PROPOSED ANIMAL HOSPITAL/ OTTAWA VALLEY WILD BIRD CARE CENTRE

SITE SERVICING AND STORM WATER MANAGEMENT REPORT
for
8520 MCARTON ROAD, OTTAWA, ONTARIO

DEC 30, 2021

Advanced Design, Assessment & Development Inc
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ADVANCED DESIGN, ASSESSMENT& DEVELOPMENT Inc.

SITE SERVICING AND STORMWATER MANAGEMENT REPORT

for

8520 MCARTON ROAD,

OTTAWA, ONTARIO

Prepared BY

ADAD Inc.

SUBMITTED TO:

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1. INTRODUCTION

1.1 General:

The following report demonstrates, in brief, the site plan servicing and the stormwater management in support of a Site Plan Application for 8520 McArton Road, City of Ottawa, Ontario. Out of 7 hectares of the total area of the land, the 0.863-hectare development being proposed will potentially be the new location for the Ottawa Valley Wild Bird Centre. The development includes an animal hospital with a rehabilitation centre, parking area, and all required services. Figure 1 shows summer and winter aerial views of the property.

The principal concept in the site plan servicing and stormwater management is to integrate the site with the surrounding environment in a sustainable yet cost-effective approach. The report covers a brief explanation of each service, detailed calculations in compliance with the City of Ottawa and provincial requirements and by-laws for submission with the engineering drawings for City of Ottawa site plan approval.

1.2 Report Structure:

The City of Ottawa and the Ontario Ministry of the Environment Guidelines were used where applicable.

This report is divided into four sections:

i. Introduction.

ii. Site Service: includes current site condition, proposed site, fire protection, and sanitary servicing.

iii. Stormwater Management: includes design criterion, pre-development release rate, calculation of allowable release rate, calculation of post-development release rate, storage requirements, and proposed stormwater management plan.

iv. Erosion and Sediment Control.

v. Summary and Conclusions.

vi. Three Appendices:

Appendix A: Calculation of Fire Flow Requirements

Appendix B: Stormwater Management Design Sheets/ Tables.

Appendix C: Stormceptor Sizing and Maintenance Report.

1.3 References:

Various documents were referred to in preparing the current report, including:

- Ottawa Sewer Design Guidelines, City of Ottawa, SDG002, October 2012.

- Tech Bulletin ISTB-2018-02, Revision to Ottawa Design Guidelines – Water Distribution.
- Fire Underwriters Survey, Water Supply for Public Fire Protection, CGI Group Inc., 2007.
- Ontario Building Code, Ontario, https://www.ontario.ca/laws/regulation/120332
- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment (MOE), 2003.

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Summer view

Winter View

Figure 1-1 – Site Location

2. SITE SERVICES

2.1 General

2.1.1 Current Site Condition

The property has an approximate surface area of 7 ha (17 acres) located at 8520 Mcarton Road in Ottawa, Ontario. The site is currently vacant and is covered by tall grasses and shrubs, with trees being on the western and southern extent of the site. The land has an irregular rectangular shape with about 191m wide (east-west) by 365 deep (north-south). The site is mostly flat. The overall site drainage goes to the east towards the existing wetlands, with some low-lying areas lacking surficial drainage due to the topography of the site. The average site slope is approximately 3% from an elevation of +133.47 ± 0.15 meters above sea level (masl) to +131.82 ± 0.15 masl.

2.1.2 Proposed Site

It is proposed to construct an institutional building that will serve as an animal/bird hospital for local wildlife with offices and an educational centre. Besides, the site will contain a parking area for employees and clients. The footprint of the building will be 623.25 m^2 with an additional 312.4 m^2 outdoor fly zone near the building on the south and west sides. There will be one entrance to access the site from McArton road. A total of 24 parking spots are required as well as a fire route running from the Mcarton Road beside the east side of the building. The site will be serviced by a private well and a conventional septic system. Referring to the approved hydrogeological report (dated September 18, 2019) regarding the (30 m) required distance between the well and the septic system; drawing SS-1 shows:

i. The distance between the well and the septic bed downgradient is 66.14 m;

ii. The distance between the well and the septic tank of the building is 33.6 m.

iii. The distance between the well and the septic tank of the Birds Aviaries is 56.2.

2.2 Water Supply and Well Water Quality

There is no municipal water available in this area of the city. The site will be serviced with water using a private well on site. The approximate location of the well was chosen on the northwest of the building (see drawing SS-1) based on the recommendations of the hydrogeological study prepared by Geofirma Engineering Ltd, dated September 18, 2018. Detailed information and hydraulic data, and water quality are provided by Geofirma Engineering Ltd. final report titled “Hydrogeological Study/ 8520 McArton Road, Ottawa, Ontario”, on April 30, 2020. As related to the water quality, the report shows a comparison of the water quality results to aesthetic, analytical and indicator parameters outlined in Procedure D-5-5, and the ODWS indicate the following:

- Hardness, reported at 283 mg/L and 290 mg/L, is above the operation guideline (OG) range of 80-100 mg/L. The ODWS states that hardness values greater than 200 mg/L, but less than 500 mg/L, are considered poor but tolerable. Hardness is easily treated with standard water softener systems.

- Iron, reported at 0.4 mg/L for both samples, is just above the aesthetic objective (AO) of 0.3 mg/L. Iron concentrations up to 5 mg/L are easily treated with a water softener or manganese green-sand filter.
- Laboratory reported colour was 12 and 20 TCU for the 3-hour and 6-hour samples, respectively. However, colour was measured at 0 TCU for both samples in the field, and there was no visible colour at the time of sampling. For these reasons, the elevated colour reported in the lab samples is attributed to the elevated level of iron in the water, which decreased during the pump test, and is considered acceptable and treatable.
- The concentration of all other aesthetic, analytical and indicator parameters satisfy applicable criteria.

2.3 Fire Protection

Follow-up phone conversations and virtual meetings with the City of Ottawa fire protection engineer (Allan Evans) took place on February 2021, to discuss fire fighting requirements for the site. The main driveway is widened to accommodate two fire trucks, and the fire hydrant location is adjusted. It was confirmed that the fire department would require a volume of 10,000 US gallons to be available on-site at any given time as a reservoir to combat fires. This volume is provided by a precast concrete tank of a capacity of 40,000 liters (see Figure A-1of Appendix A for tank details). The top surface of the tank is to be at level 136.6 masl (as shown in drawing GR-1) to enable water flow by gravity from the tank to the hydrant. The container and the pipe connecting the tank to the hydrant will be heated using a geothermal system designed by the project's mechanical engineer to prevent water from freezing in the wintertime. Drawing SS-1 shows the location and elevation of the fire protection tank.

The required flow for the fire protection of the proposed site was estimated based on the Technical Bultin ISTB-2018-02, Revision to Ottawa Design Guidelines – Water Distribution. The following equation from Appendix H, Protocol to Clarify the Application of the Fire Flow Calculation Method Published by Fire Underwriters Survey (FUS), was used for calculation of the supply rates required to be supplied by the hydrant.

$F = 220 * C * \sqrt{A}$ (PP G92-G93)

Where:

F = the required fire flow in liters per minute (L/min)

C = coefficient related to the type of construction

A = the total floor area in square meters (m^2)

Table 2-1 – Summary of Required Fire Protection Flow

Item	**Design Value**
Floors Above Grade	1 Floor
Construction Coeficent (C)	0.8
Fire Protection Type	None
Building Height (m)	6.934 m
Building Area (m^2)	623.25 m^2
Required fire flow F (L/min)	5000
Reduction due to low Occupancy	- 25%
Increase due to Separation	0%
Fire Flow Requirement	4000 (L/min) or 66.7 (L/sec)

100 mm diameter pipe is proposed to connect the fire protection tank to the hydrant as shown in drawing SS-1. Table 6.1 of Appendix A shows the detailed calculation of the fire protection flow.

