MMM Group Limited

Drainage and Stormwater Management Report

112 Montreal Road

Prepared For: DCR/Phoenix Group

COMMUNITIES

TRANSPORTATION

BUILDINGS

INFRASTRUCTURE

September 2014 | 1013081000

MMM GROUP

STANDARD LIMITATIONS

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1.0 INTRODUCTION

MMM Group Limited (MMM) was retained by DCR/Phoenix Group to conduct a drainage and stormwater management study to service the proposed redevelopment of the existing Econolodge site into a new group of residential buildings at 112 Montreal Road in Ottawa, Ontario, near the intersection of Montreal Road and the Vanier Parkway. The study area is shown on Exhibit 1. All exhibits are shown in Appendix A.

1.1 Design Criteria

The City of Ottawa (the City) was contacted to determine what stormwater management (SWM) requirements there might be for discharge into the local City sewers. Joshua White at the City specified that flows greater than the 5-year flow generated from a runoff coefficient of 0.50 must be controlled on site up to the 100-year return period.

The City directed MMM to contact the Rideau Valley Conservation Authority (RVCA) to determine any applicable water quality criteria to be used in the design. The RVCA specified no treatment criteria for this site, at this time. A record of this conversation has been included in Appendix B. Similarly, the City has not specified any water quality requirements for use at this site. Therefore, none have been specifically included in the design.

In summary, the design criteria for stormwater management at the site are:

- Control the 100-year outflow from the site to the 5-year flow using a runoff coefficient of 0.50 and a T_c of 20 minutes; and
- No water quality treatment is required.

2.0 PROPOSED DESIGN

Return period flows were determined from IDF data generated at the Ottawa International Airport. These parameters differ slightly from those presented in the City's Sewer Design Guidelines, but include more years of data and are considered to be more accurate. In order to determine the required storage volume to meet the design criteria, the modified rational method (MRM) was used. The MRM design sheet can be found in Appendix C. The control flow was determined to be 117.2 L/s using a time of concentrate of 20 minutes and the site area was estimated as 1.24ha. In order to achieve the required site release rate, two underground storage facilities are proposed; one at the north end of the site and one at the south end. These facilities would pump the stored rainfall runoff to the local storm system. Underground storage facilities were identified as the preferred storage option owing to the substantial underground parking requirement for the site which severely limit the possible storage options. Owing to the underground parking facility proposed for the site, surface storage is not a viable option and, as such, is not accounted for in this analysis. Rather, the site is proposed to drain as efficiently as possible to the underground

storage facilities.

As shown in Exhibit 2, the site area has been divided between the roof areas and the surface areas as well as between the tributary areas to each of the storage facilities. This division is also reflected in the MRM calculations. It was assumed that each rooftop area could support an individual release rate of 5L/s and that these areas would not drain to storage facilities but rather would be controlled on the rooftops. The total rooftop area on the site is 0.45ha. The storage volume on each roof varies, but the average depth of rainfall storage is 27mm.

The surface area tributary to the north storage facility is 0.36ha (Subcatchment 101) and the tributary area to the south storage facility (Subcatchment 102) is 0.33ha. In addition, there is a 0.1ha uncontrolled area around the site with a 100-year release rate of 27L/s. The 100-year release rates are 37.0L/s and 18.2L/s for Subcatchments 101 and 102 respectively. The required storage to meet these release rates is 105.9m^3 and 83.3m^3 respectively, as shown in Table 1. Flows are anticipated to be controlled by the pumps themselves. This control should be clearly indicated in the mechanical design for the underground parking structure along with the specific design of the holding tanks themselves. In the event the capacity of the tanks is exceeded, it is anticipated that the spill will occur via an overflow conveyance into the underground mechanical system. Again, this spill system should be clearly indicated in the mechanical design for the underground parking structure.

Table 1: Hydrologic Summary

ID	Roof Areas	Subcatchment 101	Subcatchment 102	Uncontrolled
Area (ha)	0.45	0.36	0.33	0.10
Release Rate (L/s)	35.0	37.0	18.2	27.0
Required Storage (m^3)	126.0	86.2	109.0	0.0

As shown in servicing plans C.03, it is proposed to discharge both pump stations to a single point connecting to the Montreal Road trunk storm sewer. This trunk storm sewer is 1050mm and it is believed that meeting the City's flow control requirements for the site (which currently drains to this same storm sewer) is sufficient to demonstrate that there will be no adverse surcharging of the storm sewer.

