ECMI PROPERTIES (125 VILLARBOIT) INC.

45 AND 47 ANDERSON BOULEVARD STORMWATER MANAGEMENT REPORT

APRIL 01, 2021

45 AND 47 ANDERSON BOULEVARD STORMWATER MANAGEMENT REPORT

ECMI PROPERTIES (125 VILLARBOIT) INC.

REZONING APPLICATION (V2)

PROJECT NO.: 20M-00392-00
DATE: APRIL 01, 2021

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REVISION HISTORY

FIRST ISSUE

December 11, 2020	Rezoning Application			
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REVISION 1				
January 22, 2021	Rezoning Application			
Prepared by	Reviewed by			
Fiona Allen, E.I.T.	Vladimir Nikolic, P.Eng.			
REVISION 2				
April 1, 2021	Rezoning Application			
Prepared by	Reviewed by			
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[1] Approval of this document is an administrative function indicating readiness for release and does not impart legal liability on to the Approver for any technical content contained herein. Technical accuracy and fit-for-purpose of this content is obtained through the review process. The Approver shall ensure the applicable review process has occurred prior to signing the document.

CONTRIBUTORS

CLIENT

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 SCOPE

WSP has been retained by ECMI Properties Inc. to prepare a Stormwater Management (SWM) Report to support the rezoning application for the proposed development at 45 & 47 Anderson Boulevard in the Township of Uxbridge, Ontario. This site is located in the TRCA's Duffins Creek Watershed. This SWM report examines the potential water quality, water quantity, and water balance impacts of the proposed development and summarizes how each will be addressed in accordance with the Toronto and Region Conservation Authority (TRCA) Stormwater Management Criteria (August 2012), CTC Source Protection Plan (March 2019), Township of Uxbridge Design Criteria (2016) and the Regional Municipality of Durham Design Specifications for Storm Sewers (April 2017). The Stormwater Management Report for Uxbridge Industrial Site, Phase 2 (October 2005) by Westlake Inc. was also used for design guidance.

The site is located on the northeast corner of Anderson Boulevard. The location of the proposed re-development is illustrated in Figure 1.

1.2 STORMWATER MANAGEMENT PLAN OBJECTIVES

The objectives of the stormwater management plan are as follows:

- Determine site specific stormwater management requirements to ensure that the proposals are in conformance with the TRCA SWM Criteria;
- Evaluate various stormwater management practices that meet the requirements of the TRCA and recommend a preferred strategy; and,
- Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and sizing of the proposed stormwater management controls.

1.3 DESIGN CRITERIA

The stormwater management criteria applicable to this project have been determined based on the *TRCA Stormwater Management Criteria (August 2012), Township of Uxbridge Design Criteria (2016)* and *Regional Municipality of Durham Design Specifications for Storm Sewers (April 2017).*

The applied design criteria are discussed as follows.

- **Water Balance**

  The subject development area is located in a "Significant Groundwater Recharge Area" and therefore on-site retention for infiltration is required. The minimum on-site runoff retention from a 5 mm rainfall event is required by the TRCA for erosion control.

- **Water Quality**

  TRCA requires that the development area provide an Enhanced Level of Protection, or a long-term average removal of 80% of TSS on an average annual basis. Water quality treatment methods must conform to

provincial standards as defined by the MOE's Stormwater Management Planning and Design Manual (SWMPDM, 2003).

There is a SWM Pond downstream of the Uxbridge Industrial Site which will provide water quality control as long as the post development runoff coefficient is equal to or less than 0.67.

— **Erosion Control**

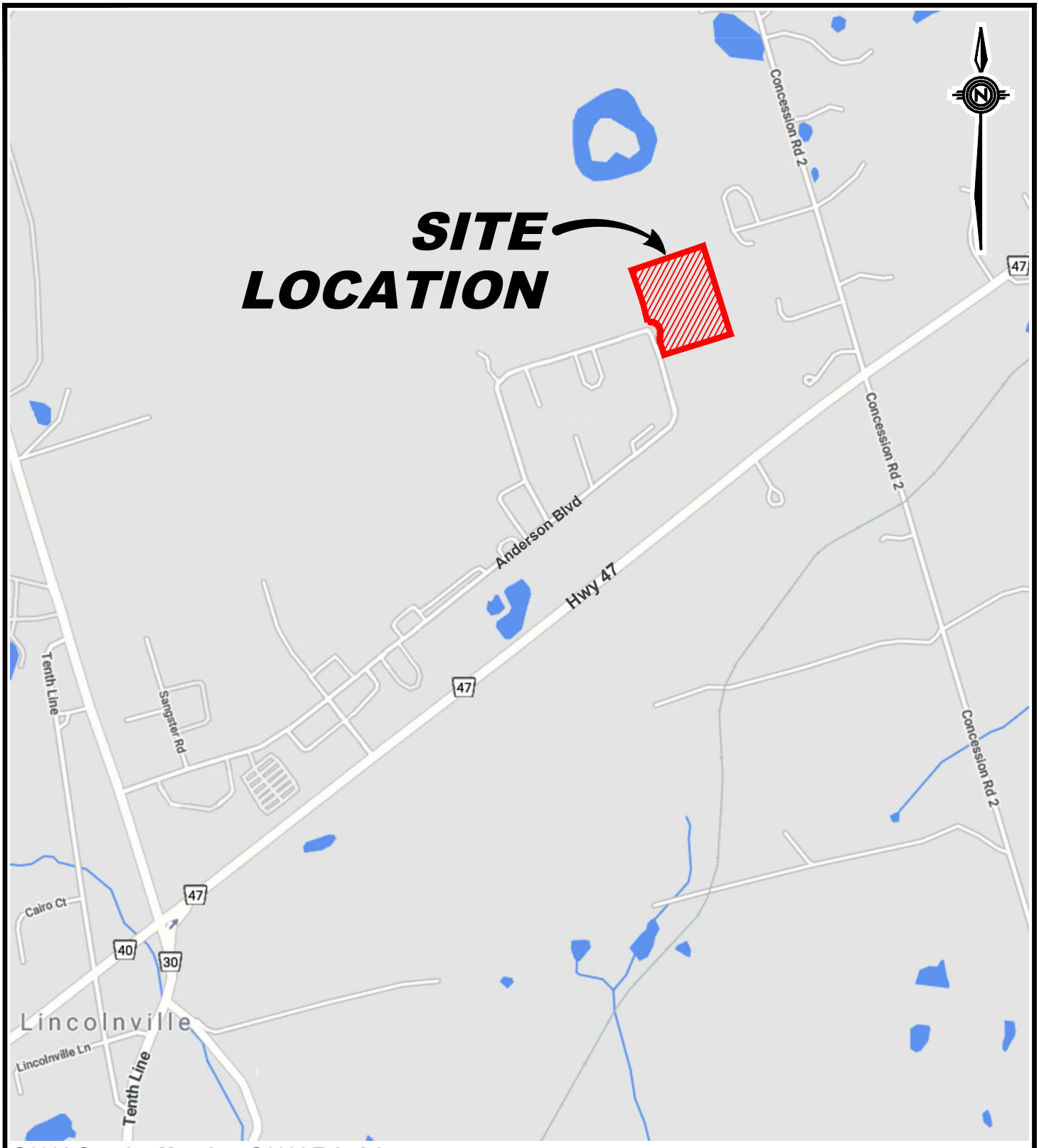
The TRCA requires that the on-site minimum runoff retention from a small design rainfall event (5 mm) is achieved under Water Balance Criteria. Note that the 5 mm retention volume requirement is above the initial abstraction.

— **Water Quantity**

This development area lies within the TRCA's Duffins Creek Watershed. Development within Duffins Creek watershed shall follow the water quantity control criteria outlined in Table 3-1 in the TRCA Criteria. Since this development is below 5 ha, it is required to control post-development peak flows to pre-development levels for the 2 to 100-year storm events.

From the Township of Oshawa's Design Criteria, the allowable release rate to the municipality's storm sewer from the development area shall not exceed the 5-year pre-development peak flow rate of the existing area directed to the right of way.

In addition, there is a SWM Pond downstream of the Uxbridge Industrial Site which will provide water quantity control as long as the post development runoff coefficient is equal to or less than 0.67.



CLIENT

ECMI PROPERTIES (125 VILLARBOIT) INC.

TITLE

45 & 47 ANDERSON BOULEVARD

SITE LOCATION

Checked V.N.	Drawn AutoCAD/B.K.B.
Date MARCH 2021	Proj. No. 20M-00392-00
Scale AS SHOWN	Figure No. 1

FIGURE 1.dwg - 45 & 47 Anderson Blvd - Site Location C:\Users\CAFA072844\BIM 360\WSP Canada projects (AMER)\Land Development Ontario\Project Files\20M-00392 Uxbridge Industrial\SWM\CAD\FIGURES\ Apr 01, 2021 - 2:54pm

2 PRE-DEVELOPMENT CONDITIONS

2.1 GENERAL

The 3.58 ha site is currently an undeveloped pervious grass field. The existing site drains southwest towards Anderson Boulevard. The site lies within the TRCA's Duffin's Creek Watershed. Figure 2 shows the existing conditions of the site. The site is comprised of two parcels of land, each with their own stormwater servicing connection. In the proposed condition, only one of the servicing connections will be used.

Note that while the property boundary is 3.58 ha, the SWM strategy will only apply to the 2.70 ha that will be developed as the rest of the area will remain the same in proposed conditions. As such, the effective area used for this report's calculations is 2.70 ha. The 2.70 ha area is currently an undeveloped grass field.

There are three external areas adjacent to the site; they are located north, northeast and east of the site. Runoff from the north and northeast external areas will be conveyed to the SWM pond via the proposed internal drainage system; stormwater runoff from the west external area will drain to an existing culvert and bypass the proposed SWM system for this site.

Figure 2 illustrates the pre-development conditions of the site.

This site is located at the northeast corner of the Uxbridge Industrial Park and is a part of the Phase 2 development. Downstream of the industrial park is a stormwater management (SWM) pond designed to provide water quality and water quantity control up to a design imperviousness of 67% as stated in the SWM Report for Uxbridge Industrial Site by Weslake Inc. (October 2005).

2.2 RAINFALL INFORMATION

The rainfall intensity for the site was calculated using the following equation: $I = A/(T + B)^C$

Where;

I = rainfall intensity in mm/hour

T = time of concentration in hours

A and C = constant parameters (see below)

The parameters (A, B, C) recommended for use by the Ontario Ministry of Transportation IDF Curve Lookup website are summarized in Table 2.1.

Table 2.1 Rainfall Parameters

RETURN PERIOD (years)	2	5	10	25	100
A	645	904	1065	1234	1799
B	5	5	5	4	5
C	0.786	0.788	0.788	0.787	0.810

Source: Township of Uxbridge Standard Drawing No. US-600

An initial time of concentration, T_C, of 10 minutes (or 0.17 hours) is recommended in the Township of Oshawa Design Criteria document.

2.3 ALLOWABLE FLOW RATES

As discussed in section 2.1, the site is located in the TRCA's Duffin's Creek Watershed. As such, it must adhere to the quantity control release rates specified in the TRCA's SWM Criteria. Since this site is a part of the Uxbridge Industrial Park development, the existing SWM pond downstream has been designed to provide water quantity and quality control to meet the TRCA's requirements.

As per the Uxbridge Phase 2 SWM Report, the SWM Pond is designed to accept stormwater discharge from the site provided that the post development percent impervious is equal or less than 67%, and this translates to a runoff coefficient of 0.69. This runoff coefficient will be used to calculate the allowable release rates for the site. The existing SWM Pond was also designed to account for the 1.58 ha north external area that will be conveyed through the proposed site. This external area has a runoff coefficient of 0.25, and this area will not be developed and will remain unchanged in the proposed condition. There is also a 2.53 ha grassed external area to the east of the site; however, this area will be piped to by-pass the site's proposed stormwater infrastructure and will not be considered in this report. The Storm Drainage Plan from the Uxbridge Phase 2 SWM Report has been included in Appendix D with the site location emphasized.

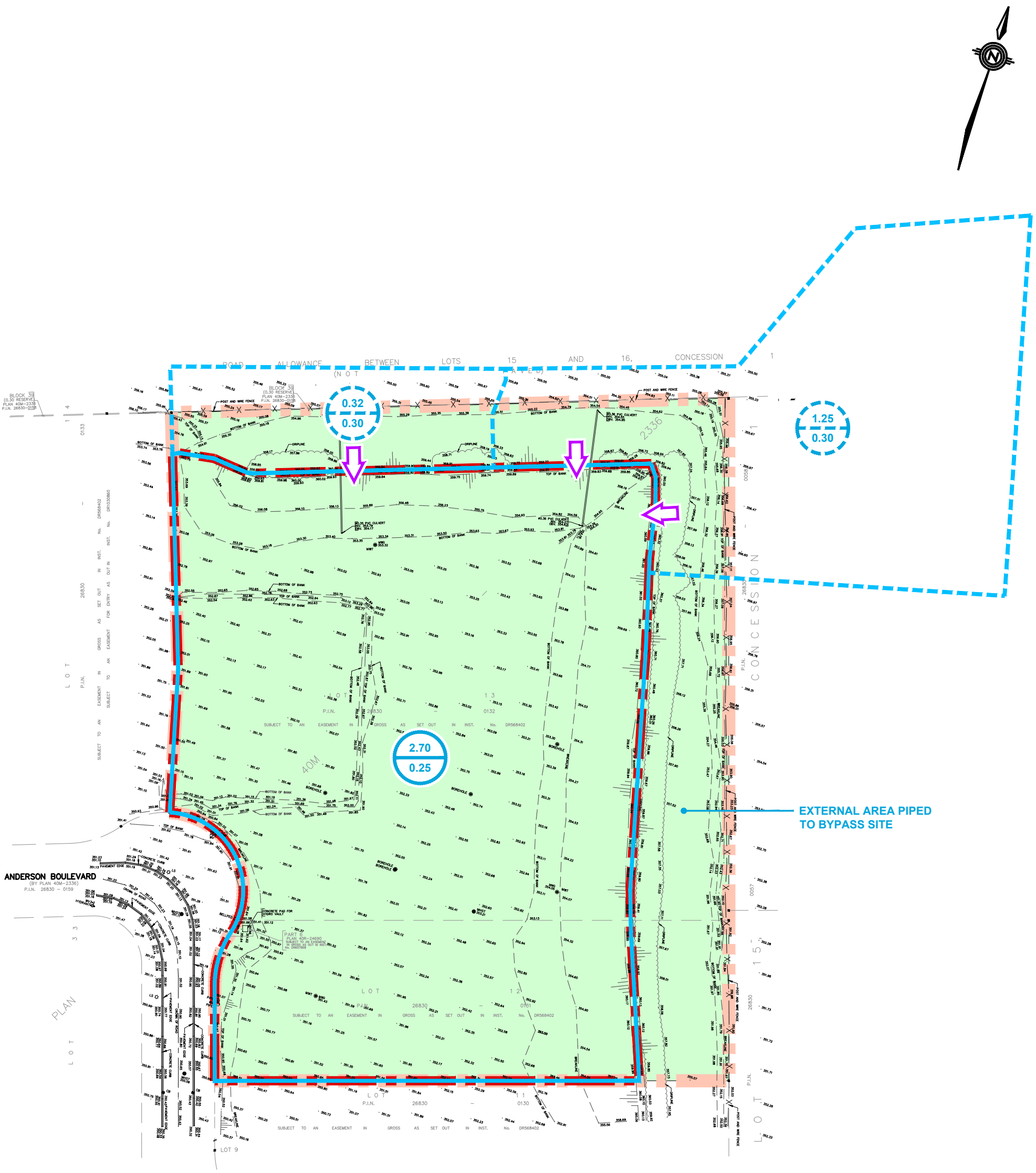
Based on as-built drawings, it was determined that the site will connect to a 675 mm diameter storm sewer on Anderson Boulevard with a capacity of 897.5 L/s. This pipe capacity is smaller than the allowable release rate calculated using the SWM Pond design parameters, as such, the more conservative 897.5 L/s will be used as the allowable release rate for the 25 and 100-year storm event.

The calculated peak flow rates for the site under pre-development conditions and the allowable release rate are summarized below in Table 2.2. Detailed calculations are contained within Appendix A.

Table 2.2 Peak Flow Rate Calculations & Allowable Site Discharge Rate

RETURN PERIOD (YEARS)	RAINFALL INTENSITY, I (mm/hr)	EXISTING SITE PEAK RUNOFF RATES, Q* (L/s)	SITE ALLOWABLE RELEASE RATE AS PER SWM POND DESIGN ** (L/s)	EXISTING NORTH EXTERNAL AREA PEAK RUNOFF RATES (L/s)	SITE + EXISTING NORTH EXTERNAL AREA PEAK RUNOFF RATE (L/s)	ALLOWABLE RELEASE RATE (L/s)
2	76.8	144.3	395.7	84.1	479.7	**479.7**
5	107.0	201.1	551.5	117.2	668.7	**668.7**
10	126.1	237.0	649.8	138.0	787.8	**787.8**
25	154.6	319.7	876.7	186.3	1,063.0	**897.5**
100	200.6	471.4	1292.6	274.7	1,567.3	

*C=0.25, total area of 3.58 ha and time of concentration of 10 minutes
**C=0.67, total area of 3.58 ha and time of concentration of 10 minutes



LEGEND

- PROPERTY BOUNDARY
- DEVELOPMENT BOUNDARY
- CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- 2.70 / 0 — DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- DRAINAGE DIRECTION
- PERVIOUS LANDSCAPE

0 10 20 30 40 50m

CLIENT: ECMI PROPERTIES (125 VILLARBOIT) INC.

TITLE: 45 & 47 ANDERSON BOULEVARD

EXISTING CONDITIONS

wsp

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Date MARCH 2021	Proj. No. 20M-00392-00
Scale AS SHOWN	Figure No. 2

3 POST DEVELOPMENT CONDITIONS

3.1 GENERAL

The proposed 2.7 ha development consists of the construction of a butler building, parking lot, outdoor storage area and landscaped areas. The SWM report supports the proposal seeks to rezone the site to permit Waster Transfer Processing and Bioremediation Facility for soil that are classified as solid non-hazardous waste (*as per the requirements of Regulation 558 under the Environmental Protection Act*). This proposal for the site is in keeping with other industrial zones in the subdivision including Lot 17, which is currently zoned to permit a waste transfer station. The external area to the north of the site is not part of the development and will remain unchanged in the proposed condition; however, it will be conveyed through the site's proposed storm system. Refer to Figure 3 for details of the post-development conditions. Table 3.1 presents the proposed land-use breakdown.

