STORMWATER REPORT

GROUND-MOUNTED PHOTOVOLTAIC SYSTEM

200 HAYNES STREET
STURBRIDGE, MA 01566

APRIL 2023
REVISED: FEBRUARY 2024

Owner/Applicant:

STURBRIDGE PV, LLC
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DENVER, CO 80202

BSC Job Number: 5-0745.00

Prepared by:

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SECTION 1.0

PROJECT INFORMATION

1.01 Project Description

The project site is located at 200 Route 15 (Haynes Street) in Sturbridge, MA. The project consists of a total of 13.92± acres of undeveloped land.

The Applicant has proposed to create a paved site access driveway connecting off of Route 15. The access road will be secured by locked gate that can be accessed by Sturbridge Fire/Police Dept., as well as Bear Peak Power maintenance personnel, in order to perform routine maintenance on the solar array. The site is bordered by residential developments to the south and east, vacant lot to the north, and Route 15 and Route 84 to the West.

The applicant is seeking to redevelop the site to develop a large-scale, ground-mounted solar photovoltaic system. The development of the site will entail tree clearing, re-grading portions of the site, installation of equipment pads, electrical service infrastructure, access drive, and stormwater management facilities.

1.02 Pre-Development Conditions

The Pre-Development conditions include the existing site, 200 Route 15. The site has steep slopes ranging from 0% - 35%. For the Pre-Development conditions, the site has been broken down into four (4) subcatchment areas, draining off-site in each direction. There is a wetland resource area that has been identified on the property, in the northwest portion of the site.

NRCS Web Soil Survey has identified five primary soil classifications underlying the project site:

- 5.5% - Map Unit 73A – Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony
- 0.7% - Map Unit 254B – Merrimac fine sandy loam, 3 to 8 percent slopes
- 0.2% - Map Unit 255A – Windsor loamy sand, 0 to 3 percent slopes
- 62.7% - Map Unit 422C – Canton fine sandy loam, 8 to 15 percent slopes, extremely stony
- 30.9% - Map Unit 422E – Canton fine sandy loam, 15 to 35 percent slopes, extremely stony

The Pre-Development HydroCAD model was developed with five (5) subcatchment areas, all flowing off-site. Subcatchment Areas 1S flows towards the wetland resource area in the northwest direction, Subcatchment Area 2S flows to the east off-site, Subcatchment Area 3S flows west towards Route 15, Subcatchment Area 4S flows to the south off-site, and Subcatchment Area 5S flows into the existing drainage ditch along Haynes Street. The five summary nodes will be used in comparison between the peak off-site flows in the Post-Development design. Please refer to Section 6.01 for the Existing Watershed Plan and Section 6.02 for the Existing Hydrology Calculations (HydroCAD Printouts).

1.03 Post-Development Conditions

The proposed stormwater management system has been designed in a manner that will meet or exceed the provisions of the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards for new construction. The design also complies fully with the Town of Sturbridge Zoning Bylaws.

The proposed stormwater management facilities on the site include three sub-surface infiltration systems consisting of ADS StormTech SC-740 chambers with end caps, one infiltration basin, and two grassed channels along the proposed driveway. These systems will work to collect and infiltrate stormwater from the proposed access driveway and portions of the photovoltaic system field. These infiltration systems have been modeled in the proposed HydroCAD model (Section 6.04) as Ponds 5P through 8P. Summary nodes 1R, 2R, 3R, and 4R (off-site flow) have also been modeled to show a direct comparison between the peak runoff rates in the Pre- and Post- Development conditions. Please refer to Section 2.02 Stormwater Runoff Rates for a further detailed analysis of the peak runoff rates. The Proposed Watershed Plan can be seen in Section 6.03 and the proposed Hydrology Calculations (HydroCAD Printouts) can be seen in Section 6.04.

Specifics of the project's compliance with the MassDEP Stormwater Management Standards are discussed in detail in the following sections.

SECTION 2.0

DRAINAGE SUMMARY

2.01 Stormwater Standard 1 – New Stormwater Conveyances

Per MassDEP Stormwater Management Standard #1, no new outfalls may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. There are no known stormwater outfalls in this development and no new outfalls are proposed.

2.02 Stormwater Standard 2 – Stormwater Runoff Rates

Watershed modeling was performed using HydroCAD Stormwater Modeling Software version 10.0, a computer aided design program that combines SCS runoff methodology with standard hydraulic calculations. A model of the site's hydrology was developed for both pre- and post-development conditions to assess the effects of the proposed development on the resource areas to the northwest of the site.

The tables below compare the pre-development peak run-off rates and run-off volume to the post-development conditions for the 2-year, 10-year, 25-year, 50-year, and 100-year storm events. There are slight increases, however these are low, insignificant amounts and should be considered to be de minimus.

Peak Flow Discharge Rates

Node 1R – Off-site Flow (Wetland - Northwest)

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	0.14	0.12	-0.02
10-Year	0.99	0.95	-0.04
25-Year	1.79	1.67	-0.12
50-Year	2.46	2.26	-0.20
100-Year	3.25	2.98	-0.27

Node 1R – Runoff Volume (Wetland - Northwest)

Storm Event	Pre-Development Runoff Volume (af)	Post-Development Runoff Volume (af)	Change in Runoff Volume (af)
2-Year	0.029	0.022	-0.007
10-Year	0.112	0.082	-0.030
25-Year	0.182	0.130	-0.052
50-Year	0.239	0.170	-0.069
100-Year	0.307	0.218	-0.089

Node 2R – Off-site Flow (East)

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	0.78	0.70	-0.08
10-Year	6.21	5.51	-0.70
25-Year	11.24	9.69	-1.55
50-Year	15.38	13.10	-2.28
100-Year	20.30	17.15	-3.15

Node 2R – Runoff Volume (East)

Storm Event	Pre-Development Runoff Volume (af)	Post-Development Runoff Volume (af)	Change in Runoff Volume (af)
2-Year	0.156	0.128	-0.028
10-Year	0.601	0.472	-0.129
25-Year	0.972	0.754	-0.218
50-Year	1.278	0.985	-0.293
100-Year	1.642	1.261	-0.381

Node 3R – Off-site Flow (Route 15)

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	0.16	0.14	-0.02
10-Year	1.20	1.02	-0.18
25-Year	2.17	1.76	-0.41
50-Year	2.97	2.36	-0.61
100-Year	3.93	3.07	-0.86

Node 3R – Runoff Volume (Route 15)

Storm Event	Pre-Development Runoff Volume (af)	Post-Development Runoff Volume (af)	Change in Runoff Volume (af)
2-Year	0.033	0.024	-0.009
10-Year	0.127	0.086	-0.041
25-Year	0.205	0.135	-0.070
50-Year	0.269	0.176	-0.093
100-Year	0.346	0.224	-0.122

Node 4R – Off-site Flow (South)

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	0.12	0.12	0.00
10-Year	0.95	0.91	-0.04
25-Year	1.71	1.61	-0.10
50-Year	2.34	2.17	-0.17
100-Year	3.09	2.84	-0.25

Node 4R – Runoff Volume (South)

Storm Event	Pre-Development Runoff Volume (af)	Post-Development Runoff Volume (af)	Change in Runoff Volume (af)
2-Year	0.023	0.021	-0.002
10-Year	0.091	0.078	-0.013
25-Year	0.146	0.125	-0.021
50-Year	0.192	0.163	-0.029
100-Year	0.247	0.209	-0.038

Node 5R – Flow to Drainage Ditch

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	0.77	0.73	-0.04
10-Year	4.15	3.10	-1.05
25-Year	7.01	4.99	-2.02
50-Year	9.32	6.51	-2.81
100-Year	12.03	8.28	-3.75

Node 5R – Flow to Drainage Ditch

Storm Event	Pre-Development Runoff Volume (af)	Post-Development Runoff Volume (af)	Change in Runoff Volume (af)
2-Year	0.137	0.129	-0.008
10-Year	0.463	0.384	-0.079
25-Year	0.725	0.582	-0.143
50-Year	0.937	0.740	-0.197
100-Year	1.189	0.925	-0.264

2.03 Stormwater Standard 3 – Groundwater Recharge

The ground water recharge is estimated based on the Massachusetts Stormwater Management Standard #3, as follows:

Rv = F x impervious area

Rv = Required Recharge Volume, expressed in cubic feet
F = Target Depth Factor associated with each Hydrologic Soil Group
Impervious Area = pavement and rooftop area on site

Recharge Target Depth by Hydrologic Soil Group

NRCS HYDROLOGIC SOIL TYPE	APPROX. SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	sand	**0.60-inch**
B	loam	**0.35-inch**
C	silty loam	**0.25-inch**
D	clay	**0.10-inch**

The Natural Resources Conservation Service (NRCS) has classified the soils underlying the project site as a combination of soil groups 73A – Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony (5.5%), 254B – Merrimac fine sandy loam. 3 to 8 percent slopes (0.7%), 255A – Windsor loamy sand. 0 to 3 percent slopes (0.2%), 422C – Canton fine sandy loam, 8 to 15 percent slopes, extremely stony (62.7%), and 422E – Canton fine sandy loam, 15 to 35 percent slopes, extremely stony (30.9%).

A number of test pits have been conducted throughout the approximate locations of proposed drainage areas. As a result of that, the site has been modeled as Hydraulic Group A.

To determine the recharge volume provided in the recharge system, the *Static Method* was used as described in the DEP's Massachusetts Stormwater Handbook, Volume 3. A drawdown calculation was performed in accordance with the DEP's Massachusetts Stormwater Handbook, Volume 3, to verify that the proposed recharge systems would drain completely within 72-hours. This drawdown calculation along with calculations to determine the recharge required are provided in Section 7.0 of this report.

2.04 Stormwater Standard 4 – TSS Removal

The project stormwater management system will achieve a TSS removal greater than 80%. The proposed stormwater management system has been designed to provide treatment of runoff in order to reduce suspended solids prior to discharge off-site through the implementation of the following best management practices:

- Subsurface Structures – (80% TSS Removal with adequate pretreatment)
- Infiltration Basin – (80% TSS Removal with adequate pretreatment)
- Grassed channel – (50% TSS Removal with adequate pretreatment)
- Water Quality Units – (Pre-Treatment)

The water quality volume is defined as the runoff volume requiring TSS Removal for the site and is equal to 1-inch of runoff (0.5-inch for a rapid infiltration rate) over the total impervious area of the post-development site. The required water quality volume required for the project is calculated below based on the post-development impervious area:

$$WQV = 1.0\ in\ x\ \frac{1\ ft}{12\ in} x\ 0.590\ ac\ x\ 43{,}560\ ft^2 = \mathbf{2,142\ ft^3}$$

∴ Water Quality Volume = 2,142 cubic feet

The infiltration systems have been sized to treat the required water quality volume and calculation are included in Section 7.0 of this Report.

A long-term pollution prevention plan complying with the requirements of Standard 4 is included in Section 5.0 of this Report.

2.05 Stormwater Standard 5 – Land Uses with Higher Potential Pollutant Loads

The Project is not a land use with higher potential pollutant loads, therefore this Standard does not apply.

2.06 Stormwater Standard 6 – Stormwater Discharges to a Critical Area

The project is not subject to Standard 6. There are no discharges to any Critical Area, as defined by the Massachusetts Stormwater Handbook.

2.07 Stormwater Standard 7 – Redevelopment Projects

This project is a new development, and as such, has been designed to fully comply with the MassDEP Stormwater Management Standards.

2.08 Stormwater Standard 8 – Sedimentation and Erosion Control Plan

Erosion and sedimentation controls are shown on the Project Site Plan set (page 6 of 7). Additionally, a Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Section 4.0 of this Report.

2.09 Stormwater Standard 9 – Long Term Operation and Maintenance Plan

A Long-Term Operation and Maintenance Plan is included in Section 5.0 of this Report.

2.10 Stormwater Standard 10 – Illicit Discharges

There are no known illicit discharges on the project site, and none are proposed. A signed, illicit discharge compliance statement will be submitted prior to the start of construction.

2.11 Conclusion

The Project has been designed to meet the applicable provisions of the Stormwater Management Standards. Site grading in concert with implementation of infiltration basin and subsurface drainage systems will serve to attenuate peak runoff rates, provide treatment to stormwater prior to discharge, and promote infiltration to groundwater. The project will not cause flooding to off-site and downgradient properties, will meet or exceed the requirements of the MassDEP Stormwater Management Standards and the Town of Sturbridge Zoning Bylaws.

SECTION 3.0

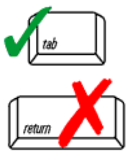
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION CHECKLIST FOR STORMWATER REPORT

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.

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[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.

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

COMMONWEALTH OF MASSACHUSETTS
BRIAN G. YERGATIAN
CIVIL
No. 46206
REGISTERED
PROFESSIONAL ENGINEER

11/10/23

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 (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 (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 (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 (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 (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 (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.

SECTION 4.0

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

4.0 CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

This Section specifies requirements and suggestions for implementation of a Stormwater Pollution Prevention Plan (SWPPP) for the proposed photovoltaic system located at 200 Route 15, Sturbridge, Massachusetts. The SWPPP shall be provided and maintained on-site by the Contractor(s) during all construction activities. The SWPPP shall be updated as required to reflect changes to construction activity.

The stormwater pollution prevention measures contained in the SWPPP shall be at least the minimum required by Local Regulations. The Contractor shall provide additional measures to prevent pollution from stormwater discharges in compliance with the National Pollution Discharge Elimination System (NPDES) Phase II permit requirements and all other local, state and federal requirements.

The SWPPP shall include provisions for, but not be limited to, the following:

1. Construction Trailers
2. Lay-down Areas
3. Equipment Storage Areas
4. Stockpile Areas
5. Disturbed Areas

The Contractor shall NOT begin construction without submitting evidence that a NPDES Notice of Intent (NOI) governing the discharge of stormwater from the construction site for the entire construction period has been filed **at least fourteen (14) days prior to construction**. It is the Contractor's responsibility to complete and file the NOI, unless otherwise determined by the project team.

The cost of any fines, construction delays and remedial actions resulting from the Contractor's failure to comply with all provisions of local regulations and Federal NPDES permit requirements shall be paid for by the Contractor at no additional cost to the Owner.

As a requirement of the EPA's NPDES permitting program, each Contractor and Subcontractor responsible for implementing and maintaining stormwater Best Management Practices shall execute a Contractor's Certification form.

Erosion and Sedimentation Control

The Contractor shall be solely responsible for erosion and sedimentation control at the site. The Contractor shall utilize a system of operations and all necessary erosion and sedimentation control measures, even if not specified herein or elsewhere, to minimize erosion damage at the site to prevent the migration of sediment into environmentally sensitive areas. Environmentally sensitive areas include all wetland resource areas within, and downstream of, the site, and those areas of the site that are not being altered.

