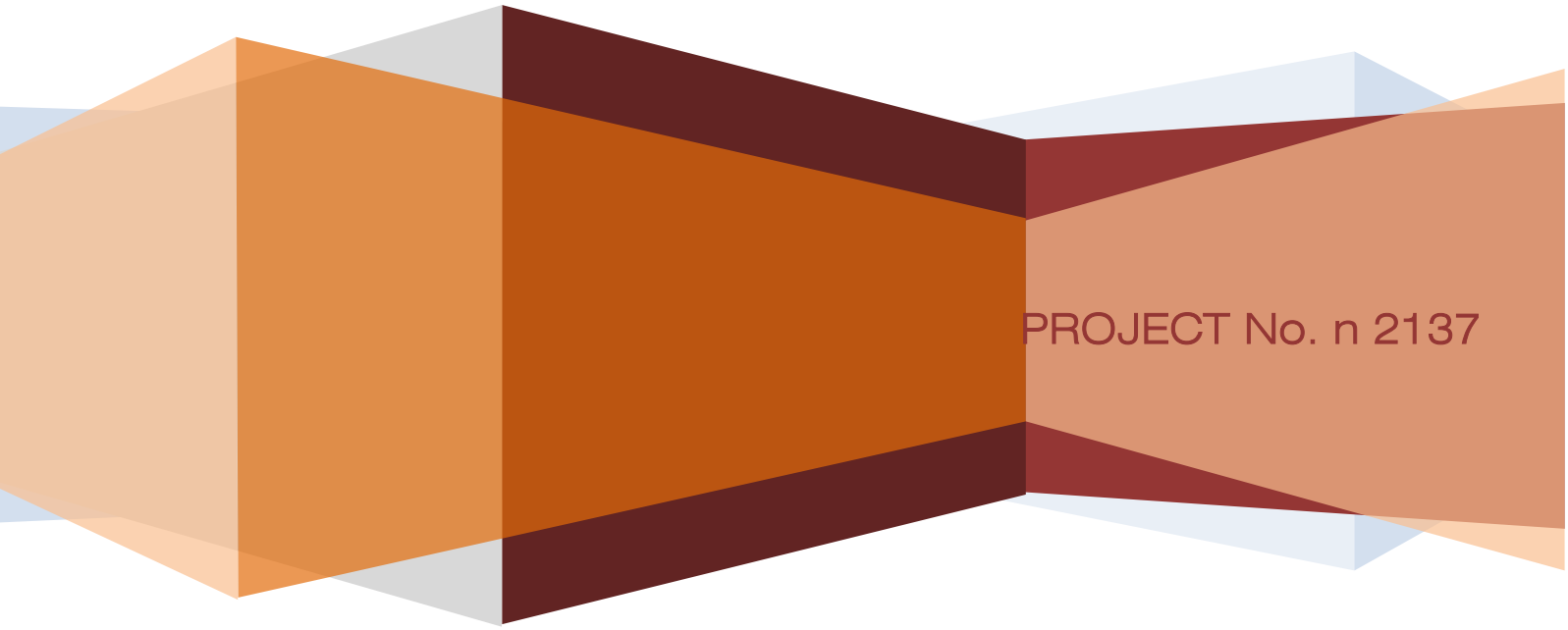
PROPOSED 2 STOREY SHOELESS JOE'S RESTAURANT AT

1144 HUGEL AVENUE, MIDLAND

TOWN OF MIDLAND, ONTARIO

Servicing and Stormwater Management Report



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May 17, 2023

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Revision No.	Date of Issue	Comments
01	March 01, 2023	Issued for SPA I
02	May 17, 2023	Re-issued for SPA I

1.0 INTRODUCTION

n Engineering Inc. is retained by the owner of the property to undertake the servicing and stormwater management design for the proposed property development. The purpose of this report is to present the storm water management, sanitary sewage disposal, water distribution and appropriate measures to mitigate the impact of storm runoff from the proposed development and also analysis the existing condition of the storm sewer to ensure the ability and accommodation for the post-development.

2.0 STUDY AREA

Site is located at north side of Hugel Avenue in the Town of Midland nearest major intersection is Hugel Avenue and County Road 93. The total area of the property is approximately 0.74 ha. The Key Plan is shown in Figure 1.

A legal and topographic survey has been prepared by F.S. Surveying Inc., dated 14th of April 2022 which identifies the site as part of the east-half of Lot 106 and part of Lot 107 Concession 1, formerly the Township of Tiny, now Town of Midland, County of Simcoe.

Figure 1 - Site Location Plan

3.0 PROPOSED DEVELOPMENT

The proponent for this site has proposed the addition to the pre-existing structure, while maintaining the current site grades. Comprehensive full-scale plans for site servicing, grading, and storm drainage have been submitted independently.

4.0 OBJECTIVES OF STORMWATER DRAINAGE AND SITE SERVICING

The report outlines proposed stormwater management (SWM) strategies that adhere to design guidelines and pre-consultation feedback from the Town of Midland. The study includes the following:

- Identifying the current site's runoff coefficient based on approved site servicing and grading plan acquired from Town;
- Identifying the site's post-development runoff coefficient;
- Assessing the change in "storm water" flow from pre-development to post-development conditions;
- Evaluating the existing "storm water" quality and quantity measures;
- Proposing alterations to the "storm water" quantity and quality control measures if necessary;
- Additionally, the report will discuss new site servicing requirements for water supply and sanitation;
- The proposed site servicing, grading, and erosion and sediment control plans will be submitted separately as full-scale drawings alongside the report.

Figure 2 - Site Existing Condition

5.0 EXISTING TOPOGRAPHY AND DRAINAGE PATTERN

The site encompasses a total area of roughly 0.74 hectares and comprises of a building, parking lot, and grassed area. Stormwater management on the site is currently facilitated by a Stormwater Management System, as delineated in Figure DR-101B attached in Appendix A. As per the approved Site Servicing Plan, the site is serviced by the following connections:

- A 300 mm diameter Storm Sewer that is linked to a Manhole (MH) located on the Town's right-of-way;

- A 100 mm diameter PVC pipe that is connected to the Town's 200 mm diameter Water Main, serving Domestic Water;
- A 150 mm diameter PVC pipe that is connected to the Town's 200 mm diameter Water Main, serving Fire Water;
- A 150 mm diameter Sanitary Sewer that is connected to a Manhole (MH) situated on the Town's right-of-way.

6.0 STORMWATER MANAGEMENT CRITERIA

StormWater Management Criteria for proposed development site determined based on following guidelines and manuals:

- Town of Midland, Engineering Development Design Standard, Revised December 2012;
- Severn Sound Remedial Action Plan Urban Stormwater management Strategy, December 1998;
- Ministry of the Environment Stormwater Management Planning and Design Manual, March 2003;
- Ministry of Environment, Design Guidelines for drinking-Water System,2008;
- Ministry of Environment, Design Guidelines for the sewage Works, 2008;
- 1991 Toronto Rainfall data from 16 Rain Gauge Stations;
- South Georgian Bay Lake Simcoe Source Protection Plan.

The criteria for proposed development are summarized below:

- **Water Quantity Control** - As per Town of Midland , Engineering Development Design Standard, Revised December 2012 , post development flows from 2 years to 100 years frequency storm shall not exceed the pre development runoff from the same frequency storm;
- **Water Quality Control** –Stormwater discharged from the post development site are required to meet a minimum 80% TSS removal or an enhanced (Level 1) of protection;
- **Water Balance -** As per pre consultation comment – the site is located within the well head protection area Q2 (WHPA-A2) and policy LUP-12 in the Approved South Georgian Bay Lake Simcoe Protection Plan would apply.
- **Erosion and Sediment Control During Construction -** The erosion potential of the study area to assessed using methods described in the MOE (2003) Manual, OPSS and OPSD of temporary erosion and sediment control measures suitable for construction sites close to major roads.

7.0 STORMWATER MANAGEMENT STUDY

7.1 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.

Table 1 – Comparison between Existing and Proposed Condition Land Use

LAND USE TYPE	PAVED AREA	ROOF AREA	GRASS AREA	TOTAL AREA
Existing Condition (m^2)	4518.83	1257.87	1651.70	7428.40
Existing Condition (%)	61%	17%	22%	100%
Proposed Condition (m^2)	4960.06	1523.42	944.92	7428.40
Proposed Condition (%)	67%	21%	13%	100%
Increase/Decrease (%)	6%	4%	-10%	

7.2 Runoff Coefficients

Runoff parameters used for site under existing and proposed conditions are shown in Table 2.

Table 2 – Runoff Coefficients

Land Use	Runoff Coefficient
Open Space <7% Slope	0.25
Impervious Area(Asphalt, Concrete)	0.95
Impervious Area (Roof Area)	0.95

Pre-development composite runoff coefficients are calculated based on existing land use and presented in Appendix B (Calculation Sheet 1). Post development catchment area is shown in DR 102 in Appendix A. Calculations for pre-development and post-development imperviousness are given in Appendix B and summarized below:

Table 3 – Composite Runoff Coefficients

Drainage Area	Runoff coefficient 'C' (Pre-development)	Runoff coefficient 'C' (Post-development)
Site	0.79	0.86

7.3 Peak Flow Rates

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

$$Q = 0.0028\ CIA$$

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

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

Where,
A, B, & C = Constant
t = Storm Duration (min)

Rainfall intensities were calculated using the rainfall intensity-duration-frequency (IDF) rainfall curve. The IDF values were obtained from the Town of Midland, Engineering Development Design Standard, as shown in Table 4.

Table 4 – IDF Parameters

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	807.440	1135.400	1387.000	1676.200	1973.100	2193.100
B	6.750	7.500	7.970	8.300	9.000	9.040
C	0.828	0.841	0.852	0.858	0.868	0.871

7.4 Pre-development Peak Flow

Pre-development peak flows are calculated based on existing land-use and presented in Calculation Sheet 1, Appendix B. The results are summarized in Table 5.

Table 5 – Pre-development Peak Flow

2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
103.35	135.70	157.39	184.39	204.99	225.36

(Unit of measurement L/sec)

7.5 Post-development Proposed Drainage Pattern and Peak Runoff Flow Rate

The proposed site development includes a mix of paved and grassed areas as well as a building. Proposed site grades designed to ensure that vehicular access will be unimpeded as well as provide surface storage for rainfall events. For the proposed development condition, the site is divided into sub-catchments as shown in Figure DR

102 (Appendix A). Runoff from these sub-catchments flows through existing inlets as presented in Site Servicing Plan (Drawing C2).

Post-development peak flow are calculated and presented in Calculation Sheet 2, Appendix B. The results are summarized in Table 6.

Table 6 – Post-development Peak Flow

2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
111.89	146.91	170.40	199.63	221.93	243.98

(Unit of measurement L/sec)

7.6 Uncontrolled Flow

Approved grading plan indicates that grassed area along property line left uncontrolled. Due to the grading limitation, drainage area UC1 as shown in figure DR102 is considered to be uncontrolled area. The uncontrolled flow is deducted from allowable flow to be discharge into the municipal storm system. The calculation of flow for the cumulated uncontrolled is shown on calculation sheet 3 Appendix B.

7.7 Comparison of Existing and Proposed Runoff Rates

Flow rates under different storm events calculated for both existing and proposed conditions using the Rational Method. Catchment areas and hydrologic parameters determined using the available landuse information and topographic maps (as shown in Figures DR-101B 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 used to create goals for the storm water management design. Table 7 presents the peak flow rates comparison for both existing and proposed conditions calculated for the entire site, while the detailed flow calculations are presented in Appendix B. It should be noted that the post-development flows in Tables 6 and 7 are to address the impact of the development only, and do not represent the final stormwater management design flows.

Table 7 – Comparison between Existing and Post-development Flow

CODITIONS/FLOW (L/SEC)	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
PRE-DEVELOPMENT	103.35	135.70	157.39	184.39	204.99	225.36
POST-DEVELOPMENT	111.89	146.91	170.40	199.63	221.93	243.98
INCREASE(DESCREASE)	8.54	11.21	13.01	15.24	16.94	18.62

7.8 Quantity Control

7.8.1 Allowable Discharge Rate

Allowable discharges (2 to 100 years) are calculated as per Town of Midland, Engineering Development Design Standard by deducting the uncontrolled flows from the pre-development flow. The calculations are presented in Appendix Dither Allowable flow from the proposed site:

Allowable flow = Pre-development flow – Uncontrolled flow

7.8.2 Orifice Control

Stormwater discharge from the site proposed to be controlled by replacing 124mm orifice plate with 280mm orifice plate installing at the outlet of storm manhole MH5 (Control Manhole). Orifice sizing calculations are presented in Appendix D as Table 1.

7.8.3 Storage for Quantity Control

Required detention storage calculated based on controlled flow and presented in Appendix D (Table 2A–2F). Allowable discharge rate, controlled flow rate and required detention storage is summarized in Table 8. The detention storage required based on 100 years rainfall event will be the maximum storage to be provided for the proposed development. Storage calculations are attached in Appendix D and summarized below in Table 8.

Table 8 – On-site Detention Storage:

Description	**Quantity (m^3)**
Required Storage	**21.64**
Catch Basin and Manhole	12.02
Pipes	16.24
Surface Ponding	107.78
Total Detention Storage Proposed	**136.04**

7.9 Water Quality Control

Quality control proposed to be achieved by using soft landscaped areas and an Oil/Grit Separator (OGS). The summary of total TSS removal from all Low Impact Development (LID) Best Management Practices (BMP) as shown in Table 9.

As per the attached Detailed Stormceptor Sizing Report (Appendix E) for the proposed site indicates that Stormceptor STC 1000 is will adequate to provide 80% of TSS removal. However, as per the servicing plan for super 8 motel provided by the Town, Stormceptor Model STC -1500 was designed – will provide adequate capacity to address the additional flow quality control from the site. Hence, existing Stormceptor model STC-1500 is used for quality control.

Table 9– TSS removal from all LID BMP

Surface Type	Treatment Method	Area (m^2)	Effective TSS Removal	% Area of Site	Overall TSS Removal (%)
Landscape	Inherent	944.9	80	12.72	10.18
Rooftop	Inherent	1523.4	80	20.51	16.41
Asphalt/Concrete Pavement	OGS(STC-1500)	4960.1	80	66.77	53.42
Total		*7428.4*		100.00	*80.00*

7.10 Water Balance

7.10.1 Water Balance Quantity Calculation

According to the Town's pre consultation comment, the property is located within the Wellhead Protection Area Q2 (WHPA-A2) and policy LUP-12 in the Approved South Georgian Bay Lake Simcoe Source Protection Plan would apply.

A Hydrogeological investigation was carried out for the site by Fisher engineering. Please refer to Hydrogeological investigation report prepared by Fisher Engineering dated 3rd May 2023 section 9 and Appendix F for water balance analysis detail. The summary of the water balance quantity is as below:

As per section 9 of the Hydrogeological investigation report, the average annual precipitation for the site is 1040.60 mm/year with an adjusted potential evapotranspiration of 613.74mm/year giving a water surplus of 408.86mm/year.

Post- Development Recharge:

Dificit in Infiltration: 247 m^3/yr

Total Area: 7428.40m^2

Dificit in Infiltration: 247 x 1000 / (7428.40) = 33.25 mm/yr

Annual precipitation percentage require for precipitation depth is calculated as:
Annual precipitation for the site = 1040.60mm/yr
% Annual Rainfall = 33.25 /1040.60 = **3.19%**

Based on % of total annual rainfall depth vs. daily rainfall amount curve derived from 1991 Toronto rainfall data from 16 rain gauge stations, statistically 100% of average rainfall event depths are 40mm and less, which means that if the proposed infiltration facility can capture 40mm rainfall event, it will capture 100% of total annual rainfall volume.

For 3.19% annual rainfall event the daily rainfall depth is 1.00 mm.
Therefore, require quantity for water balance = 7428.40* (1.0/1000) m^3 = **7.43 m^3**

7.10.2 Stormwater Infiltration Chamber

To accommodate the necessary retention storage a storm water infiltration chamber (Model MC-3500 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 stormwater infiltration chamber is summarized in Table 10 and the details are presented in Appendix F.

Table 10: Water Balance Volume

Description	Volume (m^3)
Total volume of Chamber (m^3)	9.15
Required Volume for Retention (m^3)	7.43
Volume Provided for Retention (m^3)	7.48

7.10.3 Permeability and Drawdown Calculation for Storm Chamber

The site was evaluated for potential application of infiltration based area. The Hydrogeological investigation carried out for the project by Fisher Engineering dated 3rd May 2023 provides the data regarding water table and permeability of underlying soils.

