

**Nepean Street
Residential Development
96 Nepean Street
Ottawa, Ontario
Stormwater Management Report**

**NEPEAN STREET RESIDENTIAL DEVELOPMENT
96 NEPEAN STREET
OTTAWA, ONTARIO**

STORMWATER MANAGEMENT REPORT

Prepared by:

**NOVATECH ENGINEERING CONSULTANTS LTD.
240 Michael Cowpland Dr. - Suite 200
Ottawa, Ontario
K2M 1P6**

**File No.: 111153
Report Reference No.: R-2011-184
November 25, 2011**

November 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. Joshua White

Dear Sir:

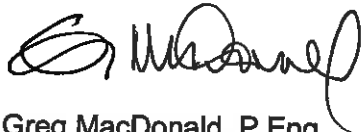
**Reference: Nepean Street Residential Development
96 Nepean Street
Stormwater Management Report
Our File No.: 111153**

Enclosed herein is the Stormwater Management Report for the proposed Nepean Street Residential Development at 96 Nepean Street, located on the south side of Nepean Street between Metcalfe Street and O'Connor Street. This report is submitted in support of the rezoning and site plan applications for the site and presents a stormwater management plan for the re-development of the property.

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

M:\2011\111153\DATA\Reports\SWM\20111018-111153-SWMREPORT.docx

TABLE OF CONTENTS

1.0 INTRODUCTION.....	1
2.0 CRITERIA.....	1
3.0 EXISTING CONDITIONS.....	2
3.1 THE SITE.....	2
3.2 ALLOWABLE RELEASE RATE.....	2
4.0 PROPOSED DEVELOPMENT STORMWATER MANAGEMENT DESIGN.....	2
4.1 DRAINAGE AREAS.....	2
4.2 UNCONTROLLED DEVELOPMENT FLOWS.....	3
4.2.1 Remaining Allowable Release Rate.....	3
4.3 CONTROLLED DEVELOPMENT FLOWS.....	4
4.4 MAJOR OVERLAND DRAINAGE.....	4
5.0 EROSION AND SEDIMENT CONTROL MEASURES.....	5
6.0 CONCLUSIONS AND RECOMMENDATIONS.....	5
7.0 CLOSURE.....	6

List of Figures

Figure 1: Key Plan
 Figure 2: Site Plan
 Figure 3: Existing Conditions

List of Appendices

Appendix A: IDF Curves, Rational Method, Release Rate
 Appendix B: SWM Calculations
 Appendix C: Zurn Roof Drain Information

List of Attached Drawings

111153-GP General Plan of Services
 111153-GR Grading and Erosion Control Plan
 111153-STM Stormwater Management Plan
 12373-11 Claridge Lts 43-46 RP2996 T F Topographical Survey

1.0 INTRODUCTION

The proposed Nepean Street Residential Development (96 Nepean Street) is located on the south side of Nepean Street, mid-block between O'Connor Street and Metcalfe Street in the City of Ottawa; as shown in Figure 1 – Key Plan. The proposed development will consist of a 27-storey high-rise building with 201 units (197 condominium units and 4 townhome units). Also, a total of approximately 161 underground parking spaces will be provided on 6 levels of underground parking. Refer to Figure 2 – Site Plan for details.

The subject site is approximately 0.12 ha in area which is currently occupied by a privately-owned surface parking lot that is open to the public. Refer to Figure 3 – Existing Conditions.

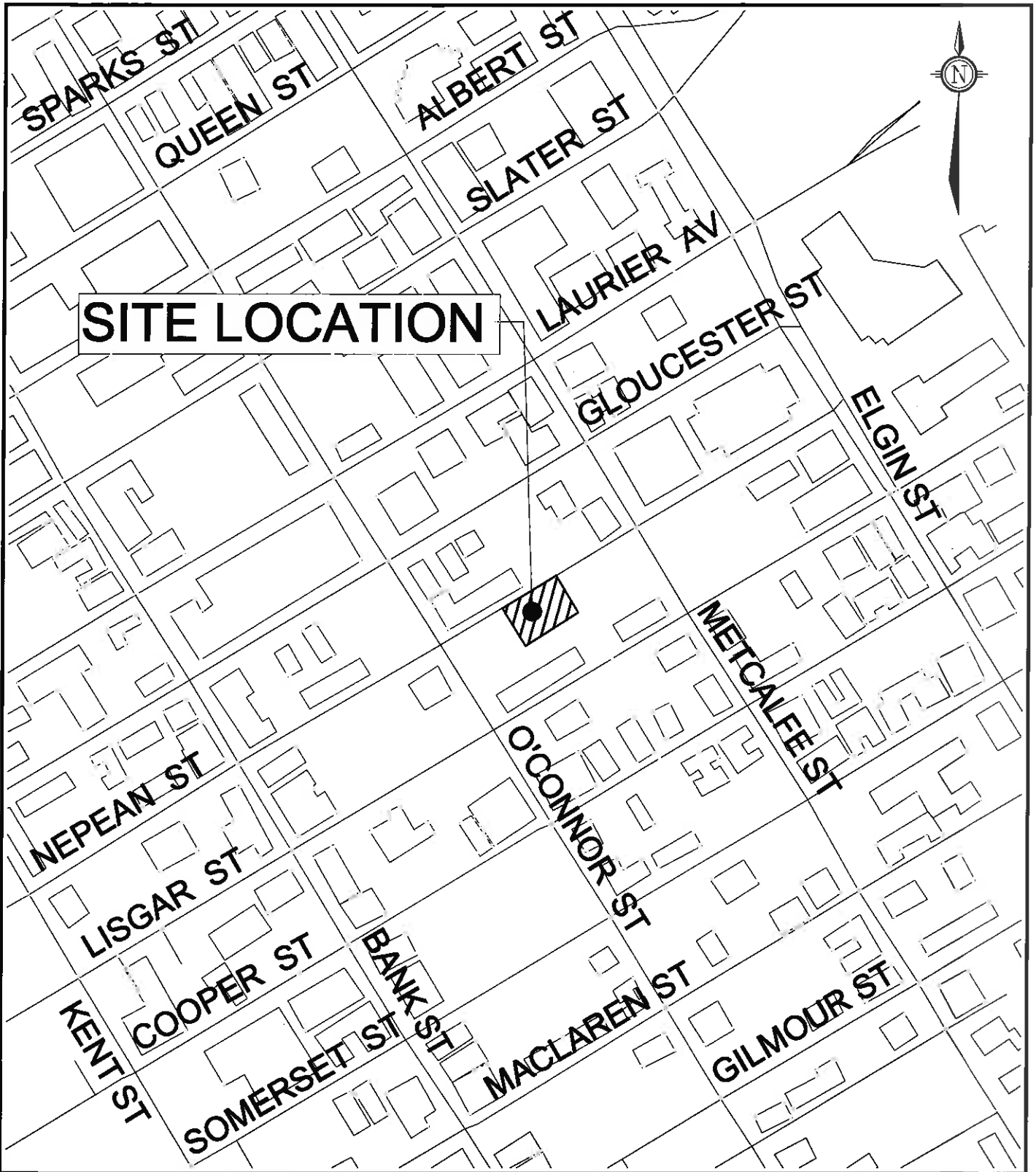
This stormwater management report will provide a solution to manage stormwater runoff from the site.

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 proposed drainage system components and identify any modifications required to existing infrastructure to meet SWM targets;
- 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 Nepean Street.



NOVATECH

**ENGINEERING
CONSULTANTS LTD.**

ENGINEERS & PLANNERS

Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

CITY OF OTTAWA

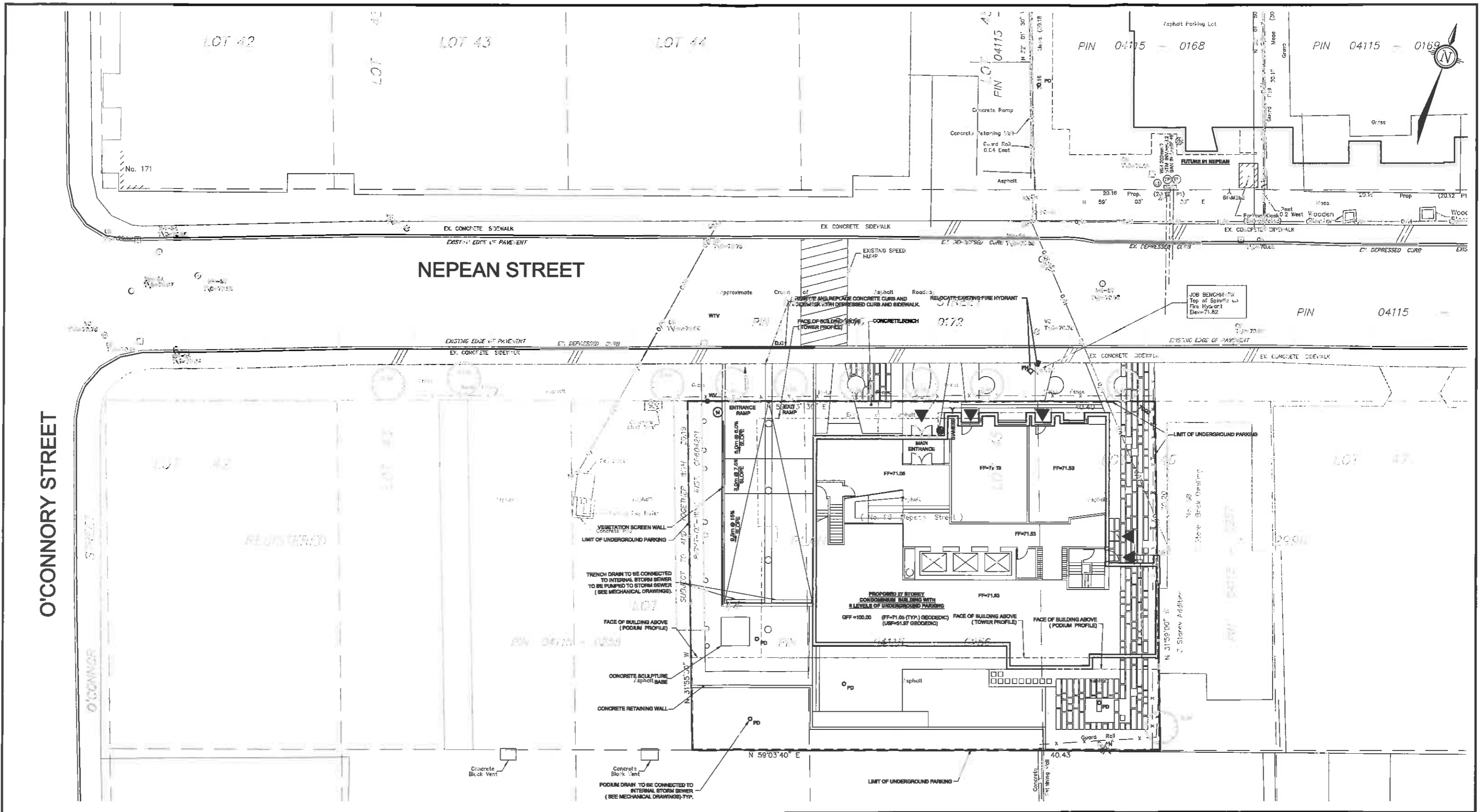
NEPEAN STREET RESIDENTIAL DEVELOPMENT
96 NEPEAN STREET

KEY PLAN



OCT. 2011

111153

FIGURE 1



LEGEND

-  SITE PLAN AREA
-  ON STREET PARKING

NTS

NOVATECH
ENGINEERING
CONSULTANTS LTD.
 ENGINEERS & PLANNERS
 Suite 200, 54th Michael Cowpland Drive
 Ottawa, Ontario, Canada
 K2M 1P6
 Telephone: (613) 254-9643
 Facsimile: (613) 254-5867
 Email: novinfo@novatech-eng.com

CITY OF OTTAWA
NEPEAN STREET RESIDENTIAL DEVELOPMENT
96 NEPEAN STREET
SITE PLAN
 OCT. 2011 111153 **FIGURE 2**



LEGEND

- SITE PLAN AREA
- ▭ ON STREET PARKING

NTS

NOVATECH
ENGINEERING
CONSULTANTS LTD.
ENGINEERS & PLANNERS
 Suite 200, 240 Michael Cowpland Drive
 Ottawa, Ontario, Canada
 K2M 1P6
 Telephone: (613) 254-9643
 Facsimile: (613) 254-5867
 Email: novainfo@novatech-eng.com

CITY OF OTTAWA
NEPEAN STREET RESIDENTIAL DEVELOPMENT
96 NEPEAN STREET
EXISTING CONDITIONS
 OCT. 2011 111153 **FIGURE 3**

3.0 EXISTING CONDITIONS

3.1 The Site

Under existing conditions, the site consists of a privately-owned surface parking lot that is open to the public, as illustrated in Figure 3. Stormwater flows from the site are currently conveyed overland to the existing storm sewer system on Nepean Street.

