Wurtemburg Tower
101 Wurtemburg Street
Ottawa, Ontario

Stormwater Management Report

WURTEMBURG TOWER
101 WURTEMBURG STREET
OTTAWA, ONTARIO

STORMWATER MANAGEMENT REPORT

Prepared by:

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File No.: 111013
Report Reference No.: R-2011-034
February 25, 2011

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February 25, 2011

City of Ottawa
Planning and Growth Management Department
Development Review (Urban) Services Branch
Infrastructure Approvals Division
110 Laurier Avenue West, 4th Floor
Ottawa ON, K1P 1J1

Attention: **Mr. Bruce Coombe**

Dear Sir:

Reference: **Wurtemburg Tower – 101 Wurtemburg Street**
Stormwater Management Report
Our File No.: 111013

Enclosed herein is the Stormwater Management Report for the proposed residential development at 101 Wurtemburg Street, located on the east side of the intersection of Wurtemburg Street and Clarence Street. This report is submitted in support of the rezoning and site plan applications and presents a stormwater management plan for the re-development of the site.

Trusting this report is adequate for your purposes. Should you have any questions, or require additional information, please contact us.

Yours truly,

NOVATECH ENGINEERING CONSULTANTS LTD.

Greg MacDonald, P.Eng
Senior Project Manager

JAG/jag

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1.0 INTRODUCTION

The proposed Wurtemburg Tower residential development at 101 Wurtemburg Street is located on the east side of the intersection of Wurtemburg Street and Clarence Street in the City of Ottawa, as shown in Figure 1 - Key Plan. The proposed development will consist of an 18 storey tower with 66 condominium units. Also, a total of 54 parking spaces will be provided on 3 levels of underground parking. Refer to Figure 2 - Site Plan for details.

The subject site consists of approximately 0.0795 ha and is currently occupied by a two-storey residential building, as shown in Figure 3 – Existing Conditions.

This stormwater management report will provide a solution to manage stormwater runoff from the site.

2.0 CRITERIA

Through correspondence with the City of Ottawa and our knowledge of development requirements in the area, the following criteria have been adopted to control post-development stormwater discharge from the site:

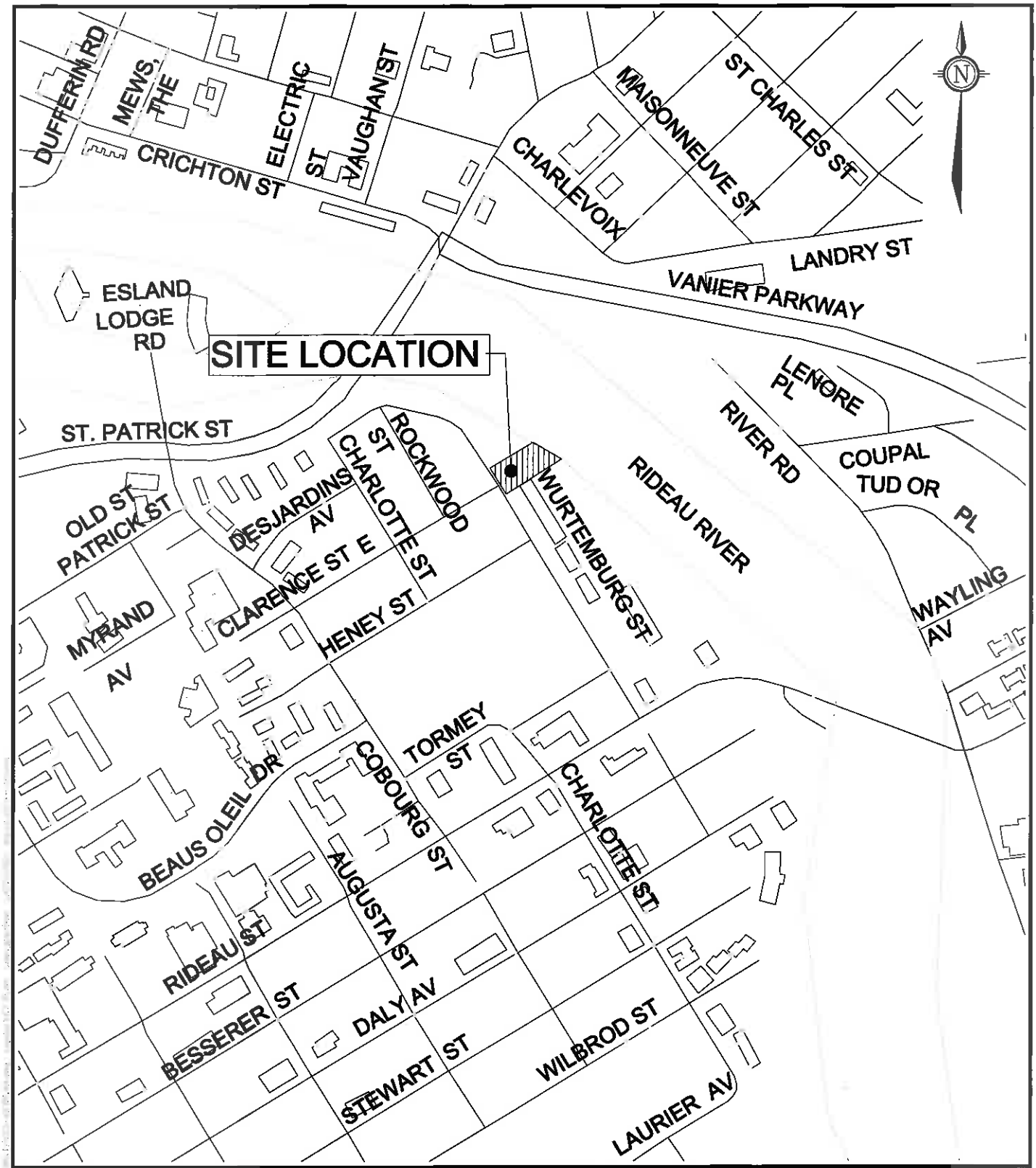
- Control proposed development flows, up to and including the 100-year storm event, to a 5-year allowable release rate calculated using a runoff coefficient (C) of 0.50 and a time of concentration (T_c) of 20 minutes;
- Determine size and location of drainage system components;
- Provide source controls which are in conformity with the City of Ottawa requirements, where possible;
- Limit ponding to 0.15 m for all rooftop storage areas; and
- Provide guidelines to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion and Sediment Control.

The approach to the stormwater management design is to determine the allowable release rate for the site, calculate the uncontrolled flow, and ensure that the remaining flow, in combination with the uncontrolled flow, does not exceed the allowable release rate. All proposed development runoff in excess of the allowable release rate, will be attenuated on-site prior to being released into the storm sewer on Wurtemburg Street.

3.0 EXISTING CONDITIONS

3.1 The Site

Under existing conditions, the site consists of a two-storey residential building, as illustrated in Figure 3. Stormwater flows from the site are currently conveyed to the existing storm sewer system via road catchbasins by overland flows. The rear portion of the site discharges overland to the Rideau River.



