PROPOSED

TWO STOREY COMMERCIAL WAREHOUSE AND OFFICE

BUILDING SITE

PART OF LOT 18

CONCESSION 1 (RIDEAU FRONT)

GEOGRAPHIC TOWNSHIP OF NEPEAN

96 BILL LEATHEM DRIVE

CITY OF OTTAWA

STORM DRAINAGE REPORT

REPORT R-822-125 (REV. 1)

MARCH 2024

T.L. MAK ENGINEERING CONSULTANTS LTD.

SEPTEMBER 2023

REFERENCE FILE NUMBER 822-125

Introduction

The site under consideration is currently a vacant commercial lot that fronts on Bill Leathem Drive. Development of this site will consist of constructing a two-storey warehouse/office building to be services by a municipal watermain, sanitary sewer main and storm sewer main along Bill Leathem Drive. The said development property is located on the south side of Bill Leathem Drive, west of Leikin Drive and east of Longfields Drive.

Municipal address of this property is referenced as 96 Bill Leathem Drive. The total area size of the commercial lot proposed for development is approximately 4,047.01 m^2. Stormwater outlet for this site is the existing 1200mm dia. storm sewer on Bill Leathem Drive located in front of this property. The existing lot is relatively flat with gravel material stockpiles along the east portion of the site. General slope of the land is from northwest to southeast.

For this proposed commercial development, the City of Ottawa requires that the allowable post-development runoff release rates shall not exceed the 5 year pre-development conditions. At this site, the allowable pre-development runoff coefficient established by the City of Ottawa is C = 0.24. If the post-development coefficient of runoff exceeds the pre-development value, then on-site stormwater management (SWM) control measures will be required.

This report will address and detail the grading, drainage, and stormwater management control measures required to develop this property. The post-development runoff coefficient for this site is estimated at C = 0.85 which exceeds the City's allowable pre-development runoff coefficient of C = 0.24. Therefore, stormwater management is required for this development site.

The stormwater management calculations that follow will detail the extent of on-site SWM control to be implemented and the storage volume required on-site to attain the appropriate runoff release that will conform to the City's established drainage criteria.

Site Data

1. Development Property Area

Post-Development Site Area Characteristics

Development Lot Area	= 4,047.01 m^2
Roof Surface Area	= 1,349.52 m^2
Asphalt Area	= 2,166.22 m^2
Concrete Area	= 239.08 m^2
Grass Area	= 292.19 m^2

$$C = \frac{(1{,}349.52 \times 0.9) + (2{,}166.22 \times 0.9) + (239.08 \times 0.9) + (292.19 \times 0.2)}{4{,}047.01}$$

$$C = \frac{3{,}437.776}{4{,}047.01}$$

$$C = 0.8495$$

Say "C" $= 0.85$

Therefore, the average post-development "C" for this site is 0.85.

2. <u>Controlled Area Data (NODE No. 1 to NODE No. 10)</u>

Roof Surface Area	= 1,349.52 m^2
Asphalt Area	= 2,082.32 m^2
Concrete Area	= 212.30 m^2
Grass Area	= 50.82 m^2
Total Storm-water Controlled Area	= 3,694.96 m^2

$$C = \frac{(1{,}349.52 \times 0.9) + (212.30 \times 0.9) + (50.82 \times 0.2) + (2{,}082.32 \times 0.9)}{3{,}694.96}$$

$$C = \frac{3{,}289.89}{3{,}694.96}$$

$$C = 0.8904$$

Say "C" $= 0.89$

Therefore, the post-development "C" for the controlled storm-water drainage area is 0.89.

3. <u>Uncontrolled Area Data (NODE No. 11 and NODE No. 12)</u>

Grass Area	= 241.37 m^2
Concrete Area	= 26.78 m^2
Asphalt Area	= 83.90 m^2
Total Storm-water Uncontrolled Area	= 352.05 m^2

$$C_5 = \frac{(83.90 \times 0.9) + (26.78 \times 0.9) + (241.37 \times 0.2)}{352.05}$$

$$C_5 = \frac{147.886}{352.05}$$

$$C_5 = 0.420$$

Say "C_5" $= 0.42$

Therefore, the post-development "C_5" for the uncontrolled stormwater drainage area of the site is $C_5 = 0.42$.

$$C_{100} = \frac{(83.90 \times 1.0) + (26.78 \times 1.0) + (241.37 \times 0.2 \times 1.25)}{352.05}$$

$$C_{100} = \frac{171.023}{352.05}$$

$$C_{100} = 0.486$$

Say "C_{100}" $= 0.49$

Therefore, the post-development "C_{100}" for the uncontrolled stormwater drainage area of the site is $C_{100} = 0.49$.

- Tributary Area consisting of approximately 352.05 m^2 will be outletting off-site uncontrolled from the warehouse/office building site.

- The SWM Area to be controlled is 3,694.96 m^2. Refer to the attached Figure 1 entitled "Drainage Area Plan" in Appendix "A" for details.

- The site SWM storage area excluding the office building rooftop area shall be controlled by an ICD in CB/MH#1 is 3,694.96 m^2 – 1,321.40 m^2 = 2,373.56 m^2 or 0.2374 ha.

The ICD type recommended is Hydrovex Model No. 100-VHV-1 or equivalent. See Appendix "B" for details.

Pre-Development Flow Estimation

MAXIMUM ALLOWABLE OFF-SITE FLOW

<u>5-Year Storm Event</u>

$C = 0.24$

$T_c = 15$ minutes

$I_5 = 83.50$ mm/hr (City of Ottawa, 5-Year Storm)

USING THE RATIONAL METHOD

$Q = 2.78\ (0.24)\ (83.50)\ (0.4047)$

$Q = 22.55$ L/s

Since 352.05 m^2 is drained uncontrolled off-site, therefore, accordingly the net allowable discharge for this site into the existing Bill Leathem Drive strom sewer is Q = [2.78 (0.24) (83.50) (0.4047)] – [2.78 (0.49) (83.50) (0.0352)] = 22.55 L/s – 4.00 L/s = 18.55 L/s.

Stormwater Management Analysis

The calculated flow rate of 18.55 L/s for on-site stormwater management detention volume storage will be used for this SWM analysis. Since a total of six (6) controlled roof drains are proposed to restrict flow from the building at a rate of 5.7 L/s (6 × 0.95 L/s) into the Bill Leathem Drive storm sewer, therefore, the remainder of the site allowable release rate from the ICD in CB/MH#1 is 18.55 L/s – 5.70 L/s = 12.85 L/s.

Therefore, the total allowable 5-Year release rate of 12.85 L/s will be entering into the existing 750mm dia. Bill Leathem Drive storm sewer from the site drainage system controlled by ICD in CB/MH#1. Runoff greater than the allowable release rate will be stored on-site in the proposed stormwater management system consisting of oversized underground storm pipes and drainage structures and the flat rooftop of the proposed warehouse/office building will be used for stormwater attenuation purposes.

The inflow rate during the 5-Year and 100-Year storm for the access roadway and parking lot underground drainage system and rooftop areas can now be calculated as follows:

Design Discharge Computation

1. Proposed Oversized Underground Pipe and Drainage System (NODE No. 7 to NODE No. 10)

   The Rational Method was used to estimate peak flows.

   Q = 2.78 CIA

   Inflow rate Q_{ACTUAL} for the site is:

   C = (AVG "C" value of controlled area excluding office building roof area)

Asphalt Area	= 2,082.32 m^2	
Concrete Area	= 212.30 m^2	
Grass Area	= 50.82 m^2	
Roof Area	= 28.12 m^2	
Total Storm-water Controlled Area	= 2,373.56 m^2	*(excluding roof area of main building)*

<u>5-Year Event</u>

$$C_5 = \frac{(2{,}082.32 \times 0.9) + (212.30 \times 0.9) + (50.82 \times 0.2) + (28.12 \times 0.9)}{2{,}373.56}$$

$$C_5 = \frac{2{,}100.63}{2{,}373.56}$$

$$C_5 = 0.885 \qquad \text{Say "}C_5\text{"} = 0.89$$

A = 0.2374 ha.

Inflow Rate $(Q_A)_5$ = 2.78 CIA

= 2.78 (0.89) (0.2374) I

= 0.5874 I I = (mm/hr)

<u>100-Year Event</u>

$$C_{100} = \frac{(2{,}082.32 \times 1.0) + (212.30 \times 1.0) + (50.82 \times 0.2 \times 1.25) + (28.12 \times 1.0)}{2{,}373.56}$$

$$C_{100} = \frac{2{,}335.445}{2{,}373.56}$$

$$C_{100} = 0.984$$

Say "C_{100}" = 0.98

A = 0.2374 ha.

Inflow Rate $(Q_A)_5$ = 2.78 CIA

= 2.78 (0.98) (0.2374) I

= 0.6468 I I = (mm/hr)

The 100-Year inflow rate for the controlled site tributary area can be calculated as follows:

Q_{100} = 0.6468 I

This now can be used to determine the storage volume for the site using the Modified Rational Method.

- Actual Flow (Q_{ACTUAL}) is calculated as:

Q = 2.78 CIA

- Q_{STORED} is calculated as:

$Q_S = Q_A - Q_{ALLOW}$

2. To Calculate Roof Storage Requirements

The proposed flat roof of the warehouse/office building on this property will consist of six (6) rooftop areas for stormwater attenuation in which each area will incorporate one (1) roof drain per area to control flow off-site. The specified roof drain maximum flow rate per each drain is 0.95 L/s

(15 U.S. gal/min.). Therefore, the stormwater flow that can be controlled from this rooftop and outletted off-site is 5.70 L/s (6 × 0.95 L/s).

C = 0.9 will be used for sizing roof storage volume in this case for the 5-Year event and C = 1.0 will be used for the 100-Year event.

Inflow rate (Q_A) = 2.78 CIA

Where C = 0.9

A = Surface are of roof

I = (mm/hr)

<u>5-Year Event</u>

<u>For Roof Area 1 (NODE No. 1)</u>

Q_{A1} = 2.78 CIA
C = 0.90
A = 179.08 m^2
I = mm/hr

= 2.78 (0.90) (0.0179) I

= 0.0448 I

<u>For Roof Area 2 (NODE No. 2)</u>

Q_{A2} = 2.78 CIA
C = 0.90
A = 173.94 m^2
I = mm/hr

= 2.78 (0.90) (0.0174) I

= 0.0436 I

<u>For Roof Area 3 (NODE No. 3)</u>

Q_{A3} = 2.78 CIA
C = 0.90
A = 178.78 m^2
I = mm/hr

= 2.78 (0.90) (0.0179) I

= 0.0448 I

For Roof Area 4 (NODE No. 4)

Q_{A4} = 2.78 CIA

C = 0.90

A = 264.86 m^2

I = mm/hr

= 2.78 (0.90) (0.0265) I

= 0.0663 I

For Roof Area 5 (NODE No. 5)

Q_{A5} = 2.78 CIA

C = 0.90

A = 260.26 m^2

I = mm/hr

= 2.78 (0.90) (0.026) I

= 0.065 I

For Roof Area 6 (NODE No. 6)

Q_{A6} = 2.78 CIA

C = 0.90

A = 264.48 m^2

I = mm/hr

= 2.78 (0.90) (0.0265) I

= 0.0663 I

100-Year Event

For Roof Area 1 (NODE No. 1)

Q_{A1} = 2.78 CIA

C = 1.0

A = 179.08 m^2

I = mm/hr

= 2.78 (1.0) (0.0179) I

= 0.0498 I

For Roof Area 2 (NODE No. 2)

Q_{A2} = 2.78 CIA

C = 1.0

A = 173.94 m^2

I = mm/hr

= 2.78 (1.0) (0.0174) I

= 0.0484 I

For Roof Area 3 (NODE No. 3)

Q_{A3} = 2.78 CIA

C = 0.90

A = 178.78 m^2

I = mm/hr

= 2.78 (0.90) (0.0179) I

= 0.0498 I

For Roof Area 4 (NODE No. 4)

Q_{A4} = 2.78 CIA

C = 0.90

A = 264.86 m^2

I = mm/hr

= 2.78 (0.90) (0.0265) I

= 0.0737 I

For Roof Area 5 (NODE No. 5)

Q_{A5} = 2.78 CIA

C = 0.90

A = 260.26 m^2

I = mm/hr

= 2.78 (0.90) (0.026) I

= 0.0723 I

For Roof Area 6 (NODE No. 6)

Q_{A6} = 2.78 CIA

C = 0.90

A = 264.48 m^2

I = mm/hr

= 2.78 (0.90) (0.0265) I

= 0.0737 I

Summary results of the calculated inflow and the required storage volume of the site and the building's flat rooftop to store the 5-Year and 100-Year storm events are shown on the Tables 1 to 14 inclusive.

