D.B. Gray Engineering Inc.

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

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SITE SERVICING & STORMWATER MANAGEMENT REPORT

3055 RICHMOND ROAD
OTTAWA, ONTARIO

REPORT NO. 24044

JANUARY 30, 2025
REVISED MAY 12, 2025
REVISED JUNE 4, 2025
REVISED JULY 29, 2025

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report has been prepared in support of the Site Plan Control application for a proposed 5-storey, 21-unit apartment building. The building will be located on a 1,065 m^2 property located at 3055 Richmond Road in Ottawa, Ontario. The property is currently occupied by a single-family dwelling that will be demolished.

This report forms part of the site servicing and stormwater management design for the proposed development. Also refer to drawings C-1 to C-7 prepared by D.B. Gray Engineering Inc.

2.0 WATER SERVICING

2.1 WATER SUPPLY FOR FIREFIGHTING

The proposed building will have a sprinkler system with the fire department connection (FDC) located on the front façade of the proposed building. The closest existing municipal fire hydrant is located in front of 3072 Richmond Road. It is 47 m unobstructed distance to the proposed fire department connection, which is more than the maximum 45 m required by the Ontario Building Code (OBC). City staff and the Ottawa Fire Services (OFS) were contacted and it was determined that private onsite fire hydrant is required.

In accordance with City of Ottawa Technical Bulletin IWSTB-2024-05, when calculating the required fire flow where municipal watermain are not being sized, the Ontario Building Code method (OBC) is to be used provided the calculated fire flow is less than 9,000 L/min. However, since a private fire hydrant is being proposed, the Fire Underwriter's Survey (FUS) method is to be used. Using the FUS method, the required fire flow is calculated to be 6,000 L/min (100.0 L/s). Refer to calculations in Appendix A.

The boundary conditions in the 400 mm Richmond Road municipal watermain provided by the City of Ottawa for a 150 L/s fire flow (greater than required 100 L/s) at the subject property indicate a hydraulic grade line (HGL) of 107.2 m. Refer to Appendix A. This HGL calculates to 304 kPa (44 psi) at the closest municipal fire hydrant. Since these pressures are above the OBC's minimum required pressure of 138 kPa (20 psi), there is an adequate water supply for firefighting from the existing municipal water distribution system.

Using EPANET, a model was created to analyze the hydraulics of the private watermain to the private fire hydrant. Based on a 96.0 L/s demand (95.0 L/s fire flow + 1.0 L/s maximum daily demand), and the 107.2 m HGL for the a 150 L/s fire flow, the pressure at the private fire hydrant was determined to be 194 kPa (28 psi). Refer to Appendix B. Since the pressure is above the OBC's minimum required pressure of 140 kPa (20 psi), the private fire hydrant can be classified as Class AA and can contribute 5,700 L/min (95 L/s).

In accordance with City of Ottawa Technical Bulletin ISTB-2018-02, the aggregate flow of all contributing fire hydrants within 150 m of the building shall not be less than the required fire flow. In accordance with City of Ottawa Technical Bulletin ISTB-2018-02 Appendix I:

Class	Distance (m)	Contribution (L/min)
AA	≤ 75	5,700
	> 75 and ≤ 150	3,800

The closest existing municipal fire hydrant is Class AA fire hydrant; and a as previously mentioned, the proposed private fire hydrant can also be considered as Class AA; as such, they can each contribute 5,700 L/min (95 L/s). Therefore, the aggregate flow of the two contributing fire hydrants is 11,400 L/min (190 L/s), which is greater than the required fire flow of 6,000 L/min (100 L/s).

2.2 DOMESTIC WATER SUPPLY

In accordance with

i. the City of Ottawa Water Design Guidelines for the populations,
ii. City of Ottawa Technical Bulletin ISTB-2021-03 for the consumption rate,
iii. the Ministry of the Environment Water Design Guidelines for the peaking factors, and

based on seventeen 1-bedroom apartment units and four 2-bedroom apartment units the average daily demand is calculated to be 0.1 L/s, the maximum daily demand is calculated to be 1.0 L/s, and the maximum hourly demand is calculated to be 1.5 L/s. Refer to calculations in Appendix A.

The boundary conditions in the 400 mm Richmond Road municipal watermain provided by the City of Ottawa at the subject property indicate a minimum HGL of 107.2 m and a maximum HGL of 115.7 m. Refer to Appendix A. Based on these boundary conditions, the pressure at the water meter is calculated to vary between 329 kPa (48 psi) and 413 kPa (60 psi). This is an acceptable range for the proposed development.

A 150 mm water service connecting to the existing 400 mm Richmond Road municipal watermain is proposed to service the sprinkler system. The same 150 mm water service will provide an adequate domestic water supply.

3.0 SANITARY SERVICING

In accordance with

i. the City of Ottawa Sewer Design Guidelines for the populations,
ii. City of Ottawa Technical Bulletin ISTB-2018-01 for the average daily flow, Harmon Formula correction factor and infiltration allowance,
iii. the Harmon Formula for the peaking factor, and

based on seventeen 1-bedroom apartment units and four 2-bedroom apartment units, the post-development sanitary flow rate is calculated to be 0.37 L/s. A 150 mm sanitary sewer service at 1% slope (14.43 L/s capacity) is proposed to service the development. At the design flow rate the sanitary sewer service will only be at 3% of its capacity. The proposed 150 mm sanitary sewer service will connect to the existing 225 mm Richmond Road municipal sanitary sewer, which at 0.81% slope has a capacity of 40.41 L/s. The post-development increase in flow is expected to have an acceptable impact on the 225 mm Richmond Road municipal sanitary sewer. Refer to Appendix B.