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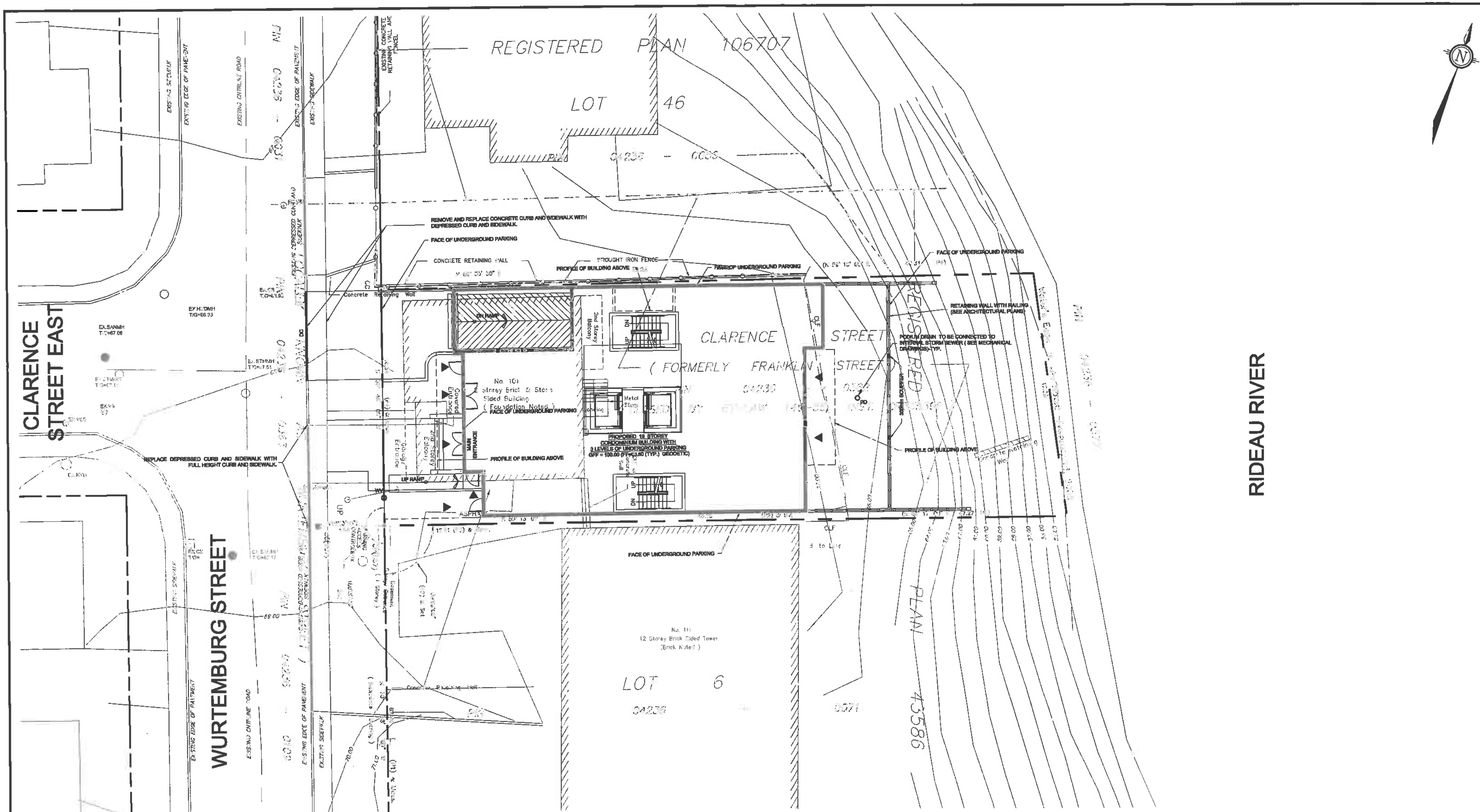
CITY OF OTTAWA

WURTEMBURG TOWER
101 WURTEMBURG STREET

KEY PLAN

FEB. 2011 111013 FIGURE 1

SHTBX11.DWG - 216mmX279mm



LEGEND

— - - — SITE PLAN AREA

NTS

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CITY OF OTTAWA
WURTEMBURG TOWER
101 WURTEMBURG STREET
SITE PLAN
FEB. 2011 111013 FIGURE 2

SHT11X17.DWG – 278mmX431mm

LEGEND

SITE PLAN AREA

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CITY OF OTTAWA

WURTEMBURG TOWER
101 WURTEMBURG STREET

EXISTING CONDITIONS

FEB. 2011 111013 FIGURE 3

SHT11X17.DWG – 279mmX431mm

As part of this development, all stormwater will be controlled on site and discharged via a 200 mm dia. service that will connect to the existing 300 mm dia. storm sewer on Wurtemburg Street. All proposed storm services will be equipped with backwater valves.

3.2 Allowable Release Rate

The City requires that on-site stormwater management be implemented to control post-development stormwater discharge for the 100 year storm event to that value calculated using a 5-year storm and a time of concentration (T_c) of 20 minutes. The allowable release rate for the proposed 0.0795 ha development was calculated using the Rational Method to be 7.76 L/s as follows:

Total Drainage Area (A) = 0.0795 ha
Runoff Coefficient (C_{allow}) = 0.50
Intensity (I_{5allow}) = 70.25 mm/hr

Q_{allow} = 2.78 CIA
Q_{allow} = 2.78 x 0.50 x 70.25 mm/hr x 0.0795 ha
Q_{allow} = 7.76 L/s

4.0 PROPOSED DEVELOPMENT STORMWATER MANAGEMENT DESIGN

Stormwater runoff flow from the site will be a combination of uncontrolled direct runoff and controlled flow. Stormwater management will be achieved through the use of rooftop controls and surface storage. The site will be graded such that flows in excess of the 100-year storm event will be conveyed overland to Wurtemburg Street and to the Rideau River.

The trench drain for the ramp to the underground parking will outlet uncontrolled to the storm sewer on Wurtemburg Street.

4.1 Drainage Areas

The development will consist of a number of drainage areas which are highlighted on the Storm Drainage Area Plan (111013-STM) enclosed in the back of this report. The following is a detailed description of how the flows from each area will be managed.

Table 4.1 Drainage Area Descriptions

Drainage Area No.	Total area (ha)	Runoff Coefficient - C	Description
A-01	0.00905	0.60	Uncontrolled
A-02	0.01115	0.76	Uncontrolled
A-03	0.01926	0.20	Uncontrolled
R-01	0.01751	0.95	Controlled – Roof Drain
R-02	0.02136	0.95	Controlled – Roof Drain
R-03	0.00073	0.95	Controlled – Roof Drain
R-04	0.00041	0.95	Controlled – Roof Drain
Total =	**0.0795**		

Drainage Areas A-01 and A-02 are the surficial uncontrolled runoff at the ground elevation and will be collected by area drains that will discharge to the storm sewer on Wurtemburg Street. Drainage Area A-03 is the surficial uncontrolled runoff at the ground elevation and will discharge overland to the Rideau River. Drainage Areas R-01 through R-04 are rooftop areas large enough for surface storage, therefore allowing controlled flow.

All the stormwater runoff from the controlled roof top areas, along with drainage areas A-01 and A-02 will flow internally and then be directed out of the building through a direct connection to the existing 300 mm dia. storm sewer on Wurtemburg Street.

4.2 Uncontrolled Development Flows

The uncontrolled development flows from Areas A-01 to A-03 were calculated using the Rational Method with a time of concentration (Tc) of 20 minutes and are summarized in Table 4.2. Detailed calculations are contained in Appendix B.

Table 4.2 Proposed Development Uncontrolled Flows Summary

Area No	POST DEVELOPMENT UNCONTROLLED RUNOFF									
	5-Year Event					100-Year Event				
	C	Tc (min)	I (mm/hr)	Area (ha)	Q (L/s)	C	Tc (min)	I (mm/hr)	Area (ha)	Q (L/s)
A-01	0.60	20	70.25	0.0091	1.06	0.68	20	119.95	0.0091	2.05
A-02	0.76	20	70.25	0.0112	1.65	0.85	20	119.95	0.0112	3.16
A-03	0.20	20	70.25	0.0193	0.75	0.25	20	119.95	0.0193	1.61
			Total =		**3.46**			**Total =**		**6.82**

Based on the above calculations, the 5-year uncontrolled roof flow is 3.46 L/s and the 100-year uncontrolled roof flow is 6.82 L/s.

4.2.1 Remaining Allowable Release Rate

The maximum allowable storm flow for the remaining areas is the allowable release rate for the entire site less the uncontrolled flow from Areas A-01 to A-03. The following table indicates the allowable release rate for the entire site, the uncontrolled runoff from Areas A-01 to A-03, and the remaining allowable release rate for the rest of the rooftop areas for both the 5-year and 100-year storm events.

Table 4.2.1 Remaining Allowable Release Rate Summary

Area		Flow (L/s)	
		5-Year	100-Year
Entire Site (Legal Boundary)	Allowable	7.76	7.76
A-01 to A-03	Uncontrolled	3.46	6.82
Remaining Allowable Flow		4.30	0.94

4.3 Controlled Development Flows

Stormwater flows from Areas R-01 through R-04 were calculated to be 7.43 L/s for the 5-year storm event and 13.33 L/s for the 100-year storm event. Both events exceed the maximum allowable flow for these areas therefore roof drain flow controls will be required. Detailed calculations are contained in Appendix B.

Due to the extent of hard surface areas and the limited allowable release rate, runoff in excess of the allowable quantity will be stored on site, up to and including the 100-year storm event. Flow from the building roof will be controlled by modified Zurn rooftop drains. Flow through these drains is dependent on the height of water above the drain (H- Head) and the number of notches in the

drain. Flow from each rooftop area has been summarized in Table 4.3. Detailed calculations are included in Appendix B.

