STORM WATER MANAGEMENT REPORT
5574 ROCKDALE ROAD, VARS
12 UNIT APARTMENT BUILDING
ROLLIN DEVELOPMENTS

STORM WATER MANAGEMENT REPORT AND SITE SERVICING STUDY

12 UNIT APARTMENT BUILDING

Located at
5574 Rockdale Road
Vars, Ontario

Report Prepared for:

Rollin Developments
880 Smith Road
Navan, Ontario
K4B 1N9

Prepared by:

A. Dagenais & Assoc. Inc.
Consulting Engineers & Architect
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September 17, 2014
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Our File Number: 013-286

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1.0 INTRODUCTION

A Dagenais & Assoc. Inc., Consulting Forensic Engineers, have been retained by Rollin Development to provide site development drawings and a storm water management report for the proposed residential project.

This report is a summary of data, calculations, design and support documentation required for the site services of this project.

2.0 PROJECT DATA

Project Name	12 Unit Apartment Building
Owner	Rollin Development 880 Smith Road Navan, Ontario K4B 1N9
Contact	Andre Rollin
Legal Address:	5574 Rockdale Road, Vars
Telephone Number:	613 - 835 - 3036

3.0 STORM WATER MANAGEMENT

3.1 Balance Flow Requirements

The site consists of approximately 1.777 ha of vacant land.

The site is proposed to be considered in three parts:

1- An affected area that will include a laneway, parking, proposed building and a storm water management swale;

2- An uncontrolled swale to service potential future development, will remain grass and be considered unaffected;

3- An unaffected area to remain entirely as is.

The unaffected area, consisting of Area A7 in the storm water management plan, is being considered for future development (such as a second building) which will require storm water management. Since the unaffected area is divided from the roadside ditch by 5 residential properties and it is uncertain if any one of them will be available for use to convey a controlled flow, the uncontrolled swale is being proposed as an option for future storm water management design.

3.0 STORM WATER MANAGEMENT (Continued...)

3.1 Balance Flow Requirements (Continued...)

The proposed storm water management will consider management of the affected area, controlling up the 100 year storm. Storm water management for the swale and unaffected area is not proposed to be controlled up to the 100 year storm, but rather, remain "as is," that is, the 100 year post development flow for these areas will be compared to the 100 year predevelopment flow and will be equivalent since the surface type is not proposed to be altered.

The pre-development flow was calculated using a 5 year storm and a 20 minute time of concentration for the affected area. The pre-development flows for the swale and the unaffected area were calculated using 5 and 100 year storms and 20 minute times of concentration to match the post development flows. From intensity duration curves established for the Ottawa area (see Appendix F) we calculated an intensity of 70.3 mm/hr for the 5yr predevelopment flow and 120mm/hr for the 100 year predevelopment flow. A run-off coefficient of 0.3 was used as per City Design Guidelines (for grass areas).

The post-development flows were based on 5 and 100 years storm events with a time concentration of 10 minutes for the affected area and 20 minutes for the unaffected areas. From intensity duration curves established for the Ottawa area, a copy included in Appendix 'F', we established rain intensities of I = 104.4 mm/hr (5 years) and I = 179.0 mm/hr (100 years) correspondingly. A runoff coefficient of 0.30 for the soft surfaces and 0.90 for the hard surfaces were used for a 5 years storm event. For the 100 year storm we have increased the coefficients by 25% as per City`s Sewer Guidelines, meaning 0.375 for soft; except for hard surfaces that were limited at 0.95.

Using the Rational Method and considering the tributary areas of the proposed development or affected area (see Appendix 'B'), we calculated the pre and post development flows. See also the Storm Sewer Design Sheet in Appendix 'D'.

3.2 One hundred Year Storm Event

In the Storm Sewer Design sheet, the pre-development flow was calculated as 173.29 L/s. The affected area was found to have a predevelopment flow of 43.37L/s. We have an uncontrolled area, (Area A6) releasing storm water at 3.03 L/s. Area's A1-A4 will surface drain to the controlled swale on the south side of the private approach. The permitted flow from the swale is 40.34L/s [43.37L/s - 3.03L/s = 40.34L/s].

The proposed design flow restriction will be achieved with an IPEX ICD at CB#1, (with a head of 0.36 m) at for a restricted flow of 40.34 L/s. Therefore, the total release flow will be 43.37L/s. For IPEX chart, see Appendix "G".

3.2.1 Roof Drain calculations

The proposed roofs are pitched, therefore roof drains are not proposed.

3.0 STORM WATER MANAGEMENT (Continued…)

3.2 One hundred Year Storm Event (Continued…)

3.2.2 Storage calculations

The total flow into CB#1 during a 100 year storm event will be the total flow from areas A1-A4. Therefore the flow is 207.24 L/s for a 100 years storm which is being limited to 40.34 L/s. The ICD by IPEX (Type E) has a head of 0.36m (77.75 (Ponding elevation) – 77.39m (outlet) = 0.36 m). Based on our Hydrographs, the accumulated volume generated by this restriction would be 118.944 cu. m. See Appendix "E" for Hydrographs.

3.2.2.1 Structure Storage

The volume is proposed to be stored in the swale. The shape of the swale is proposed to be constructed as an inverted triangle. Ponding capacity of the swale has been calculated taking the average cross sectional area of the swale in increments and multiplying by segment length. The results are tabulated in the following table:

Section	Length (m)	Ponding Elev	Lower Area (sq m)	Upper Area (sq m)	Avg Area (sqm)	Capacity (cu m)
1	10.000	77.59	0.360	1.958	1.159	11.589
2	10.000	77.59	1.958	1.536	1.747	17.472
3	10.000	77.59	1.536	1.527	1.531	15.314
4	10.000	77.59	1.527	1.234	1.380	13.804
5	10.000	77.59	1.234	1.258	1.246	12.459
6	10.000	77.59	1.258	0.987	1.123	11.225
7	10.000	77.59	0.987	1.007	0.997	9.972
8	10.000	77.59	1.007	0.795	0.901	9.008
9	10.000	77.59	0.795	0.526	0.660	6.605
10	6.400	77.59	0.526	0.396	0.461	2.952
11	10.308	77.59	0.396	0.321	0.359	3.697
12	12.909	77.59	0.321	0.180	0.251	3.235
13	12.462	77.59	0.180	0.045	0.113	1.402
14	12.514	77.59	0.045	0.005	0.025	0.313
15	13.6795	77.59	0.000	0.000	0.000	0.000
16	70	77.59	0.000	0.000	0.000	0.000
Culvert	18	77.59	0.050	0.050	0.050	0.900
17	6.8003	77.59	0.050	0.262	0.156	1.061
18	12.0552	77.59	0.262	0.180	0.221	2.664
19	6.9187	77.59	0.180	0.066	0.123	0.850
20	5	77.59	0.066	0.000	0.033	0.164
Total						124.684

3.0 STORM WATER MANAGEMENT (Continued...)

3.2 One hundred Year Storm Event (Continued...)

**Note: The table was constructed beginning at the outlet. Section 16 is adjacent to the vehicle ramp to the basement parking garage. Sections 17 through 20 are North of the private approach, between the uncontrolled swale and the septic system.*

Therefore, the surface storage capacity is 124.684/118.944*100 = 104.8% of the required volume.

3.3 Five Year Storm Event

In the Storm Sewer Design sheet, the pre-development flow was calculated as 104.26 L/s. The affected area was found to have a predevelopment flos of 43.37L/s. We have an uncontrolled area, (Area A5) releasing storm water at 1.41 L/s. Area's A1-A4 will surface drain to the controlled swale on the south side of the private approach. The permitted flow from the swale is 40.34L/s.

The proposed design flow restriction will be achieved with an IPEX ICD at CB#1, (with a head of 0.34 m) at for a restricted flow of 40.34 L/s. Therefore, the total release flow will be 41.75L/s. For IPEX chart, see Appendix "G".

3.3.1 Roof Drain Calculations:

The proposed roofs are pitched, therefore roof drains are not proposed.

3.3.2 Storage calculations

The total flow into CB#1 during a 5 year storm event will be the total flow from areas A1-A4. Therefore the flow is 106.95 L/s for a 5 years storm which is being limited to 40.34 L/s. The ICD by IPEX (Type E) has a head of 0.21m (77.61 (Ponding elevation) – 77.39m (outlet) = 0.21 m). Based on our Hydrographs, the accumulated volume generated by this restriction would be 42.583 cu. m. See Appendix "E" for Hydrographs.

3.3.2.1 Structure Storage

The volume is proposed to be stored in the swale. Ponding capacity of the swale has been calculated taking the average cross sectional area of the swale in increments and multiplying by segment length. The results are tabulated in the following table:

3.0 STORM WATER MANAGEMENT (Continued…)

3.3 Five Year Storm Event (Continued...)

Section	Length (m)	Ponding Elev	Lower Area (sq m)	Upper Area (sq m)	Avg Area (sqm)	Capacity (cu m)
1	10.000	77.48	0.210	1.064	0.637	6.371
2	10.000	77.48	1.064	0.793	0.928	9.285
3	10.000	77.48	0.793	0.713	0.753	7.526
4	10.000	77.48	0.713	0.531	0.622	6.219
5	10.000	77.48	0.531	0.441	0.486	4.861
6	10.000	77.48	0.441	0.295	0.368	3.681
7	10.000	77.48	0.295	0.180	0.238	2.376
8	10.000	77.48	0.180	0.080	0.130	1.300
9	10.000	77.48	0.080	0.020	0.050	0.500
10	6.400	77.48	0.020	0.020	0.020	0.128
11	10.308	77.48	0.020	0.000	0.010	0.103
12	12.909	77.48	0.000	0.000	0.000	0.000
13	12.462	77.48	0.000	0.000	0.000	0.000
14	12.514	77.48	0.000	0.000	0.000	0.000
15	13.6795	77.48	0.000	0.000	0.000	0.000
16	70	77.48	0.000	0.000	0.000	0.000
Culvert	18	77.48	0.050	0.000	0.025	0.450
17	6.8003	77.48	0.000	0.000	0.000	0.000
18	12.0552	77.48	0.000	0.000	0.000	0.000
19	6.9187	77.48	0.000	0.000	0.000	0.000
20	5	77.48	0.000	0.000	0.000	0.000
Total						42.800

Therefore, the surface storage capacity is 42.800/42.583*100 = 100.5% of the required volume.

3.4 Trench Drain and Pump

The proposed elevation at the bottom of the ramp will be much lower than the adjacent swale elevations, and therefore must be pumped.

3.0 STORM WATER MANAGEMENT (Continued...)

3.4 Trench Drain and Pump (continued...)

3.4.1 Pump Selection

A 3/4HP sump pump by Flotec is capable of pumping 6.3L/s (5962 GPH) with a maximum head of 1.58m (5.2ft). Therefore we propose alternating Flotec 3/4HP pumps with float actuated control panel.

3.4.2 Pit design

The discharge pipe must exit the pump chamber above the 100 year ponding elevation. We propose a 3.5% slope on the discharge pipe, draining towards the swale. This will provide a pipe invert at the pump chamber of 77.85. We therefore propose a pump inlet elevation of 76.27m (77.85 -1.58 = 76.27). The proposed pump has a 3 1/2" clearance from bottom of pit to pump inlet, therefore the pit sump will be at an elevation of 76.18m.

We propose an OFF float at 3.5" (elev = 76.27), ON float at 11" (elev = 76.47), and a high alarm float at 14" (elev = 76.54).

We also propose reserve volume to accept additional flow (up to the 100 year design storm) sufficient to provide a 1hr response time in case of pump failure.

Considering flooding would begin to occur at an elevation of 77.21, there would therefore be a reserve depth of 0.67m (77.21 - 76.54 = 0.67m). Assuming a water elevation in the pit just below the high water alarm float level at the commencement of the storm would be the worst case scenario. For a 3.0m diameter pit, there would be a reserve capacity of 5.09cu m before flooding. A 15-20 minute design storm would cause flooding (Refer to hydrograph tables in Appendix "E"), therefore the pit will have to be a 3.6m diameter pit with a capacity of 7.344 cu m in reserve. A 1hr design storm would only contribute an additional 6.7 cu m, providing the minimum 1hr response time once the high water alarm sounds.

We therefore propose a 3.6m diameter precast concrete manhole be used as a sump pit, or equivalent. Assuming a 1.8m monolithic base, the underside of transition slab would be at an elevation of 77.93m. A 1.2m diameter riser with a height of 0.5m, 1.2m diameter flat top and 6" frame and grate would bring the top of grate elevation to 79.08m. Refer to site development drawings for finished grade elevations (see appendix "A").