Table 3.1 Proposed Land-Use Area Breakdown

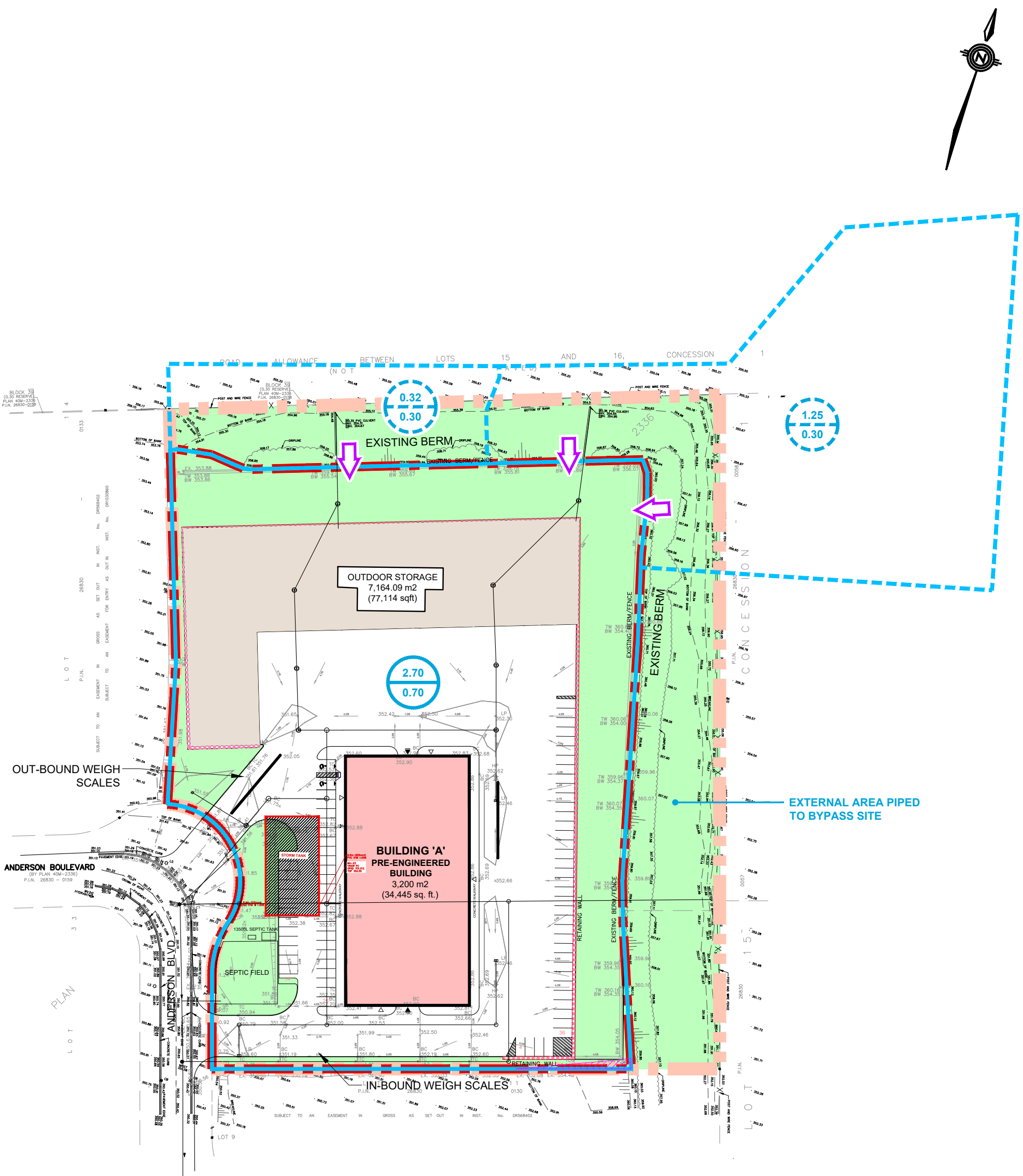
LAND-USE	AREA (m^2)	% COVERAGE	2 -10 YR RUNOFF COEFFICIENT, C	25 YR RUNOFF COEFFICIENT, C	100 YR RUNOFF COEFFICIENT, C
Impervious Roof Area	3,200	11.8	0.90	0.99	1.00
Soft Landscaping	8,129	30.1	0.25	0.28	0.31
Vehicular Surfaces	15,657	57.9	0.90	0.99	1.00
Uncontrolled	60	0.2	0.25	0.28	0.31
Site Area	27,047	100.0	0.70	0.77	0.79
External Areas	15,785	-	0.25	0.28	0.31
Total Area	42,832	-	0.54	0.59	0.62

3.2 WATER QUALITY CONTROL

Within the site, the proposed roof area is not prone to sediment generation and may be considered clean for the purposes of water quality control. Stormwater runoff from the vehicular surfaces and parking area will require water quality treatment to an 80% TSS removal standard, as per the TRCA criteria.

As outlined in Figure 3 there is an outdoor soil storage area of 7,164 m^2 that is underlain by a concrete slab base. The uncovered soil stockpiles comprise of clean soils and will therefore have no impacts on runoff water quality with the exception of possible sediment loading. Stockpiles that require bio remedial treatment will be covered with a low permeable membrane, and, therefore, the runoff from these stockpiles will have no impact on water quality. All runoff from the outdoor soil storage area will be directed to catchbasins equip with sediment control measures to ensure that this runoff meets the Storm Sewer Use by law prior to discharge to the stormwater system off site. Therefore, runoff generated from the outdoor soil storage area during operations are not anticipated to influence shallow groundwater quality or receiving surface water.

Since this site will discharge at or below the total allowable release rate which is calculated using a runoff coefficient of 0.67, the downstream SWM Pond can provide the full 80% TSS removal as per the Uxbridge Industrial Phase 2 SWM Report.



LEGEND

- PROPERTY BOUNDARY
- DEVELOPMENT BOUNDARY
- CATCHMENT BOUNDARY
- EXTERNAL CATCHMENT BOUNDARY
- 2.70 / 0.84 — DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- DRAINAGE DIRECTION
- IMPERVIOUS ROOF
- PERVIOUS LANDSCAPE
- UNCONTROLLED
- OUTDOOR STORAGE

0 10 20 30 40 50m

CLIENT: ECMI PROPERTIES (125 VILLARBOIT) INC.

TITLE: 45 & 47 ANDERSON BOULEVARD

PROPOSED CONDITIONS

Checked V.N.	Drawn AutoCAD/F.A..
Date APRIL 2021	Proj. No. 20M-00392-00
Scale AS SHOWN	Figure No. 3

3.3 WATER BALANCE

As indicated in Section 1.3, this site is located in a TRCA Significant Groundwater Recharge Area with a score of 2 with no policies associated with this area. Further, according to the MECP Source Protection Information Atlas the site is also located within the wellhead protection area Q1 and Q2 with a stress rating of moderate which means if additional water taking is required then recharge will be needed to offset any recharge loss. According to the CTC Source Protection Plan, it is recommended that the best management practices be implemented to maintain pre-development recharge.

Section 4.5.8 of the MECP's Stormwater Management Planning & Design Manual (hereafter MECP Manual) provides guidance on the design of the infiltration chamber. The information provided in the hydrogeological study prepared by WSP Canada Inc. (January 2020) (Hereafter WSP's Geotech-Study) is used in the preliminary feasibility evaluation and configuration of the infiltration chamber.

WSP's Geotech-Study indicates that the native soils on site are silty sand, silt and sandy silt till. The soil layer below is sandy slit (Borehole BH20-04 and BH20-06). Wells were in dry condition; it is estimated that the average groundwater level is 21.3 m BGS. The total infiltration chamber height is 2.06 m plus a minimum 0.15 m cover to bottom of pavement. In the MECP Manual, Table 4.9 states that a minimum 1.0 m clearance is required between the bottom of the infiltration chamber and the water table. At this site, the bottom of the infiltration chamber system would be well above the average water table.

The estimated infiltration rate is estimated to be 20 mm/hr based on the hydrogeological study. As per the TRCA guideline, a safety correction factor of 2.5 is applied; the design infiltration rate is 8 mm/hr. This safety factor is required to account for site heterogeneity, potential reduction in soil permeability during construction and the gradual accumulation of fine sediments over time. The infiltration calculation can be found in Appendix A. The 76.1 m^3 infiltration storage (i.e. storage within the clearstone layer of the infiltration gallery and chambers) was accounted for in water infiltration calculation which can infiltrate within 34.9 hours; this meets the MECP drawdown time of 48 hours.

A water balance analysis was carried out to demonstrate that, with the proposed infiltration chamber, less than 50% of annual rainfall leaves the site as runoff under proposed conditions.

The method used for analysis is based on the examples provided in Section 3.2.3 of the MECP Manual. Essentially, for each type of surface proposed on the site, the relationship between rainfall, evapotranspiration, runoff, and infiltration is determined, and the results are then weighted based on area coverage to calculate the site-wide water balance relationship.

General assumptions used in the calculations include:

- The average annual precipitation volume in Township of Oshawa is 868 mm (based on The TRSPA Water Balance Tool).
- The impervious area can accept 1.0 mm rainfall for subsequent evaporation due to shallow depression.

Table 3.2 shows that, under the existing conditions, of the total average annual rainfall, infiltration accounts for approximately 16.7%, evapotranspiration (ET) accounts for approximately 60.7%, and there is approximately 22.6% runoff.

Under the proposed condition, with the mitigation measure in place, of the total average annual rainfall, infiltration accounts for approximately 34.6%, ET accounts for approximately 23.4%, and there is approximately

42.0 % runoff. Therefore, total 58.0% of annual rainfall shall be retained on site for infiltration or evapotranspiration.

Therefore, the proposed development shall enhance the groundwater recharge and satisfy the water balance design criteria. Detailed calculations for the water balance analysis can be found in Appendix A.

Table 3.2: Water Balance Analysis – Pre-Development vs Post-Development Conditions

HYDROLOGIC CYCLE COMPONENTS	PRE-DEVELOPMENT CONDITIONS		POST-DEVELOPMENT CONDITIONS	
	ANNUAL DEPTH (MM)	% OF ANNUAL PRECIPIRATION	ANNUAL DEPTH (MM)	% OF ANNUAL PRECIPIRATION
Infiltration	145.0	16.7%	350.3	34.6%
Evapotranspiration	527.0	60.7%	108.5	23.4%
Runoff	196.0	22.6%	409.2	**42.0%**
Precipitation	868.0	100.0%	868.0	100.0%

3.4 WATER QUANTITY CONTROL

As noted in Section 2.3, the discharge from the development should be restricted to the allowable release rate, which is equivalent to the site's peak runoff rate using a runoff coefficient of 0.67 plus the stormwater runoff from the north external area during the 2-year to 100-year design storm events. The proposed flow control measures comprise of using the existing SWM pond located downstream of the site.

An ADS StormTech MC-4500 infiltration gallery is proposed for this site for quantity control. The infiltration chamber has a foot print of 537 m^2 and a storage volume of 710 m^3. The primary gravity drained outlet is a 525 mm diameter orifice tube set 0.28 m above the bottom of stone. The product sheet can be found in Appendix B.

Since design of the infiltration gallery is proposed for the site to meet the target allowable release rate, the downstream SWM Pond can provide water quantity control as per the Uxbridge Industrial Phase 2 SWM Report.

The 'HydroCAD' software package has been used to model the behaviour of the proposed flow control measures and determine its response under various storm events. This software utilises the modified rational method to calculate flow rates and related storage values. Detailed output from the modelling is included in Appendix C.

Table 3.3 presents a summary of the HydroCAD modelling results for the infiltration chamber and for the entire study area. Refer to Appendix E for the model output.

Table 3.3: Post-Development Peak Flow Rates for the Infiltration Chamber and Entire Site

RETURN PERIOD (YEARS)	NORTH EXTERNAL AREA PEAK FLOW RATE (L/S)	INFILTRATION CHAMBER PEAK ELEVATION (M)	UTILIZED INFILTRATION CHAMBER VOLUME (M^3)	INFILTRATION CHAMBER PEAK DISCHARGE RATE (L/S)	UNCONTROLLED AREA WITHIN SITE PEAK FLOW RATE (L/S)	TOTAL PEAK FLOW RATE (L/S) *	TOTAL ALLOWABLE RELEASE RATE (L/S)
2	82.76	0.673	251.6	273.9	0.3	274.1	**479.7**
5	115.2	0.794	304.8	387.2	0.4	387.5	**668.7**
10	135.8	0.881	342.2	477.0	0.5	447.3	**787.8**
25	186.5	1.098	432.1	572.4	0.7	572.8	**897.5**
100	267.9	1.458	564.9	734.2	1.0	734.8	

**Includes flows from the infiltration chamber*

The modelling results demonstrate that the post-development peak flow rates for all events up to the 100-year storm are lower than the allowable release rate calculated in Section 2.3. The maximum required storage volume in the infiltration chamber for the 100-year event is 564.9 m^3. Note that this includes the water balance volume discussed in Section 3.2.

As the majority of the flow rates are controlled by the infiltration gallery, the rainfall intensity and storm duration resulting in the maximum utilized storage produces the largest flows. This has been iteratively determined at t_d = 16 minutes (for the 100-year event).

4 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

During construction, there is potential for short-term sediment wash-off from the site. To protect the downstream receiving watercourse, on-site erosion and sediment control (ESC) measures are necessary during construction.

The ESC measures focus on minimizing adverse environmental impacts by restricting the mobilization and transport of sediment, the following general practices are recommended:

- ESC measures should be in place prior to the commencement of construction, and not removed until the end of the construction period, when the site has been stabilized.
- All disturbed areas should be stabilized as quickly as possible. Stabilization of disturbed areas may be accomplished by sodding, seeding, mulching, hydro-seeding, planting, or covering of constructed slopes with appropriate material such as geotextile or jute mesh.
- Access to the construction site must be minimized and installed with aggregates.
- A continuous siltation fence must be constructed along the perimeter of the proposed development.

Routine inspection and maintenance of the ESC measures is required to ensure these measures to function properly and effectively.

5 CONCLUSIONS

A stormwater management plan has been prepared to support the rezoning application for the proposed development of 45 & 47 Anderson Boulevard in the Township of Uxbridge. The key points are summarized below.

5.1.1.1 *WATER BALANCE*

A 79.5 m³ water balance volume provided at the bottom of the infiltration gallery for retention and control of runoff ensures that the TRCA's Signification Groundwater Recharge Area requirements. The proposed design ensures that less than 50% of the stormwater is runoff.

5.1.1.2 *WATER QUANTITY*

The use of a 525 mm diameter orifice tube to control discharge from the proposed 710 m³ stormwater infiltration gallery will ensure that the peak offsite discharge rates to municipal storm sewers will be below the allowable maximum rate defined in Section 2.3 for all storms up to and including the 100-year event.

5.1.1.3 *EROSION CONTROL*

Erosion and sediment control measures have been proposed for this site during construction.

5.1.1.4 *WATER QUALITY*

Since this site will discharge at or below the total allowable release rate which is calculated using a runoff coefficient of 0.67, the downstream SWM Pond can provide the full 80% TSS removal as per the Uxbridge Industrial Phase 2 SWM Report.

The report has demonstrated that the proposed stormwater management strategy will address stormwater management related impacts from this project in adherence with the Township of Oshawa's Design Criteria and the TRCA's Stormwater Management Criteria.

Respectfully submitted,

WSP

BIBLIOGRAPHY

- Toronto and Region Conservation Authority, Stormwater Management Criteria (August 2012, Version 1.0)
- Ministry of Environment Ontario and Climate Change,
- Toronto and Region Conservation Authority, TRSPA Water Balance Tool
  https://trca.ca/conservation/drinking-water-source-protection/trspa-water-balance-tool/
- Township of Oshawa, Design Criteria (2016)

APPENDIX

A STORMWATER CALCULATIONS

	Stormwater Management Calculations	**Project:**	**45 & 47 Anderson Boulevard, Uxbridge**	**No.:**	**20M-00392-00**	
	Existing North External Area Discharge Rate to Anderson Boulevard	**By:**	**JKC**	**Date:**	**2021-04-01**	**Page:**
		Checked:	**VN**	**Checked:**	**VN**	**1**

Calculation of existing runoff rate is undertaken using the Rational Method: **Q = 2.78 CaCIA**

Where: Q = Peak flow rate (litres/second)
C = Runoff coefficient
I = Rainfall intensity (mm/hour)
A = Catchment area (hectares)

Project Area, A **1.58** hectares
Runoff Coef, C* 0.25

Rainfall intensity calculated in accordance with the Township of Uxbridge Design Criteria Standard Drawing No. US-600:

Where: A, B and C = Parameters defined in Standard Drawing No. US-600
I = Rainfall intensity (mm/hour)
T = Time of concentration (minutes)

$$I = A/(T+B)^C$$

Return Period (Years)	2	5	10	25	100
A	645	904	1065	1234	1799
B	5	5	5	4	5
C	0.786	0.788	0.788	0.787	0.810
T (mins) **	10	10	10	10	10
T (hrs)	0.167	0.167	0.167	0.167	0.167
I (mm/hr)	76.8	107.0	126.1	154.6	200.6
Ca (Antecednet Precipitation Index)	1.00	1.00	1.00	1.10	1.25
Q (litres/sec)	84.2	117.4	138.3	186.6	275.1
Q (m3/sec)	0.084	0.117	0.138	0.187	0.275

** Note recommended minimum value for time of concentration is 10 minutes.

Calculation of existing runoff rate is undertaken using the Rational Method: **Q = 2.78 CaCIA**

Where: Q = Peak flow rate (litres/second)
C = Runoff coefficient
I = Rainfall intensity (mm/hour)
A = Catchment area (hectares)

Project Area, A **2.70** hectares
Runoff Coef, C* 0.25

Rainfall intensity calculated in accordance with the Township of Uxbridge Design Criteria Standard Drawing No. US-600:

Where: A, B and C = Parameters defined in Standard Drawing No. US-600
I = Rainfall intensity (mm/hour)
T = Time of concentration (minutes)

$$I = A/(T+B)^C$$

Return Period (Years)	2	5	10	25	100
A	645	904	1065	1234	1799
B	5	5	5	4	5
C	0.786	0.788	0.788	0.787	0.810
T (mins) **	10	10	10	10	10
T (hrs)	0.167	0.167	0.167	0.167	0.167
I (mm/hr)	76.8	107.0	126.1	154.6	200.6
Ca (Antecednet Precipitation Index)	1.00	1.00	1.00	1.10	1.25
Q (litres/sec)	144.3	201.1	237.0	319.7	471.4
Q (m3/sec)	0.144	0.201	0.237	0.320	0.471

** Note recommended minimum value for time of concentration is 10 minutes.

Calculation of existing runoff rate is undertaken using the Rational Method: **Q = 2.78 CIA**

Where: Q = Peak flow rate (litres/second)
C = Runoff coefficient
I = Rainfall intensity (mm/hour)
A = Catchment area (hectares)

Project Area, A **2.70** hectares
Runoff Coef, C* 0.69

Rainfall intensity calculated in accordance with the Township of Uxbridge Design Criteria Standard Drawing No. US-600:

Where: A, B and C = Parameters defined in Standard Drawing No. US-600
I = Rainfall intensity (mm/hour)
T = Time of concentration (hours)

$$I = A/(T+B)^C$$

Return Period (Years)	2	5	10	25	100
A	645	904	1065	1234	1799
B	5	5	5	4	5
C	0.786	0.788	0.788	0.787	0.810
T (mins) **	10	10	10	10	10
T (hrs)	0.167	0.167	0.167	0.167	0.167
I (mm/hr)	76.8	107.0	126.1	154.6	200.6
Ca (Antecednet Precipitation Index)	1.00	1.00	1.00	1.10	1.25
Q Site(litres/sec)	395.7	551.5	649.8	876.7	1,292.6
Q External Area(litres/sec)	84.2	117.4	138.3	186.6	275.1
Q Allowable to Pond (litres/sec)	**479.9**	**668.9**	**788.1**	**1,063.4**	**1,567.8**

** Note recommended minimum value for time of concentration is 10 minutes.

As per the SWM Report for Uxbridge Industrial Site by Weslake Inc., the SWM Pond downstream of the Uxbridge Industrial site has been designed such that it can provide water quantity and quality control as long as the post development site area flows from this development do not exceed the calculated discharge of a 0.69 runoff coefficient. The SWM Pond also accounts for the existing north and east external area both of which have a runoff coefficient of 0.25. The east external area will be piped to bypass the site's proposed stormwater infrastructure and has been omitted from calculations.

