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SERVICING AND STORMWATER MANAGEMENT REPORT

1946 SCOTT STREET
OTTAWA, ONTARIO

Prepared For:
Independent Development Group
88 Spadina Ave
Ottawa, Ontario
K1Y 2C1

PROJECT #: 170628

DISTRIBUTION
6 copies – City of Ottawa
1 copy – Independent Development Group
1 copy – Kollaard Associates Inc.

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1 INTRODUCTION

Kollaard Associates was retained by Independent Development Group to complete a Site Servicing and Stormwater Management Report for a new residential development in the City of Ottawa, Ontario.

This report will address the serviceability of the proposed site, specifically relating to the adequacy of the existing municipal storm sewer, sanitary sewer, and watermains to hydraulically convey the necessary storm runoff, sanitary sewage and water demands that will be placed on the existing system as a result of the proposed development located at 1946 Scott Street, Ottawa, Ontario. The report shall also summarize the stormwater management (SWM) design requirements and proposed works that will address stormwater flows arising from the site under post-development conditions and will identify any stormwater servicing concerns and also describe any measures to be taken during construction to minimize erosion and sedimentation.

The development being proposed by Independent Development Group is located on the south side of Scott Street between Clifton Road and West Village Private within the City of Ottawa.

The site has a total area of 0.064 hectares and is located within an area of mostly residential development with one commercial property adjacent to the site on the west side. The site is bordered on the north by Scott Street followed by residential development, on the east by a vacant lot followed by West Village Private and residential development, on the south by residential development and on the west by a commercial development. The site in general slopes towards Scott Street and about 95 percent of the site is surfaced with asphaltic concrete pavement.

It is understood that the owner of the subject property intends to construct a 12 storey apartment building containing 70 residential units.

2 STORMWATER DESIGN

2.1 Stormwater Management Design Criteria

Design of the storm sewer system was completed in conformance with the City of Ottawa Design Guidelines. (October 2012). Section 5 “Storm and Combined Sewer Design”.

The stormwater management design was completed to ensure that the proposed development will not result in a negative impact to the existing storm sewer infrastructure. Accordingly the 100 year post development flow from the proposed development will be restricted to the 5 year pre-development flow rates assuming a maximum pre-development runoff coefficient of C = 0.5 and a time of concentration of 10 minutes.

2.1.1 Minor System Design Criteria

The storm sewers have been designed and sized based on the rational formula and the Manning’s Equation under free flow conditions for the 5-year storm using a 10-minute inlet time.

2.1.2 Major System Design Criteria

The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the runoff generated onsite during a 100-year design storm Excess runoff above the 100 year event will flow overland to the north of the site and ultimately into the roadside catch basins along Scott Street.

On site storage is provided and calculated for up to the 100-year design storm. Calculations of the required storage volumes have been prepared based on the Rational Method as identified in Section 8.3.10.3 of the City’s Sewer Guidelines and have been provided in Appendix A.

2.2 Stormwater Quantity Control

Peak Flow for runoff quantities for the Pre-Development and Post-Development stages of the project were calculated using the rational method. The rational method is a common and straightforward calculation, which assumes that the entire drainage area is subject to uniformly distributed rainfall. The formula is:

$$Q = \frac{CiA}{360}$$

Where

Q is the Peak runoff measured in ***m³/s***

C is the Runoff Coefficient, **Dimensionless**

A is the runoff area in ***hectares***

i is the storm intensity measure in ***mm/hr***

All values for intensity, i, for this project were derived from IDF curves provided by the City of Ottawa for data collected at the Ottawa International airport. For this project two return periods were considered, 5 and 100-year events. The formulas for each are:

5-Year Event

$$i = \frac{998.071}{(t_c + 6.053)^{0.814}}$$

100-Year Event

$$i = \frac{1735.071}{(t_c + 6.014)^{0.82}}$$

where t_c is time of concentration

2.2.1 Pre-development Site Conditions

As previously indicated, the site is located on the south side of Scott Street between Clifton Road and West Village Private within the City of Ottawa. The site has a total area of about 0.064 hectares. A fenced off asphalt concrete surface currently exists on the site. The asphalt surface has a footprint of about 610 square metres (0.061 hectares). The property is serviced by asphaltic driveway. An remaining area of 30 square metres consists of a grass surface. It is understood that pre-development conditions will be considered as the lesser of current conditions or conditions resulting in a runoff coefficient of 0.5.

