APPENDICES

Appendix A HYDRAULIC ANALYSIS

Estimated Wastewater Discharge ***(50 apt high rise / commercial ground floor with underground parking)***
Site Area = 0.13ha

Residential Water Demand:

Estimated Population:

31 Apartment units x 1.8 p / unit	=	56 p
Total approximated population	=	56 p

Average Daily Demand:

$$Q_{avg} = 56p \times \frac{350L}{p \cdot d} = 19{,}600\frac{L}{d} \times \frac{1d}{86{,}400s} = 0.23\frac{L}{s}$$

Maximum Daily Demand:

$$Q_{\max\_daily} = 19{,}600\frac{L}{d} \times 2.5 = 49{,}000\frac{L}{d} \times \frac{1d}{86{,}400s} = 0.57\frac{L}{s}$$

Peak Hourly:

$$Q_{peak\_hourly} = 49{,}000\frac{L}{d} \times 2.2 = 107{,}800 \times \frac{1d}{86{,}400s} = 1.25\frac{L}{s}$$

Commercial Water Demand:

Total Commercial area:

Office/Retail	= 442 m^2	= 0.044 ha
Total Office/Retail	= 442 m^2	= 0.044 ha

Average Daily Demand:

$$Q_{avg} = 0.44ha \times \frac{28{,}000L}{ha \cdot d} = 1{,}232\frac{L}{d} \times \frac{1d}{86{,}400s} = 0.014\frac{L}{s}$$

Maximum Daily Demand:

$$Q_{\max\_daily} = 1{,}232\frac{L}{d} \times 1.5 = 1{,}848\frac{L}{d} \times \frac{1d}{86{,}400s} = 0.021\frac{L}{s}$$

Peak Hourly:

$$Q_{peak\_hourly} = 1{,}848\frac{L}{d} \times 1.8 = 3326\frac{L}{d} \times \frac{1d}{86{,}400s} = 0.04\frac{L}{s}$$

Total Demands – Residential and Commercial:

Average Daily Demand = 0.23 L/s + 0.01 L/s = **0.24 L/s**
Maximum Daily Demand = 0.57 L/s + 0.02 L/s = **0.59 L/s**
Peak Hourly Demand = 1.25 L/s + 0.04 L/s = **1.29 L/s**

Fire Flow Demands must be provided by mechanical consultants. For boundary conditions requests, a preliminary fire flow demand of **16,000 L/min** can be used.

Stantec

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 160401149
Project Name: King Edward
Date: March 9, 2016
Data input by: A. Lynch

Fire Flow Calculation #: 1
Building Type/Description/Name: Apartment Building and Ciommercial use

Assume horizontal fire separation for each floor.

Notes:

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Non-combustible construction	0.8	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	6				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			8	8	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on design with one hour rating for vertical openings and exterior vertical communications:			803 Square Metres (m2)	6,420	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) ($F = 220 * C * \sqrt{A}$) Round to nearest 1000L/min						**14,000**
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0	N/A	**14,000**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	**-4,200**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	**-1,400**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	0 to 3.0m	0.25	0.75	m	**10,500**
			East Side	3.1 to 10.0m	0.2			
			South Side	0 to 3.0m	0.25			
			West Side	30.1 to 45.0m	0.05			
6	Obtain Required Fire Flow, Duration & Volume	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**19,000**
		Total Required Fire Flow (above) in L/s:						**317**
		Required Duration of Fire Flow (hrs)						**4.25**
		Required Volume of Fire Flow (m^3)						**4,845**

Sharp, Mike

From: Wu, John <John.Wu@ottawa.ca>
Sent: Tuesday, March 17, 2015 2:25 PM
To: Kilborn, Kris
Subject: RE: Clarence and King Edward - Lauzon Group"
Attachments: 277 King Edward March 2015.pdf

Here is the result:

The following are boundary conditions, HGL, for hydraulic analysis at 277 King Edward (zone 1W) assumed to be connected to the 152mm on Clarence St. See attached PDF for location.

Minimum HGL = 106.3m

Maximum HGL = 118.6m; the estimated ground elevation is 57.98m, the maximum pressure is estimated to be more than 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is required.

MaxDay (1.03 L/s) + FireFlow (266 L/s) = 99.5m

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.

John

From: Kilborn, Kris [mailto:kris.kilborn@stantec.com]
Sent: Wednesday, February 25, 2015 2:54 PM
To: Wu, John
Cc: Sharp, Mike; Paerez, Ana
Subject: RE: Clarence and King Edward - Lauzon Group"

John

How are things today?
I was wondering if you could pass along the attached boundary request for the watermains in proximity to the proposed development
To the water group for me. I have attached a boundary conditions map along with estimated commercial and residential water demand sheet and Fireflow FUS sheet.

In addition, are you aware of any issues or surcharging in the sanitary sewers along Clarence Street or King Edward. I have attached
The estimated wastewater discharge calc sheet for your review. We will be discharging approximately 1.78l/s to the Clarence Street sewer.

Please get back to me with any timeframes for when boundary conditions can be received and if the 1.78l/s into the Clarence Street sewer can

Be accommodated without any issues.

Regards

Kris Kilborn
Associate / Project Manager
400 - 1331 Clyde Avenue Ottawa ON K2C 3G4
Phone: (613) 724-4337
Cell: (613) 297-0571
Fax: (613) 722-2799
kris.kilborn@stantec.com

Stantec

Boundary Condition for 277 King Edward

Appendix B PROPOSED SITE PLAN

△1
ZONING REVEW & STATISTICS

MUNICIPALITY: OTTAWA
MUNICIPAL ADDRESS: 275 KING EDWARD AVENUE
REGISTERED OWNER: CLAUDE LAUZON GROUP LTD.
LOT AREA = 1,262.3 sq.m. (13,587 sq.ft.) (0.31 acres)

ZONING ANALYSIS:
OTTAWA
ZONING BY-LAW: 2008-250
ZONE: TM / TM12
PROPOSED USE: 5-STOREY MIXED-USE DEVELOPMENT

BUILDING AREAS	(SQ M.)	(SQ FT.)
ABOVE GRADE:		
GROUND FLOOR	807	8,672
SECOND FLOOR	701	7,548
THIRD FLOOR	701	7,548
FOURTH FLOOR	701	7,548
FIFTH FLOOR	586	6,307
TOTAL (ABOVE GRADE):	3,496	37,623
PARKING (BELOW GRADE):		
BASEMENT	1,044	11,243
TOTAL GROSS FLOOR AREA	4,540	48,866

APARTMENT UNIT STATS:

	1-BEDROOM UNITS	2-BEDROOM UNITS	TOTAL UNIT COUNTS
2nd FLOOR	3	3	6
3rd FLOOR	2	4	6
4th FLOOR	2	4	6
5th FLOOR	2	3	5
TOTAL	9	14	23

AMENITY AREA NOTES:

REQUIRED AREA:
23 UNITS @ 6 sq.m./UNIT = 138 sq.m.
COMMUNAL = 50% OF TOTAL = 69 sq.m.

PROVIDED AREA:

COMMUNAL AREA	
REAR YARD	2,260 SQ.FT (210 SQ.M.)
ROOFTOP TERRACE	1,163 SQ.FT (108 SQ.M.)
PRIVATE (BALCONIES)	1,625 SQ.FT (151 SQ.M.)
TOTAL	5,048 SQ.FT (469 SQ.M.)

Performance Standard	By-law Requirement	Requested
Traditional Mainstreet Zone Requirements (Section 197)		
△1 Front yard setback (King Edward)	• 1st four storeys = Max. 2m • Above 4th storey = Min. 2m more than setback of 1st four storeys	• 1st - 4th storeys = 0.3 m • 5th storey = 2.3 m
Interior side yard setback	• Abutting residential zone = Min. 3m • Other cases = Max. 3m	• Abutting residential zone= 3.0 m • Other cases = 0.6 m, 2.4 m
△1 Corner side yard setback (Clarence & Murray)	• 1st four storeys = Min. 3 m • Above 4th storey = Min. 2 m more than setback of 1st four storeys	• Ground - 4th storeys: - Clarence St. = 3.0 m - Murray St. = 3.0 m • 5th storey: - Clarence St. = 5.0 m - Murray St. = N/A
Rear yard setback	• Abutting residential zone = Min. 7.5 m	• **1.9 m for portion near Murray St.**
△1 Building height	• Max. 20 m, but no more than 6 storeys • No part of a building on a lot with a rear lot line abutting an R1, R2, R3 or R4 Zone may project above a 45 degree angular plane measured at a height of 15 m from a point 7.5m from the rear lot line, projecting upwards toward the front lot line	• 5 storeys (16.75m) & 1 storey 'tail' (3.95m) on Murray St.
Landscaped area	• Abutting a residential zone: 3m, **may be reduced to 1 m where a minimum 1.4 m high opaque fence is provided**	• 1.9m & 3.0m landscape area (soft + hard) with 1.4m high fence
Glazing along King Edward	• 50%	• 56%
Parking & Loading Provisions (Sections 100 - 113)		
△1 Residential parking	0.5 spaces/dwelling unit (over 12 units) [(23 units - 12 units) x 0.5] = 6 spaces	6 spaces
△1 Visitors' parking	0.1 spaces/unit (over 12 units) = 1 spaces	1 spaces
△1 Parking for ground floor commercial in TM zone	Retail store: 1.25 spaces/100m^2 (511m^2/100m^2) x 1.25 = 6 spaces	6 spaces
Reduction of Required Parking [Section 101, 6, (c), (i)]	Where all parking spaces for a permitted land use are located below grade in the same building as that land use, the parking required for that land use may be reduced by the lesser of • 10 percent of the required parking spaces or • 20 parking spaces	Required Parking: 6+1+6 = 13 spaces 13 - (10%) = **12 spaces**
△1 Driveway Width	• Two-way = 6.7m; One-way = 3.6m • In TM zone = Min. 6.0 m leading to 20 or more parking spaces	• Murray St. = 3.6m
Aisle Width	6.7 m (two-way traffic)	• 6.7 m
△1 Bicycle parking	• Residential: 0.5 spaces/D.U. = 12 spaces • Retail: 1 space/250m^2 retail = 2 spaces • Total = 14 spaces	14 spaces
Bicycle parking space dimensions	• Vertical: Length = 1.5m; Width = 0.5m • Horizontal: Length = 1.8m; Width = 0.6m	Complies
Bicycle parking aisle width	• Min. 1.5m	1.5m
Loading Space	In TM Zone, no loading space required for each retail use with a GFA < 1,000 m^2 (0 required)	0 loading spaces
Amenity Area (Section 137)		
△1 Amenity Area	• Total (6 m^2 / d.u.) = 138 m^2 • Communal (50% of total) = 69 m^2	• Private = 151 m^2 • Communal = 318 m^2 • Total = 469 m^2

plot scale 1:1

SHEET SIZE: ARCH D (24"x36")

LEGAL DESCRIPTION:

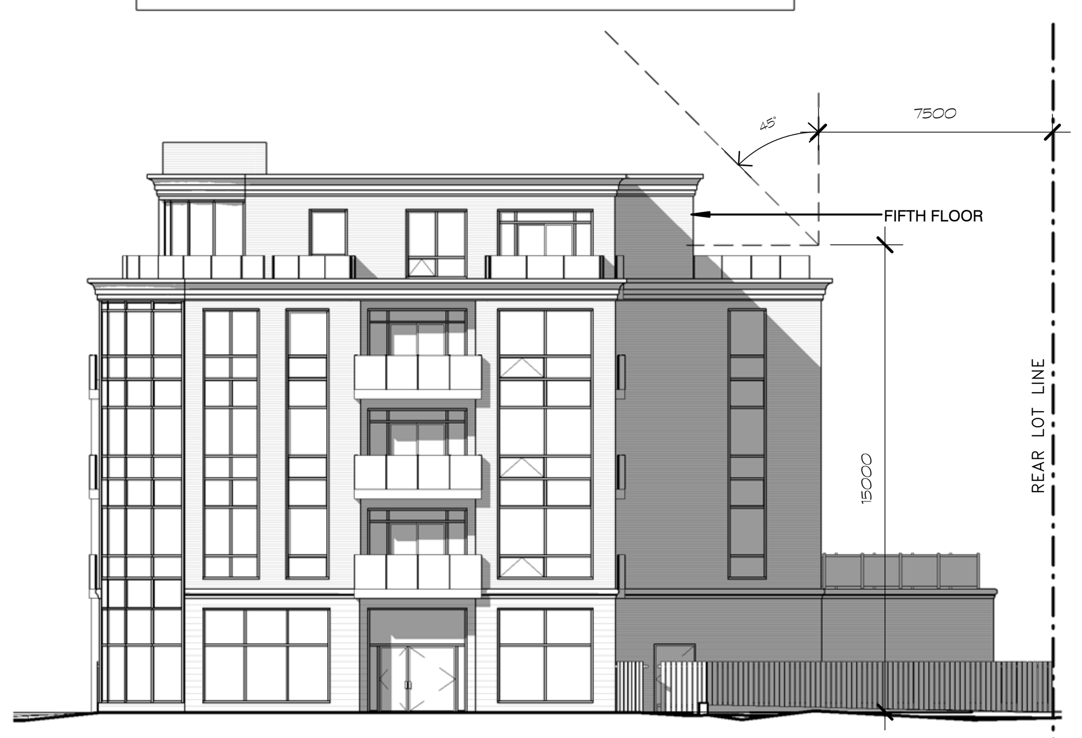
PART OF LOTS B and 7
NORTH CLARENCE STREET
(FORMERLY PARRY STREET)
REGISTERED PLAN 43586

CITY OF OTTAWA

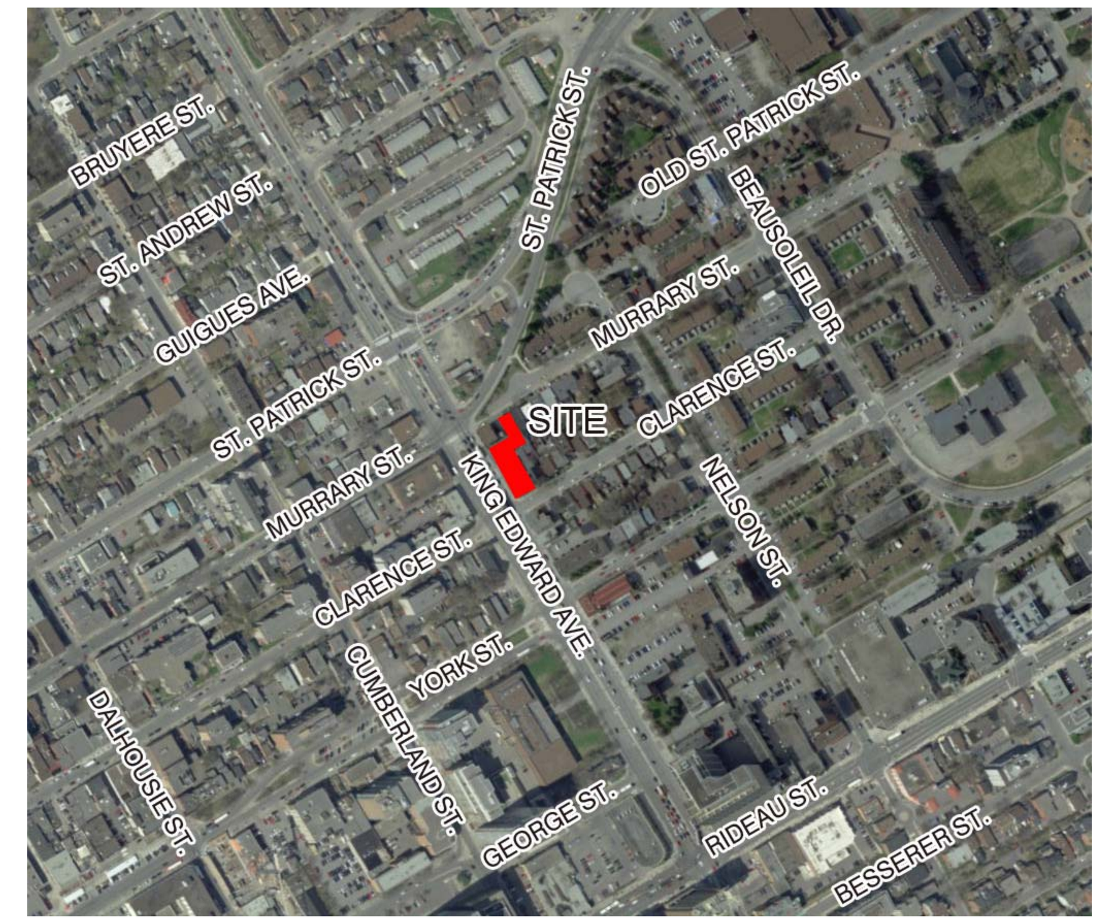
PREPARED BY
ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
SEPTEMBER 9, 2014

LEGEND:

CB = CATCH BASIN
DC = DEPRESSED CURB
FH = FIRE HYDRANT
FDC = FIRE DEPARTMENT CONNECTION
HH = HAND HOLE
LS = LIGHT STANDARD
MH = MAN HOLE
N.T.S. = NOT TO SCALE
TB = TRAFFIC BOX
TP = TRAFFIC LIGHT POST
▲ = PRINCIPAL ENTRANCE
△ = EXIT DOOR
△ O/H = OVERHEAD DOOR
△ = WITH NUMBERS, DENOTES REVISION



3 / A100 SOUTH ELEVATION
SCALE 1/16" = 1'-0"



1 / A100 LOCATION PLAN
SCALE N.T.S.

