UNIVERSITY OF OTTAWA

UNIVERSITY OF OTTAWA FACULTY OF HEALTH SCIENCES BUILDING

STORMWATER MANAGEMENT REPORT

JUNE 21, 2021

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UNIVERSITY OF OTTAWA FACULTY OF HEALTH SCIENCES BUILDING STORMWATER MANAGEMENT REPORT

UNIVERSITY OF OTTAWA

1ST SUBMISSION

PROJECT NO.: 211-01094-01
CLIENT REF: BT20-18477
DATE: JUNE 21, 2021

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REVISION HISTORY

FIRST ISSUE

June 21st, 2021	Draft SWM Report			
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June 21st, 2021

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June 21st, 2021

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1 INTRODUCTION

1.1 SCOPE

WSP Canada Inc. was retained by the University of Ottawa to prepare a Stormwater Management (SWM) report for the proposed construction of a five storey Faculty of Health Sciences building at the University of Ottawa's Lees Campus. This SWM report examines the potential water quality and quantity impacts of the proposed development and summarizes how each will be addressed in accordance with applicable guidelines.

1.2 SITE LOCATION

The proposed development is located at 200 Lees Avenue, Ottawa, Ontario. The subject site is bounded by the 417 to the north, the LRT line to the west, and the Rideau River to the east and south. The location of the proposed development is illustrated in Figure 1.

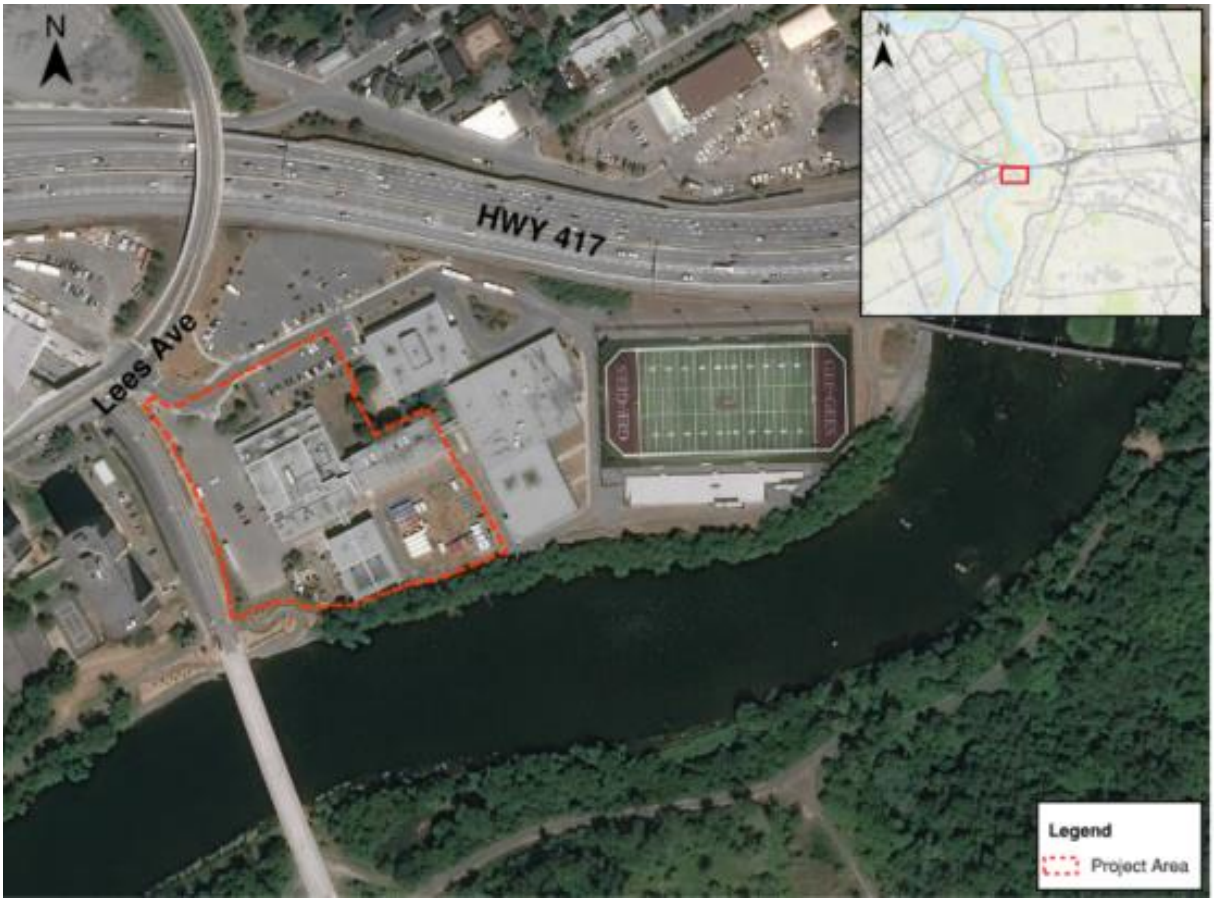

Figure 1: Project Location

1.3 STORMWATER MANAGEMENT PLAN OBJECTIVES

The objectives of the stormwater management plan are as follows:

- → Collect and review background information.
- → Determine the site-specific stormwater management requirements to ensure that the proposals are in conformance with the applicable Provincial, Municipal and Conservation Authority stormwater management and development guidelines.
- → Evaluate various stormwater management practices that meet the applicable SWM and development requirements and recommend a preferred strategy.
- → Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and sizing of the proposed stormwater management facilities.

1.4 DESIGN CRITERIA

Design criteria were taken from the Owner's Statement of Requirements Volume 1. Criteria for the University of Ottawa Lees Campus are as follows:

- → **Stormwater Quantity-** control post-development flows (2 to 100-year storm events) to the 2-year pre-development discharge with a runoff coefficient that is the lesser of the actual runoff coefficient or 0.5 per City of Ottawa Standards for a redevelopment.
- → **Storm Quality-** enhanced level of protection per the City of Ottawa, the Rideau Valley Conservation Authority (RVCA) and the Ministry of Environment, Conservation and Parks (MECP) requirements shall be met (80% TSS removal)

2 PRE-DEVELOPMENT CONDITIONS

2.1 GENERAL

The University of Ottawa's Lees Campus is comprised of a building complex (divided into five blocks, A to E), paved parking areas along the north and west boundaries, and a turf sports field at the east end of the property. The site is accessed via an entrance off Lees Avenue at the north west corner of the site.

As can be seen in Figure 2, the subject site for the proposed development is only a portion of the overall Lees Campus, consisting of three of the five blocks (B, C, and D) of the existing building complex, the east parking area, and a portion the north parking area (south of the access road). The subject site is a 1.92 ha parcel of land with a runoff coefficient of 0.69. As discussed in section 1.4, per City of Ottawa criteria, a runoff coefficient of 0.5 was used when evaluating pre-development peak flows. Figures showing exiting drainage and land use are also shown on Exhibits 1 and 2 found in **Appendix A**.

Figure 2: Existing Conditions Catchment Area

2.2 RAINFALL INFORMATION

The rainfall intensity is calculated in accordance with Section 5.4.2 of the Ottawa Sewer Design Guidelines (October, 2012):

Where;

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

- A, B, C = regression constants for each return period (defined in section 5.4.2)
- i = rainfall intensity (mm/hour)
- Td = storm duration (minutes)

The IDF parameters/regression constants are per the Ottawa Sewer Design Guidelines (October, 2012).

2.3 ALLOWABLE FLOW RATES

As noted in section 1.4, relevant policies from the City of Ottawa Sewer Design Guidelines and the Owner's Statement of Requirements require that post development discharge rates from the site match the pre-development 2-year storm event peak discharge rate (0.201m^3/s).

HydroCAD software (Modified Rational Method) was used to calculate the pre-development peak flow rates for the 2 through 100-year storm events, results are summarized in Table 1. Detailed HydroCAD output is included in **Appendix B**.

Table 1: Pre-Development Peak Flow Rate Calculations (Based on T_d = 10 minutes, C = 0.5)

RETURN PERIOD (Years)	RAINFALL INTENSITY, I (mm/hour)	SITE PEAK FLOW RATE (m^3/sec)
2	76.8	0.201
5	104.2	0.273
10	122.1	0.320
25	144.7	0.379
50	161.5	0.423
100	178.6	0.468

3 POST-DEVELOPMENT CONDITIONS

3.1 GENERAL

The proposed University of Ottawa Lees Campus project includes the demolition of Blocks B, C, and D of the existing building complex, excavation of contaminated soil, and the construction of a new five store Faculty of Health Sciences Building.

Vehicular access off Lees Avenue, as well as building Blocks A and E, the north parking area, and the sports field are outside of the proposed development boundaries and are not included in the scope of this report.

An estimated area breakdown of the proposed site layout is summarized in Table 2 and shown on Figure 3. Exhibits showing the proposed drainage strategy and proposed land use are shown on Exhibits 3 and Exhibit 4 and found in **Appendix A**.

