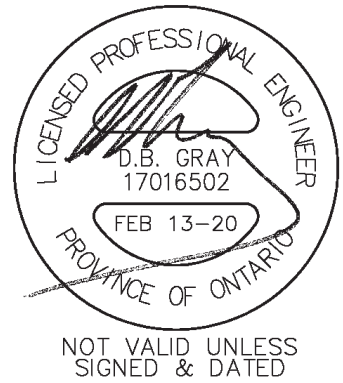
SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

1243 Teron Road
Ottawa, Ontario

Report No. 19057

February 13, 2020



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SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

1243 Teron Road
Ottawa, Ontario

This report describes the services and addresses the stormwater management requirements of a 1.98 hectare property that will be severed from a property with the municipal address of 1243 Teron Road in Kanata, Ottawa. The property is currently vacant. A 9,281 sq.m. one-storey office / warehouse building is proposed.

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

WATER SUPPLY FOR FIREFIGHTING:

There is an existing fire hydrant in the municipal road right-of-way located about 16 m west of the proposed entrance. The proposed building will have a sprinkler system. An on-site private fire hydrant is proposed to be located approximately 23 m unobstructed distance to the proposed fire department connection, less than the required minimum 45 m. The on-site hydrant will connect to a proposed private 250mm watermain which will connect to an existing 300 mm high pressure municipal watermain in Teron Road.

A fire flow of 233.3 L/s (14,000 L/min) is required, as calculated as per the Fire Underwriter Survey "Water Supply For Fire Protection".

A model was created using EPANET software to analyze the hydraulics of the proposed 250mm private watermain. Using the 121.5 m HGL boundary condition provided by the City (which was based on a 237.5 L/s flowrate (Max day (4.0 L/s) + Fire Flow (233.3 L/s)), and using these flowrates, the pressure at the hydrant was determined to be 211 kPa (30.6 psi). Since the pressure is above 138 kPa (20 psi) there will be an adequate water supply for firefighting.

WATER SERVICE:

As previously mentioned the proposed building will have a sprinkler system. To service the sprinkler system, a 150 mm water service, connecting to the private 250mm watermain, is proposed. (Also as previously mentioned the private 250mm watermain will connect to an existing 300 mm municipal watermain in Teron Road.) The 150mm service will be adequate for the domestic demand.

Based on the City of Ottawa Design Guidelines the daily average consumption rate for a light industrial development is 35,000 litres per day per hectare. The maximum daily peaking factors is 1.5 of the daily average demand and maximum hourly peaking factor

is 1.8 of the maximum daily demand. Based on this rate and peaking factors, and assuming an eight hour day, the maximum daily demand is calculated to be 2.7 L/s. Based on the peaking factors the maximum daily demand is 4.0 L/s and maximum hourly demand is 7.2 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. In summary, we requested the boundary conditions for the subject area based on the following:

Average Daily Demand: 2.7 L/s.
Maximum Daily Demand: 4.0 L/s.
Maximum Hourly Demand: 7.2 L/s
Fire Flow Demand: 233.3 L/s
Maximum Daily + Fire Flow Demand: 237.3 L/s

Based on the boundary conditions received from the city, the minimum HGL (hydraulic grade line) is 126.9 m and the maximum is 130.7 m. With these HGLs the water pressure at the water meter is calculated to vary from 397 kPa to 435 kPa (58 to 63 psi). This is an acceptable range of water pressures in the municipal watermain for the proposed development.

SANITARY SERVICE:

Based on the City of Ottawa Sewer Design Guidelines for a light industrial property (35,000 L/ha/day; 5.75 peaking factor (based on Appendix 4-B.1); and a 0.33 L/s/ha infiltration flow) the post development flow is calculated to be 5.82 L/s. This flow will be adequately handled by the proposed sanitary sewer service connection (200mm at 2.0% - 48.4 L/s capacity and 200mm at 0.32% - 19.4 L/s capacity), since at the design flow it will only be 12% to 30% full.

The proposed 200mm sanitary service will connect to an existing 200mm municipal sanitary sewer (at a proposed manhole) which, with a 0.41% slope, has a capacity of 21.9 L/s. The 5.82 L/s in sanitary flows contributing to the existing 200mm municipal sanitary sewer is expected to have an acceptable impact given its capacity.

STORMWATER MANAGEMENT:

Water Quality:

The Mississippi Valley Conservation Authority (MVCA) has been contacted to determine if permanent on-site quality control measures are required. They have not yet responded.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-2 and notes 2.1 to 2.8 on drawing C-4). In summary: to filter out construction sediment; a silt fence barrier will be installed at the perimeter of the site where runoff will drain onto adjacent properties; a straw bale flow check will be installed at the outlet from the stormwater detention area; a sediment capture filter sock inserts will be installed in all new catch basins as they are installed; a geotextile fabric mud mats will be install at the point of egress onto public roads; and any material deposited on a public road will be removed at the end of each day.