Planning Consultant:
NOVATECH ENGINEERS, PLANNERS & LANDSCAPE ARCHITECTS
240 MICHAEL COWPLAND DRIVE, SUITE 200
OTTAWA, ONTARIO K2M 1P6
Tel: (613) 254-9643 x 308
Fax: (613) 254-5867
e-mail: cjacques@novatech-eng.com

Civil Engineer:
STANTEC CONSULTING LTD.
1131 CLYDE AVENUE, SUITE 400
OTTAWA, ONTARIO
Tel: (613) 722-4420
Fax:
e-mail:

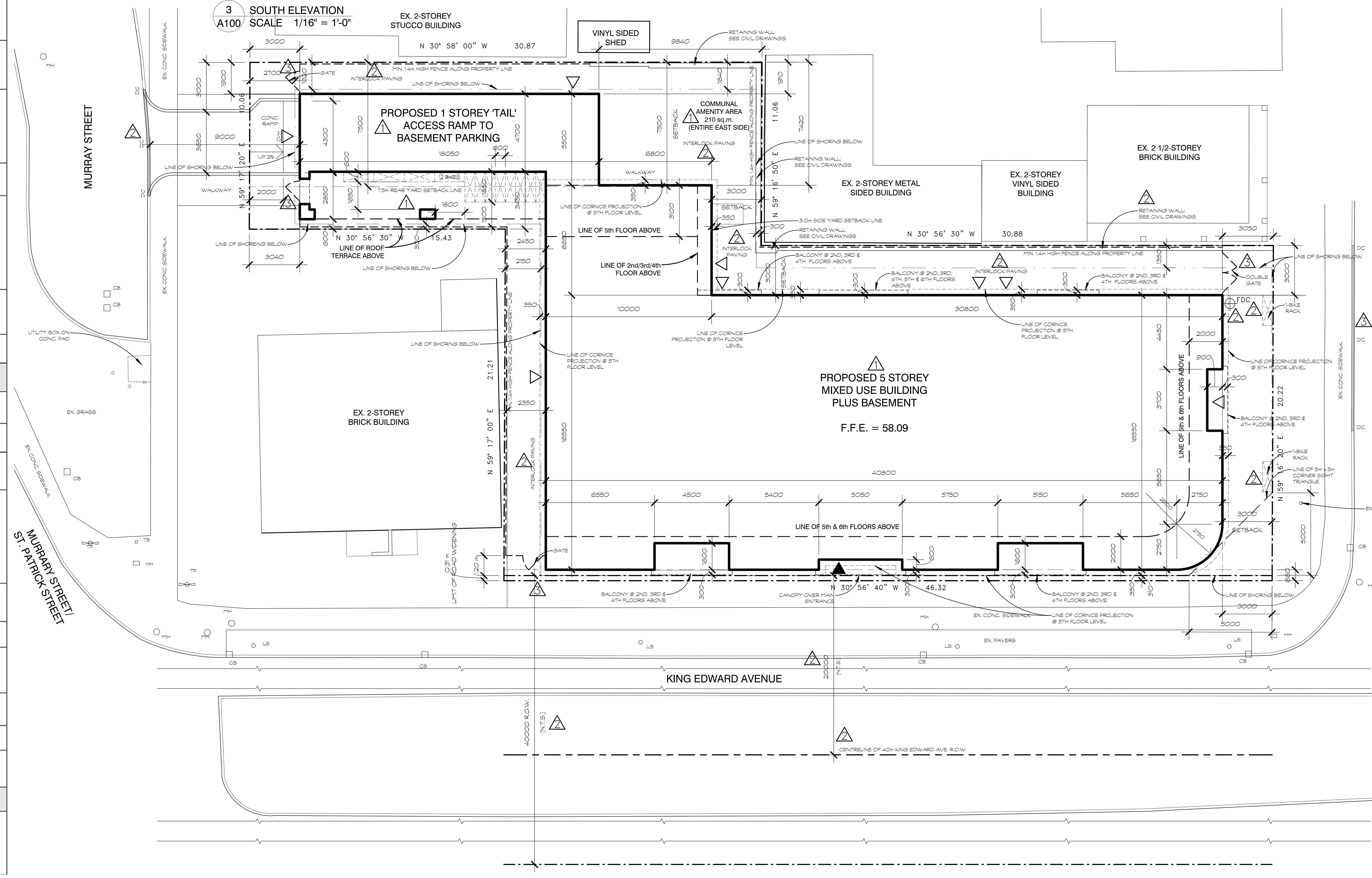
Geotechnical Engineer:
PATERSON GROUP
154 COLONNADE ROAD SOUTH
NEPEAN ONTARIO K2E 7J4
Tel: (613) 226-7381
Fax: (613) 226-6344
e-mail: carlosd@patersongroup.ca

Landscape Architect:
NOVATECH ENGINEERS, PLANNERS & LANDSCAPE ARCHITECTS
240 MICHAEL COWPLAND DRIVE, SUITE 200
OTTAWA, ONTARIO K2M 1P6
Tel: (613) 254-9643
Fax: (613) 254-5867
e-mail:

Registered Owner:
CLAUDE LAUZON GROUP LTD
274 DALHOUSIE STREET
OTTAWA, ONTARIO, K1N 7E6
Tel: (613) 241-1600 x224
Fax:
e-mail: lise@claudelauzongroup.ca

Project Manager:
CLAUDE LAUZON GROUP LTD
274 DALHOUSIE STREET
OTTAWA, ONTARIO, K1N 7E6
Tel: (819) 213-6453
Fax:
e-mail: mperron@claudelauzongroup.ca

Surveyor:
ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 CONCOURSE GATE, SUITE 500
OTTAWA, ONTARIO K2E 7S6
Tel: (613) 727-0850
Fax: (613) 727-1079
e-mail:

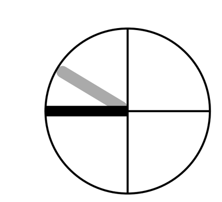


2 / A100 SITE PLAN
SCALE 1 : 150
0 1.5 3 6 9 12 15 METRES

NOTES:

Contractor shall check and verify all dimensions on site and report any discrepancies to the Architect before proceeding.

no.	revision	date
3	ISSUED FOR SPA RESONSE SUBMISSION	26 SEP 2016
2	RESPONSE TO CITY COMMENTS	06 SEP 2016
1	REVISED BUILDING DESIGN	08 AUG 2016



north nord

kwc
383 Parkdale Avenue, Suite 201
Ottawa Ontario Canada K1Y 4R4
KWC ARCHITECTS INC.
PHONE (613) 238-2117
FAX (613) 238-6595
E MAIL kwc@kwc-arch.com

detail no. / détail no. 1
sheet no. / feuille no. A1

project / projet
MIXED USE BUILDING
275 KING EDWARD AVE. OTTAWA, ON.

designed by / conçu par: TB/LK
approved by / approuvé par:
drawn by / dessiné par: AK
project no. / no. du projet: 1611
date: 07 APRIL 2016
scale: as noted

drawing / dessin
SITE PLAN

revision / révision: 3
sheet no. / no. de la feuille: **A100**

Appendix C SANITARY SEWER CALCULATIONS

Stantec

SUBDIVISION:

KING EDWARD AT CLARENCE STREET

DATE: 9/20/2016
REVISION: 1
DESIGNED BY: TKR
CHECKED BY: AL

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 1604-01149

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 L/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	50,000 L/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 L/ha/day	MANNINGS n	0.013
PEAKING FACTOR (COMM., INST.):	1.5	INDUSTRIAL (LIGHT)	35,000 L/ha/day	BEDDING CLASS	B
PERSONS / SINGLE UNIT	3.4	INSTITUTIONAL	50,000 L/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 L/s/ha		
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT.	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (L/s)	FLOW (L/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Overall Development	BUILDING	SAN 1	0.08	0	0	23	42	0.08	42	4.00	0.68	0.15	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.17	0.17	0.05	0.86	1.5	150	PVC	DR 28	1.00	15.3	**5.60%**	0.86	0.39
Existing 300mm in Clarence	MHSA38653	MHSA38650	0.89	2	20	62	172	0.89	172	4.00	2.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.89	0.25	3.90	69.4	300	CONCRETE	SDR 35	0.40	60.7	**6.43%**	0.86	0.40

Appendix D STORMWATER MANAGEMENT CALCULATIONS

Stormwater Management Calculations

File No: **PROJECT #**
Project: **PROJECT DESCRIPTION**
Date: **DATE**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table								
Catchment Type	**Sub-catchment Area ID / Description**		**Area (ha) "A"**		**Runoff Coefficient "C"**		**"A x C"**	**Overall Runoff Coefficient**
Uncontrolled - Non-Tributary	UNC1 & UNC2	Hard	0.014		0.9	0.012		
		Soft	0.004		0.2	0.001		
		Subtotal		0.018			0.01314	0.730
Controlled - Tributary	Ramp1	Hard	0.001		0.9	0.001		
		Soft	0.000		0.2	0.000		
		Subtotal		0.001			0.0009	0.900
Controlled - Tributary	4	Hard	0.009		0.9	0.008		
		Soft	0.000		0.2	0.000		
		Subtotal		0.009			0.0081	0.900
Controlled - Tributary	3	Hard	0.005		0.9	0.005		
		Soft	0.000		0.2	0.000		
		Subtotal		0.005			0.0045	0.900
Controlled - Tributary	2	Hard	0.007		0.9	0.006		
		Soft	0.000		0.2	0.000		
		Subtotal		0.007			0.0063	0.900
Controlled - Tributary	1	Hard	0.004		0.9	0.004		
		Soft	0.000		0.2	0.000		
		Subtotal		0.004			0.0036	0.900
Roof	BLDG5	Hard	0.004		0.9	0.004		
		Soft	0.000		0.2	0.000		
		Subtotal		0.004			0.0036	0.900
Roof	BLDG4	Hard	0.009		0.9	0.008		
		Soft	0.000		0.2	0.000		
		Subtotal		0.009			0.0081	0.900
Roof	BLDG3	Hard	0.003		0.9	0.003		
		Soft	0.000		0.2	0.000		
		Subtotal		0.003			0.0027	0.900
Roof	BLDG2	Hard	0.013		0.9	0.012		
		Soft	0.000		0.2	0.000		
		Subtotal		0.013			0.0117	0.900
Roof	BLDG1	Hard	0.060		0.9	0.054		
		Soft	0.000		0.2	0.000		
		Subtotal		0.06			0.054	0.900
Total				**0.133**			**0.117**	
Overall Runoff Coefficient= C:								**0.88**

Total Roof Areas	**0.089 ha**	
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.026 ha**	0.967132116
Total Tributary Area to Outlet	**0.115 ha**	
Total Uncontrolled Areas (Non-Tributary)	**0.018 ha**	
Total Site	**0.133 ha**	

Stormwater Management Calculations

Project #PROJECT #, PROJECT DESCRIPTION
Modified Rational Method Calculatons for Storage

5 yr Intensity I = a/(t + b)
City of Ottawa

		t (min)	I (mm/hr)
a =	998.071	5	141.18
b =	6.053	10	104.19
c =	0.814	15	83.56
		20	70.25
		25	60.90
		30	53.93
		35	48.52
		40	44.18
		45	40.63
		50	37.65
		55	35.12
		60	32.94

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.1330
C: 0.50

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**19.26**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: NC1 & UNC2 — Uncontrolled - Non-Tributary
Area (ha): 0.018
C: 0.73

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	5.16	5.16		
10	104.19	3.81	3.81		
15	83.56	3.05	3.05		
20	70.25	2.57	2.57		
25	60.90	2.22	2.22		
30	53.93	1.97	1.97		
35	48.52	1.77	1.77		
40	44.18	1.61	1.61		
45	40.63	1.48	1.48		
50	37.65	1.38	1.38		
55	35.12	1.28	1.28		
60	32.94	1.20	1.20		

Subdrainage Area: Ramp1 — Controlled - Tributary
Area (ha): 0.001
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	0.35	0.35	0.00	**0.00**
10	104.19	0.26	0.26	0.00	**0.00**
15	83.56	0.21	0.21	0.00	**0.00**
20	70.25	0.18	0.18	0.00	**0.00**
25	60.90	0.15	0.15	0.00	**0.00**
30	53.93	0.13	0.13	0.00	**0.00**
35	48.52	0.12	0.12	0.00	**0.00**
40	44.18	0.11	0.11	0.00	**0.00**
45	40.63	0.10	0.10	0.00	**0.00**
50	37.65	0.09	0.09	0.00	**0.00**
55	35.12	0.09	0.09	0.00	**0.00**
60	32.94	0.08	0.08	0.00	**0.00**

Storage: e Above CB

Orifice Equation: = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 0.00 m
T/G Elevation 0.00 m
Max Ponding Depth 0.10 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	0.10	0.10	3.77	0.00	1.30	OK

Subdrainage Area: 4 — Controlled - Tributary
Area (ha): 0.009
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	3.18	3.18	0.00	**0.00**
10	104.19	2.35	2.35	0.00	**0.00**
15	83.56	1.88	1.88	0.00	**0.00**
20	70.25	1.58	1.58	0.00	**0.00**
25	60.90	1.37	1.37	0.00	**0.00**
30	53.93	1.21	1.21	0.00	**0.00**
35	48.52	1.09	1.09	0.00	**0.00**
40	44.18	0.99	0.99	0.00	**0.00**
45	40.63	0.91	0.91	0.00	**0.00**
50	37.65	0.85	0.85	0.00	**0.00**
55	35.12	0.79	0.79	0.00	**0.00**
60	32.94	0.74	0.74	0.00	**0.00**

Storage: e Above CB

Orifice Equation: = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 56.20 m
T/G Elevation 58.00 m
Max Ponding Depth 0.02 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	58.02	1.82	16.10	0.00	0.40	OK

Project #PROJECT #, PROJECT DESCRIPTION
Modified Rational Method Calculatons for Storage

100 yr Intensity I = a/(t + b)
City of Ottawa

		t (min)	I (mm/hr)
a =	1735.688	5	242.70
b =	6.014	10	178.56
c =	0.820	15	142.89
		20	119.95
		25	103.85
		30	91.87
		35	82.58
		40	75.15
		45	69.05
		50	63.95
		55	59.62
		60	55.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.1330
C: 0.50

Estimated Time of Concentration after Development
control to 5-yr pre

tc (min)	I (5 yr) (mm/hr)	Q5yr (L/s)
10	104.19	**19.26**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: NC1 & UNC2 — Uncontrolled - Non-Tributary
Area (ha): 0.018
C: 0.91

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	8.15	8.15		
20	119.95	5.48	5.48		
30	91.87	4.19	4.19		
40	75.15	3.43	3.43		
50	63.95	2.92	2.92		
60	55.89	2.55	2.55		
70	49.79	2.27	2.27		
80	44.99	2.05	2.05		
90	41.11	1.88	1.88		
100	37.90	1.73	1.73		
110	35.20	1.61	1.61		
120	32.89	1.50	1.50		

Subdrainage Area: Ramp1 — Controlled - Tributary
Area (ha): 0.00
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	0.50	0.50	0.00	**0.00**
20	119.95	0.33	0.33	0.00	**0.00**
30	91.87	0.26	0.26	0.00	**0.00**
40	75.15	0.21	0.21	0.00	**0.00**
50	63.95	0.18	0.18	0.00	**0.00**
60	55.89	0.16	0.16	0.00	**0.00**
70	49.79	0.14	0.14	0.00	**0.00**
80	44.99	0.13	0.13	0.00	**0.00**
90	41.11	0.11	0.11	0.00	**0.00**
100	37.90	0.11	0.11	0.00	**0.00**
110	35.20	0.10	0.10	0.00	**0.00**
120	32.89	0.09	0.09	0.00	**0.00**

Warning, max. volume may not have been reached.

