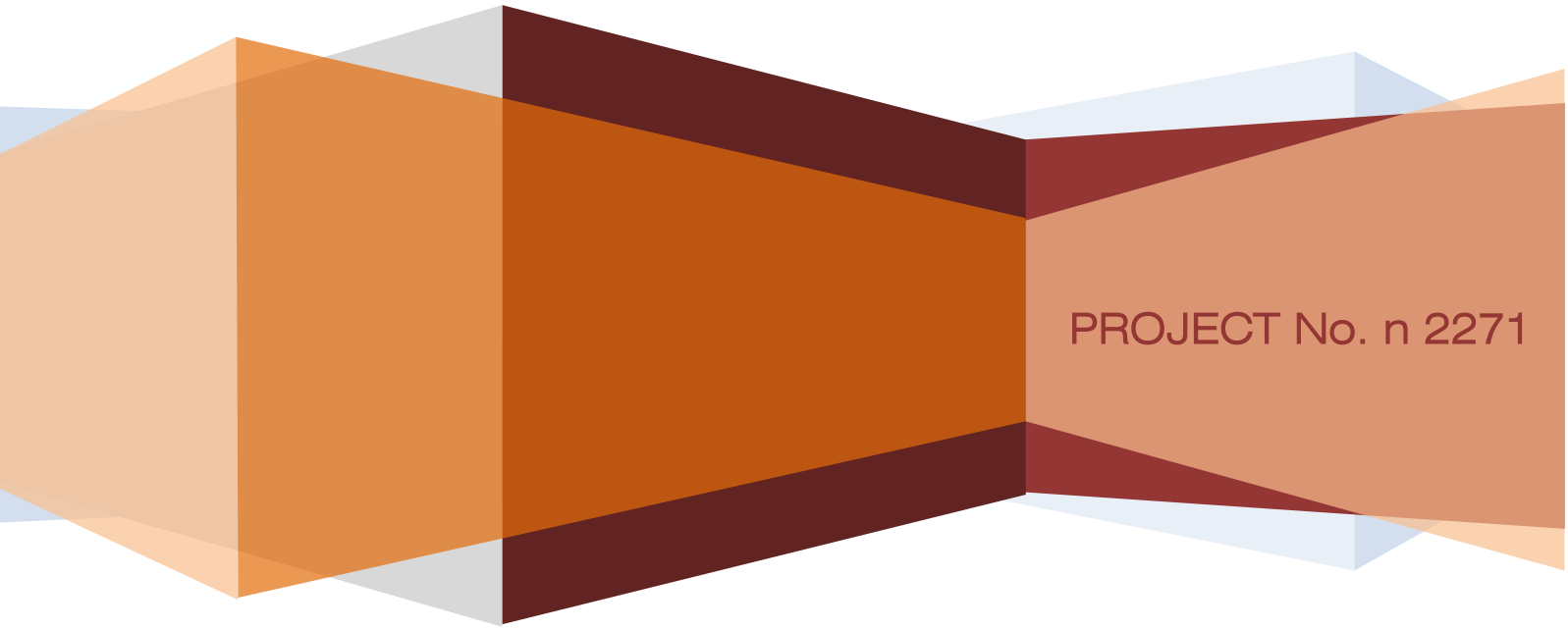
Proposed 3-Storey Mosque – 27 Winona Drive,

Whitchurch Stouffville, Ontario

Servicing and Stormwater Management Report



Prepared By:

n Engineering Inc
9120 Leslie Street, Suite-208
Richmond Hill, Ontario L4B3J9
T: 905-597-5937 F: 1.866.340.5265
https://www.nengineering.com

March 19, 2025

Table of Contents

1.0 INTRODUCTION 5
1.1 BACKGROUND 5
1.2 STUDY AREA 5
1.3 EXISTING TOPOGRAPHY AND DRAINAGE PATTERN 6
1.4 PROPOSED DEVELOPMENT 6
2.0 STORMWATER MANAGEMENT CRITERIA 7
3.0 STORMWATER MANAGEMENT STUDY 7
3.1 Comparison Existing Land Use and Proposed Conditions 7
3.2 Runoff Coefficients 7
3.3 Peak Flow Rates 8
3.4 Pre-development Peak Flow 9
3.5 Post-Development Drainage Pattern and Peak Flow Rate 9
3.6 Comparison of Existing and Proposed Runoff Rates 10
3.7 Orifice Control 10
3.7.1 Allowable Discharge Rate and Orifice Control 10
3.7.2 Storage for Ground surface Quantity Control 10
3.7.3 Storage for Roof Quantity Control 11
3.8 Water Quality Control 12
3.9 Erosion and Sediment Control during Construction 12
4.0 WATER BALANCE 13
4.1 Stormwater Infiltration Chamber 13
4.2 Permeability and Drawdown Calculation for Stormwater Infiltration Chamber 14
5.0 MINOR SYSTEM DRAINAGE 15
6.0 MAJOR SYSTEM DRAINAGE 15
7.0 SANITARY SEWAGE FLOW 15
8. 0 WATER DEMAND 16
8.1 Domestic Water Demand 16
8.2 Fire Demand 16
8.3 Total Water Demand 16
8.4 Water Supply Availability 16
9.0 SERVICE CONNECTIONS 17
9.1 Sanitary 17
9.2 Water 17
10.0 SUMMARY & CONCLUSIONS 17

List of Tables

Table 1 – Comparison between Existing and Proposed Condition Land-use
Table 2 – Runoff Coefficients
Table 3 – Composite Runoff Coefficients
Table 4 – IDF Parameters
Table 5 – Run-off Coefficient Modification Factors
Table 6 – Pre-Development Peak Flows (l/s)
Table 7– Post-Development Peak Flows and Uncontrolled Flow (l/s)
Table 8 – Comparison between Pre- and Post-Development Flows (l/s)
Table 9 – Orifice Controlled Sizing
Table 10 – Summary of 100-yr Detention Storage (m^3)
Table 11 – Roof Control Summary
Table 12 – Water Balance Summary

List of Figures

Figure 1: Site Location Plan
Figure 2: Site Existing Conditions

List of Appendices

Appendix A – Figures
Appendix B – Flow Analysis
Appendix C – Storm Drainage Design Sheet
Appendix D –Orifice Sizing, Onsite Detention Storage,
Appendix E – OGS Sizing Summary
Appendix F – Stormwater Infiltration Chamber
Appendix G –Hydrant Test
AppendixH – Statement of Limiting Conditions and Assumptions

List of Figures and Drawings

Drawing No.	Title of Drawing	Comment
DR-101	Pre-development Site Drainage Plan	Attached in Appendix A
DR-102	Post-Development Site Drainage Plan	Attached in Appendix A
DR-103	Roof Drainage Plan	Attached in Appendix A
C1	Site Grading Plan	Submitted Separately
C2	Site Servicing Plan	Submitted Separately
C3	Erosion & Sediment Control Plan	Submitted Separately
C4	Standard Drawings	Submitted Separately
C4a	General Notes	Submitted Separately

Revision History

Rev. #	Description	Date of Issue
01	Pre-Con#3	September 25, 2024
02	ZBA	March 19, 2025

REFERENCES

The preferred stormwater management for the proposed development utilizes the criteria and guidelines provided in the following reference documents:

- MOE Stormwater Planning and Design Manual;
- MTO Drainage Management Manual, MTO, 1997;
- Design Guidelines and Standard Drawings, Town of Whitchurch-Stouffville, January 2023

Some technical reports further provide data while selecting appropriate procedure in SWM:

- Survey Report for the site by Richmond Surveying Inc. dated on August 18th, 2024.
- Hydrogeological and Geotechnical Investigation by GHD. dated August 27th, 2024
- Plan and profile drawing of Main Street as built services Sheet No. 3.

1.0 INTRODUCTION

1.1 BACKGROUND

n Engineering Inc. was retained to prepare a Functional Servicing and Stormwater Management Report in support of a Site Plan Application for the proposed development, in Whitchurch-Stouffville. The purpose of this report is to provide site-specific information for the Town's review with respect to infrastructure required to support the proposed development regarding storm drainage, sanitary sewers and water supply.

More specifically, the report will present the following:

a. Identifying existing runoff pattern and quantity of runoff discharge from proposed development area;

b. Identifying post-development runoff from the site towards the existing municipality right of way;

c. Address the concerns from the reviewing agencies including: Town of Whitchurch-Stouffville.

d. New site servicing requirements for sanitary and water supply will also be discussed in the following sections

1.2 STUDY AREA

The subject site has a street address of 27 Winona Drive, Whitchurch-Stouffville, Ontario. The property is located to the North-east of the Winona and Main Street intersection. The location of the subject site is shown in Figure 1.

Figure 1 - Site Location Plan

1.3 EXISTING TOPOGRAPHY AND DRAINAGE PATTERN

The Site is located at the municipal address of 27 Winona Drive in Whitchurch-Stouffville, Ontario, northeast of the intersection of Winona Drive and Main Street. The Site encompasses an area of about 0.24 hectares (0.59 acres).

A legal and topographic survey has been prepared by Richmond Surveying Inc., dated 18th August 2024 which identifies the site as Part of Lot 26, registered plan 455, Town of Whitchurch-Stouffville, Regional Municipality of York.

The topographical survey plan has been attached in Appendix A. Locally; topography in the area of the Site is relatively flat with a gentle slope to the south. The highest elevation of the site is 271.60 at northeast side, which goes down to 270.50 at south-east side with a slope of approximately 2.9%. Based on the current drainage pattern, surface water flows overland from the property appears to drain partially toward the east side (Ninth Line) and partially toward the west side (Winona Drive).

The Figure 2 illustrates the current condition of the site. The property is characterized by a single building, pavement on the west of the building and landscape on the back of the building or east side of the property. Refer to DR-101 for existing drainage plan, attached in Appendix A.

Figure 2 - Site Existing Conditions

1.4 PROPOSED DEVELOPMENT

The site is designated for development as a Place of Worship, featuring a three-story building that includes ground-level and first-floor parking. A ramp will be incorporated to provide access to the upper parking level, accommodating a total of 53 parking spaces for the proposed development. It is also proposed that existing grades be preserved at the property boundaries to prevent any external water from entering the site.

2.0 STORMWATER MANAGEMENT CRITERIA

The criteria for proposed development are summarized below:

- **Water Quantity Control** – Post-development peak flow for the 100-year from the site to be controlled to the 2-year target flow.
- **Water Quality Control** –Stormwater discharged from the post-development site are required to meet:
  - A minimum 80% TSS removal or an enhanced (Level 1) removal as referenced in the MOECC SWMPD Manual; and
- **Roof Top Storage** –Roof-top detention will be proposed;
- **Erosion and Sediment Control During Construction** – The erosion potential of the study area to assessed using methods described in the 'MTO Drainage Management Manual' of temporary erosion and sediment control measures suitable for construction sites.
- **Water Balance –** As per the Hydrogeological investigation report, prepared by GHD dated August 27, 2024, approximately 18.3% of roof run-off from the building needs to be infiltrate for 10mm rain events.

3.0 STORMWATER MANAGEMENT STUDY

3.1 Comparison Existing Land Use and Proposed Conditions

Land-use under the proposed development was compared to land-use under existing conditions to assess the changes in runoff flows on the site. The comparison presented in Table 1. As revealed from the Table 1, there will be an overall 46 % increase in imperviousness under the proposed development condition in contrast of about 46 % decrease in grass area.

Table 1 – Comparison between Existing and Proposed Condition Land-use

LANS USE TYPE	PAVED AREA	ROOF AREA	GRASS AREA	TOTAL AREA
Existing Condition (m2)	545.79	573.30	1289.20	2408.29
Existing Condition (%)	23%	24%	54%	
Proposed Condition (m2)	263.29	1972.67	172.33	2408.29
Proposed Condition (%)	11%	82%	7%	
Increase/Decrease (%)	-12%	58%	-46%	

3.2 Runoff Coefficients

The runoff coefficient value (C) is determined based on the land use of the catchment. Runoff parameters used for site under existing and proposed conditions are shown in Table 2 below, can be found in Table D-7 of Town of Whitchurch-Stouffville Design Guidelines and Standard Drawings.

Table 2 – Runoff Coefficients

Land Use	Runoff Coefficient
Impervious Area (Asphalt, Concrete, Rooftop)	0.95
Pervious Area (Landscaped)	0.30

The scenarios in which a catchment has more than one land use or soil type, a representative or composite runoff coefficient is determined using areas of the different land cover as weighting factor. Pre-development composite runoff coefficients are calculated based on existing land use and presented in Appendix B (Calculation Sheet 1C). Post-development catchment area is shown in DR-102 in Appendix A. Calculations for pre-and post-development imperviousness are given in Appendix B and summarized below in Table 3.

Table 3 – Composite Runoff Coefficients

Drainage Area	Pre-Development	Post-Development
SITE	0.60	0.90

3.3 Peak Flow Rates

Given the size and characteristics of the site and catchment areas, the Rational Formula was used to determine the peak flows from the subject site under pre-development and post-development conditions. The rainfall-runoff relationship is as follows:

$$Q = 2.78ACCai$$

Where:
Q = Peak Flow in m^3/s;
A = Effective area of drainage basin in hectares (ha);
C = runoff coefficient; and
Ca= Antecedent Precipitation Factor
i = Rainfall intensity in mm/hr.

Rainfall intensities are calculated using the rainfall intensity-duration-frequency (IDF) values for the location coordinate of proposed site. The IDF values and Run-off Coefficient Modification Factors (Ca) are obtained from Table D-3 and Table D-8 of Town of Whitchurch-Stouffville Design Guidelines and Standard Drawings and are summarized in Table 4 and 5.

Table 4 – IDF Parameters

IDF PARAMETERS	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
A	696.679	1015.963	1279.709	1546.810	1802.604	2051.707
B	4.957	5.255	5.715	5.746	6.029	6.230
C	0.811	0.826	0.841	0.845	0.853	0.860

Table 5 – Run-off Coefficient Modification Factors for Rational Method

Design Storm Return Period	Run-off Coefficient Modification Factor (Ca)
5 Years	1.00
25 Years	1.10
50Years	1.20
100 Years	1.25

Note: C x Ca cannot exceed 1.00

3.4 Pre-development Peak Flow

Based on the topographic survey, the existing property exhibits drainage patterns flowing partially toward the east side (Ninth Line) and partially toward the west side (Winona Drive). Utilizing a Civil 3D model, the current drainage pattern was analyzed (refer to DR101). Pre-development peak flows were determined in accordance with the existing drainage characteristics and land use patterns. These calculations are detailed in Calculation Sheets 1A and 1B, located in Appendix B, with the results summarized in Table 6.

Table 6 – Pre-development Peak Flow (l/s)

Drainage Area	**2 Years**	**5 Years**	**10 Years**	**25 Years**	**50 Years**	**100 Years**
A1 (l/s)- Flow Towards East	1.98	2.72	3.21	3.83	4.30	4.75
A2(l/s)- Flow Towards West	**29.31**	40.37	47.61	56.83	63.80	70.46
Total Flow from the site (l/s)	31.28	43.10	50.83	60.66	68.11	75.22

3.5 Post-Development Drainage Pattern and Peak Flow Rate

The proposed site encloses a mix of paved and grassed areas. Proposed site grades are selected to ensure vehicular access was unimpeded.

For the proposed development condition, the side is divided into sub-catchments as shown in Figure DR-102 (Appendix A). In the proposed condition most of the area is covered by roof. The area around the building is considered as uncontrolled area. These areas are identified as UC1 and UC2 on DR-102 (Appendix A), which will remain uncontrolled under post-development conditions. Post-development peak flows from both the controlled and uncontrolled area are calculated and presented in Appendix B, Calculation Sheets 2 & 3 respectively. The results are summarized in Table 7.

Table 7 – Post-development Peak Flow and Uncontrolled Flow

Development Condition	**2 Years**	**5 Years**	**10 Years**	**25 Years**	**50 Years**	**100 Years**
Post-development Flow (Whole Site) (l/s)	46.95	64.68	76.27	100.13	113.12	124.93
Uncontrolled (l/s)	1.76	2.42	2.85	3.74	4.59	5.28

3.6 Comparison of Existing and Proposed Runoff Rates

Flow rates under 2 year to 100 years storm events are calculated for both existing and proposed conditions using the Rational Method. Catchment areas and land use information are shown in Figures DR-101 and DR-102 in Appendix A.

The primary goal of the drainage and hydrologic analysis is to examine the effect of the development on local storm drainage. This analysis was used to create goals for the SWM design. Table 8 presents the comparison of peak flow rates between existing and proposed conditions; detailed flow calculations have been presented in Appendix B. It should be noted that the post-development flows in Tables 7 and Table 8 address the impact of the development only, and do not represent the final SWM design flows.

Table 8 – Comparison of Pre-and Post-Development Flow (l/s)

Return Period (Years)	2	5	10	25	50	100
Pre-Development Flow (l/s)	31.28	43.10	50.83	60.66	68.11	75.22
Post-Development Flow (l/s)	46.95	64.68	76.27	100.13	113.12	124.93
Peak Flow Increase (l/s)	15.66	21.58	25.45	39.48	45.02	49.72

3.7 Orifice Control

3.7.1 Allowable Discharge Rate and Orifice Control

In order to control post-development flows to 2-year pre-development conditions, a target flow of 11.78 l/s is to be satisfied. A reduced orifice plate size 75 mm diameter installed at the outlet of the MH2 (OGS). Please refer to DWG C2 for the location of the Orifice plate and MH2 (OGS). Orifice Sizing Calculations are presented in Appendix D. The allowable discharge rates and corresponding controlled flow rates are summarized below in Table 9.

Table 9 – Orifice Controlled Sizing

Type of Device	Location	Size (mm)	Allowable Flow[1] (l/s)	Controlled Flow(l/ s)
Orifice Plate	MH2 (OGS)	75	11.78	11.69

3.7.2 Storage for Ground surface Quantity Control[2]

The controlled flow requirements and available detention storage quantities, based on ground surface calculations, are documented in Appendix D. A summary of the available storage and required detention storage is provided in Table 10. The 100-year High-Water Level (HWL) has been determined to be 270.10 m. Since the proposed pipe elevations are lower than the HWL, the pipes' full capacity can be utilized as detention storage. Additionally, the manhole volumes have been calculated in alignment with the HWL.

[1] Allowable Flow = 2-Years pre flow from A2 – 100 years Uncontrolled flow – 100 years Roof (R1-R7) Controlled Flow
[2] Ground surface uncontrolled areas(UC1 & UC2) and Roof RB1 is consider as an Uncontrolled roof and are included in onsite storage calculation

Table 10 – Summary of 100-yr Detention Storage (m^3) - Ground Surface

Maximum Required Storage	**19.04**
CB/ Manhole	2.41
Pipes	7.67
Stormwater Chamber	10.91
Total Proposed Storage	**20.99**

For the 100-year design storm event, the required controlled flow demands a maximum detention storage capacity of 19.04 m³. Currently, there is 20.99 m³ of available storage volume within the CB, manholes, piping systems and Stormwater Chamber.

Therefore, the proposed storage is higher than the required in post development condition.

3.7.3 Storage for Roof Quantity Control

Stormwater flow from the roofs is proposed to be controlled through the installation of parabolic weirs (Zurn Z105 Control Flow Drain—refers to Appendix A) on roofs R1 to R7. Based on the controlled flow from these roof drains, the required storage volume on the roof has been calculated as 50.89 m³ (refer to Appendix D, Table 2B). The proposed locations of the roof drains and the roof ponding details are illustrated in DR-103. A summary of roof control and storage calculations is provided in Table 11.

Table 11: Summary of 100 years Roof detention storage and Control Summary

Roof Location	Available Roof Area (m^2)	Area Covered by roof Ponding (m^2)	Allowable Flow (OBC) (l/s)	Design Controlled Flow (l/s)	Calculated Storage Volume (m^3)	Ponding Depth (mm)
R1	329.5	225.00	1.4	1.75	11.14	150.00
R2	256.76	225.00	1.1	1.75	11.14	150.00
R3	289.21	225.00	1.2	1.75	11.14	150.00
R4	266.72	225.00	1.1	1.75	11.14	150.00
R5	260.84	225.00	1.1	1.75	11.14	150.00
R6	46.53	36.00	0.2	1.75	0.71	60.00
R7	96	81.00	0.4	1.75	2.41	90.00
TOTAL	1545.56	1242	6.5	12.25	58.81	

For the 100-year design storm event, the maximum roof detention storage required for controlled flow is 50.89 m³. With 58.81 m³ of available roof storage, the proposed design provides a surplus capacity, exceeding the required storage volume.

3.8 Water Quality Control

Long term average removal of 80% of Total Suspended Solids (TSS) on an annual basis all runoff leaving the site is required. To substantially improve the water quality of the water leaving the site, an oil/grit separating device is proposed to be installed for water quality treatment. The suggested unit for the area of the site and the level of treatment desired will be in accordance with the attached "HS4" Detailed Sizing Report". The suggested unit will provide 94% TSS removal.

To mitigate sediment load upstream of the OGS, a catchbasin treatment unit, Enviro Basin, is proposed. This unit is designed to achieve 50% Total Suspended Solids (TSS) removal. The detailed analysis, owner's manual, and ETV verification for the Enviro Basin and HS4 model are included in Appendix E.

3.9 Erosion and Sediment Control during Construction

The erosion potential of the study area was assessed using methods described in the 'MTO Drainage Management Manual' of temporary erosion and sediment control measures suitable for construction sites close to highways. During site construction, various temporary measures will be implemented to prevent the discharge of sediment laden stormwater from the site. These measures include silt fencing, catch basin buffers and mud mats.
In addition to the above, the following 'good housekeeping' measures are recommended:

- All exposed soils shall be stabilized as soon as possible with seed and mulch application as directed by the Engineer;
- All construction vehicles shall leave the site via the designated location (proposed mud mat) as shown on the ESC plan (DWG. C-3)
- No construction activity or machinery shall intrude beyond the silt/snow fence or limit of construction area;
- Cleaning and repairs of mud mats and any other temporary sediment control measures shall be completed as deemed necessary through regular inspections;
- Sediment/silt shall be removed from the sediment control devices after each storm event and deposited in areas as approved by the engineer; and
- All re-graded areas within the development which are not occupied by buildings, roadways, sidewalks, or driveways shall be top-soiled and sodded/seeded immediately after completion of final grading operations as directed by the engineer.

4.0 WATER BALANCE

According to the Hydrogeological Investigation report section 5.4.1 (prepared by GHD dated 27 August 2024,) stated that –

"To maintain the pre-development infiltration and minimize impacts to groundwater base flow, the predicted infiltration volume of 41 m3/year for the undeveloped areas of the Site plus an additional 244 m3/year of infiltration from the rooftop would be required. Based upon LID literature, an underground chamber can infiltrate up to 85% of rooftop runoff resulting in an infiltration surplus of nearly 900 m3/year compared to the pre-development infiltration. Thus, only about 18.3% of the rooftop runoff is required to maintain the pre-development infiltration values."

Based on GHD recommendation water balance quantity calculated for 18.3% area to infiltrate up to 10mm rainfall as follows:

Water Balance required for the Site: = 18.3% Total roof area X 10mm
= 18.3 % of 1972.67 X 10 mm
= 360.99 m^2 X 10/1000 m^3
= 3.61 m^3

To achieve the water balance criteria a stormwater infiltration chamber is proposed to achieve the infiltration deficit in post-development condition.

4.1 Stormwater Infiltration Chamber

To accommodate the necessary retention storage a stormwater infiltration chamber (Model DC-780 or eq.) is proposed. Sizing and outlet location of the infiltration chamber was selected in a manner to ensure that sufficient retention volume is provided. Volume of water proposed to be retained by the Stormwater infiltration chamber unit has been provided by the manufacturer. Location of the chamber is shown in Drawing C 2. Required and proposed storage capacity of infiltration chamber is summarized in Table 12 and the details are presented in Appendix F.

Table 12: Water Balance Summary

Description	**Volume (m^3)**
Total volume of Chamber (m^3)	14.66
Volume for Detention storage (m^3)	10.91
Required Volume for Retention (m^3)	3.61
Volume Provided for Retention (m^3)	3.75

4.2 Permeability and Drawdown Calculation for Stormwater Infiltration Chamber

As per the Hydrogeological and Geological investigation Report Section 4.4, prepared by GHD dated 27 August 2024, the infiltration rate estimated as 48 mm/hr.

Based on the TRCA Stormwater Management Criteria Table C 3 (Safety Correction factors for calculating design infiltration rates),

Ratio of Mean Measured Infiltration = (48 mm/hr) / (48 mm/hr) = 1

Safety Correction Factor = 2.5

Design Infiltration Rate = (48 mm/hr) / 2.5 = 19.2 mm/hr
The proposed water balance volume to be infiltrated is 3.61 m^3. The Ministry of Environment's Stormwater Management and Planning Manual, March 2003 method of infiltration will be implemented. The infiltration of this remainder volume of runoff will be through a pervious bottom of an underground device.

This Manual sizes the bottom area of the infiltration device by applying the following equation:

$$A = \frac{1000V}{Pn\Delta t}$$

Where:

A = Bottom area of the infiltration trench (m^2)
V = Runoff volume to be infiltrated (m^3)
P = Percolation rate of surrounding native soil (mm / hr.)
n = Porosity of the storage media (0.40 for storm chambers)
ΔT = Retention time (48 hours)

The above equation assumes that all of the infiltration occurs through the bottom of the device.

The retention time in the underground device is calculated on the conservative side, namely 48 hours.

Substituting the known values in the above equation:

A = (1000 x 3.61m^3) / (19.2 mm per hour x 0.40 x 48 hours) = 9.79 m^2

It is proposed to provide an open bottom storm water infiltration chamber with an available bottom surface area of 22.76m^2. The maximum draw down time considering safety correction factors as per TRCA guidelines for the provided storm chamber will be 21.45 hrs.

5.0 MINOR SYSTEM DRAINAGE

Minor storm drainage (100-year storm event) is designed to convey stormwater to existing storm sewer (Refer: Drawing C2). Storm Sewer Design sheet attached in Appendix C.

6.0 MAJOR SYSTEM DRAINAGE

The overland flow will not impact the building since the grading of the site ensures storm flows greater than 100 years will be able to flow overland through the site without any impact to proposed buildings and adjacent site. The overland flow direction presented in Grading Plan (DWG. C1).

7.0 SANITARY SEWAGE FLOW

Sanitary demand calculated as per Town of Whitchurch-Stouffville Guideline.

Average Design Flow	= 28.0 m^3/ha/day
Area of Development:	=0.2408 ha.
Average Demand:	=28 x 0.2408 m^3/day = 6.74 m^3/day = 0.078 L/sec
Population	= 80 people/ ha = 80 X 0.2408 = 20 people

Peaking Factor

Harmon's Equation

$$M = 1 + \frac{14}{4 + P^{1/2}}$$

$= 1 + (14/4+ (20/1000)^{0.5})$
$= 4.38$

Peak Demand	= 0.078 L/sec x 4.38 = **0.34 L/sec**
Extraneous Flow	= 0.23 L/s.ha
Total Extraneous Flow	=0.23 x 0.2408 m^3/day = 0.055 L/sec
Total Sanitary Demand	= Peak Demand + Extraneous Flow = 0.34 + 0.055 **= 0.39 L/sec = 0.00039 m^3/sec**

By considering the min velocity of 0.6 m/sec the size of pipe is as below:

$Q = AV \rightarrow 0.00039 = A \times 0.6$

A = 0.00125m^2 → D= 29.01 mm→ D= 50mm

A 150 mm sanitary sewer pipe is proposed for the sanitary sewer.

8. 0 WATER DEMAND

8.1 Domestic Water Demand

Domestic water demand calculated as per Town of Whitchurch-Stouffville Guideline

Average demand:	= 28 m^3/ha/day
Area of Development:	=0.2408 ha.
Average Demand:	=28 x 0.2408 m^3/day = 6.74 m^3/day = 0.078 L/sec
Max Day Factor	= 2.0
Maximum Hour Factor	= 3.0
Maximum Day Demand	= 0.078 L/sec x 2 = **0.156 L/sec**
Peak Hour Demand	= 0.078 L/sec x 3 = **0.234 L/sec**

8.2 Fire Demand

As per the Town of Whitchurch-Stouffville Guideline section E2.02, minimum fire flow required for the institutional development is **175 L/s**

8.3 Total Water Demand

The total water demand for the development will be maximum day demand plus fire flow or the peak hour demand whichever is greater.

Total Water Demand = Maximum Day Demand + Fire Demand
= 0.156 + 175
= 175.156 L/s
Or
Peak Hour Demand = 0.234 L/s

Therefore, the total water demand for the proposed development is **175.156 L/s**

8.4 Water Supply Availability

Flow test was conducted by Hydratest, based on the results from the test the following flow volume can be supplied from the main street watermain while maintaining a residual pressure of 140 kPa in water trunk. The following calculation is done based on Design guidelines -Town of Whitchurch-Stouffville, January 2023. The test results attached in Appendix G.

$$Q_R = Q_F * \frac{h_r^{0.54}}{h_f^{0.54}}$$

Where,

Q_R = flow predicted at desired residual pressure (20 psi)
Q_F = total flow measured during test
hr = Static pressure – desired residual pressure (20psi)
hf = static pressure – residual pressure during fire flow test

Thus,

$Q_R = 1986 * ((70-20)/ (70-60))^{0.54}$
Q_R = 4440.83 USGPM
= **280.17 L/sec**

Therefore, based on the hydrant flow test results, there is enough flow available for domestic and fire flows for the proposed watermain connection to the site.

9.0 SERVICE CONNECTIONS

9.1 Sanitary

According to the plan and profile provided by the Town for the reconstruction of Winona Drive as part of a Capital Project, a 150mm Ø sanitary sewer plug has been installed at the property line. The proposed development will be connected to this plug via a 150mm Ø sanitary sewer line, which will pass through a proposed sanitary control manhole (SAN MH1A). The layout and associated details are outlined in Drawing C2.

9.2 Water

In accordance with the plan and profile provided by the Town for the reconstruction of Winona Drive (as part of the Capital Project), a 150mm diameter water valve has been installed at the property line. The proposed development will be served by a 150mm diameter fire water service, which will be connected to this valve. Additionally, the domestic water service will be connected through a TEE fitting to the proposed fire service, utilizing a 50mm domestic water service line. The layout and details of the water service are depicted on Drawing C2.

10.0 SUMMARY & CONCLUSIONS

This report presents a detailed SWM control plan addressing both quantity and quality controls required to meet all design criteria. Drainage boundaries have been established to estimate flows to the proposed drainage collection system for the site in order to develop a comprehensive drainage and SWM plan for the proposed development. There will be no negative impact or increase in stormwater peak flows under proposed controlled conditions.

The summary of our findings and drainage analyses for the subject property is as follows:

- The hydrologic and hydraulic analyses address the existing and proposed site conditions;
- SWM criteria of external agencies are collected and reviewed during the course of the study and all other available information are retrieved and reviewed;
- Impervious areas are calculated under both existing and proposed conditions and a significant increase in impervious areas was found;
- SWM design was performed for the subject site to provide flow quantity and quality control;
- A proposed storm sewer network has been designed to convey the minor system;
- Recommended quantity control measures for the site will be achieved through an Orifice plate;
- A stormwater infiltration chamber is proposed to mitigate the water balance deficit associated with the change from pre-development to post-development conditions.
- These measures will provide the necessary quantity and quality control to meet the criteria of Town of Whitchurch Stouffville.

We trust that this proposed stormwater management plan will provide appropriate service to the proposed site.