4.0 STORMWATER MANAGEMENT

4.1 QUANTITY CONTROL

4.1.1 Quantity Control – Roof Drainage:

The stormwater quantity control target for roof drainage is to control the post-development peak flows with the use of flow control roof drains to the pre-development 2-year peak flow rate. Using the Rational Method with the post-development roof area of 390 m^2 a time of concentration of 10 minutes and runoff coefficient of 0.50, the target release rate is calculated to be 4.16 L/s. The Rational and Modified Rational Methods were used to calculate the post-development flow rates and corresponding storage volumes. Refer to calculations in Appendix C.

Drainage Area I (Roof – 3rd Floor Balcony – 65 m^2):
The one roof drain is to be a flow control type roof drain, which will restrict the flow of stormwater and cause it to pond on the roof. The roof drain is to be Watts RD-100 c/w a Watts Adjustable Accutrol Weir in the fully closed position which will release 0.32 L/s (5 USgpm). The opening at the top of the flow control weir is to be a minimum of 50 mm in diameter. A minimum of one scupper, a minimum 300 mm wide, is to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers, 200 mm depth at the roof drains. Refer to structural.

	100-Year Event	5-Year Event
Maximum Release Rate	0.32 L/s	0.32 L/s
Maximum Depth at Roof Drains	139 mm	103 mm
Maximum Volume Stored	2.52 m^3	1.01 m^3

Drainage Area II (High Roof – 156 m^2):
The one roof drain is to be a flow control type roof drain, which will restrict the flow of stormwater and cause it to pond on the roof. The roof drain is to be Watts RD-100 c/w a Watts Adjustable Accutrol Weir in the fully closed position which will release 0.32 L/s (5 USgpm). The opening at the top of the flow control weir is to be a minimum of 50 mm in diameter. A minimum of two scuppers, a minimum 300 mm wide, are to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers, 200 mm depth at the roof drains. Refer to structural.

	100-Year Event	5-Year Event
Maximum Release Rate	0.32 L/s	0.32 L/s
Maximum Depth at Roof Drains	149 mm	113 mm
Maximum Volume Stored	8.00 m^3	3.50 m^3

Drainage Area III (Roof Apron – 169 m^2):
The three roof drains are to be flow control type roof drains, which will restrict the flow of stormwater and cause it to pond on the roof. The roof drain is to be Watts RD-100 c/w a Watts Adjustable Accutrol Weir in the fully closed position which will release 0.32 L/s (5 USgpm) each. The opening at the top of the flow control weir is to be a minimum of 50 mm in diameter. A minimum of three scuppers, a minimum 300 mm wide, are to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers, 200 mm depth at the roof drains. Refer to structural.

	100-Year Event	5-Year Event
Maximum Release Rate	0.95 L/s	0.95 L/s
Maximum Depth at Roof Drains	137 mm	101 mm
Maximum Volume Stored	6.20 m^3	2.44 m^3

Summary – Roof Drainage:
The maximum post-development release rate during the 100-year and 5-year events are calculated to be 1.58 L/s, which is 62% less than the maximum allowable flow rate. A maximum storage volume of 16.72 m^3 is required and provided. Roof drainage is to discharge to grade and drain overland (over mostly soft landscaping) to the Richmond Road roadside ditch. The post-development flow is expected to have an acceptable impact on the municipal infrastructure.

	100-Year Event	5-Year Event
Maximum Allowable Release Rate	4.16 L/s	4.16 L/s
Maximum Release Rate	1.58 L/s	1.58 L/s
Max. Volume Required & Stored	16.72 m^3	6.95 m^3

4.1.2 Quantity Control – Area Draining onto Neighbouring Properties:

The stormwater quantity control criterion for the area draining onto neighbouring properties is to control the post-development flow rates to the pre-development flow rates. Currently 882 m^2 drains onto the neighbouring properties. Using a calculated pre-development runoff coefficient of 0.36 for the 100-year, and 0.31 for the 5-year event, and a 10-minute time of concentration, the pre-development flow rates are calculated to be 15.90 L/s for the 100-year event and 7.81 L/s for the 5-year. The Rational Method and a 10-minute time of concentration is also used to calculate the post-development flow rates. Refer to calculations in Appendix C.

Drainage Area IV (526 m^2):
The runoff coefficients of the post development area draining onto neighbouring properties will increase to 0.56 for the 100-year event, and 0.49 for the 5-year event; however, the post development area will be reduced by 40% to 526 m^2. The maximum post-development release rate of the area draining onto neighbouring properties during the 100-year event is calculated to be 14.53 L/s, which is 9% less than the pre-development flow rate; and during the 5-year event it is calculated to be 7.41 L/s, 5% less than the pre-development flow rate.

Therefore, post development flow is expected to have an acceptable impact on the neighbouring properties.

	100-Year Event	5-Year Event
Pre-development Flow Rate	15.90 L/s	7.81 L/s
Post Development Flow Rate	14.53 L/s	7.41 L/s

4.1.3 Quantity Control – Areas Draining to Richmond Road:

The stormwater quantity control criterion for the area draining onto the Richmond Road ROW is to control the post-development flow rates to the pre-development flow rates. Currently 246 m^2 drains to the ROW. Using a calculated pre-development runoff coefficient of 0.59 for the 100-year, and 0.52 for the 5-year event, and a 10-minute time of concentration, the pre-development flow rates are calculated to be 7.26 L/s for the 100-year event and 3.72 L/s for the 5-year. The Rational Method and a 10-minute time of concentration is also used to calculate the post-development flow rates. Refer to calculations in Appendix C.