3.5 Quality Control

A water quality control requirement of 80% TSS removal was set by the South Nation Conservation Authority. We propose to achieve this requirement by means of an "end of the line" treatment unit. We are proposing a Stormceptor unit. Using the Stormceptor sizing software, the STC 300 unit was selected. The software generated report has been attached (See Appendix "G").

3.0 STORM WATER MANAGEMENT (Continued...)

3.5 Quality Control (Continued...)

Therefore, all proposed runoff in the controlled area (which includes all lanes, parking areas and roof spaces) is proposed to be passed through a filter media by means of infiltration. Per the guideline: "If a dry swale infiltrates and evapotranspirates100% of the flow from a site, then there is essentially no pollution leaving the site in surface runoff."

4.0 SANITARY SEWER DESIGN

As per Part 8 of the Ontario Building Code (See Appendix "H"), Table 8.2.1.3.A,

Apartments

Based on Occupant Load	275 L/c/d

Occupancy

Based on Subsection 3.1.17	2 people per bedroom

Therefore:

6 x 2 bedrooms x 2 people per room =	24people
6 x 1 bedrooms x 2 people per room =	12people
Total=	**36people**

Therefore the total daily design sanitary sewage flow for this development is 9900 L/d [275L/c/d x 36 people = 9900 L/d].

4.1 Septic Tank

Since the building will have a residential use, the volume of the septic tank must be at least 2 times the daily design sanitary sewage flow as per sentence 8.2.2.3.(1) of the OBC.

Tank Volume = 2 x 9900	=19 800 L

Therefore we will use a standard Boucher Precast Concrete Limited (or equivalent) 5000gal (22 500 L) concrete septic tank c/w Polylok PL122 or equivalent effluent filter. See details on plan.

4.0 SANITARY SEWER DESIGN (Continued...)

4.2 Tertiary Treatment Units

The Ottawa Septic System Office has included a requirement of tertiary treatment based on expected sewage characteristics of senior citizens. For a daily design sanitary sewage flow of 9900L/d, we propose two Clearstream 1500 Units in parallel.

A single Clearstream 1500 has a capacity of 1500gal/day = 5678L/d. The combined capacity of the units is therefore 11,356 L/d.

We propose a Tuff-tite distribution box be used to evenly divide the flows to the two units. We also propose a Tuff-tite drop box be used to merge the flows following the units.

4.2 Area Bed Design

The bed is to be an area bed as per Clearstream's BMEC Authorization report (BMEC file # A2002-10).

4.2.1 Stone layer

The proposed stone layer of 250mm thickness shall have an area of:

A = (9900L/d)/(50L/sq m) = 198 sqm

Distribution piping is required as per section 4.7 of the Authorization Report. We propose nin 4" diameter perforated PVC runs of 17.5m spaced at 1.17m c/c with header and footer.

4.2.2 Extended Area (Base of the septic sand)

The proposed sand layer shall be 250mm thick and have an area not less than the greater of:

1-Area of stone (198 sq m);

Or

2-A=QT/850 = (9900)(6)/850 = 70 sq m

The minimum required size of the sand layer is therefore a matching area and footprint of the stone layer. (The percolation rate of the native soil "T=6" was obtained from the geotechnical report by Morey Assoc. Ltd. for this site, dated Sept. 2013, file #013300).

4.0 SANITARY SEWER DESIGN (Continued...)

4.2.3 Elevations of structures

The proposed area bed will outlet to the west at an elevation 77.12. The footer of the proposed bed will be set back from the outlet by approximately 12.2m to avoid conflict with trees. With a contact surface at a slope of 1%, the elevation of the contact surface at the footer will be 77.24m. Continueing at 1% up to the header, the elevation of the contact surface at the header (18.8m @ 1.0%) will be 77.43.Working up from there, we have the following table of elevations of structures for the septic system:

Structure	Inlet Elevation	Outlet Elevation	Underside Elevation of Structure	Top Elevation of Structure	F/G Elevation
BLDG	N/A	78.13	N/A	N/A	N/A
Tank	78.11	78.03	75.85	78.42	78.56
DB	77.99	77.94	N/A	N/A	78.19
CS	77.91	77.91	N/A	N/A	78.37
DB	77.88	77.78	N/A	N/A	77.9
header	77.77	N/A	77.77	77.87	78.08
stone@header	N/A	N/A	77.68	77.93	N/A
sand@header	N/A	N/A	77.43	77.68	N/A
footer	77.58	N/A	77.58	77.68	77.89
stone @footer	N/A	N/A	77.49	77.74	N/A
sand @footer	N/A	N/A	77.24	77.49	N/A

4.3 Pumping Station

A pumping chamber is not proposed. The entire system is proposed to be gravity fed.

4.4 Effluent filters

Effluent filters are proposed. We are proposing that the septic tank be equipped with an effluent filter by Tuff-tite model EF-6 or equivalent.

Effluent filters are also proposed on the discharge line of the treatment units. As per the Authorization Report, these filters are to be recommended by the manufacturer. The filter is required to screen out particles 3.2mm and larger.

5.0 WATER CONNECTION DESIGN

5.1 Domestic water requirements

Based on the preliminary concept of having 12 units, 6 of which are to be 2 bedroom units and 6 of which are to be 1 bedroom units, and following the city of Ottawa design guidelines for water distribution, we have a design water demand as follows:

6 rooms at 2.1people per room for 12.6 people
6 rooms at 1.4 people per room for 8.4people

The predicted population of this building would therefore be 21people.

The guideline specifies a design flow of 350L/c/day. The total demand would therefore be 7350L/d, which translates to an average daily demand of 0.085L/s. Therefore:

ADD = 0.085L/s
MDD = 0.213L/s
MHD = 0.468L/s

5.2 Fire Flow Requirements

The required fire flow was calculated using the OBC method.

Q=KVS

-Combustible construction is assumed, therefore K=18

-Each floor is to have an area of approximately 598 sq m. Assuming a storey height of 3m, the building volume is therefore approximately 3600 cu m

-The location of the building is not within 12m of any other existing or proposed structure, therefore S = 1.

Q = (18)(3600)(1) = 64,800
Therefore, a fire flow of 45L/s is required.

5.3 Design Flow

The design flow shall be the greater of the Maximum Hourly Demand (MHD); or the combined Fire Flow plus Maximum Daily Demand. Given the scale of the required fire flow, the design flow will be the latter. Therefore:

Design Flow = 45L/s + 0.213L/s = 45.213L/s

5.0 WATER CONNECTION DESIGN (Continued...)

5.3 Design Flow (Continued...)

We are proposing a 200mm diameter private main with a 200x50x200 pre-manufactured tee servicing a private onsite fire hydrant. The branch to the building is proposed to be reduced to a 50mm service lateral between the tee and the building. Considering the flow in the building lateral will consist of the building's domestic demand only, it will be sized using the MDD alone.

5.4 Water Capacity Comments

The boundary conditions and HGL for hydraulic analysis for 5574 Rockdale Road were obtained from the city. See attached copy in Appendix "J".

From the boundary conditions, we noted that we have a minimum pressure check of 108.4 m and for the estimated water main elevation of 75.80 m, a maximum pressure estimate of 46.31 psi.

An HGL table was used to tabulate the characteristics of the private main and service (See appendix "J"), including friction and elevation losses and available pressure.

As per the table, the friction loss servicing this building is 1.79psi [46.31psi - 44.52 = 1.79psi]. There is also an approximately 0.25psi friction loss from water meter to furthest fixture, and a total elevation difference of 6.5m (21.3ft) from the water main to the shower head on the top floor. The head loss for elevation will be 9.23psi [21.3ft x 0.433 = 9.23psi], for a total pressure loss of 11.27psi to service this building. The available pressure at the furthest fixture will therefore be 35.04psi, which is adequate.

7.0 CITY OF OTTAWA DESIGN GUIDELINES

Based on the city of Ottawa design guidelines, we have completed the Development Servicing Study Checklist; please refer to Appendix "K" for checklist.

8.0 CONCLUSION

In our opinion, the proposed development project, including the design recommendations provided in this report and on the Site Development Drawings, meets the approval requirements for the applicable approval agencies as well as the 2003 MOE requirements.

The Geotechnical report is also part of this report. The project manager is to make it available to the contractors.

Should you have any questions, please do not hesitate to contact the undersigned.

Sincerely Yours,

LICENSED PROFESSIONAL ENGINEER
A. F. DAGENAIS
PROVINCE OF ONTARIO

Alain Dagenais, P.Eng.

Michael Jans, B.Eng

APPENDIX "A"
Site Development Drawings

APPENDIX "B"
Tributary Areas

APPENDIX "C"
Surface Ponding

APPENDIX "D"
Storm Water Design Sheet

Storm Sewer Design Sheet - 5574 Rockdale Road, Vars																	
100 Year Storm																	
Flow Data												Sewer Data					
	Location		"A" Area	"A" Area	Area (ha) with infill value	Ind..	Acc.	Time of	Rainfall	Peak Flow		Type of	Dia.	Slope	Length	Cap (full)	Veloc @ fu
	From	To	Hard (ha)	Soft (ha)	C= 0.50	2.78*CA	2.78*CA	Conc.	Int 1.	Q (L/S)	Accum.	Pipe	(mm)	(%)	(m)	(L/S)	M/s
Pre-development flow:																	
		Notes: Runoff coefficient "C" = 0.3															
(5 Year)	Affected Area		0.000	0.740		0.617	0.617	20	70.3	43.370	43.37						
(100 Year)	Proposed Swale Corridor		0.000	0.105		0.109	0.726	20	120.0	13.129	56.50						
(100 Year)	Unnaffected Area		0.000	0.934		0.973	1.700	20	120.0	116.788	173.29						
										Total	**173.29**						
Post-development flow: (100 year storm)		Notes: Runoff coefficient "C" = 0.95 for Hard surface & 0.375 for soft surface															
Affected Area	A1		0.040	0.229		0.345	0.345	10	179.0	61.80	61.80						
Affected Area	A2		0.175	0.148		0.615	0.961	10	179.0	110.17	171.97						
Affected Area	A3		0.024	0.094		0.162	1.123	10	179.0	29.00	200.97						
Affected Area	A4		0.013	0.000		0.035	1.158	10	179.0	6.269	207.24						
									Reduce to		**40.34**						
Unaffected	A5		0.000	0.105		0.109	0.109	20	120.0	13.13	13.13						
Affected Area	A6		0.000	0.016		0.017	0.126	10	179.0	3.03	16.16						
Unaffected	A7		0.000	0.934		0.973	1.100	20	120.0	116.79	132.95						
Total Post Development Flow											173.29						

Storm Sewer Design Sheet - 5574 Rockdale Road, Vars

5 Year Storm

	Location		"A" Area	"A" Area	Area (ha) with infill value	Ind..	Acc.	Time of	Rainfall	Peak Flow		Type of	Dia.	Slope	Length	Cap (full)	Veloc @ full
	From	To	Hard (ha)	Soft (ha)	C= 0.50	2.78*CA	2.78*CA	Conc.	Int 1.	Q (L/S)	Accum.	Pipe	(mm)	(%)	(m)	(L/S)	M/s
			Flow Data									Sewer Data					
Pre-development flow: (5 year storm)																	
		Notes: Runoff coefficient "C" = 0.3															
(5 Year)	Affected Area		0.000	0.740		0.617	0.617	20	70.3	43.370	43.37						
(5 Year)	Proposed Swale Corridor		0.000	0.105		0.088	0.704	20	70.3	6.153	49.52						
(5 Year)	Unnaffected Area		0.000	0.934		0.779	1.483	20	70.3	54.735	104.28						
										Total	**104.26**						
Post-development flow: (100 year storm)		Notes: Runoff coefficient "C" = 0.9 for Hard surface & 0.3 for soft surface															
Affected Area	A1		0.040	0.229		0.292	0.292	10	104.4	30.48	30.48						
Affected Area	A2		0.175	0.148		0.560	0.852	10	104.4	58.50	88.98						
Affected Area	A3		0.024	0.094		0.139	0.991	10	104.4	14.51	103.49						
Affected Area	A4		0.013	0.000		0.033	1.024	10	104.4	3.46	106.95						
									Reduce to		**40.34**						
Unaffected	A5		0.000	0.105		0.088	0.088	20	70.3	6.15	6.15						
Affected Area	A6		0.000	0.016		0.014	0.101	10	104.4	1.41	7.57						
Unaffected	A7		0.000	0.934		0.779	0.880	20	70.3	54.73	62.30						

