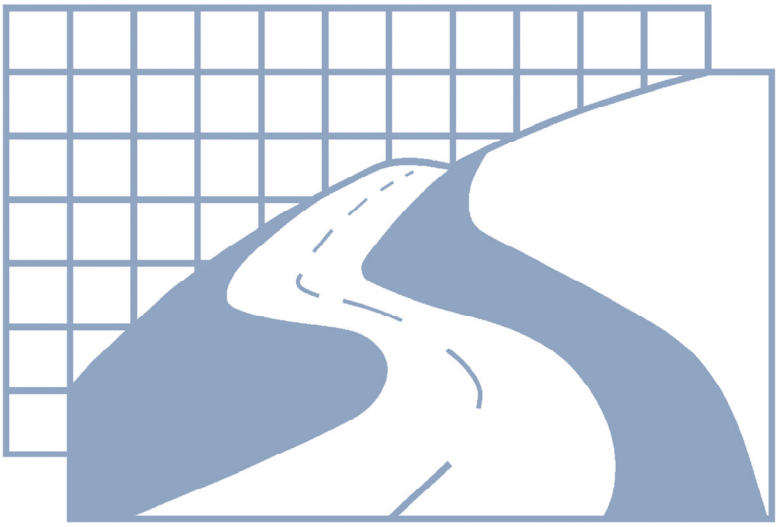
Land Planning, Inc.
Civil Engineers • Land Surveyors
Environmental Consultants

Stormwater Report

Multi-Family Site Development
288 Village Street
Medway, MA



Norman G. Hill, P.E.
4/7/2022

Owned By
Tony J. Leland, Sr. & Dawn M. Leland
290 Village Street
Medway, MA

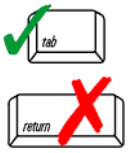
April 5, 2022

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

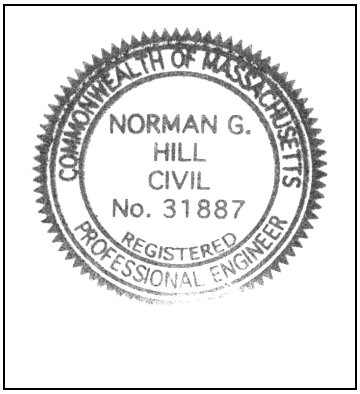
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Norman G. Hill, P.E. 4/7/2022

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☒ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Land Planning Inc.

288 Village Street, Medway MA

Multi- Family Site Development

Stormwater Management Standards Compliance

Standard 1: No New Untreated Discharges
Supporting Calculations

The proposed multi-family building and parking area will not create any new point discharges.

Existing roof runoff will be contained in a subsurface infiltration system; while impervious increase in the paved parking area will be directed and treated within the proposed rain garden.

Stormwater runoff will exit the property as shallow concentrated flow and be collected within the municipal drainage system. Except for the drainage area directed to the rain garden, existing and post development drainage patterns remain unchanged.

The requirement of no new untreated discharges has been met. Additional calculations demonstrating compliance with Standard 1 are not required.

Standard 2: Peak Rate Attenuation

The proposed peak flow rates have been reduced for the 2, 10 and 100-year storm events

Summary of Peak Flows (cfs)					
2 Year		10 Year		100 Year	
Pre	Post	Pre	Post	Pre	Post
0.43	0.41	1.15	1.09	2.52	2.21

The attached drainage analysis will further demonstrate that the proposed development will not result in an increase in peak discharge rates as compared to the existing site.

214 Worcester Street, North Grafton, MA 01536 Phone: 508-839-9526 Fax: 508-839-9528
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Standard 3: Recharge

Calculate required recharge volume:

NRCS HYDROLOGIC SOIL TYPE	APPROX. SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	sand	0.6-inch
B	loam	0.35-inch
C	silty loam	0.25-inch
D	clay	0.1-inch

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

Hydrologic Soil Type	F (Inches)	New Impervious Area (Acres)	Rv (ft^3)
A	0.60	0	0 ft^3
B	0.35	0.20	255 ft^3
C	0.25	0	0 ft^3
D	0.10	0	0 ft^3
Total Recharge Volume		**255 ft^3**	

$$R_v = \frac{F\ (in) * Impervious\ Area\ (ac.) * (43{,}560\ sf/acre)}{12\ in/ft}$$

Subsurface chamber system infiltration volume :

Chamber system storage capacity = 984 ft^3 (see HydroCAD analysis)

Roof area = 3,415 ft^2

Water Quality Volume controlling

Target Depth = 0.5 in

$$\text{Runoff volume generated} = \frac{(3{,}415\ ft^2)(0.5\ inch)}{12\ in/ft} = 143\ ft^3$$

The infiltration runoff volume to the chamber system is less than the system's storage capacity provided.

143 ft^3 < 984 ft^3 ∴ Infiltration volume provided is adequate

Infiltration system drawdown times:

Subsurface chamber system bottom area (Ba) = 431 ft^2 (see HydroCAD analysis)
Volume to be infiltrated (Rv) = 143 ft^3
K=2.41 in/hr

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

T_d = [143 ft^3 / 2.41 in/hr * (1 ft/12 in) * 431 ft^2] = 2 hr

2 hr < 72 hr ∴ **Drawdown time is adequate**

Rain garden infiltration volume :

Rain garden storage capacity = 1,041 ft³ (see HydroCAD analysis)

Pavement area = 3,192 ft²

Runoff volume generated = $\frac{(3{,}192\ ft^2)(0.5\ inch)}{12\ in/ft}$ = 133 ft³

The infiltration runoff volume to the rain garden is less than the system's storage capacity provided.

133 ft³ < 1,041 ft³ ∴ **Infiltration volume provided is adequate**

Infiltration system drawdown times:

Rain garden bottom area (Ba) = 390 ft^2 (see HydroCAD analysis)
Volume to be infiltrated (Rv) = 133 ft^3
K=2.41 in/hr

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

T_d = [133 ft^3 / 2.41 in/hr * (1 ft/12 in) * 390 ft^2] = 2 hr

2 hr < 72 hr ∴ **Drawdown time is adequate**

Standard 4: Water Quality

Water Quality Treatment Volume:

Calculate required water quality treatment volume:

A_{imp} (new impervious area) = 0.2 acres
D_{wq} (water quality depth) = 0.5 in

V_{wq}=(D_{wq} / 12 in/ft) * (A_{imp})
V_{wq}=(0.5 in / 12 in/ft) * (0.2 acres) * (43,560 ft^2/ac) = 363 ft^3 required

Determine water quality treatment volume provided:

The stormwater management system includes a subsurface chamber infiltration system and a rain garden treat surface runoff. As demonstrated within the Standard 3 section above, the stormwater management BMPs have a total storage area of 2,025 cubic feet and are sufficiently sized to handle the first ½- inch of runoff.

363 ft³ < 2,025 ft³ ∴ **Infiltration volume is adequate to treat water quality volume**

TSS Removal Requirements:

TSS Removal Calculation Worksheet

Location: **288 Village Street Medway, MA**

B BMP	C TSS Removal Rate	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping- 2%	0.02	1.00	0.02	0.98
Rain Garden	0.90	0.98	0.88	0.10

Total TSS Removal = **90%**

Project: **Multi-Family Development**
Prepared By: **SB**
Date: **4/7/2022**

*Equals remaining load from previous BMP € which enters the BMP

TSS Removal Calculation Worksheet

Location: **288 Village Street Medway, MA**

B BMP	C TSS Removal Rate	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Subsurface Infiltration System	0.08	1.00	0.80	0.20

Total TSS Removal = **80%**

Project: **Multi-Family Development**
Prepared By: **SB**
Date: **4/7/2022**

*Equals remaining load from previous BMP € which enters the BMP

Standard 5: Land Uses with Higher Potential Pollutant Loads

The existing and proposed use of the property is not classified as a Land Use with Higher Potential Pollutant Loads (LUHPPL). This standard is not applicable to this site.

Standard 6: Critical Areas

The project is not located within or adjacent to a Critical Area. This standard is not applicable to the project.

Standard 7: Redevelopment Project

This project does not qualify as a redevelopment. This standard is not applicable to this site.

Standard 8: Construction Period Pollution Prevention and Erosion Control

See attached report.

Standard 9: Operation and Maintenance Plan

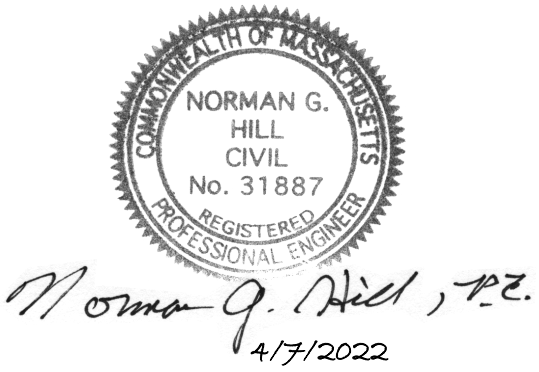
See attached report.

Standard 10: Prohibition of Illicit Discharges
Illicit Discharge Compliance Statement

Per the requirements of Standard 10 of the Stormwater Management Standards, the property has been inspected for the presence of illicit discharges. It has been determined that no illicit discharges exist on the property.

The developer, contractor, and property owner shall continue to be responsible for the prevention, detection, and elimination of illicit discharges.

Land Planning, Inc.



Norman G. Hill, P.E.
President

Attachments

- Pre and Post Development Drainage Analysis
- Watershed Maps
- NRCS Soil Report
- Storm Water Pollution Prevention Plan
- Operation & Maintenance Plan

Drainage Analysis

Located at
288 Village Street
Medway, MA

By
Land Planning, Inc.
167 Hartford Ave
Bellingham, MA 02019

April 5, 2022

1.0 INTRODUCTION

Land Planning Inc. has evaluated the hydrologic impacts for the proposed multi-family development of 288 Village Street, Medway MA. The locus is depicted as Lot 1A in Plan Book 676 Plan 87; registered at the Norfolk County Registry of Deeds on October 29, 2018.

Included in this report are the proposed method to mitigate any additional runoff from the proposed conditions of this project. The supporting hydrologic calculations are at the end of this report.

2.0 EXISTING CONDITIONS

The project site is a 22,600 square foot (s.f.) property located on the northerly side of Village Street, A Scenic Road per the Town of Medway. The project site included a single-family dwelling, two sheds, and a paved driveway. The remaining area on-site is primarily grass with a few trees located at the north easterly portion of the site.

The overall slope of the site is flat and does not exceeding 5%. Generally, the property slopes from northeast to southwest toward Village Street.

At the time of the hydrologic analysis the single-family dwelling has been removed. All other site conditions remain unchanged.

The soil located on site is Scio very fine sandy loam, 223B. Scio soils belong to the hydrologic soil group "B/D". (See attached NRCS soil report.)

Based on sub-surface exploration conducted by William Halsing, SE#2823, on February 15, 2022; the depth to groundwater was determined to be 100-inches (in.). The soil texture varied between loamy-sand and medium sand in the B and C horizons respectively (see attached soil log).

The recharge target depth for hydrologic soil group "B" utilized in the drainage analysis. The Rawls Rate of 2.41 in/hour was used for the rate of infiltration.

3.0 PROPOSED CONDITIONS

A three-unit multi-family dwelling, new paved driveway and stormwater management system shall be constructed on the locus property.

Stormwater analysis was conducted on-site. Two mitigations measures were implemented to manage stormwater. The first is to direct the parking area runoff toward a rain garden. The second is to collect and direct all roof runoff to a StormTech SC-310 infiltration system.

The remaining paved driveway access to the parking area will continue to flow to the municipal drainage system. The proposed runoff area directed to the structure has been reduced by 900 s.f..

4.0 DESIGN CRITERIA AND METHODOLOGY

4.1 Hydrologic Model

Used in the preparation of this hydrologic model were the following:

- Soil Conservation Service (SCS) Technical Release 55
    - Times of Concentration and Curve Numbers
- USDA Web Soil Survey
- Topographic Survey completed by Land Planning, Inc.
- NOAA Atlas 14
- HydroCAD software.

This report was prepared in accordance with the requirements of Volume 3, Chapter 1 of the Massachusetts Stormwater Handbook.

4.2 Design Storms and Rainfall Depth

The 2, 10, and 100-year storms were utilized to determine the runoff from the site. See the following table for rainfall intensities used for each storm event (NOAA Atlas 14).

Storm Events	
Storm Event	**24 Hour Rainfall (Inches)**
2 year	3.37
10 year	5.27
100 year	8.27

5.0 SUMMARY:

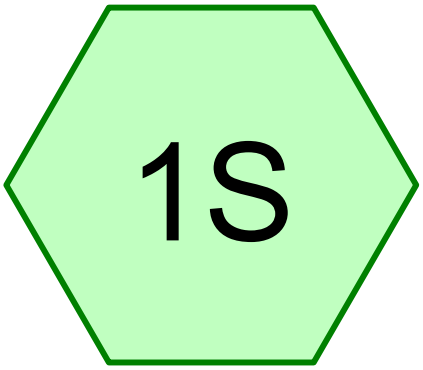
Summary of Peak Flows (cfs)					
2 Year		**10 Year**		**100 Year**	
Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
0.43	0.41	1.15	1.09	2.52	2.21

6.0 CONCLUSION:

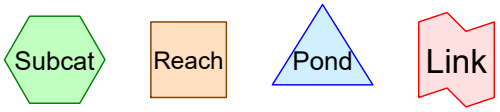
The stormwater management system, as designed, will provide for runoff rates that are less than to predevelopment levels. The proposed stormwater management system meets the objectives and requirements of Stormwater Management Standard 2.

Pre & Post Development Drainage Analysis

PRE-DEVOPMENT



Existing Site



Routing Diagram for pre-development
Prepared by Land Planning, Inc., Printed 4/7/2022

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	3.37	2
2	10-yr	Type III 24-hr		Default	24.00	1	5.27	2
3	25-yr	Type III 24-hr		Default	24.00	1	6.45	2
4	100-yr	Type III 24-hr		Default	24.00	1	8.27	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
17,816	61	>75% Grass cover, Good, HSG B (1S)
2,855	98	Paved parking, HSG B (1S)
1,929	98	Roofs, HSG B (1S)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=22,600 sf 21.17% Impervious Runoff Depth>0.88"
Flow Length=349' Tc=8.5 min CN=69 Runoff=0.43 cfs 1,648 cf

Summary for Subcatchment 1S: Existing Site

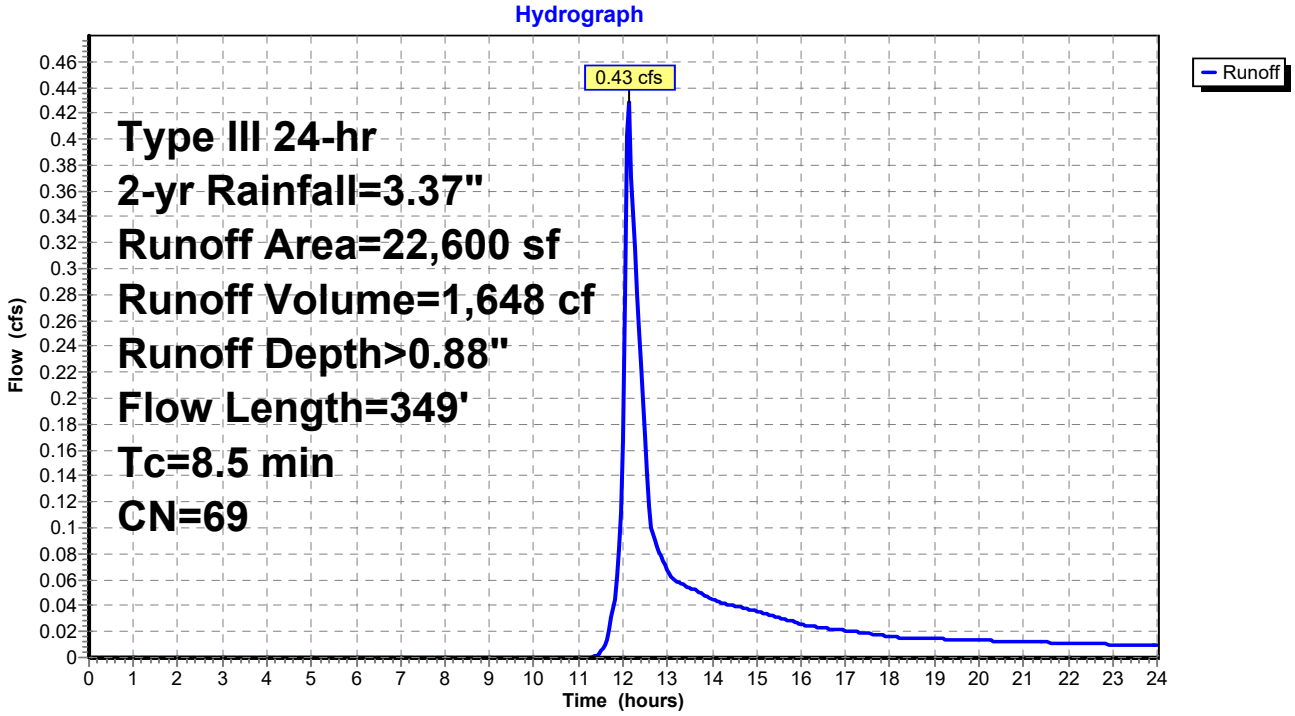
Runoff = 0.43 cfs @ 12.14 hrs, Volume= 1,648 cf, Depth> 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.37"

Area (sf)	CN	Description
1,929	98	Roofs, HSG B
2,855	98	Paved parking, HSG B
17,816	61	>75% Grass cover, Good, HSG B
22,600	69	Weighted Average
17,816		78.83% Pervious Area
4,784		21.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
1.1	56	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	243	0.0110	2.13		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.5	349	Total			

Subcatchment 1S: Existing Site



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=22,600 sf 21.17% Impervious Runoff Depth>2.15"
Flow Length=349' Tc=8.5 min CN=69 Runoff=1.15 cfs 4,053 cf

Summary for Subcatchment 1S: Existing Site

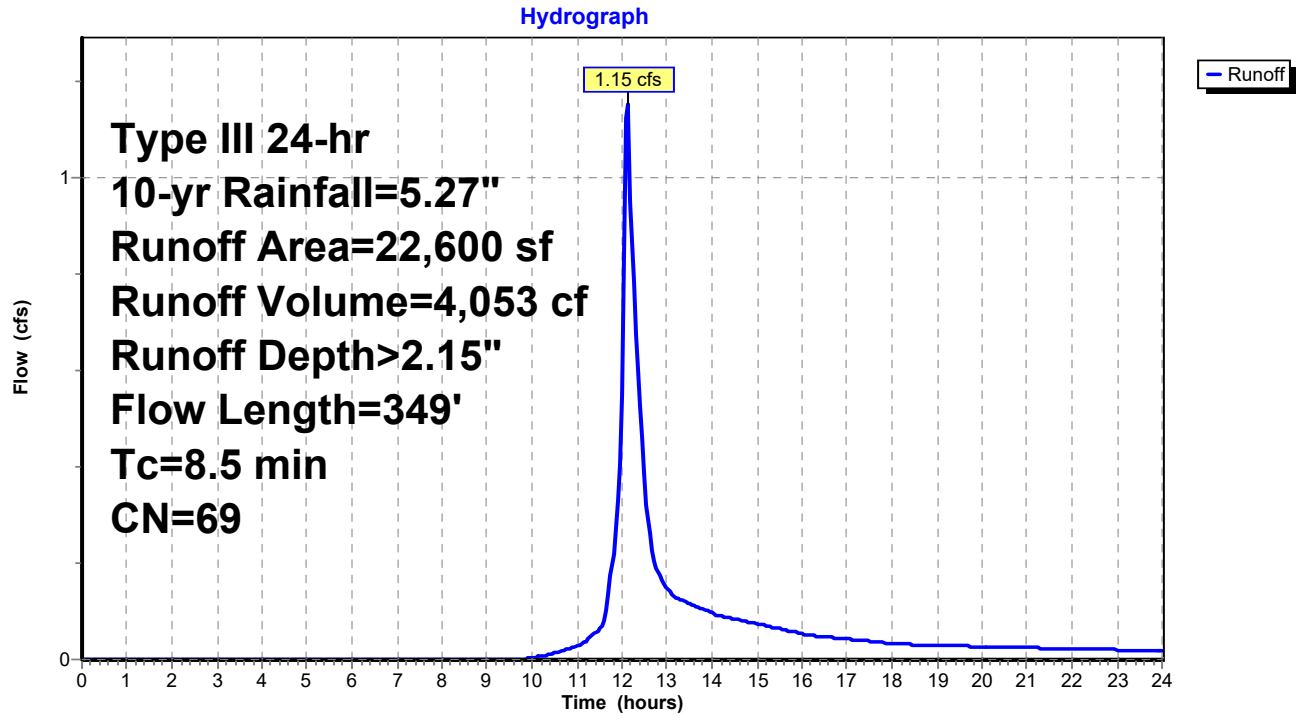
Runoff = 1.15 cfs @ 12.13 hrs, Volume= 4,053 cf, Depth> 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.27"

Area (sf)	CN	Description
1,929	98	Roofs, HSG B
2,855	98	Paved parking, HSG B
17,816	61	>75% Grass cover, Good, HSG B
22,600	69	Weighted Average
17,816		78.83% Pervious Area
4,784		21.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
1.1	56	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	243	0.0110	2.13		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.5	349	Total			

Subcatchment 1S: Existing Site



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=22,600 sf 21.17% Impervious Runoff Depth>4.57"
Flow Length=349' Tc=8.5 min CN=69 Runoff=2.52 cfs 8,614 cf

Summary for Subcatchment 1S: Existing Site

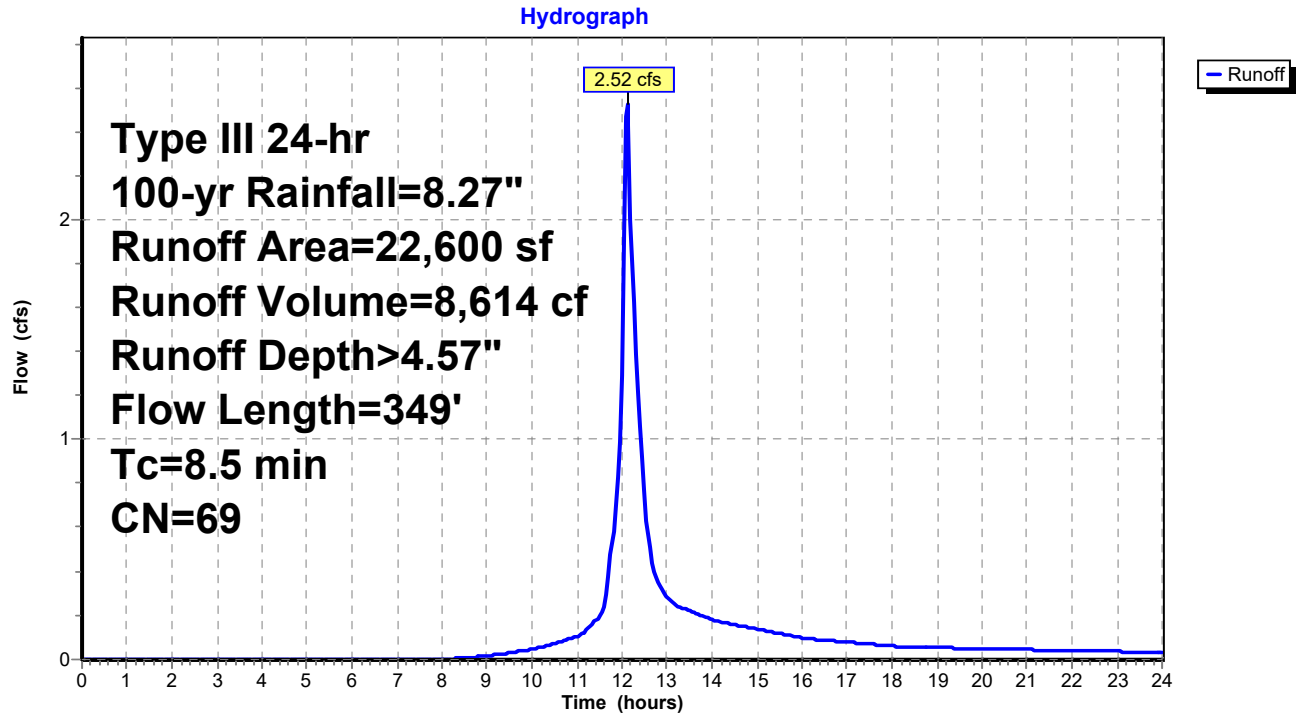
Runoff = 2.52 cfs @ 12.12 hrs, Volume= 8,614 cf, Depth> 4.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.27"

Area (sf)	CN	Description
1,929	98	Roofs, HSG B
2,855	98	Paved parking, HSG B
17,816	61	>75% Grass cover, Good, HSG B
22,600	69	Weighted Average
17,816		78.83% Pervious Area
4,784		21.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
1.1	56	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	243	0.0110	2.13		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.5	349	Total			

Subcatchment 1S: Existing Site



FLOW PATH KEY

SHEET FLOW

SHALLOW CONCENTRATED FLOW

X DESIGN POINT (DP)

(E) FENCE LINE

LOT 1A
22,600 S.F.

