

2705460 ONTARIO INC.

112 MONTREAL ROAD STORMWATER MANAGEMENT REPORT

MARCH 04, 2020





112 MONTREAL ROAD STORMWATER MANAGEMENT REPORT

2705460 ONTARIO INC.

PROJECT NO.: 19M-01935-00
CLIENT REF:
DATE: MARCH 04, 2020

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March 4, 2020	For City Review			
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March 4, 2020

Date

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Ben Worth, P.Eng., C.Eng., MICE
Manager, Water Resources

March 4, 2020

Date

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1 INTRODUCTION

1.1 SCOPE

WSP Canada Group Ltd. was retained by 2705460 Ontario Inc. to conduct a stormwater management study to service the proposed redevelopment of the existing Econolodge site into a new group of residential towers.

1.2 SITE LOCATION

The existing site is located at 112 Montreal Road in Ottawa, Ontario, close to the south-west corner of the Montreal Road and Vanier Parkway intersection. The location of the proposed re-development is illustrated in **Figure 1**.

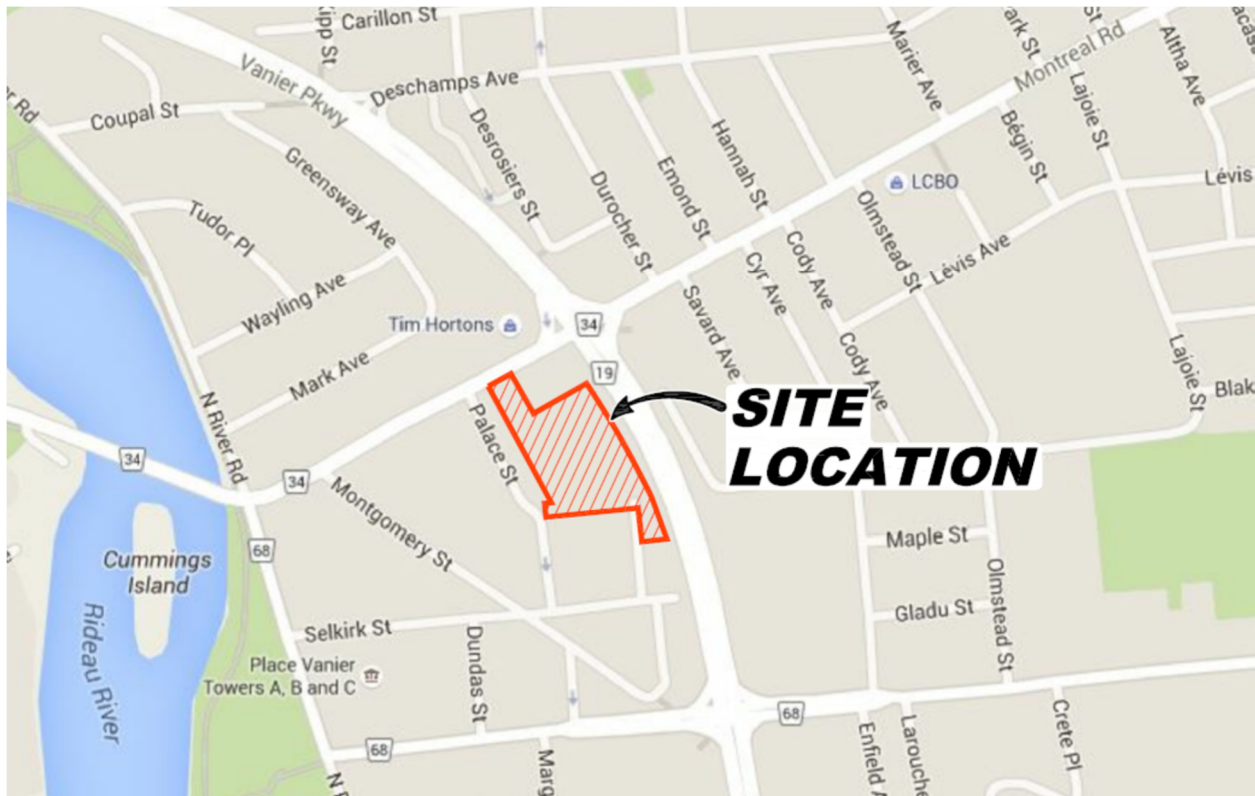


Figure 1: Site Location

1.3 STORMWATER MANAGEMENT PLAN OBJECTIVES

The objectives of the stormwater management plan are as follows:

- Determine site specific stormwater management requirements to ensure that the plan is in conformance with the City of Ottawa Sewer Design Guidelines, October 2012.
 - Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and sizing of the proposed stormwater management facilities.
-

1.4 DESIGN CRITERIA

The City of Ottawa (the City) was contacted to determine the stormwater management (SWM) requirements for discharge into the local City sewers for the project site. 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 (consistent with Section 8.3.7.3 of the Ottawa Sewer Design Guidelines, October 2012).

The runoff coefficient used for design (100-year return period), was increased by 25% to comply with section 5.4.5.2.1 of the Ottawa Sewer Design Guidelines (October 2012).

As per section 8.3.7 of the Ottawa Sewer Design Guidelines “New development draining to an existing system that has no stormwater treatment facility may be subject to on-site treatment (i.e. best management practice, oil grit separators, etc.). Some existing areas within the City may be subject to a cash-in-lieu policy with respect to stormwater treatment. The designer must confirm with the City if the development area in question is subject to this policy”. The City directed WSP 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. A record of this conversation has been included in **Appendix A**. 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 PRE-DEVELOPMENT CONDITIONS

2.1 GENERAL

The subject property pre-development includes an impervious at-grade parking lot, an existing group of commercial buildings (Econolodge) and a pervious landscaped area at the south-east corner of the project site. The total site area is 12,300 m² (1.23 ha). Please refer to **Appendix B** for existing site conditions.

2.2 RAINFALL INFORMATION

The rainfall intensity is calculated in accordance with Section 5.4.2 of the Ottawa Sewer Design Guidelines (October 2012):

$$i = \left[\frac{A}{(Td + C)^B} \right]$$

Where;

- A, B, C = regression constants for each return period (defined in section 5.4.2)
- i = rainfall intensity (mm/hour)
- Td = storm duration (minutes)
- The IDF parameters/regression constants are included in **Appendix C**.

2.3 ALLOWABLE FLOW RATES

As noted in section 1.4, the City of Ottawa specified the allowable discharge rate from this site as the 5-year flow generated from a runoff coefficient of 0.50, controlled on site up to the 100-year return period.

The allowable release rate to the municipal storm sewer system from the proposed development is 120 l/sec, based on the 5-year pre-development flow rate calculated with a runoff coefficient value of 0.50.

The calculated peak flow rates for the site in the pre-development condition are summarized below in

Table 2-1. Detailed calculations are contained within **Appendix C**.

Table 2-1: Pre-Development Peak Flow Rate Calculations (Runoff Coefficient, C = 0.50 and T_c=20 min)

RETURN PERIOD (YEARS)	RAINFALL INTENSITY (MM/HOUR)	PEAK FLOW RATE (L/SEC)	TARGET RELEASE RATE (L/SEC)
2	52.0	89.2	120.5
5	70.3	120.5	
10	82.2	141.0	
25	97.3	166.8	
50	108.5	186.1	
100	120.0	205.7	

3 POST-DEVELOPMENT CONDITIONS

3.1 GENERAL

The project proposals consist of a mixed-use development with 3 residential towers; a 19-story residential tower with main floor commercial (Tower A), a 19-story residential tower (Tower B), and a 16-story residential tower with main floor commercial (Tower C). A multi-level basement structure is proposed over the majority of the project site area. As described further in subsequent sections of the report, a SWM cistern will be provided within the basement structure adjacent to Montreal Road. Please refer to **Appendix D** for an illustration of the project (Storm Drainage Area Plan).

The following assumptions have been used to quantify stormwater runoff for modelling/analysis purposes: 100% of proposed roof surfaces have been considered as impervious, and 50% of the rooftop area of each tower will be available for temporary surface ponding (via drainage by controlled discharge roof drains).

The entire project area will comply with the target allowable release rate.

3.2 QUANTITY CONTROL

As noted in section 2.3, the target allowable discharge rate to the municipal sewer system from the site is 120 l/sec. This is equivalent to the peak runoff rate under pre-development conditions during a 5-year design storm event with a runoff coefficient of 0.50. Compliance with the target offsite discharge rate will be achieved through use of controlled flow rooftop drains, and the provision of an underground cistern storage structure. Post-development runoff calculations have accounted for uncontrolled runoff from portions of the site that will not drain to storage features.

A cistern was identified as the preferred storage option given the substantial underground parking requirement for the site; surface storage was not considered a viable option and was not accounted for in this analysis.

The cistern is designed to receive runoff (for all events up to and including the 100-year return period), from roof surfaces and at-grade areas within the development area. The controlled and uncontrolled project areas are illustrated in **Appendix E**. The cistern will discharge to the existing municipal storm sewer system via gravity, and peak outflow rates will be controlled via a vortex flow control device (**Appendix F**).

To satisfy net target release rates for controlled and uncontrolled site areas, the recommended peak discharge rate for flow control device is 98 l/sec. If a storm event that occurs fills the cistern, the access hatch at the top of the cistern would allow water to spill to the Montreal Rd. major system. It is noted that the return period associated with an overflow event requiring these facilities to spill would exceed 100-years.

As per Site Servicing Plan Drawing discharge from the cistern is proposed to the Montreal Road trunk storm sewer. This trunk storm sewer is 1050mm and it is believed that the City's flow control requirements for the site (which currently drains to this same storm sewer) are sufficient to ensure that there will be no adverse surcharging of the storm sewer.

As noted above, it has been assumed that 50% of the rooftop area of each tower will be available for temporary surface ponding (via drainage by controlled discharge roof drains), and the remaining roof areas will drain directly to the cistern without any rooftop storage. Detailed roof drain layouts were not available at this point; therefore, it was assumed that one drain would be provided for approximately every 150m² of roof area. For modelling purposes, these outlets were simulated using rating curves for a *Watts Accutrol* product (in the "fully closed" position).

Appendix E illustrates the small portions of the project site that will drain offsite uncontrolled in post-development conditions. These uncontrolled runoff rates contribute to the total allowable release rate modelled.

A HydroCAD model of the project was constructed and utilized to include:

- storage and controlled release of stormwater from 50% of rooftop areas (Towers A, B, and C) to the cistern;
- runoff from the remaining 50% of rooftop areas (Towers A, B, and C) directly to the cistern;
- controlled runoff from at-grade areas directed to the cistern; and
- uncontrolled runoff rates generated from at grade areas constructed with soft (A-23) and hard (A-24) landscaping.

The Modified Rational Method (an inherent subroutine of the HydroCAD software) has been used for the modelling exercise, and the model has informed the maximum storage volume used in the stormwater cistern based on the proposed flow. Flow rates generated from uncontrolled drainage areas within the project site and controlled flow from the cistern meet the target offsite discharge rate required (120 l/s).

The rainfall intensity and storm duration combination resulting in the largest peak flow discharged to the sewer system occurs at the critical storm duration, $t_d = 10$ minutes for the 100-year event (determined iteratively using HydroCAD). A summary of the model results and storage controls are listed in Table 3-1 to

Table 3-3 and the full modelling output is included in **Appendix G**.

The modelled post-development peak flow rates comply with the allowable release rate for the 100-year return period (**Table 3-1**).

Table 3-1 Post-Development Modelling Results (A)

RETURN PERIOD (YEARS)	MODELLED POST-DEV. PEAK FLOW RATE (L/SEC) ¹	ALLOWABLE RELEASE RATE (L/SEC)
5	104.3	120
100	118.8	

¹ Includes flow rates generated from uncontrolled drainage areas within the project site and controlled flow from the cistern

The HydroCAD analysis completed allows the performance of the SWM drainage system to be verified in all possible storm durations (based on Modified Rational method calculations), and helps identify the critical duration for different components of the system. For example, the critical storm duration for the cistern (resulting in maximum storage utilized) was found to be $t_d = 27$ minutes. A summary of these modelling results is provided below (**Table 3-2**).

The results show that the maximum utilized storage volume in the Cistern is 234.6 m³ to control the 100-year post-development runoff (**Table 3-2**).

Table 3-2 Post-Development Modelling Results (B)

RETURN PERIOD (YEARS)	MAXIMUM UTILIZED STORAGE AND ASSOCIATED PEAK FLOW (L/S)	
	(M3)	(L/S)
100	234.6	74.3

¹ Critical duration resulting in maximum storage utilized in the cistern

Maximum rooftop storage volumes and release rates (based on the critical duration for each of the different components of the system), in addition to uncontrolled flow rates generated from uncontrolled areas are provided in **Table 3-3**.

Table 3-3 Post-Development Modelling Results (C)

RETURN PERIOD (YEARS)	ROOFTOP MAXIMUM STORAGE VOLUME & PEAK RELEASE RATE						UNCONTROLLED FLOW RATE (L/SEC) ²
	TOWER A		TOWER B		TOWER C		
	(m³)	(L/S)	(m³)	(L/S)	(m³)	(L/S)	
5	14.4	12.0	11.9	12.0	8.2	9.0	10.1
100	32.4	12.0	27.1	12.0	18.6	9.0	21.5

¹ Based on the critical duration resulting in maximum storage utilized on each roof surface

² Based on the critical duration resulting in the maximum flow released

3.3 WATER QUALITY CONTROL

As per Section 1.4, no water quality treatment is required.

3.4 EROSION CONTROL

Please refer to the Erosion and Sedimentation Control plan drawing C.05 as part of the Engineering Drawing Set.

4 RIDEAU RIVER FLOOD PLAIN

The RVCA were consulted to obtain flood plain mapping for the Rideau River in the vicinity of the subject site. Please refer to mapping excerpt provided in **Appendix H**.

It is noted that the 100-year flood plain extends onto Montreal Road, to a modelled elevation of 56.52 m (cross section reference 2474). The site design has accounted for this by setting the minimum ground elevation at the project threshold to an elevation of 56.62 m (refer to Grading and Drainage Plan Drawing C.02 for details), and by specifying the use of non-return backflow preventers within the flow control device associated with the cistern.

5 CONCLUSIONS

A stormwater management plan has been prepared to support the site plan application for the 112 Montreal Road development in the City of Ottawa. The key points are summarized below.

WATER QUANTITY

Controlled runoff collected from the project site will be directed to a stormwater cistern with a minimum active storage volume of 234.6 m³ to control the 100-year event. Discharge from the cistern to the municipal storm sewer will be controlled using a vortex flow control device (specified with a peak discharge rate of 98 l/sec).

For the 100-year return period, the uncontrolled runoff from landscaped areas (A-23 and A-24) and flow control from the cistern directed to the municipal storm sewer system, will comply with the allowable 5-year release rate of 120 l/sec (calculated using a runoff coefficient of 0.50 and a T_c of 20 minutes).

WATER QUALITY

No specific water quality treatment features are required.

This report demonstrates that the proposed SWM strategy will address stormwater management related impacts from this project and meet the requirements of the City of Ottawa.

Respectfully submitted,



APPENDIX

A

RVCA
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.