Erosion and sedimentation control shall be in accordance with this Section, the design drawings, and the following:

- "National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities (EPA Construction General Permit February 16, 2017).
- Massachusetts Stormwater Management Policy Handbook issued by the Massachusetts Department of Environmental Protection, January 2008.
- Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials, March 1997.

The BMP's presented herein should be used as a guide for erosion and sedimentation control and are not intended to be considered specifications for construction. The most important BMP is maintaining a rapid construction process, resulting in prompt stabilization of surfaces, thereby reducing erosion potential. Given the primacy of rapid construction, these guidelines have been designed to allow construction to progress with essentially no hindrance by the erosion control methods prescribed. These guidelines have also been designed with sufficient flexibility to allow the Contractor to modify the suggested methods as required to suit seasonal, atmospheric, and site-specific physical constraints.

Another important BMP is the prevention of concentrated water flow. Sheet flow does not have the erosive potential of a concentrated rivulet. These guidelines recommend construction methods that allow localized erosion control and a system of construction, which inhibits the development of shallow concentrated flow. These BMP's shall be maintained throughout the construction process.

CONTACT INFORMATION AND RESPONSIBLE PARTIES

The following is a list of all project-associated parties:

Owner
Sturbridge PV, LLC
2420 17th Street
Denver, Colorado 80202

Contractor
To be determined

Environmental Consultant
BSC Group, Inc.
349 Route 28, Unit D
West Yarmouth, MA 02673

Contact: Brian G. Yergatian, P.E., LEED AP
Phone: (617) 896–4590
Email: byergatian@bscgroup.com

Qualified SWPPP Inspectors
To Be Determined

4.1 Procedural Conditions of the Construction General Permit (CGP)

The following list outlines the stormwater responsibilities for all construction operators working on the Project. The operators below agree through a cooperative agreement to abide by the following conditions throughout the duration of the construction project, effective the date of signature of the required SWPPP. These conditions apply to all operators on the project site.

The project is subject to EPA's NPDES General Permit through the CGP. The goal of this permit is to prevent the discharge of pollutants associated with construction activity from entering the existing and proposed storm drain system or surface waters.

All contractors/operators involved in clearing, grading and excavation construction activities must sign the appropriate certification statement required, which will remain with the SWPPP. The owner must also sign a certification, which is to remain with the SWPPP in accordance with the signatory requirements of the SWPPP.

Once the SWPPP is finalized, a signed copy, plus supporting documents, must be held at the project site during construction. A copy must remain available to EPA, State and Local agencies, and other interested parties during normal business hours.

The following items associated with this SWPPP must be posted in a prominent place at the construction site until final stabilization has been achieved:

- The completed/submitted NOI form
- Location where the public can view the SWPPP during normal business hours
- A copy of the signed/submitted NOI, permit number issued by the EPA and a copy of the current CGP.

Project specific SWPPP documents are not submitted to the US EPA unless the agency specifically requests a copy for review. SWPPP documents requested by a permitting authority, the permitee(s) will submit it in a timely manner.

EPA inspectors will be allowed free and unrestricted access to the project site and all related documentation and records kept under the conditions of the permit.

The permitee is expected to keep all BMP's and Stormwater controls operating correctly and maintained regularly.

Any additions to the project which will significantly change the anticipated discharges of pollutants, must be reported to the EPA. The EPA should also be notified in advance of any anticipated events of noncompliance. The permitee must also orally inform the EPA of any discharge, which may endanger health or the environment within 24 hours, with a written report following within 5 days.

In maintaining the SWPPP, all records and supporting documents will be compiled together in an orderly fashion. Inspection reports and amendments to the SWPPP must remain with the document. Federal regulations require permitee(s) to keep their Project Specific SWPPP and all reports and documents for at least three (3) years after the project is complete.

4.2 Project Description and Intended Construction Sequence

The proposed activities will include the following major components:

- Site grading.
- The construction of an access road.
- The construction of stormwater management facilities.
- Installation of photovoltaic system and landscape areas.

The installation of the photovoltaic system will disturb 9.83± acres.

Soil disturbing activities will include site demolition, clearing and grubbing, installing stabilized construction exits, installation of erosion and sedimentation controls, grading, stormwater management systems, utilities. Please refer to Table 1 for the projects anticipated construction timetable. A description of BMP's associated with project timetable and construction-phasing elements is provided in this Erosion and Sediment Control Plan.

Table 1 – Anticipated Construction Timetable

Construction Phasing Activity	Anticipated Timetable
Demolition, Grubbing and Stripping of Limits of Construction Phase	To be determined
Rough Site Grading and Site Utilities	To be determined
Utility Plan Construction	To be determined
Landscaping	To be determined

4.3 Potential Sources of Pollution

Any project site activities that have the potential to add pollutants to runoff are subject to the requirements of the SWPPP. Listed below are a description of potential sources of pollution from both sedimentation to Stormwater runoff, and pollutants from sources other than sedimentation.

Table 2 – Potential Sources of Sediment to Stormwater Runoff

Potential Source	**Activities/Comments**
Construction Site Entrance and Site Vehicles	Vehicles leaving the site can track soils onto public roadways. Site Vehicles can readily transport exposed soils throughout the site and off-site areas.
Grading Operations	Exposed soils have the potential for erosion and discharge of sediment to off-site areas.
Material Excavation, Relocation, and Stockpiling	Stockpiling of materials during excavation and relocation of soils can contribute to erosion and sedimentation. In addition, fugitive dust from stockpiled material, vehicle transport and site grading can be deposited in wetlands and waterway.
Landscaping Operations	Landscaping operations specifically associated with exposed soils can contribute to erosion and sedimentation. Hydro seeding, if not properly applied, can runoff to adjacent wetlands and waterways.

Table 3 – Potential Pollutants and Sources, other than Sediment to Stormwater Runoff

Potential Source	**Activities/Comments**
Staging Areas and Construction Vehicles	Vehicle refueling, minor equipment maintenance, sanitary facilities and hazardous waste storage
Materials Storage Area	General building materials, solvents, adhesives, paving materials, paints, aggregates, trash, etc.
Construction Activities	Construction, paving, curb/gutter installation, concrete pouring/mortar/stucco

4.4 Erosion and Sedimentation Control Best Management Practices

The project site is characterized by primarily pervious surface. All construction activities will implement Best Management Practices (BMP's) in order to minimize overall site disturbance and impacts to the sites natural features. Please refer to the following sections for a detailed description of site-specific BMP's. In addition, an Erosion and Sedimentation Control Plan is provided in the Site Plans.

4.5 Timetable and Construction Phasing

This section provides the Owner and Contractor with a suggested order of construction that shall minimize erosion and the transport of sediments. The individual objectives of the construction techniques described herein shall be considered an integral component of the project design intent of each project phase. The construction sequence is not intended to prescribe definitive construction methods and should not be interpreted as a construction specification document. However, the Contractor shall follow the general construction phase principles provided below:

- Protect and maintain existing vegetation wherever possible.
- Minimize the area of disturbance.
- To the extent possible, route unpolluted flows around disturbed areas.
- Install mitigation devices as early as possible.
- Minimize the time disturbed areas are left un-stabilized.
- Maintain siltation control devices in proper condition.
- The contractor should use the suggested sequence and techniques as a general guide and modify the suggested methods and procedures as required to best suit seasonal, atmospheric, and site-specific physical constraints for minimizing the environmental impact of construction.

Demolition, Grubbing and Stripping of Limits of Construction Phase

- Install Temporary Erosion Control (TEC) devices as required to prevent sediment transport into resource areas.
- Place a ring of silt socks and/or haybales around stockpiles.
- Stabilize all exposed surfaces that will not be under immediate construction.
- Store and/or dispose all pavement and building demolition debris as indicated in accordance with all applicable local, state, and federal regulations.

Driveway Area Sub-Base Construction

- Install temporary culverts and diversion ditches and additional TEC devices as required by individual construction area constraints to direct potential runoff toward detention areas designated for the current construction phase.
- Compact gravel as work progresses to control erosion potential.
- Apply water to control air suspension of dust.
- Avoid creating an erosive condition due to over-watering.
- Install piped utility systems as required as work progresses, keeping all inlets sealed until all downstream drainage system components are functional.

Binder Construction

- Fine grade gravel base and install processed gravel to the design grades.
- Compact pavement base as work progresses.
- Install pavement binder coat starting from the downhill end of the site and work toward the top.

Finish Paving

- Repair and stabilize damaged side slopes.
- Clean inverts of drainage structures.
- Install final top coat of pavement.

Final Clean-up

- Clean inverts of culverts and catch basins.
- Remove sediment and debris from rip-rap outlet areas.
- Remove TEC devices only after permanent vegetation and erosion control has been fully established.

4.6 Site Stabilization

Grubbing Stripping and Grading

- Erosion control devices shall be in place as shown on the design plans before grading commences.
- Stripping shall be done in a manner, which will not concentrate runoff. If precipitation is expected, earthen berms shall be constructed around the area being stripped, with a silt sock, silt fence or haybale dike situated in an arc at the low point of the berm.
- If intense precipitation is anticipated, silt socks, haybales, dikes and /or silt fences shall be used as required to prevent erosion and sediment transport. The materials required shall be stored on site at all time.
- If water is required for soil compaction, it shall be added in a uniform manner that does not allow excess water to flow off the area being compacted.
- Dust shall be held at a minimum by sprinkling exposed soil with an appropriate amount of water.

Maintenance of Disturbed Surfaces

- Runoff shall be diverted from disturbed side slopes in both cut and fill.
- Mulching may be used for temporary stabilization.
- Silt sock, haybale or silt fences shall be set where required to trap products of erosion and shall be maintained on a continuing basis during the construction process.

Loaming and Seeding

- Loam shall not be placed unless it is to be seeded directly thereafter.
- All disturbed areas shall have a minimum of 4” of loam placed before seeded and mulched.
- Consideration shall be given to hydro-mulching, especially on slopes in excess of 3 to 1.
- Loamed and seeded slopes shall be protected from washout by mulching or other acceptable slope protection until vegetation begins to grow.

Stormwater Collection System Installation

- The Stormwater drainage system shall be installed from the downstream end up and in a manner which will not allow runoff from disturbed areas to enter pipes.
- Excavation for the drainage system shall not be left open when rainfall is expected overnight. If left open under other circumstances, pipe ends shall be closed by a staked board or by an equivalent method.
- All catch basin openings shall be covered by a silt bag between the grate and the frame or protected from sediment by silt fence surrounding the catch basin grate.

Completion of Paved Areas

- During the placement of sub-base and pavement, the entrance to the Stormwater drainage systems shall be sealed when rain is expected. When these entrances are closed, consideration must be given to the direction of run-off and measures shall be undertaken to minimize erosion and to provide for the collection of sediment.
- In some situations, it may be necessary to keep catch basins open.

- Appropriate arrangements shall be made downstream to remove all sediment deposition.

Stabilization of Surfaces

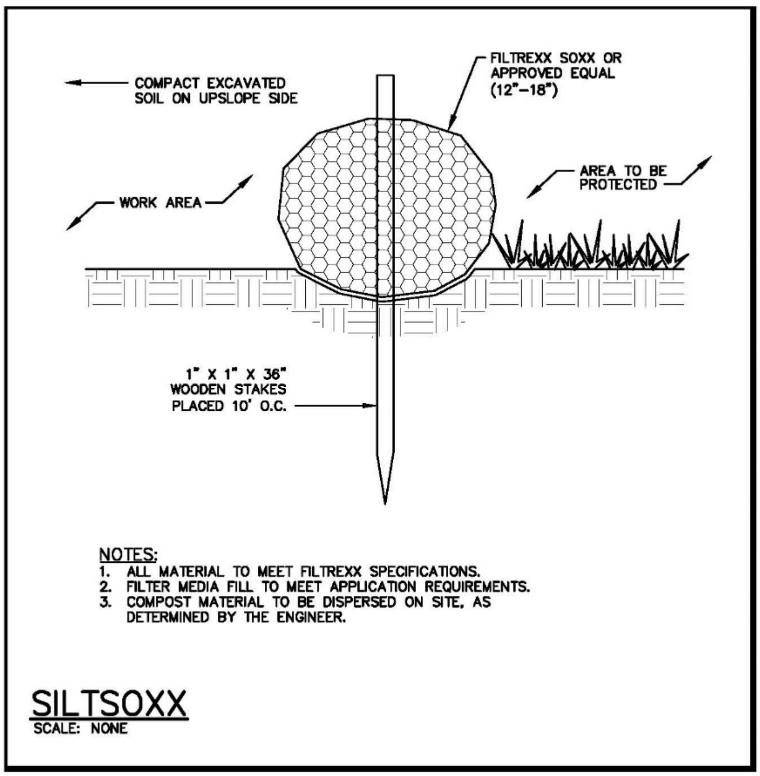
- Stabilization of surfaces includes the placement of pavement, rip-rap, wood bark mulch and the establishment of vegetated surfaces.
- Upon completion of construction, all surfaces shall be stabilized even though it is apparent that future construction efforts will cause their disturbance.
- Vegetated cover shall be established during the proper growing season and shall be enhanced by soil adjustment for proper pH, nutrients and moisture content.
- Surfaces that are disturbed by erosion processes or vandalism shall be stabilized as soon as possible.
- Areas where construction activities have permanently or temporarily ceased shall be stabilized within 14 days from the last construction activity, except when construction activity will resume within 21 days (e.g., the total time period that construction activity is temporarily ceased is less than 21 days).
- Hydro-mulching of grass surfaces is recommended, especially if seeding of the surfaces is required outside the normal growing season.
- Hay mulch is an effective method of temporarily stabilizing surfaces, but only if it is properly secured by branches, weighted snow fences or weighted chicken wire.

4.7 Temporary Structural Erosion Control Measures

Temporary erosion control measures serve to minimize construction-associated impacts to undisturbed areas. Please refer to the following sections for a description of temporary erosion control measures implemented as part of the project and this sample SWPPP.