Based on the existing ground cover the pre-development runoff coefficient was calculated to be 0.87. However, the predevelopment runoff coefficient used for the purpose of this stormwater management design was C = 0.5.

2.2.1.1 Pre-development Site Drainage Patterns

Existing stormwater runoff from the entire site in general consists of uncontrolled sheet flow towards the adjacent streets.

2.2.2 Runoff Coefficients

Runoff coefficients for impervious surfaces (roofs, asphalt, and concrete) were taken as 0.90, brick patio stones were taken as 0.70 and pervious surfaces (grass) were taken as 0.20.

A 25% increase for the post development 100-year runoff coefficients was used as per City of Ottawa guidelines. Refer to Appendix A for pre-development and post development runoff coefficients.

2.2.3 Time of Concentration

In keeping with the City of Ottawa sewer design guidelines, a time of concentration of 10 minutes was used to model both pre- and post-development conditions

2.2.4 Allowable Post Development Runoff Rate

The City of Ottawa requires that stormwater runoff be released in a controlled manner. To control runoff from the site it will be necessary to limit post-development flows for all storm return periods up to the 100-year event using onsite inlet controls. In keeping with the stormwater management criteria, the allowable post-development runoff rate from the site is to be limited to less than or equal to the 5 year pre-development runoff rate from the site.

Using a runoff coefficient of C = 0.5 and a time of concentration of 10 minutes the pre-development runoff rate from the site was calculated to be 9.3 L/sec for a 5 year storm event. It is noted that current pre-development conditions with a runoff coefficient of 0.87 would result in a runoff rate of 16.2 L/sec. Calculations are summarized in Appendix A.

2.2.5 Controlled and Uncontrolled Areas

For the purposes of this storm water management design, the site has been divided into uncontrolled and controlled areas as outlined on Figure1. The controlled area is defined as area CA1 and uncontrolled areas are defined as UA1. The Un-controlled area consists of those locations from which runoff flows directly off the site without restriction. The controlled areas are those from which the runoff rate is restricted and runoff in access of the allowable release rate is temporarily stored and released at a controlled rate following the storm event. Controlled and uncontrolled areas for the site are listed in Appendix A.

Run-off from all of the roof drains will be directed without restriction to the catch basins / maintenance holes (CB1 and CBMH2) in the parking area at the rear of the building. Surface storage will be provided on the parking area for runoff in access of the allowable release rate. An inlet control device will be installed on the outlet pipe to restrict the release rate from maintenance hole CBMH2.

Storm flows from the uncontrolled area collectively referred to as UA1 will flow un-controlled towards Scott Street.

Since run-off from these areas UA1 is uncontrolled, the maximum allowable release rate from the controlled area equals the allowable post development runoff rate minus the 100-year runoff rate from the uncontrolled portion of the site.

A post-development time of concentration of 10 minutes corresponds to a storm intensity of 104.19 mm/hr and 178.56 mm/hr on the 5-year and 100-year storm IDF curves respectively. The runoff rate from the uncontrolled areas was therefore calculated to be 0.8 L/s and 1.7 L/s for the 5 year and 100 year storm even, respectively.

$$Q_{controlled} = Q_{total\ allowable} - Q_{uncontrolled}$$

For the 5-year Storm event
$Q_{controlled}$ = 9.3 – 0.8L/s = 8.5 L/s

For the 100-year Storm event
$Q_{controlled}$ = 9.3 – 1.7L/s = 7.6 L/s

The allowable controlled area release rate for the site is summarized in Appendix A.

2.2.6 Post Development Restricted Flow and Storage

In order to meet the stormwater quantity control restriction, the post development runoff rate cannot exceed the 5 year predevelopment runoff rate. Runoff generated on site in excess of the allowable release rate will be temporarily stored on the parking area surface and within the maintenance hole and catchbasin and is to be released at a controlled rate following the storm event.