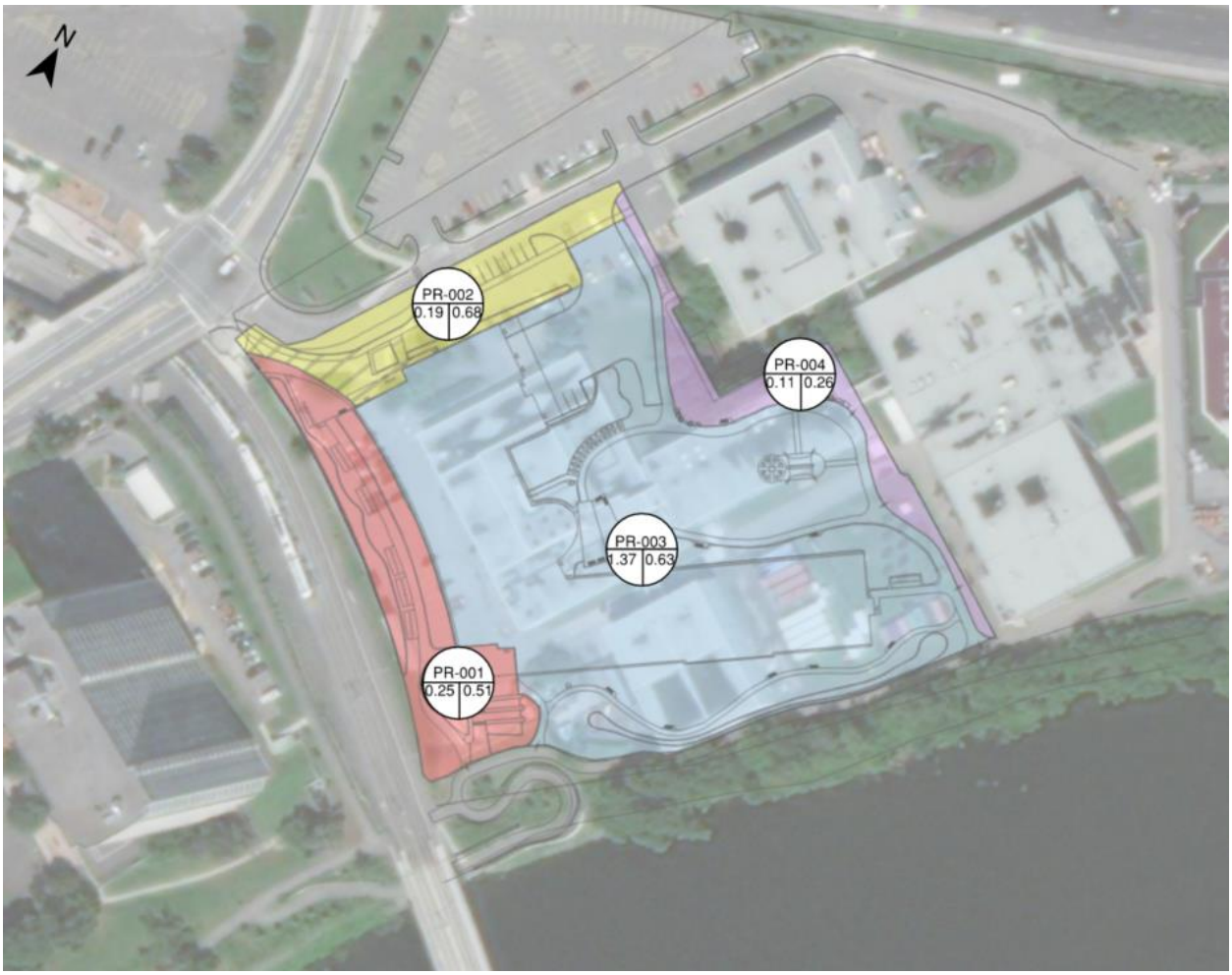

Figure 3: Proposed Conditions Catchment Areas

Table 2: Proposed Land-Use Area Breakdown

CATCHMENT ID	AREA (ha)	% COVERAGE OF PROJECT AREA	RUNOFF COEFFICIENT
Un-Controlled Drainage Areas			
PR-001	0.25	13%	0.51 (0.64*)
PR-002	0.19	10%	0.68 (0.85*)
PR-004	0.11	6%	0.26 (0.33*)
Sub Total	0.55	29%	0.52 (0.65*)
Controlled Drainage Areas			
PR-003	1.37	71%	0.63 (0.79*)
Sub Total	1.37	71%	0.63 (0.79*)
TOTAL PROJECT AREA	1.92	100%	0.60 (0.75*)

*Runoff coefficients increased by 25% for the 100-year storm per the City of Ottawa Sewer Design Guidelines (Section 5.4.5.2.1)

To meet the stormwater management objectives, as defined by the design criteria outlined in Section 1.4, the following components have been proposed:

- → Underground storage chambers (Stormtech MC 4500 or equivalent)
- → Flow control device on proposed sewer outlet
- → OGS unit (FD-4HC or equivalent)

The application and sizing of these proposed stormwater management facilities is outlined in the following sections.

3.2 WATER QUANTITY

As noted previously, it is required that the post-development discharge rate from the site be controlled to the pre-development 2-year peak flow.

Proposed features to achieve these targets include;

- → 538m^3 underground storage chambers
- → 100mm orifice plate

HydroCAD software has been used to model the behaviour of the proposed SWM system and determine its response under various storm events. The software uses Modified Rational Method to calculate flow rates and related storage values. In addition, the software helps identify the critical duration for different components of the system. The critical storm duration (100-year) for peak discharge from the site occurs at 10 minutes, however, the maximum storage utilized occurs at 129 minutes.

Due to site geometry and building placement, there are areas on the site that can not be controlled (PR-001, PR-002, PR-004) and so remain captured by the existing storm system. The west edge of the site will continue to drain to the existing storm sewer that runs along the west edge of the property and outlets to the Rideau River to the south. The north and east edge of the property (PR-002 and PR-004) will continue to drain to the existing storm sewer running along the east edge of the site and discharging to the Rideau River.

The entire controlled portion of the site (PR-003) will be detained in the proposed underground storage unit and released at a controlled rate through a suitably sized orifice plate into the existing sewer running along the east side of the site immediately prior to being released into the Rideau River. The proposed flow control device and proposed inverts have been placed such that runoff collected south of the proposed building will be directed back

into the tank prior to being released through the flow control device. It was determined using HydroCAD software that Stormtech MC-4500 storage chambers (or equivalent) with a storage volume of 538 m^3 and outflow controlled with a 100 mm orifice plate is sufficient to achieve the quantity control requirements. In December 2020, a Remediation Action Plan was prepared by Geosyntec for the west portion of the 200 Lees Avenue site (TR0885B_uOttawa_RAP_200Lees Ave Ottawa ON_FINAL). This report states that there is ongoing groundwater collection and treatment just northwest of the site at the City of Ottawa's Transit Station groundwater collection system. The study found that groundwater is strongly influenced by the presence of the system with the groundwater from the site directed largely to the northwest (Geosyntec 2020). In order to prevent additional mobilization of contaminated groundwater, the storage chambers are proposed with an impermeable liner as to prevent excessive infiltration, beyond what will naturally infiltrate in the softscape areas.

A summary of the modeling results is provided in Table 3, detailed HydroCAD output is included in **Appendix B**.

Table 3: Summary of HydroCAD Modelling Results

Return Period (Years)	Time of Conc. (min)	Utilized Storage	Total Flow Leaving Site	Allowable 100-yr Flow Rate
		(m^3)	(m^3/s)	(m^3/s)
100 (Peak Discharge)	10	299	**0.195**	**0.201**
100 (Peak Storage)	114	**538**	0.062	

3.3 WATER QUALITY

As noted previously, a single controlled outlet location is proposed at the south end of the site into the existing storm sewer discharging to the Rideau River. A Hydro First Defense FD-4HC (or equivalent) oil and grit separator (OGS) is proposed to achieve a minimum 80% TSS removal for the entire controlled area of the site (PR-003). The location of the proposed OGS unit is shown on Exhibit 3 found in **Appendix A**.

In August, 2013, an Amended Environmental Compliance Approval (ECA) was issued by the MECP regarding stormwater management works to serve the Block A renovation and the addition of an open air stadium on Lees Campus. The ECA states as part of this work, a Stormceptor STC 2000 OGS unit was installed that treats a 1.22 ha area of the site. The existing OGS has been sized to provide 80% TSS removal for the 1.22 ha drainage area with an overall imperviousness of 80%. The 1.22 ha area treated by the existing OGS includes the north parking, which will continue to be parking area under proposed conditions shown on Exhibit 3 as PR-002. Under proposed conditions, the north parking area will maintain the existing drainage patterns and approximate overall imperviousness, therefore, this area will be treated by the existing OGS unit.

As previously discussed, the western and eastern edges of the site will be drained uncontrolled to the existing storm system. These areas (PR-001 and PR-004) are primarily grass, landscaped, and pathway area and will have no vehicular traffic. Therefore, it is assumed that these areas will be free of typical sediment-generating activities and that runoff will leave effectively unchanged and can be considered clean for the purposes of water quality assessment. However, permanent and low maintenance catch basin inserts, that provide a minimum 50% TSS removal, are proposed in existing catch basins that receive uncontrolled flow to further reduce the impact to the receiving Rideau River.

4 CONCLUSIONS

A stormwater management report has been prepared to support the design of the proposed University of Ottawa Faculty of Health Sciences Building at the Lees Campus in the City of Ottawa. The key points are summarized below.

WATER QUALITY

An OGS unit (Hydro First Defense FD-4HC, or equivalent) is proposed at the outlet of the proposed sewer system into the existing storm sewer draining to the Rideau River to meet MECP Enhanced treatment standards (80% TSS removal).

WATER QUANTITY

Controlled runoff from the site will be detained in a 538m^3 underground storage unit (Stormtech MC-4500 Chambers, or equivalent) and released at a controlled rate using a 100mm orifice plate.

This report has demonstrated the proposed SWM strategy will address stormwater management related impacts from this project and meet the applicable design requirements.

APPENDIX

A EXHIBITS

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PROJECT
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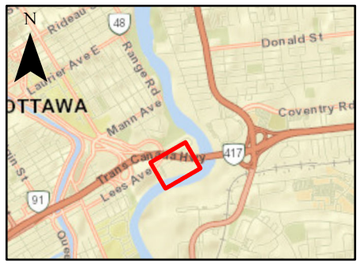
TITLE
EXHIBIT 1
EXISTING CONDITIONS
DRAINAGE MOSAIC



LEGEND

- Existing Storm
- Subcatchment

Subcatchment ID | Area (ha) | Runoff C

0 0.01 0.03 km

DRAWN BY	CHECKED BY
MO	JW
June 2021	
NAD 1983 MTM 9	
1:1,275	

wsp

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TITLE

EXHIBIT 2
EXISTING CONDITIONS
LAND USE

LEGEND

- Subcatchment
- Land Use
  - Impervious
  - Pervious

Subcatchment ID | Area (ha) | Runoff C

0 0.01 0.03 km

DRAWN BY	CHECKED BY
MO	JW
June 2021	
NAD 1983 MTM 9	
1:1,275	

wsp

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TITLE
EXHIBIT 3
PROPOSED CONDITIONS
DRAINAGE MOSAIC

LEGEND

- OGS Unit
- ICD
- Proposed Storm
- Existing Storm
- Storage Unit

Subcatchments

- PR-001
- PR-002
- PR-003
- PR-004

Subcatchment ID
Area (ha) | Runoff C

0 0.01 0.03 km

DRAWN BY	CHECKED BY
MO	JW
June 2021	
NAD 1983 MTM 9	
1:1,275	

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TITLE
EXHIBIT 4
PROPOSED CONDITIONS
LAND USE

LEGEND

- Subcatchments
- Land Use
  - Impervious
  - Pervious

Subcatchment ID | Area (ha) | Runoff C

0 0.01 0.03 km

DRAWN BY	CHECKED BY
MO	JW
June 2021	
NAD 1983 MTM 9	
1:1,275	

wsp

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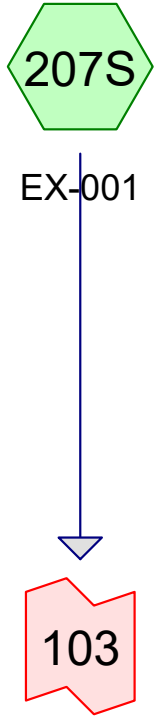
APPENDIX

B CALCULATIONS & HYDROCAD OUTPUT

PRE-DEVELOPMENT CONDITIONS



Subcat Reach Pond Link

Routing Diagram for uOttawa-LEES_2021-06-09
Prepared by WSP, Printed 6/16/2021
HydroCAD® 10.00-21 s/n 10697 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
19,200.0	0.50	(207S)
19,200.0	**0.50**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
19,200.0	Other	207S
19,200.0		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Subca Numbe
0.0	0.0	0.0	0.0	19,200.0	19,200.0		
0.0	**0.0**	**0.0**	**0.0**	**19,200.0**	**19,200.0**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 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