APPENDIX "E"
Hydrograph Tables

Hydrograph Table # 1

Ponding Calculations for the Swale

Hydrograph for a 5 year storm

Time (min.)	Intensity (I) (mm/hr)	Q=1.024i (L/s)	Restriction (L/s)	Net Flow accumulation (L/s)		Ponding (L)
5	140	143.36	40.34	103.02		30906.000
10	104.4	106.9056	40.34	66.5656		39939.360
15	**85.6**	87.6544	**40.34**	**47.3144**		**42582.960**
20	72	73.728	40.34	33.388		40065.600
30	53.9	55.1936	40.34	14.8536		26736.480
40	45	46.08	40.34	5.74		13776.000
50	38.5	39.424	40.34	-0.916		N/A
60	32	32.768	40.34	N/A		N/A
120	18.9	19.3536	40.34	N/A		N/A
360	8.4	8.6016	40.34	N/A		N/A
720	4.8	4.9152	40.34	N/A		N/A
1440	2.6	2.6624	40.34	N/A		N/A

Ponding Calculations for the Swale

Hydrograph for a 100 year storm

Time (min.)	Intensity (I) (mm/hr)	Q=1.158i (L/s)	Restriction (L/s)	Net Flow accumulation (L/s)		Ponding (L)
5	242.6	280.9308	40.34	240.5908		72177.240
10	179	207.282	40.34	166.942		100165.200
15	146.8	169.9944	40.34	129.6544		116688.960
30	**91.9**	**106.4202**	**40.34**	**66.0802**		**118944.360**
40	76	88.008	40.34	47.668		114403.200
50	65	75.27	40.34	34.93		104790.000
60	53.2	61.6056	40.34	21.2656		76556.160
120	31.5	36.477	40.34	-3.863		N/A
360	14.5	16.791	40.34	N/A		N/A
720	8	9.264	40.34	N/A		N/A
1440	4.3	4.9794	40.34	N/A		N/A

Hydrograph Table # 1

Ponding Calculations for the Pit

Hydrograph for a 5 year storm

Time (min.)	Intensity (I) (mm/hr)	Q=0.033i (L/s)	Restriction (L/s)	Net Flow accumulation (L/s)		Ponding (L)
5	140	4.62	0	4.62		1386.000
10	104.4	3.4452	0	3.4452		2067.120
15	85.6	2.8248	0	2.8248		2542.320
20	72	2.376	0	2.376		2851.200
30	53.9	1.7787	0	1.7787		3201.660
40	45	1.485	0	1.485		3564.000
50	38.5	1.2705	0	1.2705		3811.500
60	32	1.056	0	1.056		3801.600
120	18.9	0.6237	0	0.6237		4490.640
360	8.4	0.2772	0	0.2772		5987.520
720	4.8	0.1584	0	0.1584		6842.880
1440	2.6	0.0858	0	N/A		N/A

Ponding Calculations for the Pit

Hydrograph for a 100 year storm

Time (min.)	Intensity (I) (mm/hr)	Q=0.035i (L/s)	Restriction (L/s)	Net Flow accumulation (L/s)		Ponding (L)
5	242.6	8.491	0	8.491		2547.300
10	179	6.265	0	6.265		3759.000
15	146.8	5.138	0	5.138		4624.200
30	91.9	3.2165	0	3.2165		5789.700
40	76	2.66	0	2.66		6384.000
60	53.2	1.862	0	1.862		6703.200
75	47.26	1.6541	0	1.6541		7443.450
120	31.5	1.1025	0	1.1025		7938.000
360	14.5	0.5075	0	0.5075		10962.000
720	8	0.28	0	0.28		12096.000
1440	4.3	0.1505	0	N/A		N/A

APPENDIX "F"
Intensity Duration Curves

5.4.2 IDF Curves and Equations

An IDF (Intensity Duration Frequency) curve is a statistical description of the expected rainfall intensity for a given duration and storm frequency. In Ottawa, the IDF curve is derived from Meteorological Services of Canada (MSC) rainfall data taken from the Macdonald-Cartier airport. Rainfall collected from 1967 to 1997 was analyzed using the Gumbel Distribution. The following Table 5.1 shows the analysis results provided by MSC. The IDF equations have been derived on the basis of a regression equation of the form:

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

where:

Intensity = mm/hr

Td = time of duration (min)

A,B,C = regression constants for each return period

Table 5.1 Ottawa IDF Table: 1967 to 1997

Time (min)	2 year (mm/hr)	5 year (mm/hr)	10 year (mm/hr)	25 year (mm/hr)	50 year (mm/hr)	100 year (mm/hr)
5	102.80	140.20	165.00	196.00	219.00	242.60
10	77.10	104.40	122.50	145.30	162.20	179.00
15	63.30	85.60	100.40	119.10	133.00	146.80
30	39.90	53.90	63.10	74.70	83.40	91.90
60	24.20	32.00	37.10	43.60	48.50	53.20
120	14.30	18.90	22.00	25.80	28.70	31.50
360	6.20	8.40	9.90	11.70	13.10	14.50
720	3.60	4.80	5.60	6.60	7.30	8.00
1440	2.00	2.60	3.00	3.50	3.90	4.30

IDF curve equations (Intensity in mm/hr)

100 year Intensity	$= 1735.688 / (\text{Time in min} + 6.014)^{0.820}$
50 year Intensity	$= 1569.580 / (\text{Time in min} + 6.014)^{0.820}$
25 year Intensity	$= 1402.884 / (\text{Time in min} + 6.018)^{0.819}$
10 year Intensity	$= 1174.184 / (\text{Time in min} + 6.014)^{0.816}$
5 year Intensity	$= 998.071 / (\text{Time in min} + 6.053)^{0.814}$
2 year Intensity	$= 732.951 / (\text{Time in min} + 6.199)^{0.810}$

The IDF curves based on the above equations can be found in Appendix 5-A

5.4.3 Design Storms

Computer modeling requires the input of a design storm. The design storm is then used to generate a runoff hydrograph to determine how an area will respond and perform. Numerous types of design storms can be used ranging from historical storms to IDF curve-derived storms. This section briefly discusses the various types of design storms.

5.4.3.1 Application to Hydrologic Models

The design storms presented herein are meant to be used in hydrologic models to simulate runoff from events of various return frequencies. When choosing a design storm, the designer should perform a sensitivity analysis using various storms and use the one that is most conservative.

As noted below, the Chicago distribution is one of the most used storms for urban runoff applications. When dealing with rural areas, the SCS Type II storm is preferred. The ABS storm can also be used for urban applications; however, care must be taken when choosing the type of distribution. As a rule of thumb, the 30% distribution should be used unless historical data proves otherwise.

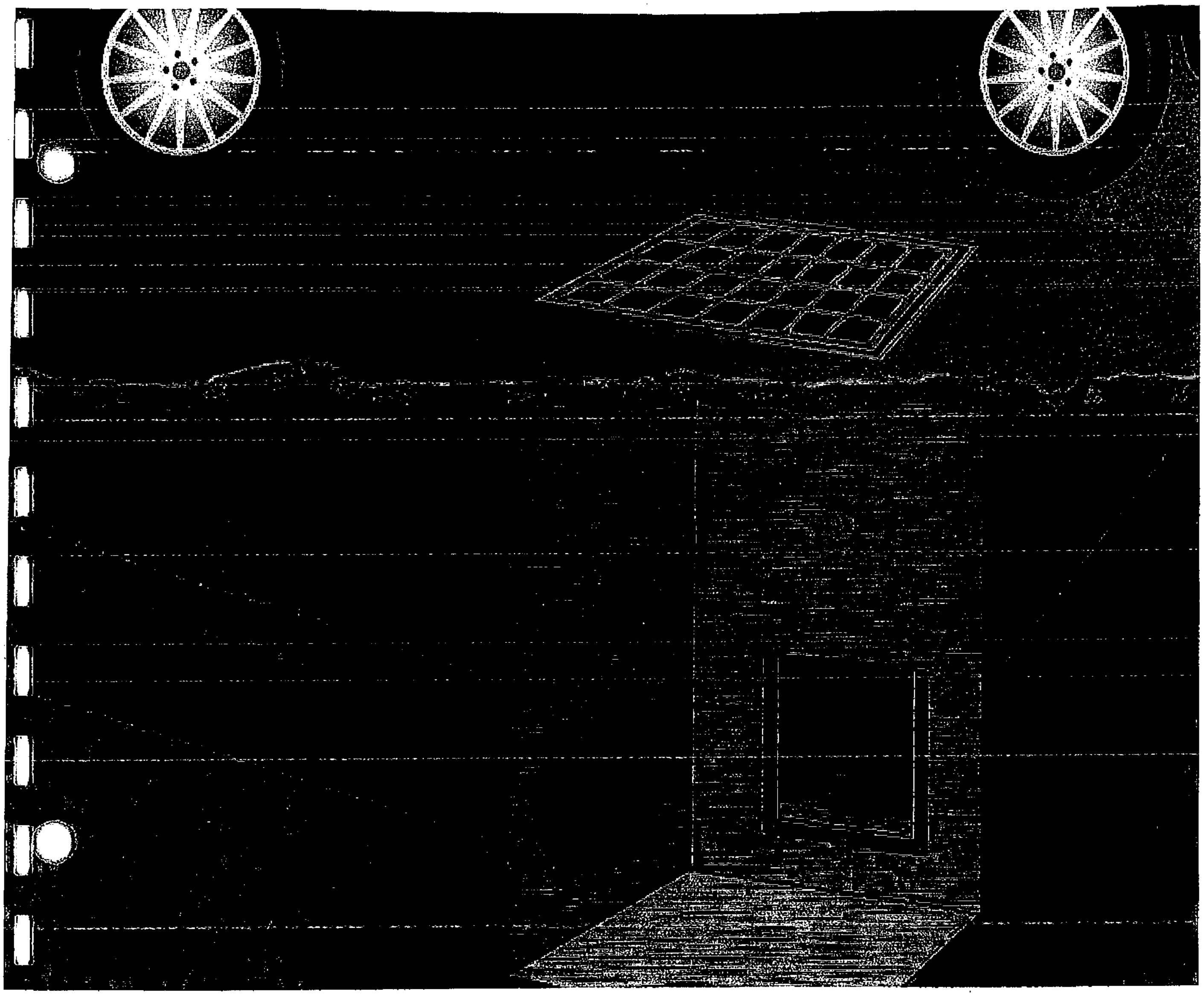
When using a design storm, the designer must be careful in choosing the right storm time step. The storm's duration should be greater than twice the basin's time of concentration. A time step that is too small may overestimate peak flows. Should it be required to maintain a storm time step less than 10 minutes, consideration should be given to averaging the peak intensities to a 10-minute or greater average.

Some historical storms are also presented below and are to be used as a check of how various systems function during extreme events. It is not the intent of these guidelines to require that these storms be used for design purposes.

5.4.3.2 Chicago Design Storm

The Chicago storm distribution was developed by C.J. Keifer and H. Chu and is based on 25 years of rainfall record in the city of Chicago. This storm distribution, which is derived with IDF curves, is generally applied to urban basins where peak runoff rates are largely influenced by peak rainfall intensities.

APPENDIX "G"
ICD Data table
& STC Design Brief



ICD

INLET CONTROL DEVICE

FOR STORMWATER MANAGEMENT

IPEX™

Committed to Excellence

DESCRIPTION

The IPEX Inlet Control Device (ICD) is a fabricated PVC fitting that helps preserve sewer capacity and control stormwater by restricting flow. Developed at the University of Ottawa's Department of Civil Engineering, the ICD is available in a 'Plug' or 'Framed' configuration.

APPLICATIONS

During major storms, a surcharged sewer may back up into foundation drains (or basement drains in the case of combined sewers) causing major flooding and damage. What usually results is a public outcry against 'inadequate' sewer systems. Designing for '100-year' storms or even '25-year' storms can be a costly alternative. The IPEX patented ICD provides a cost-effective alternative by temporarily diverting rainfall to surface storage, away from basements.