In order to achieve the allowable controlled area storm water release rate, storm water runoff will be controlled by an inlet control device (ICD) that is to be installed in CBMH2. The ICD will be designed to achieve a maximum allowable release rate of 7.6 L/s for the 100 year rainfall event. Total storage volume required to restrict flows to 7.6 L/s is 13.9 m^3 for the 100 year rainfall event. The chosen ICD will result in a restricted flow rate of about 7.4 L/sec during a 5 year storm event.

The storage depth on the parking surface during a 100 year storm event will be about 0.12 metres. The storage depth on the parking surface during a 5 year storm event will be about 0.04 metres.

The ICD will limit the flow into the municipal system and back up any excess into underground pipes and maintenance holes. The ICD will continue to release water after the storm event has passed until levels are lowered to pre event conditions. A Hydrovex 100-VHV-1 vertical vortex flow regulator or approved alternative will be used. The Hydrovex ICD should be ordered for the following parameters;

- Model number 100-VHV-1
- Outlet pipe specification: 300mm diameter PVC SDR35
- Discharge: 7.6 L/s
- Upstream Head: 1.0 m
- Manhole Dimensions: 1200 mm diameter
- 300 mm sump

The ICD was selected in order to ensure that the allowable maximum release rate for the 100 year storm events is not exceeded.

There is a maximum total potential storage of about 44.2 cubic metres available as surface storage in the parking lot. Refer to Appendix A for storage volume calculations.

2.3 Stormwater System Operation and Maintenance

2.3.1 Storm sewer and maintenance holes / catch basins

The manhole and catchbasin should be inspected for a buildup of sediment. Once the sump height is reduced to 0.15 m depth, the sediment should be removed by hydrovac excavation.

2.3.2 Inlet Control Device (ICD)

The inlet control device (ICD) should be inspected on a semi-annual basis and following major storm events. Any blockages, trash or debris should be removed.

2.4 Storm Sewer Design

The on-site storm sewers were designed to be in general conformance with the City of Ottawa Sewer Design Guidelines (October 2012). Specifically, storm sewers were sized using Manning's Equation, assuming a roughness coefficient N = 0.013, to accommodate the uncontrolled runoff from the 5-year storm, under 'open-channel' conditions. The uncontrolled runoff was determined using the rational method and the City of Ottawa IDF curve for a 10-minute time of concentration. Refer to Storm Sewer Design Sheets in Appendix A.

3 SANITARY SEWER DESIGN

The existing sanitary sewer along Scott Street near the site consists the West Nepean Collector Sewer along the north side of Scott Street. A 225 mm diameter sanitary main extends west along Scott Street from the intersection of Clifton Road and Scott Street about 39 metres west of the site. This sewer is located in the east bound lanes of Scott Street.

In order to provide sanitary services for the site, the existing 229 mm diameter sewer will have to be extended east along Scott Street to the Site. The proposed extension will consist of about 39 metres of 200 mm diameter PVC SDR 28 sanitary sewer pipe. The extension will terminate at a new manhole adjacent the site.

Sewage discharges from the proposed development will be domestic in type and in compliance with the City of Ottawa Sewer Use By-law. As previously indicated, the proposed development will consist of a 12 storey, 70 unit residential apartment building. Since the unit break down is not known at this time, it is assumed that, for preliminary design purposes, all of the units will be two bedroom apartments.

The sanitary sewage flow for the proposed building was calculated based on the City of Ottawa Sewer Design Guidelines (Section 4.4.1.2).

3.1 Design Flows

Residential

Total domestic pop:
2 Bedroom units (70) x 2.1 ppu: 147
Total: 147

$Q_{Domestic}$ = 147 x 350 L/person/day x (1/86,400 sec/day) = 0.60 L/sec

$$\text{Peaking Factor} = 1 + \frac{14}{4 + (147/1000)^{0.5}} = 4.19 \text{ use 4 maximum}$$

$Q_{Peak\ Domestic}$ = 0.60 L/sec x 4 = **2.38 L/sec**

Infiltration

$Q_{Infiltration}$ = 0.28 L/ha/sec x 0.64 ha = **0.02 L/sec**

Total Peak Sanitary Flow = 2.38 + 0.02 = 2.40 L/sec

3.2 Sanitary Service Lateral

The proposed building will be serviced by a 150 mm diameter sanitary service lateral which will be installed in accordance with City of Ottawa standards and specifications. The lateral will extend from the building to the new 200 mm diameter sanitary sewer in Scott Street which will be installed as part of the development.

