PROPOSED THREE-STOREY

RESIDENTIAL APARTMENT BUILDING SITE

PART OF LOT 8

R-PLAN 43586

33 HENEY STREET

CITY OF OTTAWA

STORM DRAINAGE REPORT

REPORT No. R-817-6

T. L. MAK ENGINEERING CONSULTANTS LTD.

JUNE 2017

REF. FILE No. 817-6

INTRODUCTION

The proposed three-storey apartment building site is located on the north side of Heney Street and situated east of Cobourg Street and west of Charlotte Street. Its legal property description is Part of Lot 8 Registered Plan 43586 City of Ottawa. Presently, the residential lot under consideration is occupied by a 2½ storey brick residential building. The municipal address of the property is referenced as 33 Heney Street.

The lot area under consideration is approximately 608.3 sq. m. in size. This property is proposed for the development of a three-storey residential apartment building with a basement. The total square footage of the building is approximately 10,597.0 sq. ft. (984 m^2).

This building will house a total of 14 units comprising of four bachelors, four (1) bedroom apartments and six (2) bedroom apartments. Stormwater outlet for this site is the existing 300mm diameter storm sewer located within the Heney Street road right of way.

From discussions with the staff at the City of Ottawa's Engineering Department, accordingly, the allowable post-development runoff release rates shall not exceed the 5 year pre-development conditions. The allowable pre-development runoff coefficient is the calculated "C" existing value or C = 0.5 (max.) and Tc = 10.0 min. If the uncontrolled stormwater runoff exceeds the specified requirements, then on-site stormwater management (SWM) control measures are necessary. The post-development runoff coefficient for this site is estimated at C = 0.72 which exceeds the calculated pre-development allowable C = 0.5 criteria for the Heney Street 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.

This report will address and detail the grading, drainage and stormwater management control measures required to develop this property. Based on the Proposed Grading, Servicing and Stormwater Management Plan (Dwg. No. 817-6, G-1), stormwater management of this proposed development property will be controlled for the most part on-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	= 608.30 sq. m.
Roof Surface Area	= 310.0 sq. m
Asphalt Area	= 113.9 sq. m
River Rock Area	= 15.5 sq. m

Concrete Area	= 18.2 sq. m
Grass Area	= 150.7 sq. m

$$C = \frac{(310.0 \times 0.9) + (113.9 \times 0.9) + (18.2 \times 0.8) + (150.7 \times 0.2) + (15.5 \times 0.5)}{608.3}$$

$$= \frac{433.96}{608.3} = 0.713$$

Say "C" = 0.72

Therefore the average post-development "C" for this site = 0.72.

2.) Controlled Area Data

Roof Surface Area	= 239.67 sq. m
Asphalt Area	= 96.95 sq. m
River Stone Area	= 6.35 sq. m
Grass Area	= 89.60 sq. m

Total Stormwater Controlled Area = 432.57 sq. m.

$$C = \frac{(239.67 \times 0.9) + (89.60 \times 0.2) + (96.95 \times 0.9) + (6.35 \times 0.5)}{432.57}$$

$$= \frac{324.06}{432.57} = 0.749$$

Say "C" = 0.75

Therefore post-development "C" for the controlled stormwater drainage area is C = 0.75.

3.) Uncontrolled Area Data

Roof Area	= 70.33 sq. m
Asphalt Area	= 16.95 sq. m
River Stone Area	= 9.15 sq. m
Grass Area	= 61.10 sq. m
Concrete Area	= 18.2 sq. m

Total Stormwater Uncontrolled Area = 175.73 sq. m.

$$C = \frac{(18.2 \times 0.8) + (61.10 \times 0.2) + (70.33 \times 0.9) + (16.95 \times 0.9) + (9.15 \times 0.5)}{175.73}$$

$$= \frac{109.92}{175.73} = 0.626$$

Say “C” = 0.63

Therefore post-development “C” for the uncontrolled stormwater drainage area of the site is <u>C = 0.63</u>.

- Tributary Area consisting of approximately 175.73 sq. m will be outletting off-site uncontrolled from the residential apartment building site.

- The SWM area to be controlled is 432.57 sq. m. Refer to the attached “Drainage Area Plan” in Figure 1 for details.

- The site SWM storage area excluding the rooftop area that is to be controlled by the ICD in CB/MH #1 is 432.57 sq. m. – 98.8 sq. m. = 333.77 sq. m. or 0.0334 ha.

