PROPOSED

SIX (6) STOREY APARTMENT BUILDING SITE

LOT 1

R-PLAN 268160

917 MERIVALE ROAD

CITY OF OTTAWA

STORM DRAINAGE REPORT

REPORT No. R-823-102

T.L. MAK ENGINEERING CONSULTANTS LTD.

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REFERENCE FILE NUMBER 823-102

Introduction

The proposed six (6) storey residential apartment building site is located on the east side of Merivale Road and situated south of Crerar Avenue and north of Anna Avenue. Its legal property description is Lot 1 Registered Plan 268160 in City of Ottawa (Ward 16 – River). Presently, the residential development site under consideration houses a 1 ½ -storey wooden sided dwelling in which the house is located at the front of the lot. The municipal address of the property is referenced as 917 Merivale Road.

The lot area under consideration is approximately 481.50 square metres. This property is proposed for the development of a (6) storey residential apartment building plus a basement. The total gross floor area at each floor covers an average area of approximately ±2,633.3 ft^2 (244.6 m) and for the proposed building is approximately 15,806.0 square feet (±1,468.0 square metres) including basement level.

The building will house a total of 20 apartment units, including ten (10) 1-bedroom unit and ten (10) bachelor units. The storm water outlet for this site is the existing 450mm diameter storm sewer located within the Merivale Road road right of way.

From storm-drainage criteria set by the staff at the City of Ottawa's Engineering Department, the allowable post-development runoff release rates shall not exceed the two (2)-year pre-development conditions because the existing storm pipe was built prior to 1970. The allowable pre-development runoff coefficient is the lesser of the calculated "C" existing value = 0.59 or C_{allow} = 0.5 maximum. If the uncontrolled storm-water runoff exceeds the specified requirements, then on-site storm-water management (SWM) control measures are necessary. The post-development runoff coefficient for this site is estimated at C = 0.82, which exceeds the calculated pre-development allowable C_{allow} = 0.5 criteria for the Merival Road storm sewer without on-site SWM control. Therefore, SWM measures are required. Refer to the attached Drainage Area Plan (Figure 1) as detailed in Appendix A. For Pre and Post site development characteristics, refer also to the storm Drainage Area Plan Dwg. No. 823-102 D-1 for details.

This report will address and detail the grading, drainage, and storm-water management control measures required to develop this property. Based on the Proposed Site Grading and Servicing Plan (Dwg. No. 823-102 G-1), and on the Proposed Rooftop Storm-water Management Plan (Dwg. No. 823-102 SWM-1), the storm water of this lot will be controlled and attenuated on-site by the building's available flat rooftop and the proposed oversized underground storage pipes located along the vehicle access lane of this lot.

The storm-water 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 where possible the appropriate runoff release that will conform to the City's established drainage criteria and review requirements.

Because the site will be connecting to and outletting into the separated Merivale Road storm sewer, therefore, the approval exemption under Ontario Regulations 525/98 would apply since storm water discharges from this site will outlet flow into a downstream storm sewer. Thus, an Environmental Compliance Application (ECA) application will not be required to be submitted to the Ministry.

Site Data

1. <u>Development Property Area</u>

Post-Development Site Area Characteristics

Development Lot Area	=	481.50 m^2
Roof Surface Area	=	290.24 m^2
Concrete Area	=	32.34 m^2
Interlock Area	=	2.65 m^2
Asphalt Area	=	100.77 m^2
Grass Area	=	55.50 m^2

$$C = \frac{(290.24 \times 0.9) + (32.34 \times 0.9) + (2.65 \times 0.9) + (100.77 \times 0.9) + (55.50 \times 0.2)}{481.50}$$

$$C = \frac{394.50}{481.50}$$

$$C = 0.819$$

Say "C" $= 0.82$

Therefore, the average post-development "C" for this site is 0.82.

2. <u>Controlled Area Data (NODE #1, NODE #2 and NODE #3)</u>

Roof Surface Area	=	290.24 m^2
Asphalt Area	=	97.46 m^2
Concrete Area	=	13.35 m^2
Grass Area	=	38.55 m^2
Total Storm-water Controlled Area	=	439.60 m^2

$$C = \frac{(290.24 \times 0.9) + (97.46 \times 0.9) + (13.35 \times 0.9) + (38.55 \times 0.2)}{439.60}$$

$$C = \frac{368.655}{439.60}$$

$$C = 0.839$$

Say "C" $= 0.84$

Therefore, the post-development "C" for the controlled storm-water drainage area (roof top and underground storage pipe) is 0.84.

3. Uncontrolled Area Data (NODE #4)

PROPOSED SITE

Asphalt Area	=	3.31 m^2
Grass Area	=	16.95 m^2
Interlock Paver Area	=	2.65 m^2
Concrete Area	=	18.99 m^2
Total Storm-water Uncontrolled Area	=	41.90 m^2

$$C = \frac{(3.31 \times 0.9) + (16.95 \times 0.2) + (2.65 \times 0.9) + (18.99 \times 0.9)}{41.90}$$

$$C = \frac{25.845}{41.90}$$

$$C = 0.617$$

$$\text{Say "C"} = 0.62$$

Therefore, the average post-development "C" for the uncontrolled storm-water drainage area of 41.90 m^2 from this site is 0.62.

The total tributary area consisting of approximately 41.90 square metres will be out-letting off site uncontrolled from the residential apartment building site which is also the surface area draining to the front of the lot and outletting to the Merivale Road road right of way.

The uncontrolled drainage area draining to the front of the lot is 41.90 m^2 and the controlled drainage area from roof top, rear parking lot and access laneway which totals to 439.60 m^2.

The SWM area to be controlled is 439.60 m^2. Refer to the attached "Drainage Area Plan" in Figure 1 of Appendix A for further details.

Pre-Development Flow Estimation

Maximum allowable off-site flow: two (2)-year storm

Node #101

Pre-Development Site Area Characteristics

Development Lot Area	=	481.50 m^2
Asphalt Area	=	33.14 m^2
Gravel/Interlock Area	=	182.61 m^2
Roof Area	=	54.82 m^2
Grass Area	=	210.93 m^2

$$C_{2pre} = \frac{(33.14 \times 0.9) + (182.61 \times 0.9) + (54.82 \times 0.9) + (210.93 \times 0.2)}{481.50}$$

$$C_{2pre} = \frac{285.699}{481.50}$$

$$C_{2pre} = 0.593$$

Say $C_{2pre} = 0.59 > C_{2allow} = 0.5$

∴ Use C_{pre} = 0.50 allowable for redevelopment

T_c = D/V where D = 25.0m, ΔH = 0.47m, S = 1.9%, and V = 1.1 feet/second = 0.34 m/s

Therefore,

$$T_c = \frac{25.0\text{m}}{0.34\text{m/s}}$$

$T_c = 1.23$ minutes

Use $T_c = 10$ minutes

I_2 = 77.10 mm/hr [City of Ottawa, two (2)-year storm]

Using the Rational Method

Q = 2.78 (0.50) (77.10) (0.0482)

Q = 5.17 L/s

Therefore, the total allowable flow off-site is 5.17 L/s.

The pre-development flow of the two (2)-year and 100-year storm event draining off-site from the lot is as follows:

2-Year Event

Where, Tc = 10 min.

$Q_{2pre} = 2.78$ CIA

$$C_{2pre} = \frac{285.699}{481.50}$$

$C_{2pre} = 0.593$

Say, $C_{2pre} = 0.59$

$Q_{2pre} = 2.78\ (0.593)\ (77.10)\ (0.04815)$

$= 6.12\ \mathrm{L/s}$

100-Year Event

$$C_{100pre} = \frac{(33.14 \times 1.0) + (182.61 \times 1.0) + (54.82 \times 1.0) + (210.93 \times 0.2 \times 1.25)}{481.50}$$

$$C_{100pre} = \frac{323.30}{481.50}$$

$$C_{100pre} = 0.671$$

Say, $C_{100pre} = 0.67$

$Q_{100pre} = 2.78\ (0.67)\ (178.6)\ (0.04815)$

$= 16.02\ \mathrm{L/s}$

Therefore under current site conditions the 2-year pre-development flow is estimated at 6.12 L/s and the 100 year pre-development flow is estimated at 16.02 L/s.

A coloured Google image and aerial photography of these current pre-development conditions of the site is provided in Appendix B of this report for reference.

Post-Development Flow Estimation

Uncontrolled Drainage Areas

The post-development flow of the two (2)-year and 100-year storm event draining off-site from the lot uncontrolled is as follows:

Where, Tc = 10 min.

Node #4

Q_{2post} = 2.78 CIA

Post Development Area Draining off-site uncontrolled is:

Asphalt Area	=	3.31 m^2
Interlock Paver Area	=	2.65 m^2
Grass Area	=	16.95 m^2
Concrete Area	=	18.99 m^2

A_{Total} = 41.90 m^2

$$C_{2post} = \frac{(3.31 \times 0.9) + (16.95 \times 0.2) + (2.65 \times 0.9) + (18.99 \times 0.9)}{41.90}$$

$$C_{2post} = \frac{25.845}{41.90}$$

$C_{2post} = 0.617$

Say, C_{2post}= 0.62 draining off-site uncontrolled.

Q_{2post}= 2.78 (0.62) (77.10) (0.0042)

= 0.56 L/s

$$C_{100post} = \frac{(3.31 \times 1.0) + (16.95 \times 0.2 \times 1.25) + (2.65 \times 1.0) + (18.99 \times 1.0)}{41.90}$$

$$C_{100post} = \frac{29.1875}{41.90}$$

$C_{100post} = 0.697$

Say, $C_{100post}$ = 0.70 draining to the front of lot uncontrolled

$Q_{100post}$ = 2.78 (0.70) (178.6) (0.0042)

= 1.46 L/s

Therefore under post development condition, the 2-year uncontrolled flow off-site is estimated at 0.56 L/s and the 100 year uncontrolled flow is 1.46 L/s.

For this site, because 41.90 square meters of the site area is drained uncontrolled off site, the net allowable discharge for this site into the existing sewer system using the two (2)-year storm event criteria at C_{allow} = 0.5 is calculated as follow: Q = {2.78 (0.5) (77.10) (0.04815) - [2.78 (0.70) (178.6) (0.0042)]} = 5.16 L/s – 1.46 L/s = 3.70 L/s. Therefore, according to this approach, the maximum calculated allowable flow rate off site is 5.16 L/s and the net allowable controlled flow rate off-site is 3.70 L/s.

Storm-Water Management Analysis

The calculated flow rate of 3.70 L/s for on-site stormwater management detention volume storage will be used for this SWM analysis. Since a total of two (2) controlled roof drains are proposed to restrict flow from the building's available flat rooftop at a rate of 2.84 L/s (1.26 L/s + 1.58 L/s) into the Merivale Road storm sewer, therefore, the remainder of the site allowable release rate from the ICD in CB/MH#1 is 3.70 L/s – 2.84 L/s = 0.86 L/s.

Therefore, release rate of 3.70 L/s will be incorporated to estimate the required site storage volume for this proposed development lot. On-site drainage system with oversized underground storm pipes controlled by ICD in CB/MH#1 and two (2) rooftop drains are proposed to attenuate the post development stormwater. 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 structure and the available flat rooftop of the proposed residential apartment building will be used for stormwater attenuation purposes.