Project:	45 & 47 Anderson Boulevard, Uxbridge	No.:	20M-00392-00	
By:	FA	Date:	2021-04-01	Page:
Checked:	VN	Checked:		4
	Water Recharge Analysis _ Pre-Development Conditions			

Water Balance

1. Design Criteria and SWM Strategies

The site is located in a Source Water Protection vulnerable area referred to as Wellhead Protection Area-Q2 (WHPA-Q2).

The implementation of best management practices is recommended to maintain pre-development recharge.

It is proposed best effort to conserve the hydrologic cycle.

LID measures such as an infiltration gallery is proposed to retain runoff to maximize water recharge

2 Pre-development Site Wide Water Balance Analysis

The TRCA's online water balance tool gives the approximate recharge amount of the site location (see below).

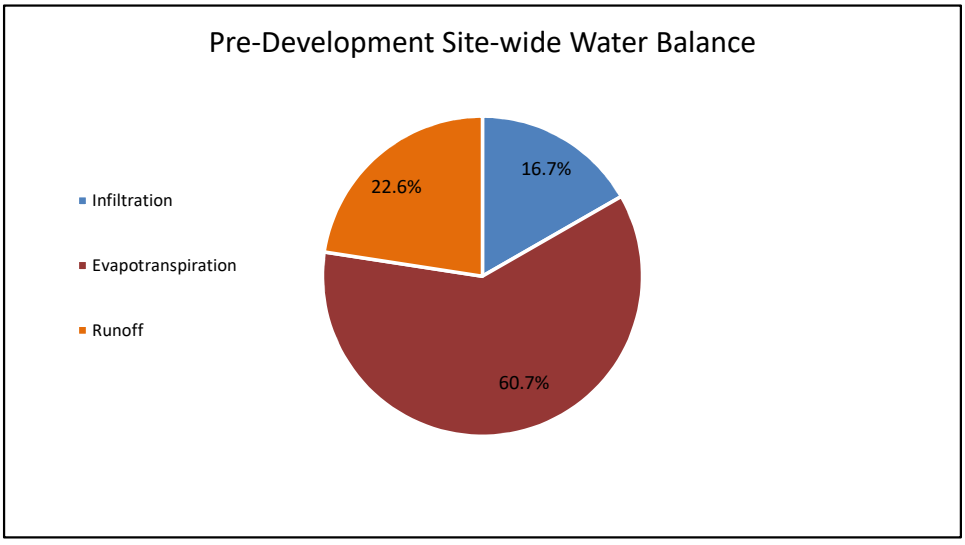
Annual Water Balance Average Function

TRCA tool

	(%)	(mm)
Infiltration	16.7	145.0
Evapotranspiration	60.7	527.0
Runoff	22.6	196.0
Precipitation	100.0	868.0

Pre-development Site Wide Water Balance Relationship

Water Budget (mm/hr)	Impervious Area	Pervious Area	Site-Wide
% Land-Use Coverage	0.0%	100.0%	100.0%
Infiltration		145.0	16.7%
Evapotranspiration		527.0	60.7%
Runoff		196.0	22.6%
Precipitation		868.0	100%



3. Post-development Site Wide Water Balance Analysis _ without Mitigation Measures

Water balance analysis for post-development conditions without mitigation measures is carried out to evaluate the impacts due to the proposed development. It follows the procedure illustrated in the pre-development water balance analysis.

3.1 Water Balance Relationship for the Impervious Area

1.89 ha or 69.7%

	(%)	(mm)	Comments/Assumptions:
Infiltration	0.0	0.0	...
Evapotranspiration	12.5	108.5	*1 mm depression, refer to Figure 1a in City of Toronto WWFMGs.*
Runoff	87.5	759.5	...
Precipitation	100.0	868.0	

3.2 Water Balance Relationship for the Pervious Area

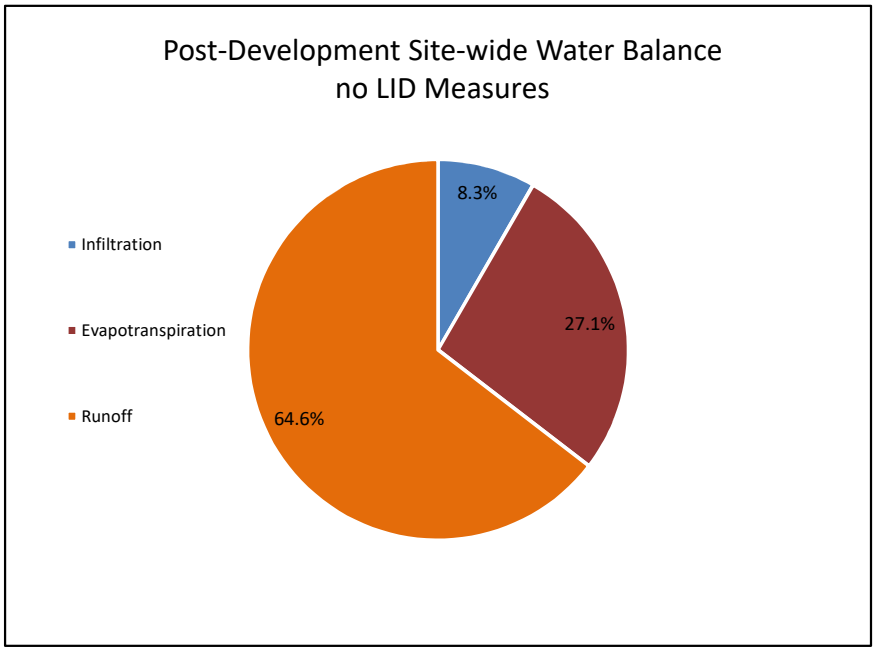
Under proposed conditions, the site pervious area is urban lawn and bushes/trees.

0.82 ha or 30.3%

	(%)	(mm)	
Infiltration	27.5	238.7	*(Precipitation - Evapotranspiration) * infiltration factor based on soil type found in Ontario Soils Map*
Evapotranspiration	60.7	527.0	
Runoff	11.8	102.3	
Precipitation	100.0	868.0	

3.3 Site Wide Water Balance Relationship _ Post-development without Mitigation Measures

	Impervious Area	Pervious Area	Site-Wide	
% Land-Use Coverage	69.7%	30.3%	100.0%	
Infiltration	0.0	238.7	72.3	8.3%
Evapotranspira	108.5	527.0	235.2	27.1%
Runoff	759.5	102.3	560.5	64.6%
Precipitation	868.0	868.0	868.0	100.0%



4. Post-development Site Wide Water Balance Analysis

Under proposed development conditions, the current pervious area will be mainly impervious area.

Therefore, LID measures shall be incorporated into the site plan to make best effort for groundwater recharge.

4.1 Water Retention Strategies

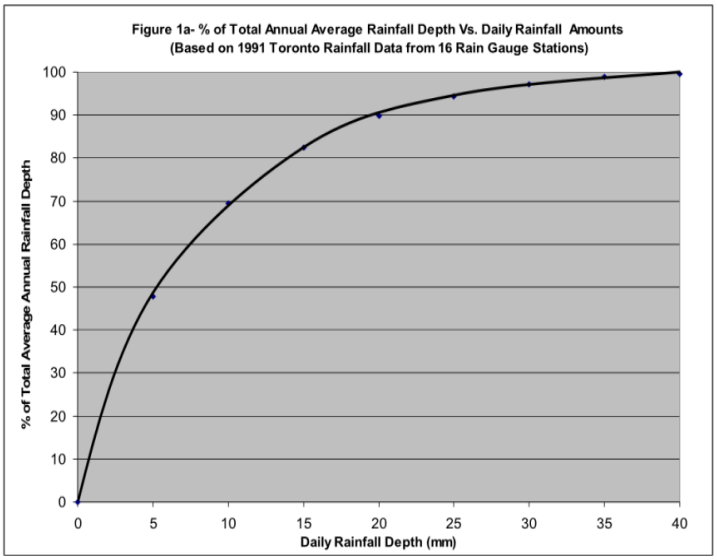
The proposed LID measures includes infiltration base of chamber system, and placement of minimum 300 mm deep absorbent soil at at-grade pervious areas

The following assumptions are applied in the analysis.

1) All pervious area will have an initial abstraction of 10 mm.

2) All impervious area shall accept 1 mm rainfall prior to runoff generation due to shallow depressions.

Figure 1a in City of Toronto WWFMGs presents the relationship of the % of the total annual rainfall depth vs. the daily rainfall amounts. This relationship will be used to conduct the water balance analysis for the subject site from an annual basis.



4.2 Define Individual Plan per Land Use

Proposed Site Plan Area to Chamber System

Pervious Area	8,189	m^2	30%
Impervious Area to Chamber System	18,858	m^2	70%
Total Site Area	**27,047**	**m^2**	**100%**

Project:	45 & 47 Anderson Boulevard, Uxbridge	No.:	20M-00392-00	
By:	FA	Date:	2021-04-01	Page:
Checked:	VN	Checked:		7

Water Recharge Analysis _ Post-Development with Mitigation Measures

1) At Grade Pervious Area -Absorbent Soil

The 300 mm deep absorbent soil can retain at least 10 mm water; it's about 70.0 % of annual precipitation

	(%)	(mm)	Comments/Assumptions:	
Infiltration	21.5	186.6	*10 mm retention through absorbent soil*	*infiltration as pre-development*
Evapotranspiration	48.5	421.0		
Runoff	30.0	260.4	...	
Precipitation	100.0	868.0		

2) Runoff from Impervious Area to be retained through Infiltration Base

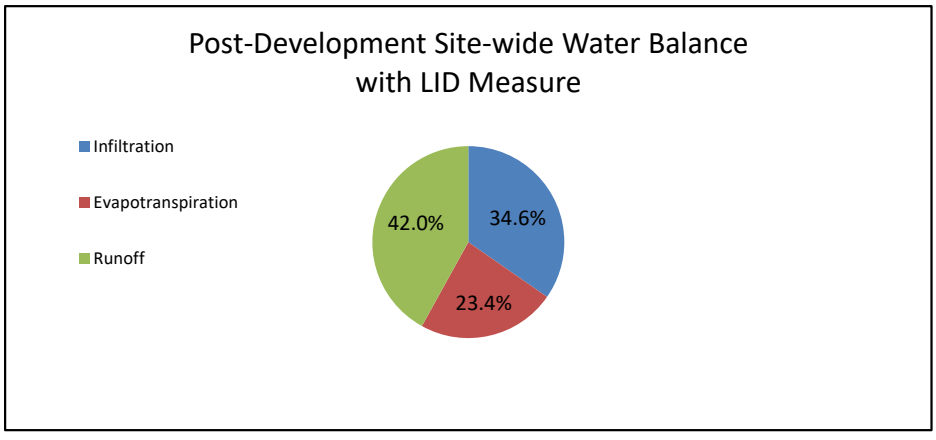
The provided Infiltration Storage 76.1 m^3 *consider 0.23m elevation from bottom of stone*

Surface	Area (m^2)	Rainfall Depth (mm)	Initial Abstraction (mm)	Runoff Depth (mm)	Retention Volume (m^3)
Hard Surface	18,858	5.0	1.0	4.0	76.1

	(%)	(mm)	Comments/Assumptions:
Infiltration	40.4	350.3	*3.9 mm infiltration through the stone base of chamber system*
Evapotranspiration	12.5	108.5	*1 mm depression*
Runoff	47.1	409.2	...
Precipitation	100.0	868.0	

4.3 Site Wide Water Balance Relationship _ Post-development Conditions with Mitigation Measures

	Impervious Area to Infiltration Base	Pervious Area - Absorbent Soil	Site-Wide Water Balance Relationship	
% Land-Use Coverage	69.7%	30.3%	69.7%	
Infiltration	350.3	186.6	300.7	34.6%
Evapotranspiration	108.5	421.0	203.1	23.4%
Runoff	409.2	260.4	364.2	42.0%
Precipitation	868.0	868.0	868.0	100.0%



5. Post-development vs Pre-Development Water Balance

Hydrologic Cycle Components	Pre-Development Conditions		Post-Development Conditions without Mitigation Measures		Post-Development Conditions with Mitigation Measures	
	mm	%	mm	%	mm	%
Infiltration	145.0	***16.7%***	72.3	8.3%	350.3	***34.6%***
Evapotranspiration	527.0	60.7%	235.2	27.1%	108.5	***23.4%***
Runoff	196.0	22.6%	560.5	64.6%	409.2	***42.0%***
Precipitation	868.0	100.0%	868.0	100.0%	868.0	***100.0%***

The comparison of water balance reveals that the water recharge under post-development with LID measure will be greater than the pre-development level, though the runoff volume will increase due to the decrease of evapotranspiration.

Drawdown Time

Equation 4.2 in 2003 MOE SWMPDM is used to calculate the allowable depth of the infiltration trench.

$$d = \frac{PT}{1000}$$ Equation 4.2 in 2003 MOE SWMPDM

Where, d = Maximum Allowable Depth of Infiltration Storage of the Trench

	0.58	m	
P = Percolation Rate	20.00	mm/hr	(used the lowest perc rate in Geotechnical report Section 4.3)
Note that a safety tactor of	2.50	is applied to the in-situ infiltraiton rate	
T = Drawdown time	73	hours	
	48	hours	

Depth of Storage	0.28	m
	279	mm
Drawdown time	34.9	hours

The 100-year elevation in the infiltration system is less than the maximum allowable depth of infiltration storage. Therefore the system meets the MOE requirements.

APPENDIX

B INFILTRATION GALLERY SPECIFICATION

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.

STORMTECH MC-3500 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
90" x 77" x 45"
2,286 mm x 1,956 mm x 1,143 mm

Chamber Storage
109.9 ft³ (3.11 m³)

Min. Installed Storage*
178.9 ft³ (5.06 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, 9" (230 mm) of stone between chambers/end caps and 40% stone porosity.

STORMTECH MC-3500 END CAP
(not to scale)

Nominal End Cap Specifications

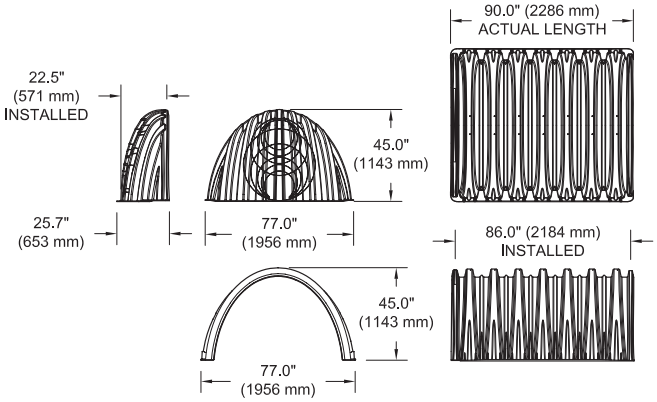
Size (L x W x H)
26.5" x 71" x 45.1"
673 mm x 1,803 mm x 1,145 mm

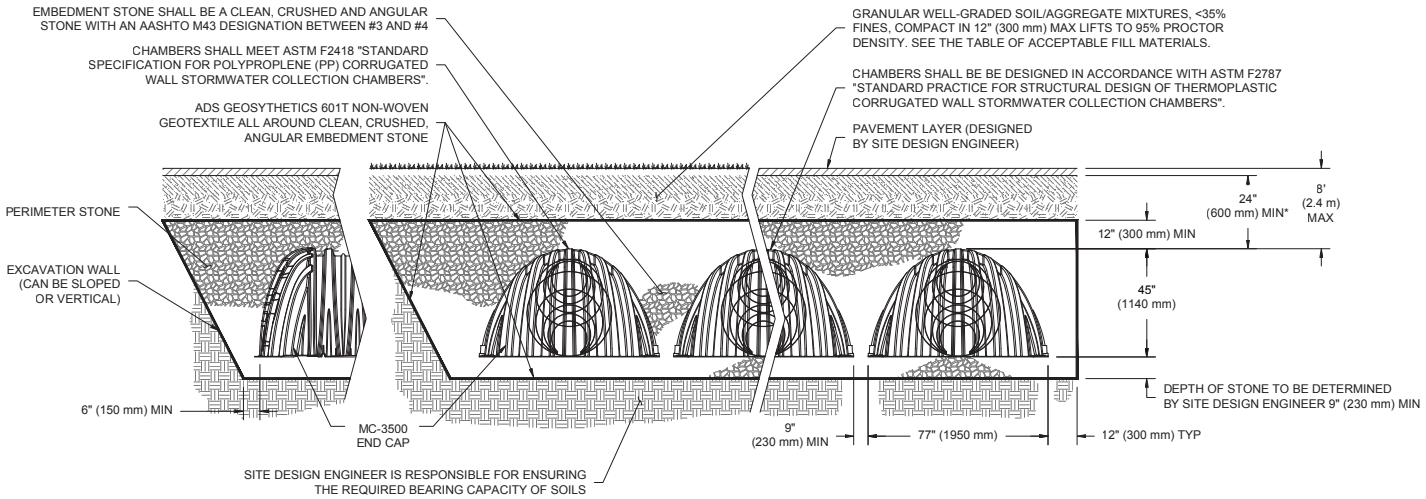
End Cap Storage
14.9 ft³ (1.30 m³)

Min. Installed Storage*
46.0 ft³ (1.30 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, 9" (230 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 30" (750 mm).

MC-3500 CHAMBER SPECIFICATION

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
MC-3500 Chamber	109.9 (3.11)	178.9 (5.06)	184.0 (5.21)	189.2 (5.36)	194.3 (5.5)
MC-3500 End Cap	14.9 (.42)	46.0 (1.33)	47.7 (1.35)	49.4 (1.40)	51.1 (1.45)

Note: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

AMOUNT OF STONE PER CHAMBER

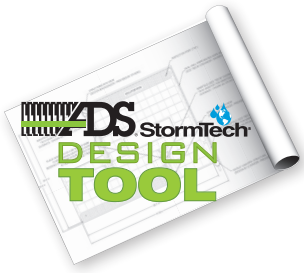
ENGLISH TONS (yds³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-3500 Chamber	9.1 (6.4)	9.7 (6.9)	10.4 (7.3)	11.1 (7.8)
MC-3500 End Cap	4.1 (2.9)	4.3 (3.0)	4.5 (3.2)	4.5 (3.2)
METRIC KILOGRAMS (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
MC-3500 Chamber	8,220 (4.9)	8,831 (5.3)	9,443 (5.6)	10,054 (6.0)
MC-3500 End Cap	3,699 (2.2)	3,900 (2.3)	4,100 (2.5)	4,301 (2.6)

Note: Assumes 12" (300 mm) of stone above and 9" (230 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" (230 mm)	12" (300 mm)	15" (375mm)	18" (450 mm)
MC-3500 Chamber	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)	13.8 (10.5)
MC-3500 End Cap	4.1 (3.1)	4.2 (3.2)	4.4. (3.3)	4.5 (3.5)

Note: Assumes 9" (230 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.