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 0.00 m
T/G Elevation 0.00 m
Max Ponding Depth 0.13 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	0.13	0.13	4.30	0.00	1.30	OK
					1.30	

Subdrainage Area: 4 — Controlled - Tributary
Area (ha): 0.009
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	4.47	4.47	0.00	**0.00**
20	119.95	3.00	3.00	0.00	**0.00**
30	91.87	2.30	2.30	0.00	**0.00**
40	75.15	1.88	1.88	0.00	**0.00**
50	63.95	1.60	1.60	0.00	**0.00**
60	55.89	1.40	1.40	0.00	**0.00**
70	49.79	1.25	1.25	0.00	**0.00**
80	44.99	1.13	1.13	0.00	**0.00**
90	41.11	1.03	1.03	0.00	**0.00**
100	37.90	0.95	0.95	0.00	**0.00**
110	35.20	0.88	0.88	0.00	**0.00**
120	32.89	0.82	0.82	0.00	**0.00**

Warning, max. volume may not have been reached.

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 56.20 m
T/G Elevation 58.00 m
Max Ponding Depth 0.05 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	58.05	1.85	16.24	0.00	0.40	OK
					0.40	

Stormwater Management Calculations

Project #PROJECT #, PROJECT DESCRIPTION
Modified Rational Method Calculatons for Storage

Subdrainage Area: 3 Controlled - Tributary
Area (ha): 0.005
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	1.77	1.77	0.00	**0.00**
10	104.19	1.30	1.30	0.00	**0.00**
15	83.56	1.05	1.05	0.00	**0.00**
20	70.25	0.88	0.88	0.00	**0.00**
25	60.90	0.76	0.76	0.00	**0.00**
30	53.93	0.67	0.67	0.00	**0.00**
35	48.52	0.61	0.61	0.00	**0.00**
40	44.18	0.55	0.55	0.00	**0.00**
45	40.63	0.51	0.51	0.00	**0.00**
50	37.65	0.47	0.47	0.00	**0.00**
55	35.12	0.44	0.44	0.00	**0.00**
60	32.94	0.41	0.41	0.00	**0.00**

Storage: e Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 56.20 m
T/G Elevation 58.00 m
Max Ponding Depth 0.02 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	58.02	1.82	16.10	0.00	0.36	OK

Subdrainage Area: 2 Controlled - Tributary
Area (ha): 0.007
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	2.47	2.47	0.00	**0.00**
10	104.19	1.82	1.82	0.00	**0.00**
15	83.56	1.46	1.46	0.00	**0.00**
20	70.25	1.23	1.23	0.00	**0.00**
25	60.90	1.07	1.07	0.00	**0.00**
30	53.93	0.94	0.94	0.00	**0.00**
35	48.52	0.85	0.85	0.00	**0.00**
40	44.18	0.77	0.77	0.00	**0.00**
45	40.63	0.71	0.71	0.00	**0.00**
50	37.65	0.66	0.66	0.00	**0.00**
55	35.12	0.62	0.62	0.00	**0.00**
60	32.94	0.58	0.58	0.00	**0.00**

Storage: e Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 56.20 m
T/G Elevation 57.95 m
Max Ponding Depth 0.04 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	57.99	1.79	15.97	0.00	1.30	OK

Subdrainage Area: 1 Controlled - Tributary
Area (ha): 0.004
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	1.41	1.41	0.00	**0.00**
10	104.19	1.04	1.04	0.00	**0.00**
15	83.56	0.84	0.84	0.00	**0.00**
20	70.25	0.70	0.70	0.00	**0.00**
25	60.90	0.61	0.61	0.00	**0.00**
30	53.93	0.54	0.54	0.00	**0.00**
35	48.52	0.49	0.49	0.00	**0.00**
40	44.18	0.44	0.44	0.00	**0.00**
45	40.63	0.41	0.41	0.00	**0.00**
50	37.65	0.38	0.38	0.00	**0.00**
55	35.12	0.35	0.35	0.00	**0.00**
60	32.94	0.33	0.33	0.00	**0.00**

Storage: e Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 56.12 m
T/G Elevation 57.92 m
Max Ponding Depth 0.02 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	57.94	1.82	1.41	0.00	0.04	OK

Project #PROJECT #, PROJECT DESCRIPTION
Modified Rational Method Calculatons for Storage

Subdrainage Area: 3 Controlled - Tributary
Area (ha): 0.005
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	2.48	2.48	0.00	**0.00**
20	119.95	1.67	1.67	0.00	**0.00**
30	91.87	1.28	1.28	0.00	**0.00**
40	75.15	1.04	1.04	0.00	**0.00**
50	63.95	0.89	0.89	0.00	**0.00**
60	55.89	0.78	0.78	0.00	**0.00**
70	49.79	0.69	0.69	0.00	**0.00**
80	44.99	0.63	0.63	0.00	**0.00**
90	41.11	0.57	0.57	0.00	**0.00**
100	37.90	0.53	0.53	0.00	**0.00**
110	35.20	0.49	0.49	0.00	**0.00**
120	32.89	0.46	0.46	0.00	**0.00**

Warning, max. volume may not have been reached.

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 56.20 m
T/G Elevation 58.00 m
Max Ponding Depth 0.05 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	58.05	1.85	16.24	0.00	0.36	OK
					0.36	

Subdrainage Area: 2 Controlled - Tributary
Area (ha): 0.007
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	3.47	3.47	0.00	**0.00**
20	119.95	2.33	2.33	0.00	**0.00**
30	91.87	1.79	1.79	0.00	**0.00**
40	75.15	1.46	1.46	0.00	**0.00**
50	63.95	1.24	1.24	0.00	**0.00**
60	55.89	1.09	1.09	0.00	**0.00**
70	49.79	0.97	0.97	0.00	**0.00**
80	44.99	0.88	0.88	0.00	**0.00**
90	41.11	0.80	0.80	0.00	**0.00**
100	37.90	0.74	0.74	0.00	**0.00**
110	35.20	0.69	0.69	0.00	**0.00**
120	32.89	0.64	0.64	0.00	**0.00**

Warning, max. volume may not have been reached.

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 56.20 m
T/G Elevation 57.95 m
Max Ponding Depth 0.09 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	58.04	1.84	16.19	0.00	1.30	OK
					1.30	

Subdrainage Area: 1 Controlled - Tributary
Area (ha): 0.004
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	1.99	1.99	0.00	**0.00**
20	119.95	1.33	1.33	0.00	**0.00**
30	91.87	1.02	1.02	0.00	**0.00**
40	75.15	0.84	0.84	0.00	**0.00**
50	63.95	0.71	0.71	0.00	**0.00**
60	55.89	0.62	0.62	0.00	**0.00**
70	49.79	0.55	0.55	0.00	**0.00**
80	44.99	0.50	0.50	0.00	**0.00**
90	41.11	0.46	0.46	0.00	**0.00**
100	37.90	0.42	0.42	0.00	**0.00**
110	35.20	0.39	0.39	0.00	**0.00**
120	32.89	0.37	0.37	0.00	**0.00**

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 75.00 mm
Invert Elevation 56.12 m
T/G Elevation 57.92 m
Max Ponding Depth 0.03 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	57.95	1.83	16.15	0.00	0.04	OK
					0.04	

Stormwater Management Calculations

Project #PROJECT #, PROJECT DESCRIPTION
Modified Rational Method Calculatons for Storage

Subdrainage Area: BLDG5 Roof
Area (ha): 0.004 Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
5	141.18	1.41	0.97	0.44	**0.13**	63.1	##
10	104.19	1.04	0.88	0.17	0.10	57.1	##
15	83.56	0.84	0.77	0.07	0.06	50.1	##
20	70.25	0.70	0.67	0.04	0.05	43.3	##
25	60.90	0.61	0.59	0.02	0.03	38.2	##
30	53.93	0.54	0.53	0.01	0.03	34.2	##
35	48.52	0.49	0.48	0.01	0.02	31.0	##
40	44.18	0.44	0.44	0.01	0.01	28.4	##
45	40.63	0.41	0.40	0.00	0.01	26.2	##
50	37.65	0.38	0.37	0.00	0.01	24.4	##
55	35.12	0.35	0.35	0.00	0.01	22.8	##
60	32.94	0.33	0.33	0.00	0.01	21.4	##

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	63.11	0.06	0.97	0.13	1.60	0.00

Subdrainage Area: BLDG4 Roof
Area (ha): 0.01 Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
5	141.18	3.18	1.23	1.94	0.58	80.4	##
10	104.19	2.35	1.27	1.07	**0.64**	82.9	##
15	83.56	1.88	1.23	0.65	0.58	80.4	##
20	70.25	1.58	1.18	0.41	0.49	76.5	##
25	60.90	1.37	1.10	0.27	0.41	71.6	##
30	53.93	1.21	1.02	0.19	0.34	66.6	##
35	48.52	1.09	0.96	0.14	0.29	62.2	##
40	44.18	0.99	0.90	0.10	0.24	58.3	##
45	40.63	0.91	0.84	0.07	0.19	54.9	##
50	37.65	0.85	0.80	0.05	0.16	51.8	##
55	35.12	0.79	0.75	0.04	0.13	49.0	##
60	32.94	0.74	0.71	0.03	0.12	46.2	##

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	82.87	0.08	1.27	0.64	3.60	0.00

Subdrainage Area: BLDG3 Roof
Area (ha): 0.00 Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
5	141.18	1.06	0.84	0.22	**0.07**	54.9	##
10	104.19	0.78	0.72	0.07	0.04	46.7	##
15	83.56	0.63	0.60	0.03	0.03	38.9	##
20	70.25	0.53	0.51	0.02	0.02	33.3	##
25	60.90	0.46	0.45	0.01	0.01	29.2	##
30	53.93	0.40	0.40	0.00	0.00	0.0	##
35	48.52	0.36	0.36	0.00	0.00	0.0	##
40	44.18	0.33	0.33	0.00	0.00	0.0	##
45	40.63	0.30	0.30	0.00	0.00	0.0	##
50	37.65	0.28	0.28	0.00	0.00	0.0	##
55	35.12	0.26	0.26	0.00	0.00	0.0	##
60	32.94	0.25	0.25	0.00	0.00	0.0	##

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	54.88	0.05	0.84	0.07	1.20	0.00

Subdrainage Area: BLDG2 Roof
Area (ha): 0.01 Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
5	141.18	4.59	1.30	3.29	0.99	84.5	##
10	104.19	3.39	1.39	2.00	**1.20**	90.4	##
15	83.56	2.72	1.39	1.33	1.20	90.4	##
20	70.25	2.28	1.35	0.93	1.12	88.1	##
25	60.90	1.98	1.31	0.67	1.01	85.1	##
30	53.93	1.75	1.26	0.50	0.89	81.9	##
35	48.52	1.58	1.21	0.37	0.78	78.6	##
40	44.18	1.44	1.16	0.28	0.67	75.5	##
45	40.63	1.32	1.10	0.22	0.59	71.8	##
50	37.65	1.22	1.05	0.18	0.53	68.3	##
55	35.12	1.14	1.00	0.14	0.47	65.1	##
60	32.94	1.07	0.96	0.12	0.42	62.2	##

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	90.43	0.09	1.39	1.20	5.20	0.00

Project #PROJECT #, PROJECT DESCRIPTION
Modified Rational Method Calculatons for Storage

Subdrainage Area: BLDG5 Roof
Area (ha): 0.004 Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	1.99	1.38	0.61	**0.36**	89.9	0.00
20	119.95	1.33	1.16	0.17	0.21	75.6	0.00
30	91.87	1.02	0.95	0.07	0.13	61.9	0.00
40	75.15	0.84	0.81	0.03	0.07	52.4	0.00
50	63.95	0.71	0.69	0.02	0.05	45.2	0.00
60	55.89	0.62	0.61	0.01	0.04	39.7	0.00
70	49.79	0.55	0.55	0.01	0.03	35.6	0.00
80	44.99	0.50	0.50	0.00	0.02	32.3	0.00
90	41.11	0.46	0.45	0.00	0.02	29.6	0.00
100	37.90	0.42	0.42	0.00	0.01	27.3	0.00
110	35.20	0.39	0.39	0.00	0.01	25.4	0.00
120	32.89	0.37	0.36	0.00	0.01	23.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	89.90	0.09	1.38	0.36	1.60	0.00

Subdrainage Area: BLDG4 Roof
Area (ha): 0.01 Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	4.47	1.75	2.72	**1.63**	113.9	0.00
20	119.95	3.00	1.72	1.29	1.54	111.7	0.00
30	91.87	2.30	1.60	0.69	1.25	104.5	0.00
40	75.15	1.88	1.48	0.40	0.97	96.1	0.00
50	63.95	1.60	1.35	0.25	0.76	87.6	0.00
60	55.89	1.40	1.24	0.16	0.58	80.5	0.00
70	49.79	1.25	1.14	0.10	0.44	74.3	0.00
80	44.99	1.13	1.05	0.08	0.37	68.3	0.00
90	41.11	1.03	0.97	0.06	0.30	63.3	0.00
100	37.90	0.95	0.91	0.04	0.25	59.0	0.00
110	35.20	0.88	0.85	0.03	0.20	55.4	0.00
120	32.89	0.82	0.80	0.02	0.16	52.1	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	113.88	0.11	1.75	1.63	3.60	0.00

Subdrainage Area: BLDG3 Roof
Area (ha): 0.00 Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	1.49	1.20	0.29	**0.17**	78.0	0.00
20	119.95	1.00	0.93	0.07	0.09	60.3	0.00
30	91.87	0.77	0.74	0.02	0.04	48.4	0.00
40	75.15	0.63	0.61	0.01	0.03	40.0	0.00
50	63.95	0.53	0.53	0.01	0.02	34.3	0.00
60	55.89	0.47	0.47	0.00	0.00	0.0	-0.47
70	49.79	0.42	0.42	0.00	0.00	0.0	-0.42
80	44.99	0.38	0.38	0.00	0.00	0.0	-0.38
90	41.11	0.34	0.34	0.00	0.00	0.0	-0.34
100	37.90	0.32	0.32	0.00	0.00	0.0	-0.32
110	35.20	0.29	0.29	0.00	0.00	0.0	-0.29
120	32.89	0.27	0.27	0.00	0.00	0.0	-0.27

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	78.00	0.08	1.20	0.17	1.20	0.00

Subdrainage Area: BLDG2 Roof
Area (ha): 0.01 Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	6.45	1.85	4.60	2.76	120.7	0.00
20	119.95	4.34	1.90	2.44	**2.92**	123.6	0.00
30	91.87	3.32	1.83	1.49	2.68	119.3	0.00
40	75.15	2.72	1.74	0.97	2.33	113.5	0.00
50	63.95	2.31	1.65	0.66	1.98	107.5	0.00
60	55.89	2.02	1.56	0.46	1.64	101.8	0.00
70	49.79	1.80	1.47	0.33	1.39	95.7	0.00
80	44.99	1.63	1.38	0.25	1.18	89.9	0.00
90	41.11	1.49	1.30	0.18	1.00	84.7	0.00
100	37.90	1.37	1.23	0.14	0.83	80.1	0.00
110	35.20	1.27	1.17	0.10	0.69	76.0	0.00
120	32.89	1.19	1.11	0.08	0.60	72.0	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	123.56	0.12	1.90	2.92	5.20	0.00

Stormwater Management Calculations

Project #PROJECT #, PROJECT DESCRIPTION
Modified Rational Method Calculatons for Storage

Subdrainage Area: BLDG1 — Roof
Area (ha): 0.06 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
5	141.18	21.19	4.06	17.14	5.14	88.0	##
10	104.19	15.64	4.49	11.15	6.69	97.4	##
15	83.56	12.54	4.61	7.93	**7.14**	100.1	##
20	70.25	10.55	4.61	5.94	7.12	100.0	##
25	60.90	9.14	4.55	4.59	6.89	98.7	##
30	53.93	8.10	4.45	3.64	6.56	96.6	##
35	48.52	7.28	4.34	2.94	6.17	94.3	##
40	44.18	6.63	4.23	2.40	5.77	91.8	##
45	40.63	6.10	4.12	1.98	5.35	89.3	##
50	37.65	5.65	4.00	1.65	4.95	86.9	##
55	35.12	5.27	3.89	1.38	4.56	84.5	##
60	32.94	4.95	3.79	1.16	4.18	82.2	##

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	100.10	0.10	4.61	7.14	24.00	0.00

Cistern calculations 0.00

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	17.59	11.00	6.59	1.98
10	104.19	15.52	11.00	4.52	2.71
15	83.56	14.04	11.00	3.04	2.73
20	70.25	12.89	11.00	1.89	2.26
25	60.90	11.95	11.00	0.95	1.43
30	53.93	11.17	11.00	0.17	0.31
35	48.52	10.50	11.00	0.00	**0.00**
40	44.18	9.93	11.00	0.00	**0.00**
45	40.63	9.41	11.00	0.00	**0.00**
50	37.65	8.95	11.00	0.00	**0.00**
55	35.12	8.54	11.00	0.00	**0.00**
60	32.94	8.17	11.00	0.00	**0.00**

