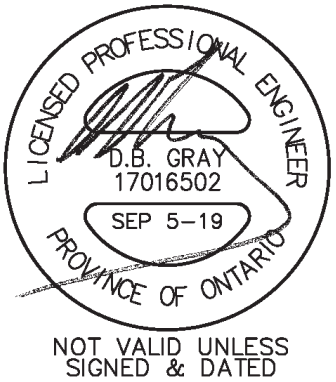
SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

5986-5992 Hazeldean Road
Ottawa, Ontario

Report No. 19042

September 5, 2019



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5986-5992 Hazeldean Road
Ottawa, Ontario

This report describes the services and addresses the stormwater management requirements of a 3,543 sq.m. property at 5986-5992 Hazeldean Road in Ottawa. There are four buildings currently on the property, all being used commercially. Two formerly residential buildings (having footprint areas of 142 and 161 sq.m.) and a garage (112 sq.m.) will be demolished. A fourth existing building, 523 sq.m. in area, will be retained.

A three-storey mixed-use building with a 594 sq.m. footprint is proposed. The ground floor will be commercial, the second floor offices and the third floor will have six apartment units.

This report forms part of the stormwater management design for the proposed development. Refer to drawing C-1 to C-6 also prepared by D. B. Gray Engineering Inc.

WATER SUPPLY FOR FIREFIGHTING:

There is an existing fire hydrant in the municipal road right-of-way located near the southeast corner of the Hazeldean Road / Springbrook Drive intersection. It is about 88 m unobstructed distance to the far end of the proposed building. Therefore, since it is less than 90 m, a private on-site fire hydrant is not required.

A fire flow of 216.7 L/s (13,000 L/min) is required, as calculated as per the Fire Underwriter Survey "Water Supply For Fire Protection".

The boundary conditions, based on the City of Ottawa computer simulation of the water distribution system in this area, are required to determine if an adequate water supply for firefighting is available. Boundary conditions have been requested but they have not yet been received. Once the boundary conditions are received the hydraulics will be analyzed.

WATER SERVICE:

One of the formerly residential buildings (to be demolished) has a water service connecting the 200 mm municipal watermain in Hazeldean Road. The other formerly residential building (also to be demolished) has 32 mm water service connection connecting to the 200 mm municipal watermain in Old Orchard Crescent. Both existing services will be decommissioned. The subject property backs onto, but does not have frontage, on Old Orchard Crescent. The 32 mm water service (and a 200 mm sanitary

service – see below) is located in an existing 8.0 m wide easement on the adjacent landowner's (a condominium corporation) property.

A 50 mm water service, connecting to the 200 mm municipal watermain in Old Orchard Crescent, is proposed to service the entire proposed development. Based on the AWWA water flow demand curve and an assumed water pressure at the meter of 414 kPa (60 psi), the peak demand is expected to be 2.8 L/s (170 L/min / 45 USgpm). The AWWA method calculates the instantaneous demand and is used to size the water service. This peak demand will produce an acceptable velocity of 1.5 m/s (1.5 to 2.4 m/s is acceptable) in the proposed 50 mm water service connection.

Based on the City of Ottawa Water Distribution Design Guidelines for residential properties (6 apartment units / 1.8 person per unit – 350 L/person/day) and Ministry of the Environment Design Guidelines for peaking factors the daily average flow is 0.04 L/s with a maximum daily and maximum hourly demand of 0.4 and 0.6 L/s respectively. Based on the City of Ottawa Design Guidelines the daily average consumption rate for a commercial development is 28,000 litres per day per hectare. The maximum daily peaking factors is 1.5 of the daily average demand and maximum hourly peaking factor is 1.8 of the maximum daily demand. Based on this rate and peaking factors, and assuming an eight hour day, the maximum daily demand is calculated to be 0.3 L/s. Based on the peaking factors the maximum daily demand is 0.5 L/s and maximum hourly demand is 0.9 L/s. Therefore, the total daily average flow (residential + commercial) is 0.4 L/s, with a maximum daily and maximum hourly demand of 0.9 and 1.6 L/s, respectively.

To determine the water pressure under these demands, boundary conditions, based on the City of Ottawa computer simulation of the water distribution system, at the subject location, are required. In summary, we have requested the boundary conditions for the subject area based on the following:

Average Daily Demand: 0.4 L/s.
Maximum Daily Demand: 0.9 L/s.
Maximum Hourly Demand: 1.6 L/s
Fire Flow Demand: 216.7 L/s
Maximum Daily + Fire Flow Demand: 217.6 L/s

Once the boundary conditions are received the hydraulics will be analyzed to determine if an acceptable range of water pressure are available.