N75°33'29"E
140.26'

N04°25'48"E
142.66'

S04°25'48"W
199.36'

#288
(E) SINGLE FAMILY
DWELLING
HAS BEEN REMOVED

(E) PAVED
DRIVEWAY

SHED

SHED

(E) PAVED DRIVEWAY

(E) PAVED SIDEWALK

L=133.22'
R=2056.82'

Catch Basin DP X

VILLAGE STREET
(COUNTY LAYOUT - VARIABLE WIDTH)
A SCENIC ROAD

181
182
180
179
179x2
179x7
179x8
180x0
180x2
180x3
180x4
180x5
180x9

PRE - DEVELOPEMENT
DRAINAGE ANALYSIS

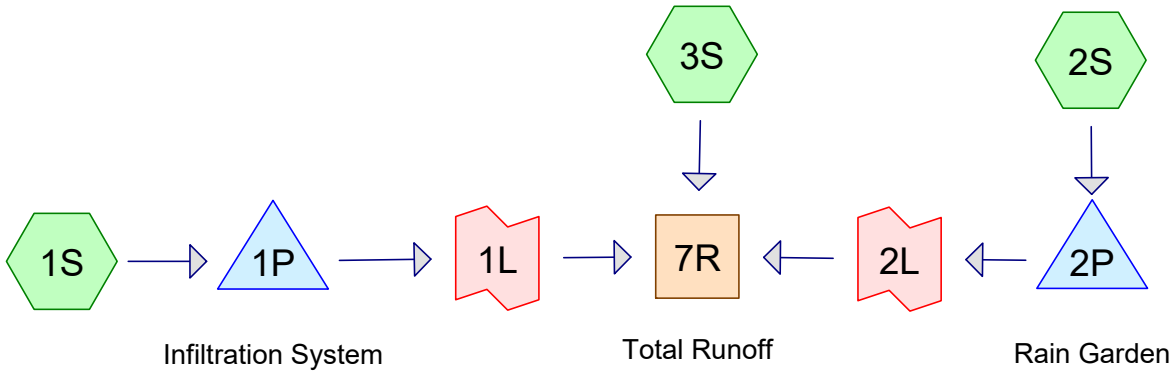
Located at
288 Village Street
Medway, MA

Scale: 1"=20'

Land Planning, Inc.
Civil Engineers • Land Surveyors
Environmental Consultants
214 Worcester St., N. Grafton, MA 01536
508-839-9526

Date	April 5, 2022	Sheet No.
Job No.	B1483	1 of 1

POST-DEVELOPEMENT



Subcat Reach Pond Link

Routing Diagram for post- development
Prepared by Land Planning, Inc., Printed 4/7/2022

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	3.37	2
2	10-yr	Type III 24-hr		Default	24.00	1	5.27	2
3	25-yr	Type III 24-hr		Default	24.00	1	6.45	2
4	100-yr	Type III 24-hr		Default	24.00	1	8.27	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
13,364	61	>75% Grass cover, Good, HSG B (2S, 3S)
5,821	98	Paved parking, HSG B (2S, 3S)
3,415	98	Unconnected roofs, HSG B (1S)

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=3,415 sf 100.00% Impervious Runoff Depth>3.14"
Flow Length=19' Slope=0.6700 '/' Tc=0.1 min CN=98 Runoff=0.29 cfs 893 cf

Subcatchment 2S: Runoff Area=5,557 sf 57.44% Impervious Runoff Depth>1.67"
Flow Length=137' Tc=4.0 min CN=82 Runoff=0.26 cfs 776 cf

Subcatchment 3S: Runoff Area=13,628 sf 19.29% Impervious Runoff Depth>0.83"
Flow Length=296' Tc=5.2 min CN=68 Runoff=0.27 cfs 938 cf

Reach 7R: Total Runoff Inflow=0.41 cfs 1,042 cf
Outflow=0.41 cfs 1,042 cf

Pond 1P: Infiltration System Peak Elev=176.77' Storage=155 cf Inflow=0.29 cfs 893 cf
Discarded=0.04 cfs 789 cf Primary=0.16 cfs 104 cf Outflow=0.20 cfs 892 cf

Pond 2P: Rain Garden Peak Elev=178.54' Storage=277 cf Inflow=0.26 cfs 776 cf
Discarded=0.03 cfs 775 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 775 cf

Link 1L: delayed by 1.6 min Inflow=0.16 cfs 104 cf
Primary=0.14 cfs 104 cf

Link 2L: delayed by 1.6 min Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Summary for Subcatchment 1S:

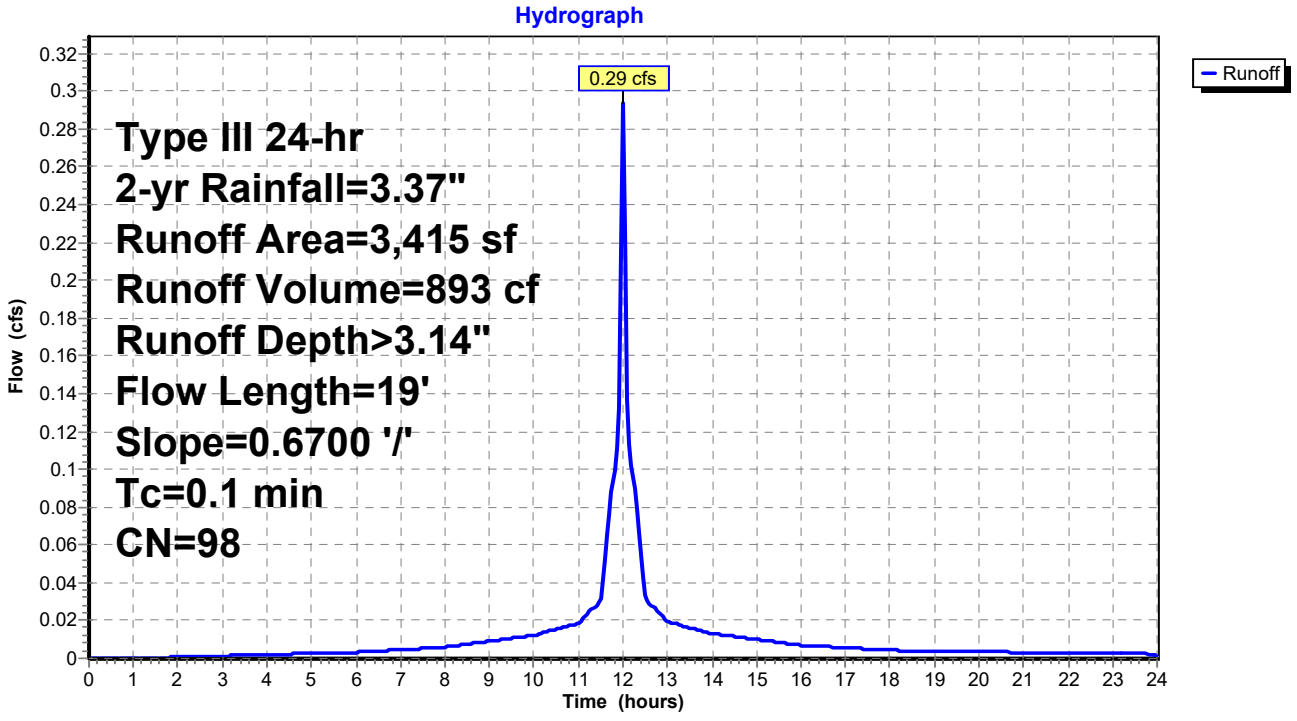
Runoff = 0.29 cfs @ 12.00 hrs, Volume= 893 cf, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.37"

Area (sf)	CN	Description
3,415	98	Unconnected roofs, HSG B
3,415		100.00% Impervious Area
3,415		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	19	0.6700	4.13		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.37"
0.0					**Direct Entry,**
0.1	19	Total			

Subcatchment 1S:



Summary for Subcatchment 2S:

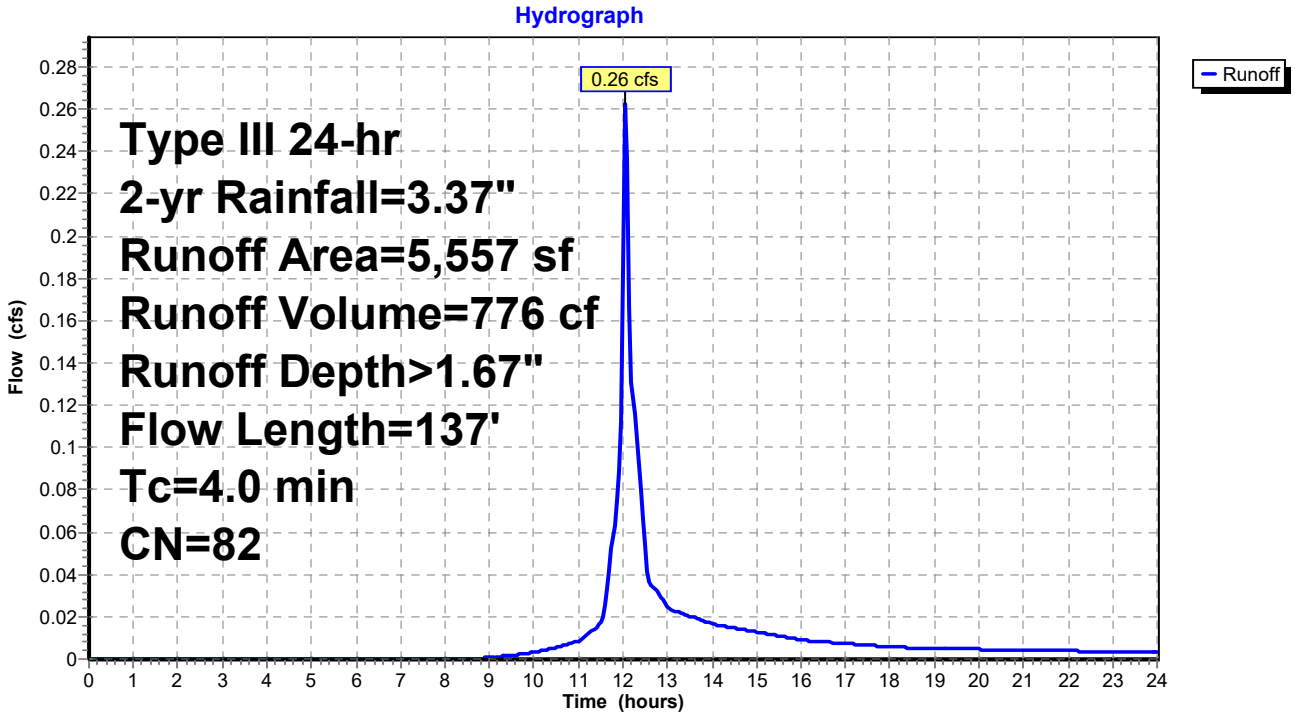
Runoff = 0.26 cfs @ 12.06 hrs, Volume= 776 cf, Depth> 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.37"

Area (sf)	CN	Description
3,192	98	Paved parking, HSG B
2,365	61	>75% Grass cover, Good, HSG B
5,557	82	Weighted Average
2,365		42.56% Pervious Area
3,192		57.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	27	0.0200	1.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.37"
2.9	23	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.2	12	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	75	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0	137	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

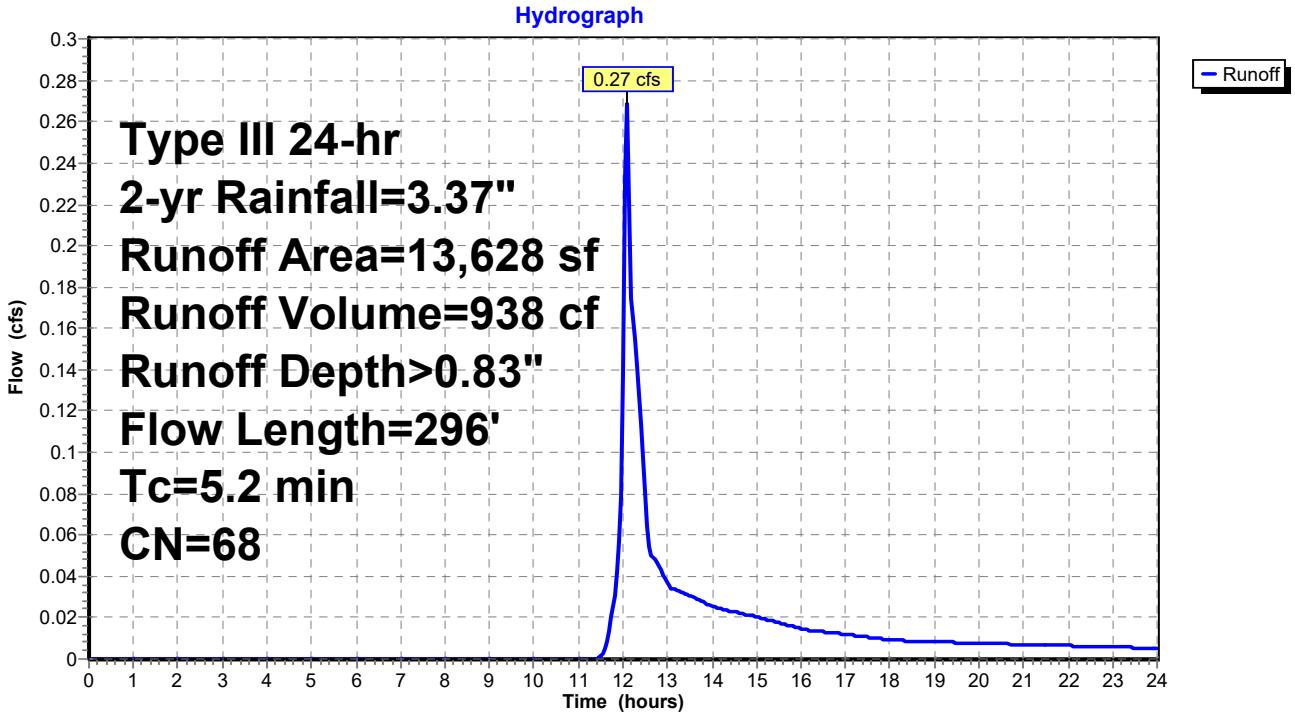
Runoff = 0.27 cfs @ 12.10 hrs, Volume= 938 cf, Depth> 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.37"

Area (sf)	CN	Description
2,629	98	Paved parking, HSG B
10,999	61	>75% Grass cover, Good, HSG B
13,628	68	Weighted Average
10,999		80.71% Pervious Area
2,629		19.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	27	0.0200	1.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.37"
2.9	23	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.2	12	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	234	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.2	296	Total			

Subcatchment 3S:

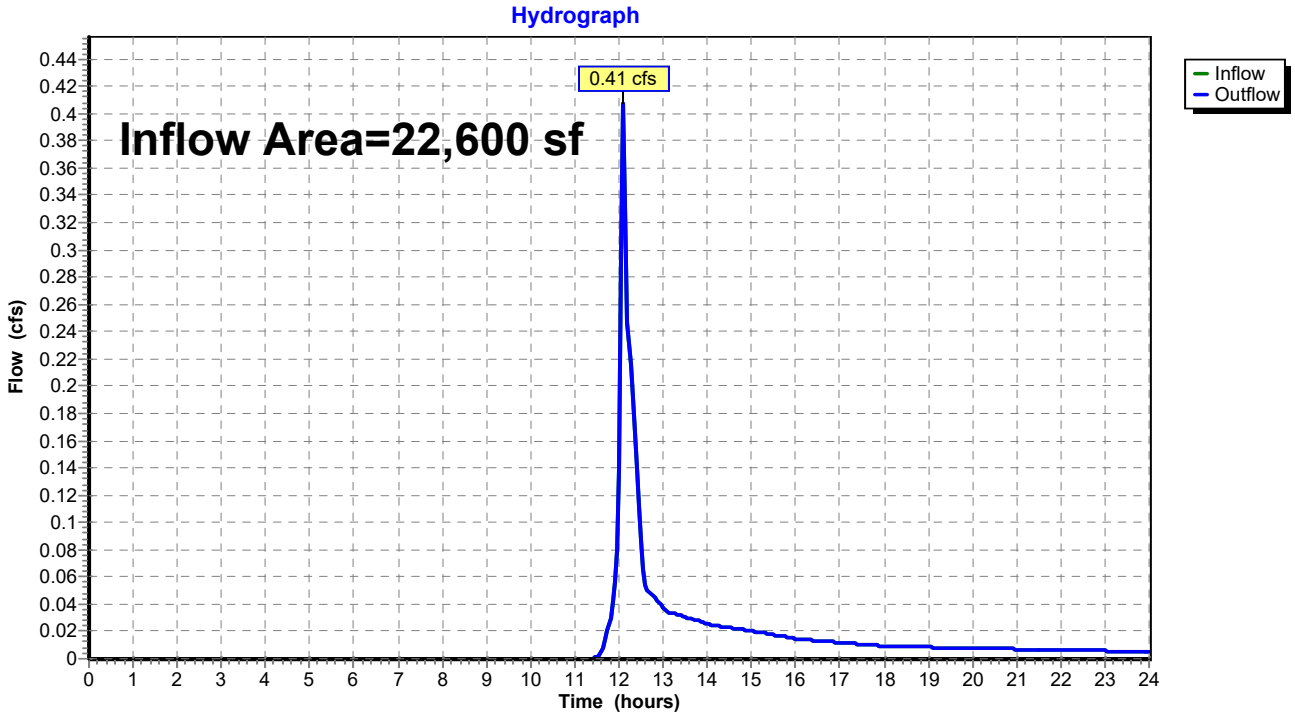


Summary for Reach 7R: Total Runoff

Inflow Area = 22,600 sf, 40.87% Impervious, Inflow Depth > 0.55" for 2-yr event
Inflow = 0.41 cfs @ 12.10 hrs, Volume= 1,042 cf
Outflow = 0.41 cfs @ 12.10 hrs, Volume= 1,042 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 7R: Total Runoff



Summary for Pond 1P: Infiltration System

Inflow Area = 3,415 sf,100.00% Impervious, Inflow Depth > 3.14" for 2-yr event
Inflow = 0.29 cfs @ 12.00 hrs, Volume= 893 cf
Outflow = 0.20 cfs @ 12.07 hrs, Volume= 892 cf, Atten= 32%, Lag= 4.4 min
Discarded = 0.04 cfs @ 12.07 hrs, Volume= 789 cf
Primary = 0.16 cfs @ 12.07 hrs, Volume= 104 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 176.77' @ 12.07 hrs Surf.Area= 681 sf Storage= 155 cf

Plug-Flow detention time= 16.1 min calculated for 891 cf (100% of inflow)
Center-of-Mass det. time= 15.8 min (765.7 - 749.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	176.20'	630 cf	**21.50'W x 31.68'L x 2.83'H Field A** 1,930 cf Overall - 354 cf Embedded = 1,576 cf x 40.0% Voids
#2A	177.20'	354 cf	**ADS_StormTech SC-310 +Cap** x 24 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 24 Chambers in 6 Rows
		984 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	176.20'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 172.43'
#2	Primary	176.70'	**6.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 12.07 hrs HW=176.76' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.14 cfs @ 12.07 hrs HW=176.76' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.14 cfs @ 0.77 fps)

Pond 1P: Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

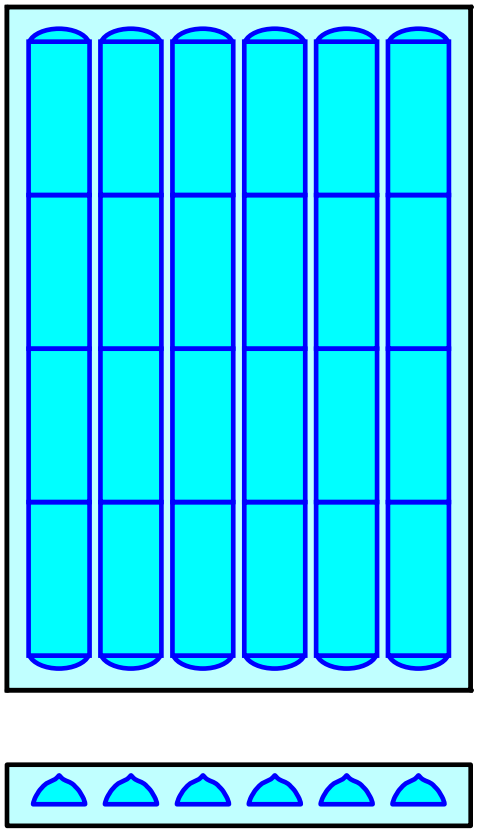
4 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 29.68' Row Length +12.0" End Stone x 2 = 31.68' Base Length
6 Rows x 34.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 21.50' Base Width
12.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.83' Field Height

24 Chambers x 14.7 cf = 353.8 cf Chamber Storage

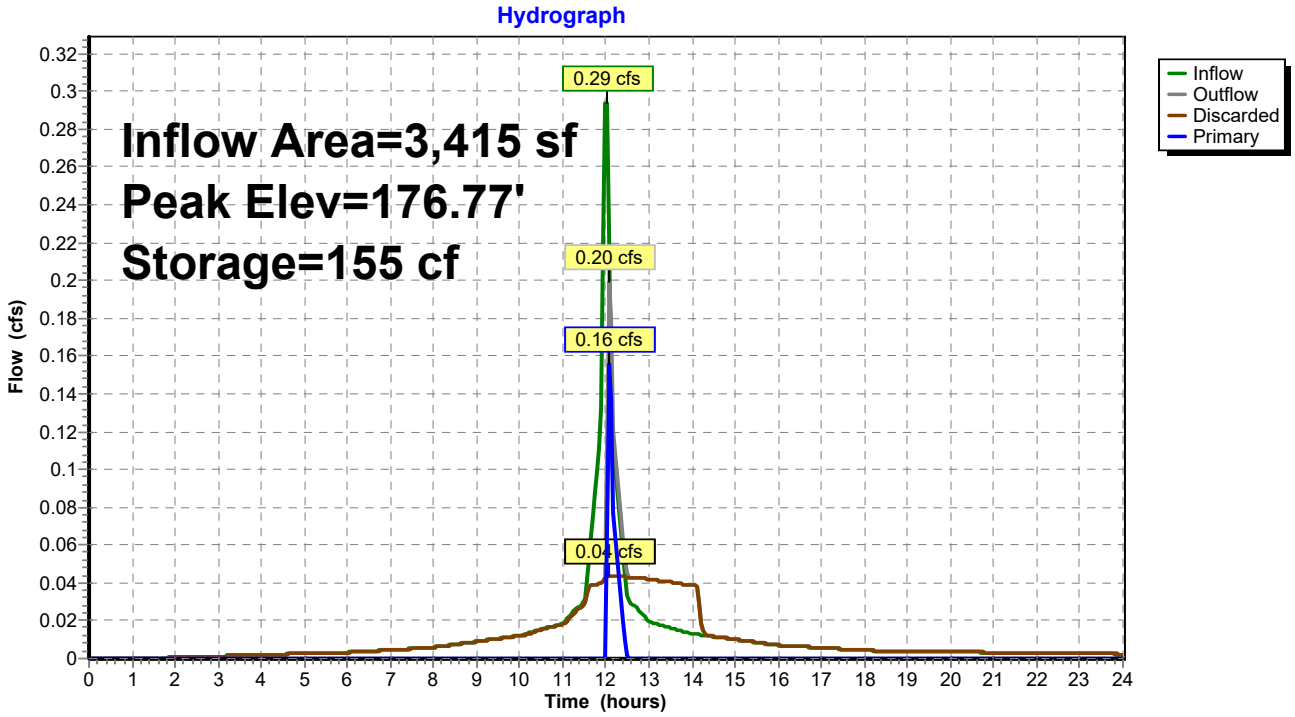
1,929.8 cf Field - 353.8 cf Chambers = 1,576.0 cf Stone x 40.0% Voids = 630.4 cf Stone Storage