Table 4.3 Roof Drain Flow Summary

Area No	Zurn Specification	G.P.M per Inch of Head	ZURN ROOFDRAIN CONTROL PARAMETERS			
			5-Year Event		100-Year Event	
			Depth (m)	Total Flow (L/s)	Depth (m)	Total Flow (L/s)
R-01	ZCF121-1W-X3-Z-105-10-77	2.50	0.112	0.83	0.143	1.07
R-02	ZCF121-1W-X2-Z-105-10-77	3.75	0.115	1.29	0.148	1.66
R-03	ZCF121-1W-X4-Z-105-10-77	1.25	0.055	0.20	0.079	0.29
R-04	ZCF121-1W-X4-Z-105-10-77	1.25	0.039	0.14	0.061	0.23
			Total =	**2.47**	**Total =**	**3.25**

The Modified Rational Method was used to determine the storage volume required for the various rooftop drainage areas. Based on a controlled flow provided via the modified Zurn rooftop drains, the ponding depth on the roof above the drains will vary between 0.039 – 0.115 m for the 5-year storm event and 0.061 – 0.148 m for the 100-year storm event, as determined through iterative calculations using the release rate, head, and corresponding storage. The flow rate for a standard Zurn roof drain (per 1 notch) is 5 G.P.M. per inch of head (1.49 L/s per 100mm of ponding), but this can be reduced by designing the weir. Refer to the Appendix B for details outlining the modified rational method used, the ponding depth, and stage-storage curves for each controlled drainage area. Zurn roof drain information, including the specification for the weirs is contained in Appendix C.

4.4 Major Overland Drainage

In the case of a storm event greater than the 100-year, scuppers will be included in the building design at a depth of 0.15 m from the roof drain to provide an overflow for excess runoff. An overland drainage flow route for major system runoff will be provided by grading the site such that excess stormwater runoff will flow overland towards Wurtemburg Street and the Rideau River.

5.0 EROSION AND SEDIMENT CONTROL MEASURES

Temporary and permanent erosion and sediment control measures will be implemented prior to, during and after construction; and will be inspected regularly.

To prevent sediment and debris from entering the storm system during construction, the following erosion and sediment control measures will be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987):

- Filter cloth will be placed under the grates of all area drains and remain in place until vegetation has been established and construction is completed;
- Street sweeping and cleaning will be performed on all roads adjacent to active construction on a regular basis;
- Stockpiles will be stabilized against erosion, and;
- Silt fence will be placed along the surrounding property lines to prevent contaminated surface runoff from migrating towards adjacent sites and straw bale check dams will be used if necessary.

As for permanent measures, seeding of disturbed areas and establishing grass growth will be utilized.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this report, a stormwater management scheme has been identified that will achieve the allowable release rate required by the City. Therefore, the following conclusions are made:

- On-site stormwater management will be provided to control the stormwater discharge from the 5-year and 100-year storm events.
- Stormwater discharge from the site for the 5-year storm event (5.94 L/s) is less than the allowable flow rate of 7.76 L/s.
- Stormwater discharge from the site for the 100-year storm event (10.05 L/s) is greater than the allowable flow rate of 7.76 L/s, however, this would have negligible impact on the existing City storm sewer system.
- The site will be graded such that flows in excess of the 100-year storm event will be conveyed overland to Wurtemburg Street and the Rideau River.
- Sediment and erosion control measures will be implemented during construction.

7.0 CLOSURE

This report has been prepared in accordance with the requirements for site plan submission and is hereby submitted for approval.

NOVATECH ENGINEERING CONSULTANTS LTD.

Prepared by:

Justin Gauthier, B.Eng.
Junior Engineer

Reviewed by:

Greg MacDonald, P.Eng.
Senior Project Manager

APPENDIX A

IDF CURVES, RATIONAL METHOD, RUNOFF

RATIONAL METHOD

The Rational Method was used to determine both the allowable runoff as well as the proposed development runoff for the site. The equation is as follows:

Q=2.78 CIA

Where:
Q is the runoff in L/s
C is the weighted runoff coefficient*
I is the rainfall intensity in mm/hr**
A is the area in hectares

*The weighted runoff coefficient is determined for each of the catchment areas as follows:

$$C = \frac{(A_{perv} \times C_{perv}) + (A_{imp} \times C_{imp})}{A_{tot}}$$

Where:
A_{perv} is the pervious area in hectares
C_{perv} is the pervious area runoff coefficient (Cperv=0.20)
A_{imp} is the impervious area in hectares
C_{imp} is the impervious area runoff coefficient (Cimp=0.90)
A_{tot} is the catchment area (Aperv + Aimp) in hectares

** The rainfall intensity is taken from the City of Ottawa IDF Curves with a time of concentration of 20 min (refer to attached IDF Curves) as specified by the City of Ottawa.

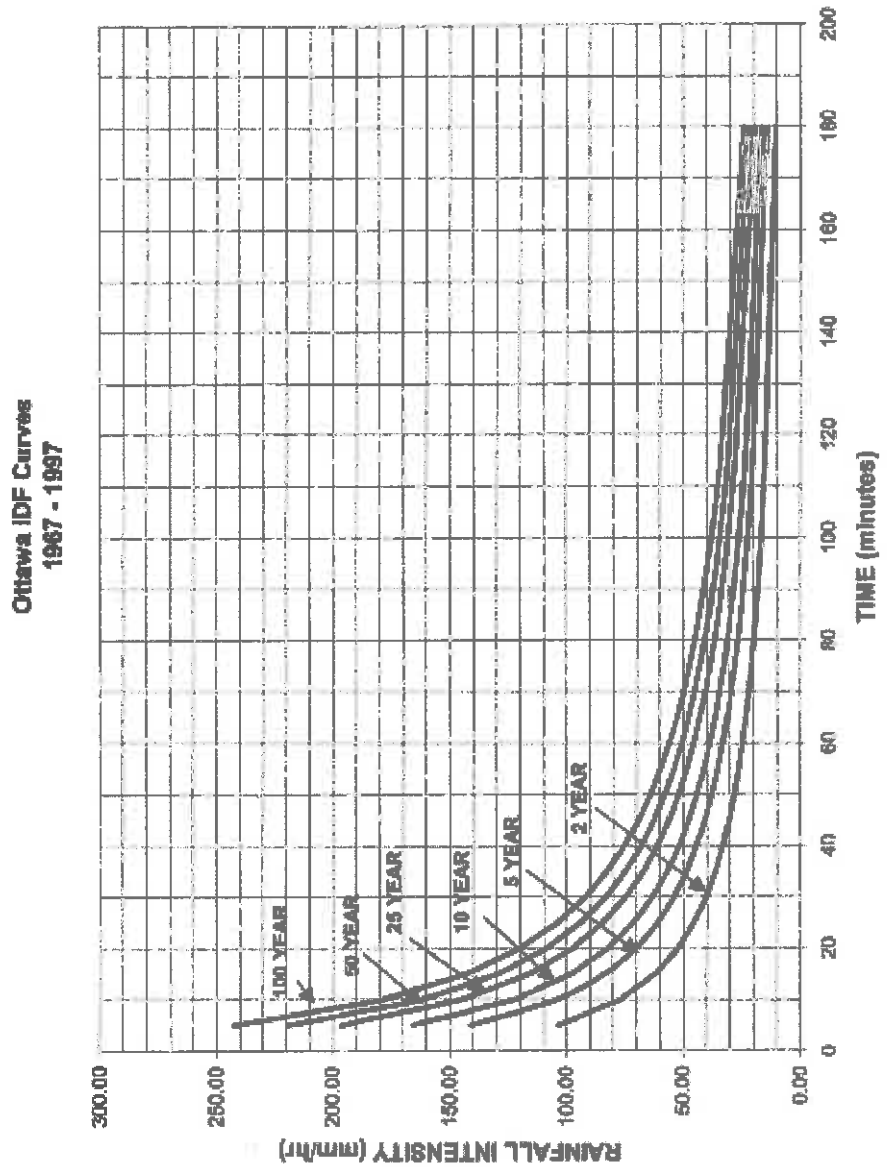
ALLOWABLE RELEASE RATE AS SPECIFIED BY THE CITY

The allowable release rate was calculated for the 0.0795 ha re-developed site, using a runoff coefficient (C) of 0.50 and a time of concentration (Tc) of 20 minutes, as specified by the City of Ottawa.