Storage: e Above CB

Orifice Equation: CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 68.00 mm
Invert Elevation 0.00 m
T/G Elevation 0.75 m
Max Ponding Depth 0.00 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	0.75	0.75	11.00	2.73	0.00	Adjust ICD

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	0.115 ha			
Total 5yr Flow to Sewer	11 L/s	0	0 m^3	Ok
Non-Tributary Area	0.018 ha			
Total 5yr Flow Uncontrolled	5 L/s			
Total Area	0.133 ha			
Total 5yr Flow	16 L/s			
Target	19 L/s			

Project #PROJECT #, PROJECT DESCRIPTION
Modified Rational Method Calculatons for Storage

Subdrainage Area: BLDG1 — Roof
Area (ha): 0.06 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	29.78	5.82	23.97	14.38	126.2	0.00
20	119.95	20.01	6.08	13.93	**16.71**	132.0	0.00
30	91.87	15.32	6.07	9.25	16.65	131.8	0.00
40	75.15	12.53	5.97	6.56	15.75	129.6	0.00
50	63.95	10.67	5.83	4.84	14.51	126.5	0.00
60	55.89	9.32	5.65	3.68	13.23	122.6	0.00
70	49.79	8.30	5.44	2.86	12.02	118.1	0.00
80	44.99	7.50	5.24	2.26	10.85	113.8	0.00
90	41.11	6.86	5.05	1.80	9.74	109.7	0.00
100	37.90	6.32	4.88	1.45	8.68	105.8	0.00
110	35.20	5.87	4.71	1.17	7.69	102.1	0.00
120	32.89	5.49	4.54	0.95	6.85	98.4	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	131.98	0.13	6.08	16.71	24.00	0.00

Cistern calculations 0.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	24.90	11.00	13.90	8.34
20	119.95	20.45	11.00	9.45	11.34
30	91.87	17.85	11.00	6.85	12.32
40	75.15	16.04	11.00	5.04	12.10
50	63.95	14.67	11.00	3.67	11.02
60	55.89	13.56	11.00	2.56	9.23
70	49.79	12.61	11.00	1.61	6.78
80	44.99	11.80	11.00	0.80	3.82
90	41.11	11.10	11.00	0.10	0.52
100	37.90	10.49	11.00	0.00	**0.00**
110	35.20	9.95	11.00	0.00	**0.00**
120	32.89	9.46	11.00	0.00	**0.00**

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 68.00 mm
Invert Elevation 0.00 m
T/G Elevation 1.50 m
Max Ponding Depth 0.00 m
Downstream W/L 0.00 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	1.50	1.50	11.00	12.32	0.00	Adjust ICD
					-12.32	

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	0.115 ha			
Total 100yr Flow to Sewer	11 L/s	0	0 m^3	Ok
Non-Tributary Area	0.018 ha			
Total 100yr Flow Uncontrolled	8 L/s			
Total Area	0.133 ha			
Total 100yr Flow	19 L/s			
Target	19 L/s			

Project #PROJECT #, PROJECT DESCRIPTION
Roof Drain Design Sheet, Area BLDG1
Standard Zurn Model Z-105-5 Control-Flo Single Notch Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0004	0.0012	0	0.025	13	0	0	0.025
0.050	0.0008	0.0023	1	0.050	53	1	1	0.050
0.075	0.0012	0.0035	3	0.075	120	2	3	0.075
0.100	0.0015	0.0046	7	0.100	213	4	7	0.100
0.125	0.0019	0.0058	14	0.125	333	7	14	0.125
0.150	0.0023	0.0069	24	0.150	480	10	24	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.8	337.6	0.8	0.09377
2.9	610.9	2.1	0.26345
7.0	892.2	4.1	0.51128
13.8	1176.7	6.8	0.83814
23.9	1462.8	10.1	1.24448

Rooftop Storage Summary

Total Building Area (sq.m)		600
Assume Available Roof Area (sq.	80%	480
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		3
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		24
Estimated 100 Year Drawdown Time (h)		1.0

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Zurn Drain Catalogue

Head (m)	L/min	L/s	Notch Rating
0.051	45.5	0.00076	232

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.005	0.006	-
Depth (m)	0.100	0.132	0.150
Volume (cu.m)	7.1	16.7	24.0
Draintime (hrs)	0.5	1.0	

Project #PROJECT #, PROJECT DESCRIPTION
Roof Drain Design Sheet, Area BLDG2
Standard Zurn Model Z-105-5 Control-Flo Single Notch Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0004	0.0004	0	0.025	3	0	0	0.025
0.050	0.0008	0.0008	0	0.050	12	0	0	0.050
0.075	0.0012	0.0012	1	0.075	26	0	1	0.075
0.100	0.0015	0.0015	2	0.100	46	1	2	0.100
0.125	0.0019	0.0019	3	0.125	72	1	3	0.125
0.150	0.0023	0.0023	5	0.150	104	2	5	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.2	219.4	0.2	0.06095
0.6	397.1	0.5	0.17124
1.5	579.9	0.9	0.33233
3.0	764.9	1.5	0.54479
5.2	950.8	2.2	0.80891

Rooftop Storage Summary

Total Building Area (sq.m)		130
Assume Available Roof Area (sq.	80%	104
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		1
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		5
Estimated 100 Year Drawdown Time (h)		0.5

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Zurn Drain Catalogue

Head (m)	L/min	L/s	Notch Rating
0.051	45.5	0.00076	232

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.001	0.002	-
Depth (m)	0.090	0.124	0.150
Volume (cu.m)	1.2	2.9	5.2
Draintime (hrs)	0.3	0.5	

Project #PROJECT #, PROJECT DESCRIPTION
Roof Drain Design Sheet, Area BLDG3
Standard Zurn Model Z-105-5 Control-Flo Single Notch Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0.00	0.000	0	0	0	0.000
0.025	0.0004	0.0004	0.01	0.025	1	0	0	0.025
0.050	0.0008	0.0008	0.04	0.050	3	0	0	0.050
0.075	0.0012	0.0012	0.15	0.075	6	0	0	0.075
0.100	0.0015	0.0015	0.36	0.100	11	0	0	0.100
0.125	0.0019	0.0019	0.69	0.125	17	0	1	0.125
0.150	0.0023	0.0023	1.20	0.150	24	1	1	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.0	50.6	0.0	0.01407
0.1	91.6	0.1	0.03952
0.4	133.8	0.2	0.07669
0.7	176.5	0.3	0.12572
1.2	219.4	0.5	0.18667

Rooftop Storage Summary

Total Building Area (sq.m)		30
Assume Available Roof Area (sq.	80%	24
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		1
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		1
Estimated 100 Year Drawdown Time (h)		0.0

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Zurn Drain Catalogue

Head (m)	L/min	L/s	Notch Rating
0.051	45.5	0.00076	232

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.001	0.001	-
Depth (m)	0.055	0.078	0.150
Volume (cu.m)	0.1	0.2	1.2
Draintime (hrs)	0.0	0.0	

Project #PROJECT #, PROJECT DESCRIPTION
Roof Drain Design Sheet, Area BLDG4
Standard Zurn Model Z-105-5 Control-Flo Single Notch Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0004	0.0004	0	0.025	2	0	0	0.025
0.050	0.0008	0.0008	0	0.050	8	0	0	0.050
0.075	0.0012	0.0012	0	0.075	18	0	0	0.075
0.100	0.0015	0.0015	1	0.100	32	1	1	0.100
0.125	0.0019	0.0019	2	0.125	50	1	2	0.125
0.150	0.0023	0.0023	4	0.150	72	2	4	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.1	151.9	0.1	0.0422
0.4	274.9	0.3	0.11855
1.1	401.5	0.6	0.23007
2.1	529.5	1.0	0.37716
3.6	658.3	1.5	0.56002

Rooftop Storage Summary

Total Building Area (sq.m)		90
Assume Available Roof Area (sq.	80%	72
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		1
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		4
Estimated 100 Year Drawdown Time (h)		0.3

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Zurn Drain Catalogue

Head (m)	L/min	L/s	Notch Rating
0.051	45.5	0.00076	232

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.001	0.002	-
Depth (m)	0.083	0.114	0.150
Volume (cu.m)	0.6	1.6	3.6
Draintime (hrs)	0.2	0.3	

Project #PROJECT #, PROJECT DESCRIPTION
Roof Drain Design Sheet, Area BLDG5
Standard Zurn Model Z-105-5 Control-Flo Single Notch Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0004	0.0004	0	0.025	1	0	0	0.025
0.050	0.0008	0.0008	0	0.050	4	0	0	0.050
0.075	0.0012	0.0012	0	0.075	8	0	0	0.075
0.100	0.0015	0.0015	0	0.100	14	0	0	0.100
0.125	0.0019	0.0019	1	0.125	22	0	1	0.125
0.150	0.0023	0.0023	2	0.150	32	1	2	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.1	67.5	0.1	0.01875
0.2	122.2	0.1	0.05269
0.5	178.4	0.3	0.10226
0.9	235.3	0.5	0.16763
1.6	292.6	0.7	0.2489

Rooftop Storage Summary

Total Building Area (sq.m)		40
Assume Available Roof Area (sq.	80%	32
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		1
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		2
Estimated 100 Year Drawdown Time (h)		0.1

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Zurn Drain Catalogue

Head (m)	L/min	L/s	Notch Rating
0.051	45.5	0.00076	232

Calculation Results

	5yr	100yr	Available
Qresult (cu.m/s)	0.001	0.001	-
Depth (m)	0.063	0.090	0.150
Volume (cu.m)	0.1	0.4	1.6
Draintime (hrs)	0.0	0.1	

ZURN CONTROL-FLO

ROOF DRAINAGE SYSTEM

ZURN | a step ahead of tomorrow

Control-Flo...Today's Successful Answer to More

THE ZURN "CONTROL-FLO CONCEPT"

Originally, Zurn introduced the scientifically-advanced "Control-Flo" drainage principle for dead-level roofs. Today, after thousands of successful applications in modern, large dead-level roof areas, Zurn engineers have adapted the comprehensive "Control-Flo" data to **sloped roof** areas.

WHAT IS "CONTROL-FLO"?

It is an advanced method of removing rain water off dead-level or sloped roofs. As contrasted with conventional drainage practices, which attempt to drain off storm water as quickly as it falls on the roof's surface, "Control-Flo" drains the roof at a controlled rate. Excess water accumulates on the roof under controlled conditions . . . then drains off at a lower rate after a storm abates.

CUTS DRAINAGE COSTS

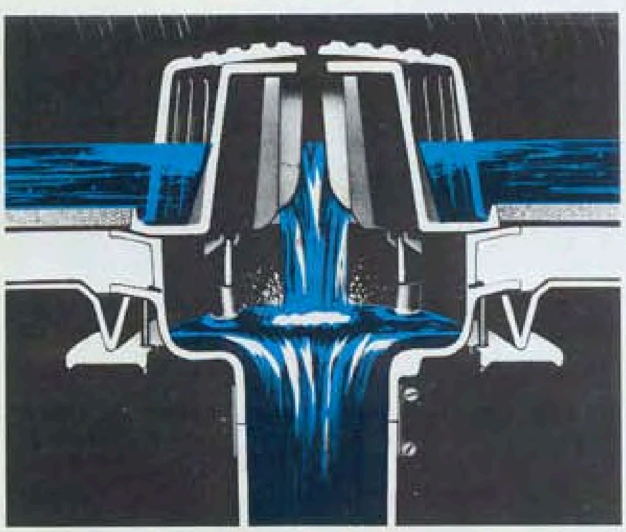
Fewer roof drains, smaller diameter piping, smaller sewer sizes, and lower installation costs are possible with a "Control-Flo" drainage system because roof areas are utilized as temporary storage reservoirs.

REDUCES PROBABILITY OF STORM DAMAGE

Lightens load on combination sewers by reducing rate of water drained from roof tops during severe storms thereby reducing probability of flooded sewers, and consequent backflow into basements and other low areas.

THANKS TO EXCLUSIVE ZURN "AQUA-WEIR" ACTION

Key to successful "Control-Flo" drainage is a unique, scientifically-designed weir containing accurately calibrated notches with sides formed by parabolic curves which provide flow rates directly proportional to the head. Shape and size of notches are based on predetermined flow rates, and all factors involved in roof drainage to assure permanent regulation of drainage flow rates for specific geographic locations and rainfall intensities.

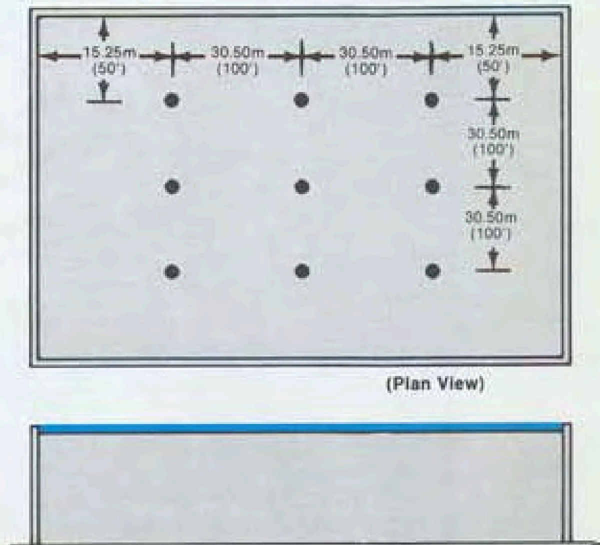


DEFINITION

DEAD LEVEL ROOFS

DIAGRAM "A"

A dead-level roof for purposes of applying the Zurn "Control-Flo" drainage principle is one which has been designed for zero slope across its entire surface. Measurements shown are for maximum distances.



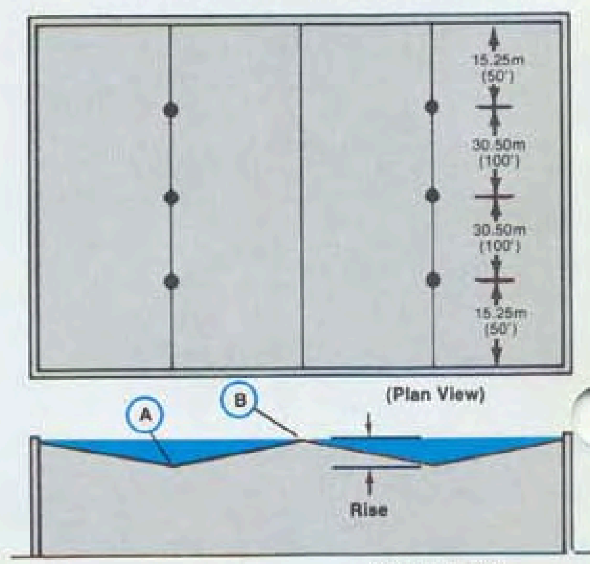
SLOPED ROOFS

DIAGRAM "B"

A sloped roof is one designed commonly with a shallow slope. The Zurn "Control-Flo" drainage system can be applied to any slope which results in a total rise up to 152mm(6").

The total rise of a roof as calculated for "Control-Flo" application is defined as the vertical increase in height in inches, from the low point or valley of a sloping roof (A) to the top of the sloping section (B). (Example: a roof that slopes 3mm(1/8") per foot having a 7.25m(24') span would have a rise of 7.25m x 3mm or 76mm (24' x 1/8" or 3")).

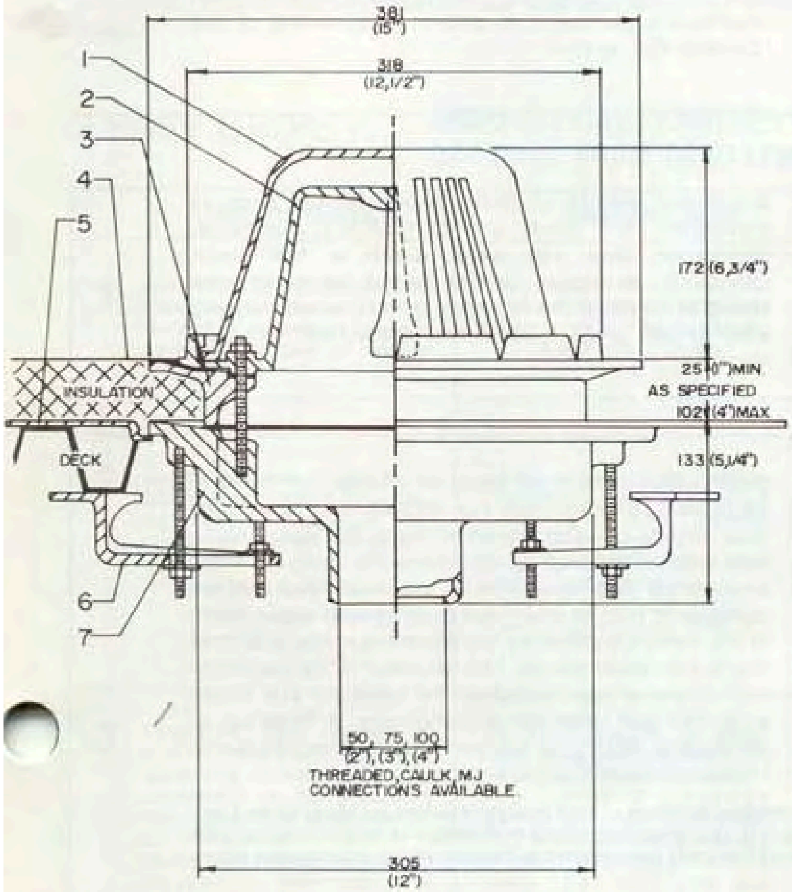
Measurements shown are for maximum distances.



