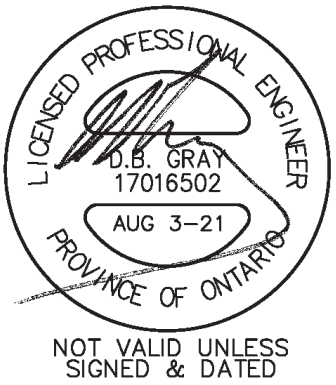
SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

155 Iber Road
Ottawa, Ontario

Report No. 21024

August 3, 2021



D.B. Gray Engineering Inc.

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

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SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

155 Iber Road
Ottawa, Ontario

This report describes the services and addresses the stormwater management requirements of a 6,073 sq.m. property at 155 Iber Road in Ottawa. There is currently a 660 sq.m. office / warehouse building with asphalted driveway leading to an asphalted area to the rear of the existing building that will remain. Immediately adjacent to the rear property line there is a 10 m easement (525 sq.m. in area) that is naturally vegetated and will remain so. The useable area of the property, net of the easement, is 5,548 sq.m. in area. The area between the asphalted area and easement is currently used as outdoor storage which will be removed and replaced with a proposed 936 sq.m. warehouse building.

This report also 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 municipal fire hydrant in the Iber Road ROW adjacent to the northwest corner of the subject property, 116 m from far end of the front façade of the proposed building. A private on-site fire hydrant is proposed. It will be located within 77 m of the far end of the front façade of the proposed addition; less than the maximum 90 m and, therefore, will provide adequate coverage for the proposed building.

The existing and proposed buildings are non-combustible construction. The existing building requires a fire flow of 100.0 L/s (6,000 L/min) and the proposed requires 116.7 L/s (7,000 L/min); both as calculated as per the Fire Underwriter Survey (FUS) "Water Supply For Fire Protection".

The boundary conditions for the 116.7 L/s fire flow (based on the city's computer model of the municipal water distribution system) were received from the City. They include a HGL (hydraulic grade line) of 156.1 m for the above flow rate in the 400 mm municipal watermain in Iber Road the subject location. This HGL calculates to be 499 kPa (72 psi). Since the pressure is above 138 kPa (20 psi) there is an adequate water supply for firefighting from the existing municipal water distribution system.

A 150 mm private watermain, connecting to the 400 mm municipal watermain, is proposed to serve the proposed private on-site fire hydrant. A model was created using

EPANET software to analyze the hydraulics of the private watermain. Using the provided HGL boundary conditions, and a 95 L/s demand, the pressure at fire hydrant is calculated to be 382 kPa (55.4 psi). Since the pressure is above 138 kPa (20 psi), the private watermain is adequately sized.

As per City of Ottawa Technical Bulletin ISTB-2018-02, the aggregate fire flow of all contributing fire hydrants within 150 m of a building can used to supply the required fire flow. The existing municipal hydrant adjacent to the property is Class AA and the private on-site hydrant will be a Class AA, and since both are between 75 and 150 m, they can each contribute 3,800 L/min (63.3 L/s) (as per Table 1 of ISTB-2018-02). Therefore, the aggregate flow from both hydrants is 7,600 L/min (126.7 L/s); greater than the required fire flow of 7,000 L/min (116.7 L/s).

WATER SERVICE:

As per the City of Ottawa Design Guidelines the daily average consumption rate for a commercial development is 28,000 litres per day per hectare. Based on an 8-hour day the maximum daily demand for the subject property is calculated to be 0.5 L/s. Based on a maximum daily peaking factor of 1.5 times the daily average demand and a maximum hourly peaking factor of 1.8 times the maximum daily demand, the maximum daily demand is 0.8 L/s and maximum hourly demand is 1.5 L/s.

To determine 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. The boundary conditions received from the City stated that the minimum HGL (hydraulic grade line) is 156.6 m and the maximum is 161.2 m. Based on these HGLs the water pressure at the water meter is calculated to vary from 502 kPa to 547 kPa (73 psi to 79 psi). This is an acceptable range of water pressures for the proposed development. However, since it is calculated that the water pressure can be close to 80 psi at times, an on-site pressure check is recommended at the completion of construction to determine if a pressure reducing valve (PRV) is required. If required install the PRV immediately after the water meter.

Based on the AWWA water flow demand curve, and an average water pressure at the meter of 524 kPa (76 psi), the peak demand for the proposed addition is expected to be 3.6 L/s (215 L/min / 57 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 1.8 m/s in the proposed 50 mm water service connection (up to 2.4 m/s is acceptable). The water service will connect to the proposed 150 mm private watermain. The existing water service connection serving the existing building will remain.