The inflow rate during the 5-Year and 100-Year storm for the access roadway 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. 3)

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 residential building flat roof area controlled by 2 roof drains)

Asphalt Area	=	$97.46m^2$
Concrete Area	=	$13.35m^2$
Grass Area	=	$38.55m^2$
Roof Area	=	$90.01m^2$

Total Stormwater Controlled Area = $239.37m^2$

5-Year Event

$$C_5 = \frac{(97.46 \times 0.9) + (90.01 \times 0.9) + (38.55 \times 0.2) + (13.35 \times 0.9)}{239.37}$$

$$C_5 = \frac{188.448}{239.37}$$

$C_5 = 0.787$ Say "C_5" = 0.79

A = 0.024 ha.

Inflow Rate $(Q_A)_5$ = 2.78 CIA

= 2.78 (0.79) (0.024) I

= 0.0527 I I = (mm/hr)

100-Year Event

$$C_{100} = \frac{(97.46 \times 1.0) + (90.01 \times 1.0) + (38.55 \times 0.2 \times 1.25) + (13.35 \times 1.0)}{239.37}$$

$$C_{100} = \frac{210.458}{239.37}$$

$C_{100} = 0.879$ Say "C_{100}" = 0.88

A = 0.024 ha.

Inflow Rate $(Q_A)_5$	=	2.78 CIA
	=	2.78 (0.88) (0.024) I
	=	0.0587 I I = (mm/hr)

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

Q_{100} = 0.0587 I

This now can be used to determine the site storage volume (oversized underground pipe drainage structures) 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 apartment building on the property will incorporate two (2) rooftop areas for stormwater attenuation in which each segmented flat roof area will incorporate one (1) roof drain per area to control flow off-site. The specified roof drain maximum flow rate for Roof Drain No. 1 is 1.26 L/s or 20.0 U.S. gal/min. under a head of 150 mm. For Roof Drain No. 2 is 1.58 L/s or 25.0 U.S. gal/min. under head of 150 mm. Therefore, the stormwater flow that can be controlled from this rooftop and outletted off-site is 2.84 L/s (1.26 L/s + 1.58 L/s) using the Watts Adjustable Accutrol specified drains (see Table 7 in Appendix C for details).

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 area of roof

I = (mm/hr)

5-Year Event

For Roof Area 1 (NODE No. 1)

Q_{A1} = 2.78 CIA
C = 0.90
A = 87.66 m^2
I = mm/hr

= 2.78 (0.90) (0.088) I

= 0.022 I

For Roof Area 2 (NODE No. 2)

Q_{A2} = 2.78 CIA
C = 0.90
A = 112.57 m^2
I = mm/hr

= 2.78 (0.90) (0.0113) I

= 0.0283 I

100-Year Event

For Roof Area 1 (NODE No. 1)

Q_{A1} = 2.78 CIA
C = 1.0
A = 87.66 m^2
I = mm/hr

= 2.78 (1.0) (0.088) I

= 0.0245 I

For Roof Area 2 (NODE No. 2)

Q_{A2} = 2.78 CIA
C = 1.0
A = 112.57 m^2
I = mm/hr

= 2.78 (1.0) (0.0113) I

= 0.0314 I

The summary results of the calculated inflow and the storage volume of the site and building's flat rooftop to store the 5-Year and 100-Year storm events are shown on the **Tables 1 to 6** inclusive.

Table 7 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 7: Design Flow and Roof Drain Table

Roof Drain 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	
RD-1 (0.0113 ha)	1	RD-100-A-ADJ (1/2 OPENING)	1.10	1.26	0.12	0.15	0.72	2.02	2.35
RD-2 (0.0088 ha)	1	RD-100-A-ADJ (3/4 OPENING)	1.34	1.58	0.12	0.15	0.97	2.63	2.69
Total Roof (0.0201 ha)	2	-	**2.44**	**2.84**	-	-	**1.69**	**4.65**	**5.04**

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 450 mm diameter storm sewer fronting on 917 Merivale Road 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 EF0-4) 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 D 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 Merivale Road 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. #823-102 ESC-1 for details.

Conclusion

At this proposed residential site and to develop this lot to house a 20 unit apartment building on a 0.0482 ha. parcel of land, the estimated allowable flow off-site is calculated at 5.17 L/s based on City of Ottawa Drainage and Stormwater Management (SWM) criteria of 2-year pre-development flow at C_{allow} = 0.50. For on-site SWM attenuation, the flat roof top of the proposed apartment building will be utilized and (2) controlled roof drains are incorporated as well as the proposed site oversized underground storm drainage system.

In order to control the 5-Year stormwater release rate off-site to an allowable rate of 5.17 L/s, a calculated site storage volume of approximately 5.26 m^3 (min.) is required during the 5-Year event. We estimate that the required storage volume of 1.69 m^3 (min.) of rooftop storage and 3.57 m^3 (min.) from the site underground drainage system are necessary to attenuate the 5-Year storm event. See Table 1 to 3 inclusive.

During the 5-Year storm event for the flat rooftop storage, the ponding depth of rooftop is estimated at 120 mm at Roof Drain No. 1 and Roof Drain No. 2 and 0 mm at the roof perimeter, assuming a 2.0% (min.) roof pitch to the roof drains. The rooftop storage available at Roof Area No. 1 is 1.17 m^3 and Roof Area No. 2 is 1.38 m^3, for a total of 2.55 m^3, which is greater than the required volume of 1.69 m^3.

As for the remaining storage volume of 3.57 m^3 (min.) required from the site development area for the 5-Year storm event, the estimated H.W.L. of 76.48 m will provide a total available underground storage volume of 4.0 m^3 consisting of the proposed underground storm piping and drainage structures. In total, the 5-Year available site storage volume is approximately 4.0 m^3 which is greater than the required site storage volume of 3.57 m^3. See Appendix E for details.

In order to control the 100-Year stormwater release rate off-site to an allowable rate of 5.17 L/s, a calculated site storage volume of approximately 13.37 m^3 (min.) is required during the 100-Year event. We estimate that the required storage volume of 4.65 m^3 (min.) of rooftop storage and 8.72 m^3 (min.) from the site underground drainage system are necessary to attenuate the 5-Year storm event. See Table 4 to 6 inclusive

During the 100-year storm event for the flat rooftop storage, the ponding depth on this rooftop is estimated at 150 mm at Roof Drain No. 1 and Roof Drain No. 2 and 0 mm at the roof perimeter assuming a 2.0% (min.) roof pitch to the drains. The rooftop storage available at Roof Area No. 1 is 2.35 m^3 and Roof Area No. 2 is 2.69 m^3 for a total of 5.04 m^3 which is greater than the required volume of 4.65 m^3.

As for the remaining storage volume of 8.72 m^3 (min.) required from the site development area for the 100-Year storm event, the estimated H.W.L. of 77.18 m will provide a total available underground storage volume of 8.90 m^3 consisting of the proposed underground storm piping and drainage structures. In total, the 100-Year available site storage volume is approximately 8.90 m^3 which is greater than the required site storage volume of 8.72 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. 823-102, G-1) the desirable 5-Year and 100-Year storm event attenuation volume of 4.0 m^3 and 8.90 m^3 respectively will be available on-site.

In order to control the release flow rate off-site from the controlled drainage are of the lot, an inlet control device (ICD) will be installed at the outlet of CB/MH#1 in the 300 mm diameter storm pipe (outlet pipe) with Q = 6.0 L/s under a head of 1.0 m. A rooftop drain with a maximum release rate of 1.26 L/s will be installed at Roof Drain No. 1 and a maximum release rate of 1.58 L/s will be installed at Roof Drain No. 2 under a head of 150 mm at the proposed apartment building flat rooftop as depicted on (Dwg. No. 823-102, G-1).

A specified inlet control device (ICD) will be installed at the outlet of CB/MH#1 in the 300 mm diameter storm pipe (outlet pipe) with Q = 6.0 L/s under a head of 1.0 m. The ICD type recommended is a Hydrovex Regulator (75-VHV-1) or equivalent. See Appendix F for ICD details. The specified ICD at 6.0 L/s is the lowest flow ICD permitted by the City of Ottawa for maintenance purposes.

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 PVC storm lateral from the apartment building whereupon both laterals "wye" into the proposed 300 mm dia. storm pipe due to one (1) connection to the existing Merivale Road storm sewer is permitted. Therefore, both storm laterals and the site storm sewer all outlets to the existing Merivale Road 450 mm diameter storm sewer with only one (1) storm pipe 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 on the City storm sewer system. Refer to the proposed site grading and servicing plan Dwg. 823-102 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 D for details).

PREPARED BY T.L. MAK ENGINEERING CONSULTANTS LTD.

TONY L. MAK, P.ENG.

LICENSED PROFESSIONAL ENGINEER
08/19/24
TONY L-M. MAK
PROVINCE OF ONTARIO

PROPOSED 917 MERIVALE ROAD SIX (6)-STOREY APARTMENT

BUILDING 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	7.44	0.86	6.58	1.97
10	104.20	5.49	0.86	4.63	2.78
15	83.50	4.40	0.86	3.54	3.19
20	70.30	3.70	0.86	2.84	3.41
25	60.90	3.21	0.86	2.35	3.53
30	53.93	2.84	0.86	1.98	3.564
35	48.60	2.56	0.86	1.70	3.57
40	44.20	2.33	0.86	1.47	3.53

Q_{ALLOW} = (3.7 L/s – 1.58 L/s – 1.26 L/s) = 0.86 L/s for underground storage sizing.

Therefore, the required storage volume is 3.57 m^3.

SITE DATA

- Drainage Area ID = Node #3
- Area = 0.024 ha.
- C_5 = 0.79

PROPOSED 917 MERIVALE ROAD SIX (6)-STOREY APARTMENT

BUILDING DEVELOPMENT SITE

TABLE 2

FIVE (5)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 1 STORAGE VOLUME

ROOF DRAIN No. 1

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	3.11	1.10	2.01	0.61
10	104.20	2.29	1.10	1.19	0.72
15	83.50	1.84	1.10	0.74	0.67
20	70.30	1.55	1.10	0.45	0.54
25	60.90	1.34	1.10	0.24	0.36

Therefore, the required rooftop storage volume is 0.72 m^3.

SITE DATA

- Drainage Area ID = Node #1
- Area = 0.0088 ha.
- C_5 = 0.9

PROPOSED 917 MERIVALE ROAD SIX (6)-STOREY APARTMENT

BUILDING DEVELOPMENT SITE

TABLE 3

FIVE (5)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 2 STORAGE VOLUME

ROOF DRAIN No. 2

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	3.99	1.34	2.65	0.80
10	104.20	2.95	1.34	1.61	0.97
15	83.50	2.36	1.34	1.02	0.92
20	70.30	1.99	1.34	0.65	0.78
25	60.90	1.72	1.34	0.38	0.57

Therefore, the required rooftop storage volume is 0.97 m^3.