The Ontario Building Code specifies minimum pipe size and maximum hydraulic loading for sanitary sewer pipe. OBC 7.4.10.8 (2) states "Horizontal sanitary drainage pipe shall be designed to carry no more than 65% of its full capacity." A 150 mm diameter sanitary service with a minimum slope of 1.0% has a capacity of 15.23 Litres per second.

The maximum peak sanitary flows for the site is 2.40 L/sec. Since 2.40 L/sec is much less than 0.65 x 15.23 = 9.90 L/s a sanitary service lateral with a diameter of 150 mm will be sufficient for the proposed development.

Table 3.1 Fixture Unit Consideration

Apartment Unit Type	Number of Apartments	Number of fixture units per apartment	Total number of Fixture Units.
• 2 Bedroom	70	10	700
• Total fixtures			700

In addition, from Table 7.4.10.8, the allowable number of fixture units for a 150 mm diameter sanitary service pipe at 1.0% slope is 700. There are approximately 700 fixtures in the building. As such a 150 mm diameter sanitary service is adequate for the proposed sanitary flow.

4 WATERMAIN DESIGN

4.1 Water Demand

The water demand for the proposed development was calculated based on the City of Ottawa Water Distribution Design Guidelines as follows:

Residential
Total domestic pop:
2 Bedroom units (70) x 2.1 ppu: 147
Total: 147

Residential Average Daily Demand = 350 L/c/d.

- Average daily demand of 350 L/c/day x 147persons =51,450 Litres/day or 0.60 L/s
- Maximum daily demand (factor of 2.5) is 0.60L/s x 2.5 = 1.49 L/s
- Peak hourly demand (factor of 2.2) = 1.49 L/s x 2.2 = 3.28 L/s

4.2 Fire Flow

Fire flow protection requirements were calculated as per the Fire Underwriter's Survey (FUS). Calculations of the fire flow required are provided following the text of this report.

Fire protection will be provided by an existing fire hydrant located on Scott Street about 45m west of the property on the south side of the road. In addition, the proposed development will have an automatic sprinkler system. As such, the minimum service diameter required for the proposed development is 150 mm.

4.3 Existing Watermain

A 200 mm diameter watermain was extended along the south side of Scott Street from Clifton Road to West Village Private. The proposed water service will be connected to this 200 mm diameter water main using a tapping valve chamber.

5 EROSION AND SEDIMENT CONTROL

The owner (and/or contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current best management practices for erosion and sediment control. It is considered to be the owners and/or contractors responsibility to ensure that the erosion control measures are implemented and maintained.

In order to limit the amount of sediment carried in stormwater runoff from the site during construction, it is recommended to install a silt fence along the property limits of the site. The silt fence may be polypropylene, nylon, and polyester or ethylene yarn.

If a standard filter fabric is used, it must be backed by a wire fence supported on posts not over 2.0 m apart. Extra strength filter fabric may be used without a wire fence backing if posts are not over 1.0 m apart. Fabric joints should be lapped at least 150 mm (6") and stapled. The bottom edge of the filter fabric should be anchored in a 300 mm (1 ft) deep trench, to prevent flow under the fence. Sections of fence should be cleaned, if blocked with sediment and replaced if torn.

Filter socks should be installed across existing storm manhole and catch basin lids. As well, filter socks should be installed across the proposed catch basin lids immediately after the catch basins are placed. The filter socks should only be removed once the asphaltic concrete is installed and the site is cleaned.

The proposed landscaping works should be completed as soon as possible. The proposed granular and asphaltic concrete surfaced areas should be surfaced as soon as possible.

The silt fences should only be removed once the site is stabilized and landscaping is completed.

These measures will reduce the amount of sediment carried from the site during storm events that may occur during construction.

6 CONCLUSIONS

SWM for the proposed development will be achieved by restricting the 100 year post development flow to the 5 year pre-development flow assuming a runoff coefficient of 0.5. This results in a reduction in the post-development runoff rate from the existing conditions of about 10.2 L/sec or about 63 percent during a 5 year storm event.