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For more information on the StormTech MC-3500 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

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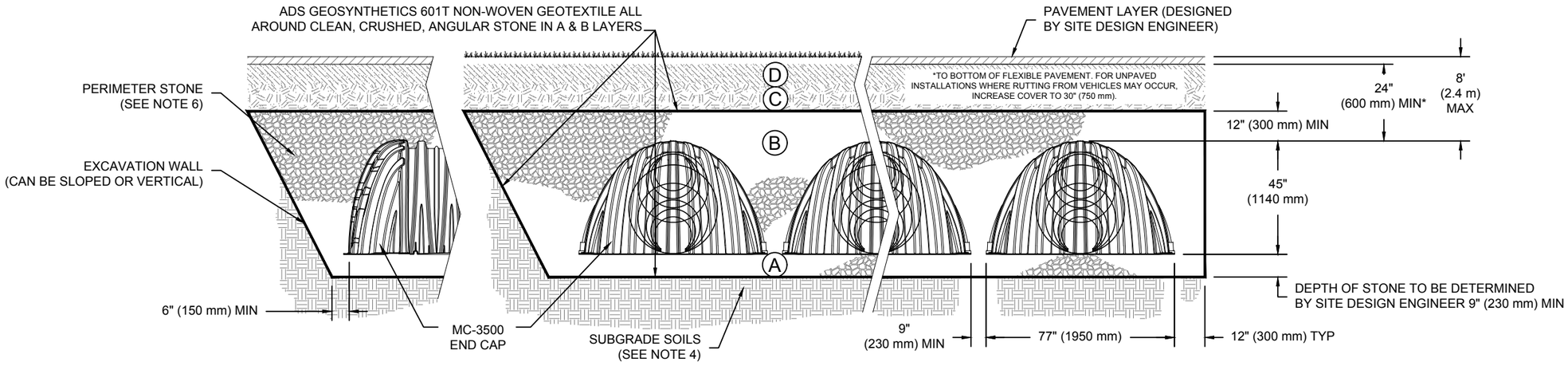
ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

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.



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

NOTES:

1. MC-3500 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
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. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. 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.
   PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. 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.

MC-3500
STANDARD CROSS SECTION

DATE: 11/18/14 | DRAWN: JLM | PROJECT #: | CHECKED: JLM

REV	DRW	CHK	DESCRIPTION
01/19/16	JLM	JLM	UPDATE

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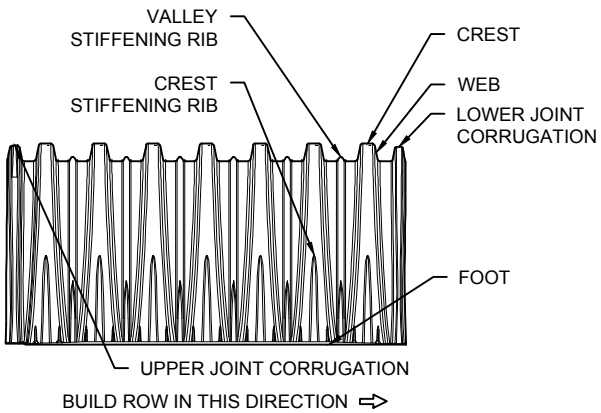
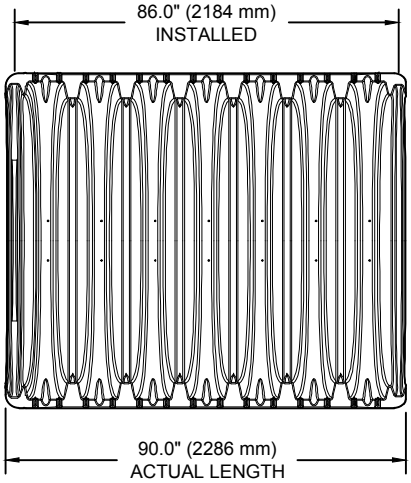
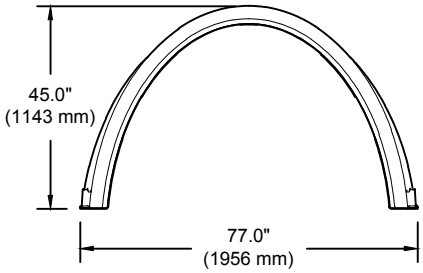
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

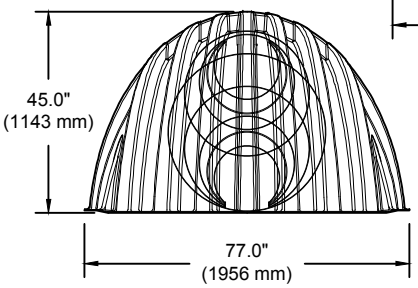
MC-3500 TECHNICAL SPECIFICATION

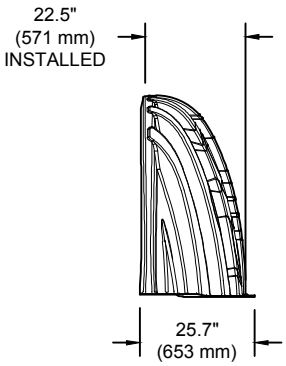
NTS











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*	178.9 CUBIC FEET	(5.06 m³)
WEIGHT	135.0 lbs.	(61.2 kg)

NOMINAL END CAP SPECIFICATIONS

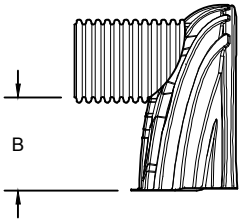
SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 22.5"	(1956 mm X 1143 mm X 571 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	46.0 CUBIC FEET	(1.30 m³)
WEIGHT	50.0 lbs.	(22.7 kg)

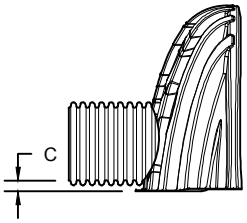
*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

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

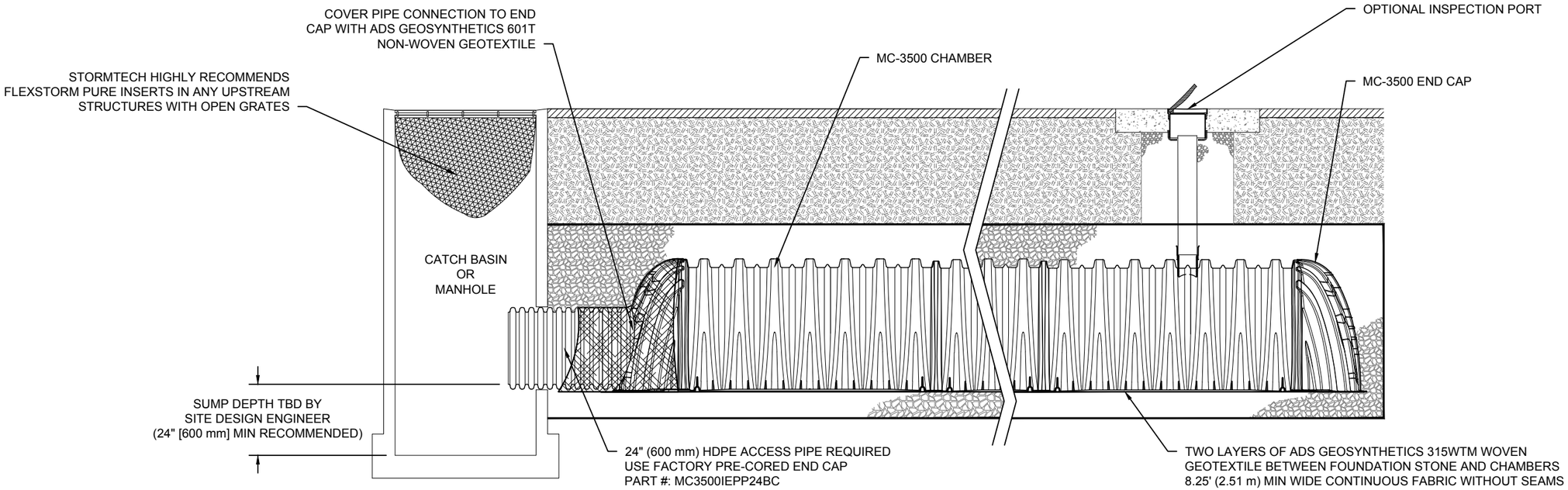
PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
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 PRECORED 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 DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW 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 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 ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW 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 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

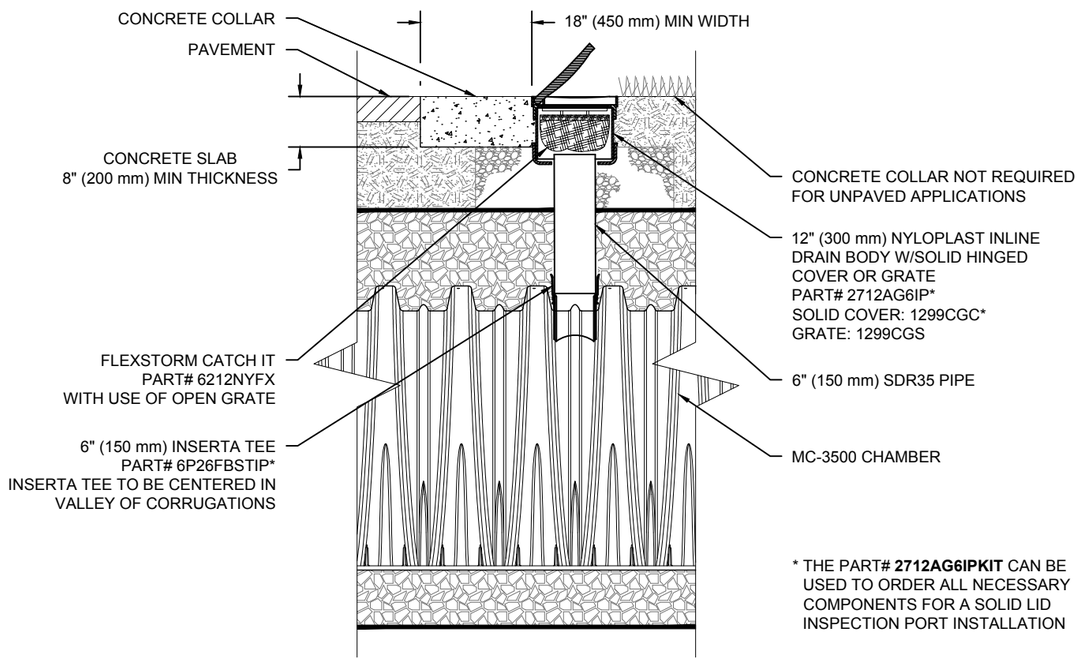
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

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.



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

MC-3500 6" INSPECTION PORT DETAIL
NTS

ISOLATOR ROW DETAILS
MC-3500

DATE: 03/08/17 | DRAWN: JLM | CHECKED:
PROJECT #:

REV	DRW	CHK	DESCRIPTION

StormTech
Detention • Retention • Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

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ADVANCED DRAINAGE SYSTEMS, INC.
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SHEET
1 OF 1

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An ADS company

Isolator® Row O&M Manual

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

ADS®

THE ISOLATOR® ROW

INTRODUCTION

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

THE ISOLATOR ROW

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

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

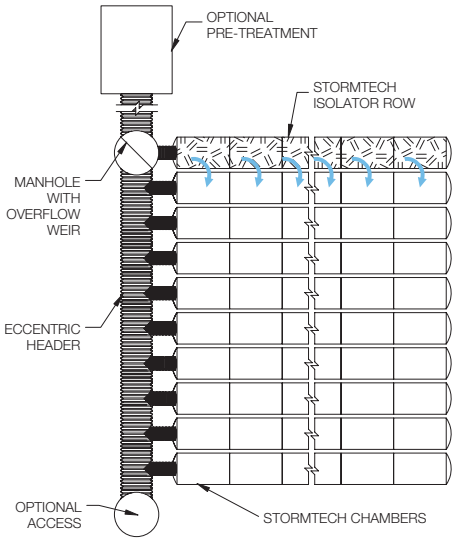
The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed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

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

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

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

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

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

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

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

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

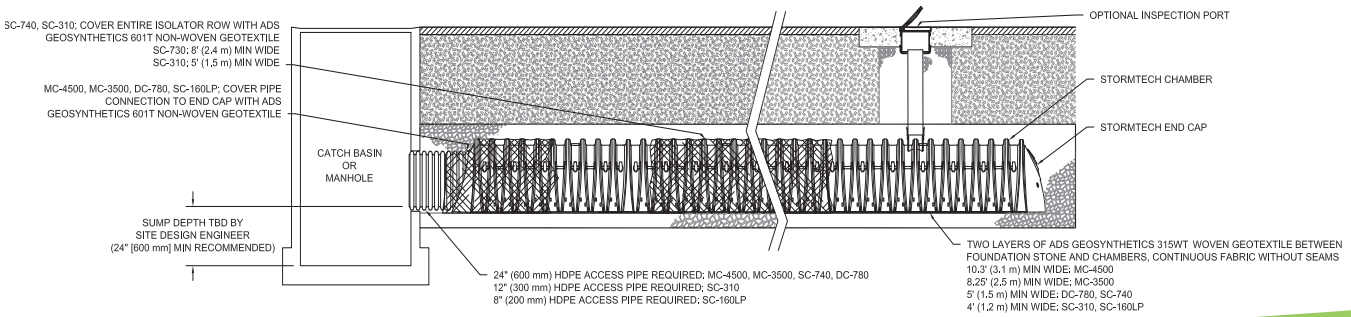
MAINTENANCE

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

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

StormTech Isolator Row (not to scale)

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



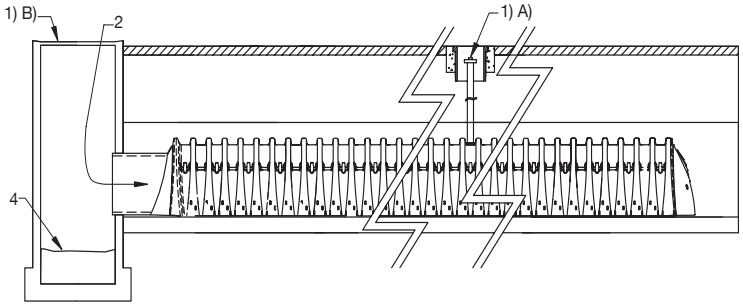
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

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

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

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

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



SAMPLE MAINTENANCE LOG

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

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MC-3500/MC-4500

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StormTech Construction Guide

REQUIRED MATERIALS AND EQUIPMENT LIST

- Acceptable fill materials per Table 1
- Woven and non-woven geotextiles
- 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

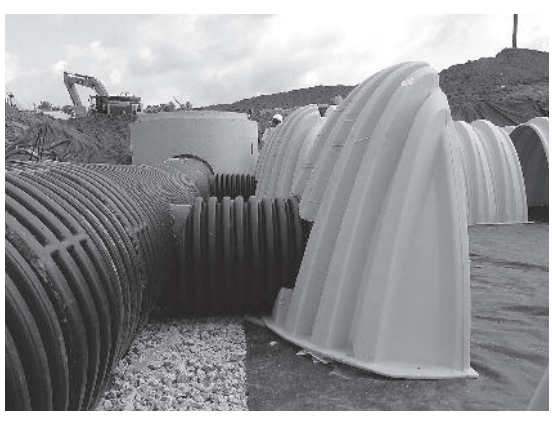
Excavate bed and prepare subgrade per engineer’s plans.

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

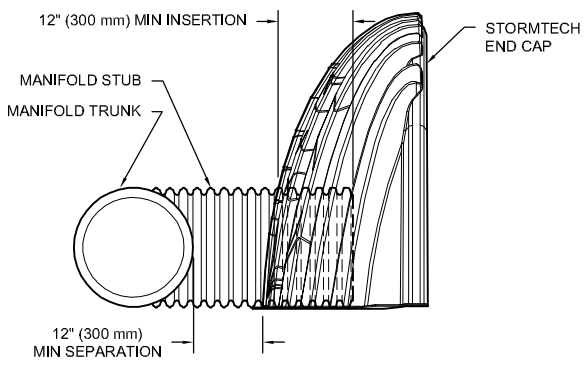
Install manifolds and lay out woven scour geotextile at inlet rows [min. 17.5 ft (5.33 m)] at each inlet end cap. Place a continuous piece (no seams) along entire length of Isolator® Row(s) in two layers.



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 9” (300 mm) spacing between rows. For the Isolator Row place two continuous layers of ADS Woven fabric between the foundation stone and the isolator row chambers, making sure the fabric lays flat and extends the entire width of the chamber feet.

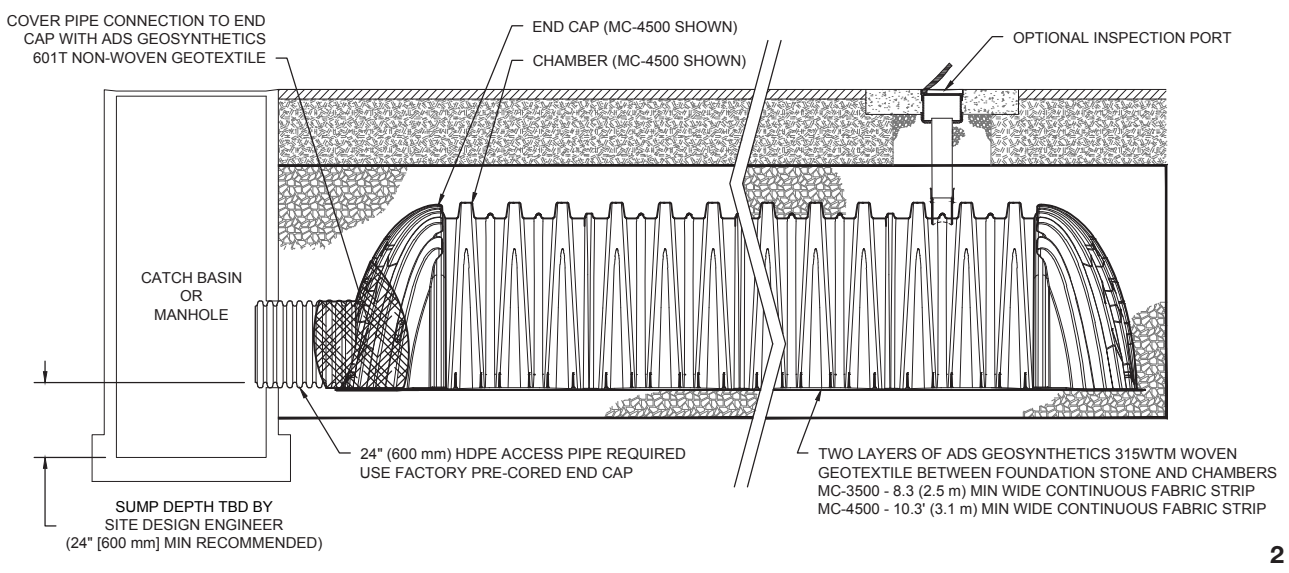
Manifold Insertion



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 Detail

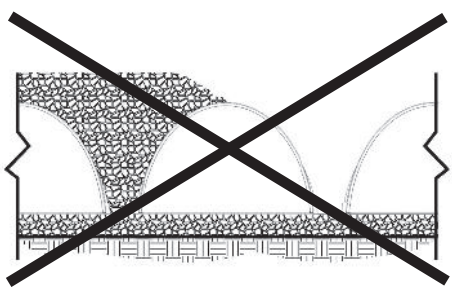


Initial Anchoring of Chambers – Embedment Stone

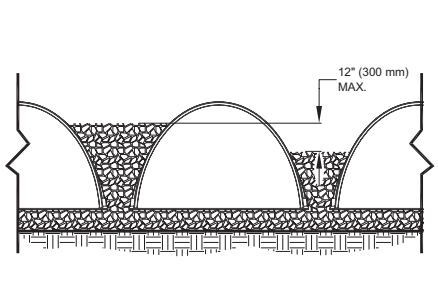
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

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

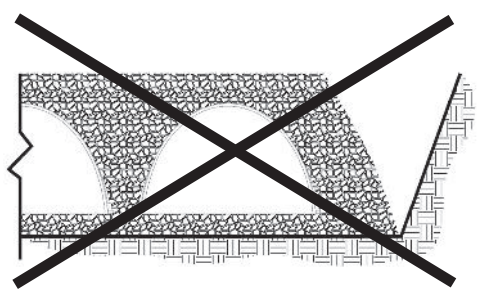


UNEVEN BACKFILL

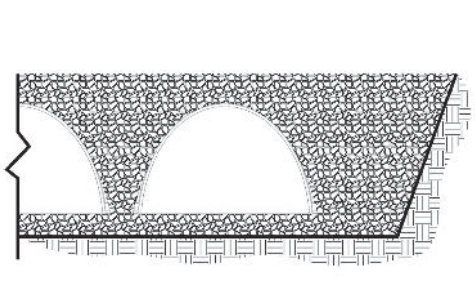


EVEN BACKFILL

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

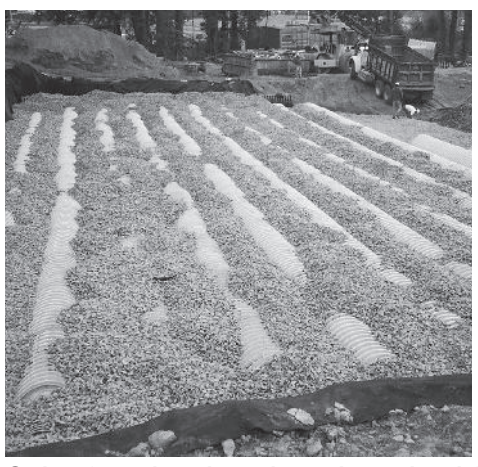


PERIMETER FULLY BACKFILLED

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.

