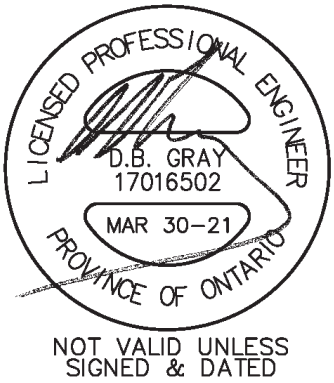
SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

157 Holland Avenue
Ottawa, Ontario

Report No. 20074

November 10, 2020
Revised March 30, 2021



D.B. Gray Engineering Inc.

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

700 Long Point Circle
Ottawa, ON K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

157 Holland Avenue
Ottawa, Ontario

This report describes the services and addresses the stormwater management requirements of a property 471 sq.m. in area located at 157 Holland Avenue in Ottawa. The property currently has a single-dwelling building on it that will be demolished. A three-storey (four levels, including basement apartments), 12-unit apartment building is proposed.

This report forms part of the stormwater management design for the proposed development. Refer to drawings C-1 to C-4 also prepared by D. B. Gray Engineering Inc.

WATER SUPPLY FOR FIREFIGHTING:

There is an existing municipal fire hydrant in the Holland Avenue municipal road right-of-way located adjacent to the northwest corner of the subject property approximately 16 m unobstructed distance to the main entrance of the proposed building. Since the municipal fire hydrant is located less than the maximum 90 m permitted, a private on-site fire hydrant is not required. There are three other existing municipal fire hydrants in the vicinity. One is located in municipal road right-of-way near the northwest corner of the Holland Avenue / Byron Avenue intersection about 80 m unobstructed distance to the proposed building. The other two hydrants are located in the Holland Avenue right-of-way about 137 m south and 138 m north of the proposed building. The Holland/Byron fire hydrant is a Class AA (colour coded blue). The other three hydrants appear to have been installed around 2013 when a new 406 mm watermain was constructed. As of 2019 these hydrants were not colour coded, but are expected to be Class AA.

A fire flow of 250.0 L/s (15,000 L/min) is required, as calculated as per the Fire Underwriter Survey (FUS) "Water Supply For Fire Protection".

The boundary conditions for the 250.0 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 109.6 m for the above flow rate in the 406 mm municipal watermain in Holland Avenue at the subject location. This HGL calculates to be 416 kPa (60 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.

As per City of Ottawa Technical Bulletin ISTB-2018-02, the aggregate flow of all contributing fire hydrants within 150 m of the building can used to supply the required fire flow. The closest hydrant is within 75 m and can contribute 5,700 L/min (95 L/s) each; and the other hydrants, being between 75 and 150 m, can contribute 3,800 L/min (63.3 L/s) each (as per Table 1 of ISTB-2018-02). Therefore, the aggregate flow from all four hydrants is 17,100 L/min (285.0 L/s), which is greater than the required fire flow of 250.0 L/s.

WATER SERVICE:

The 12 apartment units are comprised of 6 one-bedroom, 3 two-bedroom and 3 three-bedroom units. Based on the City of Ottawa Water Distribution Design Guidelines for residential properties (Table 4.1 & Table 4.2: one-bedroom apartment units / 1.4 person per unit; two-bedroom apartment units / 2.1 persons per unit; three-bedroom apartment units / 3.1 persons per unit; and 350 L/person/day) and Ministry of the Environment Design Guidelines for peaking factors (Table 3-3) the daily average flow is 0.1 L/s with a maximum daily and maximum hourly demand of 0.9 and 1.4 L/s respectively.

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.

Based on the boundary conditions received from the City, the minimum HGL (hydraulic grade line) is 108.1 m and the maximum is 114.4 m. With these HGLs the water pressure at the water meter is calculated to vary from 402 kPa to 464 kPa (58 to 67 psi). This is an acceptable range of water pressures for the proposed development.