Chamber Storage + Stone Storage = 984.2 cf = 0.023 af
Overall Storage Efficiency = 51.0%
Overall System Size = 31.68' x 21.50' x 2.83'

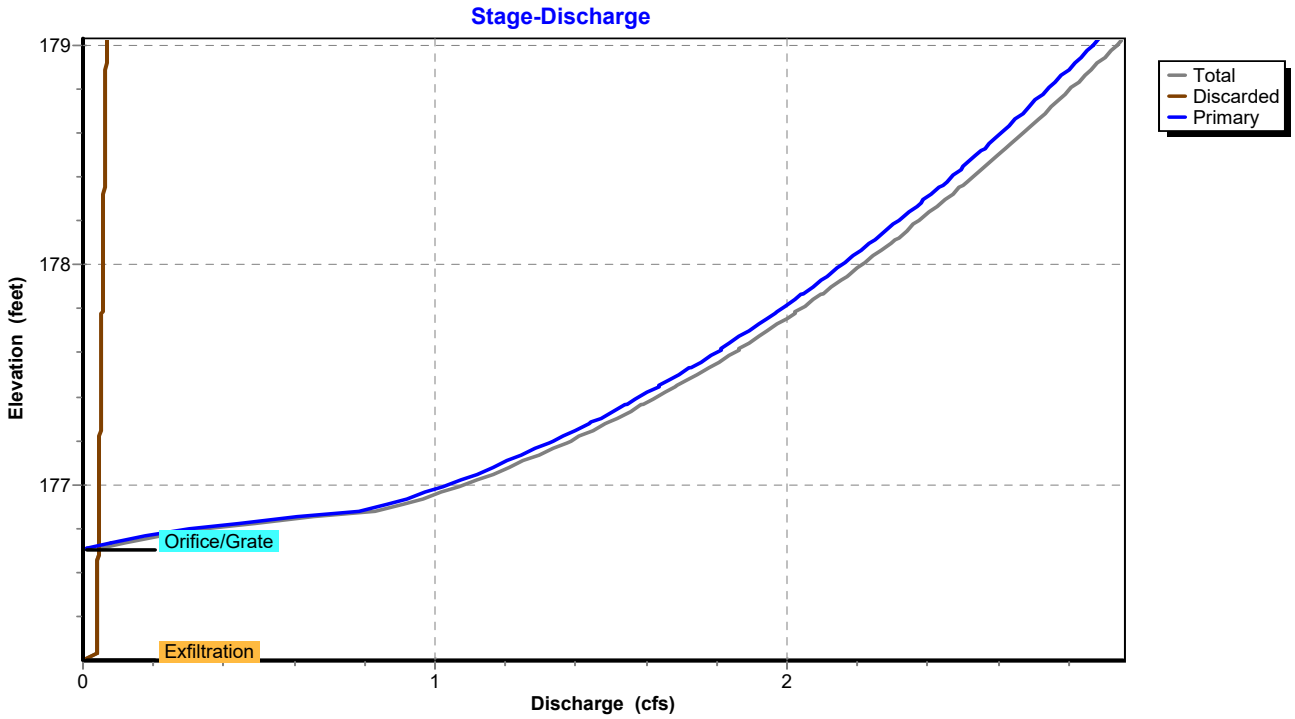
24 Chambers
71.5 cy Field
58.4 cy Stone



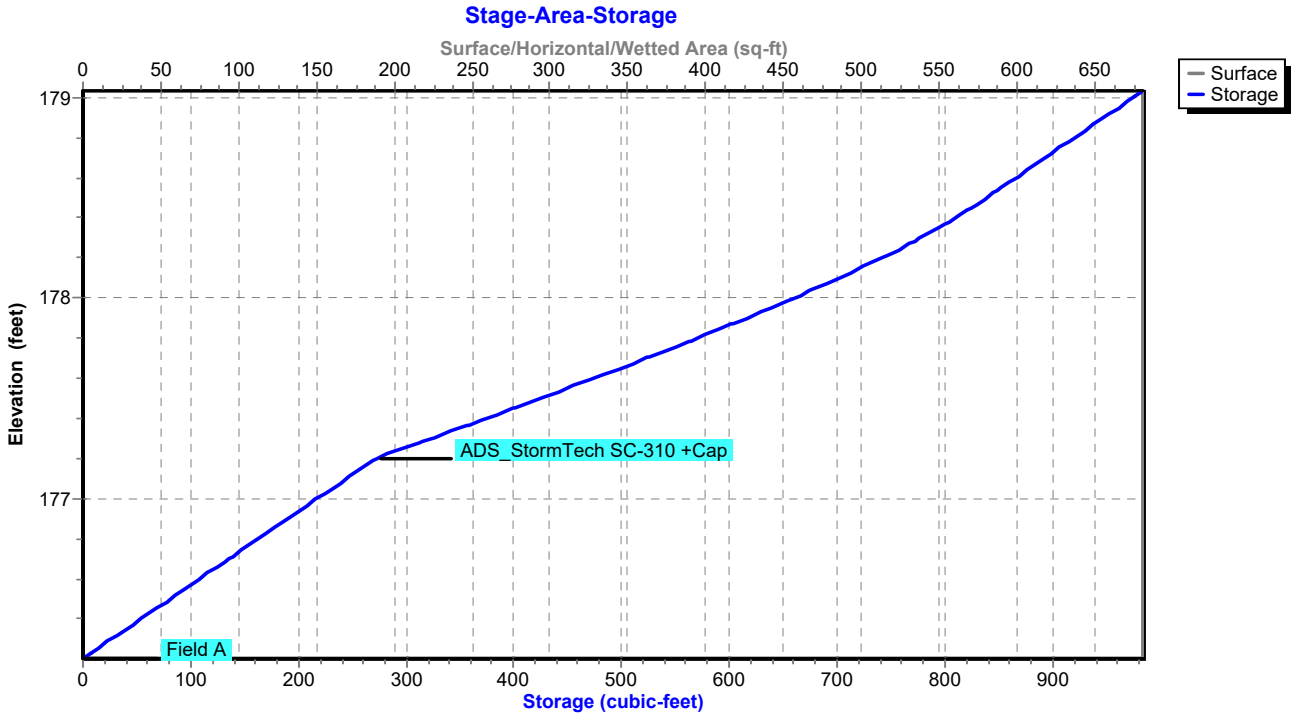
Pond 1P: Infiltration System



Pond 1P: Infiltration System



Pond 1P: Infiltration System



Summary for Pond 2P: Rain Garden

Inflow Area = 5,557 sf, 57.44% Impervious, Inflow Depth > 1.67" for 2-yr event
Inflow = 0.26 cfs @ 12.06 hrs, Volume= 776 cf
Outflow = 0.03 cfs @ 12.78 hrs, Volume= 775 cf, Atten= 88%, Lag= 42.9 min
Discarded = 0.03 cfs @ 12.78 hrs, Volume= 775 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 178.54' @ 12.78 hrs Surf.Area= 390 sf Storage= 277 cf

Plug-Flow detention time= 79.5 min calculated for 775 cf (100% of inflow)
Center-of-Mass det. time= 78.8 min (910.4 - 831.6)

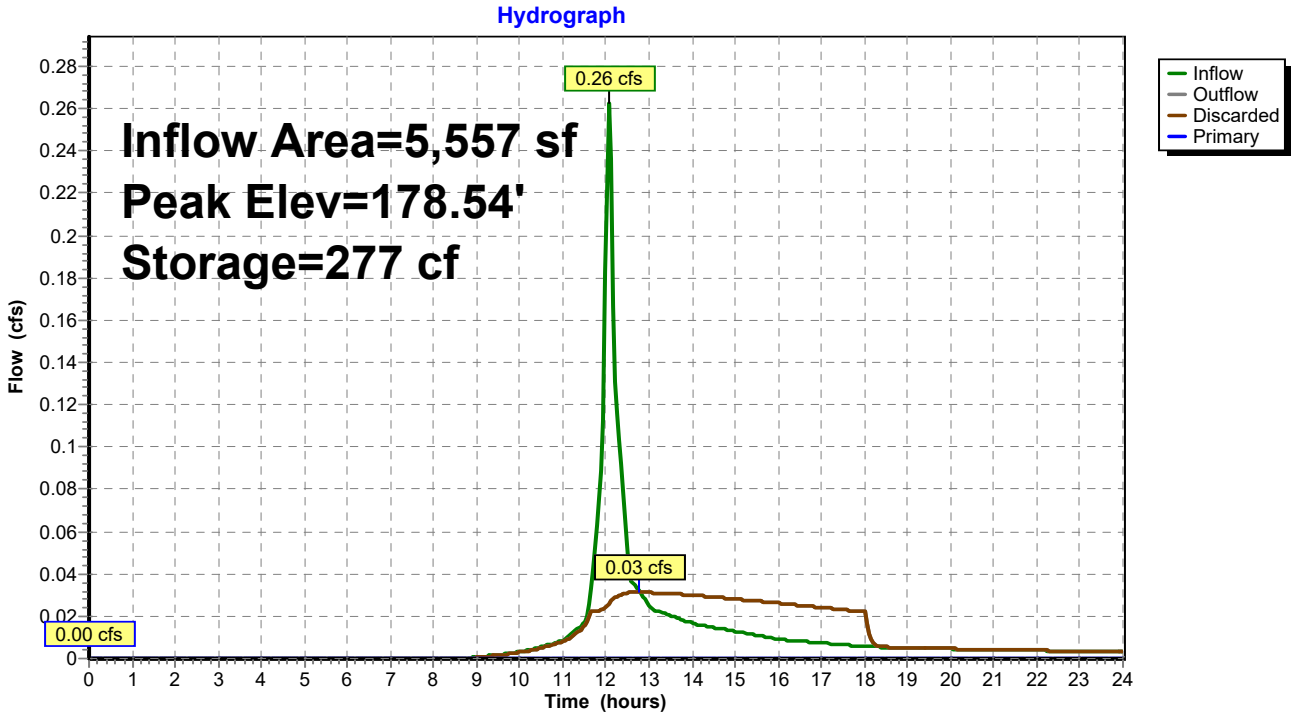
Volume	Invert	Avail.Storage	Storage Description
#1	180.09'	365 cf	**15.00'W x 26.00'L x 0.91'H Prismatoid-ponding depth Z=0.3**
#2	179.76'	51 cf	**15.00'W x 26.00'L x 0.33'H Prismatoid-mulch** 129 cf Overall x 40.0% Voids
#3	176.76'	624 cf	**15.00'W x 26.00'L x 4.00'H Prismatoid-planting medium** 1,560 cf Overall x 40.0% Voids
		1,041 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	176.76'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 172.67' Phase-In= 0.01'
#2	Primary	180.59'	**2.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

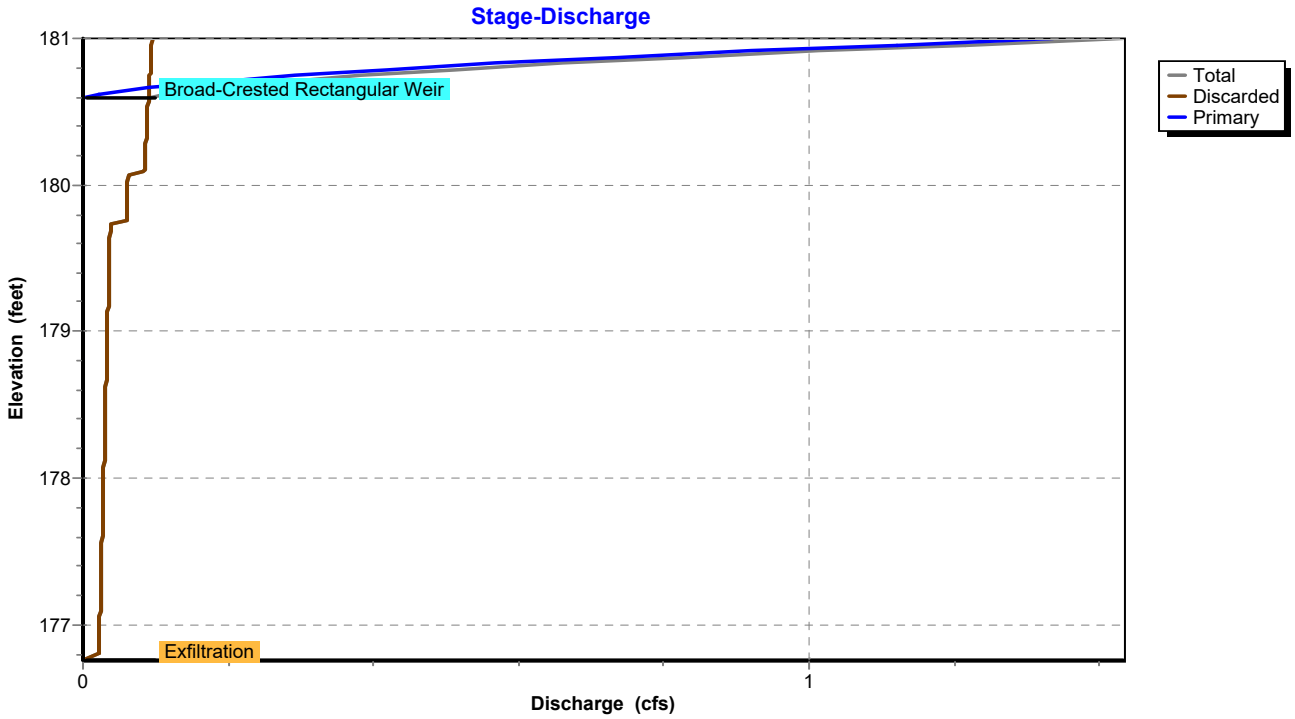
Discarded OutFlow Max=0.03 cfs @ 12.78 hrs HW=178.54' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=176.76' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

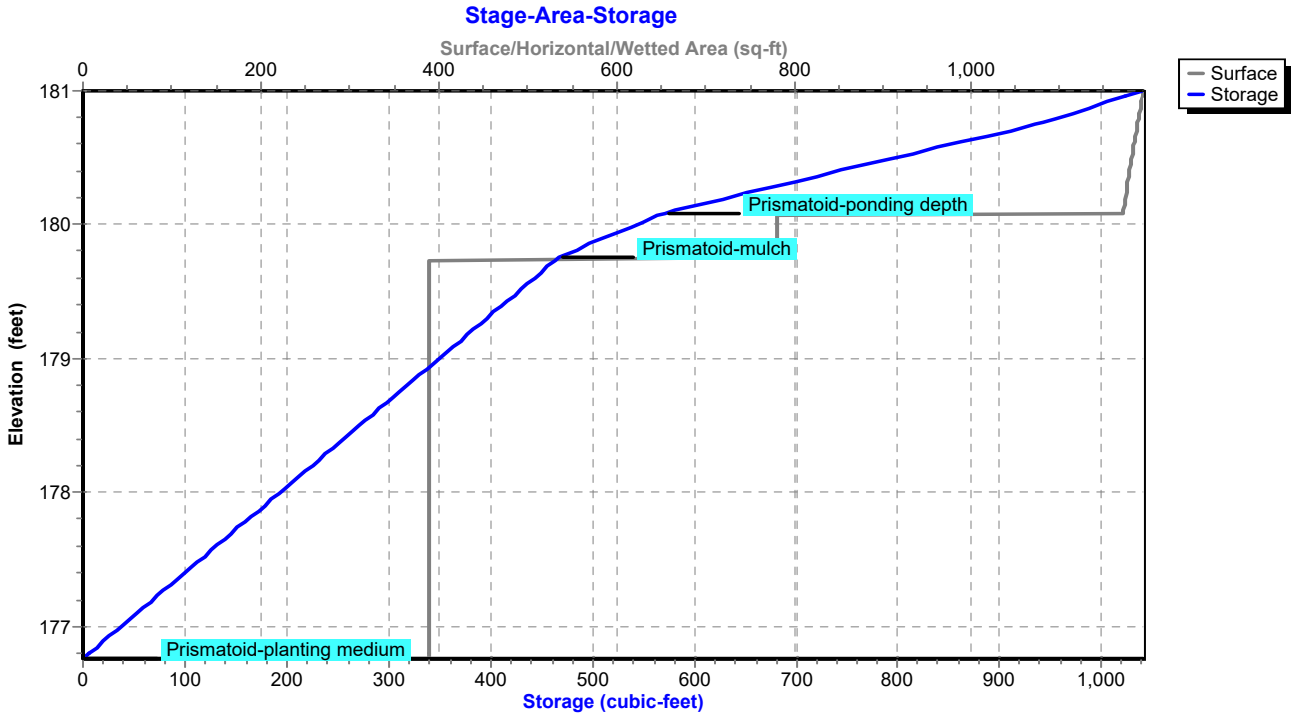
Pond 2P: Rain Garden



Pond 2P: Rain Garden



Pond 2P: Rain Garden

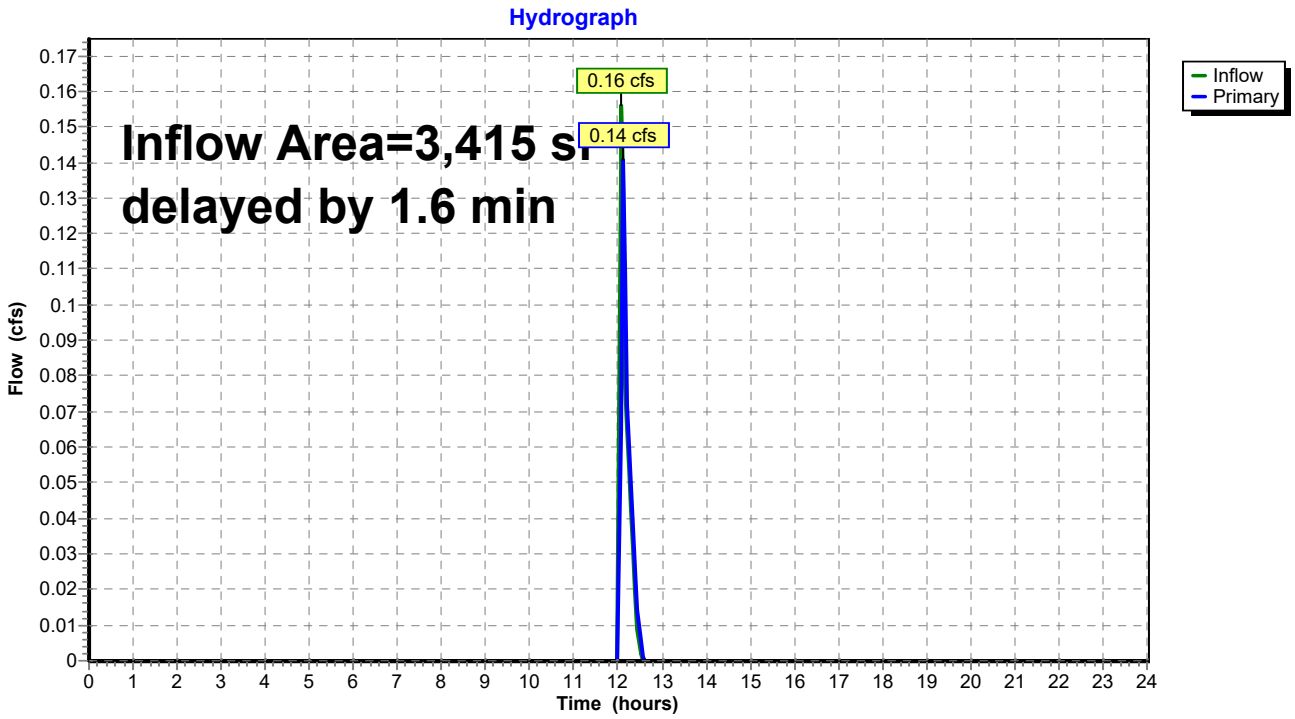


Summary for Link 1L:

Inflow Area = 3,415 sf,100.00% Impervious, Inflow Depth = 0.36" for 2-yr event
Inflow = 0.16 cfs @ 12.07 hrs, Volume= 104 cf
Primary = 0.14 cfs @ 12.11 hrs, Volume= 104 cf, Atten= 10%, Lag= 2.2 min

Primary outflow = Inflow delayed by 1.6 min, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L:

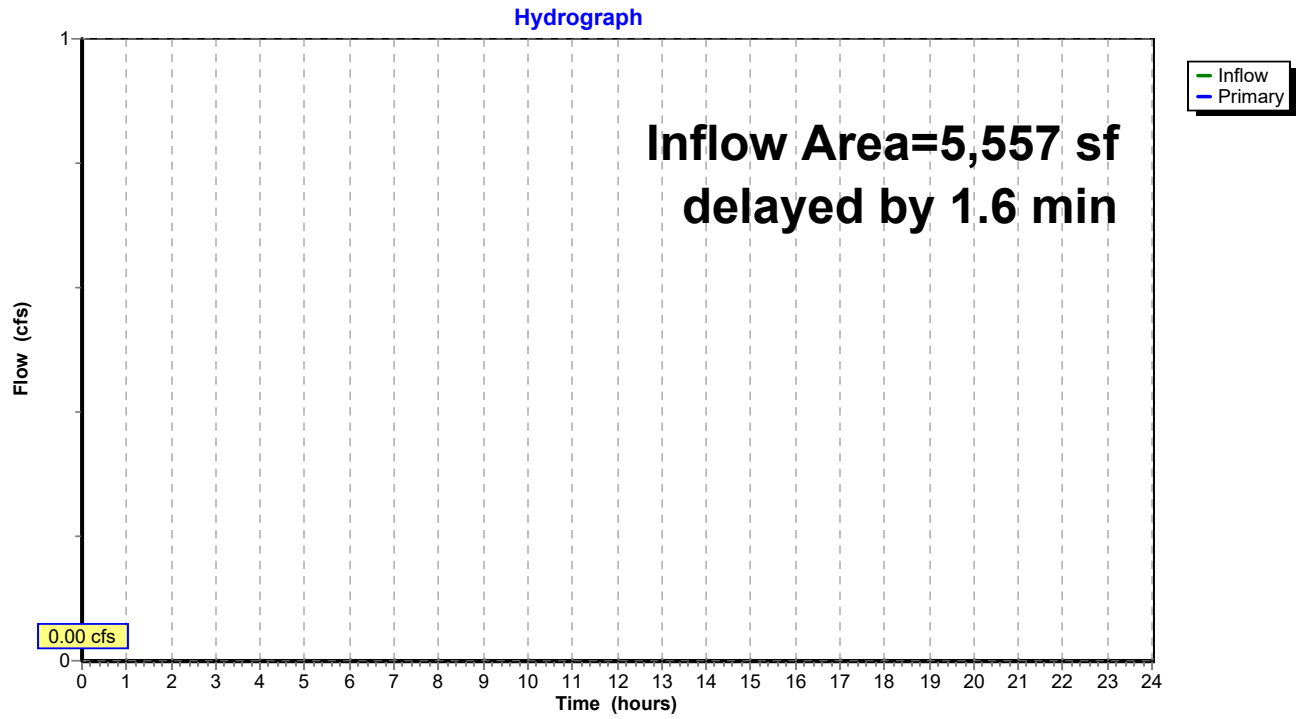


Summary for Link 2L:

Inflow Area = 5,557 sf, 57.44% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow delayed by 1.6 min, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L:



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=3,415 sf 100.00% Impervious Runoff Depth>5.03"
Flow Length=19' Slope=0.6700 '/' Tc=0.1 min CN=98 Runoff=0.46 cfs 1,432 cf

Subcatchment 2S: Runoff Area=5,557 sf 57.44% Impervious Runoff Depth>3.32"
Flow Length=137' Tc=4.0 min CN=82 Runoff=0.52 cfs 1,538 cf

Subcatchment 3S: Runoff Area=13,628 sf 19.29% Impervious Runoff Depth>2.07"
Flow Length=296' Tc=5.2 min CN=68 Runoff=0.74 cfs 2,353 cf

Reach 7R: Total Runoff Inflow=1.09 cfs 2,682 cf
Outflow=1.09 cfs 2,682 cf

Pond 1P: Infiltration System Peak Elev=176.82' Storage=168 cf Inflow=0.46 cfs 1,432 cf
Discarded=0.04 cfs 1,103 cf Primary=0.41 cfs 328 cf Outflow=0.45 cfs 1,432 cf

Pond 2P: Rain Garden Peak Elev=180.13' Storage=591 cf Inflow=0.52 cfs 1,538 cf
Discarded=0.08 cfs 1,535 cf Primary=0.00 cfs 0 cf Outflow=0.08 cfs 1,535 cf

