRAINAGE DETAILS 4.

WATERMAIN TABLE			
STATION	OFFSET (m)*	TYPE OF FITTING	TOP OF WM. ELEVATION
BOTELER			
89+980.54	28.91 LT.	305x203x305mm TEE.	55.19
89+982.90	27.07 LT.	203mm VALVE AND VALVE BOX	55.12
90+003.80	10.55 LT.	203x152x203mm HYDRANT TEE	53.69
90+005.76	14.69 LT.	HYDRANT	.
90+094.34	2.92 LT.	203x203x203mm TEE.	55.00
90+109.75	2.92 LT.	203mm VALVE AND VALVE BOX	54.83
90+173.37	2.92 LT.	203x152x203mm HYDRANT TEE	54.05
90+173.37	6.86 LT.	HYDRANT	.
90+263.37	2.92 LT.	203x152x203mm HYDRANT TEE	54.38
90+263.37	6.87 LT.	HYDRANT	
90+316.47	2.92 LT.	~~203mm VALVE AND VALVE BOX~~ *203mm CONNECTION*	±54.62
~~90+332.42~~	~~2.92 LT.~~	~~203mm VALVE AND 305mm TAPPING SLEEVE~~	~~±54.70~~

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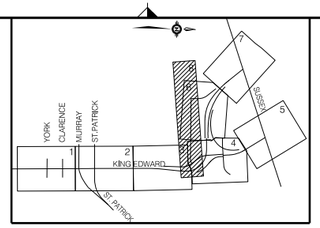


DELCAN

NO.	REVISIONS	BY	DATE
	TENDER ISSUE	MDM	06/05/26
2	CONSTRUCTION ISSUE	MDM	06/09/19
	AS BUILT	TVI	02/01/11

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage

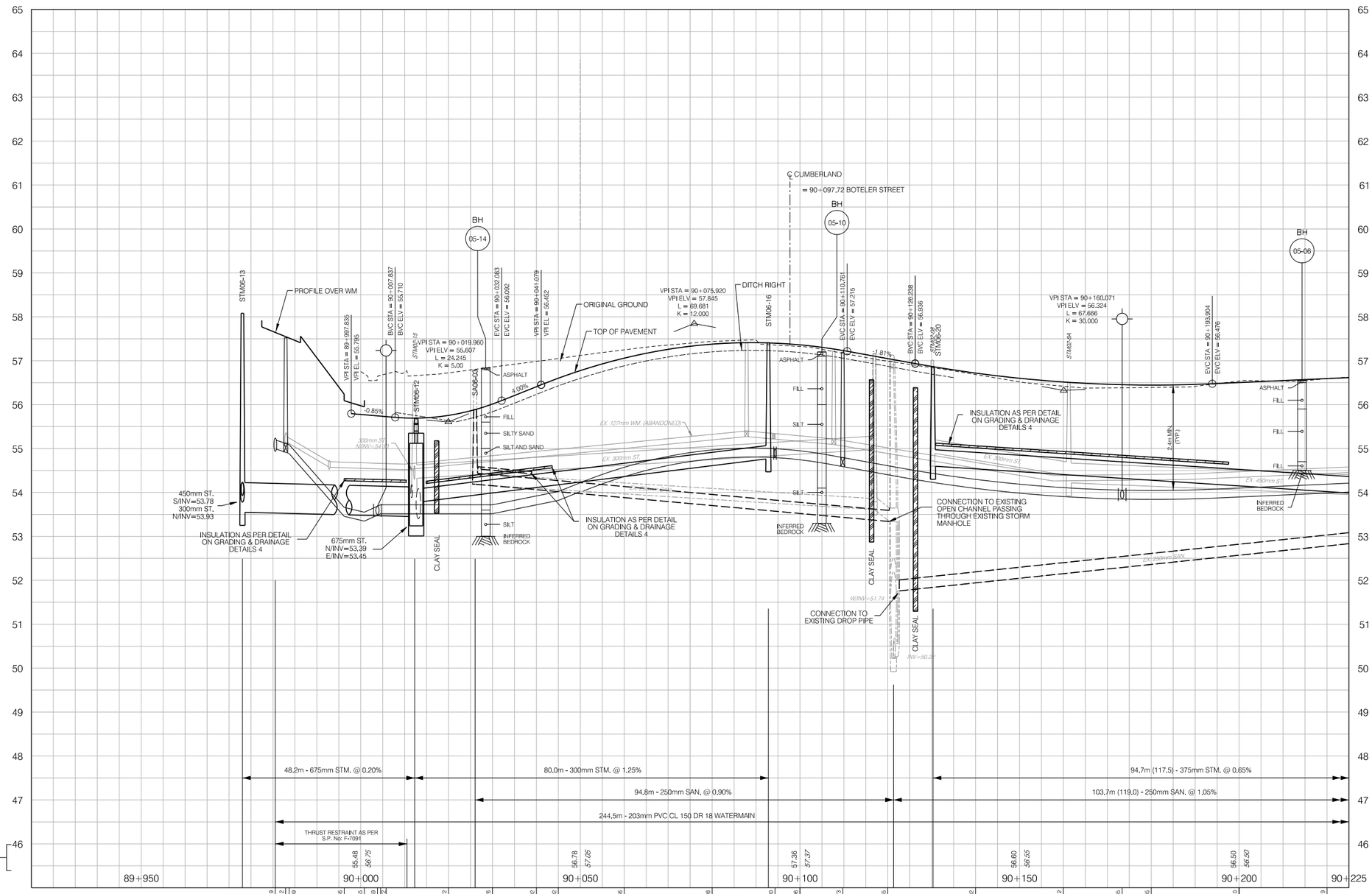
KING EDWARD AVENUE RENEWAL
YORK STREET
TO
MACDONALD CARTIER BRIDGE \ SUSSEX DRIVE