As part of this development, all stormwater will be controlled on site and discharged via a 200 mm dia. storm service that will connect to the existing 450 mm dia. storm sewer on Nepean Street. The proposed storm service connection to the building will be equipped with a backwater valve.

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, a time of concentration (T_c) of 20 minutes and a runoff coefficient (C) of 0.50. The allowable release rate for the proposed 0.12 ha development was calculated using the Rational Method to be 11.72 L/s as follows:

Total Drainage Area (A) = 0.12 ha	$Q_{\text{allow}} = 2.78 \text{ CIA}$
Runoff Coefficient (C_{allow}) = 0.50	$Q_{\text{allow}} = 2.78 \times 0.50 \times 70.25 \text{ mm/hr} \times 0.12 \text{ ha}$
Intensity ($I_{5\text{allow}}$) = 70.25 mm/hr	$Q_{\text{allow}} = 11.72 \text{ L/s}$

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. The site will be graded such that flows in excess of the 100-year storm event will be conveyed overland to Nepean Street.

The trench drains for the ramp to the underground parking will outlet uncontrolled to the storm sewer system.

4.1 Drainage Areas

The development will consist of a number of drainage areas which are highlighted on the Storm Drainage Area Plan (111153-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	0.032	0.44	Uncontrolled
A-02	0.004	0.61	Uncontrolled
R-01	0.008	0.95	Controlled – Roof Drain
R-02	0.007	0.95	Controlled – Roof Drain
R-03	0.008	0.95	Controlled – Roof Drain
R-04	0.012	0.95	Controlled – Roof Drain
R-05	0.019	0.95	Controlled – Roof Drain
R-06	0.007	0.95	Controlled – Roof Drain
R-07	0.014	0.95	Controlled – Roof Drain
R-08	0.009	0.95	Controlled – Roof Drain
R-09	0.001	0.95	Controlled – Roof Drain
R-10	0.001	0.95	Controlled – Roof Drain
Total =	0.12		

Drainage Areas A-02 is the surficial uncontrolled runoff at the ground elevation that will flow overland towards Nepean Street. Drainage Area A-01 is the surficial uncontrolled runoff at the ground elevation that will be connected internally to the storm system. Drainage Areas R-9 and R-10 are the surficial uncontrolled runoff at the roof elevation that will be connected internally to the storm system. Drainage Areas R-01 through R-08 are rooftop areas large enough for surface storage, therefore allowing controlled flow.

All the stormwater runoff from the controlled roof top areas R-01 to R-08, along with drainage areas A-01, R-09 and R-10 will flow overland and internally and then be directed out of the site through direct connections to the 450 mm dia. storm sewer on Nepean Street.

4.2 Uncontrolled Development Flows

The uncontrolled development flows from Areas A-01 and A-02 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	0.44	20.00	70.25	0.0316	2.72	0.52	20.00	119.95	0.0316	5.50
A-02	0.61	20.00	70.25	0.0042	0.51	0.70	20.00	119.95	0.0042	0.99
			Total =		3.23			Total =		6.49

Based on the above calculations, the 5-year uncontrolled flow is 3.23 L/s and the 100-year uncontrolled flow is 6.49 L/s. Roof control will be utilized to control the flow from the entire site.

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. The following table indicates the allowable release rate for the entire site, the uncontrolled runoff and the remaining allowable release rate for the rest of the site 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	11.72	11.72
	Uncontrolled	3.23	6.49
Remaining Allowable Flow		8.49	5.23

4.3 Controlled Development Flows

Stormwater flows from Areas R-01 through R-10 were calculated to be 15.99 L/s for the 5-year storm event and 28.75 L/s for the 100-year storm event. The both the 5-year and 100-year storm 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 4.3a. Detailed calculations are included in Appendix B.

Table 4.3 Roof Drain Flow Summary

Area No	Zurn Specification	L/s/m 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-X4-Z-105-10-77	3.73	0.10	0.36	0.12	0.46
R-02	ZCF121-1W-X4-Z-105-10-77	3.73	0.10	0.37	0.13	0.47
R-03	ZCF121-1W-X4-Z-105-10-77	3.73	0.11	0.40	0.14	0.51
R-04	ZCF121-1W-X3-Z-105-10-77	7.46	0.11	0.82	0.14	1.06
R-05	ZCF121-1W-X4-Z-105-10-77	3.73	0.12	0.44	0.15	0.56
R-06	ZCF121-1W-X4-Z-105-10-77	3.73	0.10	0.38	0.13	0.49
R-07	ZCF121-1W-X4-Z-105-10-77	3.73	0.11	0.43	0.15	0.54
R-08	ZCF121-1W-X4-Z-105-10-77	3.73	0.11	0.40	0.14	0.51
R-09	ZCF121-1W-X4-Z-105-10-77	3.73	0.07	0.28	0.10	0.38
R-10	ZCF121-1W-X4-Z-105-10-77	3.73	0.08	0.28	0.11	0.39
Total =				4.16	Total =	5.36

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 0.07 – 0.12 m for the 5-year storm event and 0.10 – 0.15 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 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 which 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 Nepean Street.

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:

- Stormwater discharge from the site will be controlled to a marginally greater flow than the allowable 5-year pre-development storm event rate of 11.72 L/s, more specifically to 11.86 L/s by utilizing rooftop storage for both the 5-year and 100-year post-development storm events. This would have a 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 Nepean Street.
- 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

Prepared by:

David Smith, B.Eng.

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 ($C_{perv}=0.20$)

A_{imp} is the impervious area in hectares

C_{imp} is the impervious area runoff coefficient ($C_{imp}=0.90$)

A_{tot} is the catchment area ($A_{perv} + A_{imp}$) 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 proposed 0.12 ha re-developed site, using a runoff coefficient (C) of 0.50 and a time of concentration (T_c) of 20 minutes, as specified by the City of Ottawa.

Drainage Area (A) = 0.12 ha

Runoff Coefficient (C) = 0.50

Intensity (I5) = 70.25 mm/hr

$Q_5 = 2.78 CIA$

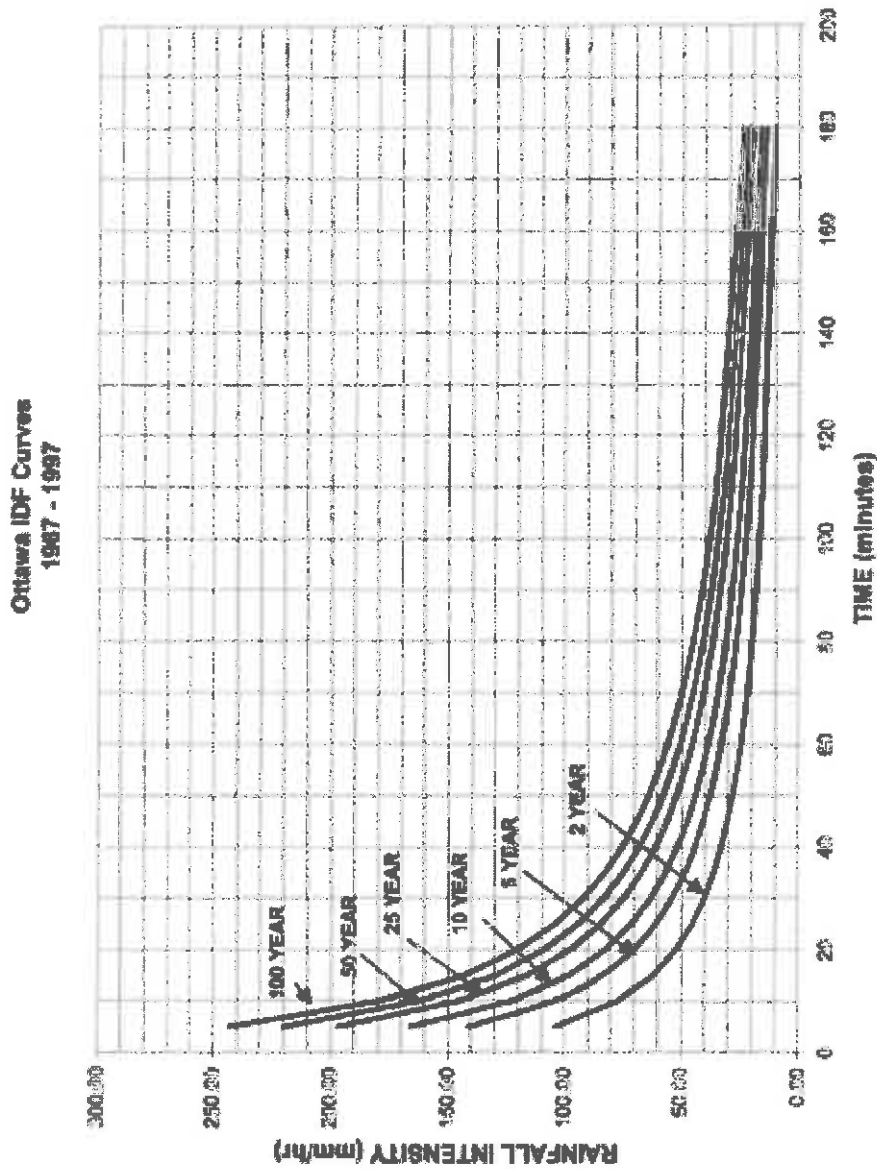
$Q_5 = 2.78 \times 0.50 \times 70.25 \text{ mm/hr} \times 0.12 \text{ ha}$

$Q_5 = 11.72 \text{ L/s}$

Ottawa Sewer Design Guidelines

APPENDIX 5-A

OTTAWA INTENSITY DURATION FREQUENCY (IDF) CURVE



* IDF CURVE FROM OTTAWA SEWER DESIGN GUIDELINES - NOV 2004

APPENDIX B
SWM CALCULATIONS

NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



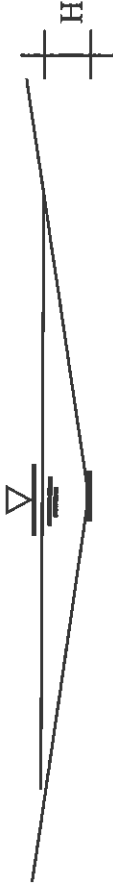
Runoff Coefficients

Drainage Area	Total Area (m ²)	Hard Surface Area		Gravel Area		Grass Area		5-Year Runoff Coefficient	100-Year Runoff Coefficient
		Area (m ²)	C	Area (m ²)	C	Area (m ²)	C		
R-01	77.7	77.7	0.95	0.0	0.70	0.0	0.20	0.95	1.00
R-02	71.8	71.8	0.95	0.0	0.70	0.0	0.20	0.95	1.00
R-03	79.2	79.2	0.95	0.0	0.70	0.0	0.20	0.95	1.00
R-04	121.3	121.3	0.95	0.0	0.70	0.0	0.20	0.95	1.00
R-05	192.4	192.4	0.95	0.0	0.70	0.0	0.20	0.95	1.00
R-06	65.7	65.7	0.95	0.0	0.70	0.0	0.20	0.95	1.00
R-07	137.9	137.9	0.95	0.0	0.70	0.0	0.20	0.95	1.00
R-08	87.6	87.6	0.95	0.0	0.70	0.0	0.20	0.95	1.00
R-09	13.8	13.8	0.95	0.0	0.70	0.0	0.20	0.95	1.00
R-10	14.6	14.6	0.95	0.0	0.70	0.0	0.20	0.95	1.00
A-01	315.5	74.9	0.90	47.8	0.70	192.8	0.20	0.44	0.52
A-02	42.4	21.803	0.90	4.4	0.70	16.1	0.20	0.61	0.70
Total	1220.03	958.8	0.94	52.3	0.70	209.0	0.20	0.81	0.87

NEPEAN STREET RESIDENTIAL DEVELOPMENT (96 NEPEAN STREET)

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) = 0.096 m for 5-year event