Link 1L: delayed by 1.6 min Inflow=0.41 cfs 328 cf
Primary=0.38 cfs 328 cf

Link 2L: delayed by 1.6 min Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Summary for Subcatchment 1S:

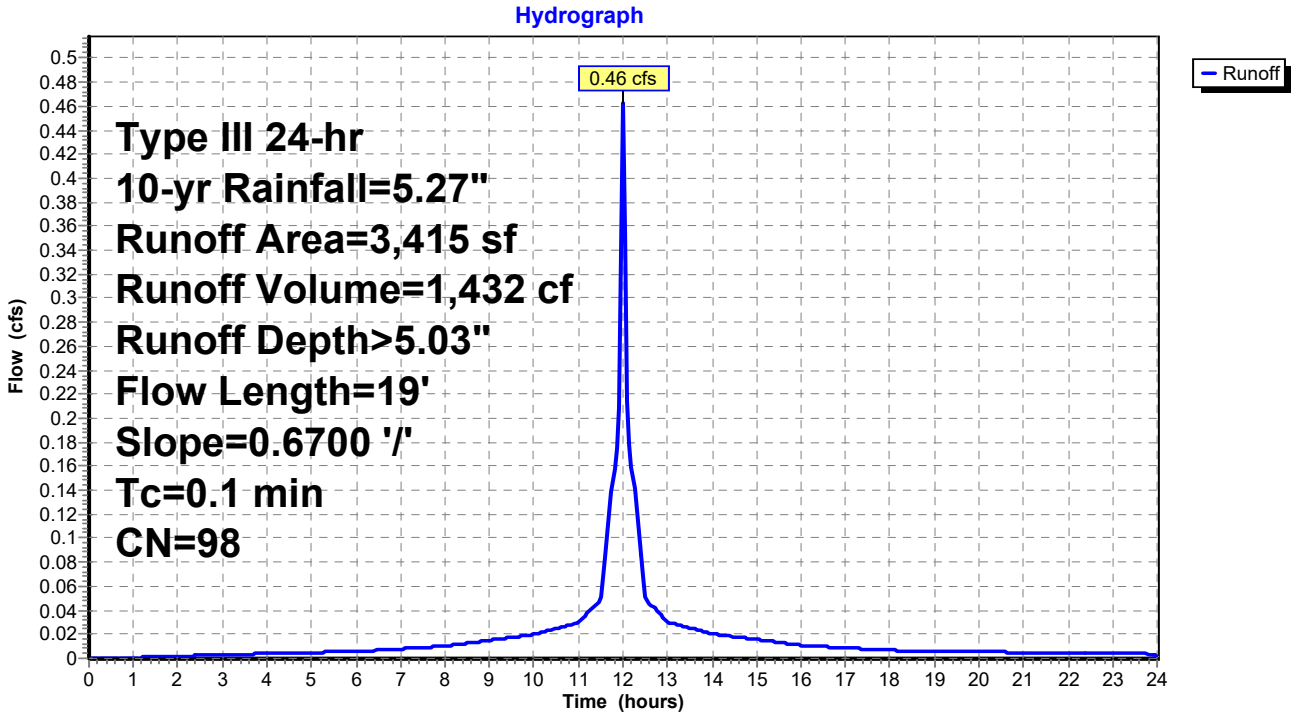
Runoff = 0.46 cfs @ 12.00 hrs, Volume= 1,432 cf, Depth> 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.27"

Area (sf)	CN	Description
3,415	98	Unconnected roofs, HSG B
3,415		100.00% Impervious Area
3,415		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	19	0.6700	4.13		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.37"
0.0					**Direct Entry,**
0.1	19	Total			

Subcatchment 1S:



Summary for Subcatchment 2S:

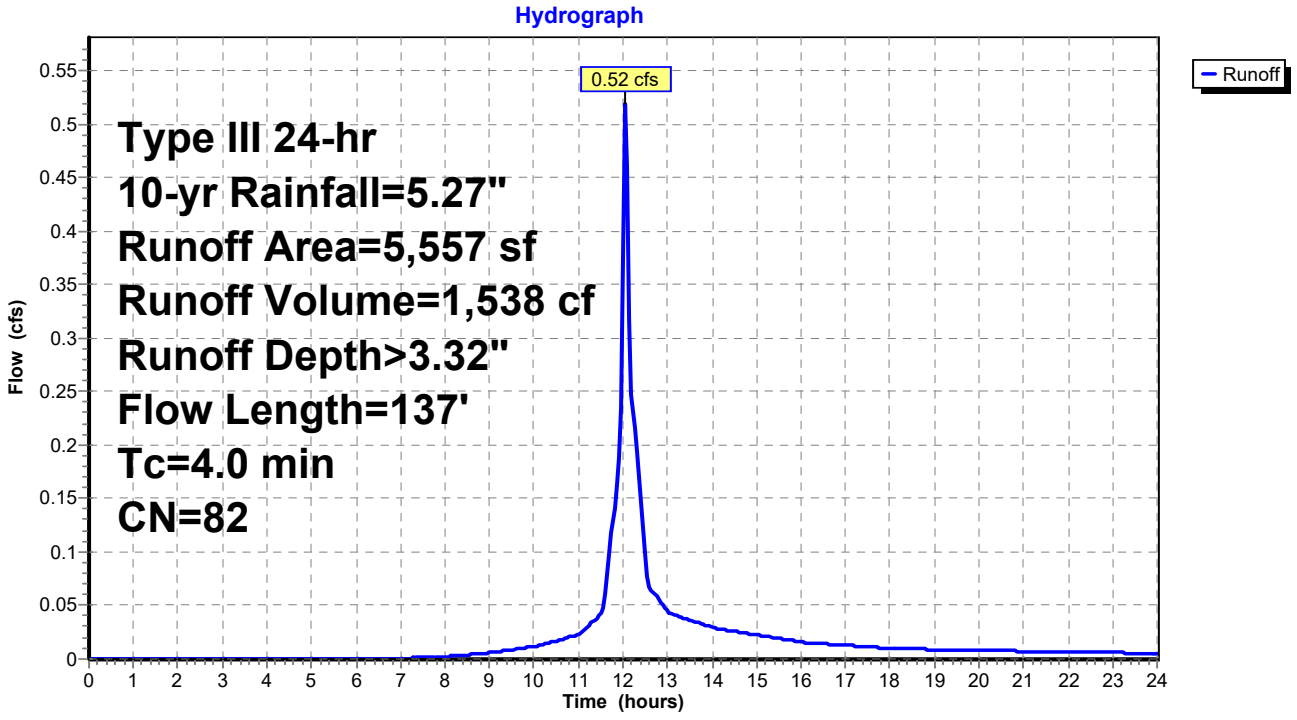
Runoff = 0.52 cfs @ 12.06 hrs, Volume= 1,538 cf, Depth> 3.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.27"

Area (sf)	CN	Description
3,192	98	Paved parking, HSG B
2,365	61	>75% Grass cover, Good, HSG B
5,557	82	Weighted Average
2,365		42.56% Pervious Area
3,192		57.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	27	0.0200	1.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.37"
2.9	23	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.2	12	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	75	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0	137	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

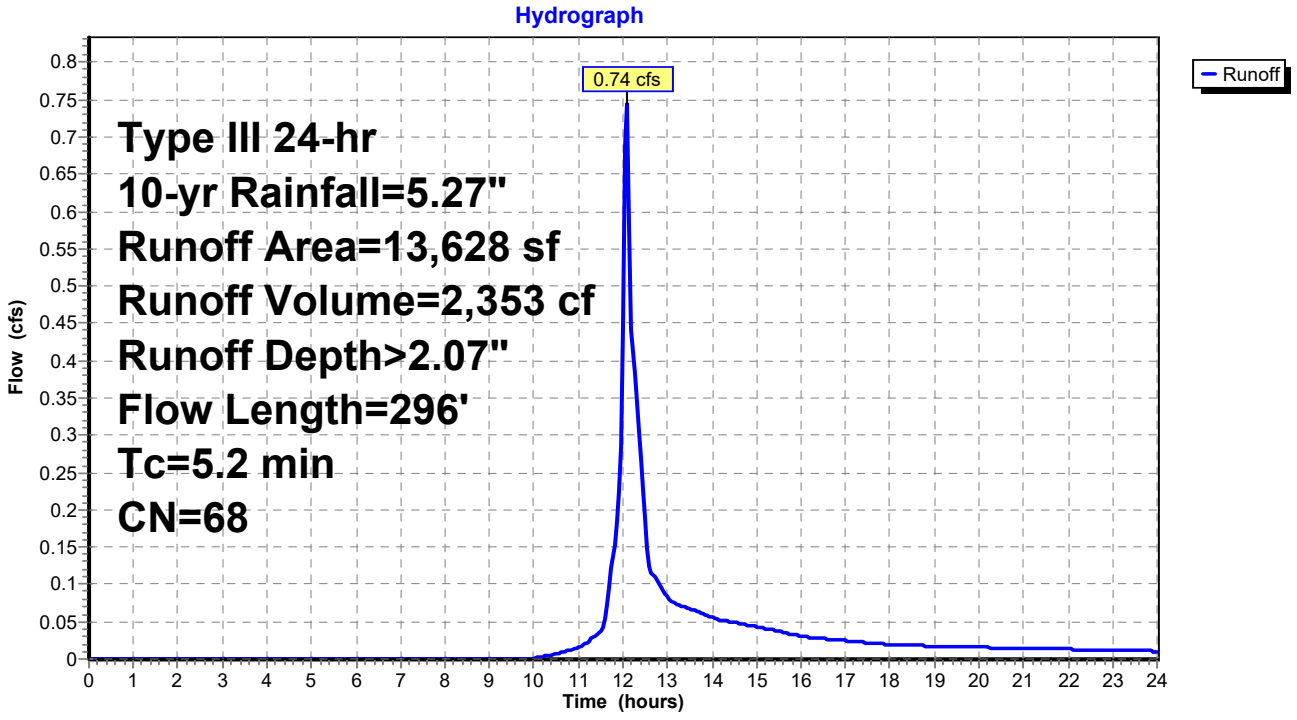
Runoff = 0.74 cfs @ 12.09 hrs, Volume= 2,353 cf, Depth> 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.27"

Area (sf)	CN	Description
2,629	98	Paved parking, HSG B
10,999	61	>75% Grass cover, Good, HSG B
13,628	68	Weighted Average
10,999		80.71% Pervious Area
2,629		19.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	27	0.0200	1.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.37"
2.9	23	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.2	12	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	234	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.2	296	Total			

Subcatchment 3S:

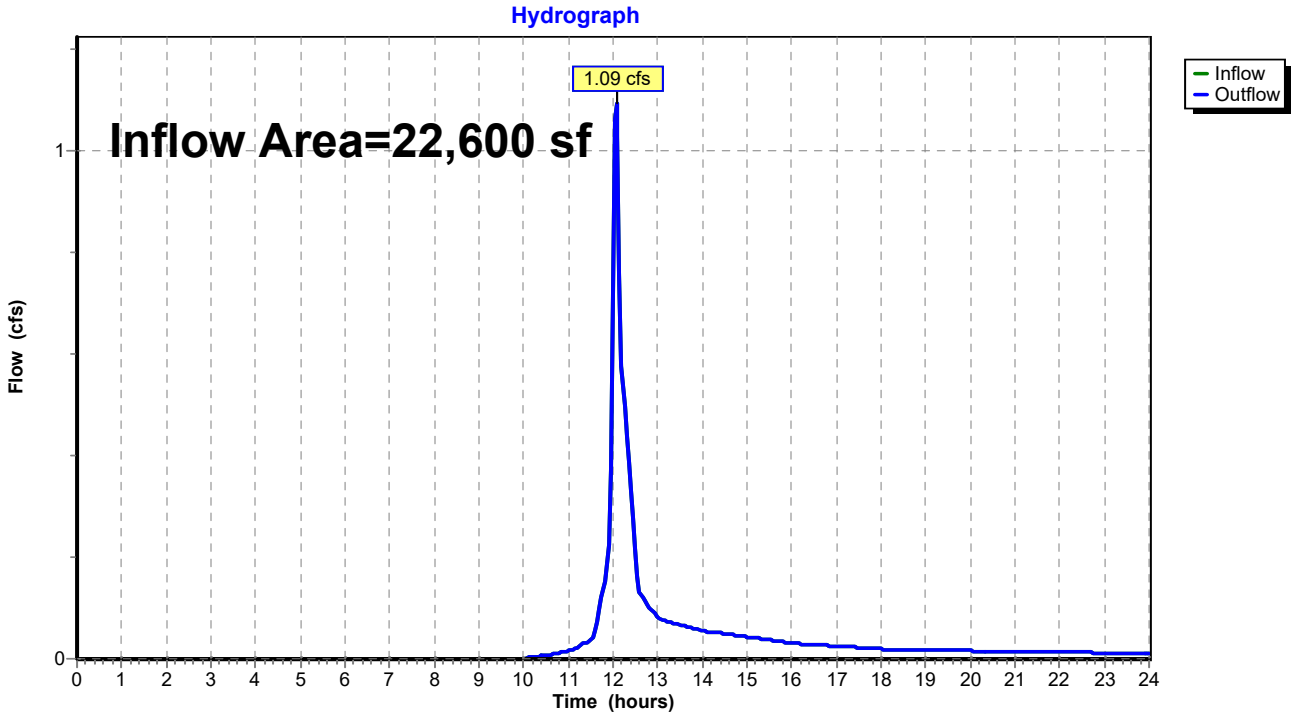


Summary for Reach 7R: Total Runoff

Inflow Area = 22,600 sf, 40.87% Impervious, Inflow Depth > 1.42" for 10-yr event
Inflow = 1.09 cfs @ 12.07 hrs, Volume= 2,682 cf
Outflow = 1.09 cfs @ 12.07 hrs, Volume= 2,682 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 7R: Total Runoff



Summary for Pond 1P: Infiltration System

Inflow Area = 3,415 sf,100.00% Impervious, Inflow Depth > 5.03" for 10-yr event
Inflow = 0.46 cfs @ 12.00 hrs, Volume= 1,432 cf
Outflow = 0.45 cfs @ 12.02 hrs, Volume= 1,432 cf, Atten= 2%, Lag= 1.0 min
Discarded = 0.04 cfs @ 12.02 hrs, Volume= 1,103 cf
Primary = 0.41 cfs @ 12.02 hrs, Volume= 328 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 176.82' @ 12.02 hrs Surf.Area= 681 sf Storage= 168 cf

Plug-Flow detention time= 14.6 min calculated for 1,432 cf (100% of inflow)
Center-of-Mass det. time= 14.4 min (756.1 - 741.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	176.20'	630 cf	**21.50'W x 31.68'L x 2.83'H Field A** 1,930 cf Overall - 354 cf Embedded = 1,576 cf x 40.0% Voids
#2A	177.20'	354 cf	**ADS_StormTech SC-310 +Cap** x 24 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 24 Chambers in 6 Rows
		984 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	176.20'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 172.43'
#2	Primary	176.70'	**6.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 12.02 hrs HW=176.81' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.38 cfs @ 12.02 hrs HW=176.81' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.38 cfs @ 1.09 fps)

Pond 1P: Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

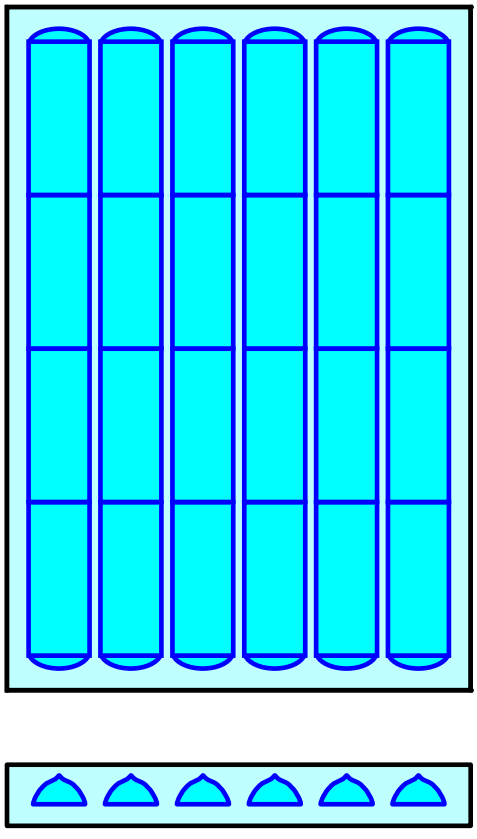
4 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 29.68' Row Length +12.0" End Stone x 2 = 31.68' Base Length
6 Rows x 34.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 21.50' Base Width
12.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.83' Field Height

24 Chambers x 14.7 cf = 353.8 cf Chamber Storage

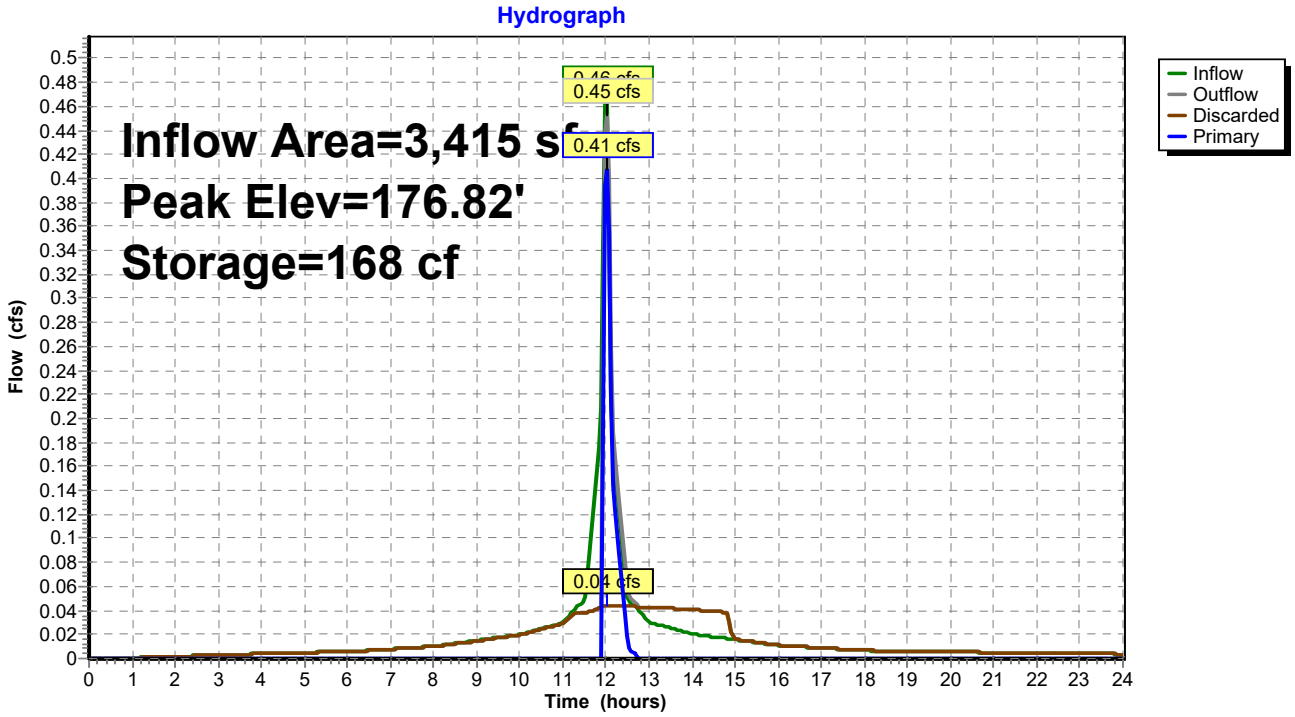
1,929.8 cf Field - 353.8 cf Chambers = 1,576.0 cf Stone x 40.0% Voids = 630.4 cf Stone Storage

Chamber Storage + Stone Storage = 984.2 cf = 0.023 af
Overall Storage Efficiency = 51.0%
Overall System Size = 31.68' x 21.50' x 2.83'

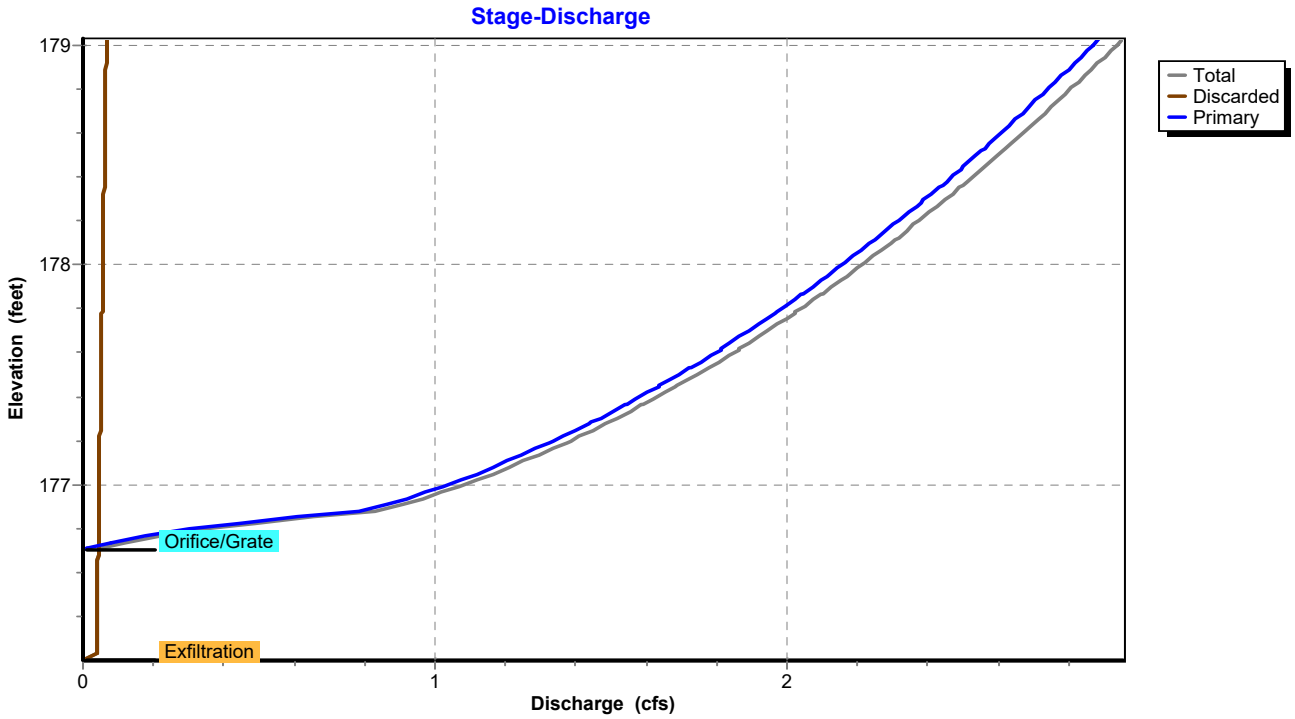
24 Chambers
71.5 cy Field
58.4 cy Stone



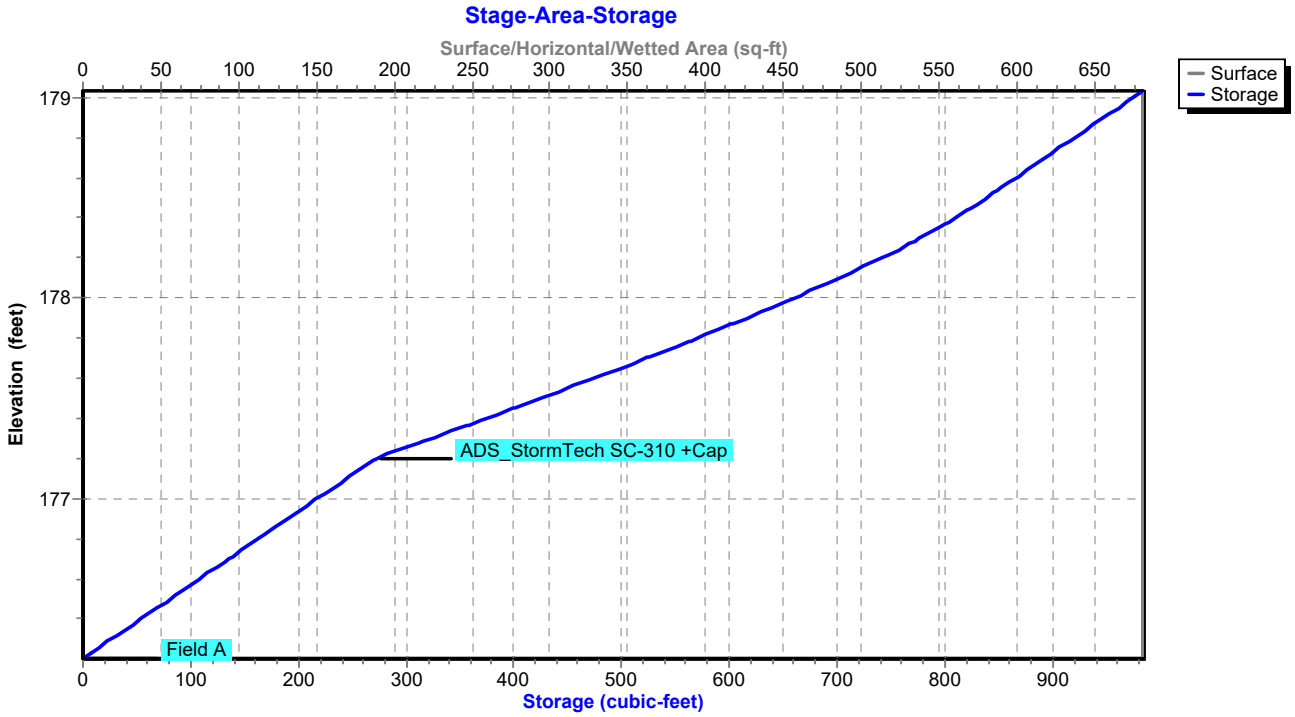
Pond 1P: Infiltration System



Pond 1P: Infiltration System



Pond 1P: Infiltration System



Summary for Pond 2P: Rain Garden

Inflow Area = 5,557 sf, 57.44% Impervious, Inflow Depth > 3.32" for 10-yr event
Inflow = 0.52 cfs @ 12.06 hrs, Volume= 1,538 cf
Outflow = 0.08 cfs @ 12.53 hrs, Volume= 1,535 cf, Atten= 84%, Lag= 28.4 min
Discarded = 0.08 cfs @ 12.53 hrs, Volume= 1,535 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 180.13' @ 12.53 hrs Surf.Area= 1,171 sf Storage= 591 cf