PRE-DEVELOPMENT FLOW ESTIMATION

Maximum allowable off-site flow: Five (5) Year Storm

Pre-development Site Area Characteristics

Development Lot Area	= 608.30 sq. m.
Roof Area	= 224.8 sq. m
Asphalt Area	= 178.29 sq. m
Gravel Area	= 115.86 sq. m
Concrete Area	= 6.0 sq. m
Grass Area	= 83.35 sq. m

$$C = \frac{(224.18 \times 0.9) + (178.29 \times 0.9) + (6.0 \times 0.8) + (83.35 \times 0.2) + (115.86 \times 0.8)}{608.3}$$

$$= \frac{476.381}{608.3}$$

$$= 0.783$$

Use C_{pre} = 0.5 maximum allowable for redevelopment

$T_c = D/V$ where D = 36.0 m, ΔH = 0.75 m, S = 2.1% and V = 3.0 ft./s = 0.91 m/s

Therefore,

$$T_c = \frac{36.0 \text{ m}}{0.91 \text{ m/s}} = 0.66 \text{ minutes}$$

Use T_c = 10 minutes
I_5 = 104.4 mm/hr. [City of Ottawa, five (5) year storm]

Using the Rational Method

$$Q = 2.78\ (0.5)\ (104.4)\ (0.06083)$$
$$= 8.83 \text{ L/s}$$

Since 175.73 square metres is drained uncontrolled off site, the **net** allowable discharge for this site into the existing Heney Street storm sewer system is Q = {2.78 (0.5) (104.4) (0.06083) – [2.78 (0.63) (179.0) (0.0176)]} = 8.83 L/s – 5.52 L/s = 3.31 L/s.

STORMWATER MANAGEMENT ANALYSIS

The calculated flow rate of 3.31 L/s for on-site stormwater management detention volume storage will be used for this SWM analysis. Since a total of one (1) controlled roof drain is proposed to restrict flow from the building at a rate of 0.63 L/s into the Heney Street storm sewer, therefore, the remainder of the site allowable release rate from the ICD in CB/MH #1 is 3.31 L/s - 0.63 L/s = 2.68 L/s.

Therefore the total allowable 5 year release rate of 8.83 L/s will be entering into the existing 300 mm diameter Heney Street storm sewer. Runoff greater than the allowable release rate will be stored on-site in the proposed stormwater management ponding area at the asphalt parking lot area and underground storm pipes and the flat rooftop of the proposed apartment building will be used for stormwater detention purposes.

The post-development inflow rate during the 5 year and 100 year storm for the parking lot drainage system and rooftop areas can now be calculated as follows:

DESIGN DISCHARGE COMPUTATION

1.) Parking Lot Surface and Underground Drainage System

The Rational Method was used to estimate peak flows.

$Q = 2.78\ CIA$

Inflow rate Q_{ACTUAL} for the site is:

5 Year Event

C_5 = (AVG "C" value of controlled area excluding roof area)

$$\text{where } C_5 = \frac{(140.87 \times 0.9) + (89.6 \times 0.2) + (96.95 \times 0.9) + (6.35 \times 0.5)}{333.77}$$

$$= \frac{235.133}{333.77} = 0.7045$$

$$C_5 = 0.71$$

A = 0.0334 ha.

Inflow rate $(Q_A)_5$ = 2.78 CIA
= 2.78 (0.71) (0.0334) I
= 0.0659 I I = (mm/hr)

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

Q_5 = 0.0659 I

100 Year Event

C_{100} = 0.80 (AVG "C" value of controlled area excluding roof area)

$$\text{where } C_{100} = \frac{(140.87 \times 1.0) + (89.6 \times 0.2 \times 1.25) + (96.95 \times 1.0) + (6.35 \times 0.5 \times 1.25)}{333.77}$$

$$= \frac{264.19}{333.77} = 0.792$$

$$C_{100} = 0.80$$

Inflow rate $(Q_A)_{100}$ = 2.78 CIA
= 2.78 (0.80) (0.0334) I
= 0.0743 I I = (mm/hr)

This can now 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 apartment building on this property will incorporate (1) roof drain to control flow off-site. The smallest standard roof drain flow rate is 0.63 L/s (10 U.S. gal/min.), therefore, the minimum stormwater flow that can be controlled from this rooftop and outletted off-site is 0.63 L/s x 1 = 0.63 L/s.

C = 0.9 will be used for sizing roof storage volume in this case.

Inflow rate (Q_A) = 2.78 CIA

where C = 0.9
A = Surface area of roof
I = (mm/hr)

For Roof Area No. 1

Q_{A1} = 2.78 CIA

5 Year Event

C_5 = 0.90
A = 98.8 sq. m
I = (mm/hr)

= 2.78 (0.90) (0.0099 ha.) I
= 0.0248 I

100 Year Event

C_{100} = 1.0
A = 98.8 sq. m
I = (mm/hr)

= 2.78 (1.0) (0.0099 ha.) I
= 0.02752 I

Summary results of the calculated inflow and the required storage volume of the site and the building flat rooftop to store the 5 year and 100 year storm events are shown in Tables 1 to 4 inclusive.

WATER QUALITY

For this site, based on the criteria set out by the City of Ottawa's representative and recommendations set out by the Rideau Valley Conservation Authority (RVCA), water quality treatment for 80% removal of total suspended solids (TSS) is typically required for redevelopment of infill properties with no on line water quality treatment.