Head (H) = 0.122 m for 100-year event

$$Q_{5 \text{ all}} = 3.729 \text{ L/s/m/notch} \times H \times N$$

$$Q_{5 \text{ all}} = 3.729 \text{ L/s/m/notch} \times 0.096 \text{ m} \times 1 \text{ notch}$$

$$Q_{5 \text{ all}} = 0.36 \text{ L/s}$$

$$Q_{100 \text{ all}} = 3.729 \text{ L/s/m/notch} \times H \times N$$

$$Q_{100 \text{ all}} = 3.729 \text{ L/s/m/notch} \times 0.122 \text{ m} \times 1 \text{ notch}$$

$$Q_{100 \text{ all}} = 0.46 \text{ L/s}$$

No. of Notches



NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



Controlled Flow

Area No	Area (sq)	C _{v,r}	Time (min)	Intensity mm/hr	Uncontrolled flow L/s	Control System	Zum 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	0.0078	0.95	20.00	70.25	1.44	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.096	0.38	5.112	1.34
R-2	0.0072	0.95	20.00	70.25	1.33	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.098	0.37	4.213	1.18
R-3	0.0079	0.95	20.00	70.25	1.47	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.106	0.40	3.666	1.31
R-4	0.0121	0.95	20.00	70.25	2.25	Zum Roof	ZCF121-1W-X3-Z-105-10-	7.46	1	0.110	0.82	4.331	1.72
R-5	0.0192	0.95	20.00	70.25	3.57	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.119	0.44	8.941	4.44
R-6	0.0066	0.95	20.00	70.25	1.22	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.103	0.38	3.030	1.01
R-7	0.0138	0.95	20.00	70.25	1.63	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.114	0.43	6.391	2.83
R-8	0.0088	0.95	20.00	70.25	1.56	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.108	0.40	4.088	1.53
R-9	0.0014	0.95	20.00	70.25	0.26	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.074	0.28	0.592	0.07
R-10	0.0015	0.95	20.00	70.25	0.27	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.076	0.28	0.592	0.07
Roof Storage	0.0862	0.95	20.00	70.25	15.99	-	-	-	-	-	-	-	-
A-01	0.0316	0.44	20.00	70.25	2.72	no control	-	-	-	-	-	-	-
A-02	0.0042	0.61	20.00	70.25	0.51	no control	-	-	-	-	-	-	-
CB Storage	-	-	-	-	-	-	-	-	-	-	-	-	-
Total:	0.1220	-	-	-	19.23	-	-	-	-	-	4.16	41.02	15.52

NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



Area ID	Area (sqm)	C no.	Time (hrs)	Intensity (mm/hr)	Uncontrolled runoff (L/s)	Control System	Zum Model Number	Release Rate (L/s/m of head)	Notches	Depth (mm)	Controlled Flow (L/s)	Storage available (sqm)	Storage used (sqm)
R-1	0.0078	1.00	20.00	119.95	2.59	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.122	0.46	5.112	2.79
R-2	0.0072	1.00	20.00	119.95	2.39	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.125	0.47	4.213	2.47
R-3	0.0079	1.00	20.00	119.95	2.64	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.136	0.51	3.666	2.75
R-4	0.0121	1.00	20.00	119.95	4.05	Zum Roof	ZCF121-1W-X3-Z-105-10-	7.46	1	0.142	1.06	4.331	3.67
R-5	0.0182	1.00	20.00	119.95	6.41	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.150	0.66	8.941	8.86
R-6	0.0066	1.00	20.00	119.95	2.19	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.133	0.49	3.090	2.14
R-7	0.0138	1.00	20.00	119.95	4.60	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.145	0.54	6.391	5.77
R-8	0.0088	1.00	20.00	119.95	2.92	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.138	0.51	4.098	3.17
R-9	0.0014	1.00	20.00	119.95	0.46	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.102	0.38	0.592	0.18
R-10	0.0015	1.00	20.00	119.95	0.49	Zum Roof	ZCF121-1W-X4-Z-105-10-	3.73	1	0.105	0.39	0.592	0.20
Roof Storage	0.0862	1.00	20.00	119.95	28.75	-	-	-	-	-	5.36	41.02	32.01
A-01	0.0316	0.52	20.00	119.95	5.50	no control	-	-	-	-	-	-	-
A-02	0.0042	0.70	20.00	119.95	0.99	no control	-	-	-	-	-	-	-
CE Storage	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	0.1220	-	-	-	35.24	-	-	-	-	-	5.36	41.02	32.01

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

NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



Allowable release rate

Area	0.12 ha
C	0.5
to	20 min
ie	70.25
allowable =	$2.78 \times C \times I \times A$
	11.72 L/s

Summary table

Area ID	Area (ha)	5 year event LA	100 year event LA	Storage available (m ³)	5 year event (m ³)	100 year event (m ³)
Controlled						
Roof	0.0862	4.18	5.36	41.02	15.52	32.01
Uncontrolled						
A-01	0.0316	2.72	5.50	-	-	-
A-02	0.0042	0.51	0.99	-	-	-
Total:	0.12	7.39	11.86	41.02	15.52	32.01

NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



REQUIRED STORAGE - 5-YEAR EVENT						
AREA		R-1	BUILDING ROOF			
OTTAWA IDF CURVE						
Area =	0.008	ha	Qallow =	0.36		
C =	0.95		Vol(max) =	1.34		
			Notes =	1		
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	141.18	2.90	2.54	0.76		
10	104.19	2.14	1.78	1.07		
15	83.56	1.72	1.36	1.22		
20	70.25	1.44	1.08	1.30		
25	60.90	1.25	0.89	1.33		
30	53.93	1.11	0.75	1.34		
35	48.52	1.00	0.64	1.34		
40	44.18	0.91	0.55	1.31		
45	40.63	0.83	0.47	1.28		
50	37.65	0.77	0.41	1.24		
55	35.12	0.72	0.36	1.19		
60	32.94	0.68	0.32	1.14		
65	31.04	0.64	0.28	1.08		
70	29.37	0.60	0.24	1.02		
75	27.89	0.57	0.21	0.96		
80	26.56	0.55	0.19	0.89		
85	25.37	0.52	0.16	0.82		
90	24.29	0.50	0.14	0.75		

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

Penning Depth (5-Year Storm)			
Area (m ²)	V (m ³)	H (m)	
0	0.00	0.00	
0	0.00	0.01	
2	0.01	0.02	
4	0.04	0.03	
7	0.10	0.04	
11	0.19	0.05	
16	0.33	0.06	
22	0.52	0.07	
29	0.78	0.08	
37	1.10	0.09	
45	1.51	0.10	
55	2.02	0.11	
65	2.62	0.12	
77	3.33	0.13	
89	4.16	0.14	
102	5.11	0.15	

Lateral Head (m)			
H	H	H	H
0.10	1.34	1.10	0.096 m
1.51	1.34	1.10	0.36 L/s

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

REQUIRED STORAGE - 10-YEAR EVENT						
AREA		R-1	BUILDING ROOF			
OTTAWA IDF CURVE						
Area =	0.008	ha	Qallow =	0.46		
C =	1.00		Vol(max) =	2.79		
			Notes =	1		
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	242.70	5.24	4.78	1.44		
10	178.56	3.86	3.40	2.04		
15	142.89	3.09	2.63	2.36		
20	119.95	2.59	2.13	2.56		
25	103.85	2.24	1.78	2.68		
30	91.87	1.98	1.52	2.74		
35	82.58	1.78	1.32	2.78		
40	75.15	1.62	1.16	2.79		
45	69.05	1.49	1.03	2.79		
50	63.95	1.38	0.92	2.77		
55	59.62	1.29	0.83	2.73		
60	55.89	1.21	0.75	2.69		
65	52.65	1.14	0.68	2.64		
70	49.79	1.08	0.62	2.59		
75	47.28	1.02	0.56	2.52		
80	44.99	0.97	0.51	2.46		
85	42.95	0.93	0.47	2.39		
90	41.11	0.89	0.43	2.31		

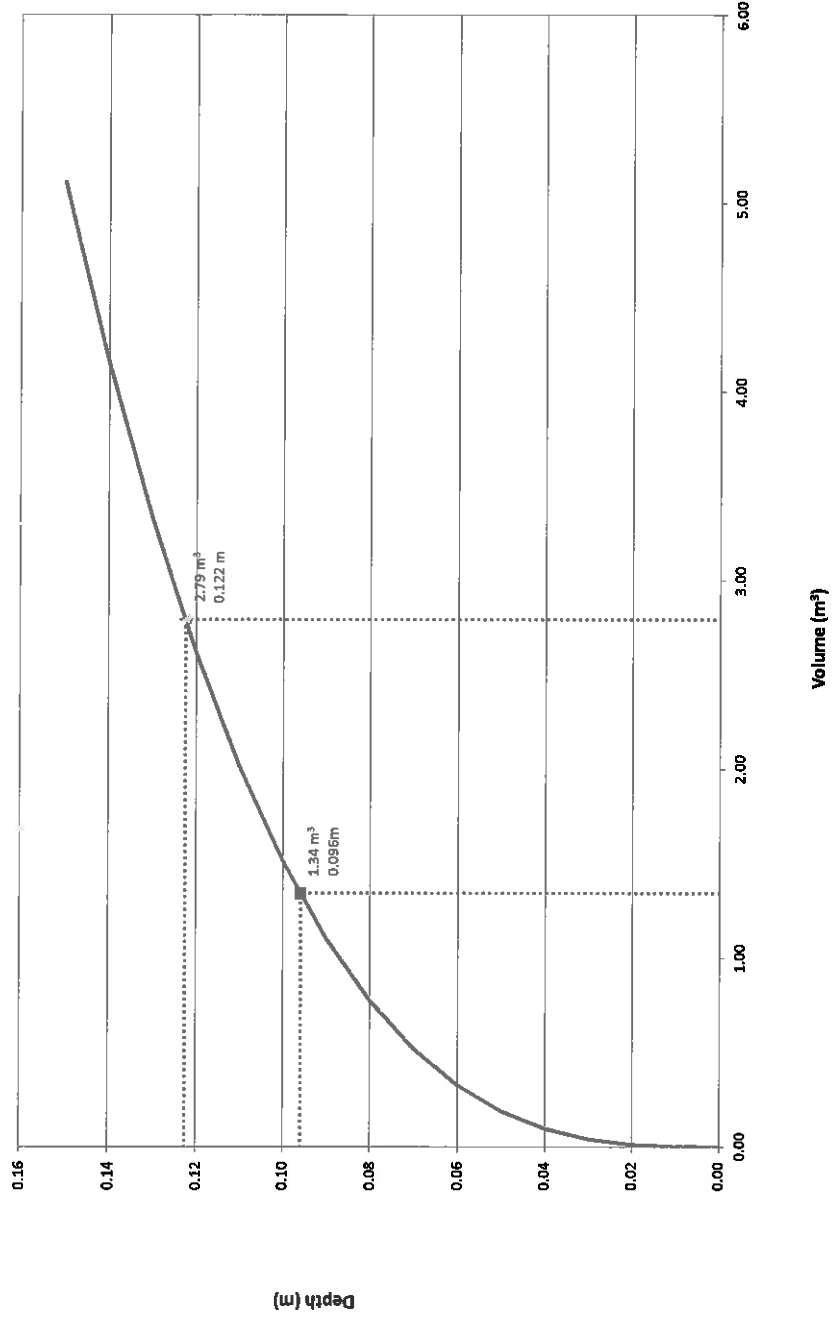
Notes: Vol = Qnet x time
Qnet = Q - Qallow

Penning Depth (5-Year Storm)			
Area (m ²)	V (m ³)	H (m)	
0	0.00	0.00	
0	0.00	0.01	
2	0.01	0.02	
4	0.04	0.03	
7	0.10	0.04	
11	0.19	0.05	
16	0.33	0.06	
22	0.52	0.07	
29	0.78	0.08	
37	1.10	0.09	
45	1.51	0.10	
55	2.02	0.11	
65	2.62	0.12	
77	3.33	0.13	
89	4.16	0.14	
102	5.11	0.15	