Drainage Area I, II, & III (Roof Drainage - refer to section 4.1.1)

Drainage Area V (237 m^2):
The runoff coefficients of the post development area draining to the ROW properties will decrease to 0.45 for the 100-year event, and 0.38 for the 5-year event; and the post development area will be reduced to 237 m^2. The maximum post-development release rate of the area draining to the ROW during the 100-year event is calculated to be 5.25 L/s, which is 28% less than the pre-development flow rate; and during the 5-year event it is calculated to be 2.63 L/s, 29% less than the pre-development flow rate. Therefore, the post development flow is expected to have an acceptable impact on the Richmond Road ROW.

Summary – Areas Draining to Richmond Road:
The maximum post-development release rate of the areas draining to Richmond Read during the 100-year event is calculated to be 6.83 L/s, which is 6% less than the pre-development flow rate. During the 5-year event it is calculated to be 4.21 L/s, 13% more than the pre-development flow rate; however, it is only 0.49 L/s more. Therefore, the post development flow is expected to have an acceptable impact on the Richmond Road ROW.

	100-Year Event	5-Year Event
Pre-development Flow Rate	7.26 L/s	3.72 L/s
Post Development Flow Rate	6.83 L/s	4.21 L/s

4.2 QUALITY CONTROL

4.2.1 Quality Control – Roof Drainage

Runoff from the roof is considered clean, and roof drainage is to discharge to grade and will drain overland (over mostly soft landscaping) to the Richmond Road roadside ditch; as such no other permanent quality control measures are proposed.

4.2.2 Quality Control – Area Draining onto Neighbouring Properties

Over half (58%) of the area that drains onto neighboring properties is soft landscaping; and the hard surfaces (i.e. the driveway) will drain overland over approximately 10 m of soft landscaping prior to draining into the neighbouring properties. As such, no other permanent stormwater quality control measures are proposed.

An Erosion & Sediment Control Plan has been developed to be implemented during construction. Refer to drawing C-2 and notes 2.1 to 2.5 on drawing C-5. A summary:

i. A silt fence barrier is to be installed along the perimeter of the site, and
ii. Any material deposited on the public road is to be removed.

4.3 STORM SERVICING

A storm sewer connection is not proposed. Roof drainage is to discharge to grade and the foundation drains will drain to a storm sump and be pumped to grade (refer to mechanical). The discharge from both will drain overland to the Richmond Road roadside ditch.

5.0 CONCLUSIONS

1. A private onsite fire hydrant is required and is proposed.

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

3. The private fire hydrant can be classified as Class AA and can contribute 5,700 L/min (95 L/s).

4. The aggregate flow of the two contributing existing municipal fire hydrants is greater than the required fire flow.

5. There is an acceptable range of water pressures in the existing municipal water distribution system for the domestic water supply.

6. The post-development sanitary flow rate will be adequately handled by the proposed sanitary sewer service and existing municipal sanitary sewer.

7. The maximum post-development release rate from the roof during the 100-year and 5-year events are calculated to be 62% less than the maximum allowable flow rate. The post-development flow is expected to have an acceptable impact on the municipal infrastructure.

8. The maximum post-development release rate of the area draining onto neighbouring properties during the 100-year event is calculated to be 9% less than the pre-development flow rate; and during the 5-year event it is calculated to be 5% less; therefore, post development flow is expected to have an acceptable impact on the neighbouring properties.

9. The maximum post-development release rate of the areas draining to Richmond Read during the 100-year event is calculated to be 6.83 L/s, which is 6% less than the pre-development flow rate. During the 5-year event it is calculated to be 4.21 L/s, 13% more than the pre-development flow rate;

however, it is only 0.49 L/s more. Therefore, the post development flow is expected to have an acceptable impact on the Richmond Road ROW.

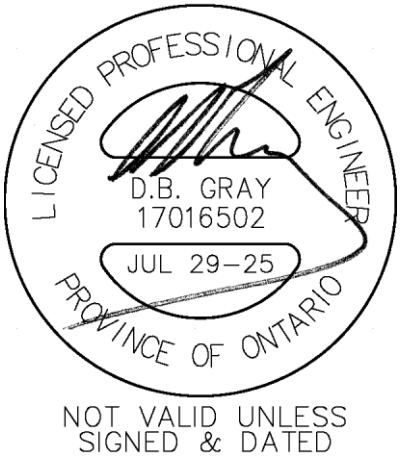
10. Runoff from the roof is considered clean; as such no other permanent quality control measures are proposed.

11. Over half of the area that drains onto neighboring properties is soft landscaping; and all the hard surfaces will drain overland over about 10 m of soft landscaping prior to draining into the neighbouring properties; as such, no other permanent stormwater quality control measures are proposed.

12. An Erosion & Sediment Control Plan has been developed to be implemented during construction.

13. A storm sewer connection is not proposed. Roof drainage is to discharge to grade and the foundation drains will drain to a storm sump and be pumped to grade.

Prepared by D.B. Gray Engineering Inc.



APPENDIX A

WATER SERVICING

D.B. Gray Engineering Inc.

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

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March 27, 2025

3055 Richmond Rd

Proposed 5-Storey Apartment Building

Ottawa, Ontario

FIRE FLOW CALCULATIONS

OBC Method

Q = Required water supply in litres
= KVS_{Total}

K = Water supply coefficient as per OBC A-3.2.5.7. Table 1
= 18 Group C Occupancy, Building is of combustible construction with fire separations and fire resistance ratings in accordance with Subsection 3.2.2.