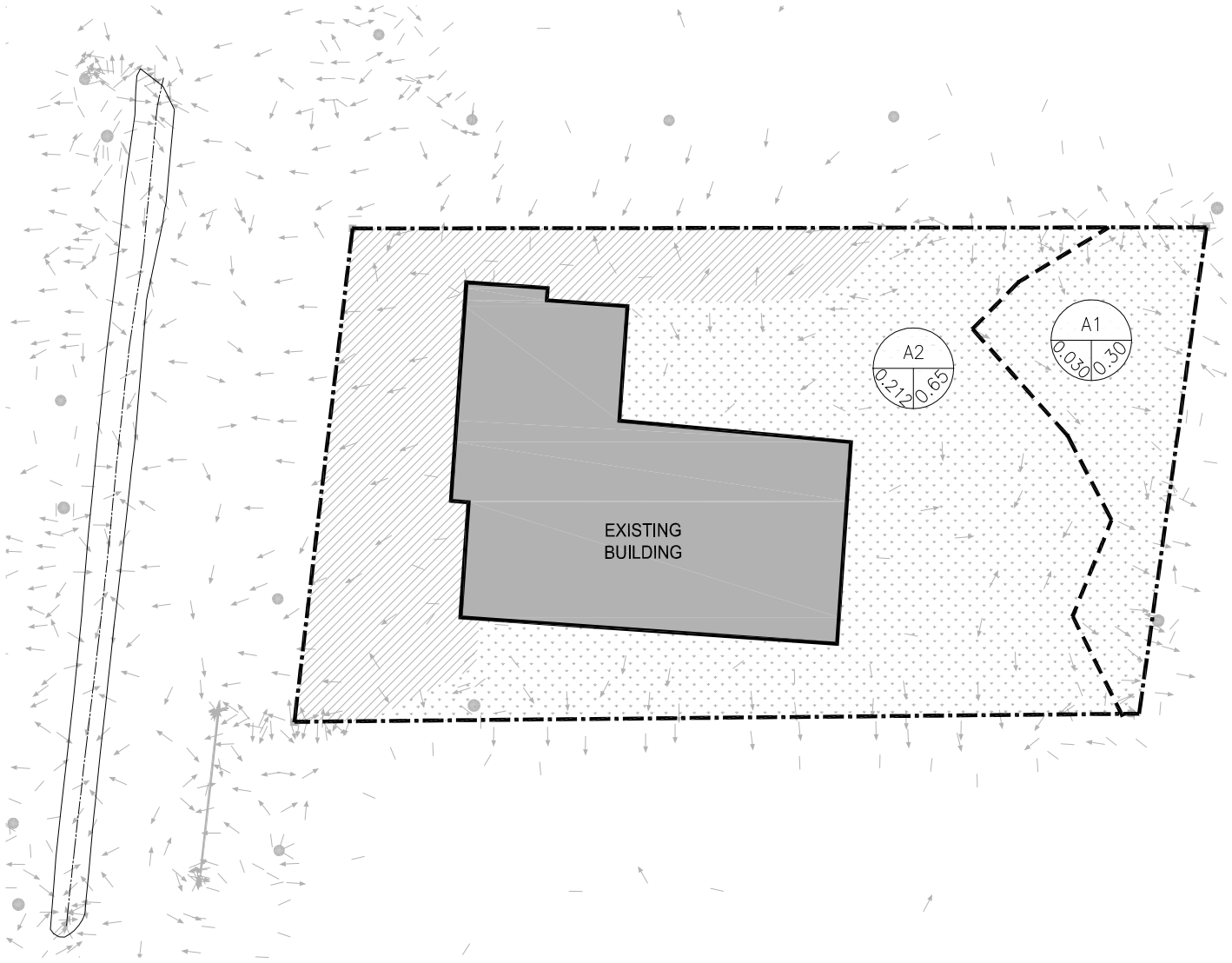
Respectfully Submitted,

n Engineering Inc.

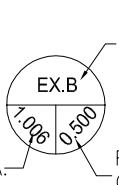
Abu. S. Ziauddin M. Eng P. Eng.
Municipal Project Manager

Lekhnath Upadhyaya EIT-M.Eng
Municipal project designer

Appendix A
Figures



LEGEND



DRAINAGE BOUNDARY

SITE BOUNDARY

OVERLAND FLOW

PRE-DEVELOPMENT LAND USE TABLE

LAND COVER	HATCH	AREA (SQ.M.)	RUNOFF CO-EFFICIENT
ROOF		573.30	0.95
LANDSCAPE		1289.20	0.30
CONCRETE/ASPHALT		545.79	0.95
TOTAL		2408.29	

SUBCATCHMENT AREA

SUBCATCHMENT	ROOF	ASPHALT /CONCRETE	LANDSCAPED	TOTAL
A1	0.00	0.00	305.44	305.44
A2	573.30	545.79	983.76	2102.85
TOTAL	573.30	545.79	1289.20	2408.29

n Engineering Inc
9120 Leslie Street, Suite-208
Richmond Hill, Ontario. L4B 3J9
T : 4 1 6 . 2 5 6 . 9 7 4 1
E: info@nengineering.com
www.nengineering.com

PROJECT:

27 WINONA DR, WHITCHURCH STOUFFVILLE, ON PLACE OF WORSHIP-MOSQUE

DRAWING TITLE:

PRE-DEVELOPMENT DRAINAGE PLAN

DRAWN BY: SJ	DATE: 26 JUNE 2024
CHECKED BY: AZ	SCALE: 1:1500
PROJECT NO.: **22-71**	DRAWING NO.: **DR-101**

N

(GEODETIC NORTH)

PROJECT NORTH

SUBCATCHMENT AREA

SUBCATCHMENT	ROOF	ASPHALT /CONCRETE	LANDSCAPED	TOTAL
A1	0.00	34.07	102.27	136.34
A2	0.00	160.88	15.31	176.19
B1	1972.67	0.00	0.00	1972.67
UC1	0.00	30.80	54.75	85.55
UC2	0.00	37.54	0.00	37.54
TOTAL	1972.67	263.29	172.33	2408.29

POST-DEVELOPMENT LAND USE TABLE

LAND COVER	HATCH	AREA (SQ.M.)	RUNOFF CO-EFFICIENT
ROOF		1972.67	0.95
LANDSCAPE		172.33	0.30
CONCRETE/ASPHALT		263.29	0.95
TOTAL		2408.29	

LEGEND

DRAINAGE AREA IDENTIFICATION

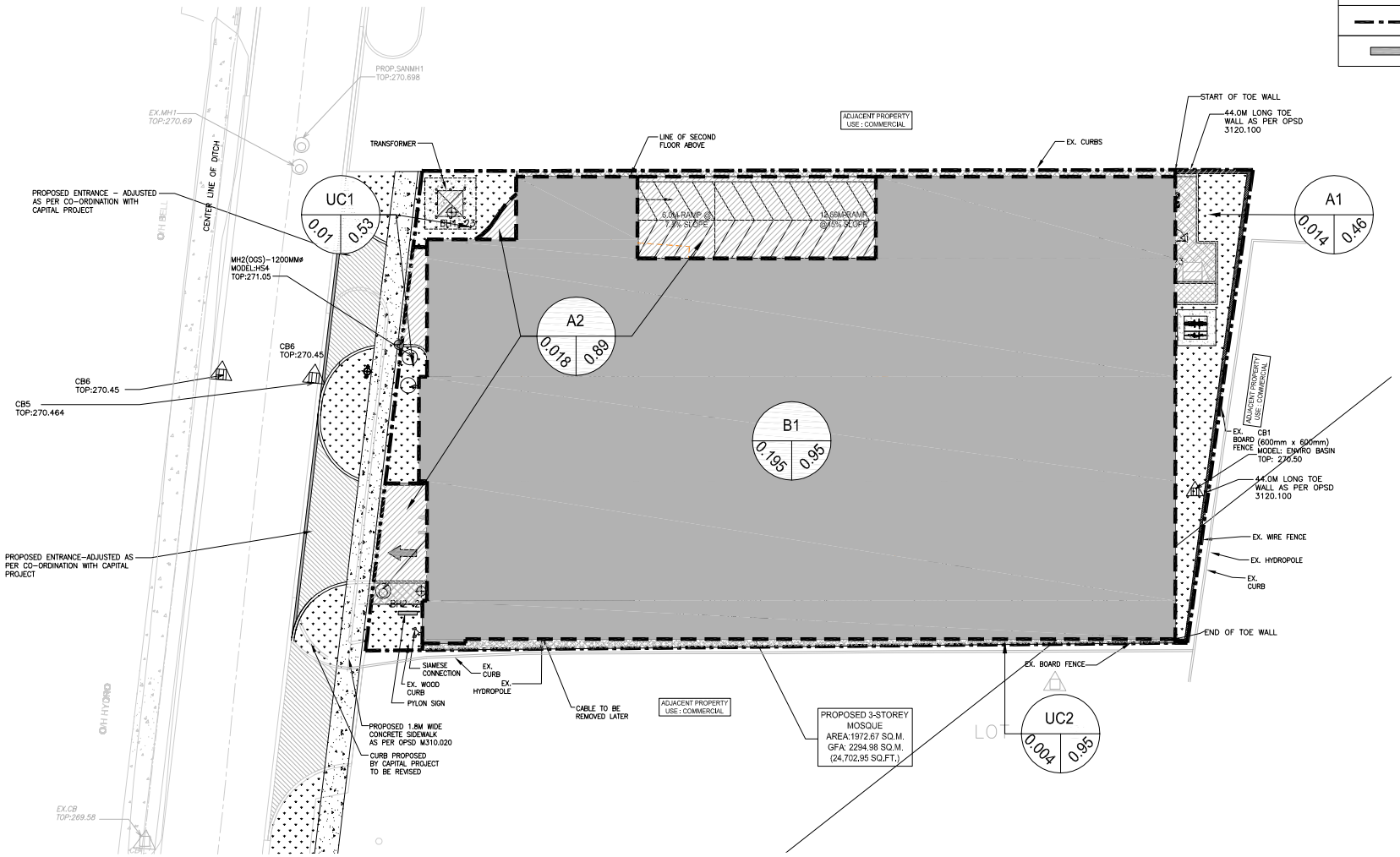
A1 (1.006 / 0.500)

AREA IN HA. — RUNOFF COEFFICIENT

DRAINAGE BOUNDARY

SITE BOUNDARY

OVERLAND FLOW



n Engineering Inc
9120 Leslie Street, Suite-208
Richmond Hill, Ontario. L4B 3J9
T : 4 1 6 . 2 5 6 . 9 7 4 1
E: info@nengineering.com
www.nengineering.com

PROJECT:

27 WINONA DR, WHITCHURCH STOUFFVILLE, ON PLACE OF WORSHIP-MOSQUE

DRAWING TITLE:

POST-DEVELOPMENT DRAINAGE PLAN

DRAWN BY: SJ	DATE: 26 JUNE 2024
CHECKED BY: AZ	SCALE: 1:1500
PROJECT NO.: **22-71**	DRAWING NO.: **DR-102**

N (GEODETIC NORTH)

PROJECT NORTH

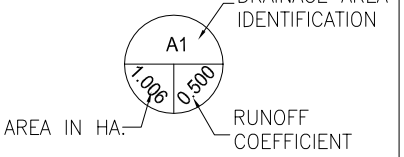
ROOF DRAINAGE

SUB AREA	ROOF (m)²	SKYLIGHT (m^2)	TOTAL AREA (m²)
R1	329.50	1.88	331.38
R2	256.76	15.06	271.82
R3	289.21	18.20	307.41
R4	266.72	18.20	284.92
R5	260.84	12.77	273.61
R6	46.53	0.00	46.53
R7	96.00	0.00	96.00
RB1	361.00	0.00	361.00
TOTAL	1906.56	66.11	1972.67

POST-DEVELOPMENT LAND USE TABLE

LAND COVER	HATCH	AREA (SQ.M.)	RUNOFF CO-EFFICIENT
ROOF		1906.56	0.95
SKYLIGHT		66.11	0.95
LANDSCAPE		172.33	0.30
CONCRETE/ASPHALT		263.29	0.95
TOTAL		2408.29	

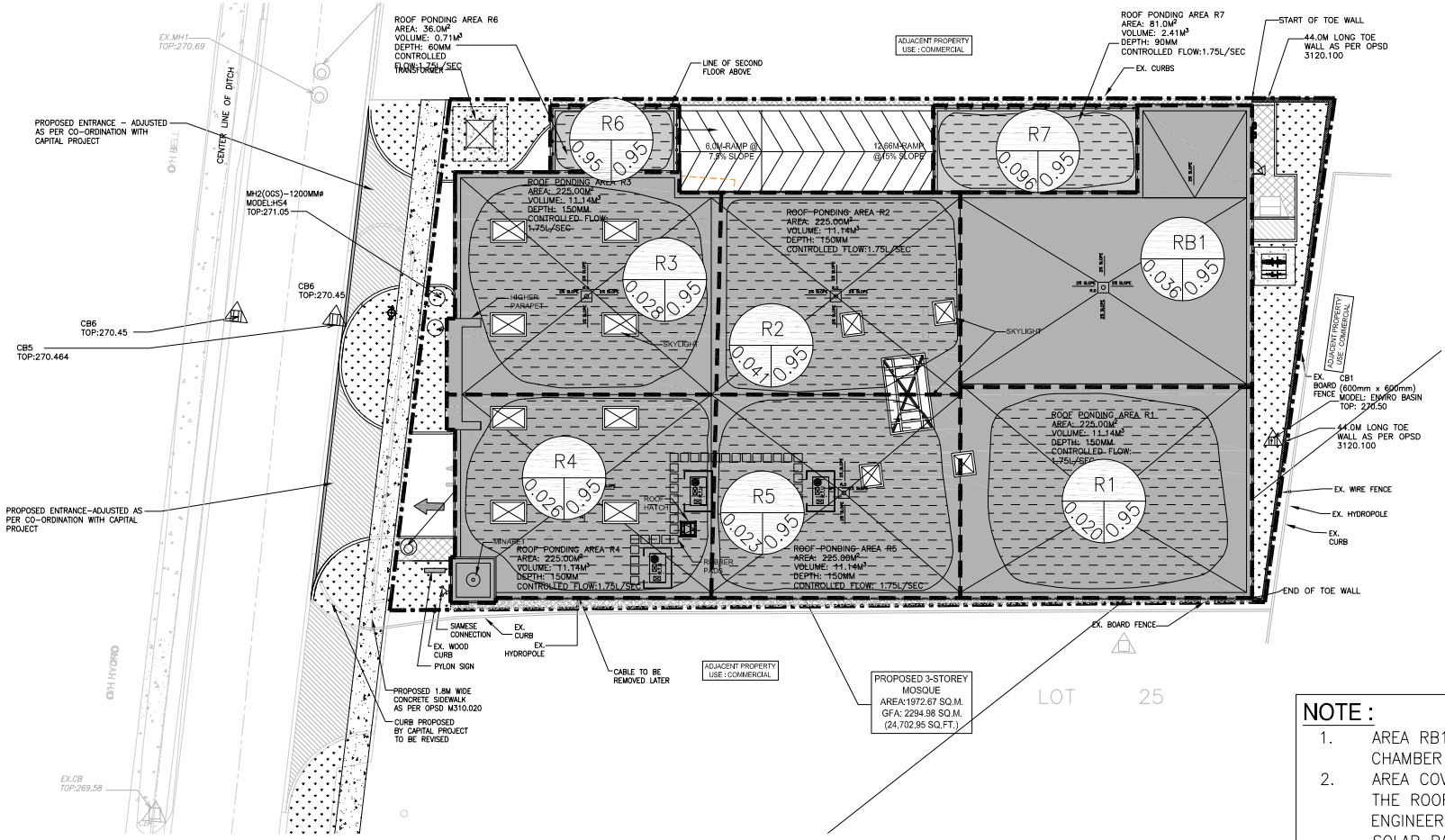
LEGEND



DRAINAGE BOUNDARY

SITE BOUNDARY

OVERLAND FLOW



NOTE :

1. AREA RB1 RESERVED FOR STORMWATER RETENTION CHAMBER A ROOF DRAIN TO BE DESIGN BY OTHERS.
2. AREA COVERED BY SKYLIGHTS ARE EXCLUDED FROM THE ROOF PONDING CALCULATION. MECHANICAL ENGINEER HAS TO DESIGN THE SKYLIGHTS AND SOLAR PANEL ABOVE THE PONDING DEPTH.

n Engineering Inc
9120 Leslie Street, Suite-208
Richmond Hill, Ontario. L4B 3J9
T : 4 1 6 . 2 5 6 . 9 7 4 1
E: info@nengineering.com
www.nengineering.com

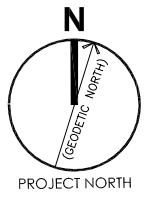
PROJECT:

27 WINONA DR, WHITCHURCH STOUFFVILLE, ON PLACE OF WORSHIP-MOSQUE

DRAWING TITLE:

ROOF STORAGE AND DRAINAGE PLAN

DRAWN BY: SJ	DATE: 26 JUNE 2024
CHECKED BY: AZ	SCALE: 1:1500
PROJECT NO.: **22-71**	DRAWING NO.: **DR-103**



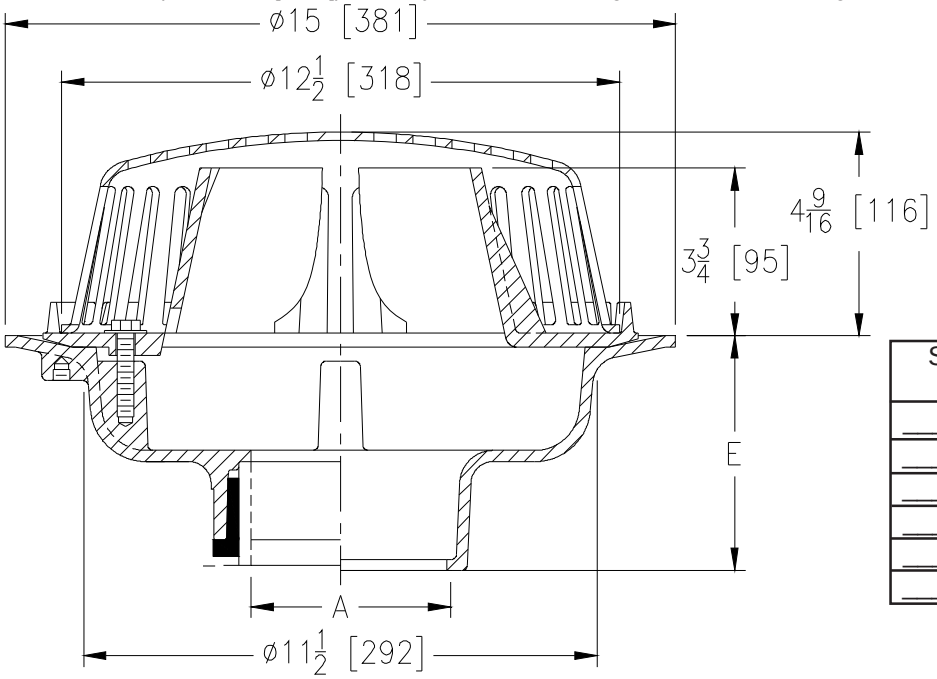
Z105

CONTROL-FLO ROOF DRAIN
W/ PARABOLIC WEIR

SPECIFICATION SHEET

TAG _____

Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice



Specify Number of Notches in Weir	
___-N1	One Notch
___-N2	Two Notches
___-N3	Three Notches
___-N4	Four Notches
___-N5	Five Notches
___-N6	Six Notches

A- Pipe Size In.[mm]	Approx. Wt. Lbs. [kg]	Dome Open Area Sq. In. [cm²]
2,3,4 [51,76,102]	34 [15]	103 [665]

ENGINEERING SPECIFICATION: ZURN Z105
15" [381mm] Diameter Control-Flo roof drain for dead-level roof construction, Dura-Coated cast iron body, Control-Flo weir shall be linear functioning with integral membrane flashing clamp/gravel guard and Poly-Dome. All data shall be verified proportional to flow rates. Each notch will allow 10 GPM [LPM] of flow per 1" [25mm] of rain water build up above the drain.

OPTIONS (Check/specify appropriate options)

PIPE SIZE
3, 4 [76, 102]
2 , 3, 4 [51, 76, 102]
2 , 3, 4 [51, 76, 102]

(Specify size/type) **OUTLET**
_____ IC Inside Caulk
_____ NH No-Hub
_____ NL Neo-Loc

E BODY HT. DIM.
5-1/4 [133]
5-1/4 [133]
4-9/16 [116]

PREFIXES
_____ Z D.C.C.I. Body with Poly-Dome*
_____ ZA D.C.C.I. Body with Aluminum Dome
_____ ZC D.C.C.I. Body with Cast Iron Dome

SUFFIXES
_____ -C Underdeck Clamp
_____ -DP Top-Set® Deck Plate (Replaces both -C & -R)
_____ -E Static Extension 1 [25] thru 4 [102] (Specify Ht.)
_____ -EA Adjustable Extension Assembly 2-1/8 [54] thru 3-1/2 [89]
_____ -G Galvanized Cast Iron
_____ -R Roof Sump Receiver
_____ -TC Neo-Loc Test Cap Gasket (2,3,4 [51,76,102] NL Bottom Outlet Only)
_____ -VP Vandal Proof Secured Top
_____ -10 6 [152] High Parabolic Weir for Sloped Roof (ZC or ZA)

* Regularly furnished unless otherwise specified.

Zurn Industries, LLC | **Specification Drainage Operation**
1801 Pittsburgh Avenue, Erie, PA U.S.A. 16502 · Ph. 855-663-9876, Fax 814-454-7929
In Canada | **Zurn Industries Limited**
3544 Nashua Drive, Mississauga, Ontario L4V 1L2 · Ph. 905-405-8272, Fax 905-405-1292
www.zurn.com

Rev. K
Date: 09/25/17
C.N. No. 137793
Prod. | Dwg. No. Z105

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Ottawa, Ontario	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	59 (13)	**6.5**	66 (2.6)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14**	76 (3)	86.5 (19)	**10**	96.5 (3.8)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	75 (16.5)	**23**	84 (3.3)	93 (20.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	79.5 (17.5)	**32**	89 (3.5)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**18**	127 (5)
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	68 (15)	**7**	76 (3.0)	86.5 (19)	**5**	96.5 (3.8)	104.5 (23)	**4**	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	77.5 (17)	**16**	86.5 (3.4)	97.5 (21.5)	**11**	109 (4.3)	118 (26)	**9**	132 (5.2)
	697 (7,500)	7.1 (16.6)	68 (15)	**29**	76 (3.0)	82 (18)	**26**	91.5 (3.6)	102.5 (22.5)	**18**	114.5 (4.5)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	**40**	81.5 (3.2)	86.5 (19)	**34**	96.5 (3.8)	107 (23.5)	**24**	119.5 (4.7)	132 (29)	**20**	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	**7**	45.5 (1.8)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	86.5 (19)	**3.3**	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	63.5 (14)	**14**	71 (2.8)	82 (18)	**9**	91.5 (3.6)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	70.5 (15.5)	**22**	78.5 (3.1)	86.5 (19)	**15**	96.5 (3.8)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	72.5 (16)	**30**	81.5 (3.2)	91 (20)	**21**	101.5 (4.0)	109 (24)	**17**	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	66 (14.5)	**7**	73.5 (2.9)	82 (18)	**4.5**	91.5 (3.6)	97.5 (21.5)	**3.5**	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	**19**	73.5 (2.9)	77.5 (17)	**16**	86.5 (3.4)	93 (20.5)	**11**	104 (4.1)	111.5 (24.5)	**9**	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	84 (18.5)	**26**	94 (3.7)	100 (22)	**18**	112 (4.4)	120.5 (26.5)	**14**	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	**42**	91.5 (3.6)	86.5 (19)	**34**	96.5 (3.8)	104.5 (23)	**24**	117 (4.6)	127.5 (28)	**20**	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	**8.5**	66 (2.6)	70.5 (15.5)	**7.5**	78.5 (3.1)	84 (18.5)	**4.5**	94 (3.7)	107 (23.5)	**4**	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	**20**	76 (3.0)	79.5 (17.5)	**16**	89 (3.5)	97.5 (21.5)	**11**	109 (4.3)	118 (26)	**9**	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	86.5 (19)	**26**	96.5 (3.8)	107 (23.5)	**18**	119.5 (4.7)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	**42**	91.5 (3.6)	91 (20)	**36**	101.5 (4.0)	113.5 (25)	**26**	127 (5.0)	129.5 (28.5)	**20**	145 (5.7)
Charlottetown, Prince Edward Island	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**3.8**	76 (3.0)	79.5 (17.5)	**3**	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	75 (16.5)	**15.5**	84 (3.3)	88.5 (19.5)	**10**	99 (3.9)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	**31**	84 (3.3)	86.5 (19)	**26**	96.5 (3.8)	102.5 (22.5)	**18**	114.5 (4.5)	113.5 (25)	**13**	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	**42**	94 (3.7)	97.5 (21.5)	**37**	106.5 (4.2)	111.5 (24.5)	**26**	124.5 (4.9)	125 (27.5)	**20**	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	**7.5**	56 (2.2)	61.5 (13.5)	**7**	68.5 (2.7)	79.5 (17.5)	**4.5**	89 (3.5)	97.5 (21.5)	**3.5**	109 (4.36)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	70.5 (15.5)	**15**	78.5 (3.1)	88.5 (19.5)	**10**	99 (3.9)	109 (24)	**8**	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	**27**	66 (2.6)	72.5 (16)	**23**	81.5 (3.2)	93 (20.5)	**16**	104 (4.1)	113.5 (25)	**13**	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	**36**	68.5 (2.7)	77.5 (17)	**31**	86.5 (3.4)	95.5 (21)	**22**	106.5 (4.2)	120.5 (26.5)	**19**	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	**8**	58.5 (2.3)	63.5 (14)	**7**	71 (2.8)	79.5 (17.5)	**4.5**	89 (3.5)	97.5 (21.5)	**3.5**	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	70.5 (15.5)	**15**	78.5 (3.1)	84 (18.5)	**10**	94 (3.7)	104.5 (23)	**8**	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	72.5 (16)	**23**	81.5 (3.2)	86.5 (19)	**15**	96.5 (3.8)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**37**	76 (3.0)	77.5 (17)	**31**	86.5 (3.4)	88.5 (19.5)	**20**	99 (3.9)	109 (24)	**17**	122 (4.8)

Appendix B
Flow Analysis

Calculation Sheet 1A

PRE- DEVELOPMENT FLOW - TOWARDS EAST(NINTH LINE)- A1

n Engineering Inc

Project:	**Mosque, Place of Worship**
Address:	**27 Winona Dr.**
Town/Township/City	**Whitcurch Stouffville, ON**
Project No.	**n2271**
Proposed Development Area (m^2)	**2408.29**

PRE-DEVELOPMENT RUNOFF COEFFICIENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT/CONC.	0.00	0.95	0.00
BUILDING	0.00	0.95	0.00
LANDSCAPED AREA	305.44	0.30	91.63
		ΣAREA X C	91.63
		WEIGHTED AVERAGE "C"	**0.30**
		DEVELOPABLE AREA "A" (Hectares)	0.03

Rainfall intensity:

$$i = \frac{A}{(t+B)^C}$$

Where:

I = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

t =Time of concentration(min) 10.00

Design Flow:

Q=2.778 (ACCai)

Where:

Q= Flow (m^3/second)

C = Runoff coefficient

A = Draingae Area (hectares)

I= Average rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	696.679	1015.963	1279.709	1546.810	1802.604	2051.707
B	4.957	5.255	5.715	5.746	6.029	6.230
c	0.811	0.826	0.841	0.845	0.853	0.860
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.67	107.00	126.19	150.60	169.09	186.74
C	0.30	0.30	0.30	0.30	0.30	0.30
Q (m^3/sec)	0.00	0.00	0.00	0.00	0.00	0.00
Q (l/sec)	**1.98**	2.72	3.21	3.83	4.30	4.75

Calculation Sheet 1B

PRE- DEVELOPMENT FLOW TOWARDS WEST (WINONA DRIVE)- A2

n Engineering Inc

Project:	**Mosque, Place of Worship**
Address:	**27 Winona Dr.**
Town/Township/City	**Whitcurch Stouffville, ON**
Project No.	**n2271**
Proposed Development Area (m^2)	**2408.29**

PRE-DEVELOPMENT RUNOFF COEFFICIENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT/CONC.	545.79	0.95	518.50
BUILDING	573.30	0.95	544.64
LANDSCAPED AREA	983.76	0.30	295.13
		ΣAREA X C	1358.26
		WEIGHTED AVERAGE "C"	**0.65**
		DEVELOPABLE AREA "A" (Hectares)	0.21

Rainfall intensity:

$$i = \frac{A}{(t+B)^C}$$

Where:

I = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

t =Time of concentration(min) 10.00

Design Flow:

Q=2.778 (ACCai)

Where:

Q= Flow (m^3/second)

C = Runoff coefficient

A = Draingae Area (hectares)

I= Average rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	696.679	1015.963	1279.709	1546.810	1802.604	2051.707
B	4.957	5.255	5.715	5.746	6.029	6.230
c	0.811	0.826	0.841	0.845	0.853	0.860
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.67	107.00	126.19	150.60	169.09	186.74
C	0.65	0.65	0.65	0.65	0.65	0.65
Q (m^3/sec)	0.03	0.04	0.05	0.06	0.06	0.07
Q (l/sec)	**29.31**	40.37	47.61	56.83	63.80	70.46

Calculation Sheet 1C

PRE- DEVELOPMENT FLOW WHOLE SITE

n Engineering Inc

Project:	**Mosque, Place of Worship**
Address:	**27 Winona Dr.**
Town/Township/City	**Whitcurch Stouffville, ON**
Project No.	**n2271**
Proposed Development Area (m^2)	**2408.29**

PRE-DEVELOPMENT RUNOFF COEFFICIENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT/CONC.	545.79	0.95	518.50
BUILDING	573.30	0.95	544.64
LANDSCAPED AREA	1289.20	0.30	386.76
		ΣAREA X C	1449.90
		WEIGHTED AVERAGE "C"	**0.60**
		DEVELOPABLE AREA "A" (Hectares)	0.24

Rainfall intensity:

$$i = \frac{A}{(t+B)^C}$$

Where:

I = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

t =Time of concentration(min) 10.00

Design Flow:

Q=2.778 (ACCai)

Where:

Q= Flow (m^3/second)

C = Runoff coefficient

A = Draingae Area (hectares)

I= Average rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	696.679	1015.963	1279.709	1546.810	1802.604	2051.707
B	4.957	5.255	5.715	5.746	6.029	6.230
c	0.811	0.826	0.841	0.845	0.853	0.860
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.67	107.00	126.19	150.60	169.09	186.74
C	0.60	0.60	0.60	0.60	0.60	0.60
Q (m^3/sec)	0.03	0.04	0.05	0.06	0.07	0.08
Q (l/sec)	**31.28**	43.10	50.83	60.66	68.11	75.22

Calculation Sheet 2

POST - DEVELOPMENT FLOW (WHOLE SITE)

n Engineering Inc

Project:	**Mosque, Place of Worship**
Address:	**27 Winona Dr.**
Town/Township/City	**Whitcurch Stouffville, ON**
Project No.	**n2271**
Proposed Development Area (m^2)	**2408.29**
Date:	**3/19/2025**

POST DEVELOPMENT RUNOFF COEFFICIENT FROM SITE

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C_5
ASPHALT/CONC.	263.29	0.95	250.13
BUILDING	1972.67	0.95	1874.04
LANDSCAPED AREA	172.33	0.30	51.70
		ΣAREA X C	2175.86
		WEIGHTED AVERAGE "C"	**0.90**
		DEVELOPABLE AREA "A" (Hectares)	0.24

Rainfall intensity:

$$i = \frac{A}{(t+B)^C}$$

Where:

I = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

t =Time of concentration(min) 10.00

Design Flow:

Q=2.778 (ACCai)

Where:

Q= Flow (m^3/second)

C = Runoff coefficient

A = Draingae Area (hectares)

I= Average rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	696.68	1015.96	1279.71	1546.81	1802.60	2051.71
B	4.957	5.255	5.715	5.746	6.029	6.230
c	0.811	0.826	0.841	0.845	0.853	0.860
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.67	107.00	126.19	150.60	169.09	186.74
C	0.90	0.90	0.90	0.90	0.90	0.90
Run-Off Coefficient Modification Factor (Ca)	1.00	1.00	1.00	1.10	1.20	1.25
C*	0.90	0.90	0.90	0.99	1.00	1.00
Q (m^3/sec)	0.05	0.06	0.08	0.10	0.11	0.12
Q (l/sec)	46.95	64.68	76.27	100.13	113.12	124.93

Calculation Sheet 2A

POST - DEVELOPMENT FLOW- FROM GROUND SURFACE (A1& A2) AND ROOF RB1

n Engineering Inc

Project:	**Mosque, Place of Worship**
Address:	**27 Winona Dr.**
Town/Township/City	**Whitcurch Stouffville, ON**
Project No.	**n2271**
Proposed Development Area (m^2)	**2408.29**
Date:	**3/19/2025**

POST DEVELOPMENT RUNOFF COEFFICIENT FROM SITE

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C_5
ASPHALT/CONC.	194.95	0.95	185.20
BUILDING (RB1)	361.00	0.95	342.95
LANDSCAPED AREA	117.58	0.30	35.27
		ΣAREA X C	563.43
		WEIGHTED AVERAGE "C"	**0.84**
		DEVELOPABLE AREA "A" (Hectares)	0.07

Rainfall intensity:

$$i = \frac{A}{(t+B)^C}$$

Where:

I = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

t =Time of concentration(min) 10.00

Design Flow:

Q=2.778 (ACCai)

Where:

Q= Flow (m^3/second)

C = Runoff coefficient

A = Draingae Area (hectares)

I= Average rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	696.68	1015.96	1279.71	1546.81	1802.60	2051.71
B	4.957	5.255	5.715	5.746	6.029	6.230
c	0.811	0.826	0.841	0.845	0.853	0.860
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.67	107.00	126.19	150.60	169.09	186.74
C	0.84	0.84	0.84	0.84	0.84	0.84
Run-Off Coefficient Modification Factor (Ca)	1.00	1.00	1.00	1.10	1.20	1.25
C*	0.84	0.84	0.84	0.92	1.00	1.00
Q (m^3/sec)	0.01	0.02	0.02	0.03	0.03	0.03
Q (l/sec)	12.16	16.75	19.75	25.93	31.64	34.94

Calculation Sheet 3

POST - DEVELOPMENT UNCONTROLLED FLOW

n Engineering Inc

Project:	**Mosque, Place of Worship**
Address:	**27 Winona Dr.**
Town/Township/City	**Whitcurch Stouffville, ON**
Project No.	**n2271**
Proposed Development Area (m^2)	**2408.29**
Date:	**3/19/2025**

UNCONTROLLED RUNOFF COEFFICIENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT/CONC..	68.340	0.95	64.92
BUILDING	0	0.95	0.00
LANDSCAPED AREA	54.750	0.30	16.43
		ΣAREA X C	81.35
		WEIGHTED AVERAGE "C"	**0.66**
		AREA "A" (Hectares)	0.01

Rainfall intensity:

Where: $$i = \frac{A}{(t+B)^C}$$

I = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

t =Time of concentration(min) 10.00

Design Flow:

Q=2.778 (ACCai)

Where:

Q= Flow (m^3/second)

C = Runoff coefficient

A = Draingae Area (hectares)

I= Average rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	696.68	1015.96	1279.71	1546.81	1802.60	2051.71
B	4.957	5.255	5.715	5.746	6.029	6.230
C	0.811	0.826	0.841	0.845	0.853	0.860
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.67	107.00	126.19	150.60	169.09	186.74
Adjustment Multiplier	1.00	1.00	1.00	1.10	1.20	1.25
C*	0.66	0.66	0.66	0.73	0.79	0.83
Q (m^3/sec)	0.002	0.00	0.00	0.00	0.00	0.01
Q (l/sec)	1.76	2.42	2.85	3.74	4.59	**5.28**

Appendix C
Storm Drainage Design Sheet

n Engineering Inc.