Based on the AWWA water flow demand curve, and a water pressure at the meter of 434 kPa (63 psi), the peak demand for the building is expected to be 2.2 L/s (132 L/min / 35 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 1.9 m/s in the proposed 38 mm water service connection (up to 2.4 m/s is acceptable). The water service will connect to the 406 mm municipal watermain in Holland Avenue.

SANITARY SERVICE:

Based on the City of Ottawa Sewer Design Guidelines for a residential property (Technical Bulletin ISTB-2018-01, Figure 4.3: 6 one-bedroom apartment units / 1.4 person per unit; 3 two-bedroom apartment units / 2.1 persons per unit; 3 three-bedroom apartment units / 3.1 persons per unit; 280 l/person/day; and a 3.2 peaking factor); and based on a 0.33 L/s/ha infiltration flow; the post development flow is calculated to be 0.26 L/s. This flow will be adequately handled by the proposed sanitary sewer service connections (150 mm at 1% - 15.89 L/s capacity) since, at the design flow, it will only be about 2% full.

The proposed 150mm sanitary service connections will connect to the 600 mm municipal sanitary sewer in Holland Avenue which, with a 0.47% slope, has a capacity of 439 L/s. The existing single family dwelling is calculated to have generated 0.05 L/s. The 0.21 L/s increase in sanitary flows contributing to the existing 600 mm sanitary sewer is expected to have an acceptable impact.

STORMWATER MANAGEMENT:

Water Quality:

The Rideau Valley Conservation Authority RVCA has stated: *"Based on there being no surface parking spaces proposed, the RVCA would accept that there is no onsite water quality treatment required save and except best management practices.."*

No permanent quality control measures are proposed. An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-2 and notes 2.1 to 2.5 on drawing C-3). In summary: to filter out construction sediment capture filter sock inserts will be installed in all existing catch basins adjacent to the site; and any material deposited on a public road shall be removed.

Water Quantity:

The stormwater management criteria for quantity control are to control the post development peak flows for the 5-year and 100-year storm events to peak flows during the 5-year storm event using a pre-development runoff coefficient or runoff coefficient of 0.50, whichever is less; and a calculated time of concentration (not less than 10 minutes). It is calculated that the pre-development conditions reflect a 5-year runoff coefficient of 0.83 and a time of concentration of 2.0 minutes. Therefore, based on a 10 minute time of concentration and the Rational Method the pre-development flow rate is 21.74 L/s for the 100-year event and 11.39 L/s for the 5-year. However, based on runoff coefficient of 0.50; the maximum allowable release rate is 6.82 L/s for all storm events. The runoff coefficients for the 100 year event are increased by 25% to maximum 1.00.

Stormwater will be stored within the development on the roof of the proposed building.

Drainage Area I
(Uncontrolled Flow Off Site – 222 sq.m.):
The runoff from the perimeter the site will be allowed to flow uncontrolled off the site. Permeable pavers are proposed to reduce this flow. The flow is calculated at 10 minutes concentration.

	100-year	5-year
Maximum flow rate:	4.61 L/s	2.28 L/s

Drainage Area II (Roof – 249 sq.m.):
The roof drain will be a flow control type which will restrict the flow and cause the storm water to pond on the roof. The flow control type roof drain shall be installed with a parabolic shaped slotted weir (1 slot per weir drain at 0.0124 l/s per mm per slot - 5 USgpm per inch per slot); the opening at top of flow control weir shall be a minimum 50 mm in diameter: Watts roof drain with a Watts Accutrol Weir RD-100-A1 or equal. Two scuppers, each 365 mm wide and installed 150 mm above the roof drains, are required (refer to architectural for exact locations and details). The roof shall be designed to carry the load of water having a 50 mm depth at scupper and 200 mm depth at roof drain (refer to structural).