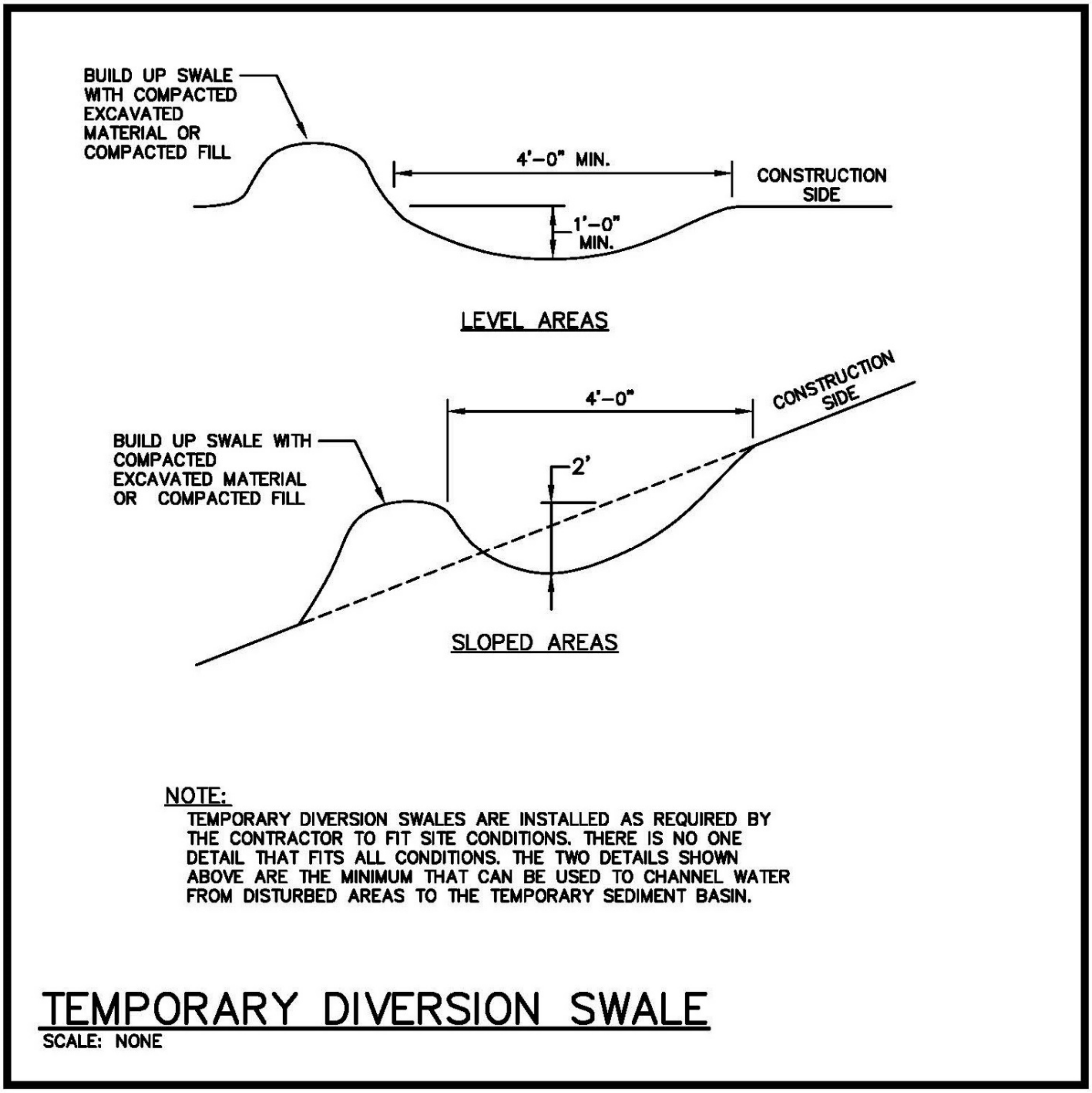
4.7.1 Staked Erosion Control Barrier

The siltation barriers will demarcate the limit of work, form a work envelope and provide additional assurance that construction equipment will not enter the undisturbed portions of the site. All barriers will remain in place until disturbed areas are stabilized.



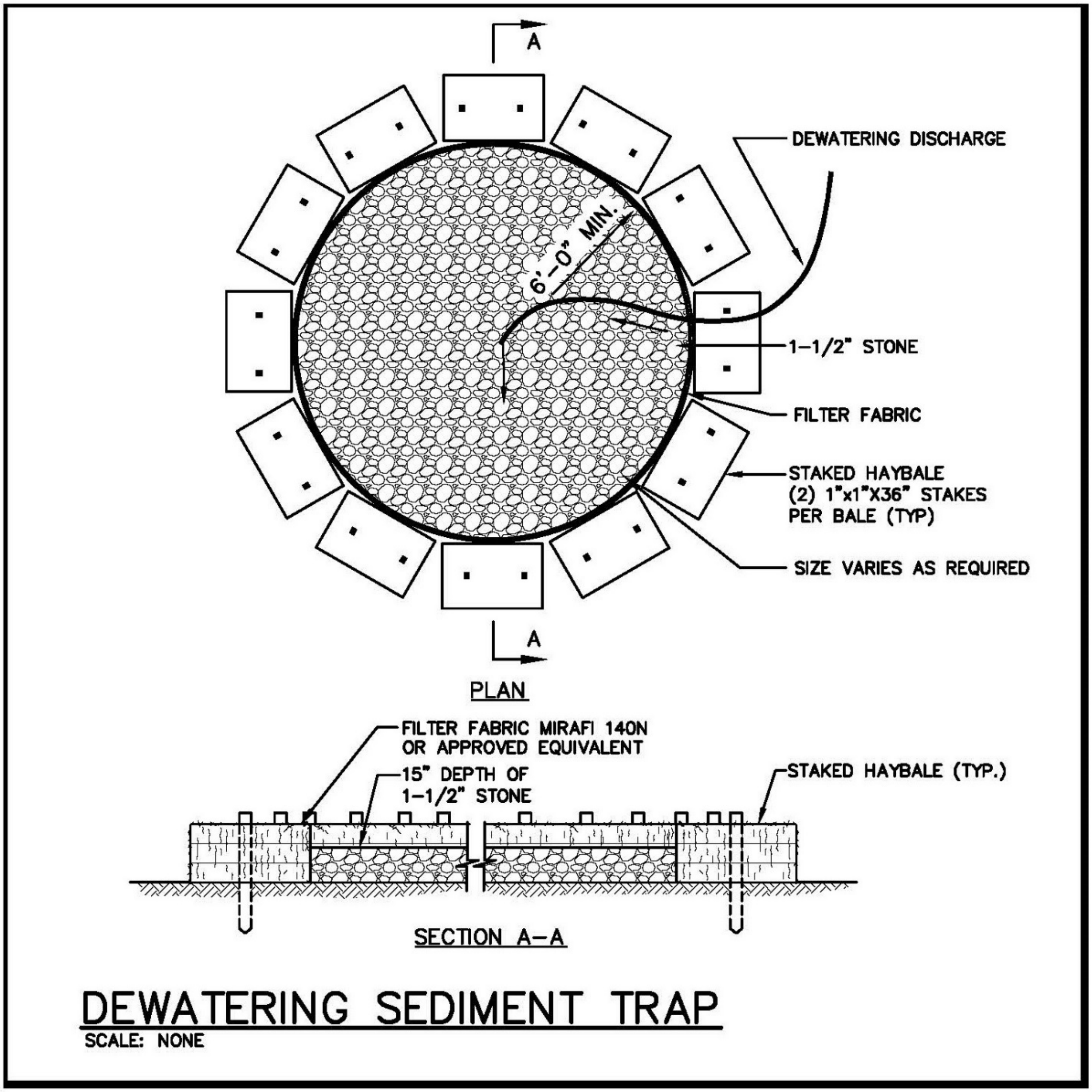
4.7.2 Temporary Stormwater Diversion Swale

A temporary diversion swale is an effective practice for temporarily diverting stormwater flows and to reduce stormwater runoff velocities during storm events. The swale channel can be installed before infrastructure construction begins at the site, or as needed throughout the construction process. The diversion swale should be routinely compacted or seeded to minimize the amount of exposed soil.



4.7.3 Dewatering Basins

Dewatering may be required during stormwater system, foundation construction and utility installation. Should the need for dewatering arise, groundwater will be pumped directly into a temporary settling basin, which will act as a sediment trap during construction. All temporary settling basins will be located within close proximity of daily work activities. Prior to discharge, all groundwater will be treated by means of the settling basin or acceptable substitute. Discharges from sediment basins will be free of visible floating, suspended and settleable solids that would impair the functions of a wetland or degrade the chemical composition of the wetland resource area receiving ground or surface water flows and will be to the combined system.



4.7.4 Material Stockpiling Locations

Piping and trench excavate associated with the subsurface utility work will be contained with a single row of silt socks and/or haybales.

4.8 Permanent Structural Erosion Control Measures

Permanent erosion control measures serve to minimize post-construction impacts to undisturbed areas. Please refer to the following sections for a description of permanent erosion control measures implemented as part of the project and this SWPPP.

4.9 Good Housekeeping Best Management Practices

4.9.1 Material Handling and Waste Management

Solid waste generation during the construction period will be primarily construction debris. The debris will include scrap lumber (used forming and shoring pallets and other shipping containers), waste packaging materials (plastic sheeting and cardboard), scrap cable and wire, roll-off containers (or dumpsters) and will be removed by a contract hauler to a properly licensed landfill. The roll-off containers will be covered with a properly secured tarp before the hauler exits the site. In addition to construction debris, the construction work force will generate some amount of household-type wastes (food packing, soft drink containers, and other paper). Trash containers for these wastes will be located around the site and will be emptied regularly to prevent wind-blown litter. This waste will also be removed by a contract hauler.

All hazardous waste material such as oil filters, petroleum products, paint and equipment maintenance fluids will be stored in structurally sound and sealed shipping containers in the hazardous-materials storage area and segregated from other non-waste materials. Secondary containment will be provided for all materials in the hazardous materials storage area and will consist of commercially available spill pallets. Additionally, all hazardous materials will be disposed of in accordance with federal, state and municipal regulations.

Two temporary sanitary facilities (portable toilets) will be provided at the site in the combined staging area. The toilets will be away from a concentrated flow path and traffic flow and will have collection pans underneath as secondary treatment. All sanitary waste will be collected from an approved party at a minimum of three times per week.

4.9.2 Building Material Staging Areas

Construction equipment and maintenance materials will be stored at the combined staging area and materials storage areas. Silt fence will be installed around the perimeter to designate the staging and materials storage area. A watertight shipping container will be used to store hand tools, small parts and other construction materials.

Non-hazardous building materials such as packaging material (wood, plastic and glass) and construction scrap material (brick, wood, steel, metal scraps, and pine cuttings) will be stored in a separate covered storage facility adjacent to other stored materials. All hazardous-waste materials such as oil filters, petroleum products, paint and equipment maintenance fluids will be stored in structurally sound and sealed containers under cover within the hazardous materials storage area.

Large items such as framing materials and stockpiled lumber will be stored in the open storage area. Such materials will be elevated on wood blocks to minimize contact with runoff.

The combined storage areas are expected to remain clean, well-organized and equipped with ample cleaning supplies as appropriate for the materials being stored. Perimeter controls such as containment structures, covers and liners will be repaired or replaced as necessary to maintain proper function.

4.9.3 Designated Washout Areas

Designated temporary, below-ground concrete washout areas will be constructed, as required, to minimize the pollution potential associated with concrete, paint, stucco, mixers etc. Signs will, if required, be posted marking the location of the washout area to ensure that concrete equipment operators use the proper facility. Concrete pours will not be conducted during or before an anticipated precipitation event. All excess concrete and concrete washout slurries from the concrete mixer trucks and chutes will be discharged to the washout area or hauled off-site for disposal.

4.9.4 Equipment/Vehicle Maintenance and Fueling Areas

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/vehicle fueling and maintenance will be performed off-site. A small, 20-gallon pickup bed fuel tank will be kept on-site in the combined staging area. When vehicle fueling must occur on-site, the fueling activity will occur in the staging area. Only minor equipment maintenance will occur on-site. All equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallets. Absorbent, spill-cleanup materials and spill kits will be available at the combined staging and materials storage area. Drip pans will be placed under all equipment receiving maintenance and vehicles and equipment parked overnight.

4.9.5 Equipment/Vehicle Wash down Area

All equipment and vehicle washing will be performed off-site.

4.9.6 Spill Prevention Plan

A spill containment kit will be kept on-site in the Contractor's trailer and/or the designated staging area throughout the duration of construction. Should there be an accidental release of petroleum product into a resource area, the appropriate agencies will be immediately notified.

4.9.7 Inspections

Maintenance of existing and proposed BMP's to address stormwater management facilities during construction is an on-going process. The purpose of the inspections is to observe all sources of stormwater or non-stormwater discharge as identified in the SWPPP as well as the status of the receiving waters and fulfill the requirements of the Order of Conditions. The following sections describe the appropriate inspection measures to adequately implement the project's SWPPP. A blank inspection form is provided at the end of this section. Completed inspection forms are to be maintained on site.

Inspection Personnel

The owner's appointed representative will be responsible for performing regular inspections of erosion controls and ordering repairs as necessary.

Inspection Frequency

Inspections will be performed by qualified personnel once every 7 days and within 24-hours after a storm event of greater than one-quarter inch, in accordance with the CGP. The inspections must be documented on the inspection form provided at the end of this section, and completed forms will be provided to the on-site supervisor and maintained at the Owner's office throughout the entire duration of construction.

Inspection Reporting

Each inspection report will summarize the scope of the inspection, name(s) and qualifications of personnel making the inspection, and major observations relating to the implementation of the SWPPP, including compliance and non-compliance items. Completed inspection reports will remain with the completed SWPPP on site.

4.9.8 Amendment Requirements

The final SWPPP is intended to be a working document that is utilized regularly on the construction site, and provides guidance to the Contractor. It must reflect changes made to the originally proposed plan and will be updated to include project specific activities and ensure that they are in compliance with the NPDES General Permit and state and local laws and regulations. It should be amended whenever there is a change in design, construction, operation or maintenance that affects discharge of pollutants. The following items should be addressed should an amendment to the SWPPP occur:

- Dates of certain construction activities such as major grading activities, clearing and initiation of and completion of stabilization measures should be recorded.
- Future amendments to the SWPPP will be recorded as required. As this SWPPP is amended, all amendments will be kept on site and made part of the SWPPP.
- Upon completion of site stabilization (completed as designed and/or 70% background vegetative cover), it can be documented and marked on the plans. Inspections are no longer required at this time.
- Inspections often identify areas not included in the original SWPPP, which will require the SWPPP to be amended. These updates should be made within seven days of being recognized by the inspector.

4.10 SWPPP Inspection and Maintenance Report

The following form is an example to be used for SWPPP Inspection Reporting.

Stormwater Construction Site Inspection and Maintenance Report

TO BE COMPLETED AT LEAST EVERY 7 DAYS AND WITHIN 24 HOURS OF A STORM EVENT OF AT LEAST 0.25 INCHES. AFTER SITE STABILIZATION, TO BE COMPLETED AT LEAST ONCE PER MONTH FOR THREE YEARS OR UNTIL A NOTICE OF TERMINATION IS FILED (IF APPLICABLE).

General Information			
Project Name	Photovoltaic System		
NPDES Tracking No. (if applicable)		**Location**	200 Route 15 Sturbridge, MA 01566
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
1	Catch Basin Protection	❑Yes ❑No	❑Yes ❑No	
2	Haybale & Silt Fencing	❑Yes ❑No	❑Yes ❑No	
3	Straw Wattles	❑Yes ❑No	❑Yes ❑No	
4	Construction Entrance	❑Yes ❑No	❑Yes ❑No	
5	Sediment Basins	❑Yes ❑No	❑Yes ❑No	
6	Dewatering Pit	❑Yes ❑No	❑Yes ❑No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any	❑Yes ❑No	❑Yes ❑No	Vehicle Maintenance not allowed on site

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
	other deleterious material?			
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Print name and title: ____.
(Qualified Person Performing the Inspection)

Signature:______________________________ **Date:** ____________.