Date Prepared 19-Mar-25
Project Mosque, Place of Worship
Project No. n2271
t_c (start): 10.0 minutes

Storm Drainage Design Chart
For Circular Drains Flowing Full
27 Winona Dr.
Whitcurch Stouffville, ON

IDF Curve	
Constants	**100-yrs**
A	2051.7
B	6.2
C	0.9

Catchments							t_c (min)	Hydrology		Hyraulics					TIME	CAPACITY
Catchment ID	**Total Area (ha.)**	**Captured By**	**Outlet to**	**R**	**A x R**	**ACC.**		**Rainfall Intensity, I (mm/hr)**	**Peak Flow (m^3/sec)**	**STORM SEWER DESIGN INFORMATION**						
				Runoff Coeff.		A x R		I_{100}	$Q_{100\text{-}yrs}$	size (mm)	slope (%)	length (m)	Q full (m^3/s)	V full (m/s)	SECT. (min)	
ROOF RB1	0.036	RB1	STM- CHAMBER	0.95	0.034	0.034	10.00	186.74	0.018	300	1.00	7.00	0.097	1.368	0.09	18%
A1	0.014	ENVIROBASIN-CB1	STM- CHAMBER	0.46	0.006	0.006	10.00	186.74	0.003	300	1.00	1.50	0.097	1.37	0.02	3%
A2	0.018	TRENCH DRAIN	STM-MH3	0.89	0.016	0.016	10.00	186.74	0.008	150	1.50	27.00	0.019	1.055	0.43	44%
CONVEYANCE		STM- CHAMBER	STM-MH3			0.041	10.43	182.62	0.021	375	0.50	54.00	0.124	1.122	0.80	17%
CONVEYANCE		STM-MH3	MH2(OGS)			0.056	11.23	175.39	0.027	375	0.50	3.50	0.124	1.122	0.05	22%
CONVEYANCE		MH2(OGS)	STM-MH1(CONTROL)			0.056	11.28	174.94	0.027	300	2.00	1.00	0.137	1.935	0.01	20%
BUILDING ROOF (R1-R7)	0.15	ROOF	STM-MH1(CONTROL)	0.95	0.147	0.147	10.00	186.74	0.076	300	2.60	1.50	0.156	2.206	0.01	49%
CONVEYANCE		STM-MH1(CONTROL)	CB5- PLUG			0.056	11.29	174.86	0.027	300	3.70	6.00	0.186	2.631	0.04	15%

Appendix D
Orifice Sizing, Onsite Detention Storage

n Engineering Inc.

Table 1
Orifice Sizing Calculations

Project:	Mosque, Place of Worship
Address:	27 Winona Dr.
Town/Township/City	Whitcurch Stouffville, ON
Project No.	n2271
Proposed Development Area (m^2)	2408.29
Date:	3/14/2025

	Location	HWL (m)	Orifice Inv. (m)	Orifice Centrer Inv. (m)	C_d	A_o (m^2)	g	Orifice dia. (m)	H (m)	Q (m^3/sec)
	MH2(OGS)	270.10	269.20	269.24	0.63	0.004415625	9.81	0.075	0.90	0.012

Orifice Flow Equation:

$Q = C_d A_o \sqrt{(2gH)}$
Where:

Q = Flow (m^3/sec)

A_o = Orifice area (m^2)
g = Gravitational Constant
H = Center line head (m)
C_d = coefficient of discharge, dimensionless, typically between 0.6 and 0.85, depending on the orifice geometry

Calculated Result:		
HWL:	270.10	m
Orifice Plate Size	75	mm
Pre-Development flow towards West (A2)-(2 year)	29.31	L/sec
Uncontrolled flow (100 years)	5.28	L/sec
100 years Roof(R1- R7) Controlled flow	12.25	L/sec
Allowable Flow	**11.78**	**L/sec**
Orfice Controlled Flow	**11.69**	**L/sec**
Required Storage	19.04	m^3
Available Storage	20.99	m^3

for Ground Surface and Roof (RB1)

On-Site Storage Calculator

Whitcurch Stouffville, ON

Project: **Mosque, Place of Worship**

Project No.: **n2271**

Date: **14-Mar-25**

n Engineering Inc

Table 2A - 100 Years Storage- Ground Surface (A1 & A2, Roof RB1 and Uncontrolled Area)

Equation of IDF:

$$i = \frac{A}{(t+B)^C}$$

R =	1.00		I = Rainfall Intensity (mm/hr)
A =	0.0797	ha	T = Time of Concentration (hr)
$Q_{release}$ =	0.012	m^3/s	A= 2051.707
			B= 6.23
Controlled Discharge=	11.69	L/s	C= 0.86
			Max Volume (m^3) 19.04

t_c (min)	i_{100} (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
5	256.324	0.057	0.045	13.645	
6	238.193	0.053	0.041	14.767	
7	222.625	0.049	0.038	15.781	
8	209.102	0.046	0.035	16.599	
9	197.239	0.044	0.032	17.256	
10	186.742	0.041	0.030	17.780	
11	177.382	0.039	0.028	18.191	
12	168.981	0.037	0.026	18.506	
13	161.396	0.036	0.024	18.739	
14	154.511	0.034	0.023	18.901	
15	148.231	0.033	0.021	19.000	
16	142.478	0.032	0.020	19.045	***
17	137.187	0.030	0.019	19.041	
18	132.304	0.029	0.018	18.994	
19	127.781	0.028	0.017	18.908	
20	123.580	0.027	0.016	18.788	
21	119.667	0.026	0.015	18.636	
22	116.012	0.026	0.014	18.456	
23	112.591	0.025	0.013	18.250	
24	109.380	0.024	0.013	18.021	
25	106.361	0.024	0.012	17.769	
26	103.517	0.023	0.011	17.498	
27	100.832	0.022	0.011	17.209	
28	98.294	0.022	0.010	16.903	
29	95.889	0.021	0.010	16.580	
30	93.609	0.021	0.009	16.244	
31	91.442	0.020	0.009	15.894	
32	89.382	0.020	0.008	15.531	
33	87.419	0.019	0.008	15.156	
34	85.547	0.019	0.007	14.770	

On-Site Storage Calculator

Whitcurch Stouffville, ON

Project: **Mosque, Place of Worship**

Project No.: **n2271**

Date: **14-Mar-25**

n Engineering Inc

Table 2B - 100 Years Storage (ROOF R1-R7)

Equation of IDF:

$$i = \frac{A}{(t+B)^C}$$

R = 1.00

A = 0.1546 ha

$Q_{release}$ = 0.012 m^3/s

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

A= 2051.707

B= 6.23

C= 0.86

Controlled Discharge= 12.25 L/s

1.5 l/s @ 7 drains

Max Volume (m^3) 50.89

t_c (min)	i_{50} (mm/hr)	Q_{50} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
5	256.324	0.111	0.099	29.603	
6	238.193	0.103	0.091	32.699	
7	222.625	0.096	0.084	35.319	
8	209.102	0.090	0.078	37.555	
9	197.239	0.085	0.073	39.478	
10	186.742	0.081	0.069	41.138	
11	177.382	0.077	0.065	42.579	
12	168.981	0.073	0.061	43.832	
13	161.396	0.070	0.058	44.924	
14	154.511	0.067	0.055	45.877	
15	148.231	0.064	0.052	46.708	
16	142.478	0.062	0.049	47.432	
17	137.187	0.059	0.047	48.061	
18	132.304	0.057	0.045	48.606	
19	127.781	0.055	0.043	49.075	
20	123.580	0.053	0.041	49.476	
21	119.667	0.052	0.040	49.816	
22	116.012	0.050	0.038	50.101	
23	112.591	0.049	0.036	50.335	
24	109.380	0.047	0.035	50.522	
25	106.361	0.046	0.034	50.668	
26	103.517	0.045	0.033	50.774	
27	100.832	0.044	0.031	50.845	
28	98.294	0.043	0.030	50.883	
29	95.889	0.041	0.029	50.889	***
30	93.609	0.041	0.028	50.868	
31	91.442	0.040	0.027	50.819	
32	89.382	0.039	0.026	50.746	
33	87.419	0.038	0.026	50.650	
34	85.547	0.037	0.025	50.533	
35	83.759	0.036	0.024	50.394	
36	82.050	0.036	0.023	50.237	
37	80.416	0.035	0.023	50.062	
38	78.849	0.034	0.022	49.870	
39	77.348	0.033	0.021	49.661	
40	75.907	0.033	0.021	49.438	
41	74.523	0.032	0.020	49.200	
42	73.192	0.032	0.019	48.949	
43	71.911	0.031	0.019	48.685	
44	70.678	0.031	0.018	48.409	
45	69.490	0.030	0.018	48.121	
46	68.345	0.030	0.017	47.821	
47	67.239	0.029	0.017	47.512	
48	66.171	0.029	0.016	47.192	
49	65.140	0.028	0.016	46.862	
50	64.142	0.028	0.016	46.524	
51	63.177	0.027	0.015	46.176	
52	62.243	0.027	0.015	45.820	
53	61.338	0.027	0.014	45.456	
54	60.461	0.026	0.014	45.084	
55	59.611	0.026	0.014	44.705	
56	58.786	0.025	0.013	44.319	

On-Site Avaiable Storage Calculator

Whitcurch Stouffville, ON

Table 3- Proposed 100-yr Detention Storage

n Engineering Inc

Project:	**Mosque, Place of Worship**
Address:	**27 Winona Dr.**
Project No.:	**n2271**
Date:	**14-Mar-25**

HWL	**270.10**

MH/CATCH BASIN

Description	Length/Dia. (m)	Inlet Elevation (m)	Invert Elevation	Height of Water (m)	Volume (m^3)
ENVIROBASIN - CB1	0.6	270.50	269.55	0.55	0.20
MH3	1.8	270.85	269.23	0.87	2.21
TOTAL					2.41

PIPE

FROM MH	TO MH	Length (m)		DIA (mm)	Volume (m^3)
ENVIROBASIN-CB1	STM- CHAMBER	1.5		300	0.11
STM-MH3	MH2(OGS)	3.5		375	0.40
TRENCH DRAIN	STM-MH3	27.0		150	0.50
RB1	STM- CHAMBER	7.0		300	0.51
STM- CHAMBER	STM-MH3	54.0		375	6.15
TOTAL					7.67

STORMWATER CHAMBER

MODEL	Area (m^2)	Size (m)	Volume (m^3)
ADS- DC780	22.76	11.95 X 1.91	10.91
TOTAL			10.91

TOTAL PROPOSED VOLUME:	**(m^3)**	**20.99**
REQUIRED VOLUME	**(m^3)**	**19.04**

Appendix E
OGS Sizing Summary

Hydroworks Sizing Summary

n2271- Mosque

27 Winona Drive , Stoffville

03-12-2025

Recommended Size: HydroStorm HS 4

Hydroworks Sizing Program Version 5.8.5

A HydroStorm HS 4 is recommended to provide 80 % annual TSS removal based on a drainage area of 0.07 (ha) with an imperviousness of 92.93 % and Toronto Central, Ontario rainfall for the Hydroworks standard particle size distribution.

The recommended HydroStorm HS 4 treats 100 % of the annual runoff and provides 94 % annual TSS removal for the Toronto Central rainfall records and Hydroworks standard particle size distribution.

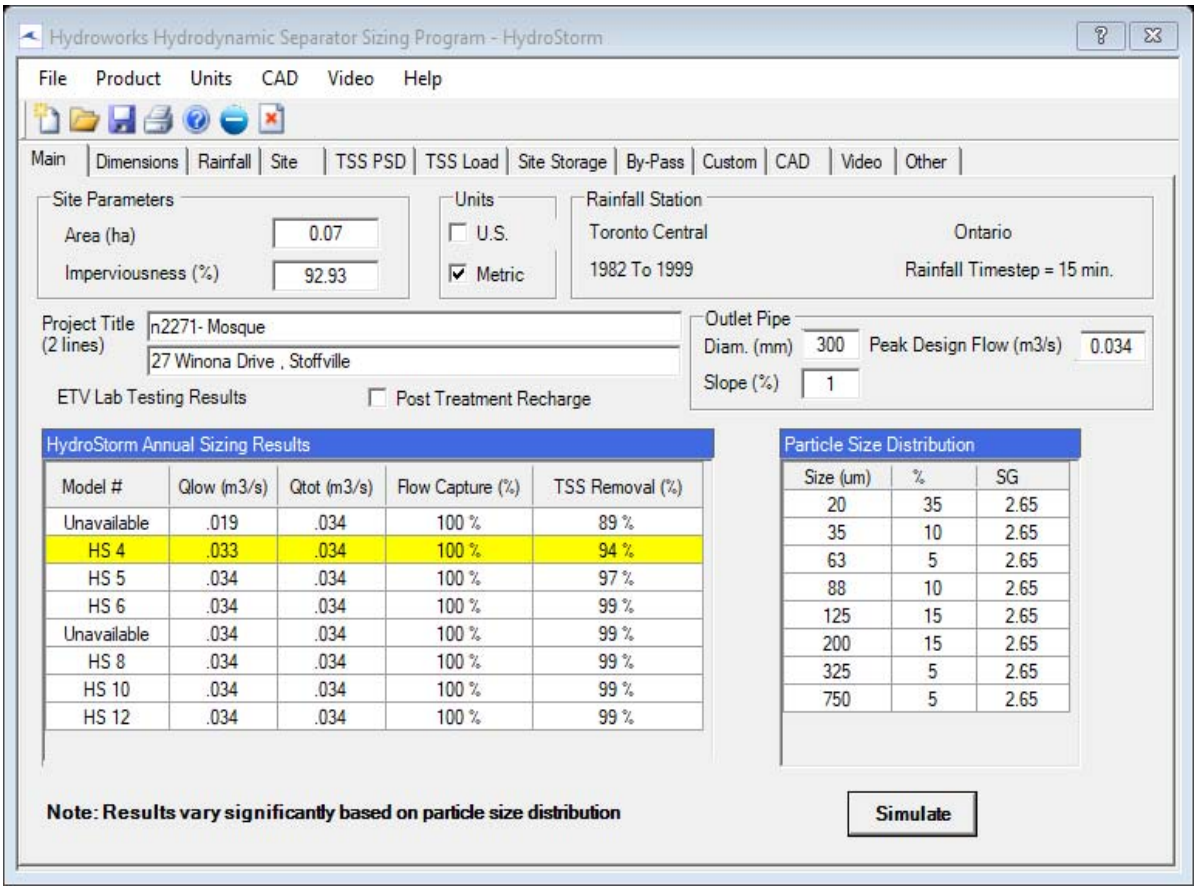
The HydroStorm has a headloss coefficient (K) of 1.04. The given peak flow of .034 (m3/s) Is less than the full pipe flow of .1 (m3/s) indicating free flow in the pipe during the peak flow assuming no tailwater condition. Partial pipe flow was assumed For the headloss calculations. The critical depth Is greater than the normal depth For the peak flow And 300 (mm) pipe diameter And 1 % slope given. Critical depth was assumed For the headloss calculations. The headloss was calculated to be 59 (mm) based on a flow depth of 140 (mm) .

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

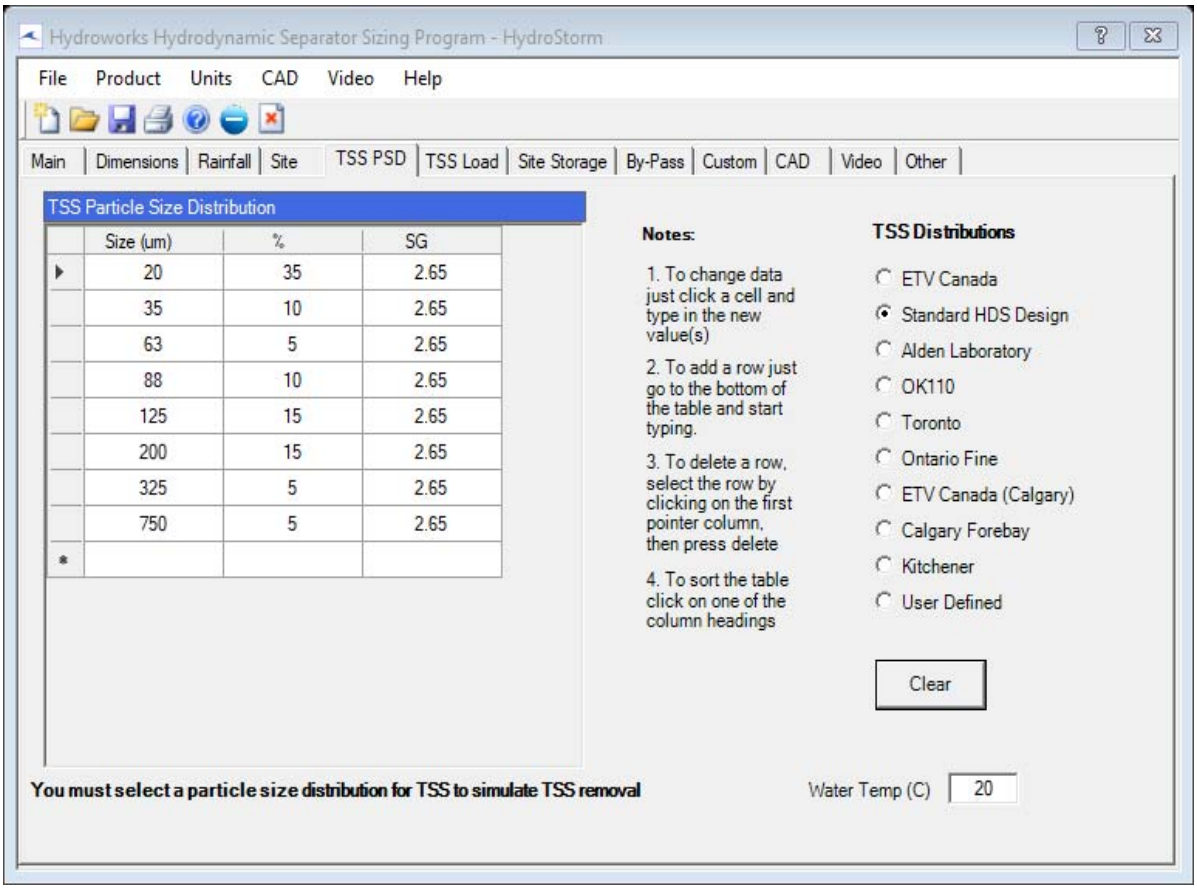
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroStorm .

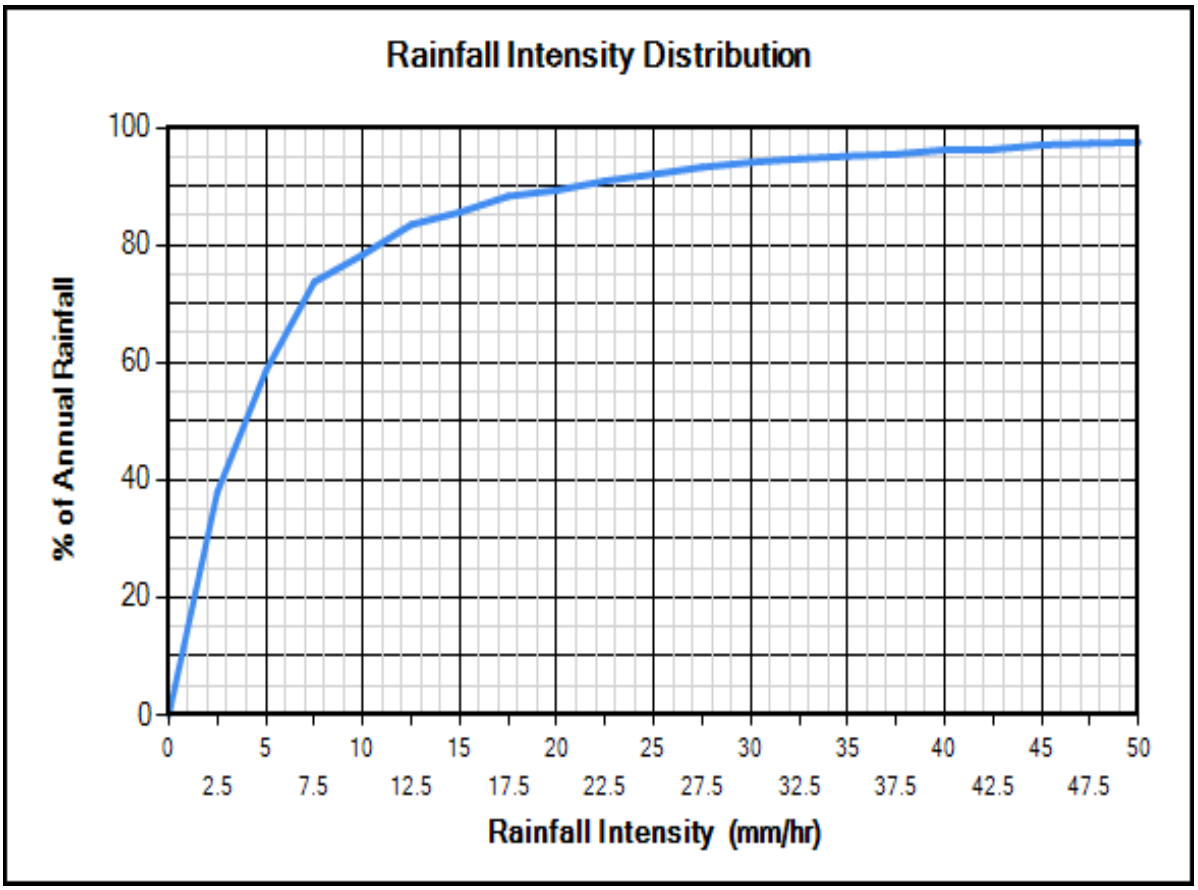
TSS Removal Sizing Summary



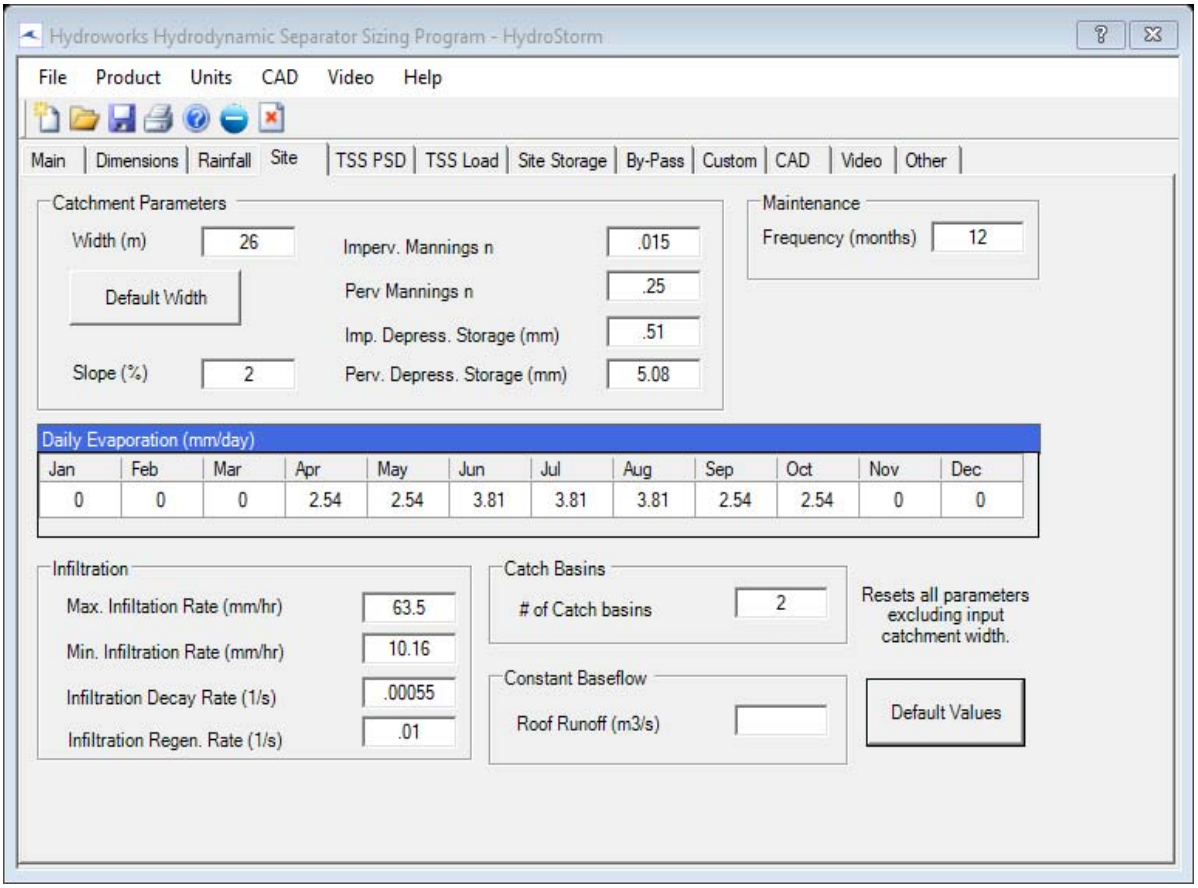
TSS Particle Size Distribution



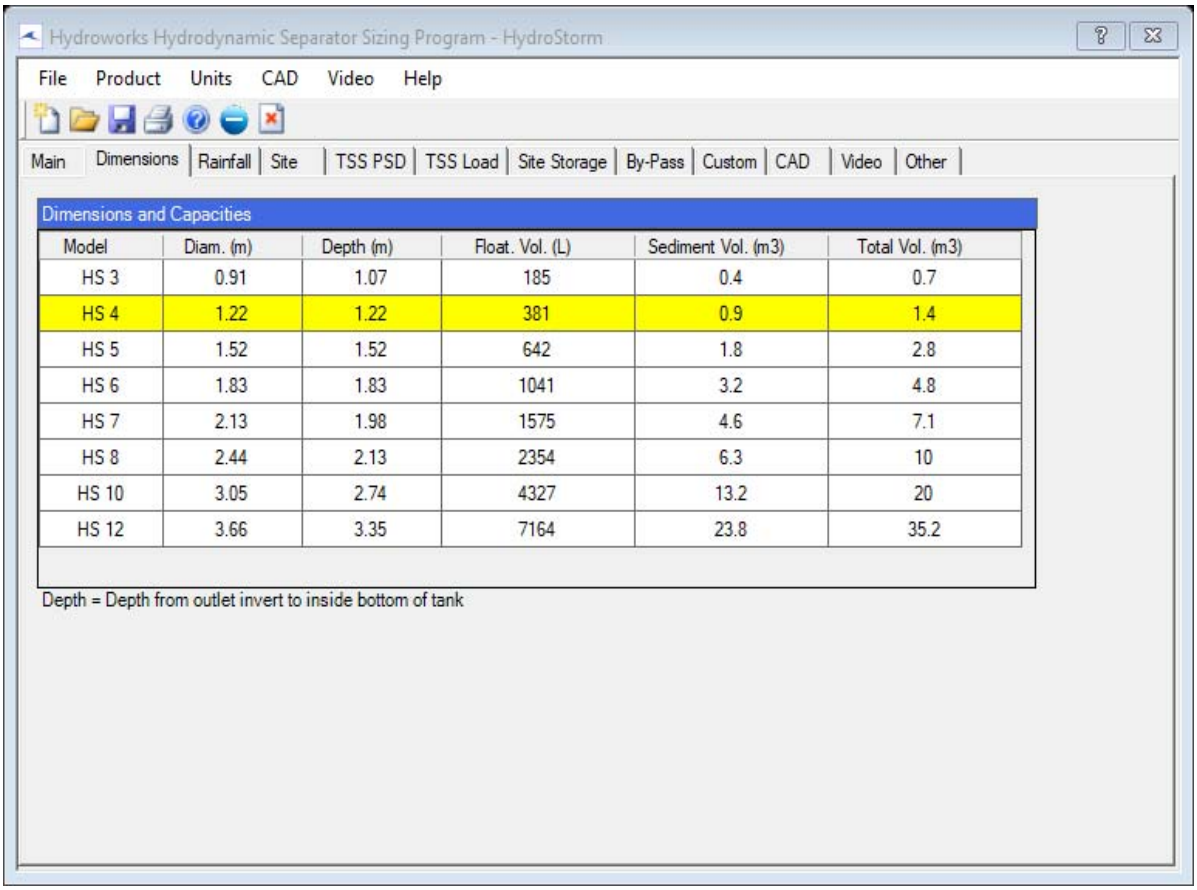
Rainfall Station - Toronto Central, Ontario(1982 To 1999)