SANITARY SERVICE:

One of the formerly residential buildings (to be demolished) is on a septic system which will be decommissioned. The other formerly residential building (also to be demolished) has 200 mm sanitary sewer connection connecting to a 250 mm municipal sanitary sewer in Meadowmist Court at a manhole in the Meadowmist / Old Orchard intersection. The portion of the existing 200 mm sanitary sewer within the 8.0 m easement will be

retained. The portion of the existing sanitary sewer from the end of the easement to the existing building to be retained will be decommissioned.

Based on the City of Ottawa Sewer Design Guidelines for a residential property (6 apartment units / 1.8 person per unit – 280 l/person/day – 3.2 peaking factor); and based on the City of Ottawa Sewer Design Guidelines for a commercial property (28,000 L/ha/day; 1.5 peaking factor; 8 hour day and a 0.33 L/s/ha infiltration flow) the post development flow is calculated to be 0.72 L/s. This flow will be adequately handled by the existing 200 mm sanitary sewer service connection having a slope of 6.1% (8.45 L/s capacity at 1%).

The 0.72 L/s in sanitary flows contributing to the existing 250mm municipal sanitary sewer is expected to have an acceptable impact given its capacity of 50.8 L/s (250 mm at 0.67%).

STORMWATER MANAGEMENT:

Water Quality:

There are currently no quality control measures on the subject property and no permanent quality control measures are proposed.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-2 and notes 2.1 to 2.5 on drawing C-3). In summary: to filter out construction sediment; a sediment capture filter sock inserts will be installed in all existing catch basins adjacent to the site and all new catch basins as they are installed.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-4 and notes 2.1 to 2.7 on drawing C-5). In summary: to filter out construction sediment a silt fence barrier will be installed around the perimeter of the property; sediment capture filter sock inserts will be installed in all existing catch basins adjacent to the site and all new catch basins as they are installed; geotextile fabric mud mats will be install at all points of egress to public roads; and any material deposited on a public road will be removed at the end of each day.

Water Quantity:

The stormwater management criteria for quantity control are to control the post development peak flows to the peak flows using a pre-development runoff coefficient or runoff coefficient of 0.50, whichever is less; and a calculated time of concentration (but not less than 10 minutes). It is calculated that the pre-development conditions reflect a 100-year runoff coefficient of 0.63 and a time of concentration of 11.6 minutes (using C=0.50). Using the Rational Method, the maximum allowable release rate during the 100-year storm event is 81.16 L/s. It is calculated that the pre-development conditions

reflect a 5-year runoff coefficient of 0.56 and a time of concentration of 11.6 minutes (using C=0.50). Using the Rational Method, the maximum allowable release rate during the 5-year storm event is 47.40 L/s.

The runoff coefficients for the 100-year event are increased by 25% to maximum 1.00.

Stormwater will be stored within the development on the surface above two catch basins.

Drainage Area I
(Uncontrolled Flow Off Site – 573 sq.m.):
The runoff from the north perimeter and a portion of the south perimeter of the site will be allowed to flow uncontrolled off the site. The flow from is calculated at 10 minutes concentration.

	100-year	5-year
Maximum flow rate:	16.57 L/s	8.47 L/s

Drainage Area II (2,970 sq.m.):
An inlet control device (ICD) located at the outlet pipe of manhole MH-3 will control the release of stormwater from the property. The ICD will restrict the flow and force the stormwater to back up onto the surface of the parking area and swale to the south and west of the proposed building. The ICD shall be a plug style with a round orifice design manufactured by Pedro Plastics (or approved equal manufactured by IPEX) and shall be sized by the manufacturer for a discharge rate of 39.41 L/s at 2.67 m head. It is calculated that an orifice area of 8,929 sq.mm. ($\pm$107 mm diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 39.41 L/s at a head of 2.67 m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 38.93 L/s at 2.60 m.

	100-year	5-year
Maximum release rate:	49.12 L/s	38.93 L/s
Maximum water elevation:	117.45 m	117.39 m
Maximum stored volume:	51.33 cu.m.	14.30 cu.m.