Plug-Flow detention time= 116.0 min calculated for 1,535 cf (100% of inflow)
Center-of-Mass det. time= 115.2 min (927.2 - 812.0)

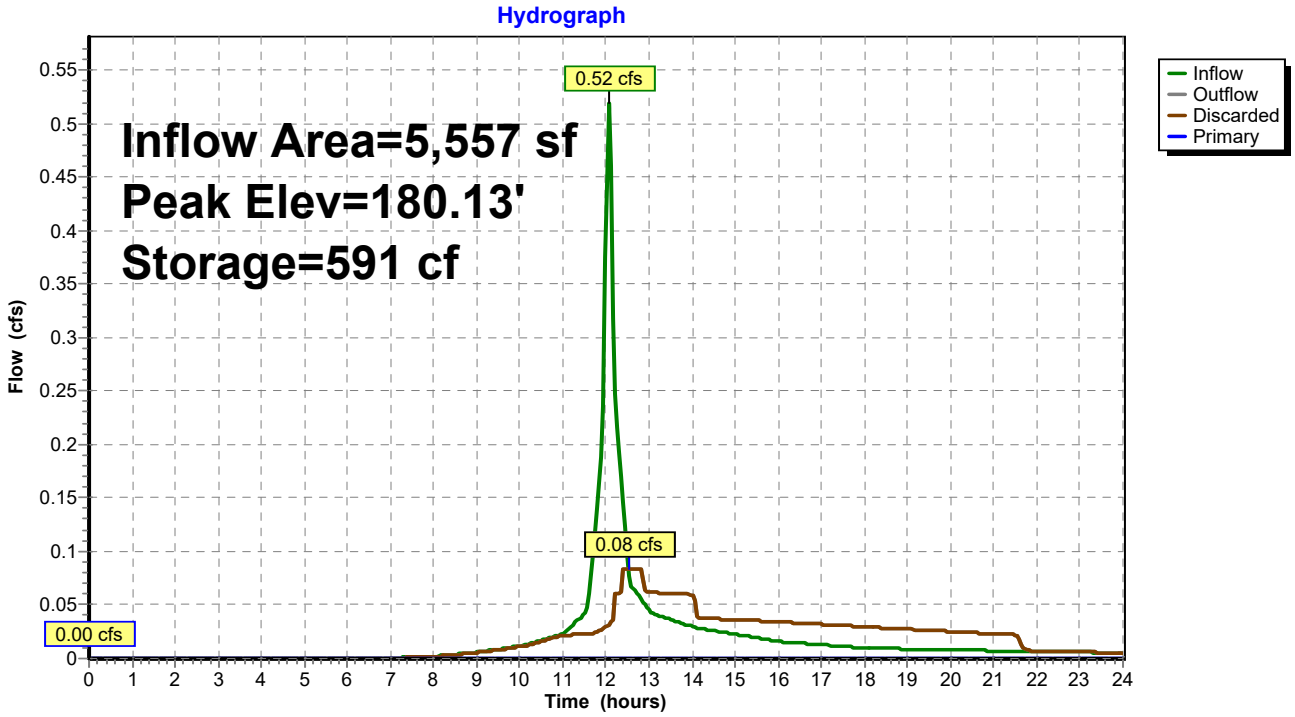
Volume	Invert	Avail.Storage	Storage Description
#1	180.09'	365 cf	**15.00'W x 26.00'L x 0.91'H Prismatoid-ponding depth Z=0.3**
#2	179.76'	51 cf	**15.00'W x 26.00'L x 0.33'H Prismatoid-mulch** 129 cf Overall x 40.0% Voids
#3	176.76'	624 cf	**15.00'W x 26.00'L x 4.00'H Prismatoid-planting medium** 1,560 cf Overall x 40.0% Voids
		1,041 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	176.76'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 172.67' Phase-In= 0.01'
#2	Primary	180.59'	**2.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

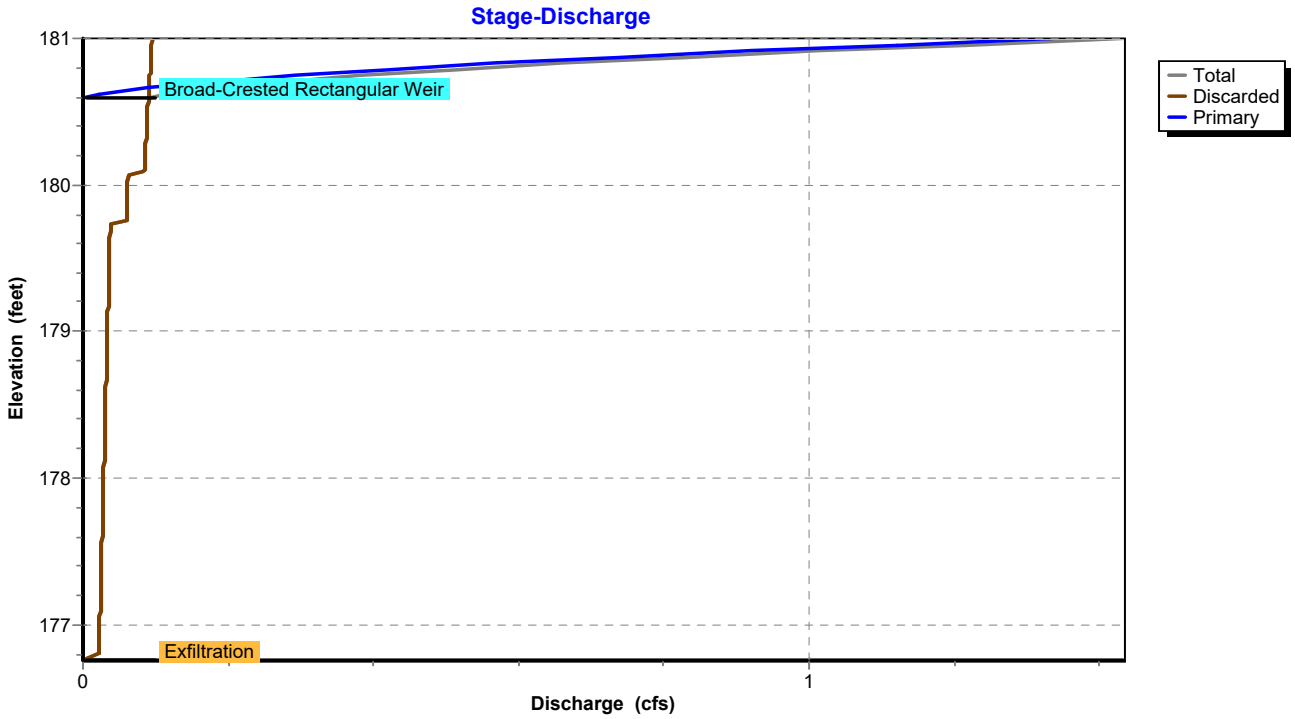
Discarded OutFlow Max=0.08 cfs @ 12.53 hrs HW=180.13' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=176.76' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

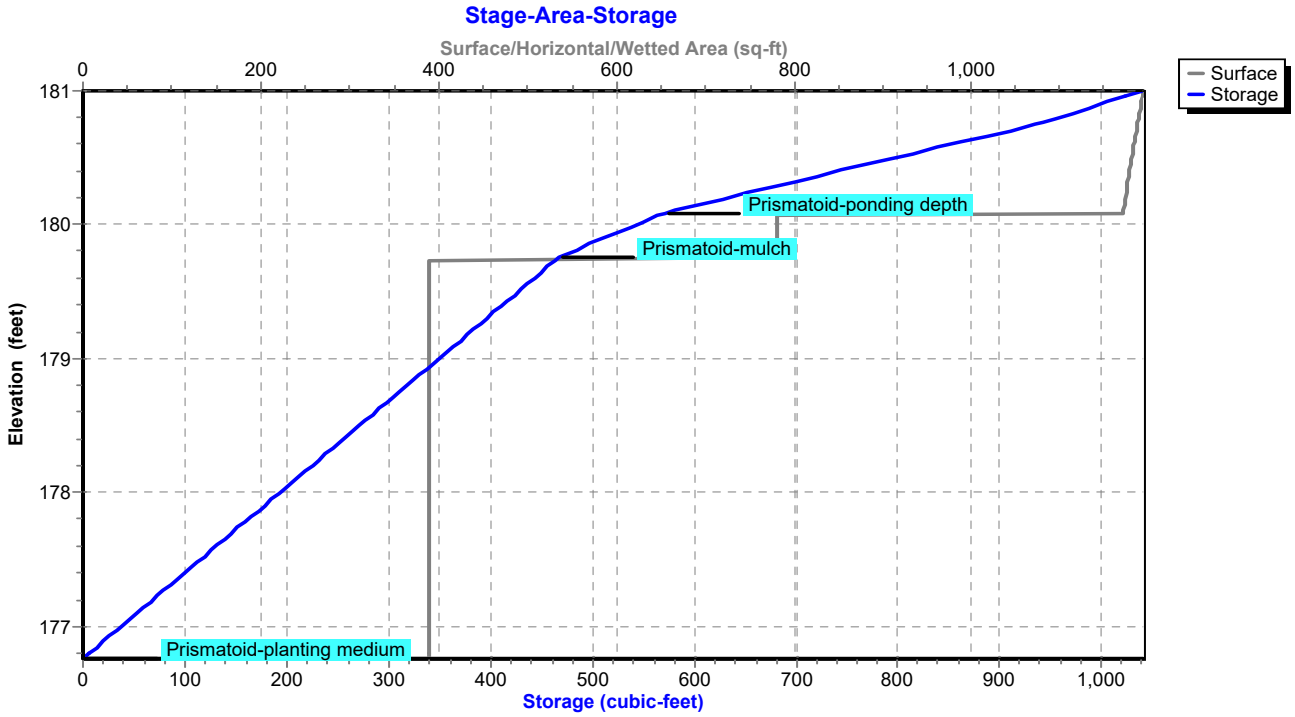
Pond 2P: Rain Garden



Pond 2P: Rain Garden



Pond 2P: Rain Garden

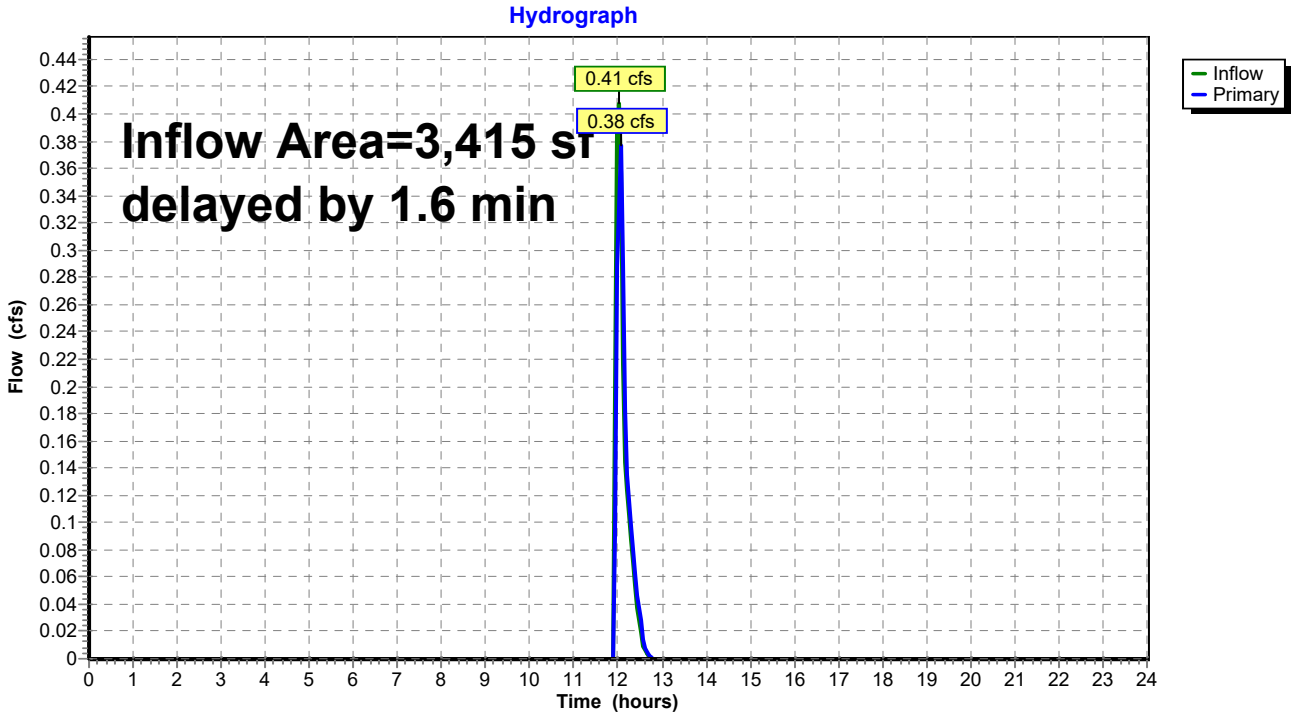


Summary for Link 1L:

Inflow Area = 3,415 sf,100.00% Impervious, Inflow Depth = 1.15" for 10-yr event
Inflow = 0.41 cfs @ 12.02 hrs, Volume= 328 cf
Primary = 0.38 cfs @ 12.05 hrs, Volume= 328 cf, Atten= 8%, Lag= 2.0 min

Primary outflow = Inflow delayed by 1.6 min, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L:

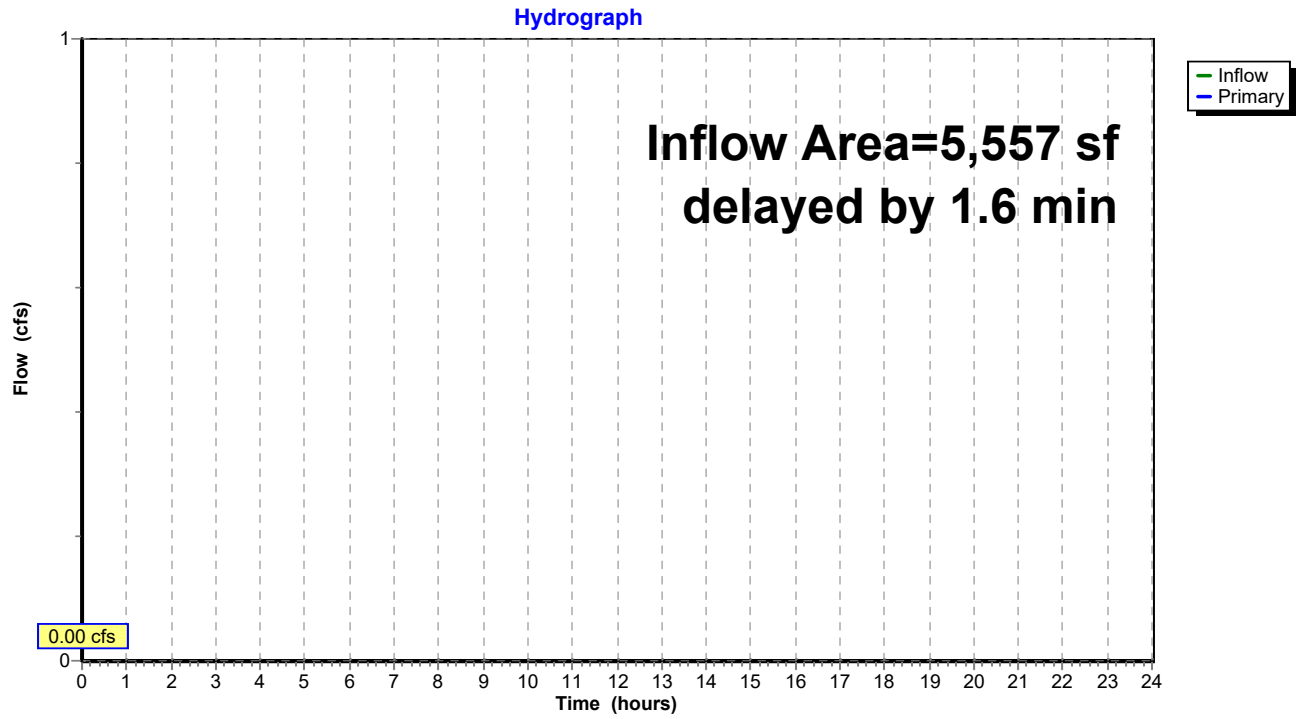


Summary for Link 2L:

Inflow Area = 5,557 sf, 57.44% Impervious, Inflow Depth = 0.00" for 10-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow delayed by 1.6 min, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L:



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=3,415 sf 100.00% Impervious Runoff Depth>8.03"
Flow Length=19' Slope=0.6700 '/' Tc=0.1 min CN=98 Runoff=0.73 cfs 2,285 cf

Subcatchment 2S: Runoff Area=5,557 sf 57.44% Impervious Runoff Depth>6.11"
Flow Length=137' Tc=4.0 min CN=82 Runoff=0.94 cfs 2,831 cf

Subcatchment 3S: Runoff Area=13,628 sf 19.29% Impervious Runoff Depth>4.46"
Flow Length=296' Tc=5.2 min CN=68 Runoff=1.63 cfs 5,065 cf

Reach 7R: Total Runoff Inflow=2.21 cfs 6,214 cf
Outflow=2.21 cfs 6,214 cf

Pond 1P: Infiltration System Peak Elev=176.86' Storage=180 cf Inflow=0.73 cfs 2,285 cf
Discarded=0.04 cfs 1,533 cf Primary=0.65 cfs 752 cf Outflow=0.70 cfs 2,284 cf

Pond 2P: Rain Garden Peak Elev=180.76' Storage=942 cf Inflow=0.94 cfs 2,831 cf
Discarded=0.09 cfs 2,413 cf Primary=0.33 cfs 397 cf Outflow=0.42 cfs 2,810 cf

Link 1L: delayed by 1.6 min Inflow=0.65 cfs 752 cf
Primary=0.62 cfs 752 cf

Link 2L: delayed by 1.6 min Inflow=0.33 cfs 397 cf
Primary=0.32 cfs 397 cf

Summary for Subcatchment 1S:

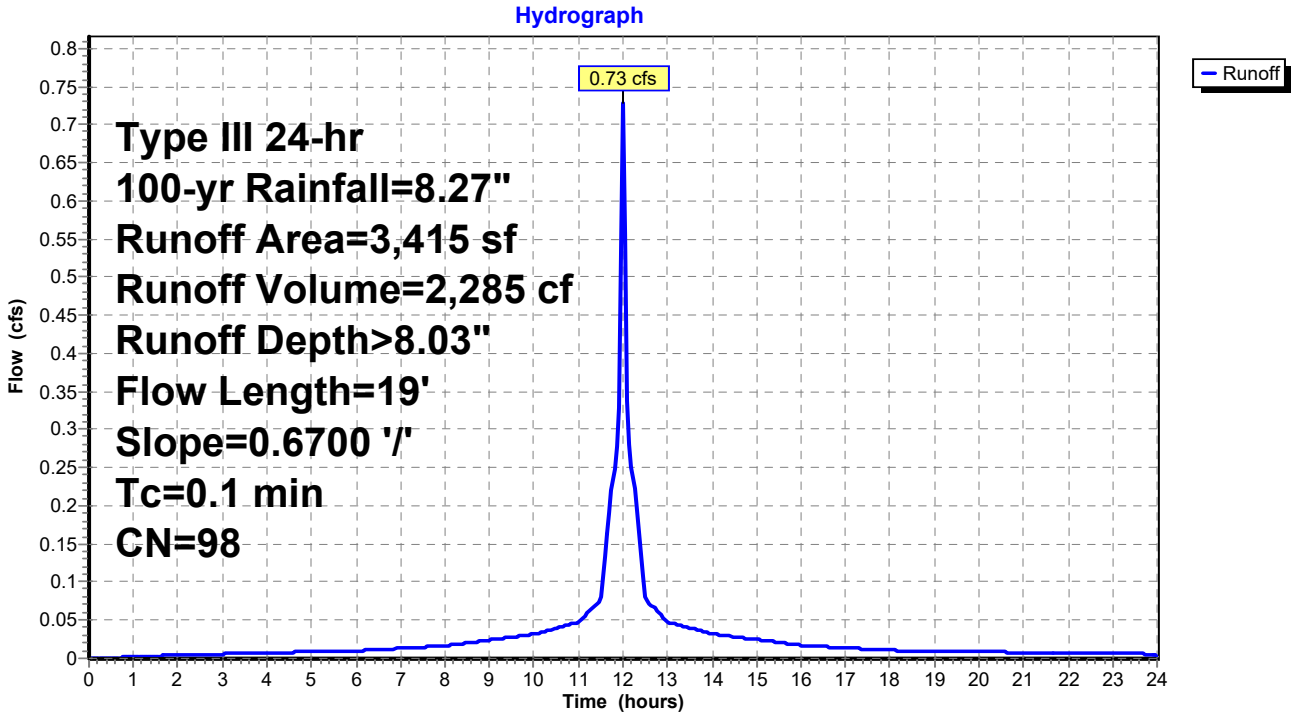
Runoff = 0.73 cfs @ 12.00 hrs, Volume= 2,285 cf, Depth> 8.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.27"

Area (sf)	CN	Description
3,415	98	Unconnected roofs, HSG B
3,415		100.00% Impervious Area
3,415		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	19	0.6700	4.13		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.37"
0.0					**Direct Entry,**
0.1	19	Total			

Subcatchment 1S:



Summary for Subcatchment 2S:

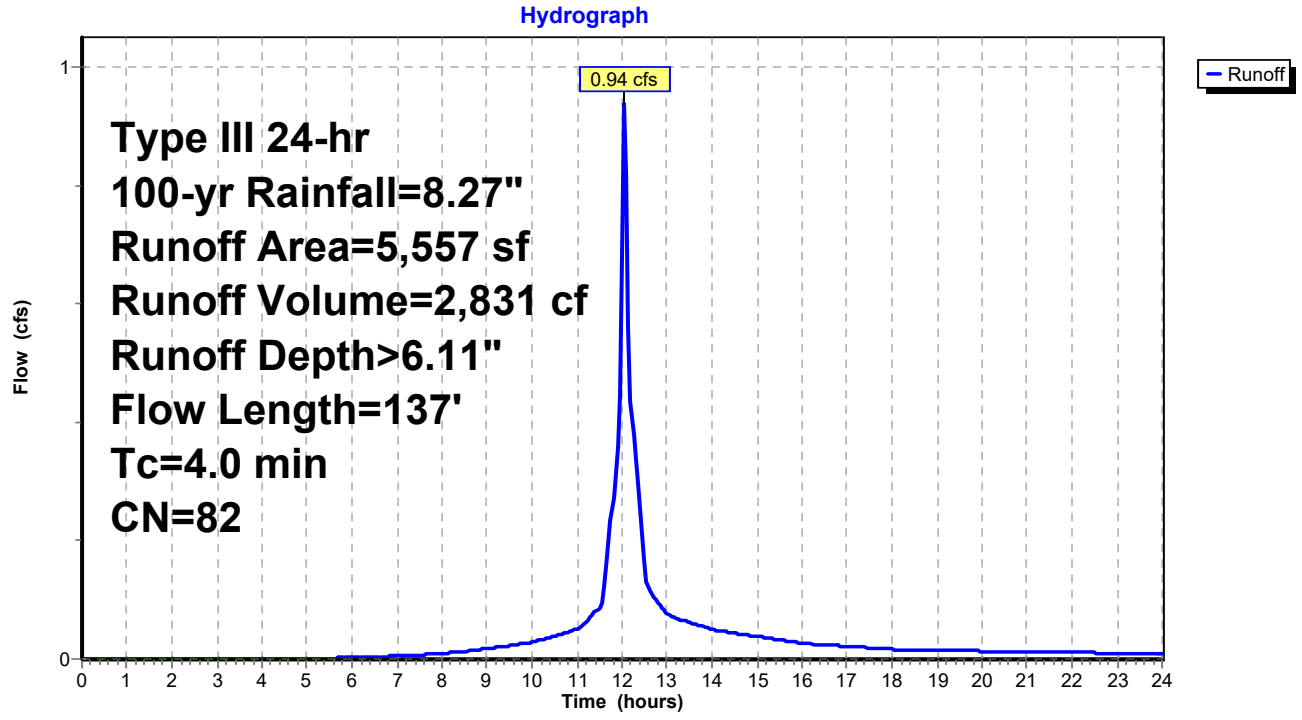
Runoff = 0.94 cfs @ 12.06 hrs, Volume= 2,831 cf, Depth> 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.27"

Area (sf)	CN	Description
3,192	98	Paved parking, HSG B
2,365	61	>75% Grass cover, Good, HSG B
5,557	82	Weighted Average
2,365		42.56% Pervious Area
3,192		57.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	27	0.0200	1.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.37"
2.9	23	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.2	12	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	75	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0	137	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

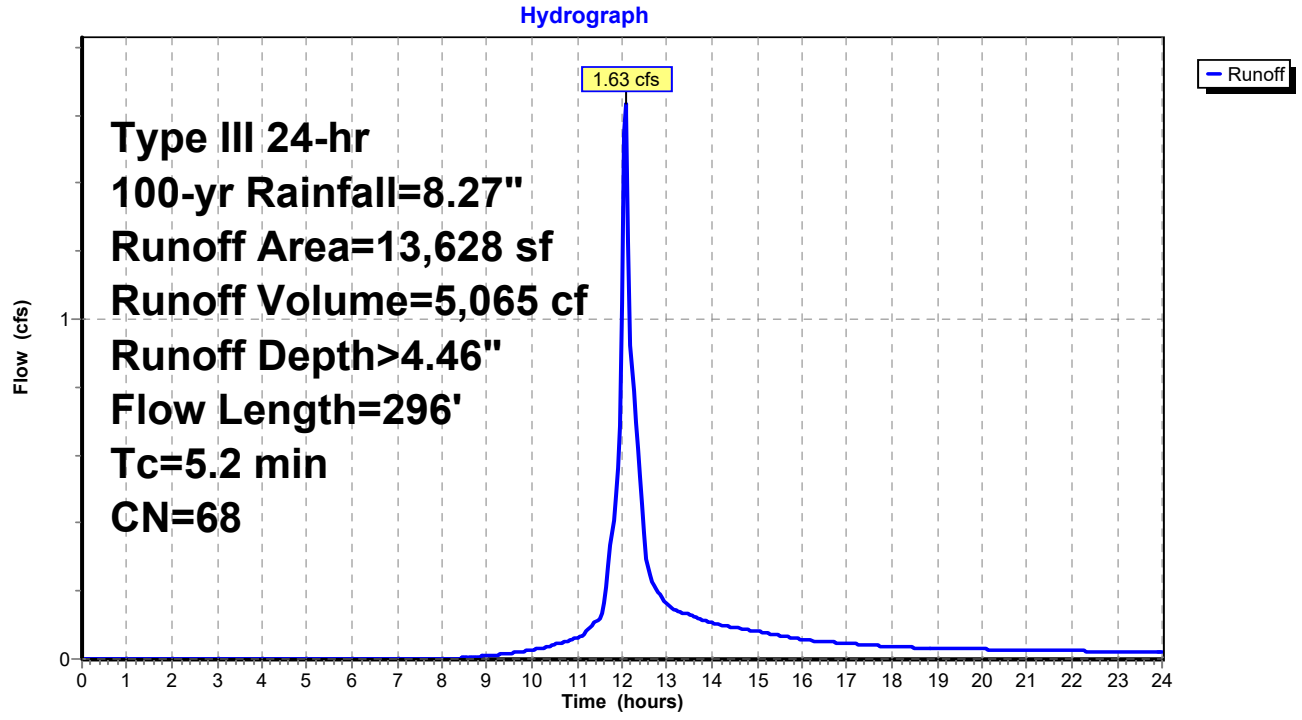
Runoff = 1.63 cfs @ 12.08 hrs, Volume= 5,065 cf, Depth> 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.27"

Area (sf)	CN	Description
2,629	98	Paved parking, HSG B
10,999	61	>75% Grass cover, Good, HSG B
13,628	68	Weighted Average
10,999		80.71% Pervious Area
2,629		19.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	27	0.0200	1.09		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.37"
2.9	23	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.37"
0.2	12	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	234	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.2	296	Total			

Subcatchment 3S:

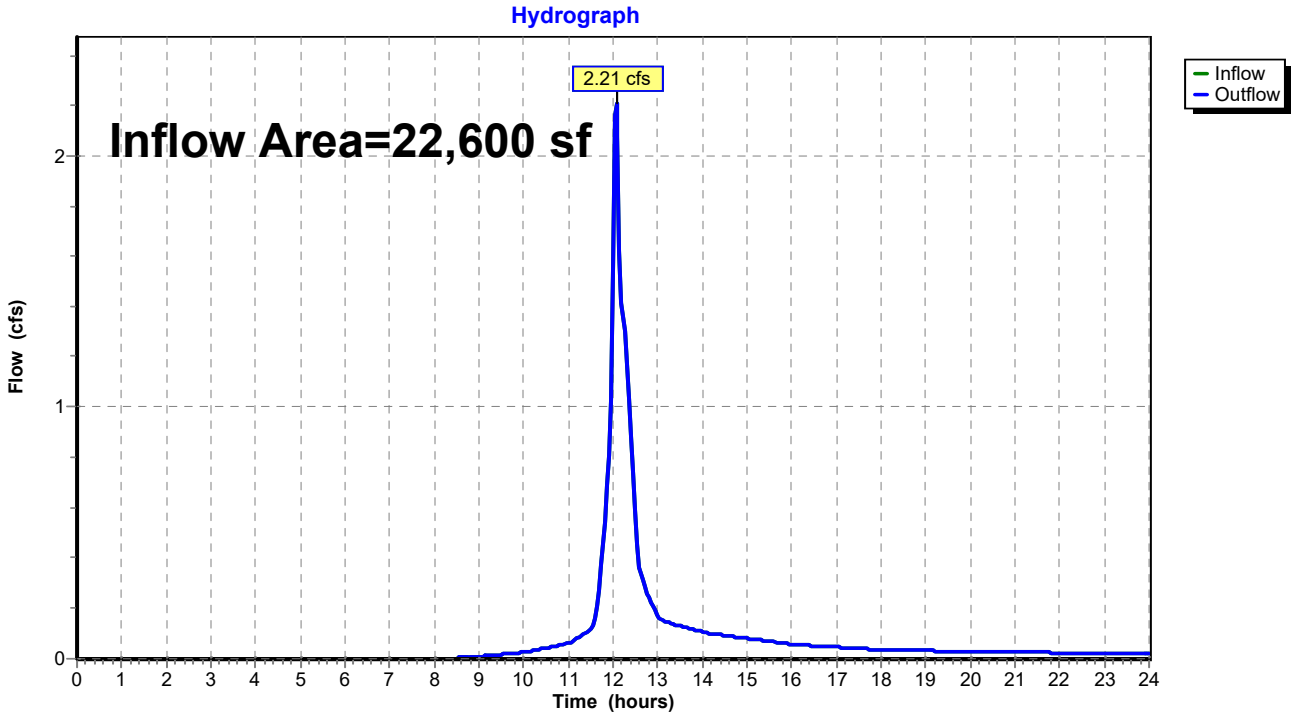


Summary for Reach 7R: Total Runoff

Inflow Area = 22,600 sf, 40.87% Impervious, Inflow Depth > 3.30" for 100-yr event
Inflow = 2.21 cfs @ 12.07 hrs, Volume= 6,214 cf
Outflow = 2.21 cfs @ 12.07 hrs, Volume= 6,214 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 7R: Total Runoff



Summary for Pond 1P: Infiltration System

Inflow Area = 3,415 sf,100.00% Impervious, Inflow Depth > 8.03" for 100-yr event
Inflow = 0.73 cfs @ 12.00 hrs, Volume= 2,285 cf
Outflow = 0.70 cfs @ 12.01 hrs, Volume= 2,284 cf, Atten= 4%, Lag= 0.8 min
Discarded = 0.04 cfs @ 12.01 hrs, Volume= 1,533 cf
Primary = 0.65 cfs @ 12.01 hrs, Volume= 752 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 176.86' @ 12.01 hrs Surf.Area= 681 sf Storage= 180 cf

Plug-Flow detention time= 14.5 min calculated for 2,284 cf (100% of inflow)
Center-of-Mass det. time= 14.2 min (749.6 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	176.20'	630 cf	**21.50'W x 31.68'L x 2.83'H Field A** 1,930 cf Overall - 354 cf Embedded = 1,576 cf x 40.0% Voids
#2A	177.20'	354 cf	**ADS_StormTech SC-310 +Cap** x 24 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 24 Chambers in 6 Rows
		984 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	176.20'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 172.43'
#2	Primary	176.70'	**6.0" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 12.01 hrs HW=176.85' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.62 cfs @ 12.01 hrs HW=176.85' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.62 cfs @ 1.28 fps)

Pond 1P: Infiltration System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

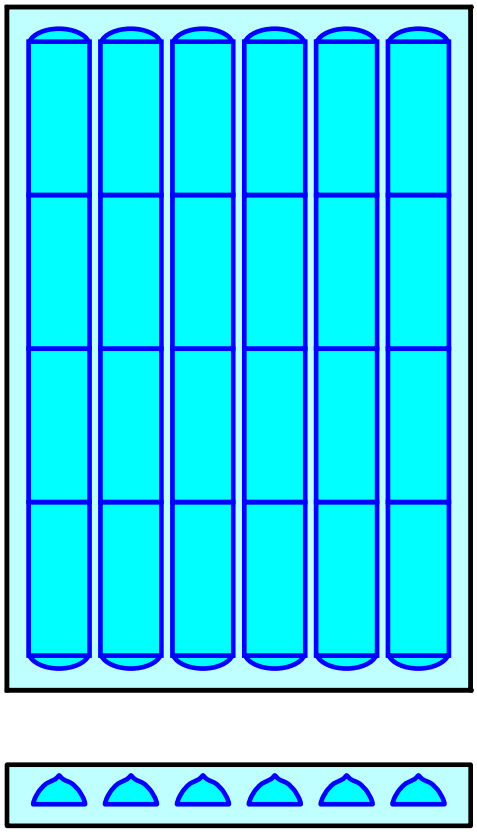
4 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 29.68' Row Length +12.0" End Stone x 2 = 31.68' Base Length
6 Rows x 34.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 21.50' Base Width
12.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.83' Field Height

24 Chambers x 14.7 cf = 353.8 cf Chamber Storage

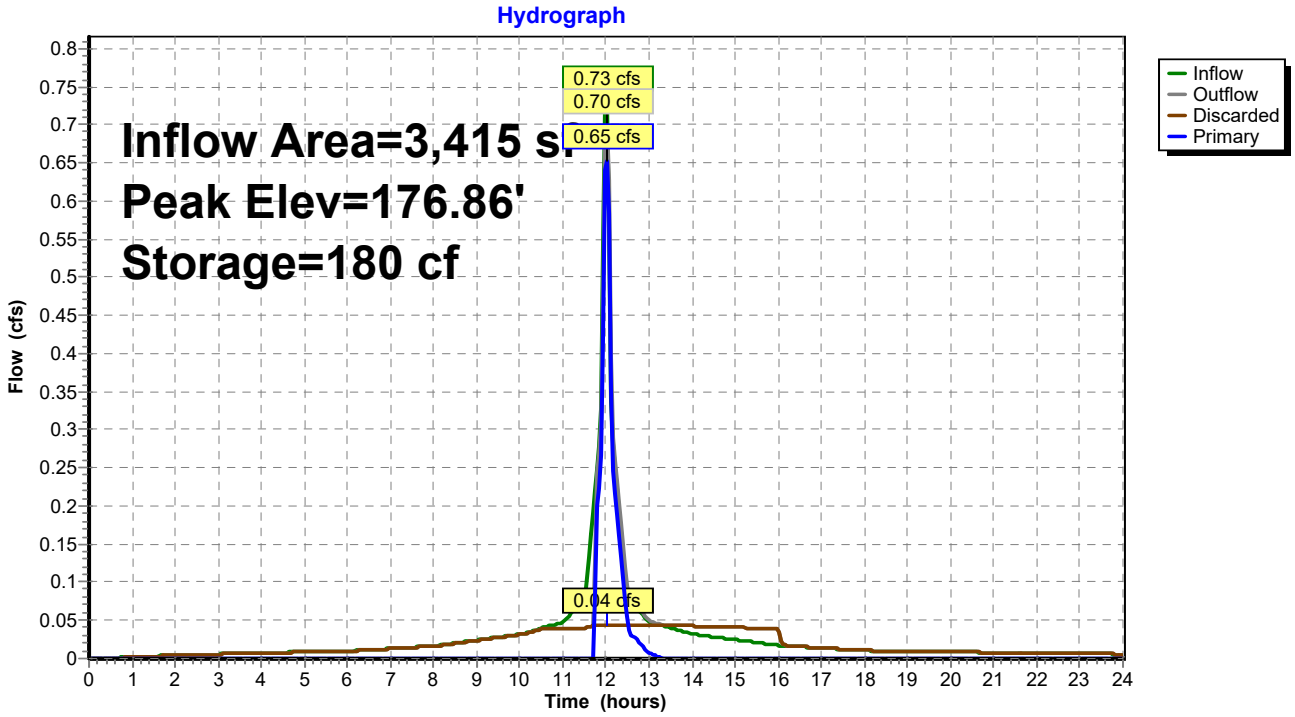
1,929.8 cf Field - 353.8 cf Chambers = 1,576.0 cf Stone x 40.0% Voids = 630.4 cf Stone Storage

Chamber Storage + Stone Storage = 984.2 cf = 0.023 af
Overall Storage Efficiency = 51.0%
Overall System Size = 31.68' x 21.50' x 2.83'

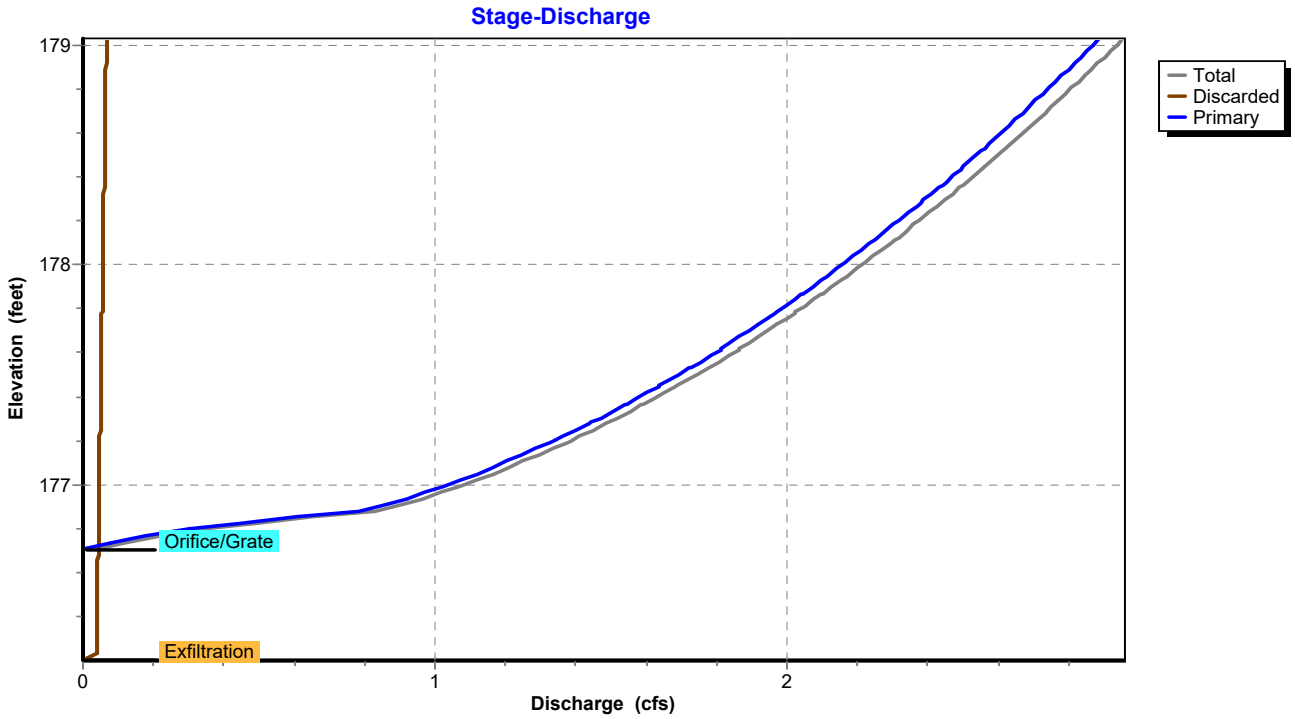
24 Chambers
71.5 cy Field
58.4 cy Stone



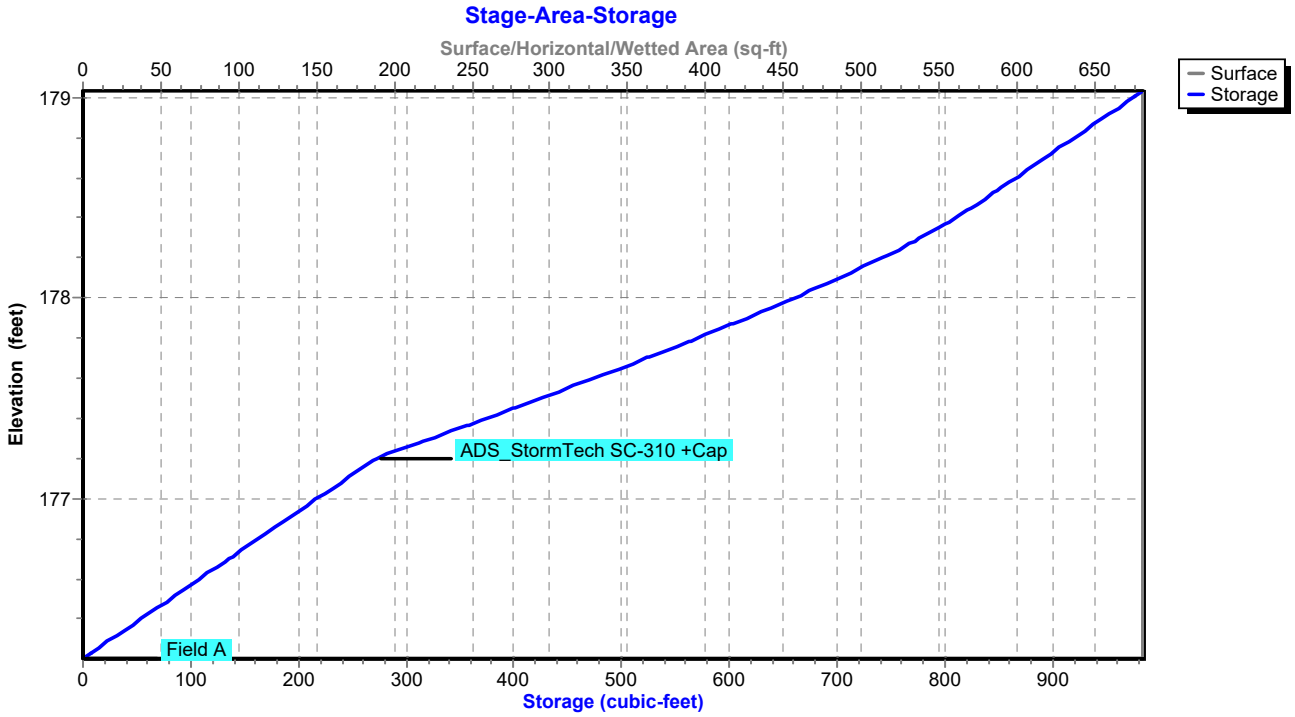
Pond 1P: Infiltration System



Pond 1P: Infiltration System



Pond 1P: Infiltration System



Summary for Pond 2P: Rain Garden

Inflow Area = 5,557 sf, 57.44% Impervious, Inflow Depth > 6.11" for 100-yr event
Inflow = 0.94 cfs @ 12.06 hrs, Volume= 2,831 cf
Outflow = 0.42 cfs @ 12.22 hrs, Volume= 2,810 cf, Atten= 55%, Lag= 9.8 min
Discarded = 0.09 cfs @ 12.22 hrs, Volume= 2,413 cf
Primary = 0.33 cfs @ 12.22 hrs, Volume= 397 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 180.76' @ 12.22 hrs Surf.Area= 1,187 sf Storage= 942 cf

Plug-Flow detention time= 108.7 min calculated for 2,804 cf (99% of inflow)
Center-of-Mass det. time= 103.9 min (898.7 - 794.8)

Volume	Invert	Avail.Storage	Storage Description
#1	180.09'	365 cf	**15.00'W x 26.00'L x 0.91'H Prismatoid-ponding depth Z=0.3**
#2	179.76'	51 cf	**15.00'W x 26.00'L x 0.33'H Prismatoid-mulch** 129 cf Overall x 40.0% Voids
#3	176.76'	624 cf	**15.00'W x 26.00'L x 4.00'H Prismatoid-planting medium** 1,560 cf Overall x 40.0% Voids
		1,041 cf	Total Available Storage

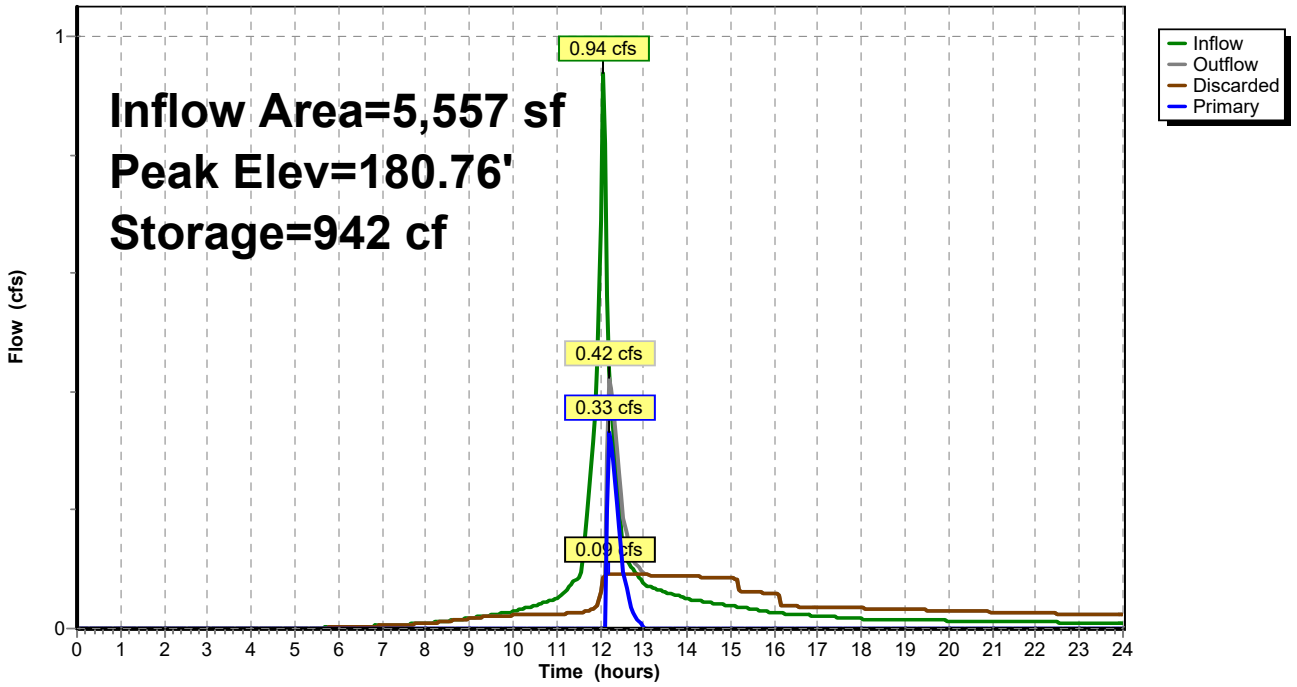
Device	Routing	Invert	Outlet Devices
#1	Discarded	176.76'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 172.67' Phase-In= 0.01'
#2	Primary	180.59'	**2.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.09 cfs @ 12.22 hrs HW=180.75' (Free Discharge)
↑**1=Exfiltration** (Controls 0.09 cfs)