As per hydrogeological investigation report section 10 by Fisher Engineering, the estimated infiltration rate using factor of safety of 2.0 is 150 mm/hr.

The proposed storm water chamber (Model MC-3500) bottom elevation will be 242.96 m and surface elevation will be 245.93 m at this elevation, the infiltration rate is 150 mm/hr.

The proposed water balance volume to be infiltrated is 7.48 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 (m2)

V = Runoff volume to be infiltrated (m3)

P = Percolation rate of surrounding native soil (mm / hr.)

n = Porosity of the storage media (0.4 for storm chambers)

Δt = Retention time (72 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 72 hours.

Substituting the known values in the above equation:

A = (1000 x 7.48m3) / (150 mm per hour x 0.40 x 72 hours) = 1.73 m^2

It is proposed to provide an open bottom storm chamber with an available bottom surface area of 10.10m^2. The maximum draw down time considering safety correction factors for the provided storm chamber will be 12.34 hrs.

Hence, proposed storm chamber with capacity of 9.15m^3 for infiltration will satisfy water balance volume recharge requirement for the well head protection area Q2 (WHPA-A2) and policy LUP-12 in the Approved South Georgian Bay Lake Simcoe Source Protection Plan.

7.11 Erosion and Sediment Control during Construction

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 soil shall be stabilized as soon as possible with a seed and mulch application as directed by the Engineer.
- No construction activity or machinery shall intrude beyond the silt/snow fence or limit of construction area. All construction vehicles shall leave the site at designated locations as shown on the plans.
- Stockpiles of soil shall be set back from any watercourse and stabilized against erosion as soon as possible. A set back of at least 15m from any top-of-bank, watercourse or pond is required.
- Cleaning and repairs of mud-mats and any other temporary sediment control measures shall be completed as deemed necessary through regular inspection.
- Sediment/slit shall be removed from the sediment control devices after storm events and deposited in areas as approved by the engineer.

- 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.

8.0 MINOR SYSTEM DRAINAGE

Minor storm drainage (2-year storm event) is designed to convey stormwater to existing storm sewer (Refer: Drawing C2). Storm Sewer Design sheet attached at Appendix C.

9.0 MAJOR SYSTEM DRAINAGE

The overland flow impact on the building is not anticipated since the grading of the site designed for runoff from greater than 100 years rainfall event proposed to flow as overland flow through the south entrance without any impact to proposed buildings and adjacent site. Overland flow direction presented in Grading Plan (Drawing C1).

10.0 WATER DEMAND AND SERVICE CONNECTIONS

Water Demand

According to Town's design standards watermain design criteria, average demand for the commercial development is 450 L /Cap/ day.

Average Daily Demand for Restaurant = 0.01 L/s
Max. Daily demand peak factor =2.0
Max. Hourly Peak Factor = 4.5
Max. Day Demand = 1.37 L/s
Max. Hourly Demand = 3.08 L/s

The anticipated water demand for this development is 3.08 L/s for domestic use. Please refer Appendix G for water demand calculations.

As per servicing plan provided by Town for super 8 Motel, the existing motel is serviced by 100 mm watermain which is adequate for water service for additional restaurant. Therefore, the additional restaurant is proposed to be served by the existing 100mm domestic water supply.

Fire Flow Demand:

As per Fire Underwriter Survey, Fire flow demand calculated and presented in Appendix G.

Required Fire Flow: 33 L/Sec

A flow and pressure test will be performed on the nearest hydrant to the site, prior to building permit application to determine compliance with the minimum requirement for suppression outlined in the FUS.

As per servicing plan provided by Town for super 8 Motel, the existing motel is serviced by 150 mm fire watermain which is adequate for fire water service for additional restaurant. Therefore, the additional restaurant is proposed to be served by the existing 150mm fire water supply.

11.0 SANITARY DEMAND AND SERVICE CONNECTIONS

Sanitary Design Flow:

Sanitary design flow is calculated as per Town of Midland, Engineering Development Design Standard. The detail calculation are attached in Appendix H and summarized as below:

The average daily flow for commercial development = 2.5 L/day.m^2 of floor area. Maximum design flows are to be determined using average daily flow and the Harmon Peaking Factor.

Harmon's Peaking Factor is calculated based on the formula:

$$M = 1 + \frac{14}{4 + P^{0.50}}$$

Where M= ratio of peak flow to average flow
P = tributary population in thousands

Inflow/ Infiltration allowance is 0.23 l/sec/ha

The peak sanitary design flow from the proposed development is:

Total Flow = Infiltration + design flow
Total flow = (0.172 + 0.69) L/s = 0.86 L/s = 0.000868 m^3/sec

Sanitary Service Connection

By considering the min velocity of 0.75 m/sec the size of pipe is as below:

Q = AV → 0.000868 = A x 0.75
A = 0.00115 m^2 → D= 38.39 mm→ D= 50 mm

As per servicing plan provided by Town for super 8 Motel, the existing motel is serviced by 150 mm sanitary sewer pipe which is adequate for flow generated by additional restaurant. Therefore, the additional restaurant is proposed to be served by the existing 150mm sanitary service connection.

13.0 SUMMARY & CONCLUSIONS

This analysis presents a detailed stormwater management 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 stormwater management plan for the proposed development. There will be no negative impact or increase in stormwater peak flows under proposed controlled conditions. The drainage summary of our findings and drainage analysis for the subject property is as follows:

- Stormwater management design was performed for the subject site to provide flow quantity and quality control;
- The hydrologic and hydraulic analysis presented in this report addresses the existing and proposed site conditions;
- External agencies' criteria were collected and reviewed during the course of the study and all other available information was retrieved and reviewed;
- Impervious areas were calculated under both existing and proposed conditions and as expected, a significant increase in impervious areas was found;
- Preliminary design was performed for the proposed storm sewer network to convey the minor system runoff;
- Recommended quantity control measures for the site will be achieved through the use of a orifice plate;
- Adequate stormwater runoff storage for large design storms will be achieved through storage in manhole, catchbasin, pipes, storm chamber and surface ponding;
- An Oil/Grit Separator recommended to ensure the required water quality control will be achieved;
- Adequate Erosion and Sediment Control measures have been proposed; and
- These measures will provide the necessary quantity and quality control to meet the criteria provided by the Town of Midland.

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

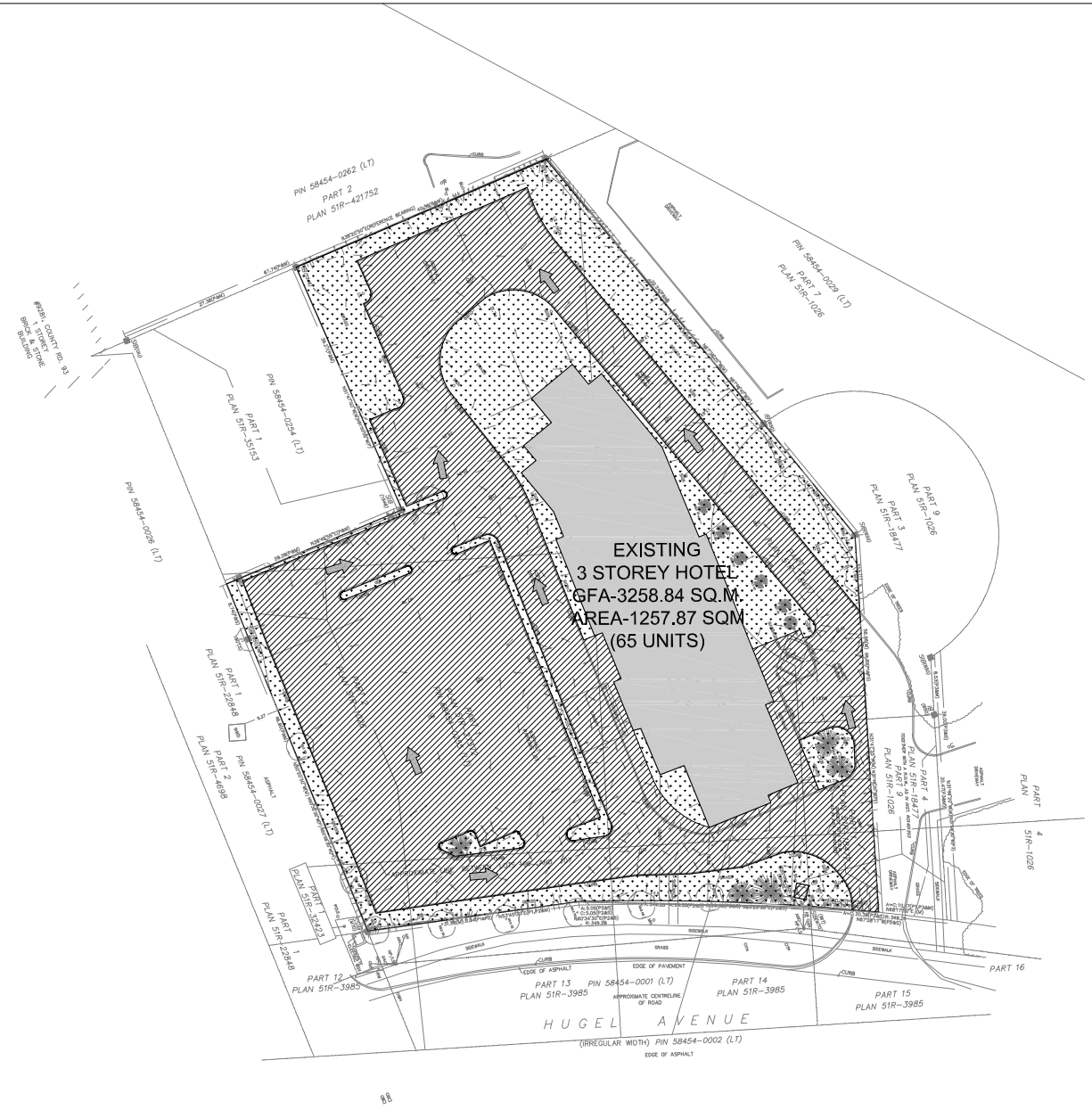
Respectfully Submitted,

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

EX.B — DRAINAGE AREA IDENTIFICATION

1.006 — AREA IN HA.

0.500 — RUNOFF COEFFICIENT

	DRAINAGE BOUNDARY
	SITE BOUNDARY
	PARCEL BOUNDARY
	OVERLAND FLOW
	MINOR FLOW DIRECTION

PRE-DEVELOPMENT LAND USE TABLE

LAND COVER	HATCH	AREA (SQ.M.)	RUNOFF CO-EFFICIENT
ROOF		1257.87	0.95
LANDSCAPED		1989.30	0.25
CONCRETE/ASPHALT		4181.23	0.95

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PROJECT:

SHOELESS JOE'S RESTAURANT
1144 HUGEL AVE
MIDLAND, ONTARIO

DRAWING TITLE:

PRE-DEVELOPMENT DRAINAGE PLAN AS PER SURVEY PLAN

DRAWN BY: SA	DATE: 25 AUG. 2022
CHECKED BY: AZ	SCALE: 1:1000
PROJECT NO.: **21-37**	DRAWING NO.: **DR-101A**

(GEODETIC NORTH) N

PROJECT NORTH

LEGEND

EX.B — DRAINAGE AREA IDENTIFICATION; 1.006 — AREA IN HA.; 0.500 — RUNOFF COEFFICIENT	
(line)	DRAINAGE BOUNDARY
(line)	SITE BOUNDARY
(line)	PARCEL BOUNDARY
(arrow)	OVERLAND FLOW

PRE-DEVELOPMENT LAND USE TABLE

LAND COVER	HATCH	AREA (SQ.M.)	RUNOFF CO-EFFICIENT
ROOF		1257.87	0.95
LANDSCAPED		1651.70	0.25
CONCRETE/ASPHALT		4518.83	0.95

NOTE:
THE PLAN REPRESENTS THE APPROVED SITE SERVICING & GRADING PLAN DATED SEPT./2005.

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PROJECT:
SHOELESS JOE'S RESTAURANT
1144 HUGEL AVE
MIDLAND, ONTARIO

DRAWING TITLE:
PRE-DEVELOPMENT DRAINAGE PLAN AS PER APPROVED SITE SERVICING AND GRADING PLAN

DRAWN BY: SA	DATE: 25 AUG. 2022
CHECKED BY: AZ	SCALE: 1:1000
PROJECT NO.: **21-37**	DRAWING NO.: **DR-101B**

N
(GEODETIC NORTH)
PROJECT NORTH

LEGEND

DRAINAGE AREA IDENTIFICATION

A1 / 1.006 / 0.500

AREA IN HA. — RUNOFF COEFFICIENT

DRAINAGE BOUNDARY

SITE BOUNDARY

PARCEL BOUNDARY

OVERLAND FLOW

POST-DEVELOPMENT LAND USE TABLE

LAND COVER	HATCH	AREA (SQ.M.)	RUNOFF CO-EFFICIENT
ROOF		1523.42	0.95
LANDSCAPED		944.92	0.25
CONCRETE/ASPHALT		4960.06	0.95

SUB-CATCHMENT AREA

SUB AREA	BUILDING (m)²	LANDSCAPE (m²)	CONC./ ASPHALT (m²)	TOTAL AREA (m²)
A1	0.00	0.00	384.73	384.73
A2	0.00	0.00	516.25	516.25
A3	0.00	3.70	800.97	804.67
A4	0.00	42.81	772.67	815.48
A5	0.00	165.98	1469.6	1635.58
A6	0.00	246.22	555.71	801.93
A7	0.00	250.81	273.68	524.49
A8	0.00	71.43	186.45	257.88
B1	1523.42	0.00	0.00	1523.42
UC1	0.00	163.97	0.00	163.97
TOTAL	1523.42	944.92	4960.06	7428.4

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PROJECT:

SHOELESS JOE'S RESTAURANT
1144 HUGEL AVE
MIDLAND, ONTARIO

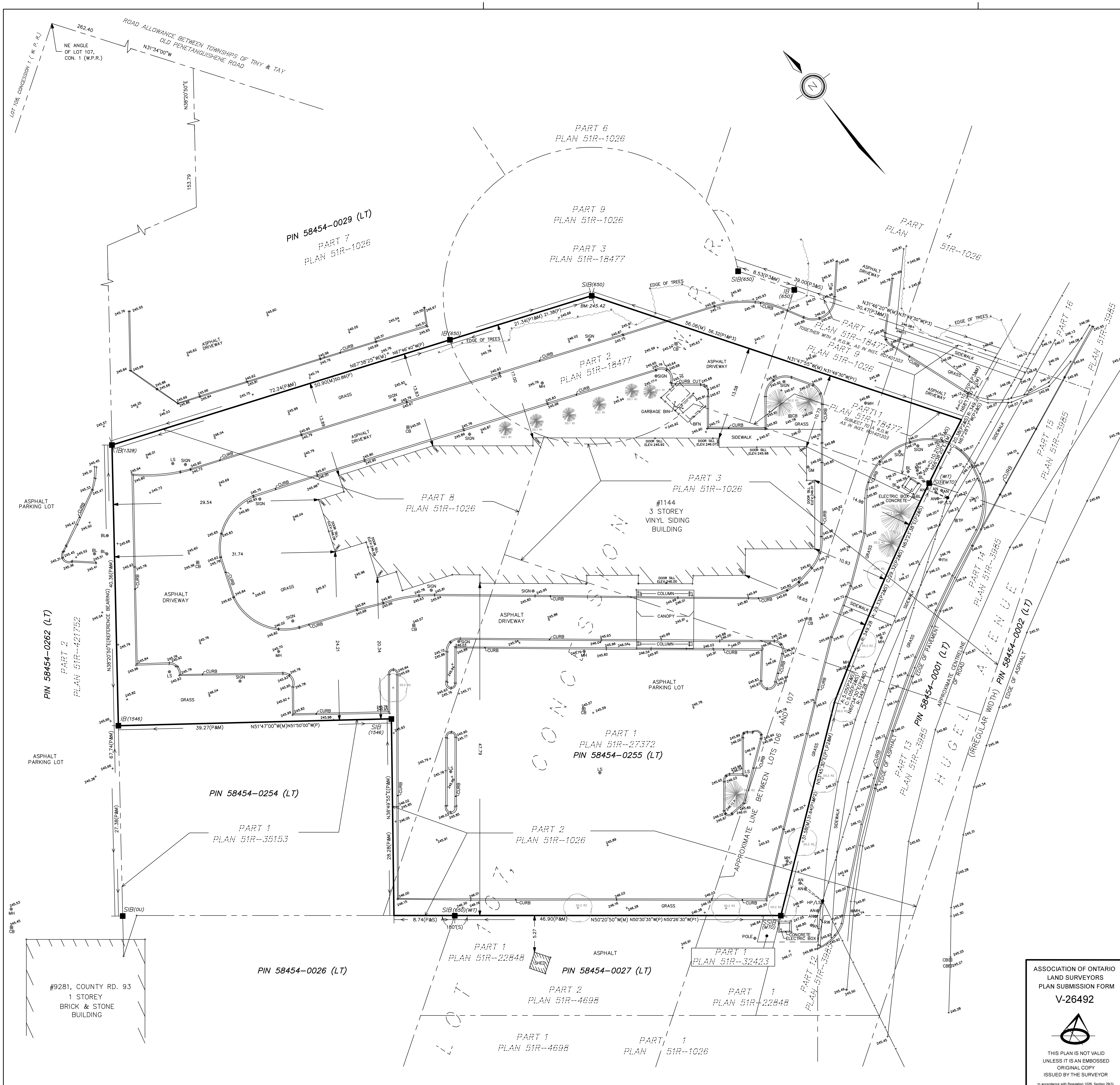
DRAWING TITLE:

POST-DEVELOPMENT DRAINAGE PLAN

DRAWN BY: SA	DATE: 25 AUG. 2022
CHECKED BY: AZ	SCALE: 1:1000
PROJECT NO.: **21-37**	DRAWING NO.: **DR-102**

(GEODETIC NORTH) N

PROJECT NORTH



SURVEYOR'S REAL PROPERTY REPORT

PART 1 - PLAN

PLAN OF SURVEY OF

PART OF THE EAST-HALF OF LOT 106
AND PART OF LOT 107
CONCESSION 1
FORMERLY THE TOWNSHIP OF TINY
NOW TOWN OF MIDLAND
(COUNTY OF SIMCOE)

FARZAD SALEHI, OLS
SCALE: 1 : 350
0 m, 4 m, 8 m, 16 m, 24 m

LEGEND

■	DENOTES – SURVEY MONUMENT FOUND
□	DENOTES – SURVEY MONUMENT PLANTED
M	DENOTES – MEASURED
S	DENOTES – SET
P	DENOTES – PLAN 51R–35153
P1	DENOTES – PLAN 51R–27372
P2	DENOTES – PLAN 51R–3985
P3	DENOTES – PLAN 51R–18477
IB	DENOTES – IRON BAR
SIB	DENOTES – STANDARD IRON BAR
(MTO)	DENOTES – MINISTRY OF TRANSPORTATION OF ONTARIO
(650)	DENOTES – C. P. O'DALE, OLS
(1328)	DENOTES – H. L. MELLISH, OLS
(1546)	DENOTES – RUDY MAK SURVEYING LTD., OLS
(OU)	DENOTES – ORIGIN UNKNOWN
TP	DENOTES – TELEPHONE PEDESTAL
	DENOTES – CONIFEROUS TREE
	DENOTES – DECIDUOUS TREE
HP/LS	DENOTES – HYDRO POLE/HYDRO POLE WITH LIGHT STANDARD
BFN	DENOTES – BOARD FENCE
CLF	DENOTES – CHAIN LINK FENCE
AN	DENOTES – ANCHOR
GM	DENOTES – GAS METER
MH	DENOTES – MANHOLE
CB	DENOTES – CATCH BASIN
BL	DENOTES – BOLLARD
FH	DENOTES – FIRE HYDRANT
RW	DENOTES – RETAINING WALL
LS	DENOTES – LIGHT STANDARD
BM	DENOTES – SITE BENCH MARK

METRIC NOTE

DISTANCES & CO-ORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

BEARING NOTE

BEARINGS ARE ASTRONOMIC, AND ARE REFERRED TO THE WESTERLY LIMIT OF HUGEL AVENUE AS SHOWN ON PLAN 51R-27372, HAVING A BEARING OF N38°20'50"E.

ELEVATION NOTE

ELEVATIONS SHOWN HEREON ARE GEODETIC, AND ARE FROM REAL TIME NETWORK GPS READINGS PROVIDED BY CAN-NET AND TOTAL STATION, AND ARE IN GEOID MODEL CGG2013.

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PART 2 - REPORT

REGISTERED EASEMENTS AND/OR RIGHT-OF-WAY:

TOGETHER WITH A RIGHT OF WAY FOR VEHICLES AND PEDESTRIANS OVER PART 4, PLAN 51R-18477, AS IN INSTRUMENT No. RO1401203.

SUBJECT TO A RIGHT OF WAY FOR VEHICLES AND PEDESTRIANS OVER PART 4, PLAN 51R-18477, AS IN INSTRUMENT No. RO1401203.

COMPLIANCE WITH MUNICIPAL ZONING BY-LAWS

THIS PLAN DOES NOT CERTIFY ZONING COMPLIANCE.

BOUNDARY FEATURES

*NOTE THE LOCATION OF THE FENCES AROUND THE SUBJECT PROPERTY.

*ALL BUILDING TIES ARE PERPENDICULAR TO PROPERTY LINES UNLESS OTHERWISE NOTED.

*THIS REPORT WAS PREPARED FOR UNITED HOTELS INC. AND UNDERSIGNED ACCEPTS NO RESPONSABILITY OF USE BY OTHER PARTIES.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM;
2. THE SURVEY WAS COMPLETED ON THE 11th DAY OF APRIL, 2022.

NORTH YORK, ONTARIO
APRIL 14, 2022

FARZAD SALEHI
ONTARIO LAND SURVEYOR

F.S. SURVEYING INC.

7 COLWICK DRIVE
NORTH YORK, ON M2K 2G2
416-786-8080

F. S. SURVEYING INC.

DATE	PARTY CHIEF	DRAWN BY	PROJECT No.
APRIL 14, 2022	F. SALEHI	N. RABIEI	2022–009

Appendix B
Pre, Post Development & Uncontrolled Flow Analysis

n Engineering Inc

Calculation Sheet 1

(Based on Approved Plans)

Project:	**SHOELESS JOE'S RESTAURANT**
Address:	**1144 HUGEL AVENUE**
Town/Township/City	**TOWN OF MIDLAND**
Project No.	**n2137**
Proposed Development Area (m^2)	**7428.4**

PRE-DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ROOF	1257.87	0.95	1194.98
LANDSCAPED AREA	1651.70	0.25	412.93
CONC./ASPHALT	4518.83	0.95	4292.89
		ΣAREA X C	5900.79
		WEIGHTED AVERAGE "C"	**0.79**
		AREA "A" (Hectares)	0.74

Rainfall Intensity:

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

Where:

i = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

C = coefficient

t =Time of concentration (min) 15.00

Design Flow:

$$Q = 0.0028\, xAxCxI$$

Where:

Q= design flow (m3/s)

c = runoff coefficient (dimensionless)

i = average rainfall intensity (mm/hr)

A = drainage area (ha)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	807.440	1135.400	1387.000	1676.200	1973.100	2193.100
B	6.750	7.500	7.970	8.300	9.000	9.040
C	0.828	0.841	0.852	0.858	0.868	0.871
t (mins)	15.00	15.00	15.00	15.00	15.00	15.00
i (mm/hr)	63.05	82.79	96.02	112.50	125.06	137.49
Weighted Avg. C	0.79	0.79	0.79	0.79	0.79	0.79
Q (l/sec)	103.35	135.70	157.39	184.39	204.99	225.36
Pre-development Flow(m^3/sec)	**0.103**	**0.136**	**0.157**	**0.184**	**0.205**	**0.225**

Note: Pre-development land-use calculated based on Approved Plans (dated Nov 19, 2008)

n Engineering Inc

Calculation Sheet 2

Project:	**SHOELESS JOE'S RESTAURANT**
Address:	**1144 HUGEL AVENUE**
Town/Township/City	**TOWN OF MIDLAND**
Project No.	**n2137**
Proposed Development Area (m^2)	**7428.4**

POST DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ROOF	1523.42	0.95	1447.25
LANDSCAPED AREA	944.92	0.25	236.23
CONC./ASPHALT	4960.06	0.95	4712.06
		ΣAREA X C	6395.54
		WEIGHTED AVERAGE "C"	**0.86**
		AREA "A" (Hectares)	0.74

Rainfall intensity:

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

Where:

i = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

C = coefficient

t =Time of concentration (min) 15.00

Design Flow:

$$Q = 0.0028\,xAxCxI$$

Where:

Q= Design flow (m^3/s)

c = Runoff coefficient (dimensionless)

i = Average rainfall intensity (mm/hr)

A = Drainage area (ha)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	807.44	1135.40	1387.00	1676.20	1973.10	2193.10
B	6.750	7.500	7.970	8.300	9.000	9.040
C	0.828	0.841	0.852	0.858	0.868	0.871
t (mins)	15.00	15.00	15.00	15.00	15.00	15.00
i (mm/hr)	63.05	82.79	96.02	112.50	125.06	137.49
Weighted Avg. C	0.86	0.86	0.86	0.86	0.86	0.86
Q (l/sec)	111.89	146.91	170.40	199.63	221.93	243.98
Q(m^3/sec)	0.112	0.147	0.170	0.200	0.222	0.244

Note: Post-development land-use calculated based on Proposed Plans (dated Nov 19, 2008)

n Engineering Inc

Calculation Sheet 3

(Uncontrolled Flow)

Project:	**SHOELESS JOE'S RESTAURANT**
Address:	**1144 HUGEL AVENUE**
Town/Township/City	**TOWN OF MIDLAND**
Project No.	**n2137**
Proposed Development Area (m^2)	**7428.4**

POST DEVELOPMENT RUNOFF COFFICENT (Uncontrolled)

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ROOF	0.00	0.95	0.00
LANDSCAPED AREA	163.97	0.25	40.99
CONC./ASPHALT	0.00	0.95	0.00
		ΣAREA X C	40.99
		WEIGHTED AVERAGE "C"	**0.25**
		AREA "A" (Hectares)	0.02

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

Where:
I = Rainfall Intensity (mm/hr)
A = coefficient
B = coefficient
C = coefficient
t =Time of concentration (min) 15.00
Design Flow:

$$Q = 0.0028\, xAxCxI$$

Where:
Q= design flow (m3/s)
C = runoff coefficient (dimensionless)
I = average rainfall intensity (mm/hr)
A = drainage area (ha)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	807.44	1135.40	1387.00	1676.20	1973.10	2193.10
B	6.750	7.500	7.970	8.300	9.000	9.040
C	0.781	0.766	0.760	0.757	0.751	0.759
t (mins)	15.00	15.00	15.00	15.00	15.00	15.00
I (mm/hr)	176.64	236.56	279.75	330.24	371.17	403.96
C	0.25	0.25	0.25	0.25	0.25	0.25
Q (l/sec)	2.01	2.69	3.19	3.76	4.23	**4.60**
Q(m^3/sec)	0.002	0.003	0.003	0.004	0.004	0.005

Note: Post-development land-use calculated based on Proposed Plans (dated Nov 19, 2008)

Appendix C
Storm Drainage Design Sheet

PREPARED BY: L.U.
DATE PREPARED 17-May-23

Storm Sewer Design Chart
For Circular Drains Flowing Full
SHOELESS JOE'S RESTAURANT
1144 HUGEL AVENUE
TOWN OF MIDLAND
n2137

IDF CURVE	
Constants	2 -yrs
a	807.44
b	6.75
c	0.83

Tc (start): 15.00 min

Catchments								Hydrology		Hydraulics						
Catchment ID	Total Area (m^2)	Captured By	Outlet to	Runoff Coeff. "R"	A x R	ACC. ΣA x R	t_d (min)	Rainfall Intensity, I_2	Peak Flow (m^3/sec) $Q_{2\text{-yrs}}$	STORM SEWER DESIGN INFORMATION size (mm)	slope (%)	length (m)	Q full (m^3/s)	V full (m/s)	TIME SECT. (min)	% FLOW
A2	516.25	EX. CB1	EX. STM MH1	0.95	0.05	0.05	15.00	161.20	0.022	250	0.50	20.0	0.050	1.012	0.33	44%
A1	384.73	EX.CB2	PIPE	0.95	0.04	0.04	15.00	161.20	0.016	250	0.50	7.0	0.050	1.012	0.12	33%
A7	524.49	EX.CB3	PIPE	0.62	0.03	0.03	15.00	161.20	0.014	250	0.50	2.0	0.050	1.012	0.03	29%
Conveyance		EX. STM MH1	EX. CBMH2			0.12	15.33	161.10	0.053	300	0.50	46.0	0.081	1.143	0.67	65%
A6	801.93	EX.CB4	PIPE	0.74	0.06	0.06	15.00	161.20	0.026	250	0.50	4.0	0.050	1.012	0.07	53%
A8	257.88	EX. CBMH2	EX. STMH5	0.76	0.02	0.14	15.44	161.06	0.062	300	0.50	37.0	0.081	1.143	0.54	76%
A3	804.67	EX. CB5	EX. STM MH3	0.95	0.08	0.08	15.00	161.20	0.034	250	0.50	17.0	0.050	1.012	0.28	69%
A4	815.48	EX. CB6	PIPE	0.91	0.07	0.07	15.00	161.20	0.033	250	0.50	3.0	0.050	1.012	0.05	67%
Conveyance		EX. STM MH3	EX. STM MH4			0.15	15.28	161.11	0.067	300	0.50	44.0	0.081	1.143	0.64	84%
A5	1635.58	EX. CB7	EX. STM MH4	0.88	0.14	0.14	15.00	161.20	0.064	300	0.50	8.0	0.081	1.143	0.12	80%
B1	1523.42	ROOF	STM CHAMBER	0.95	0.14	0.14	15.00	161.20	0.065	250	1.00	4.0	0.070	1.432	0.05	92%
Conveyance		STM CHAMBER	EX. STM MH4			0.14	15.05	161.19	0.065	250	1.00	3.0	0.070	1.432	0.03	92%
Conveyance		EX. STM MH4	EX. STMH5			0.28	15.08	161.18	0.126	375	0.50	35.0	0.147	1.326	0.44	86%
Conveyance		EX. STMH5	STORMCEPTOR STA 1500			0.28	15.52	161.04	0.126	300	0.50	2.0	0.081	1.143	0.03	Orifice Control
		STORMCEPTOR STA 1500	EX. STM MH10			0.28	15.61	161.01	0.126	300	0.50	6.0	0.081	1.143	0.09	

100 YRS Orifice Control flow =219.94 L/sec at STMH5

Appendix D
Orifice Pipe Sizing
Onsite Detention Storage

n Engineering Inc

Table 1
Orifice Sizing Calculations
SHOELESS JOE'S RESTAURANT

Project:	SHOELESS JOE'S RESTAURANT
Address:	1144 HUGEL AVENUE
Town/Township/City	TOWN OF MIDLAND
Project No.	n2137
Proposed Development Area (m^2)	7428.4

Orifice Location	STMH5	
Orifice Type	Orifice Plate	
Orifice Invert Elevation	243.940	m
Min. Ground Elevation	245.520	m
Orifice Center Elevation	244.080	
Diameter of Orifice Pipe	280	mm
Area of Orifice (A)	0.061544	m^2
Coefficient of Discharge (C_d)	0.63	
Gravitational Constant	9.81	

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

	2 years	5 years	10 years	25 years	50 years	100 years
Ponding Depth (m)	0.00	0.00	0.00	0.00	0.00	0.20
Water Elevation	244.42	244.67	244.88	245.18	245.44	245.72
Upstearm Head (m)	0.340	0.590	0.800	1.100	1.360	1.640
Controlled Discharge (L/sec)	**100.14**	**131.92**	**153.61**	**180.12**	**200.28**	**219.94**
Discharge Velocity (m/sec)	1.63	2.14	2.50	2.93	3.25	3.57
Uncontrolled Flow (L/sec)	2.01	2.69	3.19	3.76	4.23	4.60
Pre-development Flow(L/sec) (2 yrs)	103.35	135.70	157.39	184.39	204.99	225.36
Allowable Flow (L/sec)	**101.34**	**133.00**	**154.20**	**180.63**	**200.76**	**220.76**
Detention Storage Required (m^3)	**10.57**	**14.55**	**24.83**	**29.53**	**31.94**	**21.64**
Storage Used in MH (m^3)	12.02	12.02	12.02	12.02	12.02	12.02
Storage Used in Pipe (m^3)	16.24	16.24	16.24	16.24	16.24	16.24
Storage Ponding Used (m^3)	0.00	0.00	0.00	107.78	107.78	107.78
Proposed Available Storage	**28.26**	**28.26**	**28.26**	**136.04**	**136.04**	**136.04**

n Engineering Inc

On-Site Avaiable Storage Calculator

SHOELESS JOE'S RESTAURANT

Table 3 - Available Storage (100 years Proposed)