2.4 Sanitary Servicing

No sanitary sewers are servicing in this area of the city. The proposed sanitary system includes two septic tanks and two pumps, one septic tank and a pump for the building and one septic tank and a pump for the aviaries, which are connected into one leaching bed. The per design of the septic system is submitted to OSSO, and a permit is obtained. As per Ontario Building Code (OBC), Clause, 8.1.2.1, the septic system would consist of a conventional Class 4 leaching bed system, which its detailed design will be reviewed and approved by the City of Ottawa at the time of construction. Refer to the servicing drawing SS-1 for the envelope of the septic system.

2.4.1 Sanitary Servicing for the Building

The building sewage demand is estimated based on the maximum daily water demand. As follows:

i. The maximum number of employees is twenty (20), including six (6) practitioners, and assuming a maximum of10 cages.

ii. As per OBC, Table Table 8.2.1.3.B, Item 25, the maximum daily water demand is:

Q_{daily} = 6 X 275 + (20-6) X 75 + 10 X 75 = 3,450 liters / day

iii. As per OBC, Clause 8.2.2.3. (1) (a), the minimum working capacity of a septic tank is:

V_{STank} = 3 X 3,450 = 10, 450 liters

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iv. Use a septic tank with the size of 12,500 liters for the building (see drawing SS-1 for the locations of the septic system parts).

2.4.2 Servicing for Outdoor Aviaries

In the proposed design, the Birds Aviaries have a wooden roof covering half of their area (50% of their total area). The aggregate wastewater demand results from the accumulated rainwater and the required water for washing the aviaries' concrete floors and the walkway between the aviaries and the building. The rainwater from the wooden roofs is drained directly (by individual gutters) to the grass area on the west and south green zones. The design of the combined storm-and-sewage system of the Birds Aviaries is based on two assumptions: (i) the events of cleaning the aviaries and the peak rain are not simultaneous, and (ii) the peak rain generates the dominant water discharge. Hence, the sewers and the septic tank are designed to serve both; stormwater and sewage generated from aviaries' cleaning.

Area of the Aviaries (A_{BC}) = 253.3 m^2

As the service life of the building in the Ontario Building Design Code is limited to 50 years, then only the rain intensity for five years design storm is considered in this calculation.

Rain intensities for five years storm for T_c = 15 mins

Intensity, $I_5 = 998.071/(T_c+6.035)^{0.814}$ (5-year, City of Ottawa):

I_5 = 83.615 mm/hr

Total rainwater accumulated over the concentration-time of 15 mins is:

$Q = (A_{BC}/2) \times I_5 \times (T_c/60) = (253.3/2) \times (83.615/ 1000) \times (15/60) = 2.65\ m^3/hr$

The peak discharge per second is = $2.65 \times 10^3 / (15 \times 60) = 2.94$ L/sec

125 mm diameter sanitary sewers are proposed with a minimum slope of 1.5 %, having a Manning's full flow capacity of 3.5 L/sec. The pipes progressively accumulate the wastewater from the aviaries floors by inlets (SWTC-A1 through STWC-A18 and STWC-B1). Three manholes are provided (SST-MH-1 through SST-MH-3).

As per the Ontario Building Code, the septic tank size for the building is 2.5 times the wastewater demand, which is around 8000 liters. Since most of the wastewater is rainwater, and because of the nature of the birds' wastes, the septic tank size for the aviaries is reduced to 6,000 L (see drawing SS-1 for the locations of the septic system parts). As stated earlier, cleaning the aviaries and the peak rain is not simultaneous; the peak rain generates the dominant water discharge. The cleaning of the aviaries moves the majority of the birds' waste to the septic tank. The rainstorm water is then only moving some waste that occasionally exists in-between two cleaning events. Since the water drained to the septic tank during a peak rain, it does not need to remain the entire time of 2.5 days. Based on this rationale, the volume of the septic tank is reduced by 25%.

The background assumption here is that peaks of the two demands of the water pumped to the leaching bed (from the building septic tank and the Birds Aviaries septic tank) are not simultaneous.

3. STORMWATER MANAGEMENT

3.1 Design Criterion

The storm flow is calculated in conformance with the latest version of the City of Ottawa Design Guidelines (October 2012). As the site is located in a very rural zone, The post-development flow is compared to the allowable release (i.e. the pre-development flow) rate for the site is compared to 5-year and 100-year storm events using a time of concentration of 10 minutes and runoff coefficients as calculated in Table 7.1 and Table 7.4 of Appendix B. Flows in excess of the 5- year and the 100-year rate are detained on-site using on-site storage.

Minor Design Criteria

- The storm flow, Stormceptor inlet, and site open storage are designed and/or sized based on the Modified Rational Method for the 5-year storm using a 10 minute inlet time.
- Inflow rates into the minor system are limited to an allowable release rate, as noted above.

Major Design Criteria

- The major storm flow, Stormceptor inlet, and site open storage are designed and/or sized to accommodate on-site detention with sufficient capacity to attenuate the 100-year design storm. The excess runoff above the 100-year event will flow over a proposed riprap as per OPSD 810.010 (TYPE B) shown in drawing SS-1, GR-1, and WS-1.
- On-site surface storage is provided for up to the 100-year design storm by grading the area around the swale, forming an instantaneous pond (storage) that allows slow flow release avoiding possible local flood. Calculations of the required on-site storage volumes are supported by detailed calculations provided in Appendix B.
- The required storage volumes have been calculated based on the Modified Rational Method, as identified in Section 8.3.10.3 of the City's Sewer Guidelines. The details of the surface storage are illustrated on the site servicing and grading plans (SS-1 and GR-1).

Water Quality: Enhanced, 80% total suspended solids (TSS) removal and quality control are required for institutional developments per the Rideau Valley Conservation Authority requirements. Detailed information and hydraulic data, and water quality are provided by

Geofirma Engineering Ltd. final report titled “Hydrogeological Study/ 8520 McArton Road, Ottawa, Ontario”, on April 30, 2020.

Method of Analysis: The Modified Rational Method has been used to calculate the runoff rate from the drainage catchment to quantify the detention storage for all controlled measures. Refer to Appendix B for all stormwater calculations.

The stormwater management criteria for this development are based on the City of Ottawa Sewer Design Guidelines (2012), and the Ministry of the Environment (MOE) Stormwater Management Planning and Design Manual (2003).

3.2 Pre-Development Release Rate

The calculations of pre-development peak flows were estimated to ensure that the allowable release rate was less than pre-development conditions. Under pre-development conditions, the site consisted entirely of grass. From the existing ground elevations shown on the grading plan, storm runoff flowed westerly to the gravel lane behind the site.

For the calculations of pre-development runoff coefficients, the area to be developed is 8265 m^2 divided into two type area, paved and grassed. The first is the existing asphalted entry with an area of 78 m^2 named as first watershed, EWS-01, and the second is a wide grassed area of 8187 m^2. Based on the future development plans and to calculate the allowable release, grassed area is hypothetically divided into two sub-watersheds, EWS-02 and EWS-03, with areas of 2365 m^2 and 5822 m^2, respectively. This division is essential to calculate the post-development excess flow (see section 3.4).

The pre-development runoff coefficient of the 5-year storm event for EWS-01 is assumed to be 0.9, and for EWS-02 and EWS-03 is 0.3. The overall pre-development runoff coefficient for the site was determined to be 0.31, with calculations shown below and in Appendix B, Table 7.1. It is important to mention here that the pre-development runoff coefficient of the 100-year storm event is increased by 25% over the 5-year runoff coefficient

Using time of concentration (T_C) of 15 minutes and an average runoff coefficient of 0.31, the pre-development peak runoff release rates from the site is determined for the 5-year and 100-year storms using the Rational Method as follows:

$Q_{PRE} = 2.78\ C\ I\ A$

Where:

Q_{PRE}	=	Pre-development Peak Discharge (L/sec)
C_{AVG}	=	Average Runoff Coefficient
I	=	Average Rainfall Intensity for a return period (mm/hr)
	=	$998.071/(T_C+6.053)^{0.814}$ (5-year)

		=	$1735.688/ (T_C+6.014)^{0.820}$ (100-year)	
	T_c	=	Time of concentration (mins)	
	A	=	Drainage Area (hectares)	
Therefore:	I_{5PRE}	=	$998.071/ (15 + 6.053)^{0.814}$	= 83.62 mm/hr
	Q_{5PRE}	=	2.78 (0.31) (83.62 mm/hr) (0.8265 ha)	= 58.724 L/sec
	I_{100PRE}	=	$1735.688/ (15+6.014)^{0.820}$	= 142.894 mm/hr
	Q_{100PRE}	=	2.78 (0.3821) (142.894 mm/hr) (0.8265 ha)	= 125.445 L/sec

The overall site's 5-year and 100-year pre-development flow was estimated at 58.724 L/sec and 125.445 L/sec, respectively. The peak runoff release details for each of the three sub-watersheds, EWS-01, EWS-02 and EWS-03, are shown in Table 7.2 of Appendix B.