	100-year	5-year
The maximum release rate:	3.24 L/s	2.41 L/s
The maximum ponding depth:	131 mm	97 mm
The maximum stored volume:	6.07 cu.m.	2.51 cu.m.

The Entire Site:

	100-year	5-year
Pre-development Flow Rate:	21.71 L/s	11.39 L/s
Maximum allowable release rate:	6.82 L/s	6.82 L/s
Maximum release rate:	7.85 L/s	4.65 L/s

Therefore, the maximum post-development release rate for the 100-year storm event is calculated to be 15% greater than the maximum allowable; however, it is 64% less than the pre-development flow rate. For the 5-year event the maximum post-development release is calculated to be 31% less than the maximum allowable and 59% less than the pre-development flow rate.

The unrestricted flowrate resulting from one in five-year storm event will produce a peak flow of 6.49 L/s which will be adequately handled by the proposed storm sewer connection (150mm at 1% - 15.9 L/s capacity) being only at 41% of its capacity. (The storm sewer connection is only 15% full based on the 5-year restricted flowrate (due to the flow control roof drain) of 2.45 L/s.)

The restricted flowrate during a five-year storm event will produce a peak flow off the site of 4.65 L/s during the 5-year event. The 4.65 L/s in stormwater flows contributing to the 1650 mm municipal storm sewer is expected to have a positive impact given that it is 59% reduction from the pre--development flows.

CONCLUSIONS:

1. A private on-site fire hydrant is not required.

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

3. The aggregate flow from four contributing fire hydrants within 150 m of the building is 17,100 L/min (285.0 L/s), which is greater than the required fire flow of 250.0 L/s.

4. There is an acceptable range of water pressures in the municipal watermain for the proposed development.

5. The peak demand will produce an acceptable velocity of 1.9 m/s in the proposed 38 mm water service connection.

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. The proposed development has no surface parking so RVCA does not require onsite water quality treatment. Therefore, no permanent quality control measures are proposed.

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

10. The pre-development flow rate is 21.74 L/s for the 100-year event and 11.39 L/s for the 5-year. The stormwater management criteria for quantity control are to control the post development peak flows for the 5-year and 100-year storm events to peak flows during the 5-year storm event using a runoff coefficient of 0.50, and a time of concentration of 10 minutes. The maximum allowable release rate is 6.82 L/s for all storm events. The maximum post-development release rate for the 100-year storm event is calculated to be 15% greater than the maximum allowable; however, it is 64% less than the pre-development flow rate. For the 5-year event the maximum post-development release is calculated to be 31% less than the maximum allowable and 59% less than the pre-development flow rate.

11. The unrestricted flowrate resulting from one in five-year storm event will be adequately by the proposed storm service connection.

12. The restricted flowrate during a five-year storm event will produce a peak flow off the site of 4.65 L/s during the 5-year event. The 4.65 L/s in stormwater flows contributing to the 1650 mm municipal storm sewer is expected to have a positive impact given that it is 59% reduction from the pre--development flows.

D.B. Gray Engineering Inc.

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

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

08-Sep-20
REVISED 15-Oct-20

Proposed 4-Level Building
157 Holland Avenue
Ottawa, Ontario

Fire Flow Requirements

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

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

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

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

5th Floor (stairwell)	17 sq.m.
4th Floor	250 sq.m.
3rd Floor	250 sq.m.
2nd Floor	250 sq.m.
1st Floor	250 sq.m.
TOTAL FIRE AREA:	1017 sq.m.

F = 10,524 L/min
= 11,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge Combustible Occupancy

= 9,350 L/min

0% Reduction for Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

			Adjacent Building			
			Constuction	Length m	Storeys	L/H Factor
22%	North	0 to 3m	Ordinary	20	2	40
13%	East	10.1 to 20m	W-F	16	2	32
23%	South	0 to 3m	Non-Comb.	20	2	40
5%	West	30.1 to 45m	W-F	16	2	32
63%	Total Increase for Exposure (maximum 75%)					

= 5,891 L/min Increase

= 15,241 L/min
F = 15,000 L/min (rounded off to the nearest 1,000 L/min)
= 250.0 L/s

Elevation at Fire Hydrant 67.12 m ASL

Static Pressure at Fire Hydrant

250 L/s FIRE FLOW: 109.6 m ASL 60 psi 416 kPa

D.B. Gray Engineering Inc.