Lateral Head (m)			
H	H	H	H
0.13	2.79	2.62	0.127 m
3.33	2.79	2.62	0.41 L/s

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

Stage-Storage Curve
Area R-1



NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



REQUIRED STORAGE - 5-YEAR EVENT						
AREA		R-2 BUILDING ROOF		OTTAWA IDF CURVE		
Area =	0.007	ha		Qallow =	0.37	
C =	0.95			Vol(max) =	1.18	
				Notes =	1	
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	141.18	2.68	2.31	0.69		
10	104.19	1.97	1.61	0.97		
15	83.56	1.58	1.22	1.10		
20	70.25	1.33	0.97	1.16		
25	60.90	1.15	0.79	1.18		
30	53.93	1.02	0.66	1.18		
35	48.52	0.92	0.55	1.16		
40	44.18	0.84	0.47	1.13		
45	40.63	0.77	0.40	1.09		
50	37.65	0.71	0.35	1.05		
55	35.12	0.67	0.30	0.99		
60	32.94	0.62	0.26	0.93		
65	31.04	0.59	0.22	0.87		
70	29.37	0.56	0.19	0.80		
75	27.89	0.53	0.16	0.74		
80	26.56	0.50	0.14	0.66		
85	25.37	0.48	0.12	0.59		
90	24.29	0.46	0.10	0.51		

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

Fording Depth (5-Year Storm)			
Area (m ²)	V (m ³)	H (m)	
0	0.00	0.00	
0	0.00	0.01	
1	0.01	0.02	
3	0.03	0.03	
6	0.08	0.04	
9	0.16	0.05	
13	0.27	0.06	
18	0.43	0.07	
24	0.64	0.08	
30	0.91	0.09	
37	1.25	0.10	
45	1.66	0.11	
54	2.16	0.12	
63	2.74	0.13	
73	3.43	0.14	
84	4.21	0.15	

Linear Interpolation		
H	H	H =
0.10	0.09	0.09 m
1.25	0.81	Q _{allow} = 0.37 L/s

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

REQUIRED STORAGE - 100-YEAR EVENT						
AREA		R-2 BUILDING ROOF		OTTAWA IDF CURVE		
Area =	0.007	ha		Qallow =	0.47	
C =	1.00			Vol(max) =	2.47	
				Notes =	1	
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	242.70	4.84	4.37	1.31		
10	178.96	3.56	3.09	1.86		
15	142.89	2.85	2.38	2.14		
20	119.95	2.39	1.92	2.31		
25	103.85	2.07	1.60	2.40		
30	91.87	1.83	1.36	2.45		
35	82.58	1.65	1.18	2.47		
40	75.15	1.50	1.03	2.45		
45	69.05	1.38	0.91	2.42		
50	63.95	1.28	0.81	2.37		
55	59.62	1.19	0.72	2.32		
60	55.89	1.11	0.64	2.26		
65	52.65	1.05	0.58	2.20		
70	49.79	0.99	0.52	2.13		
75	47.26	0.94	0.47	2.05		
80	44.99	0.90	0.43	1.97		
85	42.95	0.86	0.39	1.89		
90	41.11	0.82	0.35			

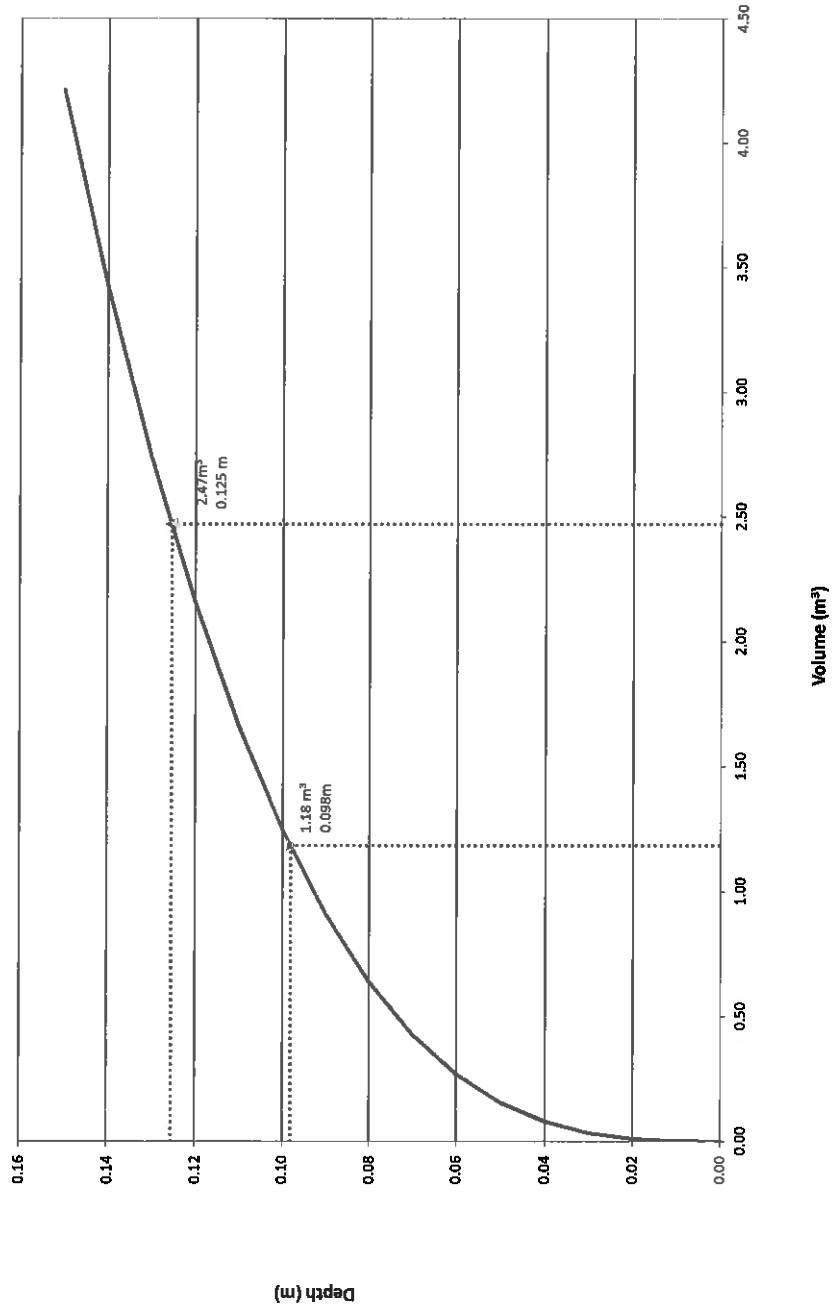
Notes: Vol = Qnet x time
Qnet = Q - Qallow

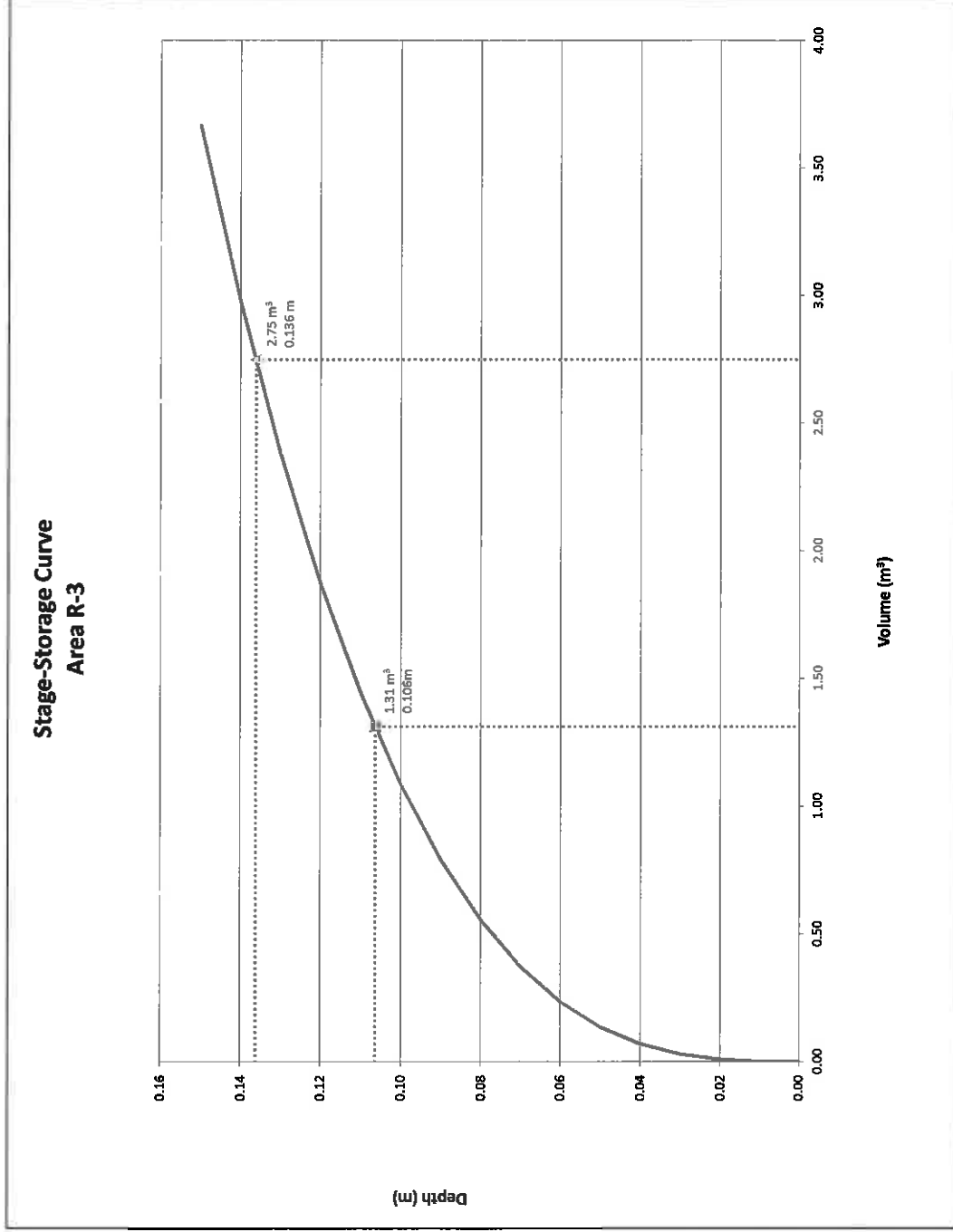
Fording Depth (100-Year Storm)			
Area (m ²)	V (m ³)	H (m)	
0	0.00	0.00	
0	0.00	0.01	
1	0.01	0.02	
3	0.03	0.03	
6	0.08	0.04	
9	0.16	0.05	
13	0.27	0.06	
18	0.43	0.07	
24	0.64	0.08	
30	0.91	0.09	
37	1.25	0.10	
45	1.66	0.11	
54	2.16	0.12	
63	2.74	0.13	
73	3.43	0.14	
84	4.21	0.15	

Linear Interpolation		
H	H	H =
0.13	0.12	0.125 m
2.74	2.16	Q _{allow} = 0.47 L/s

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

Stage-Storage Curve
Area R-2





NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



REQUIRED STORAGE - 5-YEAR EVENT						
AREA R-4 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.012	ha	Qallow =	0.02	Vol(max) =	1.72
C =	0.95		Matches =			
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	141.18	4.82	3.70	1.11		
10	104.19	3.34	2.82	1.51		
15	83.56	2.68	1.86	1.67		
20	70.25	2.25	1.43	1.72		
25	60.90	1.95	1.13	1.70		
30	53.93	1.73	0.91	1.63		
35	48.52	1.55	0.73	1.54		
40	44.18	1.42	0.60	1.43		
45	40.63	1.30	0.48	1.30		
50	37.65	1.21	0.39	1.16		
55	35.12	1.13	0.31	1.01		
60	32.94	1.06	0.24	0.85		
65	31.04	0.99	0.17	0.68		
70	29.37	0.94	0.12	0.51		
75	27.89	0.89	0.07	0.33		
80	26.56	0.85	0.03	0.15		
85	25.37	0.81	-0.01	-0.04		
90	24.29	0.78	-0.04	-0.23		

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	
2	0.01	0.02	
3	0.03	0.03	
6	0.08	0.04	
10	0.16	0.05	
14	0.28	0.06	
19	0.44	0.07	
25	0.66	0.08	
31	0.94	0.09	
39	1.28	0.10	
47	1.71	0.11	
55	2.22	0.12	
65	2.82	0.13	
75	3.52	0.14	
87	4.33	0.15	

Ponding Depth (5-Year Storm)			
Area m ²	V m ³	H m	
0	0.00	0.00	
1	0.00	0.01	
2	0.01	0.02	
3	0.03	0.03	
6	0.08	0.04	
10	0.16	0.05	
14	0.28	0.06	
19	0.44	0.07	
25	0.66	0.08	
31	0.94	0.09	
39	1.28	0.10	
47	1.71	0.11	
55	2.22	0.12	
65	2.82	0.13	
75	3.52	0.14	
87	4.33	0.15	