3.3 Calculation of Allowable Release Rate

The total site area is about 7ha. The only area around the proposed development is considered in this calculation as the remainder of the property towards the south will remain untouched. The total area of the site development portion is accounted for in this calculation is 0.8265 ha.

The existing site is divided into three watersheds, EWS-01, EWS-02 and EWS-03. EWS-01 has a total area of 0.0078 ha, and it drains towards the roadside ditch. EWS-02 & EWS-03 accounts for the majority of the development, with a grassed area of 0.8187 ha. These two watersheds drains towards the exiting wetlands located to the southeast portion of the property. As mentioned earlier (see Section 3.2), the grassed area is hypothetically divided into two sub-watersheds, EWS-02 and EWS-03, with areas of 0.2365 ha and 0.5822 ha, respectively.

The allowable release rate from the site development area is based on the 5-year and 100-year storm events with a pre-development runoff coefficient of 0.306 (or 0.31) and 0.382 (or 0.38), respectively. The City of Ottawa Sewer Design Guidelines (2012) specifies a time of concentration of 10 mins in greenfield developments with low grades and a lack of conveyance for the major design criteria.

$Q_{\#\#\#ALLOW} = 2.78\ C\ I\ A$

Where:

$Q_{\#\#\#ALLOW}$	=	Peak Discharge (L/sec) Runoff
C_{AVG}	=	Average Runoff Coefficient
$I_{\#\#\#ALLOW}$	=	Average Rainfall Intensity for a return period (mm/hr)
	=	$998.071/ (T_C+6.053)^{0.814}$ (5-year)

		=	$1735.688/ (T_C+6.014)^{0.820}$ (100-year)	
	T_c	=	Time of concentration (mins)	
	A	=	Drainage Area (hectares)	
Therefore:	I_{5ALLOW}	=	$998.071/ (10 + 6.053)^{0.814}$	= 104.288 mm/hr
	Q_{5ALLOW}	=	2.78 (0.306) (104.29 mm/hr) (0.8265 ha)	= 73.243 L/sec
	$I_{100ALLOW}$	=	$1735.688/ (10+6.014)^{0.820}$	= 178.559 mm/hr
	$Q_{100ALLOW}$	=	2.78 (0.382) (178.56 mm/hr) (0.8265 ha)	= 156.755 L/sec

Hence, the allowable release rate from the overall site is 73.243 L/s for the 5-year storm event and 156.755 L/s for the 100-years storm event. The allowable release rate for watershed EWS-01 is 2.035 L/s for the 5-year storm event and 3.872 L/s for the 100-years storm event. The allowable release rate for watershed EWS-02 is 20.570 L/s for the 5-year storm event and 44.024 L/s for the 100-years storm event. The allowable release rate for watershed EWS-03 is 50.638 L/s for the 5-year storm event and 108.375 L/s for the 100-years storm event (for detailed calculations, see Table 7.3 of Appendix B).

3.4 Calculation of Post-Development Release Rate

The site development area is divided into three (3) watersheds. Given that environmental control is required for the paved areas for any possible pollution, two of the watersheds are to be uncontrolled, and one is an environmentally controlled watershed. WS-01 is a small uncontrolled area and will drain towards the roadside ditch. WS-01 is the same as the pre-development watershed EWS-01. WS-03 will also be uncontrolled and will drain towards the wetlands by matching the existing drainage path of the property. This watershed (WS-03) is of the same area as the hypothetical pre-development watershed EWS-03, which is 0.5822 ha. Roof drainage will be directed towards the wide grass area of the uncontrolled WS-03 using eavestroughs and downspouts, as shown in drawing SS-1. WS-02 is to be controlled and will drain towards a proposed swale that will collect and convey the drainage towards an oil-grit separator (STC 750) using an inlet control device (ICD). This ICD will control the WS-2 runoff to the allowable release rate for all storm events, including 100-year storm events. The controlled flow will outlet to the STC and ultimately to the property's existing roadside ditch. The required on-site storage will be provided through on-site surface ponding within the proposed swale shown in drawing SS-1 and GR-1. The controlled site drainage is diverted towards the side-road ditch and away from the wetland to protect and preserve the wetland area. Refer to the Site Servicing Plan SS-1 for the proposed stormwater management layout and Watershed plan WS-1 for proposed drainage catchment areas.

Using time of concentration (T_C) of 10 minutes and average runoff coefficients as calculated in Table 7.4, the post-development release rates from the site are determined for the three watersheds for the 5-year and 100-year storms using the Rational Method as follows:

Q_{PRE} = 2.78 C I A

Where:

	Q_{POST}	=	Post-development Peak Discharge (L/sec)	
	C_{AVG}	=	Average Runoff Coefficient	
	I	=	Average Rainfall Intensity for a return period	(mm/hr)
		=	$998.071/(T_C+6.053)^{0.814}$ (5-year)	
		=	$1735.688/(T_C+6.014)^{0.820}$ (100-year)	
	T_c	=	Time of concentration (mins)	
	A	=	Drainage Area (hectares)	
Therefore:	I_{5POST}	=	$998.071/(10 + 6.053)^{0.814}$	= 104.288 mm/hr
WS-01:	$Q_{POST5\text{-}WS\text{-}01}$	=	2.78 (0.900) (104.288 mm/hr) (0.0078 ha)	= 2.035 L/sec
WS-02	$Q_{POST5\text{-}WS\text{-}02}$		2.78 (0.563) (104.288 mm/hr) (0.2365 ha)	= 38.591 L/sec
WS-03	$Q_{POST5\text{-}WS\text{-}03}$		2.78 (0.393) (104.288 mm/hr) (0.5822 ha)	= 66.293 L/sec
Overall Site	$Q_{POST5\text{-}Overall}$	=	2.78 (0.446) (104.288 mm/hr) (0.8265 ha)	= 106.920 L/sec
	$I_{100POST}$	=	$1735.688/(10+6.014)^{0.820}$	= 178.559 mm/hr
WS-01:	$Q_{POST100\text{-}WS\text{-}01}$	=	2.78 (1.000) (178.559 mm/hr) (0.0078 ha)	= 3.872 L/sec
WS-02	$Q_{POST100\text{-}WS\text{-}02}$	=	2.78 (0.704) (178.559 mm/hr) (0.2365 ha)	= 82.594 L/sec
WS-03	$Q_{POST100\text{-}WS\text{-}03}$	=	2.78 (0.491) (178.559 mm/hr) (0.5822 ha)	= 141.882 L/sec
Overall Site	$Q_{POST100\text{-}Overall}$	=	2.78 (558) (104.288 mm/hr) (0.8265 ha)	= 228.831 L/sec

Table 7.5 details the calculations for the estimations of the 5-year and 100-year post-development peak flows of the three watershed areas, where the time of concentration is 15 minutes. Table 7.6 detail the calculations for the estimations of the 5-year and the 100-year post-development flows of the three watershed areas, Using time of concentration (TC) of 10 minutes and average runoff coefficients as calculated in Table 7.4. Table 3.1 summarizes the pre-development releae flows, post-development release flows of each sub-watershed, and the overall site flow.