Site Physical Characteristics



Dimensions And Capacities

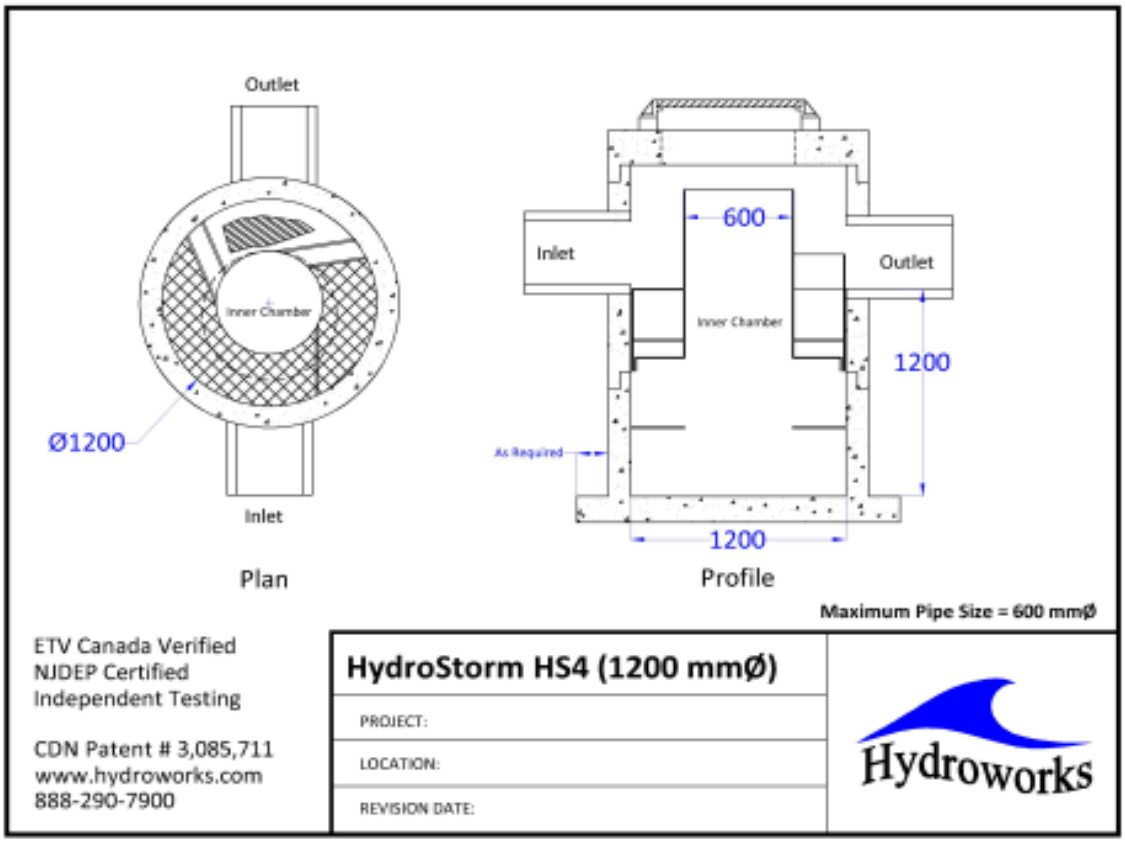


Dimensions and Capacities

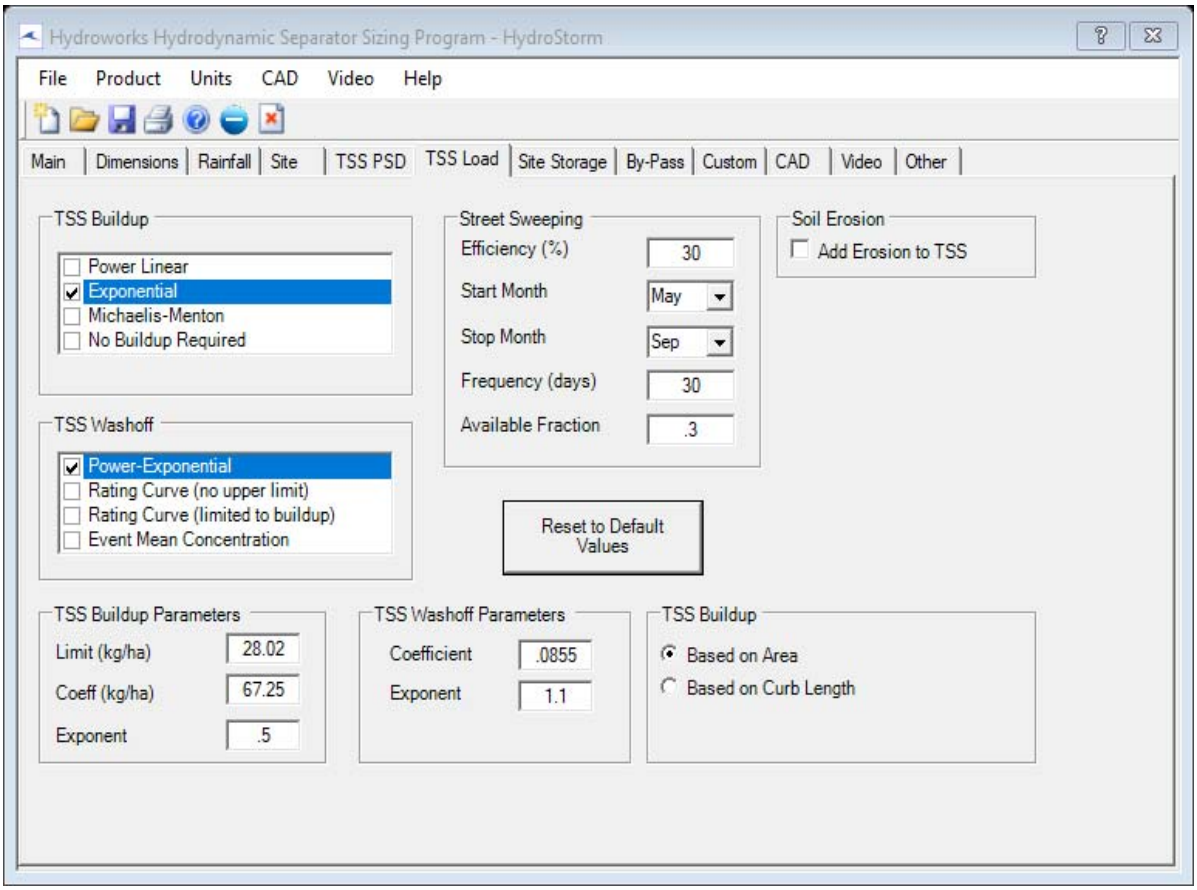
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 3	0.91	1.07	185	0.4	0.7
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

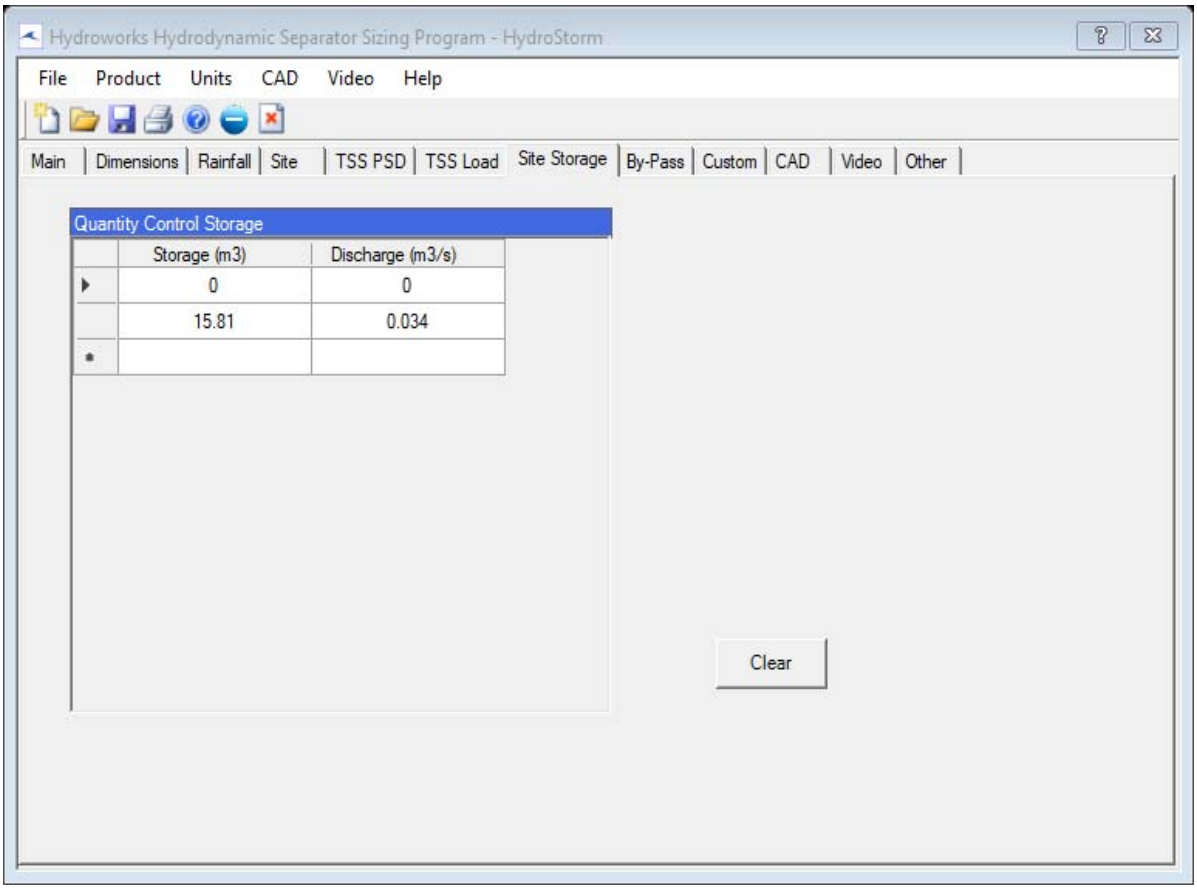
Generic HS 4 CAD Drawing



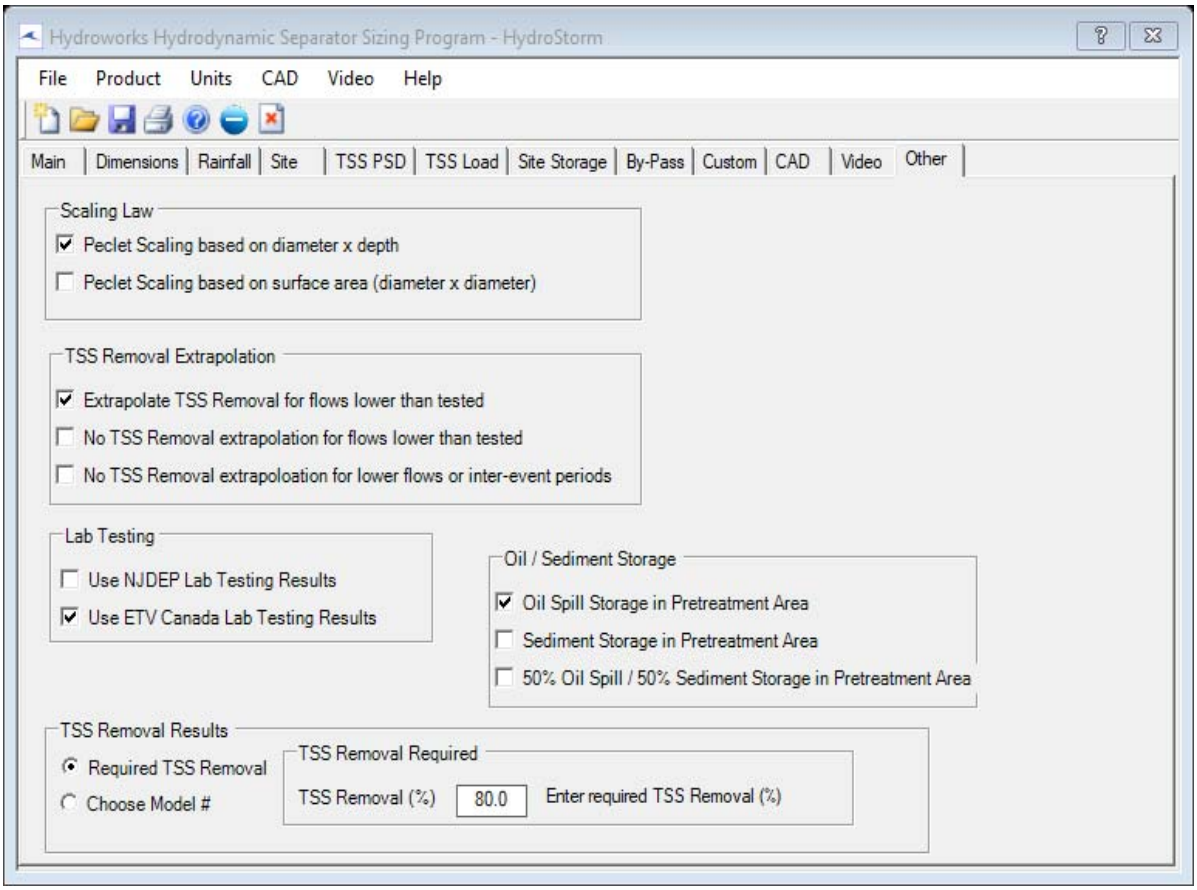
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

None

Hydroworks Sizing Program - Version 5.8.5
Copyright Hydroworks, LLC, 2024
1-800-290-7900
www.hydroworks.com

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Hydroworks® HydroStorm (HS) Hydrodynamic Separator

Developed by Hydroworks, LLC
Clark, NJ, USA

In accordance with

ISO 14034:2016

Environmental management — Environmental technology verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

May 15, 2018
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The Hydroworks® HydroStorm (HS) Hydrodynamic Separator is a concrete cylindrical device with an annular pre-treatment channel, an inner chamber, and lower collection sump. A schematic of the HS 4 test unit is shown in Figure 1. The pre-treatment channel extends below the outlet pipe invert and contains three intermediate low-flow weirs (flush with the outlet invert), and two downstream higher bypass weirs that extend above the outlet invert. The higher weirs bypass high flows to prevent oil and solids from being scoured out of the separator.

As water enters the unit through one or more inlets, coarser solids immediately start to settle below a horizontal grate extending from the inlet to two sets of lower weirs near the outlet pipe. The grating is positioned over the pre-treatment channel to help displace the inflow turbulence and protect the captured sediment from scour. Openings are located on the horizontal plate upstream of each weir to allow the flow to be conveyed into the inner chamber and lower sump. The weirs are positioned to create a counter clockwise rotation of water in the inner chamber to minimize turbulence and maximize settling. After water spirals down the inner chamber to the main settling chamber towards the floor of the separator where it deposits suspended sediments, it flows upwards between the wall of the unit and the outer edge of the disk extended from the inner chamber and through an arced opening at the bottom of the pre-treatment disk, downstream of the bypass weirs, where it is conveyed into the outlet pipe. An annular secondary horizontal plate with 32% of open-perforations is located within the lower sump to protect the collected sediment from scour. Oil and light liquids enter the inner chamber through the holes, reaching the bottom of the pre-treatment area and rises to the top of the water level where they are trapped.

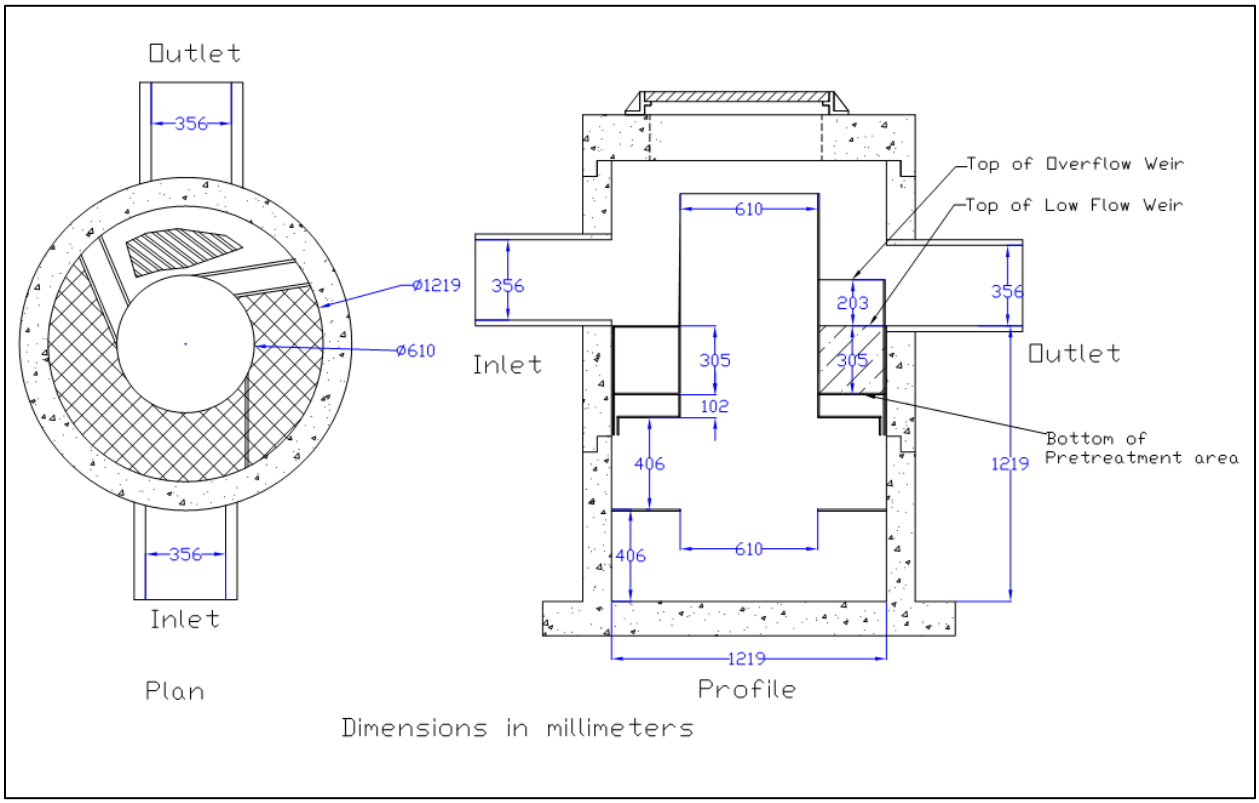


Figure 1: Schematic of the Hydroworks® HS4 Hydrodynamic Separator treatment unit tested as part of this verification.

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the Hydroworks® HS4 Hydrodynamic Separator, in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014)*. The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for the Canadian Environmental Technology Verification Program. A copy of the Procedure may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

Capture test[1]:

During the capture test, the Hydroworks® HS Hydrodynamic Separator, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 69, 64, 60, 56, 46, 41, and 36 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Scour test[1]:

During the scour test, the Hydroworks® HS Hydrodynamic Separator, with 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment sump storage depth and sediment loaded onto the pre-treatment channel emulating depositional pattern of the 40 L/min/m^2 capture test, generate corrected effluent concentrations of 22.4, 28.5, 20.0, 19.1, and 24.4 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light liquid re-entrainment test[1]:

During the light liquid re-entrainment test, the Hydroworks® HS Hydrodynamic Separator with surrogate low-density polyethylene beads preloaded within the inner chamber, representing a floating light liquid volume equal to a depth of 50.8 mm over the sedimentation area, retains 100, 99.9, 95.4, 95.7, and 97.5 percent of loaded beads by mass during the 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2indicates that the test sediment used for the capture and scour tests met this condition.

[1] The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

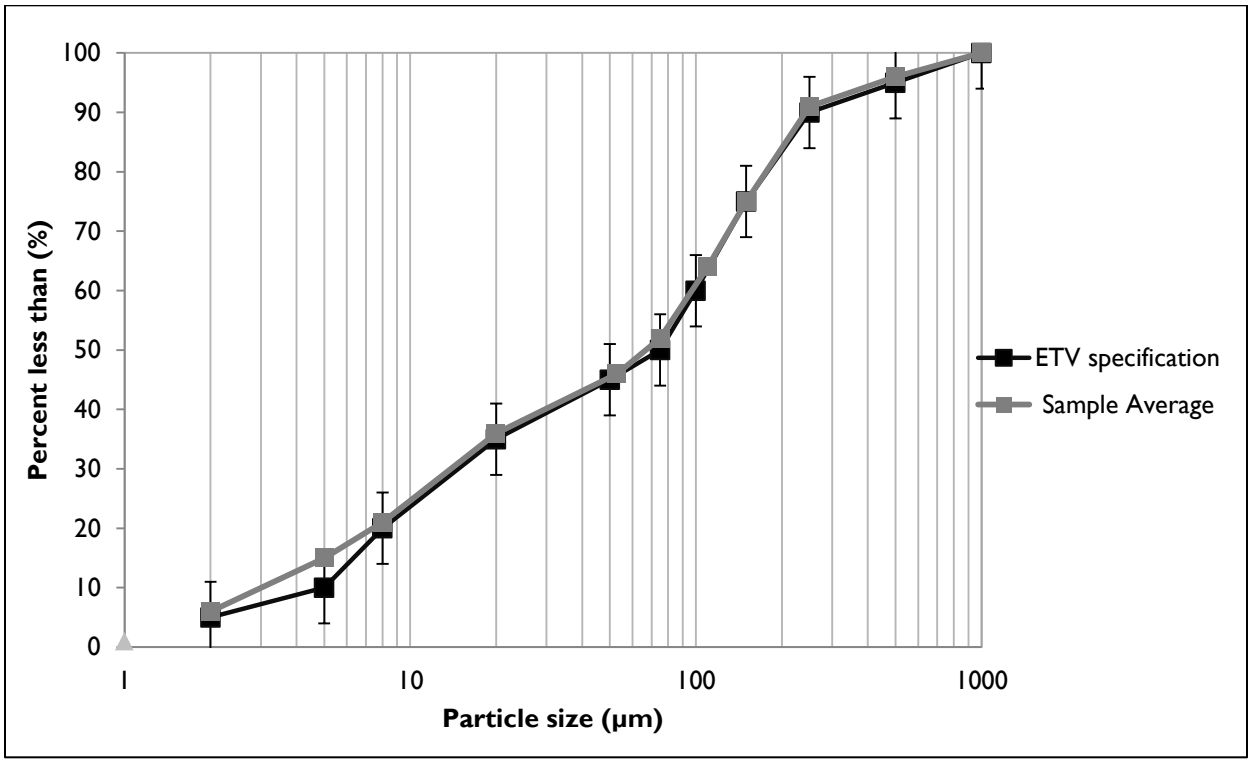


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

The capacity of the device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor at 0.15 m from the bottom, simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1).

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and may be attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "all particle sizes by mass balance" (see Table 1 and 2) are based on measurements of the total injected and retained sediment mass, and are therefore not subject to blending, sampling or PSD analysis errors.

Table 1. Removal efficiencies (%) of the HS4 unit at specified surface loading rates.

Particle size fraction (µm)	Surface loading rate (L/min/m²)						
	40	80	200	400	600	1000	1400
>500	73	100*	98	67	100*	100*	26
250 - 500	100	100*	92	64	100*	98	48
150 - 250	100*	75	89	72	89	60	69
105 - 150	94	100*	100*	100*	78	99	91
75 - 105	96	76	79	95	68	54	46
53 - 75	87	100*	100*	100*	56	69	65
20 - 53	71	54	46	44	19	14	10
8 - 20	38	23	15	8	2	2	2
5 – 8	13	6	1	1	0	0	0
<5	8	0	0	0	0	0	0
All particle sizes by mass balance	**68.6**	**64.0**	**60.0**	**56.1**	**46.1**	**41.2**	**35.7**

* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 103 and 194% (average 128%). See text and Bulletin # CETV 2016-11-0001 for more information.

Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the sediment retained by the HS4 unit at each of the tested surface loading rates. As expected, the capture efficiency for fine particles in the unit was generally found to decrease as surface loading rates increased.

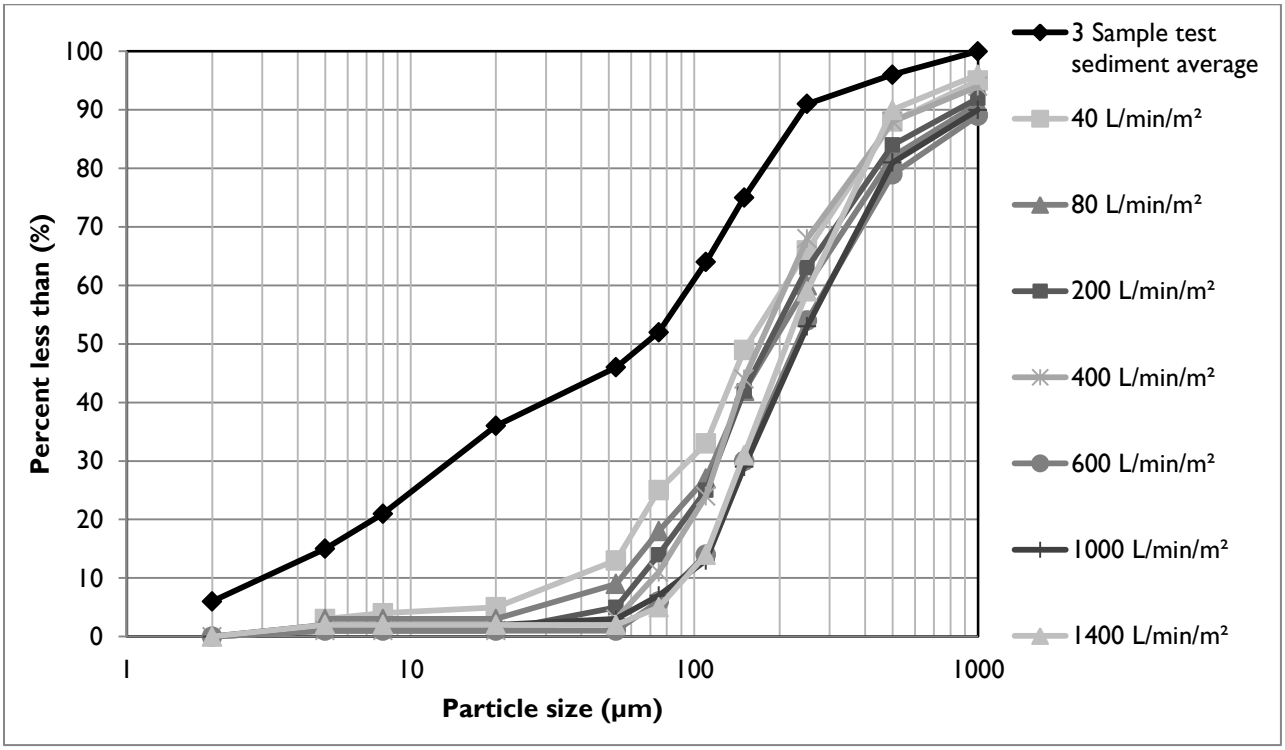


Figure 3. Particle size distribution of sediment retained in the HS4 unit in relation to the injected test sediment average.

For the sediment scour and re-suspension test, two tests were conducted. The first test was conducted with the secondary plate used in the capture tests. The second used a perforated secondary plate. Since sediment during the capture tests was found to settle in the pre-treatment channel, and in roughly the same quantities on the secondary plate and collection sump, all three of these surfaces were preloaded with sediment during the first test. The pre-treatment channel only captures coarse sediment. Therefore, this area was pre-loaded with sediment having a PSD similar to the PSD of the sediment that settled in this area during the 40 L/min/m^2 SLR sediment capture test. The pre-loaded sediment in the pre-treatment channel was shaped and leveled to correspond with sedimentation patterns and depths observed by the laboratory technician during the 40 L/min/m^2 SLR capture test. It should be noted that the actual sediment preloaded in this area was finer than the PSD of sediment captured in the same area during the 40 L/min/m^2 SLR capture test, particularly for particle sizes less than the median size. Both the sump and secondary plate were pre-loaded with the 1-1000 µm sediment mix to a depth of 10.2 cm. The preloaded sediment in the lower sump was placed on a false floor to mimic a device filled to 50% of the manufacturer's maximum recommended sediment storage depth.

After pre-loading the sediment, clean water was run through the device at five SLRs over a 25 minute period. At each SLR, five effluent samples were collected over a four minute interval (one per minute) with the first sample collected at the beginning of each flow rate, and the last collected just prior to the one minute transition to the next flow rate or end of the test. Effluent samples were analyzed for Suspended Sediment Concentration (SSC) and PSD by methods prescribed in the *Procedure*. The effluent samples were subsequently adjusted based on the background concentration of the influent water and the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test (7 um), as per the method described in Bulletin # CETV 2016-09-0001.

Measurements of sediment depths in the sump after the first test showed that most of the sediment from the secondary plate was carried into the lower sump. During this process, the fine sediment was likely re-suspended and carried out of the unit with the flow. The average adjusted effluent suspended sediment concentrations for each SLR ranged from 11.3 mg/L at the 200 L/min/m2 SLR to 196.7 mg/L at the 1400 L/min/m2 SLR. Effluent SSCs declined after the 1400 L/min/m2 SLR because the unit begins to bypass flow at this rate. It should be noted that this was a very conservative test as sediment was preloaded in three areas, rather than in the lower sump alone, and the preloaded sediment on the pre-treatment channel and secondary plate had a finer PSD than the sediment found to settle in these areas during the lowest SLR capture test.

The second sediment scour test was conducted on an identical unit but with a 32% open-area perforated secondary plate of the same size and orientation as the solid plate used in the first test. The perforated plate was intended to allow most of the sediment to settle in the lower sump, while still protecting against sediment scour, and not affecting the capacity of the unit to capture sediment. A second capture test was run at the 600 L/min/m^2 SLR to confirm that the perforated plate would have the same flow characteristics and removal efficiencies as the solid plate. Results of this comparison presented in Table 2 show that removal efficiencies were not affected and that the collection sump was receiving the majority of sediment transported into the lower chamber. Based on the observed sediment deposition zones, the second repeat test with the perforated plate had sediment preloaded in the pre-treatment channel and the lower collection sump only (*i.e.* the major deposition zones). The collection sump was preloaded with 10.2 cm of the 1- 1000 µm test sediment mix, as in the first test, and the pre-treatment channel was preloaded in much the same way as the first test, but with a sediment PSD that more closely mimicked the PSD of sediment observed to settle in this area during the 40 L/min/m^2 sediment capture test.

Table 2: Injected mass captured at the 600 L/min/m^2 SLR for two different configurations of the secondary plate

Secondary Plate type	Target Surface Loading Rate (L/min/m^2)	Tested Flow Rate (L/min)	Removal Efficiency (%)	Pre-treatment Channel (%)	Secondary Plate (%)	Outlet Dispersion Plate (%)	Collection Sump (%)
Solid Plate	600	736.2	46.1	24.7	8.5	3.1	9.9
Perforated Plate	600	740.9	45.9	25.8	2.7	3.0	14.5

Results of the second test are presented in Table 3. Background concentrations were maintained below 10.5 mg/L. The average adjusted effluent suspended sediment concentrations ranged from 19.1 to 28.5 mg/L. Since the commercially available unit will have a perforated secondary plate, these concentrations are the appropriate values to consider for approvals. The verifier acknowledges that the sediment capture removal efficiencies were not all tested with the perforated plate (see variance notes below), but that the repeat test results at the 600 L/min/m^2 SLR and a statement from the independent test laboratory were sufficient to provide reasonable confidence that the added perforations in the secondary plate would have negligible influence on sediment removal efficiencies.

Table 3. Scour test adjusted effluent sediment concentrations

Run	Surface loading rate (L/min/m^2)	Run time (min)	Background sample concentration (mg/L)[a]	Average adjusted effluent suspended sediment concentration (mg/L)[b]
1	200	5	3.6	22.4
2	800	5	8.9	28.5
3	1400	5	7.6	20.0
4	2000	5	10.4	19.1
5	2600	5	6.0	24.4

[a] Background concentrations shown here are approximate values based on graphical interpolation

[b] The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the background concentration. For more information see Bulletin # CETV 2016-09-0001. Adjusted concentrations were only calculated for the average of the five samples collected per surface loading rate.