V = Building volume in cubic meters

	Floor Area (sq.m)	Height (m)	Volume (cu.m)
Level 05:	325	2.9	943
Level 04:	369	3.2	1,181
Level 03:	369	3.2	1,181
Level 02:	369	3.2	1,181
Level 01:	369	3.2	1,181
Level 00:	369	3.2	1,181
	2,170		6,847

S_{Total} = Total of spatial coefficients from exposure distances
= $1.0 + S_{Side\ 1} + S_{Side\ 2} + S_{Side\ 3} + S_{Side\ 4}$

	Spatial Coefficient	Exposure Distance (m)	
$S_{Side\ 1}$	0.00	8.8	(to North property line)
$S_{Side\ 2}$	0.00	22.0	(to center line of road)
$S_{Side\ 3}$	0.50	3.3	(to East property line)
$S_{Side\ 4}$	0.37	6.3	(to West property line)
S_{Total}	1.87		

Q = 230,453 L
= 6,300 L/min as per OBC A-3.2.5.7. Table 2
= 105 L/s

---

150 L/s Fire Flow HGL:	107.1	m				
Elevation at Fire Hydrant:	76.06	m				
Static Pressure at Fire Hydrant:	31.0	m	304	kPa	44	psi

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29-Jul-25

3055 Richmond Rd
Ottawa, Ontario

Fire Flow Requirements

Proposed Five-Storey Apartment Building

Fire flow requirement as calculated as per Fire Underwriters 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
= 0.90 (Type IV-B Mass Timber Construction)

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

5th Floor	325 sq.m.
4th Floor	369 sq.m.
3rd Floor	369 sq.m.
2nd Floor	369 sq.m.
Ground Floor	369 sq.m.
TOTAL FIRE AREA:	1801 sq.m.

F = 8,403 L/min
= 8,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy

= 6,800 L/min

40% Reduction for Sprinkler System

= 2,720 L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Construction	Length m	Storeys	Factor
16%	North	3.1 to 10m	W-F	16	2	32
	East	over 30m				0
	South	over 30m				0
12%	West	10.1 to 20m	W-F	28	2	56

28% Total Increase for Exposure (maximum 75%)
= 1,904 L/min Increase

= 5,984 L/min
F = 6,000 L/min (rounded off to the nearest 1,000 L/min)
= 100.0 l/s

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30-Jan-25

3055 Richmond Rd
Five-Storey ,21-Unit Apartment Building
Ottawa, Ontario

Water Demand

	Number of Units	Persons Per Unit	Population
UNIT TYPE:			
Single Family:	0	3.4	0
Semi- detached:	0	2.7	0
Duplex:	0	2.3	0
Townhouse:	0	2.7	0
APARTMENTS:			
Bachelor	0	1.4	0
1 Bedroom:	17	1.4	24
2 Bedroom:	4	2.1	8
3 Bedroom:	0	3.1	0
Average Apartment:	0	1.8	0
TOTAL:	21		32

APARTMENTS:

DAILY AVERAGE: 280 litres / person / day

6.3 L/min | 0.1 L/s | 1.7 USgpm

MAXIMUM DAILY DEMAND: 9.4 (Peaking Factor for a equivalent population of 32: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)

59.0 L/min | 1.0 L/s | 16 USgpm

MAXIMUM HOURLY DEMAND: 14.2 (Peaking Factor for a equivalent population of 32: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)

88.7 L/min | 1.5 L/s | 23 USgpm

Elevation of Water Meter: 73.62 m ASL

Garage Floor Elevation: 72.72 m ASL

			Static Pressure at Water Meter			
MINIMUM HGL:	107.2	m ASL	48	psi	329	kPa
MAXIMUM HGL:	115.7	m ASL	60	psi	413	kPa

From: Dieme, Abi <Abibatou.Dieme@ottawa.ca>
Sent: December 20, 2022 9:11 AM
To: Smith, Molly <molly.smith@ottawa.ca>
Subject: 3055 Richmond - Boundary Conditions

Hi Molly,

Please transfer the boundary conditions to the applicant for 3055 Richmond Road:

The following are boundary conditions, HGL, for hydraulic analysis at 3055 Richmond Road (zone 1W) with an assumed connection to the 406 mm watermain on Richmond Road (see attached PDF for location).

Minimum HGL: 107.2 m

Maximum HGL: 115.7 m

Max Day + Fire Flow (150 L/s): 107.1 m

These are for current conditions and are based on computer model simulation.

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.

Regards,
Abibatou Dieme, EIT
Project Manager
Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique
Development Review – West Branch / Direction de l'examen des projets d'aménagement -Ouest
City of Ottawa | Ville d'Ottawa
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Boundary Conditions for 3055 Richmond Road
N
Legend
PRIVATE
PUBLIC
City of Ottawa

June 4, 2025

3055 Richmond Road

Ottawa, Ontario

EPANET RESULTS

Fire Flow Demand:	95.0	L/s
Maximum Daily Demand:	1.00	L/s
Fire Flow + Maximum Daily Demand:	96.00	L/s
Fire Flow + Maximum Daily Demand HGL:	107.2	m

Node ID	Demand (L/s)	HGL (m)	Elevation (m)	Pressure (m)	Pressure (kPa)	Pressure (psi)
1 - Reservoir	-96.00	107.2	75.9	31.3	307	44
2 - Fire Hydrant	96.00	94.3	74.5	19.8	194	28

Link ID	Length (m)	Diameter (mm)	Roughness Coefficient	Minor Loss Coefficient	Flow (L/s)	Velocity (m/s)
1 - Reservoir to Fire Hydrant	28.0	150	100	3.30	96.00	5.43

Network Table - Nodes

Node ID	Elevation m	Base Demand LPS	Demand LPS	Head m	Pressure m
Junc 2	74.5	96	96.00	94.30	19.80
Resvr 1	107.2	#N/A	-96.00	107.20	0.00

Network Table - Links

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s
Pipe 1	28	150	100	96.00	5.43