Print name and title: ____
(Contractor/Operator)

Signature:______________________________ **Date:**____________

SECTION 5.0

LONG-TERM POLLUTION PREVENTION & OPERATION AND MAINTENANCE PLAN

5.0 LONG-TERM POLLUTION PREVENTION & OPERATION AND MAINTENANCE PLAN

As required by Standard #4 of the Stormwater Management Policy, this Long-Term Pollution Prevention Plan has been developed for source control and pollution prevention at the site after construction.

MAINTENANCE RESPONSIBILITY

Ensuring that the provisions of the Long-Term Pollution Prevention Plan are followed will be the responsibility of The Applicant.

GOOD HOUSEKEEPING PRACTICES

The site to be kept clean of trash and debris at all times. Trash, junk, etc. is not to be left outside.

REQUIREMENTS FOR ROUTINE INSPECTIONS AND MAINTENANCE OF STORMWATER BMPS

All stormwater BMPs are to be inspected and maintained as follows.

Siltsoxx, Silt Fence, and other temporary measures

The temporary erosion control measures will be installed up gradient of any area where any disturbance or alteration might otherwise allow for erosion or sedimentation. They will be regularly inspected to ensure that they are functioning adequately. Additional supplies of these temporary measures will be stockpiled on site for any immediate needs or routine replacement.

Subsurface Drainage System

Maintenance is required for the proper operation of the underground infiltration system. Infiltration systems are prone to failure due to clogging if the upstream water quality units are not maintained. The use of pretreatment BMPs will minimize failure and maintenance requirements.

After construction, the infiltration system shall be inspected after every major storm for the first few months to ensure proper stabilization and function. Water levels in the access ports shall be recorded over several days to check the drainage of the systems. It is recommended that a logbook be maintained showing the depth of water in the detention infiltration systems at each observation in order to determine the rate at which the system dewaters after runoff producing storm events. Once the performance characteristics of the detention/infiltration have been verified, the monitoring schedule can be reduced to an annual basis, unless the performance data suggests that a more frequent schedule is required.

Preventative maintenance on the infiltration system shall be performed at least twice a year, and sediment shall be removed from any and all pretreatment and collection structures. Sediment shall be removed when deposits approach within six inches of the invert heights of connecting pipes between unit rows or sumped inlet structures. Ponded water inside the system (as visible from the access ports) that remain after several days most likely indicates that the bottom of the system is clogged and will require cleaning or replacement.

The system is designed with a defined top portal area at the “down-flow” end of the chamber that can be cut out to accept up to a 10-inch diameter riser pipe. The 10-inch riser can be used as an observation well and as access for a vacuum truck tube for use in removing sediment. The “down flow” ends of the units have end walls that are closed on the bottom. The closed bottom functions like a coffer dam, with most of the sediment depositing prior to flowing into the next chamber, facilitating its removal through the riser pipe, which is positioned directly above this area.

Infiltration Basin

Infiltration basins are prone to clogging and failure, so it is imperative to develop and implement aggressive maintenance plans and schedules. Installing the required pretreatment BMPs will significantly reduce maintenance requirements for the basin.

The Operation and Maintenance Plan required by Standard 9 must include inspections and preventive maintenance at least twice a year, and after every time drainage discharges through the high outlet orifice. The Plan must require inspecting the pretreatment BMPs in accordance with the minimal requirements specified for those practices and after every major storm event. A major storm event is defined as a storm that is equal to or greater than the 2-year, 24-hour storm (generally 2.9 to 3.6 inches in a 24-hour period, depending in geographic location in Massachusetts).

Once the basin is in use, inspect it after every major storm for the first few months to ensure it is stabilized and functioning properly and if necessary, take corrective action. Note how long water remains standing in the basin after a storm; standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity may have been overestimated. If the ponding is due to clogging, immediately address the reasons for clogging (such as upland sediment erosion, excessive compaction of soils, or low spots). Thereafter, inspect the infiltration basin at least twice per year. Important items to check during the inspection schedule: signs of differential settlement, cracking, erosion, leakage in the embankments, tree growth on the embankments, condition of riprap, sediment accumulation, and the health of the turf.

At least twice a year, mow the buffer area, side slopes, and basin bottom. Remove grass clippings and accumulated organic matter to prevent an impervious organic mat from forming. Remove trash and debris at the same time. Use deep tilling to break up clogged surfaces and revegetate immediately.

Remove sediment from the basin as necessary but wait until the floor of the basin is thoroughly dry. Use light equipment to remove the top layer to not compact the underlying soil. Deeply till the remaining clean pretreatment devices associated with basins at least twice a year, and ideally every other month.

Water Quality Unit, Catch Basins, and Drain Manholes

Regular maintenance is essential. Water quality units, catch basins, and drain manholes will only remain effective if they are cleaned out frequently. Inspect or clean out the unit at least four times per year and at the end of the foliage and snow-removal seasons. Sediments must also be removed four times a year or whenever the depth of the deposits is greater than or equal to one half of the depth from the bottom of the invert of the lowest pipe in the unit. Additional cleaning may be necessary.

Clamshell buckets or vacuum trucks are typical methods for removing sediment from the unit. Vacuuming is a much more time effective process. Also consider safety when cleaning the unit if the unit is in a roadway with active traffic.

Grassed Channel

Grassed channels must be inspected semi-annually for the first-year post construction, and at least once a year thereafter. Mowing shall occur on an as-needed basis during the growing season so that the height of grass does not exceed six inches. Sediment shall be removed from the channel on a yearly basis and shall also be cleaned as needed. Sediment shall be removed using hard methods to minimize the disturbance to vegetation and underlying soils. Prior to mowing, all trash and debris shall be removed from the channel. Mowing shall not occur beneath the depth of the design flow during the storm associated with the water quality event.

PROVISIONS FOR MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPE AREAS

Suggested Maintenance Operations

The use of pesticides, fertilizers, and herbicides are prohibited within the 100-foot buffer. The use of salts, quick release fertilizers, and quick release herbicides are prohibited within the 200-foot buffer.

A. Trees and Shrubs

Disease and Pest Management - Prevention of disease or infestation is the first step of Pest Management. A plant that is in overall good health is far less susceptible to disease. Good general landscape maintenance can reduce problems from disease.

Inspections of plant materials for signs of disease or infestation are to be performed monthly by the Landscape Maintenance Contractor's Certified Arborist. This is a critical step for early diagnosis. Trees and Shrubs that have been diagnosed to have a plant disease or an infestation of insect pests are to be treated promptly with an appropriate material by a licensed applicator.

Watering - Trees and Shrubs will need supplemental watering to remain in vigorous health. All new plants need to be watered once a week in cool weather, twice a week during warm weather, and up to three times in a week during periods of extreme heat and drought. Trees and shrubs should be watered in such a manner as to totally saturate the soil in the root zone area. Over-watering or constant saturation of the soil must be avoided as this could lead to root rot and other disease problems. The use of a soil moisture meter can help you monitor the soil's water intake.

Plant Replacement - Unhealthy plants that may cause widespread infestation of other nearby plants shall be immediately removed from the site. Any vegetation removed from the site must be recorded and submitted with the daily maintenance log. The area shall be treated to prevent further infestation. The plant shall then be replaced with a healthy specimen of the same species and size. This work shall have a pre-established budget allowance for the year.

A spring inspection of all plant materials shall be performed to identify those plant materials that are not in vigorously healthy condition. Unhealthy plant materials shall be evaluated. If the problem is determined to be minor the plant material shall be given appropriate restorative care in accordance with this maintenance guideline until it is restored to a vigorously healthy condition. Unhealthy plant materials that do not respond to restorative care or are determined to be beyond saving shall be replaced with a healthy specimen of the same species and size. In the case of the necessity of replacing extremely large plant materials the Landscape Architect shall determine the size of the replacement plant.

Pruning - Proper pruning is the selective removal of branches without changing the plant's natural appearance, or habit of growth. All tree pruning is to be performed by a licensed Arborist. All branches that are dead, broken, scared or crossing should be removed. All cuts should be made at the collar and not cut flush with the base.

Pruning on the site shall be done for the following purposes;

- To maintain or reduce the size of a tree or shrub
- To remove dead, diseased or damaged branches
- To rejuvenate old shrubs and encourage new growth
- To stimulate future flower and fruit development
- To maximize the visibility of twig color
- To prevent damage and reduce hazards to people and properties

All shrubs are recommended to be pruned on an annual basis to prevent the shrub from becoming overgrown and eliminate the need for drastic pruning. There are several types of pruning for deciduous shrubs. Hand snips should be used to maintain a more natural look or hand shears can be used for a more formal appearance.

Winter Protection - All trees and shrubs are to be watered and mulched before the first frost. All stakes should be checked, and ties adjusted. Damaged branches should be pruned.

Broadleaf and Coniferous Evergreen plant materials are to be sprayed with an anti-desiccant product to prevent winter burn. The application shall be repeated during a suitable mid-winter thaw.

Shrubs located in areas likely to be piled with snow during snow removal (but not designated as Snow Storage Areas) shall be marked by six-foot high poles with bright green banner flags. Stockpiles of snow are not to be located in these areas due to potential damage to the plant materials from both the weight of the snow and the snow melting chemicals.

At the fall landscape maintenance conference parameters will be discussed between the Landscape Maintenance Contractor and the snow removal contractor to assure minimal damage and loss of landscape amenities during the winter season.

Seasonal Clean Up - A thorough spring cleanup is to be performed. This includes the removal and replacement of dead or unhealthy plant materials and the cleanup of plant debris and any general debris that has accumulated over the winter season. Mulch is to be lightly raked to clean debris from the surface without removing any mulch. Twigs and debris are to be removed from the planting beds throughout the growing season.

Mulching - Planting beds shall be mulched with a treated shredded hardwood mulch free from dirt, debris, and insects. A sample of this mulch shall be given to the Owner for approval prior to installation.

Maintain a 2-3" maximum depth and keep free of weeds either by hand weeding or by the use of a pre-emergent weed control such as Treflan or Serfian. Seasonal re-mulching shall occur as necessary in the spring and the fall to maintain this minimum depth. When new mulch is added to the planting bed it shall be spread to create a total depth of no more than three inches. Edges should be maintained in a cleanly edged fashion.

Mulch shall not be placed directly against the trunk of any tree or shrub.

B. Groundcover and Perennials

Disease and Pest Management – Pesticides and herbicides should be applied only as problems occur, with the proper chemical applied only by a trained professional or in the case of pesticide, a Certified Pesticide Applicator. Plants should be monitored weekly and treated accordingly.

Water – Groundcovers and Perennials will need supplemental watering in order to become established, healthy plants. All new plants need to be watered once a week in cool weather, twice a week during warm weather, and up to three times in a week during periods of extreme heat and drought. Until established, groundcovers and perennials should be watered in such a manner as to totally saturate the soil in the root zone area, to a depth of 6 inches. Once established, perennials shall continue to be watered as necessary to maintain them in a vigorous healthy condition. Over-watering or constant saturation of the soil must be avoided as this could lead to root rot and other disease problems. The use of a soil moisture meter can help you monitor the soil's water intake.

On-site water shall be furnished by the Owner. Hose and other watering equipment shall be furnished by the Landscape Maintenance Contractor.

Replacement – Any unhealthy plant/s that may cause widespread infestation of other nearby plants shall be immediately removed from the site. Any vegetation removed from the site must be recorded and submitted with the landscape maintenance log. The area shall be treated to prevent further infestation. The plant/s shall then be replaced with healthy specimen/s of the same species and size. Old Forge shall have a pre-established budget allowance for this type of replacement, each year.

Plant material that is damaged as a result of other landscape maintenance activities, such as mowing, shall be replaced with healthy specimens of the same species and size, at no additional cost to the owner.

Deadheading – Perennials shall be checked on a weekly basis and dead-headed once flowers have faded or as necessary based on plant type and duration of flower. Spent flowers can be pinched off with the thumb and forefinger. Continue to remove all faded flowers until Fall. All associated debris shall be removed from site daily.

Staking – Upright-growing perennials need support especially when in flower. Use of bamboo stakes, galvanized wire hoops or mesh may be necessary for their support. Supports should be put in place before they have become too difficult to handle. The supports should not be taller than the mature height of the perennial plant.

Division of Perennials – Two or three-year-old perennials are easily divided in the spring if more plants are needed. To divide, cut out the entire section of plant to be divided, including roots. The larger divisions (those with three or more shoots), can be set out immediately in their permanent location, where they can be expected to bloom the same season. Smaller divisions are best planted in an out-of-the-way planting bed until the following autumn or spring, when they can be moved to their permanent location.

Weeding – All planting beds should be kept weed-free. Weed either by hand or with a pre-emergent herbicide such as Treflen used according to manufacturers' specifications. Manual weeding is to be used in combination with the use of spot applications of herbicides. Both live and dead weeds are to be pulled and removed from the site.

All herbicide applications shall be documented in the Landscape Maintenance Log. The actual product label or the manufacturer's product specification sheet for the specific product shall also be included in the Log.

Only personnel with appropriate applicator licenses shall supervise and/or perform the application of pesticide products requiring a license.

Winterizing – Perennial gardens should be cleaned-up when growth ceases in the fall. Remove foliage of plants that normally die down to the ground. Divide and replant over-grown clumps.

C. Grass Areas (Meadow)

Mowing – Meadow grasses should be maintained at a maximum height of 12 inches. Maintaining grasses no higher than this is critical to prevent tall grass from casting shadows onto the solar panels, lowering their efficiency.

Mowing frequency – Typically, a solar field will need to be mowed once every month. Mowing frequency will vary with the growing season and should be set by the plant height and not a set date. Mowing frequency should be reduced during periods of stress.

When mowing any area, try to alternate mowing patterns. This tends to keep grass blades more erect and assures an even cut. A dull mower will cause color loss due to tearing of the turf plant, and since mowing will ultimately determine the appearance of any turf area there is an absolute necessity for a clean sharp cut.

Weed & Pest Control and Fertilizing- Not needed.

Weed Control – Not needed.

Pest Control – Not needed.

Lime – Not needed.

Lawn Maintenance Task Schedule

MARCH (Weather permitting)
- Clean up winter debris, sand, leaves, trash etc.
- Re-edge mulch beds, maintain at 2-3" maximum.
- Fertilize plants

APRIL
- Reseed or sod all areas needing attention.

- Start mowing when meadow grasses reach 12”, mow to 6”

MAY
- Mow meadow grasses to height of 6”
- Check for disease and pest problems in both turf and plants.