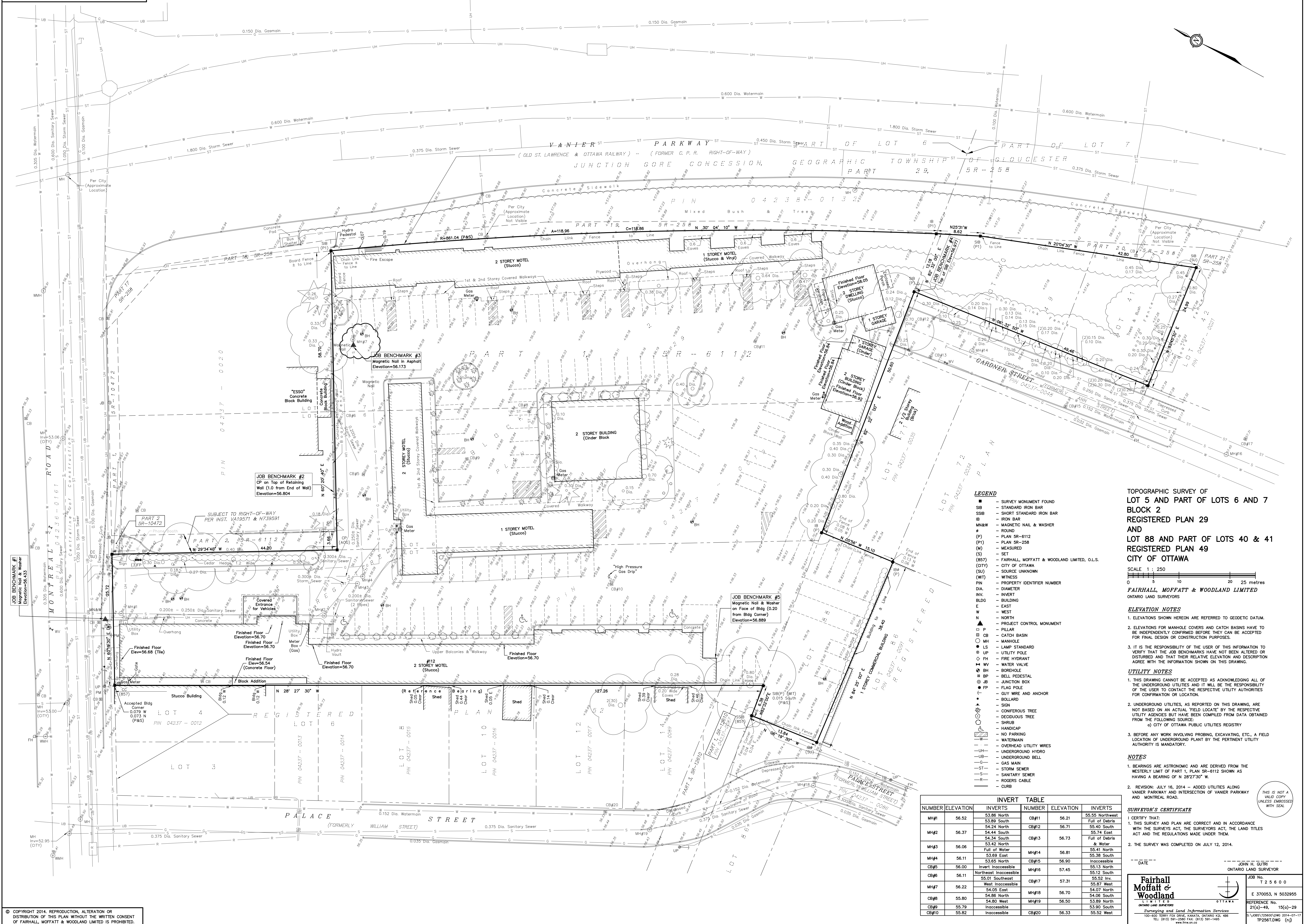
ACTION: No actions required.

CC:

APPENDIX

B

EXISTING SITE
CONDITIONS



DATE	JOHN H. GUTHRIE ONTARIO LAND SURVEYOR
Fairhall Moffatt & Woodland REALTORS Ontario Land Surveyors <i>Surveying and Land Information Services</i> 100-600 TERRY FOX DRIVE, KANATA, ONTARIO K2L 4B6 TEL: (613) 591-2580 FAX: (613) 591-1495 www.fmc.on.ca	JOB NO. T 2 5 E 370053, REFERENCE NO. 21(a)-49, S:\0605\025607\TP25670

INVERT TABLE					
NUMBER	ELEVATION	INVERTS	NUMBER	ELEVATION	INVERTS
MH#1	56.52	53.86 North 53.89 South	CB#11	56.21	55.58 Northeast Full of Debris
MH#2	56.37	54.24 North 54.34 South 53.42 North	CB#12	56.71	55.40 South 55.74 East Full of Debris & Water
MH#3	56.06	Full of Water 53.69 East 53.65 North	MH#14	56.81	55.41 North 55.38 South
MH#4	56.11		CB#15	56.90	Inaccessible
CB#5	56.00	Invert Inaccessible	MH#16	57.45	55.13 North 55.12 South
CB#6	56.11	North Inaccessible 55.01 Inaccessible	CB#17	57.31	55.52 Inv.
MH#7	56.22	West Inaccessible 54.05 East 54.96 North	MH#18	56.70	55.87 North 54.05 South
CB#8	55.80	54.80 West	MH#19	56.50	53.89 North
CB#9	55.79	Inaccessible			53.90 South
CB#10	55.82	Inaccessible	CB#20	56.33	55.52 West

APPENDIX

C

PRE-DEVELOPMENT
CALCULATIONS

	Stormwater Management Calculations	Project: 112 Montreal Road	No.: 19M-01935-00	
	Pre-Dev Release Rates	By: MS	Date: 2020-02-21	Page: 1
		Checked: BW		

Step 1: Determine Pre-development Flow using Rational Formula

* Runoff Coefficient, C in accordance with City of Ottawa Sewer Design Guidelines (section 8.3.7.3)
Runoff Coefficient, C = 0.5 -

Rainfall intensity calculated in accordance with City of Ottawa Sewer Design Guidelines (section 5.4.2):

$$i = \left[\frac{A}{(Td + C)^B} \right]$$

Where: A, B, C = regression constants for each return period (defined in section 5.4.2)
i = rainfall intensity (mm/hour)
Td = storm duration (minutes) 180 minutes

Time of Concentration = 20 minutes
Catchment Area = 1.235 ha

Return Period	2	5	10	25	50	100
a =	733.0	998.1	1,174.2	1,402.9	1,569.6	1,735.7
b =	0.810	0.814	0.816	0.819	0.820	0.820
c =	6.199	6.053	6.014	6.018	6.014	6.014
Intensity _{peak} (mm/hr) =	52.0	70.3	82.2	97.3	108.5	120.0
Q _{peak} (L/s) =	89.2	120.5	141.0	166.8	186.1	205.7
Q _{peak} (m ³ /s) =	0.089	0.121	0.141	0.167	0.186	0.206

Return Period = 5 year
Q = 120.5 L/s Pre-development flow rate

Conclusion:

The 5-year pre-development flow rate for a 20 minute Tc governs the 100-year maximum post-development release rate and is 120.5 L/s.

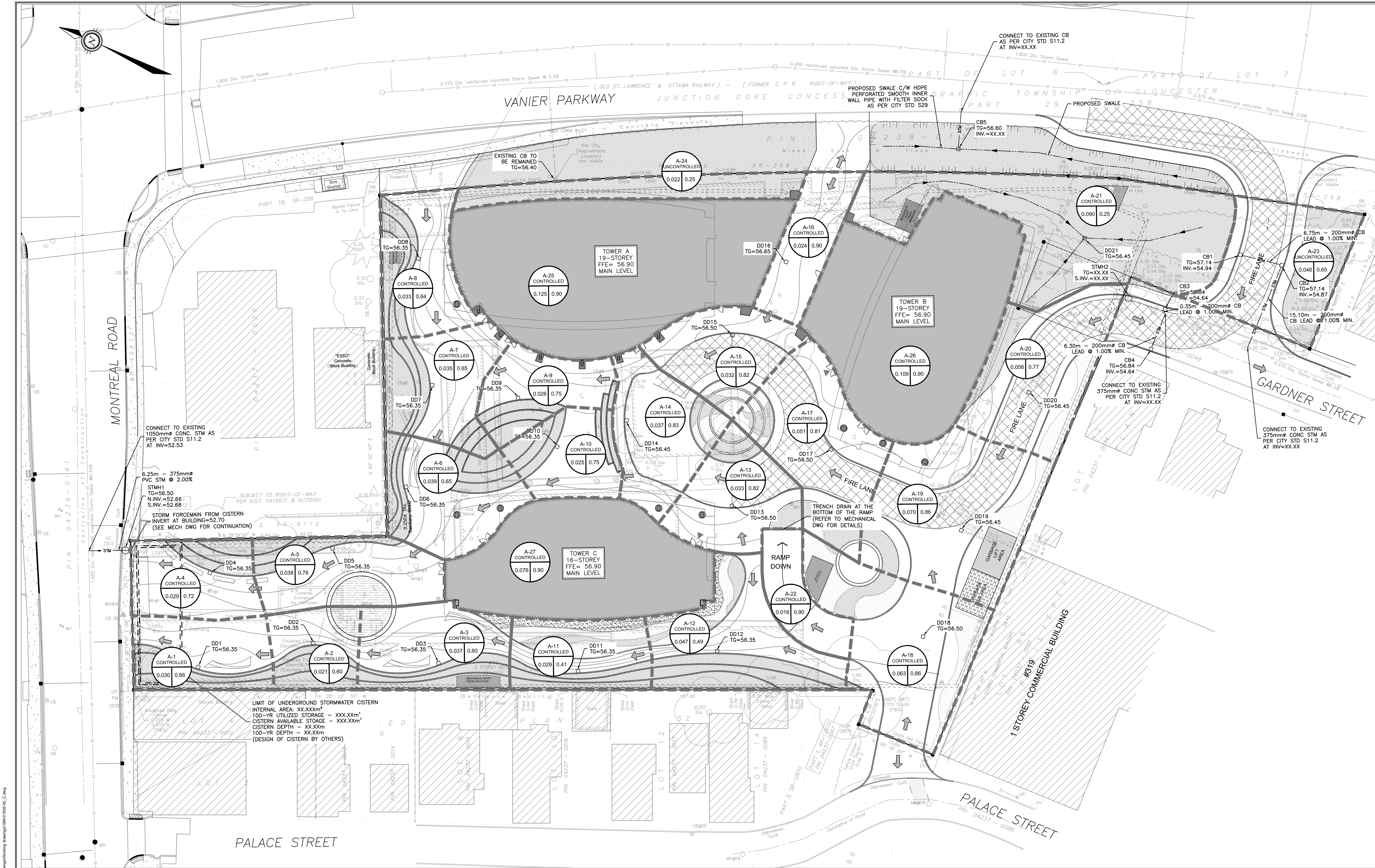
Filepath:

\\Caott100dat01\\Water Resources\Projects\Pre-2017\1013081-000 - 112 Montreal Road\2020 Work - MS\HydroCAD\Spreadsheet Calculations\[112 Montreal Rd Calcs - MS.xlsx]IDF Calcs

APPENDIX

D

PROPOSED SITE
DRAWINGS



LEGEND:

EXISTING FIRE HYDRANT

EXISTING V&B

EXISTING VALVE CHAMBER

PROPOSED FIRE HYDRANT

PROPOSED V&B

PROPOSED REMOTE METER

PROPOSED METER

PROPOSED CATCHBASIN MANHOLE

PROPOSED CATCHBASIN

EXISTING CATCHBASIN MANHOLE

EXISTING STORM SEWER AND MANHOLE

PROPOSED STORM SEWER AND MANHOLE

STORM DRAINAGE BOUNDARY

ID DENOTES WATERSHED NAME
A DENOTES AREA IN HECTARES
C DENOTES RUNOFF COEFFICIENT

OVERLAND MAJOR FLOW ROUTE

GENERAL NOTES:

THE ENGINEER WAIVES ANY AND ALL RESPONSIBILITY AND LIABILITY FOR PROBLEMS WHICH ARISE FROM FAILURE TO FOLLOW THE PLANS, SPECIFICATIONS AND THE DESIGN INTENT THEY CONVEY. OR FOR PROBLEMS WHICH ARISE FROM OTHERS FAILURE TO OBTAIN AND/OR FOLLOW THE ENGINEERS GUIDANCE WITH RESPECT TO ANY ERRORS, OMISSIONS, INCONSISTENCIES, AMBIGUITIES OR CONFLICTS WHICH ARE ALLEGED.

CONTRACTOR TO VERIFY ALL DIMENSIONS AND NOTIFY THE ENGINEER OF ANY DISCREPANCIES BEFORE WORK COMMENCES. DO NOT SCALE DRAWINGS.

KEY PLAN
(N.T.S.)

No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	D.Y.	2020-01-21

HORIZONTAL SCALE:
SCALE: 1:250

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

NOT VALID UNLESS SIGNED AND DATED

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ANNIS, O'SULLIVAN, VOLLEBECK
Ontario Land Surveyors
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DESIGNED BY: D.Y. DRAWN BY: D.Y. APPROVED BY: I.J.

PROJECT

112 MONTREAL ROAD
RESIDENTIAL DEVELOPMENT

DRAWING TITLE

STORM DRAINAGE
AREA PLAN

PROJECT NO.
19M-01935-00

DRAWING NO.
C04

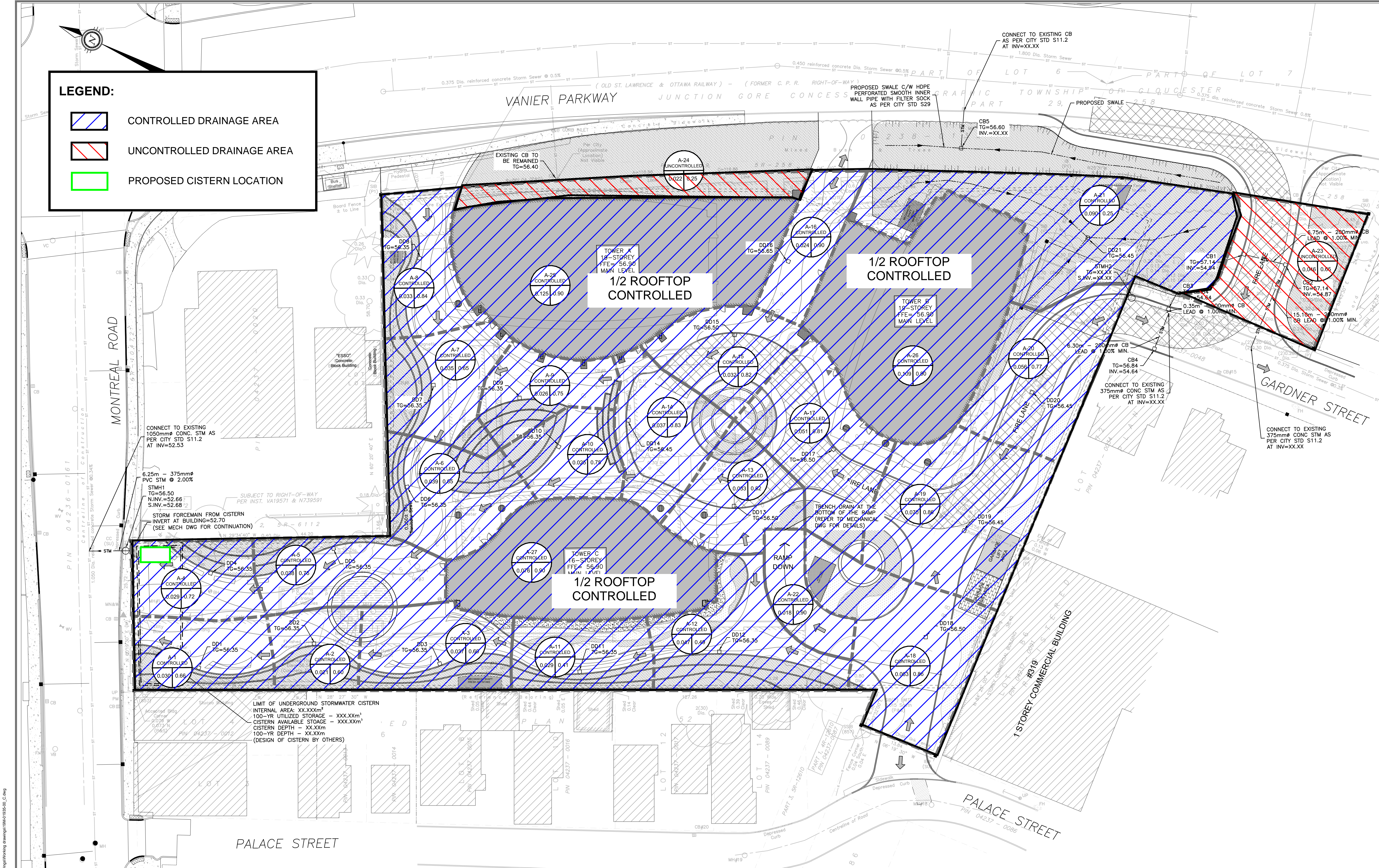
#XXXX

D07-XX-XX-XXXX

APPENDIX

E

CATCHMENT PLAN



LEGEND:

- CONTROLLED DRAINAGE AREA
- UNCONTROLLED DRAINAGE AREA
- PROPOSED CISTERN LOCATION

GENERAL NOTES:

THE ENGINEER WAIVES ANY AND ALL RESPONSIBILITY AND LIABILITY FOR PROBLEMS WHICH ARISE FROM FAILURE TO FOLLOW THE PLANS, SPECIFICATIONS AND THE DESIGN INTENT THEY CONVEY. OR FOR PROBLEMS WHICH ARISE FROM OTHERS FAILURE TO OBTAIN AND/OR FOLLOW THE ENGINEERS GUIDANCE WITH RESPECT TO ANY ERRORS, OMISSIONS, INCONSISTENCIES, AMBIGUITIES OR CONFLICTS WHICH ARE ALLEGED.