SANITARY SERVICE:

The existing sanitary sewer connection serving the existing building will remain. The proposed 150 mm sanitary connection serving the proposed addition will connect to a proposed private 150 mm sewer.

Based on the City of Ottawa Sewer Design Guidelines for a commercial property (28,000 L/ha/day; 1.5 peaking factor (and an 8-hour day); and a 0.33 L/s/ha infiltration flow) the existing development peak flow (based on the 3,520 sq.m. of property that is currently being used) is calculated to be 0.63 L/s. Similarly, the post development peak flow (based on the useable 5,548 sq.m. portion of the property) is calculated to be 0.99 L/s. This flow will be adequately handled by the private sanitary sewer with each pipe segment being only at about 2 to 3% of its capacity.

The proposed 150 mm private sanitary sewer will connect to an existing 375 mm municipal PVC sanitary sewer in Iber Road which, with a 0.17% slope, has a capacity of 75.42 L/s. The 0.36 L/s increase (= 0.99 L/s - 0.63 L/s) in sanitary flows contributing to the existing municipal sanitary sewer is expected to have an acceptable impact.

STORMWATER MANAGEMENT:

Water Quality Control:

The Mississippi Valley Conservation Authority (MVCA) has made the following comments:

1. *"The property is not regulated under Ontario Regulation 153/06 and does not contain any natural hazard or natural heritage features."*
2. *"The Carp River Watershed Subwatershed Study sets infiltration targets. The site falls between moderate to low recharge areas. We recommend a weighted average be used for the infiltration target.*
   o Moderate 104 mm/yr infiltration
   o Low 73 mm/yr infiltration"
3. *"Water quality 70% Total Suspended Solids removal."*

An infiltration trench, located below a swale that receives most of the drainage form the hard surfaces, and drains to the roadside ditch, has been sized to remove 70% TSS as per the MOE Design Manual. Based on the geotechnical report the underlying soil is silty sand / sandy silt and has an estimated infiltration rate of 30 to 75 mm/hr. To be conservative 30 mm/hr was used. The infiltration trench has a total storage volume of 11.3 cu.m. and has a draw down time of 10 hours. As per the geotechnical report the long-term groundwater level is expected to be 2 to 3m depth or at least 1 to 2m below the bottom of the infiltration trench; and bedrock is estimated to be 3 to 4m deep or at least 2 to 3m below the bottom of the infiltration trench. Therefore, since bedrock and groundwater are at least 1 m below the bottom of the infiltration trench neither are expected to be an issue. For the infiltration trench to function adequately, the area

above the trench requires regular maintenance: in the spring (and more frequently if necessary), any accumulated sediment needs to be removed.

Based on water balance and infiltration calculations the pre-development (existing) condition of the property (including the 10 m easement that will remain in a natural vegetated state) has an annual infiltration of 65 mm/year. However, as per City staff's instruction the rear outdoor storage area (with a mostly granular surface) is required to be assumed as soft landscaping (with a runoff coefficient of 0.2). Based on this assumption the pre-development condition has an annual infiltration of 109 mm/year. Ignoring the infiltration trench, the post development the annual infiltration is about the same as the existing conditions (63 mm/year). However, the infiltration trench will promote water infiltration into the ground. In eastern Ontario, on hard surfaces, approximately 150 mm of the 943 mm annual precipitation (or 16%) is lost to evapotranspiration (Eastern Ontario Water Resources Management Study (2001) & Carp River Watershed / Subwatershed Study). Therefore, 84% of the precipitation on hard surfaces is available for infiltration. As per Environment Canada's records at the Ottawa International Airport (1981-2010), there are on average 58.4 days per year where the precipitation is greater than 5 mm. Conservatively assuming only 5 mm of precipitation on each of the 58.4 days (and assuming 84%), 910 cu.m. is available for infiltration from the runoff from the 3,706 sq.m. of hard surfaces draining to the area above the infiltration trench. Therefore, about 15.6 cu.m. is available for infiltration for per each of the 58.4 days. The infiltration trench, having a capacity of 11.3 cu.m., has the capacity to capture and infiltrate into the ground about 72.5% of this volume or about 660 cu.m. annually (72.5% of 910 cu.m.). Inserting the 660 cu.m. into the water balance calculations, the post development annual infiltration for the property is 172 mm/year, 264% greater than the existing conditions, and 165 to 235% greater than the minimum 73 to 104 mm/year target.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-3 and notes 2.1 to 2.6 on drawing C-5). In summary: to filter out construction sediment a silt fence barrier will be installed around the perimeter of the site where runoff will drain off the site; straw bale check dams will be installed at the proposed culvert; and any material deposited on a public road will be removed.