SITE DATA

- Drainage Area ID = Node #2
- Area = 0.0113 ha.
- C_5 = 0.9

PROPOSED 917 MERIVALE ROAD SIX (6)-STOREY APARTMENT

BUILDING DEVELOPMENT SITE

TABLE 4

100-YEAR EVENT

SITE REQUIRED STORAGE VOLUME

UNDERGROUND STORM PIPES AND DRAINAGE STRUCTURES

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)
5	242.80	14.26	0.86	13.40	4.02
10	178.60	10.49	0.86	9.63	5.78
15	142.90	8.39	0.86	7.53	6.78
20	120.00	7.05	0.86	6.19	7.43
25	103.90	6.10	0.86	5.24	7.86
30	91.90	5.40	0.86	4.54	8.17
35	82.60	4.85	0.86	3.99	8.38
40	75.10	4.40	0.86	3.54	8.50
45	69.10	4.06	0.86	3.20	8.64
50	63.90	3.75	0.86	2.89	8.67
55	59.60	3.50	0.86	2.64	8.712
60	55.90	3.28	0.86	2.42	8.71
65	52.60	3.09	0.86	2.23	8.70
70	49.80	2.92	0.86	2.06	8.65
75	47.26	2.774	0.86	1.914	8.61

Q_{ALLOW} = (3.7 L/s – 1.58 L/s – 1.26 L/s) = 0.86 L/s for underground storage sizing.

Therefore, the required storage volume is 8.72 m^3.

SITE DATA

- Drainage Area ID = Node #3
- Area = 0.024 ha.
- C_{100} = 0.88

PROPOSED 917 MERIVALE ROAD SIX (6)-STOREY APARTMENT

BUILDING DEVELOPMENT SITE

TABLE 5

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	178.60	4.38	1.26	3.12	1.87
15	142.90	3.50	1.26	2.24	2.02
20	120.00	2.94	1.26	1.68	2.016
25	103.90	2.55	1.26	1.29	1.94
30	91.90	2.25	1.26	0.99	1.78
35	82.60	2.02	1.26	0.76	1.60

Therefore, the required rooftop storage volume is 2.02 m^3.

SITE DATA

- Drainage Area ID = Node #1
- Area = 0.0088 ha.
- C_{100} = 1.0

PROPOSED 917 MERIVALE ROAD SIX (6)-STOREY APARTMENT

BUILDING DEVELOPMENT SITE

TABLE 6

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	178.60	5.61	1.58	4.03	2.42
15	142.90	4.49	1.58	2.91	2.62
20	120.00	3.77	1.58	2.19	2.63
25	103.90	3.26	1.58	1.68	2.52
30	91.90	2.89	1.58	1.31	2.36
35	82.60	2.59	1.58	1.01	2.12

Therefore, the required rooftop storage volume is 2.63 m^3.

SITE DATA

- Drainage Area ID = Node #2
- Area = 0.0113 ha.
- C_{100} = 1.0

PROPOSED

SIX (6) STOREY APARTMENT BUILDING SITE

LOT 1

R-PLAN 268160

917 MERIVALE ROAD

CITY OF OTTAWA

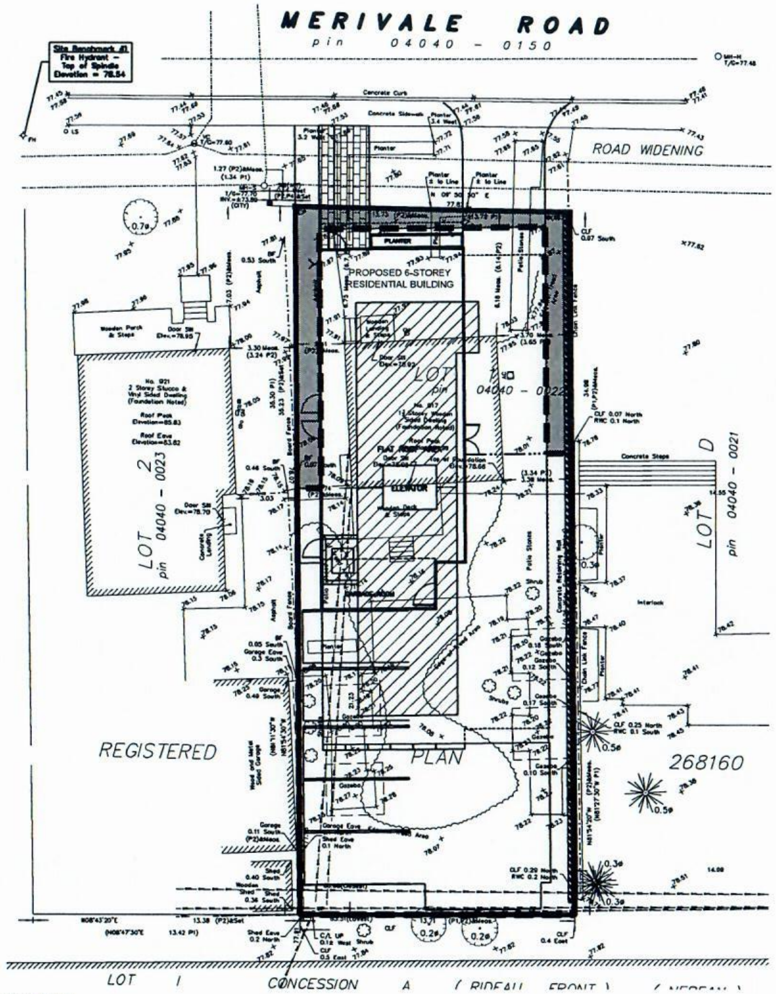
APPENDIX A

STORM DRAINAGE AREA PLAN

FIGURE 1

PROPOSED 917 MERIVALE ROAD
SITE DEVELOPMENT
DRAINAGE AREA PLAN

N.T.S.