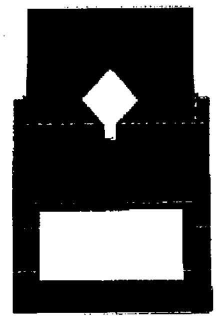
Types Available:

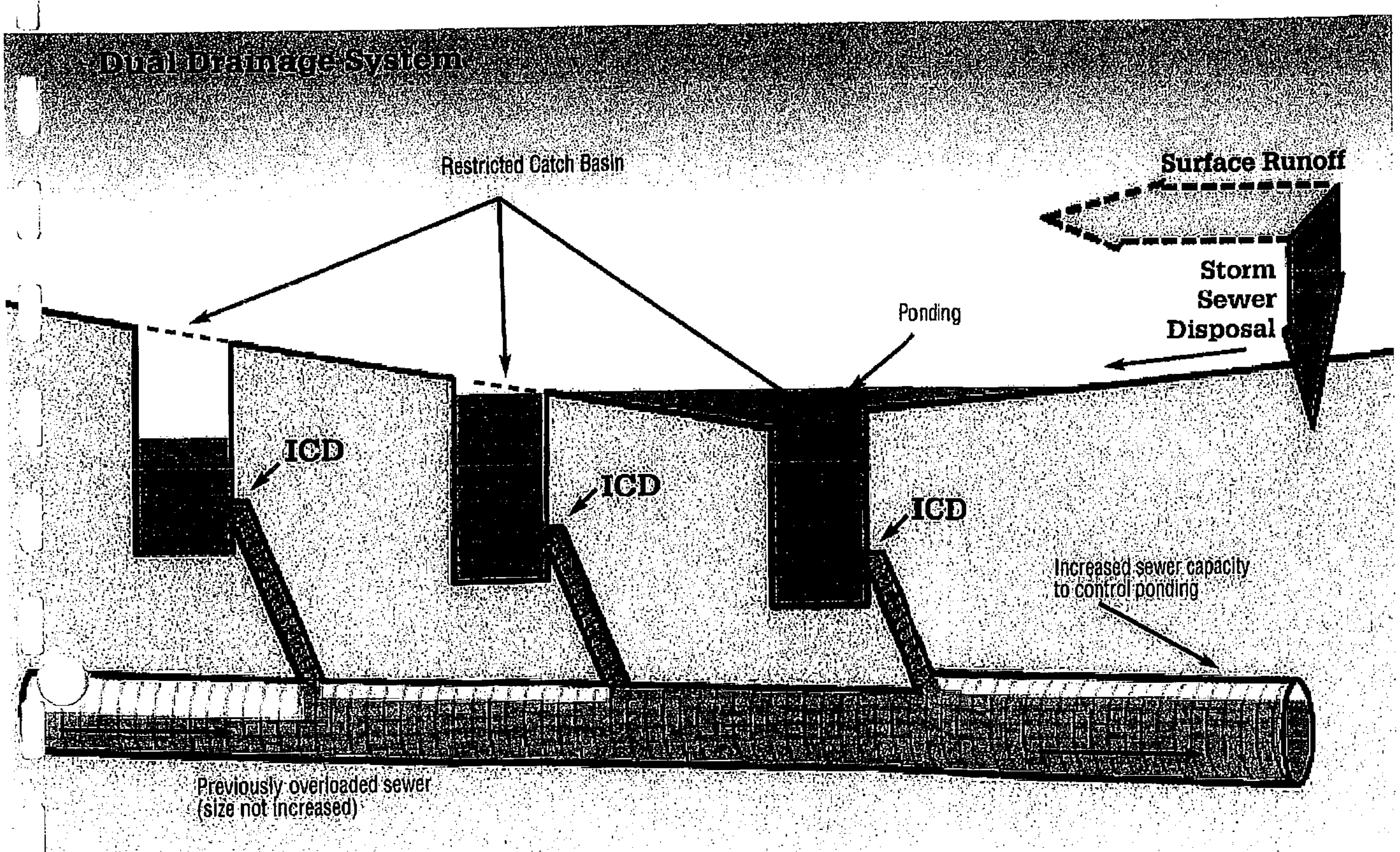
'Plug' ICD

A short, slightly tapered plug is inserted in the outlet pipe from the catchbasin. Held in place by friction and hydrostatic pressure, plug ICDs are made to fit 200mm, 250mm & 300mm (8", 10" & 12") pipe made from any material (i.e. PVC, concrete, clay, etc.). The orifice plate sits flush with the inside of the catchbasin.

'Framed' ICD

A plate containing the orifice is held in channels in the frame. The ICD frame is bolted over the outlet pipe inside the catchbasin. Framed ICDs can be fabricated for any size and type of pipe.



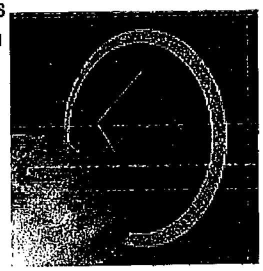


ADVANTAGES

Alleviates Basement Flooding

By restricting flow of stormwater into the sewer system, and temporarily ponding water in catchbasins, parking lots and roadways, sewer capacity is increased. Pipe upstream that would have otherwise been surcharged has greater capacity, reducing basement flooding. All this for a fraction of the cost of installing larger pipes.

Sump Scouring Action



The rectangular slot at the bottom of the orifice works effectively in two ways. First, during dry periods it draws the water level below the main orifice area, keeping it clear of floating debris. Second, it generates strong vortex action in the approach flow during heavy rainfalls, vigorously scouring sediment from the sump of the catchbasin.

Fits Any Type of Pipe

IPEX ICDs can be fabricated to fit any type of pipe – PVC, concrete, clay, or a host of other products. Simply contact your local representative with details and leave the rest to IPEX.

DESIGN NOTES

Calibration curves for the five standard sizes at various heads are shown. The values shown are empirical, developed by the University of Ottawa's Department of Civil Engineering.

*Head is measured from the centre line of the diamond to the water elevation or flood level.

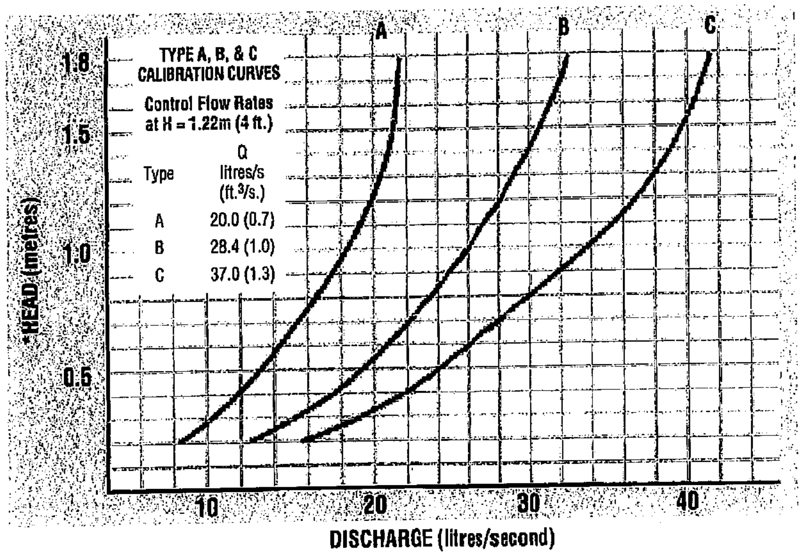
SHORT FORM SPECIFICATIONS

IPEX Inlet Control Devices (ICDs) are manufactured from Polyvinyl Chloride (PVC) to be supplied according to the type (i.e. A, B, C, D, or F) as shown in the engineer's drawings.

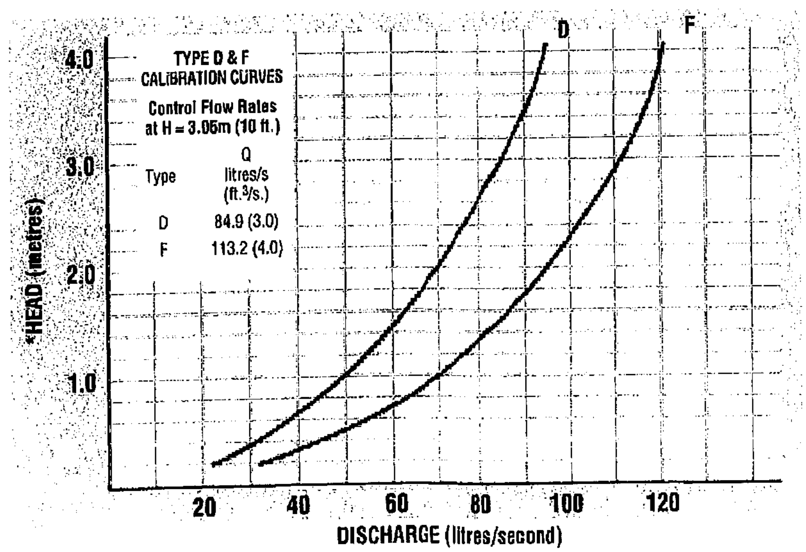
IPEX Plug ICDs are to be machined to provide a friction fit into the outlet pipe.

Framed ICDs are to be bolted in position over appropriate outlet pipe in the catchbasin/maintenance hole.

Calibration Curves for Standard ICDs



Note: 200mm (8") ICD Plugs available in Type A & B only.



Note: Type D and F can fit pipes ≥ 250mm (10").

IPEX
Committed to Excellence

ICD
INLET CONTROL DEVICE

Langley
20460 Duncan Way
Langley, British Columbia V3A 7A3
(604) 534-8631 TOLL FREE (800) 663-5864
FAX (604) 534-7616

Calgary
7710 - 40th Street S.E.
Calgary, Alberta T2C 3S4
(403) 236-8333 FAX (403) 279-8443

Edmonton
4225 - 92nd Avenue
Edmonton, Alberta T6B 3M7
(403) 468-4444 FAX (403) 465-5617

Saskatoon
611 - 47th Street East
Saskatoon, Saskatchewan S7K 5G5
(306) 933-4664 FAX (306) 934-2020

Winnipeg
2081 Logan Avenue West
Winnipeg, Manitoba R2R 0J1
(204) 633-3111 FAX (204) 633-3075

Toronto
6810 Invader Crescent
Mississauga, Ontario L5T 2B6
(416*) 670-7676 TOLL FREE (800) 268-4664
FAX (416*) 670-5295 *(905) effective Oct. 4/93

Montreal
6665 Chemin St. François
St. Laurent, Quebec H4S 1B6
(514) 337-2624 TOLL FREE (800) 363-4343
FAX (514) 337-7886

Saint John
P.O. Box 127, Grandview Industrial Park
Saint John, New Brunswick E2L 3X8
(506) 633-7473 (PIPE)
TOLL FREE (800) 561-7473 (PIPE)
FAX (506) 633-8720

St. John's
P.O. Box 13247, Station A
St. John's, Newfoundland A1B 4A5
(709) 747-7473 (PIPE) FAX (709) 368-9111

Massachusetts
54 Cross Lane
Beverley, MA 01915
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ICD93

Stormceptor®

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	27/08/2014
Project Name	12 Unit Residential
Project Number	013-286
Location	Vars

Designer Information

Company	A Dagenais
Contact	Michael

Notes

N/A

Drainage Area

Total Area (ha)	0.72
Imperviousness (%)	34

The Stormceptor System model STC 300 achieves the water quality objective removing 84% TSS for a Fine (organics, silts and sand) particle size distribution and 98% runoff volume.

Rainfall

Name	OTTAWA MACDONALD-CARTIER INT'L A
State	ON
ID	6000
Years of Records	1967 to 2003
Latitude	45°19'N
Longitude	75°40'W

Water Quality Objective

TSS Removal (%)	80
Runoff Volume (%)	95

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0.000	00.000
0.012	40.340

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %	Runoff Volume %
STC 300	84	98
STC 750	89	100
STC 1000	89	100
STC 1500	89	100
STC 2000	92	100
STC 3000	92	100
STC 4000	94	100
STC 5000	94	100
STC 6000	95	100
STC 9000	97	100
STC 10000	97	100
STC 14000	97	100

Stormceptor®

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)								
Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
20	20	1.3	0.0004					
60	20	1.8	0.0016					
150	20	2.2	0.0108					
400	20	2.65	0.0647					
2000	20	2.65	0.2870					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

APPENDIX "H"
Ontario Building Code

PART 8 SEWAGE SYSTEMS

Section 8.1. General

8.1.1. Scope

8.1.1.1. Scope

(1) The scope of this Part shall be as described in Subsection 1.1.2. of Division A and applies to the design, *construction*, operation, and maintenance of *sewage systems*.