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

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

08-Sep-20

REVISED 15-Oct-20

157 Holland Avenue
13-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:			
1 Bedroom:	6	1.4	8
2 Bedroom:	3	2.1	6
3 Bedroom:	3	3.1	9
Average Aptarment:	0	1.8	0
TOTAL:	12		24

DAILY AVERAGE

350	litres / person / day				
5.8	l/min	0.1	l/s	2	USgpm

MAXIMUM DAILY DEMAND 9.5 (Peaking Factor for a population of 30: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)

55.4	l/min	0.9	l/s	15	USgpm

MAXIMUM HOURLY DEMAND 14.3 (Peaking Factor for a population of 30: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)

83.4	l/min	1.4	l/s	22	USgpm

Elevation of Water Meter: 67.07 m ASL
Finish Floor Elevation: 66.17 m ASL

			Static Pressure at Water Meter		
MINIMUM HGL:	108.1	m ASL	58	psi	402 kPa
MAXIMUM HGL:	114.4	m ASL	67	psi	464 kPa

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

RE: 157 Holland Ave - Boundary Condition Request

1 message

Wu, John <John.Wu@ottawa.ca> Thu, Oct 15, 2020 at 8:21 AM
To: Douglas Gray <d.gray@dbgrayengineering.com>

Here is the result:

The following are boundary conditions, HGL, for hydraulic analysis at 157 Holland Avenue (zone 1W) assumed to be connected to the 406mm on Holland Avenue (see attached PDF for location).

Minimum HGL = 108.1m

Maximum HGL = 114.4m

MaxDay + Fire Flow (250 L/s) = 109.6m

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.

John

From: Douglas Gray <d.gray@dbgrayengineering.com>
Sent: October 6, 2020 7:52 AM
To: Wu, John <John.Wu@ottawa.ca>
Cc: Caoimhin Kennedy <c.kennedy@dbgrayengineering.com>
Subject: Re: 157 Holland Ave - Boundary Condition Request

Hi John

This is a reminder that we are waiting for the boundary conditions for 157 Holland Ave.

Regards, Doug

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

700 Long Point Circle Tel: 613-425-8044

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

On Tue, Sep 8, 2020 at 8:00 AM Douglas Gray <d.gray@dbgrayengineering.com> wrote:

> Hi John
>
> We are working on a 13-unit apartment building project at 157 Holland Ave.
>
> Please provide the boundary conditions at this location based on the following demands:
>
> Average daily demand: 0.1 L/s.
>
> Maximum daily demand: 0.9 L/s.
>
> Maximum hourly daily demand: 1.4 L/s
>
> Fire Flow demand: 250.0 L/s
>
> Fire Flow + Max Day: 250.9 L/s
>
> Our calculations are attached.
>
> Thanks, Doug