Water Quantity:

The stormwater quantity control measures detailed in this report are based on the following criteria: The post development release rate for the 5 and 100-year storm events shall be controlled to equal to or less than the flow produced by the pre-development (existing) conditions.

Calculations are based on the Rational Method. The runoff coefficients for the 100 year event are increased by 25% to maximum 1.00.

It is calculated that the pre-development conditions reflect a 5-year runoff coefficient of 0.20 and 0.25 for the 100-year. Using the Airport Formula for sheet flow, it is calculated that the existing time of concentration is 25 minutes for the 5-year event and 24 minutes for the 100-year. Using the Rational Method; the pre-development (existing) 5-year peak flow is 67.01 L/s and 147.30 L/s for the 100-year. Therefore the maximum allowable release rate is 67.01 L/s and 148.30 L/s for the 5 and 100-year respectively.

Stormwater will be stored within the development on the roof and on the surface in a stormwater detention (depressed grassed area) located in the front yard of the proposed development.

Drainage Area I
(Uncontrolled Flow Off Site – 1126 sq.m.):
The runoff from the perimeter of the site will be allowed to flow uncontrolled off the site. The flow from is calculated at 10 minutes concentration.

	100-year	5-year
Maximum flow rate:	13.97 L/s	6.52 L/s

Drainage Area II (Roof – 9,281 sq.m.):
All 42 roof drains 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): Watts roof drain with a Watts Accutrol Weir RD-100-A1 or equal. The roof drain will be installed at the low point of the roof which will be 145mm lower than the perimeter of the roof. Thirty-six scuppers, each 750mm wide and installed 145 mm above the roof drains, are required so that the maximum depth of water on the roof cannot exceed 150 mm as per the Ontario Building Code.

	100-year	5-year
The maximum release rate:	66.99 L/s	3.79 L/s
The maximum ponding depth:	129 mm	98 mm
The maximum stored volume:	306.75 cu.m.	135.57 cu.m.

Drainage Area II (9,404 sq.m.):
During five-year event an inlet control device (ICD) located in the inlet of the culvert for the stormwater detention area will control the release of stormwater from the property. During the one hundred-year event, in addition to the ICD, a retaining wall will act as 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 into the detention area. The top of the lower section of the wall will be at the 100-year elevation and 25.0 m long and will release 70.20 L/s. The ICD shall be a plug style with a round orifice design manufactured by Pedro Plastics (or approved equal manufactured by IPEX) and shall be sized by the manufacturer for a discharge rate of 64.23 L/s at 0.94 m head. It is calculated that an orifice area of 24,506 sq.mm. (±177 mm diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 64.23 L/s at a head of 0.94 m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 60.49 l/s at 0.83 m.

	100-year	5-year
The maximum ICD release rate:	64.23 L/s	60.49 L/s
The maximum weir release rate:	70.10 L/s	0.00 L/s
The maximum release rate:	134.33 L/s	60.49 L/s
The maximum ponding elevation:	81.77 m	81.66 m
The maximum ponding depth:	0.96 m	0.85 m
The maximum stored volume:	240.11 cu.m.	205.69 cu.m.

The Entire Site:

	100-year	5-year
Maximum allowable release rate:	148.30 L/s	67.01 L/s
Maximum release rate:	148.30 L/s	67.01 L/s
Maximum stored volume:	546.86 cu.m.	341.26 cu.m.

Therefore, the maximum post-development release rates for both the 5-year and 100-year storm events are equal to the maximum allowable.

Stormwater released through the ICD and weir will be conveyed off the site to the Teron Road roadside ditch. An existing culvert crossing Teron Road conveys the stormwater to the roadside ditch on the opposite side of the road where it appears to drain north to March Road. (A topographic survey has been ordered and is expected to confirm.)

The unrestricted flowrate resulting from one in five-year storm event will produce a peak flow of 162.9 L/s which will be adequately by the proposed storm sewer system with the last pipe segment (450mm at 0.31% - 165.6 L/s capacity) being at 98% of its capacity.

CONCLUSIONS:

1. An on-site fire hydrant is proposed to be located approximately 23 m unobstructed distance to the proposed fire department connection, less than the required minimum 45 m.

2. There is an adequate water supply for firefighting from the proposed on-site private fire hydrant.

3. The proposed water service connection is adequately sized to serve the development.

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

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

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

7. The Mississippi Valley Conservation Authority (MVCA) has been contacted to determine if permanent on-site quality control measures are required.

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

9. The maximum post-development release rate for both the 5-year and 100-year storm event are equal to the maximum allowable. To achieve the maximum release rates the maximum required stored volume is 546.86 cu.m. for the 100-year event and is 341.26 cu.m. for the 5-year event.

10. The unrestricted flowrate resulting from one in five-year storm event will produce a peak flow that will be adequately handled by the proposed storm sewer system.