Drainage Area (A) = 0.0795 ha
Runoff Coefficient (C) = 0.50
Intensity (I5) = 70.25 mm/hr

Q5= 2.78 CIA
Q5= 2.78 x 0.50 x 70.25 mm/hr x 0.0795 ha
Q5= 7.76 L/s

APPENDIX 5-A **OTTAWA INTENSITY DURATION FREQUENCY (IDF) CURVE**



** IDF CURVE FROM OTTAWA SEWER DESIGN GUIDELINES – NOV 2004*

APPENDIX B

SWM CALCULATIONS

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Runoff Coefficients

Drainage Area	Total Area (m^2)	Hard Surface Area		Grass Area		5-Year Runoff Coefficient	100-Year Runoff Coefficient
		Area (m^2)	C	Area (m^2)	C		
R-01	175.1	175.1	0.95	0.0	0.2	0.95	1.00
R-02	213.6	213.6	0.95	0.0	0.2	0.95	1.00
R-03	7.3	7.3	0.95	0.0	0.2	0.95	1.00
R-04	4.1	4.1	0.95	0.0	0.2	0.95	1.00
A-01	90.5	51.66	0.9	38.86	0.2	0.60	0.68
A-02	111.5	88.99	0.9	22.51	0.2	0.76	0.85
A-03	192.6	0.00	0.9	192.64	0.2	0.20	0.25
Total	**794.8**	**540.8**	**0.94**	**254.0**	**0.20**	**0.70**	**0.76**

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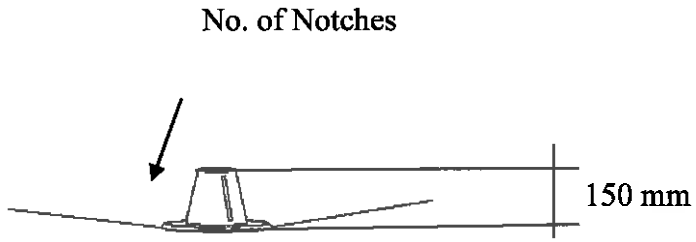
Zurn Roof Drains

Opening	G.P.M. Per Inch of Head	L.P.M. Per Inch (25 mm) of Head	L/s Per Metre of Head	L/s Per 0.15 m of Head
Standard - X1	5.00	22.730	14.915	2.237
Reduced - X2	3.75	17.048	11.186	1.678
Reduced - X3	2.50	11.365	7.458	1.119
Max Reduced - X4	1.25	5.683	3.729	0.559

SAMPLE CALCULATION:

AREA R-01

Number of notches (N) = 1
Head (H) = 0.112 m for 5-year event
Head (H) = 0.143 m for 100-year event



$Q_{5\ all}$ = 7.458 L/s/m/notch x H x N
$Q_{5\ all}$ = 7.458 L/s/m/notch x .112 m x 1 notch
$Q_{5\ all}$ = 0.83 L/s

$Q_{100\ all}$ = 7.458 L/s/m/notch x H x N
$Q_{100\ all}$ = 7.458 L/s/m/notch x .143 m x 1 notch
$Q_{100\ all}$ = 1.07 L/s

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Controlled Flow

5 YR

Area No	Area (ha)	C_{5yr}	Time (min)	Intensity mm/hr	Uncontrolled runoff L/s	Control System	Zurn Model Number	Release Rate (L/s/m of head)	Notches	Depth (m)	Controlled Flow (L/s)	Storage available (m^3)	Storage used (m^3)
R-1	0.0175	0.95	20.00	70.25	3.25	Zurn Roof	ZCF121-1W-X3-Z-105-10-	7.46	1	0.112	0.83	7.190	3.00
R-2	0.0214	0.95	20.00	70.25	3.96	Zurn Roof	ZCF121-1W-X2-Z-105-10-	11.19	1	0.115	1.29	7.060	3.22
R-3	0.0007	0.95	20.00	70.25	0.14	Zurn Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.055	0.20	0.410	0.02
R-4	0.0004	0.95	20.00	70.25	0.08	Zurn Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.039	0.14	0.220	0.00
A-01	0.0091	0.60	20.00	70.25	1.06	no control	-	-	-	-	-	0.00	0.00
A-02	0.0112	0.76	20.00	70.25	1.65	no control	-	-	-	-	-	0.00	0.00
A-03	0.0193	0.20	20.00	70.25	0.75	no control	-	-	-	-	-	0.00	0.00
Total:	0.0795				10.89						2.47	14.88	6.24

100 YR

Area ID	Area (ha)	C_{100yr}	Time (min)	Intensity mm/hr	Uncontrolled runoff L/s	Control System	Zurn Model Number	Release Rate (L/s/m of head)	Notches	Depth (m)	Controlled Flow (L/s)	Storage available (m^3)	Storage used (m^3)
R-1	0.0175	1.00	20.00	119.95	5.84	Zurn Roof	ZCF121-1W-X3-Z-105-10-	7.46	1	0.143	1.07	7.190	6.22
R-2	0.0214	1.00	20.00	119.95	7.12	Zurn Roof	ZCF121-1W-X2-Z-105-10-	11.19	1	0.148	1.66	7.060	6.83
R-3	0.0007	1.00	20.00	119.95	0.24	Zurn Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.079	0.29	0.410	0.06
R-4	0.0004	1.00	20.00	119.95	0.14	Zurn Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.061	0.23	0.220	0.01
A-01	0.0091	0.68	20.00	119.95	2.05	no control	-	-	-	-	-	0.00	0.00
A-02	0.0112	0.85	20.00	119.95	3.16	no control	-	-	-	-	-	0.00	0.00
A-03	0.0193	0.25	20.00	119.95	1.61	no control	-	-	-	-	-	0.00	0.00
Total:	0.0795				20.15						3.25	14.88	13.13

Note: In all cases, there is only one notch in the Zurn roof drain and and flows through each drain is further reduced with and adjustable weir. See Zurn roof drains sheet and adjustable weir specification for more details on the reduction of flow.

Allowable release rate

Area	0.0795	ha
C	0.5	
tc	20	min
i	70.25	
Q allowable = 2.78 x C x i x A		
	7.76	L/s

Summary table

Area ID	Area (ha)	Runoff: 5 year event L/s	Runoff: 100 year event L/s	Storage available (m^3)	Storage used: 5 year event (m^3)	Storage used: 100 year event (m^3)
Controlled						
Roof	0.0400	2.47	3.25	14.88	6.24	13.13
Uncontrolled						
A-1	0.0091	1.06	2.05	0.00	0.00	0.00
A-2	0.0112	1.65	3.16	0.00	0.00	0.00
A-3	0.0193	0.75	1.61	0.00	0.00	0.00
Total:	0.08	5.94	10.05	14.88	6.24	13.13

WUTEMBURG TOWER: 101 WURTEMBURG STREET

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REQUIRED STORAGE - 5-YEAR EVENT

AREA R-1 : BUILDING ROOF

OTTAWA IDF CURVE

Area = 0.018 ha Qallow = 0.83

C = 0.95 Vol(max) = 3.00

Hatches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	141.18	6.53	5.70	1.71
10	104.19	4.82	3.99	2.39
15	83.56	3.86	3.03	2.73
20	70.25	3.25	2.42	2.90
25	60.90	2.82	1.99	2.98
30	53.93	2.49	1.66	3.00
35	48.52	2.24	1.41	2.97
40	44.18	2.04	1.21	2.91
45	40.63	1.88	1.05	2.83
50	37.65	1.74	0.91	2.73
55	35.12	1.62	0.79	2.62
60	32.94	1.52	0.69	2.50
65	31.04	1.44	0.61	2.36
70	29.37	1.36	0.53	2.22
75	27.89	1.29	0.46	2.07
80	26.56	1.23	0.40	1.91
85	25.37	1.17	0.34	1.75
90	24.29	1.12	0.29	1.58

Notes: Vol = Qnet x time

Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
3	0.02	0.02
6	0.06	0.03
11	0.14	0.04
17	0.27	0.05
25	0.46	0.06
34	0.73	0.07
44	1.09	0.08
56	1.55	0.09
69	2.13	0.10
84	2.84	0.11
100	3.68	0.12
117	4.68	0.13
136	5.85	0.14
156	7.19	0.15

Linear Interpolation

0.12	H	0.11		H =	0.112 m
3.68	3.00	2.84		Q_{allow} =	0.83 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (7.46 L/s/m of head.)

REQUIRED STORAGE - 100-YEAR EVENT

AREA R-1 : BUILDING ROOF

OTTAWA IDF CURVE

Area = 0.018 ha Qallow = 1.07

C = 1.00 Vol(max) = 6.22

Hatches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	0.15	0.01	-1.06	-0.32
10	178.56	8.69	7.63	4.58
15	142.89	6.96	5.89	5.30
20	119.95	5.84	4.77	5.73
25	103.85	5.06	3.99	5.99
30	91.87	4.47	3.41	6.13
35	82.58	4.02	2.96	6.21
40	75.15	3.66	2.59	6.22
45	69.05	3.36	2.30	6.20
50	63.95	3.11	2.05	6.15
55	59.62	2.90	1.84	6.06
60	55.89	2.72	1.66	5.96
65	52.65	2.56	1.50	5.84
70	49.79	2.42	1.36	5.71
75	47.26	2.30	1.24	5.56
80	44.99	2.19	1.13	5.40
85	42.95	2.09	1.03	5.23
90	41.11	2.00	0.94	5.06

Notes: Vol = Qnet x time

Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
3	0.02	0.02
6	0.06	0.03
11	0.14	0.04
17	0.27	0.05
25	0.46	0.06
34	0.73	0.07
44	1.09	0.08
56	1.55	0.09
69	2.13	0.10
84	2.84	0.11
100	3.68	0.12
117	4.68	0.13
136	5.85	0.14
156	7.19	0.15

Linear Interpolation

0.15	H	0.14		H =	0.143 m
7.19	6.22	5.85		Q_{allow} =	1.07 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (7.46 L/s/m of head)