Dimensions and other measurements given in metric and imperial forms.

Economical Roof Drainage Installations

SPECIFICATION DATA



PART	DESCRIPTION
1	— POLY-DOME
2	— CONTROL FLO WEIR WITH INTEGRAL CLAMP COLLAR AND GRAVEL GUARD
3	— E-EXTENSION WITH GASKET (WHEN SPECIFIED)
4	— ROOFING MEMBRANE(BY OTHERS)
5	— R-ROOF SUMP RECEIVER(WHEN SPECIFIED)
6	— C-UNDERDECK CLAMP(WHEN SPECIFIED)
7	— BODY

Z-105-5-ERC "Control-Flo" Dura-Coated Cast Iron Body, Aluminum Parabolic Weir With Integral Clamping Collar And Gravel Guard, Poly Dome. Extension, Roof Sump Receiver, Under Deck Clamp, Aluminum Dome Available When Specified.

ROOF DESIGN RECOMMENDATIONS

Basic roofing design should incorporate protection that will prevent roof overloading by installing adequate overflow scuppers in parapet walls.

GENERAL INFORMATION

The "Control-Flo" roof drainage data is tabulated for four areas (232.25m²(2500 sq. ft.), 464.50m²(5000 sq. ft.), 696.75m²(7500 sq. ft.), 929m²(10,000 sq. ft.) notch areas ratings) for each locality. For each notch area rating the maximum discharge in L.P.M.(G.P.M.) — draindown in hours, and maximum water depth at the drain in inches for a dead level roof — 51mm(2 inch) rise — 102mm(4 inch) rise and 152mm(6 inch) rise — are tabulated. The rise is the total change in elevation from the valley to the peak. Values for areas, rise or combination thereof other than those listed, can be arrived at by extrapolation. All data listed is based on the fifty-year return frequency storm. In other words the maximum conditions as listed will occur on the average of once every fifty years.

NOTE: The tabulated "Control-Flo" data enables the individual engineer to select his own design limiting condition. The limiting condition can be draindown time, roof load factor, or maximum water depth at the drain. If draindown time is the limiting factor because of possible freezing conditions, it must be recognized that the maximum time listed will occur on the average of once every 50 years and would most likely be during a heavy summer thunder storm. Average winter drain down times would be much shorter in duration than those listed.

GENERAL RECOMMENDATIONS

On sloping roofs, we recommend a design depth referred to as an equivalent depth. An equivalent depth is the depth of water attained at the drains that results in the same roof stresses as those realized on a dead-level roof. In all cases this equivalent depth is almost equal to that attained by using the same notch area rating for the different rises to 152mm(6"). With the same depth of water at the drain the roof stresses will decrease with increasing total rise. Therefore, it would be possible to have a depth in excess of 152mm(6") at the drain on a sloping roof without exceeding stresses normally encountered in a 152mm(6") depth on a dead-level roof. However, it is recommended that scuppers be placed to limit the maximum water depth on any roof to 152mm(6") to prevent the overflow of the weirs on the drains and consequent overloading of drain piping. In the few cases where the data shows a flow rate in excess of 136 L.P.M.(30 G.P.M.) if all drains and drain lines are sized according to recommendations, and the one storm in fifty years occurs, the only consequence will be a brief flow through the scuppers or over-flow drains.

NOTE: An equivalent depth is that depth of water attained at the drains at the lowest line or valley of the roof with all other conditions such as notch area and rainfall intensity being equal. For Toronto, Ontario a notch area rating of 464.50m²(5,000 square feet) results in a 74mm(2.9 inch) depth on a dead level roof for a 50-year storm. For the same notch area and conditions, equivalent depths for a 51mm(2"), 102mm(4") and 152mm(6") rise respectively on a sloped roof would be 86mm(3.4"), 104mm(4.1") and 124mm(4.9"). Roof stresses will be approximately equal in all cases.

ZURN Control-Flo Drain Selection is Quick and Easy . . .

The exclusive Zurn "Selecta-Drain" Chart (pages 8, 9, 10, 11) tabulates selection data for 34 localities in Canada. Proper use of this chart consitutes your best assurance of sure, safe, economical application of Zurn "Control-Flo" systems for your specific geographical area. If the "Selecta-Drain" Chart does not cover your specific design criteria, contact Zurn Drainage and Control Systems Ltd., Weston, Ontario, for additional data for your locality. Listed below is additional information pertinent to proper engineering of the "Control-Flo" system.

ROOF USED AS TEMPORARY RETENTION

The key to economical "Control-Flo" is the utilization of large roof areas to temporarily store the maximum amount of water without overloading average roofs or creating excessive draindown time during periods of heavy rainfall. The data shown in the "Selecta-Drain" Chart enables the engineer to select notch area ratings from 232.25m²(2,500 ft.²) to 929m²(10,000 ft.²) and to accurately predict all other design factors such as maximum roof load, L.P.M. (G.P.M.) discharge, draindown time and water depth at the drain. Obviously, as design factors permit the notch area rating to increase the resulting money saved in being able to use small leaders and drain lines will also increase.

ROOF LOADING AND RUN-OFF RATES

The four values listed in the "Selecta-Drain" Chart for notch area ratings for different localities will normally span the range of good design. If areas per notch below 232.25m²(2,500 ft.²) are used considerable economy of the "Control-Flo" concept is being lost. The area per notch is limited to 929m²(10,000 square feet) to keep the draindown time within reasonable limits. Extensive studies show that stresses due to water load on a sloping roof for any fixed set of conditions are very nearly the same as those on a dead-level roof. A sloping roof tends to concentrate more water in the valleys and increase the water depth at this point. The greater depth around the drain leads to a faster run-off rate, particularly a faster early run-off rate. As a result, the total volume of water stored on the roof is less, and the total load on the sloping roof is less. By using the same area on the sloping roof as on the dead-level roof the increase in roof stresses due to increased water depth in the valleys is offset by the decrease in the total load due to less water stored. The net result is the maximum roof stress is approximately the same for any single span rise and fixed set of conditions. A fixed set of conditions, would be the same notch area, the same frequency storm, and the same locality.

SPECIAL CONSIDERATIONS FOR STRUCTURAL SAFETY: Normal practice of roof design is based on 18kg(40 lbs.) per 929cm²(square ft.) (subject to local codes and by-laws.) Thus it is extremely important that design is in accordance with normal load factors so deflection will be slight enough in any bay to prevent progressive deflection which could cause water depths to load the roof beyond its design limits.

ADDITIONAL NOTCH RATINGS

The "Selecta-Drain" Chart along with Tables I and II enables the engineer to select "Control-Flo" Drains and drain pipe sizes for most Canadian applications. These calculations are computed for a proportional flow weir that is sized to give a flow of 23 L.P.M. (5 G.P.M.) per inch of head. The 23 L.P.M. (5 G.P.M.) per inch of head, notch opening, is selected as the basis of design as it offers the most economical installation as applied to actual rainfall experienced in Canada.

Should you require design criteria for locations outside of Canada, or for special project applications please contact Zurn Drainage and Control Systems Ltd., Weston, Ontario.

LEADER AND DRAIN PIPE SIZING

Since all data in the "Selecta-Drain" Chart is based on the 50-year storm it is possible to exceed the water depth listed in these charts if a 100-year or 1000-year storm would occur. Therefore, for good design it is recommended that scuppers or other methods be used to limit water depth to the design depth and tables I and II be used to size the leaders and drain pipes. If the roof is capable of supporting more water than the design depth it is permissible to locate the scuppers or other overflow means at a height that will allow a greater water depth on the roof. However, in this case the leader and drain pipes should be sized to handle the higher flow rates possible based on a flow rate of 23 L.P.M. (5 G.P.M.) per inch of depth at the drain.

PROPER DRAIN LOCATION

The following good design practice is recommended for selecting the proper number of "Control-Flo" drains for a given area. **On dead-level roofs,** drains should be located no further than 15.25m(50 feet) from edge of roof and no further than 30.50m(100 feet) between drains. See diagram "A" page 2. **On sloping roofs,** drains should be located in the valleys at a distance no greater than 15.25m(50 feet) from each end of the valleys and no further than 30.50m(100 feet) between drains. See diagram "B" page 2. Compliance with these recommendations will assure good run off regardless of wind direction.

Saves Specification Time, Assures Proper Application

QUICK, EASY SELECTION

Using the "Selecta-Drain" Chart (pages 8, 9, 10, 11) in combination with the steps and examples appearing below, should save you countless hours in engineering specification time. This vast compilation of data is related to the proper selection of drains for 34 cities. All cities in alphabetical order by Provinces. If a specific city does not appear in this tabulation, choose the city nearest your area and select the proper drain using these factors.

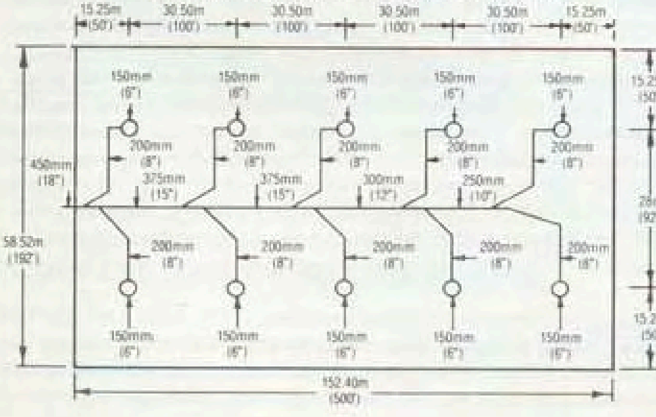
3 EASY STEPS ... AND 3 TYPICAL EXAMPLES FOR APPLICATION OF SURE, SCIENTIFIC CONTROL OF DRAINAGE FROM DEAD-LEVEL AND SLOPING ROOFS WITH THE ZURN CONCEPT

TORONTO, ONTARIO	DEAD-LEVEL ROOF	102mm(4 INCH) SLOPE	152mm(6 INCH) SLOPE
1 Determine total roof area or individual areas when roof is divided by expansion joints or peaks in the case of sloping roof.	Roof Area: 58.52m x 152.40m = 8918.40m² (192ft x 500ft = 96,000 sq.ft.) (See Z-105-5 layout bottom this page.)	3 Individual Roof Areas: 19.50m x 152.40m = 2972.80m² (64ft. x 500ft. = 32,000 sq.ft.) Valleys 152.40m(500 ft.) long 3 x 2972.80 = 8918.40m² (3 x 32,000 = 96,000 sq.ft.)	2 Individual Roof Areas: 29.87m x 152.40m = 4552m² (98 ft. x 500 ft. = 49,000 sq. ft.) Valleys 152.40m (500 ft.) long 2 x 4552 = 9104m² (2 x 49,000 = 98,000 sq.ft.)
2 Divide roof area or individual areas by Zurn Notch Area Rating selected to obtain the total number of notches required.	Zurn Notch Area Rating selected for Toronto=464.50m² (5,000 sq.ft.) from "Selecta-Drain" Chart, page 11. Total Roof Area= 8918.40m² (96,000 sq.ft.) Entire roof. 464.50m² (5,000 sq.ft.) notch area = 19.2 notches - USE 20	Zurn Notch Area Rating selected for Toronto=464.50m² (5,000 sq.ft.) from "Selecta-Drain" Chart, page 11. Total Roof Area=2972.80m² (32,000 sq.ft.) Each area. 464.50m² (5,000 sq.ft.) notch area = 6.4 notches - USE 7 PER AREA	Zurn Notch Area Rating selected for Toronto=464.50m² (5,000 sq.ft.) from "Selecta-Drain" Chart, page 11. Total Roof Area=4552m² (49,000 sq.ft.) Each area. 464.50m² (5,000 sq.ft.) notch area = 9.8 notches - USE 10 PER AREA
3 Determine total number of drains required by not exceeding maximum spacing dimensions in the preceding instructions. See Diagrams "A" or "B", page 2. Divide total number of notches required to determine the number of notches per drain. Note maximum water depth at drain and use this dimension to determine scupper height. Maximum scupper height to be used is 152mm(6"). *Use this flow rate to size leaders and drain lines.*	*10 drains required. All drains must have two notches each for a total of 20 notches. Flow rate is 66 L.P.M.(14.5 G.P.M.) per notch. Size leaders for 2 notch weirs for a flow rate of 66 L.P.M. (14.5 G.P.M.) 50mm (Two inch) pipe size leaders required. Maximum water depth and scupper height is 74 mm (2.9 inches). Requires 19 hrs. draindown time max. For drain, vertical, and horizontal pipe sizing data see Tables I and II on pages 6 and 7.	**5 drains per area required located in the valleys 15.25m(50 ft.) from each end with 3 in the middle at 30.50m(100ft.) spacings. Two drains on ends with two notches—3 drains in middle one notch each for a total of 7 notches. Maximum flow rate 93 L.P.M. (20.5 G.P.M.) per notch. Leader size 50mm(2") for single notch weirs—75mm(3") notch weirs. Maximum water depth and scupper height is 104mm(4.1 inches). Requires 11 hrs. draindown time max. For drain, vertical, and horizontal pipe sizing data see Tables I and II on pages 6 and 7.	**5 drains per area required located in the valleys 15.25m(50 ft.) from each end with 3 at 30.50m(100 ft.) spacing in the middle. 10 notches are required therefore all drains must have two notches. Flow rate is 111 L.P.M. (24.5 G.P.M.) per notch. Size all leaders for 2 notch weirs. 75mm(3 inch) pipe size required. Maximum water depth and scupper height is 124mm (4.9 inches). Requires 9 hrs. draindown time max. For drain, vertical, and horizontal pipe sizing data see Tables I and II on pages 6 and 7.

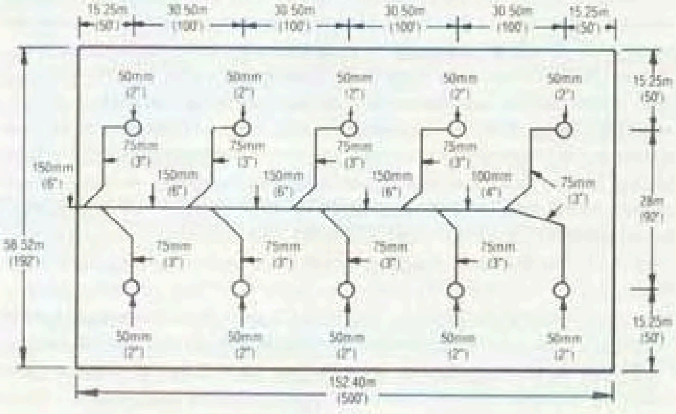
*See Diagram "A" page 2 for recommended drain placement.
**See Diagram "B" page 2 for recommended drain placement.

DEAD LEVEL ROOF
6mm(1/4") PER FT. SLOPE STORM DRAIN

CONVENTIONAL — "UNCONTROLLED" — RUN OFF



Z-105-5 "CONTROL-FLO" — RUN OFF



ZURN Select The Proper Vertical Drain Leaders

ROOF DRAINAGE DATA

The flow rate for any design condition can be easily read from the data contained on the following pages; the tabulations shown below (and on the opposite page) can be used to simplify selection of drain line sizes.

TABLE 1 —SUGGESTED RELATION OF DRAIN OUTLET AND VERTICAL LEADER SIZE TO ZURN CONTROL-FLO ROOF DRAINS (BASED ON NATIONAL PLUMBING CODE ASA-A40.8 DATA ON VERTICAL LEADERS).