JUNE
- Mow meadow grasses to height of 6”
- Check for disease and pest problems in both turf and plants, treat as necessary.

PROVISIONS FOR SOLID WASTE MANAGEMENT (SITE TRASH)

Trash will not be generated at this site and there will be no dumpsters or receptacles provided for solid waste.

SNOW DISPOSAL AND PLOWING PLANS

Snow plowing will be the responsibility of the owner. The purpose of the snow and snowmelt management plan is to provide guidelines regarding snow disposal site selection, site preparation and maintenance that are acceptable to the Department of Environmental Protection. For the areas that require snow removal, snow storage onsite will largely be accomplished by using pervious areas along the shoulder of the roadway and development as windrowed by plows.

- Avoid dumping of snow into any water body, including rivers, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid disposing of snow on top of storm drain catch basins or in stormwater basins. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

WINTER ROAD SALT AND/OR SAND USE AND STORAGE RESTRICTIONS

The owner will be responsible for sanding and salting the site. No storage on site.

STREET SWEEPING SCHEDULES

Not applicable.

This project has not included street sweeping as part of the TSS removal calculations. However, if sand accumulates on site from the adjacent roadway, a street sweeping may be required. This would likely occur after the spring snow melt.

Reuse and Disposal of Street Sweepings

Once removed from paved surfaces, the sweepings must be handled and disposed of properly. Mass DEP’s Bureau of Waste Prevention has issued a written policy regarding the reuse and disposal of street sweepings. These sweepings are regulated as a solid waste, and can be used in three ways:

- In one of the ways already approved by Mass DEP (e.g., daily cover in a landfill, additive to compost, fill in a public way)
- If approved under a Beneficial Use Determination
- Disposed in a landfill

TRAINING OF STAFF OR PERSONNEL INVOLVED WITH IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN

The Long-Term Pollution Prevention Plan is to be implemented by property owner of the site. Trained and, if required, licensed Professionals are to be hired by the owner as applicable to implement the Long-Term Pollution Prevention Plan.

LIST OF EMERGENCY CONTACTS FOR IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN

The applicant will be required to implement the Long-Term Pollution Prevention Plan and will create and maintain a list of emergency contacts.

POST CONSTRUCTION PHASE INSPECTION SCHEDULE AND EVALUATION CHECKLIST

Inspection Date	Inspector	BMP Inspected	Inspection Frequency Requirements	Comments	Recommendation	Follow-up Inspection Required (yes/no)
		Water Quality Unit, Catch Basin, & Drain Manhole	4 times a year			
		Subsurface Drainage Systems	2 times a year			
		Infiltration Basin	2 times a year			
		Grassed Channel	Annually			

1. Refer to the Massachusetts Stormwater Handbook Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspections and maintenance of specific BMP's

2. Inspections to be conducted by a qualified professional such as an environmental scientist or civil engineer.

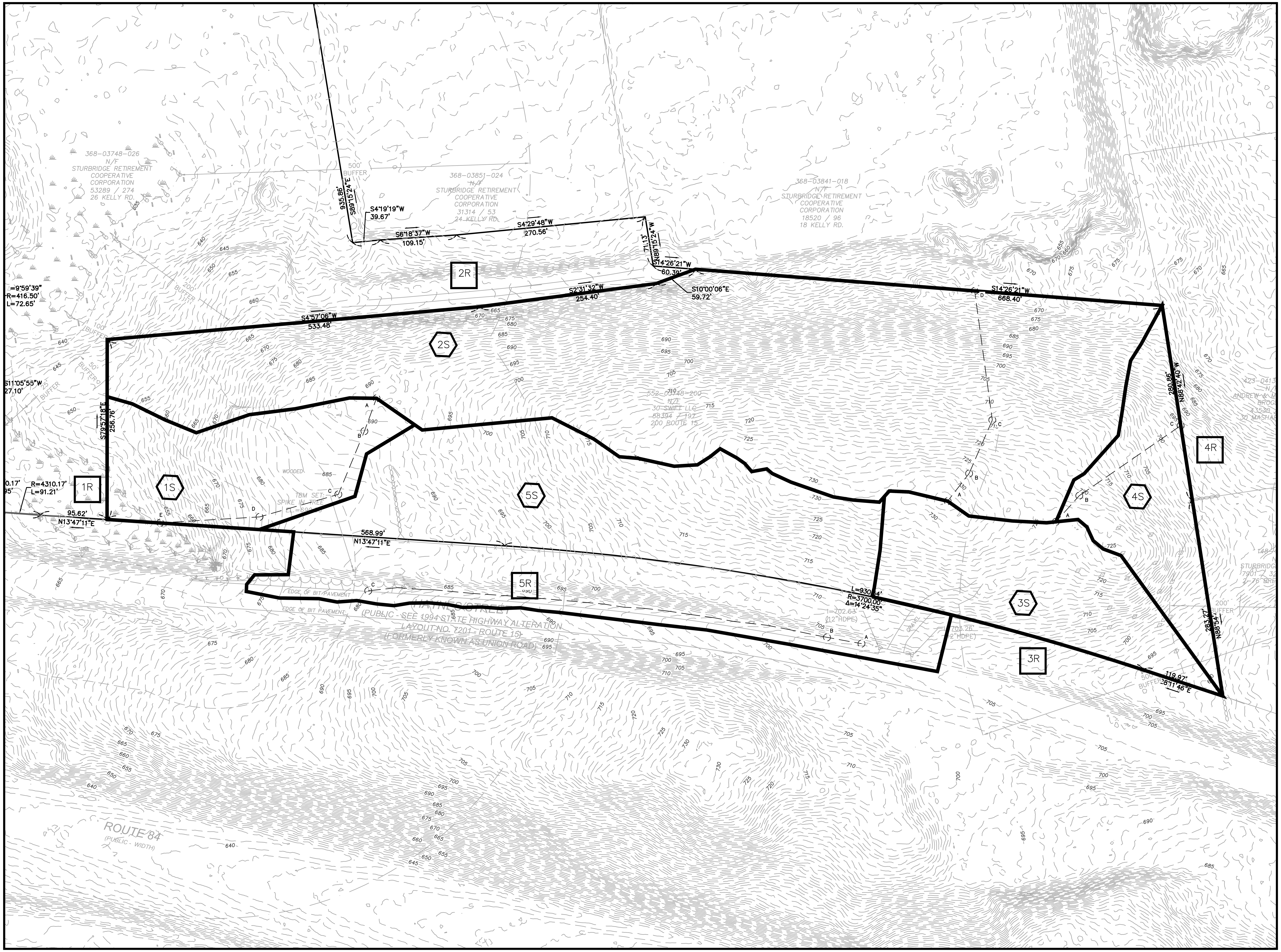
3. Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.

4. Other Notes: (Include deviations from Conservation Commission Approvals, Planning Board Approvals and Approved Plans)

SECTION 6.0

HYDROLOGY CALCULATIONS

6.01 EXISTING WATERSHED PLAN



BRIAN G. YERGATIAN
PROFESSIONAL ENGINEER

DATE

GROUND-MOUNTED PHOTOVOLTAIC SYSTEM

200 ROUTE 15

IN

STURBRIDGE MASSACHUSETTS

(WORCESTER COUNTY)

PRE-DEVELOPMENT WATERSHED PLAN

APRIL 7, 2023

REVISIONS:

NO.	DATE	DESC.

PREPARED FOR:

STURBRIDGE PV, LLC
2420 17TH STREET
DENVER, CO 80202

BSC GROUP
349 Main Street - Route 28
West Yarmouth, Massachusetts
02673
508 778 8919

SCALE: 1" = 60'

0 30 60 120 FEET

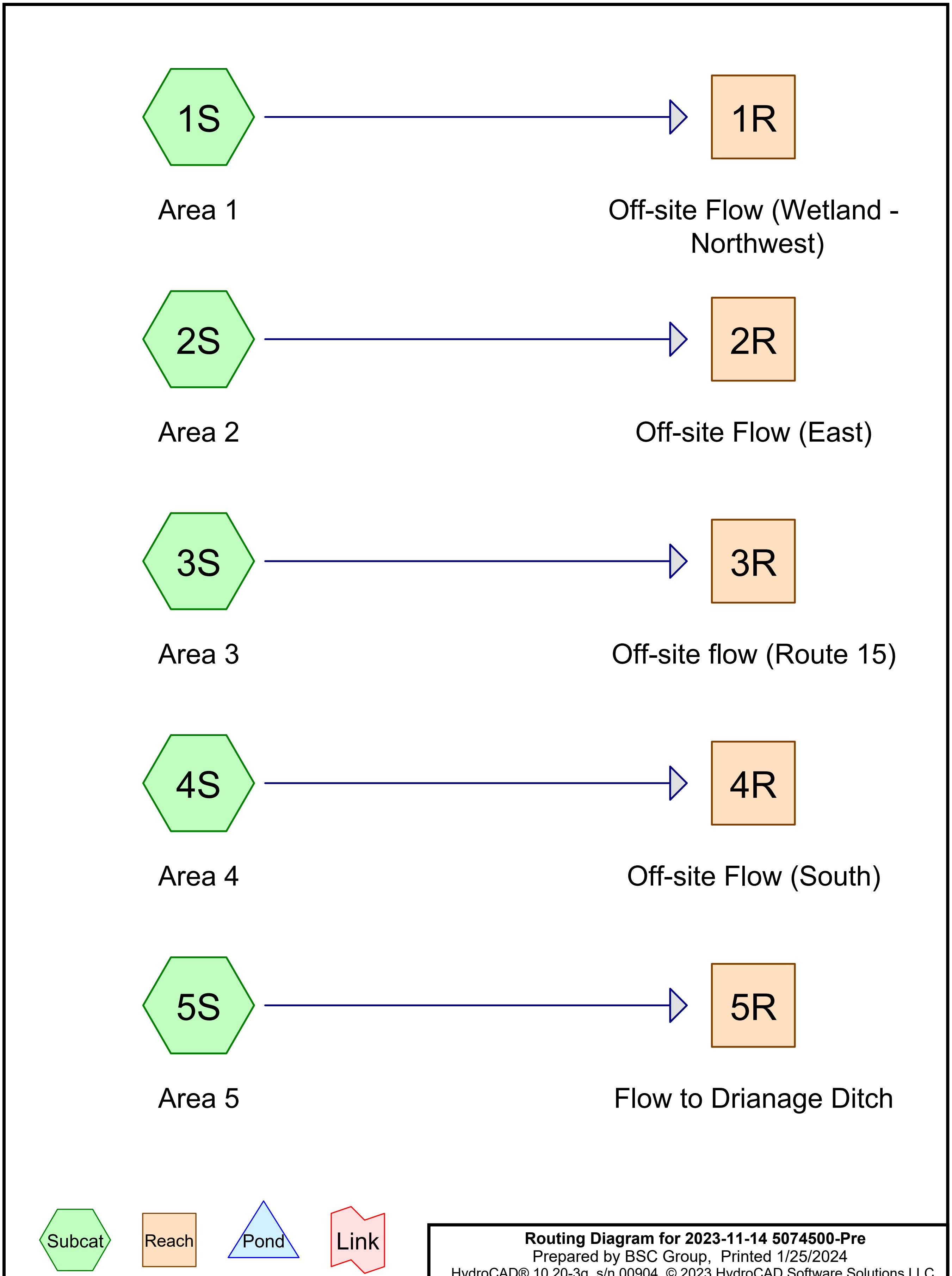
FILE: PROJECTS-YAR\5074500\C\D\5074500-SP.dwg

DWG.: DWG

JOB. NO: 5-0745.00

SHEET 1 OF 1

6.02 EXISTING HYDROLOGY CALCULATIONS (HYDROCAD™ PRINTOUTS)



Routing Diagram for 2023-11-14 5074500-Pre
Prepared by BSC Group, Printed 1/25/2024
HydroCAD® 10.20-3g s/n 00904 © 2023 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.23	2
2	10-year	Type III 24-hr		Default	24.00	1	5.04	2
3	25-year	Type III 24-hr		Default	24.00	1	6.17	2
4	50-year	Type III 24-hr		Default	24.00	1	7.00	2
5	100-year	Type III 24-hr		Default	24.00	1	7.92	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.325	61	>75% Grass cover, Good, HSG B (5S)
0.037	96	Gravel surface, HSG B (5S)
0.277	98	Paved parking, HSG B (5S)
15.255	55	Woods, Good, HSG B (1S, 2S, 3S, 4S, 5S)
15.893	**56**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
15.893	HSG B	1S, 2S, 3S, 4S, 5S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
15.893		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.325	0.000	0.000	0.000	0.325	>75% Grass cover, Good	5S
0.000	0.037	0.000	0.000	0.000	0.037	Gravel surface	5S
0.000	0.277	0.000	0.000	0.000	0.277	Paved parking	5S
0.000	15.255	0.000	0.000	0.000	15.255	Woods, Good	1S, 2S, 3S, 4S, 5S
0.000	**15.893**	**0.000**	**0.000**	**0.000**	**15.893**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area 1 Runoff Area=58,975 sf 0.00% Impervious Runoff Depth>0.26"
Flow Length=407' Tc=13.5 min CN=55 Runoff=0.14 cfs 0.029 af

Subcatchment 2S: Area 2 Runoff Area=315,168 sf 0.00% Impervious Runoff Depth>0.26"
Flow Length=318' Tc=8.5 min CN=55 Runoff=0.78 cfs 0.156 af

Subcatchment 3S: Area 3 Runoff Area=66,458 sf 0.00% Impervious Runoff Depth>0.26"
Flow Length=212' Tc=11.1 min CN=55 Runoff=0.16 cfs 0.033 af

Subcatchment 4S: Area 4 Runoff Area=47,465 sf 0.00% Impervious Runoff Depth>0.26"
Flow Length=226' Tc=8.2 min CN=55 Runoff=0.12 cfs 0.023 af

Subcatchment 5S: Area 5 Runoff Area=204,223 sf 5.90% Impervious Runoff Depth>0.35"
Flow Length=660' Slope=0.0200 '/' Tc=15.9 min CN=58 Runoff=0.77 cfs 0.137 af

Reach 1R: Off-site Flow (Wetland - Northwest) Inflow=0.14 cfs 0.029 af
Outflow=0.14 cfs 0.029 af

Reach 2R: Off-site Flow (East) Inflow=0.78 cfs 0.156 af
Outflow=0.78 cfs 0.156 af