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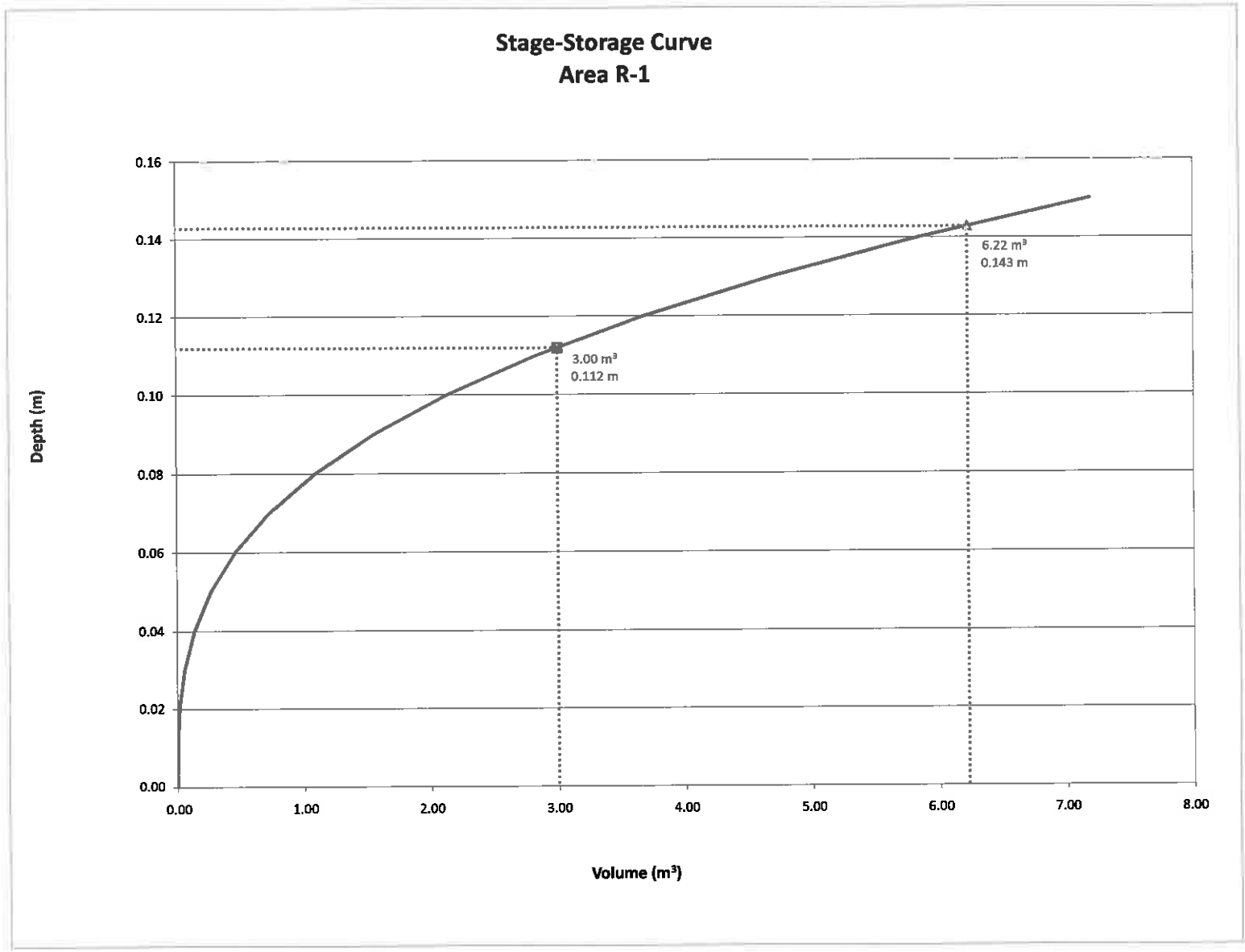

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REQUIRED STORAGE - 5-YEAR EVENT

AREA R-2 : BUILDING ROOF

OTTAWA IDF CURVE

Area = 0.021 ha | Qallow = 1.29

C = 0.95 | Vol(max) = 3.22

Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	141.18	7.96	6.67	2.00
10	**104.19**	**5.88**	**4.59**	**2.75**
15	**83.56**	**4.71**	**3.42**	**3.08**
20	70.25	3.96	2.67	3.21
25	60.90	3.44	2.15	3.22
30	53.93	3.04	1.75	3.15
35	48.52	2.74	1.45	3.04
40	44.18	2.49	1.20	2.89
45	40.63	2.29	1.00	2.71
50	37.65	2.12	0.83	2.50
55	35.12	1.98	0.69	2.28
60	32.94	1.86	0.57	2.05
65	31.04	1.75	0.46	1.80
70	29.37	1.66	0.37	1.54
75	27.89	1.57	0.28	1.28
80	26.56	1.50	0.21	1.00
85	25.37	1.43	0.14	0.72
90	24.29	1.37	0.08	0.43

Notes: Vol = Qnet x time
Qnet = Q - Qallow

REQUIRED STORAGE - 100-YEAR EVENT

AREA R-2 : BUILDING ROOF

OTTAWA IDF CURVE

Area = 0.021 ha | Qallow = 1.66

C = 1.00 | Vol(max) = 6.83

Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	14.41	12.75	3.83
10	**178.56**	**10.60**	**8.94**	**5.37**
15	**142.89**	**8.49**	**6.83**	**6.14**
20	119.95	7.12	5.46	6.56
25	103.85	6.17	4.51	6.76
30	91.87	5.46	3.80	6.83
35	82.58	4.90	3.24	6.81
40	75.15	4.46	2.80	6.73
45	69.05	4.10	2.44	6.59
50	63.95	3.80	2.14	6.41
55	59.62	3.54	1.88	6.21
60	55.89	3.32	1.66	5.97
65	52.65	3.13	1.47	5.72
70	49.79	2.96	1.30	5.45
75	47.26	2.81	1.15	5.16
80	44.99	2.67	1.01	4.86
85	42.95	2.55	0.89	4.54
90	41.11	2.44	0.78	4.22

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	**0.00**	**0.00**
1	0.00	0.01
3	0.02	0.02
6	0.06	0.03
11	0.13	0.04
18	0.26	0.05
26	0.45	0.06
35	0.72	0.07
46	1.07	0.08
58	1.52	0.09
71	2.09	0.10
86	2.78	0.11
102	3.61	0.12
120	4.60	0.13
140	5.74	0.14
160	**7.06**	**0.15**

Ponding Depth (100-Year Storm)

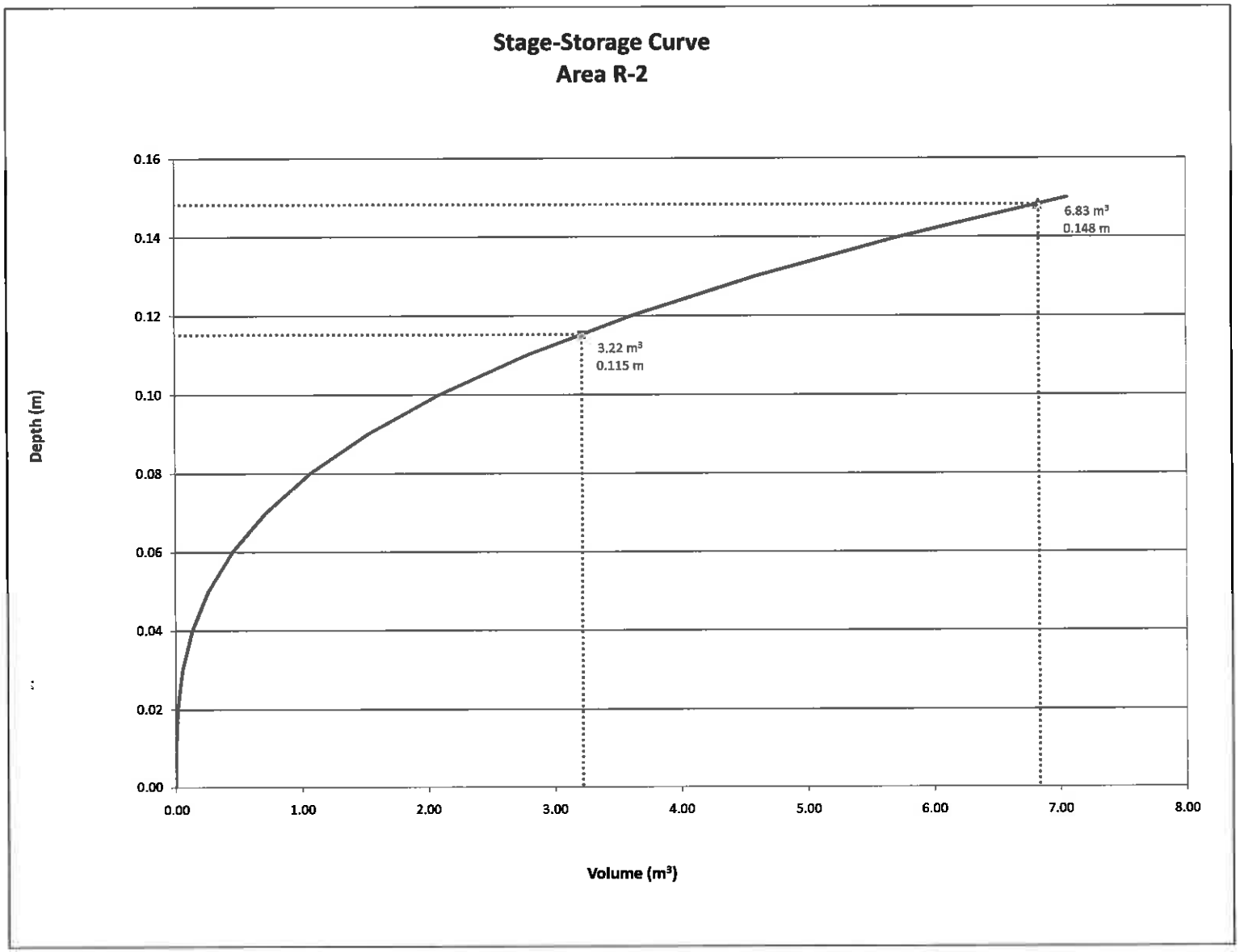
Area m^2	V m^3	H m
0	**0.00**	**0.00**
1	0.00	0.01
3	0.02	0.02
6	0.06	0.03
11	0.13	0.04
18	0.26	0.05
26	0.45	0.06
35	0.72	0.07
46	1.07	0.08
58	1.52	0.09
71	2.09	0.10
86	2.78	0.11
102	3.61	0.12
120	4.60	0.13
140	5.74	0.14
160	**7.06**	**0.15**