The results of the light liquid re-entrainment test used to evaluate the unit's capacity to prevent re-entrainment of light liquids are reported in Table 4. The test involved preloading 58.3 L (corresponding to a 5 cm depth over the collection sump area of 1.17m^2) of surrogate low-density polyethylene beads (Dow Chemical Dowlex™ 2517) within the inner chamber and running clean water through the device continuously at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m^2). Each flow rate was maintained for 5 minutes with approximately 1 minute transition time between flow rates (30 minutes total). The effluent flow was screened to capture all re-entrained pellets throughout the test. Results showed maximum re-entrainment of 4.6% at 1400 L/min/m^2, which is the highest SLR without bypass. Re-entrainment decreased at subsequent SLRs as bypass volumes increased.

Table 4. Light liquid re-entrainment test results for the HS4

Surface Loading Rate (L/min/m²)	Time Stamp (min)	Amount of Beads Re-entrained			
		Mass (g)	Volume (L)	% of Pre-loaded Mass Re-entrained	% of Pre-loaded Mass Retained
200	1:00 – 6:00	0	0	0.00	100
800	7:00 – 12:00	49	0.1	0.1	99.9
1400	13:00 – 18:00	1523	2.7	4.6	95.4
2000	19:00 – 24:00	1445	2.5	4.3	95.7
2600	25:00 – 30:00	847	1.5	2.5	97.5
Interim Collection Net		39	0.1	0.1	99.9
Total Re-entrained		3902	6.8	11.7	--
Total Retained		29,497	51.5	--	88.3
Total Loaded		33,399	58.3	--	--

Variances from testing Procedure

The following deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. The Procedure stipulates that the tested device "must be a full scale, commercially available device with the same configuration and components that would be typical for an actual installation." As noted above, the sediment capture tests were conducted with a solid secondary plate. The solid secondary plate was later modified to a 32% open area perforated plate to reduce sediment settling on the plate, while continuing to provide scour prevention. As described above, the scour test was repeated with the perforated secondary plate, but the sediment capture test was only repeated at the 600 L/min/m² SLR (i.e. one of seven tested SLRs). Removal efficiency results for the repeat test showed very close correspondence with the earlier test using the solid plate and much of the sediment that previously settled on the secondary plate was deposited in the lower collection sump (see Table 2). The independent laboratory provided the following statement regarding the potential for the added perforations to affect sediment removal efficiencies: "Taking into account the close proximity of the plate to the collection sump, as well as our knowledge of sediment transport, it is expected that the deposited sediment would have settled in the lower sump, with no impact on removal efficiency, if the plate was removed." While the verifier acknowledges that stronger evidence would have been provided by additional repeat testing at a lower and higher SLR, the close correlation between the original and repeat test, combined with the statement from the lab were sufficient to provide reasonable confidence that adding the perforations would not likely have changed the capture test results significantly.

2. The repeat test at the 600 L/min/m² SLR had background concentrations exceeding the 20 mg/L threshold during the last half of the test. The exceedances occurred in 4 of the 8 samples collected, reaching a maximum of 28.4 mg/L. The experimental apparatus is a closed loop system. Therefore, the sediment in the background samples consists of fine particles not captured by the device, and would therefore not likely bias the mass balance results.

3. It was necessary to change flow meters during the sediment scour and light liquid re-entrainment test, as the required flows exceeded the minimum and/or maximum range of any single meter. When the flow capacity of the selected meter was reached, the flow was shut down over a period of approximately 10 seconds and all flow data saved. The next data acquisition file was executed and flow increased at a rate that corresponded to reaching each previous target flow after a period of 1-minute. This procedure was approved by CETV prior to testing, in recognition that most particles susceptible to scour at low flows would not be in the sump at higher flows. Similarly, re-entrainment of the oil beads was not expected to be significantly affected by the flow meter change.

4. As part of the capture test, evaluation of the 40 and 80 L/min/m^2 surface loading rate was split into 3 and 2 parts, respectively, due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit. At the end of the first and second parts of the test, the flow rates were gradually shutdown to prevent capture of particles that would have been washed out under normal circumstances. The amended procedure was reviewed and approved by the verifier prior to testing.

Verification

The verification was completed by the Verification Expert, Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Hydroworks, LLC to support the performance claim included the following: Performance test report prepared by Alden Research Laboratory, Inc., and dated February 2018. This report is based on testing completed in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV), and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the Hydroworks® HS Hydrodynamic Separator please contact:

Hydroworks, LLC
136 Central Ave., 2nd FL
Clark, NJ
07066 USA
Tel: 888-290-7900
Email: info@hydroworks.com
www.hydroworks.com

For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
404 – 999 Canada Place
Vancouver, BC
V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com
www.globeperformance.com

Limitation of verification
GLOBE Performance Solutions and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

Hydroworks® HydroStorm

Operations & Maintenance Manual

Version 1.2

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please email a copy of the completed checklist to Hydroworks at for our records.

Introduction

The HydroStorm is a state-of-the-art hydrodynamic separator. Hydrodynamic separators remove solids, debris and lighter than water (oil, trash, floating debris) pollutants from stormwater. Hydrodynamic separators and other water quality measures are mandated by regulatory agencies (Town/City, State, Federal Government) to protect storm water quality from pollution generated by urban development (traffic, people) as part of new development permitting requirements.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. Therefore, it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The HydroStorm is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their HydroStorm.

Hydroworks® HydroStorm Operation

The Hydroworks HydroStorm (HS) separator is a unique hydrodynamic by-pass separator. It incorporates a protected submerged pretreatment zone to collect larger solids, a treatment tank to remove finer solids, and a dual set of weirs to create a high flow bypass. High flows are conveyed directly to the outlet and do not enter the treatment area, however, the submerged pretreatment area still allows removal of coarse solids during high flows.

Under normal or low flows, water enters an inlet area with a horizontal grate. The area underneath the grate is submerged with openings to the main treatment area of the separator. Coarse solids fall through the grate and are either trapped in the pretreatment area or conveyed into the main treatment area depending on the flow rate. Fines are transported into the main treatment area. Openings and weirs in the pretreatment area allow entry of water and solids into the main treatment area and cause water to rotate in the main treatment area creating a vortex motion. Water in the main treatment area is forced to rise along the walls of the separator to discharge from the treatment area to the downstream pipe.

The vortex motion forces solids and floatables to the middle of the inner chamber. Floatables are trapped since the inlet to the treatment area is submerged. The design maximizes the retention of settled solids since solids are forced to the center of the inner chamber by the vortex motion of water while water must flow up the walls of the separator to discharge into the downstream pipe.

A set of high flow weirs near the outlet pipe create a high flow bypass over both the pretreatment area and main treatment chamber. The rate of flow into the treatment area is regulated by the number and size of openings into the treatment chamber and the height of by-pass weirs. High flows flow over the weirs directly to the outlet pipe preventing the scour and resuspension of any fines collected in the treatment chamber.

A central access tube is located in the structure to provide access for cleaning. The arrangement of the inlet area and bypass weirs near the outlet pipe facilitate the use of multiple inlet pipes.

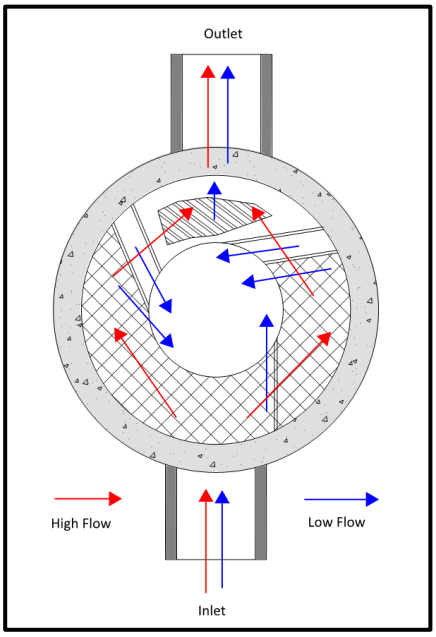


Figure 1. Hydroworks HydroStorm Operation – Plan View

Figure 2 is a profile view of the HydroStorm separator showing the flow patterns for low and high flows.

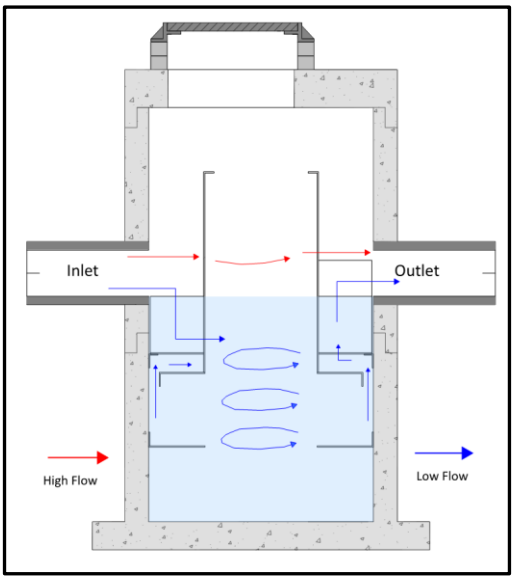


Figure 2. Hydroworks HydroStorm Operation – Profile View

Hydroworks

The HS 4i is an inlet version of the HS 4 separator. There is a catch-basin grate on top of the HS 4i. A funnel sits sits underneath the grate on the frame and directs the water to the inlet side of the separator to ensure all lows flows are properly treated. The whole funnel is removed for inspection and cleaning.

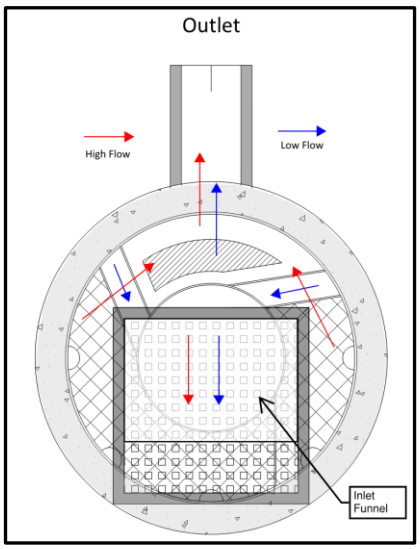


Figure 3. Hydroworks HS 4i Funnel

Construction Materials

The inner chamber and outlet baffle are made out of a copolymer plastic. The shell of the structure is pre-cast concrete. Pre-cast concrete is readily accepted by all municipalities since it has the following advantages:

- long service life
- ease of installation (less dependent on backfill (contractor proficiency) for structural integrity)
- concrete structures are designed for both anti-buoyancy and traffic loading without any field requirements (such as structural loading slabs in traffic areas and anti-buoyancy slabs to prevent groundwater uplift).
- low maintenance requirements

Hydroworks HS Separator Dimensions and Capacities

The HS separator is manufactured in a variety of sizes from 4 ft inside diameter to 12 ft inside diameter as shown in Table 1. Larger sizes may not be available in all areas. Please check with Hydroworks to ensure availability of the larger model sizes.

Table 1. Hydroworks HS Separator Dimensions*					
Model	Structure Inside Diam. (SID) (mm)	Structure Depth (mm)*	Sediment/ Sinking Trash Volume (L)	Oil/Floating Trash Volume (L)	Permanent Pool Wet Volume (L)
HS 3	900	1050	420	150	700
HS 4	1200	1200	845	355	1420
HS 5	1500	1500	1695	620	2775
HS 6	1800	1800	3110	1020	4800
HS 7	2100	1950	4530	1550	7080
HS 8	2400	2100	6225	2325	9960
HS 9	2700	2400	9200	3195	14410
HS 10	3000	2700	13025	4275	20015
HS 12	3600	3000	20525	7095	30535

*Dimensions vary with project requirements

The volumes provided in Table 1 for oil and sediment are to full capacity and not indicative of recommended depths/volumes for maintenance.

Headloss

Any water quality system implemented in a storm drain network will create headloss in the system. In general, depending on the configuration of the by-pass, systems designed to treat high flows or all of the flow will have a higher headloss impact on the storm drain network than systems that by-pass high flows.

The headloss created by the HS separator was measured in an independent laboratory (Alden Research Laboratory) for a full-scale HS 4. The K value ($h = K\ v^2/(2g)$) for headloss calculations was determined to be 1.04 as shown in Figure 3.

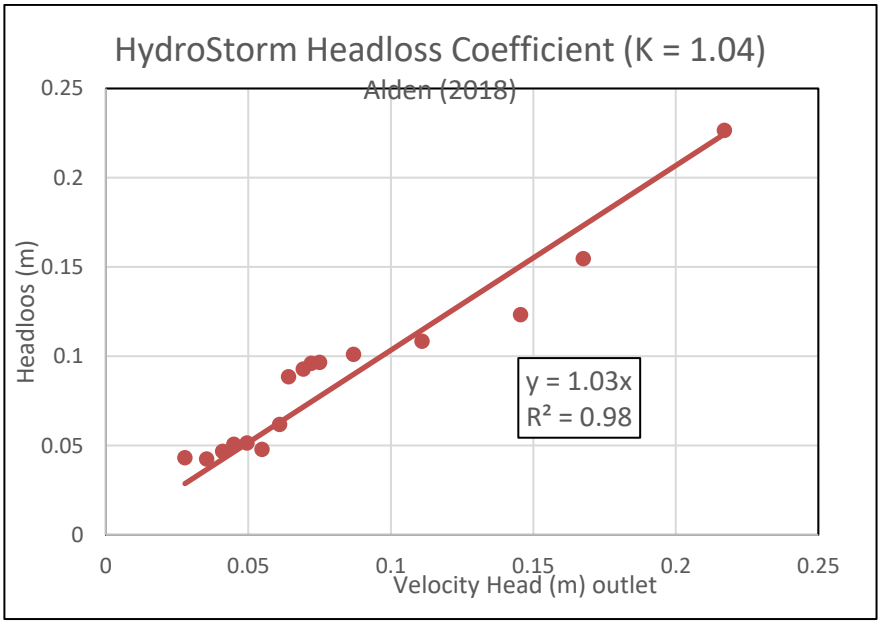


Figure 3. HydroStorm Headloss K Factor (1.04)

Hydroworks

Inspection

Procedure

Floatables

A visual inspection can be conducted for floatables by removing the covers and looking down into the center access tube of the separator. Separators with an inlet grate (HS 4i or custom separator) will have a plastic funnel located under the grate that must be removed from the frame prior to inspection or maintenance. If you are missing a funnel please contact Hydroworks at the numbers provided at the end of this document.

TSS/Sediment

Inspection for TSS build-up can be conducted using a Sludge Judge®, Core Pro®, AccuSludge® or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. These devices typically have a ball valve at the bottom of the tube that allows water and TSS to flow into the tube when lowering the tube into the unit. Once the unit touches the bottom of the device, it is quickly pulled upward such that the water and TSS in the tube forces the ball valve closed allowing the user to see a full core of water/TSS in the unit. The unit should be inspected for TSS through each of the access covers. Several readings (2 or 3) should be made at each access cover to ensure that an accurate TSS depth measurement is recorded.

Frequency

Construction Period

The HydroStorm separator should be inspected every four weeks and after every large storm (over 0.5” (12.5 mm) of rain) during the construction period.

Post-Construction Period

The Hydroworks HydroStorm separator should be inspected during the first year of operation for normal stabilized sites (grassed or paved areas). If the unit is subject to oil spills or runoff from unstabilized (storage piles, exposed soils) areas the HydroStorm separator should be inspected more frequently (4 times per year). The initial annual inspection will indicate the required future frequency of inspection and maintenance if the unit was maintained after the construction period.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

The Hydroworks HydroStorm unit is typically maintained using a vacuum truck. There are numerous companies that can maintain the HydroStorm separator. Maintenance with a vacuum truck involves removing all of the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility.

A central access opening (24” (600 mm) or greater) is provided to the gain access to the lower treatment tank of the unit. This is the primary location to maintain by vacuum truck. The pretreatment area can also be vacuumed and/or flushed into the lower treatment tank of the separator for cleaning via the central access once the water level is lowered below the pretreatment floor.

In instances where a vacuum truck is not available other maintenance methods (i.e. clamshell bucket) can be used, but they will be less effective. If a clamshell bucket is used the water must be decanted prior to cleaning since the sediment is under water and typically fine in nature.

The local municipality should be consulted for the allowable disposal options for both water and sediments prior to any maintenance operation. Once the water is decanted the sediment can be removed with the clamshell bucket.

Disposal of the contents of the separator depend on local requirements. Maintenance of a Hydroworks HydroStorm unit will typically take 1 to 2 hours based on a vacuum truck and longer for other cleaning methods (i.e. clamshell bucket).

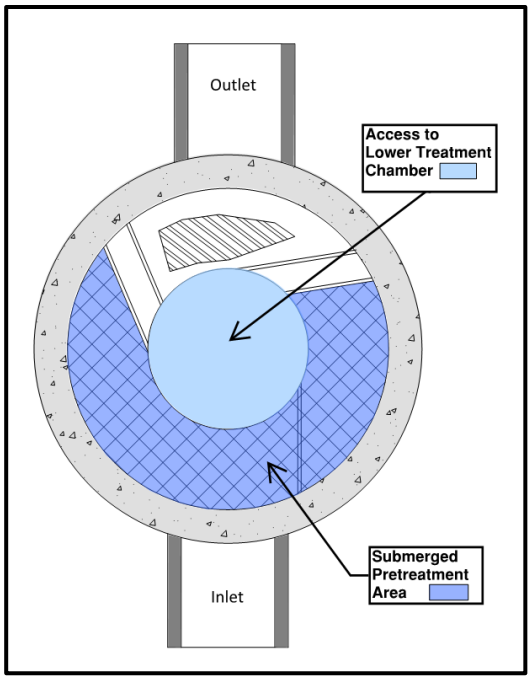


Figure 3. Maintenance Access

Frequency

Construction Period

A HydroStorm separator can fill with construction sediment quickly during the construction period. The HydroStorm must be maintained during the construction period when the depth of TSS/sediment reaches 24” (600 mm). It must also be maintained during the construction period if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the area of the separator

The HydroStorm separator should be maintained at the end of the construction period, prior to operation for the post-construction period.

Post-Construction Period

The HydroStorm was independently tested by Alden Research Laboratory in 2017. A HydroStorm HS 4 was tested for scour with a 50% sediment depth of 0.5 ft.(150 mm). The sump depths given in Table 1 are scaled larger than required based on standard scaling requirements (NJDEP, ETV Canada). Accordingly maintenance depths for units larger than the HS 4 will be larger than 300 mm.

There will be designs with increased sediment storage based on specifications or site-specific criteria. A measurement of the total depth in the separator through the central access tube should be taken and compared to sump depth given in Table 1.

The standard sump depth from Table 1 should be subtracted from the measured depth and the resulting extra depth should be added to the values given in Table 2 to determine the site-specific sediment maintenance depth for that separator.

For example, if the measured sump depth in the HS-7 is 7.5 feet, then the sediment maintenance depth for that HS-7 is 2.25 ft (= 0.5 + 1.75) and the separator does not need to be cleaned for sediment accumulation until the measure sediment depth is 2.25 ft.

The HydroStorm separator must also be maintained if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the water surface of the separator.

Table 2 Standard Maintenance Depths for HydroStorm Models

Model	Diameter ft (mm)	Sediment Maintenance Depth for Total Water Depth ft (mm)*
HS-3	3 (900)	1 (300)
HS-4	4 (1200)	1 (300)
HS-5	5 (1500)	1.75 (530)
HS-6	6 (1800)	2 (610)
HS-7	7 (2100)	1.75 (535)
HS-8	8 (2400)	1.5 (465)
HS-9	9 (2700)	1.75 (540)
HS-10	10 (3000)	2 (615)
HS-12	12 (3600)	1.5 (470)

*based on standard sump depths in Table 1

HYDROSTORM INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

HydroStorm	**Yes**	**No**
Obstructions in the inlet or outlet	☐ *	☐
Missing internal components	☐ **	☐
Improperly installed inlet or outlet pipes	☐ ***	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the separator (oil, leaves, trash)	☐	☐
Large debris visible in the separator	☐ *	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐
Water seepage (water level not at outlet pipe invert)	☐ ***	☐

Water level depth below outlet pipe invert _____“

Routine Measurements

Floating debris depth	**< 0.5” (13mm)**	☐	**>0.5” 13mm)**	☐ *
Floating debris coverage	**< 50% of surface area**	☐	**> 50% surface area**	☐ *
Sludge depth	**< 12” (300mm)**	☐	**> 12” (300mm)**	☐ ****

* Maintenance required
** Repairs required
*** Further investigation is required

Hydroworks

Other Comments:

Hydroworks

Hydroworks® HydroStorm

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks HydroStorm to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the separator has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 136 Central Ave., Clark, NJ 07066 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

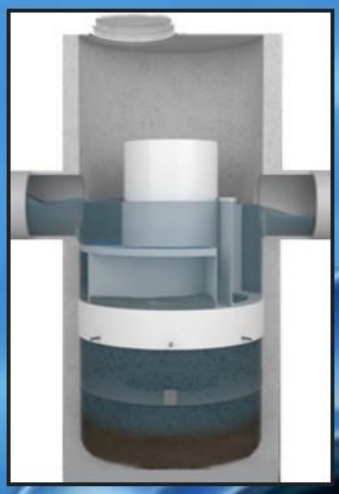
This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks HydroStorm are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the HydroStorm, or the cost of other goods or services related to the purchase and installation of the HydroStorm. For this Limited Warranty to apply, the HydroStorm must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the HydroStorm arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the HydroStorm, whether the claim is based upon contract, tort, or other legal basis.

HydroStorm

Hydrodynamic Separator



Product Info

HydroStorm efficiently removes oil, trash, and TSS (suspended solids and their associated metals, nutrients, bacteria), from stormwater runoff which is required in NDPES permits and the Clean Water Act.

Applications

HydroStorm is used as a standalone treatment solution for urban retrofit and redevelopment applications; as part of a treatment train for new developments; and as a pretreatment device for infiltration, underground storage, and bio-retention.

Features

- Internal high flow bypass prevents scour at high flows
- Designed to accommodate multiple inlet pipes
- Captures oil spills, TSS and trash
- Lower cost compared to other competitors
- Reduced sump depths to minimize excavation
- Small footprint to avoid conflicts with other services
- Engineered for traffic loading
- Can be used as a inlet, bend, or junction structure
- Sized based on independent TSS removal results
- Low Headloss (K= 1.04) to minimize impact to drainage system
- Minimum elevation drop from inlet to outlet

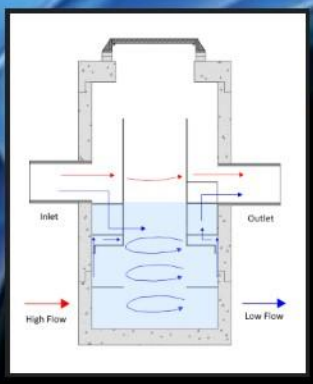
Hydroworks LLC
888-290-7900
www.hydroworks.com
info@hydroworks.com

Sizing & Design

Sized based on independent laboratory testing results. Approved and/or certified by numerous agencies (NJDEP, 2018; NJCAT, 2018; ETV Canada, 2018)

HydroStorm

Hydrodynamic Separator



HYDROSTORM WATER QUALITY FLOW RATES (cfs)					
Model	NJDEP* (67 um)	ConnDOT** (100 um)	NH*** (OK110)	150 um***	200 um***
HS 4/HS 4i	0.9	1.1	0.9	1.6	2.0
HS 5	1.4	2.0	1.5	2.5	3.2
HS 6	2.0	3.1	2.1	3.6	4.5
HS 7	2.7	4.5	2.9	4.9	6.2
HS 8	3.5	6.1	3.8	6.3	8.1
HS 10	5.5	11.3	5.9	9.9	12.6
HS 12	7.9	18.9	8.5	14.3	18.2

*50% Annual TSS Removal **60% Annual TSS Removal ***80% TSS Removal at WQF

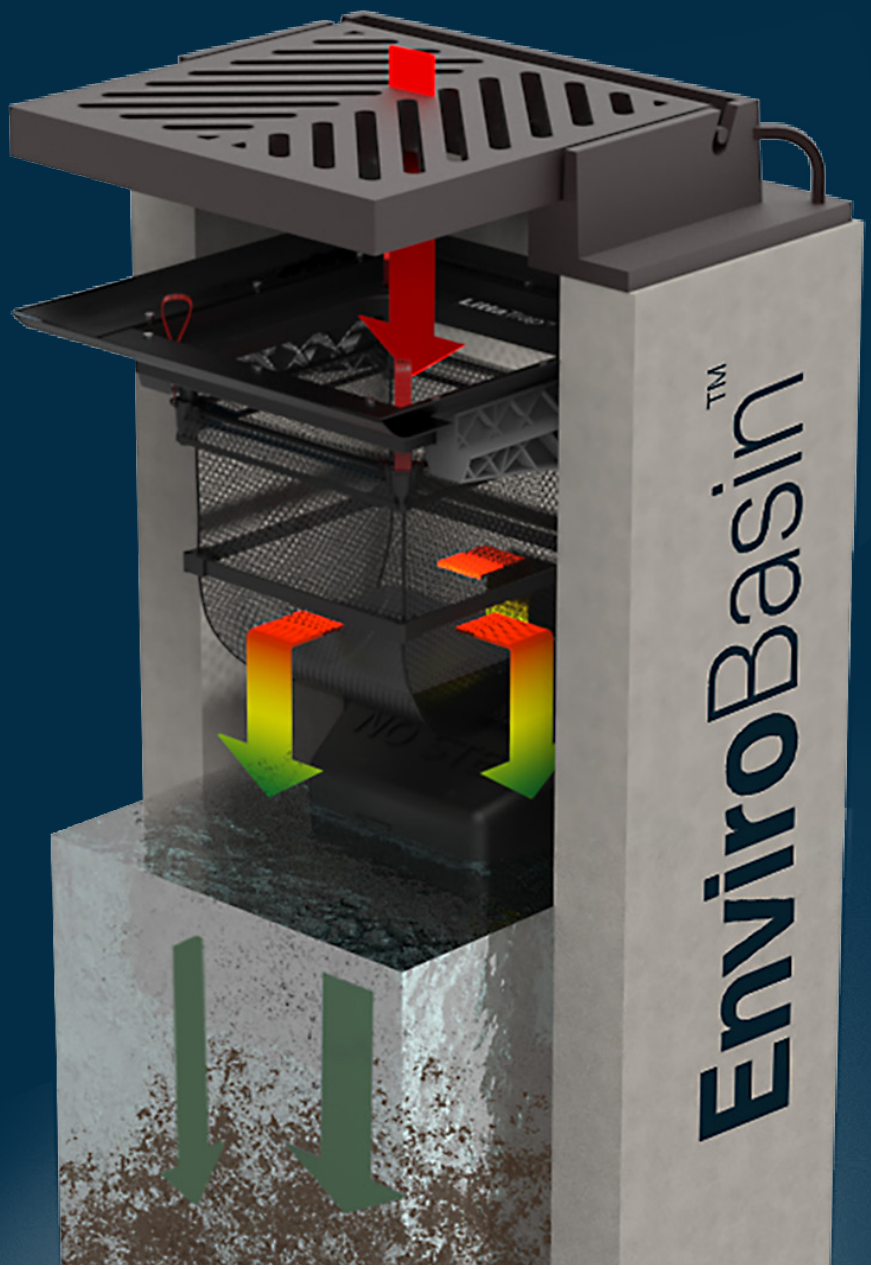
Hydroworks will design a unit for you or you can download our free design software at www.hydroworks.com

Hydroworks LLC
888-290-7900
www.hydroworks.com
info@hydroworks.com

For more information, call your local Hydroworks representative:

ENVIROPOD.COM

EnviroBasin™



Technical Guide

ENVIROPOD™
A STORMWATER360™ COMPANY

The EnviroBasin™

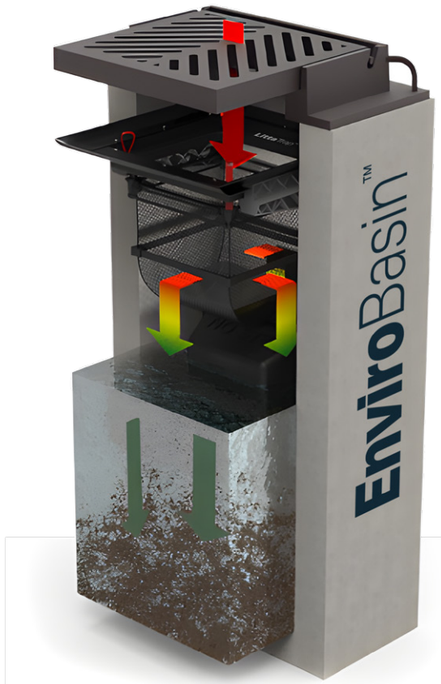
The EnviroBasin™ is an engineered water quality inlet offering two functions:

1. Conveyance of stormwater runoff from ground level into the reticulation system; and
2. Removal of pollutants and improvement of water quality.

The EnviroBasin™ consists of the LittaTrap™ catch basin insert installed into a pre-cast catch basin to dissipate energy, promote sedimentation and provide full capture of gross solids 5 mm in diameter and greater in stormwater runoff. This is done by the LittaTrap™ device in conjunction with an energy dissipator dish and submerged outlet baffle.

The system is easy and safe to maintain, with large storage capacity relative to its catchment area. Confined space entry is not required.

ISO 14034
ETV VERIFIED

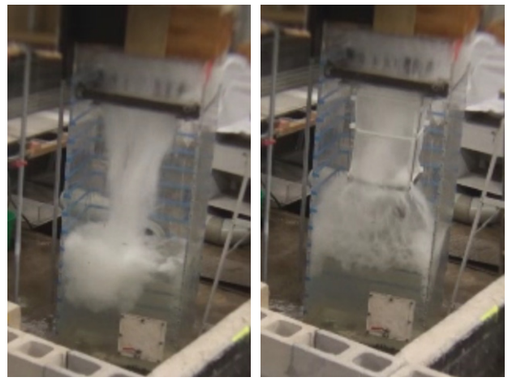


EnviroBasin™ Standard Grate Inlet

The EnviroBasin™ eliminates the need for downstream oil and grit separators, as it treats the stormwater at the source before it enters the stormwater system.

FEATURES

- High flow, dry gross solid capture.
- Enhanced nutrient removal.
- Reduced contaminant release.
- Hand maintenance of gross pollutant basket; no vactor truck or confined space entry needed.
- Enhanced energy dissipation and flow distribution.
- >50% sediment removal (Good Harbour Labs, 2017).
- Reduced resuspension.
- Large sediment sump storage volume.
- No confined space entry. Vactor truck maintenance frequency of the sump is reduced.
- Lower carbon footprint.



Turbulence in sumped stormwater inlet (left) and EnviroBasin™ (Right)

TREATABLE CATCHMENT AREA

Each jurisdiction supplies guidance around the hydraulic design, location, and capture capacity of stormwater inlets. Catchment area, gradient, cross fall, configuration, dimensions, and grate all affect the inlet capacity of a catch basin and therefore, the spacing.

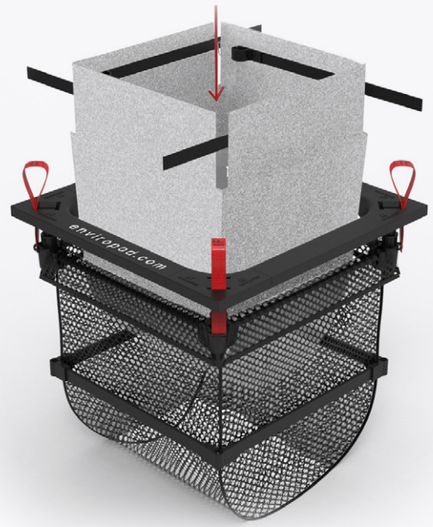
The maximum catchment area of the EnviroBasin™ is typically governed by the ability of the peak capture flow of the device, i.e. the inflow for a 5 or 10-year design storm.