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

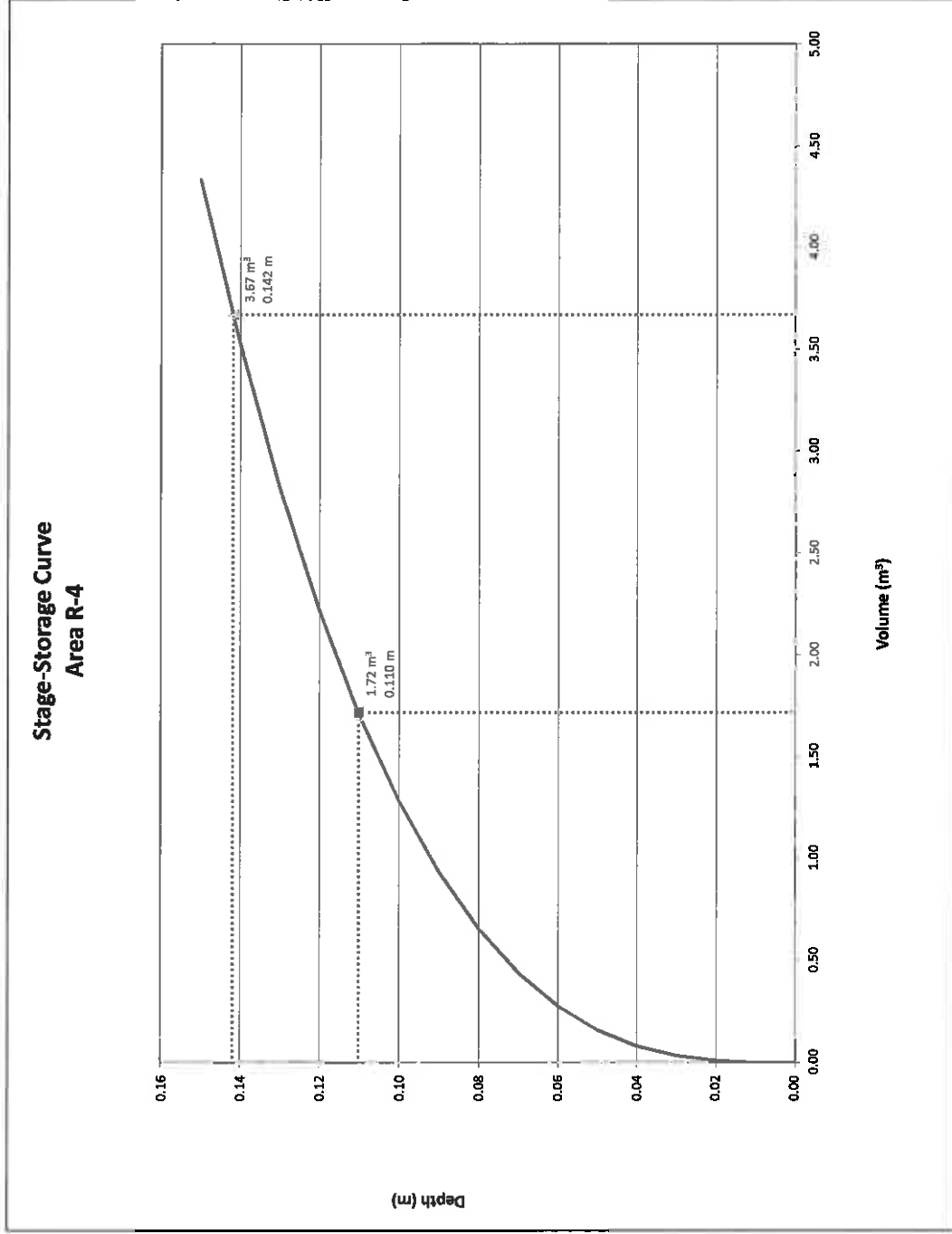
REQUIRED STORAGE - 100-YEAR EVENT						
AREA R-4 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.0121	ha	Qallow =	1.08	Vol(max) =	3.67
C =	1.00		Matches =			
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	242.70	8.19	7.13	2.14		
10	178.56	6.02	4.96	2.98		
15	142.89	4.82	3.76	3.38		
20	119.95	4.05	2.99	3.58		
25	103.85	3.50	2.44	3.66		
30	91.87	3.10	2.04	3.67		
35	82.58	2.79	1.73	3.62		
40	75.15	2.53	1.47	3.54		
45	69.05	2.33	1.27	3.43		
50	63.95	2.16	1.10	3.29		
55	59.62	2.01	0.95	3.14		
60	55.89	1.89	0.83	2.97		
65	52.65	1.78	0.72	2.79		
70	49.79	1.68	0.62	2.60		
75	47.26	1.59	0.53	2.40		
80	44.99	1.52	0.46	2.20		
85	42.95	1.45	0.39	1.98		
90	41.11	1.39	0.33	1.76		

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	
2	0.01	0.02	
3	0.03	0.03	
6	0.08	0.04	
10	0.16	0.05	
14	0.28	0.06	
19	0.44	0.07	
25	0.66	0.08	
31	0.94	0.09	
39	1.28	0.10	
47	1.71	0.11	
55	2.22	0.12	
65	2.82	0.13	
75	3.52	0.14	
87	4.33	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	
2	0.01	0.02	
3	0.03	0.03	
6	0.08	0.04	
10	0.16	0.05	
14	0.28	0.06	
19	0.44	0.07	
25	0.66	0.08	
31	0.94	0.09	
39	1.28	0.10	
47	1.71	0.11	
55	2.22	0.12	
65	2.82	0.13	
75	3.52	0.14	
87	4.33	0.15	

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



NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



REQUIRED STORAGE - 5-YEAR EVENT						
AREA R-5 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.0192	ha	Qallow =	0.44	Vol(max) =	4.44
C =	0.95		Notes =	1		
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)	Q (L/s)	Vol (m ³)
5	141.18	7.17	6.73	2.02	6.73	2.02
10	104.19	5.28	4.85	2.91	4.85	2.91
15	83.56	4.25	3.81	3.42	3.81	3.42
20	70.25	3.57	3.13	3.75	3.13	3.75
25	60.90	3.09	2.65	3.98	2.65	3.98
30	53.93	2.74	2.30	4.14	2.30	4.14
35	48.52	2.46	2.02	4.25	2.02	4.25
40	44.18	2.24	1.80	4.33	1.80	4.33
45	40.63	2.06	1.62	4.39	1.62	4.39
50	37.65	1.91	1.47	4.42	1.47	4.42
55	35.12	1.78	1.34	4.44	1.34	4.44
60	32.94	1.67	1.23	4.44	1.23	4.44
65	31.04	1.58	1.14	4.44	1.14	4.44
70	29.37	1.49	1.05	4.42	1.05	4.42
75	27.89	1.42	0.98	4.40	0.98	4.40
80	26.56	1.35	0.91	4.37	0.91	4.37
85	25.37	1.29	0.85	4.33	0.85	4.33
90	24.29	1.23	0.79	4.29	0.79	4.29

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

Penetration 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	
7	0.07	0.03	
13	0.17	0.04	
20	0.33	0.05	
29	0.57	0.06	
39	0.91	0.07	
51	1.36	0.08	
64	1.93	0.09	
79	2.65	0.10	
96	3.53	0.11	
114	4.58	0.12	
134	5.82	0.13	
156	7.27	0.14	
179	8.94	0.15	

Penetration 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	
7	0.07	0.03	
13	0.17	0.04	
20	0.33	0.05	
29	0.57	0.06	
39	0.91	0.07	
51	1.36	0.08	
64	1.93	0.09	
79	2.65	0.10	
96	3.53	0.11	
114	4.58	0.12	
134	5.82	0.13	
156	7.27	0.14	
179	8.94	0.15	

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-5 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.0192	ha	Qallow =	0.58	Vol(max) =	8.86
C =	1.00		Notes =	1		
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)	Q (L/s)	Vol (m ³)
5	242.70	12.95	12.42	3.73	12.42	3.73
10	178.56	9.55	8.99	5.39	8.99	5.39
15	142.89	7.64	7.08	6.37	7.08	6.37
20	119.95	6.41	5.85	7.03	5.85	7.03
25	103.85	5.55	4.99	7.49	4.99	7.49
30	91.87	4.91	4.35	7.84	4.35	7.84
35	82.58	4.42	3.86	8.10	3.86	8.10
40	75.15	4.02	3.46	8.30	3.46	8.30
45	69.05	3.69	3.13	8.46	3.13	8.46
50	63.95	3.42	2.86	8.58	2.86	8.58
55	59.62	3.19	2.63	8.67	2.63	8.67
60	55.89	2.99	2.43	8.75	2.43	8.75
65	52.65	2.82	2.26	8.80	2.26	8.80
70	49.79	2.66	2.10	8.83	2.10	8.83
75	47.26	2.53	1.97	8.85	1.97	8.85
80	44.99	2.41	1.85	8.86	1.85	8.86
85	42.95	2.30	1.74	8.86	1.74	8.86
90	41.11	2.20	1.64	8.85	1.64	8.85

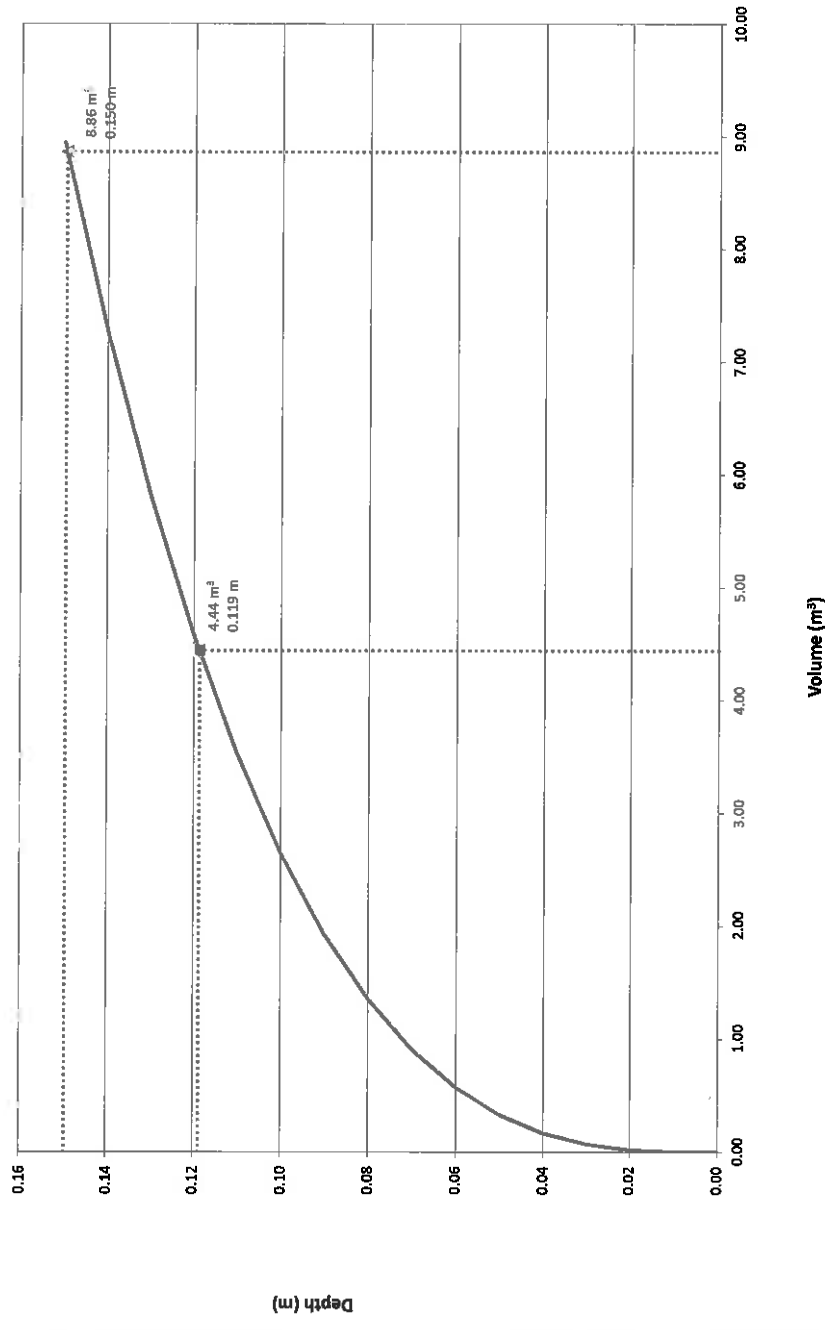
Notes: Vol = Qnet x time
Qnet = Q - Qallow