APPENDIX B

SANITARY SERVICING

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SANITARY SEWER CALCULATIONS

3055 Richmond Rd
5-Storey 21-Unit Apartment Building
Ottawa, Ontario

April 3, 2025

		Residential												Non-Residential				Infiltration			Q	Sewer Data							
		Individual									Cumulative			Individual			Cumulative	Individual	Cumulative		Total						Q_{Full}		
Location		Single	Semi		Apartment				Area	Population	Area	Population	Peaking	Flow Rate	Area	Daily Flow	Peaking	Flow Rate	Area	Area	Flow Rate	Flow Rate	Length	Nominal Diameter	Actual Diameter	Slope	Velocity	Capacity	
From	To	Family	Detached	Duplex	(1 Bed)	(2 Bed)	(3 Bed)	(Average)	(ha)		(ha)		Factor	(L/s)	(ha)	L/ha/day	Factor	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)	(mm)	(%)	(m/s)	(L/s)	Q / Q_{Full}
		ppu = 3.4	ppu = 2.7	ppu = 2.3	ppu = 1.4	ppu = 2.1	ppu = 3.1	ppu = 1.8																					
Building	MH-SA.1				17	4			0.1065	32	0.1065	32	3.2	0.33	0.0000	28,000	4.5	0.00	0.1065	0.1065	0.04	0.37	2.5	150	147	1	0.85	14.43	0.03
MH-SA.1	MH-SA.2								0.0000	0	0.1065	32	3.2	0.33	0.0000	28,000	4.5	0.00	0.0000	0.1065	0.04	0.37	13.9	150	147	1	0.85	14.43	0.03
	(225 SAN)																												
																			225 mm Richmond Rd Sanitary Sewer:				225	225	0.81	1.02	40.41	

Residential Average Daily Flow: 280 L/capita/day
Commercial Average Daily Flow: 28,000 L/ha/day
Institutional Average Daily Flow: 28,000 L/ha/day
Light Industrial Average Daily Flow: 35,000 L/ha/day
Heavy Industrial Average Daily Flow: 55,000 L/ha/day

Infiltration Allowance: 0.33 L/s/ha

Residential Peaking Factor: Harmon Formula
Harmon Formula Correction Factor: 0.8
Commercial Peaking Factor: 1.5
Institutional Peaking Factor: 1.5
Industrial Peaking Factor: Ministry of the Environment

Manning's Roughness Coefficient: 0.013

APPENDIX C

STORMWATER MANAGEMENT

SUMMARY TABLES
(ROOF DRAINAGE)

100-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 (3rd Floor Balcony)	-	0.32	2.52	2.52
AREA II (High Roof)	-	0.32	8.00	8.00
AREA III (Roof Apron)	-	0.95	6.20	6.20
TOTAL	4.16	1.58	16.72	16.72

5-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 (3rd Floor Balcony)	-	0.32	1.01	1.01
AREA II (High Roof)	-	0.32	3.50	3.50
AREA III (Roof Apron)	-	0.95	2.44	2.44
TOTAL	4.16	1.58	6.95	6.95

SUMMARY TABLES
(AREA DRAINING ONTO NEIGHBOURING PROPERTIES)

100-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA IV	-	14.53	-	-
TOTAL	15.90	14.53	0.00	0.00

5-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA IV	-	7.41	-	-
TOTAL	7.81	7.41	0.00	0.00

SUMMARY TABLES
(AREA DRAINING TO RICHMOND ROAD)

100-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (3rd Floor Balcony)	-	0.32	2.52	2.52
AREA II (High Roof)	-	0.32	8.00	8.00
AREA III (Roof Apron)	-	0.95	6.20	6.20
AREA V	-	5.25	-	-
TOTAL	7.26	6.83	16.72	16.72

5-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (3rd Floor Balcony)	-	0.32	1.01	1.01
AREA II (High Roof)	-	0.32	3.50	3.50
AREA III (Roof Apron)	-	0.95	2.44	2.44
AREA V	-	2.63	-	-
TOTAL	3.72	4.21	6.95	6.95

July 29, 2025

3055 Richmond Road

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Modified Rational Method

MAXIMUM ALLOWABLE ROOF DRAINAGE RELEASE RATE

Proposed Roof Area (A):	390	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	(2-Year Event)
Runoff Coeficient (C):	0.50		
Maximum Allowable Release Rate (2.78AiC):	4.16	L/s	

PRE-DEVELOPMENT CONDITIONS
(AREA DRAINING ONTO NEIGHBOURING PROPERTIES)

MAXIMUM ALLOWABLE FLOW RATE - 100-YEAR EVENT

			C
Roof Area:	45	sq.m	1.00
Hard Area:	88	sq.m	1.00
Soft Area:	749	sq.m	0.25
Total Catchment Area:	882	sq.m	0.36
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	(100-Year Event)
Maximum Allowable Flow Rate (2.78AiC):	15.90	L/s	

MAXIMUM ALLOWABLE FLOW RATE - 5-YEAR EVENT

			C
Roof Area:	45	sq.m	0.90
Hard Area:	88	sq.m	0.90
Soft Area:	749	sq.m	0.20
Total Catchment Area:	882	sq.m	0.31
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	(5-Year Event)
Maximum Allowable Flow Rate (2.78AiC):	7.81	L/s	

PRE-DEVELOPMENT CONDITIONS

(AREA DRAINING TO RICHMOND ROAD)

MAXIMUM FLOW RATE - 100-YEAR EVENT

			C
Hard Area:	113	sq.m	1.00
Soft Area:	133	sq.m	0.25
Total Catchment Area:	246	sq.m	0.59
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-Year Event)	
Maximum Allowable Flow Rate (2.78AiC):	7.26	L/s	