It is the Conservation Authority's position that stormwater quality control is required for this site. The storm sewer that services this site outlets to the Rideau River at Island Lodge Road (approximately 350 m to the west and north). The Rideau River is high quality aquatic habitat. As such, efforts must be made to improve the quality of runoff leaving the site, particularly since there will be little vegetated areas left once the site is redeveloped. Currently, no municipal treatment for water quality is provided. Therefore, a Stormceptor system is proposed to support the water quality improvement objective. Stormceptor (Model No. STC 300) was selected that will provide the water quality objective removal of TSS at a level above 80% which is above the minimum requirement of 80% TSS removal. In addition to TSS removal, the Stormceptor system is also an oil and sediment separator.

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 silt fence barrier (as per OPSD 219.110 and associated specifications) along Heney Street and all other areas that sheet drain off-site. Maintenance hole sediment barriers to be AMOCO 4555 nonwoven geotextile or approved equivalent.

CONCLUSION

For development of this residential site (± 0.0608 ha. in size) and in controlling the 5 year stormwater release rate off-site to an allowable rate of 8.83 L/s, a site storage volume of approximately 3.87 m^3 (min.) is required during the 5 year event. We estimate that approximately 1.33 m^3 (min.) of rooftop storage and 2.54 m^3 (min.) from the proposed rear yard surface, underground stormwater drainage pipes and drainage structures are necessary to attenuate the 5 year storm event.

During the <u>5 year storm event</u> for the flat rooftop storage, the ponding depth on this rooftop is estimated at 100 mm at the drain and 0 mm at the roof perimeter assuming a 2.1% (min.) roof pitch to the drain. The rooftop storage available at Roof Area #1 is 1.42 m^3 which is greater than the required volume of 1.33 m^3.

As for the remaining storage volume of 2.54 m^3 (min.) required from the site development area, for the 5 year storm event, the estimated H.W.L. of 64.73 m will provide a total available storage volume of 3.89 m^3 consisting of the proposed rear yard grass/asphalt surface, underground storm piping and drainage structures within the development site. In total the 5 year available site storage volume is approximately 5.31 m^3 which is greater than the required site storage volume of 3.87 m^3. See Appendix B for details.

In order to control the 100 year stormwater release rate off-site to an allowable rate of 8.83 L/s, a site storage volume of approximately 11.02 m^3 (min.) is required during the 100 year event. We estimate that approximately 3.46 m^3 (min.) of rooftop storage and 7.56 m^3 (min.) from the proposed underground drainage pipes and structures and rear yard grass/asphalt surface storage area are necessary to attenuate the 100 year storm event.

During the 100 year storm event for the flat rooftop storage, the ponding depth on this rooftop is estimated at 150 mm at the drain and 0 mm at the roof perimeter assuming a 2.1% (min.) roof pitch to the drain. The rooftop storage available at Roof Area #1 is 4.91 m^3 which is greater than the required volume of 3.46 m^3.

As for the remaining storage volume of 7.56 m^3 (min.) required from the site development area, for the 100 year storm event, the estimated H.W.L. of 64.80 m will provide a total available storage volume of 8.37 m^3 consisting of the proposed rear yard surface stormwater ponding area at CB/MH #1, CB #1, underground storm pipes and drainage structures. In total the 100 year available site storage volume is 15.55 m^3 which is greater than the required site storage volume of 11.02 m^3. See Appendix B 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 structures as shown on the Proposed Grading, Servicing and Stormwater Management Plan Dwg. No. 817-6, G-1, the desirable 5 year and 100 year storm event detention volume of 5.31 m^3 and 15.55 m^3 respectively will be available on-site.

An inlet control device (ICD) will be installed at the outlet of CB/MH #1 in the 200 mm diameter storm pipe (outlet pipe) with Q = 2.68 L/s under a head of 1.48 m. A rooftop drain with a release rate of 0.63 L/s will be installed at Roof Drain #1 on the flat portion of the proposed residential building rooftop as depicted on Dwg. No. 817-6, G-1. The 5 year and 100 year flow off-site is restricted to the established pre-development flow of 8.83 L/s.

The ICD type recommended is a Hydrovex Regulator (No. 50 VHV-1) or equivalent. See Appendix C for details.

The building weeping tile drainage will be outletted via a proposed 125 mm diameter PVC storm lateral located in the main building service lateral trench. A separate 100mm diameter PVC storm pipe is proposed to outlet the roof drain water from the southeast front corner of the building. It is to be wyed into the proposed 200 mm diameter PVC storm sewer downstream of CB/MH #1 and upstream of the water quality treatment unit Stormceptor Model No. STC 300.

In order to achieve a minimum of 80% TSS removal, a Stormceptor structure (Model No. STC 300) is proposed to be installed for site development of this property. This 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 proposed for this site, area size of the lot and impervious ratio, a greater than 80% TSS removal is estimated for all rainfall events including large storms.

PREPARED BY T. L. MAK ENGINEERING CONSULTANTS LTD.

TONY L. MAK, P. ENG.