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

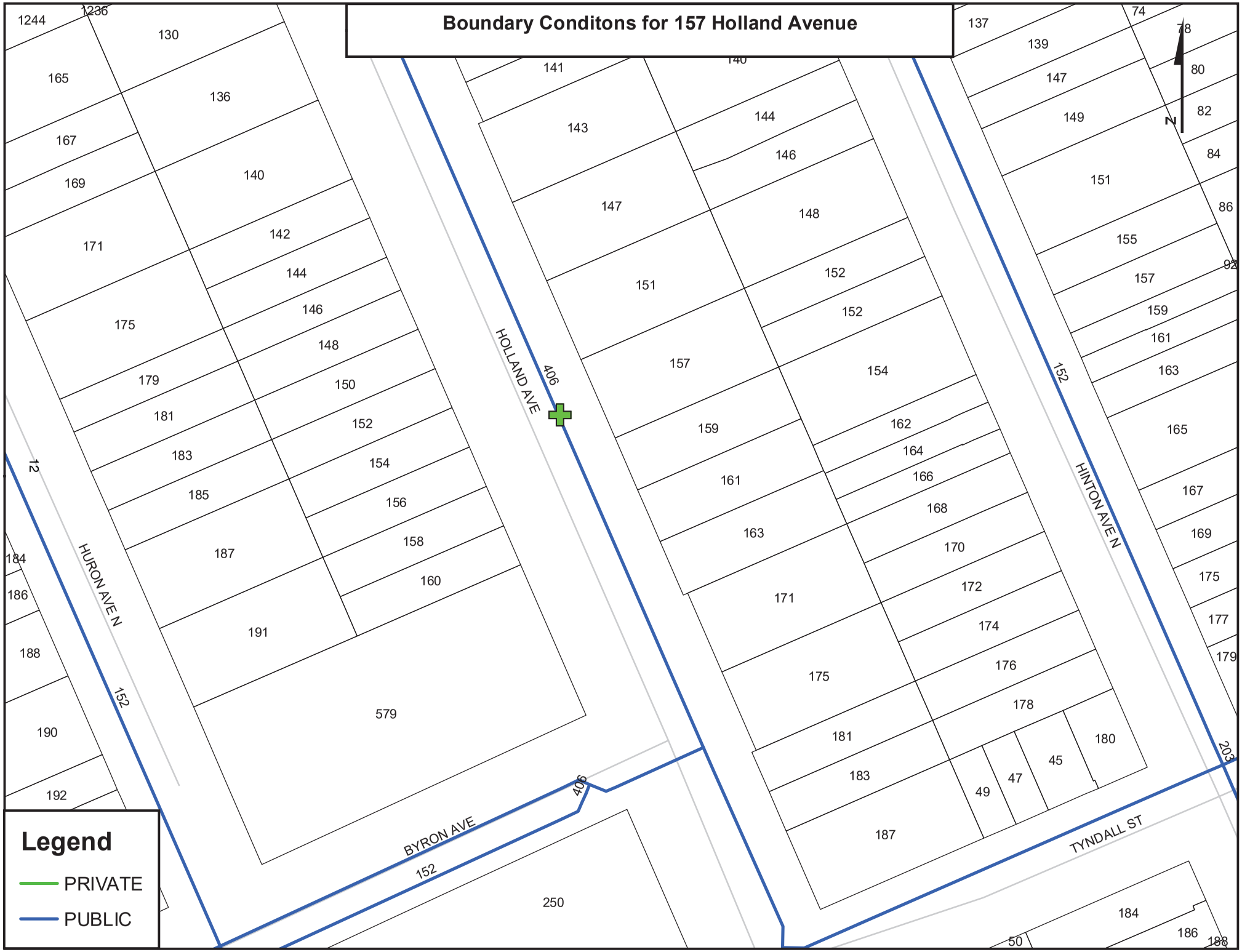
700 Long Point Circle Tel: 613-425-8044

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

'

'

157 Holland Avenue October 2020.pdf
80K



Legend

- PRIVATE
- PUBLIC

157 Holland Avenue

Ottawa, Ontario

Peak Water Demand

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

	No.	F.V.	Total
Bathtub	12	8	96
Tiolet - tank	15	6	90
Tiolet - flush valve	0	24	0
Lavs.	15	1.5	22.5
Bidet	0	2	0
Urinal - wall flush valve	0	10	0
Shower	0	2.5	0
K. Sink	12	1.8	21.6
Dishwasher	12	1.3	15.6
Clothes Washer	4	3	12
Commercial Sink	0	4	0
J. Sink	1	4	4
Commercial Dishwasher	0	4	0
Commercial Washer	0	4	0
Hose 1/2 in	0	5	0
Hose 3/4 in	0	12	0
			261.7