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KEY PLAN
(N.T.S.)

REVISIONS

No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	D.Y.	2020-01-21

HORIZONTAL SCALE:
5m 0 5 10m
SCALE: 1:250

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

NOT VALID UNLESS SIGNED AND DATED

wsp

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DESIGNED BY: D.Y. DRAWN BY: D.Y. APPROVED BY: I.J.

LEGEND:

- EXISTING FIRE HYDRANT
- EXISTING V&B
- EXISTING VALVE CHAMBER
- PROPOSED FIRE HYDRANT
- PROPOSED V&B
- PROPOSED REMOTE METER
- PROPOSED METER
- PROPOSED CATCHBASIN MANHOLE
- PROPOSE CATCHBASIN
- EXISTING CATCHBASIN MANHOLE
- EXISTING STORM SEWER AND MANHOLE
- PROPOSED STORM SEWER AND MANHOLE
- STORM DRAINAGE BOUNDARY
- ID DENOTES WATERSHED NAME
A DENOTES AREA IN HECTARES
C DENOTES RUNOFF COEFFICIENT
- OVERLAND MAJOR FLOW ROUTE

112 MONTREAL ROAD
RESIDENTIAL DEVELOPMENT

DRAWING TITLE

STORM DRAINAGE
AREA PLAN

PROJECT NO.
19M-01935-00

DRAWING NO.
C04

#XXXX

APPENDIX

F

HYDRO-BRAKE
OPTIMUM SHE-0416-
1200-1800-1200
RATING CURVE

Technical Specification

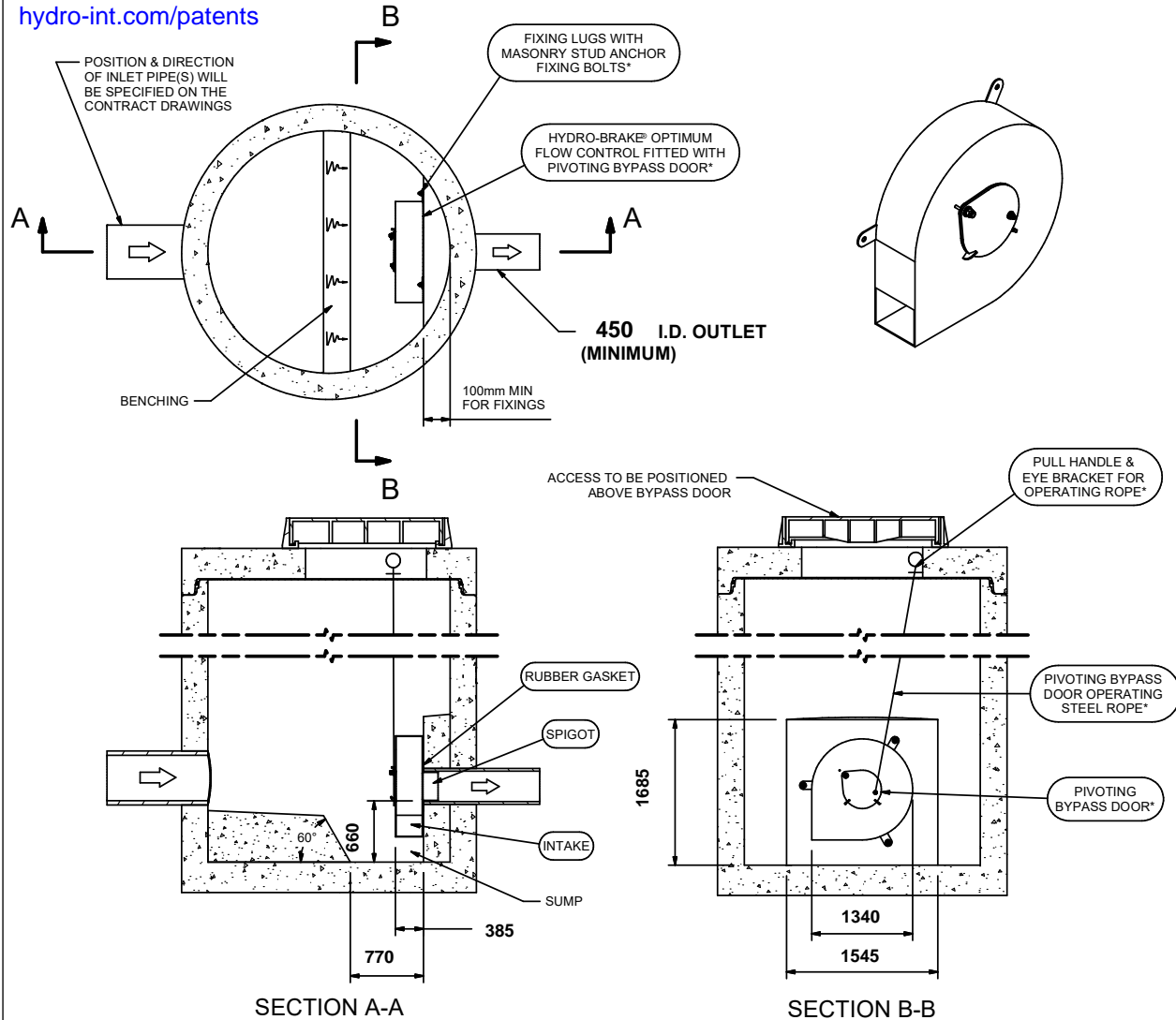
Control Point	Head (m)	Flow (l/s)
Primary Design	2.000	98.000
Flush-Flo™	0.671	97.653
Kick-Flo®	1.418	82.712
Mean Flow		82.694

Hydro-Brake® Optimum Flow Control including:

- 5 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet



hydro-int.com/patents



IMPORTANT: LIMIT OF HYDRO INTERNATIONAL SUPPLY
 THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
 FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
 ALL CIVIL AND INSTALLATION WORK BY OTHERS
 * WHERE SUPPLIED
 HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW
 CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE



The head/flow characteristics of this SHE-0379-9800-2000-9800 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International®

DATE	3/3/2020 9:29 PM	SHE-0379-9800-2000-9800 Hydro-Brake® Optimum
SITE		
DESIGNER	Michael Stewart	
REF		

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michael.stewart@wsp.com

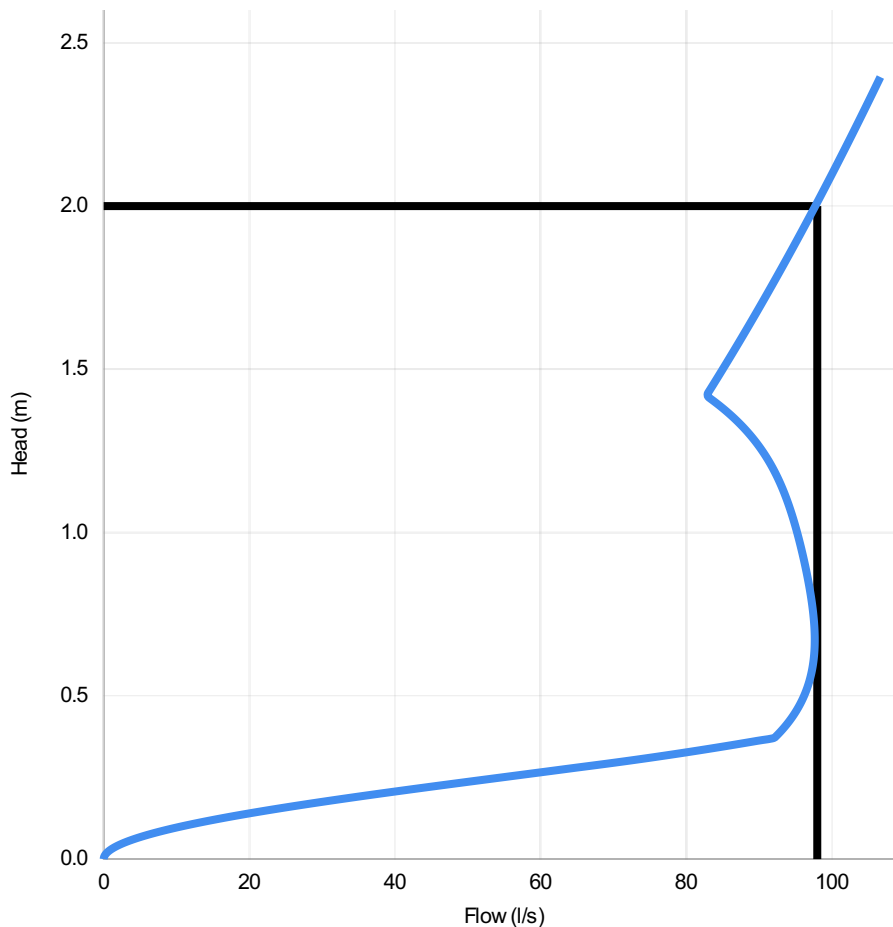
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	2.000	98.000
Flush-Flo	0.671	97.653
Kick-Flo®	1.418	82.712
Mean Flow		82.694



PT/329/0412

hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.069	5.223
0.138	19.426
0.207	39.978
0.276	63.440
0.345	85.082
0.414	93.850
0.483	95.829
0.552	96.996
0.621	97.547
0.690	97.641
0.759	97.411
0.828	96.960
0.897	96.359
0.966	95.642
1.034	94.799
1.103	93.775
1.172	92.463
1.241	90.714
1.310	88.336
1.379	85.109
1.448	83.571
1.517	85.475
1.586	87.335
1.655	89.154
1.724	90.936
1.793	92.681
1.862	94.393
1.931	96.073
2.000	97.723

DESIGN ADVICE



The head/flow characteristics of this SHE-0379-9800-2000-9800 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modeling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International

DATE 3/3/2020 9:29 PM

Site

DESIGNER Michael Stewart

Ref

SHE-0379-9800-2000-9800

Hydro-Brake Optimum®

APPENDIX

G

HYDROCAD MODEL
OUTPUT

APPENDIX

G-1 5-YEAR ANALYSIS (PEAK DISCHARGE, T_c = 10 MIN)

112MontrealRd_5 year

Prepared by WSP Canada inc.

HydroCAD® 10.00-21 s/n 10060 © 2018 HydroCAD Software Solutions LLC

Ottawa 5-Year Duration=10 min, Inten=104.2 mm/hr

Printed 2020-03-03

Page 2

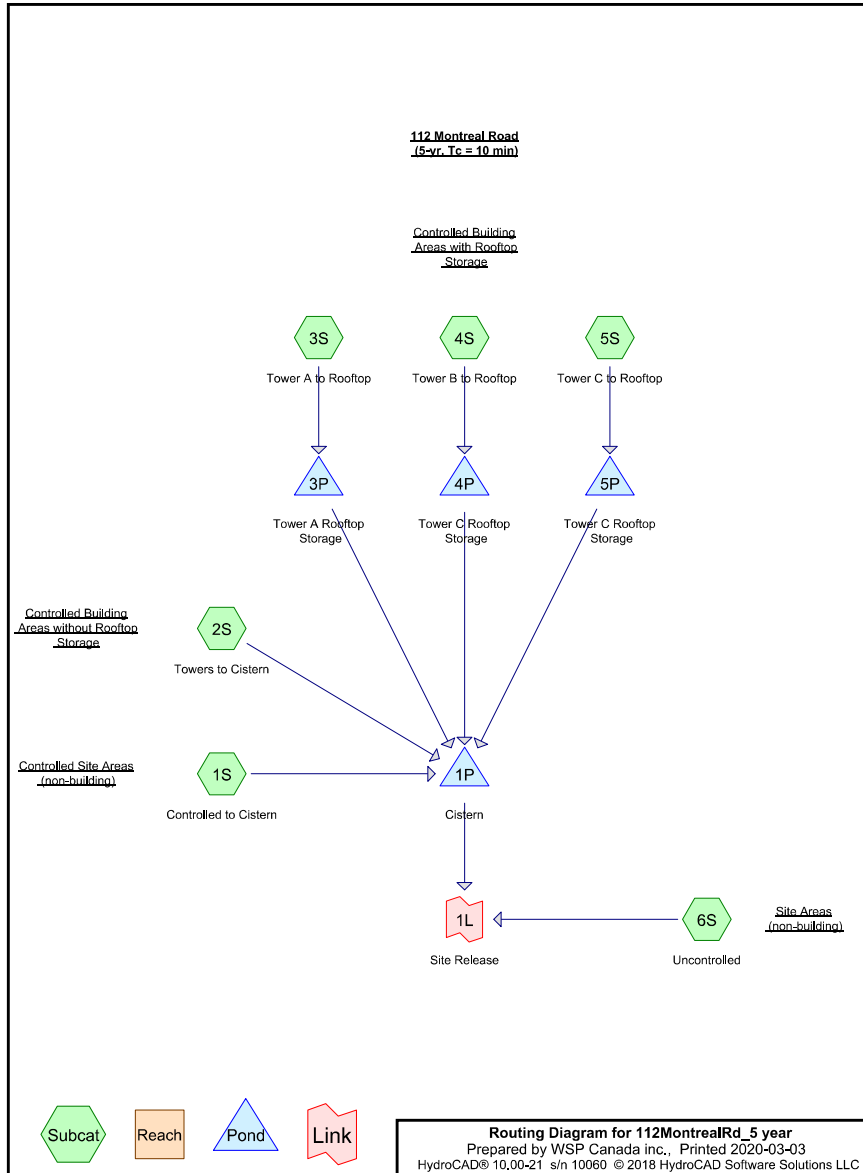
Summary for Subcatchment 1S: Controlled to Cistern

Runoff = 0.1674 m³/s @ 0.17 hrs, Volume= 102.2 m³, Depth= 12 mm

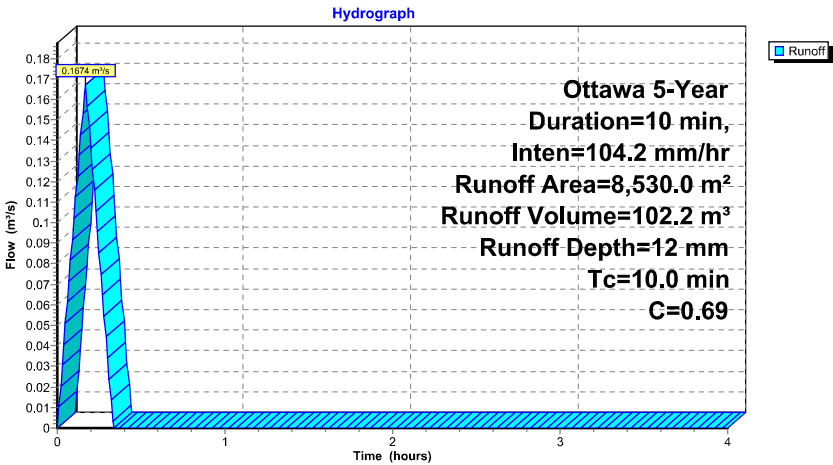
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=10 min, Inten=104.2 mm/hr

Area (m²)	C	Description
300.0	0.66	A-1
210.0	0.60	A-2
370.0	0.60	A-3
290.0	0.72	A-4
380.0	0.76	A-5
390.0	0.65	A-6
350.0	0.65	A-7
330.0	0.84	A-8
260.0	0.75	A-9
250.0	0.75	A-10
290.0	0.41	A-11
470.0	0.49	A-12
330.0	0.82	A-13
270.0	0.83	A-14
320.0	0.82	A-15
240.0	0.90	A-16
510.0	0.81	A-17
630.0	0.86	A-18
700.0	0.86	A-19
560.0	0.77	A-20
900.0	0.25	A-21
180.0	0.90	A-22
8,530.0	0.69	Weighted Average
8,530.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,



Subcatchment 1S: Controlled to Cistern



Summary for Subcatchment 2S: Towers to Cistern

Building rooftop areas that do not allow surface ponding.