LICENSED PROFESSIONAL ENGINEER
07/12/17
TONY L-M. MAK
PROVINCE OF ONTARIO

PROPOSED 33 HENEY STREET
RESIDENTIAL DEVELOPMENT SITE

TABLE 1

5 YEAR EVENT
SITE REQUIRED STORAGE VOLUME

t_c TIME (min.)	I 5 YR. (mm/hr)	Q ACTUAL (L/s)	Q ALLOW (L/s)	Q STORED (L/s)	VOLUME STORED (m^3)
5	141.20	9.31	2.68	6.63	1.99
10	104.20	6.87	2.68	4.19	2.51
15	83.50	5.50	2.68	2.82	2.54
20	70.30	4.63	2.68	1.95	2.34
25	60.90	4.01	2.68	1.33	2.00

Therefore the required storage volume is 2.54 m^3.

PROPOSED 33 HENEY STREET
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TABLE 2

5 YEAR EVENT
REQUIRED BUILDING ROOF AREA #1
STORAGE VOLUME

t_c TIME (min.)	I 5 YR. (mm/hr)	Q ACTUAL (L/s)	Q ALLOW (L/s)	Q STORED (L/s)	VOLUME STORED (m^3)
10	104.20	2.58	0.63	1.95	1.17
15	83.50	2.07	0.63	1.44	1.30
20	70.30	1.74	0.63	1.11	1.33
25	60.90	1.51	0.63	0.88	1.32
30	53.93	1.34	0.63	0.71	1.28
35	48.50	1.20	0.63	0.57	1.20

Therefore the required rooftop storage volume is 1.33 m^3.

PROPOSED 33 HENEY STREET
RESIDENTIAL DEVELOPMENT SITE

TABLE 3

100 YEAR EVENT
SITE REQUIRED STORAGE VOLUME

t_c TIME (min.)	I 100 YR. (mm/hr)	Q ACTUAL (L/s)	Q ALLOW (L/s)	Q STORED (L/s)	VOLUME STORED (m^3)
5	242.8	18.04	2.68	15.36	4.61
10	178.6	13.27	2.68	10.59	6.35
15	142.9	10.62	2.68	7.94	7.15
20	120.0	8.92	2.68	6.24	7.49
25	103.9	7.72	2.68	5.04	7.56
30	91.9	6.83	2.68	4.15	7.47
35	82.6	6.14	2.68	3.46	7.27
40	75.1	5.58	2.68	2.90	6.96

Therefore the required storage volume is 7.56 m^3.

PROPOSED 33 HENEY STREET
RESIDENTIAL DEVELOPMENT SITE

TABLE 4

100 YEAR EVENT
REQUIRED BUILDING ROOF AREA #1
STORAGE VOLUME

t_c TIME (min.)	I 100 YR. (mm/hr)	Q ACTUAL (L/s)	Q ALLOW (L/s)	Q STORED (L/s)	VOLUME STORED (m^3)
10	178.6	4.92	0.63	4.29	2.58
15	142.9	3.93	0.63	3.30	2.97
20	120.0	3.30	0.63	2.67	3.20
25	103.9	2.86	0.63	2.23	3.35
30	91.9	2.53	0.63	1.90	3.42
35	82.6	2.27	0.63	1.64	3.44
40	75.1	2.07	0.63	1.44	<u>3.46</u>
45	69.1	1.90	0.63	1.27	3.43
50	63.9	1.76	0.63	1.13	3.39
55	59.6	1.64	0.63	1.01	3.33
60	55.9	1.54	0.63	0.91	3.28

Therefore the required rooftop storage volume is 3.46 m^3.