Project:	**SHOELESS JOE'S RESTAURANT**
Address:	**1144 HUGEL AVENUE**
own/Township/City	**TOWN OF MIDLAND**
Project No.:	**n2137**

CB/CBMH — **HWL** **245.72**

Description	Length/dia. (m)	Width (m)	Lowest Invert Elevation	Height (m)	Volume (m^3)
EX.CB1	0.6	0.6	244.52	1.20	0.43
EX.CB2	0.6	0.6	244.44	1.28	0.46
EX.CB3	0.6	0.6	244.38	1.34	0.48
EX.CB4	0.6	0.6	244.02	1.70	0.61
EX.CB5	0.6	0.6	244.50	1.22	0.44
EX.CB6	0.6	0.6	244.37	1.35	0.49
EX.CB7	0.6	0.6	244.21	1.51	0.54
EX.MH1	1.2		244.43	1.29	1.46
EX.CBMH2	1.2		244.13	1.59	1.80
EX. MH3	1.2		244.37	1.35	1.53
EX. MH4	1.2		244.16	1.56	1.76
EX. MH5	1.2		243.94	1.78	2.01
TOTAL					12.02

PIPES

FROM MH	TO MH	Length		DIA	Volume
EX. CB1	EX. STM MH1	20.0		250	1.00
EX. STM MH1	EX. CBMH2	46.0		300	3.25
EX.CB2	PIPE	7.0		250	0.35
EX.CB3	PIPE	2.0		250	0.10
EX. CBMH2	EX. STMH5	37.0		300	2.61
EX.CB4	PIPE	4.0		250	0.20
EX. CB5	EX. STM MH3	17.0		250	0.85
EX. STM MH3	EX. STM MH4	44.0		300	3.11
EX. CB6	PIPE	3.0		250	0.15
EX. CB7	EX. STM MH4	8.0		300	0.57
ROOF	STM CHAMBER	4.0		250	0.20
STM CHAMBER	EX. STM MH4	3.0		250	0.15
EX. STM MH4	EX. STMH5	35.0		375	3.69
TOTAL					16.24

PONDING AREA

Ponding Location	Inlet Elevation	Ponding Depth (m)	Ponding Area (m^2)	Ponding Volume
EX.CB1	245.55	0.17	201.20	11.29
EX.CB2	245.54	0.18	294.06	17.47
EX.CB4	245.52	0.20	261.27	17.24
EX. CB5	245.56	0.16	399.92	21.12
Ex. CB6	245.57	0.15	420.11	20.80
EX.CB7	245.57	0.15	401.44	19.87
TOTAL				107.78

Total Available Volume (m^3)	**136.04**
Maximum Required Volume (m^3)	**21.64**

n Engineering Inc

On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2A - 2 Years Storage

Equation of IDF:

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

R = 0.86

A = 0.74 ha

$Q_{release}$ = 0.100 m^3/s

100.14 L/s

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

A= 807.44

B= 6.75

C= 0.828

				Max. Storage Required (m^3)	10.57
t_c (min)	i_2 (mm/hr)	Q_2 (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	Comments
15	63.05	0.112	0.012	10.572	***
16	60.75	0.108	0.008	7.352	
17	58.62	0.104	0.004	3.964	
18	56.65	0.101	0.000	0.426	

n Engineering Inc

On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2B - 5 Years Storage

Equation of IDF:

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

R = 0.86

A = 0.74 ha

$Q_{release}$ = 0.132 m^3/s

131.92 L/s

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

A= 1135.4

B= 7.5

C= 0.841

				Max. Storage Required (m^3)	14.55
t_c (min)	i_5 (mm/hr)	Q_5 (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	Comments
15	82.79	0.148	0.016	14.552	***
16	79.81	0.143	0.011	10.417	
17	77.07	0.138	0.006	6.053	
18	74.52	0.133	0.001	1.483	

n Engineering Inc

On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2C - 10 Years Storage

Equation of IDF:

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

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (min)

R =	0.86	
A =	0.74	ha
$Q_{release}$ =	0.154	m^3/s
	153.61	L/s

A= 975.865

B= 4.699

C= 0.76

				Max. Storage Required (m^3)	24.83
t_c	i_{10}	Q_{10}	Q_{stored}	Peak Volume	Comments
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	
15	101.30	0.181	0.028	24.833	***
16	97.56	0.175	0.021	20.063	
17	94.12	0.168	0.015	15.048	
18	90.95	0.163	0.009	9.812	
19	88.02	0.157	0.004	4.379	

n Engineering Inc

On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2D - 25 Years Storage

Equation of IDF:

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

R = 0.86

A = 0.74 ha

$Q_{release}$ = 0.180 m^3/s

180.12 L/s

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

A= 1146.275

B= 4.922

C= 0.757

				Max. Storage Required (m^3)	29.53
t_c (min)	i_{25} (mm/hr)	Q_{25} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	Comments
15	119.04	0.213	0.033	29.529	***
16	114.71	0.205	0.025	24.058	
17	110.72	0.198	0.018	18.293	
18	107.05	0.191	0.011	12.267	
19	103.64	0.185	0.005	6.005	

n Engineering Inc

On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2E - 50 Years Storage

Equation of IDF:

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

R = 0.86

A = 0.74 ha

$Q_{release}$ = 0.200 m^3/s

200.28 L/s

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

A= 1236.152

B= 4.699

C= 0.751

				Max. Storage Required (m^3)	**31.94**
t_c	i_{50}	Q_{50}	Q_{stored}	Peak Volume	**Comments**
(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3)	
15	131.81	0.236	0.035	31.942	***
16	127.00	0.227	0.027	25.808	
17	122.58	0.219	0.019	19.355	
18	118.50	0.212	0.012	12.615	
19	114.72	0.205	0.005	5.618	

n Engineering Inc

On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2F - 100 Years Storage

Equation of IDF:

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

R = 0.86

A = 0.74 ha

$Q_{release}$ = 0.220 m^3/s

219.94 L/s

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

A= 2193.1

B= 9.04

C= 0.871

				Max. Storage Required (m^3)	21.64
t_c (min)	i_{100} (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	Comments
15	137.49	0.244	0.024	21.640	**MAX**
16	132.69	0.235	0.016	14.914	
17	128.24	0.228	0.008	7.792	
18	124.10	0.220	0.000	0.314	

Appendix E
OGS Sizing Summary

Detailed Stormceptor Sizing Report – Shoeless Joe's

Project Information & Location			
Project Name	Shoeless Joe's	**Project Number**	n2137
City	Mindland	**State/ Province**	Ontario
Country	Canada	**Date**	2/27/2023
Designer Information		**EOR Information (optional)**	
Name	Abu Ziauddin	**Name**	
Company	n Engineering Inc.	**Company**	
Phone #	905-597-5937	**Phone #**	
Email	az@nengineering.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Shoeless Joe's
Recommended Stormceptor Model	STC 1000
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	80
PSD	Fine Distribution
Rainfall Station	BARRIE WPCC

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 300	69
STC 750	79
STC 1000	80
STC 1500	81
STC 2000	84
STC 3000	86
STC 4000	88
STC 5000	89
STC 6000	91
STC 9000	93
STC 10000	93
STC 14000	95
StormceptorMAX	Custom

Stormceptor
The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology
Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:
• Site parameters
• Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
• Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
• TSS load
• Detention time of the system

Hydrology Analysis
PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour). Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station			
State/Province	Ontario	**Total Number of Rainfall Events**	2595
Rainfall Station Name	BARRIE WPCC	**Total Rainfall (mm)**	12897.4
Station ID #	0557	**Average Annual Rainfall (mm)**	358.3
Coordinates	44°23'N, 79°41'W	**Total Evaporation (mm)**	1266.6
Elevation (ft)	725	**Total Infiltration (mm)**	0.0
Years of Rainfall Data	36	**Total Rainfall that is Runoff (mm)**	11630.8

Notes
• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. • Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. • For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	0.5
Imperviousness %	100.00

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	
Stormceptor Outlet Invert Elev (m)	
Stormceptor Rim Elev (m)	
Normal Water Level Elevation (m)	
Pipe Diameter (mm)	
Pipe Material	
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Site Name	Shoeless Joe's

Site Details

Drainage Area

Total Area (ha)	0.5
Imperviousness %	100.00

Surface Characteristics

Width (m)	141.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency

Maintenance Frequency (months) >	12

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (lps)	0

Winter Months

Winter Infiltration	0

TSS Loading Parameters

TSS Loading Function	

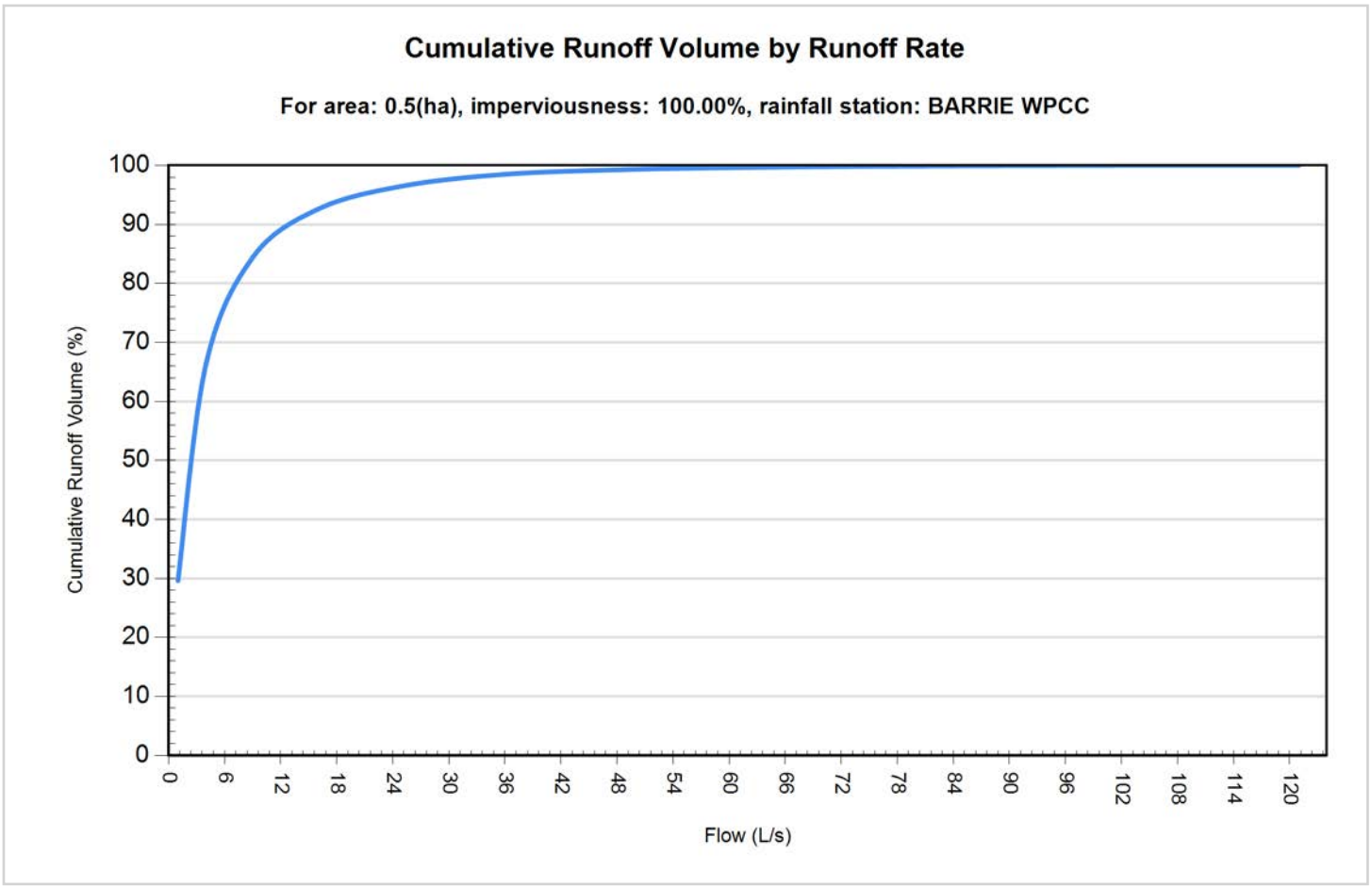
Buildup/Wash-off Parameters

Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

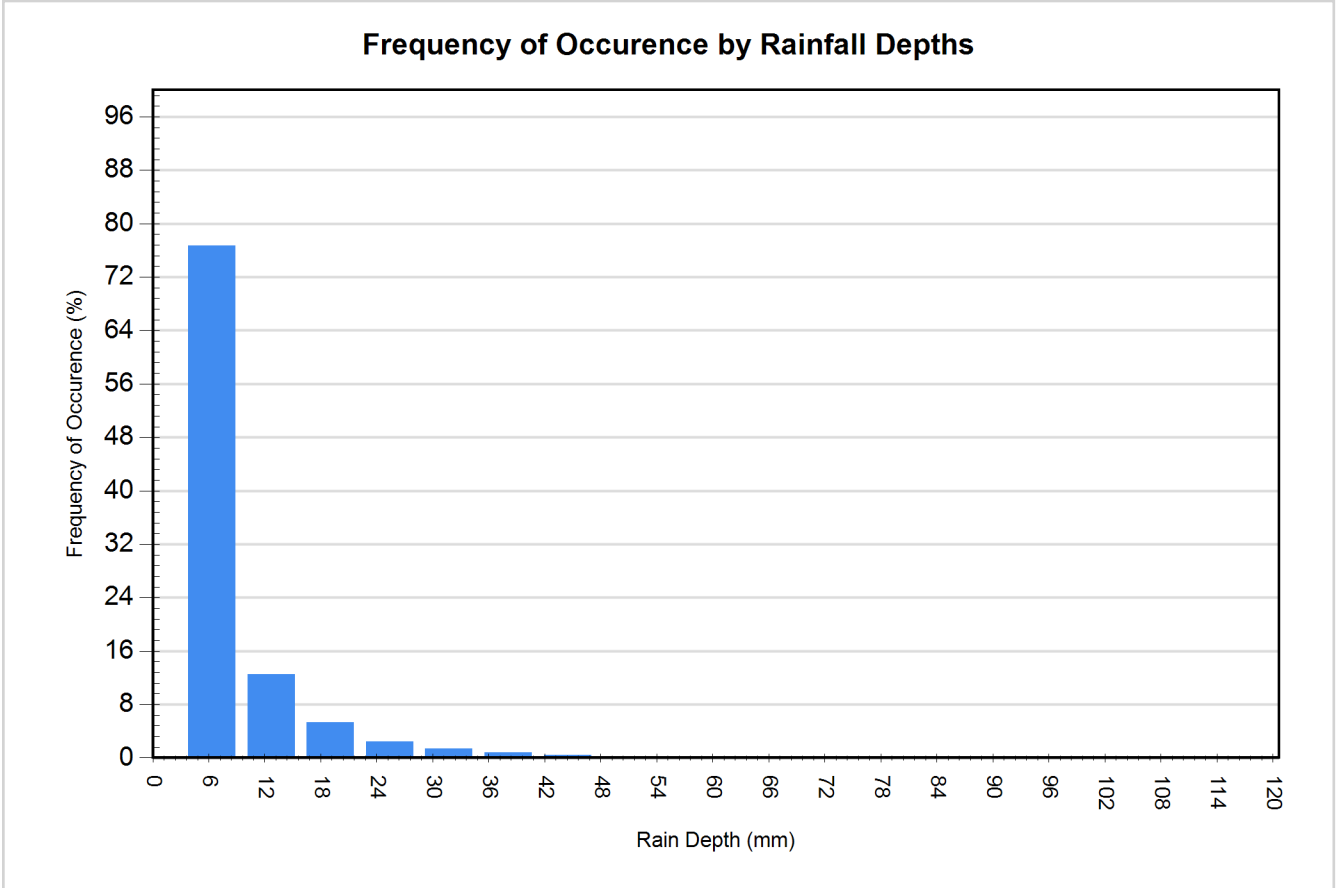
TSS Availability Parameters

Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	**Runoff Volume (m^3)**	**Volume Over (m^3)**	**Cumulative Runoff Volume (%)**
1	17298	41226	29.6
4	38821	19704	66.3
9	49392	9133	84.4
16	54168	4356	92.6
25	56484	2040	96.5
36	57628	897	98.5
49	58130	394	99.3
64	58367	158	99.7
81	58472	53	99.9
100	58518	7	100.0
121	58524	0	100.0



Rainfall Event Analysis				
Rainfall Depth (mm)	**No. of Events**	**Percentage of Total Events (%)**	**Total Volume (mm)**	**Percentage of Annual Volume (%)**
6.35	1991	76.7	3535	27.4
12.70	325	12.5	2942	22.8
19.05	137	5.3	2129	16.5
25.40	63	2.4	1420	11.0
31.75	36	1.4	1002	7.8
38.10	20	0.8	693	5.4
44.45	10	0.4	406	3.1
50.80	6	0.2	285	2.2
57.15	2	0.1	108	0.8
63.50	1	0.0	58	0.5
69.85	1	0.0	68	0.5
76.20	0	0.0	0	0.0
82.55	2	0.1	156	1.2
88.90	0	0.0	0	0.0
95.25	0	0.0	0	0.0
101.60	1	0.0	96	0.7
107.95	0	0.0	0	0.0
114.30	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Appendix F
Stormwater Infiltration Chamber

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	No
Project Name:	n2137
Engineer:	N/A
Project Location:	Ontario
Measurement Type:	Metric
Required Storage Volume:	8.00 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	229 mm.
Stone Above Chambers:	305 mm.
Average Cover Over Chambers:	458 mm.
Design Constraint Dimensions:	(5.00 m. x 6.01 m.)