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Table 3-1 – Summary of Post-Development Flows Compared to Pre-Development Flows

No.	Sub-Watershed	Area (ha)	Storm: 5 Y		Storm: 100 Y	
			Q_{5PRE} (L/Sec)	Q_{5POST} (L/Sec)	Q_{100PRE} (L/Sec)	$Q_{100POST}$ (L/Sec)
1	WS-01	0.0078	2.035	2.035	3.872	3.872
2	**WS-02**	**0.2365**	**20.570**	**38.591**	**44.024**	**82.594**
3	WS-03	0.5822	50.638	66.293	108.375	141.882
	Overall Site	0.8265	73.243	106.920	156.271	228.831

3.5 Storage Requirements

Comparing the post-development with the allowable release rates for the three watersheds, WS-01, WS-02, and WS-03 with the Allowable Runoff, for a time concentration of 10 mins for 5-years and 100 years design storms, the increase in the release rate due to the development is quantified. In this comparison, the pre-development and the post-development flows are compared for a 5-year design storm and a 100-year design storm. Watersheds WS-01 and WS-03 are of uncontrolled flow release toward the wide undeveloped area, then to the wetland, where no surface storage is required. The watershed WS-02 involves a large paved zone, and hence its flow is controlled. Table 3.2 shows a summary of this comparison between the post-development and the allowable release rates for 5-year and for 100-year design storms. The runoff increase due to the development of watershed WS-02 is 18.022 L/Sec for a 5-year design storm and 38.570 L/Sec for a 100-year design storm. Table 7-6 of Appendix B shows the detailed calculations of the excess runoff due to the proposed development.

Table 3-2 – Summary of Flows Runoff increase due to Post-Development

No.	Area Name	Area (ha)	Allowable Runoff		P-D Increase of Runoff	
			Q_{ALL5} (L/Sec)	Q_{ALL100} (L/Sec)	Q_{INC5} (L/Sec)	Q_{INC100} (L/Sec)
1	WS-01	0.0078	2.035	3.872	0.000	0.000
2	**WS-02**	**0.2365**	**20.570**	**44.024**	**18.022**	**38.570**
3	WS-03	0.5822	50.638	108.375	15.656	33.507
	Overall Site	0.8265	73.243	156.271	33.677	72.560

The required surface storage is calculated based on maintaining the same allowable release rate for watershed WS-02 for both the 5-year design storm and the 100-year design storm, where the 100-year design storm controls the design. Table 7-7 of Appendix B shows the detailed calculations for the required surface storage volume using the Modified Rational Method. The table shows that 10.813 m^3 storage volume is required for the 5-year design storm, and 23.142 m^3 storage volume is required for the 100-year design storm. Following is a sample calculation of required storage:

Storage$_{\text{xxx-year storm}}$ = Duration x Storage Rate = (T_D (min) X 60 (sec/min)) X (Storage Rate (L/sec))/ (1000 L/m^3)

Storage Required $_{\text{5-year storm}}$ = (10 (min) X 60 (sec/min)) X 18.022 (L/sec))/ (1000 L/ m^3)

= 10.813 m^3

Storage Required $_{\text{100-year storm}}$ = (10 (min) X 60 (sec/min)) X 38.570 (L/sec))/ (1000 L/ m^3)

= 23.142 m^3

3.6 Proposed Stormwater Management Plan

3.6.1 Proposed Runoff Flow Quantity Controls

The runoff flow of the proposed development site will be managed by two means; grading toward the wetland for around 71% of the site area and using proposed swale and control structures for the rest 29% of the site area. WS-01 and WS-03 having a total area of 0.590 ha, will have an open (uncontrolled) drain into the wetland following the grading, as shown in drawing GR-1. However, the drainage of watershed EWS-02 is to be managed using a storm system.

The 5-year and 100-year storm events have been analyzed. It was found that the 100-year storm governs the storm design. Hence the storm system was designed accordingly. The storm system is formed from a proposed swale, surface storage, and a control structure (see drawings SS-1, GR-1, and WS-1). The runoff will be controlled by an ICD located at the headwall at the north end of the swale. During the 5-year event, the controlled portion of the site development area will release a peak runoff rate of 20.57 L/Sec. However, the controlled area will release a peak runoff rate of 44.024 L/Sec at a maximum head of 0.67 m.

The ICD is to be installed and centred in the inlet leading to the stormceptor. The 100-year high water level (HWL) is expected to be at 134.90 masl. With the use of this ICD, and the 20.570 L/Sec release rate, 144.82 m^3 of storage volume needs to be provided on-site. The required storage will be provided as surface ponding storage in the proposed swale. The total storage volume provided is 12 m^3. The total release rate from the controlled area of the site for the 100-year storm event will be 44.02 L/s, which requires 23.14 m^3 of storage volume. The needed storage will also be provided as surface ponding storage in the proposed swale. The total storage volume provided is 30 m^3.

3.6.2 Proposed Quality Controls

Enhanced quality control providing 80% TSS removal will be accomplished with the use of a stormceptor (STC-750). The STC-750 will be located east of the development area, which will then discharge to the existing roadside ditch. Rip-rap will be used to prevent erosion at the stormceptor outlet. The STC750 will provide 84% TSS removal based on the anticipated flow rates. Therefore, on-site quality control is achievable and has been designed accordingly. Refer to Site Servicing Plan drawing SS-1 for the stormceptor location and Appendix C for the stormceptor sizing, maintenance, and technical manual- Canada.

It is noted that it will be the owner's responsibility to ensure the adequate operation & maintenance of the stormceptor. If inspection indicates the potential need for maintenance, access is provided via the manhole lid of the Stormceptor. Maintenance is accomplished with the use of a sump-vac. Refer to Appendix C for manufacturer maintenance schedule recommendations.

4. EROSION AND SEDIMENT CONTROL

During all construction activities, erosion and sedimentation shall be controlled by the following techniques:

- Install a light-duty silt fence barrier along the perimeter of the property to capture any sediments from leading into the ditch.
- Strawbales are to be placed at the downstream end of any existing swales to act as a filtering agent.
- A visual inspection shall be completed daily on sediment control barriers, and any damage will be repaired immediately. Care is to be taken to prevent damage during construction operations.
- In some cases, barriers may be removed temporarily to accommodate the construction operations. The affected barriers are to be reinstated at night when construction is completed.
- The sediment control devices are to be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract,
- During the course of construction, if ADAD Inc. performs an inspection and believes that additional prevention methods are required to control erosion and sedimentation, the contractor shall install additional silt fences or other methods as required to the satisfaction of ADAD Inc. civil team.
- Sediment control measures are to remain in place throughout the entire construction phase and monitored/maintained on a regular basis until all disturbed areas have been fully restored or vegetated.

Refer to the erosion and sediment control plan (ES-1) for more details.

5. SUMMARY & CONCLUSIONS

Based on the information presented in this report, the proposed civil engineering design ensures that stormwater management requirements for this site are achievable. The following is a summary of the stormwater management plan for this site:

- The project consists of constructing a 623.25 m^2 building along with 25 parking spots.
- The building will be serviced with a conventional septic system that will be designed and detailed at a later stage.
- The property will have water service using a drilled well.
- Forty thousand liters (>10,000 US gallons) will be provided through a precast reinforced concrete tank elevated above ground level to enable gravity water flow for fire protection.
- The allowable release rate from the overall site is 73.243 L/s for the 5-year storm event and 156.755 L/s for the 100-years storm event. The allowable release rate for watershed EWS-01 is 2.035 L/s for the 5-year storm event and 3.872 L/s for the 100-years storm event. The allowable release rate for watershed EWS-02 is 20.570 L/s for the 5-year storm event and 44.024 L/s for the 100-years storm event. The allowable release rate for watershed EWS-03 is 50.638 L/s for the 5-year storm event and 108.375 L/s for the 100-years storm event
- The 100-year post-development flow of controlled watershed WS-02 is to be in the same quantitative level as the 100-year pre-development rate, and the 5-year post-development flow is to be in the same quantitative level as the 5- year pre-development rate.
- The runoff flow of the proposed uncontrolled watersheds WS-01 and WS-03 of the development site will be managed by grading mainly toward the wetland.
- Using the Modified Rational Method, the uncontrolled watersheds WS-01 and WS-03 will release a maximum allowable runoff rate of 3.872 L/Sec and 108.375 L/Sec, respectively; while an ICD will organize the controlled watershed WS-02 to a maximum allowable rate of 44.024 L/Sec during the 100-year storm event, thereby meeting the estimated allowable release rate.
- Using the Modified Rational Method, the uncontrolled watersheds WS-01 and WS-03 will release peak runoff rates of 3.099 L/Sec and 86.729 L/Sec, respectively, while an ICD will organize the controlled watershed WS-02 to a peak rate of 35.231 L/Sec during the 100-year storm event, thereby below the allowable release rate.
- The ICD will be located within the stormceptor inlet with an invert of 134.00 masl, producing a HWL of 134.7 masl during the 100-year storm event.
- With a controlled release rate of 20.57 L/Sec, and 44.024 L/Sec, the required storage volume capacities are 10.82 m^3 and 23.14 m^3 for 5 Y Storm and 100 Y storm, respectively. Accordingly, a total storage volume of 30 m^3 will be stored above ground as ponding within the proposed swale.

- Enhanced quality control of 80% TSS removal is required for this site. A stormceptor model STC-750, has been sized to provide 84% TSS removal, thereby meeting quality control requirements.

Husham Almansour, P.Eng, Ph.D.

6. APPENDIX A: CALCULATION OF FIRE FLOW REQUIREMENTS

Table 6-1 – Calculation of Fire Flow Requirements

The Calculations are Based on **Tech Bulletin ISTB-2018-02**.

1) An estimate of the Fire Flow required for a given fire area may be estimated by:

$F = 220 * C * \sqrt{A}$

Where:

F = the required fire flow in liters per minute (L/min)

A = the total floor area in square metres (m^2)

C = coefficient related to the type of construction (page G86, of Appendix H)

1.5	for wood construction (structure essentially combustible)
1.0	for ordinary construction (brick or other masonry walls, combustible floor and interior)
0.8	for noncombustible construction (unprotected metal structural components, masonary or metal walls)
0.6	for fire-resistive construction (fully protected frame, floors, roof)

No. of Floors =	1		
Area / Floor =	623.25	m^2	
A =	623.25	m^2	
C =	0.8		
F =	4,394	L/min	Rounded to the nearest 1000 = 5,000 L/min

2) The value obtained in (1) may be reduced by as much as 25% for occupancies having a low contents fire hazard.

Non-combustible =	-25%
Limited Combustible =	-15%
Combustible =	0%
Free Burning =	15%
Rapid Burning =	25%

Reduction due to low occupancy hazard = -25% X 5,000 = 3,750 L/min

3) The value above my be reduced by up to 50% for automatic sprinlker system (not decided).

Reduction due to automatic sprinker system = 0% X 3,750 = 3,750 L/min

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4) The value obtained in (2) may be increased for structures exposed within 45 metres by the fire area under consideration..

Separation (metres)	Condtion	Charge
0m to 3.0m	1	25%
3.1m to 10.0m	2	20%
10.1m to 20.0m	3	15%
20.1m to 30.0m	4	10%
30.1m to 45.0m	5	5%
45.1m and more	6	0%

Exposure	Distance (m)	Condition	Charge
Front	6	0%	
Back	6	0%	
Side 1	6	0%	
Side 2	6	0%	

Increase due to separation = 0% X 3,750 = 0 L/min

Fire Flow Requierment is = 3,750 L/min

rounded to the nearest 1000 = 4,000 L/min Or 66.7 L/Sec

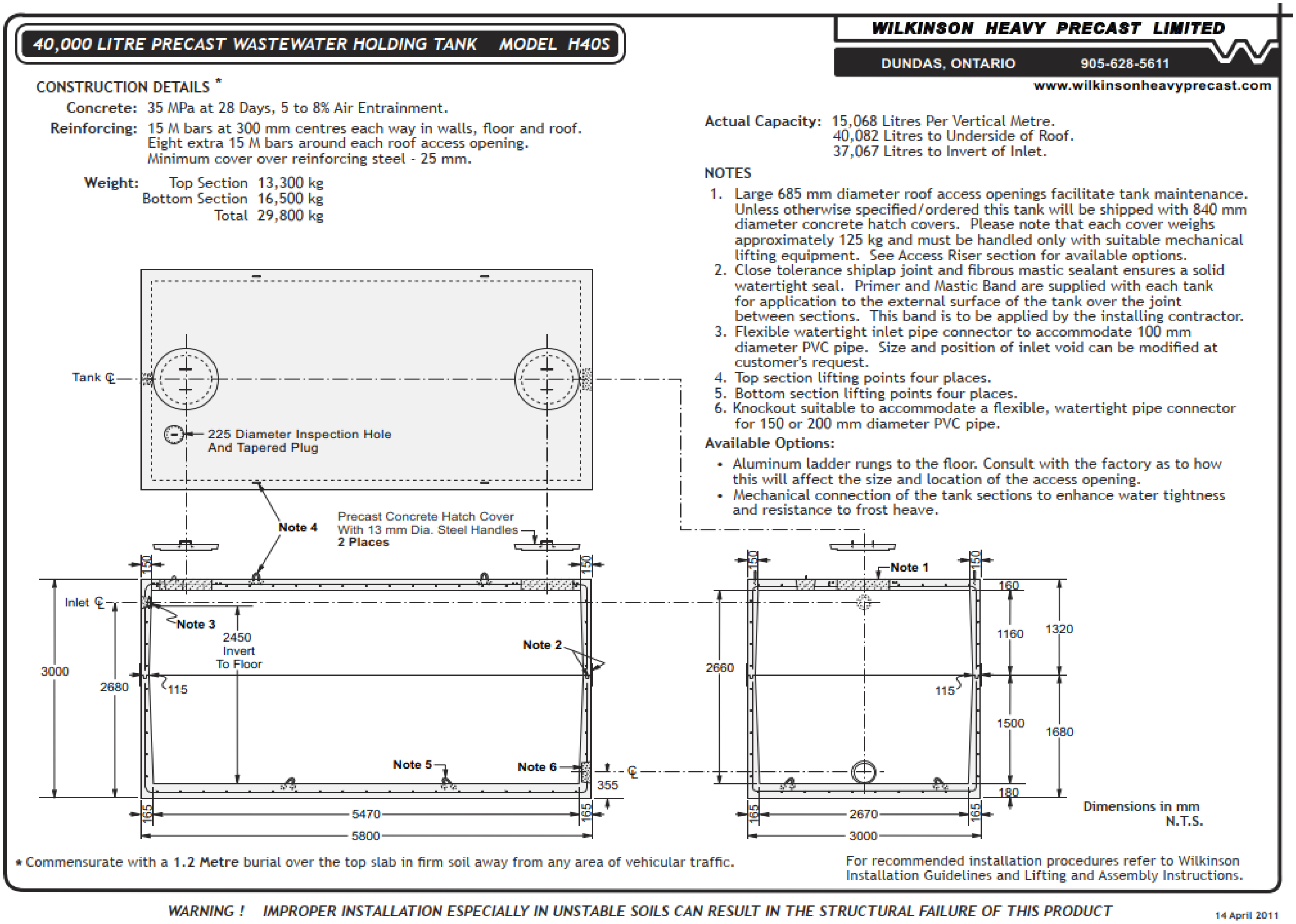

Figure 6-1 – Details of a Precast Concrete Fire Protection Tank with a 40,000 L Capacity

7. APPENDIX B: STORMWATER MANAGEMENT DESIGN SHEETS/ TABLES

Table 7-1 – Calculations of Average Runoff Coefficients (Pre-Development)