In addition to surface areas draining to the pump stations, the roof leaders for Buildings B, C, and F will also connect to the main discharge point at Montreal Road using the internal storm sewer system. Buildings A and E are proposed to share a roof leader connection to the existing CB (to be relocated) in the ditch between the site and the Vanier Parkway. Similarly, Building D is proposed to connect directly to another CB located on the Vanier Parkway. Building G is proposed to connect to the storm sewer on

Gardner Street. A typical catch basin has a capacity of 20L/s for a flow depth of 65mm following MTO Design Chart 4.19 (also used by the City). A minimum catch basin lead (a 200mm pipe at 1% according to Section 5.6.7 of the OSDG) has a capacity of 37L/s. Based on these typical calculations, the catch basins proposed for connection on the Vanier Parkway will both have the capacity to receive up to 10L/s of extra flow from site roof areas. Therefore, the proposed connection to these CBs is not anticipated to cause adverse surcharging of the local storm sewer.

Under existing conditions, a substantial proportion of the Building G area (currently grassed) drains to the Gardner Road sewer. Most of this drainage area is being diverted to the south pump station and then the Montreal Road trunk sewer following development. The addition of 5L/s from the Building G roof area is estimated to be less than the existing contribution from those same lands under existing conditions and is therefore not anticipated to cause adverse surcharging of the local storm sewer.

While not specifically identified as a requirement for this site, stormwater quality treatment on site will still occur, largely in the holding tanks. The total site area is 1.2 ha and the pervious area subject to sedimentation (i.e. not including the roof area) is 0.8ha. Therefore, the effective impervious area with respect to water quality is 65%. The holding tanks will need to be maintained frequently in order to ensure that the storage volume required is within is not being used up by undue amounts of sediment. Consequently, at a minimum they would act as a dry pond which has a varying sediment removal efficiency of 50-60% and would essentially meet basic treatment levels as identified by the Ontario Ministry of the Environment. However, given the regularity of the required maintenance, this efficiency could be as high as 70% removal of suspended solids.

3.0 CONSTRUCTION PHASING

It is proposed to develop the site in two distinct phases. Phase 1 comprises the construction of Buildings A and F and the demolition, clearing, and preliminary grading of the entire site. Phase 2 comprises the construction of the remaining buildings and the final site grading. Prior to the construction of Phase 2, the Phase 1 development will still need to meet the SWM criteria as defined in Section 1.1. A separate MRM design sheet has been provided for this case and is shown in Appendix C. The undeveloped portion of the site is assumed to be comprised of packed granular material with a runoff coefficient of 0.5. Since the north pumping station will be constructed but will not yet be accepting is full design inflow, it will use significantly less than its design storage capacity. Similarly, there will be less available rooftop storage. Consequently, additional onsite storage will be required in the undeveloped (but cleared) area to meet the SWM requirements. Using MRM, this storage volume is estimated to be 137.2 m^3 using a release rate of 70 L/s. This release rate would be achieved using an orifice plate as noted on the interim stormwater management plan C.05.

4.0 EROSION AND SEDIMENT CONTROL

Prior to topsoil stripping, earthworks or underground construction, erosion and sediment controls will be implemented and will be maintained throughout construction. Silt fences will be installed around the perimeter of the site and will be cleaned and maintained throughout construction. Silt fences will remain in place until the working areas have been stabilized or re-vegetated. Catch basins and manholes will have filter fabric installed under the grate during construction to protect from silt entering the storm sewer system. A mud mat will be installed at the construction access in order to prevent mud tracking onto adjacent roads.

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in the erosion and sediment control plan C.01 and as summarized below:

- During all construction activities, erosion and sedimentation shall be controlled by the following techniques:
- limit extent of exposed soils at any given time,
- re-vegetate exposed areas as soon as possible,
- minimize area to be cleared and grubbed,
- install silt fence to prevent sediment from entering existing conveyance systems
- no refueling or cleaning of equipment near the receiving ditch,
- installation of filter cloth between frame and cover of catch basins
- provide sediment traps and basins during dewatering,
- establish material stockpiles away from watercourses, and
- plan construction at proper times to avoid flooding.