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14-Nov-19

1243 Teron Road
Ottawa, Ontario

Fire Flow Requirements

Proposed 1 Storey Warehouse Building

Fire flow requirement as calculated as per Fire Underwriter 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	Ground Floor	9281	sq.m.
	TOTAL FIRE AREA:	9281	sq.m.

F = 16,955 L/min
= 17,000 L/min (rounded off to the nearest 1,000 L/min)

15% Charge for Free-burning Occupancy

= 19,550 L/min

40% Reduction for Sprinkler System

= 7,820 L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Constuction	Length m	Storeys	Factor
13%	North	10.1 to 20m	N.C.	18	2	36
0%	East	>45m				0
0%	South	>45m				0
0%	West	>45m				0
13%	Total Increase for Exposure (maximum 75%)					

= 2,542 L/min Increase

= 14,272 L/min
F = 14,000 L/min (rounded off to the nearest 1,000 L/min)
= 233.3 L/s

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15-Nov-19
REVISED 26-Nov-19

1243 Teron Road
Ottawa, Ontario

Water Demand

DAILY AVERAGE

LIGHT INDUSTRIAL:	35,000	L /gross ha / day (as per Ottawa Design Guidelines)				
	2.19	ha (land area)				
	76650	L / day				
	8	hour day				
	159.7	L/min	2.7	l/s	42.2	USgpm

MAXIMUM DAILY DEMAND	1.5	(Peaking Factor as per Ottawa Design Guidelines)				
	239.5	L/min	4.0	l/s	63.3	USgpm

MAXIMUM HOURLY DEMAND	1.8	(Peaking Factor as per Ottawa Design Guidelines)				
	431.2	L/min	7.2	l/s	113.9	USgpm

Elevation of Water Meter:	86.36	m ASL				
Finish Floor Elevation:	85.46	m ASL				
			Static Pressure at Water Meter			
MAXIMUM HGL:	130.7	m ASL	63	psi	435	kPa
MINIMUM HGL:	126.9	m ASL	58	psi	397	kPa

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

RE: 1243 Teron Rd

1 message

Kuruvilla, Santhosh <Santhosh.Kuruvilla@ottawa.ca> Tue, Nov 26, 2019 at 9:31 AM
To: Douglas Gray <d.gray@dbgrayengineering.com>
Cc: Caoimhin Kennedy <c.kennedy@dbgrayengineering.com>

Hi Doug,

Please find attached the boundary conditions for the subject application.

Thanks,

Santhosh

From: Douglas Gray <d.gray@dbgrayengineering.com>
Sent: November 15, 2019 5:11 PM
To: Kuruvilla, Santhosh <Santhosh.Kuruvilla@ottawa.ca>
Cc: Caoimhin Kennedy <c.kennedy@dbgrayengineering.com>
Subject: 1243 Teron Rd

Hi Santhosh

We are working on a warehouse building at 1243 Teron Rd.

Please provide the boundary conditions at this location. We have calculated the following expected demands:

Average daily demand: 2.7 L/s.

Maximum daily demand: 4.0 L/s.

Maximum hourly daily demand: 7.2 L/s 9

Fire Flow demand: 233.3 L/s

Fire Flow + Max Day: 237.3 L/s

Calculations are attached. A sketch showing the approximate location of the proposed water service is also attached.

Thanks, Doug

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

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'

'

1243 Teron Rd _Boundary Conditions_25Nov2019.docx
1050K

Boundary Conditions - 1243 Terron Road

Provided Information:

Date Provided November-19

Scenario	Demand	
	L/min	L/s
Average Daily Demand	162	2.7
Maximum Daily Demand	240	4.0
Peak Hour	432	7.2
Fire Flow Demand	14,238	237.3

Location:

Results:

Connection 1 - Terron Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.7	67.4
Peak Hour	126.9	62.2
Max Day plus Fire	121.5	54.4

[1] Ground Elevation = 83.2m

Notes:

1. A second connection is required for this commercial building as the basic day demand is greater than 50 m^3/d (0.6 L/s).

Disclaimer

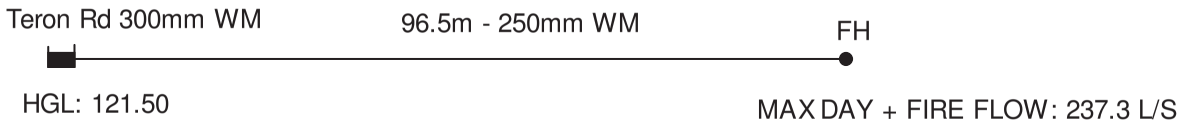
The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary 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.