LEGEND

- LIMIT OF CONTROLLED STORM DRAINAGE AREA = 439.60 SQ. M
- UNCONTROLLED STORM DRAINAGE AREA = 41.90 SQ. M

TOTAL AREA = 481.50 SQ. M

POST-DEVELOPMENT SITE AVERAGE "C" = 0.82

T.L. MAK ENGINEERING CONSULTANTS LTD.
CONSULTING ENGINEERS

PROJECT No.	DATE	DRAWING No.
823-102	AUGUST 2024	FIGURE 1

PROPOSED

SIX (6) STOREY APARTMENT BUILDING SITE

LOT 1

R-PLAN 268160

917 MERIVALE ROAD

CITY OF OTTAWA

APPENDIX B

SITE PRE-DEVELOPMENT CONDITION

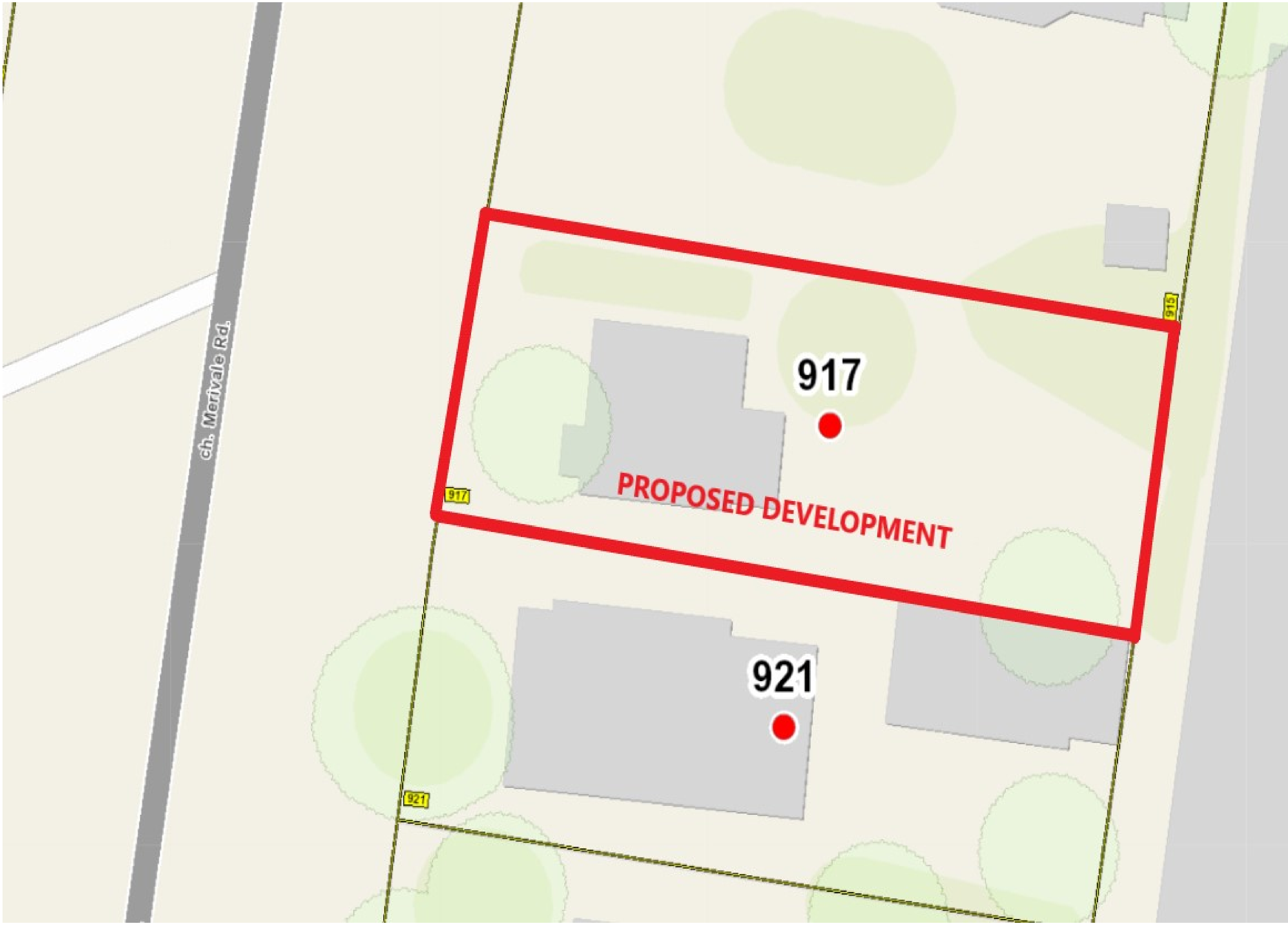
GOOGLE IMAGE 2023

AND

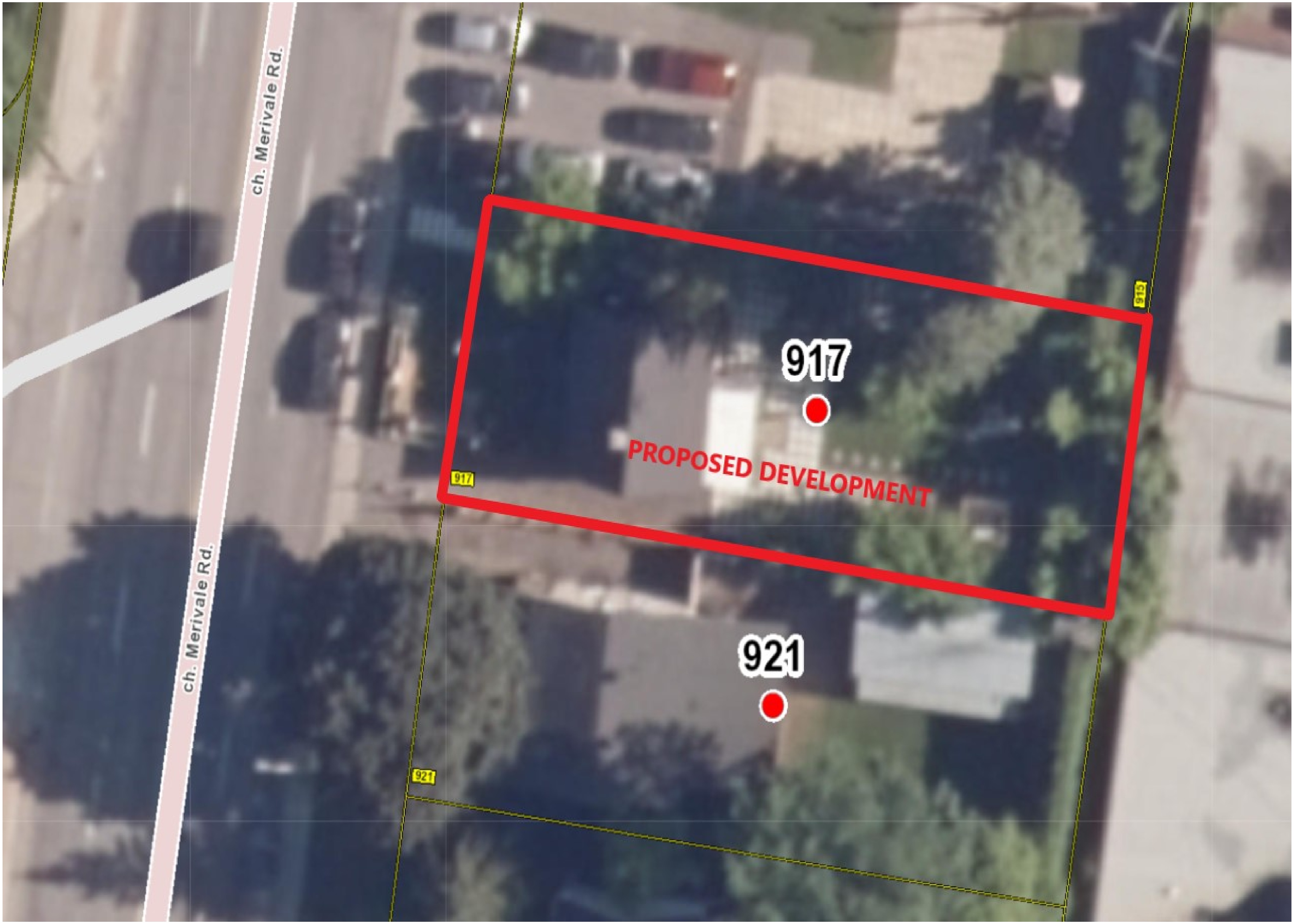
AERIAL PHOTOGRAPHY 2022 (GEOOTTAWA)


FOR SALE
House/Lot/Business
TM ZONING
SAMANTHA NELSON
SOLD
COLLEEN RUSHFORTH
613.788.2502
RE/MAX
our house serves coffee.

2023



2022


ch. Merivale Rd.
ch. Merivale Rd.
917
921
PROPOSED DEVELOPMENT
917
921
915

2022

PROPOSED

SIX (6) STOREY APARTMENT BUILDING SITE

LOT 1

R-PLAN 268160

917 MERIVALE ROAD

CITY OF OTTAWA

APPENDIX C

PROPOSED ROOF DRAIN

DETAILS

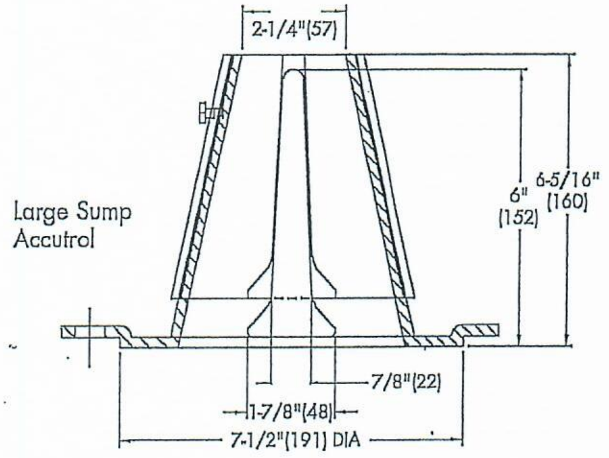
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

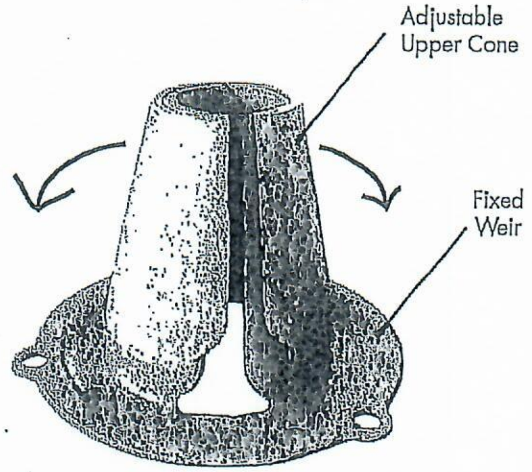
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2"of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3"of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm (per inch of head) x 2 inches of head] + 2-1/2 gpm (for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	5	5	5	5	5

Job Name ____________________ Contractor ____________________
Job Location ____________________ Contractor's P.O. No. ____________________
Engineer ____________________ Representative ____________________

USA: Tel: (800) 338-2581 • Fax: (828) 248-3929 • Watts.com
Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • Watts.ca
Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

WATTS® A Watts Water Technologies Company

PROPOSED

SIX (6) STOREY APARTMENT BUILDING SITE

LOT 1

R-PLAN 268160

917 MERIVALE ROAD

CITY OF OTTAWA

APPENDIX D

STORMCEPTOR MODEL No. EFO-4

SIZING AND DETAILS

AUGUST 15, 2024

TL MaK

From: Brandon O'Leary [brandon.oleary@RinkerPipe.com]
Sent: August 15, 2024 10:06 PM
To: TL MaK
Cc: Jessica Steffler; Kent Campbell
Subject: RE: [EXTERNAL] 917 Merivale Road
Attachments: image001.png; Stormceptor EFO - Oil Grit Separator specification (rev 12-23).doc; Stormceptor EFO - Oil Grit Separator Specification (rev 12-23).pdf; 240815 Stormceptor EFO Sizing Report, 917 Merivale Rd. Ottawa, T.L. Mak, Tony Mak.pdf

Hello Tony,

Great to hear from you. Jessica is away this week, so I am jumping here with the sizing. Attached is the requested Stormceptor EFO (ISO 14034/ETV verified) sizing report for 80% TSS removal of the MoE FINE PSD. Based on the site parameters provided below, the EFO4 is recommended; standard drawings available. This unit has a budget cost of $22,377 including purchase, delivery to site, and the 5-year value-added Quality Assurance Program unique to Stormceptor. I have also attached the standard spec. for the EFO and provided the capacities of the recommended unit below, both for incorporation into the spec. If you need anything else at all, please let me know.

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

Best Regards,

Brandon O'Leary, P.Eng., B.A.Sc.
Stormwater Specialist
Bowmanville/Cambridge Plant
Cell: (905) 630-0359

From: TL MaK <tlmakecl@bellnet.ca>
Sent: Tuesday, August 13, 2024 4:06 PM
To: Jessica Steffler <jessica.steffler@RinkerPipe.com>
Cc: Brandon O'Leary <brandon.oleary@RinkerPipe.com>
Subject: [EXTERNAL] 917 Merivale Road

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 Site Grading and Servicing Plan (Dwg. #823-102 G-1) for your reference.

The total site area is ±481.50 m^2. The controlled area regulated by the Stormceptor is approximately ±0.024 ha. The impervious area within the controlled area of the site is ±0.021 ha. and mainly comprised of the asphalt parking, concrete area and roof area. Please size the Stormceptor unit accordingly at your earliest convenience for our report. The "C" value within the Stormceptor regulated/controlled area is C=0.88. 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

08/15/2024

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20
Site Name:	917 Merivale Rd.
Drainage Area (ha):	0.04815
Runoff Coefficient 'c':	0.89
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.0
Estimated Water Quality Flow Rate (L/s):	1.44
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	

Project Name:	917 Merivale Rd.
Project Number:	823-102
Designer Name:	Brandon O'Leary
Designer Company:	Rinker Pipe
Designer Email:	brandon.oleary@RinkerPipe.com
Designer Phone:	905-630-0359
EOR Name:	Tony Mak
EOR Company:	T.L. Mak Engineering Consultants Ltd.
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	100
EFO6	100
EFO8	100
EFO10	100
EFO12	100

Recommended Stormceptor EFO Model: EFO4

Estimated Net Annual Sediment (TSS) Load Reduction (%): 100

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.

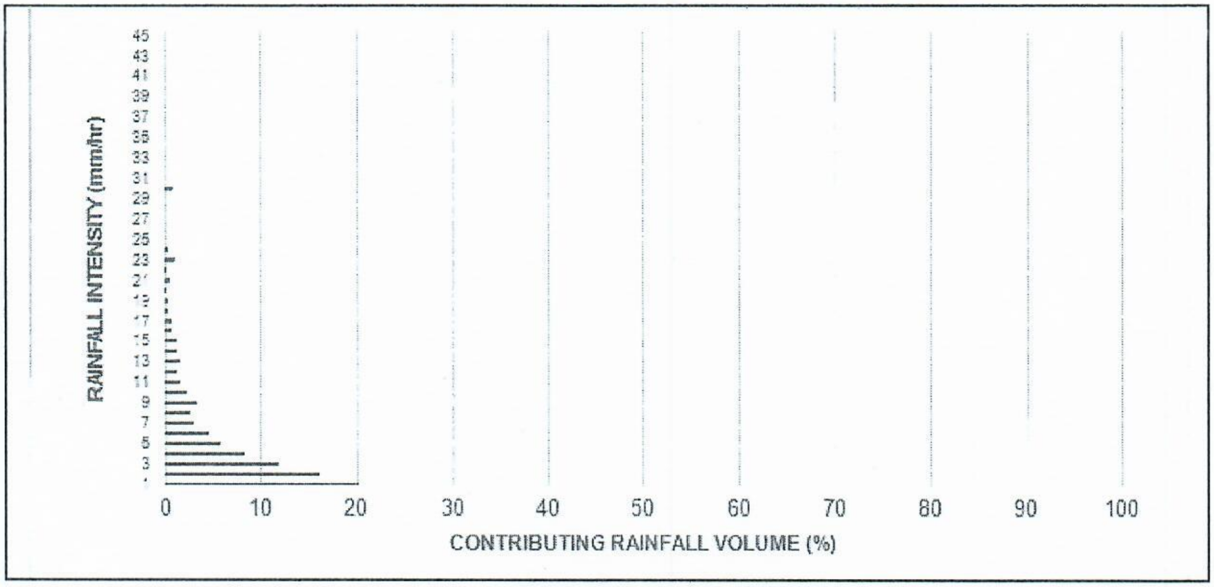
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor®EF Sizing Report