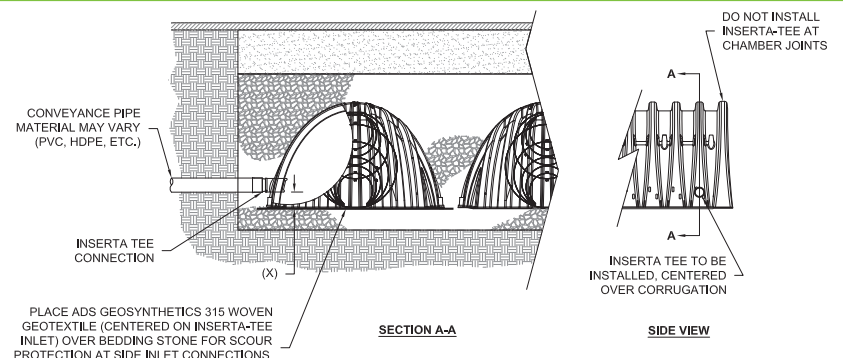


Only after chambers have been backfilled to top of chamber and with a minimum 12” (300 mm) of cover stone on top of chambers can skid loaders and small LGP dozers be used to final grade cover stone and backfill material in accordance with ground pressure limits in Table 2. Equipment must push material 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) in. where edges meet. Compact at 24” (600 mm) of fill. Roller travel parallel with rows.

Inserta Tee Detail



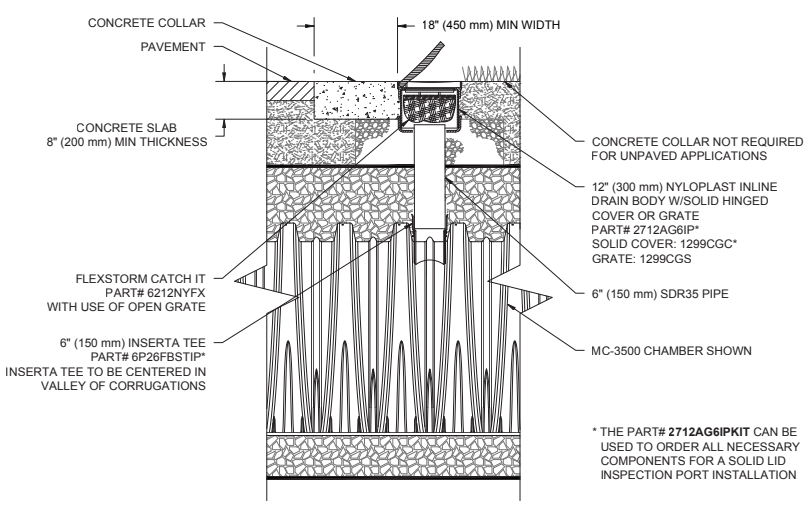
CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & 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
Ⓓ **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.
Ⓒ **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 A-1, A-2-4, A-3 or AASHTO M431 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.
Ⓑ **Embedment Stone:** Fill the surrounding surrounding chambers from the foundation stone (‘A’ layer) to the ‘C’ layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 357, 4	No compaction required.
Ⓐ **Foundation Stone:** Fill below chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 357, 4	Place and compact in 9” (230 mm) max lifts using two full coverages with a vibratory compactor.[2,3]

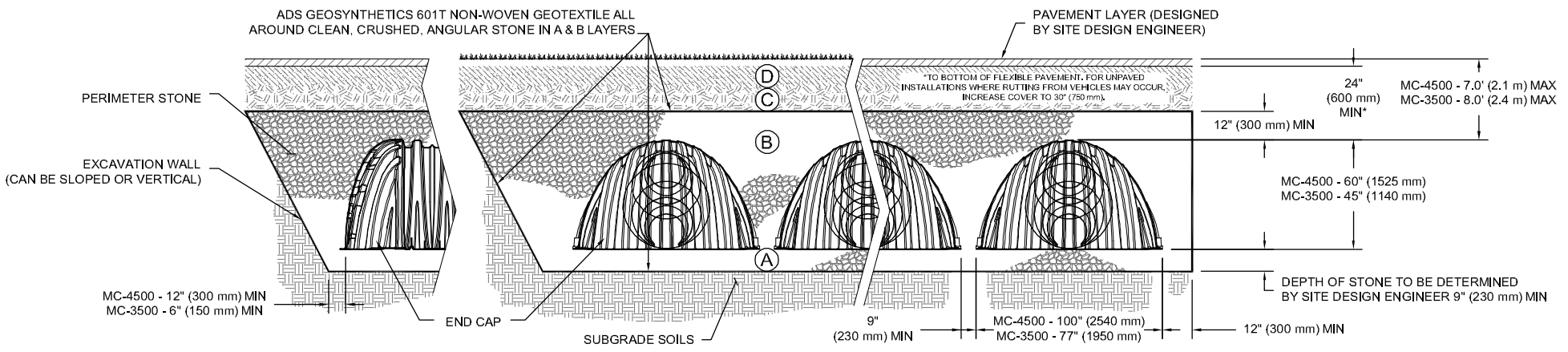
Figure 1- Inspection Port Detail



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 required for full dump truck travel and dumping.***
2. ***During paving operations, dump truck axle loads on 24” (600mm) of cover 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 24” (600 mm) of cover 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.Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.***

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]	3420 [164] 2350 [113] 1850 [89] 1510 [72] 1310 [63]	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]	2480 [119] 1770 [85] 1430 [68] 1210 [58] 1070 [51]	20,000 [89]
	24” [600] Loose/Dumped	24,000 [107]	12,000 [53]	12” [305] 18” [457] 24” [610] 30” [762] 36” [914]	2245 [107] 1625 [78] 1325 [63] 1135 [54] 1010 [48]	16,000 [71]
	18” [450]	24,000 [107]	12,000 [53]	12” [305] 18” [457] 24” [610] 30” [762]	2010 [96] 1480 [71] 1220 [58] 1060 [51]	5,000 [22] (static loads only)[5]
Ⓑ **Embedment Stone**	12” [300]	NOT ALLOWED	NOT ALLOWED	12” [305] 18” [457] 24” [610] 30” [762]	1100 [53] 715 [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.			

17.0 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. 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.

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An ADS company

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ADS GEOSYNTHETICS 0601T NONWOVEN GEOTEXTILE

Scope

This specification describes ADS Geosynthetics 6.0 oz (0601T) nonwoven geotextile.

Filter Fabric Requirements

ADS Geosynthetics 6.0 oz (0601T) is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. ADS Geosynthetics 6.0 oz (0601T) resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. ADS Geosynthetics 6.0 oz (0601T) conforms to the physical property values listed below:

Filter Fabric Properties

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Grab Tensile	ASTM D 4632	lbs (kN)	160 (0.711)
Grab Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs (kN)	60 (0.267)
CBR Puncture Resistance	ASTM D 6241	lbs (kN)	410 (1.82)
Permittivity*	ASTM D 4491	sec^{-1}	1.5
Water Flow*	ASTM D 4491	gpm/ft^2 ($l/min/m^2$)	110 (4480)
AOS*	ASTM D 4751	US Sieve (mm)	70 (0.212)
UV Resistance	ASTM D 4355	%/hrs	70/500

	PACKAGING
Roll Dimensions (W x L) – ft	3.0/5.0/6.25/7.5/9.0/12.5 x 360 / 15 x 300
Square Yards Per Roll	120/200/250/300/360/500 / 500
Estimated Roll Weight – lbs	44/65/97.5/102/141/195 / 195

* At the time of manufacturing. Handling may change these properties.

ADS GEOSYNTHETICS 315W WOVEN GEOTEXTILE

Scope

This specification describes ADS Geosynthetics 315W woven geotextile.

Filter Fabric Requirements

ADS Geosynthetics 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 Geosynthetics 315W resists ultraviolet deterioration, rotting and biological degradation and is inert to commonly encountered soil chemicals. ADS Geosynthetics 315W conforms to the physical property values listed below:

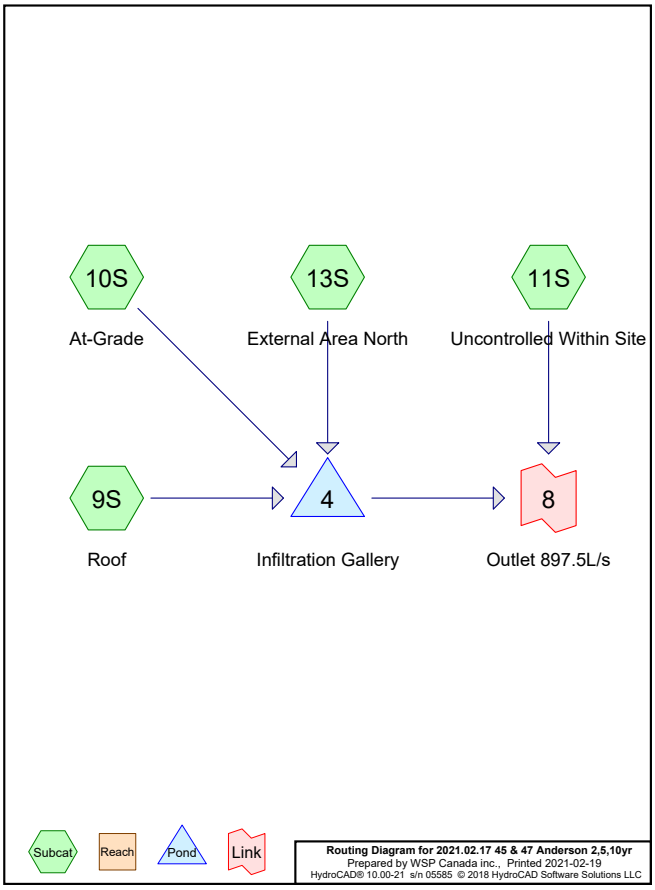
Filter Fabric Properties

PROPERTY	TEST METHOD	ENGLISH M.A.R.V. (Minimum Average Roll Value)	METRIC M.A.R.V. (Minimum Average Roll Value)
Tensile Strength (Grab)	ASTM D-4632	315 lbs	1400 N
Elongation	ASTM D-4632	15%	15%
CBR Puncture	ASTM D-6241	900 lbs	4005 N
Puncture	ASTM D-4833	150 lbs	667 N
Mullen Burst	ASTM D-3786	600 psi	4134 kPa
Trapezoidal Tear	ASTM D-4533	120 lbs	533 N
UV Resistance (at 500 hrs)	ASTM D-4355	70%	70%
Apparent Opening Size (AOS)*	ASTM D-4751	40 US Std. Sieve	0.425 mm
Permittivity	ASTM D-4491	.05 sec^{-1}	.05 sec^{-1}
Water Flow Rate	ASTM D-4491	4 gpm/ft^2	163 $l/min/m^2$
Roll Sizes		12.5' x 360' 15.0' x 300' 17.5' x 258'	3.81 m x 109.8 m 4.57 m x 91.5 m 5.33 m x 78.6 m

*Maximum average roll value.

APPENDIX

C HYDRAULIC MODELLING RESULTS



Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
15,657.6	0.90	At-Grade Impervious (10S)
15,784.9	0.25	External Pervious (13S)
3,200.0	0.90	Impervious Roof (9S)
8,129.4	0.25	Soft Landscaping (10S)
60.0	0.25	Uncontrolled pevious (11S)
42,831.9	**0.54**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment9S: Roof Runoff Area=3,200.0 m² 0.00% Impervious Runoff Depth=14 mm
Tc=10.0 min C=0.90 Runoff=0.0471 m³/s 45.2 m³

Subcatchment10S: At-Grade Runoff Area=23,787.0 m² 0.00% Impervious Runoff Depth=11 mm
Tc=10.0 min C=0.68 Runoff=0.2648 m³/s 254.1 m³

Subcatchment11S: Uncontrolled Within Site Runoff Area=60.0 m² 0.00% Impervious Runoff Depth=4 mm
Tc=10.0 min C=0.25 Runoff=0.0002 m³/s 0.2 m³

Subcatchment13S: External Area North Runoff Area=15,784.9 m² 0.00% Impervious Runoff Depth=4 mm
Tc=10.0 min C=0.25 Runoff=0.0646 m³/s 62.0 m³

Pond 4: Infiltration Gallery Peak Elev=0.673 m Storage=251.6 m³ Inflow=0.3765 m³/s 361.3 m³
Outflow=0.2739 m³/s 360.9 m³

Link 8: Outlet 897.5L/s Inflow=0.2741 m³/s 361.1 m³
Primary=0.2741 m³/s 361.1 m³

Total Runoff Area = 42,831.9 m² Runoff Volume = 361.6 m³ Average Runoff Depth = 8 mm
100.00% Pervious = 42,831.9 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 9S: Roof

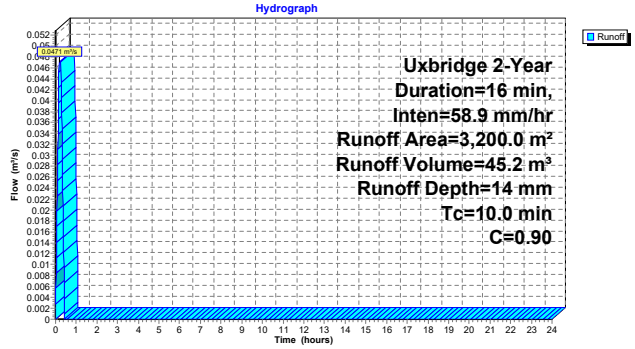
Runoff = 0.0471 m³/s @ 0.17 hrs, Volume= 45.2 m³, Depth= 14 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 2-Year Duration=16 min, Inten=58.9 mm/hr

Area (m²)	C	Description
3,200.0	0.90	Impervious Roof
3,200.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 9S: Roof



Summary for Subcatchment 10S: At-Grade

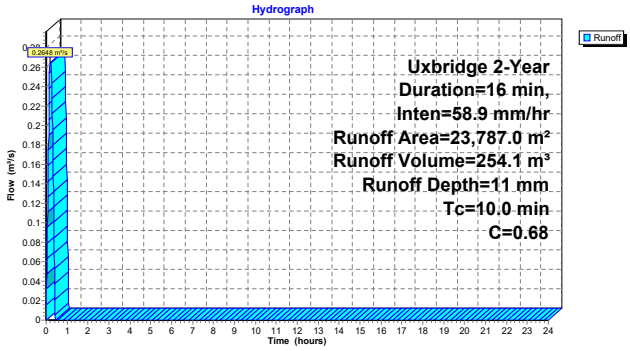
Runoff = 0.2648 m³/s @ 0.17 hrs, Volume= 254.1 m³, Depth= 11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 2-Year Duration=16 min, Inten=58.9 mm/hr

Area (m²)	C	Description
15,657.6	0.90	At-Grade Impervious
8,129.4	0.25	Soft Landscaping
23,787.0	0.68	Weighted Average
23,787.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 10S: At-Grade



Summary for Subcatchment 11S: Uncontrolled Within Site

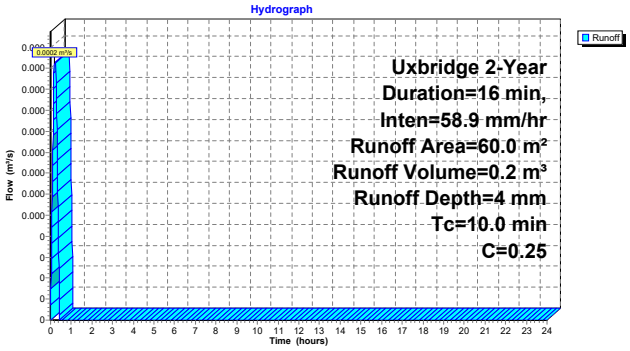
Runoff = 0.0002 m³/s @ 0.17 hrs, Volume= 0.2 m³, Depth= 4 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 2-Year Duration=16 min, Inten=58.9 mm/hr

Area (m²)	C	Description
0.0	0.90	Uncontrolled Impervious
60.0	0.25	Uncontrolled pevious
60.0	0.25	Weighted Average
60.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Uncontrolled Within Site



Summary for Subcatchment 13S: External Area North

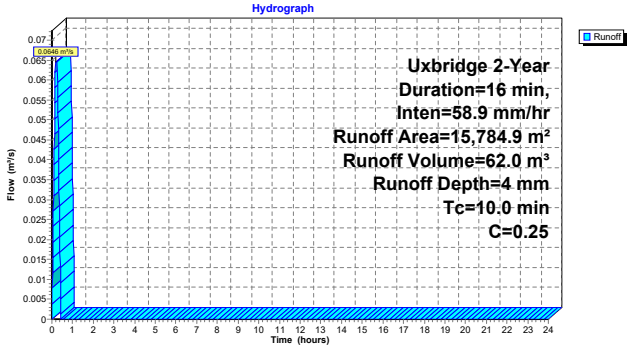
Runoff = 0.0646 m³/s @ 0.17 hrs, Volume= 62.0 m³, Depth= 4 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 2-Year Duration=16 min, Inten=58.9 mm/hr

Area (m²)	C	Description
15,784.9	0.25	External Pervious
15,784.9		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 13S: External Area North



Summary for Pond 4: Infiltration Gallery

Inflow Area = 42,771.9 m², 0.00% Impervious, Inflow Depth = 8 mm for 2-Year event
Inflow = 0.3765 m³/s @ 0.17 hrs, Volume= 361.3 m³
Outflow = 0.2739 m³/s @ 0.31 hrs, Volume= 360.9 m³, Atten= 27%, Lag= 8.5 min
Primary = 0.2739 m³/s @ 0.31 hrs, Volume= 360.9 m³

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.279 m Surf.Area= 537.3 m² Storage= 72.4 m³
Peak Elev= 0.673 m @ 0.31 hrs Surf.Area= 537.3 m² Storage= 251.6 m³ (179.1 m³ above start)