Subcatchment207S: EX-001 Runoff Area=1.9200 ha 0.00% Impervious Runoff Depth=6 mm
Tc=10.0 min C=0.50 Runoff=0.20123 m³/s 122.8 m³

Link 103: Pre-Dev Site Discharge Inflow=0.20123 m³/s 122.8 m³
Primary=0.20123 m³/s 122.8 m³

Total Runoff Area = 19,200.0 m² Runoff Volume = 122.8 m³ Average Runoff Depth = 6 mm
100.00% Pervious = 19,200.0 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 207S: EX-001

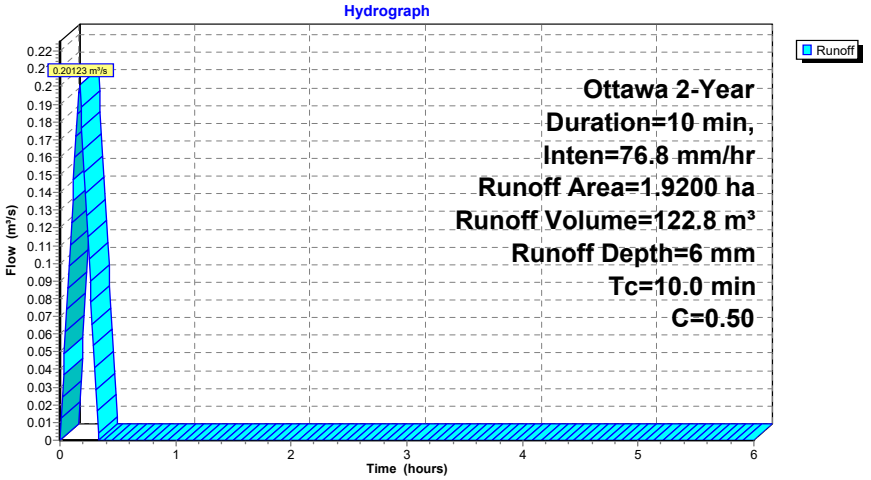
Runoff = 0.20123 m³/s @ 0.17 hrs, Volume= 122.8 m³, Depth= 6 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
1.9200	0.50	
1.9200		100.00% Pervious Area

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

Subcatchment 207S: EX-001

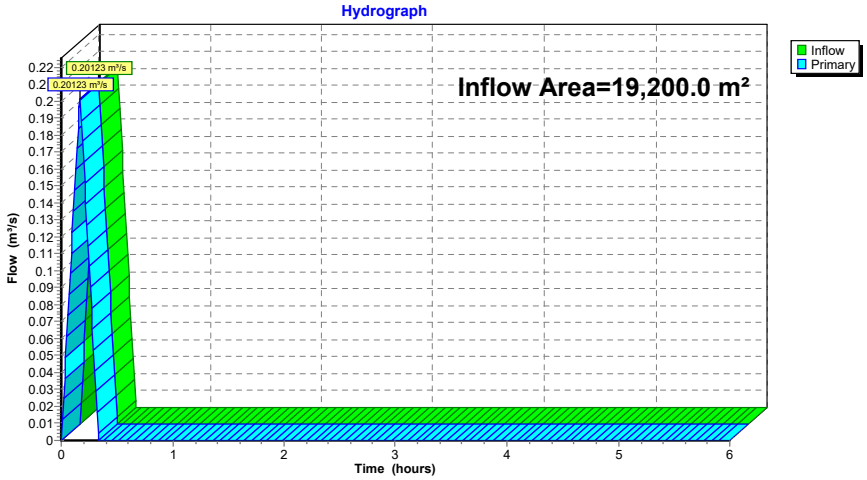


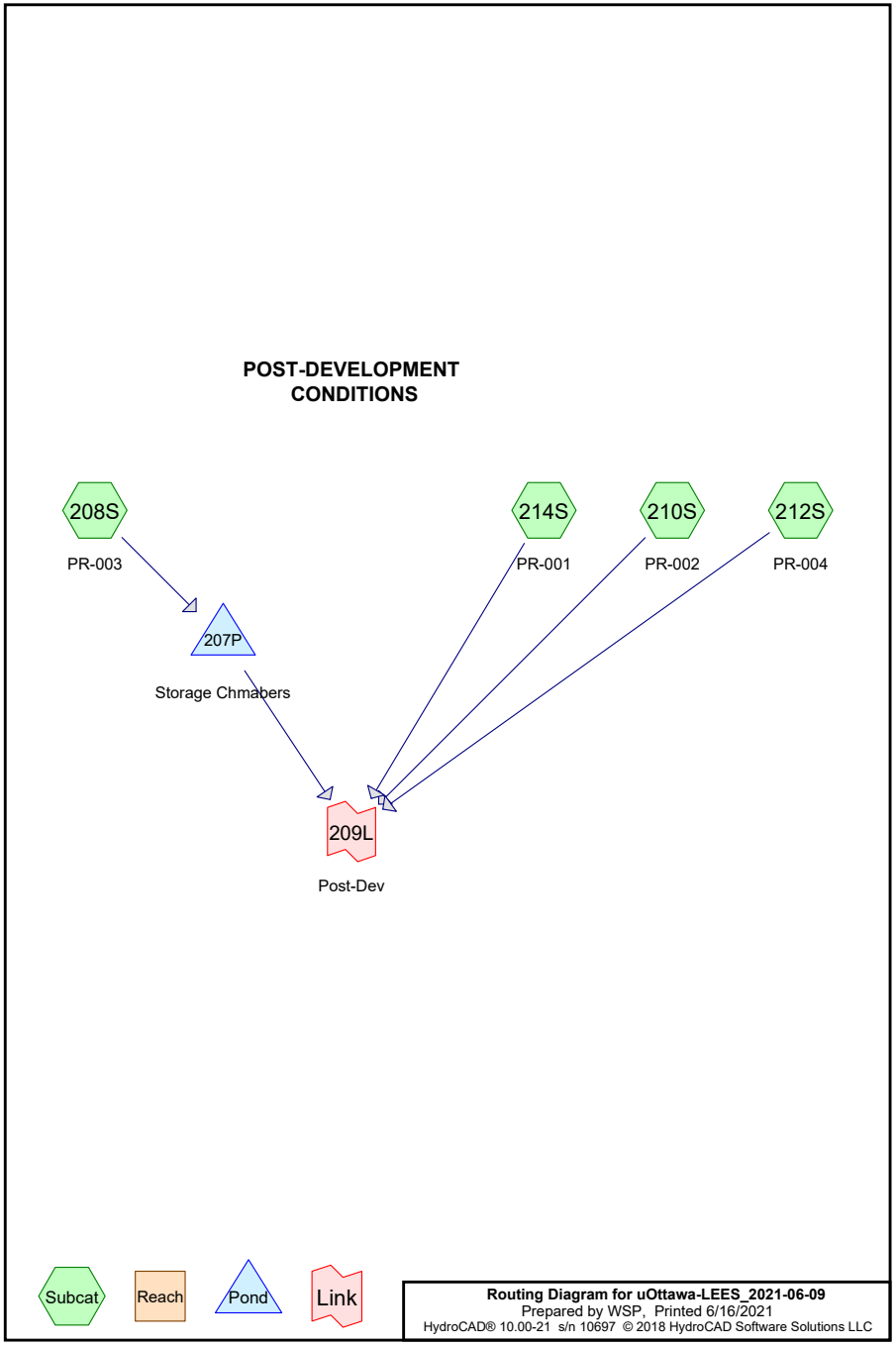
Summary for Link 103: Pre-Dev Site Discharge

Inflow Area = 19,200.0 m², 0.00% Impervious, Inflow Depth = 6 mm for 2-Year event
Inflow = 0.20123 m³/s @ 0.17 hrs, Volume= 122.8 m³
Primary = 0.20123 m³/s @ 0.17 hrs, Volume= 122.8 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 103: Pre-Dev Site Discharge





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
13,700.0	0.79	(208S)
1,900.0	0.85	Uncontrolled (210S)
1,200.0	0.33	Uncontrolled (212S)
2,500.0	0.64	Uncontrolled (214S)
19,300.0	**0.75**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
19,300.0	Other	208S, 210S, 212S, 214S
19,300.0		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Subca Numbe
0.0	0.0	0.0	0.0	13,700.0	13,700.0		
0.0	0.0	0.0	0.0	5,600.0	5,600.0	Uncontrol led	
0.0	**0.0**	**0.0**	**0.0**	**19,300.0**	**19,300.0**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 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

Subcatchment208S: PR-003 Runoff Area=1.3700 ha 0.00% Impervious Runoff Depth=24 mm
Tc=10.0 min C=0.79 Runoff=0.52742 m³/s 322.0 m³

Subcatchment210S: PR-002 Runoff Area=0.1900 ha 0.00% Impervious Runoff Depth=25 mm
Tc=10.0 min C=0.85 Runoff=0.07870 m³/s 48.0 m³

Subcatchment212S: PR-004 Runoff Area=0.1200 ha 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.33 Runoff=0.01930 m³/s 11.8 m³

Subcatchment214S: PR-001 Runoff Area=0.2500 ha 0.00% Impervious Runoff Depth=19 mm
Tc=10.0 min C=0.64 Runoff=0.07797 m³/s 47.6 m³

Pond 207P: Storage Chmabers Peak Elev=59.899 m Storage=299.2 m³ Inflow=0.52742 m³/s 322.0 m³
Outflow=0.02390 m³/s 322.0 m³

Link 209L: Post-Dev Inflow=0.19675 m³/s 429.4 m³
Primary=0.19675 m³/s 429.4 m³

Total Runoff Area = 19,300.0 m² Runoff Volume = 429.4 m³ Average Runoff Depth = 22 mm
100.00% Pervious = 19,300.0 m² 0.00% Impervious = 0.0 m²

uOttawa-LEES_2021-06-09 *Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr*
Prepared by WSP Printed 6/16/2021
HydroCAD® 10.00-21 s/n 10697 © 2018 HydroCAD Software Solutions LLC

Summary for Subcatchment 208S: PR-003

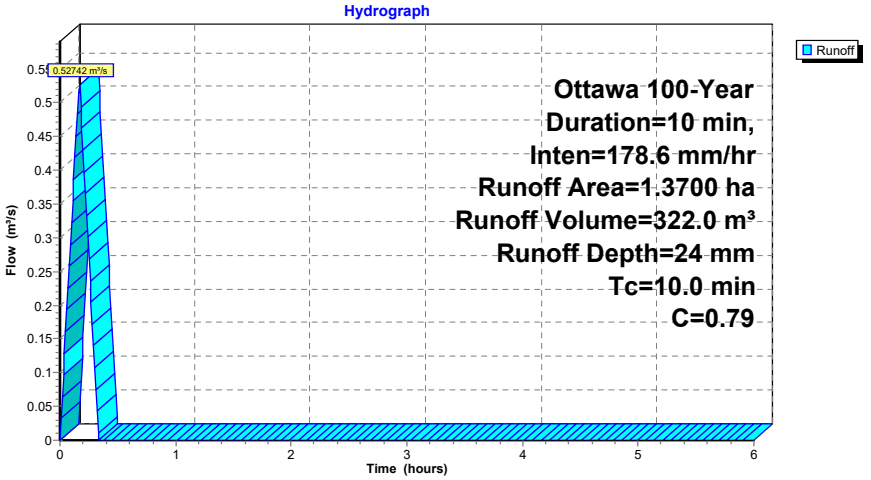
Runoff = 0.52742 m³/s @ 0.17 hrs, Volume= 322.0 m³, Depth= 24 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
1.3700	0.79	
1.3700		100.00% Pervious Area