Table 15 summarizes the post-development design flows from the building roof top area as well as the type of roof drains, the maximum anticipated ponding depths, storage volumes required, and storage volumes provided for the five (5)-year and 100-year design events.

Table 15 : Design Flow and Roof Drain Table

Roof Area ID & Drainage Area (ha)	Number of Roof Drains	Watts Roof Drain Model ID (Weir Opening)	Controlled Flow per Drain (L/s)		Approximate Ponding Depth Above Drains (m)		Storage Volume Required (m^3)		Max. Storage Available (m^3)
			5 YR	100 YR	5 YR	100 YR	5 YR	100 YR	
No. 1 (0.0179 ha)	1	RD-100-A-ADJ (1/4 OPENING EXPOSED)	0.87	0.95	0.12	0.15	2.79	6.72	8.87
No. 2 (0.0174 ha)	1	RD-100-A-ADJ (1/4 OPENING EXPOSED)	0.87	0.95	0.12	0.15	2.69	6.46	8.53
No. 3 (0.0179 ha)	1	RD-100-A-ADJ (1/4 OPENING EXPOSED)	0.87	0.95	0.12	0.15	2.79	6.72	8.63
No. 4 (0.0265 ha)	1	RD-100-A-ADJ (1/4 OPENING EXPOSED)	0.87	0.95	0.12	0.15	4.95	11.47	13.11
No. 5 (0.0260 ha)	1	RD-100-A-ADJ (1/4 OPENING EXPOSED)	0.87	0.95	0.12	0.15	4.80	11.15	12.90
No. 6 (0.0265 ha)	1	RD-100-A-ADJ (1/4 OPENING EXPOSED)	0.87	0.95	0.12	0.15	4.95	11.47	13.12
Total Roof (0.1322 ha)	6	-	**5.22**	**5.70**	-	-	**22.97**	**53.99**	**65.16**

Water Quality

Storm water quality treatment is required for this proposed development.

For this site, based on the City of Ottawa's drainage criteria and on typical recommendations set out by Rideau Valley Conservation Authority (RVCA), water quality treatment for 80 percent (min.) removal of total suspended solids (TSS) is required for development of this property.

The said property is in the watershed area where the existing 750mm diameter and 1200mm diameter storm sewer fronting on 96 Bill Leathem Drive outlets to a water course where no municipal treatment for water quality is provided. Therefore, a Stormceptor system is proposed to support the water quality improvement objective. Stormceptor (Model EFO-4) was selected to provide the water quality removal of TSS at a level above 80 percent, which is above the minimum requirement of 80 percent TSS removal. In addition to TSS removal, the Stormceptor system is also an oil and sediment separator. Refer to Appendix "C" for the Stormceptor sizing details from the manufacturer.

Erosion and Sediment Control

The contractor shall implement Best Management Practices to provide for protection of the receiving storm sewer during construction activities. These practices are required to ensure no sediment and/or associated pollutants are released to the receiving watercourse. These practices include installation of a "siltsack" catch basin sediment control device or equal in catch basins as recommended by manufacturer on-site and off-site within the Bill Leathem Drive road right of way adjacent to this property. Siltsack shall be inspected every 2 to 3 weeks and after every major storm. The deposits will be disposed of as per the requirements of the contract. See Dwg. No. 822-125 ESC-1 for details.

Additionally, silt sacs shall be placed on all storm sewer maintenance hole openings during construction. A mud mat is proposed to be installed at the construction site access in order to protect the public road right of way from potential construction traffic damages.

Conclusion

To develop this commercial site (±0.4047 ha. in size) and in controlling the 5-Year stormwater release rate off-site to an allowable rate of 22.55 L/s, a calculated site storage volume of approximately 70.10 m^3 (min.) is required during the 5-Year event, See Table No. 1 to 7 inclusive. We estimate that the required storage volume is 22.97 m^3 (min.) from rooftop storage and 47.13 m^3 (min.) from the site underground drainage system are necessary to attenuate the 5-Year storm event. Refer to the Storm Sewer Design Sheet (Sheet No. 1 of 1) in Appendix "D" for details of proposed storm sewer system for this site.

During the 5-Year storm event for the flat rooftop storage, the ponding depth on this rooftop is estimated at 120 mm at Drain No. 1, 2, 3, 4, 5 and 6 and 0 mm at the roof perimeter assuming a 1.3% (min.) roof pitch to the drains. The rooftop storage available at Roof Area No. 1 is 4.41 m^3, Roof Area No. 2 is 4.39 m^3, Roof Area No. 3 is 4.32 m^3, Roof Area No. 4 is 6.76 m^3, Roof Area No. 5 is 6.58 m^3, and Roof Area No. 6 is 6.77 for a total of 33.23 m^3 which is greater than the required volume of 22.97 m^3.

As for the remaining storage volume of 47.13 m^3 (min.) required from the site development area for the 5-Year storm event, the estimated H.W.L. of 88.22 m will provide a total available underground storage volume of 48.53 m^3 consisting of the proposed underground storm piping and drainage structures. In total, the 5-Year available site storage volume is approximately 81.76 m^3 which is greater than the required site storage volume of 70.10 m^3. See Appendix "E" for details.

In order to control the 100-Year stormwater release rate off-site to an allowable rate of 22.55 L/s, a calculated site storage volume of approximately 108.89 m^3 (min.) is required during the 100-Year event. We estimate that the required storage volume of 53.99 m^3 (min.) of rooftop storage and 108.89 m^3 (min.) from the site underground drainage system are necessary to attenuate the 100-Year storm event. See Table No. 8 to 14 inclusive.

During the 100-year storm event for the flat rooftop storage, the ponding depth on this rooftop is estimated at 150 mm at Drain No. 1, 2, 3, 4, 5 and 6 and 0 mm at the roof perimeter assuming a 1.3% (min.) roof pitch to the drains. The rooftop storage available at Roof Area No. 1 is 8.87 m^3, Roof Area No. 2 is 8.53 m^3, Roof Area No. 3 is 8.63 m^3, Roof Area No. 4 is 13.11 m^3, Roof Area No. 5 is 12.90 m^3, and Roof Area No. 6 is 13.12 and for a total of 65.16 m^3 which is greater than the required volume of 53.99 m^3.

As for the remaining storage volume of 108.89 m^3 (min.) required from the site development area for the 100-Year storm event, the estimated H.W.L. of 90.05 m will provide a total available storage volume of 109.40 m^3 consisting of the proposed oversized underground storm piping and drainage structures. In total, the 100-Year available site storage volume is 174.56 m^3 which is greater than the required site storage volume of 162.88 m^3. See Appendix "E" for details.

Therefore, by means of flat building rooftop storage, grading the site to the proposed grades and constructing the proposed underground storm piping and drainage system as shown on the Proposed Site Grading and Servicing Plan (Dwg. No. 822-125, G-1), the desirable 5-Year and 100-Year storm event attenuation volume of 81.76 m^3 and 174.56 m^3 respectively will be available on-site.

In order to control the release flow rate off-site from the controlled drainage area of the lot, an inlet control device (ICD) will be installed at the outlet of CB/MH#1 in the 375mm diameter storm pipe (outlet pipe) with Q = 12.85 L/s under a head of 2.54 m. A rooftop drain with a release rate of 0.95 L/s will be installed at Roof Drain #1, #2, #3, #4, #5 and #6 of the proposed warehouse/office building flat rooftop as depicted on (Dwg. No. 822-125, G-1). The 5-Year and 100-Year flow off-site is restricted to 22.55 L/s.

An inlet control device (ICD) will be installed at the outlet of CB/MH#1 in the 375 mm diameter storm pipe (outlet pipe) with Q = 12.85 L/s under a head of 2.54 m. The ICD type recommended is a Hydrovex Regulator (100-VHV-1) or equivalent. See Appendix "B" for ICD details.

The building weeping tile drainage will outlet via its separate 150mm diameter PVC storm lateral. The roof drains will be outletted also via a separate 150mm diameter PVC storm lateral from the office building which "wye" into the proposed 150mm dia. weeping tile storm lateral, where upon both laterals are outletting to the existing Bill Leathem Drive 750mm diameter storm sewer with only one (1) connection. The City of Ottawa recommends that pressurized drain pipe material be used in the building for the roof drain leader pipe in the event of surcharging in the City storm sewer system. Refer to the proposed site grading and servicing plan Dwg. No. 822-125-G-1 for details.

To achieve a minimum of 80 percent TSS removal, a Stormceptor structure (Model EFO-4) is proposed to be installed for the site development of this property. This Stormceptor structure shall be located downstream of the proposed CB/MH#1, which houses the site's inlet control device (ICD). Based on the Stormceptor system that is proposed for this site, size of the lot, and impervious ratio, a greater than 80 percent TSS removal is estimated for all rainfall events including large storms. (See Appendix "C" for details).

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PROPOSED 96 BILL LEATHEM DRIVE COMMERCIAL DEVELOPMENT SITE

TABLE 1

FIVE (5)-YEAR EVENT

SITE REQUIRED STORAGE VOLUME

UNDERGROUND STORM PIPES AND DRAINAGE STRUCTURES

t_c **TIME** (minutes)	**I** **5-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
5	141.20	82.94	6.43	76.51	22.95
10	104.20	61.21	6.43	54.78	32.87
15	83.50	49.05	6.43	42.62	38.36
20	70.30	41.29	6.43	34.86	41.83
25	60.90	35.77	6.43	29.34	44.01
30	53.93	31.68	6.43	25.25	45.45
35	48.60	28.55	6.43	22.12	46.45
40	44.20	25.96	6.43	19.53	46.87
45	40.63	23.87	6.43	17.44	47.09
50	37.70	22.14	6.43	15.71	47.13
55	35.12	20.63	6.43	14.20	46.86
60	32.90	19.33	6.43	12.90	46.44

Q_{ALLOW} = 1/2 (12.85 L/s) = 6.43 L/s for underground storage.

Therefore, the required storage volume is 47.13 m^3.

SITE DATA

- Drainage Area ID = Node #7, #8, #9 and #10
- Area = 0.2374 ha.
- C_5 = 0.89

TABLE 2

FIVE (5)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 1 STORAGE VOLUME

ROOF DRAIN No. 1

t_c **TIME** (minutes)	**I** **100-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
10	104.20	4.67	0.87	3.80	2.28
15	83.50	3.74	0.87	2.87	2.58
20	70.30	3.15	0.87	2.28	2.74
25	60.90	2.73	0.87	1.86	2.79
30	53.93	2.416	0.87	1.546	2.78
35	48.50	2.17	0.87	1.30	2.73
40	44.20	1.98	0.87	1.11	2.66

Therefore, the required rooftop storage volume is 2.79 m^3.

SITE DATA

- Drainage Area ID = Node #1
- Area = 0.0179 ha.
- C_5 = 0.9

PROPOSED 96 BILL LEATHEM DRIVE COMMERCIAL DEVELOPMENT SITE

TABLE 3

FIVE (5)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 2 STORAGE VOLUME

ROOF DRAIN No. 2

t_c **TIME** (minutes)	**I** **100-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
10	104.20	4.54	0.87	3.67	2.20
15	83.50	3.64	0.87	2.77	2.49
20	70.30	3.07	0.87	2.20	2.64
25	60.90	2.66	0.87	1.79	2.69
30	53.93	2.35	0.87	1.48	2.66
35	48.50	2.12	0.87	1.25	2.63
40	44.20	1.93	0.87	1.06	2.54

Therefore, the required rooftop storage volume is 2.69 m^3.