8.1.1.2. Definitions

(1) In this Part,

Soil means in-situ, naturally occurring, unconsolidated mineral or organic material, at the earth's surface that is at least 100 mm thick and capable of supporting plant growth, and includes material compacted or cemented by soil forming processes, but does not include displaced materials such as gravel dumps, mine spoils, or like deposits.

8.1.2. Application

8.1.2.1. Classification of Systems

(1) All *sewage systems* shall be classed as one of the following:

(a) Class 1 — a chemical toilet, an incinerating toilet, a recirculating toilet, a self-contained portable toilet and all forms of privy including a *portable privy*, an *earth pit privy*, a *pail privy*, a *privy vault* and a composting toilet system,

(b) Class 2 — a *greywater* system,

(c) Class 3 — a cesspool,

(d) Class 4 — a *leaching bed* system, or

(e) Class 5 — a system that requires or uses a *holding tank* for the retention of *hauled sewage* at the site where it is produced prior to its collection by a *hauled sewage system*.

8.1.2.2. Operation and Maintenance

(1) Operation and maintenance of *sewage systems* shall comply with Section 8.9.

8.1.3. Limitations

8.1.3.1. Discharge

(1) Except as provided in Sentences (2) to (6) the *sewage system* shall be designed and *constructed* to receive only *sanitary sewage* of domestic origin.

(2) Where laundry waste is not more than 20% of the total daily design *sanitary sewage* flow, it may discharge to a *sewage system*.

(3) Where industrial process waste water is treated to the contaminant levels found in domestic *sanitary sewage* it may discharge to a *leaching bed* provided the *treatment unit* and *sewage system* are designed in accordance with good engineering practice.

(4) Where all kitchen waste water from a restaurant has passed through an operating grease interceptor, it may discharge to a *leaching bed system* provided the *sewage system* has been designed in accordance with good engineering practice.

(5) Waste water from a kitchen equipped with a garbage grinder may be directed to the *sewage system* provided the system has been designed to accept such waste water.

(6) Water softener and iron filter discharge may be directed to the *sewage system* provided the system has been designed to accept such discharges.

(7) *Storm sewage* shall not be discharged into a *sewage system*.

(8) The interceptor required in Sentence (4) shall have a minimum flow rate as required by Sentence 7.4.4.3.(8) using a 60 second drain down time.

Section 8.2. Design Standards

8.2.1. General Requirements

8.2.1.1. Scope

(1) This Subsection applies to the design of *sewage systems*.

8.2.1.2. Site Evaluation

(1) A site evaluation shall be conducted on every site where a new or replacement *sewage system* is to be installed.

■ **(2)** The *percolation time* shall be determined by either percolation tests or by classifying the *soil* according to the Unified Soil Classification System as described in Supplementary Standard SB-6.

(3) Where the *percolation time* is determined by a percolation test, there shall be a minimum of 3 locations selected, suitably spaced to accurately evaluate the *leaching bed* area, with the highest *percolation time* of the tests being used

8.2.1.3. Sewage System Design Flows

(1) For *residential occupancies*, the total daily design *sanitary sewage* flow shall be at least the value in Column 2 as determined from Table 8.2.1.3.A.

(2) For all other *occupancies*, the total daily design *sanitary sewage* flow shall be at least the value in Column 2 as determined from Table 8.2.1.3.B.

(3) Where a *building* contains more than one establishment, the total daily design *sanitary sewage* flow shall be the sum of the total daily design *sanitary sewage* flow for each establishment.

(4) Where an *occupancy* is not listed in Table 8.2.1.3.B., the highest of metered flow data from at least 3 similar establishments shall be acceptable for determining total daily design *sanitary sewage* flow.

Table 8.2.1.3.A.
Residential Occupancy

Forming Part of Sentence 8.2.1.3.(1)

Column 1	2
Residential Occupancy	Volume, litres
Apartments, Condominiums, Other Multi-family Dwellings - per person[1]	275
Boarding Houses	
a) Per person,	
i) with meals and laundry facilities, or,	200
ii) without meal or laundry facilities, and	150
b) Per non-resident staff per 8 hour shift	40
Boarding School - per person	300
Dwellings	
a) 1 bedroom dwelling	750
b) 2 bedroom dwelling	1100
c) 3 bedroom dwelling	1600
d) 4 bedroom dwelling	2000
e) 5 bedroom dwelling	2500
f) Additional flow for[2]	
i) each bedroom over 5,	500
ii) A) each 10 m^2 (or part of it) over 200 m^2 up to 400 m^2 [2,3],	100
B) each 10 m^2 (or part of it) over 400 m^2 up to 600 m^2 [3], and	75
C) each 10 m^2 (or part of it) over 600 m^2 [3], or	50
iii) each fixture unit over 20 fixture units	50
Hotels and Motels (excluding bars and restaurants)	
a) Regular, per room	250
b) Resort hotel, cottage, per person	500
c) Self service laundry, add per machine	2500
Work Camp/Construction Camp, semi-permanent per worker	250

Notes to Table 8.2.1.3.A.:

[1] The *occupant load* shall be calculated using Subsection 3.1.17.

[2] Where multiple calculations of sewage volume is permitted the calculation resulting the highest flow shall be used in determining the design daily *sanitary sewage* flow.

[3] Total finished area, excluding the area of the *finished basement*.

Table 8.2.1.3.B.
Other Occupancies
Forming Part of Sentence 8.2.1.3.(2)

Column 1	2
Establishments[1]	Volume, litres
Airports, Bus Terminals, Train Stations, Dock/Port Facilities (Food Services excluded)	
a) Per passenger, and	20
b) Per employee per 8 hour shift	40
Assembly Hall - per seat	
a) No food service, or	8
b) Food service provided	36
Barber Shop/Beauty Salon - per service chair	650
Bowling Alleys (Food Service not included) - per lane	400
Churches and Similar Places of Worship - per seat	
a) No kitchen facilities, or	8
b) Kitchen facilities provided	36
Country Club (excluding Food Service)	
a) Per resident,	375
b) Per employee per 8 hour shift, and	60
c) Per member or patron	40
Day Care Facility per person (staff and children)	75
Dentist Office	
a) Per wet service chair, and	275
b) Per dry service chair	190
Doctors Office	
a) Per practitioner, and	275
b) Per employee per 8 hour shift	75
Factory (excluding process or cleaning waters) - per employee per 8 hour shift	
a) No showers, or	75
b) Including showers	125
Flea Markets[2] (open not more than 3 days per week)	

Table 8.2.1.3.B. (cont'd)

Column 1	2
Establishments[1]	Volume, litres
a) Per non-food service vendor space,	60
b) Per food service establishment / 9.25 m² of floor space, and	190
c) Per limited food service outlet	95
Food Service Operations	
a) Restaurant (not 24 hour), per seat	125
b) Restaurant (24 hour), per seat	200
c) Restaurant on controlled access highway, per seat	400
d) Paper service restaurant, per seat	60
e) Donut shop, per seat	400
f) Bar and cocktail lounge, per seat	125
g) Drive-in restaurant per parking space	60
h) Take-out restaurant (no seating area)	
i) per 9.25 m² of floor area, and	190
ii) per employee per 8 hour shift	75
i) Cafeteria – per meal	12
j) Food outlet	
i) excluding delicatessen, bakery and meat department, per 9.25 m² of floor space,	40
ii) per 9.25 m² of delicatessen floor space,	190
iii) per 9.25 m² of bakery floor space,	190
iv) per 9.25 m² of meat department floor space, and	380
v) per water closet	950
Hospitals – per bed	
a) Including laundry facilities, or	750
b) Excluding laundry facilities	550
Nursing Homes, Rest Homes, etc. – per bed	450
Office Building[3]	
a) Per employee per 8 hour shift, or	75
b) Per each 9.3 m² of floor space	75

Table 8.2.1.3.B. (cont'd)

Column 1	2
Establishments[1]	Volume, litres
Public Parks	
a) With toilets only per person, or	20
b) With bathhouse, showers, and toilets per person	50
Recreational Vehicle or Campground Park	
a) Per site without water or sewer hook-up, or	275
b) Per site with water and sewer hook-up	425
Schools - per student	
a) Day school,	30
b) With showers,	30
c) With cafeteria, and	30
d) Per non-teaching employee per 8 hour shift	50
Service Stations (no vehicle washing)[3]	
a) Per water closet, and	950
i) per fuel outlet[4], or	560
ii) per vehicle served	20
Shopping Centre (excluding food and laundry) - per 1.0 m² of floor space	5
Stadiums, Race Tracks, Ball Parks - per seat	20
Stores[3]	
a) Per 1.0 m² of floor area, or	5
b) Per water closet	1230
Swimming and Bathing Facilities (Public) - per person	40
Theatres	
a) Indoor, auditoriums per seat,	20
b) Outdoor, drive-ins per space, or	40
c) Movie theatres per seat	15
Veterinary Clinics	
a) Per practitioner,	275
b) Per employee per 8 hour shift, and	75

Table 8.2.1.3.B. (cont'd)

Column 1	2
Establishments[1]	Volume, litres
c) Per stall, kennel, or cage if floor drain connected	75
Warehouse	
a) Per water closet, and	950
b) Per loading bay	150

Notes to Table 8.2.1.3.B.:

[1] The *occupant load* shall be calculated using Subsection 3.1.17.

[2] Flea markets open more than 3 days per week shall be assessed using the volumes stated under the heading "Stores".

[3] Where multiple calculations of *sanitary sewage* volume is permitted the calculation resulting in the highest flow shall be used in determining the design daily *sanitary sewage* flow.

[4] The number of fuel outlets is considered the maximum number of gas nozzles that could be in use at the same time.

8.2.1.4. Clearances

(1) Unless it can be shown to be unnecessary, where the *percolation time* is 10 minutes or greater, the location of all components within a *sewage system* shall be in conformance with the clearances listed in Articles 8.2.1.5. or 8.2.1.6.

(2) Unless it can be shown to be unnecessary, where the *percolation time* is less than 10 minutes, the clearances listed in Articles 8.2.1.5. and 8.2.1.6. for wells, lakes, ponds, reservoirs, rivers, springs or streams shall be increased to compensate for the lower *percolation time*.

(3) No *building* shall be *constructed* closer to any part of a *sewage system* than the clearances listed in Articles 8.2.1.5. or 8.2.1.6.

(4) If more than one *sewage system* is located on a lot or parcel of land, there shall be no overlap of any part of the systems.

8.2.1.5. Clearance Distances for Class 1, 2 and 3 Sewage Systems

(1) Except as provided in Sentences 8.2.1.4.(1) and (2), no Class 1, 2, or 3 *sewage system* shall have a horizontal distance of less than that permitted by Table 8.2.1.5.

Table 8.2.1.5.
Clearance Distances for Class 1, 2 and 3 Sewage Systems

Forming Part of Sentence 8.2.1.5.(1)

Column 1	2	3	4	5
Sewage System	Minimum horizontal distance in metres from a well with watertight casing to a depth of at least 6 m	Minimum horizontal distance in metres from a spring used as a source of *potable* water or well other than a well with a water tight casing to a depth of at least 6 m	Minimum horizontal distance in metres from a lake, river, pond, stream, reservoir, or a spring not used as a source of *potable* water	Minimum horizontal distance in metres from a property line
Earth Pit Privy	15	30	15	3
Privy Vault Pail Privy	10	15	10	3
Greywater System	10	15	15	3
Cesspool	30	60	15	3

8.2.1.6. Clearances for a Class 4 or 5 Sewage System

(1) Except as provided in Sentences 8.2.1.4.(1) and (2), a *treatment unit* shall not be located closer than the minimum horizontal distances as set out in Table 8.2.1.6.A.

Table 8.2.1.6.A.
Minimum Clearances for Treatment Units
Forming Part of Sentence 8.2.1.6.(1)

Column 1	2
Object	Minimum Clearance, m
Structure	1.5
Well	15
Lake	15
Pond	15
Reservoir	15
River	15
Spring	15
Stream	15
Property Line	3

(2) Except as provided in Sentences 8.2.1.4.(1) and (2), a *distribution pipe* shall not be located closer than the minimum horizontal distances set out in Table 8.2.1.6.B. and these distances shall be increased when required by Sentence 8.7.4.2.(9).