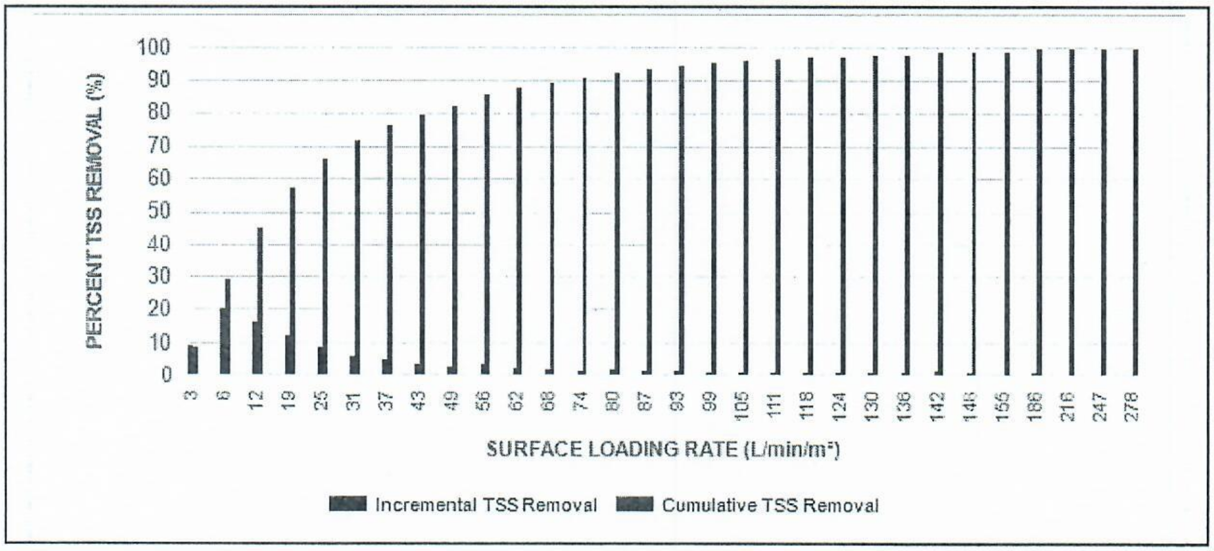
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	0.06	4.0	3.0	100	8.6	8.6
1.00	20.3	29.0	0.12	7.0	6.0	100	20.3	29.0
2.00	16.2	45.2	0.25	15.0	12.0	100	16.2	45.2
3.00	12.0	57.2	0.37	22.0	19.0	100	12.0	57.2
4.00	8.4	65.6	0.49	30.0	25.0	100	8.4	65.6
5.00	5.9	71.6	0.62	37.0	31.0	100	5.9	71.6
6.00	4.6	76.2	0.74	45.0	37.0	100	4.6	76.2
7.00	3.1	79.3	0.87	52.0	43.0	100	3.1	79.3
8.00	2.7	82.0	0.99	59.0	49.0	100	2.7	82.0
9.00	3.3	85.3	1.11	67.0	56.0	100	3.3	85.3
10.00	2.3	87.6	1.24	74.0	62.0	100	2.3	87.6
11.00	1.6	89.2	1.36	82.0	68.0	100	1.6	89.2
12.00	1.3	90.5	1.48	89.0	74.0	100	1.3	90.5
13.00	1.7	92.2	1.61	96.0	80.0	98	1.7	92.2
14.00	1.2	93.5	1.73	104.0	87.0	98	1.2	93.4
15.00	1.2	94.6	1.86	111.0	93.0	97	1.1	94.5
16.00	0.7	95.3	1.98	119.0	99.0	97	0.7	95.2
17.00	0.7	96.1	2.10	126.0	105.0	96	0.7	95.9
18.00	0.4	96.5	2.23	134.0	111.0	95	0.4	96.3
19.00	0.4	96.9	2.35	141.0	118.0	95	0.4	96.7
20.00	0.2	97.1	2.47	148.0	124.0	93	0.2	96.9
21.00	0.5	97.5	2.60	156.0	130.0	92	0.4	97.3
22.00	0.2	97.8	2.72	163.0	136.0	92	0.2	97.5
23.00	1.0	98.8	2.85	171.0	142.0	91	0.9	98.5
24.00	0.3	99.1	2.97	178.0	148.0	91	0.2	98.7
25.00	0.0	99.1	3.09	186.0	155.0	89	0.0	98.7
30.00	0.9	100.0	3.71	223.0	186.0	86	0.8	99.5
35.00	0.0	100.0	4.33	260.0	216.0	83	0.0	99.5
40.00	0.0	100.0	4.95	297.0	247.0	81	0.0	99.5
45.00	0.0	100.0	5.57	334.0	278.0	80	0.0	99.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**100 %**

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

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



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.

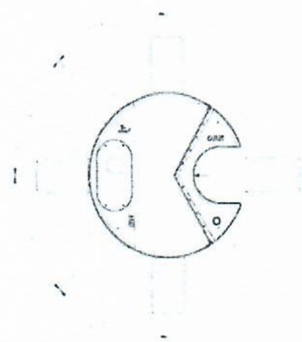
DESIGN FLEXIBILITY

►**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)	(ft³)	(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/ft³)

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.

STANDARD SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE WITH THIRD-PARTY VERIFIED LIGHT LIQUID RE-ENTRAINMENT SIMULATION PERFORMANCE TESTING RESULTS

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, designing, maintaining, and constructing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, **specifically an OGS device that has been third-party tested for oil and fuel retention capability using a protocol for light liquid re-entrainment simulation testing, with testing results and a Statement of Verification in accordance with all the provisions of ISO 14034 Environmental Management – Environmental Technology Verification (ETV)**. Work includes supply and installation of concrete bases, precast sections, and the appropriate precast section with OGS internal components correctly installed within the system, watertight sealed to the precast concrete prior to arrival to the project site.

1.2 REFERENCE STANDARDS

1.2.1 For Canadian projects only, the following reference standards apply:

CAN/CSA-A257.4-14: Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets
CAN/CSA-A257.4-14: Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings
CAN/CSA-S6-00: Canadian Highway Bridge Design Code

1.2.2 For ALL projects, the following reference standards apply:

ASTM D-4097:	Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
ASTM C 478:	Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443:	Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 891:	Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM D2563:	Standard Practice for Classification of Visual Defects in Reinforced Plastics

1.3 SHOP DRAWINGS

1.3.1 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 the precast concrete components and OGS internal components prior to shipment, including the sequence for installation.

1.3.2 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 based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record. Any and all changes to project cost estimates, bonding amounts, plan check fees for revision of approved documents, or design impacts due to regulatory requirements as a result of a product substitution shall be coordinated by the Contractor with the Engineer of Record.

1.4 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

1.4.1 OGS internal components supplied by the Manufacturer for attachment to the precast concrete vessel shall be pre-fabricated, bolted to the precast and watertight sealed to the precast vessel surface prior to site delivery to ensure Manufacturer's internal assembly process and quality control processes are fully adhered to, and to prevent materials damage on site.

1.4.2 Follow all instructions including the sequence for installation in the shop drawings during installation.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The OGS vessel shall be cylindrical and constructed from precast concrete riser and slab components.

2.1.2 The precast concrete OGS internal components shall include a fiberglass insert bolted and watertight sealed inside the precast concrete vessel, prior to site delivery. Primary internal components that are to be anchored and watertight sealed to the precast concrete vessel shall be done so only by the Manufacturer prior to arrival at the job site to ensure product quality.

2.1.3 The OGS shall be allowed to be specified and have the ability to function as a 240-degree bend structure in the stormwater drainage system, or as a junction structure.

2.1.4 The OGS to be specified shall have the capability to accept influent flow from an inlet grate and an inlet pipe.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be designed and manufactured to meet highway loading conditions per State/Provincial or local requirements.

2.3 GASKETS

Only profile neoprene or nitrile rubber gaskets that are oil resistant shall be accepted. For Canadian projects only, gaskets shall be in accordance to CSA A257.4-14. Mastic sealants, butyl tape/rope or Conseal CS-101 alone are not acceptable gasket materials.

2.4 JOINTS

The concrete joints shall be watertight and meet the design criteria according to ASTM C-990. For projects where joints require gaskets, the concrete joints shall be watertight and oil resistant and meet the design criteria according to ASTM C-443. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

2.5 FRAMES AND COVERS

Frames and covers shall be manufactured in accordance with State/Provincial or local requirements for inspection and maintenance access purposes. A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS manufacturer's product name to properly identify this asset's purpose is for stormwater quality treatment.

2.6 PRECAST CONCRETE

All precast concrete components shall conform to the appropriate CSA or ASTM specifications.

2.7 FIBERGLASS

The fiberglass portion of the OGS device shall be constructed in accordance with ASTM D2563, and in accordance with the PS15-69 manufacturing standard, and shall only be installed, bolted and watertight sealed to the precast concrete by the Manufacturer prior to arrival at the project site to ensure product quality.

2.8 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a fiberglass insert for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The total sediment storage capacity shall be a minimum 40 ft^3 (1.1 m^3). The total petroleum hydrocarbon storage capacity shall be a minimum 50 gallons (189 liters). The access opening to the sump of the OGS device for periodic inspection and maintenance purposes shall be a minimum 16 inches (406 mm) in diameter.

2.9 LADDERS

Ladder rungs shall be provided upon request or to comply with State/Provincial or local requirements.

2.10 INSPECTION

All precast concrete sections shall be level and inspected to ensure dimensions, appearance, integrity of internal components, and quality of the product meets State/Provincial or local specifications and associated standards.

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 HYDROLOGY AND RUNOFF VOLUME

The OGS device shall be engineered, designed and sized to treat a minimum of 90 percent of the average annual runoff volume, unless otherwise stated by the Engineer of Record, using historical rainfall data. Rainfall data sets should be comprised of a minimum 15-years of rainfall data or a longer continuous period if available for a given location, but in all cases a minimum 5-year period of rainfall data.

3.3 ANNUAL (TSS) SEDIMIMENT LOAD AND STORAGE CAPACITY

The OGS device shall be capable of removing and have sufficient storage capacity for the calculated annual total suspended solids (TSS) mass load and volume without scouring previously captured pollutants prior to maintenance being required. The annual (TSS) sediment load and volume transported from the drainage area should be calculated and compared to the OGS device's available storage capacity by the specifying Engineer to ensure adequate capacity between maintenance cycles. Sediment loadings shall be determined by land use and defined as a minimum of 450 kg (992 lb) of sediment (TSS) per impervious hectare of drainage area per year, or greater based on land use, as noted in Table 1 below.

Annual sediment volume calculations shall be performed using the projected average annual treated runoff volume, a typical sediment bulk density of 1602 kg/m^3 (100 lbs/ft^3) and an assumed Event Mean Concentration (EMC) of 125 mg/L TSS in the runoff, or as otherwise determined by the Engineer of Record.

Example calculation for a 1.3-hectares parking lot site:

- 1.28 meters of rainfall depth, per year
- 1.3 hectares of 100% impervious drainage area
- EMC of 125 mg/L TSS in runoff
- Treatment of 90% of the average annual runoff volume
- Target average annual TSS removal rate of 60% by OGS

Annual Runoff Volume:

- 1.28 m rain depth x 1.3 ha x 10,000 m^2/ha= 16,640 m^3 of runoff volume
- 16,640 m^3 x 1000 L/m^3 = 16,640,000 L of runoff volume
- 16,640,000 L x 0.90 = 14,976,000 L to be treated by OGS unit

Annual Sediment Mass and Sediment Volume Load Calculation:

- 14,976,000 L x 125 mg/L x kg/1,000,000 mg = 1,872 kg annual sediment mass
- 1,872 kg x m^3/1602 kg = 1.17 m^3 annual sediment volume
- 1.17 m^3 x 60% TSS removal rate by OGS = 0.70 m^3 minimum expected annual storage requirement in OGS

As a guideline, the U.S. EPA has determined typical annual sediment loads per drainage area for various sites by land use (see Table 1). Certain States, Provinces and local jurisdictions have also established such guidelines.