No	Area Name	Area Type	Areas (m^2)	C_x	C_x Value	Sum of (A x Cx)
1	**EWS-01**	Asphalt/ Pavers	78	C_{ASPH}	0.9	70.2
2	**EWS-02**	Grassed	**2365**	C_{GRASS}	0.3	709.5
3	**EWS-03**	Grassed	**5822**	C_{GRASS}	0.3	1746.6
EWS-02 & EWS-03)		Grassed	8187	C_{GRASS}	0.3	2456.1
					Oveall Area	**8265**
					Average Runoff Coefficients (Pre-Development) $C_{AVG-Pre}$	**0.31**

Table 7-2 – Calculations of Peak Runoff (Pre-Development)

Area Discribtion	Area (ha)	Time of Concentration, Tc (min)	Storm: 5 Y			Storm: 100 Y		
			I_5 (mm/hr)	C_{AVG5}	Q_{PRE5} (L/Sec)	I_{100} (mm/hr)	C_{AVG100}	Q_{PRE100} (L/Sec)
EWS-01	**0.0078**	15	83.615	0.900	1.632	142.894	1.000	3.099
EWS-02	**0.2365**	**15**	**83.615**	**0.300**	**16.492**	**142.894**	**0.375**	**35.231**
EWS-03	**0.5822**	15	83.615	0.300	40.600	142.894	0.375	86.729
Overall Site	0.8265	**15**	**83.615**	**0.306**	58.724	**142.894**	**0.382**	125.445

Notes:

1) Intensity, $I = 998.071/(Tc+6.035)^{0.814}$ (5-year, City of Ottawa)

2) Intensity, $I = 1735.688/(Tc+6.014)^{0.820}$ (100-year, City of Ottawa)

3) Cavg for 100-year is increased by 25%, with maximum of 1.00

Table 7-3 – Calculations of Allowable Runoff (Pre-Development)

Area Discribtion	Area (ha)	Time of Concentration, Tc (min)	Storm: 5 Y			Storm: 100 Y		
			I_5 (mm/hr)	$C_{AVG-Pre-5}$	Q_{PRE5} (L/Sec)	I_{100} (mm/hr)	$C_{AVG-Pre-100}$	Q_{PRE100} (L/Sec)
EWS-01	**0.0078**	10	104.288	0.900	**2.035**	178.559	1.000	**3.872**
EWS-02	**0.2365**	10	104.288	0.300	**20.570**	178.559	0.375	**44.024**
EWS-03	**0.5822**	10	104.288	0.300	**50.638**	178.559	0.375	**108.375**
Overall Site	0.8265	10	104.288	0.306	**73.243**	178.559	0.382	**156.271**

Notes:

1) Allowable Capture Rate is based on 5-year storm with T_{CONC} = 10 mins

2) Intensity, I = 998.071/(Tc+6.035)0.814 (5-year, City of Ottawa)

3) Intensity, $I = 1735.688/(Tc+6.014)^{0.820}$ (100-year, City of Ottawa)

4) Cavg for 100-year is increased by 25%, with maximum of 1.00

Table 7-4 – Calculations of Average Runoff Coefficients (Post-Development)

No.	Area Name	Area Type	Areas (m^2)	C_x	C_x Value	Sum of (A x Cx)
1	**WS-01**	**Asphalt/ Pavers**	**78**	$\mathbf{C_{ASPH}}$	**0.900**	**70.2**
2	**$WS\text{-}02_1$**	Asphalt/ Pavers	1036	C_{ASPH}	0.900	932.4
	$WS\text{-}02_2$	Grassed	1329	C_{GRASS}	0.300	398.7
	WS-02	**Total WS-02-A**	**2365**	$\mathbf{C_{AVDEWS\text{-}02\text{-}A}}$	**0.563**	**1331.1**
3	**$WS\text{-}03_1$**	Roofs	773	C_{ROOFS}	0.900	695.7
	$WS\text{-}03_2$	Birds Cages roofs	127	C_{BCAGS}	0.900	114.3
	$WS\text{-}03_3$	Grassed	4922	C_{GRASS}	0.300	1476.6
	WS-03	**Total WS-02-B**	**5822**	$\mathbf{C_{AVDEWS\text{-}02\text{-}B}}$	**0.393**	**2286.6**
					Oveall Area	**8265**
					Average Runoff Coefficients (Post-Development) $C_{AVGPost}$	**0.45**

Table 7-5 – Calculations of Peak Runoff (Post-Development)

No.	Area Name	Area (ha)	Time of Concentration, Tc (min)	Storm: 5 Y			Storm: 100 Y		
				I_5 (mm/hr)	$C_{AVG5POS}$	Q_{POST5P} (L/Sec)	I_{100} (mm/hr)	$C_{AVG100POS}$	$Q_{POST100P}$ (L/Sec)
1	**WS-01**	0.0078	15	83.615	0.900	1.632	142.894	1.000	3.099
2	**WS-02**	**0.2365**	**15**	**83.615**	**0.563**	**30.942**	**142.894**	**0.704**	**66.097**
3	**WS-03**	0.5822	15	83.615	0.393	53.152	142.894	0.491	113.543
	Overall Site	0.8265	15	83.615	0.446	**85.726**	142.894	0.558	**183.125**

Notes:

1) Intensity, $I = 998.071/(Tc+6.035)^{0.814}$ (5-year, City of Ottawa)

2) Intensity, $I = 1735.688/(Tc+6.014)^{0.820}$ (100-year, City of Ottawa)

3) Cavg for 100-year is increased by 25% over Cavg for 5-year, with a maximum of 1.0.

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Table 7-6 – Calculations of Post-Development increase in Runoff Rate Based on Allowable Runoff

No.	Area Name	Area (ha)	Time of Concentration Tc (min)	Storm: 5 Y	Storm: 100 Y	Allowable Runoff		POST-Development Increase of Runoff	
				Q_{POST5} (L/Sec)	$Q_{POST100}$ (L/Sec)	Q_{PRE5} (L/Sec)	Q_{PRE100} (L/Sec)	Q_{INC5} (L/Sec)	Q_{INC100} (L/Sec)
1	**WS-01**	0.0078	10	2.035	3.872	2.035	3.872	0.000	0.000
2	**WS-02**	**0.2365**	**10**	**38.591**	**82.594**	**20.570**	**44.028**	**18.022**	**38.570**
3	**WS-03**	0.5822	10	66.293	141.882	50.638	50.638	15.656	33.507
Overall Site		0.8265	10	106.920	228.831	73.243	156.271	33.677	72.560

Notes:
1) Intensity, I = 998.071/(Tc+6.035)0.814 (5-year, City of Ottawa)
2) Intensity, I = 1735.688/(Tc+6.014)0.820 (100-year, City of Ottawa)
3) C_{avg} for 100-year has increased by 25%
4) 'C' values for post-development are increased by 25%, with a maximum of 1.0.

Table 7-7 – Storage Volumes for 5-Year and 100 Year Return Period Storms (Modified Rational Method)

Duration T_D (min)	Release Rate = 20.57 L/Sec Return Period = 5 Years Intensity, $I = 998.071/(T_D+6.035)^{0.814}$ (5-year, City of Ottawa)					Release Rate = 44.02 L/Sec Return Period = 100 Years Intensity: $I = 1735.688/(T_D+6.014)^{0.820}$ (100-year, City of Ottawa)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	231.04	85.52	20.57	64.951	0.000	398.62	184.38	44.024	140.36	0.000
10	**104.29**	**38.60**	20.57	**18.022**	**10.813**	**178.56**	**82.59**	**44.024**	**38.57**	**23.142**
20	70.29	26.02	20.57	5.449	6.538	119.95	55.48	44.024	11.46	13.752
30	53.95	19.97	20.57	-0.600	-1.080	91.87	42.49	44.024	-1.53	-2.753
40	44.20	16.36	20.57	-4.210	-10.103	75.15	34.76	44.024	-9.26	-22.236
50	37.66	13.94	20.57	-6.629	-19.886	63.95	29.58	44.024	-14.44	-43.325
60	32.95	12.20	20.57	-8.373	-30.143	55.89	25.85	44.024	-18.17	-65.410
70	29.38	10.87	20.57	-9.696	-40.722	49.79	23.03	44.024	-20.99	-88.172
80	26.57	9.83	20.57	-10.736	-51.533	44.99	20.81	44.024	-23.21	-111.423
90	24.29	8.99	20.57	-11.578	-62.522	41.11	19.02	44.024	-25.01	-135.042
100	22.41	8.30	20.57	-12.275	-73.648	37.90	17.53	44.024	-26.49	-158.950

Notes:
1) Peak flow is equal to the product of 2.78 x C x I x A
2) $I = 998.071/(T_D+6.035)^{0.814}$ [5-year] $I = 1735.688/(T_D+6.014)^{0.820}$ [100-year] City of Ottawa, [From Ottawa Sewer Design Guidelines, Section 5.4.2, where T_D = storm duration (mins)];
3) Release Rate = Desired Capture (Release) Rate;
4) Storage Rate = Peak Flow - Release Rate;
5) Storage = Duration x Storage Rate = (T_D (min) X 60 (sec/min)) X (Storage Rate (L/sec))/ (1000 L/m^3) = ##.## m^3;
6) Maximum Storage = Max Storage Over Duration.