0.12	H	0.11		H =	0.115 m
3.61	3.22	2.78		Q_{allow} =	1.29 L/s

Note: Qallow is the flow rate through an overcontrolled Zum Roof Drain (11.19 L/s/m of head.)

0.15	H	0.14		H =	0.148 m
7.06	6.83	5.74		Q_{allow} =	1.66 L/s

Note: Qallow is the flow rate through an overcontrolled Zum Roof Drain (11.19 L/s/m of head.)


Stage-Storage Curve
Area R-2
Depth (m)
Volume (m³)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
6.83 m³
0.148 m
3.22 m³
0.115 m

NOVATECH ENGINEERING CONSULTANTS LTD.

REQUIRED STORAGE - 5-YEAR EVENT

AREA R-3 BUILDING ROOF

OTTAWA IDF CURVE

Area = 0.001 ha Qallow = 0.20

C = 0.95 Vol(max) = 0.02

Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	141.18	0.27	0.07	0.02
10	104.19	0.20	0.00	0.00
15	83.56	0.16	-0.04	-0.04
20	70.25	0.14	-0.07	-0.08
25	60.90	0.12	-0.09	-0.13
30	53.93	0.10	-0.10	-0.18
35	48.52	0.09	-0.11	-0.23
40	44.18	0.09	-0.12	-0.29
45	40.63	0.08	-0.13	-0.34
50	37.65	0.07	-0.13	-0.39
55	35.12	0.07	-0.14	-0.45
60	32.94	0.06	-0.14	-0.51
65	31.04	0.06	-0.14	-0.56
70	29.37	0.06	-0.15	-0.62
75	27.89	0.05	-0.15	-0.68
80	26.56	0.05	-0.15	-0.73
85	25.37	0.05	-0.16	-0.79
90	24.29	0.05	-0.16	-0.85

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
0	0.00	0.02
0	0.00	0.03
1	0.01	0.04
1	0.02	0.05
1	0.03	0.06
2	0.04	0.07
2	0.06	0.08
3	0.09	0.09
3	0.12	0.10
4	0.16	0.11
5	0.21	0.12
5	0.27	0.13
6	0.33	0.14
7	0.41	0.15

Orifice Equation

0.06	H	0.05		H =	0.056 m
0.03	0.02	0.02		Q_{allow} =	0.20 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

REQUIRED STORAGE - 100-YEAR EVENT

AREA R-3 BUILDING ROOF

OTTAWA IDF CURVE

Area = 0.0007 ha Qallow = 0.29

C = 1.00 Vol(max) = 0.06

Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	0.49	0.20	0.06
10	178.56	0.36	0.07	0.04
15	142.89	0.29	0.00	0.00
20	119.95	0.24	-0.05	-0.06
25	103.85	0.21	-0.08	-0.12
30	91.87	0.19	-0.11	-0.19
35	82.58	0.17	-0.12	-0.26
40	75.15	0.15	-0.14	-0.34
45	69.05	0.14	-0.15	-0.41
50	63.95	0.13	-0.16	-0.49
55	59.62	0.12	-0.17	-0.57
60	55.89	0.11	-0.18	-0.65
65	52.65	0.11	-0.19	-0.72
70	49.79	0.10	-0.19	-0.81
75	47.26	0.10	-0.20	-0.89
80	44.99	0.09	-0.20	-0.97
85	42.95	0.09	-0.21	-1.05
90	41.11	0.08	-0.21	-1.13

Notes: Vol = Qnet x time
Qnet = Q - Qallow

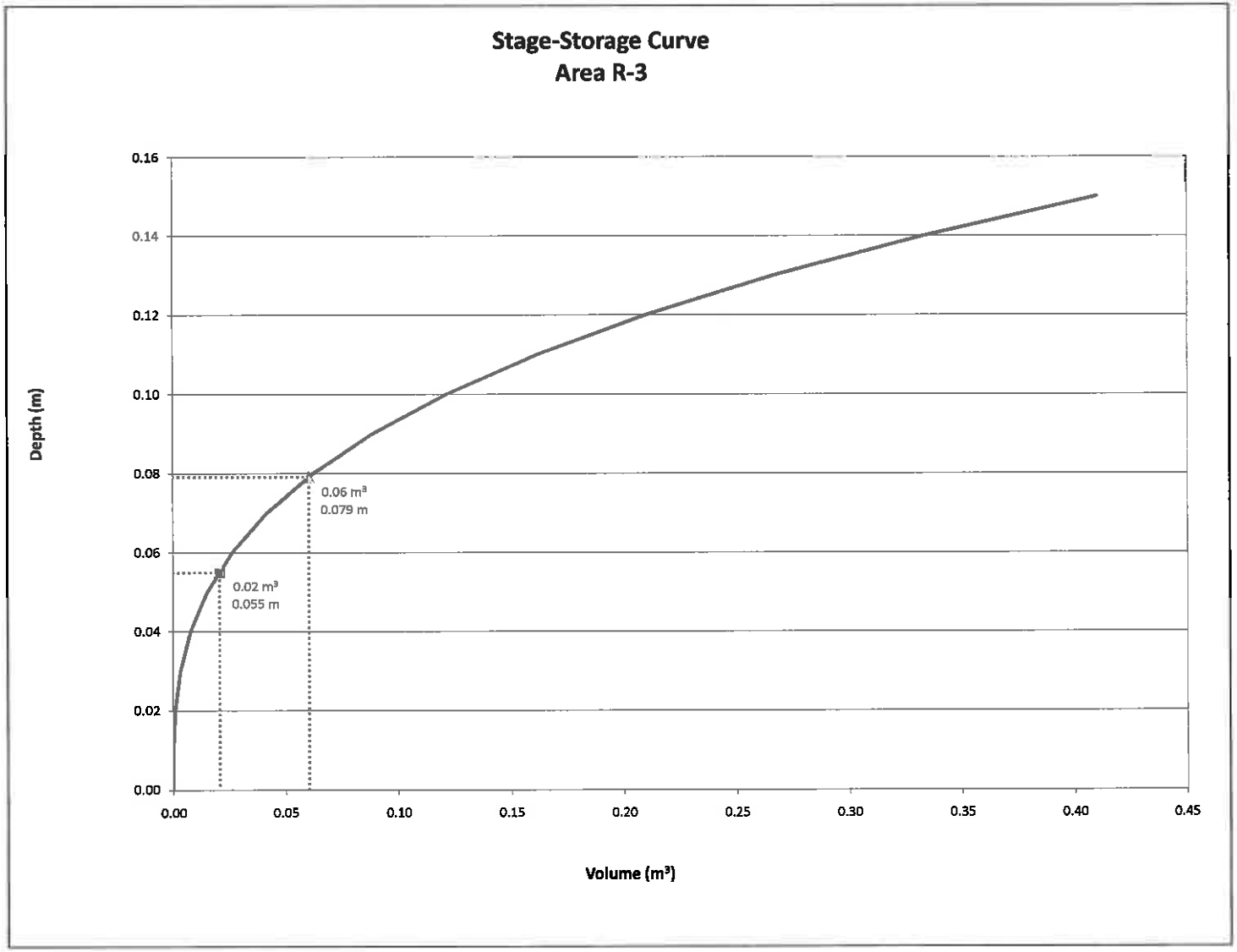
Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
0	0.00	0.02
0	0.00	0.03
1	0.01	0.04
1	0.02	0.05
1	0.03	0.06
2	0.04	0.07
2	0.06	0.08
3	0.09	0.09
3	0.12	0.10
4	0.16	0.11
5	0.21	0.12
5	0.27	0.13
6	0.33	0.14
7	0.41	0.15