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

Subcatchment 208S: PR-003



Summary for Subcatchment 210S: PR-002

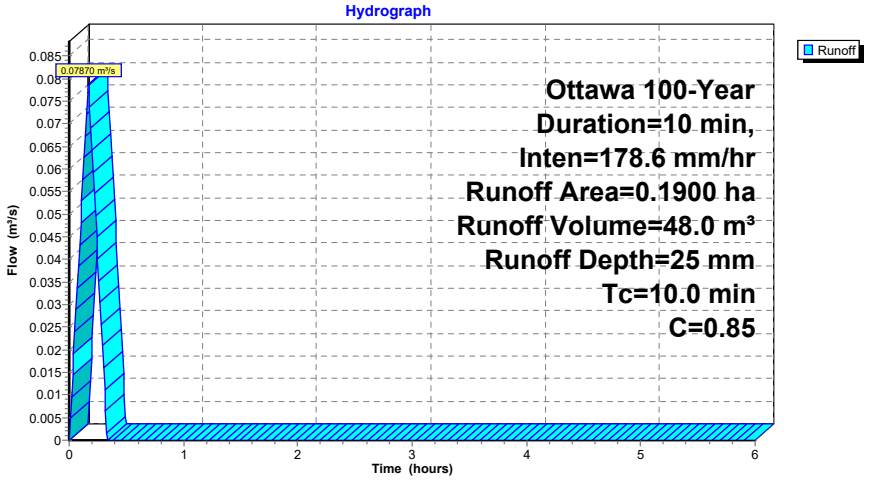
Runoff = 0.07870 m³/s @ 0.17 hrs, Volume= 48.0 m³, Depth= 25 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.1900	0.85	Uncontrolled
0.1900		100.00% Pervious Area

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

Subcatchment 210S: PR-002



Summary for Subcatchment 212S: PR-004

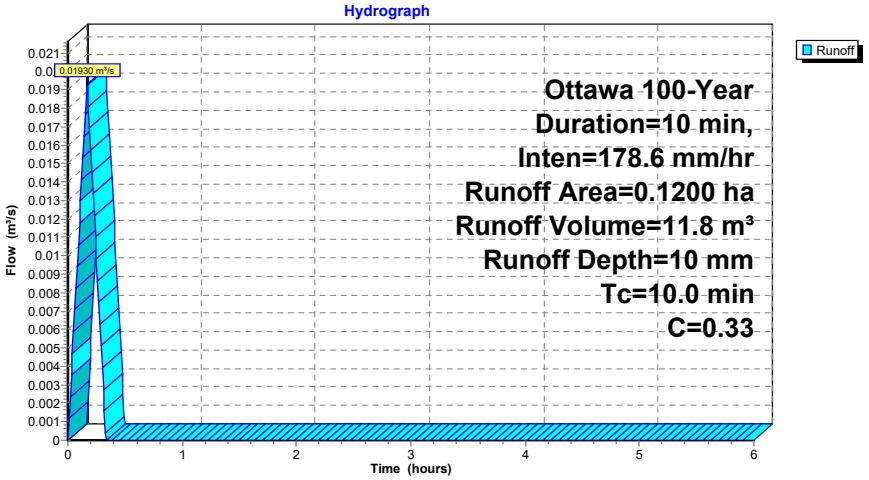
Runoff = 0.01930 m³/s @ 0.17 hrs, Volume= 11.8 m³, Depth= 10 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.1200	0.33	Uncontrolled
0.1200		100.00% Pervious Area

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

Subcatchment 212S: PR-004



Summary for Subcatchment 214S: PR-001

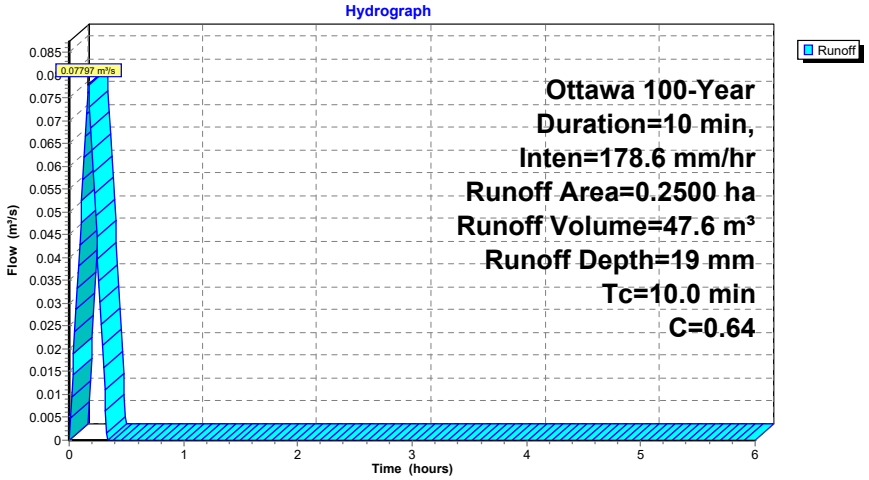
Runoff = 0.07797 m³/s @ 0.17 hrs, Volume= 47.6 m³, Depth= 19 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.2500	0.64	Uncontrolled
0.2500		100.00% Pervious Area

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

Subcatchment 214S: PR-001



Summary for Pond 207P: Storage Chmabers

Inflow Area = 13,700.0 m², 0.00% Impervious, Inflow Depth = 24 mm for 100-Year event
Inflow = 0.52742 m³/s @ 0.17 hrs, Volume= 322.0 m³
Outflow = 0.02390 m³/s @ 0.33 hrs, Volume= 322.0 m³, Atten= 95%, Lag= 9.5 min
Primary = 0.02390 m³/s @ 0.33 hrs, Volume= 322.0 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 59.899 m @ 0.33 hrs Surf.Area= 501.6 m² Storage= 299.2 m³

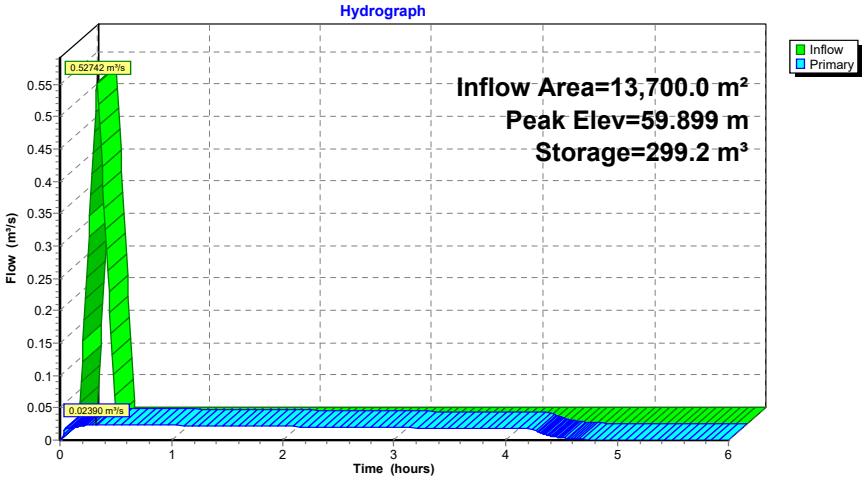
Plug-Flow detention time= 116.6 min calculated for 322.0 m³ (100% of inflow)
Center-of-Mass det. time= 116.6 min (126.6 - 10.0)

Volume	Invert	Avail.Storage	Storage Description
#1	59.300 m	990.0 m³	**9.00 mW x 55.00 mL x 2.00 mH Prismatoid**
#2	59.300 m	4.2 m³	**375 mm Round Pipe Storage** L= 38.20 m S= 0.0168 m/m
		994.2 m³	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	58.660 m	**100 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.02390 m³/s @ 0.33 hrs HW=59.899 m (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.02390 m³/s @ 3.04 m/s)