Table 8.2.1.6.B.
Minimum Clearances for Distribution Piping
Forming Part of Sentence 8.2.1.6.(2)

Column 1	2
Object	Minimum Clearance, m
Structure	5
Well with a watertight casing to a depth of 6 m	15
Any other well	30
Lake	15
Pond	15
Reservoir	15
River	15
Spring not used as a source of *potable* water	15
Stream	15
Property Line	3

(3) Except as provided in Sentences 8.2.1.4.(1) and (2), a *holding tank* shall not be located closer than the minimum horizontal distances set out in Table 8.2.1.6.C.

Table 8.2.1.6.C.
Minimum Clearances for Holding Tanks
Forming Part of Sentence 8.2.1.6.(3)

Column 1	2
Object	Minimum Clearance, m
Structure	1.5
Well with a watertight casing to a depth of at least 6 m	15
Any other well	15
Spring	15
Property Line	3

8.2.2. Treatment and Holding Tanks

8.2.2.1 Application

(1) This Subsection applies to any tank used in a *sewage system* for collecting, treating, holding or storing *sanitary sewage*.

8.2.2.2. Tanks

(1) Subject to Sentence (3), a tank that is used as a *treatment unit* in a Class 4 *sewage system* or a *holding tank* in a Class 5 *sewage system* shall conform to the requirements of CSA B66, "Design, Material, and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks".

(2) Subject to Sentence (3), material standards, access and *construction* methods and practices for a tank used for other Classes of *sewage systems* shall conform to the requirements of CSA B66, "Design, Material, and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks".

(3) Tanks referred to in Sentences (1) and (2) are not required to conform to the requirements of Clause 10.2.(j) of CSA B66 "Design, Material, and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks".

(4) Sentence (2) does not apply to a tank that is an integral part of a prefabricated Class 1 *sewage system*.

(5) Access openings shall be located to facilitate the pumping of all compartments and the servicing of the inlet and outlet of each compartment not accessible by removal of the tank top or part of it.

(6) A tank shall not be covered by *soil* or *leaching bed fill* having a depth greater than the maximum depth of burial that the tank is designed to withstand.

(7) A tank shall be securely anchored when located in an area subject to flooding or where *ground water* levels may cause hydrostatic pressures.

8.2.2.3. Septic Tanks

(1) The minimum *working capacity* of a *septic tank* shall be the greater of 3 600 L and,

(a) in *residential occupancies*, twice the daily design *sanitary sewage* flow, or

(b) in non-*residential occupancies*, three times the daily design *sanitary sewage* flow.

(2) Every *septic tank* shall be *constructed* in such a manner that any *sanitary sewage* flowing through the tank will pass through at least 2 compartments.

(3) The *working capacity* of the compartments required in Sentence (2) shall be sized such that,

(a) the first compartment is at least 1.3 times the daily design *sanitary sewage* flow but in no case less than 2 400 L, and

(b) each subsequent compartment shall be at least 50% of the first compartment.

(4) Where multiple tanks are to be used to meet the requirements of Sentences (2) and (3), the tanks shall be connected in series such that,

(a) the first tank in the series shall have at least a capacity as calculated in Clause (3)(a), however at no time shall a tank having a *working capacity* of less than 3 600 L be used,

(b) all additional tanks after the first tank, excluding pump or dosing tanks shall have at least a *working capacity* equal to Clause (3)(b),

(c) the pipe between the outlet of one tank and the inlet of the next tank in the series shall have a minimum slope of 2 per cent,

(d) there shall be no partitions in the tank except where a partition is required to maintain the structural integrity of the tank, in which case openings within the partition shall be provided to allow the free movement of *sanitary sewage* throughout the tank, and

(e) all piping between tanks shall be continuous and shall be connected to the tank through the use of flexible watertight seals that will permit differential movement between the tanks.

(5) Partitions separating the *septic tank* into compartments shall extend at least 150 mm above the liquid level at the outlet, and there shall be one or more openings through or above the partition.

(6) The openings required between compartments referred to in Sentence (2) shall have a total cross-sectional area of at least three times the area of the inlet pipe and be located between the top and a level 150 mm above the liquid level at the outlet to provide for the free flow of air between compartments.

(7) *Sanitary sewage* shall pass from one compartment to another of the *septic tank* by means of either,

(a) a device similar to that described in CSA B66, "Design, Material, and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks" for outlet devices, or

(b) through two or more openings through the partition located in a horizontal line, and evenly spaced across the width of the partition, centred at approximately 40% of the liquid depth below the surface of the liquid, and having a total area of between three and five times that of the cross-sectional area of the inlet pipe.

(8) A *septic tank* shall be of such design and *construction* as will permit the collection and holding of *sanitary sewage* in it to a depth of not less than 1 200 mm except that a depth of not less than 900 mm is permitted where the excavation is in rock, or to avoid rupture or displacement of the tank due to *ground water* pressure.

(9) Except as provided in Sentences (10) and (11), every *septic tank* shall be installed in such a manner that the access openings are located not more than 300 mm below the ground surface.

(10) Where the top of the *septic tank* is located more than 300 mm below the ground surface, it shall be equipped with risers that extend from the access opening of the *septic tank* to within 300 mm of the ground surface.

(11) Where risers are used they shall conform to the requirements of CSA B66, "Design, Material, and Manufacturing Requirements for Prefabricated Septic Tanks and Sewage Holding Tanks", and shall have adequate access openings to allow for regular maintenance of the *septic tank*.

8.2.2.4. Holding Tanks

(1) All *holding tanks* shall be of such design and *construction* as will allow the complete removal of solid matter that can be expected to settle in the *holding tank* through an apparatus or device suitable for allowing the contents of the *holding tank* to be removed from the *holding tank*.

(2) A *holding tank* shall have a *working capacity* of not less than 9 000 L.

(3) Where two or more tanks are used to meet the requirement of Sentence (2), they shall be deemed to be one *holding tank* provided they are connected in such a manner as will allow the *sanitary sewage* contained in them to flow between the tanks.

(4) The *working capacity* of the tanks described in Sentence (3) shall not include any portion of any tank that cannot be completely drained due to the manner in which the connections are made.

Section 8.6. Class 4 Sewage Systems

8.6.1. General Requirements

8.6.1.1. Scope

(1) This Section applies to the *construction* of a Class 4 *sewage system*.

8.6.1.2. General Requirements

(1) The *treatment unit* shall be connected to a *leaching bed constructed* in accordance with the requirements of Section 8.7.

8.6.1.3. Pumps and Siphons

(1) Where the total length of *distribution pipe* required is 150 m or more, the *sewage system* shall have at least one pump or a siphon contained in a dosing tank that may be a separate compartment within the tank structure, for distribution of the *effluent*.

(2) Alternating siphons shall not be installed in a *sewage system*.

(3) Where 2 or more pumps are employed within a dosing tank, the pumps shall be designed such that the pumps alternate dosing, and dosing shall continue in the event that one pump fails.

(4) Where a pump or siphon is required, the pump or siphon shall be designed to discharge a dose of at least 75% of the internal volume of the *distribution pipe* within a time period not exceeding fifteen minutes.

8.6.2. Treatment Units

8.6.2.1. Septic Tank Systems

(1) An *effluent* filter shall be installed in the outlet flow path of every *septic tank* that discharges *effluent* to a *leaching bed*.

(2) The *septic tank effluent* filter required by Sentence (1) shall conform to the requirements of NSF/ANSI 46, "Evaluation of Components and Devices Used in Wastewater Treatment Systems", and shall be sized and installed in accordance with the manufacturer's recommendations.

(3) A secured access opening to allow for regular maintenance of the *effluent* filter shall be provided at the ground surface.

8.6.2.2. Other Treatment Units

(1) A *treatment unit* other than those described in Article 8.6.2.1. and Sentence (2) shall be designed such that *effluent* does not exceed the maximum concentrations stipulated in Column 2 of Table 8.6.2.2.A

(2) A *treatment unit* that is used in conjunction with a *leaching bed constructed* as *shallow buried trenches* shall be designed such that the *effluent* does not exceed the maximum concentrations stipulated in Column 3 of Table 8.6.2.2.A.

(3) All *treatment units* referred to in Sentences (1) and (2) that contain mechanical components shall be equipped with an audible and visual warning alarm so located to warn the occupants of the *building* served or the operator of the *treatment unit* of a malfunction in the operation of the *treatment unit*.

(4) All *treatment units* referred to in Sentences (1) and (2) shall permit the sampling of the *effluent*.

(5) A *treatment unit* described in the Supplementary Standard SB-5 is deemed to comply with the requirements of Table 8.6.2.2.A.

(6) Every manufacturer or distributor of a *treatment unit* shall provide, for each model sold, printed literature that describes the unit in detail and provides complete instructions regarding the operation, servicing, and maintenance requirements of the unit and its related components necessary to ensure the continued proper operation in accordance with the original design and specifications.

Table 8.6.2.2.A.
Other Treatment Unit Effluent Quality Criteria

Forming Part of Sentence 8.6.2.2.(1), (2) and (5)

Column 1	2	3
Parameter	Secondary Effluent(1)	Tertiary Effluent(1)
BOD_5	40	15
$CBOD_5$	30	10
Suspended Solids	30	10

Note to Table 8.6.2.2.A.:

(1) Maximum concentration based on 30 day averages in milligrams per litre (mg/L)

Section 8.7. Leaching Beds

8.7.1. General Requirements

8.7.1.1. Application

(1) This Section is applicable to the *construction* of *leaching beds*.

8.7.2. Construction Requirements

8.7.2.1. General Requirements

(1) A *leaching bed* shall not be located,

(a) in an area that has an average slope that exceeds one unit vertically to four units horizontally,

(b) in *soil* or *leaching bed fill* having a *percolation time* of,

(i) less than one minute, or greater than 125 minutes if *constructed* as a *shallow buried trench*, or

(ii) less than one minute, or greater than 50 minutes for all other *leaching beds*, or

(c) in or on an area that is subject to flooding that may be expected to cause damage to the *leaching bed* or impair the operation of the *leaching bed*.

(2) A *leaching bed* shall not be covered with any material having a hydraulic conductivity less than 0.01 m/day.

(3) The surface of the *leaching bed* shall be shaped to shed water and together with the side slopes of any raised portion, shall be protected against erosion in such a manner as to not inhibit the evaporation and transpiration of waters from the *soil* or *leaching bed fill*, and to not cause plugging of the *distribution pipe*.

(4) No part of a *leaching bed* shall be sloped steeper than 1 unit vertically to 4 units horizontally.

(5) A *leaching bed* shall be designed to be protected from compaction or any stress or pressure that may result in,

(a) the impairment or destruction of any pipe in the *leaching bed*, or

(b) the *soil* or *leaching bed fill*.

8.7.3. Absorption Trench Construction

8.7.3.1. Length of Distribution Pipe

(1) The total length of *distribution piping* shall,

(a) not be less than 30 m when *constructed* as a *shallow buried trench*, or

(b) not be less than 40 m for any other *absorption trench*.

(2) Except as provided in Sentences (1), (3), and (4) every *leaching bed constructed* by means of *absorption trenches* shall have a total length of *distribution pipe* not less than the value determined by the formula,

$$L = \frac{QT}{200}$$

where,

L = total length of *distribution pipe* in metres

Q = the total daily design *sanitary sewage* flow in litres

T = the design *percolation time*

(3) Except as provided in Sentence (1), where the *treatment unit* is described in Article 8.6.2.2., the *leaching bed* may have a total length of *distribution pipe* not less than the value determined by the formula,

$$L = \frac{QT}{300}$$

where,

L = total length of *distribution pipe* in metres

Q = the total daily design *sanitary sewage* flow in litres

T = the design *percolation time*

(4) Except as provided in Sentence (1), where the *leaching bed* is *constructed* as a *shallow buried trench*, the total length of the *distribution pipe* shall not be less than the value determined by Table 8.7.3.1.

Table 8.7.3.1.
Length of Shallow Buried Trench
Forming Part of Sentence 8.7.3.1.(4)

Column 1	2
Percolation Time, T of *soil*, min/cm	Trench Length, m
$1 < T \le 20$	Q/75
$20 < T \le 50$	Q/50
$50 < T < 125$	Q/30

where,

Q = the total daily design *sanitary sewage* flow in litres, and

T = the design *percolation time*.