The Entire Site:

	100-year	5-year
Maximum allowable release rate:	81.16 L/s	47.40 L/s
Maximum release rate:	55.98 L/s	47.40 L/s
Maximum stored volume:	51.33 cu.m.	14.30 cu.m.

Therefore maximum post-development release rate for the 100-year storm event is calculated to be only 69% of the maximum allowable at 55.98 L/s and to achieve this release rate the maximum required stored volume is 51.33 cu.m. And the maximum post-development release rate for the 5-year storm event is calculated to be equal than the maximum allowable and to achieve this release rate the maximum required stored volume is 14.30 cu.m.

Stormwater released through the ICD will be conveyed off the site via a 300mm storm sewer (located in the 8.0 m easement) connecting existing 375 mm municipal storm sewer in Old Orchard Crescent at a new manhole.

The unrestricted flowrate resulting from one in five-year storm event will produce a peak flow of 61.0 L/s which will be adequately by the proposed storm sewer system with the last pipe segment (300mm at 0.79% - 89.7 L/s capacity) being at 68% of its capacity. However, the inlet control device (ICD) will restrict the flow to 38.9 L/s during the one in five storm event so that flow in the last segment will be only at 43% its capacity.

The 38.9 L/s in stormwater flows contributing to the existing 375mm municipal storm sewer (at 0.39% - 114.2 l/s capacity) is expected to have an acceptable impact.

CONCLUSIONS:

1. An existing fire municipal hydrant is about 88 m unobstructed distance to the far end of the proposed building, therefore, a private on-site fire hydrant is not required.

2. Boundary conditions are required to determine if an adequate water supply for firefighting is available.

3. Boundary conditions are required to determine if the proposed water service connection is adequately sized to serve the development.

4. The boundary conditions are required to determine if there is an acceptable range of water pressures in the municipal watermain for the proposed development.

5. The expected sanitary sewage flow rate will be adequately handled by the existing sanitary sewer service connection.

6. The sanitary flow contributing to the existing municipal sanitary sewer is expected to have an acceptable impact.

7. There are currently no quality control measures on the subject property and none are proposed.

8. An erosion and sediment control plan has been developed to be implemented during construction.

9. The maximum release rate for the 100-year event is less than the maximum allowable and for the 5-year event it is equal to maximum allowable. To achieve the release rates the maximum required stored volume is 51.33 cu.m. for the 100-year event and 14.30 cu.m. for the 5-year.

10. The flowrate produced by a one in five-year storm event will be adequately handled by the proposed storm sewer system.

11. The restricted stormwater flow contributing to the existing municipal storm sewer is expected to have an acceptable impact.

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20-Aug-19

5992 Hazeldean Road
Ottawa, Ontario

Fire Flow Requirements

Proposed 3 Storey Mixed Use Building

Fire flow requirement as calculated as per Fire Undewriter Survey "Water Supply For Fire Protection".

F = 220 C $A^{0.5}$ = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 1.5 Wood Frame Construction

A = total floor area (all storeys excluding basements at least 50% below grade)

Proposed Building	Ground Floor	594	sq.m.
	2nd Floor	594	sq.m.
	3rd Floor	594	sq.m.
	TOTAL FIRE AREA:	1782	sq.m.

F = 13,931 L/min
= 14,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy

= 11,900 L/min

0% Reduction for Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Constuction	Length m	Storeys	Factor
0%	North	>45m				0
12%	East	10.1 to 20m	W-F	13	1	13
0%	South	>45m				0
0%	West	>45m				0
12%	Total Increase for Exposure (maximum 75%)					

= 1,428 L/min Increase

= 13,328 L/min
F = 13,000 L/min (rounded off to the nearest 1,000 L/min)
= 216.7 L/s

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5992 Hazeldean Road
Ottawa, Ontario

Fire Flow Requirements

Proposed 3 Storey Mixed Use Building
With Firewall

Fire flow requirement as calculated as per Fire Undewriter Survey "Water Supply For Fire Protection".

$F = 220\ C\ A^{0.5}$ = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 1.5 Wood Frame Construction

A = total floor area (all storeys excluding basements at least 50% below grade)

Proposed Building	Ground Floor	297	sq.m.
	2nd Floor	297	sq.m.
	3rd Floor	297	sq.m.
	TOTAL FIRE AREA:	891	sq.m.