PROFILE 16
BOTELER STREET 1
STA. 89+997.835 TO STA. 90+250

Ottawa

CONTRACT NO.
ISB05-5270
DWG. NO.
R-ISB05-5270-042
SHEET 42 OF
Date: JANUARY 2006
Scale: HORIZONTAL 0m 5 10 20
VERTICAL 0m 1 2

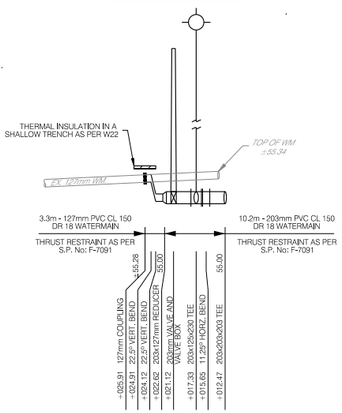
W. NEWELL, P.ENG. Director Infrastructure Services		B. MASON, P.ENG. Manager Construction Services	
Dwn: MDM	Chkd: DAH	Des: MDM	Chkd: DAH



STORM SEWER & CATCH BASIN LEAD DATA					
LOCATION No. TO No.	DIA. SIZE (mm)	CLASS OF PIPE	LENGTH (m)	INVERT ELEVATION DOWNSTREAM	INVERT ELEVATION UPSTREAM
06-12 TO 06-16	300	SDR 35	80.0	53.77	54.77
06-19 TO 06-20	375	SDR 35	117.5	53.84	54.60
MAIN TO CB 84	250	SDR 35	2.5	.	54.60
MAIN TO CB 85	250	SDR 35	6.9	.	54.60
MAIN TO CB 86	250	SDR 35	6.1	.	55.08
MAIN TO CB 87	200	SDR 35	2.9	.	54.09
MAIN TO CB 88	200	SDR 35	4.0	.	54.39
MAIN TO CB 89	200	SDR 35	1.5	.	54.16

SANITARY SEWER DATA					
LOCATION No. TO No.	DIA. SIZE (mm)	CLASS OF PIPE	LENGTH (m)	INVERT ELEVATION DOWNSTREAM	INVERT ELEVATION UPSTREAM
EXIST. TO 06-03	250	SDR 35	94.8	53.34	54.19
EXIST. TO 06-02	250	SDR 35	119.0	51.74	52.99

CUMBERLAND WM.