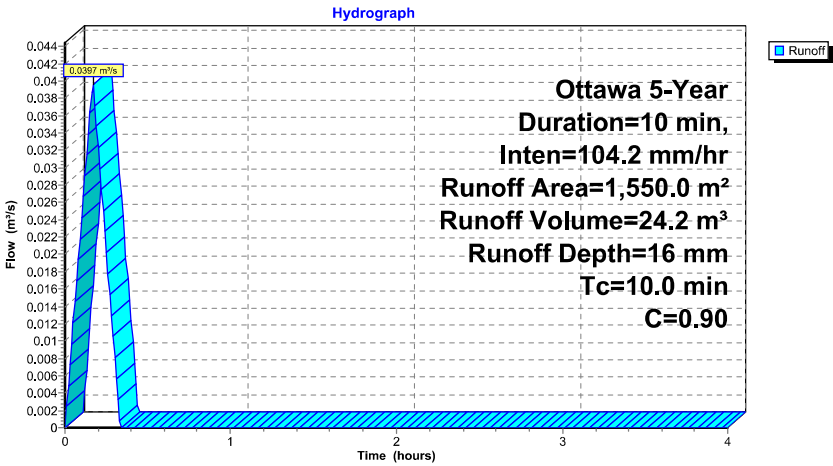
Runoff = 0.0397 m³/s @ 0.17 hrs, Volume= 24.2 m³, Depth= 16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=10 min, Inten=104.2 mm/hr

Area (m²)	C	Description
380.0	0.90	Tower C
625.0	0.90	Tower A
545.0	0.90	Tower B
1,550.0	0.90	Weighted Average
1,550.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 2S: Towers to Cistern



Summary for Subcatchment 3S: Tower A to Rooftop

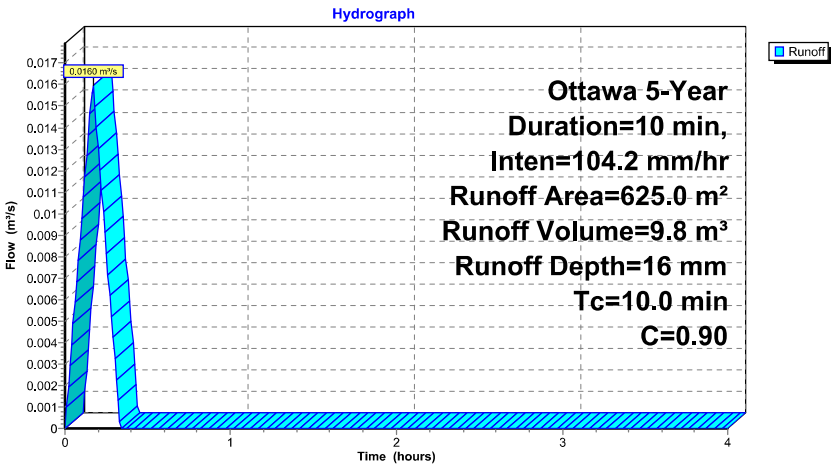
Runoff = 0.0160 m³/s @ 0.17 hrs, Volume= 9.8 m³, Depth= 16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=10 min, Inten=104.2 mm/hr

Area (m²)	C	Description
625.0	0.90	Tower A
625.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 3S: Tower A to Rooftop



Summary for Subcatchment 4S: Tower B to Rooftop

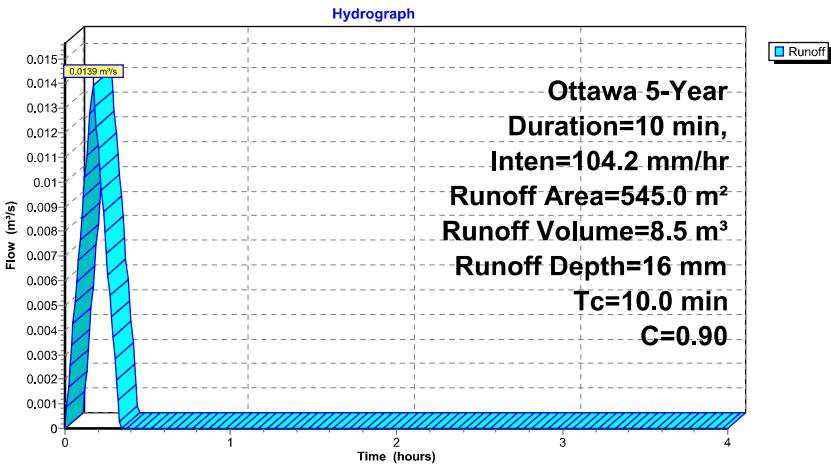
Runoff = 0.0139 m³/s @ 0.17 hrs, Volume= 8.5 m³, Depth= 16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=10 min, Inten=104.2 mm/hr

Area (m²)	C	Description
545.0	0.90	Tower B
545.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 4S: Tower B to Rooftop



Summary for Subcatchment 5S: Tower C to Rooftop

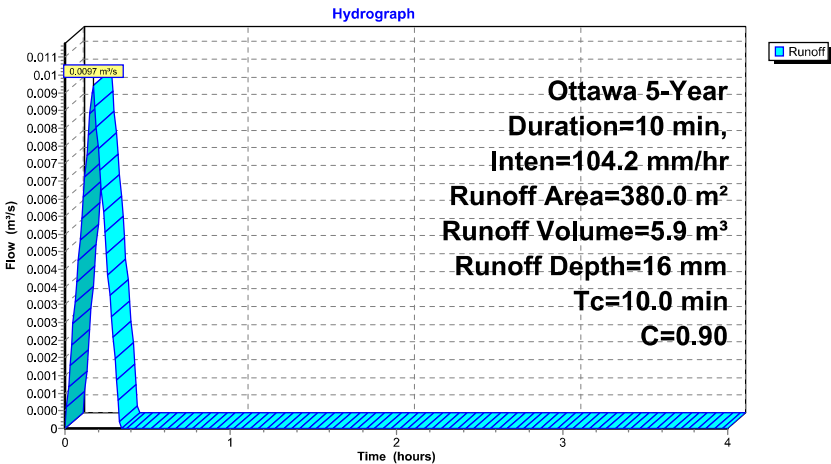
Runoff = 0.0097 m³/s @ 0.17 hrs, Volume= 5.9 m³, Depth= 16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=10 min, Inten=104.2 mm/hr

Area (m²)	C	Description
380.0	0.90	Tower C
380.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 5S: Tower C to Rooftop



Summary for Subcatchment 6S: Uncontrolled

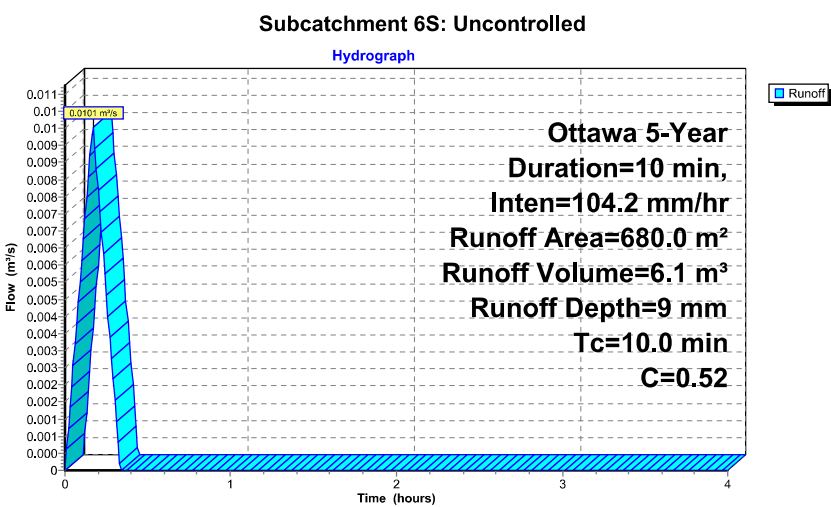
Runoff = 0.0101 m³/s @ 0.17 hrs, Volume= 6.1 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 5-Year Duration=10 min, Inten=104.2 mm/hr

Area (m²)	C	Description
460.0	0.65	A-23
220.0	0.25	A-24
680.0	0.52	Weighted Average
680.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 6S: Uncontrolled



Summary for Pond 1P: Cistern

Inflow Area = 11,630.0 m², 0.00% Impervious, Inflow Depth > 13 mm for 5-Year event
Inflow = 0.2103 m³/s @ 0.17 hrs, Volume= 150.2 m³
Outflow = 0.0966 m³/s @ 0.26 hrs, Volume= 147.9 m³, Atten= 54%, Lag= 5.5 min
Primary = 0.0966 m³/s @ 0.26 hrs, Volume= 147.9 m³
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 0.522 m @ 0.26 hrs Surf.Area= 130.0 m² Storage= 67.9 m³

Plug-Flow detention time= 15.0 min calculated for 147.6 m³ (98% of inflow)
Center-of-Mass det. time= 12.8 min (32.9 - 20.0)

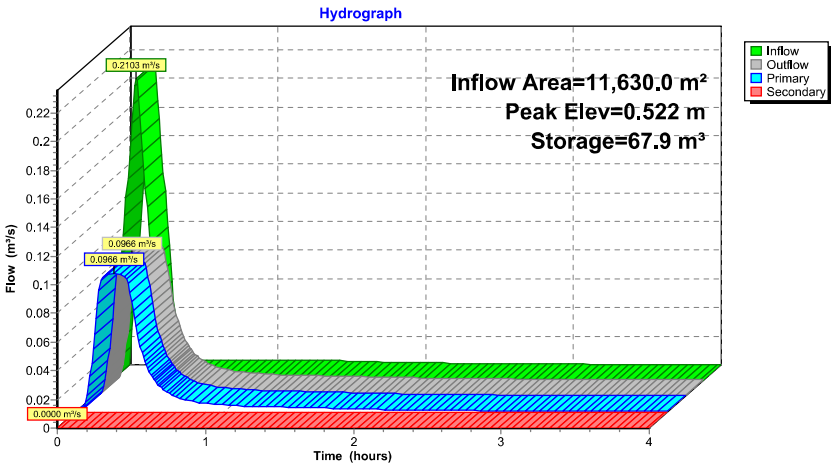
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	260.0 m³	10.00 mW x 13.00 mL x 2.00 mH Cistern

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	Hydrovex Hydro-Break Optimum SHE-0379-9800-2000-9800
#2	Secondary	2.000 m	***Overflow Check
			Head (meters) 0.000 0.010
			Disch. (m³/s) 0.00000 10.00000

Primary OutFlow Max=0.0966 m³/s @ 0.26 hrs HW=0.522 m (Free Discharge)
1=Hydrovex Hydro-Break Optimum SHE-0379-9800-2000-9800Custom Controls 0.0966 m³/s

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=0.000 m (Free Discharge)
2=***Overflow Check (Controls 0.0000 m³/s)

Pond 1P: Cistern



Summary for Pond 3P: Tower A Rooftop Storage

Inflow Area = 625.0 m², 0.00% Impervious, Inflow Depth = 16 mm for 5-Year event
Inflow = 0.0160 m³/s @ 0.17 hrs, Volume= 9.8 m³
Outflow = 0.0012 m³/s @ 0.16 hrs, Volume= 9.6 m³, Atten= 92%, Lag= 0.0 min
Primary = 0.0012 m³/s @ 0.16 hrs, Volume= 9.6 m³
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 100.056 m @ 0.32 hrs Surf.Area= 156.3 m² Storage= 8.8 m³

Plug-Flow detention time= 67.9 min calculated for 9.6 m³ (98% of inflow)
Center-of-Mass det. time= 67.7 min (77.7 - 10.0)

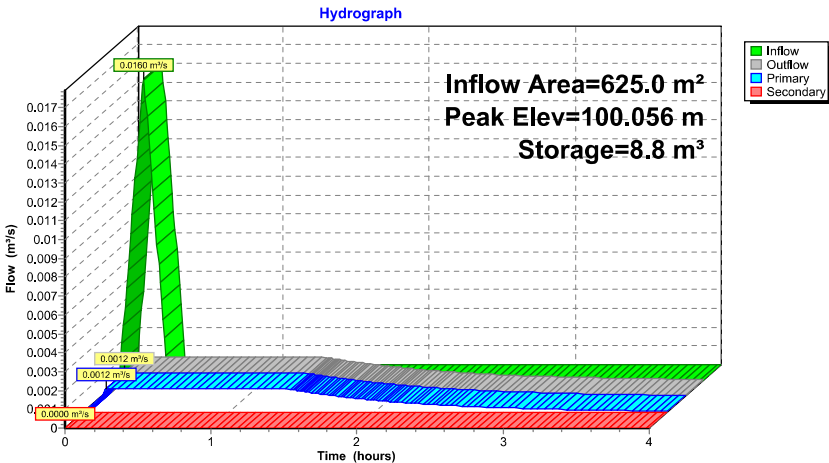
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	46.9 m³	12.50 mW x 12.50 mL x 0.30 mH BLDG A

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	WATTS Accutrol_5-Closed X 4.00
			Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152
			Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031
#2	Secondary	100.300 m	Special & User-Defined
			Head (meters) 0.000 0.001 0.010
			Disch. (m³/s) 0.00000 1.00000 10.00000

Primary OutFlow Max=0.0012 m³/s @ 0.16 hrs HW=100.027 m (Free Discharge)
1=WATTS Accutrol_5-Closed(Custom Controls 0.0012 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=100.000 m (Free Discharge)
2=Special & User-Defined (Controls 0.0000 m³/s)

Pond 3P: Tower A Rooftop Storage



Summary for Pond 4P: Tower C Rooftop Storage

Inflow Area = 545.0 m², 0.00% Impervious, Inflow Depth = 16 mm for 5-Year event

Inflow = 0.0139 m³/s @ 0.17 hrs, Volume= 8.5 m³

Outflow = 0.0012 m³/s @ 0.16 hrs, Volume= 8.4 m³, Atten= 91%, Lag= 0.0 min

Primary = 0.0012 m³/s @ 0.16 hrs, Volume= 8.4 m³

Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Peak Elev= 100.055 m @ 0.32 hrs Surf.Area= 136.2 m² Storage= 7.5 m³

Plug-Flow detention time= 60.2 min calculated for 8.4 m³ (99% of inflow)

Center-of-Mass det. time= 60.1 min (70.1 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	40.9 m³	11.67 mW x 11.67 mL x 0.30 mH BLDG B