No. of Notches in Drain	Max. Flow per Notch in L.P.M. (G.P.M.)		
	Pipe Size		
	50mm (2")	75mm (3")	100mm (4")
1	136* (30*)	—	—
2	68 (15)	136* (30*)	—
3	45 (10)	136* (30*)	—
4	—	105 (23)	136* (30*)
5	—	82 (18)	136* (30*)
6	—	68 (15)	136* (30*)

*Maximum flow obtainable from 1 notch with 152mm(six inch) water depth at drain.

Table 1 should be used to select **vertical drain** leaders which at the same time establishes the drain outlet size. This table illustrates the maximum flow per notch in L.P.M. (G.P.M.) Since the Z-105-5 drain is available with a minimum of one and a maximum of six notches, calculations have already been made and are listed in this table for any quantity of weir notch openings established in your design. It was determined ten drains with two notches each weir would be required in Dead-Level Roof example on page 5. A 66 L.P.M. (14.5 G.P.M.) discharge per notch flow rate was also established.

Once this design criteria has been determined it will be the key to the proper selection of all drain outlet sizes, vertical and horizontal storm drain sizes in Table I and II. Enter the column "Number of Notches in Drain", Table I, read down the column to the figure 2 which indicates two notches in weir, then read across until you reach a figure equal to or closest figure in excess of 66 L.P.M. (14.5 G.P.M.) You will find fifteen in the column under 50mm(2") which represents the pipe size. Therefore all drain outlets and vertical leaders are 50mm(2") size.

Let us digress for a moment assuming a specific structure requires a total of six drains each containing a weir with a different number of notches. One with 1, one with 2, etc. Table 1 discloses the pipe size for one notch is 50mm(2"), two notch is 50mm(2"), three notch is 75mm(3"), four notch is 75mm(3"), five notch is 75mm(3") and six notch is 75mm(3") as they all equal or closely exceed the 66 L.P.M. (14.5 G.P.M.) design.

NOTE: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

Table II should be used to select **horizontal** storm drain piping. Use the same flow rate 66 L.P.M. (14.5 G.P.M.) used to establish the vertical leaders to size the storm drainage system and main storm drain. Let us assume the ten drains each with two notch weirs were actually on the roof in two separate lines of five drains each and joined at a common point before leaving the building. Since Table II includes 3mm(1/8"), 6mm(¼") and 13mm(½") per foot slope, **let us use 6mm(¼") as our basis for selection** which will take us to the centre section. Starting with the first of five drains we enter the extreme left column in Table II and read down to the figure 2 since this drain has two notches in weir, read across horizontally and the size of first section of horizontal storm drain is 75mm(3") between 1st and 2nd drain, return to left hand column proceed reading down until you reach figure 4 then read across horizontally and the pipe size will be 100mm(4") between 2nd and 3rd drain, 100mm(4") between 3rd and 4th and 125mm(5") (if available) between 4th and 5th. If not available use 150mm(6"). (You may be tempted to use 100m(4") since the capacity is close. We recommend you go to the larger size.) Pipe size leaving 5th drain would be 150mm(6"). The same sizing would hold true for the second line of five drains. Since both columns of five drains each are being joined together before leaving the building there will be a total of twenty notches discharging into the main building storm sewer. Enter left hand column Table II, read down until you reach the figure twenty, then read across horizontally to the 6mm(¼") per 305mm(foot) slope column and you will see a 150mm(6") storm drain will handle the job adequately. The same procedure should be followed for sloped roof installations. The above method of sizing was done to better acquaint you with Table II and its use. The more economical and practical way of laying out and installing this same job is illustrated in the control-flo layout shown on bottom of page 5.

NOTE: Although pipe size calculations should be based on accumulated flow rates, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

Select Proper Horizontal Storm Drain Piping

TABLE II —SUGGESTED RELATION OF HORIZONTAL STORM DRAIN SIZE TO ZURN CONTROL-FLO ROOF DRAINAGE

MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.) — Storm Drain Size 3mm(1/8") per 305mm(ft.) slope

Total No. of Notches Discharging to Storm Drain	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")	375 (15")
1	136*(30*)	—	—	—	—	—	—	—
2	77(17)	136*(30*)	—	—	—	—	—	—
3	50(11)	118(26)	136*(30*)	—	—	—	—	—
4	36(8)	86(19)	136*(30*)	—	—	—	—	—
5	—	68(15)	127*(28*)	136*(30*)	—	—	—	—
6	—	59(13)	105(23)	136*(30*)	—	—	—	—
7	—	50(11)	91(20)	136*(30*)	—	—	—	—
8	—	—	77(17)	127(28)	136*(30*)	—	—	—
9	—	—	68(15)	114(25)	136*(30*)	—	—	—
10	—	—	64(14)	100(22)	136*(30*)	—	—	—
11	—	—	55(12)	91(20)	136*(30*)	—	—	—
12	—	—	—	82(18)	136*(30*)	—	—	—
13	—	—	—	77(17)	136*(30*)	—	—	—
14	—	—	—	73(16)	136*(30*)	—	—	—
15	—	—	—	68(15)	136*(30*)	—	—	—
16	—	—	—	64(14)	136*(30*)	—	—	—
17	—	—	—	59(13)	127(28)	136*(30*)	—	—
18	—	—	—	55(12)	118(26)	136*(30*)	—	—
19	—	—	—	—	114(25)	136*(30*)	—	—
20	—	—	—	—	109(24)	136*(30*)	—	—
23	—	—	—	—	91(20)	136*(30*)	—	—
25	—	—	—	—	86(19)	136*(30*)	—	—
30	—	—	—	—	73(16)	127(28)	136*(30*)	—
35	—	—	—	—	59(13)	109(24)	136*(30*)	—
40	—	—	—	—	55(12)	95(21)	136*(30*)	—
45	—	—	—	—	—	86(19)	136*(30*)	—
50	—	—	—	—	—	77(17)	123(27)	136*(30*)
55	—	—	—	—	—	68(15)	114(25)	136*(30*)
60	—	—	—	—	—	64(14)	105(23)	136*(30*)
65	—	—	—	—	—	59(13)	95(21)	136*(30*)
70	—	—	—	—	—	55(12)	91(20)	136*(30*)

MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.) — Storm Drain Size 6mm(¼") per 305mm(ft.) slope

Total No. of Notches Discharging to Storm Drain	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")
1	136*(30*)	—	—	—	—	—	—
2	109(24)	136*(30*)	—	—	—	—	—
3	73(16)	136*(30*)	—	—	—	—	—
4	55(12)	127(28)	136*(30*)	—	—	—	—
5	—	100(22)	136*(30*)	—	—	—	—
6	—	82(18)	136*(30*)	—	—	—	—
7	—	73(16)	127(28)	136*(30*)	—	—	—
8	—	64(14)	114(25)	136*(30*)	—	—	—
9	—	55(12)	100(22)	136*(30*)	—	—	—
10	—	—	91(20)	136*(30*)	—	—	—
11	—	—	82(18)	132(29)	136*(30*)	—	—
12	—	—	73(16)	118(26)	136*(30*)	—	—
13	—	—	68(15)	109(24)	136*(30*)	—	—
14	—	—	64(14)	100(22)	136*(30*)	—	—
15	—	—	59(13)	95(21)	136*(30*)	—	—
16	—	—	—	91(20)	136*(30*)	—	—
17	—	—	—	82(18)	136*(30*)	—	—
18	—	—	—	77(17)	136*(30*)	—	—
19	—	—	—	73(16)	136*(30*)	—	—
20	—	—	—	68(15)	136*(30*)	—	—
23	—	—	—	64(14)	132(29)	136*(30*)	—
25	—	—	—	59(13)	123(27)	136*(30*)	—
30	—	—	—	—	100(22)	136*(30*)	—
35	—	—	—	—	86(19)	136*(30*)	—
40	—	—	—	—	77(17)	136*(30*)	—
45	—	—	—	—	68(15)	123(27)	136*(30*)
50	—	—	—	—	59(13)	109(24)	136*(30*)
55	—	—	—	—	—	100(22)	136*(30*)
60	—	—	—	—	—	91(20)	136*(30*)
65	—	—	—	—	—	82(18)	136*(30*)
70	—	—	—	—	—	77(17)	127(28)

MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.) — Storm Drain Size 13mm(½") per 305mm(ft.) slope

Total No. of Notches Discharging to Storm Drain	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")
1	136*(30*)	—	—	—	—	—	—
2	136*(30*)	—	—	—	—	—	—
3	100(22)	136*(30*)	—	—	—	—	—
4	77(17)	136*(30*)	—	—	—	—	—
5	59(13)	136*(30*)	—	—	—	—	—
6	50(11)	118(26)	136*(30*)	—	—	—	—
7	—	100(22)	136*(30*)	—	—	—	—
8	—	86(19)	136*(30*)	—	—	—	—
9	—	77(17)	136*(30*)	—	—	—	—
10	—	68(15)	123(27)	136*(30*)	—	—	—
11	—	64(14)	114(25)	136*(30*)	—	—	—
12	—	59(13)	105(23)	136*(30*)	—	—	—
13	—	55(12)	95(21)	136*(30*)	—	—	—
14	—	—	86(19)	136*(30*)	—	—	—
15	—	—	82(18)	132(29)	136*(30*)	—	—
16	—	—	77(17)	123(27)	136*(30*)	—	—
17	—	—	73(16)	118(26)	136*(30*)	—	—
18	—	—	68(15)	109(24)	136*(30*)	—	—
19	—	—	64(14)	105(23)	136*(30*)	—	—
20	—	—	59(13)	100(22)	136*(30*)	—	—
23	—	—	55(12)	86(19)	136*(30*)	—	—
25	—	—	—	77(17)	136*(30*)	—	—
30	—	—	—	64(14)	136*(30*)	—	—
35	—	—	—	55(12)	123(27)	136*(30*)	
40	—	—	—	—	105(23)	136*(30*)	—
45	—	—	—	—	95(21)	136*(30*)	—
50	—	—	—	—	86(19)	136*(30*)	—
55	—	—	—	—	77(17)	136*(30*)	—
60	—	—	—	—	68(15)	127(28)	136*(30*)
65	—	—	—	—	64(14)	118(26)	136*(30*)
70	—	—	—	—	59(13)	109(24)	136*(30*)

*Maximum flow obtainable from 1 notch with 152mm(six inch) water depth at drain.

TABLE III —TO BE USED WHEN ROOF STORM WATER RUN OFF AND OTHER SURFACE WATER RUN OFF IS BEING CONSOLIDATED INTO ONE COMMON MAIN HORIZONTAL STORM SEWER.

Flow capacity of vertical leaders litres per minute (gallons per minute)

Pipe Size	Maximum Capacity L.P.M.(G.P.M.)
50mm(2")	136(30)
75mm(3")	409(90)
100mm(4")	864(190)
†125mm(5")	1582(348)
150mm(6")	2550(561)

†In some areas 125mm(5") drainage pipe may not be available.

Flow capacity of horizontal storm sewers litres per minute (gallons per minute).

Pipe Size	Slope per 305mm(Per Foot)		
	3mm(1/8")	6mm(¼")	13mm(½")
75mm(3")	163(36)	232(51)	327(72)
100mm(4")	355(78)	505(111)	714(157)
†125mm(5")	646(142)	914(201)	1291(284)
150mm(6")	1050(231)	1487(327)	2100(462)
200mm(8")	2264(498)	3205(705)	4528(996)
250mm(10")	4100(902)	5796(1275)	8201(1804)
300mm(12")	6669(1467)	9437(2076)	13338(2934)
375mm(15")	12120(2666)	17157(3774)	24239(5332)

Note: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

SCUPPERS AND OVERFLOW DRAINS

Roofing members and understructures, weakened by seepage and rot resulting from improper drainage and roof construction can give away under the weight of rapidly accumulated water during flash storms. Thus, it is recommended, and often required by building codes, to install scuppers and overflow drains in parapet-type roofs. Properly selected and sized scuppers and overflow drains are vital to a well-engineered drainage system to prevent excessive loading, erosion, seepage and rotting.

ZURN Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS (LBS.)	TOTAL ROOF SLOPE: DEAD-LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth
Calgary, Alberta	232 (2,500)	4.7 (10.4)	45.5 (10)	7	51 (2)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	66 (14.5)	14	73.5 (2.9)	82 (18)	9	91.5 (3.6)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	28	68.5 (2.7)	72.5 (16)	22	81.5 (3.2)	88.5 (19.5)	15	99 (3.9)	104.5 (23)	12	117 (4.6)
	929 (10,000)	6.8 (15.1)	66 (14.5)	38	73.5 (2.9)	77.5 (17)	31	86.5 (3.4)	93 (20.5)	22	104 (4.1)	109 (24)	17	122 (4.8)
Edmonton, Alberta	232 (2,500)	4.5 (9.9)	43 (9.5)	7	48.5 (1.9)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	82 (18)	3	91.5 (3.6)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	14.5	76 (3)	84 (18.5)	9.5	94 (3.7)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.6 (14.5)	63.5 (14)	28	71 (2.8)	75 (16.5)	24	84 (3.3)	97.5 (21.5)	16	104 (4.1)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	38	76 (3.0)	79.5 (17.5)	32	89 (3.5)	100 (22)	22	112 (4.4)	113.5 (25)	18	127 (5.0)
Penticton, British Columbia	232 (2,500)	3.8 (8.3)	36.5 (8)	6	40.5 (1.6)	38.5 (8.5)	4	43 (1.7)	52.5 (11.5)	3	58.5 (2.3)	61.5 (13.5)	2.3	68.5 (2.7)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	13	43 (1.7)	41 (9)	9	45.5 (1.8)	57 (12.5)	6	63.5 (2.5)	68 (15)	5	76 (3.0)
	697 (7,500)	4.2 (9.3)	41 (9)	21	45.5 (1.8)	43 (9.5)	14.5	48.5 (1.9)	61.5 (13.5)	10.5	68.5 (2.7)	72.5 (16)	8	81.5 (3.2)
	929 (10,000)	4.2 (9.3)	41 (9)	27	45.5 (1.8)	45.5 (10)	20	51 (2.0)	63.5 (14)	14	71 (2.8)	75 (16.5)	11	84 (3.3)
Vancouver, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	5.5	35.5 (1.4)	38.5 (8.5)	4	43 (1.7)	47.5 (10.5)	2.8	53.5 (2.1)	57 (12.5)	2	63.5 (2.5)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	13	43 (1.7)	45.5 (10)	10	51 (2)	57 (12.5)	6	63.5 (2.5)	68 (15)	5	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	22	48.5 (1.9)	50 (11)	17	56 (2.2)	63.5 (14)	11	71 (2.8)	75 (16.5)	8.5	84 (3.3)
	929 (10,000)	4.9 (10.9)	47.5 (10.5)	30	53.5 (2.1)	54.5 (12)	24	61 (2.4)	68 (15)	15	76 (3)	79.5 (17.5)	12	89 (3.5)
Victoria, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	5.5	35.5 (1.4)	38.5 (8.5)	4	43 (1.7)	43 (9.5)	2.5	48.5 (1.9)	54.5 (12)	2	61 (2.4)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	13	43 (1.7)	45.5 (10)	10	51 (2)	54.5 (12)	6	61 (2.4)	68 (15)	5	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	22	48.5 (1.9)	50 (11)	16	56 (2.2)	59 (13)	10	66 (2.6)	75 (16.5)	8	84 (3.3)
	929 (10,000)	4.7 (10.4)	45.5 (10)	30	51 (2)	54.5 (12)	23	61 (2.4)	63.5 (14)	14	71 (2.8)	79.5 (17.5)	12	89 (3.5)
Brandon, Manitoba	232 (2,500)	5.9 (13)	57 (12.5)	8	63.5 (2.5)	68 (15)	7	76 (3)	82 (18)	4.5	91.5 (3.6)	95.5 (21)	3.5	106.5 (4.2)
	465 (5,000)	7.3 (16.1)	73 (16)	20	81.5 (3.2)	84 (18.5)	17	94 (3.7)	97.5 (21.5)	11	109 (4.3)	113.5 (25)	8.5	127 (5)
	697 (7,500)	8.3 (18.2)	79.5 (17.5)	32	89 (3.5)	93 (20.5)	27	104 (4.1)	107 (23.5)	19	119.5 (4.7)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	9.0 (19.8)	86.5 (19)	43	96.5 (3.8)	100 (22)	38	112 (4.4)	113.5 (25)	26	127 (5.0)	132 (29)	21	147.5 (5.8)
Winnipeg, Manitoba	232 (2,500)	4.7 (10.4)	45.5 (10)	7	51 (2)	57 (12.5)	6	63.5 (2.5)	75 (16.5)	4	84 (3.3)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	15	76 (3)	84 (18.5)	10	94 (3.7)	100 (22)	7.5	112 (4.4)
	697 (7,500)	6.6 (14.5)	63.5 (14)	28	71 (2.8)	75 (16.5)	24	84 (3.3)	93 (20.5)	16	104 (4.1)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	39	76 (3)	82 (18)	32	91.5 (3.6)	97.5 (21.5)	22	109 (4.3)	113.5 (25)	17	127 (5.0)
Campbellton, New Brunswick	232 (2,500)	6.4 (14)	62 (13.5)	9	68.5 (2.7)	70.5 (15.5)	7	78.5 (3.1)	79.5 (17.5)	4.5	89 (3.5)	91 (20)	3.5	101.5 (4.0)
	465 (5,000)	9.0 (19.8)	86.5 (19)	22	96.5 (3.8)	91 (20)	18	101.5 (4)	102.5 (22.5)	12	115 (4.5)	113.5 (25)	9	127 (5.0)
	697 (7,500)	10.4 (22.9)	100 (22)	35	112 (4.4)	102.5 (22.5)	28	114.5 (4.5)	118 (26)	20	132 (5.2)	132 (29)	15	147.5 (5.8)
	929 (10,000)	11.3 (25)	109 (24)	47	122 (4.8)	111.5 (24.5)	40	124.5 (4.9)	127.5 (28)	29	142 (5.6)	141 (31)	22	157.5 (6.2)