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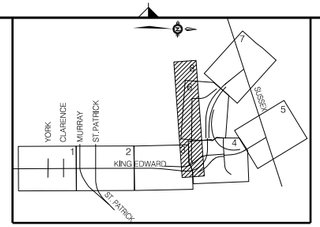

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NO.	REVISIONS	BY	DATE
	TENDER ISSUE	MDM	06/05/26
2	CONSTRUCTION ISSUE	MDM	06/09/19
	AS BUILT	TVI	02/01/11

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage

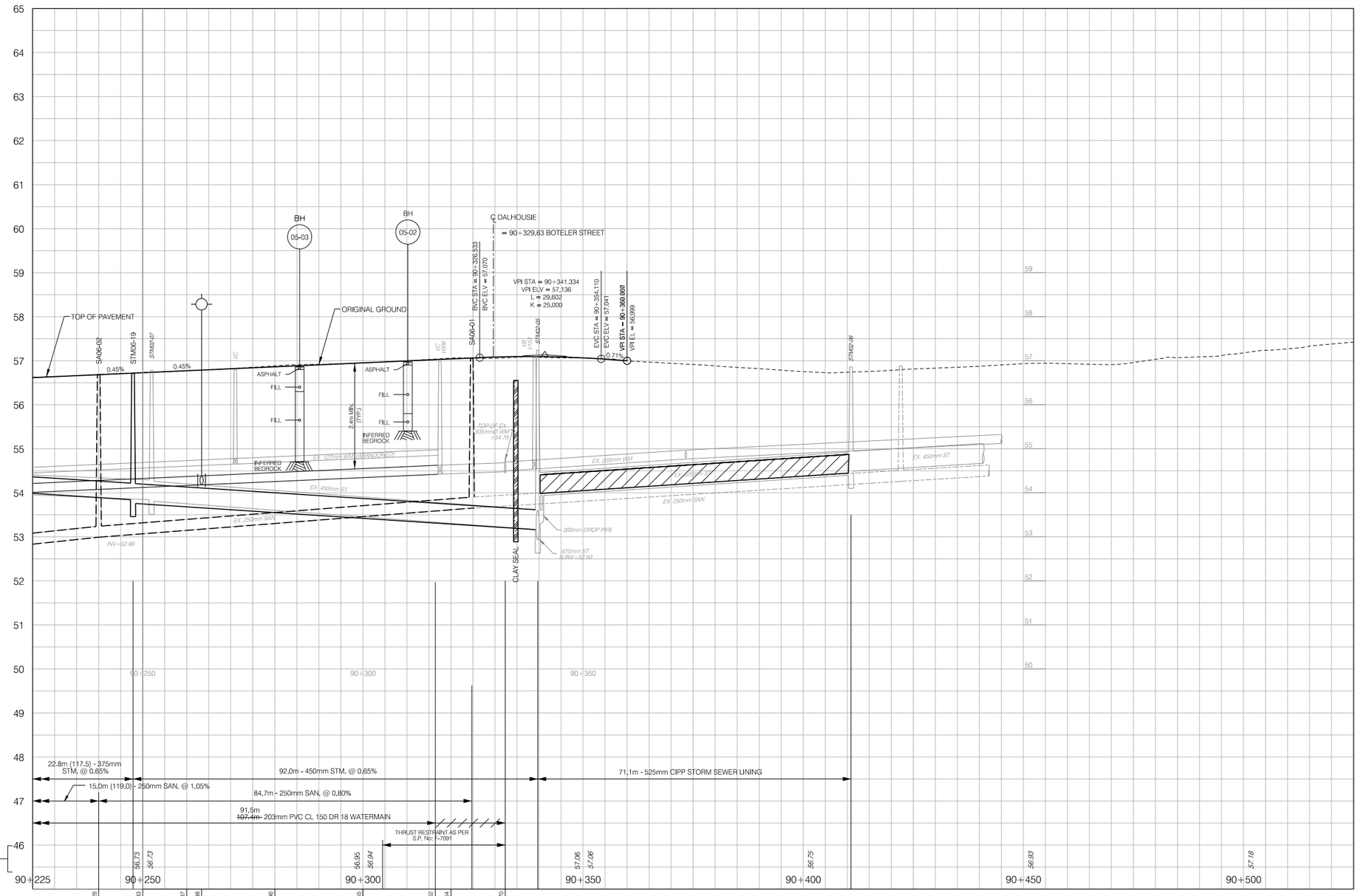
KING EDWARD AVENUE RENEWAL
YORK STREET
TO
MACDONALD CARTIER BRIDGE \ SUSSEX DRIVE