1243 Teron Road
(Kanata) Ottawa, Ontario

EPANET HYDRAULIC MODELLING RESULTS

Node ID	Demand	Head	Elevation	Pressure		
	L/s	m	m	m	psi	kPa
1 Reservoir 1 (300 WM - Teron Rd)	-237.30	121.50	82.61	38.89	55.3	381
2 Proposed FH	237.30	106.56	85.02	21.54	30.6	211

Link ID	Diameter	Length	Roughness	Loss Coeff.	Flow	Velocity
	mm	m			L/s	m/s
Pipe 1	250	96.5	110	4.00	237.30	4.83


Teron Rd 300mm WM
96.5m - 250mm WM
FH
HGL: 121.50
MAX DAY + FIRE FLOW: 237.3 L/S

Network Table - Nodes

Node ID	Elevation m	Base Demand LPS	Demand LPS	Head m	Pressure m
Junc 2	85.02	237.3	237.30	106.56	21.54
Resvr 1	121.50	#N/A	-237.30	121.50	0.00

Network Table - Links

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s
Pipe 1	96.5	250	110	237.30	4.83

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SANITARY SEWER DESIGN FORM

Average Daily Flows:

Residential:	280	l / capita / day
Commercial:	28,000	l / ha / day
Institutional:	28,000	l / ha / day
Light Industrial:	35,000	l / ha / day
Heavy Industrial:	55,000	l / ha / day

Infiltration Allowance: 0.33 l / s / ha

Peaking Factor:

Residential (Harmon Equation): $P.F. = 1 + \frac{14}{4 + P^{0.5}}$

P = Population / 1000

Harmon Correction Factor	0.8	
Commercial & Institutional:	1.5	If contrinbution > 20%
Commercial & Institutional:	1.0	If contrinbution < 20%

Industrial: As per Ottawa Guidelines Appendix 4-B

PROJECT: 1243 Teron Road

Designed By: D.B.G.

26-Nov-19

LOCATION			Section								Cumulative Residential		Section Non-Residential			Cumulative					SEWER DATA								COMMENTS
			Single Family	Semi/Townhouse	Duplex / Triplex	Apartments (average)	Apartments (1 Bed.)	Apartments (2 Bed.)	Apartments (3 Bed.)	Residential Area	Pop.	Peaking Factor	Area	Flow	Peaking Factor	Flow	Area	Sewage Flow	Infiltration Flow	Total Flow			n =	0.013					
STREET	FROM	TO	ppu = 3.4	ppu = 2.7	ppu = 2.3	ppu = 1.8	ppu = 1.4	ppu = 2.1	ppu = 3.1												Type of Pipe	Dia. Actual	Dia. Nom.	Slope	Length	Capacity	Velocity	Ratio	
			No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	ha			ha	l/ha/day		l/s	ha	l/s	l/s	l/s		(mm)	(mm)	(%)	(m)	(l/s)	(m/s)	Q/Qfull	
	BLDG	MH-SA.1									0	3.2	2.19	35000	5.75	5.10	2.19	5.10	0.72	5.82	PVC	203.2	200	2.0	20.1	48.4	1.49	0.12	Peaking Factor as per City Guidelines Appendix 4-B.1
	MH-SA.1	MH-SA.2									0					5.10	2.19	5.10	0.72	5.82	PVC	203.2	200	0.32	18.0	19.4	0.60	0.30	
																					SANITARY SEWER IN TERON RD								
																						203.2	200	0.41		21.9	0.68		

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 area are based on the following formula for volume of a cone:

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

where:

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

Storage calculations for the stormwater detention area are based on the following formula for volume of a prismodal shape (the formula is accurate if both length and width are changing proportionally):

$$V = (A_{top} + A_{bottom} + (A_{top} \times A_{bottom}))^{0.5}) / 3 \times d$$

where:

V = volume in cu.m.
A_{top} = area of pond in sq.m.
A_{bottom} = area of bottom of depressed area
d = ponding depth in meters

Summary Tables

ONE HUNDRED YEAR EVENT				
Drainage Area	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	13.97	-	-
AREA II (Roof)	-	66.99	306.75	306.75
AREA III	-	134.33	240.11	240.11
TOTAL	148.30	148.30	546.86	546.86

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)	-	6.52	-	-
AREA II (Roof)	-	51.03	135.57	135.57
AREA III	-	60.49	205.69	205.69
TOTAL	67.01	67.01	341.26	341.26

1243 Teron Road

Ottawa, Ontario

STORM WATER MANAGEMENT CALCULATIONS
Rational Method

ONE HUNDRED YEAR EVENT

Pre-Development Conditions

Roof Area:	0	sq.m	1.00	
Asphalt/Concrete Area:	0	sq.m	1.00	
Gravel Area:	0	sq.m	0.875	Table 5.7 x 125%
Pasture / Woodland - Sandy Loam / Clay Silt Loam:	19811	sq.m	0.25	City Sewer Guidelines
Total Catchment Area:	19811	sq.m	0.25	