Plug-Flow detention time= 32.9 min calculated for 288.4 m³ (80% of inflow)
Center-of-Mass det. time= 24.6 min (37.6 - 13.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	263.7 m³	**17.00 mW x 31.61 mL x 2.06 mH Field A** 1,105.7 m³ Overall - 446.4 m³ Embedded = 659.3 m³ x 40.0% Voids
#2A	0.229 m	446.4 m³	**ADS_StormTech MC-4500 +Cap**x 144 Inside #1 Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³ Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap 6 Rows of 24 Chambers Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³
		710.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.279 m	**525 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.2738 m³/s @ 0.31 hrs HW=0.673 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.2738 m³/s @ 1.57 m/s)

Pond 4: Infiltration Gallery - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³
Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap
Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³

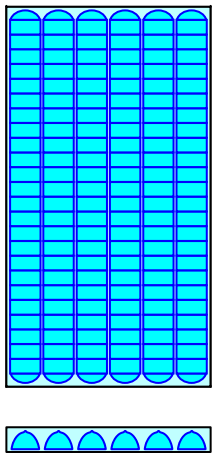
2,540 mm Wide + 229 mm Spacing = 2,769 mm C-C Row Spacing

24 Chambers/Row x 1.23 m Long +0.78 m Cap Length x 2 = 31.00 m Row Length +305 mm End Stone x 2 = 31.61 m Base Length
6 Rows x 2,540 mm Wide + 229 mm Spacing x 5 + 305 mm Side Stone x 2 = 17.00 m Base Width
229 mm Base + 1,524 mm Chamber Height + 305 mm Cover = 2.06 m Field Height

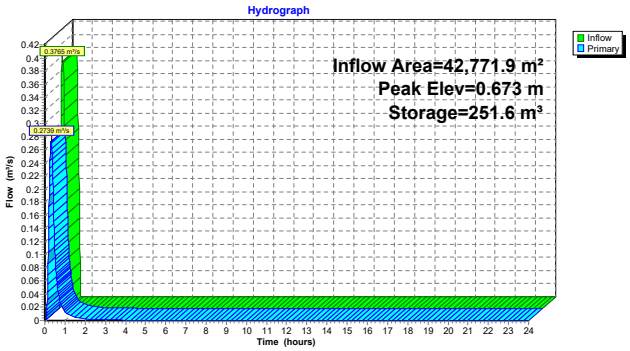
144 Chambers x 3.02 m³ + 1.01 m³ Cap Volume x 2 x 6 Rows = 446.36 m³ Chamber Storage

1,105.70 m³ Field - 446.36 m³ Chambers = 659.34 m³ Stone x 40.0% Voids = 263.73 m³ Stone Storage

Chamber Storage + Stone Storage = 710.09 m³ = 0.710 MI
Overall Storage Efficiency = 64.2%
Overall System Size = 31.61 m x 17.00 m x 2.06 m



Pond 4: Infiltration Gallery



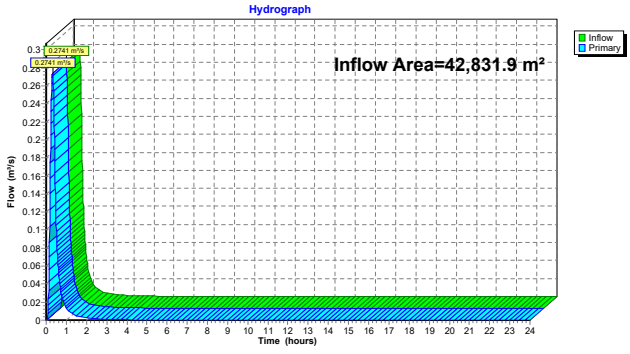
Summary for Link 8: Outlet 897.5L/s

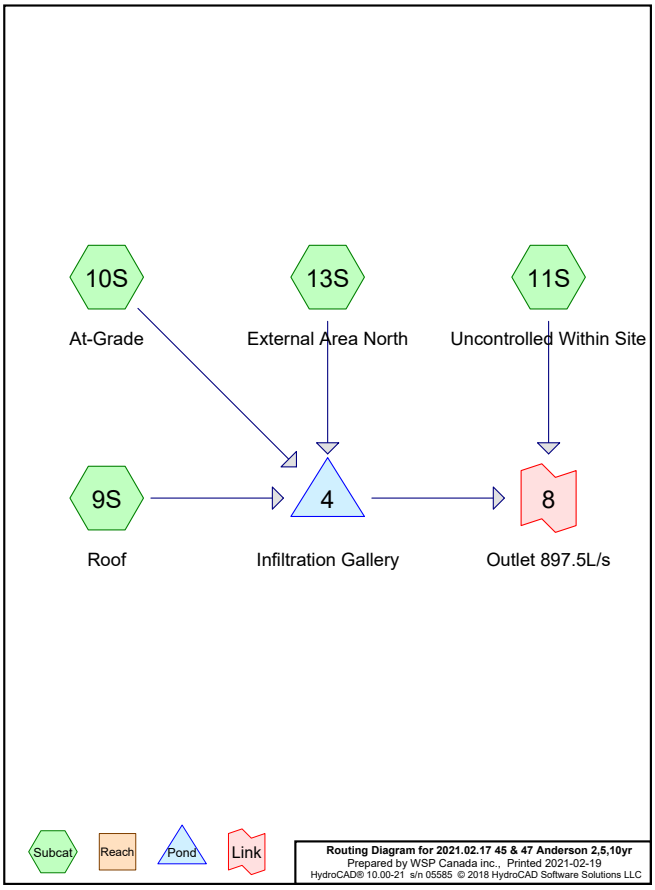
20 L/s release rate

Inflow Area = 42,831.9 m², 0.00% Impervious, Inflow Depth = 8 mm for 2-Year event
Inflow = 0.2741 m³/s @ 0.31 hrs, Volume= 361.1 m³
Primary = 0.2741 m³/s @ 0.31 hrs, Volume= 361.1 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 8: Outlet 897.5L/s





Area Listing (all nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
15,657.6	0.90	At-Grade Impervious (10S)
15,784.9	0.25	External Pervious (13S)
3,200.0	0.90	Impervious Roof (9S)
8,129.4	0.25	Soft Landscaping (10S)
60.0	0.25	Uncontrolled pevious (11S)
42,831.9	**0.54**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment9S: Roof Runoff Area=3,200.0 m² 0.00% Impervious Runoff Depth=19 mm
Tc=10.0 min C=0.90 Runoff=0.0682 m³/s 61.4 m³

Subcatchment10S: At-Grade Runoff Area=23,787.0 m² 0.00% Impervious Runoff Depth=15 mm
Tc=10.0 min C=0.68 Runoff=0.3833 m³/s 344.9 m³

Subcatchment11S: Uncontrolled Within Site Runoff Area=60.0 m² 0.00% Impervious Runoff Depth=5 mm
Tc=10.0 min C=0.25 Runoff=0.0004 m³/s 0.3 m³

Subcatchment13S: External Area North Runoff Area=15,784.9 m² 0.00% Impervious Runoff Depth=5 mm
Tc=10.0 min C=0.25 Runoff=0.0935 m³/s 84.2 m³

Pond 4: Infiltration Gallery Peak Elev=0.794 m Storage=304.8 m³ Inflow=0.5450 m³/s 490.5 m³
Outflow=0.3872 m³/s 490.1 m³

Link 8: Outlet 897.5L/s Inflow=0.3875 m³/s 490.4 m³
Primary=0.3875 m³/s 490.4 m³

Total Runoff Area = 42,831.9 m² Runoff Volume = 490.8 m³ Average Runoff Depth = 11 mm
100.00% Pervious = 42,831.9 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 9S: Roof

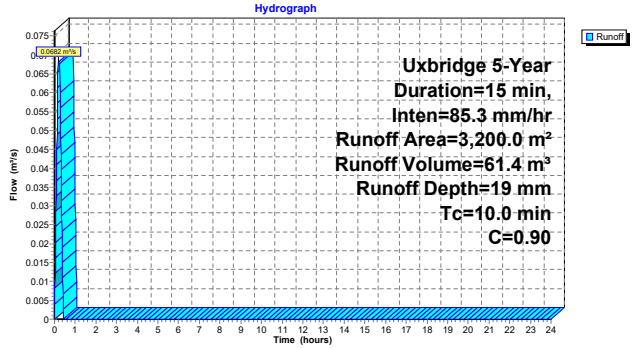
Runoff = 0.0682 m³/s @ 0.17 hrs, Volume= 61.4 m³, Depth= 19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 5-Year Duration=15 min, Inten=85.3 mm/hr

Area (m²)	C	Description
3,200.0	0.90	Impervious Roof
3,200.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 9S: Roof



Summary for Subcatchment 10S: At-Grade

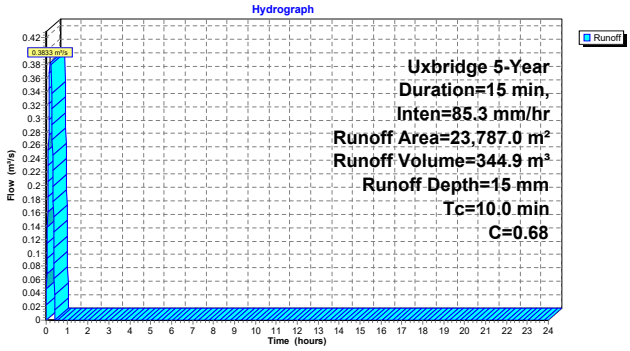
Runoff = 0.3833 m³/s @ 0.17 hrs, Volume= 344.9 m³, Depth= 15 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 5-Year Duration=15 min, Inten=85.3 mm/hr

Area (m²)	C	Description
15,657.6	0.90	At-Grade Impervious
8,129.4	0.25	Soft Landscaping
23,787.0	0.68	Weighted Average
23,787.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 10S: At-Grade



Summary for Subcatchment 11S: Uncontrolled Within Site

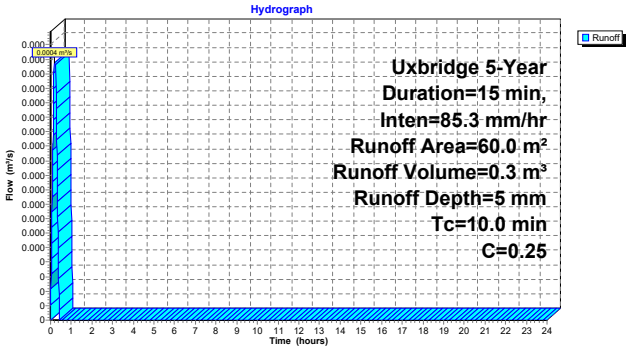
Runoff = 0.0004 m³/s @ 0.17 hrs, Volume= 0.3 m³, Depth= 5 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 5-Year Duration=15 min, Inten=85.3 mm/hr

Area (m²)	C	Description
0.0	0.90	Uncontrolled Impervious
60.0	0.25	Uncontrolled pevious
60.0	0.25	Weighted Average
60.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Uncontrolled Within Site



Summary for Subcatchment 13S: External Area North

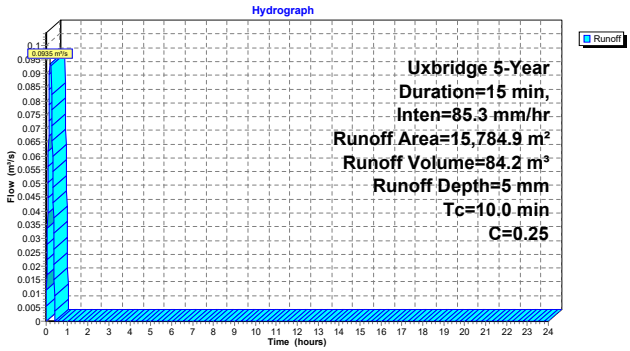
Runoff = 0.0935 m³/s @ 0.17 hrs, Volume= 84.2 m³, Depth= 5 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 5-Year Duration=15 min, Inten=85.3 mm/hr

Area (m²)	C	Description
15,784.9	0.25	External Pervious
15,784.9		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 13S: External Area North



Summary for Pond 4: Infiltration Gallery

Inflow Area = 42,771.9 m², 0.00% Impervious, Inflow Depth = 11 mm for 5-Year event
Inflow = 0.5450 m³/s @ 0.17 hrs, Volume= 490.5 m³
Outflow = 0.3872 m³/s @ 0.30 hrs, Volume= 490.1 m³, Atten= 29%, Lag= 7.7 min
Primary = 0.3872 m³/s @ 0.30 hrs, Volume= 490.1 m³

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.279 m Surf.Area= 537.3 m² Storage= 72.4 m³
Peak Elev= 0.794 m @ 0.30 hrs Surf.Area= 537.3 m² Storage= 304.8 m³ (232.3 m³ above start)

Plug-Flow detention time= 25.1 min calculated for 417.4 m³ (85% of inflow)
Center-of-Mass det. time= 20.4 min (32.9 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	263.7 m³	**17.00 mW x 31.61 mL x 2.06 mH Field A** 1,105.7 m³ Overall - 446.4 m³ Embedded = 659.3 m³ x 40.0% Voids
#2A	0.229 m	446.4 m³	**ADS_StormTech MC-4500 +Cap**x 144 Inside #1 Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³ Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap 6 Rows of 24 Chambers Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³
		710.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.279 m	**525 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.3875 m³/s @ 0.30 hrs HW=0.794 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.3875 m³/s @ 1.80 m/s)

Pond 4: Infiltration Gallery - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³
Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap
Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³

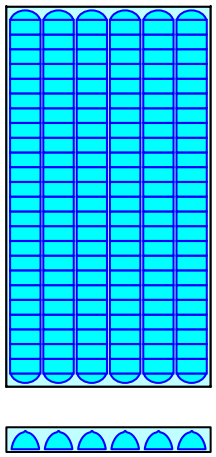
2,540 mm Wide + 229 mm Spacing = 2,769 mm C-C Row Spacing

24 Chambers/Row x 1.23 m Long +0.78 m Cap Length x 2 = 31.00 m Row Length +305 mm End Stone x 2 = 31.61 m Base Length
6 Rows x 2,540 mm Wide + 229 mm Spacing x 5 + 305 mm Side Stone x 2 = 17.00 m Base Width
229 mm Base + 1,524 mm Chamber Height + 305 mm Cover = 2.06 m Field Height

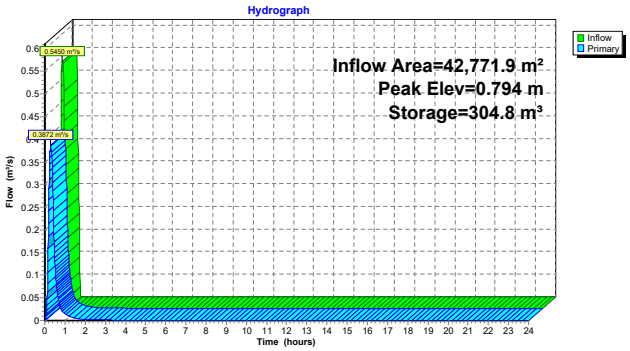
144 Chambers x 3.02 m³ + 1.01 m³ Cap Volume x 2 x 6 Rows = 446.36 m³ Chamber Storage

1,105.70 m³ Field - 446.36 m³ Chambers = 659.34 m³ Stone x 40.0% Voids = 263.73 m³ Stone Storage

Chamber Storage + Stone Storage = 710.09 m³ = 0.710 Ml
Overall Storage Efficiency = 64.2%
Overall System Size = 31.61 m x 17.00 m x 2.06 m



Pond 4: Infiltration Gallery



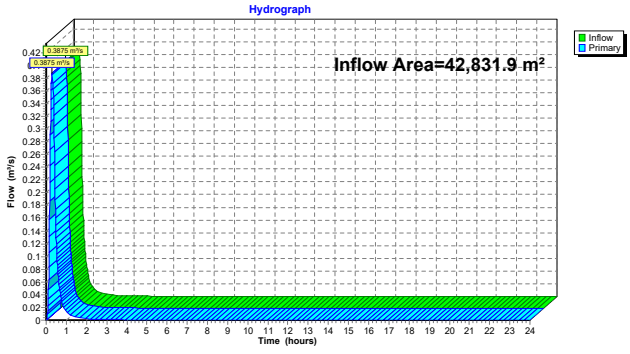
Summary for Link 8: Outlet 897.5L/s

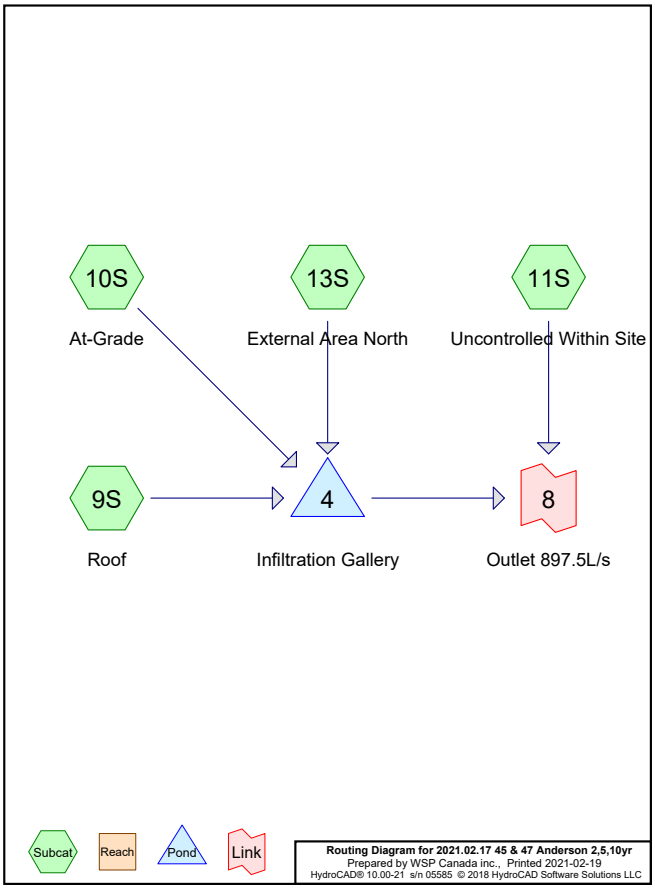
20 L/s release rate

Inflow Area = 42,831.9 m², 0.00% Impervious, Inflow Depth = 11 mm for 5-Year event
Inflow = 0.3875 m³/s @ 0.30 hrs, Volume= 490.4 m³
Primary = 0.3875 m³/s @ 0.30 hrs, Volume= 490.4 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 8: Outlet 897.5L/s





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
15,657.6	0.90	At-Grade Impervious (10S)
15,784.9	0.25	External Pervious (13S)
3,200.0	0.90	Impervious Roof (9S)
8,129.4	0.25	Soft Landscaping (10S)
60.0	0.25	Uncontrolled pevious (11S)
42,831.9	**0.54**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment9S: Roof Runoff Area=3,200.0 m² 0.00% Impervious Runoff Depth=23 mm
Tc=10.0 min C=0.90 Runoff=0.0804 m³/s 72.4 m³

Subcatchment10S: At-Grade Runoff Area=23,787.0 m² 0.00% Impervious Runoff Depth=17 mm
Tc=10.0 min C=0.68 Runoff=0.4515 m³/s 406.4 m³

Subcatchment11S: Uncontrolled Within Site Runoff Area=60.0 m² 0.00% Impervious Runoff Depth=6 mm
Tc=10.0 min C=0.25 Runoff=0.0004 m³/s 0.4 m³

Subcatchment13S: External Area North Runoff Area=15,784.9 m² 0.00% Impervious Runoff Depth=6 mm
Tc=10.0 min C=0.25 Runoff=0.1102 m³/s 99.1 m³

Pond 4: Infiltration Gallery Peak Elev=0.881 m Storage=342.2 m³ Inflow=0.6421 m³/s 577.9 m³
Outflow=0.4470 m³/s 577.4 m³

