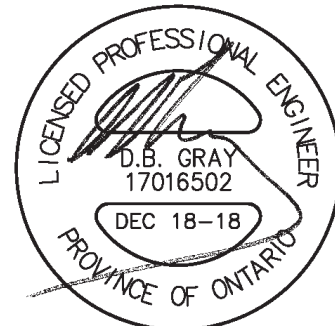


# SERVICING BRIEF & STORMWATER MANAGEMENT REPORT

Mitch Owens / Boundary Road  
Ottawa, Ontario

Report No. 18029

December 18, 2018



NOT VALID UNLESS  
SIGNED & DATED

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# SERVICING BRIEF & STORMWATER MANAGEMENT REPORT

Mitch Owens / Boundary Road  
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This Servicing Brief & Stormwater Management Report is a description of the services for a 5,213 sq.m. (±56,000 sq.ft.) cross dock facility and addresses the stormwater management requirements of 4.2 hectares of land located at the southwest of the Mitch Owens Road / Boundary Road intersection.

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

## WATER SUPPLY FOR FIREFIGHTING:

The property is in a rural area with no municipal water supply. The proposed building will have a sprinkler system. The mechanical engineer has calculated that 114,000 litres (±25,000 imperial gallons) is the required water supply. A water fill station (an underground tank with a water chute and draw pipe) with this capacity is proposed to be located adjacent to the fire route near the entrance to the site.

## ON-SITE WELL:

A drilled well is proposed to be located approximately 3m from the front (north) façade of the proposed building.

## ON-SITE SEWAGE SYSTEM:

An on-site septic system is proposed. It will be is a Class 4 system consisting of a 16,300 L septic tank, a dosing reservoir, two ECOFLO ST-730P Biofilter treatment units, a pump chamber and an area bed. An application for a septic permit has been submitted to the Ottawa Septic System Office (OSSO).

## STORMWATER MANAGEMENT:

### Water Quality:

The Rideau Valley Conservation Authority (RVCA) has been contacted with respect to the required quality control measures. Rainfall runoff from approximately 86% of the

total developed (and virtually all of the hard surfaces) will drain to one of three grassed stormwater detention areas prior to discharging to the roadside ditch. The grassed detention areas will have minimal slopes that will keep flow velocities low making them effective for pollutant removal and they will tend to increase the removal of TSS. The low flow conditions in these grassed areas will filter out coarse sediment from runoff and the grass will take up nutrients. However it is difficult to quantify the percent TSS removal. On other sites infiltration trenches have been incorporated to achieve the 80% TSS removal but on the subject site the water table will be 0.5m to 1.0m below the bottom of the stormwater detention areas so that infiltration trenches cannot be used.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-3 and notes 2.1 to 2.5 on drawing C-5). In summary: to filter out construction sediment a silt fence barrier will be installed around the perimeter of the site; straw bale check dams will be installed in the roadside ditch and swales; and geotextile fabric mud mats will be install at all points of egress to public roads

Water Quantity:

The stormwater quantity control measures detailed in this report are based on the criteria that the release rate for post-development storm events is 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 0.33 and 0.39 for the 100-year. Using the Airport Formula for sheet flow, it is calculated that the existing time of concentration is 68 minutes for the 5-year event and 60 minutes for the 100-year. Using the Rational Method; the pre-development (existing) 5-year peak flow is 117.50 l/s and 271.43 l/s for the 100-year.

Drainage Area I (Uncontrolled Flow Off Site – 5,702 sq.m.):

The runoff from the perimeter of the site (about 14% of the total) will be allowed to flow uncontrolled off the site.

	100-year	5-year
The maximum flow rate:	71.75 l/s	33.50 l/s

Drainage Area II (12,151 sq.m.):

During five-year event an inlet control device (ICD) located in the inlet of the outlet culvert for Stormwater Detention Area A1 will control the release of stormwater from Drainage Area III. During the one hundred-year event, in addition to the ICD, a broad-crested weir will control the release of stormwater. The ICD and weir will restrict the flow and force the stormwater to back up into the detention area. The broad-crested weir will be a concrete curb with a 3.24m long depressed section. The top of the depressed portion of the curb will be 0.04 m below the 100-year ponding elevation and will release 44.25 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 37.29 l/s at 0.58m head. It is calculated that an orifice area of 18,120 sq.mm. ( $\pm 152$  mm diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 37.29 l/s at a head of 0.58m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 32.86 l/s at 0.45 m.

	100-year	5-year
The maximum ICD release rate:	37.29 l/s	32.86 l/s
The maximum weir release rate:	<u>44.25</u> l/s	<u>0.00</u> l/s
The maximum release rate:	81.54 l/s	32.86 l/s
The maximum ponding elevation:	77.22 m	77.09 m
The maximum ponding depth:	0.66 m	0.53 m
The maximum stored volume:	343.87 cu.m.	193.17 cu.m.