Airport Formula

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

Runoff Coefficient (C):	0.25	see above
Sheet Flow Distance (L):	167	m
Slope of Land (Sw):	4	%
Time of Concentration (Sheet Flow):	24	min
Area (A):	19811	sq.m
Time of Concentration:	23.6	min
Rainfall Intensity (i):	108	mm/hr (100-year event)
Runoff Coeficient (C):	0.25	
100 Year Maximum Allowable Release Rate (2.78AiC):	148.30	L/s

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(ONE HUNDRED YEAR EVENT)

Roof Area:	0	sq.m	1.00
Asphalt/Concrete Area:	0	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	1126	sq.m	0.25
Total Catchment Area:	1126	sq.m	0.25
Area (A):	1126	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.25		
Flow Rate (2.78AiC):	13.97	L/s	

DRAINAGE AREA II (Roof)

(ONE HUNDRED YEAR EVENT)

Roof Area:	9281	sq.m	1.00
Asphalt/Concrete Area:	0	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	0	sq.m	0.25
Total Catchment Area:	9281	sq.m	1.00

No. of Roof Drains: 42

Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 129 mm

Maximum Release Rate: 66.99 L/s

Pond Area: 7154 sq.m

Achieved Volume: 306.75 cu.m

Maximum Volume Required: 306.75 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	626.20	66.99	559.21	167.76
10	179	460.70	66.99	393.71	236.23
15	143	368.68	66.99	301.69	271.52
20	120	309.49	66.99	242.50	290.99
25	104	267.94	66.99	200.95	301.42
30	92	237.03	66.99	170.04	306.07
35	83	213.06	66.99	146.07	306.75
40	75	193.88	66.99	126.89	304.54
45	69	178.16	66.99	111.17	300.15
50	64	165.01	66.99	98.02	294.06
55	60	153.84	66.99	86.85	286.59
60	56	144.21	66.99	77.22	278.01
65	53	135.83	66.99	68.84	268.49
70	50	128.46	66.99	61.47	258.18
75	47	121.92	66.99	54.93	247.20
80	45	116.08	66.99	49.09	235.64
85	43	110.83	66.99	43.84	223.56
90	41	106.07	66.99	39.08	211.03
95	39	101.75	66.99	34.76	198.11
100	38	97.79	66.99	30.80	184.82
105	36	94.17	66.99	27.18	171.21
110	35	90.83	66.99	23.84	157.32
115	34	87.74	66.99	20.75	143.15
120	33	84.87	66.99	17.88	128.75
125	32	82.21	66.99	15.22	114.12
130	31	79.72	66.99	12.73	99.30
135	30	77.40	66.99	10.40	84.28
140	29	75.22	66.99	8.22	69.09
145	28	73.17	66.99	6.18	53.74
150	28	71.24	66.99	4.25	38.23
180	24	61.67	61.67	0.00	0.00
210	21	54.56	54.56	0.00	0.00
240	19	49.04	49.04	0.00	0.00
270	17	44.62	44.62	0.00	0.00
300	16	41.00	41.00	0.00	0.00

DRAINAGE AREA III

(ONE HUNDRED YEAR EVENT)

Roof Area:	0	sq.m	1.00
Asphalt/Concrete Area:	7345	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	2059	sq.m	0.25
Total Catchment Area:	9404	sq.m	0.84

Water Elevation:	81.77	m
Invert of Culvert Inlet:	80.74	m
Centroid of ICD Orifice:	80.83	m
Head:	0.94	m
Orifice Diameter:	177	mm
Orifice Area:	24506	sq.mm
Coefficient of Discharge:	0.61	
Maximum ICD Release Rate:	64.23	L/s
Maximum Weir Release Rate:	70.10	L/s
Total Maximum Release Rate:	134.33	L/s