8.7.3.2. Absorption Trenches

(1) Except as provided in Sentence (2), *absorption trenches* shall be,

(a) approximately the same length and not more than 30 m in length,

(b) not less than 500 mm and not more than 1 000 mm in width,

(c) not less than 300 mm and not more than 900 mm in depth,

(d) centred not less than 1 600 mm apart,

(e) located so that the bottom of the trench is not less than 900 mm above the *high ground water table*, rock or *soil* with a *percolation time* more than 50 minutes, and

(f) backfilled, after the installation of the *distribution pipe* with *leaching bed fill*, so as to ensure that after the *leaching bed fill* settles, the surface of the *leaching bed* will not form any depressions.

(2) *Absorption trenches constructed* as *shallow buried trenches* shall be,

(a) approximately the same length and not more than 30 m in length,

(b) not less than 300 mm and not more than 600 mm in width,

(c) not less than 300 mm and not more than 600 mm in depth,

(d) centred not less than 2 000 mm apart,

(e) not less than 900 mm at all points on the bottom of the *absorption trench* above the *high ground water table* or rock, and

(f) backfilled, after the installation of the *distribution pipe* with *leaching bed fill*, so as to ensure that after the *leaching bed fill* settles, the surface of the *leaching bed* will not form any depressions.

8.7.3.3. Distribution Pipe

(1) Except for *shallow buried trenches*, the *distribution pipe* used in the *construction* of a *leaching bed* shall be,

(a) of not less than 3 in. trade *size* for gravity flow systems, or 1 in. trade *size* for pressurized systems,

(b) installed with a uniform downward slope from the inlet with a drop of not less than 30 mm and not more than 50 mm for each 10 m of *distribution pipe*, and

(c) installed within a layer of stone conforming to Sentence (5).

(2) Prior to backfilling, the stone layer required in Clause (1)(c) shall be protected in such a manner so as to prevent *soil*, or *leaching bed fill* from entering the stone by completely covering with,

(a) untreated building paper, or

(b) a permeable geo-textile fabric.

(3) Every pressurized *distribution pipe* shall be self-draining so as to prevent freezing of its contents.

(4) Every pressurized *distribution pipe* shall have orifices of at least 3 mm in diameter, spaced equally along the length of the pipe.

(5) The layer of stone required by Clause (1)(c) shall,

(a) be comprised of washed septic stone, free of fine material, with gradation conforming to Table 8.7.3.3.A.,

(b) be not less than 500 mm in width,

(c) extend not less than 150 mm below the *distribution pipe*, and

(d) extend not less than 50 mm above the *distribution pipe*.

Table 8.7.3.3.A.
Gradation of Septic Stone

Forming Part Of Sentence 8.7.3.3.(5)

Column 1	2
Particle Size	Percent Passing
53 mm	100
19 mm	0-5
75 μm	0-1

8.7.4. Fill Based Absorption Trenches

8.7.4.1. Loading Requirements

(1) The area described in Sentence 8.7.4.2.(1) shall be designed such that the *loading rate* does not exceed, for *soil* having a *percolation time* set out in Column 1 of Table 8.7.4.1.A., the maximum value set out opposite it in Column 2 of Table 8.7.4.1.A.

Table 8.7.4.1.A.
Loading Rates for Fill Based Absorption Trenches and Filter Beds

Forming Part of Sentences 8.7.4.1.(1) and 8.7.5.2.(2)

Column 1	2
Percolation Time (T) of *Soil*, min/cm	Loading Rates, (L/m²)/day
$1 < T \leq 20$	10
$20 < T \leq 35$	8
$35 < T \leq 50$	6
$T > 50$	4

8.7.4.2. Construction Requirements

(1) A *leaching bed* comprised of *absorption trenches* may be *constructed* in *leaching bed fill* if unsaturated *soil* or *leaching bed fill* complying with Clause 8.7.2.1.(1)(b) extends,

(a) to a depth of at least 250 mm over the area covered by the *leaching bed fill*, and

(b) for at least 15 m beyond the outer *distribution pipes* in any direction in which the *effluent* entering the *soil* or *leaching bed fill* will move horizontally.

(2) If the unsaturated *soil* or *leaching bed fill* described in Sentence (1) has a *percolation time* greater than 15 minutes, any *leaching bed fill* added to form the *leaching bed* shall have a *percolation time* not less than 75% of the *percolation time* of the unsaturated *soil* or *leaching bed fill*.

(3) *Leaching bed fill* that does not meet the requirements of Sentence (2) may be used to form the *leaching bed* if,

(a) the distance from the bottom of the *absorption trench* to native *soil* is not less than 900 mm, or

(b) where the distance from the bottom of the *absorption trench* to native *soil* is less than 900 mm, the *percolation time* of the least permeable *soil* or *leaching bed fill* within 900 mm from the bottom of the *absorption trench* is used to calculate the length of the *distribution pipe* under Article 8.7.3.1.

(4) Sentence (2) does not apply to any *leaching bed fill* added as backfill above the stone layer in which the *distribution pipe* is located.

(5) All *leaching bed fill* added shall be stabilized against erosion.

(6) The site to which the *leaching bed fill* is added shall be generally clear of vegetation.

(7) The *leaching bed fill* that is added shall be compacted in layers in such a manner as to avoid uneven settlement of the *distribution pipes*.

(8) Any *distribution boxes, header lines, absorption trenches*, or *distribution pipes* shall be installed only after the *leaching bed fill* has been compacted in accordance with Sentence (7).

(9) Except as provided in Sentence (10), the sides of the added *leaching bed fill* shall be sloped to ensure stability, but shall not be steeper than one unit vertically to four units horizontally.

(10) The side slope of the *leaching bed fill* may be increased up to one unit vertically to three units horizontally if measures are taken to prevent erosion and ensure stability of the *leaching bed fill*.

(11) The distances as set out in Column 2 of Table 8.2.1.6.B. shall be increased by twice the height that the *leaching bed* is raised above the original grade.

8.7.5. Filter Beds

8.7.5.1. Application

(1) The total daily design *sanitary sewage* flow shall not exceed 5 000 L where the *treatment unit* is a *septic tank*, or 10 000 L where the *treatment unit* is described in Article 8.6.2.2.

8.7.5.2. Loading Requirements

(1) The effective area of the surface of the filter medium in each filter bed shall be at least 10 m^2 and not more than 50 m^2.

(2) The area described in Sentence 8.7.4.2.(1) shall be designed such that the *loading rate* does not exceed, for *soil* having a *percolation time* set out in Column 1 of Table 8.7.4.1.A., the maximum value set out opposite thereto in Column 2 of Table 8.7.4.1.A.

(3) Except as provided in Sentence (5), where the total daily design *sanitary sewage* flow does not exceed 3 000 L, the effective area shall be such that the loading on the surface of the filter medium does not exceed 75 L/m^2 per day.

(4) Except as provided in Sentence (5), where the total daily design *sanitary sewage* flow exceeds 3 000 L,

(a) the effective area shall be such that the loading on the surface of the filter medium does not exceed 50 L/m^2 per day, and

(b) the *leaching bed* shall be comprised of more than one filter bed, each of similar size and adjacent to each other.

(5) Where a *treatment unit* designed to produce *effluent* not exceeding the maximum concentrations stipulated in Column 2 of Table 8.6.2.2.A. is used in conjunction with a filter bed, the effective area shall be such that the loading on the surface of the filter medium does not exceed 100 L/m^2 per day.

8.7.5.3. Construction Requirements

(1) Sentences 8.7.4.2.(1), (2) and (4) to (11) apply to the *construction* of a filter bed.

(2) The lines of *distribution pipe* shall be evenly spaced over the surface of the filter medium to which the *sanitary sewage* is applied.

(3) The filter medium shall have a minimum depth of 750 mm below the stone layer and shall be clean sand comprised of particles ranging in size between the limits of,

(a) an effective size of 0.25 mm with a uniformity coefficient not less than 3.5,

(b) an effective size of 2.5 mm with a uniformity coefficient not greater than 1.5, and

(c) having a uniformity coefficient not greater than 4.5.

(4) The filter medium shall be unsaturated for its entire depth.

(5) Where there is more than one filter bed in a *leaching bed*, the filter beds shall be separated by at least 5 m between the *distribution pipes* of the filter beds.

(6) The base of the filter medium shall extend to a thickness of at least 250 mm over an area meeting the requirements of the following formula:

$$A = \frac{QT}{850}$$

where,

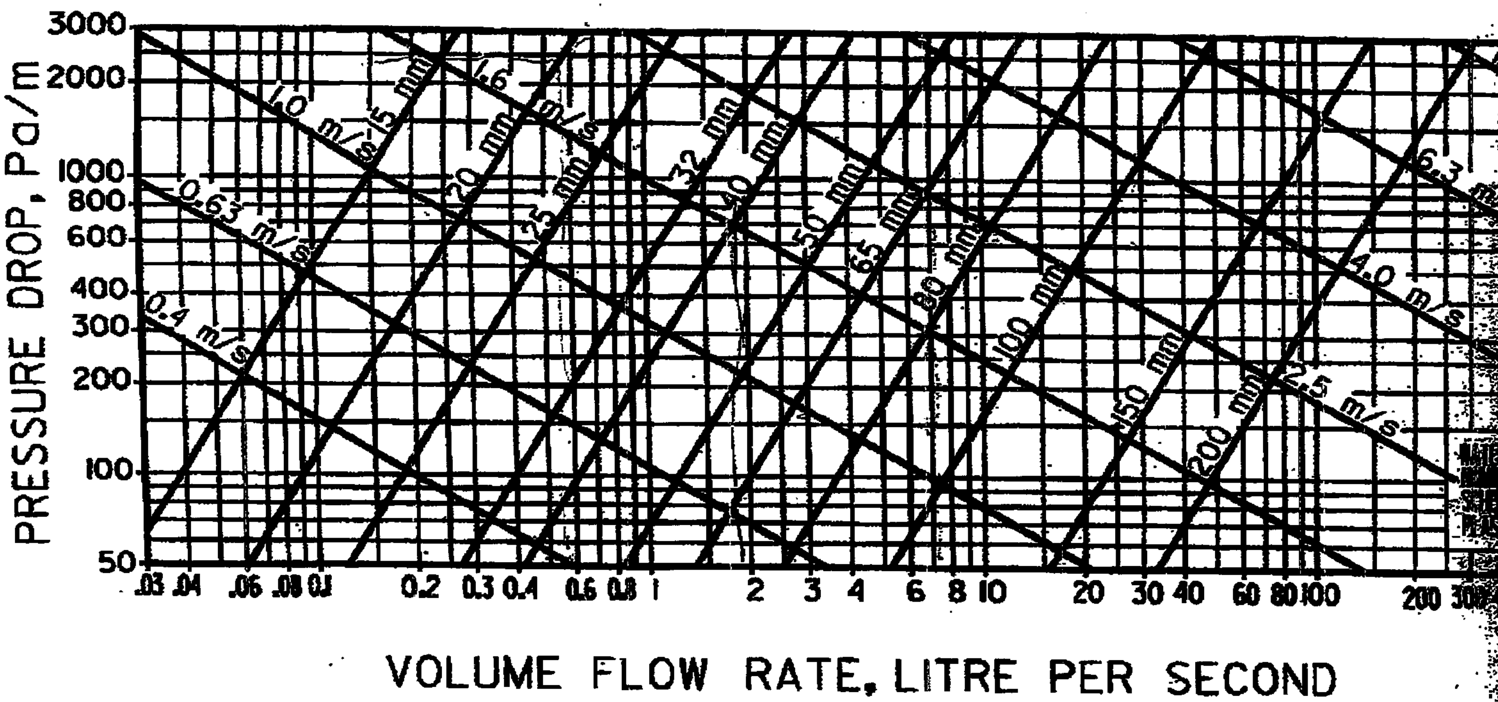
A = the area of contact in square metres between the base of the filter medium and the underlying *soil*,

Q = the total daily design *sanitary sewage flow* in litres, and

T = the lesser of 50 and the *percolation time* of the underlying *soil*.

(7) The stone layer required by Clause 8.7.3.3.(1)(b) shall be not less than 900 mm above the *high ground water table*, rock or *soil* with a *percolation time* more than 50 minutes,

APPENDIX "I"
ASHRAE TABLES & OTTAWA SEWER CAPACITY TABLES



Notes: 1. The chart is based on straight tees, i.e., branches A, B and C are the same size.

2. Pressure loss in desired circuit is obtained by selecting proper curve according to illustrations, determining the flow at the circled branch and multiplying the pressure loss for the same size elbow at the flow rate in the circled branch by the equivalent elbows indicated.