Primary OutFlow Max=0.31 cfs @ 12.22 hrs HW=180.75' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 0.31 cfs @ 0.96 fps)

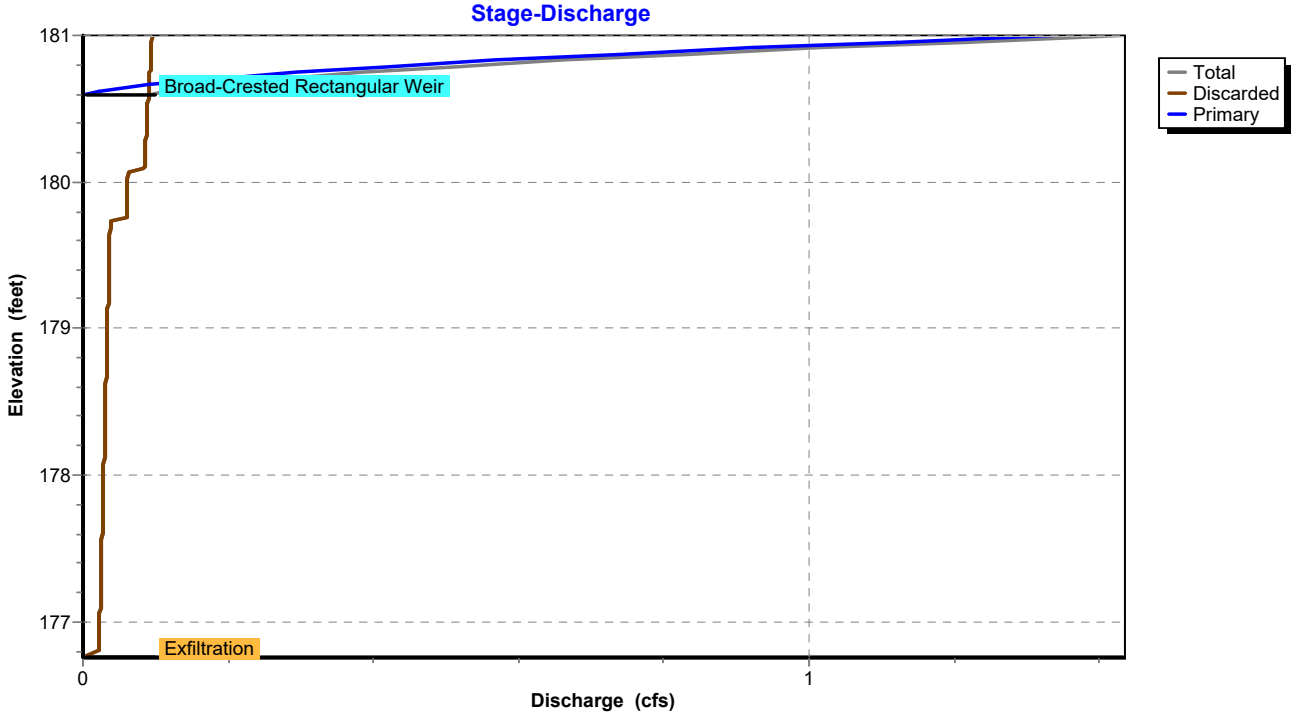
Pond 2P: Rain Garden

Hydrograph

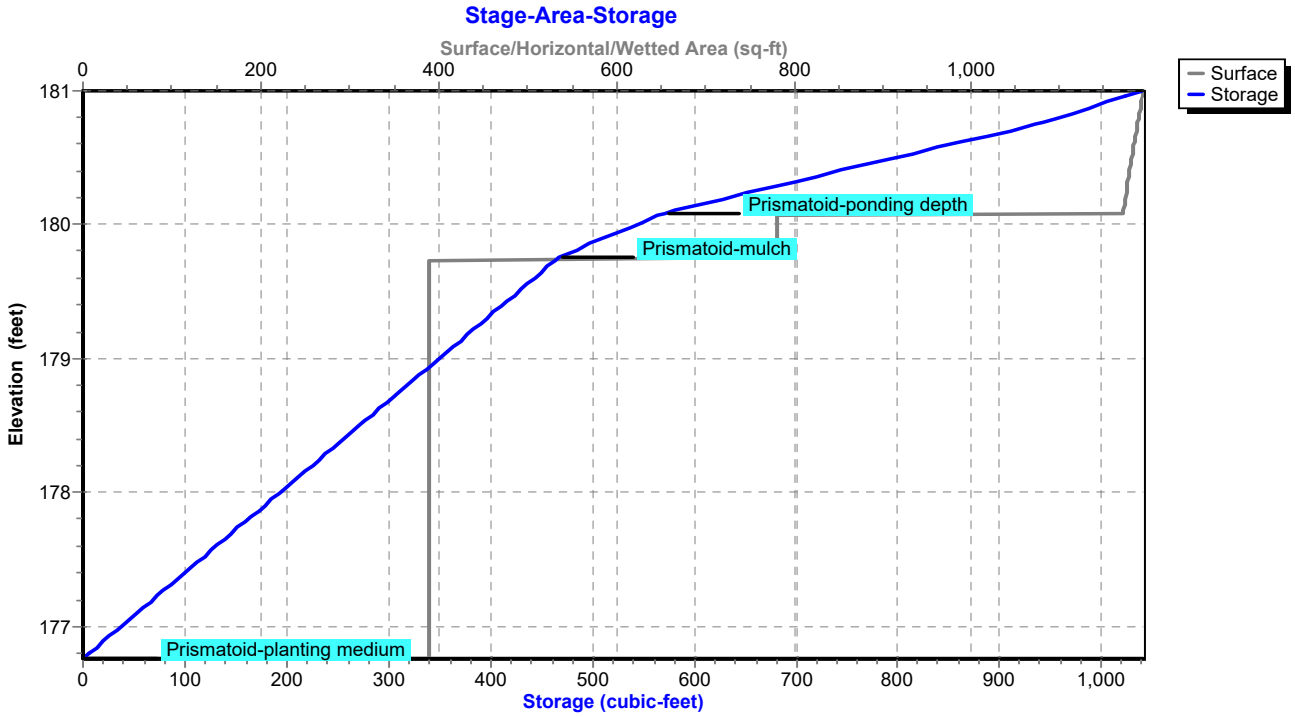


Pond 2P: Rain Garden

Stage-Discharge



Pond 2P: Rain Garden

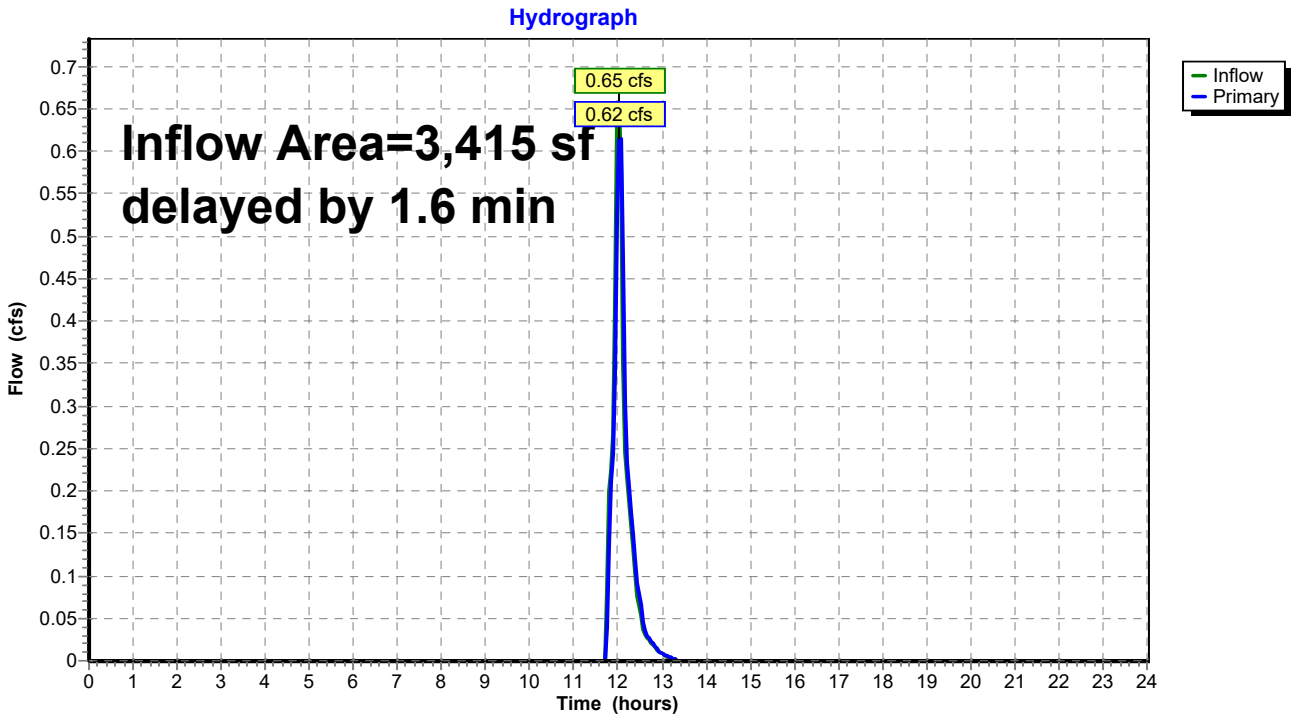


Summary for Link 1L:

Inflow Area = 3,415 sf,100.00% Impervious, Inflow Depth = 2.64" for 100-yr event
Inflow = 0.65 cfs @ 12.01 hrs, Volume= 752 cf
Primary = 0.62 cfs @ 12.04 hrs, Volume= 752 cf, Atten= 6%, Lag= 1.8 min

Primary outflow = Inflow delayed by 1.6 min, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L:

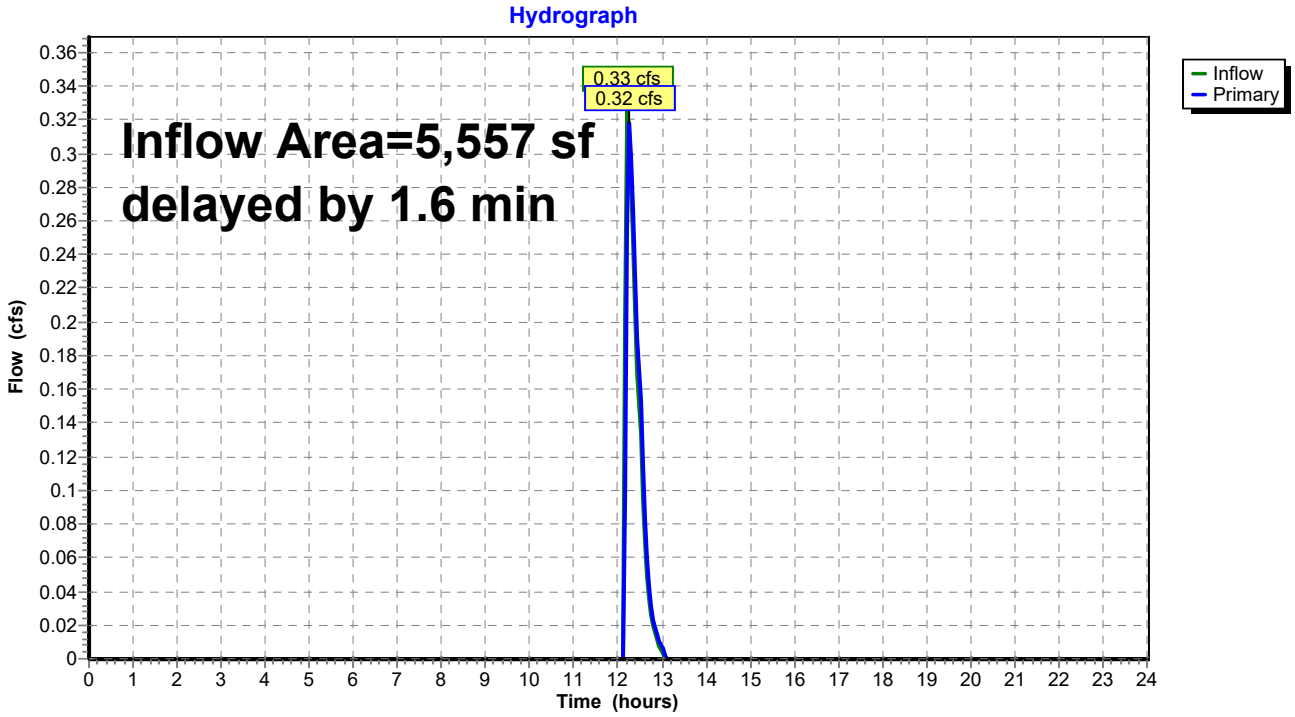


Summary for Link 2L:

Inflow Area = 5,557 sf, 57.44% Impervious, Inflow Depth = 0.86" for 100-yr event
Inflow = 0.33 cfs @ 12.22 hrs, Volume= 397 cf
Primary = 0.32 cfs @ 12.26 hrs, Volume= 397 cf, Atten= 4%, Lag= 2.5 min

Primary outflow = Inflow delayed by 1.6 min, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L:



FLOW PATH KEY

SHEET FLOW

SHALLOW CONCENTRATED FLOW

FLOW LINK

X DESIGN POINT (DP)

(E) FENCE LINE

LOT 1A
22,600 S.F.

(P) RAIN GARDEN

SC-310 TYP.

1S

2S

3S

N75°33'29"E 140.26'

N04°25'48"E 142.66'

S04°25'48"W 199.36'

L=133.22'
R=2056.82'

Catch Basin DP X

VILLAGE STREET
(COUNTY LAYOUT - VARIABLE WIDTH)
A SCENIC ROAD

POST - DEVELOPEMENT DRAINAGE ANALYSIS

Located at
288 Village Street
Medway, MA

Scale: 1"=20'

Land Planning, Inc.
Civil Engineers • Land Surveyors
Environmental Consultants
214 Worcester St., N. Grafton, MA 01536
508-839-9526

Date	April 5, 2022	Sheet No.
Job No.	B1483	1 of 1

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts

288 Village Street Medway MA

February 7, 2022

Map Scale: 1:2,590 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 17, Sep 3, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 31, 2020—Oct 22, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
5	Saco silt loam, frequently ponded, 0 to 1 percent slopes, frequently flooded	7.0	20.7%
223B	Scio very fine sandy loam, 2 to 5 percent slopes	9.2	27.3%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	15.8	46.6%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	1.8	5.4%
Totals for Area of Interest		**33.8**	**100.0%**

Norfolk and Suffolk Counties, Massachusetts

223B—Scio very fine sandy loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: vkxy
Elevation: 100 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Scio and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scio

Setting

Landform: Plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Soft coarse-silty eolian deposits over hard coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 9 inches: very fine sandy loam
H2 - 9 to 40 inches: silt loam
H3 - 40 to 60 inches: stratified very gravelly sand to silt loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B/D
Ecological site: F144AY026CT - Moist Silty Outwash
Hydric soil rating: No

Minor Components

Sudbury

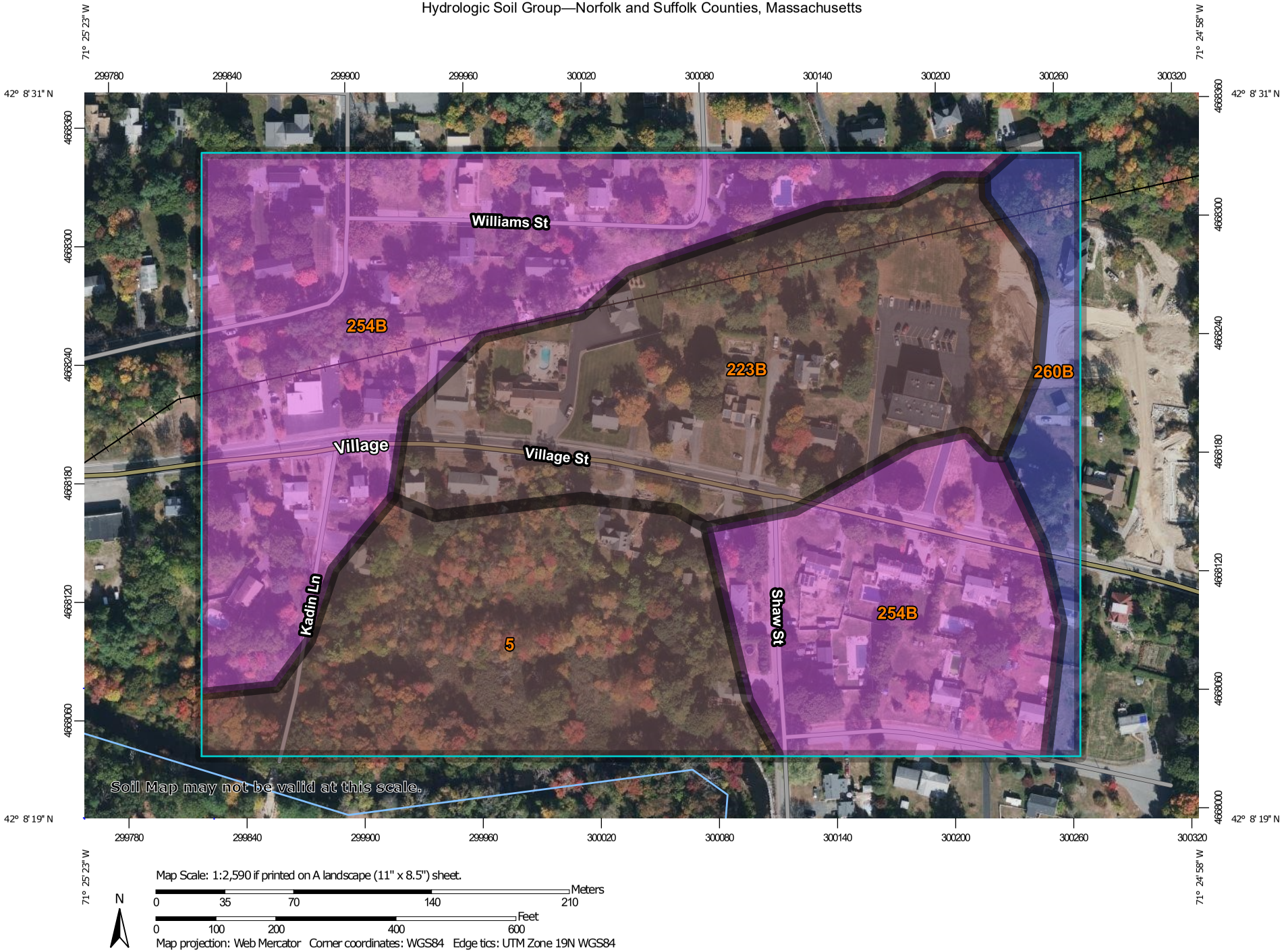
Percent of map unit: 10 percent
Hydric soil rating: No

Haven

Percent of map unit: 10 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 17, Sep 3, 2021



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N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

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Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
5	Saco silt loam, frequently ponded, 0 to 1 percent slopes, frequently flooded	B/D	7.0	20.7%
223B	Scio very fine sandy loam, 2 to 5 percent slopes	B/D	9.2	27.3%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	15.8	46.6%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	B	1.8	5.4%
Totals for Area of Interest			**33.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Evaluation Report

Client: Tony Leland

Location: 288 Village St, Medway

Soil Evaluator: WM

Witness:

Observation Hole 1 Date 2/15/22 Time 9 AM Weather Sunny Slope Surface Stones

Depth	Horizon	Texture	Color	Stones	Structure	Consistence	Redoximorphic
0-14	Fill	SL LS Sil	10YR 7.5YR 5YR 2.5YR 2.5Y	% Gravel	Gran Blocky	Loose	10YR 7.5YR 5YR 2.5YR 2.5Y
		FS MS CS	Value 2 3 4 5 6 7 8	% Cobbles	SubAngBlocky	V.Friable	Value 2 3 4 5 6 7 8
		SCL SC CL	Chroma 1 2 3 4 6 8		Platy	Friable	Chroma 1 2 3 4 6 8
		SiC SiCL			single grain	Firm	%
		CLAY			massive	V. Firm	Depth
						Rigid	

Depth	Horizon	Texture	Color	Stones	Structure	Consistence	Redoximorphic
14-28	B	SL LS Sil	10YR 7.5YR 5YR 2.5YR 2.5Y	% Gravel	Gran Blocky	Loose	10YR 7.5YR 5YR 2.5YR 2.5Y
		FS MS CS	Value 2 3 4 5 6 7 8	% Cobbles	SubAngBlocky	V.Friable	Value 2 3 4 5 6 7 8
		SCL SC CL	Chroma 1 2 3 4 6 8		Platy	Friable	Chroma 1 2 3 4 6 8
		SiC SiCL			single grain	Firm	%
		CLAY			massive	V. Firm	Depth
						Rigid	

Depth	Horizon	Texture	Color	Stones	Structure	Consistence	Redoximorphic	Perc Test:
28-112	C	SL LS Sil	10YR 7.5YR 5YR 2.5YR 2.5Y	% Gravel	Gran Blocky	Loose	10YR 7.5YR 5YR 2.5YR 2.5Y	PreSoak:
		FS MS CS	Value 2 3 4 5 6 7 8	% Cobbles	SubAngBlocky	V.Friable	Value 2 3 4 5 6 7 8	12"
		SCL SC CL	Chroma 1 2 3 4 6 8		Platy	Friable	Chroma 1 2 3 4 6 8	9"
		SiC SiCL			single grain	Firm	%	6"
		CLAY			massive	V. Firm	Depth None observed	Depth
						Rigid		

Depth	Horizon	Texture	Color	Stones	Structure	Consistence	Redoximorphic
		SL LS Sil	10YR 7.5YR 5YR 2.5YR 2.5Y	% Gravel	Gran Blocky	Loose	10YR 7.5YR 5YR 2.5YR 2.5Y
		FS MS CS	Value 2 3 4 5 6 7 8	% Cobbles	SubAngBlocky	V.Friable	Value 2 3 4 5 6 7 8
		SCL SC CL	Chroma 1 2 3 4 6 8		Platy	Friable	Chroma 1 2 3 4 6 8
		SiC SiCL			single grain	Firm	%
		CLAY			massive	V. Firm	Depth
						Rigid	

Depth	Horizon	Texture	Color	Stones	Structure	Consistence	Redoximorphic
		SL LS Sil	10YR 7.5YR 5YR 2.5YR 2.5Y	% Gravel	Gran Blocky	Loose	10YR 7.5YR 5YR 2.5YR 2.5Y
		FS MS CS	Value 2 3 4 5 6 7 8	% Cobbles	SubAngBlocky	V.Friable	Value 2 3 4 5 6 7 8
		SCL SC CL	Chroma 1 2 3 4 6 8		Platy	Friable	Chroma 1 2 3 4 6 8
		SiC SiCL			single grain	Firm	%
		CLAY			massive	V. Firm	Depth
						Rigid	

Weeping: 100" Standing Water:

Storm Water
Pollution Prevention Plan
For:

288 Village Street
Medway, MA

Site Owner/Operator
Tony J. Leland, Sr.
290 Village Street
Medway, MA

Prepared by:
Land Planning, Inc.
167 Hartford Ave
Bellingham, MA 02019

April 7, 2022

1.0 Site Evaluation, Assessment, and Planning

1.1 Project Information

The construction site is located at 288 Village Street, Medway MA.