EnviroPod in conjunction with AECOM Canada have developed a performance estimating tool to determine the Total Suspended Solids (TSS) removal of the EnviroBasin™ for a given catchment. The performance estimating tool uses third party performance data obtained from Canadian Environmental Technology Verification Program (CETV) procedure for Laboratory Testing of Oil-Grit Separators ISO14034 testing and historical rainfall data to estimate flow, determine surface loading rate and estimate performance for a catchment area.

Field Trials

EnviroBasin™ Components

EnviroPod Construction Liner



EnviroBasin™ installed with a EnviroPod Geotextile Constriction Liner protects the catch basin from construction to completion.

- **One product for two jobs** (Construction and post-construction trash control).
- **Easy maintenance.** The construction liner is supported by the LittaTrap™ basket allowing easy removal and replacement.
- **Hydraulically designed** not to cause flooding.
- **Cost savings.** Construction liners are a low cost addition to your site.
- **Readily available** online and through distributors.

✓ High hydraulic capacity
✓ Large sediment storage volume
✓ Structurally robust
✓ Easily maintained

× Blocks storm drain
× Can't be maintained
× Ineffective

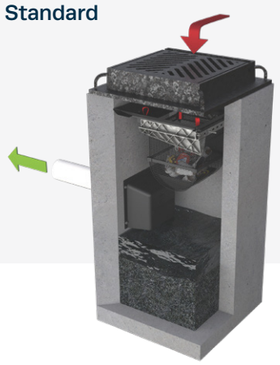
MODEL AND SIZE SPECIFICATION

The EnviroBasin™ has six standard models. Table 1 below details the standard models available.

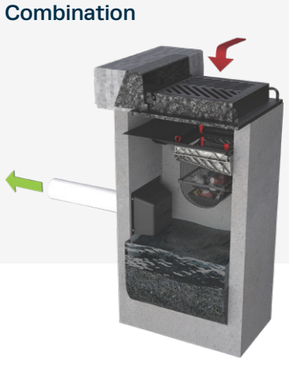
Model	LittaTrap™ Size	Impervious area for 60% TSS* (m_2)	Gross Solid Storage (L)	Sediment Storage (m_3)
Standard	LT6060	950	43	0.32
London Combination	LT6060 with seal kit	1330	43	0.45
Twin	2 x LT6060	2300	43	0.78
Ditch	LT6060	950	43	0.32
Junction	LT6060	950	43	0.32
Round	Specification dependant on the catch basins size. Contact EnviroPod for more info.			

*Estimated using ETV PSD modelled in a specification based on 6 hour 25mm storm depth. Note this is a guide only and site specific design may be required.

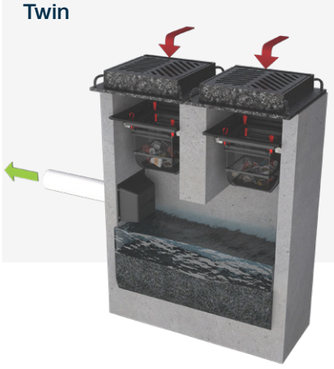
Standard



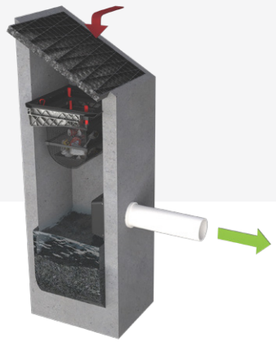
Combination



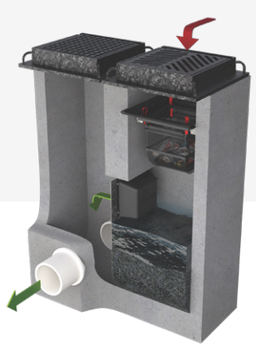
Twin



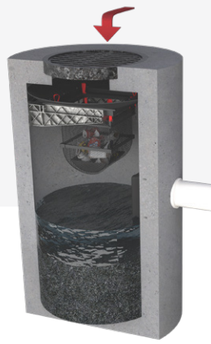
Ditch



Junction



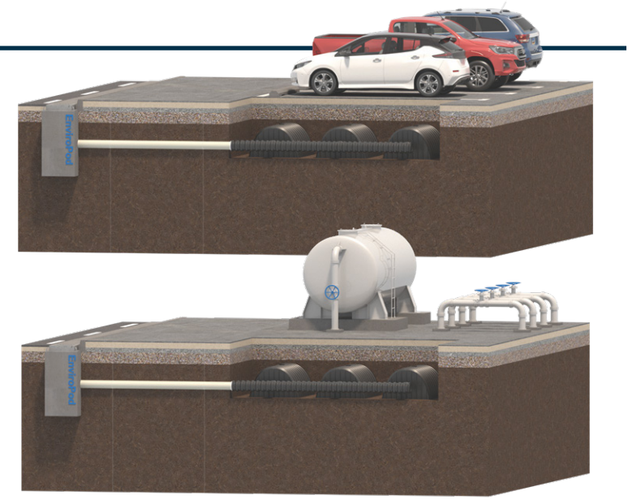
Round



Applications

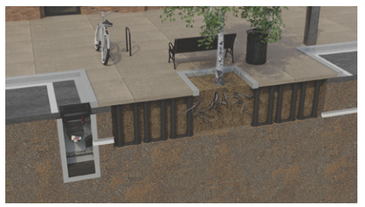
PRE-TREATMENT

Ideal pre-treatment to infiltration. As a pre-treatment device or as a stand-alone alternative to a catch basin, the EnviroBasin™ can be used in carpark roads, retail, industrial sites and other high contaminant generating areas.



LOW IMPACT DESIGN

Ideal for pre-treatment to Low Impact Design or infiltration. Using EnviroBasin™ allows a distributed entry into these drainage structures.



URBAN COASTAL AREAS

Ideal for urban coastal areas such as waterfronts, marinas and ports where catch basins often directly discharge into the ocean or lake.

What is ETV testing and why does it matter

In Canada and other jurisdictions, regulatory agencies and permitting authorities may have requirements and performance criteria to approve and accept various stormwater treatment devices for specific applications and operating conditions.

Regulatory agencies and authorities can benefit from scientifically defensible, verifiable performance data applicable to different end-use requirements and operating conditions.

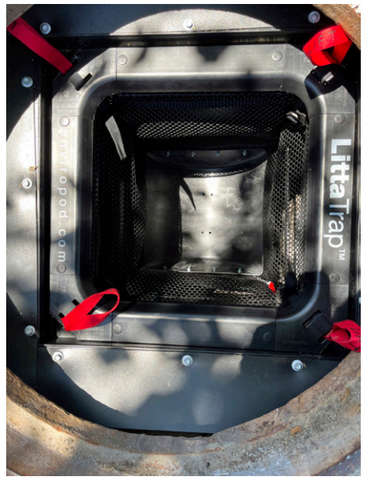
The "Procedure for Laboratory Testing of Oil-Grit Separators" was initially prepared in 2013 by TRCA for the Canadian Environmental Technology Verification (ETV) Program and subsequent verification following the International Organization for Standardization ISO requirements 14034:2016 ETV standard, published in November 2016.

The procedure intends to provide a standard procedure for testing and verifying the performance of OGS under controlled conditions independently and transparently. Independent verification of the performance data using the procedure as the basis for testing has assisted Canadian regulatory agencies, permitting authorities and other affected stakeholders in evaluating treatment technology options.

The ETV ISO 14034 testing standard represents a practical approach for testing to produce verifiable performance data on specific technologies under defined operating conditions. The procedure reduces uncertainties and improves the likelihood of market acceptance of the independently generated performance data, contributing to more informed technology decisions.

The EnviroBasin™ has been tested to the Procedure for Laboratory Testing of Oil-Grit Separators and has ETV-verified results.

Stormwater designers and municipalities can adopt the use of the EnviroBasin™ with confidence knowing it is verified and accepted across Canada.



Maintenance

The system is easy to maintain and the EnviroBasin's™ unique enhanced storage sump capacity extends vactor truck maintenance requirements to once every two-to-three years.

3–12 months	**Routine maintenance** of LittaTrap™ by hand or vactor truck (dependent on site specific loading).
2–3 years	**Periodic maintenance** by vactor truck maintenance of the EnviroBasin™ sump (depending on site specific loading).

LittaTrap™ Basket Hand Maintenance

It is recommended the LittaTrap™ basket be emptied when 75% full (generally every 3–12 months). To empty the basket, simply "Lift, Tip, Reuse". The following steps detail hand maintenance:

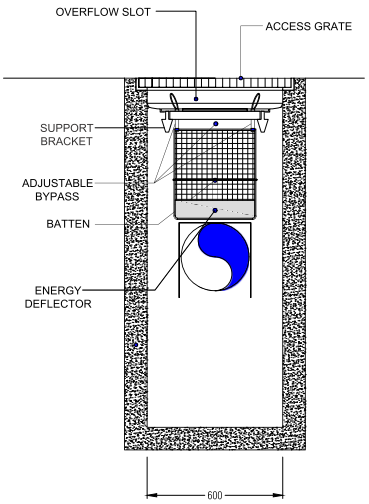
1. Establish a safe working area per typical catch basin service activity.
2. Remove grate/access cover.
3. Remove the basket with two lifting hooks or lift by hand through the loops on the top of the basket. Excess debris should be scooped out first if the basket is over half full.
4. Pour contents of the basket into a disposal container.
5. Replace grate.

EnviroBasin™ Sump Vactor Maintenance

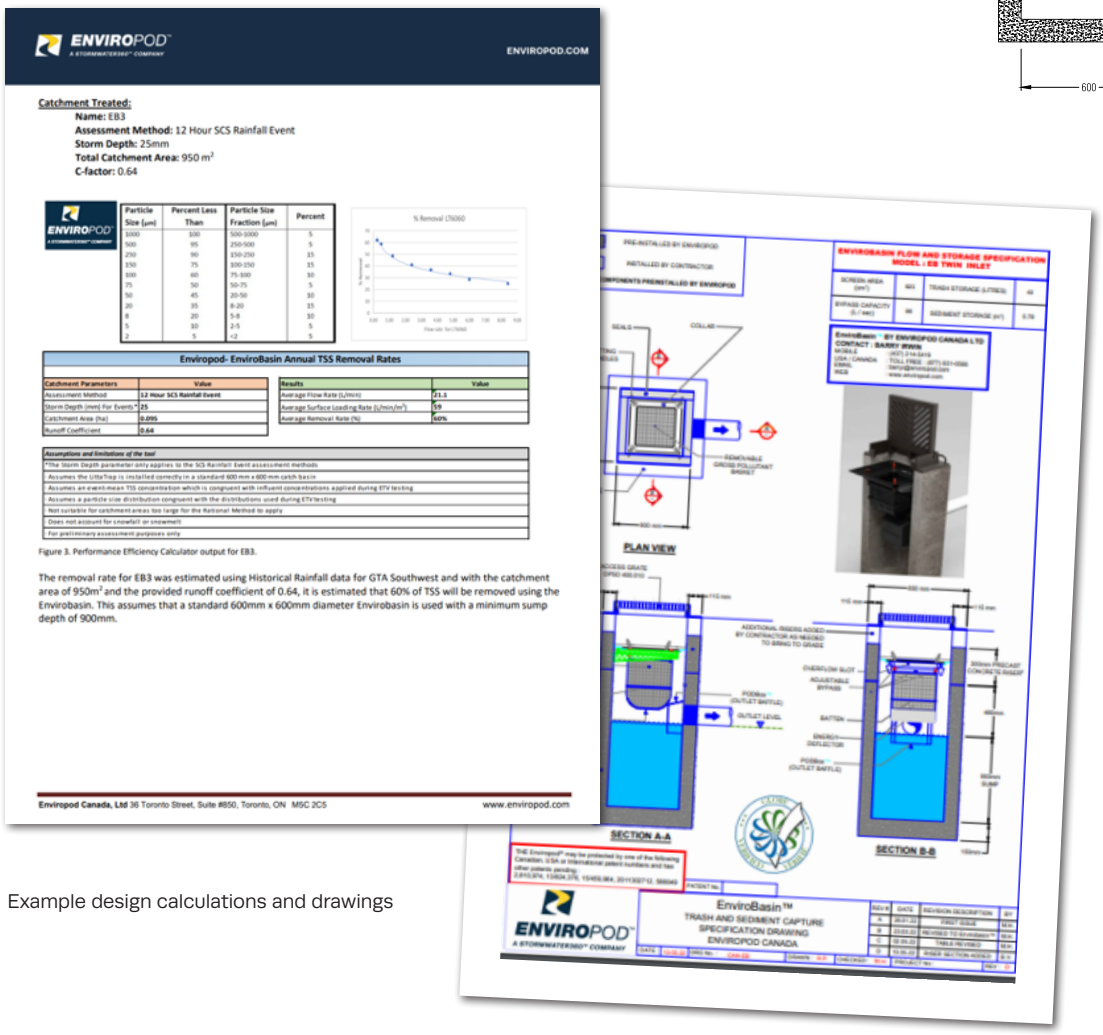
Steps for vactor maintenance are as detailed below:

1. Establish a safe working area per typical catch pit service activity.
2. Remove grate/access cover.
3. Vacuum accumulated debris from the basket.
4. Vactor the contents from the sump of the catch basin (if required).
5. Inspect the LittaTrap™ and EnviroBasin™ for any damage. Reinstall the LittaTrap™ basket.
6. Replace grate/access cover.

Free Design support & regulatory assistance



EnviroPod offers a free design service where the cumulative performance of several EnviroBasin's can be modelled for a specific project based on local rainfall and treatment needs. This service allows stormwater consultants to optimize the number and the location of EnviroBasin's for their projects.



ENVIROPOD
ENVIROPOD.COM

Catchment Treated:
Name: EB3
Assessment Method: 12 Hour SCS Rainfall Event
Storm Depth: 25mm
Total Catchment Area: 950 m²
C-factor: 0.64

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Enviropod- EnviroBasin Annual TSS Removal Rates

Catchment Parameters	Value
Assessment Method	12 Hour SCS Rainfall Event
Storm Depth (mm) For Events	25
Catchment Area (ha)	0.095
Runoff Coefficient	0.64

Results	Value
Average Flow Rate (L/min)	21.1
Average Surface Loading Rate (L/min/m²)	59
Average Removal Rate (%)	60%

Assumptions and limitations of the tool
*The Storm Depth parameter only applies to the SCS Rainfall Event assessment methods
Assumes the LittaTrap is installed correctly in a standard 600 mm x 600 mm catch basin
Assumes an event-mean TSS concentration which is congruent with influent concentrations applied during ETV testing
Assumes a particle size distribution congruent with the distributions used during ETV testing
Not suitable for catchment areas too large for the Rational Method to apply
Does not account for snowfall or snowmelt
For preliminary assessment purposes only

Figure 3. Performance Efficiency Calculator output for EB3.

The removal rate for EB3 was estimated using Historical Rainfall data for GTA Southwest and with the catchment area of 950m² and the provided runoff coefficient of 0.64, it is estimated that 60% of TSS will be removed using the Envirobasin. This assumes that a standard 600mm x 600mm diameter Envirobasin is used with a minimum sump depth of 900mm.

Enviropod Canada, Ltd 36 Toronto Street, Suite #850, Toronto, ON M5C 2C5 www.enviropod.com

ENVIROBASIN FLOW AND STORAGE SPECIFICATION
MODEL : ES TWIN INLET

PLAN VIEW
SECTION A-A
SECTION B-B

EnviroBasin™
TRASH AND SEDIMENT CAPTURE
SPECIFICATION DRAWING
ENVIROPOD CANADA

Example design calculations and drawings

ABOUT ENVIROPOD

EnviroPod is the world's leading catch basin insert technology provider. The company has over 50,000 installations worldwide, including catchment wide retrofits. The EnviroBasin™ is a result of 26 years' of research, implementation and operation of source treatment solutions.

For further information please see www.enviropod.com

International patent numbers for: CA – 2,810,974 ; USA – 9,642,658 ; AU – 2011302712 ; NZ – 588049. Other patents pending.

ENVIROPOD™
A STORMWATER360™ COMPANY

1960 05/23

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

LittaTrap™ Catch Basin System

Enviropod International Ltd.
North Harbour, Auckland, New Zealand

Registration: GPS-ETV_V2021-11-15

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

November 15, 2021
Vancouver, BC, Canada

GLOBE PERFORMANCE SOLUTIONS

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The LittaTrap™ Catch Basin System is a removable insert installed in a pre-cast sumped catch basin with a submerged outlet baffle designed to improve the capture of solids, trash and debris, and reduce resuspension of captured sediment particles in the sump (Figure 1). The system employs screening, energy dissipation, flow distribution and gravitational settling to remove pollutants from stormwater runoff.

The system functions by draining stormwater surface runoff through a grate, curb opening or both. Once the runoff drops below the surface it is diverted through the screened basket where it is intercepted by a patented energy dissipation mechanism. This mechanism reverses the direction of flow and distributes the sediment across the surface area of the sump. The process of intercepting and distributing the flow enhances settling in the catch basin sump and reduces the resuspension of TSS, while retaining and storing gross solids and debris (>5 mm) in a dewatered environment. Retention of organic gross pollutants and holding them in a dry environment prevents them from breaking down and releasing nutrients and other contaminants into the water.

The patented mesh batten basket is made of inert light weight plastic for easy removal and maintenance without the need for specialized equipment. An adjustable bypass at the top of the basket provides a secondary flow path into the catch basin should the basket become filled or temporarily clogged. The unit comes in different sizes to fit standard catch basins of variable dimensions.

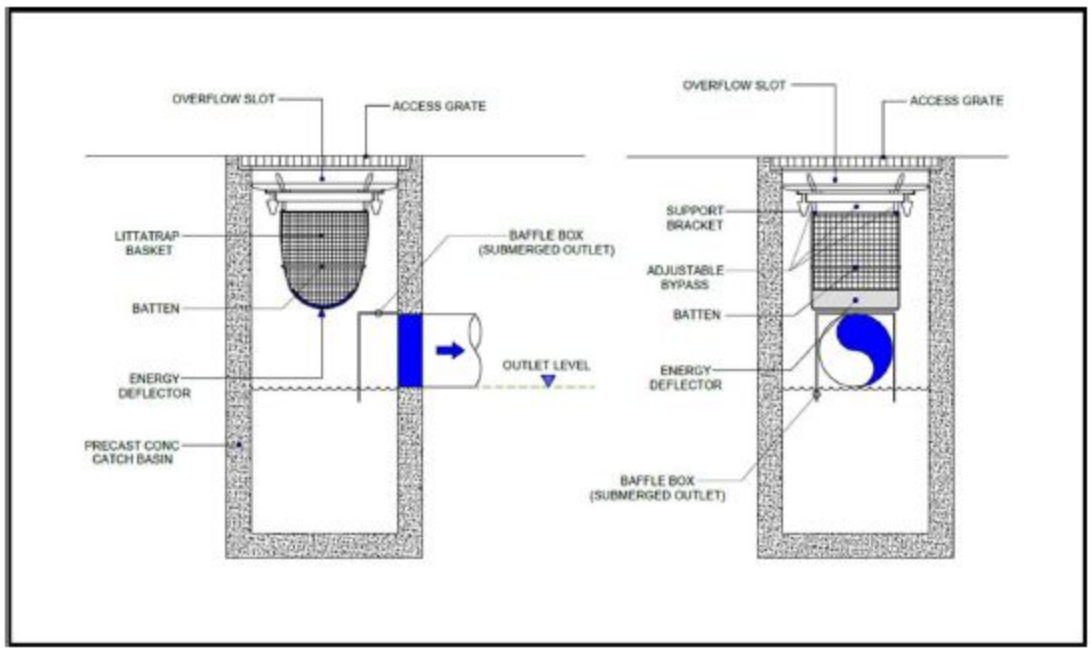


Figure 1: Enviropod® LittaTrap™ Catch Basin System

Performance conditions

The data and results published in this Technology Verification Statement were obtained from a testing program conducted on Enviropod International's LittaTrap™ Catch Basin System. The testing program was based on the *Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014)*, and associated *Bulletins*, with modifications to accommodate the surface inlet and small storage capacity of the catch basin (see variance section below for details). These modifications to the *Procedure* were developed to comply with the ISO 14034 Environmental Technology Verification standard and were approved by the verifier in advance of the test. The *Procedure for Laboratory Testing of Oil-Grit Separators* was prepared by the Toronto and Region Conservation Authority (TRCA) for the Canadian Environmental Technology Verification Program. A copy of the Procedure may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

Capture test[1]:

During the capture test, the LittaTrap™ Catch Basin System device, with a false floor set at 50% of the maximum sediment storage depth and influent test sediment concentration of 200 mg/L, removes 62, 59, 49, 41, 37, 34, 28 and 25 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 800, 1000, and 1400 L/min/m^2, respectively.

Scour test[1]:

During the scour test, the LittaTrap™ Catch Basin System, with 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the maximum sediment storage depth, generates corrected effluent concentrations of 2.8, 2.3, 0.1, 0.5 and 0.7 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Performance results

The sediment used to test the technology consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the average (minimum 3 samples) of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%, with a median no greater than 75 µm. Comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 indicates that the test sediment used for the capture and scour tests met these conditions, with an average d50 particle size of 73 µm. The average was determined from three samples prepared for each of the tested surface loading rates. All three samples had a median particle size less than 75 µm.

[1] The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

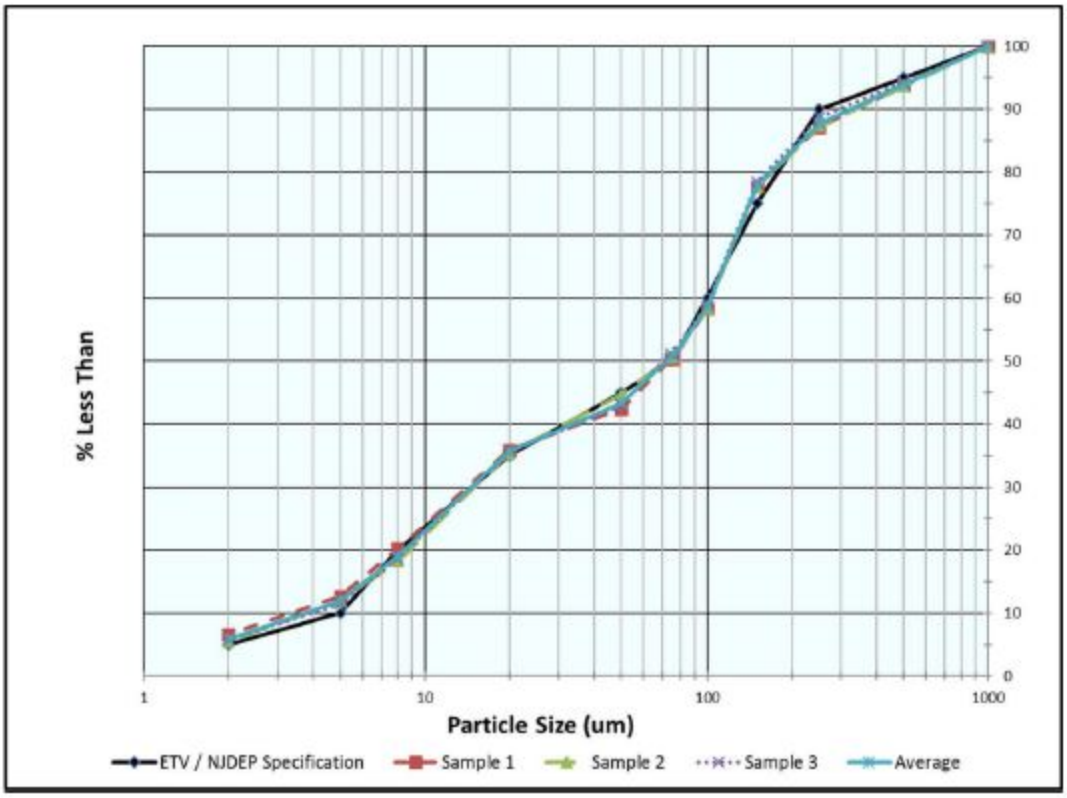


Figure 2: Average particle size distribution of test sediment relative to the ETV specification

Calibration samples of the test sediment were taken for each of the 8 runs. This includes one additional run (800 L/min/m²) not specified in the *Procedure* that was undertaken at the request of the vendor. The results presented in Figure 2 show that the PSD met the specification for all runs, with median PSDs less than or equal to 75 µm. An anomaly occurred on the feed sediment for the 1000 L/min/m² which the test laboratory attributed to a sediment sieving error that was not expected to affect the capture test results.

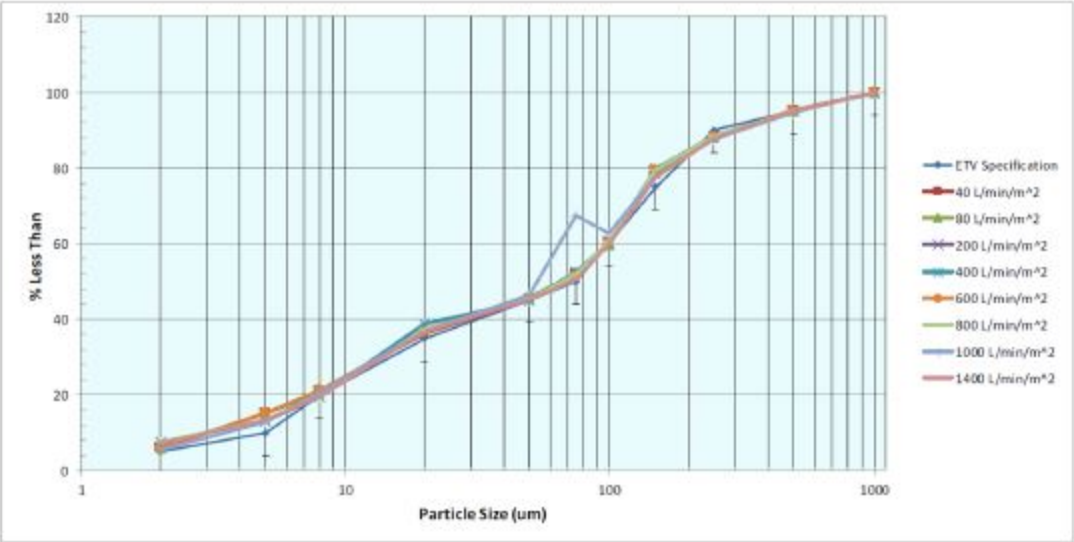


Figure 3: Particle size distribution of individual feed sediment calibration samples compared to the ETV specification

The LittaTrap technology was installed into a simulated 600 x 600 mm catch basin based on the design specified by the City of Toronto in the drawing *T-705.010, Pre-cast Catch Basin with Sump, Rev1; Apr2013.* Since runoff flows into catch basins through a surface grate, a simulated streetscape was used to test the capacity of the unit to capture sediment and prevent re-entrainment of captured sediment. The streetscape was graded at a 2% slope and a 2% cross slope with baffles to concentrate flow and direct it towards the sediment injection point 0.7 m upstream of the catch basin grate. Slopes and surface coatings were used to minimize build-up of sediment on the surface. The mass of feed sediment injected, averaging 4.2 kg, was less than the 11.3 kg min prescribed in the *Procedure* because of the much smaller storage capacity of a catch basin sump relative to an Oil Grit Separator. Test durations remained the same as specified in the *Procedure*.

The capacity of the LittaTrap™ Catch Basin system to retain sediment was determined at eight surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor at 45 cm from the bottom, simulating the technology filled to 50% of the sediment storage depth (as measured between the outlet invert and catch basin bottom). The test was carried out with clean water that maintained a sediment concentration below 20 mg/L.

Table 1 shows the location of sediment deposition in the unit during the capture test. No sediment was retained on the streetscape surface and an insignificant amount was retained on the grate. During the two lowest surface loading rates, between 32 and 37% of the retained sediment was captured in the basket on the flow deflection device. Subsequent PSD analysis of this sediment showed that the sediment retained in the basket was coarser than the sediment in the sump. Approximately 10% of retained sediment was captured in the basket at the 200 L/min/m^2 surface loading rate.

Table 1: Location of sediment deposition during the capture test. No sediment was retained on the streetscape during any of the tested surface loading rates.

Surface Loading Rate ($L/min/m^2$)	40	80	200	400	600	800	1000	1400
Total Mass Injected (kg)	4.011	3.974	4.313	4.302	4.058	4.257	4.056	4.533
Sediment Captured in sump (kg)	1.6487	1.4553	1.8777	1.7114	1.4983	1.4284	1.1547	1.1435
Sediment Captured in basket (kg)	0.7976	0.8526	0.2162	0.0581	-	-	-	-
Sediment Captured on the catch basin grate (kg)	0.0525	0.0233	0.0028	-	-	-	-	-
Total Mass Retained (kg)	2.4989	2.3312	2.0967	1.7695	1.4983	1.4284	1.1547	1.1435

Removal efficiency results for individual particle size classes and for the test sediment as a whole are presented in Table 2. In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and are attributed to challenges relating to the blending of sediment and the collection of representative samples for laboratory submission. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "removal efficiency based on mass balance" (see Table 2) are based on measurements of the total mass of injected and retained sediment, and are therefore not subject to blending, sub-sampling or PSD analysis errors or anomalies.

Table 2. Removal efficiency summary at each surface loading rate by particle size and total mass.

Particle Size Fraction (µm)	Removal Efficiency (%)							
	40 ($L/min/m^2$)	80 ($L/min/m^2$)	200 ($L/min/m^2$)	400 ($L/min/m^2$)	600 ($L/min/m^2$)	800 ($L/min/m^2$)	1000 ($L/min/m^2$)	1400 ($L/min/m^2$)
> 500	100*	100*	95	100*	100*	99	68	100*
250 - 500	100*	100*	99	100*	100*	96	67	99
150 - 250	93	100	78	82	64	71	51	48
100 - 150	98	94	97	66	49	54	63	31
75 - 100	81	77	56	49	32	36	-66**	10
50 - 75	100*	55	85	25	18	24	9	2
20 - 50	41	25	11	12	4	4	0	0
8 - 20	25	11	2	1	0	0	0	0
5 - 8	0	0	0	0	0	0	0	0
< 5	10	9	9	7	6	6	6	4
Removal Efficiency based on mass balance (%)	62.31	58.65	48.61	41.13	36.92	33.56	28.47	25.23

* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 106 and 158%

** An outlier in the retained sediment sample sieve data resulted in negative removal for this size fraction

Figure 4 compares the particle size distribution (PSD) specification of the test sediment to the PSD of the sediment retained in the catch basin at each of the tested surface loading rates. As expected, the capture efficiency for fine particles in the unit was generally found to decrease as surface loading rates increased although retained sediment at the 600 L/min/m² surface loading rate was unexpectedly coarse.

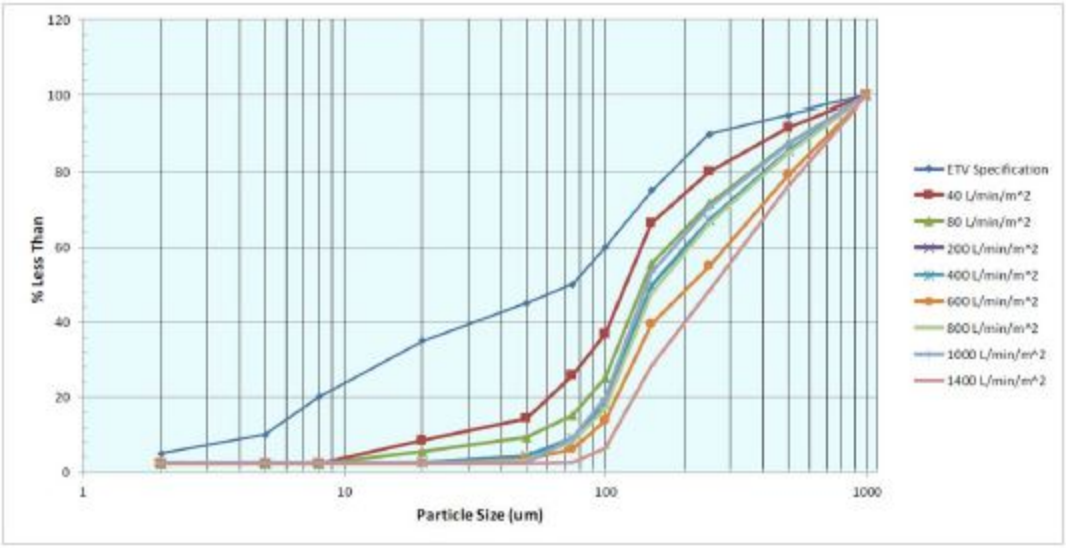


Figure 4: Particle size distribution of retained sediment compared to the ETV specified test sediment.