The following practices will be followed after every rainfall to guarantee the proper performance:

- verify that water is not flowing under silt fences,
- built-up material should be removed when it reaches a depth equal to half the height of the fence,
- a visual inspection shall be completed daily on sediment control barriers and any damage repaired immediately, and in some cases barriers may be removed temporarily to accommodate the construction operations; affected barriers will be reinstated at night when construction is completed
- during the course of construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer,
- construction and maintenance requirements for erosion and sediment controls to comply with Ontario Provincial Standard Specification OPSS 577, and City of Ottawa specifications.

- The contractor shall implement best management practices, to provide for protection of the area drainage system and the receiving watercourse, during construction activities. The contractor acknowledges that failure to implement appropriate erosion and sediment control measures may be subject to penalties imposed by any applicable regulatory agency.

5.0 CONCLUSIONS

The stormwater management design criteria identified for the site are:

- Control the 100-year outflow from the site to the 5-year flow using a runoff coefficient of 0.50 and a T_c of 20 minutes; and
- No water quality treatment is required but the site meets the MOE basic treatment standard as described above.

These requirements are met through the use of two proposed underground storage facilities to be located in the underground parking structure. The total on-site storage provided between the roof areas and the underground storage facilities is 321m^3 to meet the overall site release rate of 117.2L/s.

6.0 CORPORATE AUTHORIZATION

This document entitled "Drainage and Stormwater Management Draft Report – 112 Montreal Road" was prepared by MMM Group Limited (MMM) for the account of DCR/Phoenix. The material in is reflects MMM's best judgment in light of the information available to them at the time of preparation. Any use which a third party makes of this report, or reliance on or decisions made based on it, are the responsibilities of such third parties. MMM accepts no responsibilities for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Prepared by:

Bryan Orendorff, M.A.Sc., P. Eng.

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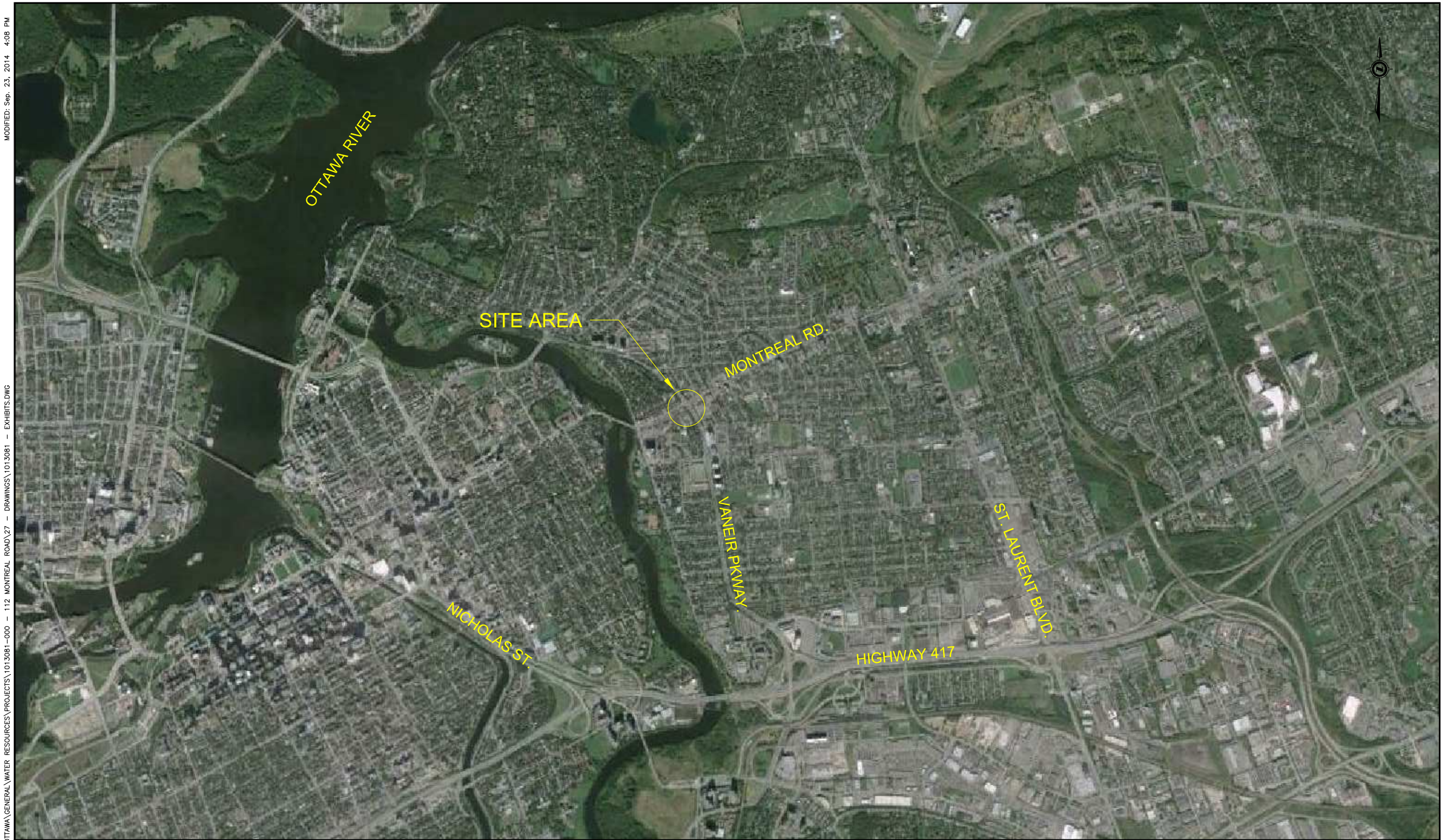
APPENDIX A – EXHIBITS