PROPOSED THREE-STOREY

RESIDENTIAL APARTMENT BUILDING SITE

PART OF LOT 8

R-PLAN 43586

33 HENEY STREET

CITY OF OTTAWA

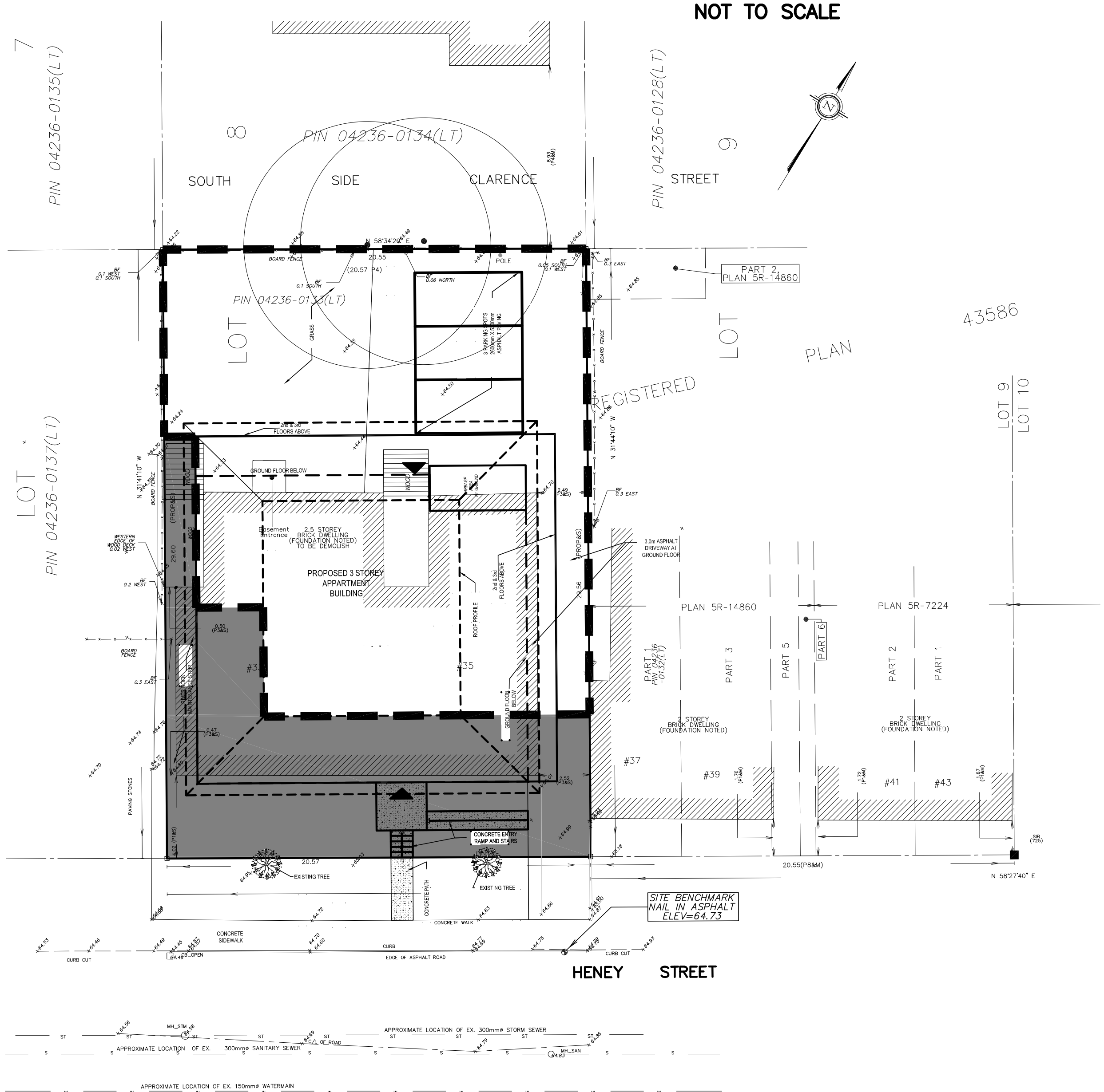
APPENDIX A

STORM DRAINAGE AREA PLAN

FIGURE 1

PROPOSED 33 HENEY STREET SITE DEVELOPMENT DRAINAGE AREA PLAN

NOT TO SCALE



LEGEND

LIMIT OF CONTROLLED STORM DRAINAGE AREA =432.57 SQ. M

UNCONTROLLED STORM DRAINAGE AREA =175.73 SQ. M

TOTAL AREA = 608.30 SQ. M

POST-DEVELOPMENT SITE AVERAGE "C" = 0.72

FIGURE 1

PROPOSED THREE-STOREY

RESIDENTIAL APARTMENT BUILDING SITE

PART OF LOT 8

R-PLAN 43586

33 HENEY STREET

CITY OF OTTAWA

APPENDIX B

DETAILED CALCULATIONS

FOR THE 5 YEAR AND 100 YEAR

AVAILABLE STORAGE VOLUME

AVAILABLE STORAGE VOLUME CALCULATIONS

5 Year Event

1.) Rear Yard Grass/Asphalt Area – Surface Storage Volume

Assume 5 year H.W.L. = 64.73 m (See attached Dwg. No. 817-6, G-1 with the flood limit shown.)

CB #2

$$\text{Available Storage Volume} = \frac{d}{6} (A_1 + 4A_2 + A_3)$$

$$V = \frac{0.10}{6} [49.0 + 4 (12.2) + 0]$$

$$= \frac{(0.10)(97.8)}{6}$$

$$= 1.63 \text{ m}^3$$

Total parking lot area surface storage volume = 1.63 m^3.

2.) Drainage Structures Storage

CB/MH #1

$$V = 3.14 (0.6)^2 (0.31) + 3.14 (0.3)^2 (1.2)$$
$$= 0.35 + 0.34$$
$$= 0.69 \text{ m}^3$$

CB #2

$$V = (0.6)(0.6)(1.30)$$
$$= 0.47 \text{ m}^3$$

Total drainage structure storage volume = 1.16 m^3.

3.) Underground Pipe Storage

Storm Pipe Storage

- 10.0 m of 375 mm diameter PVC pipe $V = \pi (0.1875)^2 (10.0)$
$= 1.10 \text{ m}^3$

Total pipe storage volume = 1.10 m^3.

Total underground storm pipe and drainage structure volume = 2.26 m^3.