70.0974557

Stormwater Detention Area

Top Area (sq.m)	Avg. Depth (m)	Volume	
334	0.96	240.11	cu.m
	Achieved Volume:	240.11	cu.m
	Maximum Volume Required:	240.11	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Flow from Roof (L/s)	TOTAL Inflow (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	530.31	66.99	597.30	64.23	0.00	64.23	533.07	159.92
10	179	390.15	66.99	457.14	64.23	0.00	64.23	392.91	235.75
15	143	312.23	66.99	379.22	64.23	48.19	112.43	266.79	240.11
20	120	262.09	66.99	329.08	64.23	64.76	128.99	200.09	240.11
25	104	226.91	66.99	293.90	64.23	69.59	133.82	160.07	240.11
30	92	200.73	66.99	267.72	64.23	70.10	134.33	133.39	240.11
35	83	180.44	66.99	247.43	64.23	68.86	133.09	114.34	240.11
40	75	164.19	66.99	231.18	64.23	66.91	131.14	100.05	240.11
45	69	150.88	66.99	217.87	64.23	64.71	128.94	88.93	240.11
50	64	139.74	66.99	206.73	64.23	62.46	126.69	80.04	240.11
55	60	130.28	66.99	197.27	64.23	60.28	124.51	72.76	240.11
60	56	122.13	66.99	189.12	64.23	58.19	122.42	66.70	240.11
65	53	115.03	66.99	182.02	64.23	56.23	120.46	61.57	240.11
70	50	108.79	66.99	175.78	64.23	54.38	118.61	57.17	240.11
75	47	103.25	66.99	170.24	64.23	52.66	116.89	53.36	240.11
80	45	98.31	66.99	165.30	64.23	51.04	115.27	50.02	240.11
85	43	93.85	66.99	160.85	64.23	49.53	113.77	47.08	240.11
90	41	89.83	66.99	156.82	64.23	48.12	112.35	44.46	240.11
95	39	86.17	66.99	153.16	64.23	46.80	111.03	42.12	240.11
100	38	82.82	66.99	149.81	64.23	45.56	109.79	40.02	240.11
105	36	79.75	66.99	146.74	64.23	44.39	108.63	38.11	240.11
110	35	76.92	66.99	143.91	64.23	43.30	107.53	36.38	240.11
115	34	74.30	66.99	141.29	64.23	42.26	106.49	34.80	240.11
120	33	71.88	66.99	138.87	64.23	41.29	105.52	33.35	240.11
125	32	69.62	66.99	136.61	64.23	40.36	104.59	32.01	240.11
130	31	67.51	66.99	134.50	64.23	39.49	103.72	30.78	240.11
135	30	65.54	66.99	132.53	64.23	38.66	102.89	29.64	240.11
140	29	63.70	66.99	130.69	64.23	37.87	102.10	28.58	240.11
145	28	61.96	66.99	128.95	64.23	37.12	101.35	27.60	240.11
150	28	60.33	66.99	127.32	64.23	36.41	100.64	26.68	240.11
180	24	52.23	61.67	113.90	64.23	27.43	91.67	22.23	240.11
210	21	46.20	54.56	100.76	64.23	17.47	81.70	19.06	240.11
240	19	41.53	49.04	90.56	64.23	9.66	73.89	16.67	240.11
270	17	37.79	44.62	82.41	64.23	3.36	67.59	14.82	240.11
300	16	34.72	41.00	75.72	64.23	0.00	64.23	11.49	206.88

FIVE YEAR EVENT

Pre-Development Conditions

Roof Area:	0	sq.m	0.90	
Asphalt/Concrete Area:	0	sq.m	0.90	
Gravel Area:	0	sq.m	0.70	Table 5.7
Pasture / Woodland - Sandy Loam / Clay Silt Loam:	19811	sq.m	0.20	City Sewer Guidelines
Total Catchment Area:	19811	sq.m	0.20	

Airport Formula

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

Runoff Coefficient (C):	0.20	see above
Sheet Flow Distance (L):	166.5	m
Slope of Land (Sw):	4	%
Time of Concentration (Sheet Flow):	25.0	min
Area (A):	19811	sq.m
Time of Concentration:	25	min
Rainfall Intensity (i):	61	mm/hr
Runoff Coeficient (C):	0.20	
5 Year Maximum Allowable Release Rate (2.78AiC):	67.01	L/s

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(FIVE YEAR EVENT)

Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	0	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	1126	sq.m	0.20
Total Catchment Area:	1126	sq.m	0.20

Area (A):	1126	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	104	mm/hr (5-year event)
Runoff Coeficient (C):	0.20	
Flow Rate (2.78AiC):	6.52	L/s

DRAINAGE AREA II (Roof)

(FIVE YEAR EVENT)

Roof Area:	9281	sq.m	0.90
Asphalt/Concrete Area:	0	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	0	sq.m	0.20
Total Catchment Area:	9281	sq.m	0.90

No. of Roof Drains: 42

Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 98 mm

Maximum Release Rate: 51.03 L/s

Pond Area: 4151 sq.m

Achieved Volume: 135.57 cu.m

Maximum Volume Required: 135.57 cu.m

Time	i	2.78AiC	Release Rate	Stored Rate	Stored Volume
min.	mm/hr	L/s	L/s	L/s	cu.m
5	141	327.83	51.03	276.80	83.04
10	104	241.95	51.03	190.92	114.55
15	84	194.03	51.03	143.00	128.70
20	70	163.13	51.03	112.10	134.52
25	61	141.41	51.03	90.38	135.57
30	54	125.23	51.03	74.20	133.56
35	49	112.66	51.03	61.64	129.43
40	44	102.60	51.03	51.57	123.78
45	41	94.34	51.03	43.32	116.95
50	38	87.43	51.03	36.41	109.22
55	35	81.56	51.03	30.53	100.76
60	33	76.50	51.03	25.47	91.69
65	31	72.09	51.03	21.06	82.13
70	29	68.20	51.03	17.18	72.14
75	28	64.76	51.03	13.73	61.79
80	27	61.68	51.03	10.65	51.13
85	25	58.91	51.03	7.88	40.19
90	24	56.40	51.03	5.37	29.01
95	23	54.12	51.03	3.09	17.61
100	22	52.03	51.03	1.00	6.02
105	22	50.12	50.12	0.00	0.00
110	21	48.35	48.35	0.00	0.00
115	20	46.72	46.72	0.00	0.00
120	19	45.21	45.21	0.00	0.00
125	19	43.80	43.80	0.00	0.00
130	18	42.48	42.48	0.00	0.00
135	18	41.25	41.25	0.00	0.00
140	17	40.10	40.10	0.00	0.00
145	17	39.02	39.02	0.00	0.00
150	16	37.99	37.99	0.00	0.00
180	14	32.93	32.93	0.00	0.00
210	13	29.15	29.15	0.00	0.00
240	11	26.23	26.23	0.00	0.00
270	10	23.88	23.88	0.00	0.00
300	9	21.96	21.96	0.00	0.00