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS (LBS.)	TOTAL ROOF SLOPE: DEAD-LEVEL L.P.M. (G.P.M.) Discharge	DEAD-LEVEL Draindown Time Hrs.	DEAD-LEVEL mm (In.) Water Depth	51mm (2") RISE L.P.M. (G.P.M.) Discharge	51mm (2") RISE Draindown Time Hrs.	51mm (2") RISE mm (In.) Water Depth	102mm (4") RISE L.P.M. (G.P.M.) Discharge	102mm (4") RISE Draindown Time Hrs.	102mm (4") RISE mm (In.) Water Depth	152mm (6") RISE L.P.M. (G.P.M.) Discharge	152mm (6") RISE Draindown Time Hrs.	152mm (6") RISE mm (In.) Water Depth
Chatham, New Brunswick	232 (2,500)	4.5 (9.9)	43 (9.5)	7	48.5 (1.9)	52.5 (11.5)	5.5	58.5 (2.3)	63.5 (14)	3.5	71 (2.8)	77.5 (17)	2.9	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	63.5 (14)	13	71 (2.8)	77.5 (17)	9	86.5 (3.4)	91 (20)	7	101.5 (4.0)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	68 (15)	22	76 (3)	84 (18.5)	14	94 (3.7)	102.5 (22.5)	12	114.5 (4.5)
	929 (10,000)	6.6 (14.6)	63.5 (14)	37	71 (2.8)	75 (16.5)	30	84 (3.3)	91 (20)	20	101.5 (4.0)	107 (23.5)	16	119.5 (4.7)
Moncton, New Brunswick	232 (2,500)	4.3 (9.4)	41 (9)	7	45.5 (1.8)	54.5 (12)	6	61 (2.4)	63.5 (14)	3.5	71 (2.8)	72.5 (16)	2.7	81.5 (3.2)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	14	76 (3)	82 (18)	9	91.5 (3.6)	93 (20.5)	7	104 (4.1)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	79.5 (17.5)	24	89 (3.5)	93 (20.5)	16	104 (4.1)	104.5 (23)	12	117 (4.6)
	929 (10,000)	7.5 (16.6)	72.5 (16)	39	81.5 (3.2)	84 (18.5)	34	94 (3.7)	100 (22)	23	112 (4.4)	113.5 (25)	17	127 (5.0)
Saint John, New Brunswick	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	57 (12.5)	6	63.5 (2.5)	75 (16.5)	4	84 (3.3)	86.5 (19)	3	96.5 (3.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	20	81.5 (3.2)	79.5 (17.5)	16	89 (3.5)	95.5 (21)	11	106.5 (4.2)	104.5 (23)	8	117 (4.6)
	697 (7,500)	8.7 (19.2)	84 (18.5)	32	94 (3.7)	93 (20.5)	27	104 (4.1)	107 (23.5)	19	119.5 (4.7)	118 (26)	13.5	132 (5.2)
	929 (10,000)	9.7 (21.3)	93 (20.5)	44	104 (4.1)	104.5 (23)	38	117 (4.6)	113.5 (25)	27	127 (5.0)	127.5 (28)	20	142 (5.6)
Gander, Newfoundland	232 (2,500)	3.5 (7.8)	34 (7.5)	5.5	38 (1.5)	45.5 (10)	5	51 (2.0)	57 (12.5)	3.5	63.5 (2.5)	68 (15)	2.5	76 (3.0)
	465 (5,000)	4.7 (10.4)	45.5 (10)	15	51 (2.0)	57 (12.5)	12	63.5 (2.5)	72.5 (16)	8	81.5 (3.2)	82 (18)	6.5	91.5 (3.6)
	697 (7,500)	5.7 (12.5)	54.5 (12)	25	61 (2.4)	63.5 (14)	21	71 (2.8)	79.5 (17.5)	13.5	89 (3.5)	93 (20.5)	11	104 (4.1)
	929 (10,000)	6.1 (13.5)	59 (13)	35	66 (2.6)	70.5 (15.5)	29	78.5 (3.1)	84 (18.5)	19	94 (3.7)	100 (22)	15	112 (4.4)
St. Andrews, Newfoundland	232 (2,500)	3.5 (7.8)	34 (7.5)	5.5	38 (1.5)	45.5 (10)	5	51 (2.0)	59 (13)	3.5	66 (2.6)	63.5 (14)	2.5	71 (2.8)
	465 (5,000)	5.2 (11.4)	47.5 (10.5)	15	53.5 (2.1)	59 (13)	13	66 (2.6)	72.5 (16)	8	81.5 (3.2)	79.5 (17.5)	6	89 (3.5)
	697 (7,500)	5.9 (13)	57 (12.5)	26	63.5 (2.5)	66 (14.5)	21	73.5 (2.9)	82 (18)	14	91.5 (3.6)	88.5 (19.5)	10	99 (3.9)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	72.5 (16)	30	81.5 (3.2)	86.5 (19)	20	96.5 (3.8)	95.5 (21)	14.5	106.5 (4.2)
St. John's, Newfoundland	232 (2,500)	5.9 (13)	57 (12.5)	8	63.5 (2.5)	68 (15)	7	76 (3.0)	77.5 (17)	4.5	86.5 (3.4)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	21	91.5 (3.6)	91 (20)	18	101 (4.0)	100 (22)	11	112 (4.4)	113.5 (25)	9	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	34	114.5 (4.5)	109 (24)	29	122 (4.8)	122.5 (27)	21	137 (5.4)	132 (29)	15	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	48	127 (5.0)	129.5 (28.5)	43	145 (5.7)	143 (31.5)	33	160 (6.3)	150 (33)	24	167.5 (6.6)
Torbay, Newfoundland	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	61.5 (13.5)	6.5	68.5 (2.7)	75 (16.5)	4	84 (3.3)	84 (18.5)	3	94 (3.7)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	75 (16.5)	15.5	84 (3.3)	88.5 (19.5)	10	99 (3.9)	102.5 (22.5)	8	114.5 (4.5)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	29	78.5 (3.1)	84 (18.5)	25	94 (3.7)	100 (22)	17.5	112 (4.4)	113.5 (25)	13	127 (5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	40	86.5 (3.4)	88.5 (19.5)	34	99 (3.9)	107 (23.5)	24	119.5 (4.7)	122.5 (27)	19	137 (5.4)
Halifax, Nova Scotia	232 (2,500)	5.9 (13)	57 (12.5)	8	63.5 (2.5)	68 (15)	7	76 (3.0)	77.5 (17)	4.5	86.5 (3.4)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	21	91.5 (3.6)	91 (20)	18	101.5 (4.0)	100 (22)	11	112 (4.4)	113.5 (25)	9	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	34	114.5 (4.5)	109 (24)	29	122 (4.8)	122.5 (27)	21	137 (5.4)	132 (29)	15	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	48	127 (5.0)	129.5 (28.5)	43	145 (5.7)	143 (31.5)	33	160 (6.3)	150 (33)	24	167.5 (6.6)

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS (LBS.)	TOTAL ROOF SLOPE: DEAD-LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (In.) Water Depth
Sydney, Nova Scotia	232 (2,500)	4.3 (9.4)	41 (9)	6.5	45.5 (1.8)	45.5 (10)	5	51 (2.0)	57 (12.5)	3.5	63.5 (2.5)	68 (15)	2.5	76 (3.0)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	59 (13)	13	66 (2.6)	75 (16.5)	8	84 (3.3)	84 (18.5)	6.5	94 (3.7)
	697 (7,500)	6.4 (14)	61.5 (13.5)	28	68.5 (2.7)	68 (15)	22	76 (3.0)	84 (18.5)	14	94 (3.7)	97.5 (21.5)	11	109 (4.3)
	929 (10,000)	7.1 (15.6)	68 (15)	38	76 (3.0)	75 (16.5)	30	84 (3.3)	91 (20)	20	101.5 (4.0)	104.5 (23)	16	117 (4.6)
Yarmouth, Nova Scotia	232 (2,500)	6.4 (14)	61.5 (13.5)	9	68.5 (2.7)	70.5 (15.5)	7.5	78.5 (3.1)	82 (18)	4.5	91.5 (3.6)	91 (20)	3.5	101.5 (4.0)
	465 (5,000)	8.3 (18.2)	79.5 (17.5)	21	89 (3.5)	88.5 (19.5)	18	99 (3.9)	104.5 (23)	12	117 (4.6)	116 (25.5)	9	129.5 (5.1)
	697 (7,500)	9.4 (20.8)	91 (20)	34	101.5 (4.0)	102.5 (22.5)	29	114.5 (4.5)	118 (26)	21	132 (5.2)	132 (29)	15	147.5 (5.8)
	929 (10,000)	10.4 (22.9)	100 (22)	45	112 (4.4)	109 (24)	41	122 (4.8)	129.5 (28.5)	29	145 (5.7)	141 (31)	22	157.5 (6.2)
Thunder Bay, Ontario	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	61.5 (13.5)	6.5	68.5 (2.7)	75 (16.5)	4	84 (3.3)	88.5 (19.5)	3.5	91.5 (3.6)
	465 (5,000)	6.1 (13.5)	59 (13)	18	66 (2.6)	72.5 (16)	15	81.5 (3.2)	86.5 (19)	9.5	96.5 (3.8)	102.5 (22.5)	7.5	114.5 (4.5)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	77.5 (17)	24	86.5 (3.4)	93 (20.5)	16	104 (4.1)	109 (24)	13	122 (4.8)
	929 (10,000)	7.1 (15.6)	68 (15)	38	76 (3.0)	84 (18.5)	33	94 (3.7)	97.5 (21.5)	22	109 (4.3)	116 (25.5)	18	129.5 (5.1)
Guelph, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	63.5 (14)	7	71 (2.8)	86.5 (19)	5	96.5 (3.8)	100 (22)	3.7	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	75 (16.5)	15.5	84 (3.3)	97.5 (21.5)	11	109 (4.3)	116 (25.5)	9	129.5 (5.1)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	29	78.5 (3.1)	82 (18)	25	91.5 (3.6)	104.5 (23)	18	117 (4.6)	125 (27.5)	14	139.5 (5.5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	40	86.5 (3.4)	84 (18.5)	34	94 (3.7)	109 (24)	26	122 (4.8)	132 (29)	20	147.5 (5.8)
Hamilton, Ontario	232 (2,500)	5.9 (13)	57 (12.5)	8.5	63.5 (2.5)	72.5 (16)	7.5	81.5 (3.2)	93 (20.5)	5	104 (4.1)	109 (24)	4	122 (4.8)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	79.5 (17.5)	16	89 (3.5)	104.5 (23)	12	117 (4.6)	122.5 (27)	9	137 (5.4)
	697 (7,500)	6.8 (15.1)	66 (14.5)	28	73.5 (2.9)	84 (18.5)	26	94 (3.7)	111.5 (24.5)	20	124.5 (4.9)	127.5 (28)	15	142 (5.6)
	929 (10,000)	7.1 (15.6)	68 (15)	39	76 (3.0)	86.5 (19)	34	96.5 (3.8)	116 (25.5)	27	129.5 (5.1)	134 (29.5)	21	150 (5.9)
Kingston, Ontario	232 (2,500)	6.4 (14)	61.5 (13.5)	9	68.5 (2.7)	77.5 (17)	8	86.5 (3.4)	91 (20)	5	101.5 (4.0)	109 (24)	4	122 (4.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	20	81.5 (3.2)	86.5 (19)	18	96.5 (3.8)	104.5 (23)	12	117 (4.6)	122.5 (27)	9.5	137 (5.4)
	697 (7,500)	8.5 (18.7)	82 (18)	31	91.5 (3.6)	93 (20.5)	28	104 (4.1)	111.5 (24.5)	20	124.5 (4.9)	132 (29)	15	147.5 (5.8)
	929 (10,000)	8.7 (19.2)	86.5 (19)	42	96.5 (3.8)	97.5 (21.5)	38	109 (4.3)	116 (25.5)	27	129.5 (5.1)	68 (15)	21	152.5 (6.0)
London, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	8.5	66 (2.6)	72.5 (16)	7.5	81.5 (3.2)	88.5 (19.5)	5	99 (3.9)	107 (23.5)	4	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	20	76 (3.0)	84 (18.5)	17	94 (3.7)	102.5 (22.5)	12	114.5 (4.5)	122.5 (27)	9.5	137 (5.4)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	88.5 (19.5)	27	99 (3.9)	109 (24)	19	122 (4.8)	129.5 (28.5)	15	145 (5.7)
	929 (10,000)	8.5 (18.7)	82 (18)	41	91.5 (3.6)	91 (20)	36	101.5 (4.0)	113.5 (25)	27	127 (5.0)	134 (29.5)	21	150 (5.9)
North Bay, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	68 (15)	7	76 (3.0)	86.5 (19)	5	96.5 (3.8)	100 (22)	3.8	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	79.5 (17.5)	16	89 (3.5)	97.5 (21.5)	11	109 (4.3)	113.5 (25)	9	127 (5.0)
	697 (7,500)	7.5 (16.6)	72.5 (16)	30	81.5 (3.2)	86.5 (19)	26	96.5 (3.8)	107 (23.5)	19	119.5 (4.7)	122.5 (27)	14	137 (5.4)
	929 (10,000)	8.3 (18.2)	77.5 (17)	40	86.5 (3.4)	93 (20.5)	36	104 (4.1)	111.5 (24.5)	26	124.5 (4.9)	127.5 (28)	20	142 (5.6)
Ottawa, Ontario	232 (2,500)	4.7 (10.4)	45.5 (10)	7	51 (2.0)	59 (13)	6.5	66 (2.6)	77.5 (17)	4.5	86.5 (3.4)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	14	76 (3.0)	86.5 (19)	10	96.5 (3.8)	100 (22)	7.5	112 (4.4)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	75 (16.5)	23	84 (3.3)	93 (20.5)	16	104 (4.1)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	79.5 (17.5)	32	89 (3.5)	97.5 (21.5)	22	109 (4.3)	113.5 (25)	18	127 (5.0)