SITE DATA

- Drainage Area ID = Node #2
- Area = 0.0174 ha.
- C_5 = 0.9

TABLE 4

FIVE (5)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 3 STORAGE VOLUME

ROOF DRAIN No. 3

t_c **TIME** (minutes)	**I** **100-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
10	104.20	4.67	0.87	3.80	2.28
15	83.50	3.74	0.87	2.87	2.58
20	70.30	3.15	0.87	2.28	2.74
25	60.90	2.73	0.87	1.86	2.79
30	53.93	2.416	0.87	1.546	2.78
35	48.50	2.17	0.87	1.30	2.73
40	44.20	1.98	0.87	1.11	2.66

Therefore, the required storage volume is 2.79 m^3.

SITE DATA

- Drainage Area ID = Node #3
- Area = 0.0179 ha.
- C_5 = 0.9

TABLE 5

FIVE (5)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 4 STORAGE VOLUME

ROOF DRAIN No. 4

t_c **TIME** (minutes)	**I** **100-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
10	104.20	6.91	0.87	6.04	3.62
15	83.50	5.54	0.87	4.67	4.20
20	70.30	4.66	0.87	3.79	4.55
25	60.90	4.04	0.87	3.17	4.76
30	53.93	3.58	0.87	2.71	4.88
35	48.50	3.22	0.87	2.35	4.94
40	44.20	2.93	0.87	2.06	4.95
45	40.60	2.69	0.87	1.83	4.91
50	37.70	2.50	0.87	1.63	4.89

Therefore, the required rooftop storage volume is 4.95 m^3.

SITE DATA

- Drainage Area ID = Node #4
- Area = 0.0265 ha.
- C_5 = 0.9

TABLE 6

FIVE (5)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 5 STORAGE VOLUME

ROOF DRAIN No. 5

t_c TIME (minutes)	I 100-YEAR (mm/hr)	Q ACTUAL (L/s)	Q ALLOW (L/s)	Q STORED (L/s)	VOLUME STORED (m^3)
10	104.20	6.77	0.87	5.90	3.54
15	83.50	5.43	0.87	4.56	4.10
20	70.30	4.57	0.87	3.70	4.44
25	60.90	3.96	0.87	3.09	4.64
30	53.93	3.51	0.87	2.64	4.75
35	48.50	3.15	0.87	2.28	4.79
40	44.20	2.87	0.87	2.00	4.80
45	40.60	2.64	0.87	1.77	4.78
50	37.70	2.45	0.87	1.58	4.74

Therefore, the required rooftop storage volume is 4.80 m^3.

SITE DATA

- Drainage Area ID = Node #5
- Area = 0.0260 ha.
- C_5 = 0.9

TABLE 7

FIVE (5)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 6 STORAGE VOLUME

ROOF DRAIN No. 6

t_c **TIME** (minutes)	**I** **100-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
10	104.20	6.91	0.87	6.04	3.62
15	83.50	5.54	0.87	4.67	4.20
20	70.30	4.66	0.87	3.79	4.55
25	60.90	4.04	0.87	3.17	4.76
30	53.93	3.58	0.87	2.71	4.88
35	48.50	3.22	0.87	2.35	4.94
40	44.20	2.93	0.87	2.06	4.95
45	40.60	2.69	0.87	1.83	4.91
50	37.70	2.50	0.87	1.63	4.89

Therefore, the required rooftop storage volume is 4.95 m^3.

SITE DATA

- Drainage Area ID = Node #6
- Area = 0.0265 ha.
- C_5 = 0.9

TABLE 8

100-YEAR EVENT

SITE REQUIRED STORAGE VOLUME

UNDERGROUND STORM PIPES AND DRAINAGE STRUCTURES

t_c **TIME** (minutes)	**I** **5-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
5	242.80	157.04	6.43	150.61	45.18
10	178.60	115.52	6.43	109.09	65.45
15	142.90	92.43	6.43	86.00	77.40
20	120.00	77.62	6.43	71.19	85.43
25	103.90	67.20	6.43	60.77	91.16
30	91.90	59.44	6.43	53.01	95.42
35	82.60	53.43	6.43	47.00	98.70
40	75.10	48.58	6.43	42.15	101.16
45	69.10	44.69	6.43	38.26	103.30
50	63.90	41.33	6.43	34.90	104.70
60	55.90	36.16	6.43	29.73	107.03
65	52.60	34.02	6.43	27.59	107.60
70	49.80	32.21	6.43	25.78	108.28
75	47.26	30.57	6.43	24.14	108.63
80	45.00	29.11	6.43	22.68	108.86
85	42.95	27.78	6.43	21.35	108.89
90	41.10	26.58	6.43	20.15	108.81

Q_{ALLOW} = 1/2 (12.85 L/s) = 6.43 L/s for underground storage.

Therefore, the required storage volume is 108.89 m^3.

SITE DATA

- Drainage Area ID = Node #7, #8, #9 and #10
- Area = 0.2374 ha.
- C_{100} = 0.98

TABLE 9

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 1 STORAGE VOLUME

ROOF DRAIN No. 1

t_c **TIME** (minutes)	**I** **100-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
10	178.6	8.89	0.95	7.94	4.76
15	142.9	7.12	0.95	6.17	5.55
20	120.0	5.98	0.95	5.03	6.04
25	103.9	5.17	0.95	4.22	6.33
30	91.90	4.58	0.95	3.63	6.53
35	82.60	4.11	0.95	3.16	6.64
40	75.10	3.74	0.95	2.79	6.70
45	69.10	3.44	0.95	2.49	6.72
50	63.90	3.18	0.95	2.23	6.69
55	59.62	2.97	0.95	2.02	6.67
60	55.90	2.78	0.95	1.83	6.59

Therefore, the required rooftop storage volume is 6.72 m^3.

SITE DATA

- Drainage Area ID = Node #1
- Area = 0.0179 ha.
- C_{100} = 1.0

PROPOSED 96 BILL LEATHEM DRIVE COMMERCIAL DEVELOPMENT SITE

TABLE 10

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 2 STORAGE VOLUME

ROOF DRAIN No. 2

t_c TIME (minutes)	I 100-YEAR (mm/hr)	Q ACTUAL (L/s)	Q ALLOW (L/s)	Q STORED (L/s)	VOLUME STORED (m^3)
10	178.6	8.64	0.95	7.69	4.61
15	142.9	6.92	0.95	5.97	5.37
20	120.0	5.81	0.95	4.86	5.83
25	103.9	5.03	0.95	4.08	6.12
30	91.90	4.45	0.95	3.50	6.30
35	82.60	4.00	0.95	3.05	6.41
40	75.10	3.64	0.95	2.69	6.46
45	69.10	3.34	0.95	2.39	6.45
50	63.90	3.09	0.95	2.14	6.42
55	59.62	2.89	0.95	1.94	6.40

Therefore, the required rooftop storage volume is 6.46 m^3.

SITE DATA

- Drainage Area ID = Node #2
- Area = 0.0174 ha.
- C_{100} = 1.0

TABLE 11

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 3 STORAGE VOLUME

ROOF DRAIN No. 3

t_c TIME (minutes)	I 100-YEAR (mm/hr)	Q ACTUAL (L/s)	Q ALLOW (L/s)	Q STORED (L/s)	VOLUME STORED (m^3)
10	178.6	8.89	0.95	7.94	4.76
15	142.9	7.12	0.95	6.17	5.55
20	120.0	5.98	0.95	5.03	6.04
25	103.9	5.17	0.95	4.22	6.33
30	91.90	4.58	0.95	3.63	6.53
35	82.60	4.11	0.95	3.16	6.64
40	75.10	3.74	0.95	2.79	6.70
45	69.10	3.44	0.95	2.49	6.72
50	63.90	3.18	0.95	2.23	6.69
55	59.62	2.97	0.95	2.02	6.67
60	55.90	2.78	0.95	1.83	6.59

Therefore, the required rooftop storage volume is 6.72 m^3.

SITE DATA

- Drainage Area ID = Node #3
- Area = 0.0179 ha.
- C_{100} = 1.0

TABLE 12

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 4 STORAGE VOLUME

ROOF DRAIN No. 4

t_c **TIME** (minutes)	**I** **100-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
10	178.6	13.16	0.95	12.21	7.33
15	142.9	10.53	0.95	9.58	8.62
20	120.0	8.84	0.95	7.89	9.47
25	103.9	7.66	0.95	6.71	10.07
30	91.90	6.77	0.95	5.82	10.48
35	82.60	6.09	0.95	5.14	10.79
40	75.10	5.54	0.95	4.59	11.02
45	69.10	5.09	0.95	4.14	11.18
50	63.90	4.71	0.95	3.76	11.28
55	59.62	4.39	0.95	3.44	11.35
60	55.90	4.12	0.95	3.17	11.41
65	52.65	3.88	0.95	2.93	11.43
70	49.80	3.67	0.95	2.73	<u>11.47</u>
75	47.30	3.49	0.95	2.54	11.43
80	44.99	3.32	0.95	2.37	11.38

Therefore, the required rooftop storage volume is 11.47 m^3.

<u>SITE DATA</u>

- Drainage Area ID = Node #4
- Area = 0.0265 ha.
- C_{100} = 1.0

TABLE 13

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 5 STORAGE VOLUME

ROOF DRAIN No. 5

t_c TIME (minutes)	I 100-YEAR (mm/hr)	Q ACTUAL (L/s)	Q ALLOW (L/s)	Q STORED (L/s)	VOLUME STORED (m^3)
10	178.6	12.91	0.95	11.96	7.18
15	142.9	10.33	0.95	9.38	8.44
20	120.0	8.68	0.95	7.73	9.28
25	103.9	7.51	0.95	6.56	9.84
30	91.90	6.64	0.95	5.69	10.24
35	82.60	5.97	0.95	5.02	10.54
40	75.10	5.43	0.95	4.48	10.75
45	69.10	5.00	0.95	4.05	10.94
50	63.90	4.62	0.95	3.67	11.01
55	59.62	4.31	0.95	3.36	11.09
60	55.90	4.04	0.95	3.09	11.12
65	52.65	3.81	0.95	2.86	11.15
70	49.80	3.60	0.95	2.65	11.13
75	47.30	3.42	0.95	2.47	11.12

Therefore, the required rooftop storage volume is 11.15 m^3.

SITE DATA

- Drainage Area ID = Node #5
- Area = 0.0260 ha.
- C_{100} = 1.0

TABLE 14

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 6 STORAGE VOLUME

ROOF DRAIN No. 6

t_c TIME (minutes)	I 100-YEAR (mm/hr)	Q ACTUAL (L/s)	Q ALLOW (L/s)	Q STORED (L/s)	VOLUME STORED (m^3)
10	178.6	13.16	0.95	12.21	7.33
15	142.9	10.53	0.95	9.58	8.62
20	120.0	8.84	0.95	7.89	9.47
25	103.9	7.66	0.95	6.71	10.07
30	91.90	6.77	0.95	5.82	10.48
35	82.60	6.09	0.95	5.14	10.79
40	75.10	5.54	0.95	4.59	11.02
45	69.10	5.09	0.95	4.14	11.18
50	63.90	4.71	0.95	3.76	11.28
55	59.62	4.39	0.95	3.44	11.35
60	55.90	4.12	0.95	3.17	11.41
65	52.65	3.88	0.95	2.93	11.43
70	49.80	3.67	0.95	2.73	11.47
75	47.30	3.49	0.95	2.54	11.43
80	44.99	3.32	0.95	2.37	11.38

Therefore, the required rooftop storage volume is 11.47 m^3.