F = 9,850 L/min
= 10,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy

= 8,500 L/min

0% Reduction for Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Constuction	Length m	Storeys	Factor
0%	North	>45m				0
12%	East	10.1 to 20m	W-F	13	1	13
10%	South	Firewall				0
0%	West	>45m				0
22%	Total Increase for Exposure (maximum 75%)					

= 1,870 L/min Increase

= 10,370 L/min
F = 10,000 L/min (rounded off to the nearest 1,000 L/min)
= 166.7 L/s

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20-Aug-19

5592 Hazeldean Road
Three-Storey Mixed Use Building
6 Apartment Units / Ground & 2nd Floor Commercial
Ottawa, Ontario

Water Demand

RESIDENTIAL:		Number of Units	Persons Per Unit	Population			
	Average Apartment:	6	1.8	11			
			TOTAL:	11			
	DAILY AVERAGE:	350	litres / person / day				
		2.6	l / min	0.04	l / sec	0.7	USgpm
	MAXIMUM DAILY DEMAND:	9.5	(Peaking Factor for a equivalent population of <30: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)				
		24.9	l / min	0.4	l/s	7	USgpm
	MAXIMUM HOURLY DEMAND:	14.3	(Peaking Factor for a equivalent population of <30: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)				
		37.5	l / min	0.6	l/s	10	USgpm
COMMERCIAL							
	DAILY AVERAGE:	28,000	l /gross ha / day (as per Ottawa Design Guidelines)				
		0.35	ha (land area)				
		9918	l / day				
		8	hour day				
		20.7	l/min	0.3	l/s	5.5	USgpm
	MAXIMUM DAILY DEMAND:	1.5	(Peaking Factor as per Ottawa Design Guidelines)				
		31.0	l/min	0.5	l/s	8.2	USgpm
	MAXIMUM HOURLY DEMAND:	1.8	(Peaking Factor as per Ottawa Design Guidelines)				
		55.8	l/min	0.9	l/s	14.7	USgpm
TOTAL:							
	TOTAL DAILY AVERAGE:	23.3	l/min	0.4	l/s	6.2	USgpm
	TOTAL MAXIMUM DAILY DEMAND:	55.9	l/min	0.9	l/s	14.8	USgpm
	TOTAL MAXIMUM HOURLY DEMAND:	93.3	l/min	1.6	l/s	24.7	USgpm

5-Sep-19

5986-5992 Hazeldean Road
Ottawa, Ontario

Peak Water Demand

WATER FIXTURE VALUE
(AWWA Manual M22 - Sizing Water Service Lines and Meters)

	No.	F.V.	Total
Bathtub	0	8	0
Tiolet - tank	16	6	96
Tiolet - flush valve	0	24	0
Lavs.	16	1.5	24
Bidet	0	2	0
Urinal - wall flush valve	0	10	0
Shower	6	2.5	15
K. Sink	7	1.8	12.6
Dishwasher	6	1.3	7.8
Clothes Washer	0	6	0
Commercial Sink	0	4	0
J. Sink	0	4	0
Commercial Dishwasher	0	4	0
Commercial Washer	0	4	0
Hose 1/2 in	0	5	0
Hose 3/4 in	0	12	0
			155.4

Peak Demand (fig 4-2 or 4-3 AWWA M22)			45	USgpm		
Pressure @ Meter	414	kPa	60	psi (assumed)		
Pressure Factor (table 4-1 AWWA M22)			1.00			
Peak Demand			45	USgpm		
Irrigation - hose 1/2 in	0		0	USgpm (includes pressure factor)		
TOTAL PEAK DEMAND	170	l/min	45	USgpm	2.8	l/s
		Nominal Size	2.0	in	50	mm
			4.8	ft/s	1.5	m/s

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SANITARY SEWER DESIGN FORM

Average Daily Flows:
- Residential: 280 l / capita / day
- Commercial: 28,000 l / ha / day
- Instituational: 28,000 l / ha / day
- Light Industrial: 35,000 l / ha / day
- Heavy Industrial: 55,000 l / ha / day

Infiltration Allowance: 0.33 l / s / ha

Peaking Factor:
- Residential (Harmon Equation): $P.F. = 1 + \frac{14}{4 + P^{0.5}}$
- P = Population / 1000
- Harmon Correction Factor 0.8
- Commercial & Institutional: 1.5 If contrinbution > 20%
- Commercial & Institutional: 1.0 If contrinbution < 20%
- Industrial: As per Ottawa Guidelines Appendix 4-B

PROJECT: 5986-5992 Hazeldean

Designed By: D.B.G.