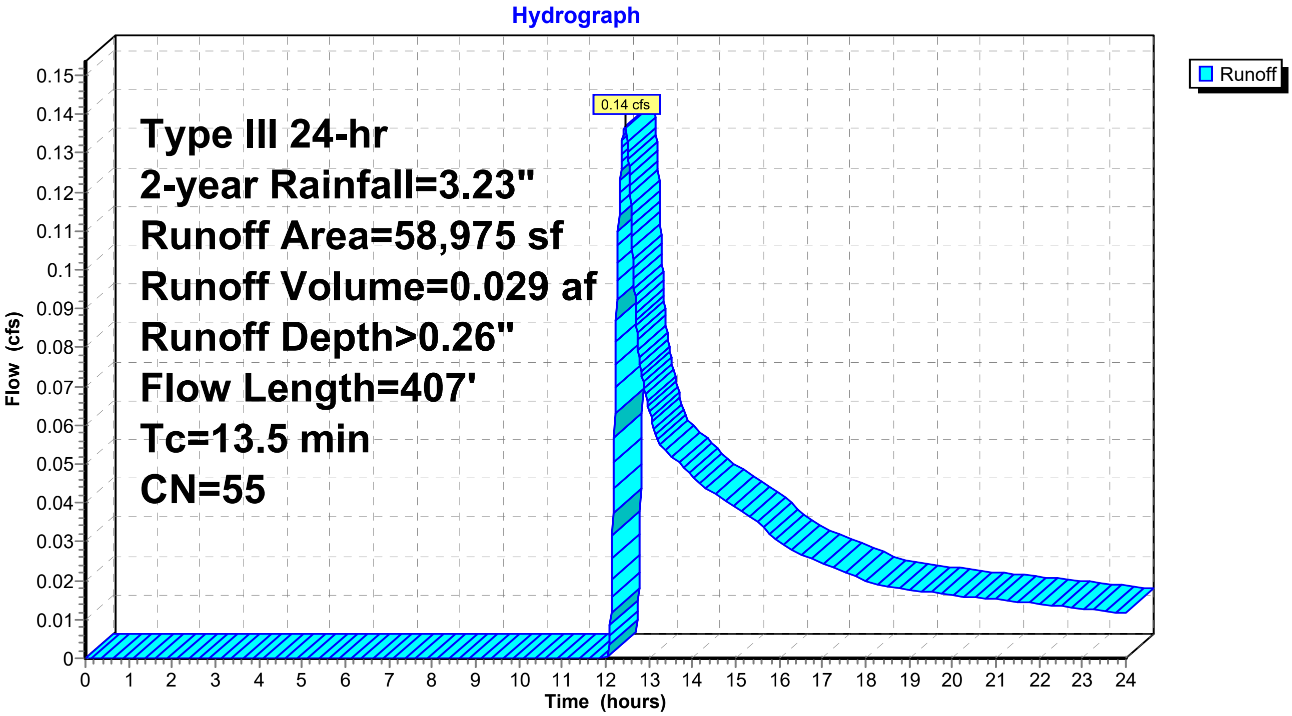
Reach 3R: Off-site flow (Route 15) Inflow=0.16 cfs 0.033 af
Outflow=0.16 cfs 0.033 af

Reach 4R: Off-site Flow (South) Inflow=0.12 cfs 0.023 af
Outflow=0.12 cfs 0.023 af

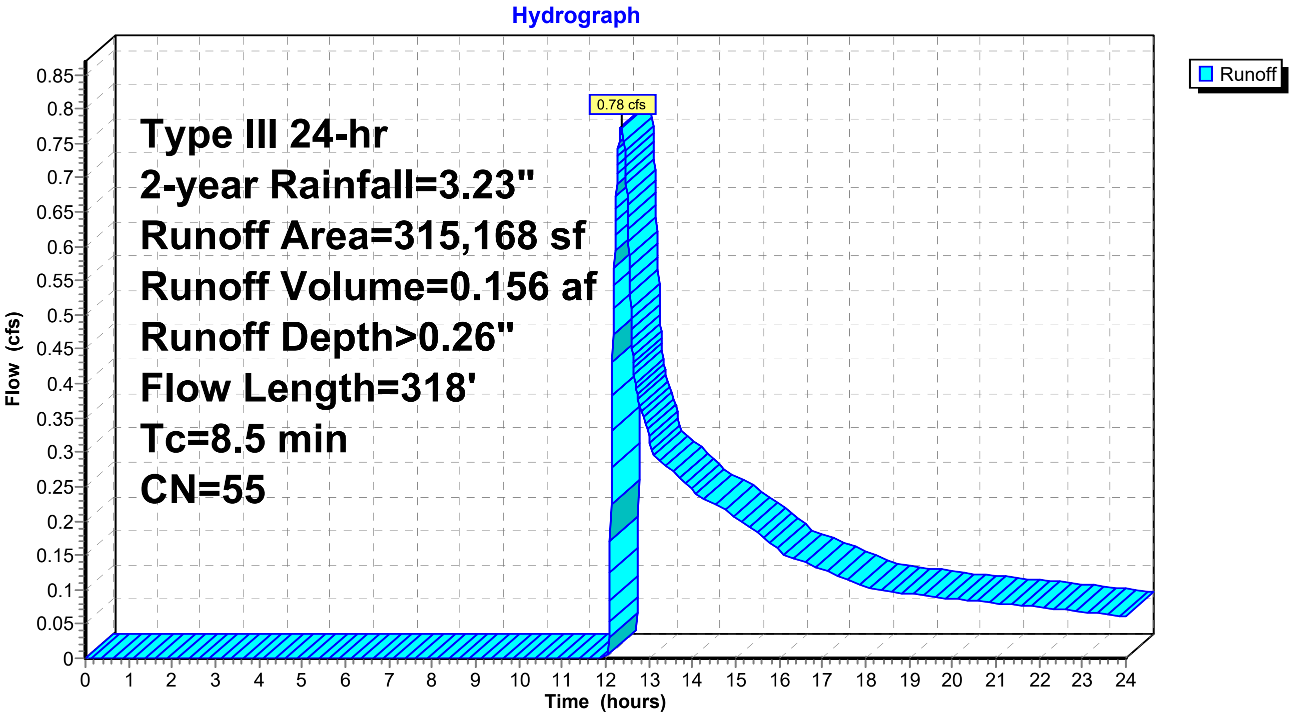
Reach 5R: Flow to Drianage Ditch Inflow=0.77 cfs 0.137 af
Outflow=0.77 cfs 0.137 af

Total Runoff Area = 15.893 ac Runoff Volume = 0.378 af Average Runoff Depth = 0.29"
98.26% Pervious = 15.616 ac 1.74% Impervious = 0.277 ac