The peak sewage flow rate from the proposed development will be 2.4 L/sec. An existing sanitary sewer will be extended along Scott Street to service the proposed development. The existing municipal sanitary sewer should have adequate capacity to accommodate the increase in peak flow.

The existing municipal watermain along Scott Street will have adequate capacity to service the proposed development for both domestic and fire protection.

During all construction activities, erosion and sedimentation shall be controlled.

We trust that this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we can be of any further assistance to you on this project, please do not hesitate to contact our office.

Sincerely,
Kollaard Associates, Inc.

____
Steven deWit, P.Eng.

Appendix A: Storm Design Information

- Allowable Release Rate and SWM Summary
- Storage Volume Requirements
- Storage Volume Required
- Storage Volume Provided
- Outlet Control Structure Design Sheet
- Storm Sewer Design Sheet

APPENDIX A: STORMWATER MANAGEMENT MODEL

ALLOWABLE RELEASE RATE AND SWM SUMMARY

Client: Independent Development
Job No.: 170628
Location: 1646 Scott Street, Ottawa, Ontario
Date: September 12, 2017

PRE DEVELOPMENT FLOW

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2 + A_{gravel} \times 0.6)/A_{tot}$

Area	Surface	Ha	"C"	C_{avg}
Total	Gravel	0.000	0.60	**0.87**
0.064	Asphalt	0.061	0.90	
	Grass	0.003	0.20	

5 Year Event

Pre Dev.	C	Intensity	Area
5 Year	0.50	104.19	0.064
2.78CIA= 9.30			
	9.3 L/s		

**Use a 10 minute time of concentration for 5 year

Total Allowable Release: 9.3 L/s

5 Year Event

Pre Dev.	C	Intensity	Area
5 Year	0.87	104.19	0.064
2.78CIA= 16.19			
	16.2 L/s		

**Use a 10 minute time of concentration for 5 year and calculated runoff coefficient for predevelopment conditions

STORMWATER MANAGEMENT SUMMARY

Sub Area I.D.	Sub Area (ha)	5 year C	100 year 'C'	Outlet Location	2 Year Controlled Release (L/s)	Required 2 year Storage (m^3)	5 Year Controlled Release (L/s)	Required 5 year Storage (m^3)	100 Year Controlled Release (L/s)	Required 100 year Storage (m^3)	100 year Storage Level (m)
UA1	0.006	0.45	0.56	OFFSITE	0.6	0	0.8	0.0	1.7	0.0	0.0
CA1	0.058	0.90	0.99	Street	7.4	2.2	7.4	4.6	7.6	13.9	63.7
TOTAL	**0.064**				**8**	**2.2**	**8.2**	**4.6**	**9.3**	**13.9**	**63.7**

APPENDIX A: STORMWATER MANAGEMENT MODEL
STORAGE VOLUME REQUIRED

Client: Independent Development
Job No.: 170628
Location: 1646 Scott Street, Ottawa, Ontario
Date: September 12, 2017

UA1 - UNCONTROLLED AREA

Post Dev run-off Coefficient "C"

			5 Year Event		5 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C"**	**C_{avg}**
Total	Concrete/Asphalt	0.00063	0.90	**0.45**	0.99	**0.56**
0.00623	patio stones	0.00286	0.60		0.99	
	Grass	0.00274	0.20		0.25	

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

2 Year Event

Pre Dev.	C	Intensity	Area
2 Year	0.45	76.81	0.006
2.78CIA= 0.60			
0.6 L/S			

**Use a 10 minute time of concentration for 5 year

5 Year Event

Pre Dev.	C	Intensity	Area
5 Year	0.45	104.19	0.006
2.78CIA= 0.81			
0.8 L/S			

**Use a 10 minute time of concentration for 5 year

100 Year Event

Pre Dev.	C*	Intensity	Area
100 Year	0.56	178.56	0.006
2.78CIA= 1.74			
1.7 L/S			

**Use a 10 minute time of concentration for 100 year
*C value multiplied by 1.25 for 100 year event

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

APPENDIX A: STORMWATER MANAGEMENT MODEL
STORAGE VOLUME REQUIRED

Client: Independent Development
Job No.: 170628
Location: 1646 Scott Street, Ottawa, Ontario
Date: September 12, 2017