3. When the size of an outlet is reduced the equivalent [illegible] chart do not apply. Therefore, the maximum loss for any [illegible] will not exceed 2 elbow equivalents at the maximum flow [illegible] any branch of the tee.

4. The top curve of the chart is the average of 4 curves, [illegible] circuits illustrated.

Fig. 3 Friction Loss for Water in Plastic Pipe (Schedule 80)

Hydraulic Elements of Smooth Walled Circular Sewers Flowing Full: 200 - 375 mm Diameter (n=0.013)

	FLOW (L/s)							
Actual (mm)	203.2		254		304.8		381	
Nominal (mm)	200		250		300		375	
% Gr.	Q	V	Q	V	Q	V	Q	V
8.1	97.35	3.00						
7	90.63	2.79						
6	83.91	2.59	151.96	3.00				
5	76.61	2.36	138.72	2.74				
4.7	74.16	2.29	134.50	2.65	218.73	3.00		
4	68.43	2.11	124.08	2.45	201.70	2.77		
3.5	64.01	1.97	116.06	2.29	188.73	2.59	342.20	3.00
3	59.28	1.83	107.45	2.12	174.73	2.39	316.81	2.78
2	48.39	1.49	87.74	1.73	142.67	1.96	258.68	2.27
1	34.22	1.06	62.04	1.22	100.85	1.38	182.91	1.60
0.95	33.35	1.03	60.47	1.19	98.33	1.35	178.28	1.56
0.9	32.46	1.00	58.86	1.16	95.76	1.31	173.52	1.52
0.88	32.10	0.99	58.20	1.15	94.64	1.30	171.58	1.51
0.86	31.73	0.98	57.53	1.14	93.55	1.28	169.62	1.49
0.84	31.38	0.97	56.86	1.12	92.48	1.27	167.64	1.47
0.82	30.98	0.96	56.18	1.11	91.35	1.25	165.63	1.45
0.8	30.63	0.94	55.49	1.10	90.23	1.24	163.60	1.43
0.78	30.22	0.93	54.79	1.08	89.10	1.22	161.54	1.42
0.76	29.83	0.92	54.09	1.07	87.95	1.21	159.46	1.40
0.74	29.43	0.91	53.37	1.05	86.78	1.19	157.35	1.38
0.72	29.03	0.90	52.64	1.04	85.59	1.17	155.21	1.36
0.7	28.63	0.88	51.91	1.02	84.40	1.16	153.03	1.34
0.68	28.22	0.87	51.16	1.01	83.19	1.14	150.83	1.32
0.66	27.80	0.86	50.40	0.99	81.93	1.12	148.60	1.30
0.64	27.37	0.84	49.63	0.98	80.71	1.11	146.33	1.28
0.62	26.94	0.83	48.85	0.96	79.49	1.09	144.02	1.26
0.6	26.50	0.82	48.06	0.95	78.14	1.07	141.68	1.24
0.58	26.06	0.80	47.25	0.93	76.82	1.05	139.30	1.22
0.56	25.61	0.79	46.43	0.92	75.48	1.03	136.88	1.20
0.54	25.14	0.78	45.59	0.90	74.15	1.02	134.41	1.18
0.52	24.67	0.76	44.74	0.88	72.75	1.00	131.90	1.16
0.5	24.19	0.75	43.87	0.87	71.33	0.98	129.34	1.13
0.48	23.71	0.73	42.98	0.85	69.89	0.96	126.72	1.11
0.46	23.21	0.72	42.08	0.83	68.42	0.94	124.05	1.09
0.432	22.49	0.69	40.78	0.80	66.31	0.91	120.22	1.05
0.42	22.17	0.68	40.21	0.79	65.36	0.90	118.54	1.04
0.40	21.64	0.67	39.24	0.77	63.59	0.87	115.66	1.01
0.38	21.23	0.66	38.55	0.76	62.15	0.86	113.66	1.00
0.35	20.24	0.62	36.70	0.72	[illegible]	0.82	109.11	0.95
0.34	19.80	0.61	35.91	0.71	58.39	0.80	106.07	0.93
0.320	19.36	0.60	35.09	0.69	57.07	0.78	103.47	0.91
0.30			34.09	0.67	55.49	0.76	100.50	0.88
0.25			31.02	0.61	50.44	0.69	91.46	0.80
0.230			29.29	0.60	48.42	0.66	88.61	0.78
0.20					46.12	0.62	81.93	0.72
0.185					43.51	0.60	78.69	0.69
0.17							75.42	0.66
0.16							73.16	0.64
0.15							70.84	0.62
0.14							68.44	0.60

Hydraulic Elements of Smooth Walled Circular Sewers Flowing Full:
450 - 675 mm Diameter (n=0.013)

	FLOW (L/s)							
Actual (mm)	457.2		533.4		609.6		685.8	
Nominal (mm)	450		525		600		675	
%Gr.	Q	V	Q	V	Q	V	Q	V
2.75	493.24	3.00						
2.5	470.25	2.86						
2.25	444.98	2.71	659.90	3.00				
2	420.85	2.56	634.50	2.84				
1.87	409.73	2.48	613.55	2.75	878.0	3.00		
1.8	399.05	2.43	601.94	2.69	859.4	2.94		
1.6	376.25	2.29	567.61	2.54	810.3	2.78	1102.2	3.00
1.5	364.29	2.22	549.49	2.45	784.6	2.69	1074.0	2.91
1.4	351.93	2.14	530.85	2.36	757.9	2.60	1037.6	2.81
1.3	339.13	2.07	511.55	2.28	730.4	2.50	999.9	2.71
1.2	325.83	1.98	491.48	2.20	701.7	2.40	960.6	2.60
1.1	311.95	1.90	470.55	2.11	671.8	2.30	919.7	2.49
1	297.43	1.81	448.65	2.01	640.6	2.19	876.9	2.37
0.9	282.17	1.72	425.63	1.90	607.7	2.08	831.9	2.25
0.85	274.22	1.67	413.64	1.85	590.6	2.02	808.5	2.19
0.8	266.03	1.62	401.29	1.80	572.9	1.96	784.4	2.12
0.75	257.58	1.57	388.55	1.74	554.7	1.90	759.4	2.06
0.7	248.85	1.52	375.37	1.68	535.9	1.84	733.7	1.99
0.65	239.80	1.46	361.72	1.62	516.4	1.77	707.0	1.91
0.6	230.39	1.40	347.53	1.56	496.2	1.70	679.3	1.84
0.55	220.58	1.34	332.73	1.49	475.1	1.63	650.4	1.76
0.5	210.32	1.28	317.23	1.42	452.9	1.55	620.1	1.68
0.45	199.52	1.22	300.97	1.35	429.7	1.47	588.3	1.59
0.4	188.11	1.15	283.76	1.27	405.1	1.39	554.6	1.50
0.35	175.96	1.07	265.43	1.19	379.0	1.30	518.8	1.40
0.33	170.86	1.04	257.73	1.15	368.0	1.26	503.8	1.36
0.32	168.25	1.02	253.80	1.14	362.4	1.24	496.1	1.34
0.31	165.60	1.01	249.80	1.12	356.6	1.22	488.3	1.32
0.3	162.91	0.99	245.74	1.10	350.8	1.20	480.3	1.30
0.29	160.17	0.98	241.61	1.08	345.0	1.18	472.2	1.28
0.28	157.39	0.96	237.41	1.06	339.0	1.16	464.0	1.26
0.27	154.55	0.94	233.13	1.04	332.8	1.14	455.7	1.23
0.26	151.66	0.92	228.77	1.02	326.6	1.12	447.1	1.21
0.25	148.72	0.91	224.33	1.00	320.3	1.10	438.5	1.19
0.24	145.71	0.89	219.80	0.98	313.8	1.08	429.6	1.16
0.23	142.64	0.87	215.17	0.96	307.2	1.05	420.6	1.14
0.22	139.51	0.85	210.44	0.94	300.4	1.03	411.3	1.11
0.21	136.30	0.83	205.60	0.92	293.6	1.01	401.9	1.09
0.195	131.34	0.80	198.12	0.89	282.9	0.97	387.2	1.05
0.19	129.65	0.79	195.57	0.88	279.2	0.96	382.2	1.03
0.18	126.19	0.77	190.35	0.85	271.8	0.93	372.1	1.01
0.17	122.63	0.75	184.99	0.83	264.1	0.90	361.6	0.98
0.16	118.97	0.72	179.46	0.80	256.2	0.88	350.8	0.95
0.15	115.20	0.70	173.76	0.78	248.1	0.85	339.6	0.92
0.14	112.29	0.68	167.89	0.75	242.7	0.83	332.3	0.90
0.132	108.05	0.66	163.01	0.73	232.7	0.80	318.6	0.86
0.12	103.03	0.63	155.42	0.70	221.9	0.76	303.8	0.82
0.113	99.98	0.61	150.82	0.67	215.3	0.74	294.8	0.80
0.111	99.09	0.60	149.48	0.67	213.4	0.73	292.2	0.79
0.10			141.88	0.64	205.1	0.70	280.7	0.76

APPENDIX "J"
BOUNDARY CONDITIONS
& HGL

Michael Jans

From: Alvey, Harry [Harry.Alvey@ottawa.ca]
Sent: August-07-13 1:07 PM
To: 'Michael Jans'
Cc: Fitzpatrick, Anne
Subject: RE: 5574 Rockdale, vars

Good Afternoon Michael;

Here are the water boundary conditions as you requested;

The boundary conditions depend strongly on pump selection. Ignoring fires, minimum pressure actually occurs during basic (average) demand conditions when the duty pump is running. During peak hour or fire conditions, the duty pump does not operate. Larger capacity pumps with higher discharge pressures operate during these conditions.

Boundary conditions at the site are as follows:

Basic Day average= 115.4 m
Minimum pressure during Basic Day = 108.4m
Peak Hour on Max Day = 119.3 m

The system is not designed to supply the required fire demand. The development will need to consider the fire supply limitation, adjust building design accordingly, and/or provide additional on-site fire fighting measures. Below I have provided two boundary conditions based on fire flows that would result in the range of roughly 20 psi and above at the property.

FF = 95 L/s, Max Day + Fire = 93.6 m (~21 psi)
FF = 90 L/s, Max Day + Fire = 98.3 m (~28 psi)

For the record, a 3 hour fire flow of 95 L/s at max day would drop the pump station clearwells to 30% full, assuming a starting point of 75%.

If you have any questions or need any additional information let me know.

Sincerely;

Harry

Harry R. Alvey
Senior Infrastructure Approval Engineer
Development Review Rural Services

APPENDIX "K"
SITE SERVICING CHECKLIST

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

- N.A. ☐ Executive Summary (for larger reports only).
- ☒ Date and revision number of the report.
- ☒ Location map and plan showing municipal address, boundary, and layout of proposed development.
- ☒ Plan showing the site and location of all existing services.
- N.A. ☐ 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.
- ☒ 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.
- ☒ Identification of existing and proposed infrastructure available in the immediate area.
- N.A. ☐ 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 address potential impacts.

N.A. ☐ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:

- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

N.A. ☐ Confirm consistency with Master Servicing Study, if available

☒ Availability of public infrastructure to service proposed development

N.A. ☐ Identification of system constraints

☒ Identify boundary conditions

☒ Confirmation of adequate domestic supply and pressure

N.A. ☐ 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.

N.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.

N.A. ☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

☒ 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

N.A. ☐ 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.

N.A. ☐ 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.

☒ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.

N.A. ☐ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

N.A ☐ 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).

N.A. ☐ 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.

☒ Description of existing sanitary sewer available for discharge of wastewater from proposed development.

☒ 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)

N.A. ☐ Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.

N.A. ☐ Description of proposed sewer network including sewers, pumping stations, and forcemains.

N.A. ☐ 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 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.

4.4 Development Servicing Report: Stormwater Checklist

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

☒ Analysis of available capacity in existing public infrastructure.

N.A. ☐ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

☒ 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.

N.A. ☐ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

N.A. ☐ 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.A. ☐ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

- ☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).
- ☒ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.
- ☒ 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.
- N.A. ☐ 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
- ☒ Identification of municipal drains and related approval requirements.
- ☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.
- ☒ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.
- N.A. ☐ Inclusion of hydraulic analysis including hydraulic grade line elevations.
- ☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
- N.A. ☐ 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.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

N.A. ☐ 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.)

4.6 Conclusion Checklist

☒ Clearly stated conclusions and recommendations

☒ 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.

☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

APPENDIX "L"
EROSION AND SEDIMENT CONTROL