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS (LBS.)	TOTAL ROOF SLOPE: DEAD-LEVEL L.P.M. (G.P.M.) Discharge	DEAD-LEVEL Draindown Time Hrs.	DEAD-LEVEL mm (In.) Water Depth	51mm (2") RISE L.P.M. (G.P.M.) Discharge	51mm (2") RISE Draindown Time Hrs.	51mm (2") RISE mm (In.) Water Depth	102mm (4") RISE L.P.M. (G.P.M.) Discharge	102mm (4") RISE Draindown Time Hrs.	102mm (4") RISE mm (In.) Water Depth	152mm (6") RISE L.P.M. (G.P.M.) Discharge	152mm (6") RISE Draindown Time Hrs.	152mm (6") RISE mm (In.) Water Depth
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	68 (15)	7	76 (3.0)	86.5 (19)	5	96.5 (3.8)	104.5 (23)	4	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	77.5 (17)	16	86.5 (3.4)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	7.1 (15.6)	68 (15)	29	76 (3.0)	82 (18)	26	91.5 (3.6)	102.5 (22.5)	18	114.5 (4.5)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	40	81.5 (3.2)	86.5 (19)	34	96.5 (3.8)	107 (23.5)	24	119.5 (4.7)	132 (29)	20	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	7	45.5 (1.8)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	86.5 (19)	3.3	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	63.5 (14)	14	71 (2.8)	82 (18)	9	91.5 (3.6)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	70.5 (15.5)	22	78.5 (3.1)	86.5 (19)	15	96.5 (3.8)	104.5 (23)	12	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	72.5 (16)	30	81.5 (3.2)	91 (20)	21	101.5 (4.0)	109 (24)	17	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	66 (14.5)	7	73.5 (2.9)	82 (18)	4.5	91.5 (3.6)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	19	73.5 (2.9)	77.5 (17)	16	86.5 (3.4)	93 (20.5)	11	104 (4.1)	111.5 (24.5)	9	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	84 (18.5)	26	94 (3.7)	100 (22)	18	112 (4.4)	120.5 (26.5)	14	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	86.5 (19)	34	96.5 (3.8)	104.5 (23)	24	117 (4.6)	127.5 (28)	20	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	8.5	66 (2.6)	70.5 (15.5)	7.5	78.5 (3.1)	84 (18.5)	4.5	94 (3.7)	107 (23.5)	4	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	20	76 (3.0)	79.5 (17.5)	16	89 (3.5)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	86.5 (19)	26	96.5 (3.8)	107 (23.5)	18	119.5 (4.7)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	91 (20)	36	101.5 (4.0)	113.5 (25)	26	127 (5.0)	129.5 (28.5)	20	145 (5.7)
Charlottetown, P.E.I.	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	57 (12.5)	6	63.5 (2.5)	68 (15)	3.8	76 (3.0)	79.5 (17.5)	3	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	75 (16.5)	15.5	84 (3.3)	88.5 (19.5)	10	99 (3.9)	100 (22)	7.5	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	31	84 (3.3)	86.5 (19)	26	96.5 (3.8)	102.5 (22.5)	18	114.5 (4.5)	113.5 (25)	13	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	42	94 (3.7)	97.5 (21.5)	37	106.5 (4.2)	111.5 (24.5)	26	124.5 (4.9)	125 (27.5)	20	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	7.5	56 (2.2)	61.5 (13.5)	7	68.5 (2.7)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	70.5 (15.5)	15	78.5 (3.1)	88.5 (19.5)	10	99 (3.9)	109 (24)	8	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	27	66 (2.6)	72.5 (16)	23	81.5 (3.2)	93 (20.5)	16	104 (4.1)	113.5 (25)	13	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	36	68.5 (2.7)	77.5 (17)	31	86.5 (3.4)	95.5 (21)	22	106.5 (4.2)	120.5 (26.5)	19	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	8	58.5 (2.3)	63.5 (14)	7	71 (2.8)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	70.5 (15.5)	15	78.5 (3.1)	84 (18.5)	10	94 (3.7)	104.5 (23)	8	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	72.5 (16)	23	81.5 (3.2)	86.5 (19)	15	96.5 (3.8)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	37	76 (3.0)	77.5 (17)	31	86.5 (3.4)	88.5 (19.5)	20	99 (3.9)	109 (24)	17	122 (4.8)
Regina, Saskatchewan	232 (2,500)	4.5 (9.9)	43 (9.5)	7	48.5 (1.9)	54.5 (12)	6	61 (2.4)	72.5 (16)	4	81.5 (3.2)	79.5 (17.5)	3	89 (3.5)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	68 (15)	14	76 (3.0)	86.5 (19)	10	96.5 (3.8)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	29	78.5 (3.1)	77.5 (17)	24	86.5 (3.4)	100 (22)	17	112 (4.4)	109 (24)	12	122 (4.8)
	929 (10,000)	8.3 (18.2)	79.5 (17.5)	40	89 (3.5)	82 (18)	32	91.5 (3.6)	104.5 (23)	24	117 (4.6)	118 (26)	18	132 (5.2)
Saskatoon, Saskatchewan	232 (2,500)	4.0 (8.8)	38.5 (8.5)	6	43 (1.7)	57 (12.5)	6	63.5 (2.5)	66 (14.5)	3.8	73.5 (2.9)	77.5 (17)	2.8	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	68 (15)	14.5	76 (3.0)	82 (18)	9	91.5 (3.6)	95.5 (21)	7	106.5 (4.2)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	75 (16.5)	24	84 (3.3)	91 (20)	16	101.5 (4.0)	104.5 (23)	12	117 (4.6)
	929 (10,000)	7.1 (15.6)	68 (15)	38	76 (3.0)	82 (18)	32	91.5 (3.6)	97.5 (21.5)	22	109 (4.3)	113.5 (25)	18	127 (5.0)

ZURN Control-Flo Roof Drains

the most advanced drainage control available, lets you design roof drainage systems with confidence

Check These ZURN Engineered Features

Large 955cm²(148 Square-Inch) Open Area Dome permits unobstructed flow. Dome is made of lightweight, shock-resistant aluminum and is bayonet-locked to gravel guard on weir. Aluminum Dome supplied when specified. Poly-Dome supplied standard.

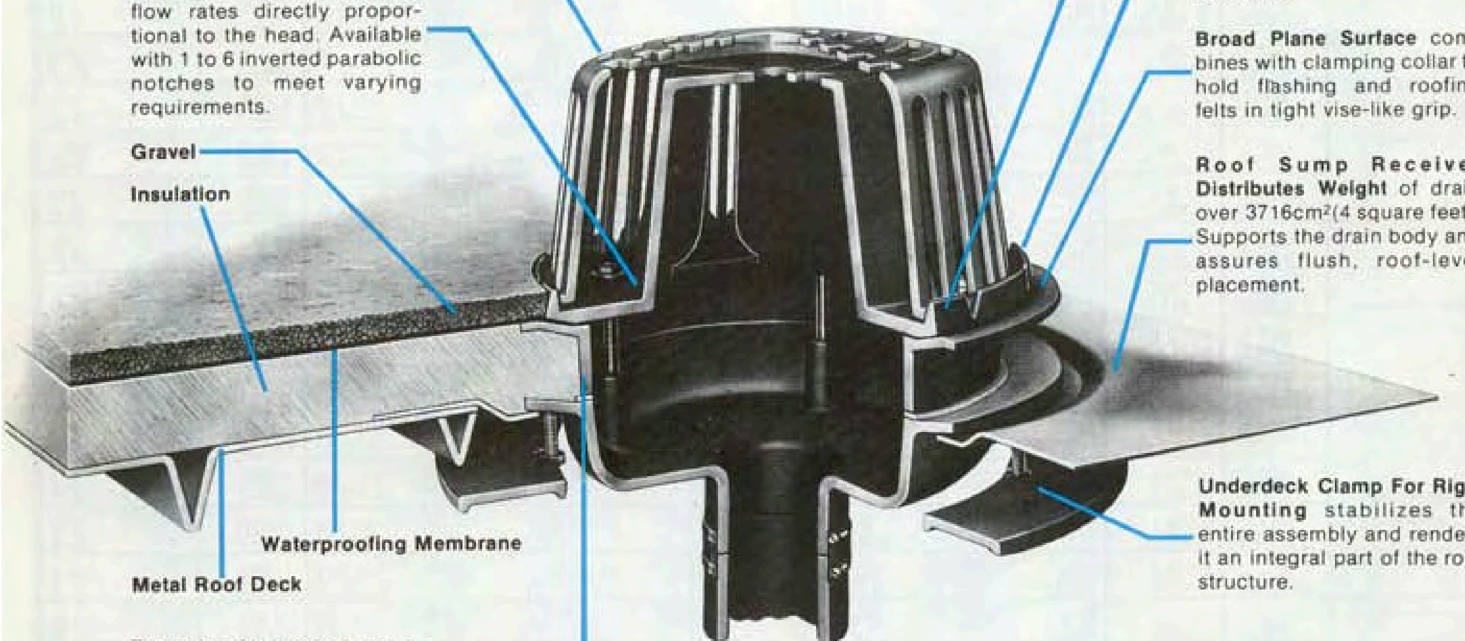
Multi-weir Barrier provides flow rates directly proportional to the head. Available with 1 to 6 inverted parabolic notches to meet varying requirements.

Integral Clamping-Collar at bottom of weir provides positive clamping action without puncturing roof or flashing. Also provides integral gravel guard.

Bayonet-type Locking Device on dome holds dome firmly in place with weir yet allows dome to be easily removed.

Broad Plane Surface combines with clamping collar to hold flashing and roofing felts in tight vise-like grip.

Roof Sump Receiver Distributes Weight of drain over 3716cm²(4 square feet). Supports the drain body and assures flush, roof-level placement.



Underdeck Clamp For Rigid Mounting stabilizes the entire assembly and renders it an integral part of the roof structure.

Extension Sleeve Accommodates the Addition of Insulation to a roof deck. Height as required by thickness of insulation.

Threaded, caulk, M. J. connections available. (Z-105-5-ERC w/Aluminum dome illustrated.)

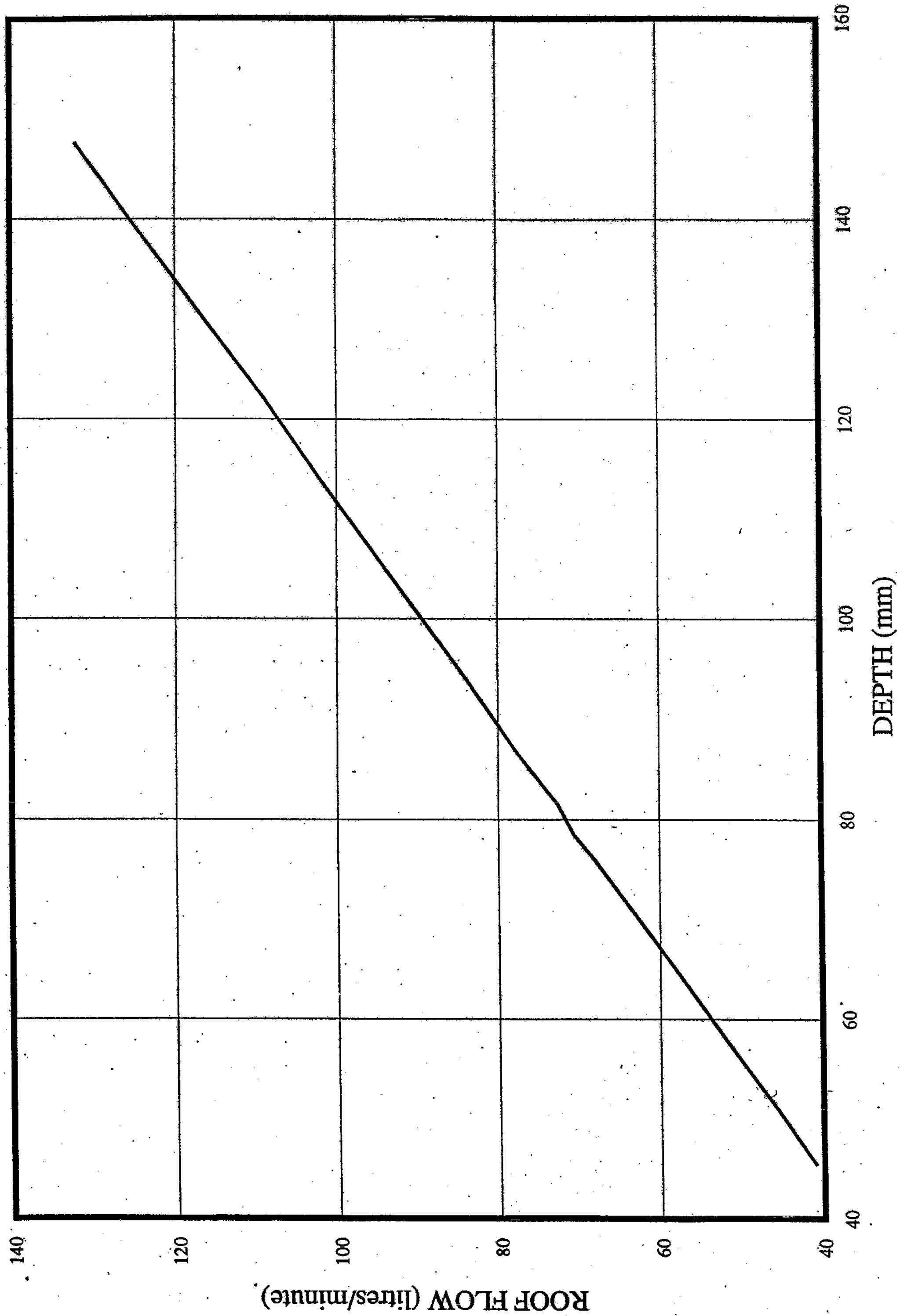
ZURN

ZURN DRAINAGE AND CONTROL SYSTEMS LTD.

Telephone: (416) 741-8260 Fax: (416) 741-7477

STAGE VERSUS DISCHARGE FOR ZURN Z-105-5-ERC

"CONTROL-FLO" ROOF DRAIN



Quick Method:

For Roof Load Factor of ~~232~~ 4.7 kg & notch area rating of 232 m² (highest flow)

(Dead Load) → release rate = 0.0033 L/s/m² (roof area) or 0.2 L/min/m²

(i.e. 45.5 L/min/232 m²)

Appendix E CITY OF OTTAWA SERVICING STUDY CHECKLIST

Stantec

Development Servicing Study Checklist

Job#: 160401149

4.1 General Content	Addressed (Y/N/NA)	Section	Comments
Executive Summary (for larger reports only).	N/A	-	Introduction
Date and revision number of the report.	Y	-	
Location map and plan showing municipal address, boundary, and layout of proposed development.	Y	1.0	
Plan showing the site and location of all existing services.	Y		Existing Condtions Plan
Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Y		Appendix B
Summary of Pre-consultation Meetings with City and other approval agencies.	N/A		
Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	N/A		
Statement of objectives and servicing criteria.	Y		In each section
Identification of existing and proposed infrastructure available in the immediate area.	Y		In each section
Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	N/A		
Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	N/A		
Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to addresspotential impacts.	N/A		
Proposed phasing of the development, if applicable.	N/A		
Reference to geotechnical studies and recommendations concerning servicing.			
All preliminary and formal site plan submissions should have the following information:			
Metric scale	Y		Appendix F Drawings
North arrow (including construction North)	N/A		Appendix F Drawings
Key plan	Y		Appendix F Drawings
Name and contact information of applicant and property owner	Y		Appendix F Drawings
Property limits including bearings and dimensions	Y		Appendix F Drawings
Existing and proposed structures and parking areas	Y		Appendix F Drawings
Easements, road widening and rights-of-way	Y		Appendix F Drawings
Adjacent street names	Y		Appendix F Drawings

4.2 Water	Addressed (Y/N/NA)	Section	Comments
Confirm consistency with Master Servicing Study, if available	N/A	3.0	
Availability of public infrastructure to service proposed development	Y	3.0	
Identification of system constraints	Y	3.0	
Identify boundary conditions	Y	3.0	
Confirmation of adequate domestic supply and pressure	Y	3.0	

Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.		3.0	Appendix A
Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Y	3.0	
Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design.	N/A		
Address reliability requirements such as appropriate location of shut-off valves	N/A		
Check on the necessity of a pressure zone boundary modification.	N/A		
Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range		3.0	
Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Y	3.0	
Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	Y	3.0	
Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Y	3.0	
Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	N/A		

4.3 Wastewater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Y	4.0	
Confirm consistency with Master Servicing Study and/or justifications for deviations.	N/A		
Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	N/A		
Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Y	4.0	
Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Y	4.0	Appendix C
Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Y	4.0	Appendix C
Description of proposed sewer network including sewers, pumping stations, and forcemains.	Y	4.0	
Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	N/A		
Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	N/A		
Forcemain capacity in terms of operational redundancy, surge	N/A		

pressure and maximum flow velocity.	N/A		
Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	N/A		
Special considerations such as contamination, corrosive environment etc.	N		
4.4 Stormwater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Y	5.0	
Analysis of available capacity in existing public infrastructure.	N		
A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Y		
Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Y	5.0	Appendix D
Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	N		
Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Y	5.0	Appendix D
Set-back from private sewage disposal systems.	N/A		
Watercourse and hazard lands setbacks.	N/A		
Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	N		
Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	N/A		
Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Y	5.0	Appendix D
Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	N		
Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Y	5.0	Appendix D
Any proposed diversion of drainage catchment areas from one outlet to another.	N/A		
Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	N/A		
If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	N/A		
Identification of potential impacts to receiving watercourses	N/A		
Identification of municipal drains and related approval requirements.	N/A		
Descriptions of how the conveyance and storage capacity will be achieved for the development.	Y	5.0	Appendix D
100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	N		
Inclusion of hydraulic analysis including hydraulic grade line elevations.	N		

Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	N		
Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	N/A		
Identification of fill constraints related to floodplain and geotechnical investigation.	N/A		
4.5 Approval and Permit Requirements	**Addressed (Y/N/NA)**	**Section**	**Comments**
Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	N/A		
Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	N/A		
Changes to Municipal Drains.	N/A		
Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	N/A		
4.6 Conclusion	**Addressed (Y/N/NA)**	**Section**	**Comments**
Clearly stated conclusions and recommendations	Y	10.0	
Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	N		
All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario	Y		

Appendix F DRAWINGS