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SITE LOCATION

112 MONTREAL ROAD, OTTAWA

EXHIBIT 1

MODIFIED: Sep. 24, 2014 8:31 AM

DRAWING NAME: I:\OTTAWA\GENERAL\WATER RESOURCES\PROJECTS\101308I-000 – 112 MONTREAL ROAD\27 – DRAWINGS\101308I – EXHIBITS.DWG

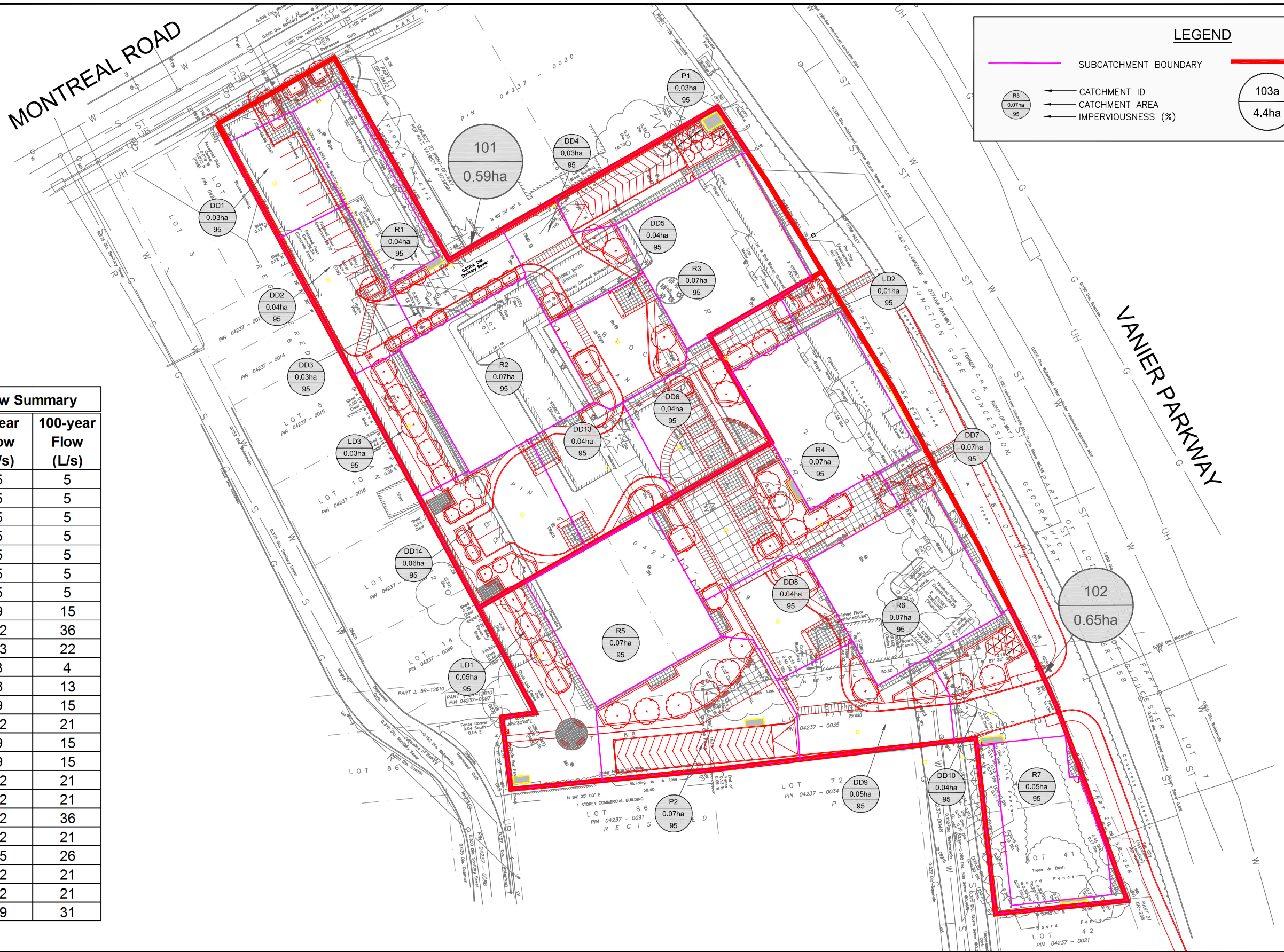

Table 1: Flow Summary

Area ID	5-year Flow (L/s)	100-year Flow (L/s)
R1	5	5
R2	5	5
R3	5	5
R4	5	5
R5	5	5
R6	5	5
R7	5	5
P1	9	15
P2	22	36
LD1	13	22
LD2	3	4
LD3	8	13
DD1	9	15
DD2	12	21
DD3	9	15
DD4	9	15
DD5	12	21
DD6	12	21
DD7	22	36
DD8	12	21
DD9	15	26
DD10	12	21
DD13	12	21
DD14	19	31

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STORMWATER DRAINAGE AREA PLAN

112 MONTREAL ROAD, OTTAWA

EXHIBIT

2

APPENDIX B – PROJECT CORRESPONDENCE

MMM GROUP

1145 Hunt Club Road, Suite 300
Ottawa, Ontario K1V 0Y3
Tel: (613) 736-7200
Fax: (613) 736-8710

TELECOM RECORD

W.O.: 1013081
DATE: August 11, 2014
TIME: 2:30
CALL FROM: Bryan Orendorff
REPRESENTING: MMM
CALL TO: Brandon Williams
REPRESENTING: RVCA

REGARDING: SWM requirements for proposed 112 Montreal Road Development

DISCUSSION: MMM contacted the RVCA to determine if they had any SWM requirements for the proposed site. The City had previously directed MMM to take this action. Brandon replied that the RVCA did not anticipate any involvement was required on their part for this site from a floodplain perspective (the site is outside the floodplain) and that they typically would not comment on a site application until it was circulated to them by the City. He indicated that the RVCA in this case could rely on the City to ensure that all appropriate requirements were being met.

ACTION: No actions required.