Water Quantity Control:

The stormwater management criteria for quantity control are to control the post development peak flows to pre-development flow rates (assuming that the rear outdoor storage area is soft landscaping, and excluding the 10 m easement). It is calculated that the pre-development conditions reflect a 5-year runoff coefficient of 0.45, therefore, based on a 10 minute time of concentration; and using the Rational Method; the maximum allowable release rate is 143.98 L/s for the 100-year storm event, and 73.06 L/s for the 5-year. The Modified Rational Method is used to calculate the required storage volume. The runoff coefficients for the 100-year event are increased by 25% to maximum 1.00.

Stormwater will be stored on-site above the asphalted area. (The capacity of the infiltration trench and the area above the infiltration trench is ignored.)

Drainage Area I (Uncontrolled Flow Off Site – 2,061 sq.m.):
The runoff from the perimeter of the property will be allowed to flow uncontrolled off the site.

	100-year	5-year
The maximum flow rate:	46.76 L/s	23.48 L/s

Drainage Area II (3,487 sq.m.):
During the five-year event an inlet control device (ICD) will control the release of stormwater from the property. The ICD is located in the inlet of the culvert that discharges site drainage to the roadside ditch. During the one hundred-year event, in addition to the ICD, a broad-crested weir will control the release of stormwater. The ICD and weir will restrict the flow and force the stormwater to back up and onto the asphalted area. The ICD and weir will discharge to the roadside ditch near the northwest corner of the property. The broad-crested weir will be a concrete retaining wall with a 3.0 m long depressed section which will release 43.71 L/s at 0.04 m water depth above the weir. To be conservative the depressed portion of the wall will be at the 100-year ponding elevation. The ICD shall be a plug style with a round orifice design manufactured by Pedro Plastics (or approved equal) and each shall be sized by the manufacturer for a discharge rate of 53.51 L/s at 0.32 m head. It is calculated that an orifice area of 35,276 sq.mm. (±212mm diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 53.61 L/s at a head of 0.32 m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 49.58 L/s at 0.27 m.

	100-year	5-year
Maximum ICD release rate:	53.51 L/s	49.58 L/s
Maximum weir release rate:	43.71 L/s	0.00 L/s
Maximum release rate:	97.22 L/s	49.58 L/s
Maximum ponding elevation:	104.21 m	104.17 m
Maximum ponding depth: (in asphalted area)	0.21 m	0.17 m
Maximum stored volume:	37.71 cu.m.	20.53 cu.m.

The Entire Site:

	100-year	5-year
Maximum allowable release rate:	143.98 L/s	73.06 L/s
Maximum release rate:	143.98 L/s	73.06 L/s
Maximum stored volume:	37.71 cu.m.	20.53 cu.m.

Therefore, the maximum post-development release rate for the 100 and 5-year storm events are calculated to be equal to the maximum allowable; and, therefore, the stormwater flow off the site is expected to have an acceptable impact.

Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA):

The proposed addition is a warehouse building; therefore, MECP may consider the property “industrial lands” and a MECP ECA may be required for the proposed stormwater management facility.

CONCLUSIONS:

1. The proposed private on-site fire hydrant will provide adequate coverage for the proposed building.

2. There is an adequate water supply for firefighting from the existing municipal water distribution system.

3. The pressure at the proposed on-site private fire hydrant is calculated to be above 138 kPa (20 psi) and, therefore, the private watermain is adequately sized.

4. The aggregate flow from both hydrants is greater than the required fire flow.

5. There is an acceptable range of water pressures in the municipal watermain for the proposed development. However, since it is calculated that the water pressure can be close to 80 psi at times, an on-site pressure check is recommended to determine if a pressure reducing valve (PRV) is required.

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

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

8. To meet the water quality target an infiltration trench located below a swale has been sized to remove 70% TSS.

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

10. The existing conditions has an annual infiltration of 65 mm/yr. The post development annual infiltration will increase to 172 mm/year, greater than the minimum required target of 73 to 104 mm/year.

11. The stormwater management criteria for quantity control are to control the post development peak flows to pre-development flow rates (assuming that the rear outdoor storage area is soft landscaping and excluding the 10 m easement). The maximum post-development release rate for the 100 and 5-year storm events are

calculated to be equal to the maximum allowable, therefore, the stormwater flow off the site is expected to have an acceptable impact.

12. The proposed building is a warehouse building; therefore, the MECP may consider the property “industrial lands” and a MECP ECA may be required for the proposed stormwater management facility.