PROFILE 17
BOTELER STREET 2
STA. 90+250 TO LIMIT OF CONTRACT

Ottawa

CONTRACT NO.
ISB05-5270
DWG. NO.
R-ISB05-5270-043
SHEET 43 OF
Date: JANUARY 2006
Scale: HORIZONTAL 0m 5 10 20
0m 1 2
VERTICAL

W. NEWELL, P.ENG. Director Infrastructure Services		B. MASON, P.ENG. Manager Construction Services	
Dwn: MDM	Chkd: DAH	Des: MDM	Chkd: DAH



STORM SEWER & CATCH BASIN LEAD DATA					
LOCATION No. TO No.	DIA. SIZE (mm)	CLASS OF PIPE	LENGTH (m)	INVERT ELEVATION DOWNSTREAM	UPSTREAM
02-05 TO 02-06	*525*	CIPP	*71.1*	*53.93*	*54.40*
02-05 TO 06-19	450	SDR 35	92.0	53.16	53.76
MAIN TO CB 81	200	SDR 35	7.6	.	55.54
MAIN TO CB 82	200	SDR 35	2.4	.	55.18
MAIN TO CB 83	200	SDR 35	6.9	.	55.18

SANITARY SEWER DATA					
LOCATION No. TO No.	DIA. SIZE (mm)	CLASS OF PIPE	LENGTH (m)	INVERT ELEVATION DOWNSTREAM	UPSTREAM
06-02 TO 06-01	250	SDR 35	84.7	52.99	53.65

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C-13-05

Metres

RAMP FROM MACDONALD CARTIER BRIDGE

MACDONALD CARTIER BRIDGE APPROACH

BOTELER STREET

DALHOUSIE STREET

C-13-07

C-14-03

REVISIONS / RÉVISIONS	DATE	BY
BELL - BEL06047 -AUG 20061 CONDUIT ADDED TO MacDONALD CARTIER RAMP	JULY 2010	
13559 - SUSSEX (MAY 2005) SERVICES ADDED TO 199 SUSSEX DR.	DEC 2011	
HYDRO,BELL,ENBRIDGE,ROGERS, CITY SEWER, WATER, TRAFFIC, SL COMPILED/DIGITIZED FROM UTILITY/CITY DATA	DEC 2014	

LEGEND

Poles: Rogers, Bell, Hydro, Hydro One, Traffic, Utility	
Poles w/ Light Std.: Bell, Hydro, Hydro-Bell, Traffic, Utility	
Manholes-City: Sanitary,Storm,Water, Catchbasin, Generic	
Manholes-Utility: Bell,Hydro,Traffic,Allstream, Atrla, PWGSC, Group Telecom, Rogers, Street Lighting, OC Transpo	
Catch Basins: Heavy Duty, Standard, Curb Inlet, CI for CBMH Ditch Inlet, Rear Yard, Wing Wall	
Pedestals: Allstream, Atrla, Bell, Hydro, Gas, Group Telecom, Rogers, Telus, Videotron	A H B H R T V
Hand Holes: Allstream, Atrla, Group Telecom, Hydro, Hydro One Traffic, Street Lighting, OC Transpo	
Bell: Bell Dip, Guy Wire, Bell Panel, Telephone Booth	BD
Gas: Reducer, Meter, Valve, Regulator	
Hydro: Thermocouple, Transformer, Tower	
OC Transpo: Bus Shelter-No Power, Energized, Isolated	BUS BUS BUS
Rogers: Power Supply, Panel, Vault, Amplifier	
Street Lighting: Light Standard, Disconnect	SDR
Streetscape: Decorative Light, Planter Box	
Traffic: Connect Box, Disconnect Box, Ground Rod	TCB TDB
Water : Reducer, Fire Hydrant, Water Valve, Meter, Wall Hydrant	
Pipe, Duct, Conduit, Lateral	
Culvert	
Abandoned	
Capped	
Buried Cable	
Property Line	

CAUTION/ATTENTION

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100 Constellation Cres., 6th Floor East / 6ème Étage Est, Ottawa, ON K2G 6J8

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COMITÉ DE COORDINATION DES SERVICES PUBLICS D'OTT
ENREGISTREMENT CENTRAL