5-Sep-19

LOCATION			Section								Cumulative Residential		Section Non-Residential			Cumulative					SEWER DATA								COMMENTS
			Single Family	Semi/Townhouse	Duplex / Triplex	Apartments (average)	Apartments (1 Bed.)	Apartments (2 Bed.)	Apartments (3 Bed.)	Residential Area											n =	0.013							
STREET	FROM	TO	ppu = 3.4	ppu = 2.7	ppu = 2.3	ppu = 1.8	ppu = 1.4	ppu = 2.1	ppu = 3.1		Pop.	Peaking Factor	Area	Flow	Peaking Factor	Flow	Area	Sewage Flow	Infiltration Flow	Total Flow	Type of Pipe	Dia. Actual	Dia. Nom.	Slope	Length	Capacity	Velocity	Ratio	
			No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	ha			ha	l/ha/day		l/s	ha	l/s	l/s	l/s		(mm)	(mm)	(%)	(m)	(l/s)	(m/s)	Q/Qfull	
Existing 1 Storey		MH-SA.1											0.106	28000	4.5	0.16	0.106	0.16	0.04	0.19	PVC	152.4	150	1.0	43.1	15.9	0.87	0.01	
Proposed 3 Storey		MH-SA.1					6				8.4	3.2	0.248	28000	4.5	0.36	0.248	0.45	0.08	0.53	PVC	152.4	150	1.0	26.3	15.9	0.87	0.03	
	MH-SA.1	Existing MH									8.4	3.2				0.52	0.354	0.60	0.12	0.72	PVC	203.2	200	6.1	36.2	84.5	2.61	0.01	
																					DOWNSTREAM OF CONNECTION TO EXISTING SANITARY MANHOLE								
																						254.0	250	0.67		50.8	1.00	0.00	

STORMWATER MANAGEMENT CALCULATIONS

The orifice calculations are based on the following formula:

$$Q = C_d \times A_o \sqrt{2gh} \times 1000$$

where:

Q = flowrate in litres per second
C_d = coefficient of discharge
A_o = orifice area in sq.m.
g = 9.81 m/s2
h = head above orifice in meters

Storage calculations on surface above the catch basins are based on the following formula for volume of a cone:

$$V = (A \times d)/3$$

where:

V = volume in cu.m.
A = ponding area in sq.m.
d = ponding depth in meters

Summary Tables

ONE HUNDRED YEAR EVENT				
Drainage Area	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	16.57	-	-
AREA II	-	39.41	51.33	51.33
TOTAL	81.16	55.98	51.33	51.33

FIVE YEAR EVENT				
Drainage Area	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	8.47	-	-
AREA II	-	38.93	14.30	14.30
TOTAL	47.40	47.40	14.30	14.30

5986-5992 Hazeldean Road

Ottawa, Ontario

STORM WATER MANAGEMENT CALCULATIONS
Rational Method

ONE HUNDRED YEAR EVENT

Pre-Development Conditions

Roof Area:	668	sq.m	1.00
Asphalt/Concrete Area:	1141	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	1734	sq.m	0.25
Total Catchment Area:	3543	sq.m	0.63

Airport Formula

$$Tc = \frac{3.26\,(1.1 - C)\,(L)^{1/2}}{Sw^{0.33}} \text{ min}$$

Runoff Coefficient (C):	0.50	see above
Sheet Flow Distance (L):	56	m
Slope of Land (Sw):	2	%
Time of Concentration (Sheet Flow):	11.6	min
Area (A):	3543	sq.m
Time of Concentration:	11.6	min
Rainfall Intensity (i):	165	mm/hr
Runoff Coeficient (C):	0.50	
100 Year Maximum Allowable Release Rate (2.78AiC):	81.16	L/s

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(ONE HUNDRED YEAR EVENT)

Roof Area:	126	sq.m	1.00
Asphalt/Concrete Area:	128	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	319	sq.m	0.25
Total Catchment Area:	573	sq.m	0.58
Area (A):	573	sq.m	
Time of Concentration:	10.0	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.58		
Flow Rate (2.78AiC):	16.57	L/s	

DRAINAGE AREA II

(ONE HUNDRED YEAR EVENT)

Roof Area:	867	sq.m	1.00
Asphalt/Concrete Area:	1380	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	723	sq.m	0.25
Total Catchment Area:	2970	sq.m	0.82