8. APPENDIX C: STORMCEPTOR SIZING , MAINTENANCE, AND TECHNICAL MANUAL- CANADA

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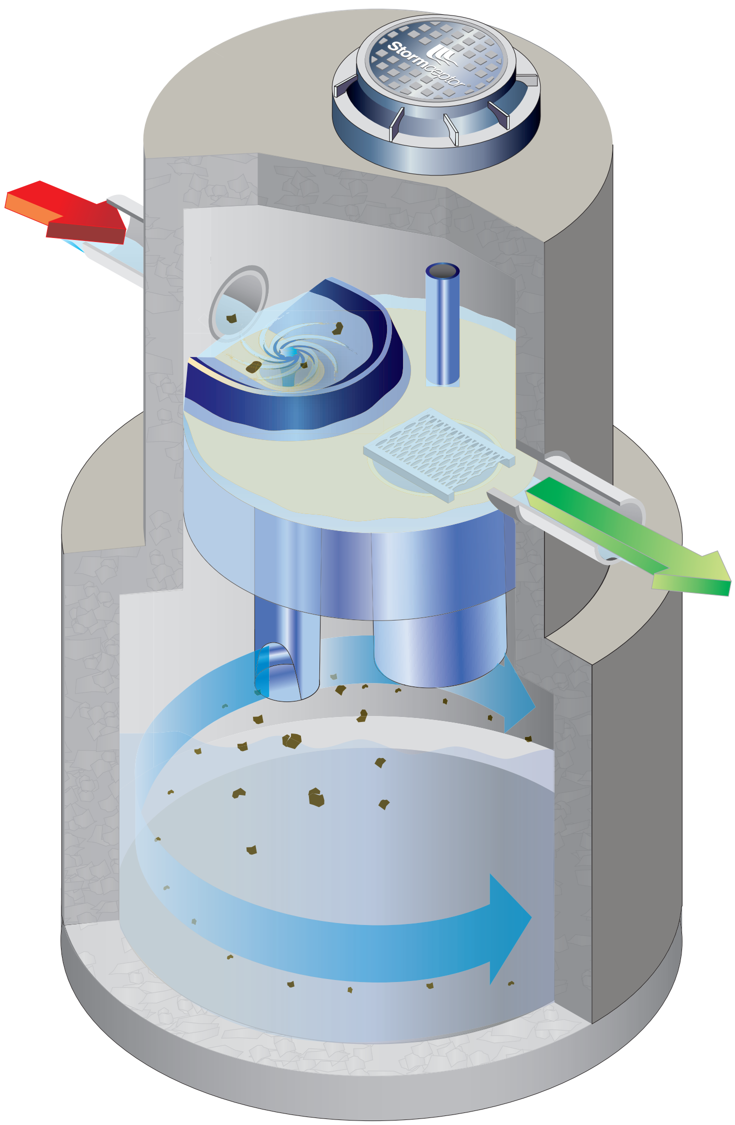
Stormceptor®

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Indonesia Patent No. 0007058
Japan Patent No. 3581233
Japan Patent No. 9-11476
Korean Patent No. 0519212
Malaysia Patent No. 118987
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

Table of Contents

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a “Hydrodynamic Separator (HDS)” or an “Oil Grit Separator (OGS)”, engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- “STORMCEPTOR” is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site’s tailwater conditions)
- Series Unit (combines treatment in two systems)

Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

Figure 1.

Inline Stormceptor

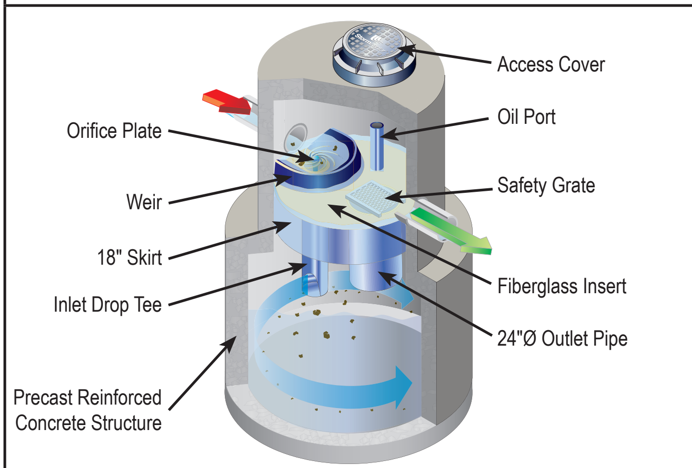
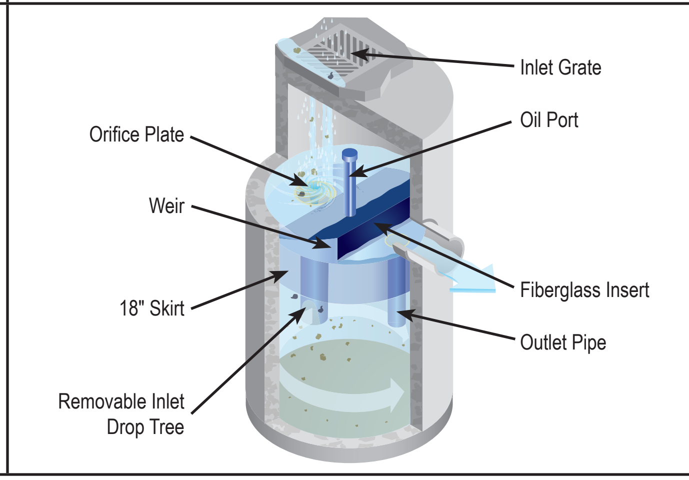


Figure 2.

Inlet Stormceptor



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel’s watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name “Stormceptor” embossed on each access cover at the surface. To determine the location of “inlet” Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name “Stormceptor” is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (in.)
450	60
900	55
1200	71
1800	105
2400	94
3600	134
4800	128
6000	150
7200	134
11000*	128
13000*	150
16000*	134

EOS Model	Insert to Base (in.)
4-175	60
9-365	55
12-590	71
18-1000	105
24-1400	94
36-1700	134
48-2000	128
60-2500	150
72-3400	134
110-5000*	128
130-6000*	150
160-7800*	134

OSR Model	Insert to Base (in.)
65	60
140	55
250	94
390	128
560	134
780*	128
1125*	134

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
1500	2.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
11000*	4.0
14000*	3.7

EOS Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
10000*	4.0
14000*	3.7

OSR Model	Insert to Base (m)
300	1.7
750	1.6
2000	2.6
4000	3.6
6000	3.7
9000*	3.6
14000*	3.7

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

Table 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3	EOS Model	Hydrocarbon Storage Capacity gal	OSR Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3
450	86	46	**4-175**	175	**065**	115	46
900	251	89	**9-365**	365	**140**	233	58
1200	251	127	**12-590**	591			
1800	251	207	**18-1000**	1198			
2400	840	205	**24-1400**	1457	**250**	792	156
3600	840	373	**36-1700**	1773			
4800	909	543	**48-2000**	2005	**390**	1233	465
6000	909	687	**60-2500**	2514			
7200	1059	839	**72-3400**	3418	**560**	1384	690
11000*	2797	1089	**110-5000***	5023	**780***	2430	930
13000*	2797	1374	**130-6000***	6041			
16000*	3055	1677	**160-7800***	7850	**1125***	2689	1378