Pond 207P: Storage Chmabers

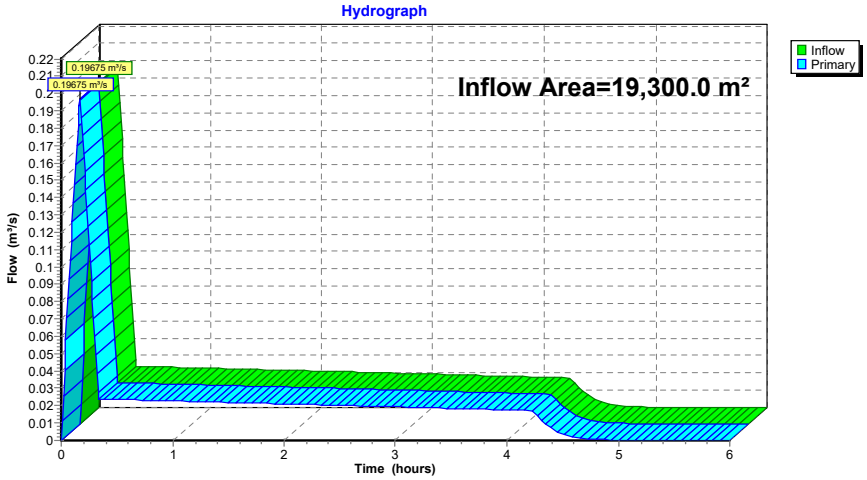


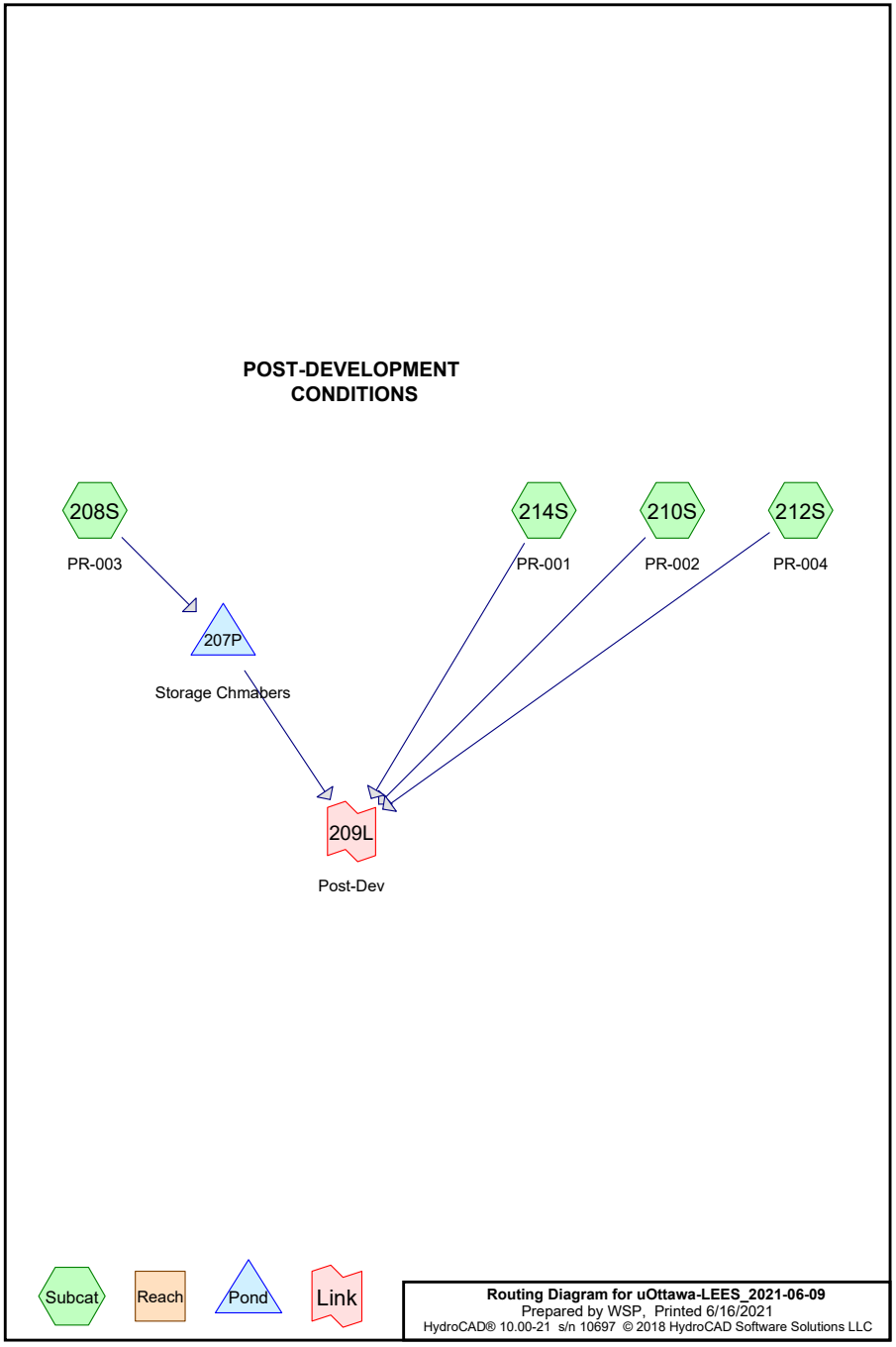
Summary for Link 209L: Post-Dev

Inflow Area = 19,300.0 m², 0.00% Impervious, Inflow Depth = 22 mm for 100-Year event
Inflow = 0.19675 m³/s @ 0.17 hrs, Volume= 429.4 m³
Primary = 0.19675 m³/s @ 0.17 hrs, Volume= 429.4 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 209L: Post-Dev





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
13,700.0	0.79	(208S)
1,900.0	0.85	Uncontrolled (210S)
1,200.0	0.33	Uncontrolled (212S)
2,500.0	0.64	Uncontrolled (214S)
19,300.0	**0.75**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-meters)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
0.0	HSG D	
19,300.0	Other	208S, 210S, 212S, 214S
19,300.0		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (sq-meters)	HSG-B (sq-meters)	HSG-C (sq-meters)	HSG-D (sq-meters)	Other (sq-meters)	Total (sq-meters)	Ground Cover	Subca Numbe
0.0	0.0	0.0	0.0	13,700.0	13,700.0		
0.0	0.0	0.0	0.0	5,600.0	5,600.0	Uncontrol led	
0.0	**0.0**	**0.0**	**0.0**	**19,300.0**	**19,300.0**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 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

Subcatchment208S: PR-003 Runoff Area=1.3700 ha 0.00% Impervious Runoff Depth=51 mm
Tc=10.0 min C=0.79 Runoff=0.10293 m³/s 704.0 m³

Subcatchment210S: PR-002 Runoff Area=0.1900 ha 0.00% Impervious Runoff Depth=55 mm
Tc=10.0 min C=0.85 Runoff=0.01536 m³/s 105.1 m³

Subcatchment212S: PR-004 Runoff Area=0.1200 ha 0.00% Impervious Runoff Depth=21 mm
Tc=10.0 min C=0.33 Runoff=0.00377 m³/s 25.8 m³

Subcatchment214S: PR-001 Runoff Area=0.2500 ha 0.00% Impervious Runoff Depth=42 mm
Tc=10.0 min C=0.64 Runoff=0.01522 m³/s 104.1 m³

Pond 207P: Storage Chmabers Peak Elev=60.378 m Storage=537.9 m³ Inflow=0.10293 m³/s 704.0 m³
Outflow=0.02831 m³/s 520.7 m³

Link 209L: Post-Dev Inflow=0.06237 m³/s 755.6 m³
Primary=0.06237 m³/s 755.6 m³

Total Runoff Area = 19,300.0 m² Runoff Volume = 938.9 m³ Average Runoff Depth = 49 mm
100.00% Pervious = 19,300.0 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 208S: PR-003

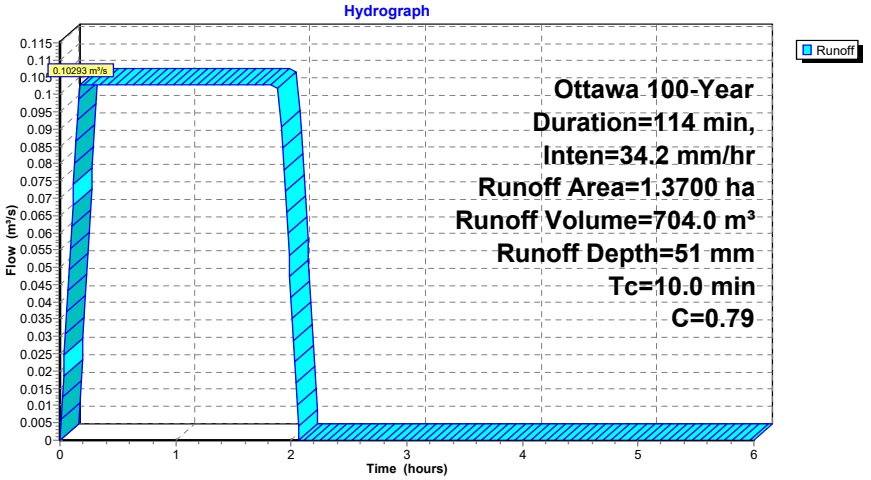
Runoff = 0.10293 m³/s @ 0.17 hrs, Volume= 704.0 m³, Depth= 51 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=114 min, Inten=34.2 mm/hr

Area (ha)	C	Description
1.3700	0.79	
1.3700		100.00% Pervious Area

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

Subcatchment 208S: PR-003



Summary for Subcatchment 210S: PR-002

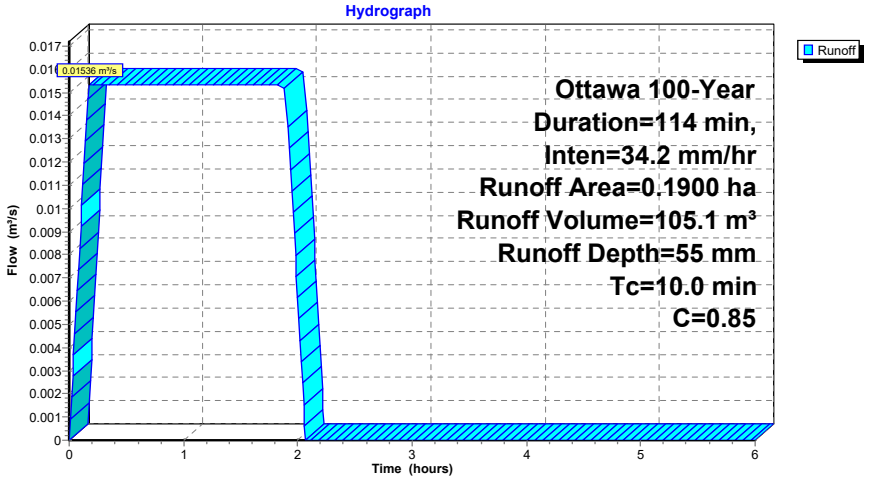
Runoff = 0.01536 m³/s @ 0.17 hrs, Volume= 105.1 m³, Depth= 55 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=114 min, Inten=34.2 mm/hr

Area (ha)	C	Description
0.1900	0.85	Uncontrolled
0.1900		100.00% Pervious Area

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

Subcatchment 210S: PR-002



Summary for Subcatchment 212S: PR-004

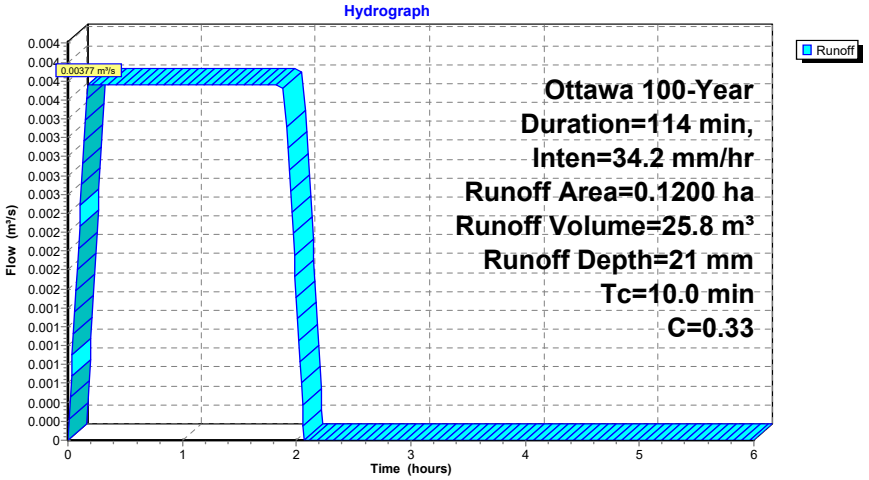
Runoff = 0.00377 m³/s @ 0.17 hrs, Volume= 25.8 m³, Depth= 21 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=114 min, Inten=34.2 mm/hr