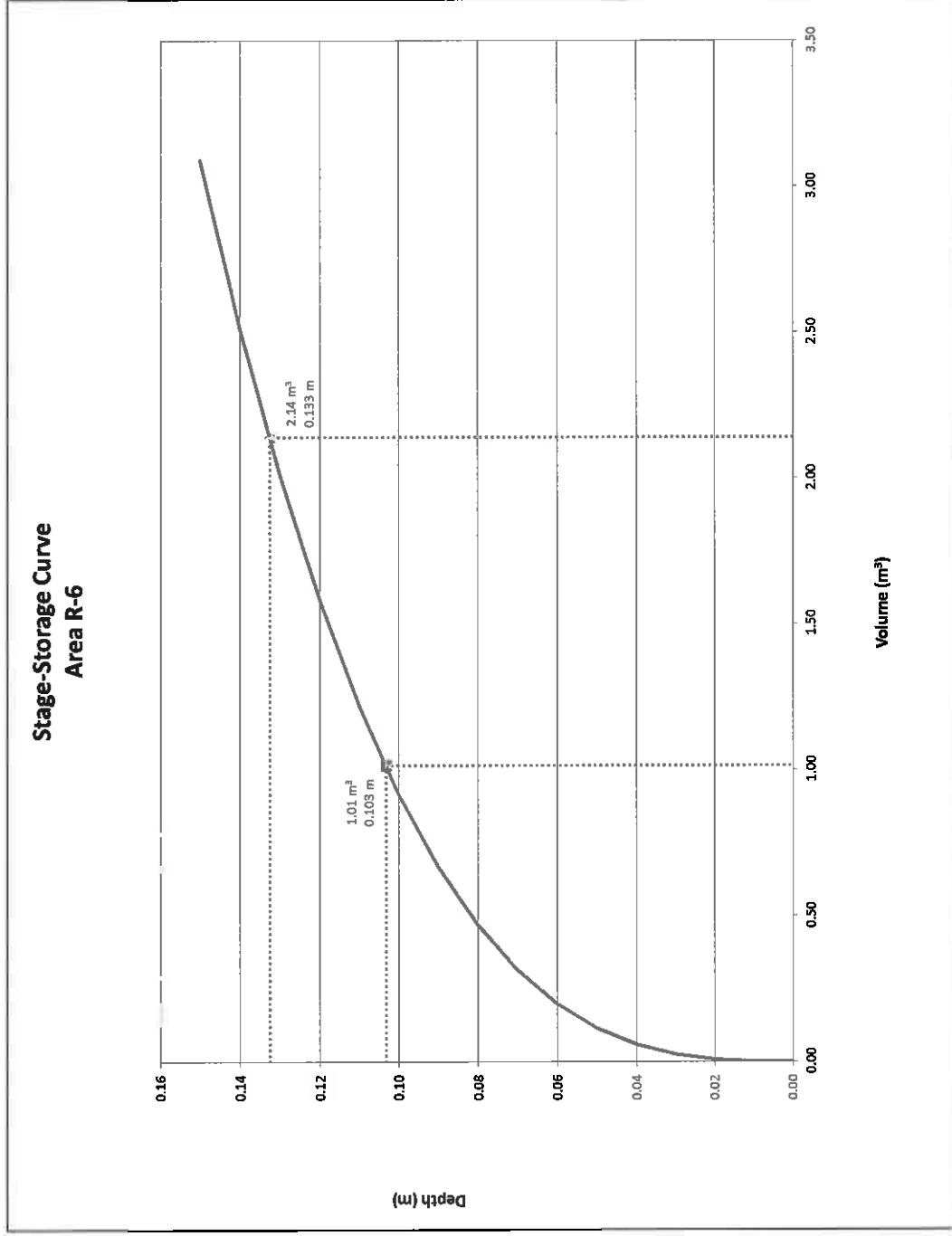
Penetration Depth (100-Year Storm)			
Area m ²	V m ³	H m	
0	0.00	0.00	
1	0.00	0.01	
3	0.02	0.02	
7	0.07	0.03	
13	0.17	0.04	
20	0.33	0.05	
29	0.57	0.06	
39	0.91	0.07	
51	1.36	0.08	
64	1.93	0.09	
79	2.65	0.10	
96	3.53	0.11	
114	4.58	0.12	
134	5.82	0.13	
156	7.27	0.14	
179	8.94	0.15	

Penetration 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	
7	0.07	0.03	
13	0.17	0.04	
20	0.33	0.05	
29	0.57	0.06	
39	0.91	0.07	
51	1.36	0.08	
64	1.93	0.09	
79	2.65	0.10	
96	3.53	0.11	
114	4.58	0.12	
134	5.82	0.13	
156	7.27	0.14	
179	8.94	0.15	

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

Stage-Storage Curve
Area R-5





NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



REQUIRED STORAGE - 3-YEAR EVENT						
AREA R-7 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.0138	ha	Qallow =	0.43		
C =	0.95		Vol(max) =	2.83		
			Notes =	1		
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	141.18	5.14	4.71	1.41		
10	104.19	3.79	3.36	2.02		
15	83.56	3.04	2.61	2.35		
20	70.25	2.56	2.13	2.55		
25	60.90	2.22	1.79	2.68		
30	53.93	1.96	1.53	2.76		
35	48.52	1.77	1.34	2.81		
40	44.18	1.61	1.18	2.83		
45	40.63	1.48	1.05	2.83		
50	37.65	1.37	0.94	2.82		
55	35.12	1.28	0.85	2.80		
60	32.94	1.20	0.77	2.77		
65	31.04	1.13	0.70	2.73		
70	29.37	1.07	0.64	2.69		
75	27.89	1.02	0.59	2.64		
80	26.56	0.97	0.54	2.58		
85	25.37	0.92	0.49	2.52		
90	24.29	0.88	0.45	2.45		

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

Ponding depth (3-Year Storm)			
Area m ²	V m ³	H m	H ft
0	0.00	0.00	0.00
1	0.00	0.01	0.01
2	0.02	0.02	0.02
5	0.05	0.03	0.03
9	0.12	0.04	0.04
14	0.24	0.05	0.05
20	0.41	0.06	0.06
28	0.65	0.07	0.07
36	0.97	0.08	0.08
46	1.38	0.09	0.09
57	1.89	0.10	0.10
69	2.52	0.11	0.11
82	3.27	0.12	0.12
96	4.16	0.13	0.13
111	5.20	0.14	0.14
128	6.39	0.15	0.15

Linear Interpolation			
H	H	H	H
0.12	2.83	0.11	0.114 m
3.27	2.83	2.52	Qallow =

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

REQUIRED STORAGE - 100-YEAR EVENT						
AREA R-7 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.0138	ha	Qallow =	0.54		
C =	1.00		Vol(max) =	5.77		
			Notes =	1		
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	242.70	8.30	6.76	2.63		
10	178.56	6.84	6.30	3.78		
15	142.89	5.48	4.94	4.44		
20	119.95	4.60	4.06	4.87		
25	103.85	3.98	3.44	5.16		
30	91.87	3.52	2.98	5.37		
35	82.58	3.17	2.63	5.51		
40	75.15	2.88	2.34	5.62		
45	69.05	2.65	2.11	5.69		
50	63.95	2.45	1.91	5.73		
55	59.62	2.29	1.75	5.76		
60	55.89	2.14	1.60	5.77		
65	52.65	2.02	1.48	5.76		
70	49.79	1.91	1.37	5.75		
75	47.26	1.81	1.27	5.72		
80	44.99	1.72	1.18	5.69		
85	42.95	1.65	1.11	5.64		
90	41.11	1.58	1.04	5.59		

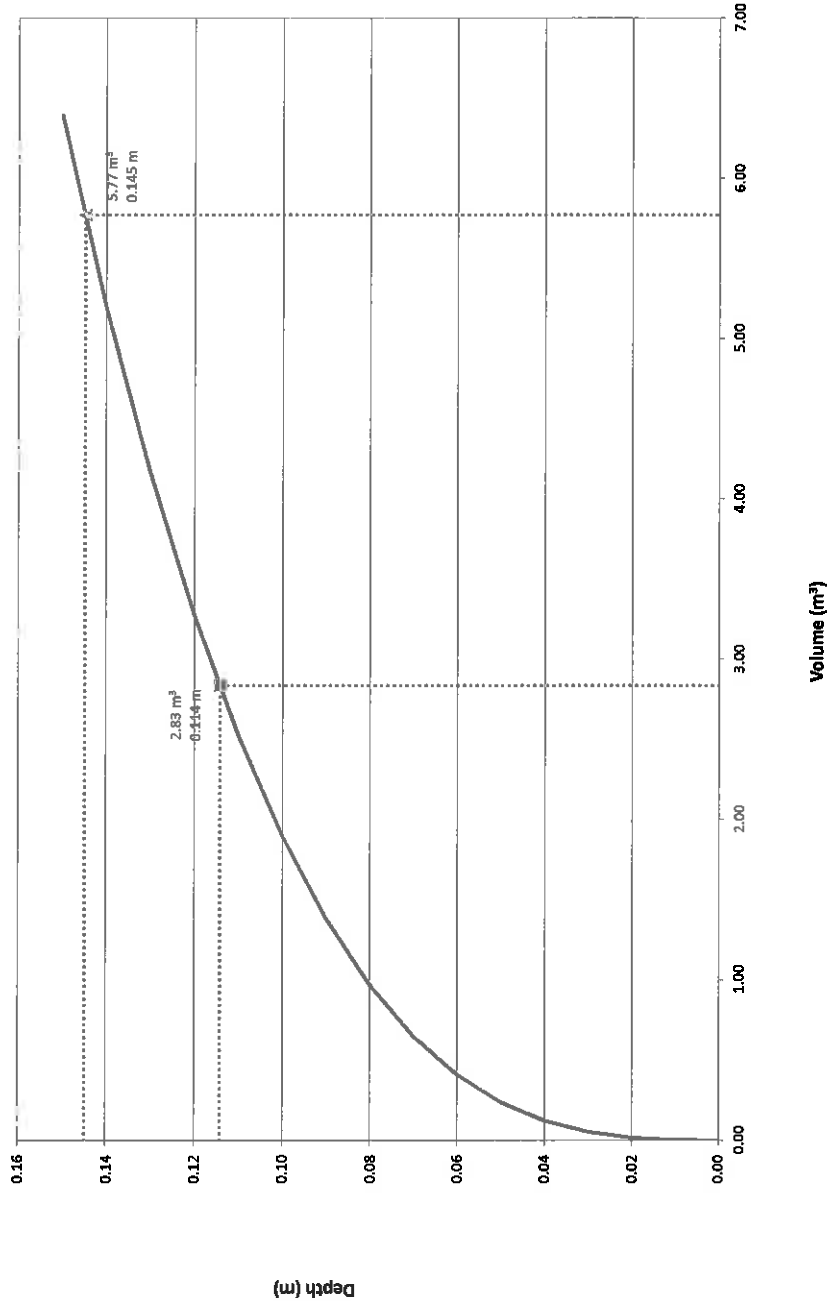
Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding depth (100-Year Storm)			
Area m ²	V m ³	H m	H ft
0	0.00	0.00	0.00
1	0.00	0.01	0.01
2	0.02	0.02	0.02
5	0.05	0.03	0.03
9	0.12	0.04	0.04
14	0.24	0.05	0.05
20	0.41	0.06	0.06
28	0.65	0.07	0.07
36	0.97	0.08	0.08
46	1.38	0.09	0.09
57	1.89	0.10	0.10
69	2.52	0.11	0.11
82	3.27	0.12	0.12
96	4.16	0.13	0.13
111	5.20	0.14	0.14
128	6.39	0.15	0.15

Linear Interpolation			
H	H	H	H
0.15	5.77	0.14	0.145 m
6.39	5.77	5.20	Qallow =

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

Stage-Storage Curve
Area R-7



NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



REQUIRED STORAGE - 6-YEAR EVENT						
AREA R-8 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.0088	ha	Qallow =	0.40		
C =	0.95		Vol(max) =	1.53		
			Notes =	1		
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	141.18	3.27	2.87	0.66		
10	104.19	2.41	2.01	1.21		
15	83.56	1.93	1.53	1.38		
20	70.25	1.63	1.23	1.47		
25	60.90	1.41	1.01	1.51		
30	53.93	1.25	0.85	1.53		
35	48.52	1.12	0.72	1.52		
40	44.18	1.02	0.62	1.49		
45	40.63	0.94	0.54	1.46		
50	37.65	0.87	0.47	1.41		
55	35.12	0.81	0.41	1.36		
60	32.94	0.76	0.36	1.30		
65	31.04	0.72	0.32	1.24		
70	29.37	0.68	0.28	1.17		
75	27.89	0.65	0.25	1.10		
80	26.56	0.61	0.21	1.03		
85	25.37	0.59	0.19	0.95		
90	24.29	0.56	0.16	0.88		