Therefore the total rear yard grass/asphalt surface and underground storm pipe and drainage structure storage volume available at H.W.L. = 64.73 m is estimated at 3.89 m^3 > required 5 year storage volume of 2.54 m^3 from Table 1.

4.) <u>Roof Storage at Flat Roof Building</u>

The flat Roof Area #1 will be used for stormwater detention. This roof area will be drained by a controlled drain designed for a release rate of 10 U.S. gal/min. or 0.63 L/s.

<u>Roof Storage Area #1</u>

- Available flat roof area for storage = 98.8 m^2 @ roof slope of 2.1% (min.) or 100 mm of water height above the roof drain, therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$= \frac{0.10\ m\ (43.18 + 4\ (10.52) + 0)}{6} \qquad = \frac{(0.10)\ (85.26)}{6}$$

$$= \underline{1.42\ m^3}$$

The available Roof Area #1 storage volume of 1.42 m^3 > required 5 year storage volume of 1.33m^3 from Table 2.

Therefore ponding depth at the drain location is approximately 0.10 m (100 mm) and the 5 year level is estimated not to reach the roof perimeter of the building.

Hence Roof Area #1 of the proposed residential building flat rooftop storage is adequate to store the minimum required 5 year storm event volume of 1.33 m^3 given it can store up to 1.42 m^3. The total available rear yard grass/asphalt surface and underground drainage structure and storm pipe storage volume is 3.89 m^3 which is greater than the required 2.54 m^3 calculated volume at the estimated H.W.L. = 64.73 m. Total storage available is 5.31 m^3 which is greater than the minimum required volume of 3.87 m^3.

AVAILABLE STORAGE VOLUME CALCULATIONS

100 Year Event

1.) Rear Yard Grass/Asphalt Area – Surface Storage Volume

Assume 100 year H.W.L. = 64.80 m (See attached Dwg. No. 817-6, G-1 with the flood limit shown.)

CB/MH #1

$$\text{Available Storage Volume} = \frac{d}{6}\,(A_1 + 4A_2 + A_3)$$

$$V = \frac{0.06}{6}\,[26.8 + 4\,(7.0) + 0]$$

$$= \frac{(0.06)\,(54.8)}{6}$$

$$= 0.55\ m^3$$

CB #2

$$\text{Available Storage Volume} = \frac{d}{6}\,(A_1 + 4A_2 + A_3)$$

$$V = \frac{0.17}{6}\,[136.0 + 4\,(35.0) + 0]$$

$$= \frac{(0.17)\,(276.0)}{6}$$

$$= 7.82\ m^3$$

Total parking lot area surface storage volume = 8.37 m^3.

2.) Drainage Structures Storage

CB/MH #1

$$V = 3.14\,(0.6)^2\,(0.32) + 3.14\,(0.3)^2\,(1.2)$$
$$= 0.36 + 0.34$$
$$= 0.70\ m^3$$

CB #2

$V = (0.6)\ (0.6)\ (1.30)$
$\quad = 0.47\ m^3$

Total drainage structure storage volume = 1.17 m^3.

3.) Underground Pipe Storage

Storm Pipe Storage

- 10.0 m of 375 mm diameter PVC pipe $\quad V = \pi\ (0.1875)^2\ (10.0)$
$\quad = 1.10\ m^3$

Total pipe storage volume = 1.10 m^3.

Total underground storm pipe and drainage structure volume = 2.27 m^3.

Therefore the total parking lot surface, underground storm pipe and drainage structure storage volume available at H.W.L. = 64.80 m is estimated at 10.64 m^3 > required 100 year storage volume of 7.56 m^3 from Table 3.

4.) Roof Storage at Flat Roof Building

The flat Roof Area #1 will be used for stormwater detention. This roof area will be drained by a controlled drain designed for a release rate of 10 U.S. gal/min. or 0.63 L/s.

Roof Storage Area #1

- Available flat roof area for storage = 98.8 m^2 @ roof slope of 2.1% (min.) or 150 mm of fall from roof perimeter to roof drain, therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$= \frac{0.15\ m\ (98.8 + 4\ (24.44) + 0)}{6} \qquad = \frac{(0.15)\ (196.56)}{6}$$

$$= \underline{4.91\ m^3}$$

The available Roof Area #1 storage volume of 4.91 m^3 > required 100 year storage volume of 3.46 m^3 from Table 4.

Therefore ponding depth at the drain location is approximately 0.15 m (150 mm) and at the perimeter of the flat roof area is 0 mm above the roof perimeter surface. Accordingly it is recommended that (2) roof scuppers as shown on Dwg. No. 817-6, G-1 and the architect's roof plan be installed at the perimeter height of the rooftop for emergency overflow purposes in case of blockage from debris build up at the roof drain.

Hence Roof Area #1 of the proposed residential building flat rooftop storage is adequate to store the minimum required 100 year storm event volume of 3.46 m^3 given it can store up to 4.91 m^3. The total available parking lot surface, underground storm pipe and drainage structure storage volume is 10.64 m^3 which is greater than the required 7.56 m^3 calculated volume at the estimated H.W.L. = 64.80 m. Total site storage available is 15.55 m^3 which is greater than the minimum site required volume of 11.02 m^3.