CA1 - Controlled

Area 100 Post Dev run-off Coefficient "C'

			5 Year Event		100 Year Event	
Area (ha)	**Surface**	**Area (ha)**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total 0.058	Asphalt/Cement/Roof	0.058	0.90	**0.90**	0.99	**0.99**
	Patio Stones	0.000	0.60		0.99	
	Grass	0.000	0.20		0.25	

Equations:

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.058 = Area(ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	*Allowable Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
2 YEAR	10	76.81	11.1	7.4	3.7	2.2
	20	52.03	7.6	7.2	0.4	0.4
	30	40.04	5.8	5.8	0.0	0.0
	40	32.86	4.8	4.8	0.0	0.0
	50	28.04	4.1	4.1	0.0	0.0
	60	24.56	3.6	3.6	0.0	0.0

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	*Allowable Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
5 YEAR	10	104.19	15.1	7.4	7.7	4.6
	20	70.25	10.2	7.4	2.8	3.4
	30	53.93	7.8	7.2	0.6	1.1
	40	44.18	6.4	6.4	0.0	0.0
	50	37.65	5.5	5.5	0.0	0.0
	60	32.94	4.8	4.8	0.0	0.0

Orifice Sizing

Pipe				
Flow (L/s)	**Head (m)**	**ORIFICE AREA(m^2)**	**SQUARE (1-side mm)**	**CIRC (mmØ)**
7.6	2.08	0.002	45	50

*Note - Hydrovex 50VHV-1 is required

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.058 = Area(ha)
0.99 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	*Allowable Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
100 YEAR	10	178.56	28.5	7.6	20.9	12.5
	20	119.95	19.1	7.6	11.5	13.9
	30	91.87	14.7	7.6	7.1	12.7
	40	75.15	12.0	7.6	4.4	10.5
	50	63.95	10.2	7.6	2.6	7.8
	60	55.89	8.9	7.6	1.3	4.8
	70	49.79	7.9	7.4	0.5	2.3

Orifice Control Sizing
$Q = 0.6 \times A \times (2gh)^{1/2}$
Where:
Q is the release rate in m^3/s
A is the orifice area in m^2
g is the acceleration due to gravity, $9.81 m/s^2$
h is the head of water above the orifice centre in m
d is the diameter of the orifice in m

Orifice Invert = 88.97 m
Ponding Elevation = 91.05 m
Top of CB Elevation = 90.80 m
Note: Orifice #1 is located on the downstream invert of CBMH 1

APPENDIX A: STORMWATER MANAGEMENT MODEL
STORAGE VOLUME PROVIDED

Client: Independent Development
Job No.: 170628
Location: 1646 Scott Street, Ottawa, Ontario
Date: September 12, 2017

Underground Pipe Storage

Diameter (mm)	Area (m^2)	Length (m)	Volume (m^3)
300	0.071	36.0	2.5
		Total Volume	***2.5***

Manhole Storage @ 90.80

MH ID	Diameter / Width (mm)	Area (m^2)	Depth (m)	Volume (m^3)
CBMH 1	1200	1.13	0.88	0.99
CB2	600	0.36	0.88	0.32
			Total Volume	***1.3***

Required Surface Storage

Storm Event		Pond Depth (mm)		Volume (m^3)
2 year		--	--	--
5 year		40		0.8
100 year		120		10.0
Max Available		250		44.2

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APPENDIX A: STORMWATER MANAGEMENT MODEL

OUTLET CONTROL STRUCTURE DESIGN SHEET

Client: **Independent Development**
Job No.: **170628**
Location: **1646 Scott Street, Ottawa, Ontario**
Date: **September 12, 2017**

Stage, WSE Elev (m)	Comments	Layer Thickness (m)	Top Layer Area (m^2)	Bottom Layer Area (m^2)	Active Quantity Volume (m^3)	Quantity Storage (m3)	Outflow Hydrovex (L/sec)	Outflow Weir (L/sec)	Total Outflow (L/sec)
63.85		0.050	253.7	253.7	12.7	44.2	7.9		7.9
63.80		0.050	253.7	226.7	12.0	31.5	7.8		7.8
63.75		0.050	226.7	204.2	10.8	19.5	7.6		7.6
63.70		0.050	204.2	91.0	7.2	8.7	7.4		7.4
63.65		0.050	91.0	0.0	1.5	1.5	7.2		7.2
63.60	Bottom of Pond	0.000	0.0	0.0	0.0	0.0	7.0		7.0