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

Ponding Depth (6-Year Storm)			
Area m ²	V m ³	H m	
0	0.00	0.00	
0	0.00	0.01	
1	0.01	0.02	
3	0.03	0.03	
6	0.08	0.04	
9	0.15	0.05	
13	0.26	0.06	
18	0.42	0.07	
23	0.62	0.08	
30	0.89	0.09	
36	1.21	0.10	
44	1.62	0.11	
52	2.10	0.12	
62	2.67	0.13	
71	3.33	0.14	
82	4.10	0.15	

Storage Head (6-Year Storm)			
Area m ²	H m	Qallow m ³ /s	H = 0.108 m
0.11	0.10	0.10	
1.62	1.53	1.21	Qallow = 0.108 m

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

REQUIRED STORAGE - 100-YEAR EVENT						
AREA R-9 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.0088	ha	Qallow =	0.51		
C =	1.00		Vol(max) =	3.17		
			Notes =	1		
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	242.70	5.91	5.40	1.82		
10	178.56	4.35	3.84	2.30		
15	142.89	3.48	2.97	2.67		
20	119.95	2.92	2.41	2.89		
25	103.85	2.53	2.02	3.03		
30	91.87	2.24	1.73	3.11		
40	75.15	1.83	1.32	3.17		
45	69.05	1.68	1.17	3.16		
50	63.95	1.56	1.05	3.14		
55	59.62	1.45	0.94	3.11		
60	55.89	1.36	0.85	3.07		
65	52.65	1.28	0.77	3.01		
70	49.79	1.21	0.70	2.95		
75	47.26	1.15	0.64	2.88		
80	44.99	1.10	0.59	2.81		
85	42.95	1.05	0.54	2.74		
90	41.11	1.00	0.49	2.65		

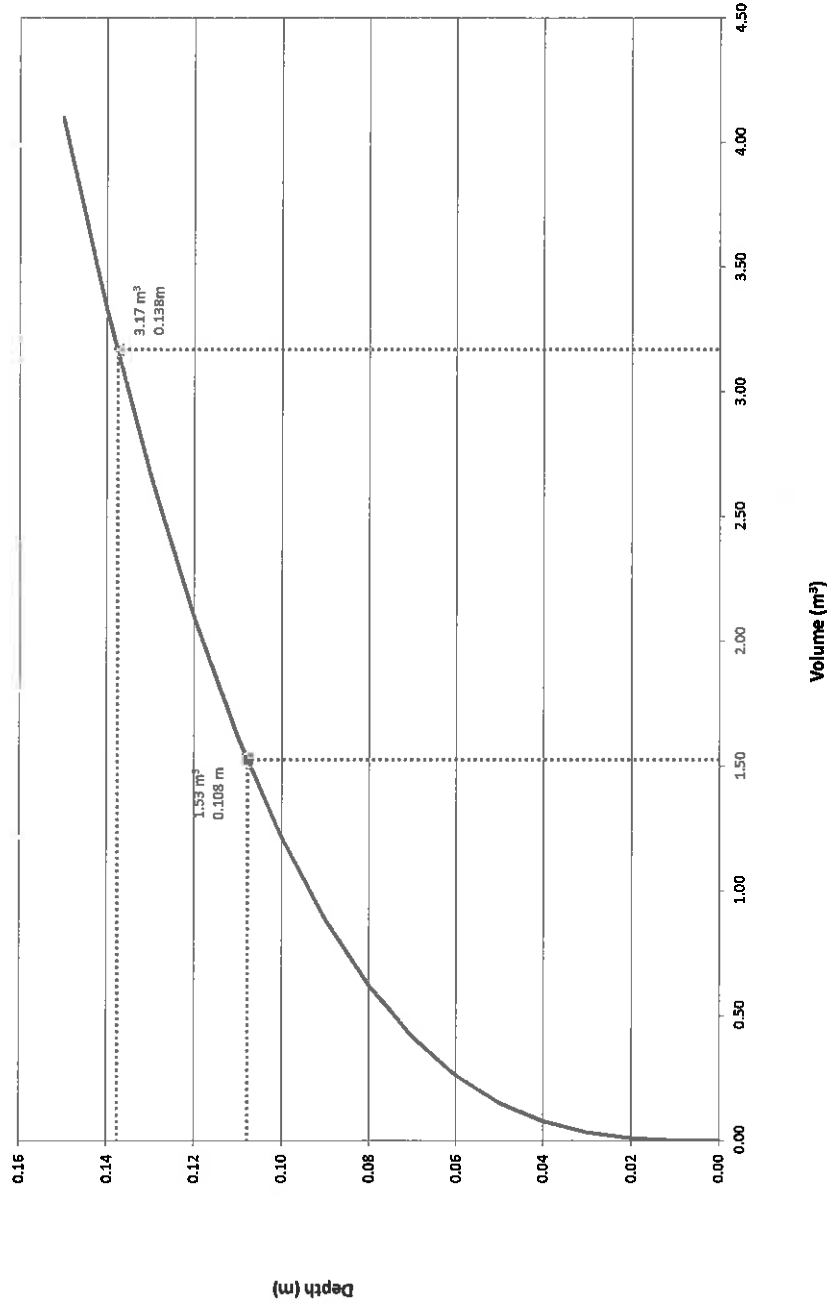
Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)			
Area m ²	V m ³	H m	
0	0.00	0.00	
0	0.00	0.01	
1	0.01	0.02	
3	0.03	0.03	
6	0.08	0.04	
9	0.15	0.05	
13	0.26	0.06	
18	0.42	0.07	
23	0.62	0.08	
30	0.89	0.09	
36	1.21	0.10	
44	1.62	0.11	
52	2.10	0.12	
62	2.67	0.13	
71	3.33	0.14	
82	4.10	0.15	

Storage Head (100-Year Storm)			
Area m ²	H m	Qallow m ³ /s	H = 0.138 m
0.14	0.13	0.13	
3.33	3.17	2.67	Qallow = 0.138 m

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

Stage-Storage Curve
Area R-8



NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



REQUIRED STORAGE - 5-YEAR EVENT						
AREA R-9 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.0014	ha	Qallow =	0.28	Vol(max) =	0.07
C =	0.95					Notes =
						1
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	141.18	0.52	0.24	0.07		
10	104.19	0.38	0.10	0.06		
15	83.56	0.31	0.03	0.02		
20	70.25	0.26	-0.02	-0.03		
25	60.90	0.22	-0.06	-0.09		
30	53.93	0.20	-0.08	-0.15		
35	48.52	0.18	-0.10	-0.22		
40	44.18	0.16	-0.12	-0.28		
45	40.63	0.15	-0.13	-0.36		
50	37.65	0.14	-0.14	-0.43		
55	35.12	0.13	-0.15	-0.50		
60	32.94	0.12	-0.16	-0.57		
65	31.04	0.11	-0.17	-0.65		
70	29.37	0.11	-0.17	-0.73		
75	27.89	0.10	-0.18	-0.80		
80	26.56	0.10	-0.18	-0.88		
85	25.37	0.09	-0.19	-0.96		
90	24.29	0.09	-0.19	-1.03		

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	
2	0.04	0.06	
3	0.06	0.07	
3	0.09	0.08	
4	0.13	0.09	
5	0.17	0.10	
6	0.23	0.11	
7	0.30	0.12	
9	0.38	0.13	
10	0.47	0.14	
12	0.58	0.15	

Linear Slopeweight			
Slope	H		H =
0.08	0.07		0.074 m
0.09	0.06		Qallow =

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

REQUIRED STORAGE - 100-YEAR EVENT						
AREA R-4 BUILDING ROOF						
OTTAWA IDF CURVE						
Area =	0.0014	ha	Qallow =	0.36	Vol(max) =	0.18
C =	1.00					Notes =
						1
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)		
5	242.70	0.93	0.55	0.17		
10	178.56	0.69	0.31	0.18		
15	142.89	0.55	0.17	0.15		
20	119.95	0.46	0.08	0.10		
25	103.85	0.40	0.02	0.03		
30	91.87	0.35	-0.03	-0.05		
35	82.58	0.32	-0.06	-0.13		
40	75.15	0.29	-0.08	-0.22		
45	69.05	0.27	-0.11	-0.31		
50	63.95	0.25	-0.13	-0.40		
55	59.62	0.23	-0.15	-0.50		
60	55.99	0.22	-0.16	-0.59		
65	52.65	0.20	-0.18	-0.69		
70	49.79	0.19	-0.19	-0.79		
75	47.26	0.18	-0.20	-0.89		
80	44.99	0.17	-0.21	-0.99		
85	42.95	0.17	-0.21	-1.10		
90	41.11	0.16	-0.22	-1.20		

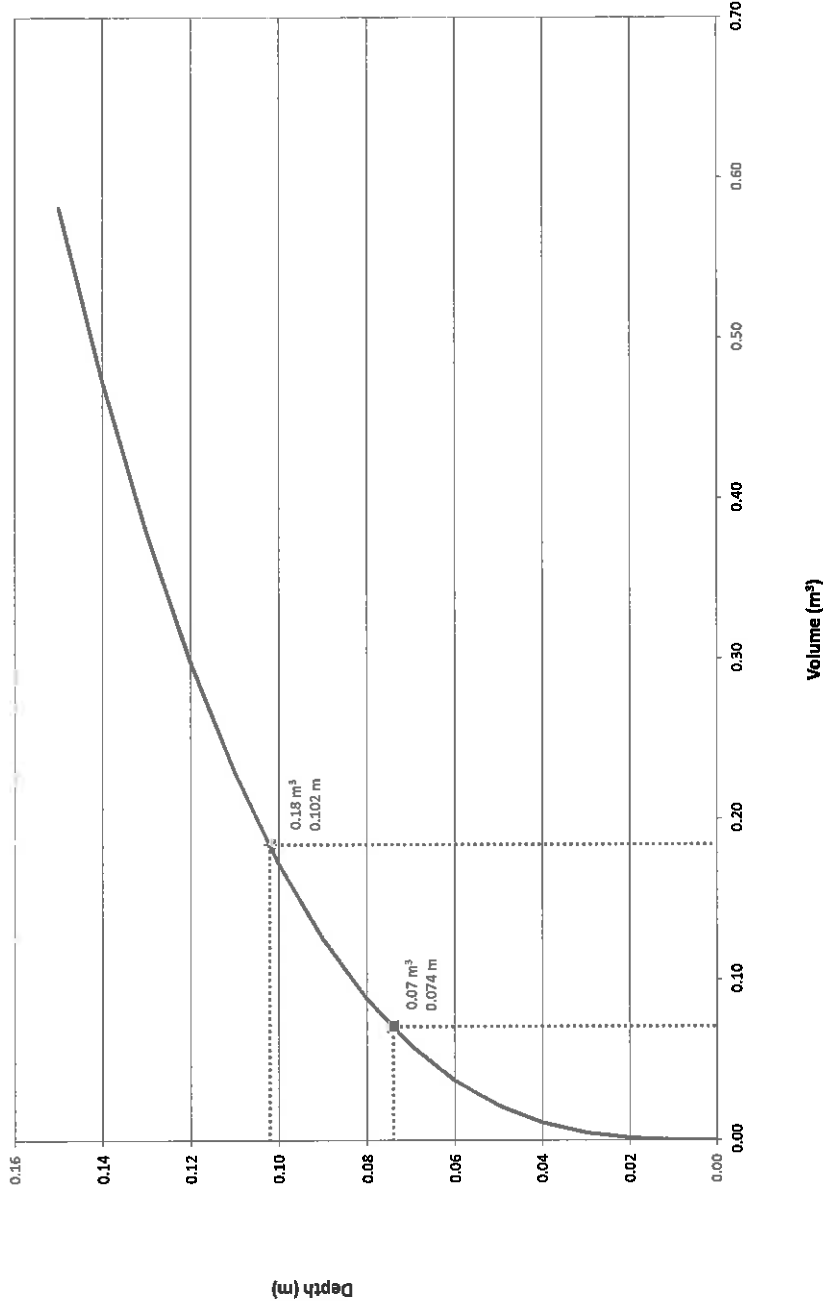
Notes: Vol = Qnet x time
Qnet = Q - Qallow