DRAINAGE AREA III

(FIVE YEAR EVENT)

Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	7345	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	2059	sq.m	0.20
Total Catchment Area:	9404	sq.m	0.75

Water Elevation:	81.66	m
Invert of Culvert Inlet:	80.74	m
Centroid of ICD Orifice:	80.83	m
Head:	0.83	m
Orifice Diameter:	177	mm
Orifice Area:	24506	sq.mm
Coefficient of Discharge:	0.61	
Maximum ICD Release Rate:	60.49	L/s
Maximum Weir Release Rate:	0.00	L/s
Total Maximum Release Rate:	60.49	L/s

Stormwater Detention Area

Top Area (sq.m)	Avg. Depth (m)	Volume	
317	0.85	205.69	cu.m
	Achieved Volume:	205.69	cu.m
	Maximum Volume Required:	205.69	cu.m

Time	i	2.78AiC	Flow from Roof	Total Inflow	ICD Release Rate	Weir Release Rate	TOTAL Release Rate	Stored Rate	Stored Volume
min	mm/hr	L/s	(L/s)	(L/s)	L/s	(L/s)	(L/s)	L/s	cu.m
5	141	275.61	51.03	326.64	60.49	0.00	60.49	266.15	79.84
10	104	203.41	51.03	254.43	60.49	0.00	60.49	193.94	116.37
15	84	163.12	51.03	214.15	60.49	0.00	60.49	153.66	138.29
20	70	137.14	51.03	188.17	60.49	0.00	60.49	127.68	153.22
25	61	118.88	51.03	169.91	60.49	0.00	60.49	109.42	164.13
30	54	105.28	51.03	156.31	60.49	0.00	60.49	95.82	172.47
35	49	94.72	51.03	145.74	60.49	0.00	60.49	85.25	179.03
40	44	86.26	51.03	137.28	60.49	0.00	60.49	76.79	184.31
45	41	79.32	51.03	130.34	60.49	0.00	60.49	69.85	188.60
50	38	73.51	51.03	124.53	60.49	0.00	60.49	64.04	192.13
55	35	68.57	51.03	119.60	60.49	0.00	60.49	59.11	195.05
60	33	64.31	51.03	115.34	60.49	0.00	60.49	54.85	197.46
65	31	60.60	51.03	111.63	60.49	0.00	60.49	51.14	199.45
70	29	57.34	51.03	108.37	60.49	0.00	60.49	47.88	201.09
75	28	54.44	51.03	105.47	60.49	0.00	60.49	44.98	202.42
80	27	51.85	51.03	102.88	60.49	0.00	60.49	42.39	203.48
85	25	49.52	51.03	100.55	60.49	0.00	60.49	40.06	204.32
90	24	47.42	51.03	98.44	60.49	0.00	60.49	37.95	204.95
95	23	45.50	51.03	96.52	60.49	0.00	60.49	36.03	205.40
100	22	43.74	51.03	94.77	60.49	0.00	60.49	34.28	205.69
105	22	42.13	50.12	92.25	60.49	0.00	60.49	31.76	200.09
110	21	40.65	48.35	89.00	60.49	0.00	60.49	28.51	188.18
115	20	39.28	46.72	86.00	60.49	0.00	60.49	25.51	176.00
120	19	38.00	45.21	83.21	60.49	0.00	60.49	22.72	163.59
125	19	36.82	43.80	80.62	60.49	0.00	60.49	20.13	150.95
130	18	35.71	42.48	78.20	60.49	0.00	60.49	17.71	138.11
135	18	34.68	41.25	75.93	60.49	0.00	60.49	15.44	125.09
140	17	33.71	40.10	73.81	60.49	0.00	60.49	13.32	111.89
145	17	32.80	39.02	71.82	60.49	0.00	60.49	11.33	98.53
150	16	31.94	37.99	69.94	60.49	0.00	60.49	9.45	85.02
180	14	27.68	32.93	60.61	60.49	0.00	60.49	0.12	1.30
210	13	24.51	29.15	53.67	53.67	0.00	53.67	0.00	0.00
240	11	22.05	26.23	48.28	48.28	0.00	48.28	0.00	0.00
270	10	20.08	23.88	43.96	43.96	0.00	43.96	0.00	0.00
300	9	18.46	21.96	40.42	40.42	0.00	40.42	0.00	0.00