Drainage Area III (10,256 sq.m.):

During five-year event an inlet control device (ICD) located in the inlet of the outlet culvert for Stormwater Detention Area B1 will control the release of stormwater from Drainage Area II. During the one hundred-year event, in addition to the ICD, a broad-crested weir will control the release of stormwater. The ICD and weir will restrict the flow and force the stormwater to back up into the detention area. The broad-crested weir will be a concrete curb with a 2.59m long depressed section. The top of the depressed portion of the curb will be 0.05 m below the 100-year ponding elevation and will release 49.37 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 47.97 l/s at 0.44m head. It is calculated that an orifice area of 26,647 sq.mm. ( $\pm 184$  mm diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 47.97 l/s at a head of 0.44m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 42.06 l/s at 0.34 m.

	100-year	5-year
The maximum ICD release rate:	47.97 l/s	42.06 l/s
The maximum weir release rate:	<u>49.37</u> l/s	<u>0.00</u> l/s
The maximum release rate:	97.34 l/s	42.06 l/s
The maximum ponding elevation:	77.22 m	77.11 m
The maximum ponding depth:	0.54 m	0.43 m
The maximum stored volume:	227.80 cu.m.	113.02 cu.m.

Drainage Area IV (13,958 sq.m.):

During five-year event an inlet control device (ICD) located in the inlet of the outlet culvert for Stormwater Detention Area C1 will control the release of stormwater from Drainage Area IV. During the one hundred-year event, in addition to the ICD, a broad-crested weir will control the release of stormwater. The ICD and weir will restrict the flow and force the stormwater to back up into the detention area. The broad-crested weir will be a concrete curb with a 5.59m long depressed section. The top of the depressed portion of the curb will be 0.01 m below the 100-year ponding elevation and will release 9.53 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 11.27 l/s at 0.49m head. It is calculated that an orifice area of 5.945 sq.mm. ( $\pm 87$  mm diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 11.27 l/s at a head of 0.49m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 9.09 l/s at 0.32 m.

	100-year	5-year
The maximum ICD release rate:	11.27 l/s	9.09 l/s
The maximum weir release rate:	<u>9.53 l/s</u>	<u>0.00 l/s</u>
The maximum release rate:	20.80 l/s	9.09 l/s
The maximum ponding elevation:	77.22 m	77.04 m
The maximum ponding depth:	0.54 m	0.36 m
The maximum stored volume:	571.02 cu.m.	298.29 cu.m.

As previously stated the maximum allowable release rate (pre-development flow rate) for the 100-year storm event for the site is 271.43 l/s. The maximum post-development release rate for the 100-year storm event is calculated to be 271.43 l/s, equal to the maximum allowable. To achieve this release rate the total maximum required storage capacity for the 1:100-year event is 1142.69 cu.m.

The maximum allowable release rate (pre-development flow rate) for the 5-year storm event for the site is 117.50 l/s. The maximum post-development release rate for the 5-year storm event is calculated to be 117.50 l/s, equal to the maximum allowable. To achieve this release rate the total maximum required storage capacity for the 1:5-year event is 604.48 cu.m.

## CONCLUSIONS:

1. The mechanical engineer has calculated that 25,000 imperial gallons is the required water supply for the sprinkler system and for firefighting. A water fill station with this capacity is proposed.
2. A drilled well is proposed.
3. An on-site Class 4 septic system is proposed. An application for a septic permit has been submitted to the Ottawa Septic System Office (OSSO).
4. The Rideau Valley Conservation Authority (RVCA) has been contacted with respect to the required quality control measures. Three grassed stormwater detention areas will be effective for pollutant removal and will tend to increase the removal of TSS. The low flow conditions in these grassed areas will filter out coarse sediment from runoff and the grass will take up nutrients. Infiltration trenches cannot be used due to the water table 0.5m to 1.0m below the bottom of the stormwater detention areas.
5. An erosion and sediment control plan has been developed to be implemented during construction.
6. With the proposed stormwater management design the post-development storm events are less than the flow produced by the (existing) pre-development.

## 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/s<sup>2</sup>

h = head above orifice in meters

Storage calculations on the parking 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 prismoidal 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 Table

ONE HUNDRED YEAR EVENT				
Drainage Area	Maximum Allowable Release Rate	Maximum Release Rate	Maximum Volume Required	Maximum Volume Stored
	l/s	l/s	cu.m.	cu.m.
AREA I (Uncontrolled flow off site)	-	71.75	-	-
AREA II	-	81.54	343.87	343.87
AREA III	-	97.34	227.80	227.80
AREA IV	-	20.80	571.02	571.02
TOTAL	271.43	271.43	1142.69	1142.69

FIVE YEAR EVENT				
Drainage Area	Maximum Allowable Release Rate	Maximum Release Rate	Maximum Volume Required	Maximum Volume Stored
	l/s	l/s	cu.m.	cu.m.
AREA I (Uncontrolled flow off site)	-	33.50	-	-
AREA II	-	32.86	193.17	193.17
AREA III	-	42.06	113.02	113.02
AREA IV	-	9.09	298.29	298.29
TOTAL	117.50	117.50	604.48	604.48

Mitch Owens Road / Boundary Road  
Ottawa, Ontario

STORM WATER MANAGEMENT CALCULATIONS  
Rational Method

ONE HUNDRED YEAR EVENT

Maximum Allowable Release Rate  
Pre-development Conditions

			C
Roof Area:	0	sq.m.	1.00
Asphalt/Concrete Area:	0	sq.m.	1.00
Gravel Area:	3496	sq.m.	0.875
"Pasture" Areas:	38571	sq.m.	0.375
Total Catchment Area	42067	sq.m.	0.42