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	
2	0.04	0.06	
3	0.06	0.07	
3	0.09	0.08	
4	0.13	0.09	
5	0.17	0.10	
6	0.23	0.11	
7	0.30	0.12	
9	0.38	0.13	
10	0.47	0.14	
12	0.58	0.15	

Linear Slopeweight			
Slope	H		H =
0.11	0.1		0.102 m
0.23	0.18		Qallow =

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

Stage-Storage Curve
Area R-9



NEPEAN STREET RESIDENTIAL DEVELOPMENT
(96 NEPEAN STREET)



REQUIRED STORAGE - 5-YEAR EVENT										
AREA R-10 BUILDING ROOF										
OTTAWA IDF CURVE										
Area =	0.0015	ha	Qallow =	0.26	Vol(max) =	0.08	Qallow =	0.26	Vol(max) =	0.08
C =	0.95		Notes =	1						
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)	Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)	
5	141.18	0.95	0.26	0.08	10	104.19	0.40	0.12	0.07	
10	83.56	0.32	0.04	0.04	15	70.25	0.27	-0.01	-0.01	
20	60.90	0.24	-0.05	-0.07	25	53.93	0.21	-0.07	-0.13	
30	48.52	0.19	-0.10	-0.20	35	44.18	0.17	-0.11	-0.27	
40	40.83	0.16	-0.13	-0.34	45	37.65	0.15	-0.14	-0.41	
50	35.12	0.14	-0.15	-0.49	55	32.94	0.13	-0.16	-0.56	
60	31.04	0.12	-0.16	-0.64	65	28.37	0.11	-0.17	-0.71	
70	27.89	0.11	-0.18	-0.79	75	26.56	0.10	-0.18	-0.87	
80	25.37	0.10	-0.18	-0.94	85	24.29	0.09	-0.19	-1.02	
90										

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

Fondling Depth (5-Year Storm)			
Area (m ²)	V (m ³)	H (m)	H (m)
0	0.00	0.00	0.00
0	0.00	0.01	0.02
0	0.00	0.02	0.03
1	0.01	0.04	0.05
1	0.02	0.06	0.07
2	0.04	0.08	0.09
3	0.06	0.10	0.11
3	0.09	0.12	0.13
4	0.13	0.14	0.14
5	0.18	0.15	0.15
6	0.23	0.16	0.15
8	0.30	0.17	0.15
9	0.39	0.18	0.15
10	0.48	0.19	0.15
12	0.59	0.20	0.15

Fondling Depth (5-Year Storm)			
Area (m ²)	V (m ³)	H (m)	H (m)
0.08	0.08	0.07	0.076 m
0.09	0.08	0.06	Qallow = 0.076 m

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

REQUIRED STORAGE - 10-YEAR EVENT										
AREA R-10 BUILDING ROOF										
OTTAWA IDF CURVE										
Area =	0.0015	ha	Qallow =	0.39	Vol(max) =	0.20	Qallow =	0.39	Vol(max) =	0.20
C =	1.00		Notes =	1						
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)	Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m ³)	
5	242.70	0.99	0.60	0.18	10	178.96	0.73	0.34	0.20	
10	142.89	0.58	0.19	0.17	15	119.95	0.49	0.10	0.12	
20	103.85	0.42	0.03	0.05	25	91.87	0.37	-0.02	-0.03	
30	82.58	0.34	-0.05	-0.11	35	75.15	0.31	-0.08	-0.20	
40	69.05	0.28	-0.11	-0.29	45	63.95	0.26	-0.13	-0.39	
50	59.62	0.24	-0.15	-0.49	55	55.89	0.23	-0.16	-0.58	
60	52.65	0.21	-0.18	-0.69	65	49.79	0.20	-0.19	-0.79	
70	47.26	0.19	-0.20	-0.89	75	44.99	0.18	-0.21	-0.99	
80	42.95	0.17	-0.22	-1.10	85	41.11	0.17	-0.22	-1.20	
90										

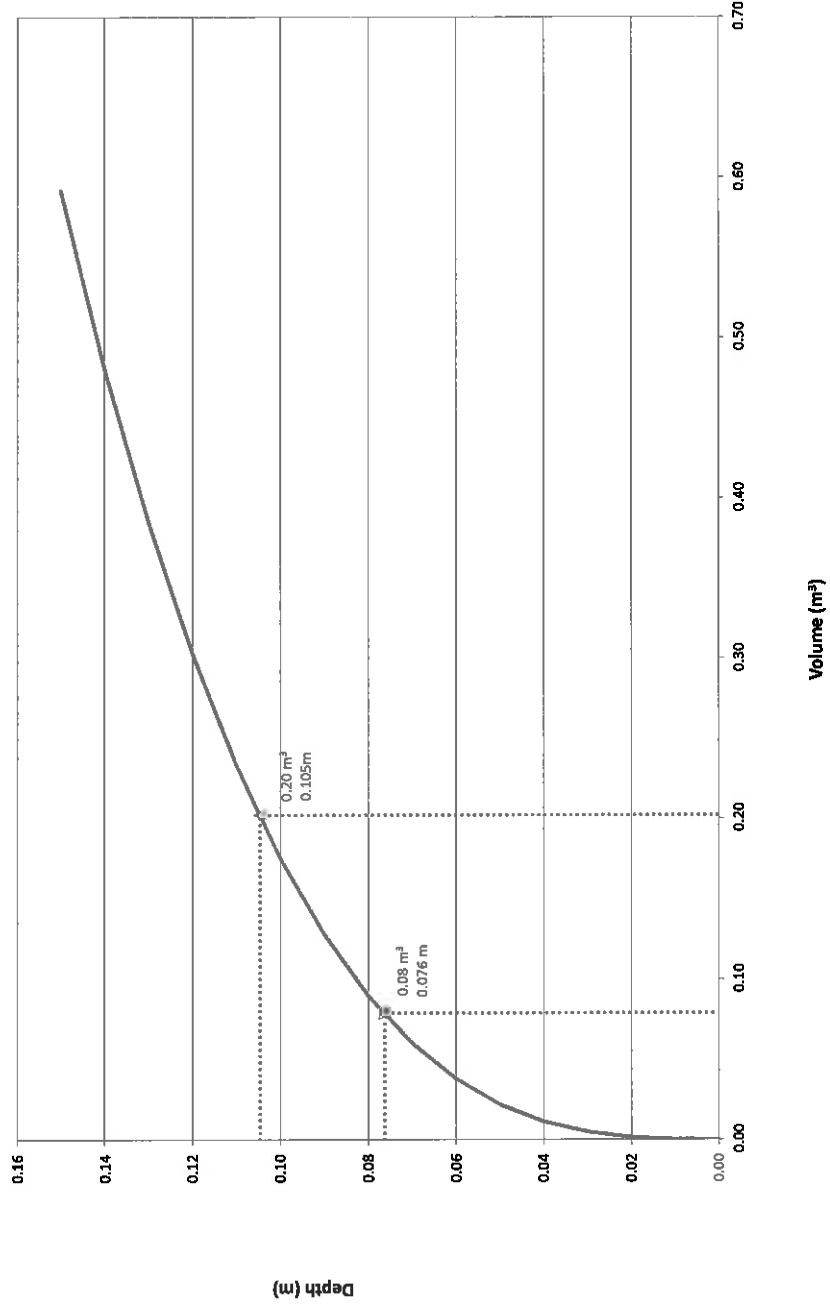
Notes: Vol = Qnet x time
Qnet = Q - Qallow

Fondling Depth (10-Year Storm)			
Area (m ²)	V (m ³)	H (m)	H (m)
0	0.00	0.00	0.00
0	0.00	0.01	0.02
0	0.00	0.02	0.03
1	0.01	0.04	0.05
1	0.02	0.06	0.07
2	0.04	0.08	0.09
3	0.06	0.10	0.11
3	0.09	0.12	0.13
4	0.13	0.14	0.14
5	0.18	0.15	0.15
6	0.23	0.16	0.15
8	0.30	0.17	0.15
9	0.39	0.18	0.15
10	0.48	0.19	0.15
12	0.59	0.20	0.15

Fondling Depth (10-Year Storm)			
Area (m ²)	V (m ³)	H (m)	H (m)
0.23	0.20	0.18	H = 0.105 m
0.23	0.20	0.18	Qallow = 0.105 m

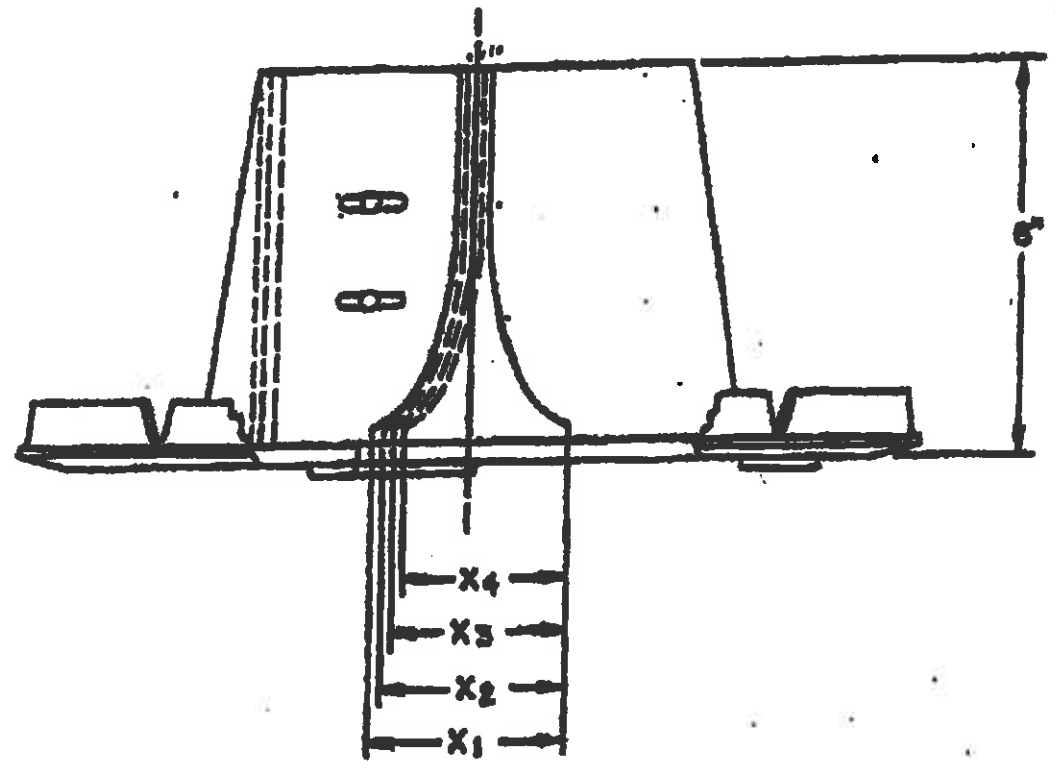
Note: Qallow is the flow rate through an overcontrolled Zum Roof Drain (3.73 L/s/m of head.)

Stage-Storage Curve
Area R-10



APPENDIX C
ZURN ROOF DRAIN INFORMATION

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



OPENING	GPM PER INCH OF HEAD	MAX FLOW GPM
X ₁	10.5	60.50
X ₂	7.5	45.20
X ₃	5.0	30.15
X ₄	2.5	15.25

not to be used in any application where the flow rate is not controlled by the weir. The weir is not to be used in any application where the flow rate is not controlled by the weir. The weir is not to be used in any application where the flow rate is not controlled by the weir. Property of Zurn Industries, Inc., Erie, Pa.

REV. 11-1-88 BY CR ENG. MM APPR. AB LAST REV.

1986 BY ZURN IND., INC.		a 50th ANNIVERSARY	ZURN INDUSTRIES, INC. ERIE, PA. U.S.A. 16512	PRODUCT NUMBER Z-105-10-77
			DRAWING NUMBER P-13521	

ATTACHED DRAWINGS

- 7 111153-GP GENERAL PLAN OF SERVICES
- 8 111153-GR GRADING AND EROSION CONTROL PLAN
- 9 111153-STM STORMWATER MANAGEMENT PLAN
- 10 12373-11 Claridge Lts 43-46 RP2996 T F Topographical Survey