26-Nov-19

1243 Teron Road
Ottawa, Ontario

BROAD CRESTED WEIR CALCULATIONS

1:100 YEAR EVENT

Lower Section of Retaining Wall
at Stormwater Detention Area
(25m wide / T.O.W. 81.77)

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

if Q=	70.10	l/s (maximum permited flow)	assumes Cd= 0.577
=	0.07010	cu.m./s	
& H=	0.014	m (max. depth of water above top of weir)	(assumes P/H is large)
then L=	25.00	m (length of weir) L = (Q / ((1.705 x H^(3/2))	

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

if P=	0.95	m (depth of pond)
& Lp=	31.0	m (width of pond: perpendicular to direction of flow)
then Vp=	0.0023	m/s (velocity in pond: Vp = Q / (P+H) / Lp)
& E=	0.013934	m (energy: E = H + 2V^2/2g)
& Cd=	0.577	(Cd = 0.577 x (E/H)^(3/2))

if Q=	70.10	l/s (maximum permited flow)
=	0.07010	cu.m./s
& H=	0.01	m (depth of water above top of weir)
then L=	25.00	m (length of weir) L = (Q / ((Cd^(2/3) x (2x9.81)^(1/2) x H^(3/2))

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

STORM SEWER COMPUTATION FORM

RATIONAL METHOD Q = 2.78 A I R FIVE YEAR EVENT

n = 0.013

Project: 1243 Teron Road

Designed By: DBG

Date: December 20, 2019

LOCATION			AREA (ha)				Individual 2.78 A R	Accum. 2.78 A R	Time of Conc. (min)	Rainfall Intensity i (mm/hr)	Peak Flow Q (L/s)	SEWER DATA									COMMENTS
			Hard	Gravel	Landscape	Roof						Type of Pipe	Dia. Actual (mm)	Dia. Nominal (mm)	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Time of Flow (min)	Ratio Q/Qfull	
STREET	FROM	TO	R = 0.90	R = 0.70	R = 0.20	R = 0.90															
	CB-1	CB/MH-2	0.0376				0.094	0.094	10.00	104.2	9.8	PVC	254.0	250	0.43	36.8	40.7	0.80	0.76	0.24	
	CB/MH-2	CB/MH-3	0.1447		0.0306		0.379	0.473	10.76	100.3	47.5	PVC	304.8	300	0.34	33.7	58.8	0.81	0.70	0.81	
	CB/MH-3	CB/MH-4	0.1443		0.0112		0.367	0.840	11.46	97.1	81.6	PVC	381.0	375	0.25	49.7	91.5	0.80	1.03	0.89	
	CB-5	CB/MH-4	0.0420				0.105	0.105	10.00	104.2	10.9	PVC	254.0	250	0.43	41.7	40.7	0.80	0.87	0.27	
	CB/MH-4	MH-6	0.2099		0.0356		0.545	1.490	12.49	92.6	138.1	PVC	381.0	375	0.70	19.3	153.0	1.34	0.24	0.90	
	MH-6	CB/MH-7						1.490	12.73	91.7	136.6	CONC	457.2	450	0.26	89.2	151.7	0.92	1.61	0.90	
	CB/MH-7	SWM Detention Area	0.1560		0.0336		0.409	1.899	14.34	85.7	162.9	CONC	457.2	450	0.31	28.0	165.6	1.01	0.46	0.98	

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

Request for MVCA Stormwater Management Comments

1 message

Ryan Faith <r.faith@dbgrayengineering.com> Tue, Nov 5, 2019 at 4:20 PM
To: NNakhaei@mvc.on.ca
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Hi Nader,

We are working on a proposed 1 storey light industrial building on 21,994 sq.m of land at 1243 Teron Road 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

2019-11-04 1243 Teron Rd. KWC A010 Site Plan (kwc 1943).pdf
114K

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 1 of Servicing Brief and Stormwater Management Report

Identification of existing and proposed infrastructure available in the immediate area: see drawings C-1 to C-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-4

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

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

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

Development Servicing Report: Water

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

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

Identification of system constraints: see page 2 of Servicing Brief

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

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

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

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

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

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

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

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

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

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

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

Development Servicing Report: Wastewater

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

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

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

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

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

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

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

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

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

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

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

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

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

Development Servicing Report: Stormwater Checklist

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

Analysis of available capacity in existing public infrastructure. not applicable

A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern: see drawing C-1 & C-4

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 drawing C-2 & notes 2.1 to 2.7 on drawing C-4

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