Table 1 – Annual Mass Sediment Loading by Land Use

	Commercial	Parking Lot	Residential			Highways	Industrial	Shopping Center
			High	Med.	Low			
(lbs/acre/yr)	1,000	400	420	250	10	880	500	440
(kg/hectare/yr)	1,124	450	472	281	11	989	562	494

Source: U.S. EPA Stormwater Best Management Practice Design Guide Volume 1, Appendix D, Table D-1, Burton and Pitt 2002

3.4 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 Table 2, Section 3.5, and based on third-party performance testing conducted in accordance with the Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** 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:

3.4.1 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.

3.4.2 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.

3.4.3 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.

3.4.4 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 3.3.

3.4.5 The Peclet Number is not an approved method or model for calculating TSS removal, sizing, or scaling OGS devices.

3.4.6 If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates:

- Canadian ETV or ISO 14034 ETV Verification Statement which verifies third-party performance testing conducted in accordance with the **Procedure for Laboratory Testing of Oil-Grit Separators,** including the Light Liquid Re-entrainment Simulation Testing.
- Equal or better sediment (TSS) removal of the PSD specified in Table 2 at equivalent surface loading rates, as compared to the OGS device specified herein.
- Equal or better Light Liquid Re-entrainment Simulation Test results (using low-density polyethylene beads as a surrogate for light liquids such as oil and fuel) at equivalent surface loading rates, as compared to the OGS device specified herein. However, an alternative OGS device shall not be allowed as a substitute if the Light Liquid Re-entrainment Simulation Test was performed with screening components within the OGS device that are effective at retaining the low-density polyethylene beads, but would not be expected to retain light liquids such as oil and fuel.
- Equal or greater sediment storage capacity, as compared to the OGS device specified herein.
- Supporting documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.5 PARTICLE SIZE DISTRIBUTION (PSD) FOR SIZING

The OGS device shall be sized to achieve the Engineer-specified average annual percent sediment (TSS) removal based solely on the test sediment used in the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** This test sediment is comprised of inorganic ground silica with a specific gravity of 2.65, uniformly mixed, and containing a broad range of particle sizes as specified in Table 2. No alternative PSDs or deviations from Table 2 shall be accepted.

Table 2
Canadian ETV Program Procedure for Laboratory Testing of Oil-Grit Separators
Particle Size Distribution (PSD) of Test Sediment

Particle Diameter (Microns)	% by Mass of All Particles	Specific Gravity
1000	5%	2.65
500	5%	2.65
250	15%	2.65
150	15%	2.65
100	10%	2.65
75	5%	2.65
50	10%	2.65
20	15%	2.65
8	10%	2.65
5	5%	2.65
2	5%	2.65

3.6 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party scour testing conducted and have in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. This scour testing is conducted with the device pre-loaded with test sediment comprised of the particle size distribution (PSD) illustrated in Table 2.

3.6.1 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.

Data generated from laboratory scour testing performed with an OGS device pre-loaded with a coarser PSD than in Table 2 (i.e. the coarser PSD has no particles in the 1-micron to 50-micron size range, or the D_{50} of the test sediment exceeds 75 microns) shall not be acceptable for the determination of the device's suitability for on-line installation.

3.7 DESIGN ACCOUNTING FOR BYPASS

3.7.1 The OGS device shall be specified to achieve the TSS removal performance and water quality objectives without washout of previously captured pollutants. The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. To ensure this is achieved, there are two design options with associated requirements:

3.7.1.1 The OGS device shall be placed **off-line** with an upstream diversion structure (typically in an upstream manhole) that only allows the water quality volume to be diverted to the OGS device, and excessive flows diverted downstream around the OGS device to prevent high flow washout of pollutants previously captured. This design typically incorporates a triangular layout including an upstream bypass manhole with an appropriately engineered weir wall, the OGS device, and a downstream junction manhole, which is connected to both the OGS device and bypass structure. In this case with an external bypass required, the OGS device manufacturer must provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.

3.7.1.2 Alternatively, OGS devices in compliance with Section 3.6 shall be acceptable for an **on-line** design configuration, thereby eliminating the requirement for an upstream bypass manhole and downstream junction manhole.

3.7.2 The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates equal or better hydraulic conveyance capacity as compared to the OGS device specified herein. This documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.8 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.

3.8.1 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.

3.9 <u>PETROLEUM HYDROCARBONS AND FLOATABLES STORAGE CAPACITY</u>

Petroleum hydrocarbons and floatables storage capacity in the OGS device shall be a minimum 50 gallons (189 Liters), or more as specified.

3.9.1 The OGS device shall have gasketed precast concrete joints that are watertight, and oil resistant and meet the design criteria according to ASTM C-443 to provide safe oil and other hydrocarbon materials storage and ground water protection. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

3.10 <u>SURFACE LOADING RATE SCALING OF DIFFERENT MODEL SIZES</u>

The reference device for scaling shall be an OGS device that has been third-party tested in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Other model sizes of the tested device shall only be scaled such that the claimed TSS removal efficiency of the scaled device shall be no greater than the TSS removal efficiency of the tested device at identical **surface loading rates** (flow rate divided by settling surface area). The depth of other model sizes of the tested device shall be scaled in accordance with the depth scaling provisions within Section 6.0 of the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.10.1 The Peclet Number and volumetric scaling are not approved methods for scaling OGS devices.

PART 4 – INSPECTION & MAINTENANCE

The OGS manufacturer shall provide an Owner's Manual upon request.
Maintenance shall be performed by a professional service provider who has experience in cleaning OGS devices and has been trained and certified in applicable health and safety practices, including confined space entry procedures.

4.1 A Quality Assurance Plan that provides inspection for a minimum of 5 years shall be included with the OGS stormwater quality device, and written into the Environmental Compliance Approval (ECA) or the appropriate State/Provincial or local approval document.

4.2 OGS device inspection shall include determination of sediment depth and presence of petroleum hydrocarbons below the insert. Inspection shall be easily conducted from finished grade through a frame and cover of at least 22 inch (560 mm) in diameter.

4.3 Inspection and pollutant removal shall be conducted periodically. For routine maintenance cleaning activities, pollutant removal shall typically utilize a truck equipped with vacuum apparatus, and shall be easily conducted from finished grade through a frame and cover of at least 22-inches (560 mm) in diameter.

4.4 Diameter of the maintenance access opening to the lower chamber and sump shall be scaled consistently across all model sizes, and shall be 1/3 the inside diameter of the OGS structure, or larger.

4.5 No confined space entry shall be required for routine inspection and maintenance cleaning activities.

4.6 For OGS model sizes of diameter 72 inches (1828 mm) and greater, the access opening to the OGS device's lower chamber and sump shall be large enough to allow a maintenance worker to enter the lower chamber to facilitate non-routine maintenance cleaning activities and repairs, as needed.

4.7 The orifice-containing component (i.e. drop pipe, duct, chute, etc.) of the OGS device used to control flow rate into the lower chamber shall be removable from the insert to facilitate cleaning, repair, or replacement of the orifice-containing component, as needed.

PART 5 – EXECUTION

5.1 PRECAST CONCRETE INSTALLATION

The installation of the precast concrete OGS stormwater quality treatment device shall conform to ASTM C 891, ASTM C 478, ASTM C 443, CAN/CSA-A257.4-14, CAN/CSA-A257.4-14, CAN/CSA-S6-00 and all highway, State/Provincial, or local specifications for the construction of manholes. Selected sections of a general specification that are applicable are summarized below. The Contractor shall furnish all labor, equipment and materials necessary to offload, assemble as needed the OGS internal components as specified in the Shop Drawings.

5.2 EXCAVATION

5.2.1 Excavation for the installation of the OGS stormwater quality treatment device shall conform to highway, State/Provincial or local specifications. Topsoil that is removed during the excavation for the OGS stormwater quality treatment device shall be stockpiled in designated areas and not be mixed with subsoil or other materials. Topsoil stockpiles and the general site preparation for the installation of the OGS stormwater quality device shall conform to highway, State/Provincial or local specifications.

5.2.2 The OGS device shall not be installed on frozen ground. Excavation shall extend a minimum of 12 inch (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

5.2.3 In areas with a high water table, continuous dewatering shall be provided to ensure that the excavation is stable and free of water.

5.3 BACKFILLING

Backfill material shall conform to highway, State/Provincial or local specifications. Backfill material shall be placed in uniform layers not exceeding 12 inches (300 mm) in depth and compacted to highway, State/Provincial or local specifications.

5.4 OGS WATER QUALITY DEVICE CONSTRUCTION SEQUENCE

5.4.1 The precast concrete OGS stormwater quality treatment device is installed and leveled in sections in the following sequence:

- aggregate base
- base slab, or base
- riser section(s) (if required)
- riser section w/ pre-installed fiberglass insert
- upper riser section(s)
- internal OGS device components
- connect inlet and outlet pipes
- riser section, top slab and/or transition (if required)
- frame and access cover

5.4.2 The precast concrete base shall be placed level at the specified grade. The entire base shall be in contact with the underlying compacted granular material. Subsequent sections, complete with oil resistant, watertight joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations.

5.4.3 Adjustment of the OGS stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the OGS stormwater quality treatment device has been constructed, any lift holes must be plugged with mortar.

5.5 DROP PIPE AND OIL INSPECTION PIPE

Once the upper precast concrete riser has been attached to the lower precast concrete riser section, the OGS device Drop Pipe and Oil Inspection Pipe must be attached, and watertight sealed to the fiberglass insert using Sikaflex 1a. Installation instructions and required materials shall be provided by the OGS manufacturer.

5.6 INLET AND OUTLET PIPES

Inlet and outlet pipes shall be securely set using grout or approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight. Non-secure inlets and outlets will result in improper performance.

5.7 FRAME AND COVER OR FRAME AND GRATE INSTALLATION

Precast concrete adjustment units shall be installed to set the frame and cover/grate at the required elevation. The adjustment units shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover/grate should be set in a full bed of mortar at the elevation specified.

5.7.1 A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS device brand or product name to properly identify this asset's purpose is for stormwater quality treatment.

PROPOSED

SIX (6) STOREY APARTMENT BUILDING SITE

LOT 1

R-PLAN 268160

917 MERIVALE ROAD

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

The flat Roof Area 1 and Roof Area 2 will be used for storm-water detention. Each roof area will be drained by one (1) controlled drain. Rood Drain No. 1 will have a maximum release rate of 20.0 U.S. gal/min. or 1.26 L/s under a head of 150 mm. Roof Drain No. 2 will have a maximum release rate of 25.0 U.S. gal/min. or 1.58 L/s under a head of 150 mm. Thus, from the flat roof area of this building, the controlled flow off-site is 2.84 L/s (1.26 L/s + 1.58 L/s). Therefore, the (2) roof drains specified is the Watts model Adjustable Accutrol Weir (Model No. RD-100A-ADJ) with 1/2 opening as specified for Roof Drain No. 1 and 3/4 opening for Roof Drain No. 2. Refer to Dwg. No. 823-102 SWM-1 for details. As for the remainder of the site, the proposed oversized underground drainage pipes and drainage structures within this site is designed to provide stormwater detention in order to control the allowable site release rate of 3.70 L/s.