Peak Demand (fig 4-2 or 4-3 AWWA M22)			34	USgpm		
Pressure @ Meter	434	kPa	63	psi		
Pressure Factor (table 4-1 AWWA M22)			1.03			
Peak Demand			35	USgpm		
Irrigation - hose 1/2 in	0		0	USgpm (includes pressure factor)		
TOTAL PEAK DEMAND	132	l/min	35	USgpm	2.2	l/s
		Nominal Size	1.5	in	38	mm
			6.4	ft/s	1.9	m/s

D.B. Gray Engineering Inc.

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

700 Long Point Circle
Ottawa, Ontario

613-425-8044
d.gray@dbgrayengineering.com

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

Project: 157 Holland Avenue
Designed By: D.B.G
October 15, 2020
Page: 1 of 1
n = 0.013

Location		Section								Cumulative		Section			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	Residential		Non-Residential			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	Area (ha)	Flow (L/ha/day)	Peaking Factor	(L/s)	(ha)	(L/s)	(L/s)	(L/s)	Material	(mm)	(mm)	(%)	(m)	(L/s)	(m/s)	Q/Qfull	
		Existing Single Family Dwelling																										
Existing	Existing	1							0.0471	3.4	3.20					0.0471	0.04	0.02	0.05	PVC	101.6	100	1.00	19.9	5.39	0.66	0.01	
Dwelling	600 SAN																											
		Proposed Apartment Building																										
Proposed	Existing					6	3	3	0.0471	24	3.20					0.0471	0.25	0.02	0.26	PVC	152.4	150	1.00	21.2	15.89	0.87	0.02	
Building	600 SAN																											
																					Existing 600 SAN in Holland Avenue							
																					609.6	600	0.47		439.15	1.50		

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

RE: RVCA Stormwater Management Comments - 157 Holland Avenue

1 message

Jamie Batchelor <jamie.batchelor@rvca.ca> Mon, Oct 5, 2020 at 10:13 PM
To: Ryan Faith <r.faith@dbgrayengineering.com>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Hi Ryan,

Based on there being no surface parking spaces proposed, the RVCA would accept that there is no onsite water quality treatment required save and except best management practices.

Jamie Batchelor, MCIP, RPP

Planner, ext. 1191

Jamie.batchelor@rvca.ca

Rideau Valley Conservation Authority

3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
T 613-692-3571 | 1-800-267-3504 F 613-692-0831 | www.rvca.ca

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: Thursday, October 1, 2020 11:55 AM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: RVCA Stormwater Management Comments - 157 Holland Avenue

Hi Jamie,

We are working on a proposed 3 storey apartment building on 471 sq.m of land at 157 Holland Avenue in Ottawa.

Please comment on the stormwater management for the site.

I have attached a site plan for your reference.

Thanks,

Ryan Faith

D.B. Gray Engineering Inc.

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

700 Long Point Circle 613-425-8044
Ottawa, Ontario r.faith@dbgrayengineering.com

STORMWATER MANAGEMENT CALCULATIONS

The orifice calculations are based on the following formula:

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

where:

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

Flow control roof drain calculations are based on the following formula:

$$Q = N \times S \times d \times F$$

where:

Q = flowrate in litres per second
N = number of roof drains
S = slots per weir
d = pond depth at roof drain in mm
F = flowrate through each slot
0.0124 litres per second per mm pond depth (5 USgpm per inch)

Storage calculations on the roof is based on the following formula for volume of a cone:

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

where:

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

Summary Tables

ONE HUNDRED YEAR EVENT					
Drainage Area	Pre-development Flow Rate (L/s)	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)	-	-	4.61	-	-
AREA II (Roof)	-	-	3.24	6.07	6.07
TOTAL	21.74	6.82	7.85	6.07	6.07