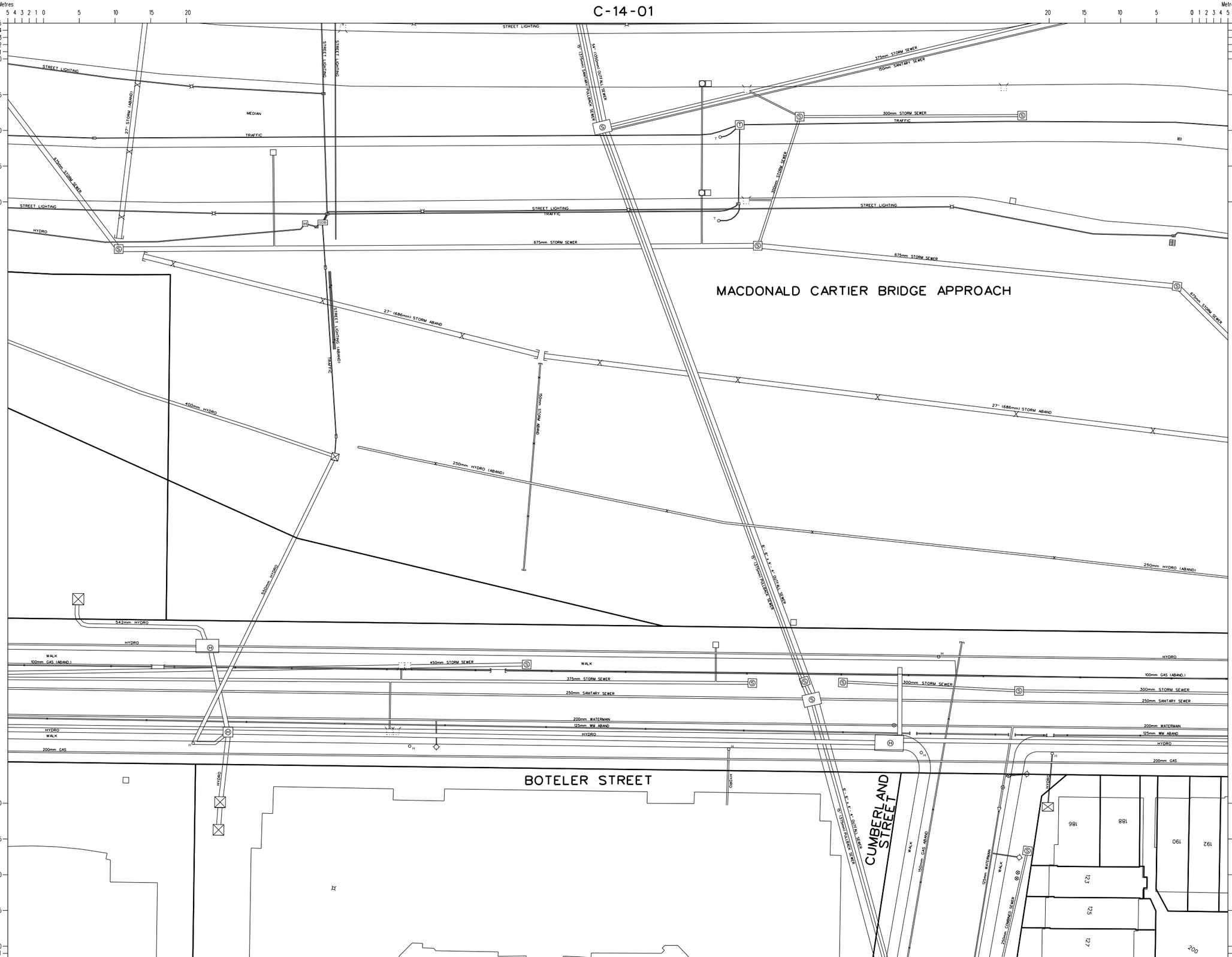
UTILITY COORDINATING COMMITTEE UCC Ottawa CCSP COMITÉ DE COORDINATION DES SERVICES PUBLICS