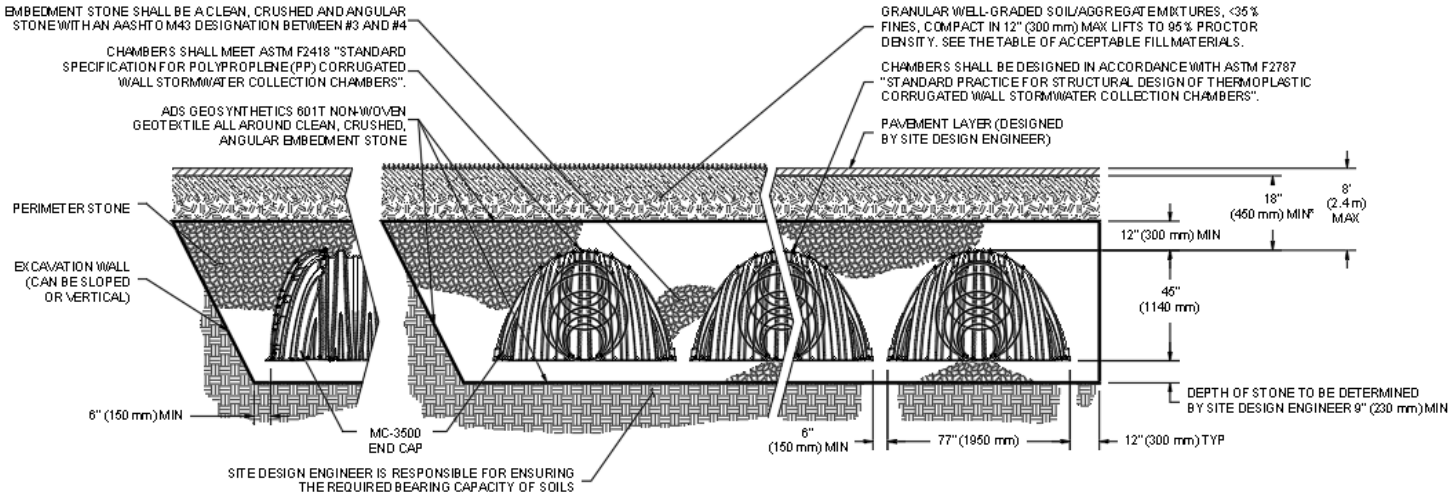
Results

System Volume and Bed Size

Installed Storage Volume:	9.15 cubic meters.
Storage Volume Per Chamber:	3.12 cubic meters.
Number Of Chambers Required:	1
Number Of End Caps Required:	2
Chamber Rows:	1
Maximum Length:	3.94 m.
Maximum Width:	2.57 m.
Approx. Bed Size Required:	10.10 square meters.

System Components

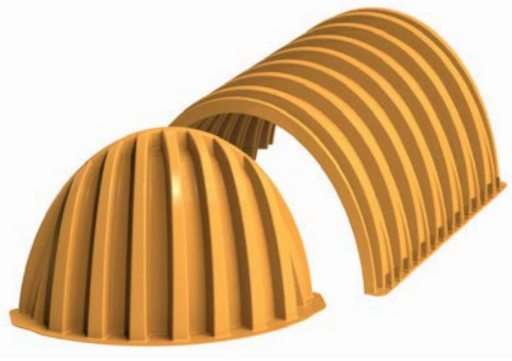
Amount Of Stone Required:	13 cubic meters
Volume Of Excavation (Not Including Fill):	17 cubic meters
Total Non-woven Geotextile Required:	51 square meters
Woven Geotextile Required (excluding Isolator Row):	0 square meters
Woven Geotextile Required (Isolator Row):	11 square meters
Total Woven Geotextile Required:	11 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"

StormTech® MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



Nominal Chamber Specifications
(not to scale)

Size (L x W x H)
90” x 77” x 45”
2286 mm x 1956 mm x 1143 mm

Chamber Storage
109.9 ft³ (3.11 m³)

Min. Installed Storage*
175.0 ft³ (4.96 m³)

Weight
134 lbs (60.8 kg)

Shipping
15 chambers/pallet
7 end caps/pallet
7 pallets/truck

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below chambers, 6” (150 mm) of stone between chambers/ end caps and 40% stone porosity.

Nominal End Cap Specifications
(not to scale)

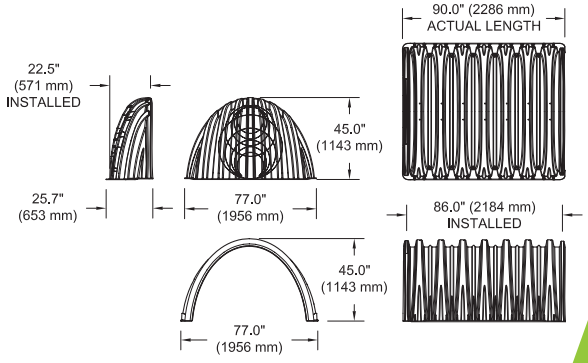
Size (L x W x H)
26.5” x 71” x 45.1”
673 mm x 1803 mm x 1145 mm

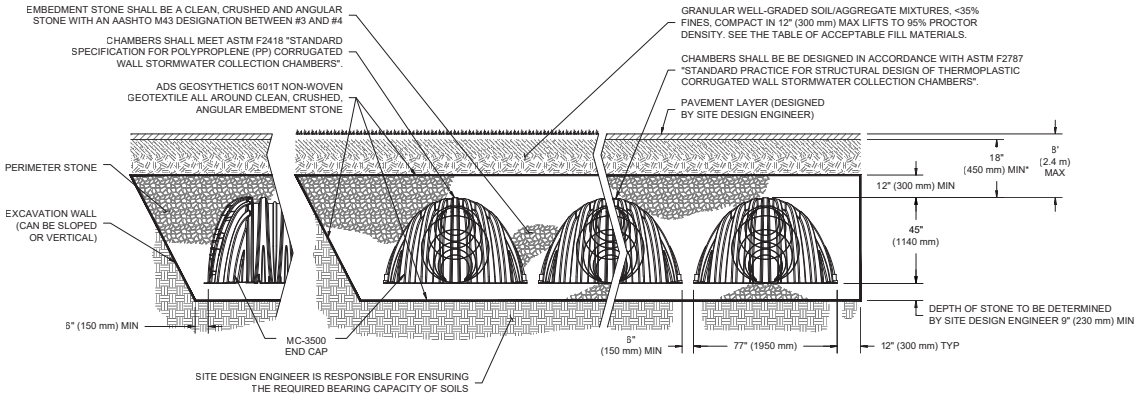
End Cap Storage
14.9 ft³ (0.42 m³)

Min. Installed Storage*
45.1 ft³ (1.28 m³)

Weight
49 lbs (22.2 kg)

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below, 6” (150 mm) of stone perimeter, 6” (150 mm) of stone between chambers/ end caps and 40% stone porosity.





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

ADS StormTech™

StormTech MC-3500 Specifications

Storage Volume Per Chamber

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9 in (230 mm)	12 in (300 mm)	15 in (375 mm)	18 in (450 mm)
Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
End Cap	14.9 (0.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

Note: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

Amount of Stone Per Chamber

English Tons (yds³)	Stone Foundation Depth			
	9 in	12 in	15 in	18 in
Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
Metric Kilograms (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

Note: Assumes 12" (300 mm) of stone above and 6" (150 mm) row spacing and 6" (150 mm) of perimeter stone in front of end caps.

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth			
	9 in (230 mm)	12 in (300 mm)	15 in (375mm)	18 in (450 mm)
Chamber	11.9 (9.1)	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)
End Cap	4.0 (3.1)	4.1 (3.3)	4.3 (3.3)	4.4 (3.4)

Note: Assumes 6" (150 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

ADS StormTech products, manufactured in accordance with ASTM F2418 or ASTMF2922, comply with all requirements in the Build America, Buy America (BABA) Act.

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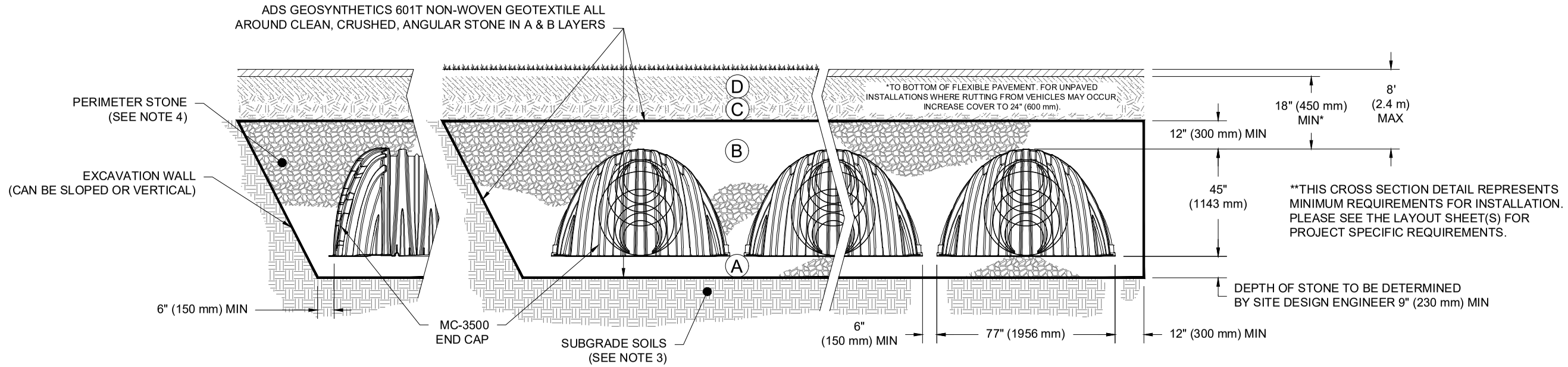
ADS StormTech™

adspipe.com
800-821-6710

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



*FOR COVER DEPTHS GREATER THAN 8.0' (2.4 m) PLEASE CONTACT ADS

NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

MC-3500
STANDARD CROSS SECTION
DATE: 8/03/22 | DRAWN: KLJ | PROJECT #: | CHECKED: KLJ

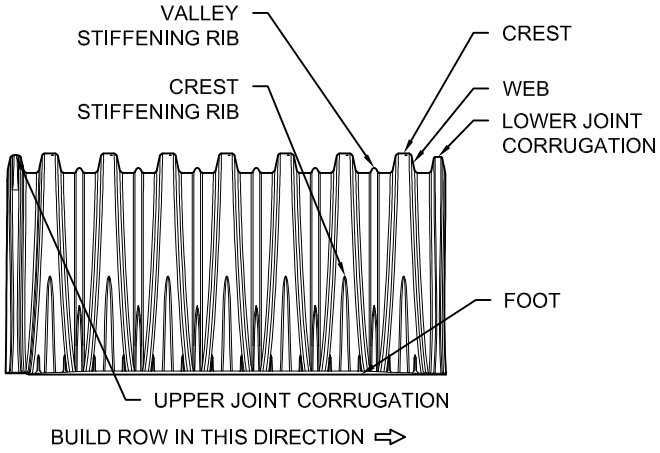
DATE	DESCRIPTION	DRWN	CHKD

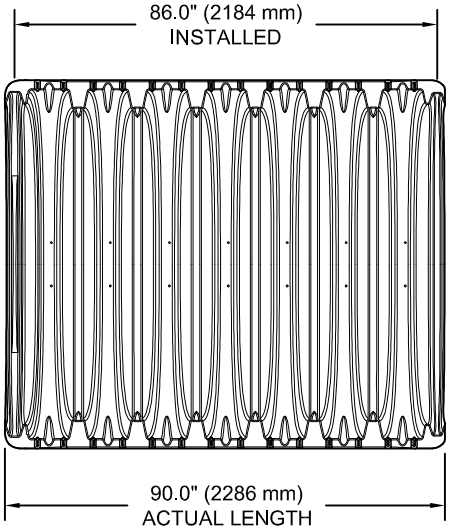
StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

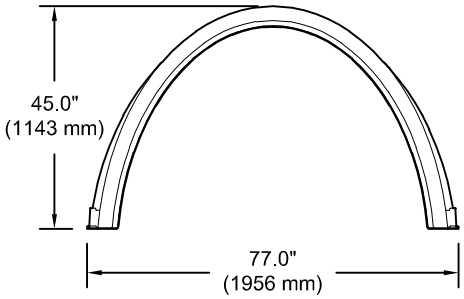
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

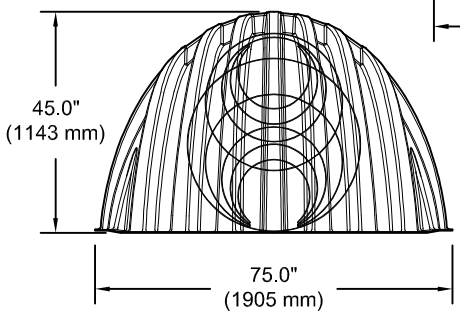
MC-3500 TECHNICAL SPECIFICATION

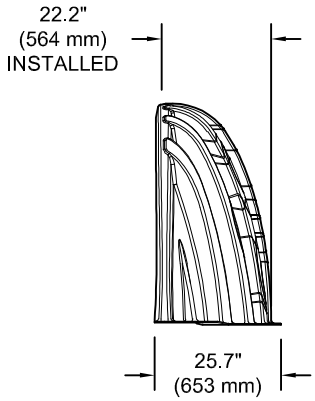
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

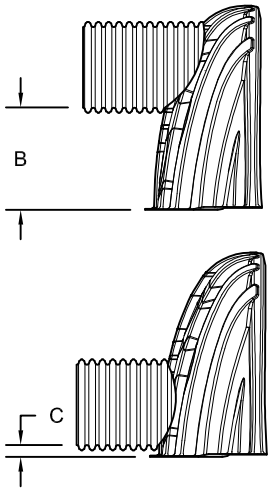
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" (152 mm) STONE BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

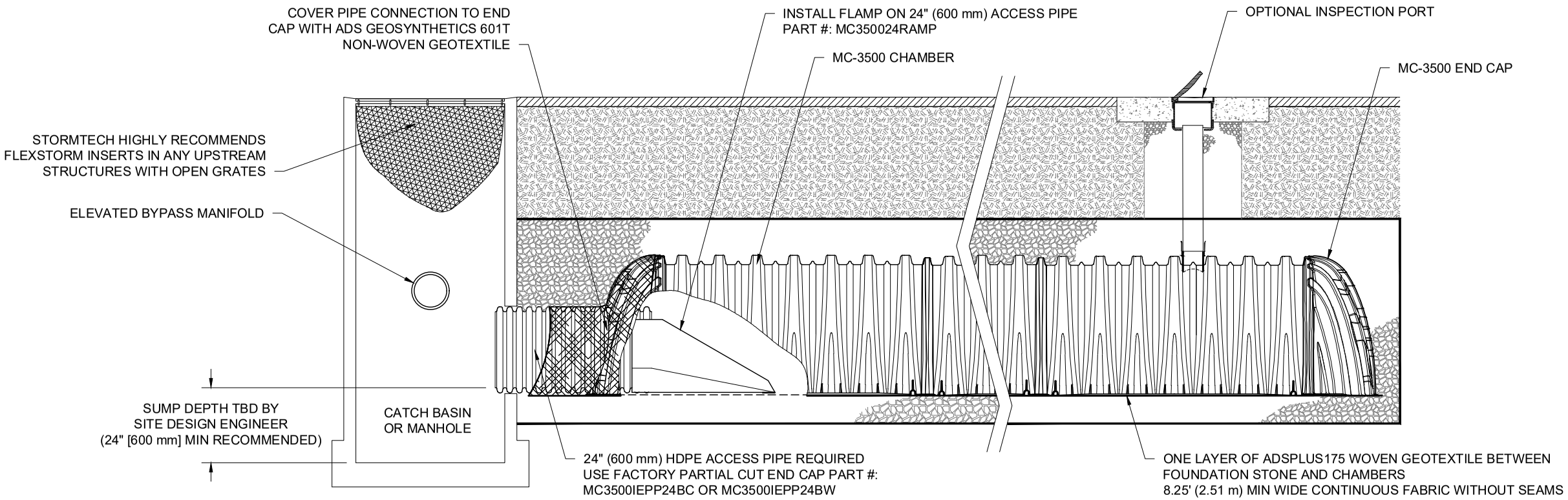
PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.



MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

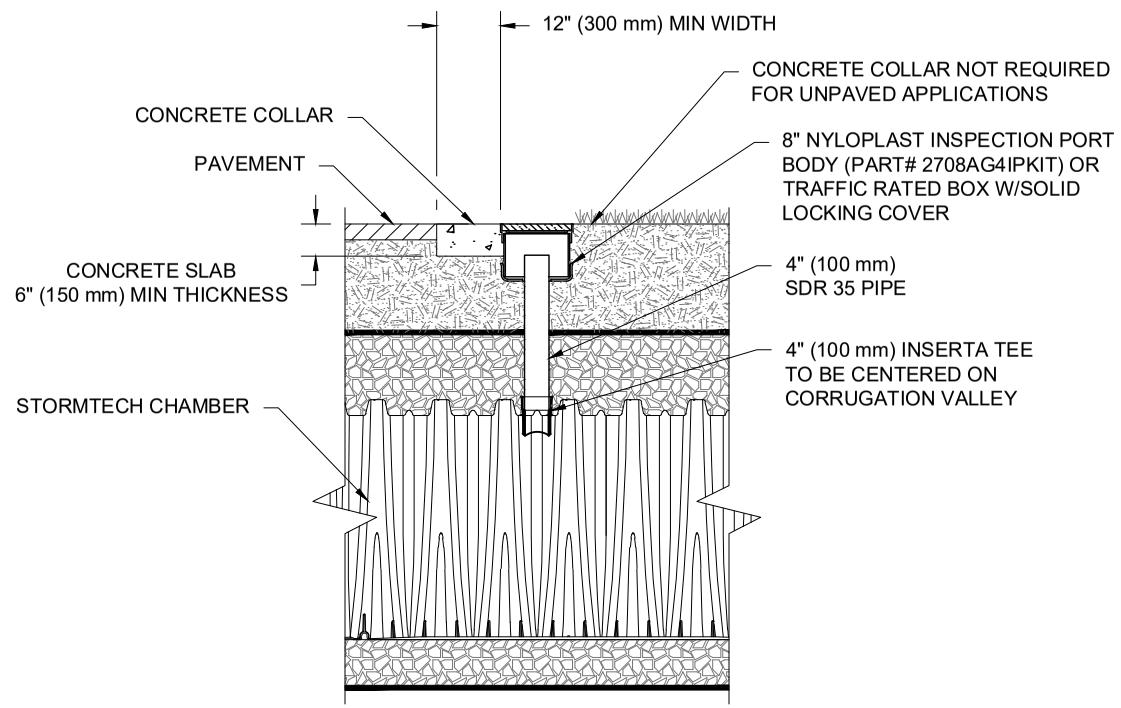
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

4" PVC INSPECTION PORT DETAIL
(MC SERIES CHAMBER)
NTS

MC-3500
ISOLATOR ROW PLUS DETAILS
DATE: 8/03/22 | DRAWN: KLJ | PROJECT #: | CHECKED: KLJ

DATE	DRWN	CHKD	DESCRIPTION

StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM
4640 TRUEMAN BLVD
HILLIARD, OH 43026
ADS

Isolator® Row Plus
O&M Manual

ADS StormTech™

The Isolator® Row Plus

Introduction

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

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

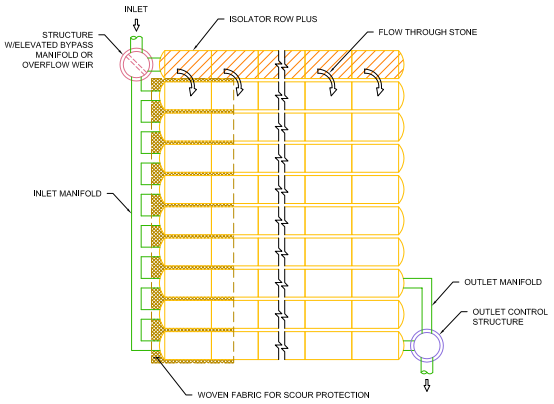
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus 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 Plus.*

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



Isolator Row Plus 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 Plus 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.

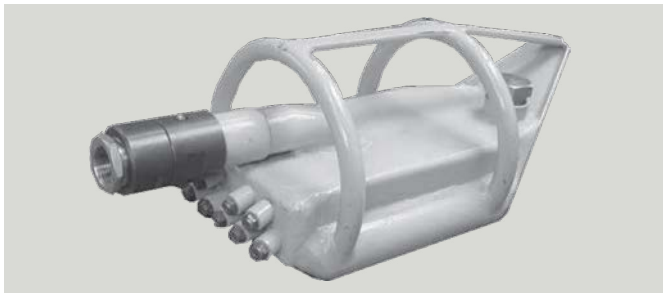
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

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 Plus, clean-out should be performed.

Maintenance

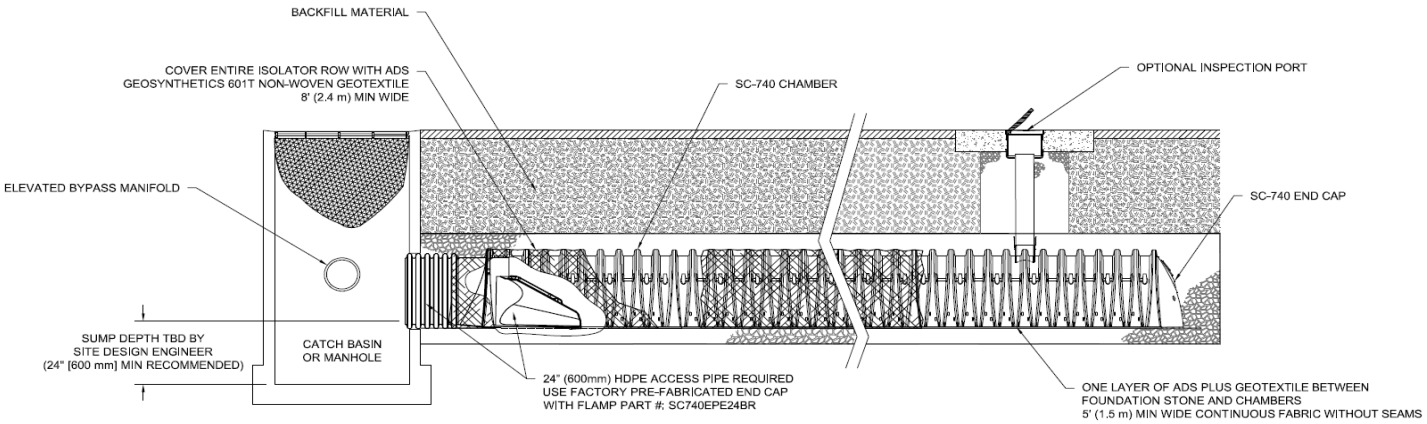
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided 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 Plus 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. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (*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-7200 chamber models and is not required over the entire Isolator Row PLUS.*



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus 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 Row Plus
   i. Remove cover from manhole at upstream end of Isolator Row Plus
   ii. Using a flashlight, inspect down Isolator Row Plus 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 Plus using the JetVac process.

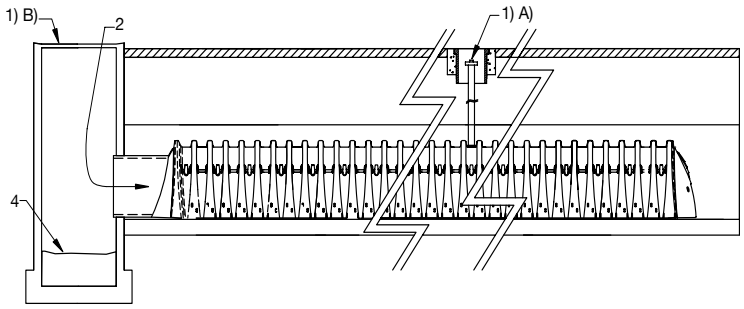
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

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		Sedi-ment 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 PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

adspipe.com
800-821-6710

StormTech® Installation Guide

MC-3500 & MC-4500 Chamber

StormTech Installation Video

Required Materials and Equipment List

- Acceptable fill materials per Table 1
- ADS Plus and non-woven geotextile fabrics
- StormTech solid end caps, pre-cored and pre-fabricated end caps
- StormTech chambers, manifolds and fittings

Note: MC-3500 chamber pallets are 77" x 90" (2.0 m x 2.3 m) and weigh about 2010 lbs. (912 kg) and MC-4500 pallets are 100" x 52" (2.5 m x 1.3 m) and weigh about 840 lbs. (381 kg). Unloading chambers requires 72" (1.8 m) (min.) forks and/or tie downs (straps, chains, etc).

Important Notes:

A. This installation guide provides the minimum requirements for proper installation of chambers. Nonadherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.

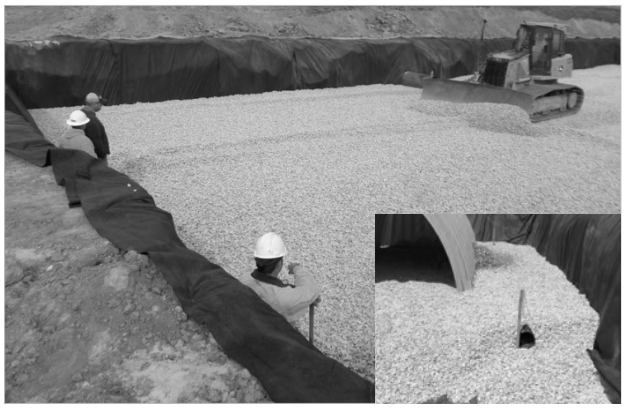
B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

C. Care should be taken in the handling of chambers and end caps. End caps must be stored standing upright. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation

Excavate bed and prepare subgrade per engineer's plans. Plans and specifications should include Best Management Practices (BMPs) to deter contamination of open pits during construction.

Place non-woven geotextile over prepared soils and up excavation walls.



Place clean, crushed, angular stone foundation 9" (230 mm) min. Install underdrains if required. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly

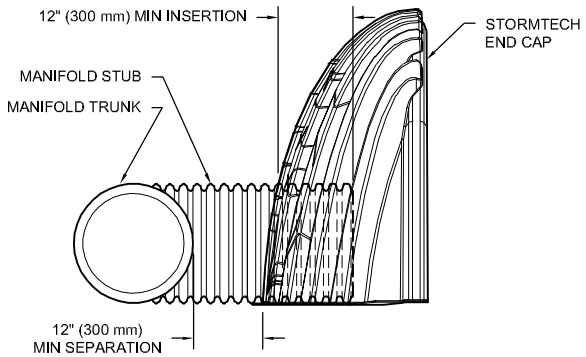
Install manifolds and lay out ADS PLUS fabric at inlet rows [min. 17.5 ft (5.33 m)] at each inlet end cap. Place a continuous piece (no seams) along entire length of Isolator® PLUS Row(s).

Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled “Lower Joint – Overlap Here” and “Build this direction – Upper Joint” Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 6” (150 mm) spacing between MC-3500 rows and 9” (230 mm) spacing between MC-4500 rows.

Place a continuous layer of ADS PLUS fabric between the foundation stone and the Isolator Row PLUS chambers, making sure the fabric lays flat and extends the entire width of the chamber feet.
When used on an Isolator Row PLUS, a 24” FLAMP (flared end ramp) is attached to the inside of the inlet pipe with a provided threaded rod and bolt. The FLAMP then lays on top of the ADS PLUS fabric.

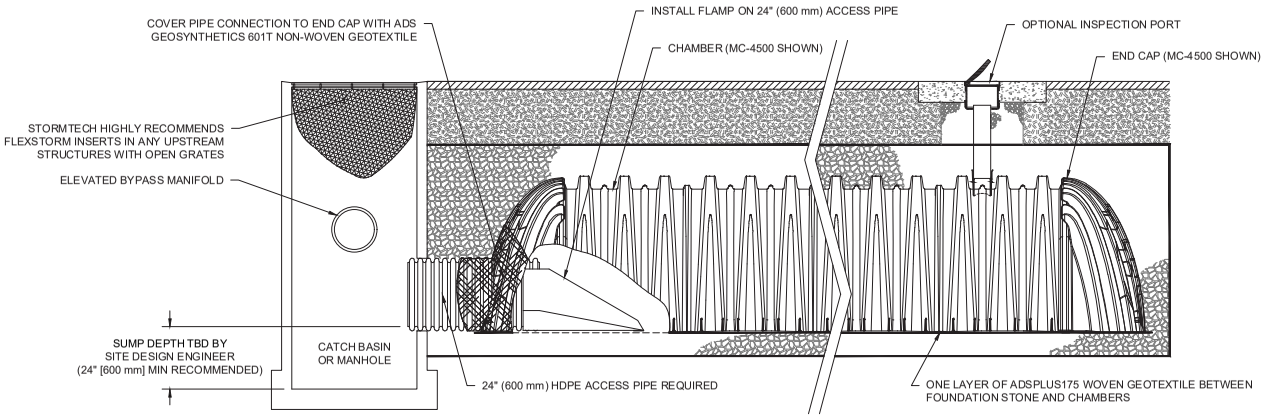
Manifold Insertion



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

Insert inlet and outlet manifolds a minimum 12” (300 mm) into chamber end caps. Manifold header should be a minimum 12” (300 mm) from base of end cap.

StormTech Isolator Row Plus Detail

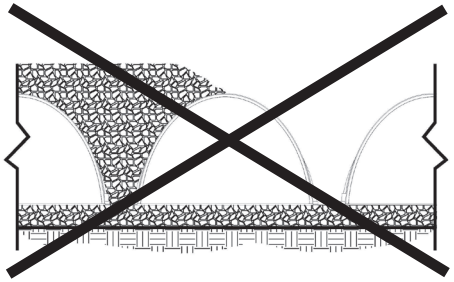


Initial Anchoring of Chambers – Embedment Stone

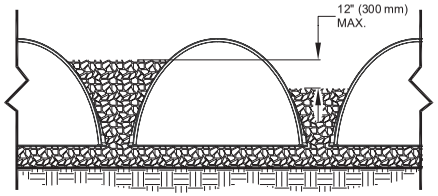
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

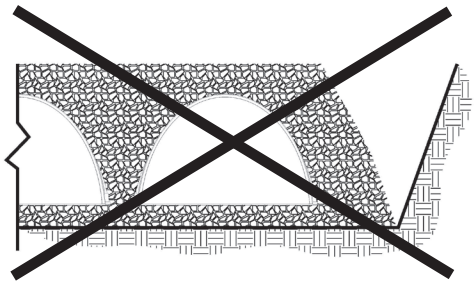


Uneven Backfill

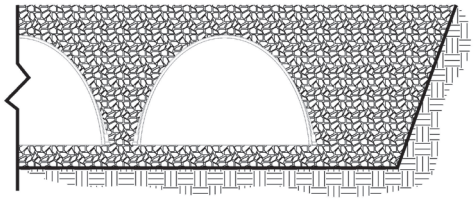


Even Backfill

Backfill chambers evenly. Stone column height should never differ by more than 12” (300 mm) between adjacent chamber rows or between chamber rows and perimeter.