1.2 Contact Information / Responsible Parties

Project Manager or Site Supervisor

Name:_____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____

SWPPP Contact

Name:_____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____

SWPPP prepared by

Norman G. Hill, P.E.

Land Planning, Inc.

214 Worcester Street

N. Grafton, MA 01536

508-839-9526

Property Owner

Tony J. Leland, Sr. & Dawn M. Leland

290 Village Street

Medway, MA

1.3 Nature and Sequence of Construction Activity

The property is to be developed for a three-unit multi-family building. Soil disturbing activities will include building construction, utility connection, grading and driveway.

1.4 Soils, Slopes, Vegetation, Drainage Patterns

The project site included a single-family dwelling, two sheds, and a paved driveway. The remaining area on-site is primarily grass with a few trees located at the north easterly portion of the site.

The overall slope of the site does is flat and does not exceeding 5%. Generally, the property slopes from northeast to southwest toward Village Street.

At the time of the hydrologic analysis the single-family dwelling has been removed. All other site conditions remain unchanged.

The soil located on site is Scio very fine sandy loam, 223B. Scio soils belong to the hydrologic soil group “B/D”. (See attached NRCS soil report.)

Based on sub-surface exploration conducted by William Halsing, SE#2823, on February 15, 2022; the depth to groundwater was determined to be 100-inches (in.). The soil texture varied between loamy-sand and medium sand in the B and C horizons respectively (see attached soil log).

1.5 Construction Site Estimates

The following are estimates of the construction site:

Size of property	22,600 ft²
Construction site area to be disturbed	19,000 ft²
Percentage of preconstruction impervious area	22%
Percentage of postconstruction impervious area	38%

1.6 Receiving Waters

Stormwater runoff from the site generally flows across the site in a southerly direction and ends up in the municipal drainage system. Two catch basins exist at the left and right lot line of the project site.

1.7 Site Features and Sensitive Areas to be Protected

There are no sensitive or protected resource areas on or adjacent to the site.

1.8 Potential Sources of Pollution

Potential sources of sediment to stormwater runoff include:

- Grading and excavation operations
- Vehicle tracking
- Topsoil stripping and stockpiling
- Landscaping operations

Potential pollutants and sources, other than sediment, to stormwater runoff:

- Combined Staging Area – fueling activities, equipment maintenance, sanitary facilities, waste storage
- Materials Storage Area – general building materials, solvents, adhesives, paving materials, paints, aggregates, and trash.
- Construction Activity – building construction, paving, concrete pouring,
- Concrete Washout Area

See table below for potential construction site pollutants:

TRADE NAME MATERIAL	CHEMICAL/PHYSICAL DESCRIPTION	STORM WATER POLLUTANTS
Pesticides	Various colored to colorless liquid, powder, grains, or pellets	Chlorinated hydrocarbons, organophosphates, carbamates, arsenic
Fertilizer	Liquid or solid grains	Nitrogen, Phosphorous
Plaster	White granules or powder	Calcium sulphate, calcium carbonate, sulfuric acid
Cleaning solvents	Colorless, blue, or yellow-green liquid	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates
Asphalt	Black solid	Oil, petroleum distillates
Concrete	White solid	Limestone, sand
Glue, adhesives	White or yellow liquid	Polymers, epoxies
Paints	Various colored liquid	Metal oxides, stoddard solvent, talc, calcium carbonate, arsenic
Curing compounds	Creamy white liquid	Naphtha
Waste water from construction equipment washing	Water	Soil, oil and grease, solids
Wood preservatives	Clear amber or dark brown liquid	Stoddard solvent, petroleum distillates, arsenic, copper, chromium
Hydraulic oil/fluids	Brown oily petroleum hydrocarbon	Mineral oil
Gasoline	Colorless, pale brown or pink petroleum hydrocarbon	Benzene, ethyl benzene, toluene, xylene, MTBE
Diesel fuel	Clear, blue-green to yellow liquid	Petroleum distillate, oil and grease, naphthalene, xylenes
Kerosene	Pale yellow liquid petroleum hydrocarbon	Coal oil, petroleum distillates
Antifreeze/coolant	Clear green/yellow liquid	Ethylene glycol, propylene glycol, heavy metals (copper, zinc, lead)
Sanitary toilets	Various colored liquid	Bacteria, parasites, and viruses

2.0 Erosion and Sedimentation Control BMPs

- **Minimize disturbed area and protect natural features and soil**

  Topsoil to be stripped from the construction area will be stockpiled as identified on the Sedimentation & Erosion Control Plan. The stockpile shall be surrounded by sediment barriers at its base.

- **Phase Construction Activity**

  The proposed site is too small for phased disturbance areas to be practical. To minimize erosion construction activities should be limited to the spring, summer, and fall seasons.

- **Control stormwater flowing onto and through the project**

  The runoff entering the site from the north shall be diverted around the disturbed areas of the site.

- **Stabilize soils**

  Temporary Stabilization

  Hydromulching will provide immediate protection to exposed soils where construction will cease for more than 14 days and over the winter months. Straw mulch and wood fiber will be mixed with a tackifier (amount specified per manufacturer's instructions) and applied uniformly by machine with an application rate of 90–100 pounds (2–3 bales) per 1,000 square feet or 2 tons (100–200 bales) per acre. If the tackifier does not appear effective in anchoring the mulch to the disturbed soil, crimping equipment will be used to provide additional binding to the soil. The mulch will cover 75 to 90 percent of the ground surface. In areas, where hydromulching is inaccessible, straw mulch will be applied by hand with an application rate of 90–100 pounds (2–3 bales) per 1,000 square feet.

  Permanent Stabilization

  Permanent stabilization will be done immediately after the final design grades are achieved but no later than 14 days after construction ceases. Native species of plants will be used to establish vegetative cover on exposed soils. Permanent stabilization will be completed in accordance with the final stabilization procedures.

- **Protect slopes**

  The project does not include slopes exceeding 3:1.

- **Establish perimeter controls and sediment barriers**

  Sediment barriers consisting of straw wattles and silt fence will be installed at the perimeter of the site as indicated on the Sedimentation & Erosion Control Plan. See the detail provided on the Sedimentation & Erosion Control Plan for specifications and installation requirements of the sediment barrier.

- **Establish stabilized construction exits**

  An anti-tracking pads consisting of washed stone will be installed at the exit of the project site, as identified on the Sedimentation & Erosion Control Plan, to prevent the off-site transport of sediment by construction vehicles. The anti-tracking pads will be at least 30 feet long, a minimum of 10 feet wide, flared at the end closest to the road.

3.0 Good Housekeeping BMPs

3.1 Material Handling and Waste Management

- **Waste Materials**

  All waste materials will be collected and disposed of into metal trash dumpsters. Dumpsters will have a secure watertight lid, be placed away from stormwater conveyances and drains, and meet all federal, state, and municipal regulations. Only trash and construction debris from the site will be deposited in the dumpster. No construction materials will be buried on-site.

- **Hazardous Waste Materials**

  All hazardous waste materials such as oil filters, petroleum products, paint, and equipment maintenance fluids will be stored in structurally sound and sealed shipping containers, within the hazardous materials storage area. Hazardous waste materials will be stored in appropriate and clearly marked containers and segregated from other non-waste materials. Secondary containment will be provided for all waste materials in the hazardous materials storage area and will consist of commercially available spill pallets. Additionally, all hazardous waste materials will be disposed of in accordance with federal, state, and municipal regulations. Hazardous waste materials will not be disposed of into the on-site dumpsters.

- **Sanitary Waste**

  Temporary sanitary facilities (portable toilets) will be provided at the site throughout the construction phase. The toilets will be in the staging area. The portable toilets will be located away from a concentrated flow paths and traffic flow and will have collection pans underneath as secondary containment.

3.2 Equipment/Vehicle Fueling and Maintenance Practices

- **Fueling and Maintenance**

  Several types of vehicles and equipment will be used on-site throughout the project, including graders, scrapers, excavators, loaders, paving equipment, rollers, trucks and trailers, backhoes, and forklifts. All major equipment maintenance will be performed off-site. Vehicle fueling and minor maintenance will be performed outside of and, as far as practicable, away from the resource areas. Absorbent, spill-cleanup materials and spill kits will be available on-site.

3.6 Spill Prevention and Control

- **Spill Prevention and Control Procedures**

  I. Employee Training: All employees will be trained via monthly tailgate sessions.
  II. Vehicle Maintenance: Vehicles and equipment will be maintained off-site. All vehicles and equipment including subcontractor vehicles will be checked for leaking oil and fluids. Vehicles leaking fluids will not be allowed on-site.
  III. Hazardous Material Storage: Hazardous materials will be stored in accordance with Section 3 and federal and municipal regulations.
  IV. Spill Kits: Spill kits will be within the materials storage area and concrete washout areas.
  V. Spills: All spills will be cleaned up immediately upon discovery. Spent absorbent materials and rags will be hauled off-site immediately after the spill is cleaned up for proper disposal. Spills large enough to discharge to surface water will be reported to the National Response Center at 1-800-424-8802 and MassDEP Emergency Response Line at 1-888-304-1133.
  VI. Material safety data sheets, a material inventory, and emergency contact information will be maintained at the on-site project trailer.

4.0 Inspections

4.1 Inspection Schedule and Procedures

- Inspections of the site will be performed once every 7 days and within 24 hours of the end of a storm event of one-half inch or greater. The inspections will verify that all BMPs required in Sections 2 and 3 are implemented, maintained, and effectively minimizing erosion and preventing stormwater contamination from construction materials. For detailed inspection procedures, see Sections 2 and 3.

- A maintenance inspection report will be made after each inspection. A copy of the report form to be completed by the SWPPP Coordinator is provided Section 8. Completed forms will be maintained on-site throughout construction. Following construction, the completed forms will be retained at the site operators' office for a minimum of 1 year.

5.0 Recordkeeping and Training

5.1 Recordkeeping

- Records will be retained for a minimum period of at least 3 years after the Certificate of Compliance is issued.

5.2 Log of Changes to the SWPPP

No.	Description of Amendment	Date of Amendment	Amendment Prepared by

5.3 Training

- **General stormwater and BMP awareness training**

  The SWPPP Coordinator will conduct informal training for all staff, including subcontractors, on the site. The training will be conducted primarily via tailgate sessions and will focus on avoiding damage to stormwater BMPs and preventing illicit discharges. The tailgate sessions will be conducted monthly and will address the following topics: Erosion Control BMPs, Sediment Control BMPs, Non-Stormwater BMPs, Waste Management and Materials Storage BMPs, and Emergency Procedures specific to the construction site.

- **Detailed training for staff with specific stormwater responsibilities**

  The SWPPP Coordinator will provide formal training to all staff and subcontractors with specific stormwater responsibilities, such as installing and maintaining BMPs. The formal training will cover all design and construction specifications for installing the BMPs and proper procedures for maintaining each BMP. Formal training will occur before any BMPs are installed on the site.

6.0 Final Stabilization

6.1 Permanent Seeding

- **Seedbed Preparation**

a. In areas where disturbance results in subsoil or fill material being the final grade surface, topsoil will be spread over the finished area at minimum depth of 4 inches.

b. The seedbed will be free of large clods, rocks, woody debris and other objectionable materials.

c. Fertilizer and lime will be applied to the seedbed according to the manufacturer's recommendations or soil tests.

d. The top layer of soil will be loosened to a depth of 3–5 inches by raking, tilling, disking or other suitable means.

- **Grass Selection/Application**

a. Lawns will be stabilized with a mixture of Kentucky Blue Grass and Creeping Red Fescue at an application rate of 100 pounds per acre or 2.3 pounds per 1,000 square feet.

b. Seed will be applied uniformly by hydroseeding or broadcasting. Where broadcasting is used, the seed will be covered with .25 inch of soil or less.

- **Mulching**

a. Hydromulch will be applied immediately following seeding at an application rate of 90–100 pounds (2–3 bales) per 1,000 square feet.

7.0 SWPPP Coordinator and Duties

The construction site SWPPP Coordinator for the facility is:

Name: _____ Title: _____

Company: _____ Phone:_____.

The SWPPP Coordinator's duties include the following:

- Implement the SWPPP plan;
- Oversee maintenance practices identified as BMPs in the SWPPP;
- Implement and oversee employee training;
- Conduct or provide for inspection and monitoring activities;
- Identify other potential pollutant sources and make sure they are added to the SWPPP;
- Identify any deficiencies in the SWPPP and make sure they are corrected and
- Ensure that any changes in construction plans are addressed in the SWPPP.

8.0 Forms and Logs

Initial Inspection of Erosion and Sediment Control

DEP File Number: _____ Date:_____

Contractor/Representative:_____

Evaluated by SWPPP Coordinator:_____

A. Project Overview

- How Many Acres Total Does the Project Disturb? _____
- Project Start Date:_____ Project End Date:_____
- Phase I start date?_____

B. Paperwork

• *Does the project have a Order of Conditions?	Yes	No	N/A
• *Is the SWPPP Notebook onsite?	Yes	No	N/A

C. Site Preparation

• *Has the contractor installed temporary construction entrance(s) and are the vehicles using it?	Yes	No	N/A
• *Is there a place for concrete wash-out, is it clearly marked and do concrete trucks appear to be using it?	Yes	No	N/A
• *Is the site largely free of construction trash? (cups, lunch sacks, material packaging, etc.)	Yes	No	N/A
• *Have perimeter sediment controls been installed?	Yes	No	N/A
• *Have pre-construction controls been installed per the plan been installed?	Yes	No	N/A
• *Have easily recognizable indications of the construction limits been installed? (fencing, staking, physical barriers)	Yes	No	N/A

* Must be “yes” or N/A in order for inspection to be “satisfactory”.

Note: The local Conservation Commission must inspect and approve of the initial erosion and sediment controls, as installed, prior to the start of construction.

Erosion and Sediment Control Inspection Report Form

Project Name and Location

Weather:	**Pollution Control Measures (BMP) Checklist:**
Rain in last 24 hrs (inches):	____ Inlet Barrier (ie: filter bags) ____ Sediment Barriers (ie: wattles/silt fence) ____ Erosion Blankets, Hydromulch / Seed ____ Stabilized Construction Entrance ____ Diversion Berms ____ Seed / Sod Areas ____ Sediment Basins & Discharge ____ Borrow Areas ____ General Site Condition (trash, etc)
Owner / Permittee:	
A. Current Construction / Active Areas:	

B. Problem Areas / Special Observations(*Note problem areas ONLY below*):

BMP	Location	Observations, Effectiveness, & Corrective Actions Ordered

C. Listing of Areas where construction operations have permanently or temporarily stopped; stabilization measures initiated.

D. Have items noted on last inspection been corrected? Yes No (if No, Explain:)

Note: Inspection comments above indicate deficiencies only. Deficiencies must be corrected within 7 days, unless otherwise noted. All other BMP's on site are considered to be in good working condition.

Inspection Date **SWPPP Coordinator Signature**

BMP INSPECTION CHECKLIST

General notes about Inspections:
1) Site inspected weekly
2) Within 24 hours of the end of a storm with rain >0.5”
3) Deficiencies corrected within 7 calendar days of inspection

Key elements to look at during inspection
1) Proper installation
2) Operation
3) Maintenance

Inlet Barriers (ie:sand bags, filter bags, straw wattles)

- √ Is the structure deteriorating
- √ Is sediment >1/2 the height of structure?
- √ Evidence of water/sediment getting **around or under** barrier?
- √ Are there other structures that require inlet barriers?

Sediment Barriers (ie: silt fence/straw wattles)

- √ Are they trenched in or falling down?
- √ Evidence of sediment/water getting **around** or **under** barrier?
- √ Is sediment more than 1/3 height of structure?
- √ Are there areas where more sediment barriers are required or need extended?

Stabilized Construction Entrance

- √ Is gravel clean or getting filled with mud?
- √ Evidence of sediment being tracked off site onto public streets?

Final or temporary Stabilization area

- √ Mulches/Grasses-are areas thinning or have been disturbed? Re-application req’d?
- √ Straw Blankets-are they deteriorating and need replaced?

Borrow Areas

- √ When on site or offsite borrow areas, which include contractor furnished, are to be excavated below ground elevations, an earth berm must be constructed around the borrow area to prevent runoff from entering excavation area

Sediment Basin

- √ Note the basin depth. Is the basin more than ½ full of sediment from original design?
- √ Condition of basin side slopes
- √ Evidence of overtopping embankment
- √ Condition of outfall

General Site Conditions

- √ Trash barrels-any evidence of trash lying around site
- √ Location of porta potties
- √ Leaking vehicles
- √ Concrete Washouts Designated

Quality Assurance Field Review – Erosion and Sediment Control

DEP File Number: _____ Contractor/Representative:_____

Date:_____ Evaluated by SWPPP Coordinator:_____

A. Project Status: *(brief description of the current phase of construction; major items of work in progress; and general observations of effectiveness and maintenance of site controls, and stormwater discharge at outfalls).*

B. Deficiencies Noted *(List any specific deficiencies found during the review).*

C. Have weekly and rainfall-required inspections been conducted since the last compliance evaluation? Were noted deficiencies corrected within 7 days?

Notice to Contractor: All deficiencies must be corrected within 7 days unless otherwise noted. A record of corrected deficiencies must be maintained.

Final Inspection of Erosion and Sediment Control

DEP File Number: _____ Date:_____

Contractor/Representative:_____

Evaluated by SWPPP Coordinator:_____

Project Overview

- How Many Acres Total Does the Project Disturb? _____
- Project Start Date_____ Project End Date _____

Paperwork

- Is the SWPPP Notebook onsite? Yes No N/A

Final Site Preparation*

- Has the concrete wash-out area been cleaned? Yes No N/A
- Is the site free of construction trash? (cups, lunch sacks, material packaging, wood debris, etc.) Yes No N/A
- Have perimeter sediment controls been taken down? Yes No N/A
- Have indications of the construction limits been taken down? (fencing, staking, physical barriers) Yes No N/A
- Has all the dirt on the site been covered? Yes No N/A
- Have appropriate grasses/sod/trees been planted? Yes No N/A
- Have the plants accepted? Yes No N/A
- Have gutters and streets been cleaned of soil/trash? Yes No N/A
- Have all erosion controls been removed? Yes No N/A

* Must be “yes” or N/A in order for inspection to be “satisfactory”.

Stormwater Management
Operation & Maintenance Plan

288 Village Street
Medway, MA

Prepared by:
Land Planning, Inc.
167 Hartford Ave
Bellingham, MA 02019

April 7, 2022

Operation & Maintenance Plan

Property Owner
Tony J. Leland, Sr. & Dawn M. Leland
290 Village Street
Medway, MA

Site Operator
Tony J. Leland, Sr.
290 Village Street
Medway, MA

Facility Location
288 Village Street
Medway, MA

This Operation & Maintenance Plan is transferable to future property owners and operators. The above information shall be updated as required should a change in ownership or operation occur.

BMPs & Structural Controls

Subsurface Infiltration System

A subsurface infiltration system consisting of StormTech SC-310 chambers within a field of washed stone is provided to recharge roof runoff to groundwater. The system is provided with access ports at the ground surface to provide for inspection and maintenance. A copy of the manufacturers operation and maintenance plan is attached to this report.

Subsurface Infiltration System	
Activity	**Frequency**
Check inlets for clogging	Two times per year
Other maintenance	See attached manufacturers operation and maintenance manual

Rain Garden

Subsurface Infiltration System	
Activity	**Frequency**
Inspect and remove trash	Monthly
Mow	2 to 12 times per year
Mulch	Annually
Fertilize	Annually
Remove dead vegetation	Annually
Prune	Annually

Non-Structural Controls and Housekeeping

Snow Removal

Snow shall be plied along the easterly side of the driveway and at the northerly end of the parking facility as necessary.

Deicing Chemicals

Application of deicing chemicals shall be done sparingly as needed to ensure the safety of the vehicles and pedestrians. Exterior storage of deicing materials on this property is prohibited.

Fertilizers, Pesticides, Herbicides

Organic, slow-release fertilizers should be used within the landscaped areas and maintained lawn areas. Use of pesticides and herbicides is discouraged. Outside storage of fertilizers, pesticides, and herbicides is prohibited.

Landscape Maintenance

Leaves, trimmings, and grass clippings shall be properly disposed of. If these materials are to be composted on-site, it shall be done outside of any wetland resource area or buffer zone.

Street Sweeping

The driveway shall be swept as necessary with a minimum frequency of twice per year. The first sweeping shall take place in early spring after the snow has melted. The second sweeping should be done in autumn.

Maintenance and Inspection Log

Inspections for year _____

BMP	Action	Date	Comment	By
Rain Garden	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Clean			
	Clean			
	Clean			
Subsurface Infiltration System	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Other			
	Other			

Isolator® Row
O&M Manual

ADS StormTech™

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) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

The Isolator Row

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

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

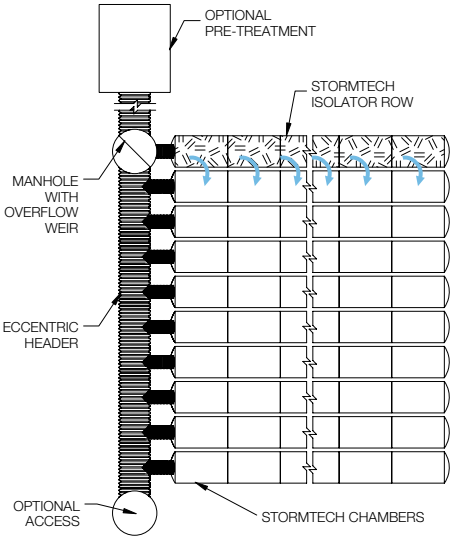
The Isolator Row is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of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

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

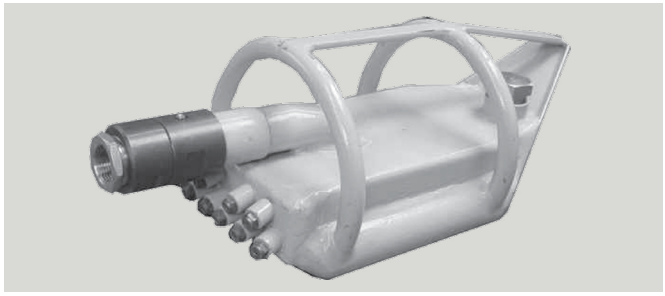
The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

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

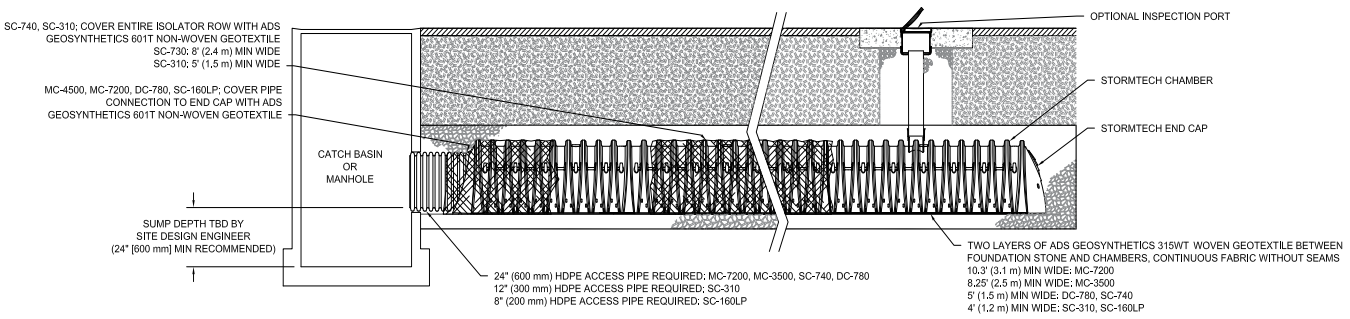
The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via 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. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row lengths up to 200" (61 m). **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-7200 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 Row
   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.

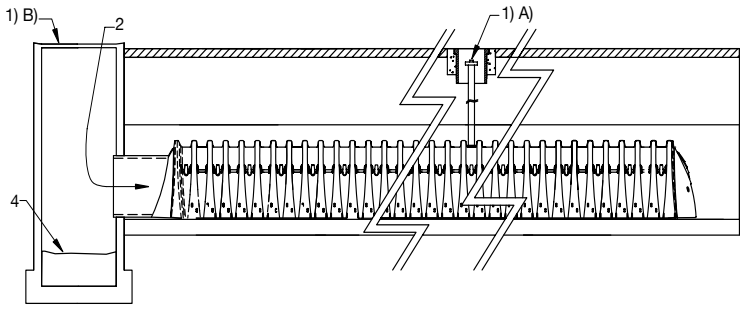
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

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

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