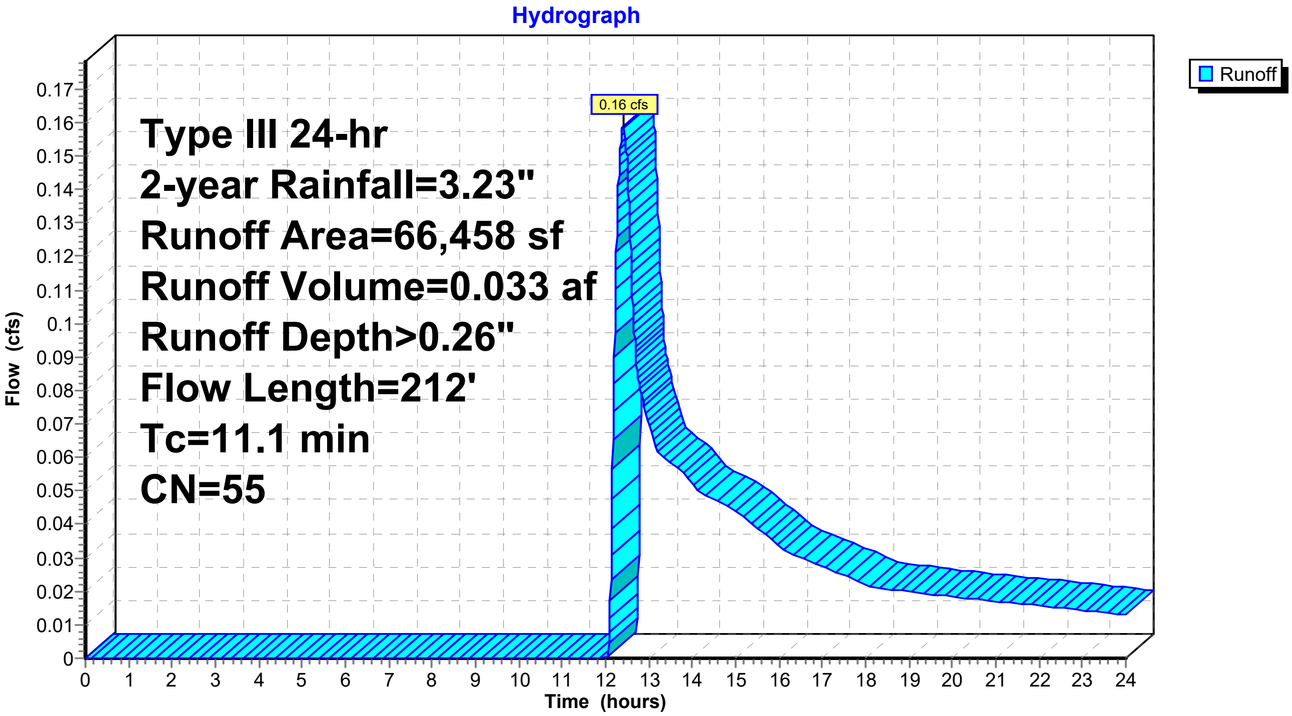
Subcatchment 1S: Area 1



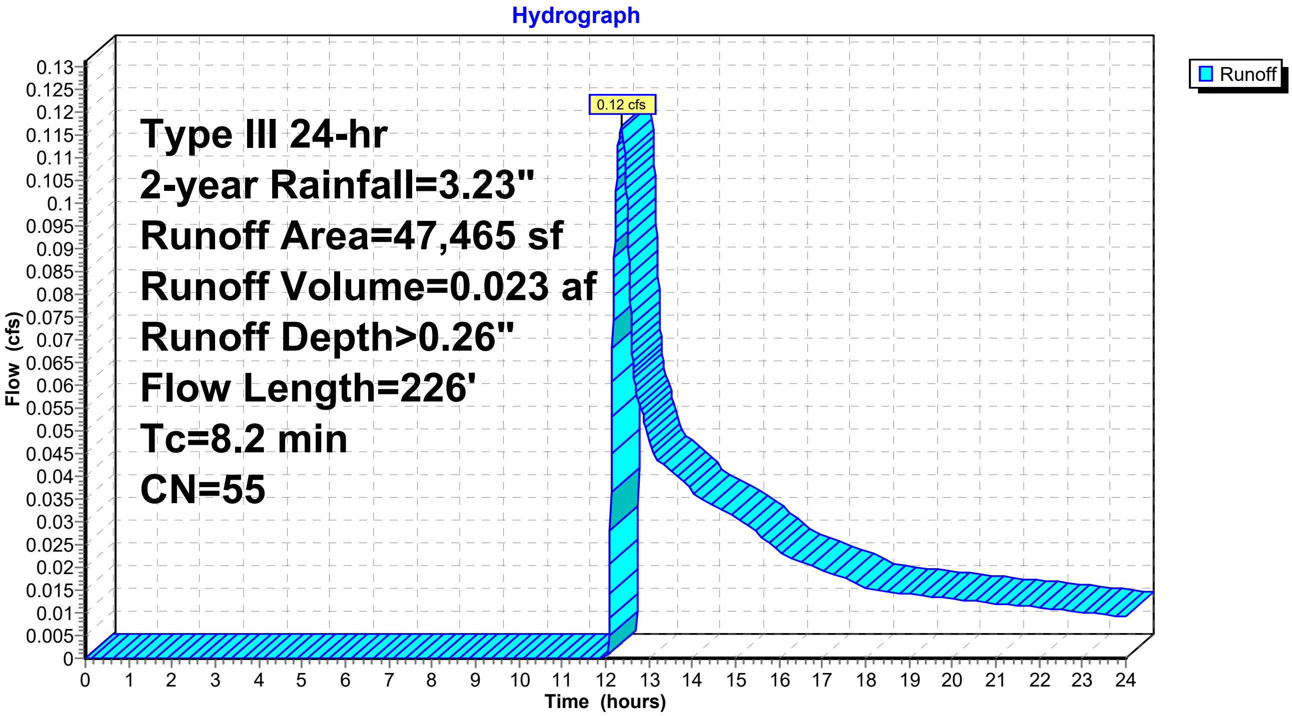
Subcatchment 2S: Area 2



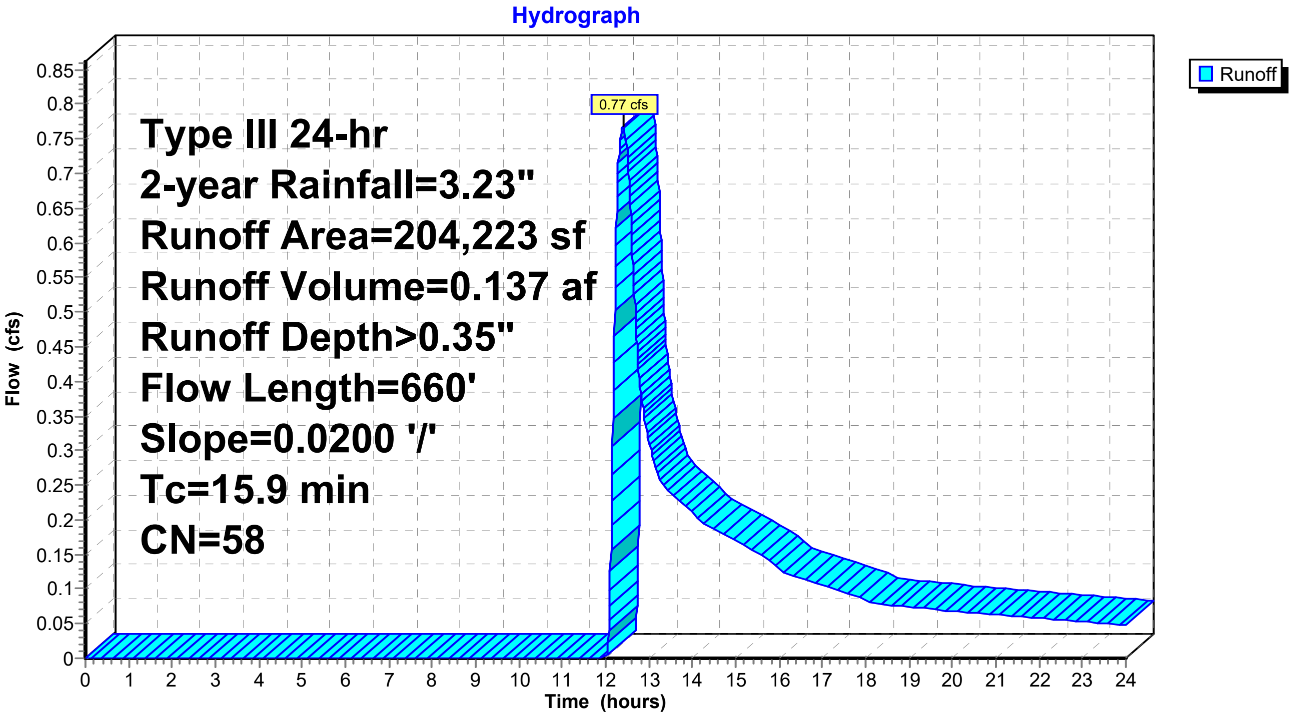
Subcatchment 3S: Area 3



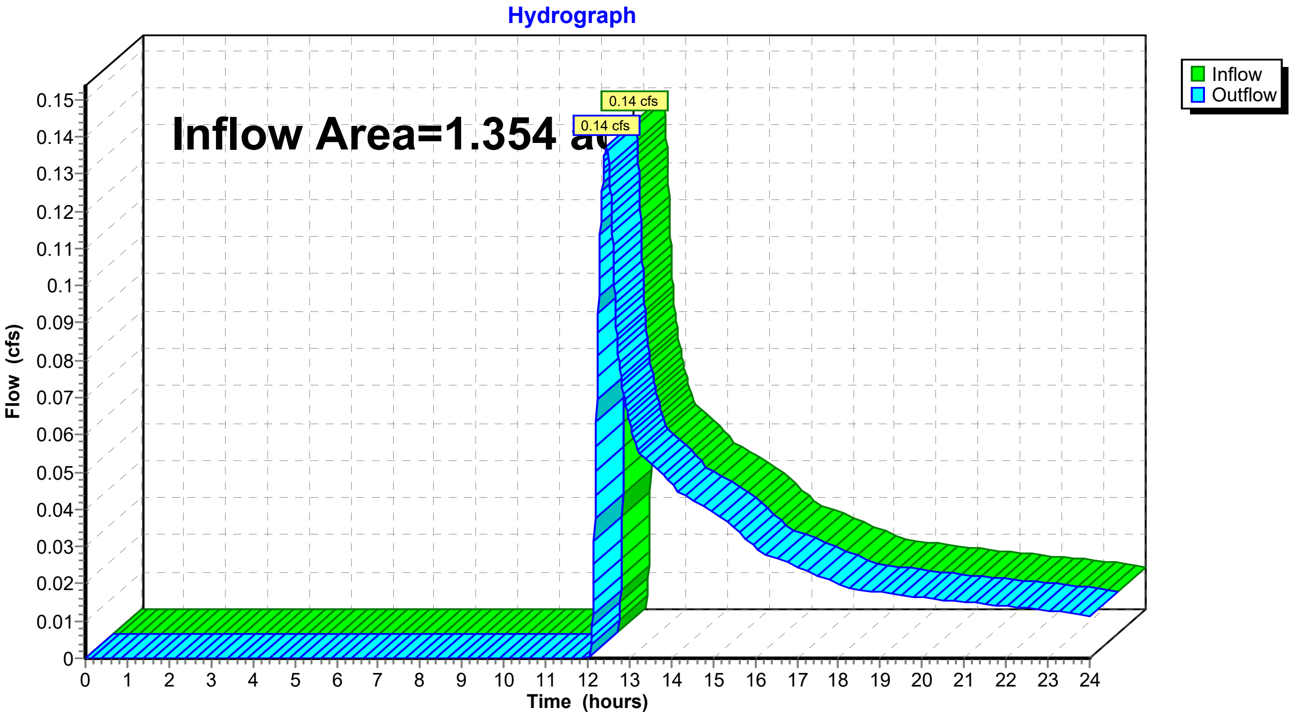
Subcatchment 4S: Area 4



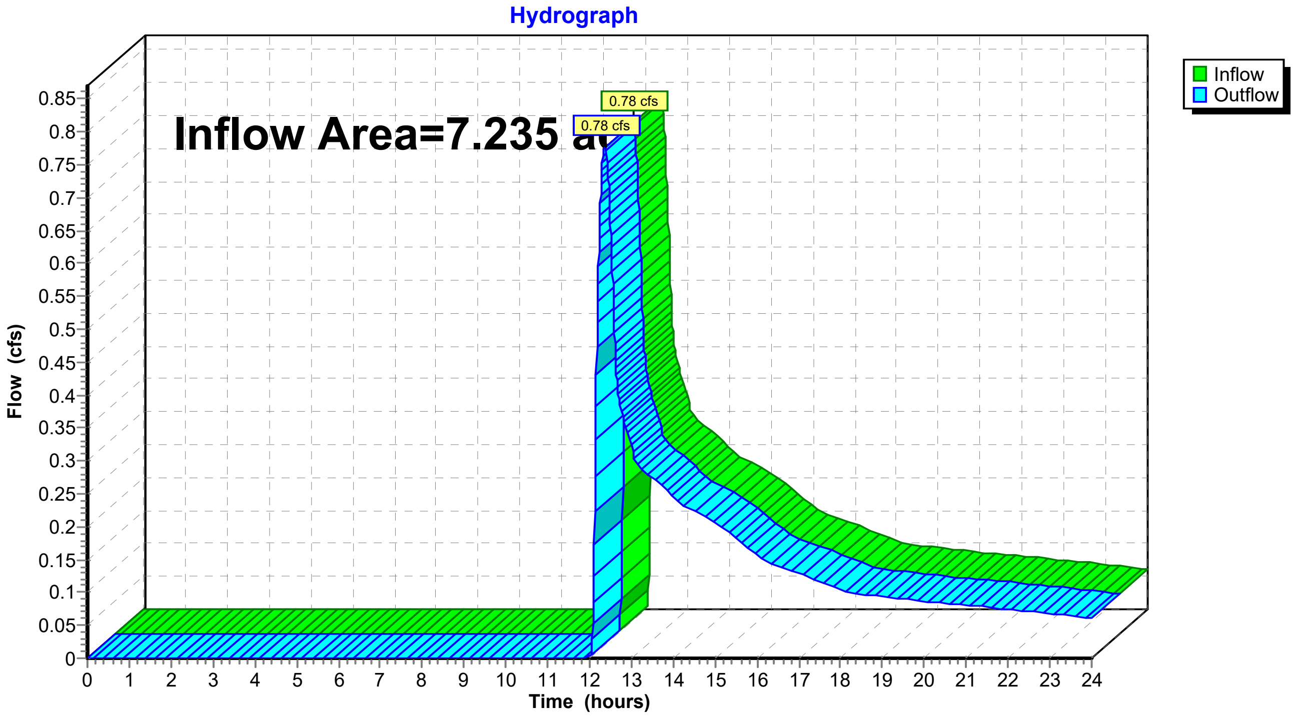
Subcatchment 5S: Area 5



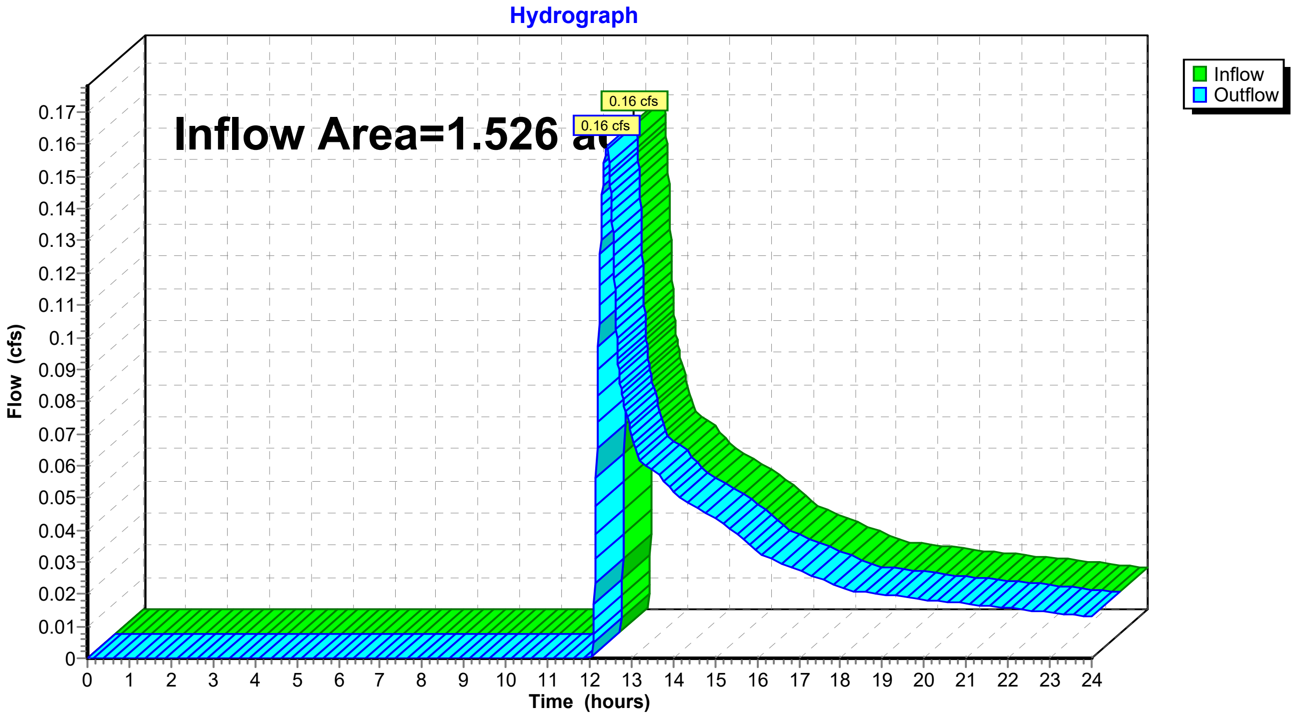
Reach 1R: Off-site Flow (Wetland - Northwest)



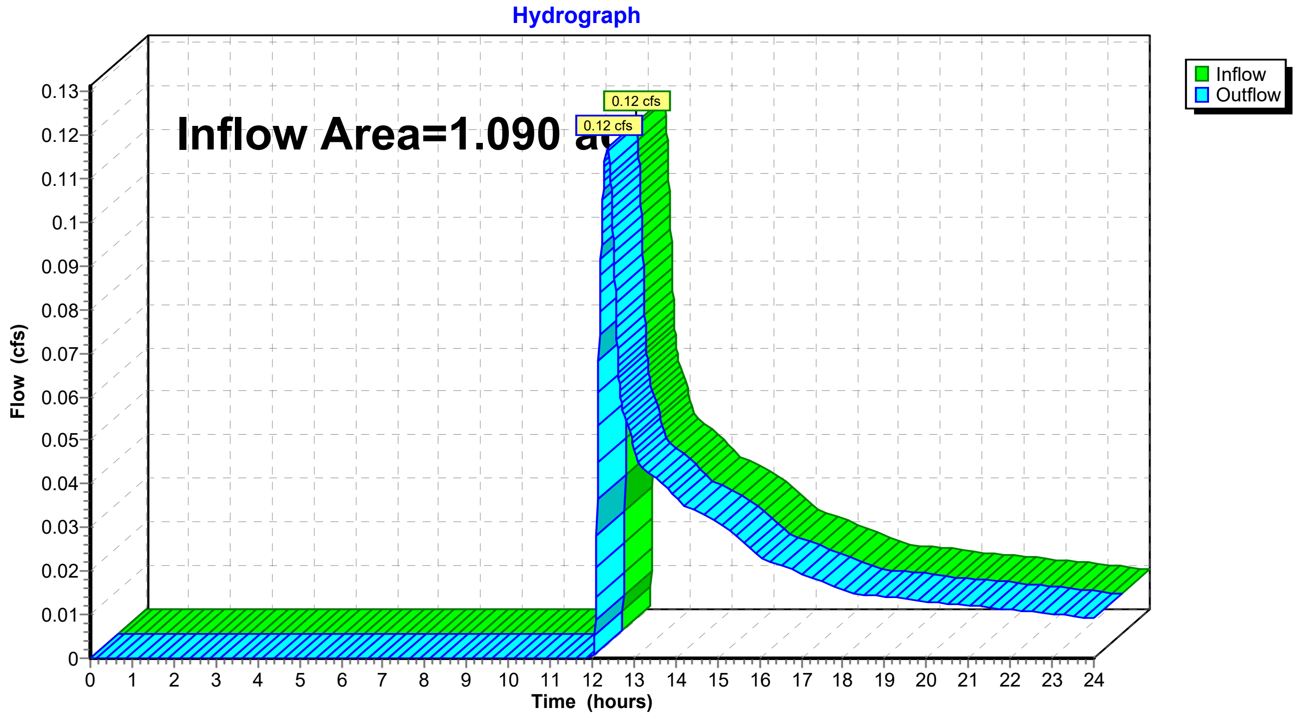
Reach 2R: Off-site Flow (East)



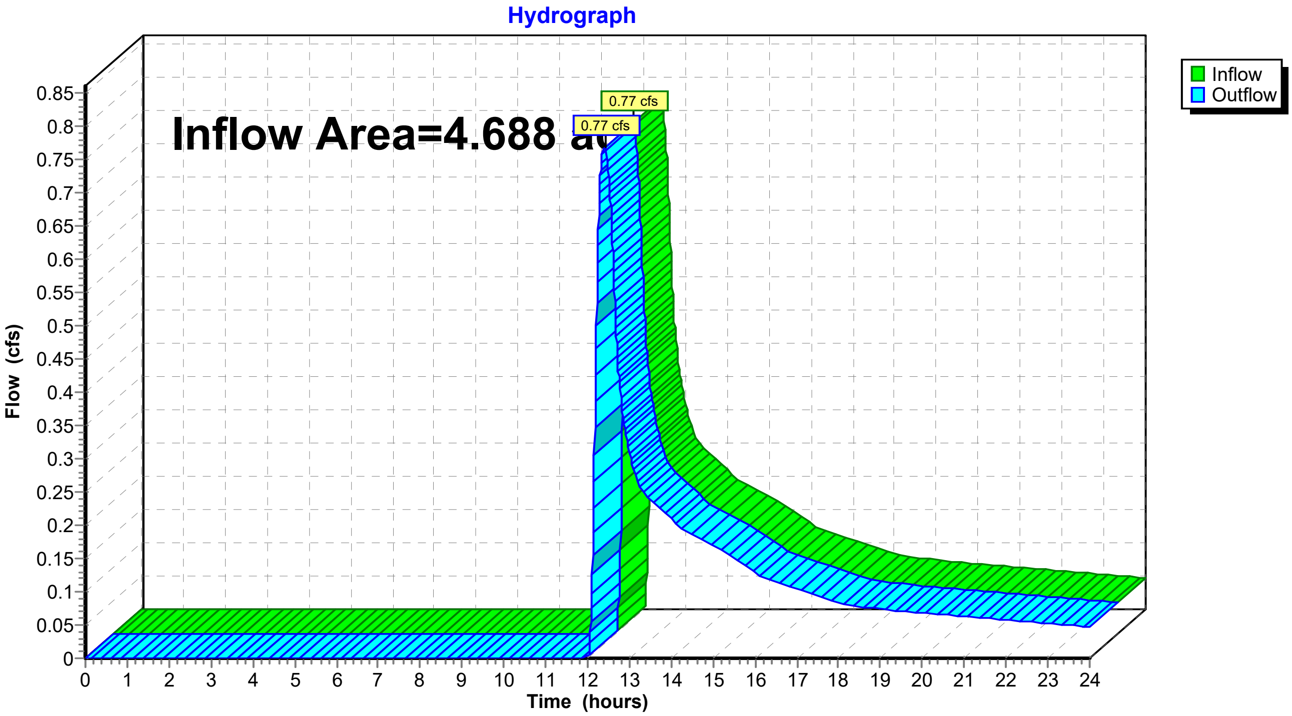
Reach 3R: Off-site flow (Route 15)