Orifice Equation

0.08	H	0.07		H =	0.079 m
0.06	0.06	0.04		Q_{allow} =	0.29 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)


Stage-Storage Curve
Area R-3
Depth (m)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.06 m³
0.079 m
0.02 m³
0.055 m
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
Volume (m³)

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REQUIRED STORAGE - 5 YEAR EVENT

AREA R-4 BUILDING ROOF

OTTAWA IDF CURVE

Area = 0.000 ha Qallow = 0.14

C = 0.95 Vol(max) = 0.00

Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	141.18	0.15	0.01	0.00
10	**104.19**	**0.11**	**-0.03**	**-0.02**
15	83.56	0.09	-0.05	-0.05
20	70.25	0.08	-0.06	-0.08
25	60.90	0.07	-0.08	-0.11
30	53.93	0.06	-0.08	-0.15
35	48.52	0.05	-0.09	-0.19
40	44.18	0.05	-0.09	-0.22
45	40.63	0.04	-0.10	-0.26
50	37.65	0.04	-0.10	-0.30
55	35.12	0.04	-0.10	-0.34
60	32.94	0.04	-0.11	-0.38
65	31.04	0.03	-0.11	-0.42
70	29.37	0.03	-0.11	-0.46
75	27.89	0.03	-0.11	-0.50
80	26.56	0.03	-0.11	-0.54
85	25.37	0.03	-0.11	-0.58
90	24.29	0.03	-0.11	-0.62

Notes: Vol = Qnet x time
Qnet = Q - Qallow

REQUIRED STORAGE - 100 YEAR EVENT

AREA R-4 BUILDING ROOF

OTTAWA IDF CURVE

Area = 0.0004 ha Qallow = 0.23

C = 1.00 Vol(max) = 0.01

Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	0.28	0.05	0.01
10	**178.56**	**0.20**	**-0.03**	**-0.02**
15	142.89	0.16	-0.07	-0.06
20	119.95	0.14	-0.09	-0.11
25	103.85	0.12	-0.11	-0.17
30	91.87	0.10	-0.13	-0.23
35	82.58	0.09	-0.14	-0.29
40	75.15	0.09	-0.14	-0.35
45	69.05	0.08	-0.15	-0.41
50	63.95	0.07	-0.16	-0.47
55	59.62	0.07	-0.16	-0.53
60	55.89	0.06	-0.17	-0.60
65	52.65	0.06	-0.17	-0.66
70	49.79	0.06	-0.17	-0.73
75	47.26	0.05	-0.18	-0.79
80	44.99	0.05	-0.18	-0.86
85	42.95	0.05	-0.18	-0.92
90	41.11	0.05	-0.18	-0.99

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area (m^2)	V (m^3)	H (m)
0	0.00	0.00
0	0.00	0.01
0	0.00	0.02
0	0.00	0.03
0	0.00	0.04
0	0.01	0.05
1	0.01	0.06
1	0.02	0.07
1	0.03	0.08
1	0.04	0.09
2	0.06	0.10
2	0.08	0.11
3	0.10	0.12
3	0.13	0.13
4	0.18	0.14
4	0.22	0.15

Ponding Depth (100-Year Storm)

Area (m^2)	V (m^3)	H (m)
0	0.00	0.00
0	0.00	0.01
0	0.00	0.02
0	0.00	0.03
0	0.00	0.04
0	0.01	0.05
1	0.01	0.06
1	0.02	0.07
1	0.03	0.08
1	0.04	0.09
2	0.06	0.10
2	0.08	0.11
3	0.10	0.12
3	0.13	0.13
4	0.18	0.14
4	0.22	0.15

Linear Interpolation

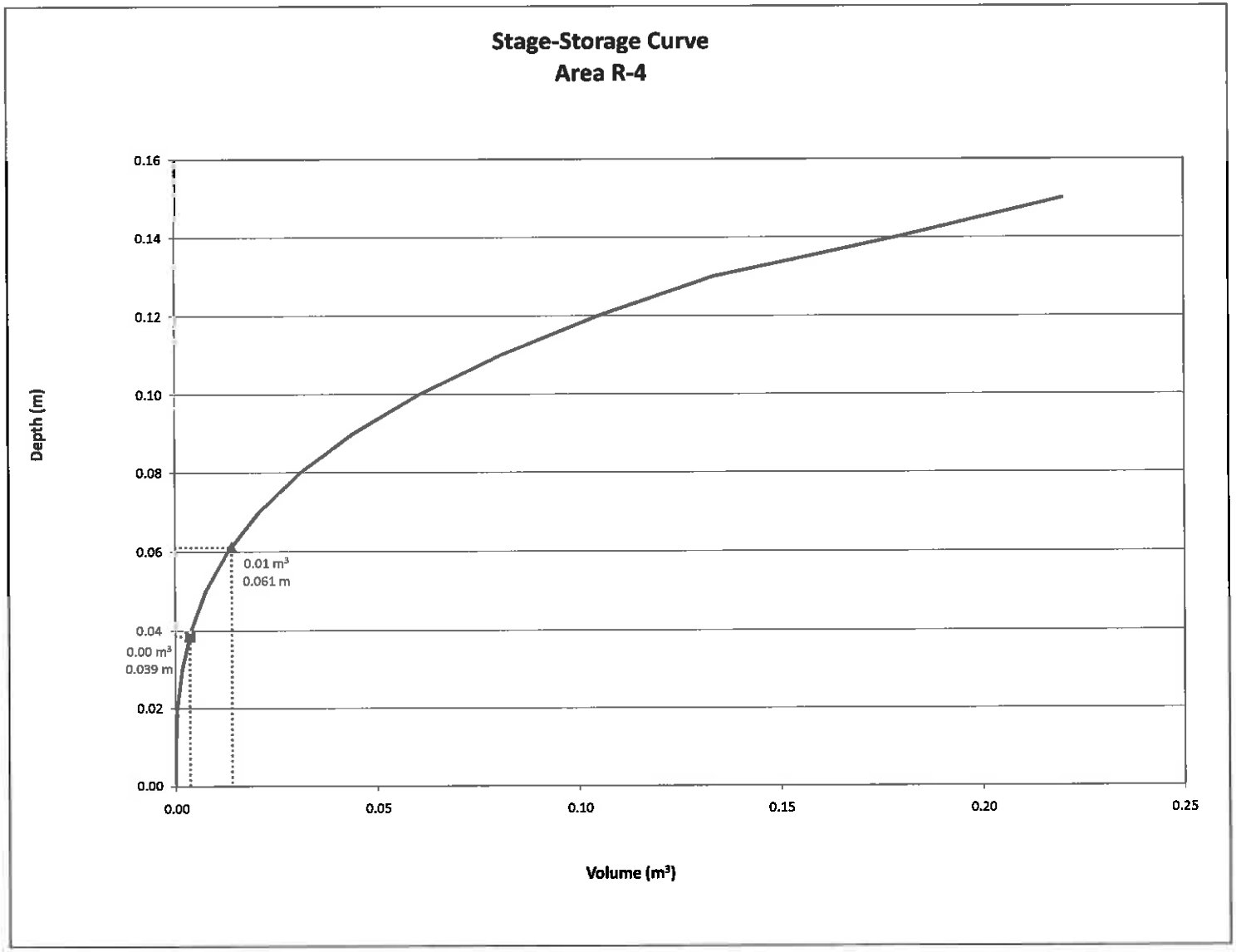
0.04	H	0.03		H =	0.039 m
0.00	0.00	0.00		Q_{allow} =	[illegible]