HYDROVEX SELECTION INFORMATION

Model No:	100-VHV-1
Oulet pipe Spec:	300 mm PVC SDR 35
Discharge	7.6 L/s
Upstream Head:	1.0 m
Manhole Diameter	1200 mm
Sump depth:	300 mm

APPENDIX A: STORM SEWER DESIGN SHEET

Client: Independemt Development Group
Job No.: 170628
Location: 1946 Scott Street, Ottawa, Ontario
Date: September 12, 2017

Storm Sewer Design Sheet (5-yr storm)

LOCATION											PROPOSED SEWER								
								TIME	RAINFALL	PEAK	TYPE	PIPE	PIPE			FULL FLOW	TIME OF	EXCESS	
FROM	TO	Total Area	C	C	Actual R	INDIV	ACCUM	OF	INTENSITY	FLOW	OF	SIZE	SLOPE	LENGTH	CAPACITY	VELOCITY	FLOW	CAPACITY	Q/Qfull
		(ha)	0.20	0.90	('C')	2.78 AR	2.78 AR	CONC.	I	Q (l/s)	PIPE	(mm)	(%)	(m)	(l/s)	(m/s)	(min.)	(l/s)	
CBMH 1	MAIN	0.058	0.000	0.058	0.90	0.15	0.15	10.00	104.19	15.12	PVC	300.0	0.34	34.0	56.44	0.80	0.71	41.32	0.27

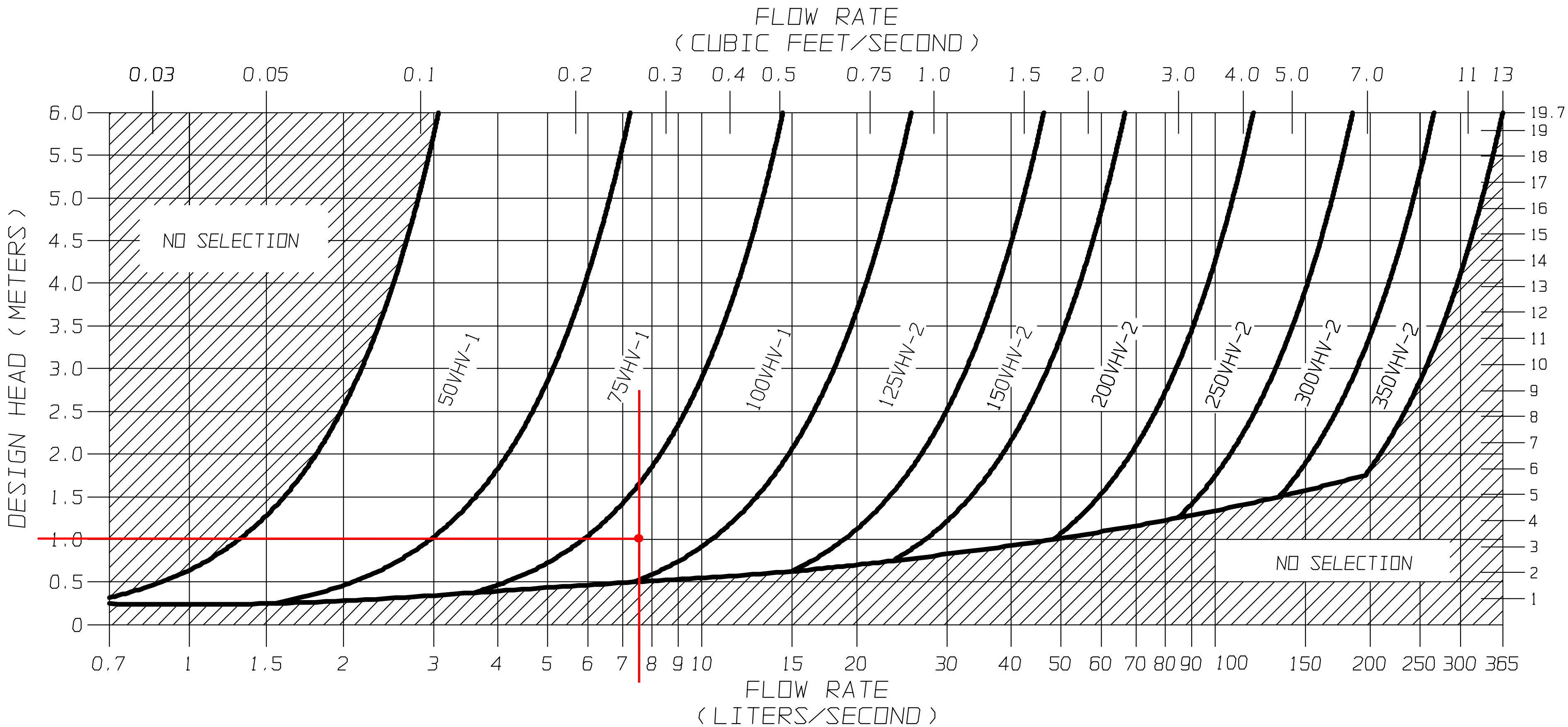
Rainfall Intensity = $998.071/(T+6.053)^{-0.814}$ T= time in minutes
(City of Ottawa, 5 year storm)