Roof Storage Area 1 (NODE No. 1)

Available flat roof area for storage = 46.23 m^2 @ roof slope of 2.0% (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.

$$V = \frac{(0.12\text{m})[28.42 + 4(7.51) + 0]}{6}$$

$$V = \frac{(0.12)(58.46)}{6}$$

$$V = 1.17\ \text{m}^3$$

The available Roof Area 1 storage volume of 1.17 m^3 > required five (5)-Year storage volume of 0.72 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 2 (NODE No.2)

Available flat roof area for storage = 53.90 m^2 @ roof slope of 2.0% (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.

$$V = \frac{(0.12\text{m})[34.35 + 4(8.65) + 0]}{6}$$

$$V = \frac{(0.12)(68.95)}{6}$$

$$V = 1.38\ \text{m}^3$$

The available Roof Area 2 storage volume of 1.38 m^3 > required five (5)-Year storage volume of 0.97 m^3 from Table 3.

During the 5-Year event the required rooftop storage volume is estimated at 1.69 m^3 (min.) and the available storage volume is 2.55 m^3 at the 0.12 m ponding depth specified above at each of the (2) drains.

Storm Pipe Storage @ 5-Year HWL = 76.48 m

- 23.5 m of 600 mm diameter

$$V_1 = \frac{\pi(0.3)^2(23.5)}{2} = 3.32\ \mathrm{m}^3$$

Total Pipe Storage Volume = 3.32 m^3

Drainage Structures Storage

- CB/MH#1 (1200∅) = $\pi\ (0.6)^2\ (0.3) = 0.34\ m^3$
- CB/MH#2 (1200∅) = $\pi\ (0.6)^2\ (0.3) = 0.34\ m^3$

Total Pipe Storage Volume = 0.68 m^3

Therefore at the estimated 5-Year H.W.L. = 76.48 m, the 5-Year available site storage volume from underground piping and drainage structures is estimated at 4.0 m^3 which is greater than the required (min.) storage volume of 3.57 m^3 from Table 1.

AVAILABLE STORAGE VOLUME CALCULATIONS

<u>100-Year Event</u>

Roof Storage at Flat Roof Building

The flat Roof Area 1 and Roof Area 2 will be used for storm-water detention. Each roof area will be drained by one (1) controlled drain. Rood Drain No. 1 will have a maximum release rate of 20.0 U.S. gal/min. or 1.26 L/s under a head of 150 mm. Roof Drain No. 2 will have a maximum release rate of 25.0 U.S. gal/min. or 1.58 L/s under a head of 150 mm. Thus, from the flat roof area of this building, the controlled flow off-site is 2.84 L/s (1.26 L/s + 1.58 L/s). Therefore, the (2) roof drains specified is the Watts model Adjustable Accutrol Weir (Model No. RD-100A-ADJ) with 1/2 opening as specified for Roof Drain No. 1 and 3/4 opening for Roof Drain No. 2. Refer to Dwg. No. 823-102 SWM-1 for details. As for the remainder of the site, the proposed oversized underground drainage pipes and drainage structures within this site is designed to provide stormwater detention in order to control the allowable site release rate of 3.70 L/s.

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

Available flat roof area for storage = 46.23 m^2 @ roof slope of 2.0% (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.

$$V = \frac{(0.15\text{m})[46.23 + 4(11.90) + 0]}{6}$$

$$V = \frac{(0.15)(93.83)}{6}$$

$$V = 2.35\ \text{m}^3$$

The available Roof Area 1 storage volume of 2.35 m^3 > required 100-Year storage volume of 2.02 m^3 from Table 5.

Therefore, the ponding depth at the proposed Roof Drain No. 1 location is approximately 0.15 m (150 mm) and 0 mm 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.

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

Available flat roof area for storage = 53.90 m^2 @ roof slope of 2.0% (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.

$$V = \frac{(0.15\text{m})[53.90 + 4(13.40) + 0]}{6}$$

$$V = \frac{(0.15)(107.50)}{6}$$

$$V = 2.69\ \text{m}^3$$

The available Roof Area 2 storage volume of 2.69 m^3 > required 100-Year storage volume of 2.63 m^3 from Table 6.

During the 100-Year event the required rooftop storage volume is estimated at 4.65 m^3 (min.) and the available storage volume is 5.04 m^3 at the 0.12 m ponding depth specified above at each of the (2) drains.

Storm Pipe Storage @ 5-Year HWL = 77.18 m

- 23.5 m of 600 mm diameter

$$V_1 = \pi(0.3)^2(23.5) = 6.64\ m^3$$

Total Pipe Storage Volume = 6.64 m^3

Drainage Structures Storage

- CB/MH#1 (1200Ø) = π $(0.6)^2$ (1.0) = 1.13 m^3
- CB/MH#2 (1200Ø) = π $(0.6)^2$ (1.0) = 1.13 m^3

Total Pipe Storage Volume = 2.26 m^3

Therefore at the estimated 5-Year H.W.L. = 77.18 m, the 100-Year available site storage volume from underground piping and drainage structures is estimated at 8.90 m^3 which is greater than the required (min.) storage volume of 8.72 m^3 from Table 4.

Thus, the 100-Year available site storage volume is estimated at 8.90 m^3 which is greater than the required storage volume of 8.72 m^3.

PROPOSED

SIX (6) STOREY APARTMENT BUILDING SITE

LOT 1

R-PLAN 268160

917 MERIVALE ROAD

CITY OF OTTAWA

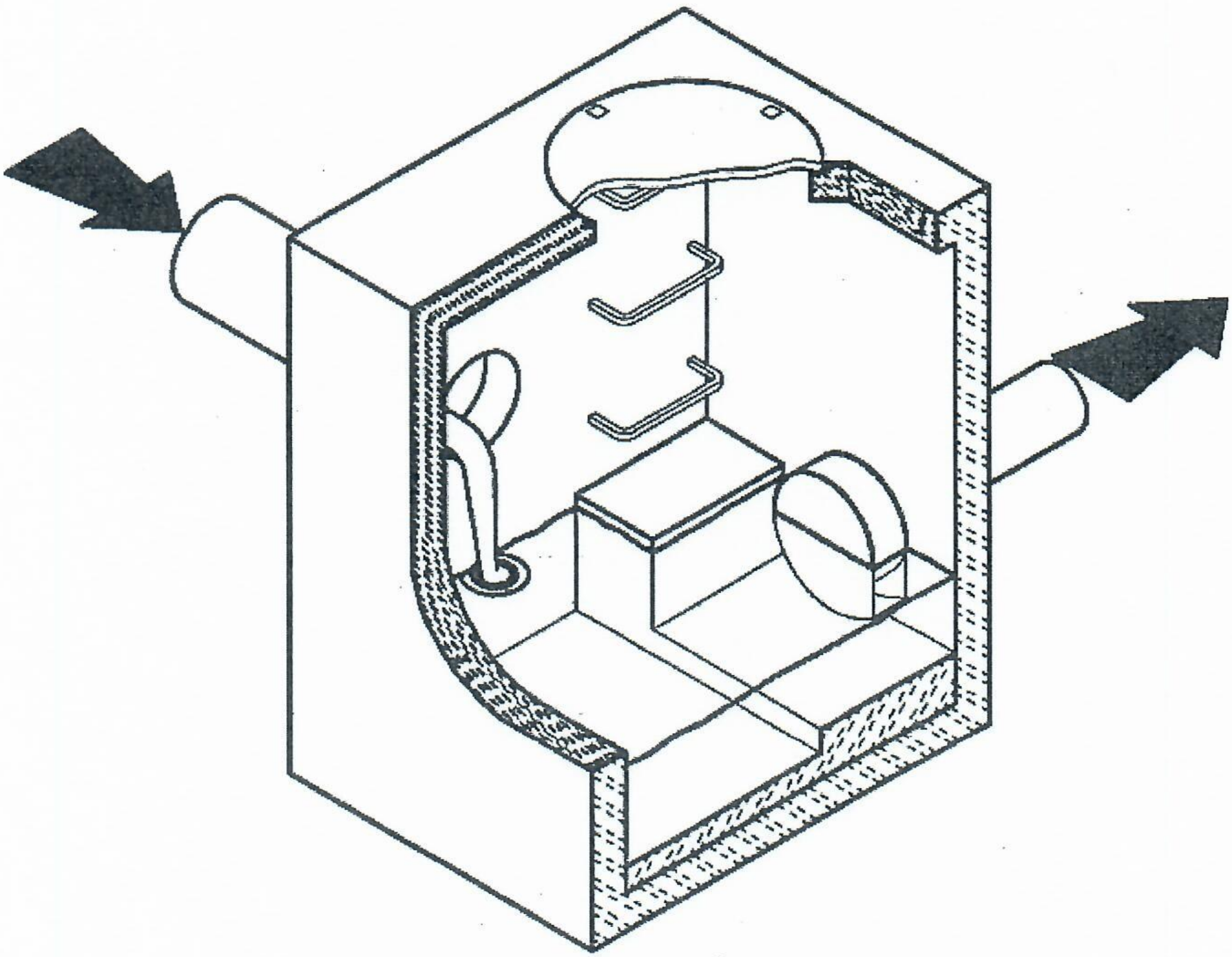
APPENDIX F

INLET CONTROL DEVICE (ICD) DETAILS

HYDROVEX MODEL No. 75-VHV-1

CSO/STORMWATER MANAGEMENT

® HYDROVEX® VHV / SVHV
Vertical Vortex Flow Regulator



JOHN MEUNIER

HYDROVEX® VHV / SVHV VERTICAL VORTEX FLOW REGULATOR

APPLICATIONS

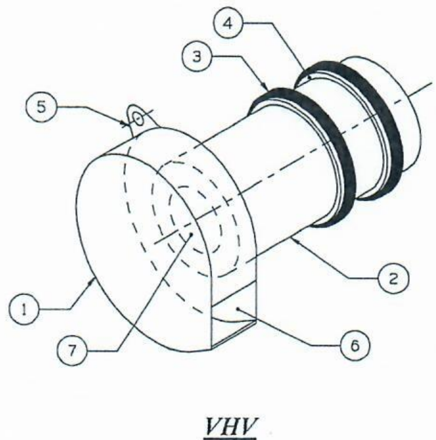
One of the major problems of urban wet weather flow management is the runoff generated after a heavy rainfall. During a storm event, uncontrolled flows may overload the drainage system and cause flooding. Sewer pipe wear and network deterioration are increased dramatically as a result of increased flow 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



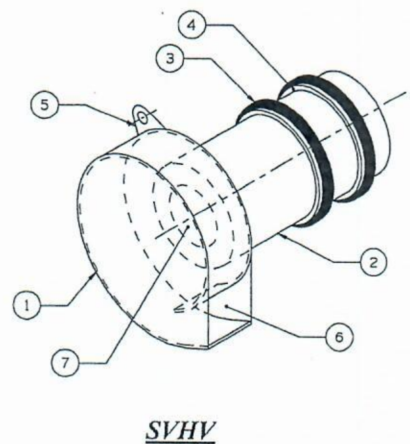


FIGURE 1: HYDROVEX® VHV-SVHV VERTICAL VORTREX FLOW REGULATORS

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.