Perimeter Not Backfilled



Perimeter Fully Backfilled

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.

Backfill of Chambers – Embedment Stone and Cover Stone

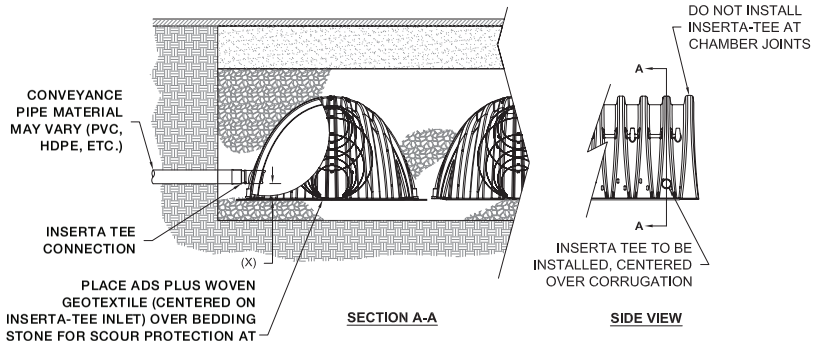
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers and a minimum 12” (300 mm) of cover stone is in place. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. The recommended backfill methods are with a stone conveyor outside of the bed or build as you go with an excavator inside the bed reaching along the rows. Backfilling while assembling chambers rows as shown in the picture will help to ensure that equipment reach is not exceeded.

Only after chambers have been backfilled to top of chamber and with a minimum 12” (300 mm) of cover stone on top of chambers can skid loaders and small LGP dozers be used to final grade cover stone and backfill material in accordance with ground pressure limits in Table 2. Equipment must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends the contractor inspect chamber rows before placing final backfill. Any chambers damaged by construction equipment shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24” (600 mm) where edges meet. Compact at 24” (600 mm) of fill. Roller travel parallel with rows.

Inserta Tee Detail



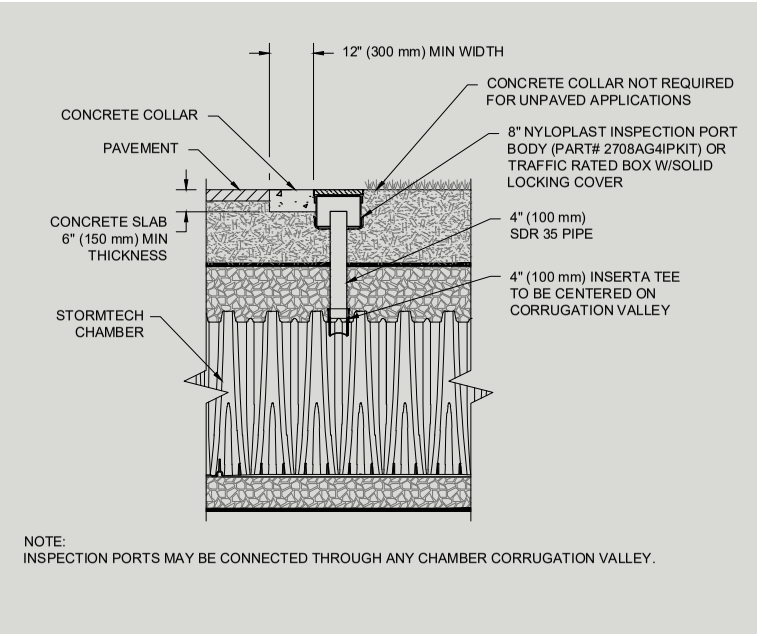
CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
MC-3500	12” (250 mm)	6” (150 mm)
MC-4500	12” (250 mm)	8” (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
(D) **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
(C) **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 24" (600 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M145[1] A-1, A-2-4, A-3 or AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 24" (600 mm) of material over the chambers is reached. Compact additional layers in 12" (300 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials.
(B) **Embedment Stone:** Fill the surrounding chambers from the foundation stone ('A' layer) to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 4	No compaction required.
(A) **Foundation Stone:** Fill below chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 4	Place and compact in 9" (230 mm) max lifts using two full coverages with a vibratory compactor.[2, 3]

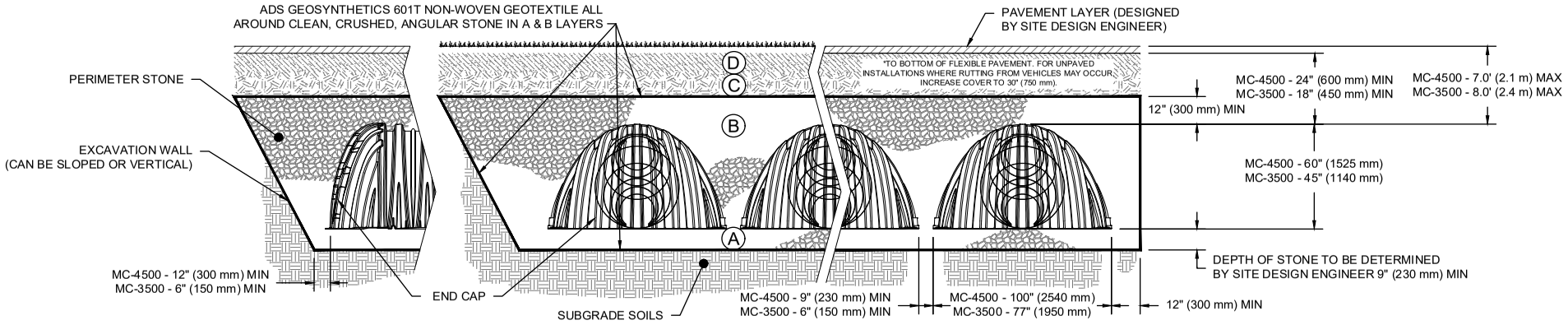
Figure 1- Inspection Port Detail



Please Note:

1. The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".
2. StormTech compaction requirements are met for 'A' location materials when placed and compacted in 9" (230 mm) (max) lifts using two full coverages with a vibratory compactor.
3. Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.

Figure 2 - Fill Material Locations



Notes:

1. 36" (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.
2. During paving operations, dump truck axle loads on 18" (450mm) of cover for MC-3500s may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18" (450mm) of cover for MC-3500s exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
3. Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
4. Mini-excavators (<8,000lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
5. StormTech does not require compaction of initial fill at 18" (450 mm) of cover. However, requirements by others for 6" (150 mm) lifts may necessitate the use of small compactors at 18" (450 mm) of cover.
6. Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.
7. Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Call StormTech at **888.892.2694** for technical and product information or visit www.stormtech.com

Table 2 - Maximum Allowable Construction Vehicle Loads[6]

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	Max Drum Weight or Dynamic Force lbs (kN)
Ⓓ Final Fill Material	36" (900) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	4050 (194) 2760 (132) 2130 (102) 1770 (84) 1530 (73)	38,000 (169)
Ⓒ Initial Fill Material	24" (600) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2750 (131) 1920 (92) 1520 (73) 1310 (63) 1180 (56)	20,000 (89)
	24" (600) Loose/Dumped	MC-3500		12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2430 (116) 1730 (82) 1390 (66) 1210 (58) 1100 (52)	16,000 (71)
		32,000 (142)	16,000 (71)			
		MC-4500				
		24,000 (107)	12,000 (53)			
	18" (450)	MC-3500		12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2140 (102) 1530 (73) 1260 (60) 1120 (53) 1030 (49)	5,000 (22) (static loads only)[5]
		32,000 (142)	16,000 (71)			
		MC-4500				
		24,000 (107)	12,000 (53)			
Ⓑ Embedment Stone	12" (300)	Not Allowed	Not Allowed	12" (305) 18" (457) 24" (610) 30" (762)	1100 (53) 710 (34) 660 (32) 580 (28)	Not Allowed
	6" (150)	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows.[4]	Roller travel parallel to rows only until 36" (900 mm) compacted cover is reached.
Ⓒ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 24" (600 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 12" (300 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 24" (600 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 12" (300 mm) cover stone is in place.	No rollers allowed.
Ⓐ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

StormTech® Standard Limited Warranty

STANDARD LIMITED WARRANTY OF STORMTECH LLC ("STORMTECH"): PRODUCTS

(A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and end plates are collectively referred to as the "Products."

(B) The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech's liability specifically excludes the cost of removal and/or installation of the Products.

(C) THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

(D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.

(E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.

(F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.

(G) THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH 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 DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLECT; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.

ADS StormTech™

adspipe.com
800-821-6710

ADS 0601T/O NONWOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 0601T/O nonwoven geotextile.

Filter Fabric Requirements

ADS 0601T/O is an orange nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. ADS 0601T/O is inert to biological degradation and resists naturally encountered chemicals, alkali and acids. ADS 0601T/O conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	Typical Value[1] MD	Typical Value[1] CD
Grab Tensile Strength	ASTM D4632	lbs (N)	175 (779)	175 (779)
Grab Tensile Elongation	ASTM D4632	%	75	75
Trapezoid Tear Strength	ASTM D4533	lbs (N)	85 (378)	85 (378)
CBR Puncture Strength	ASTM D6241	lbs (N)	480 (2136)	480 (2136)
Permittivity	ASTM D4491	sec^{-1}	1.5	1.5
Flow Rate	ASTM D4491	$gal/min/ft^2$ ($l/min/m^2$)	105 (4278)	105 (4278)
UV Resistance (at 500 hours)[1]	ASTM D4355	% strength retained	80	80

Physical Properties

Property	Test Method	Unit	Typical Value[2]
Weight	ASTM D5161	oz/yd^2 (g/m^2)	6.5 (220)
Thickness	ASTM D5199	mils (mm)	65 (1.7)
Roll Dimensions (W x L)	-	ft (m)	15 x 300 (4.5 x 91)
Roll Area	-	yd^2 (m^2)	500 (418)
Estimated Roll Weight	-	lb (kg)	220 (100)

1 Modified, Minimum Test Value
2 ASTM D4439 Standard Terminology for Geosynthetics: typical value, n-*for geosynthetics*, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.

Separation

ADS 315W WOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 315W woven geotextile.

Filter Fabric Requirements

ADS 315W is manufactured using high-tenacity polypropylene yarns that are woven to form a dimensionally stable network, which allows the yarns to maintain their relative position. ADS 315W resists ultraviolet deterioration, rotting and biological degradation and is inert to commonly encountered soil chemicals. ADS 315W conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value)[2]
Tensile Strength (Grab)	ASTM D4632	lbs (N)	315 (1400)
Elongation	ASTM D4632	%	15
CBR Puncture	ASTM D6241	lbs (N)	900 (4005)
Puncture	ASTM D4833	lbs (N)	150 (667)
Mullen Burst	ASTM D3786	psi (kPa)	600 (4134)
Trapezoidal Tear	ASTM D4533	lbs (N)	120 (533)
UV Resistance (at 500 hours)	ASTM D4355	%	70
Apparent Opening Size (AOS)*	ASTM D4751	U.S. Sieve (mm)	40 (.425)
Permittivity	ASTM D4491	sec^{-1}	.05
Water Flow Rate	ASTM D4491	gpm/ft^2 ($l/min/m^2$)	4 (163)

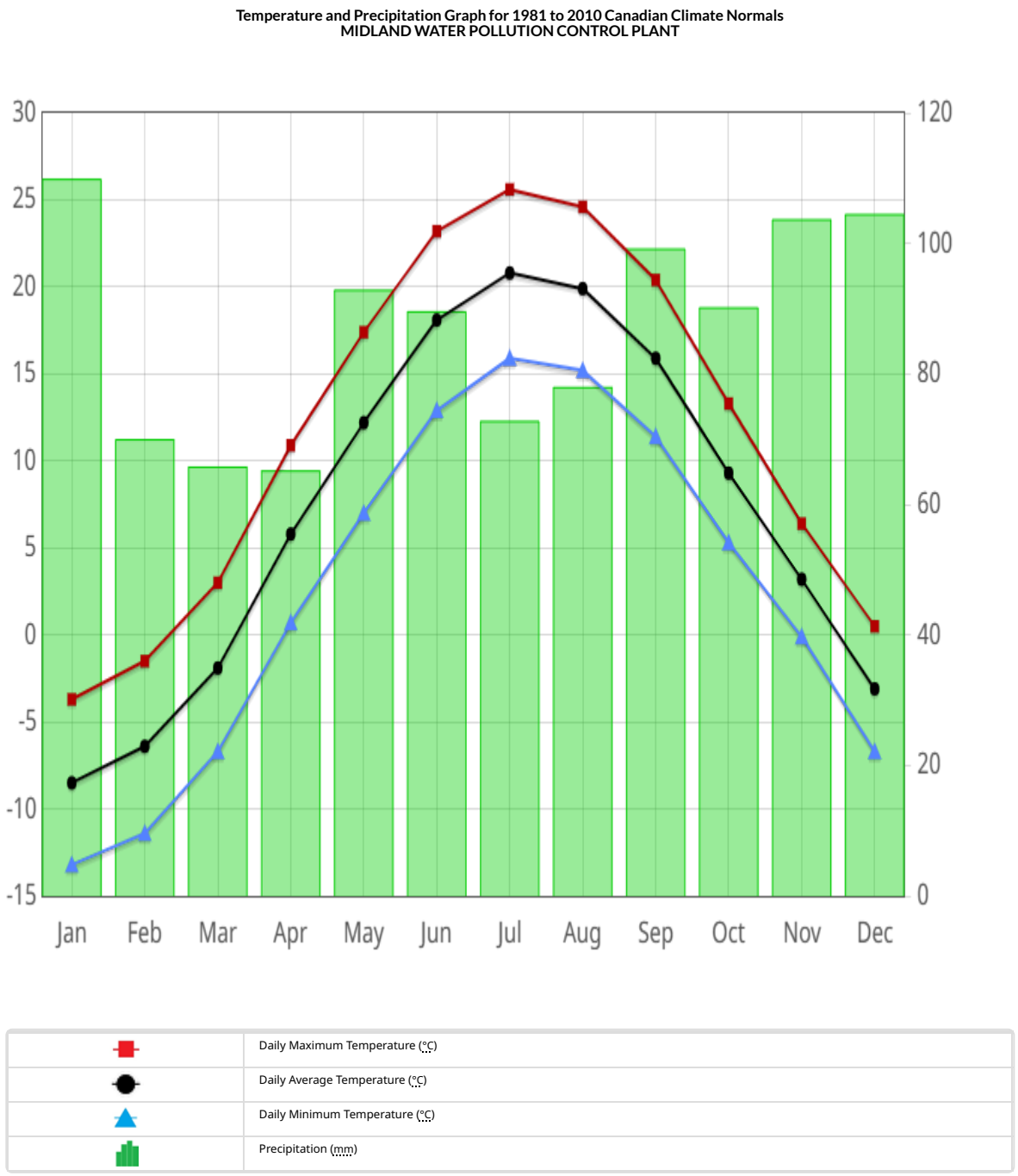
* Maximum average roll value.