SITE DATA

- Drainage Area ID = Node #6
- Area = 0.0265 ha.
- C_{100} = 1.0

PROPOSED

TWO STOREY COMMERCIAL AND OFFICE BUILDING SITE

PART OF LOT 18

CONCESSION 1 (RIDEAU FRONT)

GEOGRAPHIC TOWNSHIP OF NEPEAN

96 BILL LEATHEM DRIVE

CITY OF OTTAWA

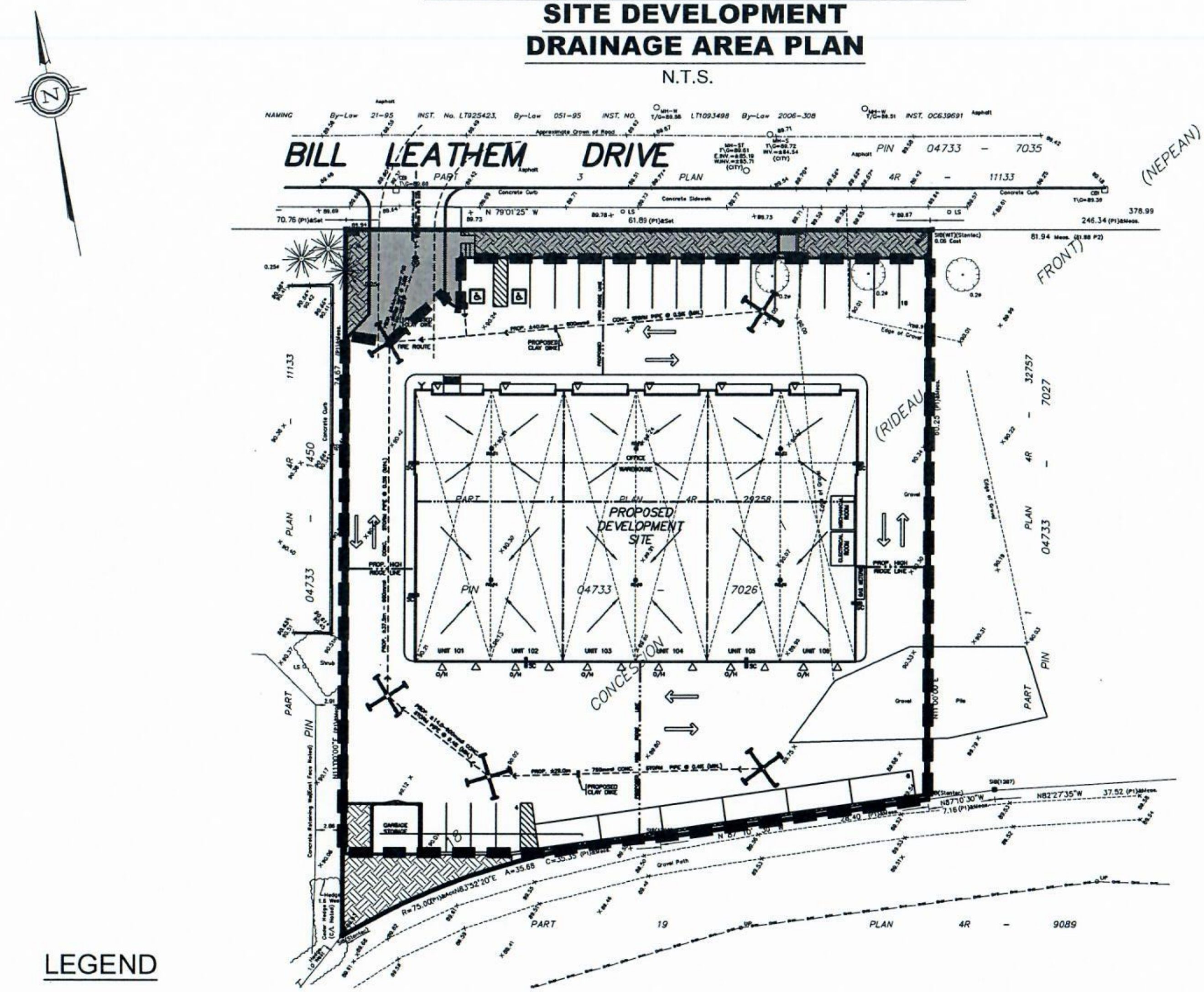
APPENDIX A

STORM DRAINAGE AREA PLAN

FIGURE 1

PROPOSED 96 BILL LEATHEM DRIVE
SITE DEVELOPMENT
DRAINAGE AREA PLAN

N.T.S.



LEGEND

LIMIT OF CONTROLLED STORM DRAINAGE AREA = 3,694.96 SQ. M

UNCONTROLLED STORM DRAINAGE AREA = 352.05 SQ. M

TOTAL AREA = 4,047.01 SQ. M

POST-DEVELOPMENT SITE AVERAGE "C" = 0.85

T.L. MAK ENGINEERING CONSULTANTS LTD.
CONSULTING ENGINEERS

REV.		PROJECT No.	DATE	DRAWING No.
REV. #1	03/04/24	822-125	FEBRUARY 2024	FIGURE 1

PROPOSED

TWO STOREY COMMERCIAL AND OFFICE BUILDING SITE

PART OF LOT 18

CONCESSION 1 (RIDEAU FRONT)

GEOGRAPHIC TOWNSHIP OF NEPEAN

96 BILL LEATHEM DRIVE

CITY OF OTTAWA

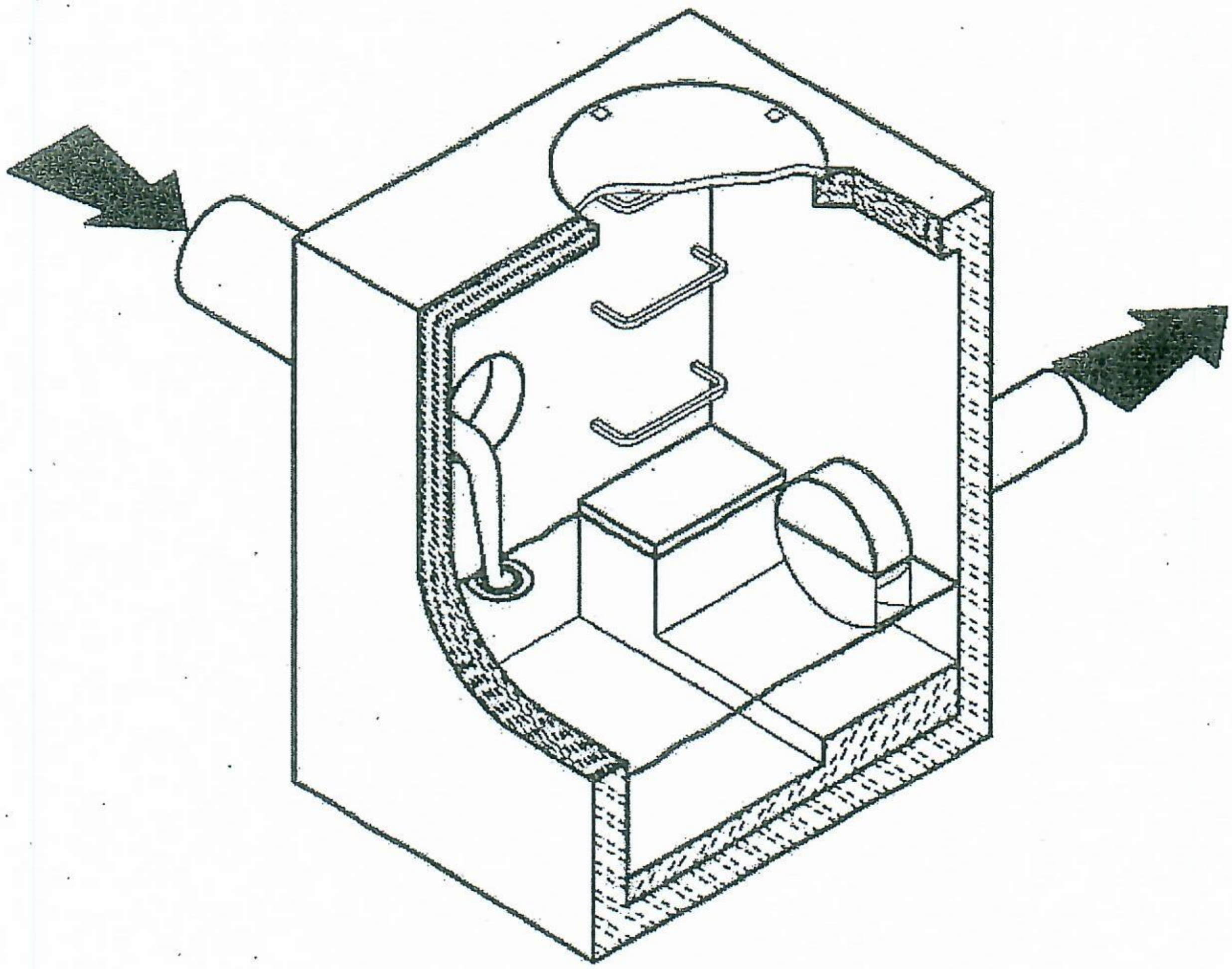
APPENDIX B

INLET CONTROL DEVICE (ICD) DETAILS

HYDROVEX MODEL No. 100-VHV-1

CSO/STORMWATER MANAGEMENT

® HYDROVEX® VHV / SVHV
Vertical Vortex Flow Regulator



JOHN MEUNIER

HYDROVEX® VHV / SVHV VERTICAL VORTEX FLOW REGULATOR

APPLICATIONS

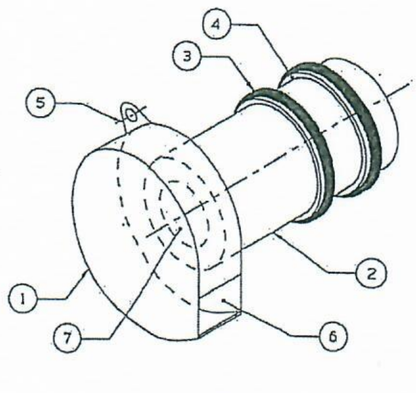
One of the major problems of urban wet weather flow management is the runoff generated after a heavy rainfall. During a storm event, uncontrolled flows may overload the drainage system and cause flooding. Sewer pipe wear and network deterioration are increased dramatically as a result of increased flow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

A simple means of managing excessive water runoff is to control excessive flows at their point of origin, the manhole. **John Meunier Inc.** manufactures the **HYDROVEX® VHV / SVHV** line of vortex flow regulators for point source control of stormwater flows in sewer networks, as well as manholes, catch basins and other retention structures.

The **HYDROVEX® VHV / SVHV** design is based on the fluid mechanics principle of the forced vortex. The discharge is controlled by an air-filled vortex which reduces the effective water passage area without physically reducing orifice size. This effect grants precise flow regulation without the use of moving parts or electricity, thus minimizing maintenance. Although the concept is quite simple, over 12 years of research and testing have been invested in our vortex technology design in order to optimize its 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 operation.

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



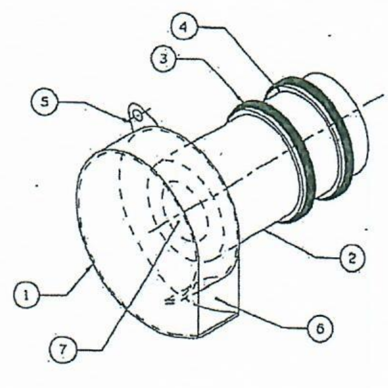


FIGURE 1: HYDROVEX® VHV-SVHV VERTICAL VORTREX FLOW REGULATORS

ADVANTAGES

- As a result of the air-filled vortex, a **HYDROVEX® VHV / SVHV** flow regulator will typically have an opening 4 to 6 times larger than an orifice plate. Larger opening sizes decrease the chance of blockage caused by sediments and debris found in stormwater flows. **Figure 2** shows the discharge curve of a vortex regulator compared to an equally sized orifice plate. One can see that for the same height of water and same opening size, the vortex regulator controls a flow approximately four times smaller than the orifice plate.
- Having no moving parts, they require minimal maintenance.
- Submerged inlet for floatables control.
- The **HYDROVEX® VHV / SVHV** line of flow regulators are manufactured entirely of stainless steel, making them durable and corrosion resistant.
- Installation of the **HYDROVEX® VHV / SVHV** flow regulators is quick and straightforward and is performed after all civil works are completed.
- Installation requires no assembly, special tools or equipment and may be carried out by any contractor.