Water Elevation:	117.45	m
Invert of Outlet Pipe - MH-3:	114.73	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of MH-3)	114.78	m
Head:	2.67	m
Orifice Diameter:	107	mm
Orifice Area:	8929	sq.mm
Coefficient of Discharge:	0.61	
Maximum Release Rate:	39.41	L/s

Surface Storage Above Catch Basin

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-1	772	0.20	51.33	cu.m
		Achieved Volume:	51.33	cu.m
		Maximum Volume Required:	51.33	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	163.80	39.41	124.39	37.32
10	179	120.51	39.41	81.10	48.66
15	143	96.44	39.41	57.03	51.33
20	120	80.96	39.41	41.54	49.85
25	104	70.09	39.41	30.68	46.01
30	92	62.00	39.41	22.59	40.66
35	83	55.73	39.41	16.32	34.28
40	75	50.72	39.41	11.30	27.13
45	69	46.60	39.41	7.19	19.42
50	64	43.16	39.41	3.75	11.25
55	60	40.24	39.41	0.83	2.74
60	56	37.72	37.72	0.00	0.00
65	53	35.53	35.53	0.00	0.00
70	50	33.60	33.60	0.00	0.00
75	47	31.89	31.89	0.00	0.00
80	45	30.37	30.37	0.00	0.00
85	43	28.99	28.99	0.00	0.00
90	41	27.75	27.75	0.00	0.00
95	39	26.62	26.62	0.00	0.00
100	38	25.58	25.58	0.00	0.00
105	36	24.63	24.63	0.00	0.00
110	35	23.76	23.76	0.00	0.00
115	34	22.95	22.95	0.00	0.00
120	33	22.20	22.20	0.00	0.00
125	32	21.50	21.50	0.00	0.00
130	31	20.85	20.85	0.00	0.00
135	30	20.25	20.25	0.00	0.00
140	29	19.68	19.68	0.00	0.00
145	28	19.14	19.14	0.00	0.00
150	28	18.63	18.63	0.00	0.00
180	24	16.13	16.13	0.00	0.00
210	21	14.27	14.27	0.00	0.00
240	19	12.83	12.83	0.00	0.00
270	17	11.67	11.67	0.00	0.00
300	16	10.73	10.73	0.00	0.00

FIVE YEAR EVENT

Pre-Development Conditions

Roof Area:	668	sq.m	0.90
Asphalt/Concrete Area:	1141	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	1734	sq.m	0.20
Total Catchment Area:	3543	sq.m	0.56

Airport Formula

$$Tc = \frac{3.26\,(1.1 - C)\,(L)^{1/2}}{Sw^{0.33}} \text{ min}$$

Runoff Coefficient (C):	0.50	see above
Sheet Flow Distance (L):	56	m
Slope of Land (Sw):	2	%
Time of Concentration (Sheet Flow):	11.6	min
Area (A):	3543	sq.m
Time of Concentration:	11.6	min
Rainfall Intensity (i):	96	mm/hr
Runoff Coeficient (C):	0.50	
5 Year Maximum Allowable Release Rate (2.78AiC):	47.40	L/s

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(FIVE YEAR EVENT)

Roof Area:	126	sq.m	0.90
Asphalt/Concrete Area:	128	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	319	sq.m	0.20
Total Catchment Area:	573	sq.m	0.51
Area (A):	573	sq.m	
Time of Concentration:	10.0	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.51		
Flow Rate (2.78AiC):	8.47	L/s	

DRAINAGE AREA II

(FIVE YEAR EVENT)

Roof Area:	867	sq.m	0.90
Asphalt/Concrete Area:	1380	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	723	sq.m	0.20
Total Catchment Area:	2970	sq.m	0.73

Water Elevation:	117.39	m
Invert of Outlet Pipe - MH-3:	114.73	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of MH-3)	114.78	m
Head:	2.60	m
Orifice Diameter:	107	mm
Orifice Area:	8929	sq.mm
Coefficient of Discharge:	0.61	
Maximum Release Rate:	38.93	L/s

Surface Storage Above Catch Basin

CB/MH	Top Area (sq.m)	Depth (m)	Volume	
CB-1	354	0.14	14.30	cu.m
		Achieved Volume:	14.30	cu.m
		Maximum Volume Required:	14.30	cu.m