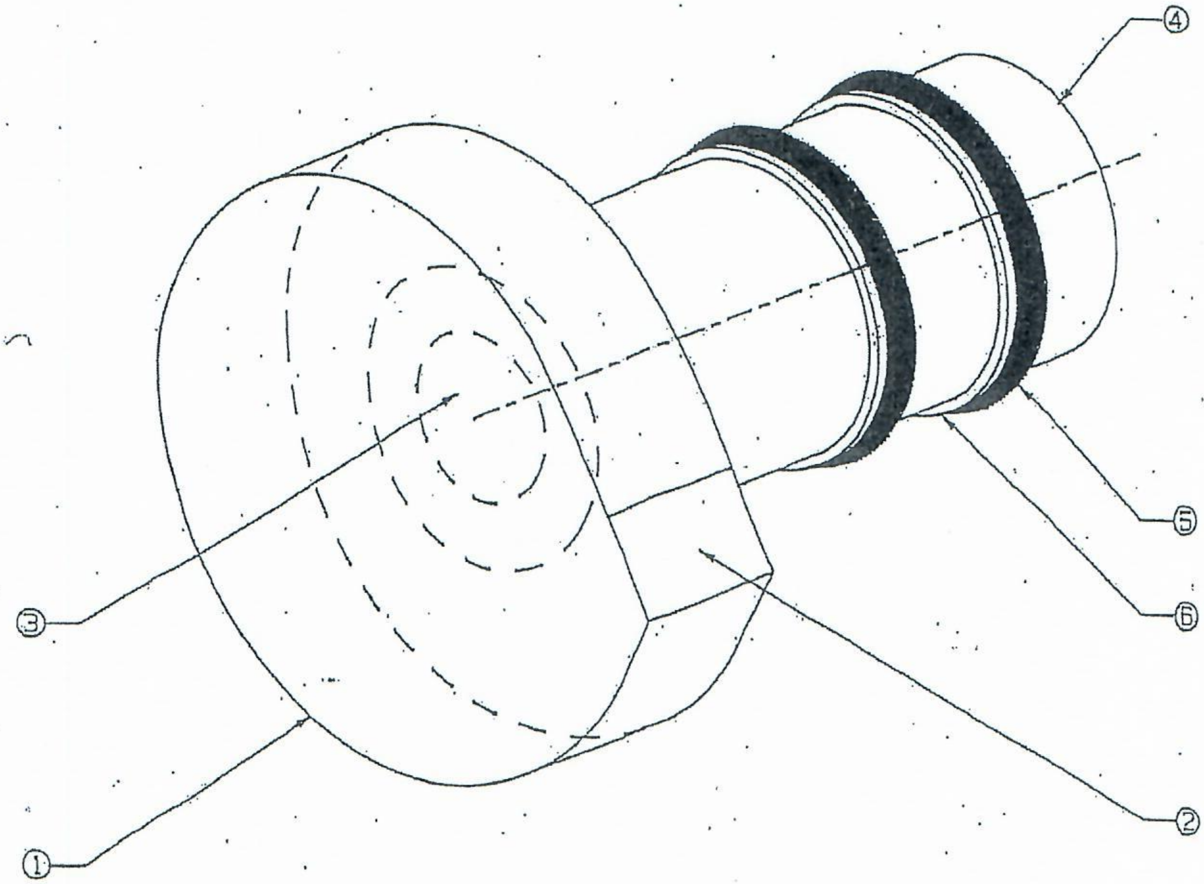
- The **HYDROVEX® VHV / SVHV** line of flow regulators are manufactured entirely of stainless steel, making them durable and corrosion resistant.

- 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

① BODY
② INLET
③ OUTLET ORIFICE
④ SLEEVE
⑤ "O"RING
⑥ SQUARE BAR



JOHN MEUNIER INC.

HYDROVEX®
VHV/SVHV Vortex Flow Regulator

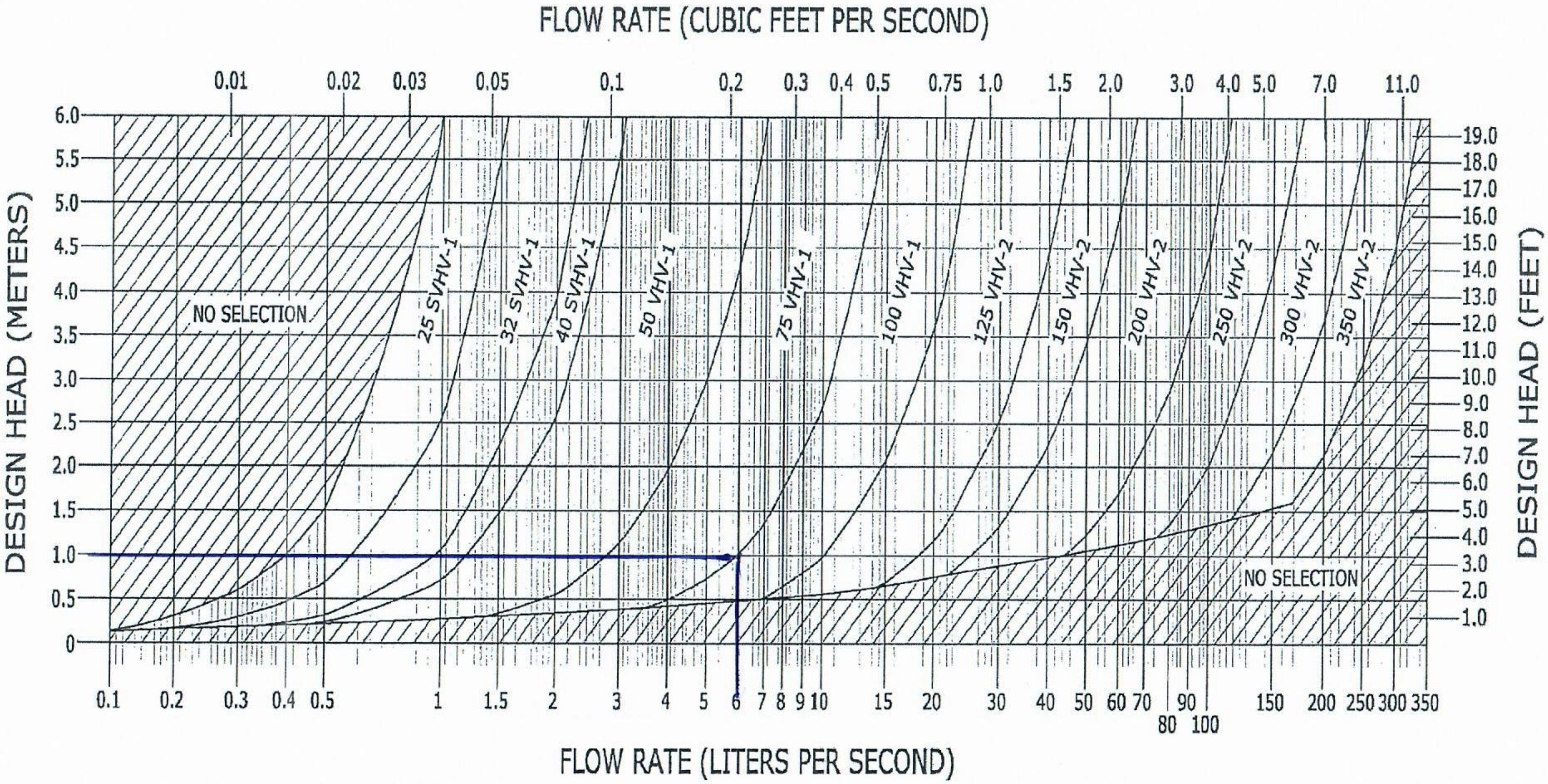


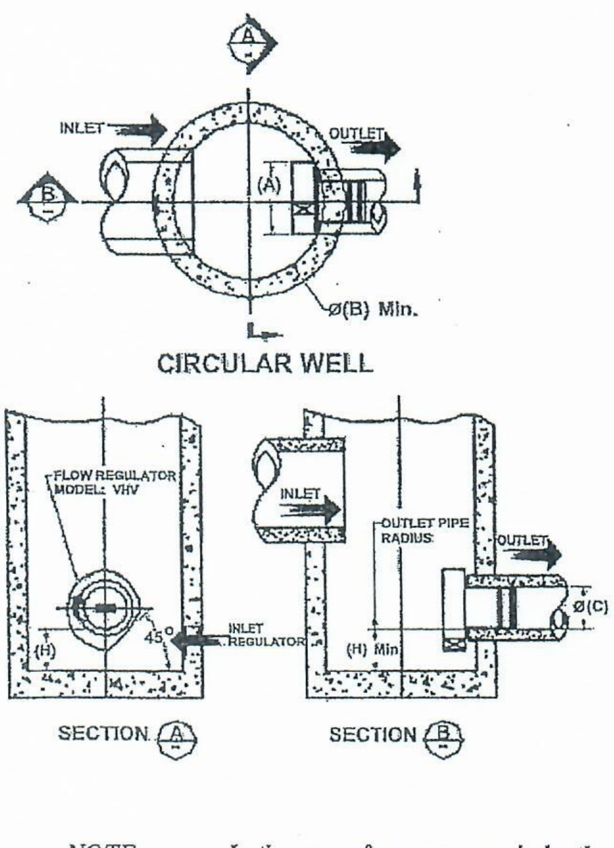
FIGURE 3

JOHN MEUNIER

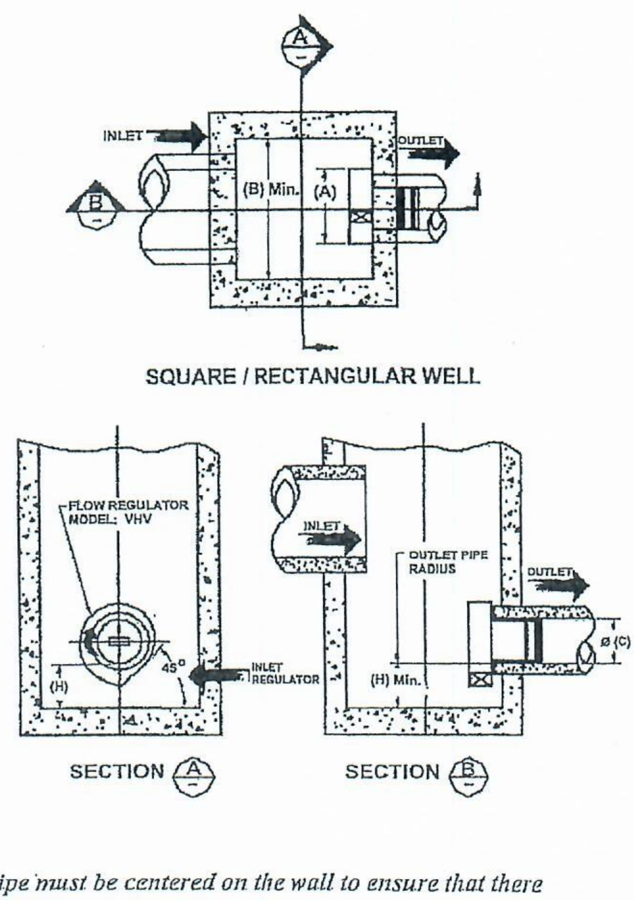
TYPICAL INSTALLATION OF A VORTEX FLOW REGULATOR IN A CIRCULAR OR SQUARE/RECTANGULAR MANHOLE
FIGURE 4

Model	Regulator Diameter A (mm) [in]	CIRCULAR Minimum Manhole Diameter B (mm) [in]	SQUARE 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.*