FIVE YEAR EVENT					
Drainage Area	Pre-development Flow Rate (L/s)	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)	-	-	2.28	-	-
AREA II (Roof)	-	-	2.41	2.51	2.51
TOTAL	11.39	6.82	4.70	2.51	2.51

157 Holland Avenue
Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Rational Method

PRE-DEVELOPMENT CONDITIONS

100-Year Release Rate

			C
Roof Area:	163	sq.m	1.00
Asphalt/Concrete Area:	264	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	44	sq.m	0.25
Total Catchment Area:	471	sq.m	0.93

Bransby William Formula

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

Sheet Flow Distance (L):	30	m
Slope of Land (Sw):	2	%
Area (A):	0.0471	ha
Time of Concentration (Sheet Flow):	2.0	min
Area (A):	471	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
Runoff Coeficient (C):	0.93	
100 Year Pre-Development Release Rate (2.78AiC):	21.74	L/s

5-Year Release Rate

			C
Roof Area:	163	sq.m	0.90
Asphalt/Concrete Area:	264	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	44	sq.m	0.20
Total Catchment Area:	471	sq.m	0.83

Area (A):	471	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	104	mm/hr
Runoff Coeficient (C):	0.83	
5 Year Pre-Development Release Rate (2.78AiC):	11.39	L/s

Maximum Allowable Release Rate

Area (A):	471	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	(5 year event)
Runoff Coeficient (C):	0.50		
100 Year Maximum Allowable Release Rate (2.78AiC):	6.82	L/s	

ONE HUNDRED YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(ONE HUNDRED-YEAR EVENT)

			C
Roof Area:	21	sq.m	1.00
Asphalt/Concrete Area:	24	sq.m	1.00
Permeable Pavers Area:	29	sq.m	0.375
Landscaped Area:	148	sq.m	0.25
Total Catchment Area:	222	sq.m	0.42
Area (A):	222	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.42		
Release Rate (2.78AiC):	4.61	L/s	

DRAINAGE AREA II (Roof)

(ONE HUNDRED-YEAR EVENT)

			C
Roof Area:	249	sq.m	1.00
Asphalt/Concrete Area:	0	sq.m	1.00
Permeable Pavers Area:	0	sq.m	0.375
Landscaped Area:	0	sq.m	0.25
Total Catchment Area:	249	sq.m	1.00

No. of Roof Drains: 2

Slots per Wier: 1 0.0124 L/s/mm/slot (5 USGPM/in/slot)

Depth at Roof Drain: 131 mm

Maximum Release Rate: 3.24 L/s Pond Area: 139 sq.m

Achieved Volume: 6.07 cu.m

Maximum Volume Required: 6.07 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	16.80	3.24	13.56	4.07
10	179	12.36	3.24	9.12	5.47
15	143	9.89	3.24	6.65	5.99
20	120	8.30	3.24	5.06	6.07
25	104	7.19	3.24	3.95	5.92
30	92	6.36	3.24	3.12	5.61
35	83	5.72	3.24	2.48	5.20
40	75	5.20	3.24	1.96	4.71
45	69	4.78	3.24	1.54	4.16
50	64	4.43	3.24	1.19	3.56
55	60	4.13	3.24	0.89	2.92
60	56	3.87	3.24	0.63	2.26
65	53	3.64	3.24	0.40	1.57
70	50	3.45	3.24	0.21	0.86
75	47	3.27	3.24	0.03	0.14
80	45	3.11	3.11	0.00	0.00
85	43	2.97	2.97	0.00	0.00
90	41	2.85	2.85	0.00	0.00

FIVE YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(FIVE-YEAR EVENT)

			C
Roof Area:	21	sq.m	0.90
Asphalt/Concrete Area:	24	sq.m	0.90
Permeable Pavers Area:	29	sq.m	0.30
Landscaped Area:	148	sq.m	0.20
Total Catchment Area:	222	sq.m	0.35
Area (A):	222	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.35		
Release Rate (2.78AiC):	2.28	L/s	