MAXIMUM FLOW RATE - 5-YEAR EVENT

			C
Hard Area:	113	sq.m	0.90
Soft Area:	133	sq.m	0.20
Total Catchment Area:	246	sq.m	0.52
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr (5-Year Event)	
Maximum Allowable Flow Rate (2.78AiC):	3.72	L/s	

100-YEAR EVENT

DRAINAGE AREA I (Roof - 3rd Floor Balcony)

(100-YEAR EVENT)

			C
Total Catchment Area:	65	sq.m	1.00

No. of Roof Drains:	1	
Wier Opening:	0	(Fully Closed)
Depth at Roof Drains:	139	mm
Maximum Release Rate:	0.32	L/s

Pond Area:	54.3	sq.m
Maximum Volume Stored:	2.52	cu.m
Maximum Volume Required:	2.52	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	3.23	0.32	2.91	1.75
15	143	2.58	0.32	2.27	2.04
20	120	2.17	0.32	1.85	2.22
25	104	1.88	0.32	1.56	2.34
30	92	1.66	0.32	1.34	2.42
35	83	1.49	0.32	1.18	2.47
40	75	1.36	0.32	1.04	2.50
45	69	1.25	0.32	0.93	2.52
50	64	1.16	0.32	0.84	2.52
55	60	1.08	0.32	0.76	2.51
60	56	1.01	0.32	0.69	2.50
65	53	0.95	0.32	0.64	2.48
70	50	0.90	0.32	0.58	2.45
75	47	0.85	0.32	0.54	2.42
80	45	0.81	0.32	0.50	2.39
85	43	0.78	0.32	0.46	2.35
90	41	0.74	0.32	0.43	2.31
120	33	0.59	0.32	0.28	2.01
150	28	0.50	0.32	0.18	1.65
180	24	0.43	0.32	0.12	1.26
210	21	0.38	0.32	0.07	0.84
240	19	0.34	0.32	0.03	0.40
270	17	0.31	0.31	0.00	0.00
300	16	0.29	0.29	0.00	0.00
330	15	0.27	0.27	0.00	0.00
360	14	0.25	0.25	0.00	0.00

DRAINAGE AREA II (High Roof)

(100-YEAR EVENT)

			C	
Total Catchment Area:	156	sq.m	1.00	
No. of Roof Drains:	1			
Wier Opening:	0	(Fully Closed)		
Depth at Roof Drains:	149	mm		
Maximum Release Rate:	0.32	L/s	Pond Area:	160.7 sq.m
			Maximum Volume Stored:	8.00 cu.m
			Maximum Volume Required:	8.00 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	7.74	0.32	7.43	4.46
15	143	6.20	0.32	5.88	5.29
20	120	5.20	0.32	4.89	5.86
25	104	4.50	0.32	4.19	6.28
30	92	3.98	0.32	3.67	6.60
35	83	3.58	0.32	3.27	6.86
40	75	3.26	0.32	2.94	7.06
45	69	2.99	0.32	2.68	7.23
50	64	2.77	0.32	2.46	7.37
55	60	2.59	0.32	2.27	7.49
60	56	2.42	0.32	2.11	7.59
65	53	2.28	0.32	1.97	7.67
70	50	2.16	0.32	1.84	7.74
75	47	2.05	0.32	1.73	7.80
80	45	1.95	0.32	1.64	7.85
85	43	1.86	0.32	1.55	7.89
90	41	1.78	0.32	1.47	7.92
120	33	1.43	0.32	1.11	8.00
150	28	1.20	0.32	0.88	7.94
180	24	1.04	0.32	0.72	7.79
210	21	0.92	0.32	0.60	7.58
240	19	0.82	0.32	0.51	7.33
270	17	0.75	0.32	0.43	7.04
300	16	0.69	0.32	0.37	6.73
330	15	0.64	0.32	0.32	6.39
360	14	0.60	0.32	0.28	6.04

DRAINAGE AREA III (Roof Apron)

(100-YEAR EVENT)

			C
Total Catchment Area:	169	sq.m	1.00

No. of Roof Drains:	3	
Wier Opening:	0	(Fully Closed)
Depth at Roof Drains:	137	mm
Maximum Release Rate:	0.95	L/s

Pond Area:	135.6	sq.m
Maximum Volume Stored:	6.20	cu.m
Maximum Volume Required:	6.20	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	8.39	0.95	7.44	4.47
15	143	6.71	0.95	5.77	5.19
20	120	5.64	0.95	4.69	5.63
25	104	4.88	0.95	3.93	5.90
30	92	4.32	0.95	3.37	6.07
35	83	3.88	0.95	2.93	6.16
40	75	3.53	0.95	2.58	6.20
45	69	3.24	0.95	2.30	6.20
50	64	3.00	0.95	2.06	6.17
55	60	2.80	0.95	1.85	6.12
60	56	2.63	0.95	1.68	6.05
65	53	2.47	0.95	1.53	5.96
70	50	2.34	0.95	1.39	5.85
75	47	2.22	0.95	1.27	5.73
80	45	2.11	0.95	1.17	5.60
85	43	2.02	0.95	1.07	5.46
90	41	1.93	0.95	0.98	5.32
120	33	1.55	0.95	0.60	4.31
150	28	1.30	0.95	0.35	3.16
180	24	1.12	0.95	0.18	1.91
210	21	0.99	0.95	0.05	0.59
240	19	0.89	0.89	0.00	0.00
270	17	0.81	0.81	0.00	0.00
300	16	0.75	0.75	0.00	0.00
330	15	0.69	0.69	0.00	0.00
360	14	0.64	0.64	0.00	0.00

DRAINAGE AREA IV

(AREA DRAINING ONTO NEIGHBOURING PROPERTIES)

(100-YEAR EVENT)