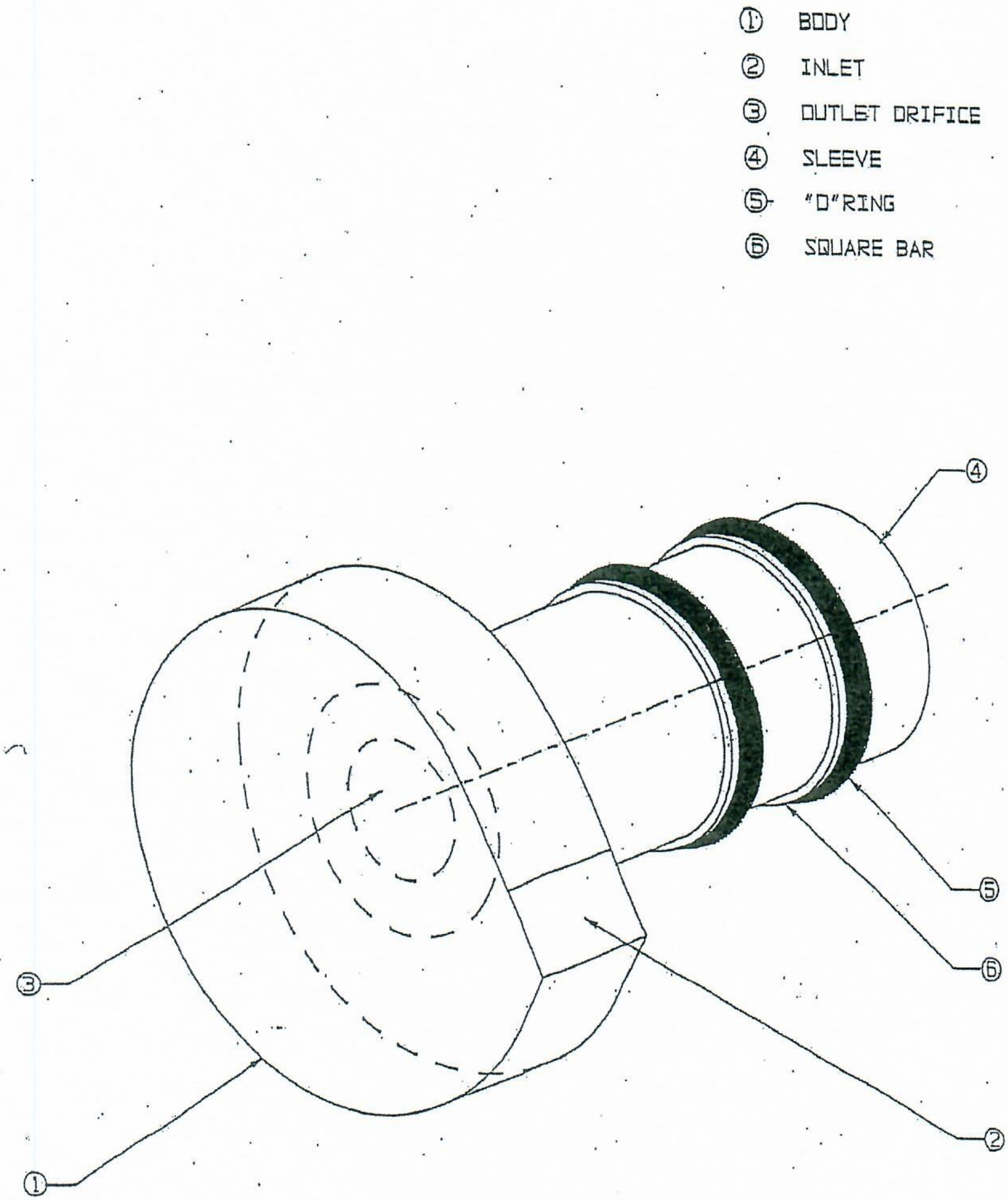


FIGURE 1-VHV

HYDROVEX®
VHV/SVHV Vortex Flow Regulator

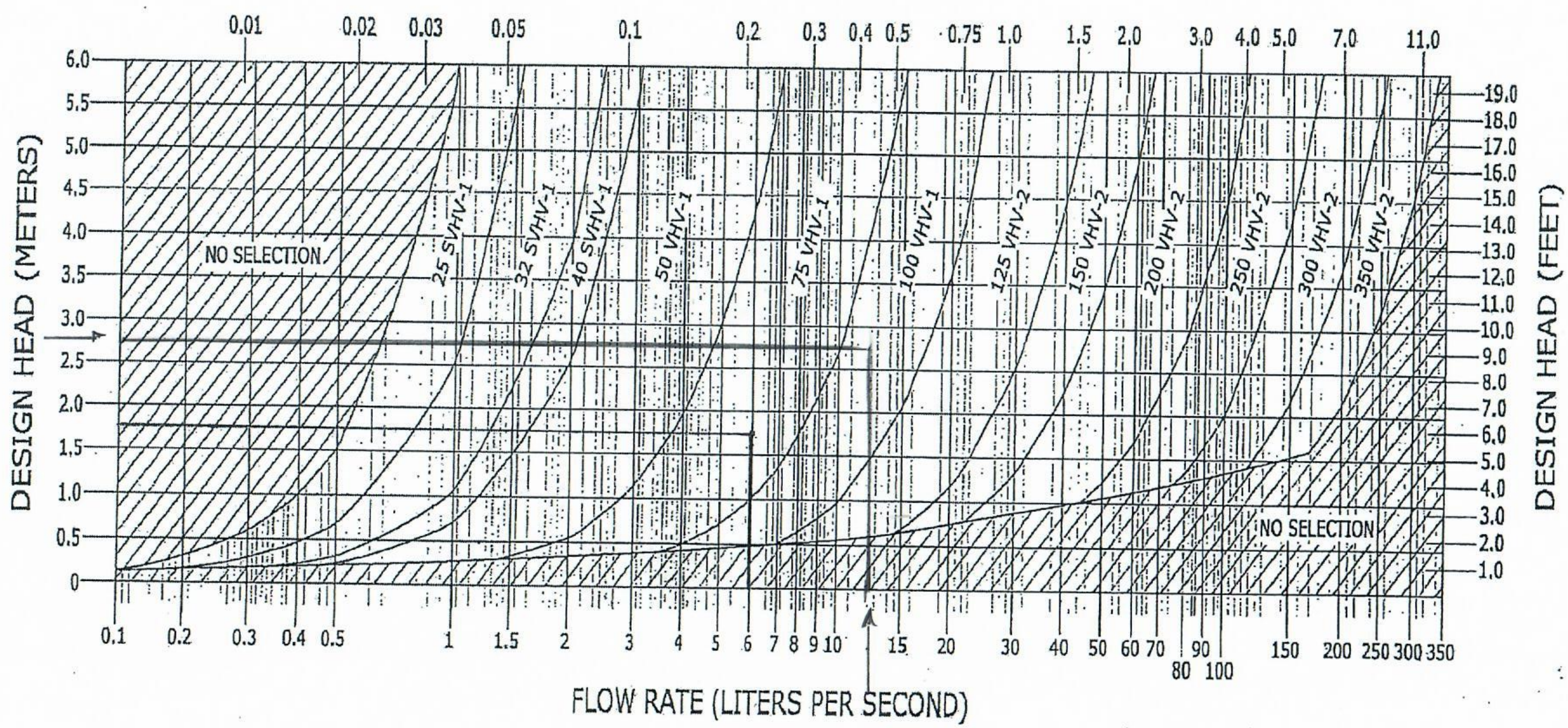


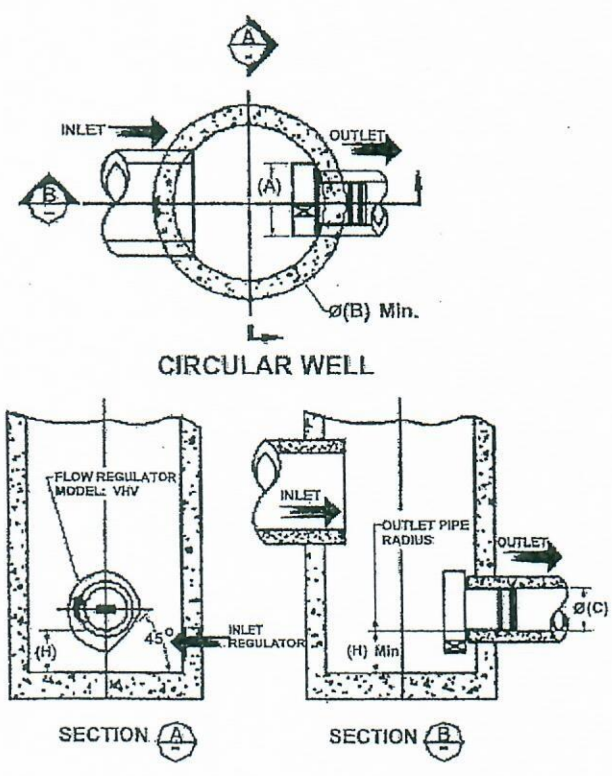
FIGURE 3

JOHN MEUNIER

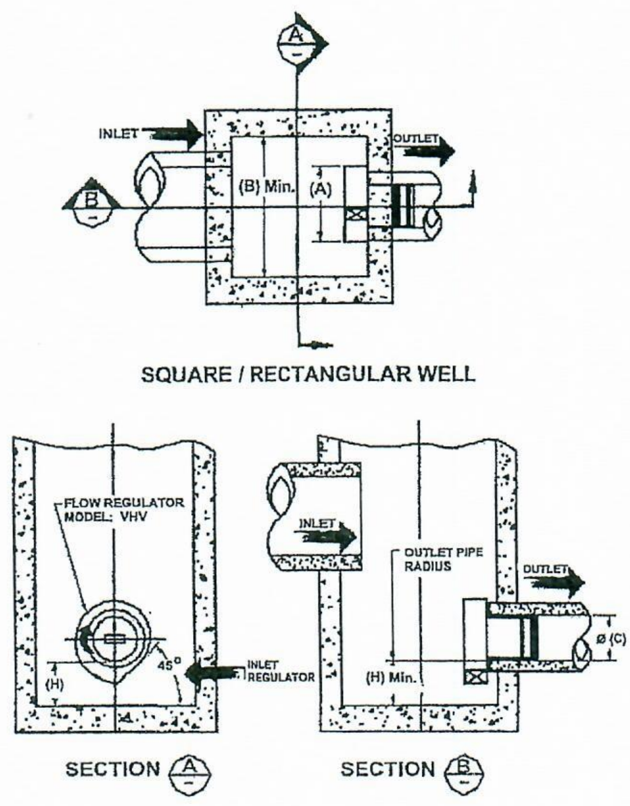
TYPICAL INSTALLATION OF A VORTEX FLOW REGULATOR IN A CIRCULAR OR SQUARE/RECTANGULAR MANHOLE
FIGURE 4