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity L	Sediment Capacity L	EOS Model	Hydrocarbon Storage Capacity L	OSR Model	Hydrocarbon Storage Capacity L	Sediment Capacity L
300	300	1450	**300**	662	**300**	300	1500
750	915	3000	**750**	1380	**750**	900	3000
1000	915	3800	**1000**	2235			
1500	915	6205					
2000	2890	7700	**2000**	5515	**2000**	2790	7700
3000	2890	11965	**3000**	6710			
4000	3360	16490	**4000**	7585	**4000**	4700	22200
5000	3360	20940	**5000**	9515			
6000	3930	26945	**6000**	12940	**6000**	5200	26900
9000*	10555	32980	**9000***	19010	**9000***	9300	33000
11000*	10555	37415	**10000***	22865			
14000*	11700	53890	**14000***	29715	**14000***	10500	53900

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

   **Consist of two chamber structures in series.*

4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

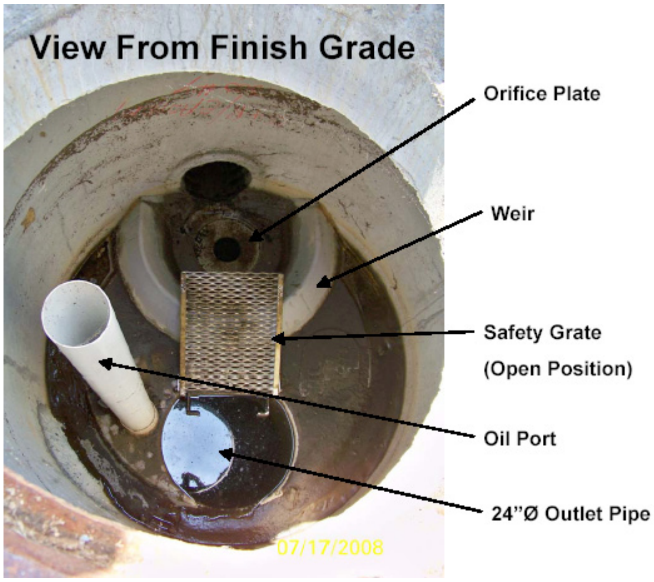
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

Figure 4.



What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. ***DO NOT ENTER THE STORMCEPTOR CHAMBER*** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
    - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
    - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

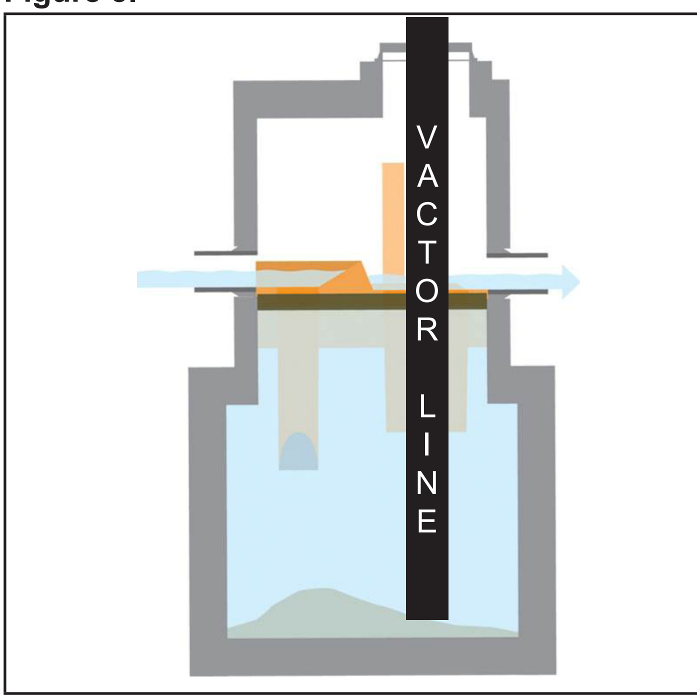
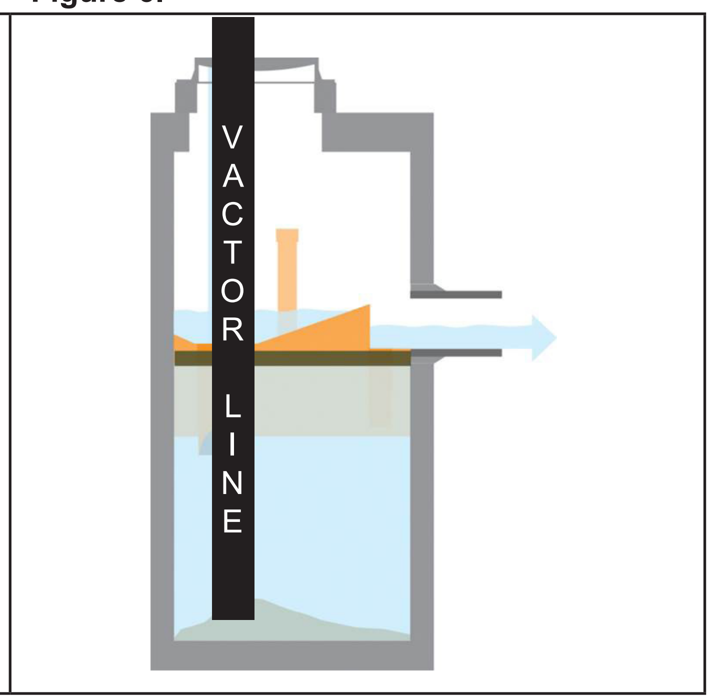


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.

Figure 8.

A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

What is required for proper disposal?
The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?
Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?
With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at

very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

Table 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	**4-175**	9	24	**065**	8
900	8	**9-365**	9	24	**140**	8
1200	10	**12-590**	11	39		
1800	15					
2400	12	**24-1400**	14	68	**250**	12
3600	17	**36-1700**	19	79		
4800	15	**48-2000**	16	68	**390**	17
6000	18	**60-2500**	20	79		
7200	15	**72-3400**	17	79	**560**	17
11000*	17	**110-5000***	16	68	**780***	17
13000*	20	**130-6000***	20	79		
16000*	17	**160-7800***	17	79	**1125***	17

Note:

1. *The values above are for typical standard units.*

   **Per structure.*

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	**300**	225	610	**300**	200
750	230	**750**	230	610	**750**	200
1000	275	**1000**	275	990		
1500	400					
2000	350	**2000**	350	1727	**2000**	300
3000	475	**3000**	475	2006		
4000	400	**4000**	400	1727	**4000**	375
5000	500	**5000**	500	2006		
6000	425	**6000**	425	2006	**6000**	375
9000*	400	**9000***	400	1727	**9000***	425
11000*	500	**10000***	500	2006		
14000*	425	**14000***	425	2006	**14000***	425

Note:

1. *The values above are for typical standard units.*

   **Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: ______________________

Allowable Sediment Depth: ______________________

Serial Number: ______________________

Installation Date: ______________________

Location Description of Unit: ______________________

Other Comments: ______________________

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.
www.lafargepipe.com

403-292-9502 / 1-888-422-4022	Calgary, AB
780-468-5910	Edmonton, AB
204-958-6348	Winnipeg, MB, NW. ON, SK

Langley Concrete Group
www.langleyconcretegroup.com

604-502-5236	BC

Hanson Pipe & Precast Inc.
www.hansonpipeandprecast.com

519-622-7574 / 1-888-888-3222	ON

Lécuyer et Fils Ltée.
www.lecuyerbeton.com

450-454-3928 / 1-800-561-0970	QC

Strescon Limited
www.strescon.com

902-494-7400	NS, NF
506-633-8877	NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

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Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

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www.stormceptor.com