N. SCHEPERS, P.Eng.
DCM-ISCS

W. NEWELL, P. Eng.
DIRECTOR, INFRASTRUCTURE SERVICES

C-14-01

Metres 5 4 3 2 1 0 5 10 15 20



C-13-08

C-14-04

REVISIONS / RÉVISIONS	DATE	BY
AERIAL SURVEY, 5416 - 2002 BOTELER, CUMBERLAND TO DALHOUSIE	JAN 2006	
HYDRO,BELL,ENBRIDGE,ROGERS, CITY SEWER, WATER, TRAFFIC, SL COMPILED/DIGITIZED FROM UTILITY/CITY DATA	DEC 2014	

LEGEND

- Poles: Rogers, Bell, Hydro, Hydro One, Traffic, Utility
- Poles w/ Light Std.: Bell, Hydro, Hydro-Bell, Traffic, Utility
- Manholes-City: Sanitary,Storm,Water, Catchbasin, Generic
- Manholes-Utility: Bell,Hydro,Traffic,Allstream, Atrla, PWGSC, Group Telecom, Rogers, Street Lighting, OC Transpo
- Catch Basins: Heavy Duty, Standard, Curb Inlet, CI for CBMH, Ditch Inlet, Rear Yard, Wing Wall
- Pedestals: Allstream, Atrla, Bell, Hydro, Gas, Group Telecom, Rogers, Telus, Videotron
- Hand Holes: Allstream, Atrla, Group Telecom, Hydro, Hydro One Traffic, Street Lighting, OC Transpo
- Bell: Bell Dip, Guy Wire, Bell Panel, Telephone Booth
- Gas: Reducer, Meter, Valve, Regulator
- Hydro: Thermocouple, Transformer, Tower
- OC Transpo: Bus Shelter-No Power, Energized, Isolated
- Rogers: Power Supply, Panel, Vault, Amplifier
- Street Lighting: Light Standard, Disconnect
- Streetscape: Decorative Light, Planter Box
- Traffic: Connect Box, Disconnect Box, Ground Rod
- Water : Reducer, Fire Hydrant, Water Valve, Meter, Wall Hydrant
- Pipe, Duct, Conduit, Lateral
- Culvert
- Abandoned
- Capped
- Buried Cable
- Property Line

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N. SCHEPERS, P.Eng.
DCM, ISCS

W. NEWELL, P. Eng.
DIRECTOR, INFRASTRUCTURE SERVICES

C-14-02

C-14-03

C-14-05

KING EDWARD AVENUE

BOTELER STREET

REVISIONS / RÉVISIONS	DATE	BY
BELL - BEL05004 (JULY 2007) BELL CONDUIT ADDED TO KING EDWARD	JUNE 2008	
13297 - KING EDWARD (FEB 2011) SEWER, WATER, ROAD AND UTILITY REVISED	SEPT 2012	
HYDRO,BELL,ENBRIDGE,ROGERS, CITY SEWER, WATER, TRAFFIC, SL COMPILED/DIGITIZED FROM UTILITY/CITY DATA	DEC 2014	

LEGEND

Poles: Rogers, Bell, Hydro, Hydro One, Traffic, Utility	R HB B H H1
Poles w/ Light Std.: Bell, Hydro, Hydro-Bell, Traffic, Utility	B H HB
Manholes-City: Sanitary,Storm,Water, Catchbasin, Generic	
Manholes-Utility: Bell,Hydro,Traffic,Allstream, Atria, PWGSC, Group Telecom, Rogers, Street Lighting, OC Transpo	B H A TH E1
Catch Basins: Heavy Duty, Standard, Curb Inlet, CI for CBMH Ditch Inlet, Rear Yard, Wing Wall	
Pedestals: Allstream, Atria, Bell, Hydro, Gas, Group Telecom, Rogers, Telus, Videotron	A AI B H R T V
Hand Holes: Allstream, Atria, Group Telecom, Hydro, Hydro One Traffic, Street Lighting, OC Transpo	B B B B B
Bell: Bell Dip, Guy Wire, Bell Panel, Telephone Booth	BD
Gas: Reducer, Meter, Valve, Regulator	
Hydro: Thermocouple, Transformer, Tower	
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Rogers: Power Supply, Panel, Vault, Amplifier	PS
Street Lighting: Light Standard, Disconnect	SDH
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ENREGISTREMENT CENTRAL