Time of Concentration: Sheet Flow  
Airport Formula

$$T_c = \frac{3.26 (1.1 - C) (L)^{1/2}}{S_w^{0.33}} \quad \text{min}$$

Runoff Coefficient (C):	0.42	(see above)
Sheet Flow Distance (L):	160	m
Slope of Land (Sw):	0.1	%
Time of Concentration (Sheet Flow):	60	min

Area (A):	42067	sq.m.
Time of Concentration:	60	min. (see above - use not less than 10 min.)
Rainfall Intensity (i):	56	mm/hr (100-year event)
Runoff Coefficient (C):	0.42	(see above)

Pre-development 100-year Flow Rate (2.78AiC): 271.43 l/s  
(100-year Maximum Allowable Release Rate)



**DRAINAGE AREA I (Uncontrolled Flow Off Site):**  
 (ONE HUNDRED YEAR EVENT)

			C
Roof Area:	0	sq.m.	1.00
Asphalt/Concrete Area:	0	sq.m.	1.00
Gravel Area:	32		0.875
Landscaped Area:	5670	sq.m.	0.25
			<hr/>
Total Catchment Area	5702		0.25
Area (A):	5702	sq.m.	
Time of Concentration:	10	min.	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Runoff Coefficient (C):	0.25		
Flow Rate (2.78AiC):	71.75	l/s	

# DRAINAGE AREA II

(ONE HUNDRED YEAR EVENT)

				C		
	Roof Area:	2496	sq.m.	1.00		
	Asphalt/Concrete Area:	4399	sq.m.	1.00		
	Gravel Area:	3942	sq.m.	0.875		
	Landscaped Areas:	1314	sq.m.	0.25		
Total Catchment Area				12151	sq.m.	0.88
Storage Granular Surface						
	Water Elevation:	77.22	m	Area	Max. Depth	
	Invert of Culvert Inlet:	76.56	m	sq.m.	m	
				857	0.28	78.84 cu.m.
Stormwater Detention Area A1						
	Centroid of ICD Orifice:	76.64	m	Area	Ave. Depth	
	(ICD in Culvert Inlet)			sq.m.	m	
	Head:	0.58	m	534	0.51	219.34 cu.m.
Stormwater Detention Area A2						
	Orifice Diameter	152	mm	Area	Ave. Depth	
	Orifice Area:	18120	sq.mm.	sq.m.	m	
				169	0.33	45.68 cu.m.
	Coefficient of Discharge:	0.61				
	Maximum ICD Release Rate:	37.29	l/s		Achieved Vol:	343.87 cu.m.
	Maximum Weir Release Rate:	44.25	l/s			
	Maximum Release Rate:	81.54	l/s			
					Max. Vol. Required:	343.87 cu.m.

Time	i	2.78AiC	ICD	Weir	Total	Stored	Stored
min.	mm/hr	l/s	Release	Release	Release	Rate	Volume
			Rate	Rate	Rate	l/s	cu.m.
			l/s	l/s	l/s		
5	243	720.11	37.29	0.00	37.29	682.82	204.85
10	179	529.79	37.29	0.00	37.29	492.50	295.50
15	143	423.97	37.29	4.60	41.89	382.08	343.87
20	120	355.90	37.29	32.05	69.34	286.56	343.87
25	104	308.12	37.29	41.58	78.87	229.25	343.87
30	92	272.58	37.29	44.25	81.54	191.04	343.87
35	83	245.01	37.29	43.98	81.26	163.75	343.87
40	75	222.96	37.29	42.39	79.68	143.28	343.87
45	69	204.87	37.29	40.23	77.51	127.36	343.87
50	64	189.75	37.29	37.84	75.13	114.62	343.87
55	60	176.91	37.29	35.41	72.70	104.20	343.87
60	56	165.84	37.29	33.03	70.32	95.52	343.87
65	53	156.20	37.29	30.74	68.03	88.17	343.87
70	50	147.73	37.29	28.57	65.85	81.87	343.87
75	47	140.21	37.29	26.51	63.79	76.42	343.87
80	45	133.49	37.29	24.56	61.85	71.64	343.87
85	43	127.45	37.29	22.73	60.02	67.43	343.87
90	41	121.98	37.29	21.01	58.30	63.68	343.87
95	39	117.00	37.29	19.39	56.68	60.33	343.87
100	38	112.46	37.29	17.86	55.15	57.31	343.87
105	36	108.29	37.29	16.42	53.71	54.58	343.87
110	35	104.45	37.29	15.06	52.35	52.10	343.87
115	34	100.89	37.29	13.77	51.06	49.84	343.87
120	33	97.60	37.29	12.55	49.84	47.76	343.87
125	32	94.53	37.29	11.40	48.69	45.85	343.87
130	31	91.68	37.29	10.30	47.59	44.09	343.87
135	30	89.00	37.29	9.26	46.55	42.45	343.87
140	29	86.49	37.29	8.27	45.56	40.94	343.87
145	28	84.14	37.29	7.33	44.61	39.53	343.87
150	28	81.92	37.29	6.43	43.71	38.21	343.87
180	24	70.92	37.29	1.79	39.08	31.84	343.87
210	21	62.74	37.29	0.00	37.29	25.45	320.65
240	19	56.39	37.29	0.00	37.29	19.10	275.08
270	17	51.31	37.29	0.00	37.29	14.03	227.22
300	16	47.15	37.29	0.00	37.29	9.86	177.53
330	15	43.67	37.29	0.00	37.29	6.38	126.37
360	14	40.71	37.29	0.00	37.29	3.42	73.98
390	13	38.17	37.29	0.00	37.29	0.88	20.55
420	12	35.95	35.95	0.00	35.95	0.00	0.00
450	11	34.00	34.00	0.00	34.00	0.00	0.00
480	11	32.27	32.27	0.00	32.27	0.00	0.00
510	10	30.72	30.72	0.00	30.72	0.00	0.00
540	10	29.33	29.33	0.00	29.33	0.00	0.00
570	9	28.07	28.07	0.00	28.07	0.00	0.00
600	9	26.93	26.93	0.00	26.93	0.00	0.00
630	9	25.88	25.88	0.00	25.88	0.00	0.00
660	8	24.92	24.92	0.00	24.92	0.00	0.00
690	8	24.04	24.04	0.00	24.04	0.00	0.00
720	8	23.22	23.22	0.00	23.22	0.00	0.00