CC:

APPENDIX C – HYDRAULIC OUTPUT FILES

Modified Rational Method Storage Calculations

Project Number 1013081
Project Name 112 Montreal Road
Date 11/08/2014

Calculate Allowable Release Rate (in this case assume pre-development peak flow)

Modified Rational Method for Simple Storage Calculations on Highly Impervious Surfaces

IDF	5yr	100yr
A	831.891	1341.438
B	5.091	5.023
C	0.777	0.765
i	68.0	114.2

I = A/(T+b)^c

Pre-development Conditions

A =	1.24	ha	Catchments 101 + 102
C =	0.50		From City guidelines
tc =	20	min	From City guidelines
Q5 =	**117.2**	L/s	target flow rate

Area ID	101 - Roof	
A	0.18	ha
C100	0.95	

Area ID	101 - Paved	
A	0.36	ha
C100	0.95	

0.05ha is ubtracted from area 101 as uncontrolled drainage

Subcatchment 101

Roof Areas - storage volume averaged across roof = 27mm

Tc (min)	I (mm/hr)	Q unc (L/s)	Q cont (L/s)	Qstored (L/s)	V stored (m3)
5	230.04	109.4	15.0	94.4	28.3
10	168.79	80.2	15.0	65.2	39.1
15	135.49	64.4	15.0	49.4	44.5
20	114.25	54.3	15.0	39.3	47.2
25	99.38	47.2	15.0	32.2	48.4
30	88.34	42.0	15.0	27.0	48.6
35	79.76	37.9	15.0	22.9	48.1
40	72.89	34.7	15.0	19.7	47.2
45	67.25	32.0	15.0	17.0	45.8
50	62.53	29.7	15.0	14.7	44.2
55	58.50	27.8	15.0	12.8	42.3
60	55.03	26.2	15.0	11.2	40.2
65	51.99	24.7	15.0	9.7	37.9
				Max Storage	***48.6***

*release rate of 5L/s/building

Paved Areas

Tc (min)	I (mm/hr)	Q unc (L/s)	Q cont (L/s)	Qstored (L/s)	V stored (m3)
5	230.04	218.7	37.0	181.7	54.5
10	168.79	160.5	37.0	123.5	74.1
15	135.49	128.8	37.0	91.8	82.6
20	114.25	108.6	37.0	71.6	85.9
25	99.38	94.5	37.0	57.5	86.2
30	88.34	84.0	37.0	47.0	84.6
35	79.76	75.8	37.0	38.8	81.6
40	72.89	69.3	37.0	32.3	77.5
45	67.25	63.9	37.0	26.9	72.7
50	62.53	59.4	37.0	22.4	67.3
55	58.50	55.6	37.0	18.6	61.4
60	55.03	52.3	37.0	15.3	55.1
65	51.99	49.4	37.0	12.4	48.5
				Max Storage	***86.2***

Subcatchment 102

Area ID	102 - Roof	
A	0.27	ha
C100	0.95	

Area ID	102 - Paved	
A	0.33	ha
C100	0.95	

0.05ha is ubtracted from area 102 as uncontrolled drainage
Total external drainage area is 0.1ha with a 100-year flow of 27L/s

Roof Areas - storage volume averaged across roff of 27mm

Tc (min)	I (mm/hr)	Q unc (L/s)	Q cont (L/s)	Qstored (L/s)	V stored (m3)
5	230.04	164.0	20.0	144.0	43.2
10	168.79	120.4	20.0	100.4	60.2
15	135.49	96.6	20.0	76.6	69.0
20	114.25	81.5	20.0	61.5	73.8
25	99.38	70.9	20.0	50.9	76.3
30	88.34	63.0	20.0	43.0	77.4
35	79.76	56.9	20.0	36.9	77.4
40	72.89	52.0	20.0	32.0	76.7
45	67.25	48.0	20.0	28.0	75.5
50	62.53	44.6	20.0	24.6	73.8
55	58.50	41.7	20.0	21.7	71.7
60	55.03	39.2	20.0	19.2	69.3
65	51.99	37.1	20.0	17.1	66.6
				Max Storage	***77.4***

*release rate of 5L/s/building

Paved Areas

Tc (min)	I (mm/hr)	Q unc (L/s)	Q cont (L/s)	Qstored (L/s)	V stored (m3)
5	230.04	200.5	18.2	182.2	54.7
10	168.79	147.1	18.2	128.9	77.3
15	135.49	118.1	18.2	99.8	89.9
20	114.25	99.6	18.2	81.3	97.6
25	99.38	86.6	18.2	68.4	102.6
30	88.34	77.0	18.2	58.7	105.7
35	79.76	69.5	18.2	51.3	107.7
40	72.89	63.5	18.2	45.3	108.7
45	67.25	58.6	18.2	40.4	109.0
50	62.53	54.5	18.2	36.3	108.8
55	58.50	51.0	18.2	32.7	108.1
60	55.03	48.0	18.2	29.7	107.0
65	51.99	45.3	18.2	27.1	105.6
				Max Storage	***109.0***