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24-Jun-21
REVISED 30-Jul-21

155 Iber Road
Ottawa, Ontario

Fire Flow Requirements

Existing One-Storey Office / Warehouse 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
= 0.8 Non-Combustible Construction (Unprotected structural components)

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

Existing Building: Office 365
Warehouse 295 sq.m.

TOTAL FIRE AREA: 660 sq.m.

F = 4,522 L/min
= 5,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy (Office)
15% Charge for Free-burning Occupancy (Warehouse)

-1.6% (weighted average)

= 4,920 L/min

0% Reduction: No Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Constuction	Length m	Storeys	Factor
5%	NE	30.1 to 45m	N-C			0
12%	SE	10.1 to 20m	N-C	27	1	27
0%	SW	>45m				0
0%	NW	>45m				0

17% Total Increase for Exposure (maximum 75%)
= 836 L/min Increase

= 5,757 L/min
F = 6,000 L/min (rounded off to the nearest 1,000 L/min)
= 100.0 L/s

Elevation at Existing Fire Hydrant 105.18 m ASL

Static Pressure at Fire Hydrant

117 L/s FIRE FLOW: 156.1 m ASL 72 psi 499 kPa

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24-Jun-21
REVISED 30-Jul-21

155 Iber Road
Ottawa, Ontario

Fire Flow Requirements

Proposed One-Storey Warehouse 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
= 0.8 Non-Combustible Construction (Unprotected structural components)

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

Proposed Building: 936 sq.m.

TOTAL FIRE AREA: 936 sq.m.

F = 5,385 L/min
= 5,000 L/min (rounded off to the nearest 1,000 L/min)

15% Charge for Free-burning Occupancy

= 5,750 L/min

0% Reduction: No Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Constuction	Length m	Storeys	Factor
0%	NE	>45m				0
12%	SE	10.1 to 20m	N-C	25	1	25
5%	SW	30.1 to 45m				0
5%	NW	30.1 to 45m				0

22% Total Increase for Exposure (maximum 75%)
= 1,265 L/min Increase

= 7,015 L/min
F = 7,000 L/min (rounded off to the nearest 1,000 L/min)
= 116.7 l/s

			Static Pressure at Fire Hydrant			
Elevation at Existing Fire Hydrant	105.18	m ASL				
117 l/s FIRE FLOW:	156.1	m ASL	72	psi	499	kPa

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155 Iber Road
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Water Demand

DAILY AVERAGE

COMMERCIAL:	28,000	L / gross ha / day (as per Ottawa Design Guidelines)				
	0.55	ha (land area)				
	15534	L / day				
	8	hour day				
	32.4	L /min	0.5	L/s	8.6	USgpm

MAXIMUM DAILY DEMAND	1.5	(Peaking Factor as per Ottawa Design Guidelines)				
	48.5	L /min	0.8	L/s	12.8	USgpm

MAXIMUM HOURLY DEMAND	1.8	(Peaking Factor as per Ottawa Design Guidelines)				
	87.4	L /min	1.5	L/s	23.1	USgpm

Elevation of Water Meter:	105.39	m ASL				
Finish Floor Elevation:	104.49	m ASL				
			Static Pressure at Water Meter			
MINIMUM HGL:	156.6	m ASL	73	psi	502	kPa
MAXIMUM HGL:	161.2	m ASL	79	psi	547	kPa

155 Iber 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	10	6	60
Tiolet - flush valve	0	24	0
Lavs.	10	1.5	15
Bidet	0	2	0
Urinal - wall flush valve	0	10	0
Shower	0	2.5	0
K. Sink	0	1.8	0
Dishwasher	0	1.3	0
Clothes Washer	0	3	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	5	5	25
Hose 3/4 in	0	12	0
			100

Peak Demand (fig 4-2 or 4-3 AWWA M22)			50	USgpm		
Pressure @ Meter	524	kPa	76	psi.		
Pressure Factor (table 4-1 AWWA M22)			1.14			
Peak Demand			57	USgpm		
Irrigation - hose 1/2 in	0		0	USgpm (includes pressure factor)		
TOTAL PEAK DEMAND	215	L/min	57	USgpm	3.6	L/s
		Nominal Size	2.0	in	50	mm
			6.0	ft/s	1.8	m/s

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

FW: 155 Iber Rd - Boundary Condition Request

1 message

Elsayed, Ahmed <ahmed.elsayed@ottawa.ca> Mon, Jul 19, 2021 at 10:36 AM
To: Douglas Gray <d.gray@dbgrayengineering.com>
Cc: "Schaeffer, Gabrielle" <gabrielle.schaeffer@ottawa.ca>

Hi Douglas,

Attached is the B.C. as requested.