# DRAINAGE AREA III

(ONE HUNDRED YEAR EVENT)

				C		
	Roof Area:	0	sq.m.	1.00		
	Asphalt/Concrete Area:	457	sq.m.	1.00		
	Gravel Area:	9128	sq.m.	0.875		
	Landscaped Areas:	671	sq.m.	0.25		
Total Catchment Area				10256	sq.m.	0.84
Storage Granular Surface						
	Water Elevation:	77.22	m	Area	Max. Depth	
				sq.m.	m	
	Invert of Culvert Inlet:	76.68	m	1110	0.33	120.58 cu.m.
Stormwater Detention Area C1						
	Centroid of ICD Orifice:	76.77	m	Area	Ave. Depth	
	(ICD in Culvert Inlet)			sq.m.	m	
	Head:	0.44	m	246	0.44	82.05 cu.m.
Stormwater Detention Area C2						
	Orifice Diameter	184	mm	Area	Ave. Depth	
				sq.m.	m	
	Orifice Area:	26647	sq.mm.	100	0.30	25.17 cu.m.
	Coefficient of Discharge:	0.61				
	Maximum ICD Release Rate:	47.97	l/s		Achieved Vol:	227.80 cu.m.
	Maximum Weir Release Rate:	49.37	l/s			
	Maximum Release Rate:	97.34	l/s			
					Max. Vol. Required:	227.80 cu.m.

Time	i	2.78AiC	ICD	Weir	Total	Stored	Stored
min.	mm/hr	l/s	Release	Release	Release	Rate	Volume
			Rate	Rate	Rate	l/s	cu.m.
			l/s	l/s	l/s		
5	243	581.05	47.97	0.00	47.97	533.08	159.92
10	179	427.48	47.97	0.00	47.97	379.51	227.71
15	143	342.10	47.97	41.02	88.99	253.11	227.80
20	120	287.17	47.97	49.37	97.34	189.83	227.80
25	104	248.62	47.97	48.78	96.75	151.86	227.80
30	92	219.94	47.97	45.42	93.39	126.55	227.80
35	83	197.70	47.97	41.25	89.22	108.47	227.80
40	75	179.90	47.97	37.02	84.99	94.91	227.80
45	69	165.31	47.97	32.97	80.94	84.37	227.80
50	64	153.11	47.97	29.21	77.18	75.93	227.80
55	60	142.74	47.97	25.74	73.71	69.03	227.80
60	56	133.82	47.97	22.57	70.54	63.28	227.80
65	53	126.04	47.97	19.66	67.63	58.41	227.80
70	50	119.20	47.97	16.99	64.96	54.24	227.80
75	47	113.13	47.97	14.54	62.51	50.62	227.80
80	45	107.71	47.97	12.28	60.25	47.46	227.80
85	43	102.83	47.97	10.20	58.17	44.67	227.80
90	41	98.42	47.97	8.27	56.24	42.18	227.80
95	39	94.41	47.97	6.48	54.45	39.96	227.80
100	38	90.74	47.97	4.81	52.78	37.97	227.80
105	36	87.38	47.97	3.25	51.22	36.16	227.80
110	35	84.28	47.97	1.79	49.76	34.51	227.80
115	34	81.41	47.97	0.43	48.40	33.01	227.80
120	33	78.75	47.97	0.00	47.97	30.78	221.63
125	32	76.28	47.97	0.00	47.97	28.31	212.32
130	31	73.97	47.97	0.00	47.97	26.00	202.82
135	30	71.81	47.97	0.00	47.97	23.84	193.14
140	29	69.79	47.97	0.00	47.97	21.82	183.30
145	28	67.89	47.97	0.00	47.97	19.92	173.32
150	28	66.10	47.97	0.00	47.97	18.13	163.19
180	24	57.22	47.97	0.00	47.97	9.25	99.95
210	21	50.62	47.97	0.00	47.97	2.65	33.41
240	19	45.50	45.50	0.00	45.50	0.00	0.00
270	17	41.40	41.40	0.00	41.40	0.00	0.00
300	16	38.05	38.05	0.00	38.05	0.00	0.00
330	15	35.24	35.24	0.00	35.24	0.00	0.00
360	14	32.85	32.85	0.00	32.85	0.00	0.00
390	13	30.80	30.80	0.00	30.80	0.00	0.00
420	12	29.01	29.01	0.00	29.01	0.00	0.00
450	11	27.43	27.43	0.00	27.43	0.00	0.00
480	11	26.03	26.03	0.00	26.03	0.00	0.00
510	10	24.79	24.79	0.00	24.79	0.00	0.00
540	10	23.66	23.66	0.00	23.66	0.00	0.00
570	9	22.65	22.65	0.00	22.65	0.00	0.00
600	9	21.73	21.73	0.00	21.73	0.00	0.00
630	9	20.88	20.88	0.00	20.88	0.00	0.00
660	8	20.11	20.11	0.00	20.11	0.00	0.00
690	8	19.39	19.39	0.00	19.39	0.00	0.00
720	8	18.73	18.73	0.00	18.73	0.00	0.00