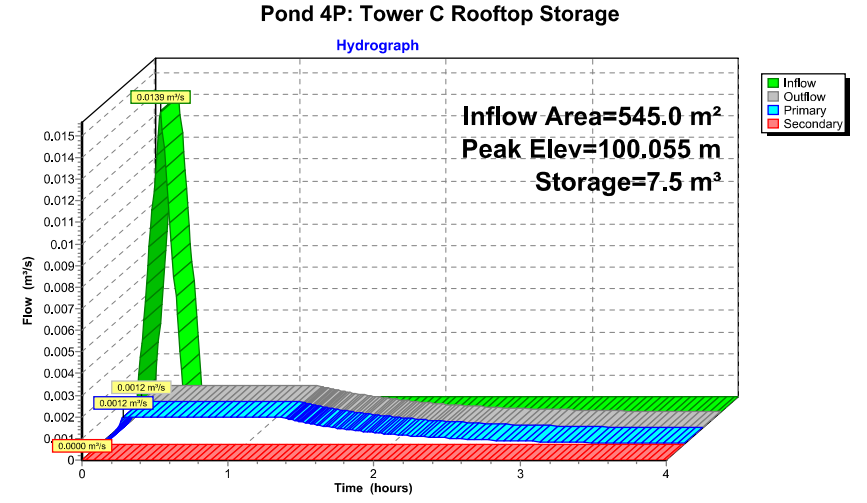
Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	WATTS Accutrol_5-Closed X 4.00
			Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152
			Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031
#2	Secondary	100.300 m	Special & User-Defined
			Head (meters) 0.000 0.001 0.010
			Disch. (m³/s) 0.00000 1.00000 10.00000

Primary OutFlow Max=0.0012 m³/s @ 0.16 hrs HW=100.027 m (Free Discharge)

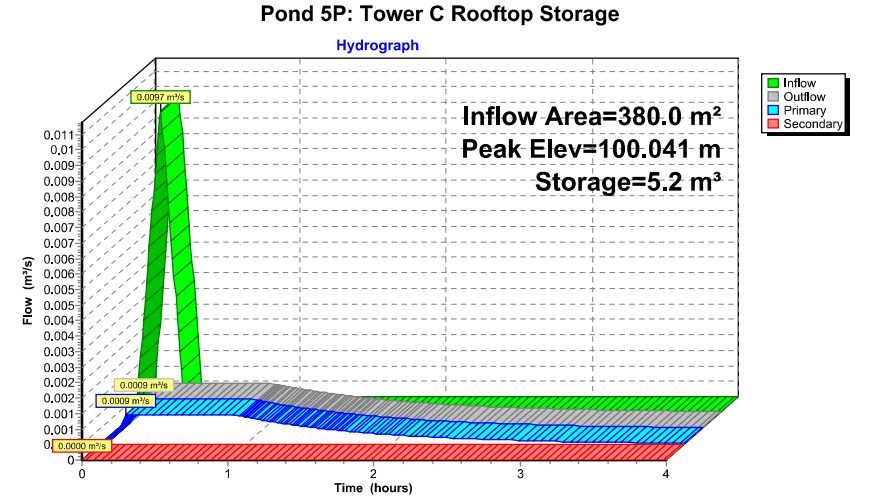
1=WATTS Accutrol_5-Closed(Custom Controls 0.0012 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=100.000 m (Free Discharge)

2=Special & User-Defined (Controls 0.0000 m³/s)



Summary for Pond 5P: Tower C Rooftop Storage			
Inflow Area =	380.0 m²,	0.00% Impervious,	Inflow Depth = 16 mm for 5-Year event
Inflow =	0.0097 m³/s @	0.17 hrs,	Volume= 5.9 m³
Outflow =	0.0009 m³/s @	0.18 hrs,	Volume= 5.8 m³, Atten= 90%, Lag= 0.7 min
Primary =	0.0009 m³/s @	0.18 hrs,	Volume= 5.8 m³
Secondary =	0.0000 m³/s @	0.00 hrs,	Volume= 0.0 m³
Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs			
Peak Elev= 100.041 m @ 0.32 hrs Surf.Area= 126.6 m² Storage= 5.2 m³			
Plug-Flow detention time= 60.8 min calculated for 5.8 m³ (98% of inflow)			
Center-of-Mass det. time= 60.6 min (70.6 - 10.0)			
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	38.0 m³	11.25 mW x 11.25 mL x 0.30 mH BLDG C
Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	WATTS Accutrol_5-Closed X 3.00
			Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152
			Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031
#2	Secondary	100.300 m	Special & User-Defined
			Head (meters) 0.000 0.001 0.010
			Disch. (m³/s) 0.00000 1.00000 10.00000
Primary OutFlow Max=0.0009 m³/s @ 0.18 hrs HW=100.025 m (Free Discharge)			
1=WATTS Accutrol_5-Closed(Custom Controls 0.0009 m³/s)			
Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=100.000 m (Free Discharge)			
2=Special & User-Defined (Controls 0.0000 m³/s)			



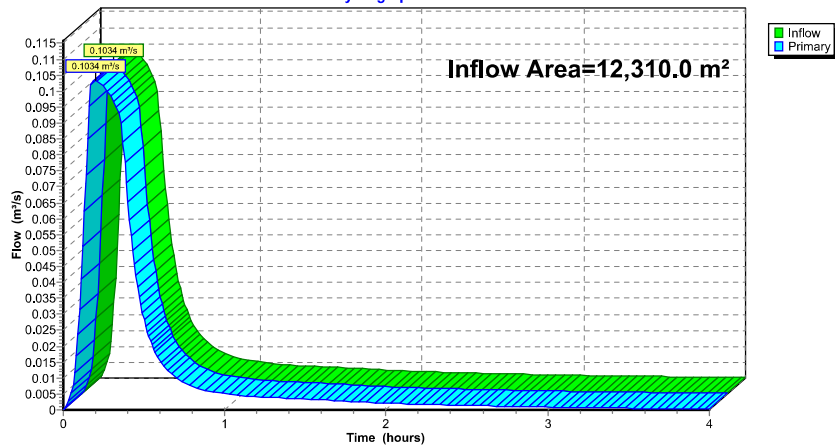
Summary for Link 1L: Site Release

Inflow Area = 12,310.0 m², 0.00% Impervious, Inflow Depth > 13 mm for 5-Year event
Inflow = 0.1034 m³/s @ 0.20 hrs, Volume= 154.1 m³
Primary = 0.1034 m³/s @ 0.20 hrs, Volume= 154.1 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Link 1L: Site Release

Hydrograph



APPENDIX

G-2 100-YEAR ANALYSIS (PEAK DISCHARGE, T_c = 10 MIN)

112MontrealRd_100 year

Prepared by WSP Canada inc.

HydroCAD® 10.00-21 s/n 10060 © 2018 HydroCAD Software Solutions LLC

Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Printed 2020-03-03

Page 2

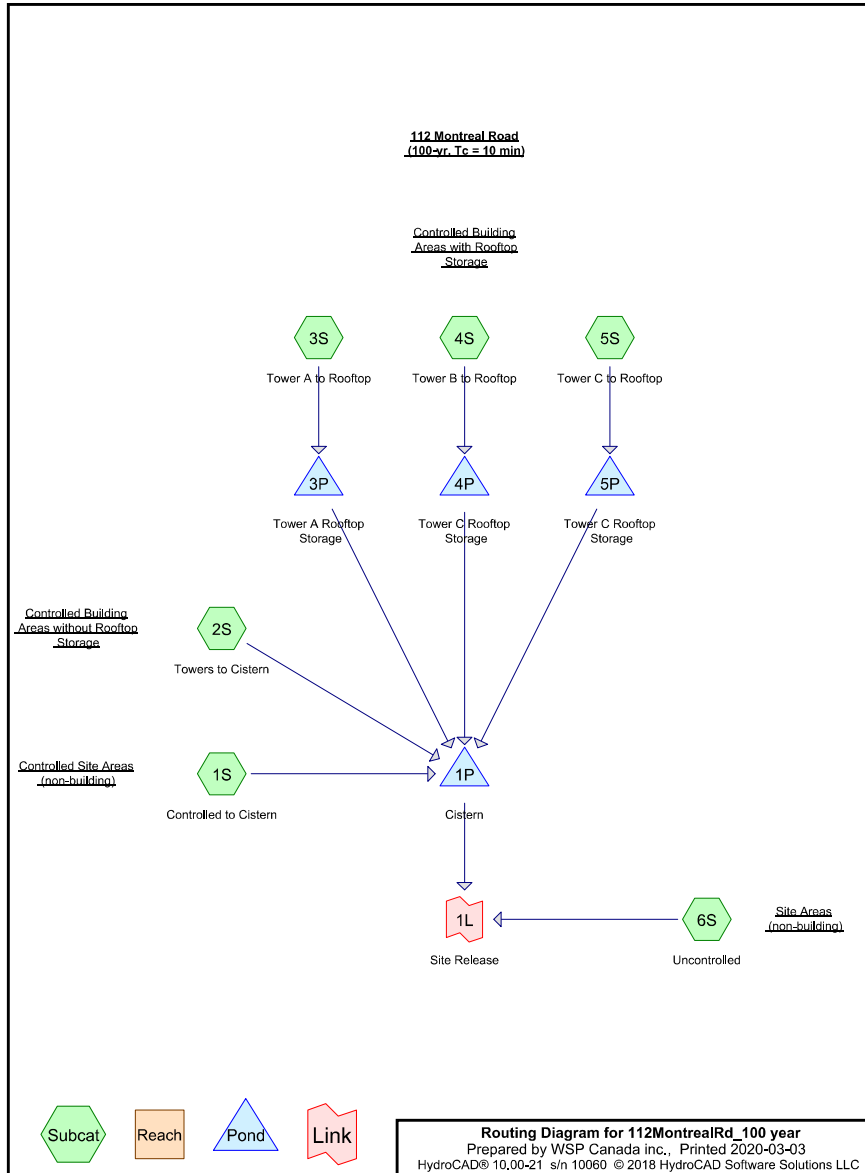
Summary for Subcatchment 1S: Controlled to Cistern

Runoff = 0.3492 m³/s @ 0.17 hrs, Volume= 213.1 m³, Depth= 25 mm

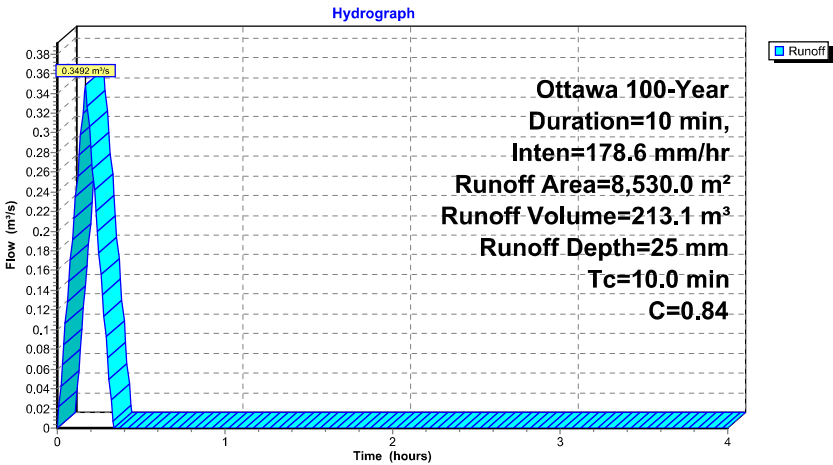
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (m²)	C	Description
300.0	0.83	A-1
210.0	0.75	A-2
370.0	0.75	A-3
290.0	0.90	A-4
380.0	0.95	A-5
390.0	0.81	A-6
350.0	0.81	A-7
330.0	1.00	A-8
260.0	0.94	A-9
250.0	0.94	A-10
290.0	0.51	A-11
470.0	0.61	A-12
330.0	1.00	A-13
270.0	1.00	A-14
320.0	1.00	A-15
240.0	1.00	A-16
510.0	1.00	A-17
630.0	1.00	A-18
700.0	1.00	A-19
560.0	0.96	A-20
900.0	0.31	A-21
180.0	0.90	A-22
8,530.0	0.84	Weighted Average
4,260.0		49.94% Pervious Area
4,270.0		50.06% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,



Subcatchment 1S: Controlled to Cistern



Summary for Subcatchment 2S: Towers to Cistern

Building rooftop areas that do not allow surface ponding.

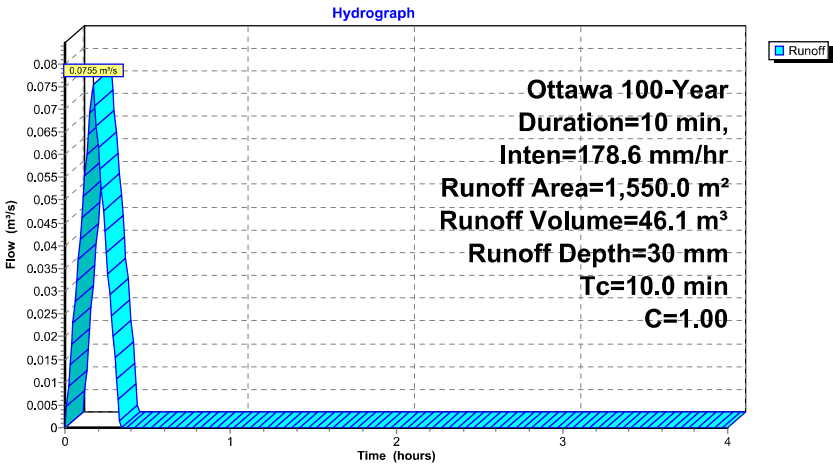
Runoff = 0.0755 m³/s @ 0.17 hrs, Volume= 46.1 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (m²)	C	Description
380.0	1.00	Tower C
625.0	1.00	Tower A
545.0	1.00	Tower B
1,550.0	1.00	Weighted Average
1,550.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 2S: Towers to Cistern



Summary for Subcatchment 3S: Tower A to Rooftop

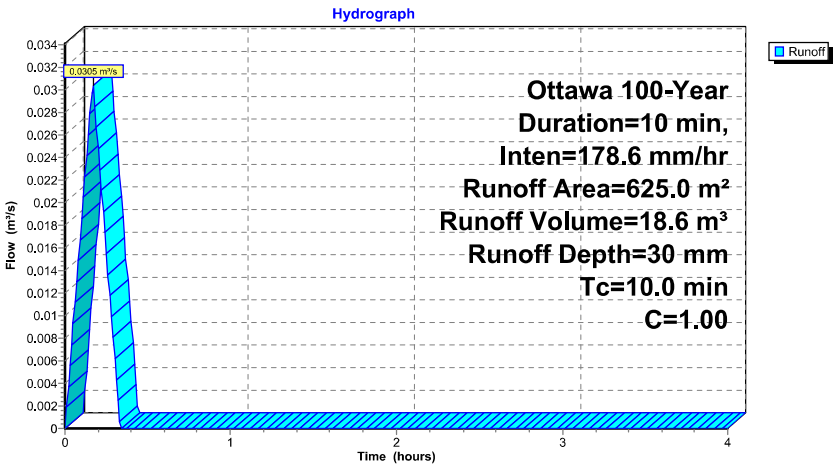
Runoff = 0.0305 m³/s @ 0.17 hrs, Volume= 18.6 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (m²)	C	Description
625.0	1.00	Tower A
625.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 3S: Tower A to Rooftop



Summary for Subcatchment 4S: Tower B to Rooftop

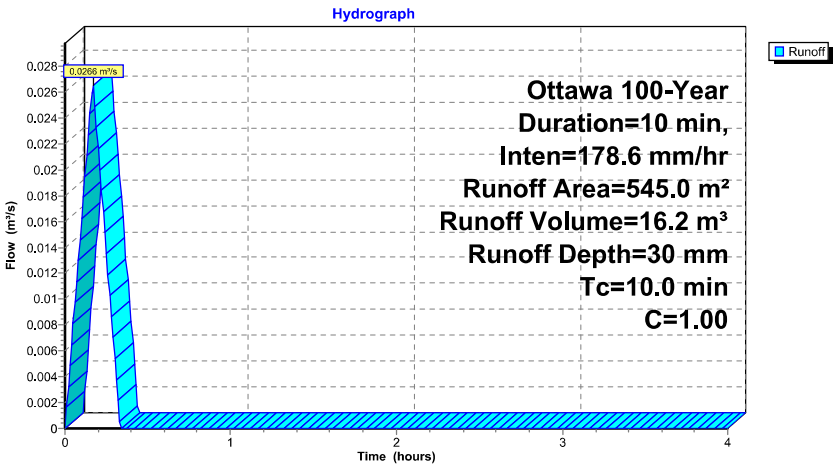
Runoff = 0.0266 m³/s @ 0.17 hrs, Volume= 16.2 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (m²)	C	Description
545.0	1.00	Tower B
545.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 4S: Tower B to Rooftop