Packaging

Roll Dimensions (W x L) - ft. (m)	12.5 x 360/ 15 x 300 / 17.5 x 258 (3.81 x 109.8/ 4.57 x 91.5 / 5.33 x 78.6)

Canadian Climate Normals 1981-2010 Station Data

▼ Temperature and Precipitation Graph



▼ Normals Data

The minimum number of years used to calculate these Normals is indicated by a code for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

MIDLAND WATER POLLUTION CONTROL PLANT
ONTARIO
Current Station Operator: CCN

Latitude:	44°45'28.056" N
Longitude:	79°52'31.014" W
Elevation:	180.00 m
Climate ID:	6115127
WMO ID:	
TC ID:	

▼ Temperature

Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-8.5	-6.4	-1.9	5.8	12.2	18.1	20.8	19.9	15.9	9.3	3.2	-3.1	7.1	D
Standard Deviation	3.5	2.6	1.8	1.4	2.0	1.4	1.1	1.4	1.6	1.3	1.7	2.9	1.5	D
Daily Maximum (°C)	-3.7	-1.5	3.0	10.9	17.4	23.2	25.6	24.6	20.4	13.3	6.4	0.5	11.7	D
Daily Minimum (°C)	-13.2	-11.4	-6.7	0.7	7.0	12.9	15.9	15.2	11.4	5.3	-0.1	-6.7	2.5	D
Extreme Maximum (°C)	14.0	15.0	23.5	30.0	34.0	**35.5**	34.5	34.5	32.5	30.0	22.0	18.0		
Date (yyyy/dd)	1995/ 14	1984/ 23	1998/ 30	2002/ 16	2006/ 30	**1998/ 21**	1993/ 05	2001/ 09	2002/ 08	2005/ 04	1978/ 05	1982/ 03		
Extreme Minimum (°C)	-36.0	**-36.0**	-31.0	-16.5	-3.0	2.0	4.0	4.0	0.0	-4.5	-19.0	-31.0		
Date (yyyy/dd)	2003/ 27	**1979/ 18**	2003/ 03	2003/ 07	1978/ 01	1980/ 09	1982/ 01	1986/ 28	1980/ 27	1978/ 17	1995/ 30	1980/ 25		

▼ Precipitation

Precipitation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Rainfall (mm)	21.5	20.9	36.1	59.3	92.8	89.5	72.7	77.9	99.1	88.0	74.8	27.5	760.0	D
Snowfall (cm)	88.3	49.3	29.6	5.9	0.0	0.0	0.0	0.0	0.0	2.1	28.9	76.9	280.9	D
Precipitation (mm)	109.8	69.9	65.7	65.1	92.8	89.5	72.7	77.9	99.1	90.1	103.6	104.4	1040.6	D
Extreme Daily Rainfall (mm)	37.8	27.4	39.0	41.4	73.0	79.8	89.0	61.0	80.0	**95.5**	37.2	34.0		
Date (yyyy/dd)	1891/ 01	1968/ 01	1998/ 30	1995/ 21	2004/ 23	1996/ 29	1999/ 03	1981/ 14	1985/ 05	**1954/ 15**	1978/ 13	1889/ 24		
Extreme Daily Snowfall (cm)	35.8	42.0	34.0	35.6	9.7	0.0	0.0	0.0	0.0	17.0	45.7	**50.0**		
Date (yyyy/dd)	1965/ 28	1984/ 28	1983/ 21	1909/ 09	1976/ 03	1889/ 01	1889/ 01	1889/ 01	1889/ 01	1997/ 26	1964/ 21	**1980/ 20**		
Extreme Daily Precipitation (mm)	37.8	42.0	39.0	41.4	73.0	79.8	89.0	61.0	80.0	**95.5**	45.7	50.0		
Date (yyyy/dd)	1891/ 01	1984/ 28	1998/ 30	1995/ 21	2004/ 23	1996/ 29	1999/ 03	1981/ 14	1985/ 05	**1954/ 15**	1964/ 21	1980/ 20		
Extreme Snow Depth (cm)	65	79	**98**	28	0	0	0	0	0	9	60	79		

Precipitation														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Date (yyyy/dd)	1981/06	1982/09	**2003/09**	2003/05	1983/01	1983/01	1983/01	1983/01	1983/01	1997/27	1995/30	1980/21		

▶ Days with Rainfall

▶ Days With Snowfall

▶ Days with Precipitation

▶ Days with Snow Depth

Legend

- A = WMO "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for **either** temperature **or** precipitation)
- B = At least 25 years
- C = At least 20 years
- D = At least 15 years

▼ Station / Element Metadata

Statistics listed below are provided as a guide to determine the validity of Normals and Extremes calculations. For example, a station with 30 years of record between 1981 and 2010 with no missing years would be a more reliable normal than a station with 15 years of record and 2 missing years. Less than 100% possible observations indicates that out of the total number of observations used, some records were missing.

MIDLAND WATER POLLUTION CONTROL PLANT

Province/Territory	ON
Latitude (dd mm):	44 45 N
Country	CAN
Longitude (ddd mm):	79 52 W
Time Zone	EST
Latitude (decimal degrees):	44.76 N
Climate ID:	6115127
Longitude (decimal degrees):	79.88 W
WMO ID:	
Elevation (m):	180
TC ID:	

▼ Temperature

Temperature

	Begin Year	End Year	Total Number of Years	Missing Years	Total Count of Observations	% of Possible Observations
Daily Average (°C)	1981	2006	20	7	7099	98
Standard Deviation	1981	2006	20	7	7099	98
Daily Maximum (°C)	1981	2006	20	7	7126	98.4
Daily Minimum (°C)	1981	2006	20	7	7123	98.4
Extreme Maximum (°C)	1974	2006			9611	99.6
Extreme Minimum (°C)	1974	2006			9601	99.5

▼ Precipitation

Precipitation

	Begin Year	End Year	Total Number of Years	Missing Years	Total Count of Observations	% of Possible Observations
Rainfall (mm)	1981	2006	20	7	6943	95.8
Snowfall (cm)	1981	2006	20	7	6943	95.8
Precipitation (mm)	1981	2006	20	7	6943	95.8
Extreme Daily Rainfall (mm)	1889	2006			27236	99.9
Extreme Daily Snowfall (cm)	1889	2006			28515	99.8
Extreme Daily Precipitation (mm)	1889	2006			27174	99.7
Extreme Snow Depth (cm)	1980	2006			5393	83.7

▶ Days with Rainfall

▶ Days With Snowfall

▶ Days with Precipitation

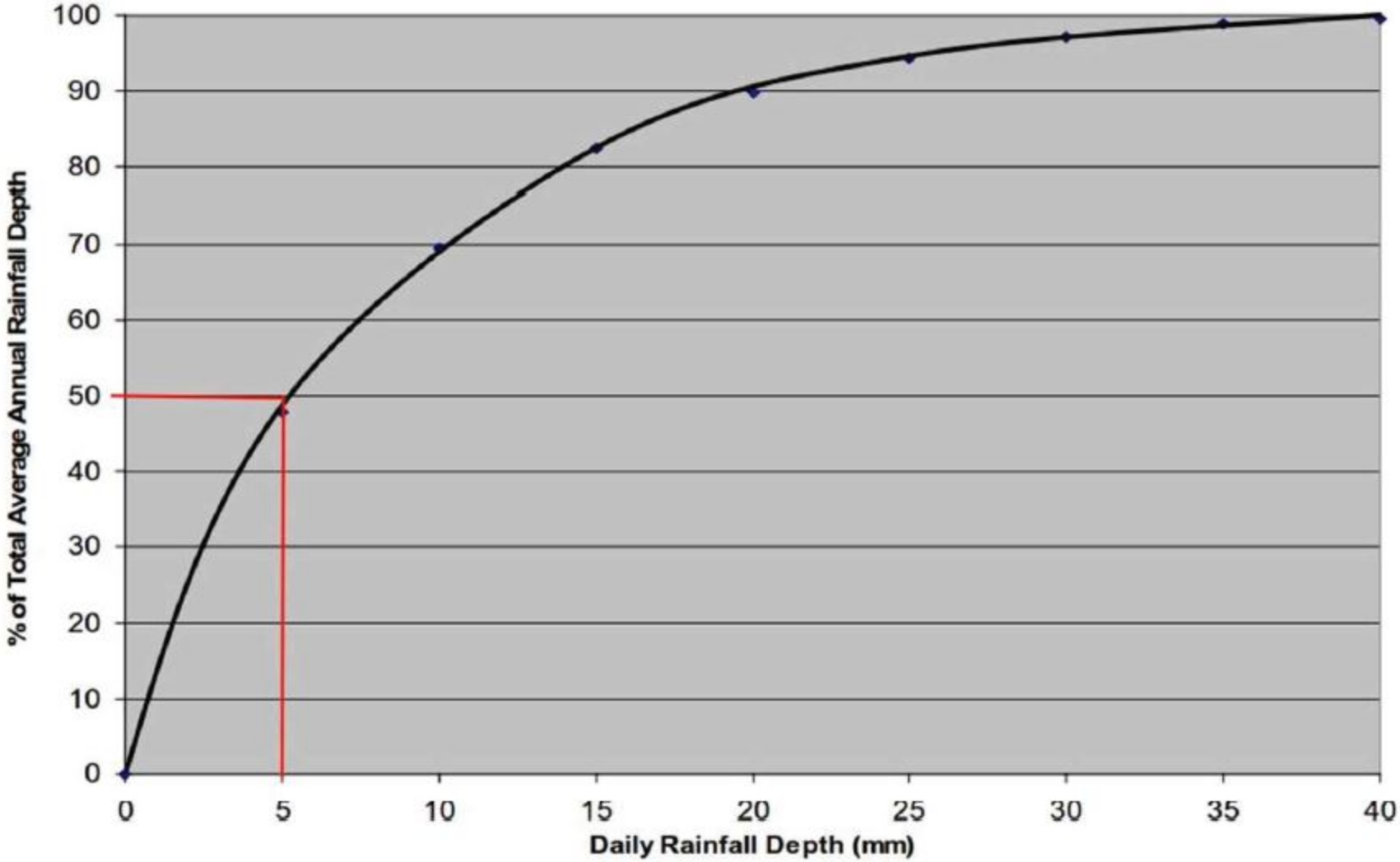
▶ Days with Snow Depth

▶ Frost-Free

Date modified:

2023-01-31

Figure 1a- % of Total Annual Average Rainfall Depth Vs. Daily Rainfall Amounts
(Based on 1991 Toronto Rainfall Data from 16 Rain Gauge Stations)



Appendix G
Water Demand & Fire Flow Calculations

TABLE 2. **FIRE FLOW CALCULATION as per FIRE UNDERWRITERS SURVEY (1999)**

PROJECT: Shoeless Joe's Restaurant
1144 Hugel Ave, ON

Date: 4-20-23

1. Fire Flow Equation

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

where F is the required fire flow [LPM]
C is the coefficient determined by type of construction [unitless]
A is the total protection area [sq.m]

2. Architecture Information

	Restaurant	
Type of Construction	Non-Combustible	A
Fire Rating	Non-Combustible	
Sprinkler Provided (Y/N)	NO	
Floor Area (Largest Unit)		
Total Floor Area [sq.m]	334	B
Coefficient, C [1]	0.8	
Fire Flow, F [LPM]	3218	D

3. Combustible Product Risk

Occupancy Adjustment	75%	
Fire Flow, F [LPM]	2414	E

4. Sprinkler Reduction

Sprinkler Reduction	0.00	
Sprinkler Reduction [LPM]	0	F

5. Exposure Adjustment

North	0.00%	
East	0.00%	
South	0.00%	
West	0.05%	
Total	**0%**	
Exposure Adjustment [LPM]	2	G

6. Required Fire Flow, Duration & Volume

Fire Flow, F [LPM]	2415	
Sprinkler Reduction [LPM]	0	
Exposure Adjustment [LPM]	2	
Required Fire Flow [LPM]	2417	H
Required Fire Flow [LPM]	**2000**	*
Required Fire Flow [LPS]	**33**	

n Engineering Inc

TABLE 2

Water Demand Calculation

SHOELESS JOE'S RESTAURANT
1144 HUGEL AVENUE
Project No. n2137

Average Consumption Rate	450	L/capita/day	*1.Section 11.2.3*
Max Day Factor	2		
Peak Hour Factor	4.5		
Domestic Demand(Ex. Motel)			
Pop: Equivallent	2	Person/unit	
Number of Unit	65		
Population	130	Person	
			Water demand for pre development condition
Average Domestic Water Deamnd	58500.00	l/day	
	0.68	L/sec	
Max Day Demand	1.35	L/sec	
Max Hour Deamd	3.05	L/sec	
Commercial Demand- (Restaurant)			
Gross Commercial Area	0.0334	ha	*Site Plan (Note 3)*
Water Demand for Restaurant	20	m^3/ha/day	*2.Section 6.4 (Note 1)*
Average Restaurant Water Deamnd	668.76	l/day	
	0.01	L/sec	
Max Day Demand	0.02	L/sec	
Max Hour Deamd	0.03	L/sec	

Total water demand from Hotel and Restaurant

Max Day Demand	1.37	L/sec	*Water demand for Post development condition*
Max Hour Deamd	3.08	L/sec	

Note:

1. Town of Innisfil, Engineering Design Standards and Specifications
2. MOE, Design Guidelines For Sewage Works
3. Site Plan, Preapred by n Architecture Inc.

Appendix H
Saniatry Demand & Capacity Analysis

PROJECT	SHOELESS JOE'S RESTAURANT
ADDRESS	1144 HUGEL AVENUE
Town/Township/City	TOWN OF MIDLAND
CONSULTANT	**n Engineering Inc.**
PROJECT NO.	n2137

DESIGN CHART S2: SANITARY SEWER- POST DEVELOPMENT CONDITION

AREA (Land Use Type)	UPSTREAM MH	DOWNSTREAM MH	Flow from Restaurant		FLOW from Motel				TOTAL AREA	AVG FLOW		PEAK FLOW		CUM. FLOW		PIPE							
			Floor area(m^2)	*Average Flow(L/s)	Area (ha.)	EQUIV. POP.	PEAK FACT.	AVG. FLOW (L/s)	(ha.)	INFILTRATION FLOW (L/s)	TOTAL FLOW (L/s)	INFILTRATION FLOW (L/s)	TOTAL FLOW (L/s)	DESIGN FLOW (L/s)	EXTREME FLOW (L/s)	LENGTH m	SIZE	GRADE	CAP. FULL L/sec	(DES.)CAP. (%)	EXTR. CAP. (%)	DES. VEL.FULL (m/sec)	EXTR. VEL. FULL
Proposed Restaurant and Ex.Hotel	***Building Plug***	***SAN MH-1***	***334***	***0.010***	0.743	130	4.2	0.68	0.743	0.171	0.86	0.171	3.06	**0.86**	**3.06**	*30.0*	*150*	*2.00*	21.5	4%	14.2%	0.05	0.17
	SAN MH-1	*Ex. MH*												**0.86**	**3.06**	*33.0*	*150*	*2.00*	21.5	4%	14.2%	0.05	0.17
	EX.MH	Ex. Municipal SAN MH												**0.86**	**3.06**	*30.0*	*150*	*2.00*	21.5	4%	14.2%	0.05	0.17
	* As per Town of Midland Engineering Development Design Standard section 6.1.4																						

PROJECT	SHOELESS JOE'S RESTAURANT
ADDRESS	1144 HUGEL AVENUE
Town/Township/City	TOWN OF MIDLAND
CONSULTANT	**n Engineering Inc.**
PROJECT NO.	n2137

DESIGN CHART S1: SANITARY SEWER - Pre development condition

n Engineering Inc

AREA (Land Use Type)	UPSTREAM MH	DOWNSTREAM MH	FLOW				TOTAL AREA (ha.)	AVG FLOW		PEAK FLOW		CUM. FLOW		PIPE							
			Area (ha.)	EQUIV. POP.	PEAK FACT.	AVG. FLOW (L/s)		INFILTRATION FLOW (L/s)	TOTAL FLOW (L/s)	INFILTRATION FLOW (L/s)	TOTAL FLOW (L/s)	DESIGN FLOW (L/s)	EXTREME FLOW (L/s)	LENGTH m	SIZE	GRADE	CAP. FULL L/sec	(DES.)CAP. (%)	EXTR. CAP. (%)	DES. VEL.FULL (m/sec)	EXTR. VEL. FULL
Hotel	***Building Plug***	***SAN MH-1***	0.743	130	4.2	0.68	0.743	0.171	3.02	0.171	0.85	**0.85**	**3.02**	*30.0*	*150*	*2.00*	21.5	4%	14.0%	0.05	0.17
	SAN MH-1	***Ex. MH***										**0.85**	**3.02**	*33.0*	*150*	*2.00*	21.5	4%	14.0%	0.05	0.17
	EX.MH	**Ex. Municipal SAN MH**										**0.85**	**3.02**	*10.0*	*150*	*2.00*	21.5	4%	14.0%	0.05	0.17

Appendix I

Limiting Condition of 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.
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

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