Link 8: Outlet 897.5L/s Inflow=0.4473 m³/s 577.8 m³
Primary=0.4473 m³/s 577.8 m³

Total Runoff Area = 42,831.9 m² Runoff Volume = 578.2 m³ Average Runoff Depth = 14 mm
100.00% Pervious = 42,831.9 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 9S: Roof

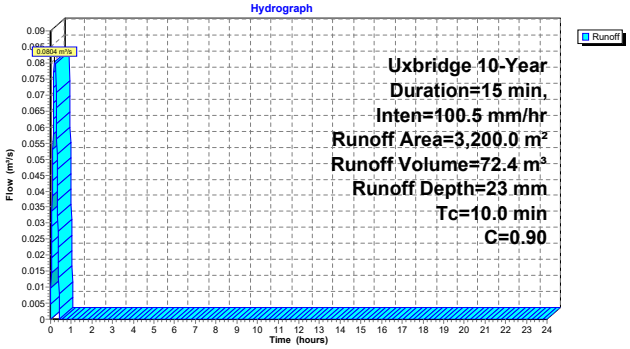
Runoff = 0.0804 m³/s @ 0.17 hrs, Volume= 72.4 m³, Depth= 23 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 10-Year Duration=15 min, Inten=100.5 mm/hr

Area (m²)	C	Description
3,200.0	0.90	Impervious Roof
3,200.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 9S: Roof



Summary for Subcatchment 10S: At-Grade

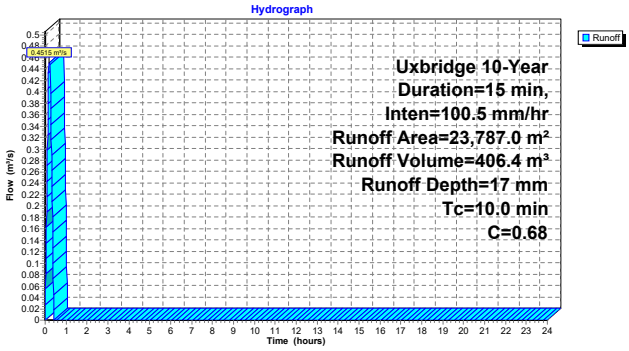
Runoff = 0.4515 m³/s @ 0.17 hrs, Volume= 406.4 m³, Depth= 17 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 10-Year Duration=15 min, Inten=100.5 mm/hr

Area (m²)	C	Description
15,657.6	0.90	At-Grade Impervious
8,129.4	0.25	Soft Landscaping
23,787.0	0.68	Weighted Average
23,787.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 10S: At-Grade



Summary for Subcatchment 11S: Uncontrolled Within Site

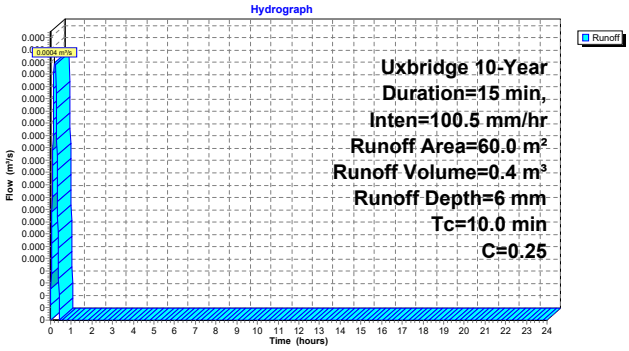
Runoff = 0.0004 m³/s @ 0.17 hrs, Volume= 0.4 m³, Depth= 6 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 10-Year Duration=15 min, Inten=100.5 mm/hr

Area (m²)	C	Description
0.0	0.90	Uncontrolled Impervious
60.0	0.25	Uncontrolled pevious
60.0	0.25	Weighted Average
60.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Uncontrolled Within Site



Summary for Subcatchment 13S: External Area North

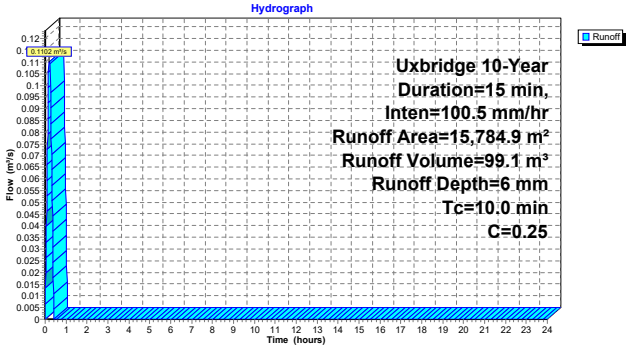
Runoff = 0.1102 m³/s @ 0.17 hrs, Volume= 99.1 m³, Depth= 6 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 10-Year Duration=15 min, Inten=100.5 mm/hr

Area (m²)	C	Description
15,784.9	0.25	External Pervious
15,784.9		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 13S: External Area North



Summary for Pond 4: Infiltration Gallery

Inflow Area = 42,771.9 m², 0.00% Impervious, Inflow Depth = 14 mm for 10-Year event
Inflow = 0.6421 m³/s @ 0.17 hrs, Volume= 577.9 m³
Outflow = 0.4470 m³/s @ 0.30 hrs, Volume= 577.4 m³, Atten= 30%, Lag= 7.8 min
Primary = 0.4470 m³/s @ 0.30 hrs, Volume= 577.4 m³

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.279 m Surf.Area= 537.3 m² Storage= 72.4 m³
Peak Elev= 0.881 m @ 0.30 hrs Surf.Area= 537.3 m² Storage= 342.2 m³ (269.7 m³ above start)

Plug-Flow detention time= 22.5 min calculated for 504.7 m³ (87% of inflow)
Center-of-Mass det. time= 18.7 min (31.2 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	263.7 m³	**17.00 mW x 31.61 mL x 2.06 mH Field A** 1,105.7 m³ Overall - 446.4 m³ Embedded = 659.3 m³ x 40.0% Voids
#2A	0.229 m	446.4 m³	**ADS_StormTech MC-4500 +Cap**x 144 Inside #1 Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³ Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap 6 Rows of 24 Chambers Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³
		710.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.279 m	**525 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.4470 m³/s @ 0.30 hrs HW=0.881 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.4470 m³/s @ 2.06 m/s)

Pond 4: Infiltration Gallery - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³
Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap
Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³

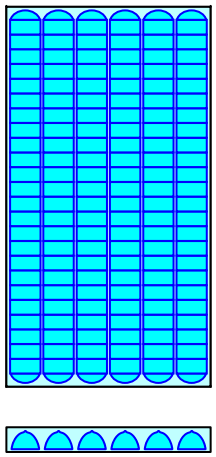
2,540 mm Wide + 229 mm Spacing = 2,769 mm C-C Row Spacing

24 Chambers/Row x 1.23 m Long +0.78 m Cap Length x 2 = 31.00 m Row Length +305 mm End Stone x 2 = 31.61 m Base Length
6 Rows x 2,540 mm Wide + 229 mm Spacing x 5 + 305 mm Side Stone x 2 = 17.00 m Base Width
229 mm Base + 1,524 mm Chamber Height + 305 mm Cover = 2.06 m Field Height

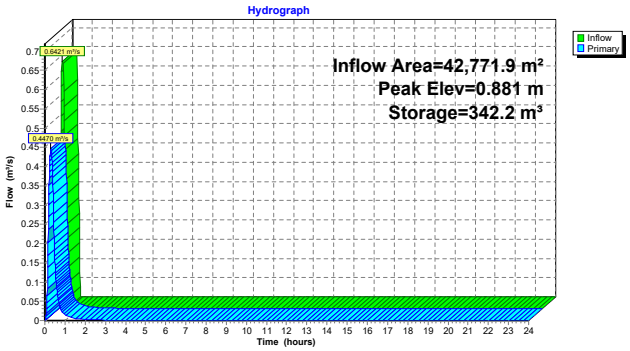
144 Chambers x 3.02 m³ + 1.01 m³ Cap Volume x 2 x 6 Rows = 446.36 m³ Chamber Storage

1,105.70 m³ Field - 446.36 m³ Chambers = 659.34 m³ Stone x 40.0% Voids = 263.73 m³ Stone Storage

Chamber Storage + Stone Storage = 710.09 m³ = 0.710 MI
Overall Storage Efficiency = 64.2%
Overall System Size = 31.61 m x 17.00 m x 2.06 m



Pond 4: Infiltration Gallery



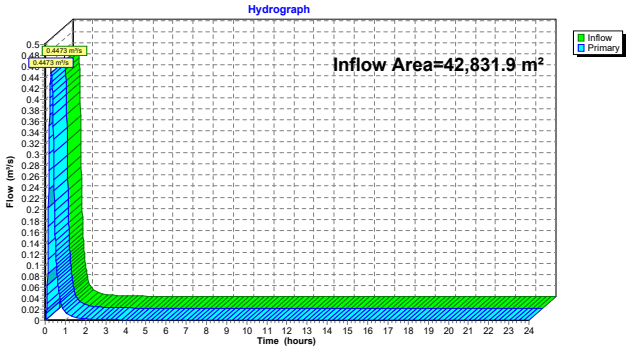
Summary for Link 8: Outlet 897.5L/s

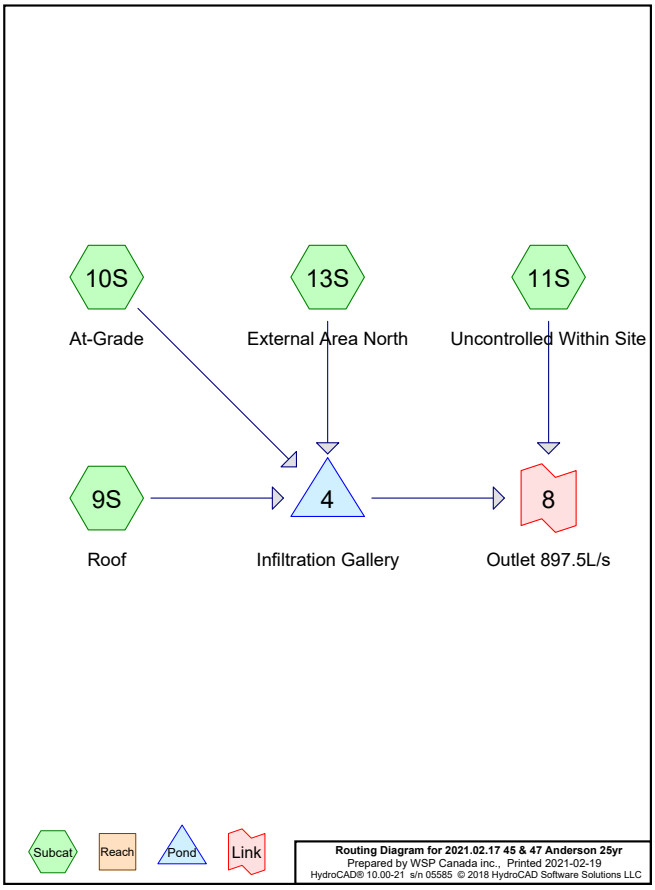
20 L/s release rate

Inflow Area = 42,831.9 m², 0.00% Impervious, Inflow Depth = 13 mm for 10-Year event
Inflow = 0.4473 m³/s @ 0.30 hrs, Volume= 577.8 m³
Primary = 0.4473 m³/s @ 0.30 hrs, Volume= 577.8 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 8: Outlet 897.5L/s





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
15,657.6	0.99	At-Grade Impervious (10S)
15,784.9	0.28	External Pervious (13S)
3,200.0	0.99	Impervious Roof (9S)
8,129.4	0.28	Soft Landscaping (10S)
60.0	0.28	Uncontrolled pevious (11S)
42,831.9	**0.59**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment9S: Roof Runoff Area=3,200.0 m² 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=0.99 Runoff=0.1070 m³/s 96.3 m³

Subcatchment10S: At-Grade Runoff Area=23,787.0 m² 65.82% Impervious Runoff Depth=23 mm
Tc=10.0 min C=0.75 Runoff=0.6026 m³/s 542.3 m³

Subcatchment11S: Uncontrolled Within Site Runoff Area=60.0 m² 0.00% Impervious Runoff Depth=9 mm
Tc=10.0 min C=0.28 Runoff=0.0006 m³/s 0.5 m³

Subcatchment13S: External Area North Runoff Area=15,784.9 m² 0.00% Impervious Runoff Depth=9 mm
Tc=10.0 min C=0.28 Runoff=0.1493 m³/s 134.4 m³

Pond 4: Infiltration Gallery Peak Elev=1.098 m Storage=432.1 m³ Inflow=0.8589 m³/s 773.0 m³
Outflow=0.5724 m³/s 772.6 m³

Link 8: Outlet 897.5L/s Inflow=0.5728 m³/s 773.1 m³
Primary=0.5728 m³/s 773.1 m³

Total Runoff Area = 42,831.9 m² Runoff Volume = 773.5 m³ Average Runoff Depth = 18 mm
55.97% Pervious = 23,974.3 m² 44.03% Impervious = 18,857.6 m²

Summary for Subcatchment 9S: Roof

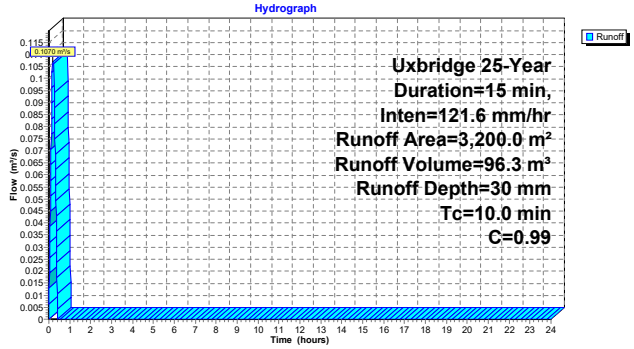
Runoff = 0.1070 m³/s @ 0.17 hrs, Volume= 96.3 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 25-Year Duration=15 min, Inten=121.6 mm/hr

Area (m²)	C	Description
3,200.0	0.99	Impervious Roof
3,200.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					Direct Entry,

Subcatchment 9S: Roof



Summary for Subcatchment 10S: At-Grade

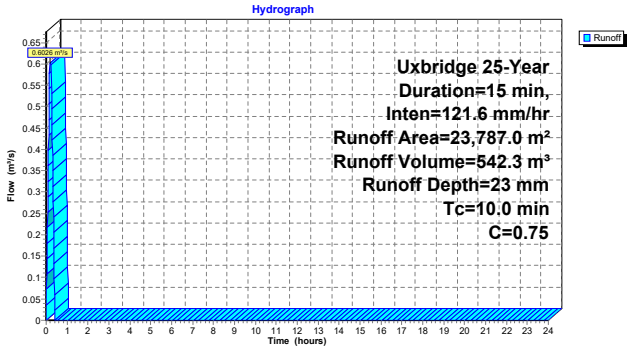
Runoff = 0.6026 m³/s @ 0.17 hrs, Volume= 542.3 m³, Depth= 23 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 25-Year Duration=15 min, Inten=121.6 mm/hr

Area (m²)	C	Description
15,657.6	0.99	At-Grade Impervious
8,129.4	0.28	Soft Landscaping
23,787.0	0.75	Weighted Average
8,129.4		34.18% Pervious Area
15,657.6		65.82% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 10S: At-Grade



Summary for Subcatchment 11S: Uncontrolled Within Site

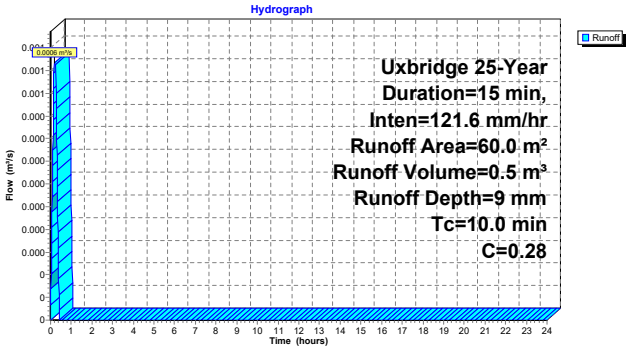
Runoff = 0.0006 m³/s @ 0.17 hrs, Volume= 0.5 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 25-Year Duration=15 min, Inten=121.6 mm/hr

Area (m²)	C	Description
0.0	0.99	Uncontrolled Impervious
60.0	0.28	Uncontrolled pevious
60.0	0.28	Weighted Average
60.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Uncontrolled Within Site



Summary for Subcatchment 13S: External Area North

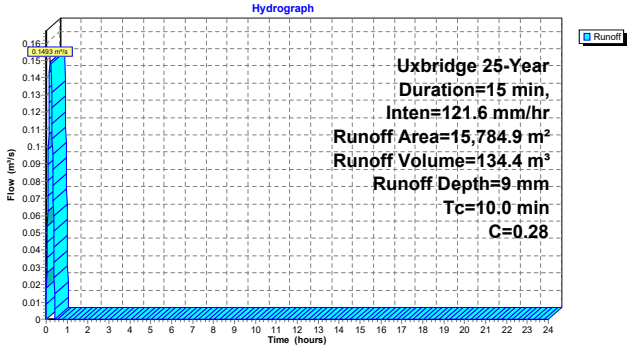
Runoff = 0.1493 m³/s @ 0.17 hrs, Volume= 134.4 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 25-Year Duration=15 min, Inten=121.6 mm/hr

Area (m²)	C	Description
15,784.9	0.28	External Pervious
15,784.9		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 13S: External Area North



Summary for Pond 4: Infiltration Gallery

Inflow Area = 42,771.9 m², 44.09% Impervious, Inflow Depth = 18 mm for 25-Year event
Inflow = 0.8589 m³/s @ 0.17 hrs, Volume= 773.0 m³
Outflow = 0.5724 m³/s @ 0.31 hrs, Volume= 772.6 m³, Atten= 33%, Lag= 8.1 min
Primary = 0.5724 m³/s @ 0.31 hrs, Volume= 772.6 m³

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.279 m Surf.Area= 537.3 m² Storage= 72.4 m³
Peak Elev= 1.098 m @ 0.31 hrs Surf.Area= 537.3 m² Storage= 432.1 m³ (359.6 m³ above start)

Plug-Flow detention time= 19.7 min calculated for 700.1 m³ (91% of inflow)
Center-of-Mass det. time= 16.6 min (29.1 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	263.7 m³	**17.00 mW x 31.61 mL x 2.06 mH Field A** 1,105.7 m³ Overall - 446.4 m³ Embedded = 659.3 m³ x 40.0% Voids
#2A	0.229 m	446.4 m³	**ADS_StormTech MC-4500 +Cap**x 144 Inside #1 Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³ Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap 6 Rows of 24 Chambers Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³
		710.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.279 m	**525 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.5722 m³/s @ 0.31 hrs HW=1.098 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.5722 m³/s @ 2.64 m/s)

Pond 4: Infiltration Gallery - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³
Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap
Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³

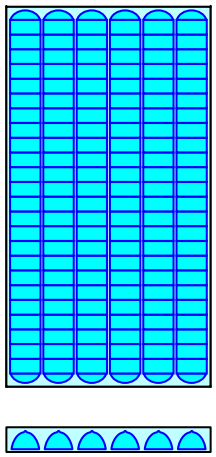
2,540 mm Wide + 229 mm Spacing = 2,769 mm C-C Row Spacing