Thanks,

Ahmed

From: Douglas Gray <d.gray@dbgrayengineering.com>
Sent: June 24, 2021 1:37 PM
To: Rasool, Rubina <Rubina.Rasool@ottawa.ca>
Cc: Caoimhin Kennedy <c.kennedy@dbgrayengineering.com>
Subject: 155 Iber Rd - Boundary Condition Request

Hi Rubina

Please provide the boundary conditions at 155 Iber Rd. We have calculated the following expected demands based on an existing office / warehouse building and a proposed warehouse building.

Average daily demand: 0.5 L/s.

Maximum daily demand: 0.8 L/s.

Maximum hourly daily demand: 1.4 L/s

Fire Flow demand: 116.7 L/s

Fire Flow + Max Day: 117.5 L/s

Our calculations are attached.

Thanks, Doug

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Ottawa, Ontario K1T 4E9 d.gray@dbgrayengineering.com

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Boundary Conditions
155 Iber Road

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	30	0.50
Maximum Daily Demand	48	0.80
Peak Hour	84	1.40
Fire Flow Demand #1	7,000	116.67

Location

Results

Connection 1 – Iber Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.2	80.6
Peak Hour	156.6	74.0
Max Day plus Fire 1	156.1	73.3

Ground Elevation = 104.5 m

Notes

1. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

155 Iber Road
Ottawa, Ontario

EPANET HYDRAULIC MODELLING RESULTS

Node ID	Demand	Head	Elevation	Pressure		
	L/s	m	m	m	psi	kPa
1 Reservoir (400 WM - Iber Rd)	-95.00	156.10	104.49	51.61	73.4	506
2 Proposed FH	95.00	143.25	104.28	38.97	55.4	382

Link ID	Diameter	Length	Roughness	Loss Coeff.	Flow	Velocity
	mm	m			L/s	m/s
Pipe 1	150	25.3	100	3.95	95.0	5.38


1
1
2
25.3m - 150mm WM
FH
RESERVOIR
400 WM - IBER RD

Network Table - Nodes

Node ID	Elevation m	Demand LPS	Head m	Pressure m
Junc 2	104.28	95.00	143.25	38.97
Resvr 1	156.1	-95.00	156.10	0.00

Network Table - Links

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s
Pipe 1	25.3	150	100	95.00	5.38

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SANITARY SEWER DESIGN FORM

Average Daily Flows
Residential: 280 L / capita / day
Commercial: 28000 L / ha / day
Instituational: 28000 L / ha / day
Light Industrial: 35000 L / ha / day
Heavy Industrial: 55000 L / ha / day

Infiltration Allowance: 0.33 l / s / ha

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

n = 0.013

Project: 155 Iber Road
Designed By: D.B.G
July 30, 2021
Page: 1 of 1

Location		Section								Cumulative Residential		Section Non-Residential			Cumulative					Sewer Data								Comments
		Single Family ppu = 3.4	Semi / Townhouse ppu = 2.7	Duplex / Triplex ppu = 2.3	Apartment (average) ppu = 1.8	Apartment (1 Bed) ppu = 1.4	Apartment (2 Bed) ppu = 2.1	Apartment (3 Bed) ppu = 3.1	Area			Area	Flow	Peaking	Flow	Area	Sewage Flow	Infiltration Flow	Total Flow		Actual Diameter	Nominal Diameter	Slope	Length	Capacity	Velocity	Ratio	
From	To	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	(ha)	Pop.	Peaking Factor	(ha)	(L/ha/day	Factor	(L/s)	(ha)	(L/s)	(L/s)	(L/s)	Material	(mm)	(mm)	(%)	(m)	(L/s)	(m/s)	Q/Qfull	
		Pre-Development																										
		Existing Commercial Building																										
Existing	Existing											0.3520	28000	4.5	0.51	0.352	0.51	0.12	0.63									
Building	375 SAN												1.5 x 24hrs / 8hrs															
		Post-Development																										
		Existing Commercial Building																										
												0.3520	28000	4.5	0.51	0.352	0.51	0.12	0.63									
													1.5 x 24hrs / 8hrs															
		Proposed Commercial Warehouse																										
Proposed	MH-SA.1											0.2028	28000	4.5	0.30	0.2028	0.30	0.07	0.36	PVC	152.4	150	1.00	5.3	15.89	0.87	0.02	
Building													1.5 x 24hrs / 8hrs															
MH-SA.1	Existing														0.30	0.2028	0.30	0.07	0.36	PVC	152.4	150	0.47	70.1	10.89	0.60	0.03	
	375 SAN																											
										Total Area:		0.5548						Total Flow:	0.99									
																					Existing 375 SAN in Iber Road							
																					381.0	375	0.17		75.42	0.66		