# DRAINAGE AREA IV

(ONE HUNDRED YEAR EVENT)

				C		
	Roof Area:	2717	sq.m.	1.00		
	Asphalt/Concrete Area:	2579	sq.m.	1.00		
	Gravel Area:	5572	sq.m.	0.875		
	Landscaped Areas:	3090	sq.m.	0.25		
Total Catchment Area				13958	sq.m.	0.78
Storage Granular Surface						
Water Elevation:	77.22	m		Area	Max. Depth	
				sq.m.	m	
Invert of Culvert Inlet:	76.68	m		1107	0.34	123.84 cu.m.
Stormwater Detention Area C1						
Centroid of ICD Orifice:	76.72	m		Area	Ave. Depth	
(ICD in Culvert Inlet)				sq.m.	m	
Head:	0.49	m		418	0.68	210.30 cu.m.
Stormwater Detention Area C2						
Orifice Diameter	87	mm		Area	Ave. Depth	
				sq.m.	m	
Orifice Area:	5945	sq.mm.		577	0.45	236.88 cu.m.
Coefficient of Discharge:	0.61					
Maximum ICD Release Rate:	11.27	l/s		Achieved Vol:	571.02	cu.m.
Maximum Weir Release Rate:	9.53	l/s				
Maximum Release Rate:	20.80	l/s		Max. Vol. Required:	571.02	cu.m.

Time	i	2.78AiC	ICD	Weir	Total	Stored	Stored
min.	mm/hr	l/s	Release	Release	Release	Rate	Volume
			Rate	Rate	Rate	l/s	cu.m.
			l/s	l/s	l/s		
5	243	738.41	11.27	0.00	11.27	727.14	218.14
10	179	543.25	11.27	0.00	11.27	531.99	319.19
15	143	434.75	11.27	0.00	11.27	423.48	381.13
20	120	364.94	11.27	0.00	11.27	353.67	424.41
25	104	315.95	11.27	0.00	11.27	304.68	457.02
30	92	279.50	11.27	0.00	11.27	268.24	482.82
35	83	251.24	11.27	0.00	11.27	239.97	503.94
40	75	228.62	11.27	0.00	11.27	217.36	521.66
45	69	210.08	11.27	0.00	11.27	198.81	536.80
50	64	194.58	11.27	0.00	11.27	183.31	549.93
55	60	181.40	11.27	0.00	11.27	170.13	561.44
60	56	170.06	11.27	0.17	11.44	158.62	571.02
65	53	160.17	11.27	2.49	13.76	146.42	571.02
70	50	151.48	11.27	4.26	15.52	135.96	571.02
75	47	143.77	11.27	5.61	16.88	126.89	571.02
80	45	136.88	11.27	6.65	17.92	118.96	571.02
85	43	130.68	11.27	7.45	18.72	111.96	571.02
90	41	125.08	11.27	8.07	19.33	105.74	571.02
95	39	119.98	11.27	8.53	19.80	100.18	571.02
100	38	115.32	11.27	8.88	20.15	95.17	571.02
105	36	111.04	11.27	9.14	20.40	90.64	571.02
110	35	107.10	11.27	9.32	20.58	86.52	571.02
115	34	103.46	11.27	9.44	20.70	82.76	571.02
120	33	100.08	11.27	9.51	20.77	79.31	571.02
125	32	96.94	11.27	9.53	20.80	76.14	571.02
130	31	94.01	11.27	9.53	20.80	73.21	571.02
135	30	91.26	11.27	9.50	20.77	70.50	571.02
140	29	88.69	11.27	9.45	20.71	67.98	571.02
145	28	86.28	11.27	9.38	20.64	65.63	571.02
150	28	84.00	11.27	9.29	20.56	63.45	571.02
180	24	72.72	11.27	8.58	19.85	52.87	571.02
210	21	64.33	11.27	7.74	19.01	45.32	571.02
240	19	57.82	11.27	6.90	18.17	39.65	571.02
270	17	52.62	11.27	6.10	17.37	35.25	571.02
300	16	48.35	11.27	5.36	16.63	31.72	571.02
330	15	44.78	11.27	4.67	15.94	28.84	571.02
360	14	41.75	11.27	4.04	15.31	26.44	571.02
390	13	39.14	11.27	3.47	14.73	24.40	571.02
420	12	36.86	11.27	2.93	14.20	22.66	571.02
450	11	34.86	11.27	2.44	13.71	21.15	571.02
480	11	33.09	11.27	1.99	13.26	19.83	571.02
510	10	31.50	11.27	1.57	12.84	18.66	571.02
540	10	30.07	11.27	1.18	12.45	17.62	571.02
570	9	28.78	11.27	0.82	12.09	16.70	571.02
600	9	27.61	11.27	0.48	11.75	15.86	571.02
630	9	26.54	11.27	0.00	11.27	15.27	577.21
660	8	25.55	11.27	0.00	11.27	14.29	565.72
690	8	24.65	11.27	0.00	11.27	13.38	553.90
720	8	23.81	11.27	0.00	11.27	12.54	541.77