Summary for Subcatchment 5S: Tower C to Rooftop

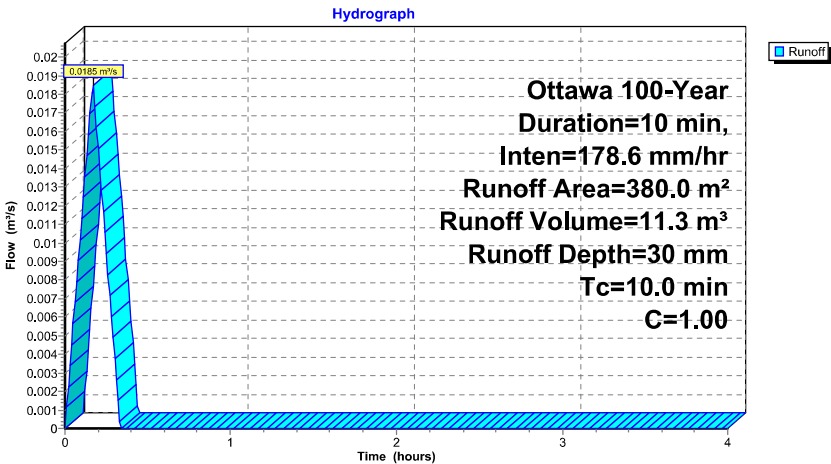
Runoff = 0.0185 m³/s @ 0.17 hrs, Volume= 11.3 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (m²)	C	Description
380.0	1.00	Tower C
380.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 5S: Tower C to Rooftop



Summary for Subcatchment 6S: Uncontrolled

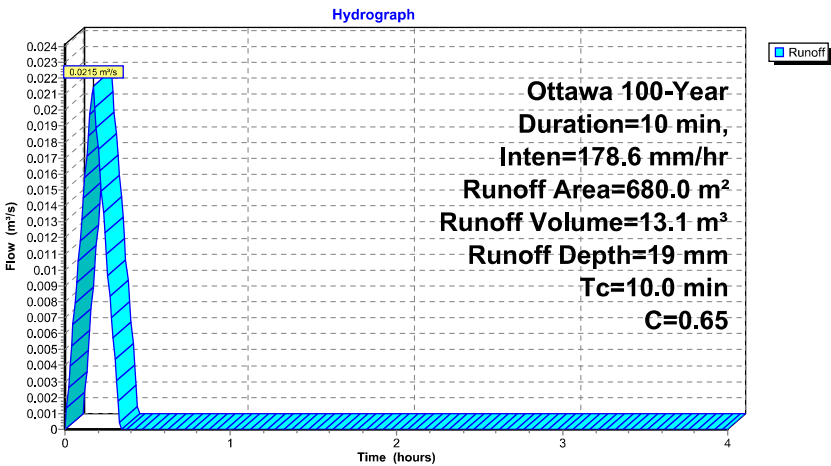
Runoff = 0.0215 m³/s @ 0.17 hrs, Volume= 13.1 m³, Depth= 19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (m²)	C	Description
460.0	0.81	A-23
220.0	0.31	A-24
680.0	0.65	Weighted Average
680.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 6S: Uncontrolled



Summary for Pond 1P: Cistern

Inflow Area = 11,630.0 m², 63.37% Impervious, Inflow Depth > 26 mm for 100-Year event
Inflow = 0.4281 m³/s @ 0.17 hrs, Volume= 302.0 m³
Outflow = 0.0976 m³/s @ 0.62 hrs, Volume= 297.0 m³, Atten= 77%, Lag= 27.0 min
Primary = 0.0976 m³/s @ 0.62 hrs, Volume= 297.0 m³
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 1.416 m @ 0.30 hrs Surf.Area= 130.0 m² Storage= 184.1 m³

Plug-Flow detention time= 21.4 min calculated for 297.0 m³ (98% of inflow)
Center-of-Mass det. time= 18.2 min (42.5 - 24.2)

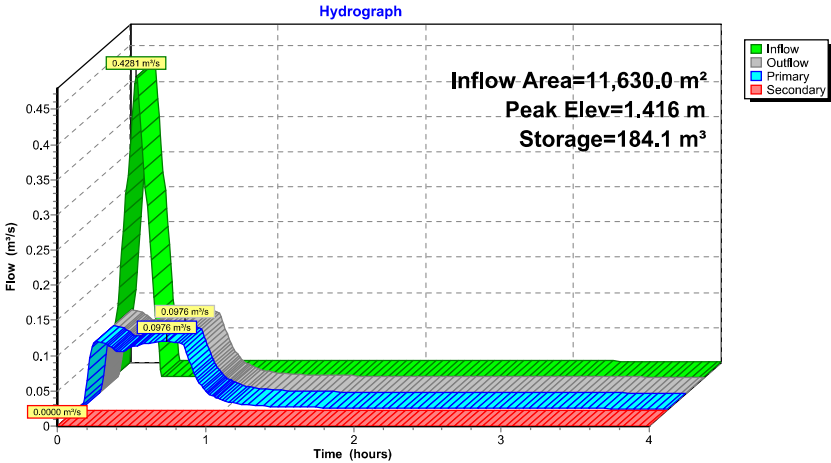
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	260.0 m³	10.00 mW x 13.00 mL x 2.00 mH Cistern

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	Hydrovex Hydro-Break Optimum SHE-0379-9800-2000-9800
#2	Secondary	2.000 m	***Overflow Check
			Head (meters) 0.000 0.010
			Disch. (m³/s) 0.00000 10.00000

Primary OutFlow Max=0.0976 m³/s @ 0.62 hrs HW=0.671 m (Free Discharge)
1=Hydrovex Hydro-Break Optimum SHE-0379-9800-2000-9800Custom Controls 0.0976 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=0.000 m (Free Discharge)
2=***Overflow Check (Controls 0.0000 m³/s)

Pond 1P: Cistern



Summary for Pond 3P: Tower A Rooftop Storage

Inflow Area = 625.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0305 m³/s @ 0.17 hrs, Volume= 18.6 m³
Outflow = 0.0012 m³/s @ 0.12 hrs, Volume= 16.7 m³, Atten= 96%, Lag= 0.0 min
Primary = 0.0012 m³/s @ 0.12 hrs, Volume= 16.7 m³
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 100.112 m @ 0.33 hrs Surf.Area= 156.3 m² Storage= 17.4 m³

Plug-Flow detention time= 107.6 min calculated for 16.7 m³ (90% of inflow)
Center-of-Mass det. time= 107.1 min (117.1 - 10.0)

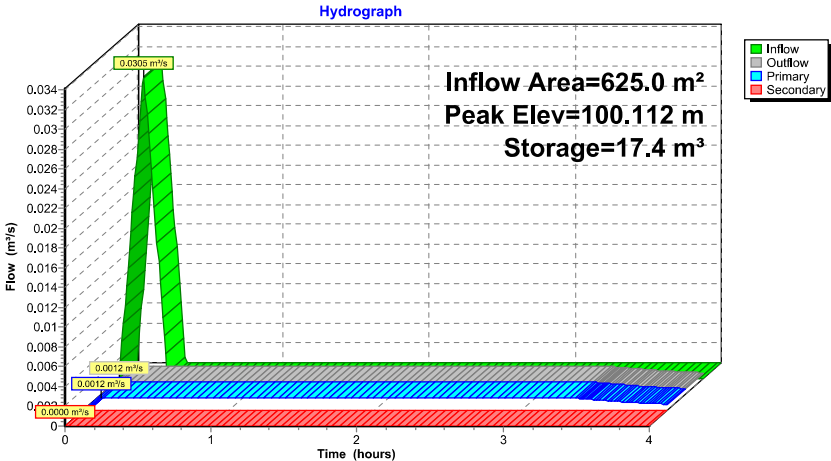
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	46.9 m³	12.50 mW x 12.50 mL x 0.30 mH BLDG A

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	WATTS Accutrol_5-Closed X 4.00 Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031
#2	Secondary	100.300 m	Special & User-Defined Head (meters) 0.000 0.001 0.010 Disch. (m³/s) 0.00000 1.00000 10.00000

Primary OutFlow Max=0.0012 m³/s @ 0.12 hrs HW=100.030 m (Free Discharge)
1=WATTS Accutrol_5-Closed(Custom Controls 0.0012 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=100.000 m (Free Discharge)
2=Special & User-Defined (Controls 0.0000 m³/s)

Pond 3P: Tower A Rooftop Storage



Summary for Pond 4P: Tower C Rooftop Storage

Inflow Area = 545.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0266 m³/s @ 0.17 hrs, Volume= 16.2 m³
Outflow = 0.0012 m³/s @ 0.12 hrs, Volume= 15.4 m³, Atten= 95%, Lag= 0.0 min
Primary = 0.0012 m³/s @ 0.12 hrs, Volume= 15.4 m³
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 100.111 m @ 0.33 hrs Surf.Area= 136.2 m² Storage= 15.1 m³

Plug-Flow detention time= 99.0 min calculated for 15.3 m³ (95% of inflow)
Center-of-Mass det. time= 98.9 min (108.9 - 10.0)

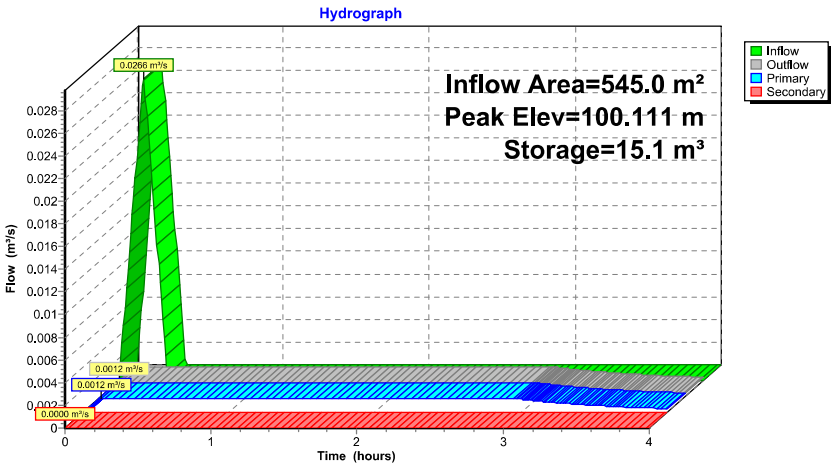
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	40.9 m³	11.67 mW x 11.67 mL x 0.30 mH BLDG B

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	WATTS Accutrol_5-Closed X 4.00 Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031
#2	Secondary	100.300 m	Special & User-Defined Head (meters) 0.000 0.001 0.010 Disch. (m³/s) 0.00000 1.00000 10.00000

Primary OutFlow Max=0.0012 m³/s @ 0.12 hrs HW=100.029 m (Free Discharge)
1=WATTS Accutrol_5-Closed(Custom Controls 0.0012 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=100.000 m (Free Discharge)
2=Special & User-Defined (Controls 0.0000 m³/s)

Pond 4P: Tower C Rooftop Storage



Summary for Pond 5P: Tower C Rooftop Storage

Inflow Area = 380.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0185 m³/s @ 0.17 hrs, Volume= 11.3 m³
Outflow = 0.0009 m³/s @ 0.13 hrs, Volume= 10.6 m³, Atten= 95%, Lag= 0.0 min
Primary = 0.0009 m³/s @ 0.13 hrs, Volume= 10.6 m³
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 100.083 m @ 0.33 hrs Surf.Area= 126.6 m² Storage= 10.5 m³

Plug-Flow detention time= 93.5 min calculated for 10.6 m³ (94% of inflow)
Center-of-Mass det. time= 93.1 min (103.1 - 10.0)

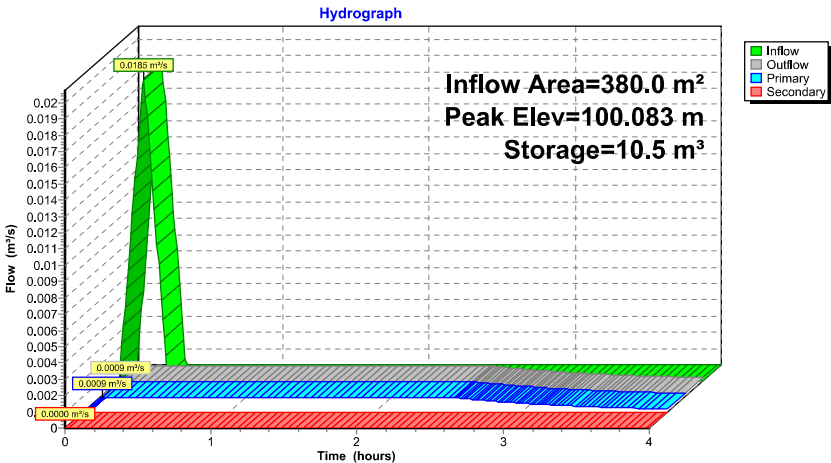
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	38.0 m³	11.25 mW x 11.25 mL x 0.30 mH BLDG C

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	WATTS Accutrol_5-Closed X 3.00 Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031
#2	Secondary	100.300 m	Special & User-Defined Head (meters) 0.000 0.001 0.010 Disch. (m³/s) 0.00000 1.00000 10.00000

Primary OutFlow Max=0.0009 m³/s @ 0.13 hrs HW=100.026 m (Free Discharge)
1=WATTS Accutrol_5-Closed(Custom Controls 0.0009 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=100.000 m (Free Discharge)
2=Special & User-Defined (Controls 0.0000 m³/s)

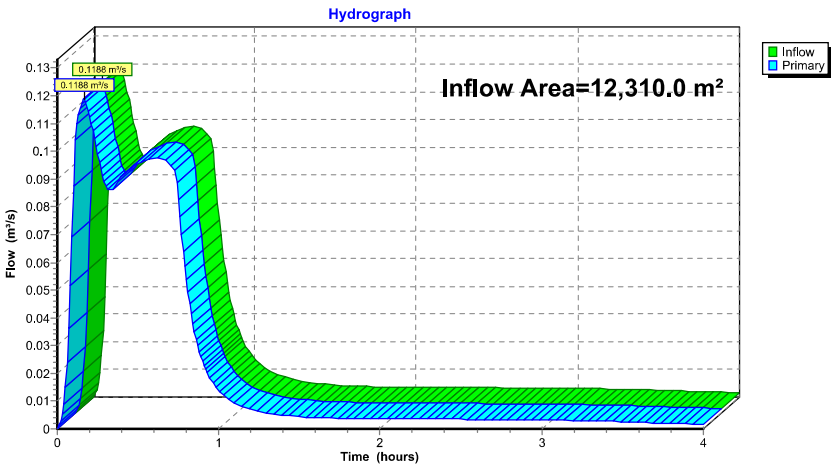
Pond 5P: Tower C Rooftop Storage



Summary for Link 1L: Site Release

Inflow Area = 12,310.0 m², 59.87% Impervious, Inflow Depth > 25 mm for 100-Year event
Inflow = 0.1188 m³/s @ 0.16 hrs, Volume= 310.2 m³
Primary = 0.1188 m³/s @ 0.16 hrs, Volume= 310.2 m³, Atten= 0%, Lag= 0.0 min
Primary outflow = Inflow, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Link 1L: Site Release



APPENDIX

G-3 100-YEAR ANALYSIS (PEAK STORAGE, $T_c =$ 27 MIN)

112MontrealRd_100 year

Prepared by WSP Canada inc.