Area (ha)	C	Description
0.1200	0.33	Uncontrolled
0.1200		100.00% Pervious Area

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

Subcatchment 212S: PR-004



Summary for Subcatchment 214S: PR-001

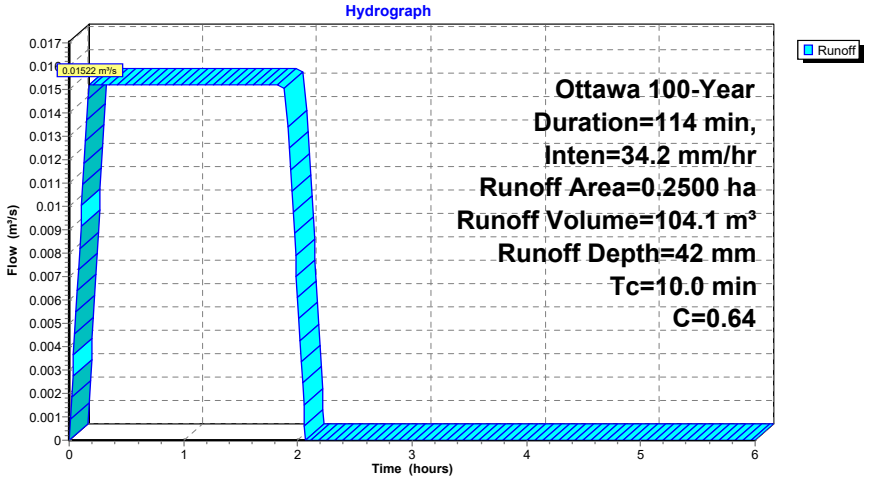
Runoff = 0.01522 m³/s @ 0.17 hrs, Volume= 104.1 m³, Depth= 42 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=114 min, Inten=34.2 mm/hr

Area (ha)	C	Description
0.2500	0.64	Uncontrolled
0.2500		100.00% Pervious Area

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

Subcatchment 214S: PR-001



Summary for Pond 207P: Storage Chmabers

Inflow Area = 13,700.0 m², 0.00% Impervious, Inflow Depth = 51 mm for 100-Year event
Inflow = 0.10293 m³/s @ 0.17 hrs, Volume= 704.0 m³
Outflow = 0.02831 m³/s @ 2.02 hrs, Volume= 520.7 m³, Atten= 72%, Lag= 111.0 min
Primary = 0.02831 m³/s @ 2.02 hrs, Volume= 520.7 m³

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 60.378 m @ 2.02 hrs Surf.Area= 495.0 m² Storage= 537.9 m³

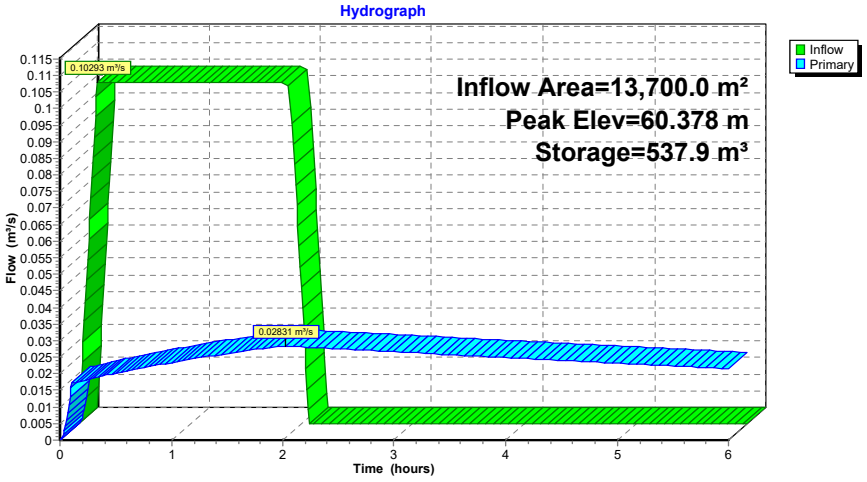
Plug-Flow detention time= 135.2 min calculated for 519.9 m³ (74% of inflow)
Center-of-Mass det. time= 120.5 min (182.5 - 62.0)

Volume	Invert	Avail.Storage	Storage Description
#1	59.300 m	990.0 m³	**9.00 mW x 55.00 mL x 2.00 mH Prismatoid**
#2	59.300 m	4.2 m³	**375 mm Round Pipe Storage** L= 38.20 m S= 0.0168 m/m
		994.2 m³	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	58.660 m	**100 mm Vert. Orifice/Grate** C= 0.630

Primary OutFlow Max=0.02831 m³/s @ 2.02 hrs HW=60.378 m (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.02831 m³/s @ 3.60 m/s)

Pond 207P: Storage Chmabers

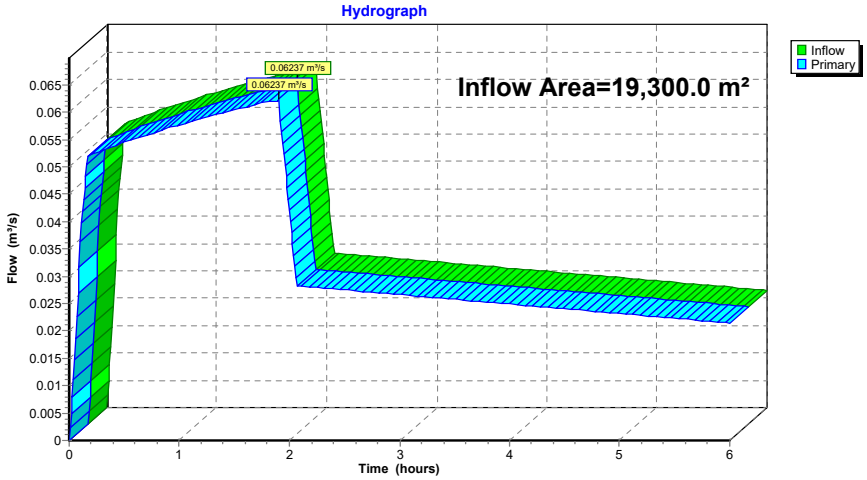


Summary for Link 209L: Post-Dev

Inflow Area = 19,300.0 m², 0.00% Impervious, Inflow Depth > 39 mm for 100-Year event
Inflow = 0.06237 m³/s @ 1.90 hrs, Volume= 755.6 m³
Primary = 0.06237 m³/s @ 1.90 hrs, Volume= 755.6 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 209L: Post-Dev



APPENDIX

C SUPPORTING DOCUMENTS

Hydro First Defense® - HC

Net Annual Water Quality Worksheet

Rev. 9.9

Hydro International

Project Name:	**University of Ottawa FHS**	*Report Date:*	**6/9/2021** (Paste)
Street:	**Lees Ave**	*City:*	**Ottawa**
Province:	**ON**	*Country:*	**Canada**
Designer:	**Meaghan O'Neill**	*email:*	**Meaghan.Oneill@wsp.com**

Treatment Parameters:

Structure ID:	OGS	
TSS Goal:	80	% Removal
TSS Particle Size:	Fine	
Area:	1.37	ha
Percent Impervious:		
Rational C value:	0.63	Calc. Cn
Rainfall Station:	Ottawa, ONT	MAP
Peak Storm Flow:	-	L/s

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	80.9%	96.3%
FD-4HC	**85.3%**	**99.4%**
FD-5HC	89.3%	99.8%
FD-6HC	91.5%	100.0%
FD-8HC	94.7%	99.9%

Model Specification:

Model:	**FD-4HC**	
Diameter:	1200	mm
Peak Flow Capacity:	510.00	L/s
Sediment Storage:	0.54	m^3
Oil Storage:	723.00	L

Installation Configuration:

Placement:	Online		
Outlet Pipe Size:	375	mm	*OK*
Inlet Pipe 1 Size:	375	mm	*OK*
Inlet Pipe 2 Size:		mm	*OK*
Inlet Pipe 3 Size:		mm	*OK*
Rim Level:	62.110	m	(Calc Invs.)
Outlet Pipe Invert:	58.440	m	*OK*
Invert Pipe 1:	58.470	m	*OK*
Invert Pipe 2:		m	
Invert Pipe 3:		m	

Designer Notes:

Net Annual Removal Model: FD-4HC

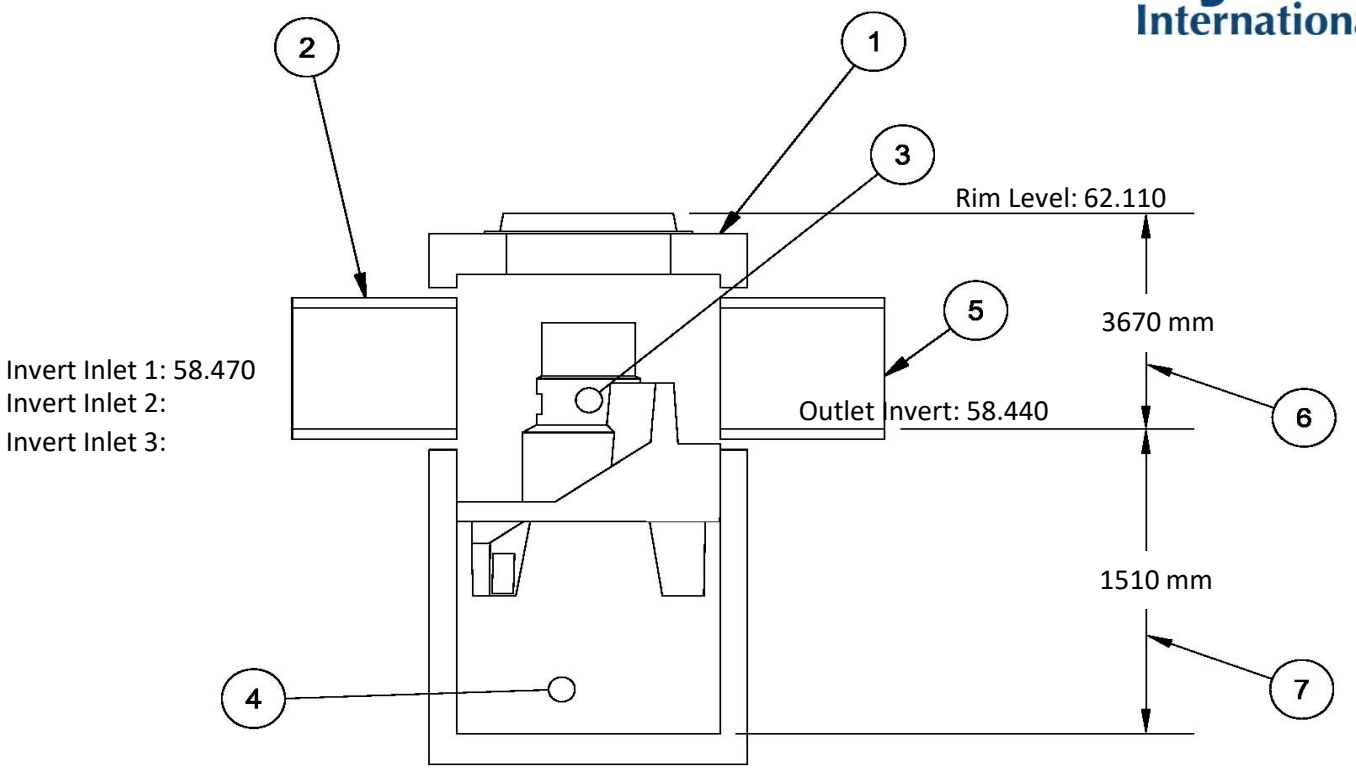
Intensity[1]	Fraction of Rainfall[1]	FD-4HC Removal Efficiency[2]	Weighted Net Annual Efficiency
(mm/hr)	(%)	(%)	(%)
0.50	0.1%	100.0%	0.1%
1.00	14.1%	95.9%	13.5%
1.50	14.2%	92.3%	13.1%
2.00	14.1%	89.9%	12.7%
2.50	4.2%	88.0%	3.7%
3.00	1.5%	86.6%	1.3%
3.50	8.5%	85.3%	7.3%
4.00	5.4%	84.3%	4.6%
4.50	1.2%	83.4%	1.0%
5.00	5.5%	82.5%	4.6%
6.00	4.3%	81.2%	3.5%
7.00	4.5%	80.0%	3.6%
8.00	3.1%	79.0%	2.4%
9.00	2.3%	78.1%	1.8%
10.00	2.6%	77.4%	2.0%
20.00	9.2%	72.6%	6.7%
30.00	2.6%	69.9%	1.8%
40.00	1.2%	68.0%	0.8%
50.00	0.5%	66.6%	0.4%
100.00	0.7%	62.5%	0.4%
150.00	0.1%	60.2%	0.0%
200.00	0.0%	58.6%	0.0%
Total Net Annual Removal Efficiency:			**85.3%**
Total Annual Runoff Volume Treated:			**99.4%**