# FIVE YEAR EVENT

## Maximum Allowable Release Rate Pre-development Conditions

			C
Roof Area:	0	sq.m.	0.90
Asphalt/Concrete Area:	0	sq.m.	0.90
Gravel Area:	3496	sq.m.	0.70
"Pasture" Areas:	<u>38571</u>	<u>sq.m.</u>	<u>0.30</u>
Total Catchment Area	42067	sq.m.	0.33

Time of Concentration: Sheet Flow  
Airport Formula

$$T_c = \frac{3.26 (1.1 - C) (L)^{1/2}}{S_w^{0.33}} \quad \text{min}$$

Runoff Coefficient (C):	0.33	(see above)
Sheet Flow Distance (L):	160	m
Slope of Land (Sw):	0.1	%
Time of Concentration (Sheet Flow):	68	min

Area (A):	42067	sq.m.
Time of Concentration:	68	min. (see above - use not less than 10 min.)
Rainfall Intensity (i):	30	mm/hr (5-year event)
Runoff Coefficient (C):	0.33	(see above)

Pre-development 5-year Flow Rate (2.78AiC): 117.50 l/s  
(5-year Maximum Allowable Release Rate)

**DRAINAGE AREA I (Uncontrolled Flow Off Site):**  
(FIVE YEAR EVENT)

			C
Roof Area:	0	sq.m.	0.90
Asphalt/Concrete Area:	0	sq.m.	0.90
Gravel Area:	32		0.70
Landscaped Area:	5670	sq.m.	0.20
<hr/>			<hr/>
Total Catchment Area	5702		0.20
Area (A):	5702	sq.m.	
Time of Concentration:	10	min.	
Rainfall Intensity (i):	104	mm/hr (5-year event)	
Runoff Coefficient (C):	0.20		
Flow Rate (2.78AiC):	33.50	l/s	



# DRAINAGE AREA III

(FIVE YEAR EVENT)

				C		
Roof Area:	0	sq.m.		0.90		
Asphalt/Concrete Area:	457	sq.m.		0.90		
Gravel Area:	9128	sq.m.		0.70		
Landscaped Areas:	671	sq.m.		0.20		
<hr/>						
Total Catchment Area	10256	sq.m.		0.68		
Storage Granular Surface						
Water Elevation:	77.11	m		Area	Max. Depth	
Invert of Culvert Inlet:	76.68	m		sq.m.	m	
				521	0.22	38.78 cu.m.
Stormwater Detention Area C1						
Centroid of ICD Orifice: (ICD in Culvert Inlet)	76.77	m		Area	Ave. Depth	
				sq.m.	m	
Head:	0.34	m		219	0.34	58.83 cu.m.
Stormwater Detention Area C2						
Orifice Diameter	184	mm		Area	Ave. Depth	
Orifice Area:	26647	sq.mm.		sq.m.	m	
				88	0.20	15.41 cu.m.
Coefficient of Discharge:	0.61					
Maximum Release Rate:	42.06	l/s		Achieved Vol:	113.02	cu.m.