Time	i	2.78AiC	Release Rate	Stored Rate	Stored Volume
min	mm/hr	L/s	L/s	L/s	cu.m
5	141	85.05	38.93	46.12	13.84
10	104	62.77	38.93	23.84	14.30
15	84	50.33	38.93	11.41	10.27
20	70	42.32	38.93	3.39	4.07
25	61	36.68	36.68	0.00	0.00
30	54	32.49	32.49	0.00	0.00
35	49	29.23	29.23	0.00	0.00
40	44	26.62	26.62	0.00	0.00
45	41	24.47	24.47	0.00	0.00
50	38	22.68	22.68	0.00	0.00
55	35	21.16	21.16	0.00	0.00
60	33	19.85	19.85	0.00	0.00
65	31	18.70	18.70	0.00	0.00
70	29	17.69	17.69	0.00	0.00
75	28	16.80	16.80	0.00	0.00
80	27	16.00	16.00	0.00	0.00
85	25	15.28	15.28	0.00	0.00
90	24	14.63	14.63	0.00	0.00
95	23	14.04	14.04	0.00	0.00
100	22	13.50	13.50	0.00	0.00
105	22	13.00	13.00	0.00	0.00
110	21	12.54	12.54	0.00	0.00
115	20	12.12	12.12	0.00	0.00
120	19	11.73	11.73	0.00	0.00
125	19	11.36	11.36	0.00	0.00
130	18	11.02	11.02	0.00	0.00
135	18	10.70	10.70	0.00	0.00
140	17	10.40	10.40	0.00	0.00
145	17	10.12	10.12	0.00	0.00
150	16	9.86	9.86	0.00	0.00
180	14	8.54	8.54	0.00	0.00
210	13	7.56	7.56	0.00	0.00
240	11	6.80	6.80	0.00	0.00
270	10	6.20	6.20	0.00	0.00
300	9	5.70	5.70	0.00	0.00

D.B. GRAY ENGINEERING INC.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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STORM SEWER COMPUTATION FORM

RATIONAL METHOD Q = 2.78 A I R FIVE YEAR EVENT

n = 0.013

Project: 5986-5992 Hazeldean Road

Designed By: DBG

Date: September 5, 2019

LOCATION			AREA (ha)				Individual 2.78 A R	Accum. 2.78 A R	Time of Conc. (min)	Rainfall Intensity i (mm/hr)	Peak Flow Q (l/s)	SEWER DATA									COMMENTS
			Hard	Gravel	Landscape	Roof						Type of Pipe	Dia. Actual (mm)	Dia. Nominal (mm)	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Time of Flow (min)	Ratio Q/Qfull	
STREET	FROM	TO	R = 0.90	R = 0.70	R = 0.20	R = 0.90															
	CB-1	MH-3	0.1366		0.0436	0.0126	0.398	0.398	10.00	104.2	41.4	PVC	254.0	250	0.46	20.0	42.1	0.83	0.40	0.98	
	CB-2	MH-3	0.0014		0.0287	0.0741	0.205	0.205	10.00	104.2	21.3	PVC	254.0	250	0.43	28.3	40.7	0.80	0.59	0.52	
	MH-3	MH-4						0.602	10.59	101.2	61.0	PVC	304.8	300	0.79	35.3	89.7	1.23	0.48	0.68	
											38.9	PVC	304.8	300	0.79	35.3	89.7	1.23	0.48	0.43	FLOW THROUGH ICD
													EXISTING 375 ST IN OLD ORCHARD CRESCENT								
													381.0	375	0.39		114.2	1.00			

City of Ottawa Servicing Study Checklist

General Content

Executive Summary (for large reports only): not applicable

Date and revision number of the report: see page 1 of Servicing Brief and Stormwater Management Report

Location map and plan showing municipal address, boundary, and layout of proposed development: see drawings C-1 to C-6

Plan showing the site and location of all existing services: see drawings C-1 to C-6

Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere: not applicable

Summary of Pre-consultation Meetings with City and other approval agencies: not available

Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria: not applicable

Statement of objectives and servicing criteria: see page 1 of Servicing Brief and Stormwater Management Report

Identification of existing and proposed infrastructure available in the immediate area: see drawings C-1 to C-6

Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available). see drawings C-1 to C6

Concept level master grading plan to confirm existing and proposed grades in the development and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths: not applicable

Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts: not applicable

Proposed phasing of the development, if applicable: not applicable

Reference to geotechnical studies and recommendations concerning servicing: see note 1.5 on drawing C-4

All preliminary and formal site plan submissions should have the following information:

- **Metric scale:** included
- **North arrow:** included
    - **(including construction North):** not included
- **Key Plan:** included

- **Name and contact information of applicant and property owner:** not available
- **Property limits**: included
    - **including bearings and dimensions:** not included
- **Existing and proposed structures and parking areas:** included
- **Easements, road widening and rights-of-way:** included
- **Adjacent street names:** included

Development Servicing Report: Water

Confirm consistency with Master Servicing Study, if available: not applicable

Availability of public infrastructure to service proposed development: see page 2 of Servicing Brief

Identification of system constraints: see page 2 of Servicing Brief

Confirmation of adequate domestic supply and pressure: see page 2 of Servicing Brief

Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow locations throughout the development: see page 2 & 5 to 8 of Servicing Brief

Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves: see page 2 of Servicing Brief

Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design: not applicable

Address reliability requirements such as appropriate location of shut-off valves: not applicable

Check on the necessity of a pressure zone boundary modification:. not applicable

Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range: not applicable

Description of the proposed water distribution network, including locations of proposed connections to the existing systems, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions: not applicable

Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation: not applicable

Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines: see page 2 of Servicing Brief

Provision of a model schematic showing the boundary conditions locations, streets , parcels, and building locations for reference: not applicable

Development Servicing Report: Wastewater

Summary of proposed design criteria: see page 3 of Servicing Brief

(Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure): not applicable

Confirm consistency with Master Servicing Study and /or justification for deviations: not applicable

Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and conditions of sewers: not applicable

Descriptions of existing sanitary sewer available for discharge of wastewater from proposed development: see page 3 of Servicing Brief

Verify available capacity in downstream sanitary sewer and / or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable): not applicable

Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix C) format. see page 12 of Servicing Brief

Description of proposed sewer network including sewers, pumping stations, and forcemains: see page 3 of Servicing Brief

Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality): not applicable

Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development: not applicable

Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity: not applicable

Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding: not applicable

Special considerations such as contamination, corrosive environment etc: not applicable

Development Servicing Report: Stormwater Checklist

Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property): see page 4 of Servicing Brief and Stormwater Management Report

Analysis of available capacity in existing public infrastructure. not applicable

A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern: see drawing C-3 & C-6

Water quality control objective (e/g/ controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects: see Stormwater Management Report Servicing Brief and Stormwater Management Report

Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements: Servicing Brief and Stormwater Management Report

Descriptions of the references and supporting information.
Set-back from private sewage disposal systems. not applicable

Watercourse and hazard lands setbacks: not applicable

Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed: the pre-application consultation record is not yet been issued

Confirm consistency with sub-waterched and Master Servicing Study, if applicable study exists: not applicable

Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period). see drawings C-1 to C-6 and Servicing Brief and Stormwater Management Report

Identification of watercourses within the proposed development and how watercourses will be protected, or , if necessary, altered by the proposed development with applicable approvals. see drawings C-1 to C-6 and Servicing Brief and Stormwater Management Report

Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions: see Servicing Brief and Stormwater Management Report

Any proposed diversion of drainage catchment areas from one outlet to another. : not applicable

Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities. : not applicable

If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event: not applicable

Identification of potential impacts to receiving watercourses: Servicing Brief and Stormwater Management Report

Identification of municipal drains and related approval requirements. : not applicable

Descriptions of how the conveyance and storage capacity will be achieved for the development: see page 3 of Servicing Brief and Stormwater Management Report

100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading:

Inclusion of hydraulic analysis including hydraulic grade line elevations. : not applicable

Description of approach to erosion and sediment control during construction for the protection of receiving watercourses of drainage corridors: see notes 2.1 to 2.7 on drawing C-5

Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplains elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current: not applicable

Identification of fill constraints related to floodplain and geotechnical investigation. : not applicable

Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act: see page 19 of Servicing Brief and Stormwater Management Report

Application for Certificate of Approval (CofA) under the Ontario Water Resources Act:

Changes to Municipal Drains. : not applicable

Other permits (National Capital commission, Parks Canada, public Works and Government Services Canada, Ministry of transportation etc.) : not applicable

Conclusion Checklist

Clearly stated conclusions and recommendations: see page 6 of Servicing Brief

Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario: included