155 Iber Road

Ottawa, Ontario

INFILTRATION CALCULATIONS

DRAINAGE AREA II

Roof Area:	1134	sq.m
Asphalt/Concrete Area:	2003	sq.m
Gravel Area:	0	sq.m
Landscaped Area:	350	sq.m
Total Catchment Area	3487	sq.m.
Pervious(Landscaped) Area:	350	sq.m.
Total Catchment Area:	3487	sq.m.
Percentage Pervious:	10%	
Percentage Impervious:	90%	

Require Storage Volume *: 90% Impervious Level 31.7 cu.m./ha (extrapolated from Table 3.2 *)
(for 70% TSS removal) 11.0 cu.m. (3487) sq.m.

* As per MOE Stormwater Management Planning and Design Manual, March 2003

Infiltration Trench

Depth m	Width m	Length m	Total Volume cu.m.	Void Volume 40% cu.m.
0.30	1.0	57.0	17.1	6.8
0.30	2.4	15.5	11.2	4.5
				11.3

Percolation Rate: 30 mm/hr (silty sand / sandy silt)

Time to Draw Down: 10.0 Hours

155 Iber Road

Ottawa, Ontario

Water Balance and Infiltration Calculations

Water Balance is based on the equation: Mean Annual Precipitation - Change in Groundwater Storage - Evapotranspiration = Runoff + Infiltration

Where: Long term changes to groundwater storage are assumed to be negligible
and
Short term or seasonal changes to groundwater are assumed to balance out over the year.

Therefore: Mean Annual Precipitation - Evapotranspiration = Runoff + Infiltration

Infiltration is based on the equations: Surplus (available for infiltration) = Mean Annual Precipitation - Evapotranspiration
and
Infiltration = Surplus x Infiltration Coefficient
and
Infiltration Coefficient = Topography Factor + Soil Factor + Vegetation Factor
(as per the MOE SWM Planning & Design Manual, 2003 - see below)

Pre (Existing) Development

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient	Infiltration (mm/yr)
10m Easement	525	943	575	368	0.1	0.15	0.1	0.35	129
Landscape	2218	943	575	368	0.15	0.15	0.1	0.40	147
Hard Surfaces	3330	943	150	793				0.00	0
Total:	6073							Weighted Average:	65

Pre (Existing) Development
(rear outdoor storage area is assumed to be soft landscaping)

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient	Infiltration (mm/yr)
10m Easement	525	943	575	368	0.1	0.2	0.10	0.40	147
Landscape	3530	943	575	368	0.15	0.2	0.10	0.45	166
Hard Surfaces	2018	943	150	793				0.00	0
Total:	6073							Weighted Average:	109

Post Development

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient	Infiltration (mm/yr)	Volume Including Infiltration Trench (cu.m.)	Infiltration (mm/yr)
10m Easement	525	943	575	368	0.1	0.2	0.1	0.40	147	77	147
Landscape	1842	943	575	368	0.15	0.2	0.1	0.45	166	305	166
Hard Surfaces	3706	943	150	793				0.00	0	660	178
Total:	6073									1042	
								Weighted Average:	63		172

	mm	Days with Precipitation +	Hard Surfaces Surplus / Precipitation	Hard Surfaces Area (sq.m.)	Hard Surfaces Available Annual Volume (cu.m.)	Hard Surfaces Annual Percentage Captured	Hard Surfaces Annual Volume Captured (cu.m.)	Required Volume of Infiltration Trench (cu.m.)
>=	0.2	163.6	0.84	3706	102	72.5%	74	0.5
>=	5	58.4	0.84	3706	910	72.5%	660	11.3
>=	10	30.0	0.84	3706	935	72.5%	678	22.6
>=	25	5.5	0.84	3706	429	72.5%	311	56.5

+ Ottawa International Airport (1981-2010)
++ Eastern Ontario Water Resources Management Study (2001) & Carp River Watershed / Subwatershed Study

		Factor	Subject Property
* Topography:	Flat Land, average slope < 0.6m/km (<.06%)	0.3	
	Rolling Land, average slope 2.8 to 3.8m/km (0.28% to 0.38%)	0.2	= 0.15 (+/- 2% ave. slope except easement)
	Hilly Land, average slope 28 to 47m/km (2.8 to 4.7%)	0.1	= 0.1 for 10m easement
** Soil:	Tight impervious clay	0.1	
	Medium combination of clay and loam	0.2	= 0.2 for silty sand / sandy silt
	Open sandy loam	0.4	
*** Cover:	Cultivated Lands	0.1	= 0.1 (soft landscaping)
	Woodland	0.2	