Modified Rational Method Storage Calculations - Phase 1

Project Number 1013081
Project Name 112 Montreal Road
Date 21/08/2014

Calculate Allowable Release Rate (in this case assume pre-development peak flow)

Modified Rational Method for Simple Storage Calculations on Highly Impervious Surfaces

IDF	5yr	100yr
A	831.891	1341.438
B	5.091	5.023
C	0.777	0.765
i	68.0	114.2

I = A/(T+b)^c

Pre-development Conditions

A =	1.24	ha	Catchments 101 + 102
C =	0.50		From City guidelines
tc =	20	min	From City guidelines
Q5 =	**117.2**	L/s	target flow rate

Area ID	101 - Roof	
A	0.11	ha
C100	0.95	

Area ID	101 - Paved	
A	0.20	ha
C100	0.95	

Phase 1

Roof Areas - storage volume averaged across roof = 27mm

Tc (min)	I (mm/hr)	Q unc (L/s)	Q cont (L/s)	Qstored (L/s)	V stored (m3)
5	230.04	66.8	10.0	56.8	17.0
10	168.79	49.0	10.0	39.0	23.4
15	135.49	39.4	10.0	29.4	26.4
20	114.25	33.2	10.0	23.2	27.8
25	99.38	28.9	10.0	18.9	28.3
30	88.34	25.7	10.0	15.7	28.2
35	79.76	23.2	10.0	13.2	27.7
40	72.89	21.2	10.0	11.2	26.8
45	67.25	19.5	10.0	9.5	25.8
50	62.53	18.2	10.0	8.2	24.5
55	58.50	17.0	10.0	7.0	23.1
60	55.03	16.0	10.0	6.0	21.5
65	51.99	15.1	10.0	5.1	19.9
				Max Storage	***28.3***

*release rate of 5L/s/building

Paved Areas

Tc (min)	I (mm/hr)	Q unc (L/s)	Q cont (L/s)	Qstored (L/s)	V stored (m3)
5	230.04	121.5	37.0	84.5	25.4
10	168.79	89.2	37.0	52.2	31.3
15	135.49	71.6	37.0	34.6	31.1
20	114.25	60.3	37.0	23.3	28.0
25	99.38	52.5	37.0	15.5	23.2
30	88.34	46.7	37.0	9.7	17.4
35	79.76	42.1	37.0	5.1	10.8
40	72.89	38.5	37.0	1.5	3.6
45	67.25	35.5	37.0	0.0	0.0
50	62.53	33.0	37.0	0.0	0.0
55	58.50	30.9	37.0	0.0	0.0
60	55.03	29.1	37.0	0.0	0.0
65	51.99	27.5	37.0	0.0	0.0
				Max Storage	***31.3***

Phase 2

Area ID	Phase 2	
A	0.93	ha
C100	0.63	C = 0.50 during 10-year storm

Roof Areas - storage volume averaged across roff of 27mm

Tc (min)	I (mm/hr)	Q unc (L/s)	Q cont (L/s)	Qstored (L/s)	V stored (m3)
5	230.04	371.7	70.2	301.5	90.4
10	168.79	272.7	70.2	202.5	121.5
15	135.49	218.9	70.2	148.7	133.8
20	114.25	184.6	70.2	114.4	137.2
25	99.38	160.6	70.2	90.4	135.5
30	88.34	142.7	70.2	72.5	130.5
35	79.76	128.9	70.2	58.6	123.2
40	72.89	117.8	70.2	47.5	114.1
45	67.25	108.7	70.2	38.4	103.8
50	62.53	101.0	70.2	30.8	92.4
55	58.50	94.5	70.2	24.3	80.2
60	55.03	88.9	70.2	18.7	67.2
65	51.99	84.0	70.2	13.8	53.7
				Max Storage	***137.2***