Table 3 shows the results of the sediment scour and re-suspension test for the LittaTrap™ Catch Basin system. The scour test involved preloading 10.2 cm of fresh test sediment into the sedimentation sump of the catch basin. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum sediment storage depth. Clean water was run through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water. The smallest 5% of particles captured during the 40 L/min/m² surface loading rate are also commonly used to adjust the concentration, as per the method described in Bulletin # CETV 2016-09-0001. However, the sediment concentration was too low to conduct aqueous sample PSD tests, hence the results are adjusted based on background concentration of influent water alone. Results showed average adjusted effluent sediment concentrations below 3 mg/L at all tested surface loading rates.

Table 3: Sediment effluent concentration from the scour test, adjusted by the background concentration.

Run	SLR (L/min/m^2)	Run Time	SSC $_{Initial}$ (mg/L)	SSC $_{Adjusted}$ (mg/L)	Average Adjusted (mg/L)
1	200	1:00	9.6	4.9	2.8
		2:00	10	5.3	
		3:00	7.1	2.5	
		4:00	6.4	1.8	
		5:00	5.5	0.9	
		6:00	6.1	1.6	
2	800	7:00	7.1	2.6	2.3
		8:00	11	6.3	
		9:00	8.9	4.0	
		10:00	5.9	0.8	
		11:00	4.2	0	
		12:00	4.2	0	
3	1400	13:00	5.9	0.1	0.1
		14:00	6.9	0.4	
		15:00	4.1	0	
		16:00	4.7	0	
		17:00	2.9	0	
		18:00	1.8	0	
4	2000	19:00	13	3.0	0.5
		20:00	8.2	0	
		21:00	3.0	0	
		22:00	3.2	0	
		23:00	1.9	0	
		24:00	3.0	0	
5	2600	25:00	4.2	2.2	0.7
		26:00	2.6	0.8	
		27:00	2.1	0.5	
		28:00	1.0	0	
		29:00	1.4	0.2	
		30:00	1.7	0.7	

Variances from testing Procedure

The *Procedure for Laboratory Testing of Oil Grit Separators* was used as the basis for testing with the following modifications to accommodate the surface inlet and small size of the catch basin sump:

1. A simulated streetscape (2.4 m long x 0.61 m wide) was used to direct flows into the catch basin through a surface grate. The streetscape had a 2% slope to the catchbasin (CB) and a 2% cross slope to the outlet side of the CB. Baffles were used to direct water towards the sediment injection point 0.7 m upslope of the surface grate to promote thorough mixing of sediment and avoid accumulation of sediment on the streetscape surface.
2. The sump area of a catchbasin is approximately one third that of a typical 1.2 m diameter Oil Grit Separator. To ensure test durations similar to those normally completed for OGS, the mass of sediment injected per run was reduced to an average of 4.2 kg (see Table1 above).
3. The two lowest surface loading rates of 40 and 80 L/min/m2 had flow rates of only 0.24 and 0.48 L/s. These low flow rates required that: (i) sediment calibration samples be taken over 2 minutes rather than one to capture the minimum quantity of sediment for weighing, and (ii) higher tolerance for flow meter error (0.9% rather than 0.2%) as the lowest flow rate (0.24 L/s) lies outside of the flow meter calibration range. Although greater tolerances were suggested for sediment concentrations in the test plan, the test was within the 200±25 mg/L specified in the *Procedure*.
4. The highest flow rate during the scour test (15.6 L/s) requires switching of pumps which meant that flow rates were recorded manually ever 30 seconds for the 5 minute duration of this flow rate.

Verification

The verification was completed by the Verification Expert, Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management – Environmental technology verification (ETV)***. Data and information provided by Enviropod International Inc. to support the performance claim included the Performance Test Report prepared by Good Harbour Laboratories, Inc , and dated June 8, 2021. This report is based on testing completed in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) and associated Bulletins, with some modifications required to accommodate the application of the *Procedure* to a catch basin treatment unit.

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the LittaTrap™ Catch Basin System please contact:

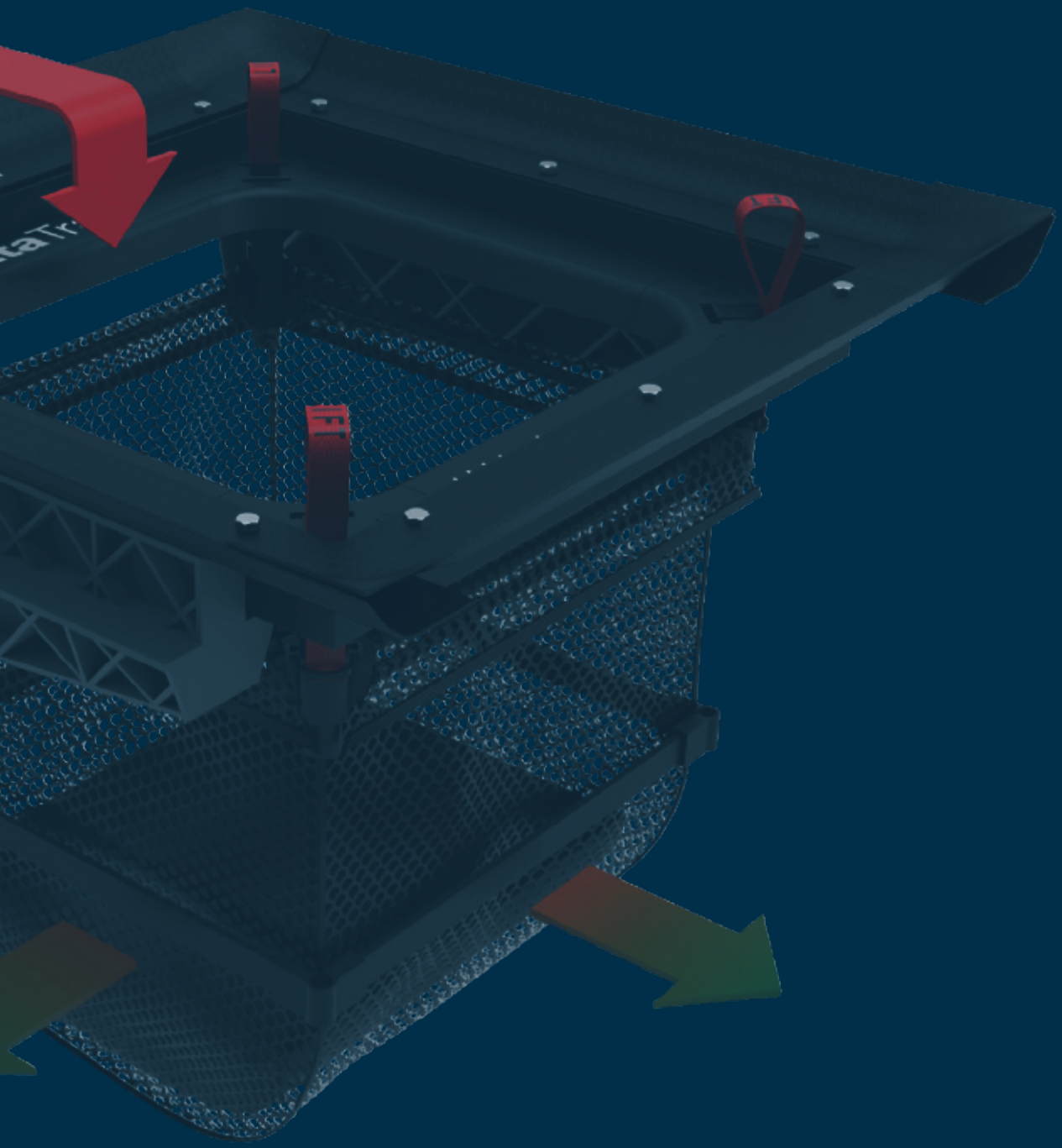
Enviropod Canada
PO Box 98037
CARLAW
970 Queen Street East
Toronto, ON
M4M 1J0 Canada
Toll Free: 1-877-651-0566
Email. Will@enviropod.com

For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
World Trade Centre
404 – 999 Canada Place
Vancouver, BC
V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com
www.globeperformance.com

Limitation of verification - Registration: GPS-ETV_ V2021-11-15
GLOBE Performance Solutions and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

ENVIROPOD.COM



LittaTrap™ – Operations and Maintenance Guide

ENVIROPOD™
A STORMWATER360™ COMPANY

The EnviroPod® LittaTrap™

The EnviroPod® LittaTrap™ is an innovative catch basin inlet filter (insert) device designed to be easily installed into new and existing stormwater catch basins of any size or configuration. The EnviroPod® LittaTrap™ can be installed in grate (drop) inlets, curb inlets, combination grate/ curb inlets, or round manhole catch basins. Figure 1: EnviroPod® LittaTrap™ example catch basin applications shows these types of installations.

The EnviroPod® LittaTrap™ is an effective stormwater treatment technology that is designed to capture and remove a variety of stormwater pollutants conveyed in runoff, such as trash, debris, sediment, macro or micro plastic debris and other pollutants of concern. In addition, the EnviroPod® LittaTrap™ maintains catch basin hydraulic capacity and allows for easy maintenance when completely full of trash and debris. The EnviroPod® LittaTrap™ is available in a range of standard model sizes and configurations.

The EnviroPod® LittaTrap™ FC model is also approved for use by numerous State and local agencies throughout the USA as well as certified by the California State Water Resources Control Board, Trash Implementation Program.

The EnviroPod® LittaTrap™ FC model is fitted with a "full capture" liner that insures 100% of particles 5mm and over are captured in the trap.

The EnviroPod® LittaTrap™ FC also includes an optional hinged vector port seal (HVPS) when installed in a grated inlet or combination inlet catch basin, if required. The HVPS allows visual inspection under the basket for access by local or State Vector Control field personnel. In addition, the design of the HPVS has been approved by the Mosquito Vector Control Association of California (MVCAC) for California certified full trash capture applications.

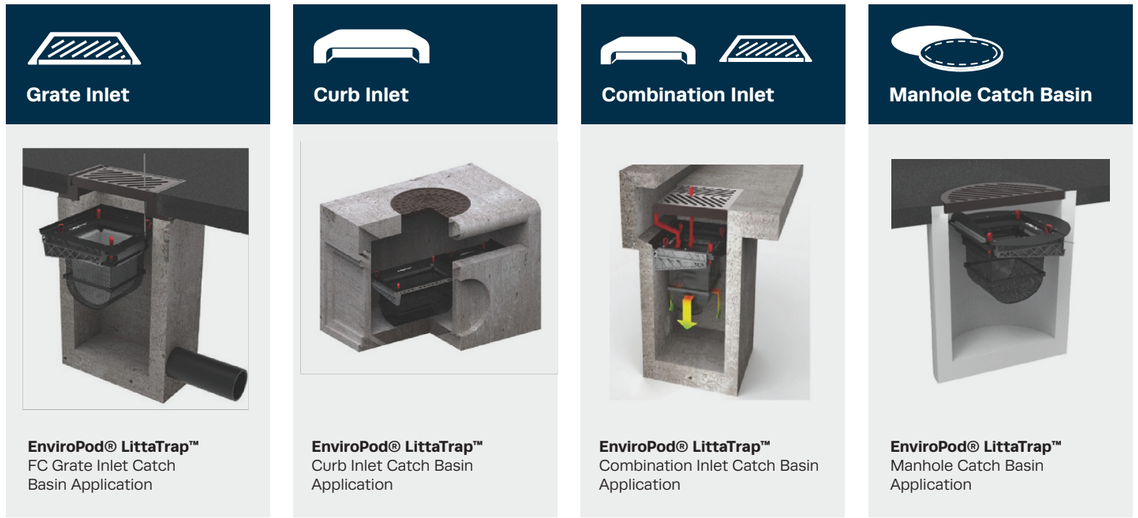


Figure 1: EnviroPod® LittaTrap™ example catch basin applications

Components and Operation

During a storm event, stormwater runoff flows enter a catch basin through a grate (drop) inlet, curb inlet, combination inlet or manhole type structure. The downward flow is intercepted and captured by the EnviroPod® LittaTrap™ device that is placed inside the entry portion of these catch basin types. Once flow enters the EnviroPod® LittaTrap™, the EnviroPod® LittaTrap™ seals and basket collar direct the flow over the bypass slots and into the basket and optional liner (as applicable). The LittaTrap™ seals are adjustable to ensure all particles diverted into the basket and liner will not cause "short-circuiting" or create early bypass of the design volume of runoff or treatment flows.

The LittaTrap™ filter box sits on a support bracket that cantilevers off a single wall of the catch basin. The support bracket is located approximately 8 inches below the surface level creating a driving head to increase the maximum bypass flow rate without causing surface ponding. The support bracket has been structurally designed to take the load of the basket that is filled with sediment, while the peak bypass flow is conveyed into the catch basin.

The patented EnviroPod® LittaTrap™ gross pollutant basket incorporates a structural batten that has three functions:

1. Constrains the basket preventing the expansion or "bulging" so the basket can be easily removed when full of material.
2. Maintains a secondary flow path around the basket for bypass flows; and
3. Maximizes the screen area and material storage volume of the basket.

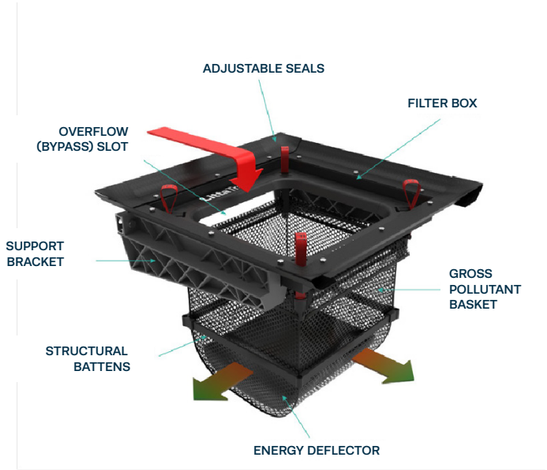


Figure 2: EnviroPod® LittaTrap™ FC Operation

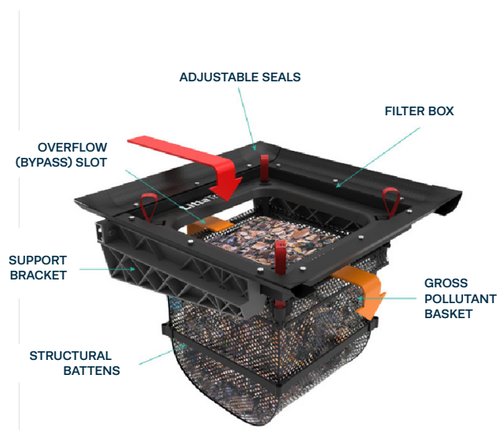


Figure 3: EnviroPod® LittaTrap™ FC Bypass Operation

Inspection and Maintenance Procedures

HEALTH AND SAFETY:

EnviroPod® recommends that owners check and utilize any applicable State and local regulatory requirements for applying a Site-Specific Safety Plan before undertaking any installation, inspection, or maintenance service. Personal Protection Equipment (PPE) is required when installing, inspecting, or maintaining a EnviroPod® LittaTrap™. Field personnel shall utilize personal protection equipment (PPE) as required, including gloves, long sleeve shirts or outwear, long pants, Hi-Viz clothing as well as steel toe shoes. For additional advice on the relevant health and safety requirements, we recommend that you consult the local health and safety regulator.

INSPECTIONS:

All stormwater inlet filter devices require routine inspection and maintenance service to ensure continued functionality of the device as well as identify and remove trapped contaminants and to minimize bypass. Due to the variable nature of stormwater pollution, annual rainfall characteristics and localized site pollutant loadings, maintenance service frequencies can vary for any catch basin location.

Figure 4: LittaTrap™ seen with 1mm liner installed to target micro-plastics such as plastic pellets. Hand maintenance shown.

It is recommended to inspect the LittaTrap™ EnviroPod® LittaTrap™ at least four times per year during the first year of operation to determine seasonal and annual maintenance requirements. First year inspection service frequency is recommended by conducting one inspection visit for every three months after a LittaTrap™ Inlet Filter device is installed and is placed in operation. However, if there is a presence of a high potential loading activity within the drainage area, it's recommended that catch basin inspection frequency be revised. High loading activity in the upstream drainage area may include the following:

- A high number of trees or vegetation.
- Construction activity.
- Uncovered or unsealed roadways

Additional inspections are recommended after major storm events. The LittaTrap™ should be inspected after a major storm event to check for any unforeseen damage or to find evidence of illicit discharge.

MAINTENANCE FREQUENCY

Maintenance of the EnviroPod® LittaTrap™ is recommended when more than 75% of the maximum trash capture volume of the LittaTrap™ model size installed. Maintenance frequency is typically conducted 1 or 2 times per year, depending on pollutant load conditions within a particular drainage area. If applicable, maintenance frequency shall be conducted as per any local municipal or State stormwater permit requirements.

MAINTENANCE PROCEDURES

The EnviroPod® LittaTrap™ maintenance service involves two activities. These activities are as follows:

1. Routine removal and emptying of the gross pollutant basket and liner (if used); and
2. Inspection for any structural damage or flow impedance.

The recommended maintenance procedure for grate (drop) inlets or combination grate/curb inlet catch basins is for the end-user or maintenance service contractor to conduct maintenance service by "hand" to reduce operational cost. Each EnviroPod® LittaTrap™ basket is fitted with lifting handles on four sides of the basket, so that maintenance personnel will have no personal contact with the captured and retained pollutants.

EnviroPod® also recommends the use of a vacuum induction truck (ie; vactor truck or heavy industrial vacuum equipment) for the maintenance of curb entry catch basin LittaTrap™ inlet filter devices.

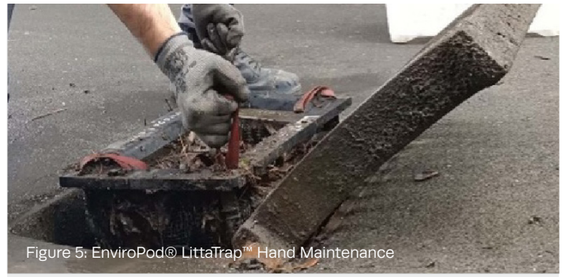


Figure 5: EnviroPod® LittaTrap™ Hand Maintenance

EnviroPod® LittaTrap™ FC Hand Maintenance

It is recommended that the EnviroPod® LittaTrap™ FC basket and liner be emptied when 75% Full. To empty the EnviroPod® LittaTrap™ FC, it is a simple one-minute exercise "Lift, Tip, Replace". The following steps detail hand maintenance:

1. Establish a safe working area per typical catch basin service activity.
2. Remove grate/access cover.
3. Remove the basket and liner with two lifting hooks or lift by hand through the loops on the top of the basket. Excess debris should be scooped out first if the basket is over half full.
4. Pour contents of the basket and liner into a disposal container.
5. Replace grate.

Figure 6: LittaTrap™ Vactor Maintenance

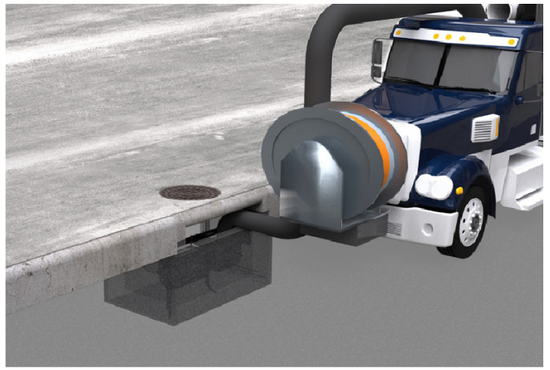
EnviroPod® LittaTrap™ FC Vactor Maintenance

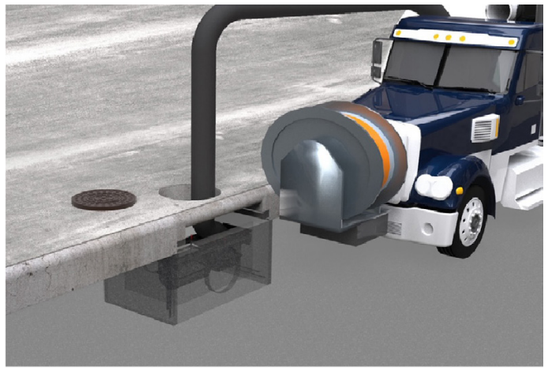
The steps for induction maintenance are detailed below:

1. Establish a safe working area per typical catch pit service activity.
2. Remove grate/access cover.
3. Vacuum accumulated debris from the basket.
4. Vacuum contents from the base of the catch basin (if required).
5. Inspect basket, filter box, and seals for any damage.
6. Replace grate/access cover.

CURB ENTRY CATCH BASIN MAINTENANCE

For curb entry catch basins, the geometry of the EnviroPod® LittaTrap™ basket allows a vactor hose to enter the basket through the curb opening, as shown in the figure below. Alternatively, baskets can be accessed through the catch basin access manhole.





ENVIROPOD® LITTATRAP™ BASKET AND FULL CAPTURE LINER CLEANING.

Material trapped in the EnviroPod® LittaTrap™ basket and or full capture liner is easily removed by shaking the basket or tapping the basket against a hard surface. If required a power washer can used to remove excess sediment or debris trapped in the screen

RECORD-KEEPING MAINTENANCE PROCEDURES

- Following maintenance and/or inspection, EnviroPod® recommends that the owner or maintenance service contractor prepare a maintenance/inspection record. The record shall include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
- The owner shall retain the maintenance/inspection records in accordance with local and/or state requirements.

REQUIRED EQUIPMENT AND MATERIALS FOR MAINTENANCE ACTIVITIES.

The following equipment is helpful when conducting EnviroPod® LittaTrap™ Grate Inlet and Curb Inlet inspections and maintenance:

- Recording device (pen and paper form, voice recorder, iPad, etc.)
- Personal protection equipment (protective footwear, gloves, hardhat, safety glasses, high visibility clothing, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure
- Vacuum truck (optional)
- Pressure washer (optional)
- Replacement oil absorbent pouches (Optional)

REPAIR OR REPLACEMENT PROCEDURES.

In the unlikely event of an EnviroPod® LittaTrap™ FC structural component requiring repair, the system can be easily uninstalled by reversing the installation procedure. Once uninstalled, any faulty part or component can be replaced.

Inspection and Maintenance Form

ADDRESS:

OWNER/LOCATION NAME:

DATE:

INSPECTOR NAME/COMPANY

Catch Basin Name/Number	Percentage Full of Trash/Debris (Mark X in appropriate box)				Condition of the LittaTrap™ Good/Poor (Requires Attached?)	Annual Weighting factor	Comments
	0–25%	25–50%	50–75%	75–100%			

COMMENTS:

Please include 3 photographs of each catch basin with the grate closed, grate open and upstream catchment.

Is the LittaTrap™ more than 75% full?

>75%: Proceed with maintenance.

If 50–75%: Maintenance recommended in the next 2 months.

QR CODE FOR THE ONLINE SURVEY

Download the ArcGIS Survey123 app on Android or Apple. No sign-in required, simply scan the QR code and complete. EnviroPod® will send you the Inspection or maintenance report.

ABOUT ENVIROPOD

EnviroPod® is Australasia's leading catch basin insert technology provider. The company has over 25,000 installs of its technology worldwide, including catchment wide retrofits. The LittaTrap™ is a result of 25 years' of research, implementation and operation of source treatment solutions.

For further information please see www.enviropod.com

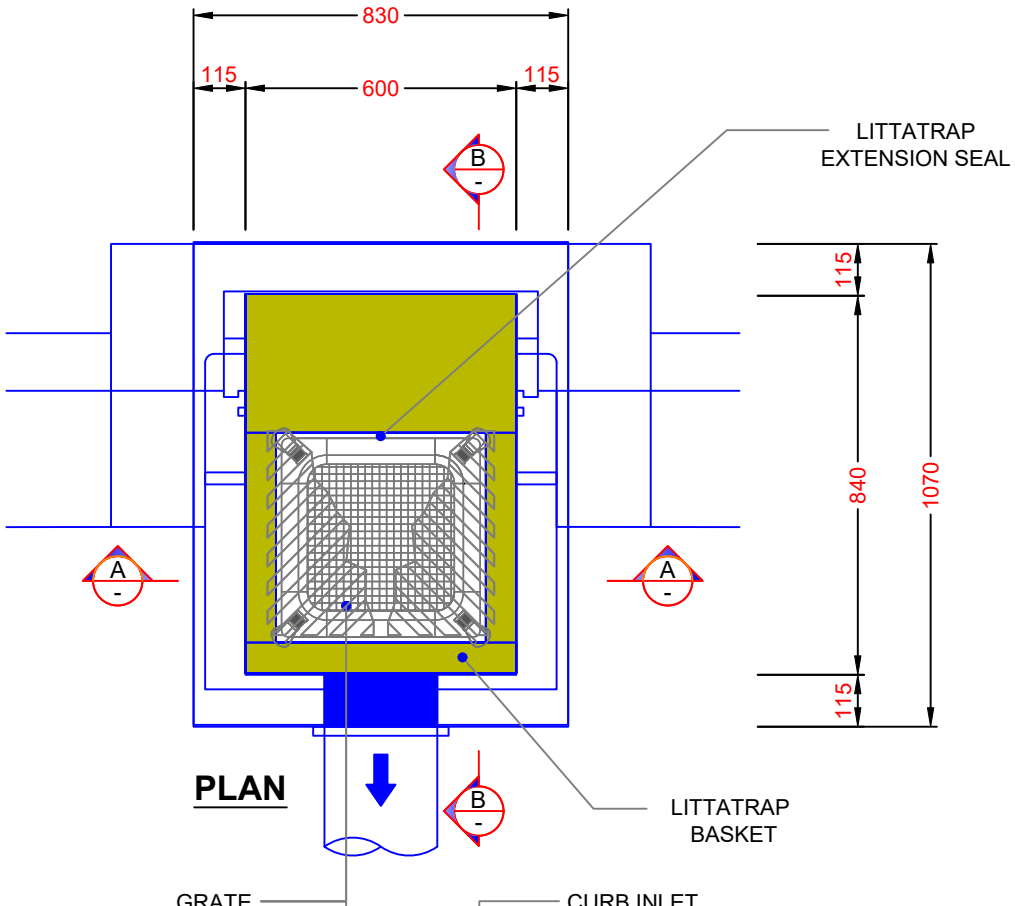
International patent numbers for : CA– 2,810,974 ; USA – 9,642,658 ; AU – 2011302712 ;NZ – 588049 . Other patents pending.

ENVIROPOD™
A STORMWATER360™ COMPANY

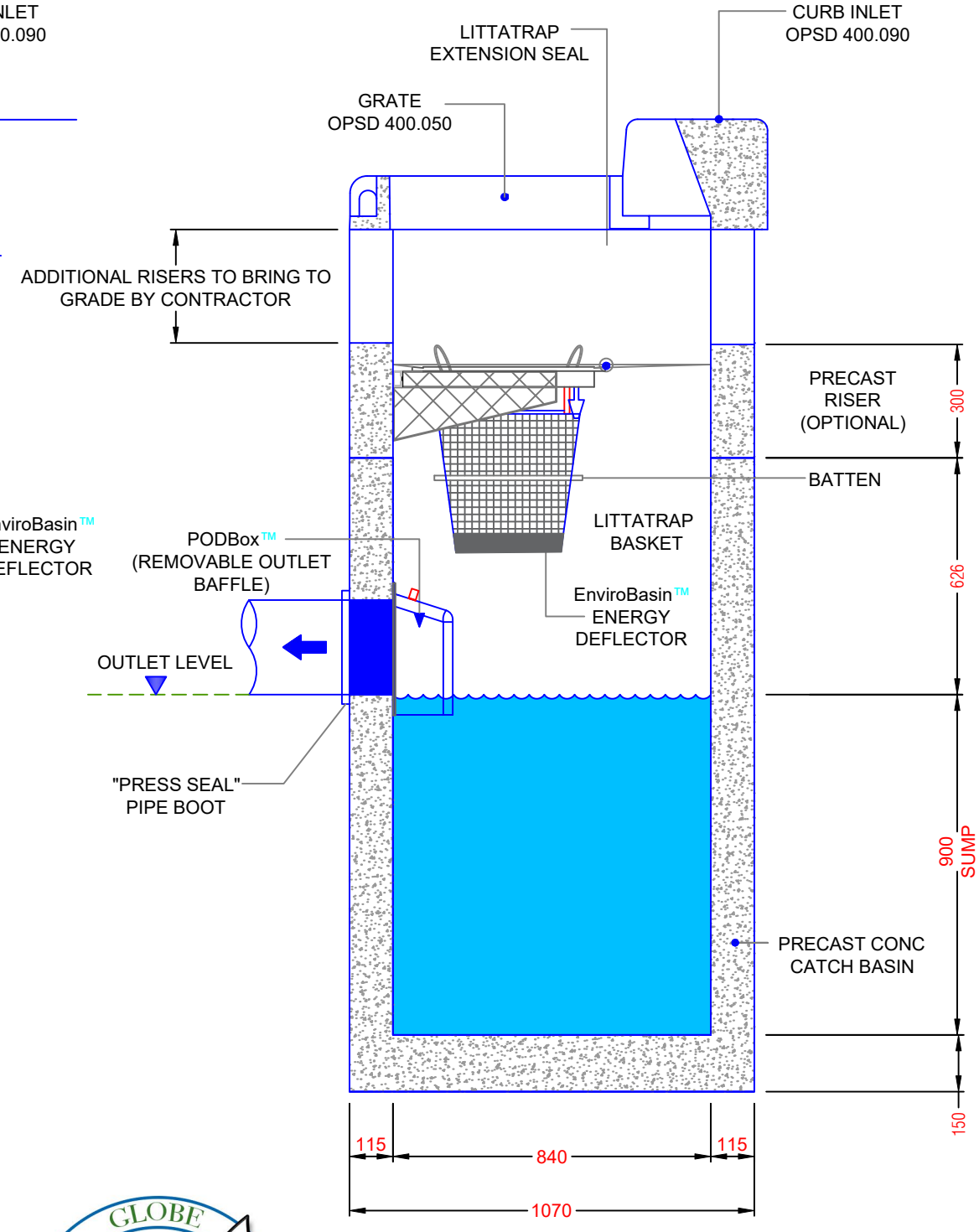
ENVIROBASIN FLOW AND STORAGE SPECIFICATION
MODEL : EB6060 COMBINATION INLET

SCREEN AREA (cm^2)	6250	TRASH STORAGE (LITRES)	43
BYPASS CAPACITY (L / sec)	88	SEDIMENT STORAGE (m^3)	0.45

EnviroBasin™ BY ENVIROPOD CANADA LTD
CONTACT : BARRY IRWIN
MOBILE : (437) 214-5419
USA / CANADA : TOLL FREE : (877) 651-0566
EMAIL : barryi@enviropod.com
WEB : www.enviropod.com



SECTION A-A



SECTION B-B

THE EnviroBasin® may be protected by one of the following Canadian, USA or International patent numbers and has other patents pending :
2,810,974, 13/824,376, 15/459,964, 2011302712, 588049

PATENT No.