As per MOE SWM Planning & Design Manual, 2003

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)	-	46.76	-	-
AREA II	-	97.22	37.71	37.71
TOTAL	143.98	143.98	37.71	37.71

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)	-	23.48	-	-
AREA II	-	49.58	20.53	20.53
TOTAL	73.06	73.06	20.53	20.53

155 Iber Road

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Rational Method

ONE HUNDRED-YEAR EVENT

Pre-Development Conditions

			C
Roof Area:	661	sq.m	1.00
Asphalt/Concrete Area:	1357	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	3530	sq.m	0.25
Total Catchment Area:	5548	sq.m	0.52

Bransby William Formula

$$Tc = \frac{0.057 \bullet L}{Sw^{0.2} \bullet A^{0.1}} \text{ min}$$

Sheet Flow Distance (L):	105	m
Slope of Land (Sw):	1	%
Area (A):	0.5548	ha
Time of Concentration (Sheet Flow):	6.3	min
Area (A):	5548	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
Runoff Coeficient (C):	0.52	
100-Year Pre-Development Flow Rate (2.78AiC): (Maximum 100-Year Release Rate)	143.98	L/s

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(ONE HUNDRED-YEAR EVENT)

			C
Roof Area:	473	sq.m	1.00
Asphalt/Concrete Area:	96	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	1492	sq.m	0.25
Total Catchment Area:	2061	sq.m	0.46
Area (A):	2061	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.46		
Release Rate (2.78AiC):	46.76	L/s	

DRAINAGE AREA II

(ONE HUNDRED-YEAR EVENT)

			C
Roof Area:	1134	sq.m	1.00
Asphalt/Concrete Area:	2003	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	350	sq.m	0.25
Total Catchment Area:	3487	sq.m	0.92

Water Elevation:	104.21	m
Invert of Inlet of Culvert:	103.79	m
Centroid of ICD Orifice: (ICD in Inlet of Culvert)	103.90	m
Head:	0.32	m
Orifice Diameter:	212	mm
Orifice Area:	35276	sq.mm
Coefficient of Discharge:	0.61	
Maximum ICD Release Rate:	53.51	L/s
Maximum Weir Release Rate:	43.71	L/s
Total Maximum Release Rate:	97.22	L/s

Top Area (sq.m)	Depth (m)	Volume	
536	0.21	37.71	cu.m
	Achieved Volume:	37.71	cu.m
	Maximum Volume Required:	37.71	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Weir Release Rate (L/s)	Total Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	217.56	53.51	38.36	91.87	125.69	37.71
10	179	160.06	53.51	43.71	97.22	62.84	37.71
15	143	128.09	53.51	32.69	86.20	41.90	37.71
20	120	107.52	53.51	22.59	76.10	31.42	37.71
25	104	93.09	53.51	14.44	67.95	25.14	37.71
30	92	82.35	53.51	7.89	61.40	20.95	37.71
35	83	74.02	53.51	2.56	56.07	17.96	37.71
40	75	67.36	53.51	0.00	53.51	13.85	33.24
45	69	61.90	53.51	0.00	53.51	8.39	22.65
50	64	57.33	53.51	0.00	53.51	3.82	11.46
55	60	53.45	53.45	0.00	53.45	0.00	0.00
60	56	50.10	50.10	0.00	50.10	0.00	0.00
65	53	47.19	47.19	0.00	47.19	0.00	0.00
70	50	44.63	44.63	0.00	44.63	0.00	0.00
75	47	42.36	42.36	0.00	42.36	0.00	0.00
80	45	40.33	40.33	0.00	40.33	0.00	0.00
85	43	38.50	38.50	0.00	38.50	0.00	0.00
90	41	36.85	36.85	0.00	36.85	0.00	0.00
95	39	35.35	35.35	0.00	35.35	0.00	0.00
100	38	33.98	33.98	0.00	33.98	0.00	0.00
105	36	32.72	32.72	0.00	32.72	0.00	0.00
110	35	31.56	31.56	0.00	31.56	0.00	0.00
115	34	30.48	30.48	0.00	30.48	0.00	0.00
120	33	29.49	29.49	0.00	29.49	0.00	0.00

FIVE-YEAR EVENT

Pre-Development Conditions

			C
Roof Area:	661	sq.m	0.90
Asphalt/Concrete Area:	1357	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	3530	sq.m	0.20
Total Catchment Area:	5548	sq.m	0.45
Area (A):	5548	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.45		

5-Year Pre-Development Flow Rate (2.78AiC): 73.06 L/s
(Maximum 5-Year Release Rate)