DRAINAGE AREA II (Roof)

(FIVE-YEAR EVENT)

			C
Roof Area:	249	sq.m	0.90
Asphalt/Concrete Area:	0	sq.m	0.90
Permeable Pavers Area:	0	sq.m	0.30
Landscaped Area:	0	sq.m	0.20
Total Catchment Area:	249	sq.m	0.90

No. of Roof Drains: 2

Slots per Wier: 1 0.0124 L/s/mm/slot (5 USGPM/in/slot)

Depth at Roof Drain: 97 mm

Maximum Release Rate: 2.41 L/s

Pond Area: 77 sq.m

Achieved Volume: 2.51 cu.m

Maximum Volume Required: 2.51 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	141	8.80	2.41	6.38	1.91
10	104	6.49	2.41	4.08	2.45
15	84	5.21	2.41	2.79	2.51
20	70	4.38	2.41	1.96	2.35
25	61	3.79	2.41	1.38	2.07
30	54	3.36	2.41	0.95	1.70
35	49	3.02	2.41	0.61	1.28
40	44	2.75	2.41	0.34	0.81
45	41	2.53	2.41	0.12	0.31
50	38	2.35	2.35	0.00	0.00
55	35	2.19	2.19	0.00	0.00
60	33	2.05	2.05	0.00	0.00
65	31	1.93	1.93	0.00	0.00
70	29	1.83	1.83	0.00	0.00
75	28	1.74	1.74	0.00	0.00
80	27	1.65	1.65	0.00	0.00
85	25	1.58	1.58	0.00	0.00
90	24	1.51	1.51	0.00	0.00

STORM SEWER DESIGN FORM

Rational Method

FIVE YEAR EVENT

Q = 2.78 A i C

October 19, 2020

n = 0.013

Location		Areas (ha)									Pipe Data									Notes
		Hard	Gravel	Landscape	Roof	Individual	Accum.	Time of Conc.	Rainfall Intensity i	Peak Flow Q		Actual Diameter	Nominal Diameter	Slope	Length	Capacity	Velocity	Time of Flow	Ratio	
From	To	C = 0.9	C = 0.7	C = 0.2	C = 0.9	2.78AC	2.78AC	(min)	(mm/hr)	(L/s)	Material	(mm)	(mm)	(%)	(m)	(L/s)	(m/s)	(min)	Q/Qfull	
Roof Drains	Existing 1650 ST				0.0249	0.0623	0.0623	10.00	104	6.49	PVC	152.4	150	1.00	15.0	15.9	0.87	0.29	0.41	
										2.45	PVC	152.4	150	1.00	15.0	15.9	0.87	0.29	0.15	Through flow control RD
												Existing 1650 ST in Holland Avenue								
												1677.0	1650	0.33		5467.5	2.48			

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-4

Plan showing the site and location of all existing services: see drawings C-1 to C-4

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-4

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-4

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-3

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

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

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

Development Servicing Report: Water

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

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

Identification of system constraints: see page 2 of Servicing Brief

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

Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow locations throughout the development: see page 2 & 7 of Servicing Brief

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

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

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

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

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

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

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

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

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

Development Servicing Report: Wastewater

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

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

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

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

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

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

Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix C) format. see page 9 of Servicing Brief

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

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

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

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

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

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

Development Servicing Report: Stormwater Checklist

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

Analysis of available capacity in existing public infrastructure. not applicable

A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern: see drawing C-1 & C-2

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

into account long-term cumulative effects: see Stormwater Management Report Servicing Brief and Stormwater Management Report

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

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

Watercourse and hazard lands setbacks: not applicable

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

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

Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period). see drawings C-1 to C-4 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-4 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 2.5 on drawing C-3

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: not applicable

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 5 & 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