		CIRCULAR	SQUARE		
Model	Regulator Diameter A (mm) [in]	Minimum Manhole Diameter B (mm) [in]	Minimum Chamber Width B (mm) [in]	Minimum Outlet Pipe Diameter C (mm) [in]	Minimum Clearance H (mm) [in]
25 SVHV-1	125 [5]	600 [24]	600 [24]	150 [6]	150 [6]
32 SVHV-1	150 [6]	600 [24]	600 [24]	150 [6]	150 [6]
40 SVHV-1	200 [8]	600 [24]	600 [24]	150 [6]	150 [6]
50 VHV-1	150 [6]	600 [24]	600 [24]	150 [6]	150 [6]
75 VHV-1	250 [10]	600 [24]	600 [24]	150 [6]	150 [6]
100 VHV-1	325 [13]	900 [36]	600 [24]	150 [6]	200 [8]
125 VHV-2	275 [11]	900 [36]	600 [24]	150 [6]	200 [8]
150 VHV-2	350 [14]	900 [36]	600 [24]	150 [6]	225 [9]
200 VHV-2	450 [18]	1200 [48]	900 [36]	200 [8]	300 [12]
250 VHV-2	575 [23]	1200 [48]	900 [36]	250 [10]	350 [14]
300VHV-2	675 [27]	1600 [64]	1200 [48]	250 [10]	400 [16]
350VHV-2	800 [32]	1800 [72]	1200 [48]	300 [12]	500 [20]

Circular Manhole



Square / Rectangular Manhole



NOTE: *In the case of a square manhole, the outlet pipe must be centered on the wall to ensure that there is enough clearance for installation of the regulator.*

PROPOSED

TWO STOREY COMMERCIAL AND OFFICE BUILDING SITE

PART OF LOT 18

CONCESSION 1 (RIDEAU FRONT)

GEOGRAPHIC TOWNSHIP OF NEPEAN

96 BILL LEATHEM DRIVE

CITY OF OTTAWA

APPENDIX C

STORMCEPTOR MODEL No. EFO-4

SIZING AND DETAILS

SEPTEMBER 25, 2023

TL MaK

From: Jessica Steffler [jessica.steffler@RinkerPipe.com]
Sent: September 25, 2023 9:52 AM
To: TL MaK
Cc: Brandon O'Leary; Kent Campbell
Subject: RE: [EXTERNAL] 96 Bill Leathem Drive
Attachments: Stormceptor EFO4 Sizing Report-96 Bill Leathem Drive- 96 Bill Leathem Dr Ottawa.pdf; EFO4-DETAIL (2).pdf; Stormceptor EF Owner's Manual_7-26-18 (1).pdf; QAP PROGRAM FOR STC Rinker Materials.pdf

Tony,

Sorry for the delay in getting this to you. Based on the site parameters below, the Stormceptor EFO4 is recommended. I have attached the sizing report, the standard drawings, the owner's manual and information on the Quality Assurance Program. The budgetary price for the Stormceptor EFO4 is $22,377. The price includes the unit, delivery to site and the Quality Assurance Program.

Stormceptor EFO4 Capacities:
Maximum Treatment Flow Rate: 10.4 L/s
Maintenance Sediment Volume: 270 L
Maximum Sediment Capacity: 1,190 L
Maximum Hydrocarbon Storage Capacity: 265 L
Total Storage Volume: 1,780 L

Please feel free to reach out if you have any questions.

Jessica

From: TL MaK <tlmakecl@bellnet.ca>
Sent: Thursday, September 21, 2023 5:43 PM
To: Jessica Steffler <jessica.steffler@RinkerPipe.com>
Subject: [EXTERNAL] 96 Bill Leathem Drive

CAUTION: This email originated from outside of the organization. Exercise caution when opening attachments or clicking links, especially from *UNKNOWN* senders.

Hi Jessica,

Currently we are working on a project in the west end of the City of Ottawa, Ontario. Regarding the above-noted site, we are requesting your assistance in sizing a Stormceptor structure for TSS removal of 80% (min.). Attached is a PDF of our Preliminary Site Grading and Servicing Plan (Dwg. #822-125 G-1 Rev. 1) for your reference.

The total site area is ±4,047.0 m^2 and the average "C" = 0.87 for the controlled drainage area. The controlled area regulated by the Stormceptor is approximately ±0.3774 ha. The impervious area within the controlled area of the site is ±0.361 ha. and mainly comprised of the asphalt parking, concrete/interlock, and roof areas. Please size the Stormceptor unit accordingly at your earliest convenience for our report. If you need more information, please let me know.

Thanks,

Tony Mak

T.L. Mak Engineering Consultants Ltd.
1455 Youville Drive, Suite 218
Ottawa, ON. K1C 6Z7
Tel. 613-837-5516 | Fax: 613-837-5277
E-mail: tlmakecl@bellnet.ca

Stormceptor® Rinker MATERIALS® A QUIKRETE® COMPANY

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

09/25/2023

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20
Site Name:	96 Bill Leathem Dr, Ottawa
Drainage Area (ha):	0.38
Runoff Coefficient 'c':	0.87

Project Name:	96 Bill Leathem Drive
Project Number:	822-125
Designer Name:	Jessica Steffler
Designer Company:	Forterra Pipe & Precast
Designer Email:	jessica.steffler@forterrabp.com
Designer Phone:	519-239-6958
EOR Name:	Tony Mak
EOR Company:	T.L. Mak Engineering Consultants Ltd
EOR Email:	tlmakecl@bellnet.ca
EOR Phone:	613-837-5516

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	10.67
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	393
Estimated Average Annual Sediment Volume (L/yr):	320

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	88
EFO6	95
EFO8	98
EFO10	99
EFO12	100

Recommended Stormceptor EFO Model: EFO4

Estimated Net Annual Sediment (TSS) Load Reduction (%): 88

Water Quality Runoff Volume Capture (%): > 90

imbrium

Stormceptor® EF Sizing Report

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

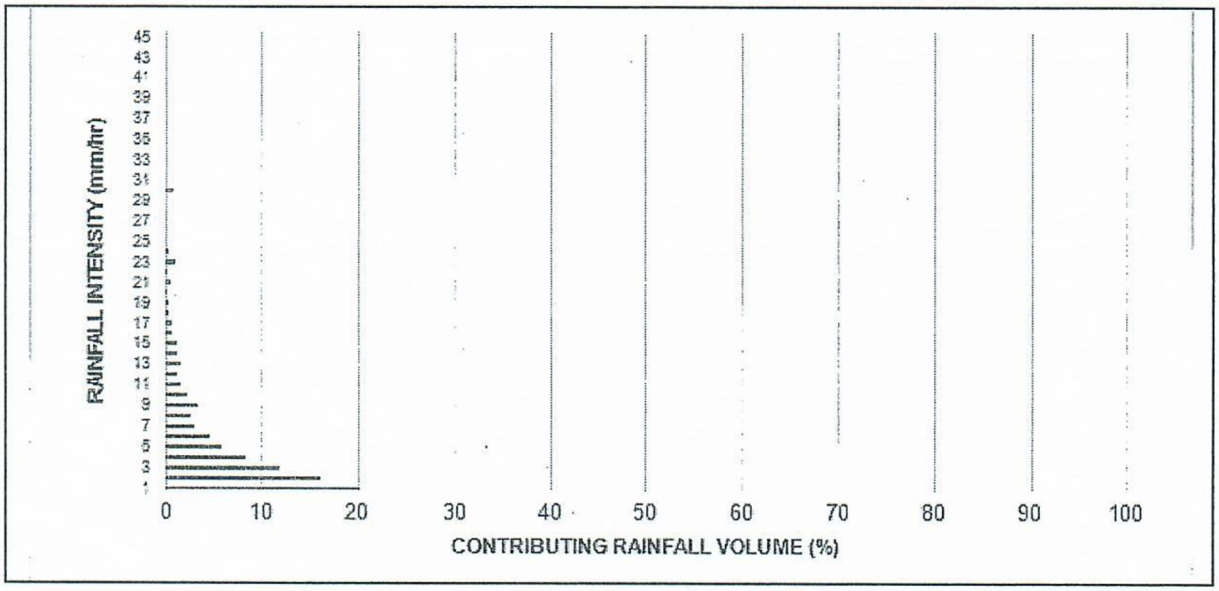
Stormceptor® EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	0.46	28.0	23.0	100	8.6	8.6
1.00	20.3	29.0	0.92	55.0	46.0	100	20.3	29.0
2.00	16.2	45.2	1.84	110.0	92.0	97	15.8	44.7
3.00	12.0	57.2	2.76	165.0	138.0	92	11.0	55.8
4.00	8.4	65.6	3.68	221.0	184.0	86	7.2	63.0
5.00	5.9	71.6	4.60	276.0	230.0	82	4.9	67.9
6.00	4.6	76.2	5.51	331.0	276.0	80	3.7	71.6
7.00	3.1	79.3	6.43	386.0	322.0	78	2.4	73.9
8.00	2.7	82.0	7.35	441.0	368.0	76	2.1	76.0
9.00	3.3	85.3	8.27	496.0	414.0	73	2.4	78.5
10.00	2.3	87.6	9.19	551.0	460.0	71	1.6	80.1
11.00	1.6	89.2	10.11	607.0	505.0	69	1.1	81.2
12.00	1.3	90.5	11.03	662.0	551.0	67	0.9	82.0
13.00	1.7	92.2	11.95	717.0	597.0	65	1.1	83.2
14.00	1.2	93.5	12.87	772.0	643.0	64	0.8	84.0
15.00	1.2	94.6	13.79	827.0	689.0	64	0.7	84.7
16.00	0.7	95.3	14.71	882.0	735.0	64	0.4	85.1
17.00	0.7	96.1	15.62	937.0	781.0	63	0.5	85.6
18.00	0.4	96.5	16.54	993.0	827.0	63	0.3	85.9
19.00	0.4	96.9	17.46	1048.0	873.0	63	0.3	86.1
20.00	0.2	97.1	18.38	1103.0	919.0	62	0.1	86.2
21.00	0.5	97.5	19.30	1158.0	965.0	62	0.3	86.5
22.00	0.2	97.8	20.22	1213.0	1011.0	61	0.2	86.7
23.00	1.0	98.8	21.14	1268.0	1057.0	60	0.6	87.3
24.00	0.3	99.1	22.06	1323.0	1103.0	59	0.2	87.5
25.00	0.0	99.1	22.98	1379.0	1149.0	58	0.0	87.5
30.00	0.9	100.0	27.57	1654.0	1379.0	53	0.5	87.9
35.00	0.0	100.0	32.17	1930.0	1608.0	46	0.0	87.9
40.00	0.0	100.0	36.76	2206.0	1838.0	40	0.0	87.9
45.00	0.0	100.0	41.36	2481.0	2068.0	36	0.0	87.9
Estimated Net Annual Sediment (TSS) Load Reduction =								**88 %**

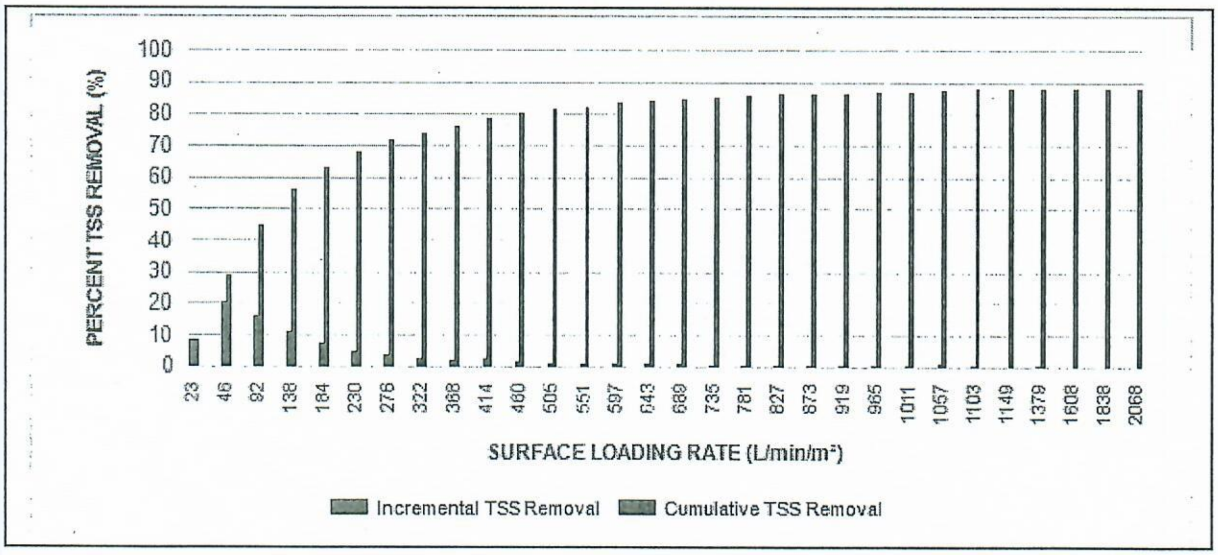
Climate Station ID: 6105978 *Years of Rainfall Data*: 20

Stormceptor® EF Sizing Report

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Stormceptor® EF Sizing Report

Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

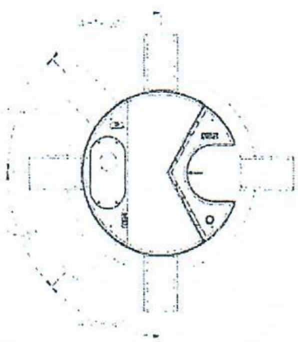
DESIGN FLEXIBILITY

►**Stormceptor®** EF and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.