Max. Vol. Required: 113.02 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	272.19	42.06	230.13	69.04
10	104	200.88	42.06	158.82	95.29
15	84	161.09	42.06	119.04	107.13
20	70	135.44	42.06	93.38	112.06
25	61	117.41	42.06	75.35	113.02
30	54	103.97	42.06	61.91	111.44
35	49	93.54	42.06	51.48	108.11
40	44	85.19	42.06	43.13	103.50
45	41	78.33	42.06	36.27	97.93
50	38	72.59	42.06	30.53	91.60
55	35	67.72	42.06	25.66	84.67
60	33	63.51	42.06	21.45	77.24
65	31	59.85	42.06	17.79	69.39
70	29	56.63	42.06	14.57	61.19
75	28	53.77	42.06	11.71	52.69
80	27	51.21	42.06	9.15	43.93
85	25	48.91	42.06	6.85	34.94
90	24	46.83	42.06	4.77	25.74
95	23	44.93	42.06	2.87	16.37
100	22	43.20	42.06	1.14	6.84
105	22	41.61	41.61	0.00	0.00
110	21	40.14	40.14	0.00	0.00
115	20	38.79	38.79	0.00	0.00
120	19	37.53	37.53	0.00	0.00
125	19	36.36	36.36	0.00	0.00
130	18	35.27	35.27	0.00	0.00
135	18	34.25	34.25	0.00	0.00
140	17	33.29	33.29	0.00	0.00
145	17	32.39	32.39	0.00	0.00
150	16	31.55	31.55	0.00	0.00
180	14	27.34	27.34	0.00	0.00
210	13	24.21	24.21	0.00	0.00
240	11	21.78	21.78	0.00	0.00
270	10	19.83	19.83	0.00	0.00
300	9	18.23	18.23	0.00	0.00
330	9	16.90	16.90	0.00	0.00
360	8	15.76	15.76	0.00	0.00
390	8	14.78	14.78	0.00	0.00
420	7	13.93	13.93	0.00	0.00
450	7	13.18	13.18	0.00	0.00
480	6	12.51	12.51	0.00	0.00
510	6	11.92	11.92	0.00	0.00
540	6	11.38	11.38	0.00	0.00
570	6	10.90	10.90	0.00	0.00
600	5	10.45	10.45	0.00	0.00
630	5	10.05	10.05	0.00	0.00
660	5	9.68	9.68	0.00	0.00
690	5	9.34	9.34	0.00	0.00
720	5	9.02	9.02	0.00	0.00



# DRAINAGE AREA IV

(FIVE YEAR EVENT)

			C
Roof Area:	2717	sq.m.	0.90
Asphalt/Concrete Area:	2579	sq.m.	0.90
Gravel Area:	5572	sq.m.	0.70
Landscaped Areas:	3090	sq.m.	0.20

Total Catchment Area 13958 sq.m. 0.67

Water Elevation:	77.04	m	Storage Granular Surface			
Invert of Culvert Inlet:	76.68	m	Area	Max. Depth		
Centroid of ICD Orifice: (ICD in Culvert Inlet)	76.72	m	sq.m.	m		
Head:	0.32	m	264	0.16	14.40	cu.m.
Orifice Diameter	87	mm	Stormwater Detention Area C1			
Orifice Area:	5945	sq.mm.	Area	Ave. Depth		
Coefficient of Discharge:	0.61		sq.m.	m		
Maximum Release Rate:	9.09	l/s	364	0.51	144.60	cu.m.
			Stormwater Detention Area C2			
			Area	Ave. Depth		
			sq.m.	m		
			528	0.28	139.28	cu.m.
			Achieved Vol: 298.29 cu.m.			

Max. Vol. Required: 298.29 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	364.41	9.09	355.32	106.59
10	104	268.94	9.09	259.85	155.91
15	84	215.68	9.09	206.59	185.93
20	70	181.33	9.09	172.24	206.69
25	61	157.18	9.09	148.09	222.14
30	54	139.20	9.09	130.11	234.19
35	49	125.23	9.09	116.14	243.90
40	44	114.05	9.09	104.96	251.90
45	41	104.87	9.09	95.78	258.60
50	38	97.19	9.09	88.10	264.30
55	35	90.66	9.09	81.57	269.18
60	33	85.03	9.09	75.94	273.39
65	31	80.13	9.09	71.04	277.05
70	29	75.81	9.09	66.72	280.24
75	28	71.98	9.09	62.89	283.03
80	27	68.56	9.09	59.47	285.46
85	25	65.48	9.09	56.39	287.59
90	24	62.69	9.09	53.60	289.45
95	23	60.16	9.09	51.07	291.07
100	22	57.84	9.09	48.75	292.48
105	22	55.71	9.09	46.62	293.69
110	21	53.75	9.09	44.66	294.73
115	20	51.93	9.09	42.84	295.61
120	19	50.25	9.09	41.16	296.34
125	19	48.68	9.09	39.59	296.95
130	18	47.22	9.09	38.13	297.42
135	18	45.85	9.09	36.76	297.79
140	17	44.57	9.09	35.48	298.05
145	17	43.37	9.09	34.28	298.21
150	16	42.23	9.09	33.14	298.29
180	14	36.60	9.09	27.51	297.12
210	13	32.41	9.09	23.32	293.80
240	11	29.15	9.09	20.06	288.90
270	10	26.55	9.09	17.46	282.80
300	9	24.41	9.09	15.32	275.73
330	9	22.62	9.09	13.53	267.88
360	8	21.10	9.09	12.01	259.38
390	8	19.79	9.09	10.70	250.33
420	7	18.65	9.09	9.56	240.82
450	7	17.64	9.09	8.55	230.89
480	6	16.75	9.09	7.66	220.60
510	6	15.95	9.09	6.86	210.00
540	6	15.24	9.09	6.15	199.12
570	6	14.59	9.09	5.50	187.99
600	5	14.00	9.09	4.91	176.62
630	5	13.46	9.09	4.37	165.05
660	5	12.96	9.09	3.87	153.29
690	5	12.50	9.09	3.41	141.35
720	5	12.08	9.09	2.99	129.26