UCC Ottawa CCSP

N. SCHEPERS, P.Eng.
DOM (EC)

W. NEWELL, P. Eng.
DIRECTOR, INFRASTRUCTURE SERVICES

Appendix G – Checklist

GENERAL CONTENT		RESPONSE
☐	Executive Summary (for larger reports only).	Not included
☒	Date and revision number of the report.	Date of report provided
☒	Location map and plan showing municipal address, boundary, and layout of proposed development.	Appendix A – Fig A1
☒	Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Section 1 of report
☒	Summary of Pre-consultation Meetings with City and other approval agencies.	In Appendix E
☐	Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	No Master Servicing Studies.
☒	Statement of objectives and servicing criteria.	Section 1 of report
☒	Identification of existing and proposed infrastructure available in the immediate area.	Section 2 of report
☐	Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	Not applicable
☐	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Not applicable
☐	Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	Not applicable
☐	Proposed phasing of the development, if applicable.	Not applicable
☐	Reference to geotechnical studies and recommendations concerning servicing.	Not applicable
☒	All preliminary and formal site plan submissions should have the following information: Metric scale North arrow (including construction North) Key plan name and contact information of applicant and property owner Property limits including bearings and dimensions Existing and proposed structures and parking areas Easements, road widening and rights-of-way Adjacent street names	Functional Report, Civil and Architectural Plans provided all this information.
DEVELOPMENT SERVICING REPORT: WATER		**RESPONSE**
☐	Confirm consistency with Master Servicing Study, if available Availability of public infrastructure to service proposed development Identification of system constraints	Not applicable
☒	Identify boundary conditions	Section 4.3
☒	Confirmation of adequate domestic supply and pressure	Section 4.3
☒	Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Section 4.1
☒	Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Section 4.3 & Table B-3 Appendix B
☐	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design	Not applicable
☒	Address reliability requirements such as appropriate location of shut-off valves Check on the necessity of a pressure zone boundary modification.	Section 4.3
☒	Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range	Section 4.2, 4.3. Table B-3, Table B-2 in Appendix B
☒	Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Section 4

☐	Description of off-site required feeder mains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	Not applicable
☒	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Table B-1 Appendix B
☐	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Not applicable
DEVELOPMENT SERVICING REPORT: WASTEWATER		**RESPONSE**
☒	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Section 5
☐	Confirm consistency with Master Servicing Study and/or justifications for deviations.	Not applicable
☒	Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	Section 5
☒	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 5
☐	Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Not applicable
☒	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Table C-1 in Appendix C
☒	Description of proposed sewer network including sewers, pumping stations, and forcemains.	Section 5
☐	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	Not applicable
☐	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	Not applicable
☐	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	Not applicable
☐	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	Not applicable
☐	Special considerations such as contamination, corrosive environment etc.	Not applicable
DEVELOPMENT SERVICING REPORT: STORMWATER CHECKLIST		**RESPONSE**
☒	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 6
☐	Analysis of available capacity in existing public infrastructure.	Not applicable
☒	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Civil Plan #C400 and C500.
☒	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Section 6
☐	Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Not Applicable
☒	Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Section 6
☐	Set-back from private sewage disposal systems. Watercourse and hazard lands setbacks.	Not Applicable
☒	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	Appendix E
☐	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	Not Applicable
☒	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Section 6 & Appendix D

☐	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	Not Applicable
☒	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Section 6.2 and 6.4 and Appendix D
☐	Any proposed diversion of drainage catchment areas from one outlet to another.	Not Applicable
☒	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Section 6.4
☐	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	Not Applicable
☐	Identification of potential impacts to receiving watercourses Identification of municipal drains and related approval requirements.	Not Applicable
☒	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Section 6.4
☒	100-year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Civil drawings C200, C300 and C500
☐	Inclusion of hydraulic analysis including hydraulic grade line elevations.	Not Applicable
☒	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 7
☐	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	Not Applicable – No requirements from Conservation Authority
☐	Identification of fill constraints related to floodplain and geotechnical investigation.	See geotechnical report
☒	The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:	Appendix E
☐	Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in theAct.	Not Applicable
☐	Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	Not Applicable
☐	Changes to Municipal Drains.	Not Applicable
☐	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	Not Applicable
CONCLUSION CHECKLIST		**RESPONSE**
☒	Clearly stated conclusions and recommendations	Section 8
☒	Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	Appendix E
☒	All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario	Signed and stamped