Stormceptor® EF Sizing Report



INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 $L/min/m^2$ to 1400 $L/min/m^2$, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 $L/min/m^2$ and 1400 $L/min/m^2$ shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 $L/min/m^2$ shall be assumed to be identical to the sediment removal efficiency at 40 $L/min/m^2$. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 $L/min/m^2$.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 $L/min/m^2$ shall assume zero sediment removal for the portion of flow that exceeds 1400 $L/min/m^2$, and shall be calculated using a simple proportioning formula, with 1400 $L/min/m^2$ in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 $L/min/m^2$.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

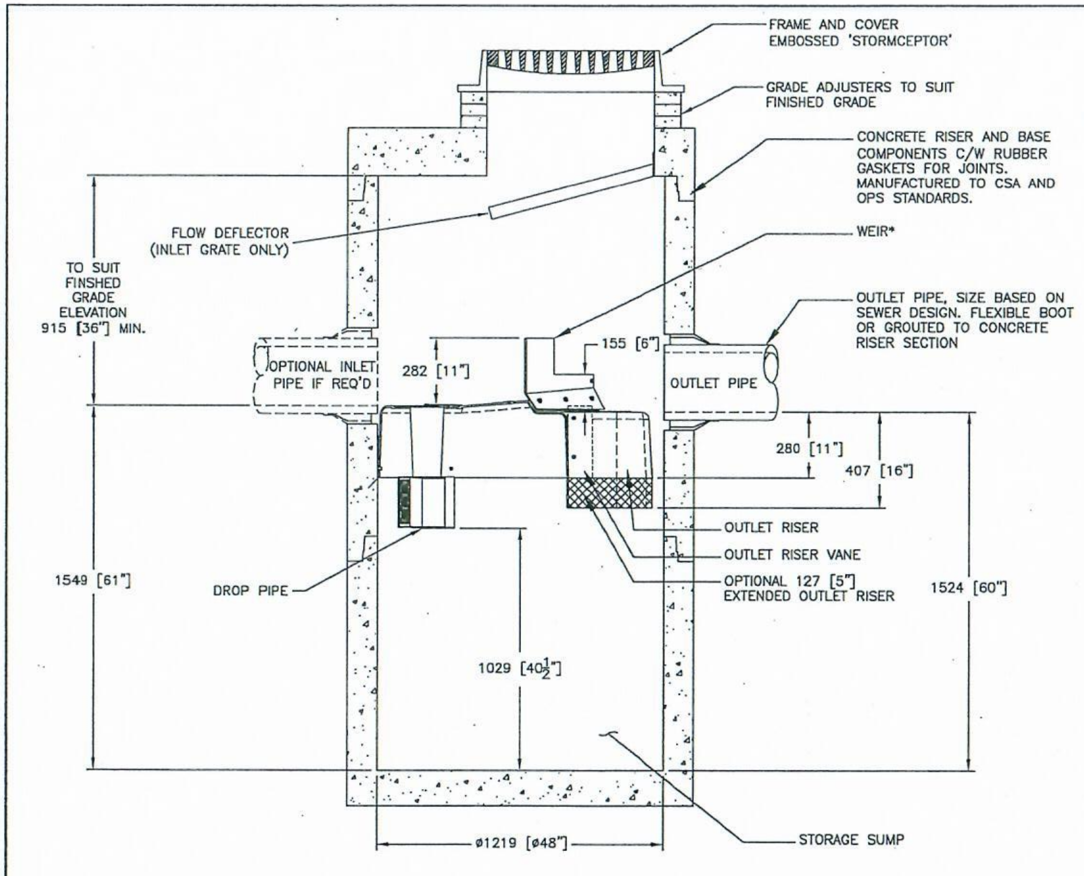
The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

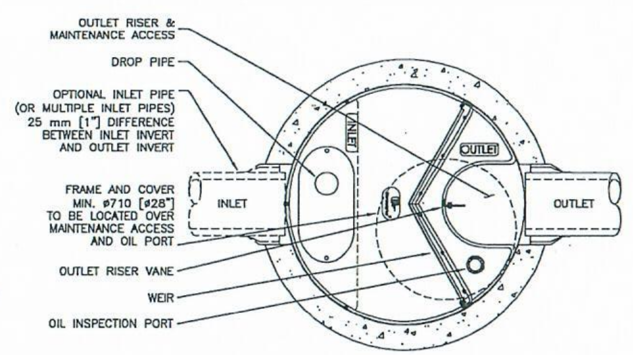
3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

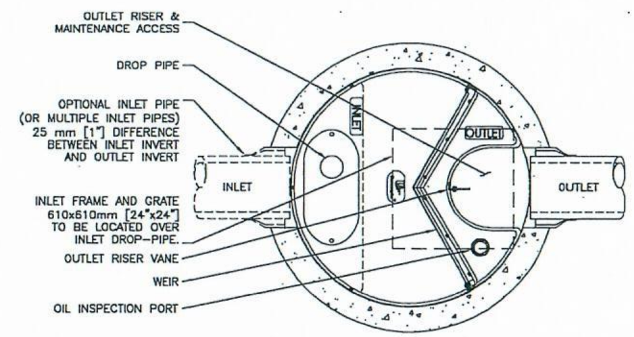
3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF4 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EF04 (OIL CAPTURE CONFIGURATION). WEIR HEIGHT IS 150 mm (6 INCH) FOR EF04.

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF04				
STRUCTURE ID					*
HYDROCARBON STORAGE REQ'D (L)					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
####	####	####	####
####	####	####	####
####	####	####	####
1	6/8/18	UPDATES	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®

DATE: 10/13/2017
DESIGNED: JSK | DRAWN: JSK
CHECKED: BSF | APPROVED: SP
PROJECT No.: EF04 | SEQUENCE No.: *
SHEET: 1 OF 1

PROPOSED

TWO STOREY COMMERCIAL AND OFFICE BUILDING SITE

PART OF LOT 18

CONCESSION 1 (RIDEAU FRONT)

GEOGRAPHIC TOWNSHIP OF NEPEAN

96 BILL LEATHEM DRIVE

CITY OF OTTAWA

APPENDIX D

STORM SEWER DESIGN SHEET

(SHEET No. 1 OF 1)

STORM SEWER DESIGN SHEET

CITY OF OTTAWA
5 YEAR STORM EVENT (IDF CURVE)

Q 2.78 AIR
Where Q peak flow in litres per second (L/s)
A area in hectares (ha)
I rainfall intensity in millimetres per hour (mm/h)
R runoff coefficient

T_c = 10 minutes

LOCATION			AREAS (ha)								SEWER DATA							
STREET	FROM	TO	R = 0.86	R = 0.89	R =	indiv. 2.78 AR	Accum 2.78 AR	Time of Conc.	Rainfall Intensity I	Peak Flow Q (L/s)	Diameter (mm)	Slope (%)	Length (m)	Capacity (L/s) n = 0.013	Velocity (m/s)	Time of Flow (minutes)		
96 BILL LEATHEM DRIVE	CB/MH#5	CB/MH#4	0.059	·		0.144	0.144	10.0	104.4	15.1	900	0.30	29.0	1039.3	1.58	0.31		
	CB/MH#4	ST.MH#3	0.071			0.174	0.318	10.31	102.7	32.7	900	0.35	14.0	1,122.5	1.70	0.14		
	ST.MH#3	CB/MH#1	—			—	0.318	10.45	102.0	32.5	1050	0.45	37.5	1,936	2.15	0.29		
	CB/MH#2	CB/MH#1		0.063		0.156	0.156	10.0	104.4	16.3	900	0.40	40.0	1,200	1.82	0.37		
	CB/MH#1	STORM-CEPTOR EFO-4		0.045		0.112	0.268	10.37	102.5	27.5	375	4.0	9.0	365.8	3.21	0.05		
	STORM-CEPTOR EFO-4	EX.750ø STORM SEWER	—	—		—	0.586	10.74	101.8	59.7	375	4.2	10.0	374.9	3.29			

LICENSED PROFESSIONAL ENGINEER
03/05/24
TONY L.M. MAK
PROVINCE OF ONTARIO

(FILE# 822-125)

DESIGN TLM	PROJECT 96 BILL LEATHEM DRIVE	SHEET No.	
CHECKED TLM	PROPOSED COMMERCIAL/WAREHOUSE	1 OF 1	
DATE FEB. 2024	BUILDING DEVELOPMENT SITE - OTTAWA		

PROPOSED

TWO STOREY COMMERCIAL AND OFFICE BUILDING SITE

PART OF LOT 18

CONCESSION 1 (RIDEAU FRONT)

GEOGRAPHIC TOWNSHIP OF NEPEAN

96 BILL LEATHEM DRIVE

CITY OF OTTAWA

APPENDIX E

DETAILED CALCULATIONS

FOR FIVE (5)-YEAR AND 100-YEAR

AVAILABLE STORAGE VOLUME

AVAILABLE STORAGE VOLUME CALCULATIONS

Five (5)-Year Event

Roof Storage at Flat Roof Building

Roof Area 1 to Roof Area 6 will be used for storm-water detention. Each roof area will be drained by one (1) controlled drain. Each roof drain will have a maximum release rate of 15.0 U.S.gal./min. or 0.95 L/s under a head of 150mm. Thus from the flat roof area of this building the controlled flow off-site is 5.7 L/s (6 × 0.95 L/s). Therefore, the (6) roof drains specified is the Watts model Adjustable Accutrol Weir (Model No. RD-100A-ADJ) with 1/4 opening as specified. Refer to Dwg. No. 822-125 SWM-1 for details. As for the remainder of the site, the proposed oversized underground drainage pipes and structures within this site will be designed to provide stormwater detention in order to control the allowable site release rate of 22.55 L/s.

Roof Storage Area No. 1

Available flat roof area for storage = 179.08 m^2, @ roof slope of 1.6% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.12\text{m})[110.14 + 4\ (27.57) + 0]}{6}$$

$$V = \frac{(0.12\text{m})(220.42)}{6}$$

$$V = 4.41\ \text{m}^3$$

The available Roof Area 1 storage volume of 4.41 m^3 > required five (5)-Year storage volume of 2.79 m^3 from Table 2.

Therefore, the ponding depth at the proposed Roof Drain No. 1 location is approximately 0.12 m (120 mm) and the five (5)-Year level is estimated not to reach the roof perimeter of the building.

Roof Storage Area No. 2

Available flat roof area for storage = 173.94 m^2, @ roof slope of 1.6 % (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.12\text{m})[109.60 + 4\ (27.44) + 0]}{6}$$

$$V = \frac{(0.12\text{m})(219.36)}{6}$$

$$V = 4.39\ \text{m}^3$$

The available Roof Area 2 storage volume of 4.39 m^3 > required five (5)-year storage volume of 2.69 m^3 from Table 3.