Appendix B: Product Information

- Hydrovex Selection Chart

Hydrovex®

VHV Vertical Vortex Flow Regulator



Flow Rate = 2.0L/s
Design Head = 1.75m

FIGURE 2 - VHV

John Meunier

Appendix C: Fire Flow Calculations

- Fire Water Storage and Supply Flow Rate Requirements

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APPENDIX C: CALCULATION OF FIRE FLOW REQURIEMENTS - 1946 SCOTT STREET

Calculation Based on Fire Underwriters Survey, 1999

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

$$F = 220 \times C \times \sqrt{A}$$

where F = required fire flow in litres per minute

A = Fire-Resistive Buildings with 1hr fire rating. Consider only area of the largest floor plus 25 percent of each of the two immedately adjoining floors. Largest floors are floors 2-8. Therefore consider 3rd floor area with 25% of 2cd and 25% of 4th floor areas.

C = coefficient related to the type of construction:

1.5	for wood construction (structure essentially combustible)
1.0	for ordinary construction (brick or other masonry walls, combustible floor and interior)
0.8	for noncombustible construction (unprotected metal structural components, masonary or metal walls)
0.6	for fire-resistive construction (fully protected frame, floors, roof)

Area of floors 2 - 8 = 354.3 m^2 25% of 2cd and 4th Floors = 177.2 m^2

A = 531.45 m^2 (Fire Resistive Construction)

C = 1.0

F = 5,072 L/min -----------------------> Rounded to nearest 1000 = **5,000**

2) The value obtained in 1. may be reduced by as much as 25% for occupancies having a low

Non-combustible =	-25%
Limited Combustible =	-15%
Combustible =	0%
Free Burning =	15%
Rapid Burning =	25%

L/min

Reduction due to low occupancy hazard = -25% x 5,000 = = **3,750** L/min

3) The value above my be reduced by up to 50% for automatic sprinlker system

Reduction due to automatic sprinker system = -30% x 3,750 = **2,625**

4) The value obtained in 2. may be increased for structures exposed within 45 metres by the fire

Separation (metres)	Condtion	Charge
0m to 3.0m	1	25%
3.1m to 10.0m	2	20%
10.1m to 20.0m	3	15%
20.1m to 30.0m	4	10%
30.1m to 45.0m	5	5%
45.1m to	6	0%

Exposures	Distance(m)	Condtion		Charge
Side 1	1.5	1	-------->	25%
Side 2	1.5	1	-------->	25%
Front	13.9	3	-------->	15%
Back	9.1	2	-------->	20%
				75%

L/min

Increase due to separation = 75% x 2,625 = **1,969** L/min

The fire flow requirement is = **2,625**

Increase due to Separation = 1,969

The Total fire flow requirement is = 4,594

or **76.6** **L/sec**