24 Chambers/Row x 1.23 m Long +0.78 m Cap Length x 2 = 31.00 m Row Length +305 mm End Stone x 2 = 31.61 m Base Length
6 Rows x 2,540 mm Wide + 229 mm Spacing x 5 + 305 mm Side Stone x 2 = 17.00 m Base Width
229 mm Base + 1,524 mm Chamber Height + 305 mm Cover = 2.06 m Field Height

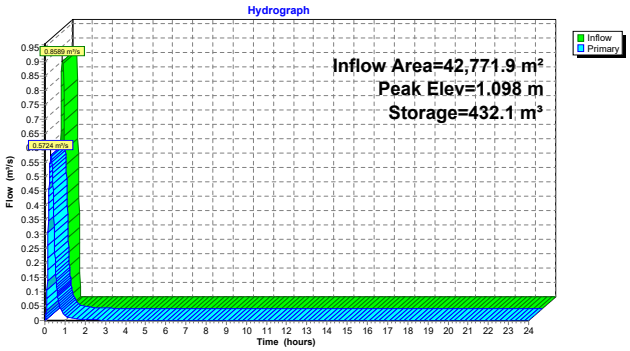
144 Chambers x 3.02 m³ + 1.01 m³ Cap Volume x 2 x 6 Rows = 446.36 m³ Chamber Storage

1,105.70 m³ Field - 446.36 m³ Chambers = 659.34 m³ Stone x 40.0% Voids = 263.73 m³ Stone Storage

Chamber Storage + Stone Storage = 710.09 m³ = 0.710 Ml
Overall Storage Efficiency = 64.2%
Overall System Size = 31.61 m x 17.00 m x 2.06 m



Pond 4: Infiltration Gallery



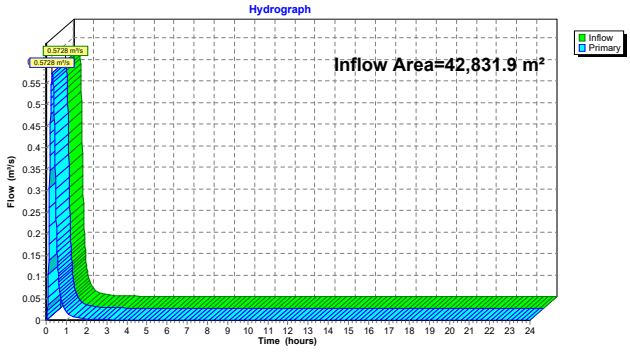
Summary for Link 8: Outlet 897.5L/s

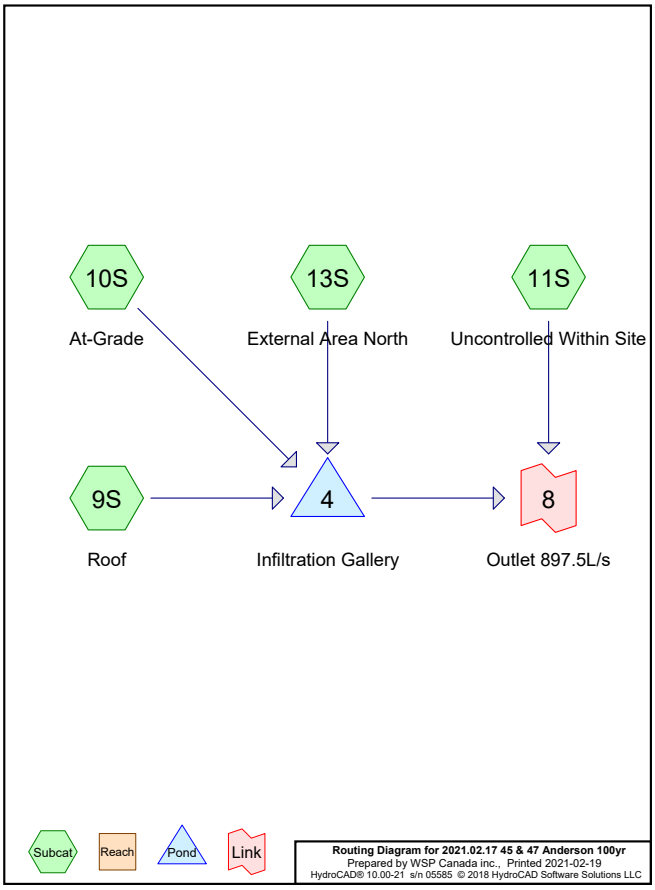
20 L/s release rate

Inflow Area = 42,831.9 m², 44.03% Impervious, Inflow Depth = 18 mm for 25-Year event
Inflow = 0.5728 m³/s @ 0.31 hrs, Volume= 773.1 m³
Primary = 0.5728 m³/s @ 0.31 hrs, Volume= 773.1 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 8: Outlet 897.5L/s





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
15,657.6	1.00	At-Grade Impervious (10S)
15,784.9	0.31	External Pervious (13S)
3,200.0	1.00	Impervious Roof (9S)
8,129.4	0.31	Soft Landscaping (10S)
60.0	0.31	Uncontrolled previous (11S)
42,831.9	**0.61**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment9S: Roof Runoff Area=3,200.0 m² 100.00% Impervious Runoff Depth=40 mm
Tc=10.0 min C=1.00 Runoff=0.1413 m³/s 127.1 m³

Subcatchment10S: At-Grade Runoff Area=23,787.0 m² 65.82% Impervious Runoff Depth=30 mm
Tc=10.0 min C=0.76 Runoff=0.7981 m³/s 718.3 m³

Subcatchment11S: Uncontrolled Within Runoff Area=60.0 m² 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.31 Runoff=0.0008 m³/s 0.7 m³

Subcatchment13S: External Area North Runoff Area=15,784.9 m² 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.31 Runoff=0.2160 m³/s 194.4 m³

Pond 4: Infiltration Gallery Peak Elev=1.458 m Storage=564.9 m³ Inflow=1.1554 m³/s 1,039.8 m³
Outflow=0.7342 m³/s 1,039.4 m³

Link 8: Outlet 897.5L/s Inflow=0.7348 m³/s 1,040.1 m³
Primary=0.7348 m³/s 1,040.1 m³

Total Runoff Area = 42,831.9 m² Runoff Volume = 1,040.6 m³ Average Runoff Depth = 24 mm
55.97% Pervious = 23,974.3 m² 44.03% Impervious = 18,857.6 m²

Summary for Subcatchment 9S: Roof

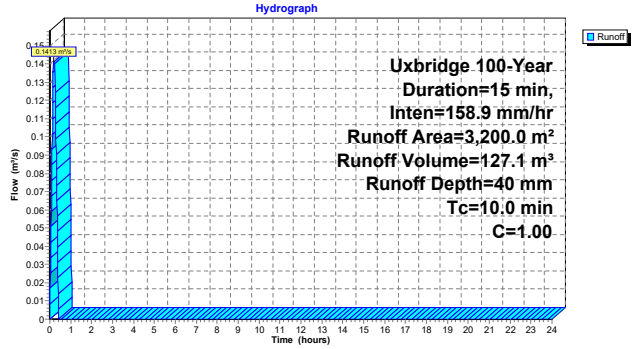
Runoff = 0.1413 m³/s @ 0.17 hrs, Volume= 127.1 m³, Depth= 40 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 100-Year Duration=15 min, Inten=158.9 mm/hr

Area (m²)	C	Description
3,200.0	1.00	Impervious Roof
3,200.0		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 9S: Roof



Summary for Subcatchment 10S: At-Grade

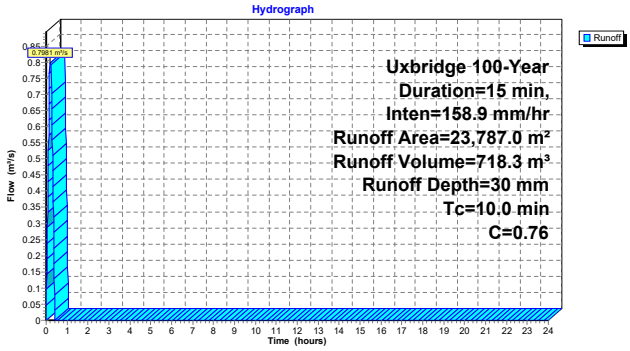
Runoff = 0.7981 m³/s @ 0.17 hrs, Volume= 718.3 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 100-Year Duration=15 min, Inten=158.9 mm/hr

Area (m²)	C	Description
15,657.6	1.00	At-Grade Impervious
8,129.4	0.31	Soft Landscaping
23,787.0	0.76	Weighted Average
8,129.4		34.18% Pervious Area
15,657.6		65.82% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 10S: At-Grade



Summary for Subcatchment 11S: Uncontrolled Within Site

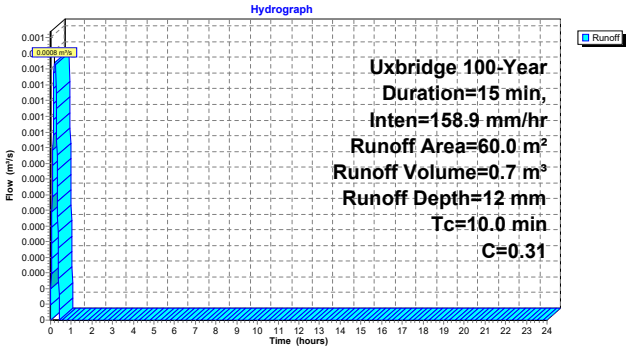
Runoff = 0.0008 m³/s @ 0.17 hrs, Volume= 0.7 m³, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 100-Year Duration=15 min, Inten=158.9 mm/hr

Area (m²)	C	Description
0.0	1.00	Uncontrolled Impervious
60.0	0.31	Uncontrolled previous
60.0	0.31	Weighted Average
60.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Uncontrolled Within Site



Summary for Subcatchment 13S: External Area North

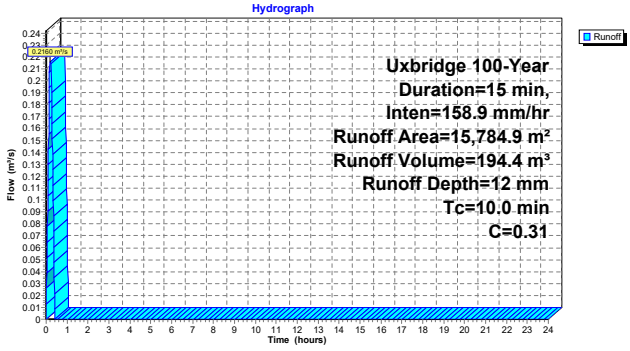
Runoff = 0.2160 m³/s @ 0.17 hrs, Volume= 194.4 m³, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Uxbridge 100-Year Duration=15 min, Inten=158.9 mm/hr

Area (m²)	C	Description
15,784.9	0.31	External Pervious
15,784.9		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 13S: External Area North



Summary for Pond 4: Infiltration Gallery

Inflow Area = 42,771.9 m², 44.09% Impervious, Inflow Depth = 24 mm for 100-Year event
Inflow = 1.1554 m³/s @ 0.17 hrs, Volume= 1,039.8 m³
Outflow = 0.7342 m³/s @ 0.31 hrs, Volume= 1,039.4 m³, Atten= 36%, Lag= 8.4 min
Primary = 0.7342 m³/s @ 0.31 hrs, Volume= 1,039.4 m³

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.279 m Surf.Area= 537.3 m² Storage= 72.4 m³
Peak Elev= 1.458 m @ 0.31 hrs Surf.Area= 537.3 m² Storage= 564.9 m³ (492.5 m³ above start)

Plug-Flow detention time= 17.0 min calculated for 966.5 m³ (93% of inflow)
Center-of-Mass det. time= 15.3 min (27.8 - 12.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	263.7 m³	**17.00 mW x 31.61 mL x 2.06 mH Field A** 1,105.7 m³ Overall - 446.4 m³ Embedded = 659.3 m³ x 40.0% Voids
#2A	0.229 m	446.4 m³	**ADS_StormTech MC-4500 +Cap**x 144 Inside #1 Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³ Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap 6 Rows of 24 Chambers Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³
		710.1 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	0.279 m	**525 mm Vert. Orifice/Grate** C= 0.800

Primary OutFlow Max=0.7341 m³/s @ 0.31 hrs HW=1.457 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.7341 m³/s @ 3.39 m/s)

Pond 4: Infiltration Gallery - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 2,297 mmW x 1,524 mmH => 2.458 m² x 1.23 mL = 3.02 m³
Overall Size= 2,540 mmW x 1,524 mmH x 1.32 mL with 0.09 m Overlap
Cap Storage= +1.01 m³ x 2 x 6 rows = 12.13 m³

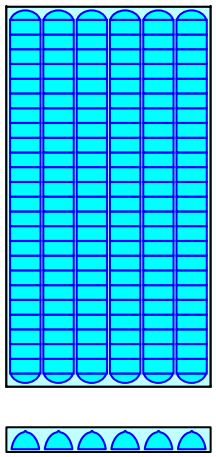
2,540 mm Wide + 229 mm Spacing = 2,769 mm C-C Row Spacing

24 Chambers/Row x 1.23 m Long +0.78 m Cap Length x 2 = 31.00 m Row Length +305 mm End Stone x 2 = 31.61 m Base Length
6 Rows x 2,540 mm Wide + 229 mm Spacing x 5 + 305 mm Side Stone x 2 = 17.00 m Base Width
229 mm Base + 1,524 mm Chamber Height + 305 mm Cover = 2.06 m Field Height

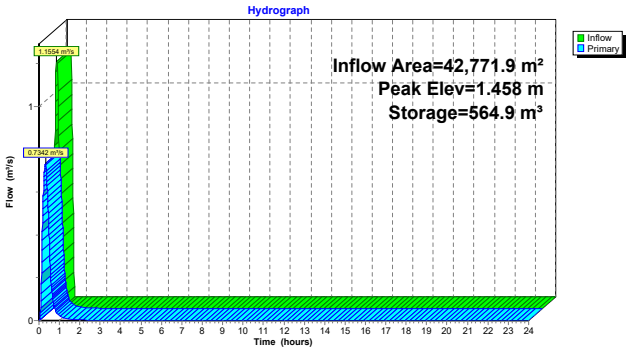
144 Chambers x 3.02 m³ + 1.01 m³ Cap Volume x 2 x 6 Rows = 446.36 m³ Chamber Storage

1,105.70 m³ Field - 446.36 m³ Chambers = 659.34 m³ Stone x 40.0% Voids = 263.73 m³ Stone Storage

Chamber Storage + Stone Storage = 710.09 m³ = 0.710 Ml
Overall Storage Efficiency = 64.2%
Overall System Size = 31.61 m x 17.00 m x 2.06 m



Pond 4: Infiltration Gallery



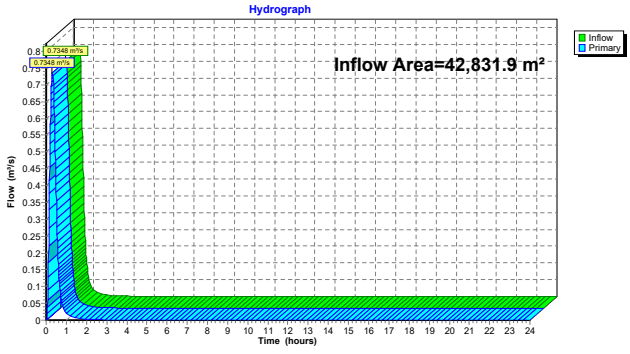
Summary for Link 8: Outlet 897.5L/s

20 L/s release rate

Inflow Area = 42,831.9 m², 44.03% Impervious, Inflow Depth = 24 mm for 100-Year event
Inflow = 0.7348 m³/s @ 0.31 hrs, Volume= 1,040.1 m³
Primary = 0.7348 m³/s @ 0.31 hrs, Volume= 1,040.1 m³, Atten= 0%, Lag= 0.0 min

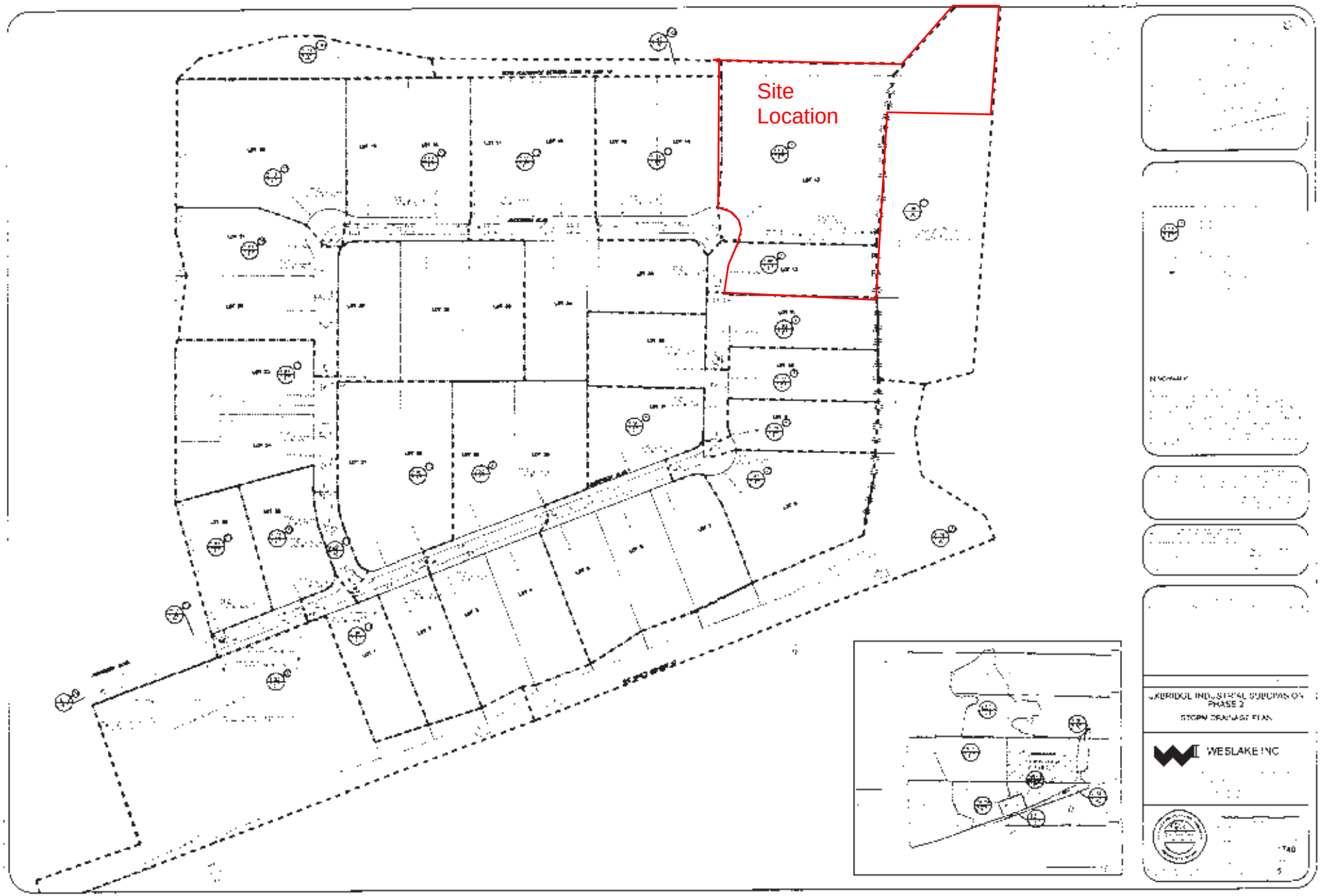
Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 8: Outlet 897.5L/s



APPENDIX

D THE UXBRIDGE PHASE 2 SWM REPORT STORM DRAINAGE PLAN


Site
Location
WESLAKE INC