Therefore, the ponding depth at the proposed Roof Drain No. 2 location is approximately 0.12 m (120 mm) and the five (5)-year level is estimated not to reach the roof perimeter of the building.

Roof Storage Area No. 3

Available flat roof area for storage = 178.78 m^2, @ roof slope of 1.6% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.12\text{m})[108.23 + 4\,(26.96) + 0]}{6}$$

$$V = \frac{(0.12\text{m})(216.07)}{6}$$

$$V = 4.32\text{ m}^3$$

The available Roof Area 3 storage volume of 4.32 m^3 > required five (5)-Year storage volume of 2.79 m^3 from Table 4.

Therefore, the ponding depth at the proposed Roof Drain No. 3 location is approximately 0.12 m (120 mm) and the five (5)-Year level is estimated not to reach the roof perimeter of the building.

Roof Storage Area No. 4

Available flat roof area for storage = 264.86 m^2, @ roof slope of 1.3% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.12\text{m})[167.98 + 4\,(42.52) + 0]}{6}$$

$$V = \frac{(0.12\text{m})(338.06)}{6}$$

$$V = 6.76\text{ m}^3$$

The available Roof Area 1 storage volume of 6.76 m^3 > required five (5)-Year storage volume of 4.95 m^3 from Table 5.

Therefore, the ponding depth at the proposed Roof Drain No. 4 location is approximately 0.12 m (120 mm) and the five (5)-Year level is estimated not to reach the roof perimeter of the building.

Roof Storage Area No. 5

Available flat roof area for storage = 260.26 m^2, @ roof slope of 1.3% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.12\text{m})[166.78 + 4\,(40.59) + 0]}{6}$$

$$V = \frac{(0.12\text{m})(329.14)}{6}$$

$V = 6.58\ m^3$

The available Roof Area 5 storage volume of 6.58 m^3 > required five (5)-Year storage volume of 4.80 m^3 from Table 6.

Therefore, the ponding depth at the proposed Roof Drain No. 5 location is approximately 0.12 m (120 mm) and the five (5)-Year level is estimated not to reach the roof perimeter of the building.

<u>Roof Storage Area No. 6</u>

Available flat roof area for storage = 264.48 m^2, @ roof slope of 1.3% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.12m)[171.98 + 4\ (41.57) + 0]}{6}$$

$$V = \frac{(0.12m)(338.26)}{6}$$

$$V = 6.77\ m^3$$

The available Roof Area 6 storage volume of 6.77 m^3 > required five (5)-Year storage volume of 4.95 m^3 from Table 7.

Therefore, the ponding depth at the proposed Roof Drain No. 6 location is approximately 0.12 m (120 mm) and the five (5)-Year level is estimated not to reach the roof perimeter of the building.

During the 5-Year event the required rooftop storage volume is estimated at 22.97 m^3 (min.) and the available storage volume is 33.23 m^3 at the 0.12m ponding depth specified above at each of the 6 drains.

<u>Storm Pipe Storage @ 5-Year HWL = 88.22 m</u>

- 37.5 m of 1050 mm diameter

$$V_2 = \frac{\pi\ (0.525)^2\ (37.5)}{2} = 16.23\ m^3$$

- 83.0 m of 900 mm diameter

$$V_3 = \frac{\pi\ (0.45)^2\ (83.0)}{2} = 26.39\ m^3$$

Total pipe storage volume = 42.62 m^3

Drainage Structure Storage

- CB/MH #1 (2400∅) = $\pi\ (1.2)^2\ (0.90)$ = 4.07 m^3
- CB/MH #2 (1500∅) = $\pi\ (0.75)^2\ (0.22)$ = 0.39 m^3
- ST.MH #3 (1800∅) = $\pi\ (0.9)^2\ (0.36)$ = 0.92 m^3
- CB/MH #4 (1800∅) = $\pi\ (0.9)^2\ (0.16)$ = 0.41 m^3
- CB/MH #5 (1500∅) = $\pi\ (0.75)^2\ (0.07)$ = 0.12 m^3

Total drainage structure available storage volume = 5.91 m^3

Therefore at the estimated 5-Year H.W.L. = 88.22 m, the 5-Year available site storage volume from underground piping and drainage structures is estimated at 48.53 m^3 which is greater than the required (min.) storage volume of 47.13 m^3 from Table 1.

AVAILABLE STORAGE VOLUME CALCULATIONS

100-Year Event

Roof Storage at Flat Roof Building

Roof Area 1 to Roof Area 6 will be used for storm-water detention. Each roof area will be drained by one (1) controlled drain. Each roof drain will have a maximum release rate of 15.0 U.S.gal./min. or 0.95 L/s under a head of 150mm. Thus for each roof area the controlled flow off-site is 5.7 L/s (6 × 0.95 L/s). Therefore, the (6) roof drains specified is the Watts model Adjustable Accutrol Weir (Model No. RD-100A-ADJ) with 1/4 opening as specified. Refer to Dwg. No. 822-125 SWM-1 for details. As for the remainder of the site, the proposed oversized underground drainage pipes and structures within this site will be designed to provide stormwater detention in order to control the allowable site release rate of 22.55 L/s.

Roof Storage Area No. 1

Available flat roof area for storage = 179.08 m^2, @ roof slope of 1.6% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.15\text{m})[179.08 + 4\,(43.93) + 0]}{6}$$

$$V = \frac{(0.15\text{m})(354.80)}{6}$$

$$V = 8.87\ \text{m}^3$$

The available Roof Area 1 storage volume of 8.87 m^3 > required 100-Year storage volume of 6.72 m^3 from Table 9.

Therefore, the ponding depth at the proposed Roof Drain No. 1 location is approximately 0.15 m (150 mm) and 0mm above the roof perimeter surface. Therefore, it is recommended that roof scuppers be installed at an elevation to match the top of roof drain elevation for emergency overflow purposes in case of blockage from debris build up at the roof drains as per City's requirements.

Roof Storage Area No. 2

Available flat roof area for storage = 173.94 m^2, @ roof slope of 1.6 % (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.15\text{m})[173.94 + 4\,(47.88) + 0]}{6}$$

$$V = \frac{(0.15\text{m})(341.46)}{6}$$

$$V = 8.53\ \text{m}^3$$

The available Roof Area 2 storage volume of 8.53 m^3 > required five 100-Year storage volume of 6.46 m^3 from Table 10.

Therefore, the ponding depth at the proposed Roof Drain No. 2 location is approximately 0.15 m (150 mm) and 0mm above the roof perimeter surface. Therefore, it is recommended that roof scuppers be installed at an elevation to match the top of roof drain elevation for emergency overflow purposes in case of blockage from debris build up at the roof drains as per City's requirements.

Roof Storage Area No. 3

Available flat roof area for storage = 178.78 m^2, @ roof slope of 1.6% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.15\text{m})[178.78 + 4\ (41.57) + 0]}{6}$$

$$V = \frac{(0.15\text{m})(345.06)}{6}$$

$$V = 8.63\ \text{m}^3$$

The available Roof Area 3 storage volume of 8.63 m^3 > required 100-Year storage volume of 6.72 m^3 from Table 11.

Therefore, the ponding depth at the proposed Roof Drain No. 3 location is approximately 0.15 m (150 mm) and 0mm above the roof perimeter surface. Therefore, it is recommended that roof scuppers be installed at an elevation to match the top of roof drain elevation for emergency overflow purposes in case of blockage from debris build up at the roof drains as per City's requirements.

Roof Storage Area No. 4

Available flat roof area for storage = 264.86 m^2, @ roof slope of 1.3% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.15\text{m})[264.86 + 4\ (64.86) + 0]}{6}$$

$$V = \frac{(0.15\text{m})(524.30)}{6}$$

$$V = 13.11\ \text{m}^3$$

The available Roof Area 4 storage volume of 13.11 m^3 > required 100-Year storage volume of 11.47 m^3 from Table 12.

Therefore, the ponding depth at the proposed Roof Drain No. 4 location is approximately 0.15 m (150 mm) and 0mm above the roof perimeter surface. Therefore, it is recommended that roof scuppers be installed at an elevation to match the top of roof drain elevation for emergency overflow purposes in case of blockage from debris build up at the roof drains as per City's requirements.

Roof Storage Area No. 5

Available flat roof area for storage = 260.26 m^2, @ roof slope of 1.3% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.15\text{m})[260.26 + 4\ (63.91) + 0]}{6}$$

$$V = \frac{(0.15\text{m})(515.90)}{6}$$

$$V = 12.90\ \text{m}^3$$

The available Roof Area 5 storage volume of 12.90 m^3 > required 100-Year storage volume of 11.15 m^3 from Table 13.

Therefore, the ponding depth at the proposed Roof Drain No. 5 location is approximately 0.15 m (150 mm) and 0mm above the roof perimeter surface. Therefore, it is recommended that roof scuppers be installed at an elevation to match the top of roof drain elevation for emergency overflow purposes in case of blockage from debris build up at the roof drains as per City's requirements.

Roof Storage Area No. 6

Available flat roof area for storage = 264.48 m^2, @ roof slope of 1.3% (min.). Therefore, the available roof area regulated by one (1) controlled roof drain will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.15\text{m})[264.48 + 4\ (65.09) + 0]}{6}$$

$$V = \frac{(0.15\text{m})(524.84)}{6}$$

$$V = 13.12\ \text{m}^3$$

The available Roof Area 6 storage volume of 13.12 m^3 > required 100-Year storage volume of 11.47 m^3 from Table 14.

Therefore, the ponding depth at the proposed Roof Drain No. 6 location is approximately 0.15 m (150 mm) and 0mm above the roof perimeter surface. Therefore, it is recommended that roof scuppers be installed at an elevation to match the top of roof drain elevation for emergency overflow purposes in case of blockage from debris build up at the roof drains as per City's requirements.

During the 100-Year event the required rooftop storage volume is estimated at 53.99 m^3 (min.) and the available storage volume is 65.16 m^3 at the 0.15m ponding depth specified above at each of the 6 drains.

Storm Pipe Storage @ 100-Year HWL = 90.05 m

- 37.50 m of 1050 mm diameter

$$V_1 = \pi\ (0.525)^2\ (37.5) = 32.46\ \text{m}^3$$

- 83.0 m of 900 mm diameter

$$V_2 = \pi\ (0.45)^2\ (83.0) = 52.78\ \text{m}^3$$

- 3.0 m of 200 mm diameter

$$V_3 = \pi\ (0.1)^2\ (3.0) = 0.09\ \text{m}^3$$

Total pipe storage volume = $85.33\ m^3$

Drainage Structure Storage

- CB/MH #1 (2400ø) = $\pi\ (0.3)^2\ (0.73) + \pi\ (1.2)^2\ (2.0) = 0.21 + 9.04 = 9.25\ m^3$
- CB/MH #2 (1500ø) = $\pi\ (0.3)^2\ (0.45) + \pi\ (0.75)^2\ (1.6) = 0.13 + 2.83 = 2.96 m^3$
- ST.MH #3 (1800ø) = $\pi\ (0.3)^2\ (0.49) + \pi\ (0.9)^2\ (1.7) = 0.14 + 4.32 = 4.46\ m^3$
- CB/MH #4 (1800ø) = $\pi\ (0.3)^2\ (0.44) + \pi\ (0.9)^2\ (1.6) = 0.12 + 4.07 = 4.19\ m^3$
- CB/MH #5 (1500ø) = $\pi\ (0.3)^2\ (0.45) + \pi\ (0.75)^2\ (1.45) = 0.13 + 2.56 = 2.69\ m^3$
- CB #6 = $0.6 \times 0.6 \times 1.43 = 0.52\ m^3$

Total drainage structure available storage volume = $24.07\ m^3$

Therefore at the estimated 100-Year H.W.L. = 90.05 m, the 100-Year available site storage volume from underground piping and drainage structures is estimated at 109.40 m^3 which is greater than 108.89 m^3 required volume from Table 8.

Thus the 100-Year available site storage volume is estimated at 109.40 m^3 which is greater than the required storage volume of 108.89 m^3.