Mitch Owens Road / Boundary Road  
Ottawa, Ontario

## BROAD CRESTED WEIR CALCULATIONS

1:100 YEAR EVENT

### DRAINAGE AREA II (SWM Detention Area A1 Overflow Weir)

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

if Q=	44.25 l/s (maximum permitted flow)	assumes Cd= 0.577 (assumes P/H is large)
=	0.04425 cu.m./s	
& H=	0.040 m (max. depth of water above top of weir)	
then L=	3.24 m (length of weir) $L = ( Q / ((1.705 \times H^{3/2}))$	

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

if P=	0.58 m (depth of pond)
& Lp=	6.10 m (width of pond: perpendicular to direction of flow)
then Vp=	0.0117 m/s (velocity in pond: $V_p = Q / (P+H) / L_p$ )
& E=	0.040007 m (energy: $E = H + 2V^2/2g$ )
& Cd=	0.578 ( $Cd = 0.577 \times (E/H)^{3/2}$ )
if Q=	44.25 l/s (maximum permitted flow)
=	0.04425 cu.m./s
& H=	0.040 m (depth of water above top of weir)
then L=	3.24 m (length of weir) $L = ( Q / ((Cd^{2/3}) \times (2 \times 9.81)^{1/2}) \times H^{3/2}$ )

## BROAD CRESTED WEIR CALCULATIONS (continued)

1:100 YEAR EVENT

### DRAINAGE AREA III (SWM Detention Area B1 Overflow Weir)

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

if Q=	49.37 l/s (maximum permitted flow)	assumes Cd= 0.577 (assumes P/H is large)
=	0.04937 cu.m./s	
& H=	0.050 m (max. depth of water above top of weir)	
then L=	2.59 m (length of weir) $L = ( Q / ((1.705 \times H^{3/2}))$	

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

if P=	0.44 m (depth of pond)
& Lp=	3.10 m (width of pond: perpendicular to direction of flow)
then Vp=	0.0325 m/s (velocity in pond: $Vp = Q / (P+H) / Lp$ )
& E=	0.050054 m (energy: $E = H + 2V^2/2g$ )
& Cd=	0.578 ( $Cd = 0.577 \times (E/H)^{3/2}$ )
if Q=	49.37 l/s (maximum permitted flow)
=	0.04937 cu.m./s
& H=	0.050 m (depth of water above top of weir)
then L=	2.59 m (length of weir) $L = ( Q / ((Cd^{2/3}) \times (2 \times 9.81)^{1/2} \times H^{3/2}))$

### DRAINAGE AREA IV (SWM Detention Area C1 Overflow Weir)

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

if Q=	9.53 l/s (maximum permitted flow)	assumes Cd= 0.577 (assumes P/H is large)
=	0.00953 cu.m./s	
& H=	0.010 m (max. depth of water above top of weir)	
then L=	5.59 m (length of weir) $L = ( Q / ((1.705 \times H^{3/2}))$	

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

if P=	0.49 m (depth of pond)
& Lp=	9.60 m (width of pond: perpendicular to direction of flow)
then Vp=	0.0020 m/s (velocity in pond: $Vp = Q / (P+H) / Lp$ )
& E=	0.010000 m (energy: $E = H + 2V^2/2g$ )
& Cd=	0.577 ( $Cd = 0.577 \times (E/H)^{3/2}$ )
if Q=	9.53 l/s (maximum permitted flow)
=	0.00953 cu.m./s
& H=	0.010 m (depth of water above top of weir)
then L=	5.59 m (length of weir) $L = ( Q / ((Cd^{2/3}) \times (2 \times 9.81)^{1/2} \times H^{3/2}))$

## City of Ottawa Servicing Study Checklist

### General Content

**Executive Summary (for large reports only):** not applicable

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

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

**Plan showing the site and location of all existing services:** see drawings C-1 to C63

**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 defensible design criteria:** not applicable

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

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

**Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development ( Reference can be made to the Natural Heritage Studies, if available).** see drawings C-1 to C-6

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

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

**Proposed phasing of the development, if applicable:** not applicable

**Reference to geotechnical studies and recommendations concerning servicing:** see note 1.5 on drawing C-1

**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 and Stormwater Management Report

**Identification of system constraints:** see page 2 of Servicing Brief and Stormwater Management Report

**Confirmation of adequate domestic supply and pressure:** not applicable

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

**Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves:** not applicable

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

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

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

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

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

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

**Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines:** not applicable

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

**Development Servicing Report: Wastewater**

**Summary of proposed design criteria:** see page 2 of Servicing Brief

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

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

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

**Descriptions of existing sanitary sewer available for discharge of wastewater from proposed development:** see page 3 Servicing Brief and Stormwater Management Report

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

**Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix C) format.** not applicable

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

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

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

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

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

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

#### **Development Servicing Report: Stormwater Checklist**

**Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property):** see pages 2-5 of Servicing Brief and Stormwater Management Report

**Analysis of available capacity in existing public infrastructure.** not applicable

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

**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 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-watershed and Master Servicing Study, if applicable study exists:** not applicable

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

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

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

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

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

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

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

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

**Descriptions of how the conveyance and storage capacity will be achieved for the development:** see pages 2-5 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: see page 2 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 5 of Servicing Brief and Stormwater Management Report

**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