1. Rainfall Data: 1960:2007, HLY03, Ottawa, ONT, 6105976 & 6105978.

2. Based on third party verified data and appoximating the removal of a PSD similar to the STC Fine distribution

3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Hydro First Defense® - HC



All drawing elevations are metres.

FD-4HC Specification

1	Vortex Chamber Diameter	1200	mm
2	Inlet Pipe Diameter	375	mm
3	Oil Storage Capacity	723.00	L
4	Min. Provided Sediment Storage Capacity	0.54	m^3
5	Outlet Pipe Diameter	375	mm
6	Height(Final Grade to Outlet Invert)	3670	mm

Notes:

7	Sump Depth(Outlet Invert to Sump)	1130	mm
	Total Depth	**4800**	**mm**

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteASSIST™
FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

UOTTAWA FHS

OTTAWA, ONTARIO

MC-4500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 75 mm (3").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-4500 CHAMBER SYSTEM

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 230 mm (9") SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 300 mm (12") INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm).
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 300 mm (12") BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-4500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

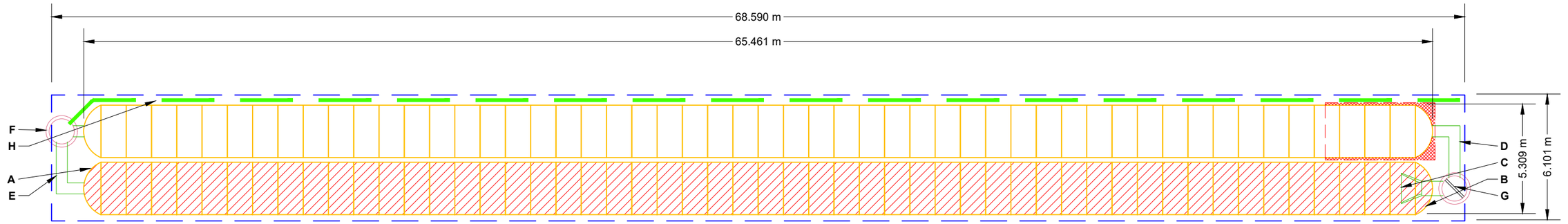
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS	
104	STORMTECH MC-4500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	3.963
4	STORMTECH MC-4500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	2.591
305	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	2.439
305	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	2.439
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	2.439
548.0	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	2.134
		TOP OF MC-4500 CHAMBER:	1.829
		600 mm ISOLATOR ROW PLUS INVERT:	0.362
		450 mm x 450 mm BOTTOM MANIFOLD INVERT:	0.355
418.5	SYSTEM AREA (m^2)	450 mm x 450 mm BOTTOM MANIFOLD INVERT:	0.355
149.4	SYSTEM PERIMETER (m)	450 mm BOTTOM CONNECTION INVERT:	0.355
		BOTTOM OF MC-4500 CHAMBER:	0.305
		UNDERDRAIN INVERT:	0.000
		BOTTOM OF STONE:	0.000

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	450 mm BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP18B / TYP OF ALL 450 mm BOTTOM CONNECTIONS	50 mm	
PREFABRICATED END CAP	B	600 mm BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	57 mm	
FLAMP	C	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: MC450024RAMP		
MANIFOLD	D	450 mm x 450 mm BOTTOM MANIFOLD, ADS N-12	50 mm	
MANIFOLD	E	450 mm x 450 mm BOTTOM MANIFOLD, ADS N-12	50 mm	
CONCRETE STRUCTURE	F	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		227 L/s OUT
CONCRETE STRUCTURE W/WEIR	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		156 L/s IN
UNDERDRAIN	H	150 mm ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 5.334 m OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

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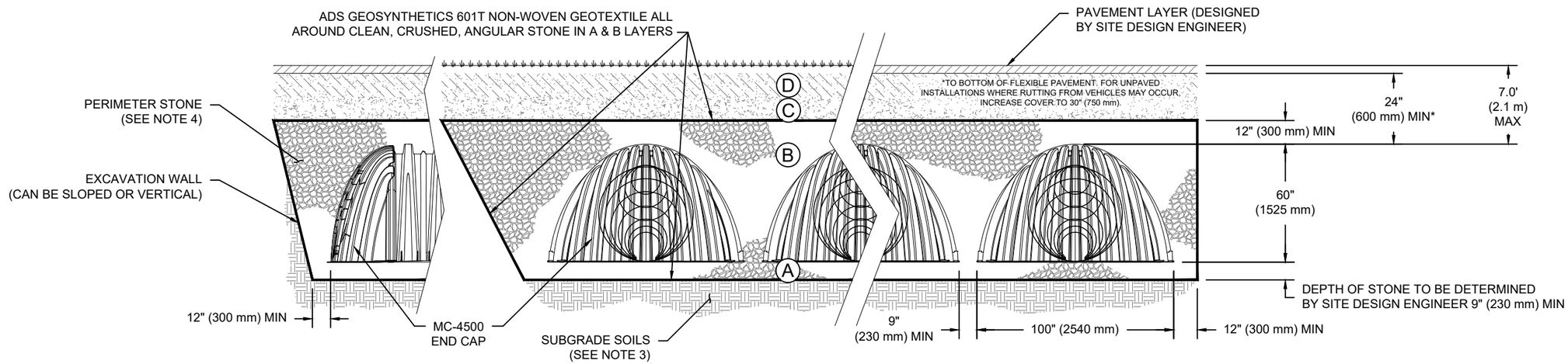
SCALE = 1 : 200

SHEET
2 OF 5

ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

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

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



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-4500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

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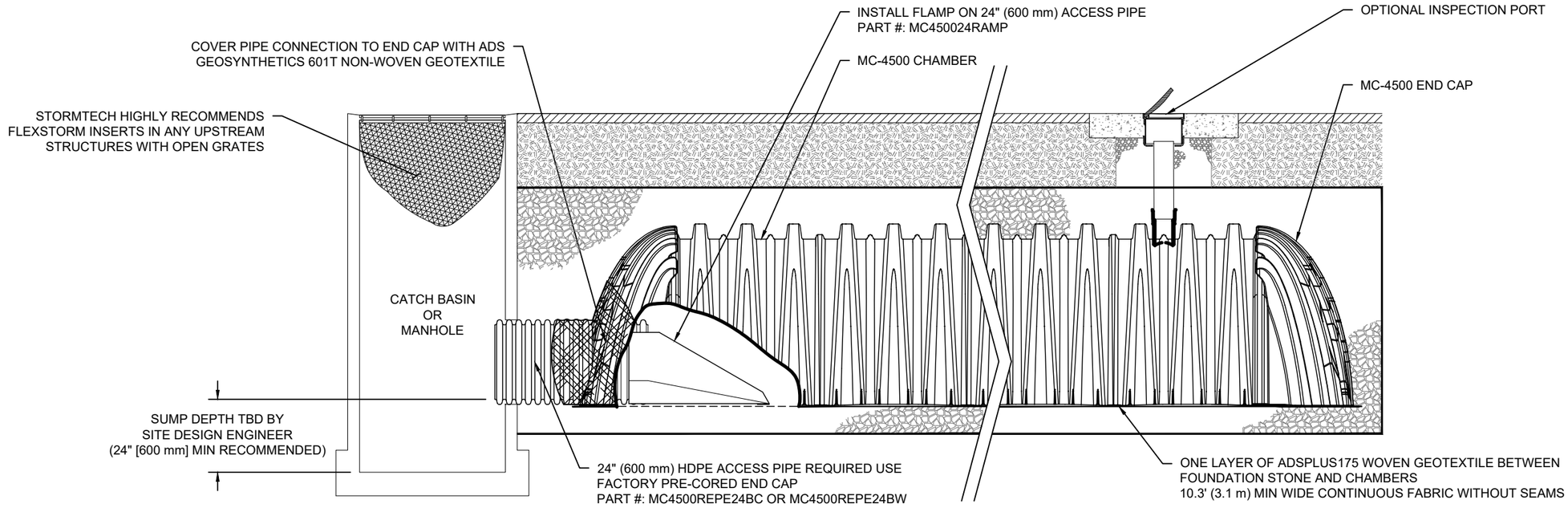