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(FIVE-YEAR EVENT)

			C
Roof Area:	473	sq.m	0.90
Asphalt/Concrete Area:	96	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	1492	sq.m	0.20
Total Catchment Area:	2061	sq.m	0.39
Area (A):	2061	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.39		
Release Rate (2.78AiC):	23.48	L/s	

DRAINAGE AREA II

(FIVE-YEAR EVENT)

			C
Roof Area:	1134	sq.m	0.90
Asphalt/Concrete Area:	2003	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	350	sq.m	0.20
Total Catchment Area:	3487	sq.m	0.83

Water Elevation:	104.17	m
Invert of Inlet of Culvert:	103.79	m
Centroid of ICD Orifice: (ICD in Inlet of Culvert)	103.90	m
Head:	0.27	m
Orifice Diameter:	212	mm
Orifice Area:	35276	sq.mm
Coefficient of Discharge:	0.61	
Maximum ICD Release Rate:	49.58	L/s
Maximum Weir Release Rate:	0.00	L/s
Total Maximum Release Rate:	49.58	L/s

Top Area (sq.m)	Depth (m)	Volume	
370	0.17	20.53	cu.m

Achieved Volume: 20.53 cu.m

Maximum Volume Required: 20.53 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Weir Release Rate (L/s)	Total Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	141	113.56	49.58	0.00	49.58	63.97	19.19
10	104	83.81	49.58	0.00	49.58	34.22	20.53
15	84	67.21	49.58	0.00	49.58	17.62	15.86
20	70	56.51	49.58	0.00	49.58	6.92	8.31
25	61	48.98	48.98	0.00	48.98	0.00	0.00
30	54	43.38	43.38	0.00	43.38	0.00	0.00
35	49	39.02	39.02	0.00	39.02	0.00	0.00
40	44	35.54	35.54	0.00	35.54	0.00	0.00
45	41	32.68	32.68	0.00	32.68	0.00	0.00
50	38	30.29	30.29	0.00	30.29	0.00	0.00
55	35	28.25	28.25	0.00	28.25	0.00	0.00
60	33	26.50	26.50	0.00	26.50	0.00	0.00
65	31	24.97	24.97	0.00	24.97	0.00	0.00
70	29	23.62	23.62	0.00	23.62	0.00	0.00
75	28	22.43	22.43	0.00	22.43	0.00	0.00
80	27	21.36	21.36	0.00	21.36	0.00	0.00
85	25	20.40	20.40	0.00	20.40	0.00	0.00
90	24	19.54	19.54	0.00	19.54	0.00	0.00
95	23	18.75	18.75	0.00	18.75	0.00	0.00
100	22	18.02	18.02	0.00	18.02	0.00	0.00
105	22	17.36	17.36	0.00	17.36	0.00	0.00
110	21	16.75	16.75	0.00	16.75	0.00	0.00
115	20	16.18	16.18	0.00	16.18	0.00	0.00
120	19	15.66	15.66	0.00	15.66	0.00	0.00

July 30, 2021

155 Iber Road
Ottawa, Ontario

BROAD CRESTED WEIR CALCULATIONS

1:100 YEAR EVENT

DRAINAGE AREA II

Length of Weir based on an assumed coefficient of discharge (Cd):

if Q =	43.71	L/s (maximum permited flow)	assumes Cd= 0.577
=	0.04371	cu.m/s	(assumes P/H is large)
& H =	0.04	m (max. depth of water above top of weir)	
then L =	3.0	m (length of weir) L = Q / ((1.705) x H^(3/2))	

Length of Weir based on a calculated coefficient of discharge (Cd):

if P =	0.37	m (depth of pond)
& Lp =	5.0	m (width of pond perpendicular to direction of flow)
then Vp =	0.02	m/s (velocity in pond) Vp = Q / ((P+H) / Lp
& E =	0.04	m (energy) E = H + V^2/2g
& Cd =	0.578	= 0.577 x (E/H)^(3/2)

if Q =	43.71	L/s (maximum permited flow)
=	0.04371	cu.m/s
& H =	0.04	m (depth of water above top of weir)
then L =	3.0	m (length of weir) L = Q / (Cd^(2/3) x (2x9.81)^(1/2) x H^(3/2))

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 2 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 C-6

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-5

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: not applicable

Identification of system constraints: not applicable

Confirmation of adequate domestic supply and pressure: not applicable

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: not applicable

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: not applicable

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: not applicable

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 2 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 2 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. not applicable

Description of proposed sewer network including sewers, pumping stations, and forcemains: see not applicable

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 5 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-1 to 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 has not 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 2.6 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