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Ottawa 100-Year Duration=27 min, Inten=98.7 mm/hr

Printed 2020-03-03

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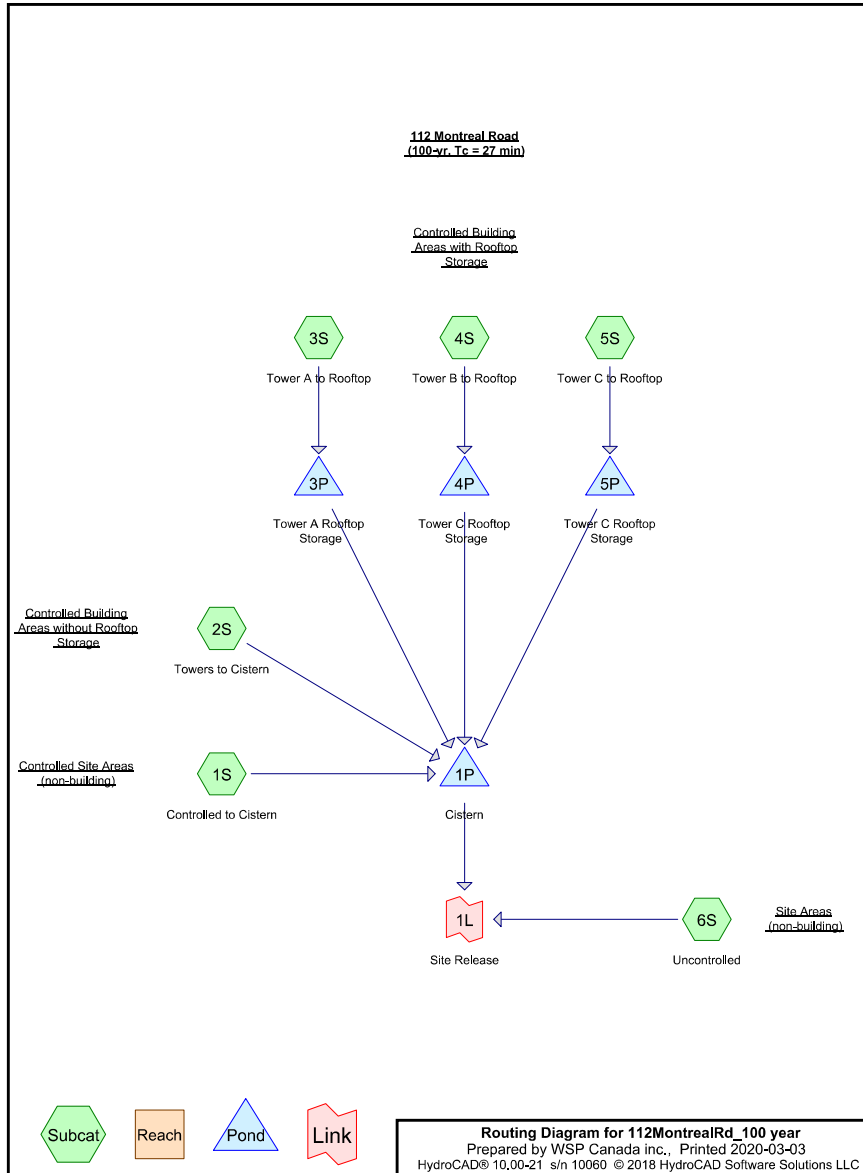
Summary for Subcatchment 1S: Controlled to Cistern

Runoff = 0.1964 m³/s @ 0.17 hrs, Volume= 318.1 m³, Depth= 37 mm

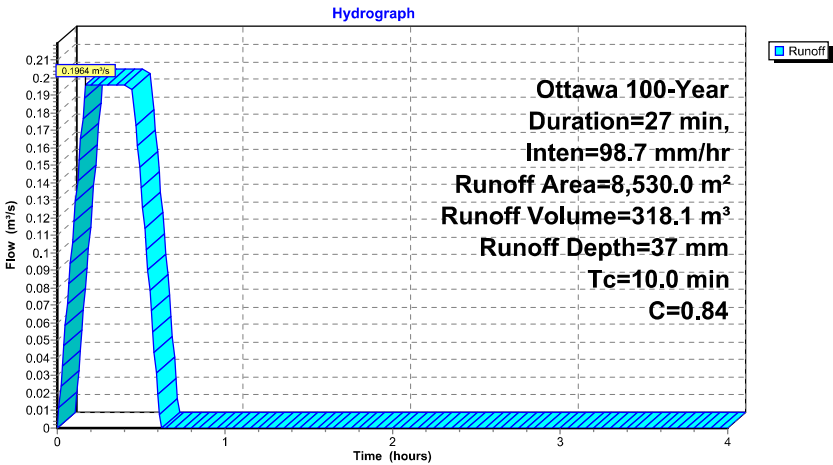
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=27 min, Inten=98.7 mm/hr

Area (m²)	C	Description
300.0	0.83	A-1
210.0	0.75	A-2
370.0	0.75	A-3
290.0	0.90	A-4
380.0	0.95	A-5
390.0	0.81	A-6
350.0	0.81	A-7
330.0	1.00	A-8
260.0	0.94	A-9
250.0	0.94	A-10
290.0	0.51	A-11
470.0	0.61	A-12
330.0	1.00	A-13
270.0	1.00	A-14
320.0	1.00	A-15
240.0	1.00	A-16
510.0	1.00	A-17
630.0	1.00	A-18
700.0	1.00	A-19
560.0	0.96	A-20
900.0	0.31	A-21
180.0	0.90	A-22
8,530.0	0.84	Weighted Average
4,260.0		49.94% Pervious Area
4,270.0		50.06% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,



Subcatchment 1S: Controlled to Cistern



Summary for Subcatchment 2S: Towers to Cistern

Building rooftop areas that do not allow surface ponding.

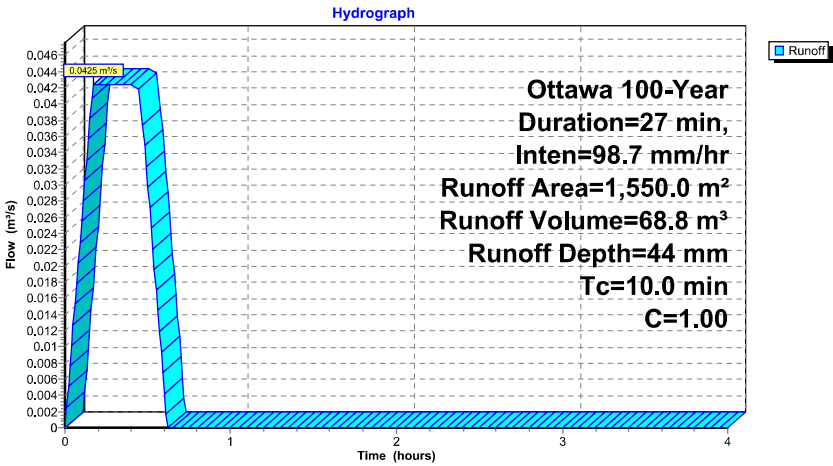
Runoff = 0.0425 m³/s @ 0.17 hrs, Volume= 68.8 m³, Depth= 44 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=27 min, Inten=98.7 mm/hr

Area (m²)	C	Description
380.0	1.00	Tower C
625.0	1.00	Tower A
545.0	1.00	Tower B
1,550.0	1.00	Weighted Average
1,550.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 2S: Towers to Cistern



Summary for Subcatchment 3S: Tower A to Rooftop

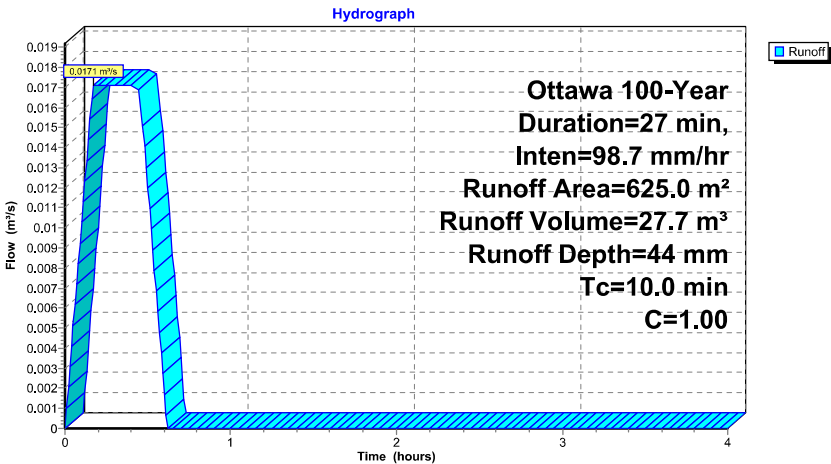
Runoff = 0.0171 m³/s @ 0.17 hrs, Volume= 27.7 m³, Depth= 44 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=27 min, Inten=98.7 mm/hr

Area (m²)	C	Description
625.0	1.00	Tower A
625.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 3S: Tower A to Rooftop



Summary for Subcatchment 4S: Tower B to Rooftop

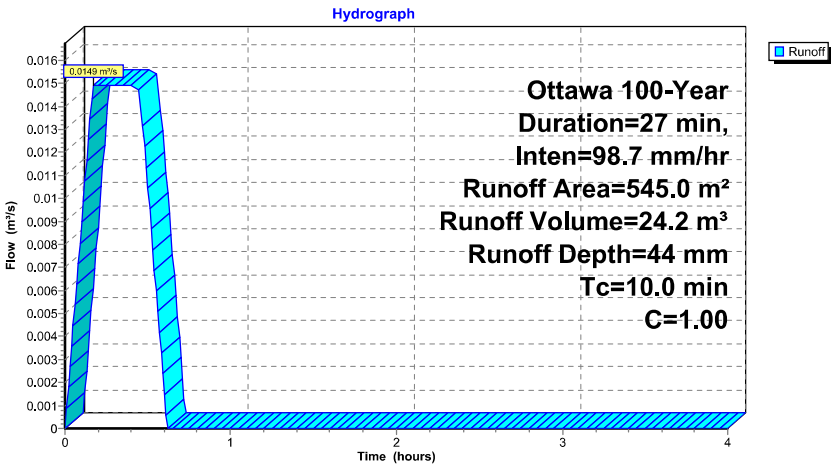
Runoff = 0.0149 m³/s @ 0.17 hrs, Volume= 24.2 m³, Depth= 44 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=27 min, Inten=98.7 mm/hr

Area (m²)	C	Description
545.0	1.00	Tower B
545.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 4S: Tower B to Rooftop



Summary for Subcatchment 5S: Tower C to Rooftop

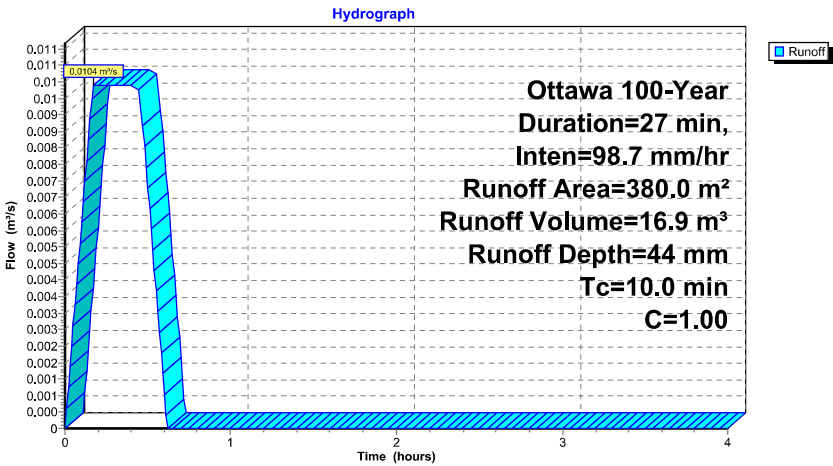
Runoff = 0.0104 m³/s @ 0.17 hrs, Volume= 16.9 m³, Depth= 44 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=27 min, Inten=98.7 mm/hr

Area (m²)	C	Description
380.0	1.00	Tower C
380.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 5S: Tower C to Rooftop



Summary for Subcatchment 6S: Uncontrolled

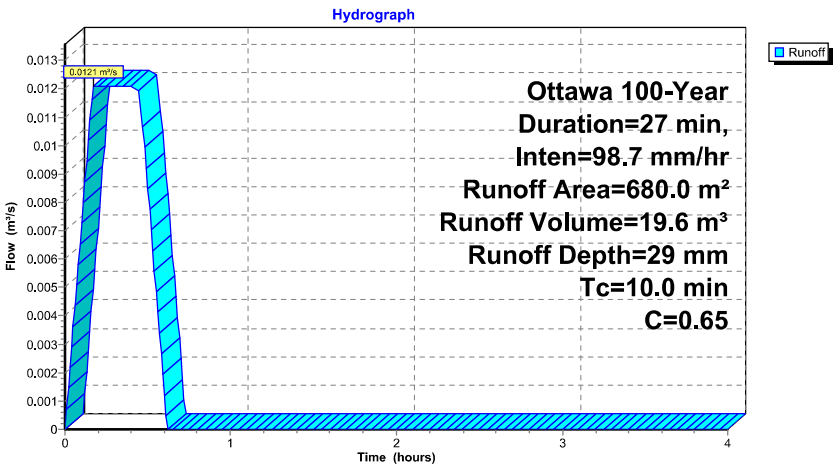
Runoff = 0.0121 m³/s @ 0.17 hrs, Volume= 19.6 m³, Depth= 29 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=27 min, Inten=98.7 mm/hr

Area (m²)	C	Description
460.0	0.81	A-23
220.0	0.31	A-24
680.0	0.65	Weighted Average
680.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 6S: Uncontrolled



Summary for Pond 1P: Cistern

Inflow Area = 11,630.0 m², 63.37% Impervious, Inflow Depth > 37 mm for 100-Year event
Inflow = 0.2423 m³/s @ 0.18 hrs, Volume= 434.8 m³
Outflow = 0.0976 m³/s @ 0.23 hrs, Volume= 427.7 m³, Atten= 60%, Lag= 3.1 min
Primary = 0.0976 m³/s @ 0.23 hrs, Volume= 427.7 m³
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 1.805 m @ 0.55 hrs Surf.Area= 130.0 m² Storage= 234.6 m³

Plug-Flow detention time= 25.1 min calculated for 426.6 m³ (98% of inflow)
Center-of-Mass det. time= 21.9 min (52.0 - 30.0)

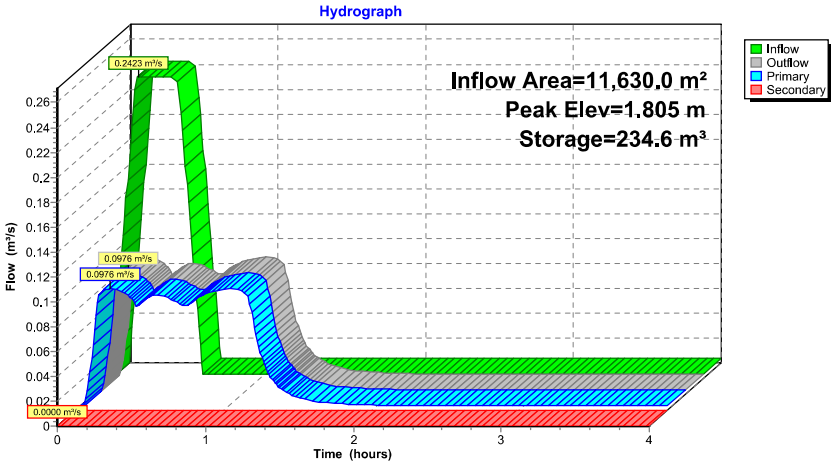
Volume	Invert	Avail.Storage	Storage Description
#1	0.000 m	260.0 m³	10.00 mW x 13.00 mL x 2.00 mH Cistern

Device	Routing	Invert	Outlet Devices
#1	Primary	0.000 m	Hydrovex Hydro-Break Optimum SHE-0379-9800-2000-9800
#2	Secondary	2.000 m	***Overflow Check
			Head (meters) 0.000 0.010
			Disch. (m³/s) 0.00000 10.00000

Primary OutFlow Max=0.0976 m³/s @ 0.23 hrs HW=0.673 m (Free Discharge)
↑1=Hydrovex Hydro-Break Optimum SHE-0379-9800-2000-9800Custom Controls 0.0976 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=0.000 m (Free Discharge)
↑2=***Overflow Check (Controls 0.0000 m³/s)