			C
Hard Area:	215	sq.m	1.00
Soft Area:	311	sq.m	0.25
Total Catchment Area:	526	sq.m	0.56
Area (A):	526	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.56		
Flow Rate (2.78AiC):	14.53	L/s	

DRAINAGE AREA V

(AREA DRAINING TO RICHMOND ROAD)

(100-YEAR EVENT)

			C
Hard Area:	62	sq.m	1.00
Soft Area:	175	sq.m	0.25
Total Catchment Area:	237	sq.m	0.45
Area (A):	237	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.45		
Flow Rate (2.78AiC):	5.25	L/s	

5-YEAR EVENT

DRAINAGE AREA I (Roof - 3rd Floor Balcony)

(5-YEAR EVENT)

			C
Total Catchment Area:	65	sq.m	0.90

No. of Roof Drains:	1	
Wier Opening:	0	(Fully Closed)
Depth at Roof Drains:	103	mm
Maximum Release Rate:	0.32	L/s

Pond Area:	30	sq.m
Maximum Volume Stored:	1.01	cu.m
Maximum Volume Required:	1.01	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	1.69	0.32	1.38	0.83
15	84	1.36	0.32	1.04	0.94
20	70	1.14	0.32	0.83	0.99
25	61	0.99	0.32	0.67	1.01
30	54	0.88	0.32	0.56	1.01
35	49	0.79	0.32	0.47	0.99
40	44	0.72	0.32	0.40	0.97
45	41	0.66	0.32	0.35	0.93
50	38	0.61	0.32	0.30	0.89
55	35	0.57	0.32	0.26	0.84
60	33	0.54	0.32	0.22	0.79
65	31	0.50	0.32	0.19	0.74
70	29	0.48	0.32	0.16	0.68
75	28	0.45	0.32	0.14	0.62
80	27	0.43	0.32	0.12	0.56
85	25	0.41	0.32	0.10	0.50
90	24	0.40	0.32	0.08	0.43
120	19	0.32	0.32	0.00	0.01
150	16	0.27	0.27	0.00	0.00
180	14	0.23	0.23	0.00	0.00
210	13	0.20	0.20	0.00	0.00
240	11	0.18	0.18	0.00	0.00
270	10	0.17	0.17	0.00	0.00
300	9	0.15	0.15	0.00	0.00
330	9	0.14	0.14	0.00	0.00
360	8	0.13	0.13	0.00	0.00

DRAINAGE AREA II (High Roof)

(5-YEAR EVENT)

			C
Total Catchment Area:	156	sq.m	0.90

No. of Roof Drains:	1	
Wier Opening:	0	(Fully Closed)
Depth at Roof Drains:	113	mm
Maximum Release Rate:	0.32	L/s

Pond Area:	93	sq.m
Maximum Volume Stored:	3.50	cu.m
Maximum Volume Required:	3.50	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	4.07	0.32	3.75	2.25
15	84	3.26	0.32	2.95	2.65
20	70	2.74	0.32	2.43	2.91
25	61	2.38	0.32	2.06	3.09
30	54	2.10	0.32	1.79	3.22
35	49	1.89	0.32	1.58	3.31
40	44	1.72	0.32	1.41	3.38
45	41	1.59	0.32	1.27	3.43
50	38	1.47	0.32	1.15	3.46
55	35	1.37	0.32	1.06	3.48
60	33	1.29	0.32	0.97	3.49
65	31	1.21	0.32	0.90	3.50
70	29	1.15	0.32	0.83	3.49
75	28	1.09	0.32	0.77	3.48
80	27	1.04	0.32	0.72	3.46
85	25	0.99	0.32	0.67	3.44
90	24	0.95	0.32	0.63	3.42
120	19	0.76	0.32	0.44	3.20
150	16	0.64	0.32	0.32	2.91
180	14	0.55	0.32	0.24	2.57
210	13	0.49	0.32	0.17	2.20
240	11	0.44	0.32	0.13	1.80
270	10	0.40	0.32	0.09	1.39
300	9	0.37	0.32	0.05	0.96
330	9	0.34	0.32	0.03	0.53
360	8	0.32	0.32	0.00	0.08

DRAINAGE AREA III (Roof Apron)

(5-YEAR EVENT)

			C
Total Catchment Area:	169	sq.m	0.90

No. of Roof Drains:	3	
Wier Opening:	0	(Fully Closed)
Depth at Roof Drains:	101	mm
Maximum Release Rate:	0.95	L/s

Pond Area:	73	sq.m
Maximum Volume Stored:	2.44	cu.m
Maximum Volume Required:	2.44	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	104	4.41	0.95	3.46	2.08
15	84	3.53	0.95	2.59	2.33
20	70	2.97	0.95	2.02	2.43
25	61	2.57	0.95	1.63	2.44
30	54	2.28	0.95	1.33	2.40
35	49	2.05	0.95	1.11	2.32
40	44	1.87	0.95	0.92	2.21
45	41	1.72	0.95	0.77	2.08
50	38	1.59	0.95	0.65	1.94
55	35	1.49	0.95	0.54	1.78
60	33	1.39	0.95	0.45	1.61
65	31	1.31	0.95	0.37	1.43
70	29	1.24	0.95	0.30	1.24
75	28	1.18	0.95	0.23	1.05
80	27	1.12	0.95	0.18	0.85
85	25	1.07	0.95	0.13	0.64
90	24	1.03	0.95	0.08	0.43
120	19	0.82	0.82	0.00	0.00
150	16	0.69	0.69	0.00	0.00
180	14	0.60	0.60	0.00	0.00
210	13	0.53	0.53	0.00	0.00
240	11	0.48	0.48	0.00	0.00
270	10	0.43	0.43	0.00	0.00
300	9	0.40	0.40	0.00	0.00
330	9	0.37	0.37	0.00	0.00
360	8	0.35	0.35	0.00	0.00