PROPOSED THREE-STOREY

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CITY OF OTTAWA

APPENDIX C

INLET CONTROL DEVICE

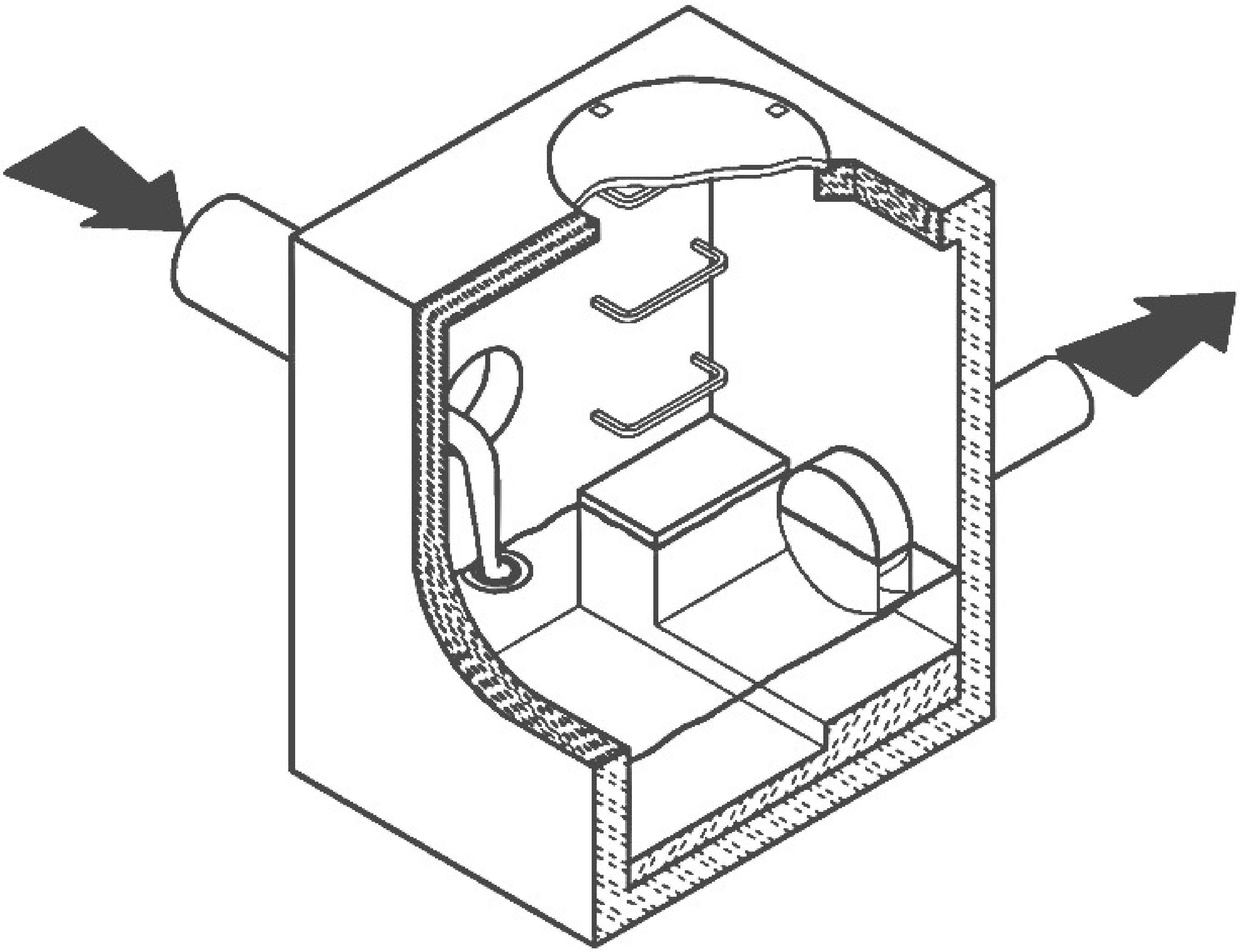
(ICD) DETAILS

HYDROVEX MODEL No. (50 VHV-1)