Pond 1P: Cistern



Summary for Pond 3P: Tower A Rooftop Storage

[95] Warning: Outlet Device #1 rise exceeded

Inflow Area = 625.0 m², 100.00% Impervious, Inflow Depth = 44 mm for 100-Year event
Inflow = 0.0171 m³/s @ 0.17 hrs, Volume= 27.7 m³
Outflow = 0.0012 m³/s @ 0.15 hrs, Volume= 17.4 m³, Atten= 93%, Lag= 0.0 min
Primary = 0.0012 m³/s @ 0.15 hrs, Volume= 17.4 m³
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 100.163 m @ 0.60 hrs Surf.Area= 156.3 m² Storage= 25.5 m³

Plug-Flow detention time= 109.6 min calculated for 17.4 m³ (63% of inflow)
Center-of-Mass det. time= 104.6 min (123.1 - 18.5)

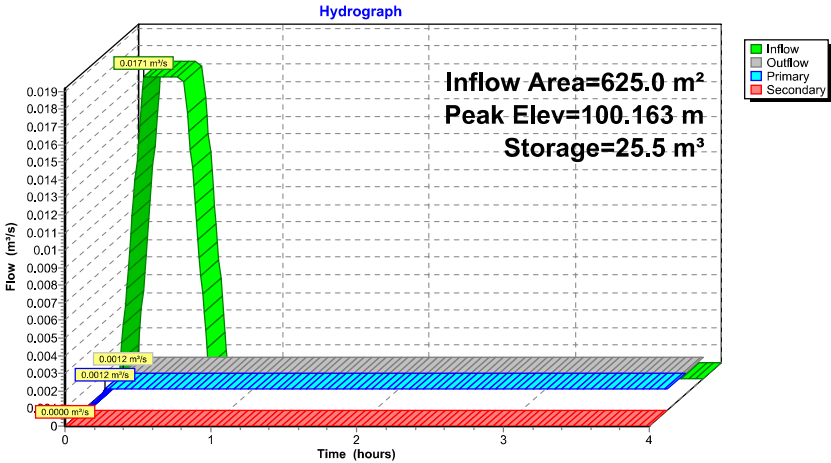
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	46.9 m³	12.50 mW x 12.50 mL x 0.30 mH BLDG A

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	WATTS Accutrol_5-Closed X 4.00 Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031
#2	Secondary	100.300 m	Special & User-Defined Head (meters) 0.000 0.001 0.010 Disch. (m³/s) 0.00000 1.00000 10.00000

Primary OutFlow Max=0.0012 m³/s @ 0.15 hrs HW=100.025 m (Free Discharge)
└─1=WATTS Accutrol_5-Closed(Custom Controls 0.0012 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=100.000 m (Free Discharge)
└─2=Special & User-Defined (Controls 0.0000 m³/s)

Pond 3P: Tower A Rooftop Storage



Summary for Pond 4P: Tower C Rooftop Storage

[95] Warning: Outlet Device #1 rise exceeded

Inflow Area = 545.0 m², 100.00% Impervious, Inflow Depth = 44 mm for 100-Year event
Inflow = 0.0149 m³/s @ 0.17 hrs, Volume= 24.2 m³
Outflow = 0.0012 m³/s @ 0.16 hrs, Volume= 17.4 m³, Atten= 92%, Lag= 0.0 min
Primary = 0.0012 m³/s @ 0.16 hrs, Volume= 17.4 m³
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs
Peak Elev= 100.161 m @ 0.60 hrs Surf.Area= 136.2 m² Storage= 21.9 m³

Plug-Flow detention time= 108.3 min calculated for 17.4 m³ (72% of inflow)
Center-of-Mass det. time= 104.6 min (123.1 - 18.5)

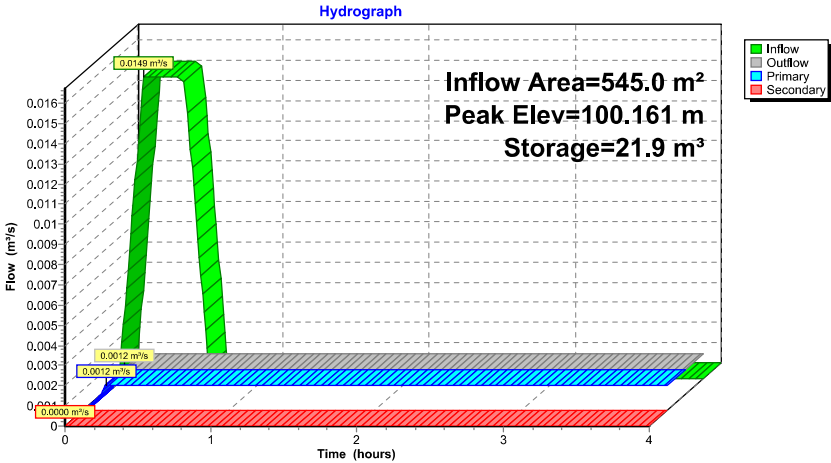
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	40.9 m³	11.67 mW x 11.67 mL x 0.30 mH BLDG B

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	WATTS Accutrol_5-Closed X 4.00 Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031
#2	Secondary	100.300 m	Special & User-Defined Head (meters) 0.000 0.001 0.010 Disch. (m³/s) 0.00000 1.00000 10.00000

Primary OutFlow Max=0.0012 m³/s @ 0.16 hrs HW=100.028 m (Free Discharge)
└─1=WATTS Accutrol_5-Closed(Custom Controls 0.0012 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=100.000 m (Free Discharge)
└─2=Special & User-Defined (Controls 0.0000 m³/s)

Pond 4P: Tower C Rooftop Storage



Summary for Pond 5P: Tower C Rooftop Storage

Inflow Area = 380.0 m², 100.00% Impervious, Inflow Depth = 44 mm for 100-Year event

Inflow = 0.0104 m³/s @ 0.17 hrs, Volume= 16.9 m³

Outflow = 0.0009 m³/s @ 0.18 hrs, Volume= 13.0 m³, Atten= 91%, Lag= 0.6 min

Primary = 0.0009 m³/s @ 0.18 hrs, Volume= 13.0 m³

Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.0 m³

Routing by Stor-Ind method, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

Peak Elev= 100.120 m @ 0.60 hrs Surf.Area= 126.6 m² Storage= 15.2 m³

Plug-Flow detention time= 108.1 min calculated for 13.0 m³ (77% of inflow)

Center-of-Mass det. time= 105.1 min (123.6 - 18.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	38.0 m³	11.25 mW x 11.25 mL x 0.30 mH BLDG C

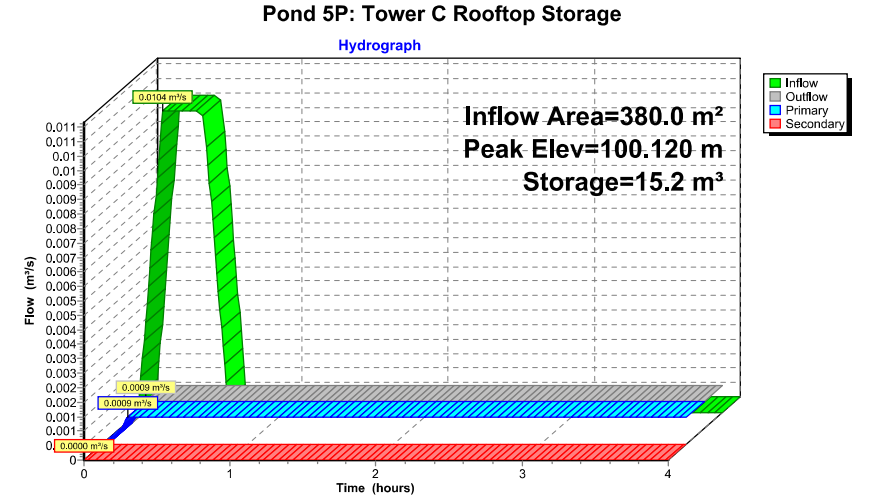
Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	WATTS Accutrol_5-Closed X 3.00 Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031
#2	Secondary	100.300 m	Special & User-Defined Head (meters) 0.000 0.001 0.010 Disch. (m³/s) 0.00000 1.00000 10.00000

Primary OutFlow Max=0.0009 m³/s @ 0.18 hrs HW=100.027 m (Free Discharge)

1=WATTS Accutrol_5-Closed(Custom Controls 0.0009 m³/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=100.000 m (Free Discharge)

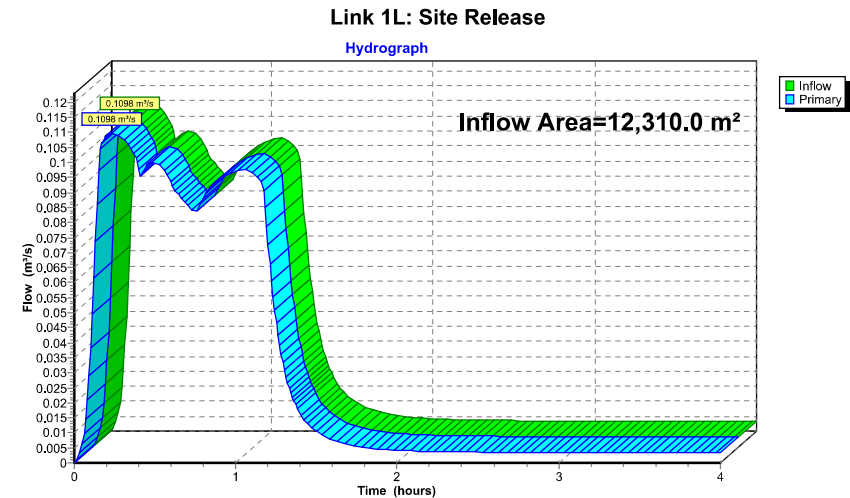
2=Special & User-Defined (Controls 0.0000 m³/s)



Summary for Link 1L: Site Release

Inflow Area = 12,310.0 m², 59.87% Impervious, Inflow Depth > 36 mm for 100-Year event
Inflow = 0.1098 m³/s @ 0.23 hrs, Volume= 447.3 m³
Primary = 0.1098 m³/s @ 0.23 hrs, Volume= 447.3 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-4.00 hrs, dt= 0.01 hrs

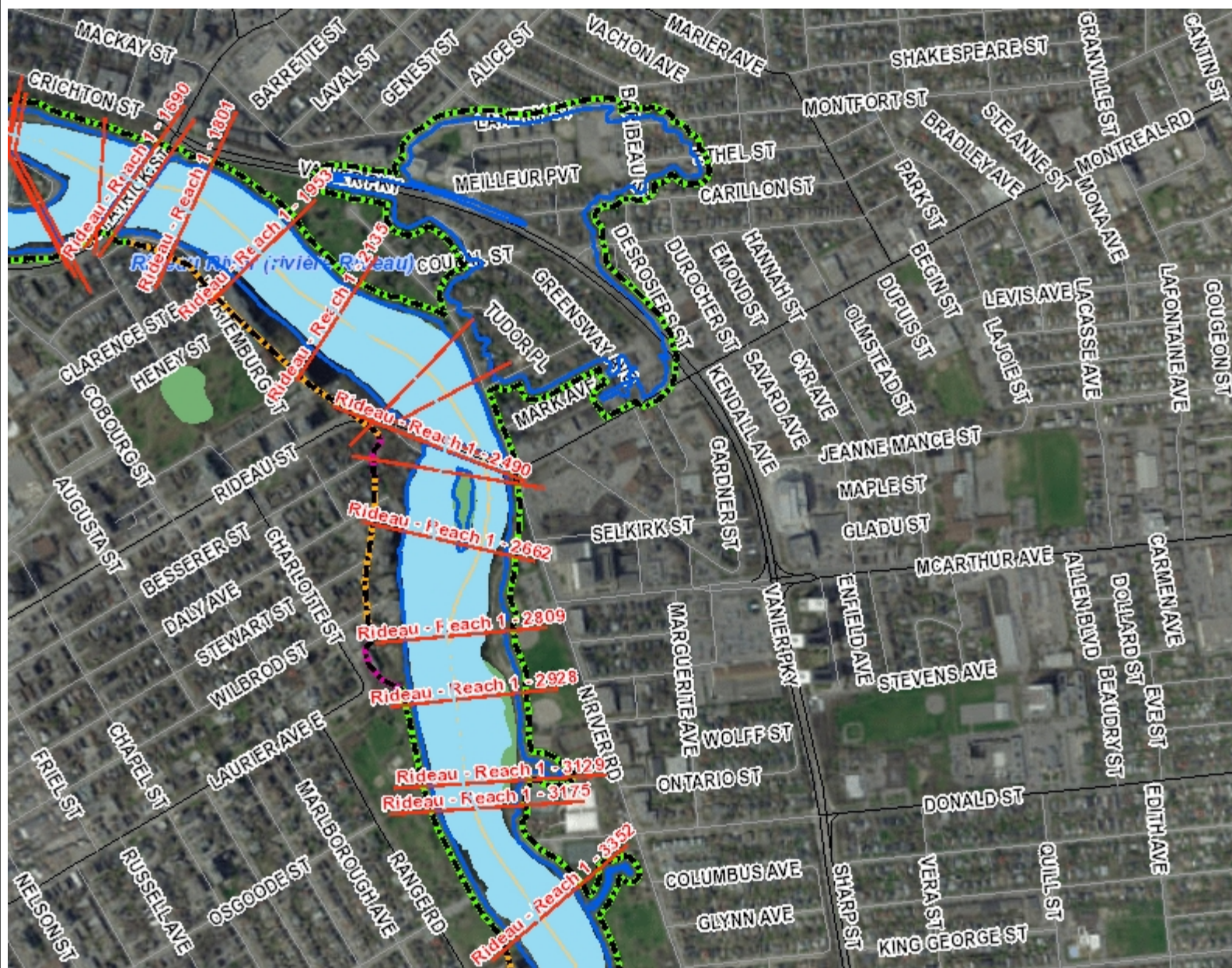


APPENDIX

H

FLOOD PLAIN MAPPING AND ELEVATIONS

Rideau River at Cumming Island



Legend

- OHN Watercourse
- RVCA Sub-Watersheds
- RVCA Catchments
- Floodplain Cross-sections
- ⊠ Regulation Limit
- 100yr Floodline
- Reg Limit Dominant Hazard
 - Floodplain
 - Geo-technical Hazard Limit
 - Meander Belt
 - Stable Slope
 - Top of Slope
 - Unstable Slope
 - Wetland
- Township Municipal
- Geographic Township
- Conservation Authorities (East)
- Roads
 - Freeway
 - Expressway / Highway
 - Arterial
 - Local
 - Ramp
 - Rapid Transit
 - Service
- Waterbody
- Wetlands
 - Evaluated-Provincial
 - Evaluated-Other
 - Not evaluated per OWES



1: 15,084.78

Map Projection: WGS_1984_Web_Mercator_Auxiliary_Sphere

Notes

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766.3 0 383.15 766.3

Meters

Data Received from RVCA September 2015

FPM_UNIQUE	PROFILE	Q_TOTAL_C	WS_ELEV_M	EG_ELEV_M
Rideau - Reach 1 - 2474	50 Year	626	56.44	56.52
Rideau - Reach 1 - 2474	5 Year	513	56.1	56.17
Rideau - Reach 1 - 2474	25 Year	598	56.36	56.44
Rideau - Reach 1 - 2474	100 Year	654	56.52	56.6
Rideau - Reach 1 - 2474	10 Year	552	56.22	56.29
Rideau - Reach 1 - 2490	50 Year	626	56.46	56.54
Rideau - Reach 1 - 2490	5 Year	513	56.12	56.18
Rideau - Reach 1 - 2490	25 Year	598	56.38	56.46
Rideau - Reach 1 - 2490	100 Year	654	56.54	56.63
Rideau - Reach 1 - 2490	10 Year	552	56.24	56.31
Rideau - Reach 1 - 2512	50 Year	626	56.47	56.55
Rideau - Reach 1 - 2512	5 Year	513	56.13	56.19
Rideau - Reach 1 - 2512	25 Year	598	56.39	56.47
Rideau - Reach 1 - 2512	100 Year	654	56.56	56.64
Rideau - Reach 1 - 2512	10 Year	552	56.25	56.32