DRAINAGE AREA IV

(AREA DRAINING ONTO NEIGHBOURING PROPERTIES

(5-YEAR EVENT)

			C
Hard Area:	215	sq.m	0.90
Soft Area:	311	sq.m	0.20
Total Catchment Area:	526	sq.m	0.49
Area (A):	526	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.49		
Flow Rate (2.78AiC):	7.41	L/s	

DRAINAGE AREA V

(AREA DRAINING TO RICHMOND ROAD)

(5-YEAR EVENT)

			C
Hard Area:	62	sq.m	0.90
Soft Area:	175	sq.m	0.20
Total Catchment Area:	237	sq.m	0.38
Area (A):	237	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.38		
Flow Rate (2.78AiC):	2.63	L/s	

APPENDIX D

CITY OF OTTAWA SERVICING STUDY CHECKLIST

GENERAL

Executive Summary: **N/A**

Date and revision number of report: **Included**

Location map and plan showing municipal address, boundary and layout of proposed development: **Included**

Plan showing site and location of all existing services: **Included**

Development statistics, land use, density, adherence to zoning and Official Plan and reference to applicable watershed and subwatershed plans: **N/A**

Summary of Pre-Application Consultation meetings with City of Ottawa and other approval agencies: **Included**

Confirmation of conformance with higher level studies: **N/A**

Statement of objectives and servicing criteria: **Included**

Identification of existing and proposed infrastructure available in the immediate area: **Included**

Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development: **N/A**

Concept level master grading plan to confirm existing and proposed grades in the proposed development: **Included**

Identification of potential impacts of proposed piped services on private services on adjacent lands: **N/A**

Proposed phasing of proposed development: **N/A**

Reference to geotechnical studies: **Included**

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

- Metric scale: **Included**
- North arrow: **Included**
- Key plan: **Included**
- Property limits: **Included**
- Existing and proposed structures and parking areas: **Included**
- Easements, road widenings and right-of-ways: **N/A**
- Street names: **Included**

WATER SERVICING

Confirmation of conformance with Master Servicing Study: **N/A**

Availability of public infrastructure to service proposed development: **Included**

Identification of system constraints: **Included**

Identification of boundary conditions: **Included**

Confirmation of adequate domestic supply: **Included**

Confirmation of adequate fire flow: **Included**

Check of high pressures: **Included**

Definition of phasing constraints: **N/A**

Address reliability requirements: **N/A**

Check on necessity of a pressure zone boundary modification: **N/A**

Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for proposed development: **Included**

Description of proposed water distribution network: **Included**

Description of required off-site infrastructure to service proposed development: **N/A**

Confirmation that water demands are calculated based on the City of Ottawa Water Design Guidelines: **Included**

Provision of a model schematic showing the boundary conditions locations, streets, parcels and building locations: **Included**

SANITARY SERVICING

Summary of proposed design criteria: **Included**

Confirmation of conformance with Master Servicing Study: **N/A**

Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the City of Ottawa Sewer Design Guidelines: **N/A**

Description of existing sanitary sewer available for discharge of wastewater from proposed development: **Included**

Verification of available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service proposed development: **N/A**

Calculations related to dry-weather and wet-weather flow rates: **Included**

Description of proposed sewer network: **Included**

Discussion of previously identified environmental constraints and impact on servicing: **N/A**

Impacts of proposed development on existing pumping stations or requirements for new pumping station: **N/A**

Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity: **N/A**

Identification and implementation of emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding: **N/A**

Special considerations (e.g. contamination, corrosive environment): **N/A**

STORMWATER MANAGEMENT & STORM SERVICING

Description of drainage outlets and downstream constraints: **Included**

Analysis of available capacity in existing public infrastructure: **N/A**

Plan showing subject lands, its surroundings, receiving watercourse, existing drainage pattern and proposed drainage pattern: **Included**

Water quantity control objective: **Included**

Water quality control objective: **Included**

Description of the stormwater management concept: **Included**

Setback from private sewage disposal systems: **N/A**

Watercourse and hazard lands setbacks: **N/A**

Record of pre-consultation with the Ministry of the Environment, Conservation and Parks and the Conservation Authority having jurisdiction on the affected watershed: **N/A**

Confirmation of conformance with Master Servicing Study: **N/A**

Storage requirements and conveyance capacity for minor events (5-year return period) and major events (100-year return period): **Included**

Identification of watercourses within the proposed development and how watercourses will be protected or if necessary altered by the proposed development: **N/A**

Calculation of pre-development and post-development peak flow rates: **Included**

Any proposed diversion of drainage catchment areas from one outlet to another: **N/A**

Proposed minor and major systems: **N/A**

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: **N/A**

Identification of potential impacts to receiving watercourses: **N/A**

Identification of municipal drains: **N/A**

Description of how the conveyance and storage capacity will be achieved for the proposed development: **Included**

100-year flood levels and major flow routing: **N/A**

Inclusion of hydraulic analysis including hydraulic grade line elevations: **N/A**

Description of erosion and sediment control during construction: **Included**

Obtain relevant floodplain information from Conservation Authority: **N/A**

Identification of fill constraints related to floodplain and geotechnical investigation: **N/A**

APPROVAL AND PERMIT REQUIREMENTS

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 the 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: **N/A**

Application for Certificate of Approval (CofA) under the Ontario Water Resources Act: **N/A**

Changes to Municipal Drains: **N/A**

Other permits (e.g. National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation): **N/A**

CONCLUSIONS

Clearly stated conclusions and recommendations: **Included**

Comments received from review agencies: **N/A**

Signed and stamped by a professional Engineer registered in Ontario: **Included**