PRE-INSTALLED BY ENVIROPOD

INSTALLED BY CONTRACTOR

ALL LITTATRAP COMPONENTS PREINSTALLED BY ENVIROPOD

ENVIROPOD™
A STORMWATER360™ COMPANY

EnviroBasin™
TRASH AND SEDIMENT CAPTURE
COMBINATION INLET SPECIFICATION DRAWING
ENVIROPOD CANADA

REV #	DATE	REVISION DESCRIPTION	BY
B	10/26/22	RISER NOTES	BVL
C	02/23/23	PLAN VIEW ADJUST	BVL
D	04/04/23	REMOVABLE BAFFLE	BVL
E	06/22/23	LARGER STRUCTURE	BVL

DATE :	09/23/22	DRG No. :	CAN-EB-8460CICB	DRAWN :	R.P.	CHECKED :	BVL	PROJECT No :	REV :	E

PRE-INSTALLED BY ENVIROPOD

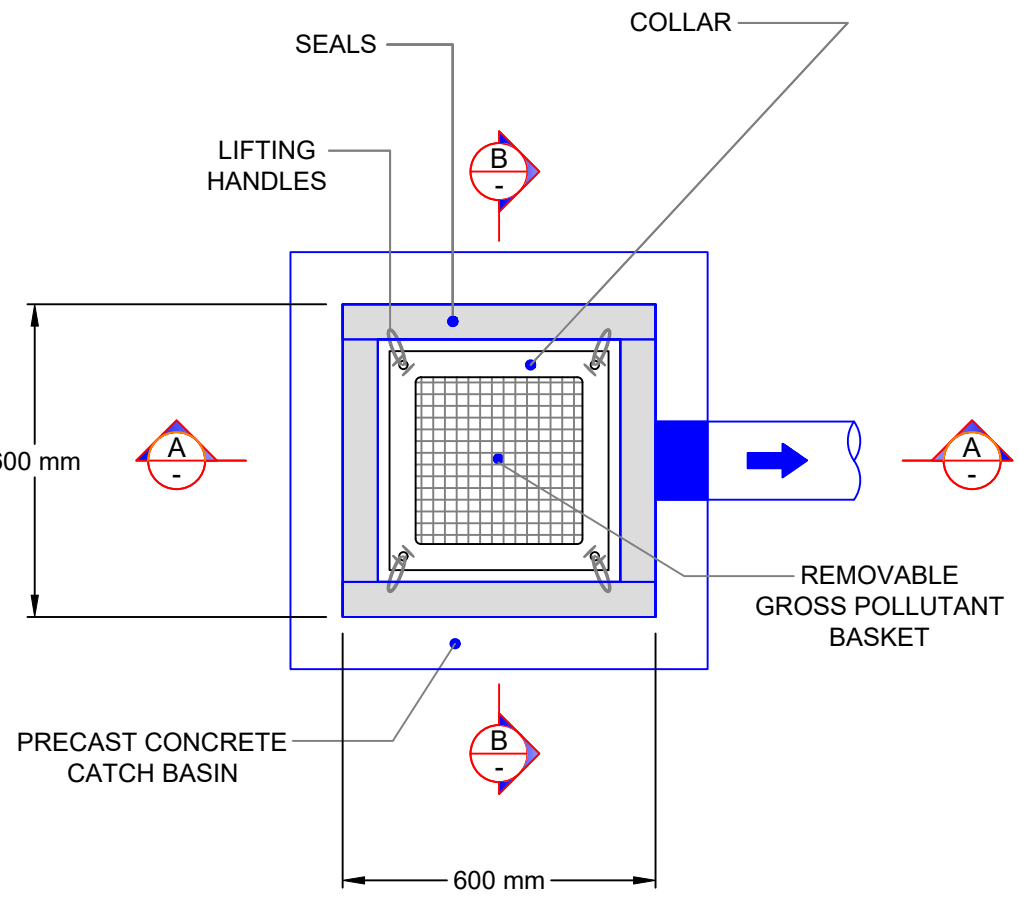
INSTALLED BY CONTRACTOR

ALL LITTATRAP COMPONENTS PREINSTALLED BY ENVIROPOD

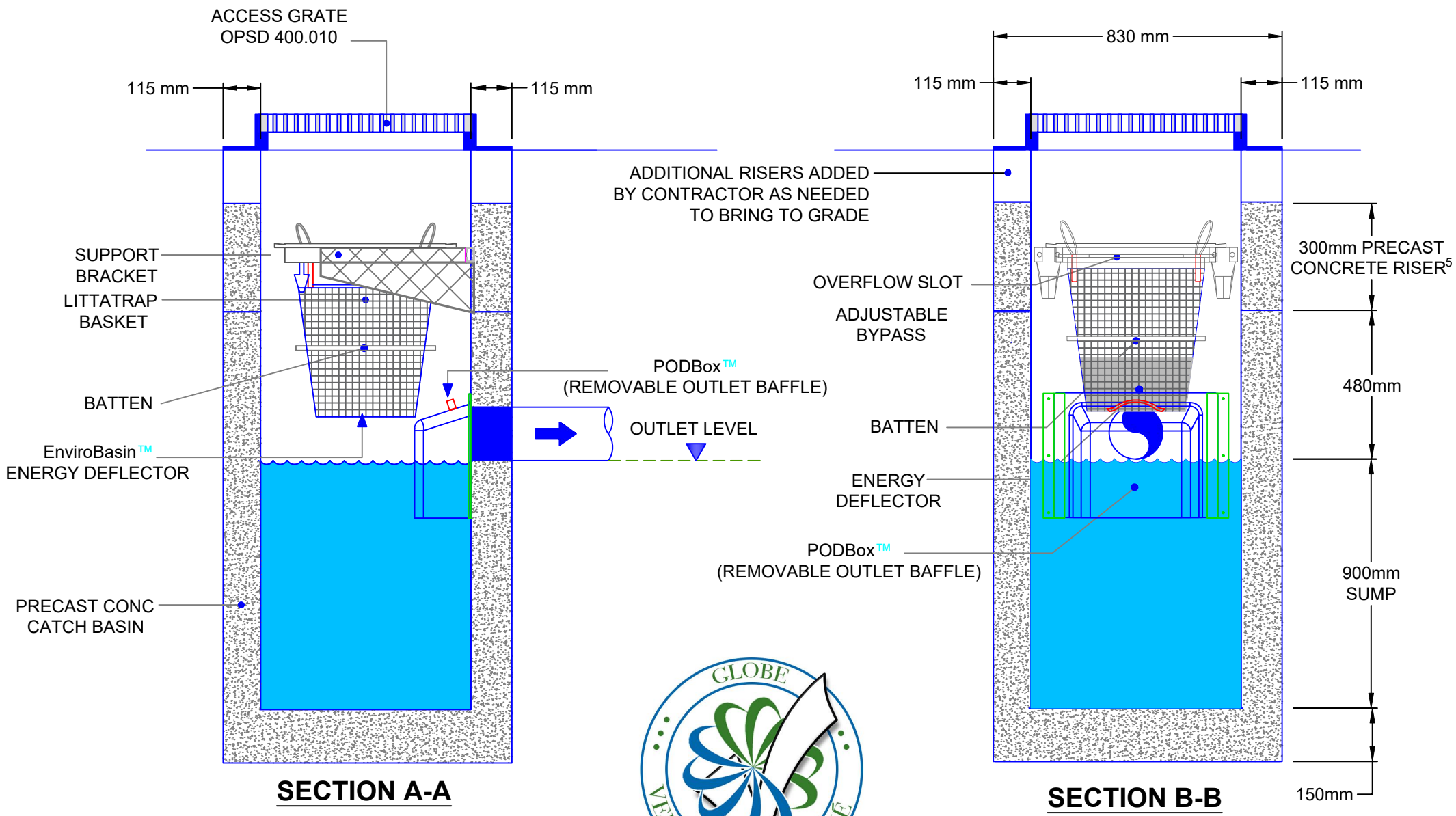
ENVIROBASIN FLOW AND STORAGE SPECIFICATION
MODEL : EB TWIN INLET

SCREEN AREA (cm^2)	6250	TRASH STORAGE (LITRES)	43
BYPASS CAPACITY (L / sec)	88	SEDIMENT STORAGE (m^3)	0.32

EnviroBasin™ BY ENVIROPOD CANADA LTD
CONTACT : BARRY IRWIN
MOBILE : (437) 214-5419
USA / CANADA : TOLL FREE : (877) 651-0566
EMAIL : barryi@enviropod.com
WEB : www.enviropod.com



PLAN VIEW



SECTION A-A

SECTION B-B

THE Enviropod® may be protected by one of the following Canadian, USA or International patent numbers and has other patents pending :
2,810,974, 13/824,376, 15/459,964, 2011302712, 588049

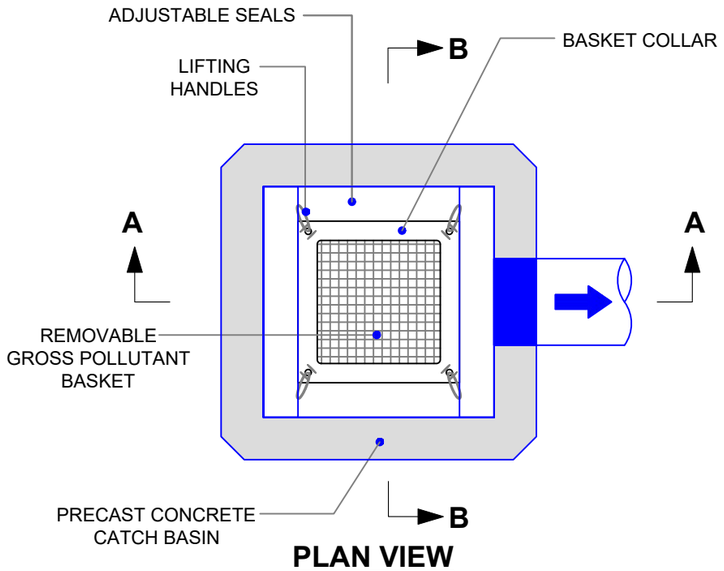
PATENT No.

ENVIROPOD™
A STORMWATER360™ COMPANY

EnviroBasin™
TRASH AND SEDIMENT CAPTURE SPECIFICATION DRAWING
ENVIROPOD CANADA

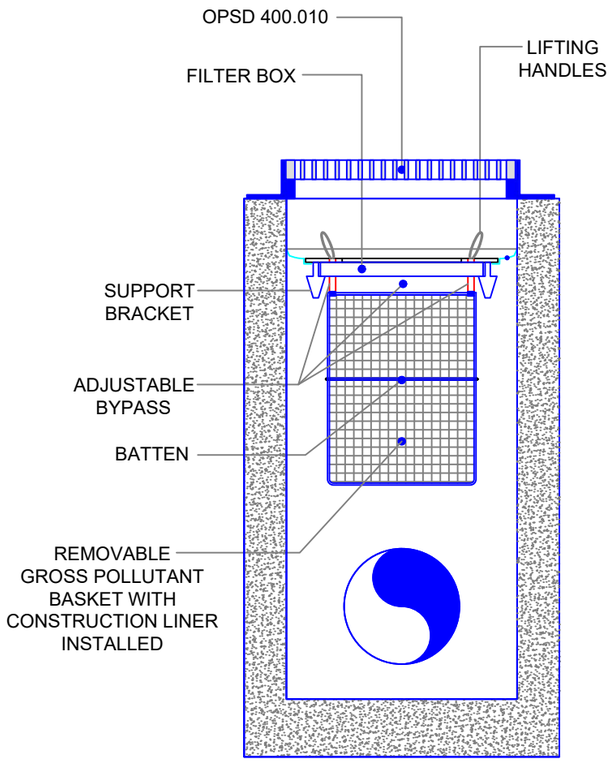
REV #	DATE	REVISION DESCRIPTION	BY
E	04.04.22	REMOVABLE BAFFLE	B.V.

DATE :	13.05.22	DRG No. :	CAN-EB	DRAWN :	R.P.	CHECKED :	M.H.	PROJECT No :	REV :	E

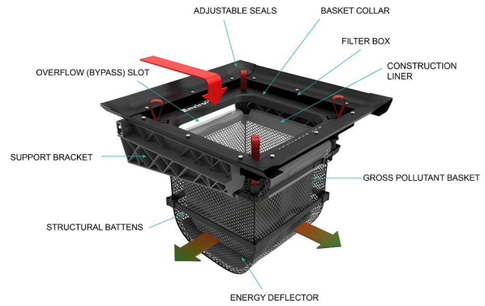


PLAN VIEW

COVER AND FRAME OMITTED FOR CLARITY



SECTION A-A



LittaTrap™ BY ENVIROPOD CANADA LTD
CONTACT : BARRY IRWIN

MOBILE	: (437) 214-5419
USA / CANADA	: Toll Free : (877) 651-0566
EMAIL	: barryi@enviropod.com
WEB	: www.enviropod.com

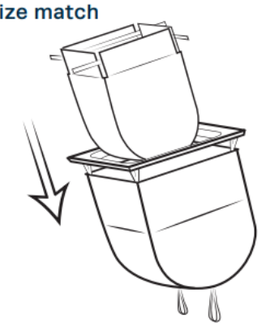
TO USE THE LITTATRAP AS A CONSTRUCTION BMP:

1. INSTALL LITTATRAP WITH CONSTRUCTION LINER DURING CONSTRUCTION.
2. CHECK REGULARLY AND REPLACE CONSTRUCTION LINER AS NEEDED
3. REMOVE CONSTRUCTION LINER WHEN CONSTRUCTION IS FINISHED FOR POST CONSTRUCTION USE.

INSTALLATION

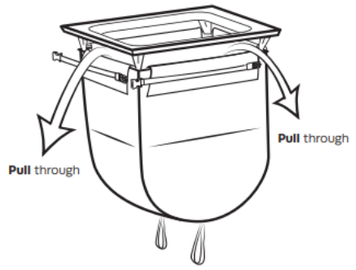
1 Insert LinerBag

Check LittaTrap & LinerBag size match



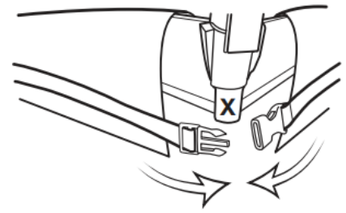
2 Pull LinerBag flaps through gap

Check LinerBag is **not stressed** in corners and no gaps



3 Clip corners

Position strap **below** corner posts (X). Clip all **four** corners



ENVIROPOD LittaTrap™ TRASH CAPTURE FLOW AND STORAGE SPECIFICATION

Catch Basin Nominal Dimensions (mm)	LittaTrap Model Size	Screen Area cm²	Maximum Trash Capture Volume (MCTV) (L)	Design Flow Rate 75% MCTV (L/s)	Standard Bypass Flow (L/s)
450 x 450	LT4545	3880	17	42	55
600 x 600	LT6060	6250	43	69	88
900 x 600	LT9060	9500	81	102	124

Notes:

Standard Bypass based on factory set bypass dimensions.

Other catch basin sizes are possible, please contact us for more detail.

THE Enviropod® may be protected by one of the following Canadian, USA or International patent numbers and has other patents pending : 2,810,974, 13/824,376, 15/459,964, 2011302712, 588049

PATENT No.

ENVIROPOD™
A STORMWATER360™ COMPANY

ENVIROPOD CANADA
600mmx600mm LITTATRAP WITH CONSTRUCTION LINER
GENERAL ARRANGEMENT

DRG No : CAN-LT-SPEC-CONST | REV : E | DATE : 05/31/23

JOB NO :			REV	REVISION DETAIL	DATE
PROJECT :			A	FIRST ISSUE	08/12/21
			B	IMAGE EDITS	07/03/22
			C	TABLE EDITS	10/18/22
DRN :	R.P.	08/12/21	D	CONSTRUCTION	02/14/23
CKD :	BVL	08/12/21	E	TITLE BLOCK	05/31/23

Appendix F
Stormwater Infiltration Chamber

User Inputs

Chamber Model:	DC-780
Outlet Control Structure:	No
Project Name:	n2271
Engineer:	Sachin Panjwani
Project Location:	Ontario
Measurement Type:	Metric
Required Storage Volume:	15.00 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	230 mm.
Stone Above Chambers:	153 mm.
Design Constraint Dimensions:	(2.11 m. x 12.00 m.)

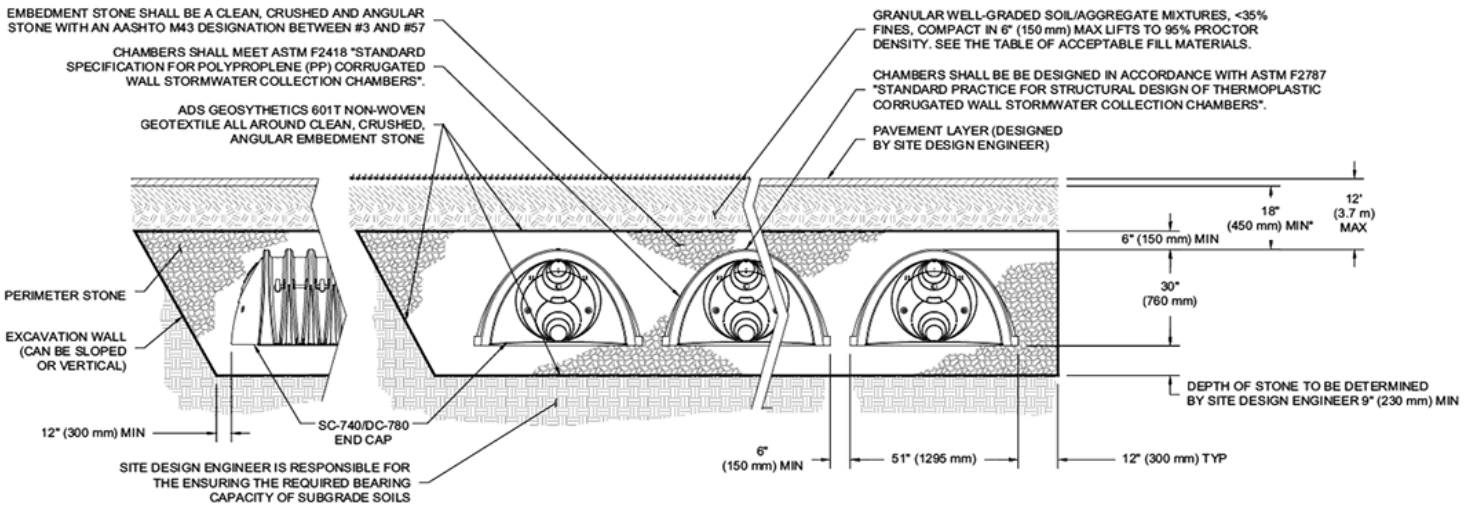
Results

System Volume and Bed Size

Installed Storage Volume:	14.66 cubic meters.
Storage Volume Per Chamber:	1.31 cubic meters.
Number Of Chambers Required:	5
Number Of End Caps Required:	2
Chamber Rows:	1
Maximum Length:	11.95 m.
Maximum Width:	1.91 m.
Approx. Bed Size Required:	22.76 square meters.
Average Cover Over Chambers:	N/A .

System Components

Amount Of Stone Required:	20 cubic meters
Volume Of Excavation (Not Including Fill):	27 cubic meters
Total Non-woven Geotextile Required:	93 square meters
Woven Geotextile Required (excluding Isolator Row):	0 square meters
Woven Geotextile Required (Isolator Row):	21 square meters
Total Woven Geotextile Required:	21 square meters
Impervious Liner Required:	0 square meters



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

Project:

Chamber Model -	DC-780		
Units -	**Metric**	Click Here for Imperial	
Number of chambers -	5		
Voids in the stone (porosity) -	40	%	
Base of Stone Elevation -	268.19	m	☑ Include Perimeter Stone in Calculations
Amount of Stone Above Chambers -	153	mm	
Amount of Stone Below Chambers -	230	mm	
Area of system -	22.76	sq.meters	Min. Area - 15.7 sq.meters

StormTech DC-780 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1143	0.00	0.00	0.23	0.23	14.337	269.33
1118	0.00	0.00	0.23	0.23	14.106	269.31
1092	0.00	0.00	0.23	0.23	13.874	269.28
1067	0.00	0.00	0.23	0.23	13.643	269.26
1041	0.00	0.00	0.23	0.23	13.412	269.23
1016	0.00	0.00	0.23	0.23	13.181	269.21
991	0.00	0.01	0.23	0.24	12.949	269.18
965	0.00	0.02	0.22	0.25	12.713	269.16
940	0.01	0.04	0.22	0.26	12.468	269.13
914	0.02	0.09	0.20	0.28	12.212	269.10
889	0.02	0.11	0.19	0.30	11.929	269.08
864	0.03	0.14	0.18	0.31	11.629	269.05
838	0.03	0.15	0.17	0.32	11.316	269.03
813	0.03	0.17	0.16	0.33	10.993	269.00
787	0.04	0.18	0.16	0.34	10.661	268.98
762	0.04	0.19	0.15	0.35	10.321	268.95
737	0.04	0.21	0.15	0.35	9.974	268.93
711	0.04	0.22	0.14	0.36	9.619	268.90
686	0.05	0.23	0.14	0.37	9.258	268.88
660	0.05	0.23	0.14	0.37	8.892	268.85
635	0.05	0.24	0.13	0.38	8.520	268.83
610	0.05	0.25	0.13	0.38	8.144	268.80
584	0.05	0.26	0.13	0.39	7.763	268.77
559	0.05	0.26	0.13	0.39	7.378	268.75
533	0.05	0.27	0.12	0.39	6.989	268.72
508	0.06	0.28	0.12	0.40	6.595	268.70
483	0.06	0.28	0.12	0.40	6.199	268.67
457	0.06	0.29	0.12	0.40	5.799	268.65
432	0.06	0.29	0.11	0.41	5.396	268.62
406	0.06	0.30	0.11	0.41	4.990	268.60
381	0.06	0.30	0.11	0.41	4.581	268.57
356	0.06	0.30	0.11	0.41	4.170	268.55
330	0.06	0.31	0.11	0.42	3.757	268.52
305	0.06	0.31	0.11	0.42	3.341	268.49
279	0.06	0.31	0.11	0.42	2.923	268.47
254	0.06	0.32	0.10	0.42	2.503	268.44
229	0.00	0.00	0.23	0.23	2.081	268.42
203	0.00	0.00	0.23	0.23	1.850	268.39
178	0.00	0.00	0.23	0.23	1.619	268.37
152	0.00	0.00	0.23	0.23	1.388	268.34
127	0.00	0.00	0.23	0.23	1.156	268.32
102	0.00	0.00	0.23	0.23	0.925	268.29
76	0.00	0.00	0.23	0.23	0.694	268.27
51	0.00	0.00	0.23	0.23	0.463	268.24
25	0.00	0.00	0.23	0.23	0.231	268.22

StormTech
Detention • Retention • Water Quality
An ADS company

Isolator® Row O&M Manual

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

ADS®

THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

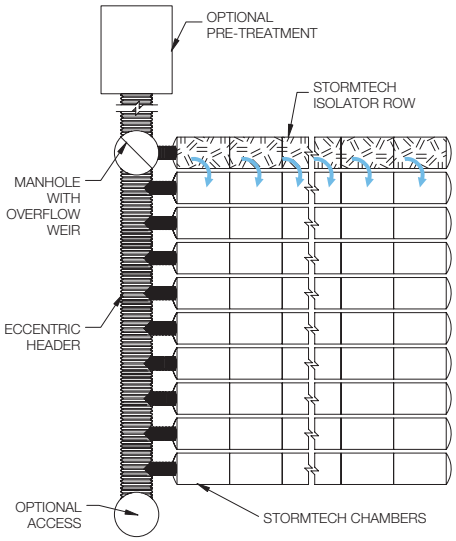
The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

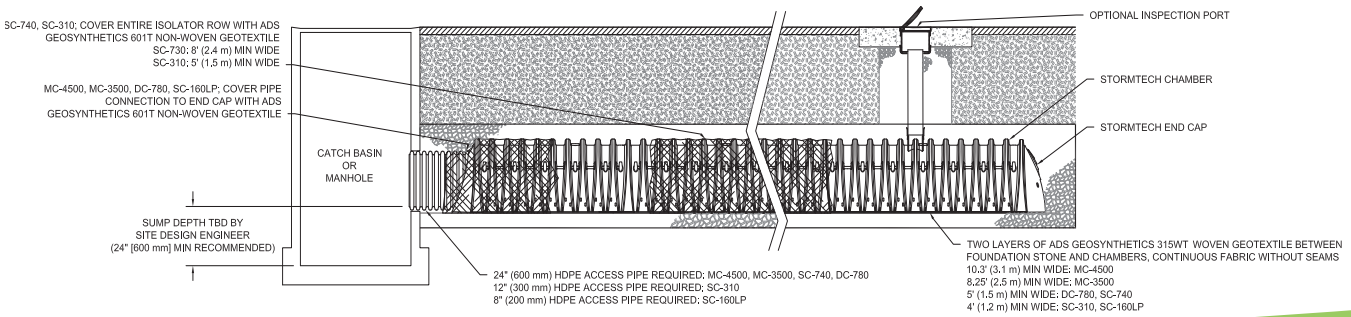
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



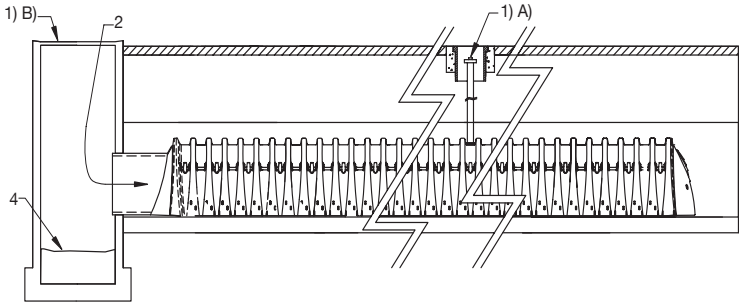
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.
- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
  - i. Remove cover from manhole at upstream end of Isolator Row
  - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

ADS "Terms and Conditions of Sale" are available on the ADS website, www.ads-pipe.com
The ADS logo and the Green Stripe are registered trademarks of Advanced Drainage Systems, Inc.
Stormtech® and the Isolator® Row are registered trademarks of StormTech, Inc.
© 2017 Advanced Drainage Systems, Inc. #11011 03/17 CS

StormTech® Detention • Retention • Water Quality
A division of ADS

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

Appendix G
Hydrant Test

HYDRATEST

JOB NO. _____ DATE: September 19, 2024

LOCATION 27 Winona Rd. Stoufville, ON

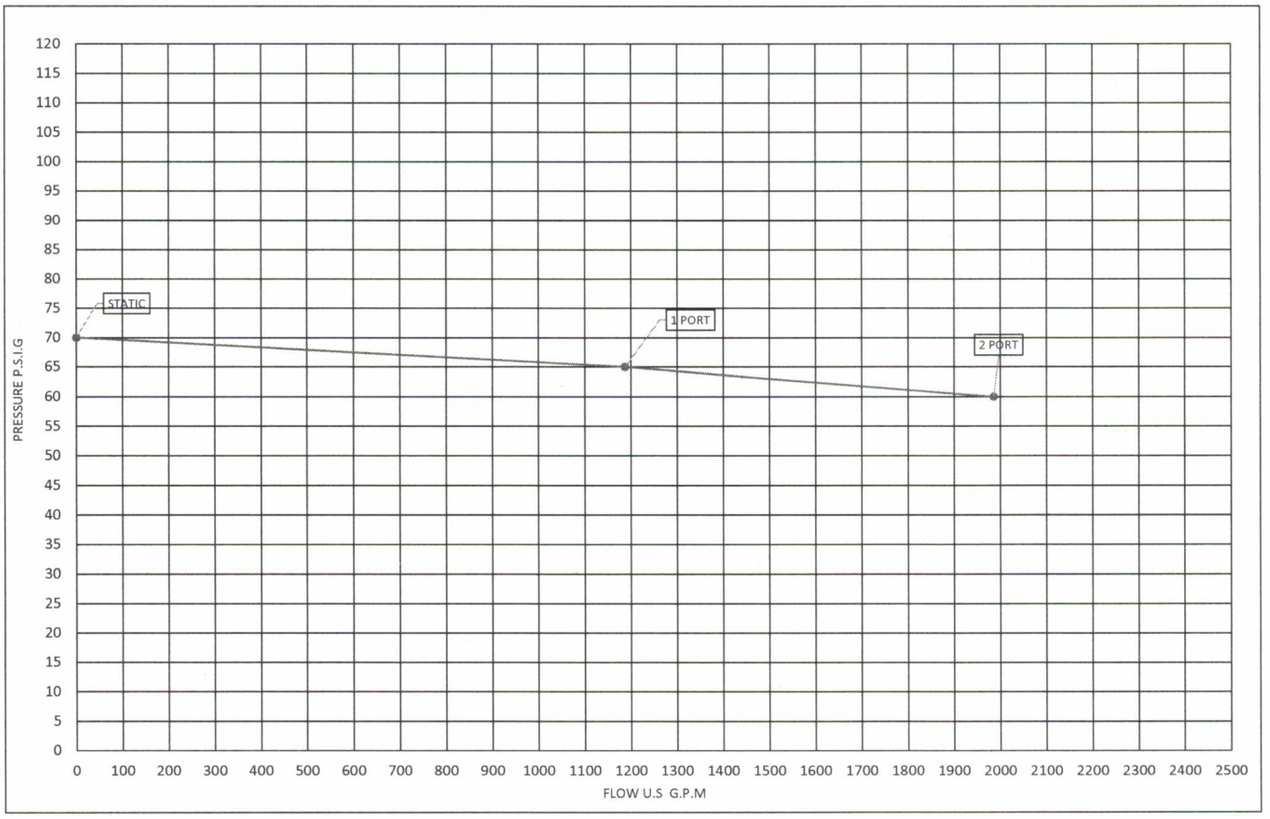
TIME OF TEST 8:30 AM

LOCATION OF TEST (FLOW) NW Corner of Main St. and Winona Dr.

(RESIDUAL) 341 Rupert Ave.

MAIN SIZE: 250mm/ 150mm STATIC PRESSURE: 70

Number of Outlets & Orifice Size	Pitot Presure	Flow (USGPM)	Residual Pressure
1 X $2^{1/2"}$ PORT	50	1187	65
2 X $2^{1/2"}$ PORTS	35	1986	60



COMMENTS: Class "AA" Hydrant- Light Blue

Authorized Signature: _____ Hydratest Signature: _____

Appendix I
Statement of Limiting Conditions and Assumptions

Statement of Limiting Conditions and Assumptions

1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other then the intended users has the right to use and rely on the work without first obtaining the written authorization of n Engineering and its Owners.
2. The comments, recommendations and material in this report reflect n Engineering best judgment in light of the information available to it at the time of preparation of this report. It is not qualified to and is not providing legal or planning advice in this work.
3. n Engineering expressly excludes liability to any third party except the Intended Users for any use of, and/or reliance upon, the work.
4. n Engineering notes that the following assumptions were made in completing the work
   a) The land use description(s) supplied n Engineer Inc. is correct;
   b) The surveys and other data supplied to n Engineering by the Owner are accurate;
   c) Market timing, approval delivery and secondary information are within the control of parties other then n Engineering;
   d) There are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances, which would significantly affect the use or servicing;
   Investigations have not carried out to verify these assumptions. n Engineering deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respect.
5. All the plans, photographs, and sketches prepared and presented in this report/study are included solely to aid the visualizing the location of the property, the boundaries of the site, and the relative position of the improvements on the said lands are based on information provided by Owner
6. n Engineering accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub soil conditions, environmental, Engineering or other factual and technical matters disclosed by the owner, the clients, or any public agency, which by their nature, may change the outcome of the work.
7. In the preparation of this report, n Engineering have made investigations from secondary sources as documented in the work, but did not checked compliance with by laws, codes, agency and government regulations, etc., unless specifically noted in the work.
8. The value of proposed improvements should apply only with regard to the purpose and function of the work, as outlined in the body of this work. Any cost estimated set out in the work based on construction averages and subject to change.
9. Neither possession of Work, nor a copy of it, carries the right of publication. All copyright in the work reserved to n Engineering and considered confidential by n Engineering. The Work shall not be disclosed, reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of n Engineering and the Owner.
10. The work is only valid if it bears the Professional Engineer's seal and original signature of author, and if considered in its entity. Responsibility for unauthorized alteration to the Work is denied.

End of the Statement

BLANK PAGE