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

Linear Interpolation

0.07	H	0.06		H =	0.061 m
0.02	0.01	0.01		Q_{allow} =	[illegible]

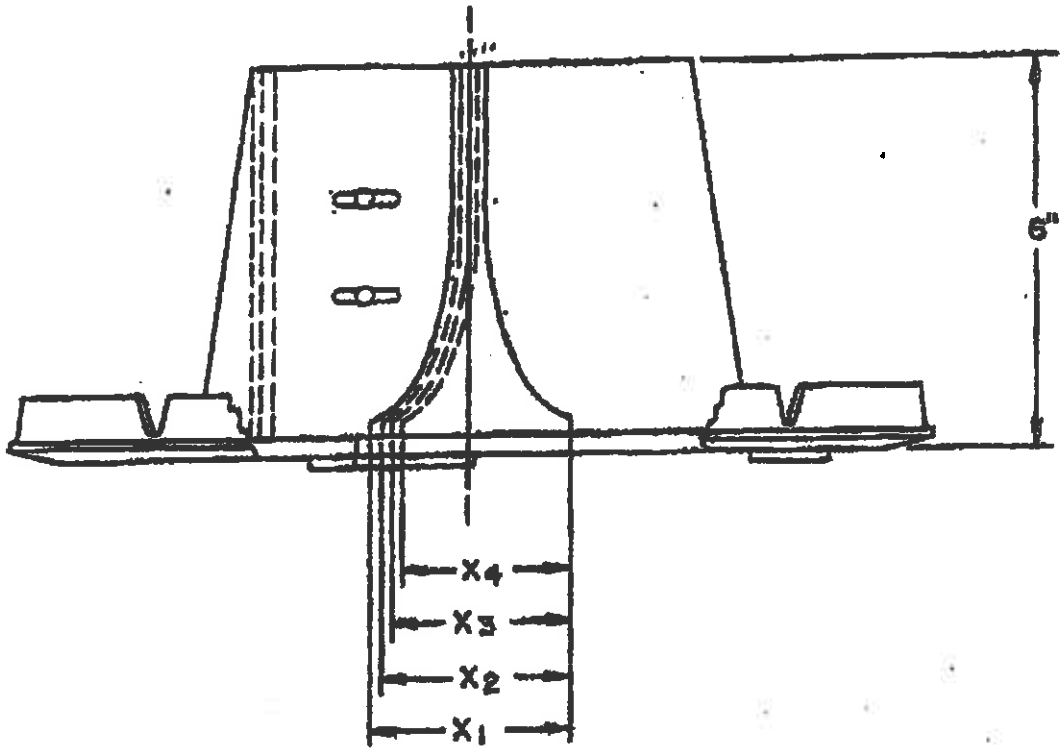
Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)


Stage-Storage Curve
Area R-4
Depth (m)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.01 m³
0.061 m
0.00 m³
0.039 m
0.00
0.05
0.10
0.15
0.20
0.25
Volume (m³)

APPENDIX C

ZURN ROOF DRAIN INFORMATION

NOTE:
ADJUSTABLE WEIR CAN BE ADJUSTED TO FLOW AT VARIOUS RATES. FOR SIZING CONTACT ZURN IND., INC.



OPENING	G.P.M. PER INCH OF HEAD		MAX FLOW G.P.M.	
X_1	10	5	60	30
X_2	7.5	3.75	45	22.5
X_3	5.0	2.5	30	15
X_4	2.5	1.25	15	7.5

ADJUSTABLE WEIR FOR SLOPED-ROOF "CONTROL-FLO" ROOF DRAIN

PRODUCT NUMBER
Z-105-10-77

ZURN a step ahead of tomorrow

ZURN INDUSTRIES, INC.
ERIE, PA. U.S.A. 16512

DRAWING NUMBER
P-13521

APPENDIX D

CORRESPONDENCE

Justin Gauthier

From: Coombe, Bruce [Bruce.Coombe@ottawa.ca]
Sent: Thursday, February 10, 2011 2:11 PM
To: j.gauthier@novatech-eng.com
Subject: RE: 101 Wurtemburg Street
Attachments: 101 Wurtemburg.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Hi Justin,

Infrastructure Services Department provide the following comments:

No objections to the proposed sanitary flows and SWM criteria using C=0.50, 5-year storm and store up to 100 year storm on site. Install full-port backwater valves on all sanitary and storm services.

The following are boundary conditions, HGL, for hydraulic analysis at Location 1 (see attached PDF for location).

Max Day + FF = 109.0 m assuming a fire flow of 44.16 L/s

Minimum Pressure during Peak Hour = 109.8 m

Max Pressure Check = 119.28 m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Thanks, Bruce

From: Justin Gauthier [mailto:j.gauthier@novatech-eng.com]
Sent: February 07, 2011 11:29 AM
To: Coombe, Bruce
Subject: RE: 101 Wurtemburg Street

Hi Bruce,

The following is in response to the information you require to proceed with our request for design criteria's for the site (STM, etc.) and obtain water boundary conditions:

- Average sanitary flow (L/sec): based on City of Ottawa = (350 L/c/d * 48 units * 1.8 c/unit) = 30,240 L/d = 0.35 L/s;
- Peak sanitary flow (L/sec): based on City of Ottawa = 4.0 * avg. flow = 4.0 * 0.35 L/s = 1.40 L/s (PF = 4.26 ∴ used 4.0 ⇒ max).

- Infiltration Allowance (L/sec): based on City of Ottawa = 0.28 L/s/effective gross ha * 0.0795 ha = 0.022 L/s
- Approximate existing sanitary flow (L/sec): based on City of Ottawa ≅ 350 L/c/d * 1 unit * 3.4 c/unit) ≅ 1,190 L/d ≅ 0.014 L/s

⇒ with PF = 4.45 ∴ used 4.0 ⇒ max, approx. existing peak sanitary flow ≅ 0.056 L/s

⇒ Existing flows could be more and definitely larger flows can be anticipated since zoning currently in place is R5C [926] F(2.5).

- Location of Service: on south side of building fronting Wurtemburg Street, the mechanical room is located to the south limit of the site;
- Type of development (plus # of Units): 13 storey condo building with 48 units (as shown on the site plan);
- Amount of Fire Flow required: mechanical informed that 44.16 L/s with fire pump (700 US gal/min) would be required;
- Average daily demand (L/sec): based on City of Ottawa = (350 L/c/d * 48 units * 1.8 c/unit) = 30,240 L/d = 0.35 L/s;
- Maximum daily demand (L/sec): based on City of Ottawa = 2.5 * avg. day = 2.5 * 0.35 L/s = 0.875 L/s
  based on MOE (less than 500 c) = 4.9 * avg. day = 4.9 * 0.35 L/s = 1.715 L/s;
- Maximum hour demand (L/sec): based on City of Ottawa = 2.2 * max. day = 2.2 * 0.875 L/s = 1.925 L/s
  based on MOE (less than 500 c) = 7.4 * avg. day = 7.4 * 0.35 L/s = 2.590 L/s.

⇒ The mechanical informed that the max peak day to size the meter would be 5.68 L/s (75 imp gal/min), there seems to be a large variance.

Don't hesitate to call if you want to discuss any issues.

Also, do you have any expected timeline for the other information requested previously and will you be able to provide the map?

Should you have any questions, or require additional information, don't hesitate to contact me.

Regards,

Justin Gauthier, B.A.Sc.
EIT

Novatech Engineering Consultants Ltd.
Suite 200, 240 Michael Cowpland Drive
Kanata, Ontario, Canada, K2M 1P6
Phone: 613.254.9643 x217
Fax: 613.254.5867
Email: j.gauthier@novatech-eng.com
Website: www.novatech-eng.com

From: Coombe, Bruce [mailto:Bruce.Coombe@ottawa.ca]
Sent: Thursday, February 03, 2011 1:43 PM
To: j.gauthier@novatech-eng.com
Subject: RE: 101 Wurtemburg Street

Hi Justin,

Please provide the existing and proposed sanitary flows.

For water boundary conditions, please provide the following information:

Location of Service
Type of development & amount of fire flow
Average daily demand: L/sec
Maximum daily demand: L/sec
Maximum hourly daily demand: L/sec

Thanks, Bruce

From: Justin Gauthier [mailto:j.gauthier@novatech-eng.com]
Sent: February 02, 2011 3:10 PM
To: Coombe, Bruce
Subject: 101 Wurtemburg Street
Importance: High

Hi Bruce,

I am working on the 101 Wurtemburg Street project which is located north east of the Clarence Street East and Wurtemburg Street intersection. Find attached PDF's showing the site location, partial survey and proposed 13 storey condo building development. If you could please inform of the design criteria's for the site (STM, etc.) as well as if you have specific instructions with regards to connection locations/constraints (e.g. 1 on each street). Also, if you could please provide the wm boundary conditions as well as the schematic showing the servicing information of the area in question (location, direction, size, etc.). Thanks in advance for your help.

Should you have any questions, or require additional information, don't hesitate to contact me.

Regards,

Justin Gauthier, B.A.Sc.
EIT

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Location 1
PATRICK ST
COLUMBIA ST
RUSSELL ST

ATTACHED DRAWINGS

7 111013-GP GENERAL PLAN OF SERVICES
8 111013-GR GRADING AND EROSION CONTROL PLAN
9 111013-STM STORMWATER MANAGEMENT PLAN