MC-4500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

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

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

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

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

NOTES

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

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

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UNDERDRAIN DETAIL

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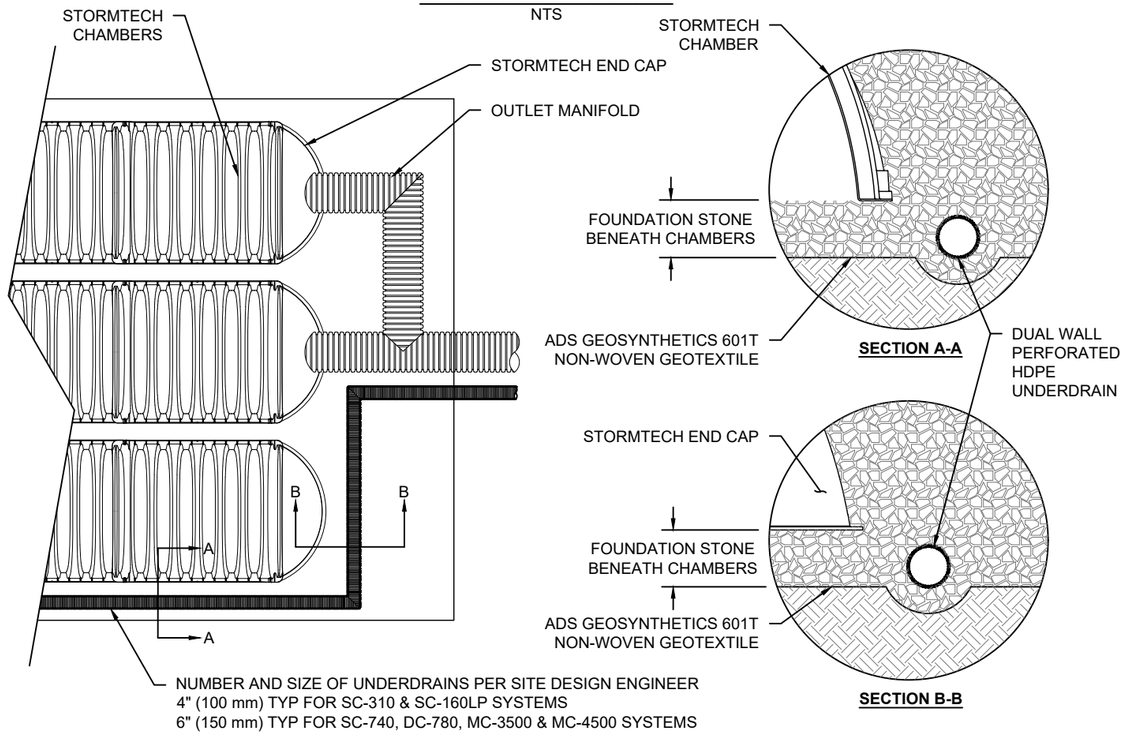
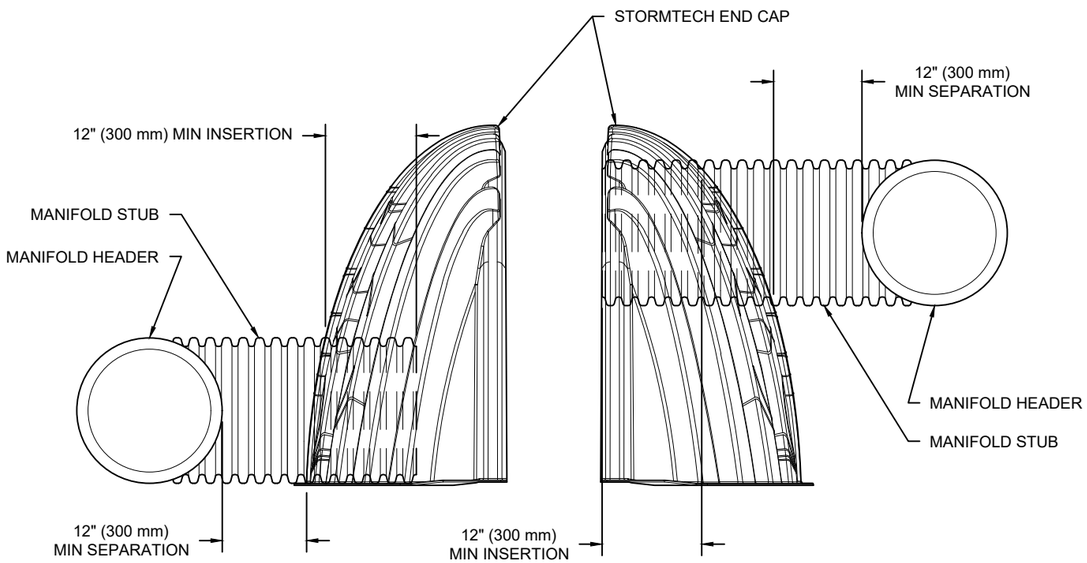


MC-SERIES END CAP INSERTION DETAIL

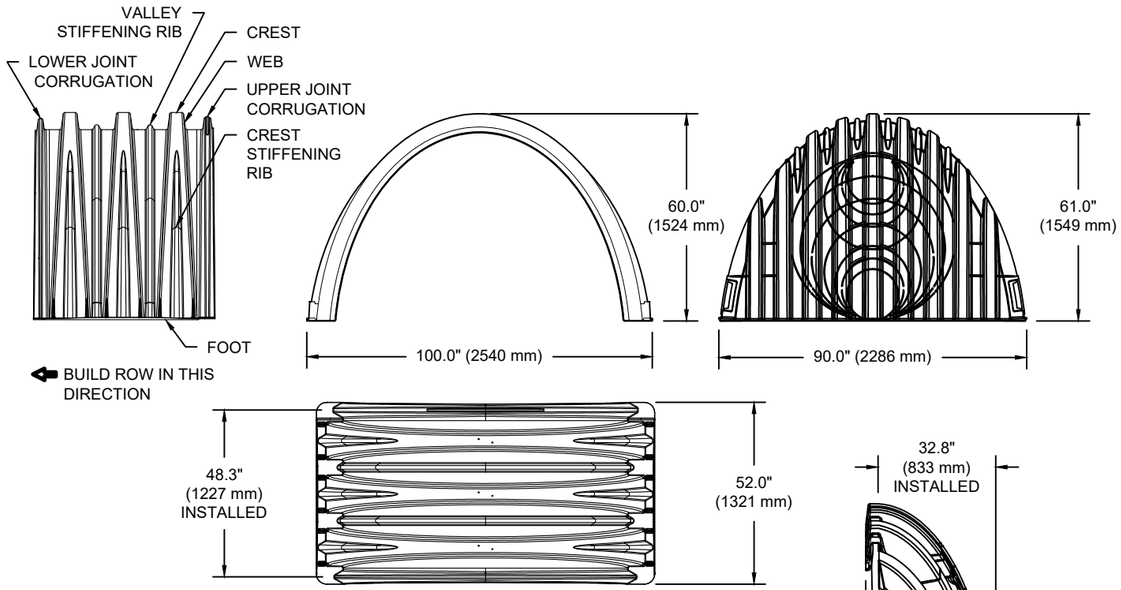
NTS



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

MC-4500 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3"	(2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET	(3.01 m³)
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET	(4.60 m³)
WEIGHT (NOMINAL)	125.0 lbs.	(56.7 kg)

NOMINAL END CAP SPECIFICATIONS

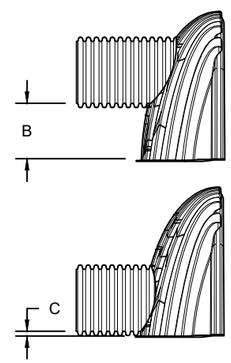
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*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.

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

PART #	STUB	B	C
MC4500IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC4500IEPP06B		---	0.86" (22 mm)
MC4500IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC4500IEPP08B		---	1.01" (26 mm)
MC4500IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC4500IEPP10B		---	1.33" (34 mm)
MC4500IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC4500IEPP12B		---	1.55" (39 mm)
MC4500IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC4500IEPP15B		---	1.70" (43 mm)
MC4500IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC4500IEPP18TW			
MC4500IEPP18B		---	1.97" (50 mm)
MC4500IEPP18BW			
MC4500IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC4500IEPP24TW			
MC4500IEPP24B		---	2.26" (57 mm)
MC4500IEPP24BW			
MC4500IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC4500IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC4500IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-4500 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.

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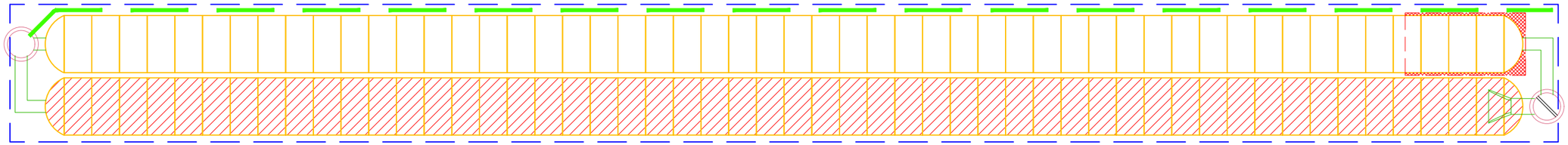


StormTech
Detention • Retention • Water Quality
An ADS company

Isolator® Row O&M Manual


SC-740


MC-3500


MC-4500

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.

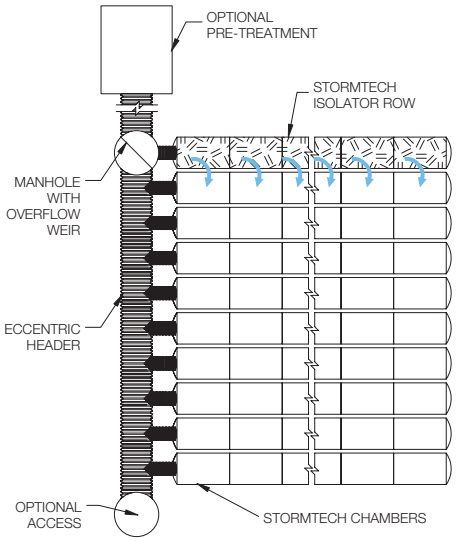
The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed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

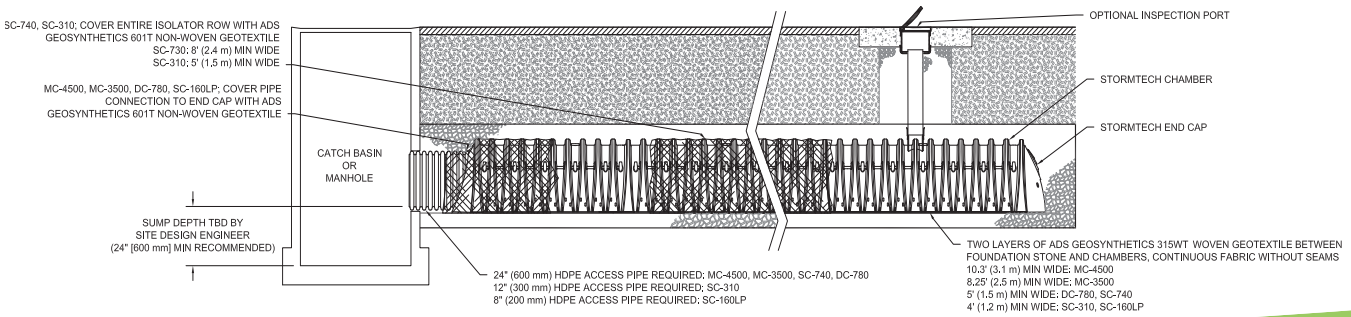
MAINTENANCE

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.



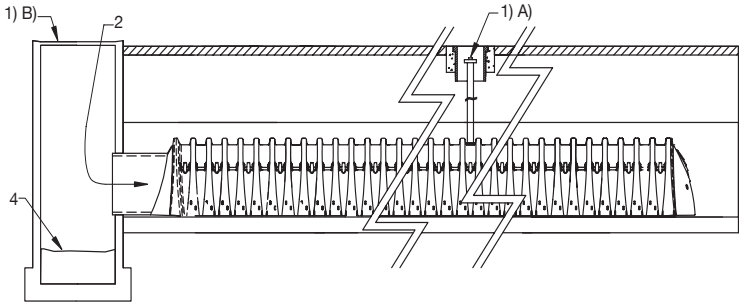
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

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	

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