CSO/STORMWATER MANAGEMENT

® HYDROVEX® VHV / SVHV

Vertical Vortex Flow Regulator



JOHN MEUNIER

APPLICATIONS

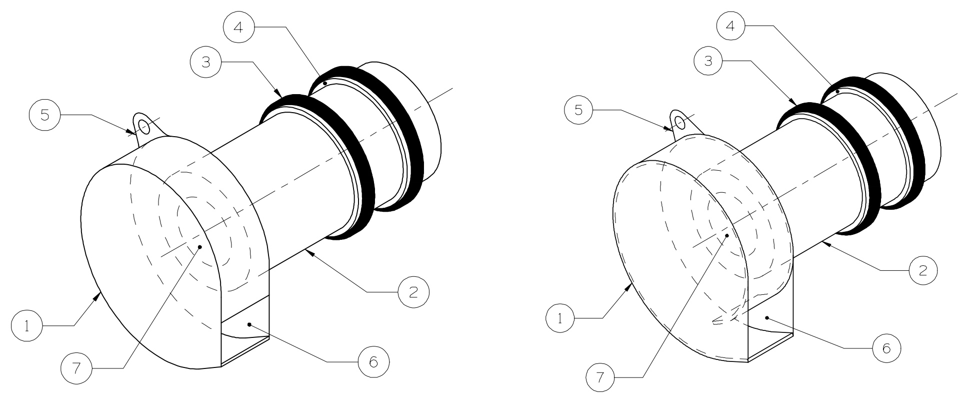
One of the major problems of urban wet weather flow management is the runoff generated after a heavy rainfall. During a storm event, uncontrolled flows may overload the drainage system and cause flooding. Sewer pipe wear and network deterioration are increased dramatically as a result of increased flow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



<u>*VHV*</u> <u>*SVHV*</u>

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.

HYDROVEX®
VHV/SVHV Vortex Flow Regulator

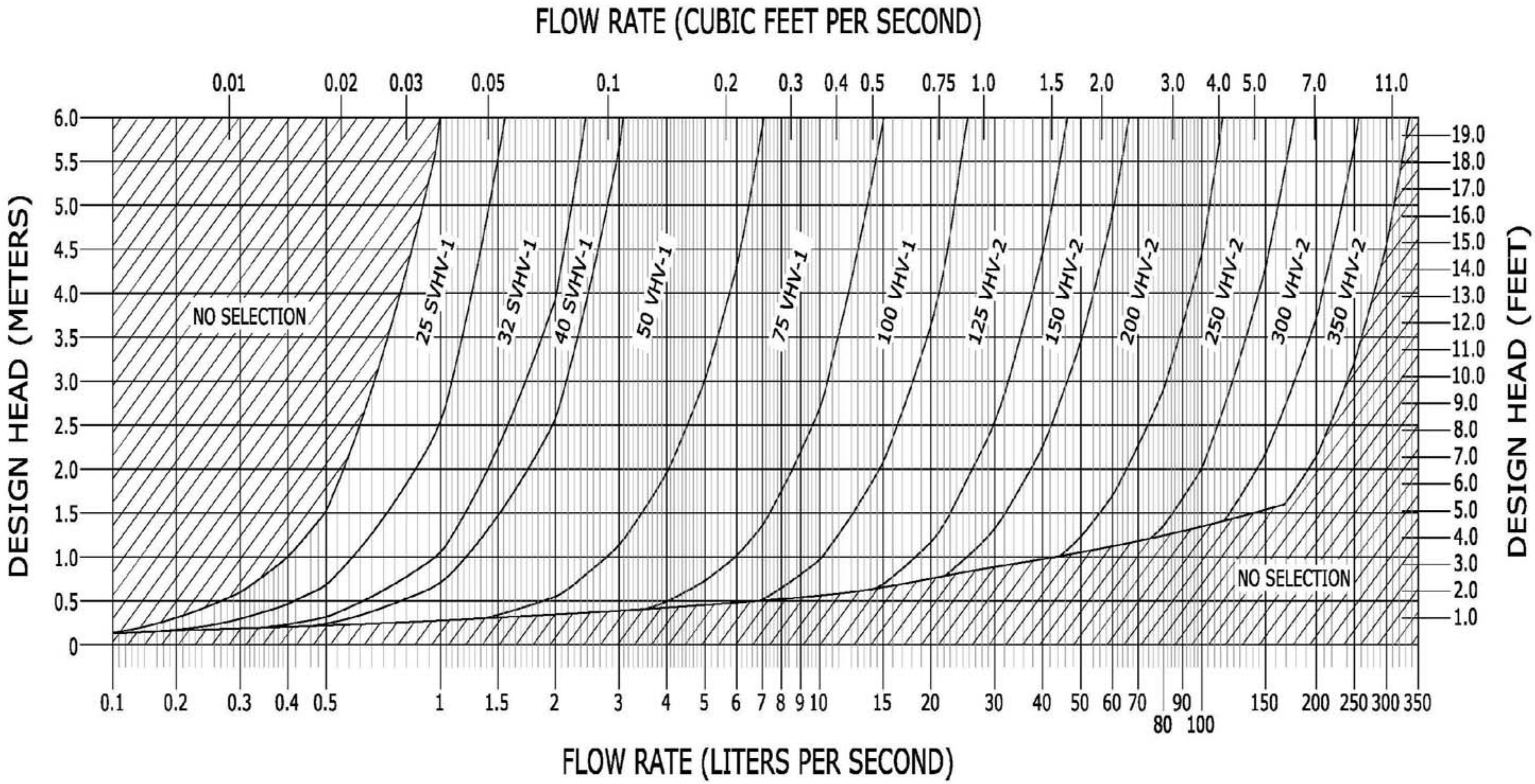


FIGURE 3

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