Reach 4R: Off-site Flow (South)



Reach 5R: Flow to Drianage Ditch



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Area 1 Runoff Area=58,975 sf 0.00% Impervious Runoff Depth>1.00"
Flow Length=407' Tc=13.5 min CN=55 Runoff=0.99 cfs 0.112 af

Subcatchment2S: Area 2 Runoff Area=315,168 sf 0.00% Impervious Runoff Depth>1.00"
Flow Length=318' Tc=8.5 min CN=55 Runoff=6.21 cfs 0.601 af

Subcatchment3S: Area 3 Runoff Area=66,458 sf 0.00% Impervious Runoff Depth>1.00"
Flow Length=212' Tc=11.1 min CN=55 Runoff=1.20 cfs 0.127 af

Subcatchment4S: Area 4 Runoff Area=47,465 sf 0.00% Impervious Runoff Depth>1.00"
Flow Length=226' Tc=8.2 min CN=55 Runoff=0.95 cfs 0.091 af

Subcatchment5S: Area 5 Runoff Area=204,223 sf 5.90% Impervious Runoff Depth>1.19"
Flow Length=660' Slope=0.0200 '/' Tc=15.9 min CN=58 Runoff=4.15 cfs 0.463 af

Reach 1R: Off-site Flow (Wetland - Northwest) Inflow=0.99 cfs 0.112 af
Outflow=0.99 cfs 0.112 af

Reach 2R: Off-site Flow (East) Inflow=6.21 cfs 0.601 af
Outflow=6.21 cfs 0.601 af

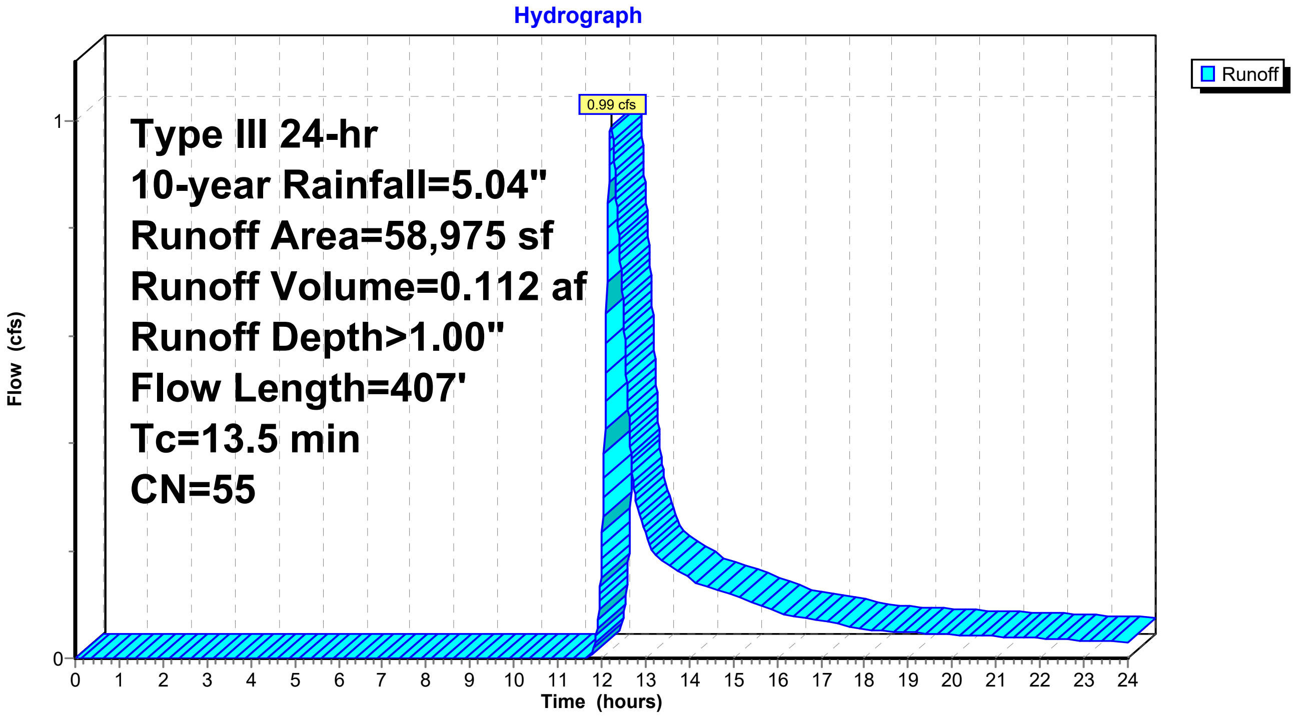
Reach 3R: Off-site flow (Route 15) Inflow=1.20 cfs 0.127 af
Outflow=1.20 cfs 0.127 af

Reach 4R: Off-site Flow (South) Inflow=0.95 cfs 0.091 af
Outflow=0.95 cfs 0.091 af

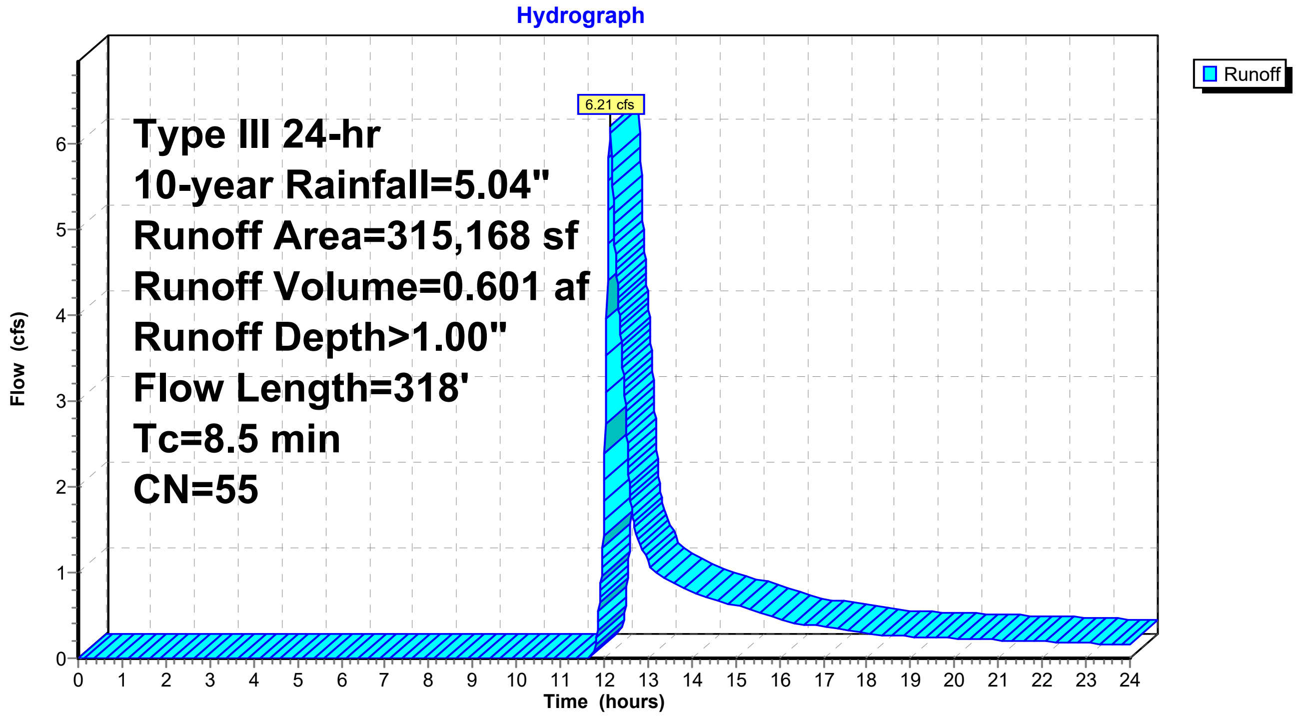
Reach 5R: Flow to Drianage Ditch Inflow=4.15 cfs 0.463 af
Outflow=4.15 cfs 0.463 af

Total Runoff Area = 15.893 ac Runoff Volume = 1.394 af Average Runoff Depth = 1.05"
98.26% Pervious = 15.616 ac 1.74% Impervious = 0.277 ac

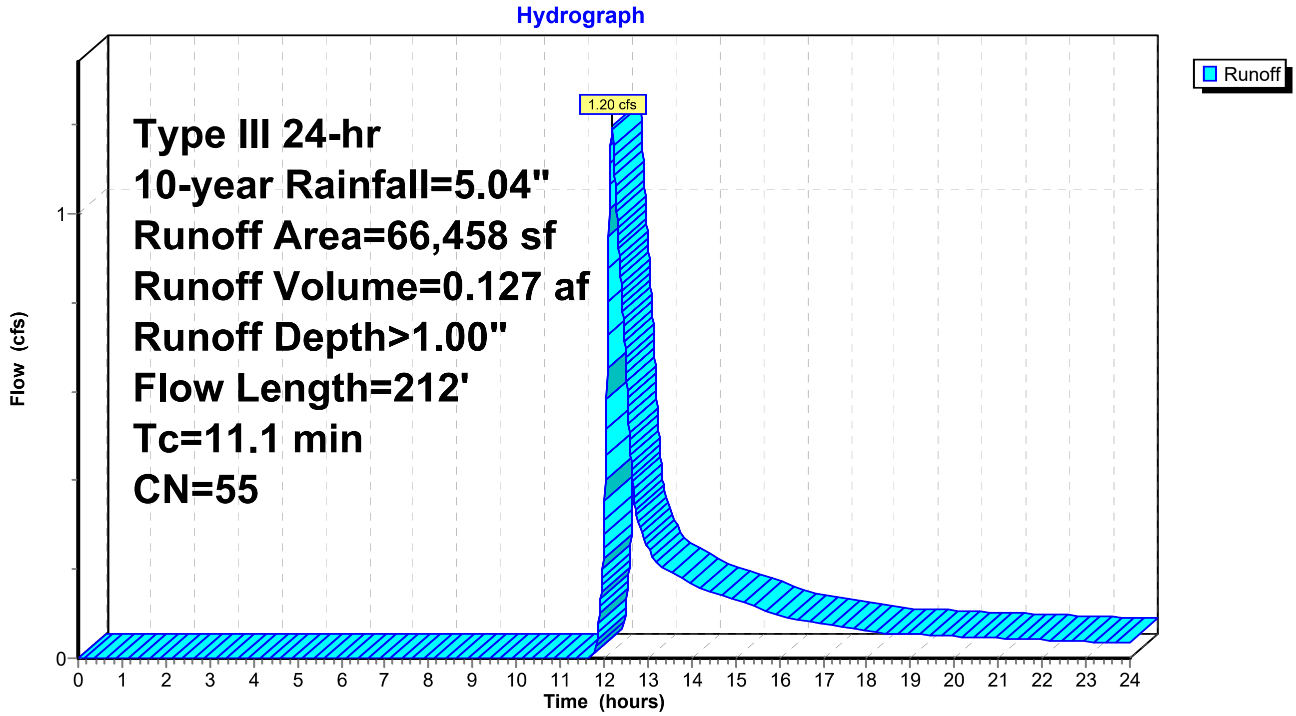
Subcatchment 1S: Area 1



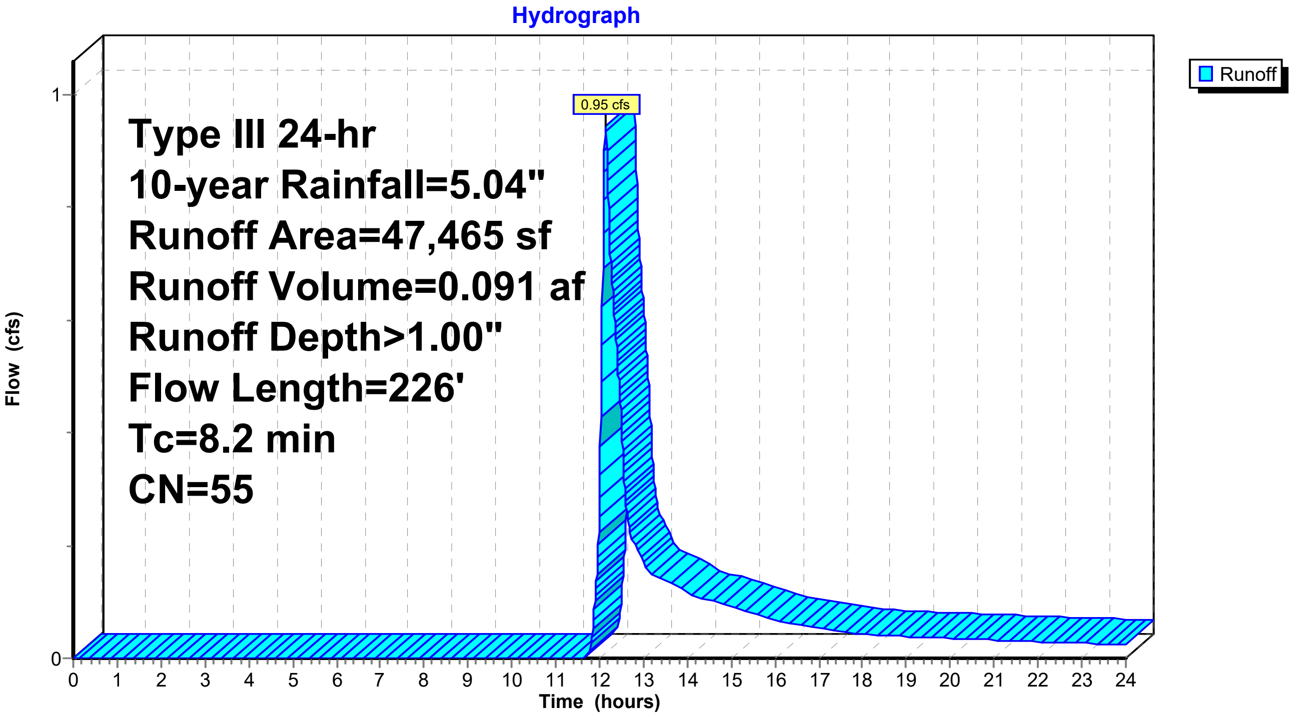
Subcatchment 2S: Area 2



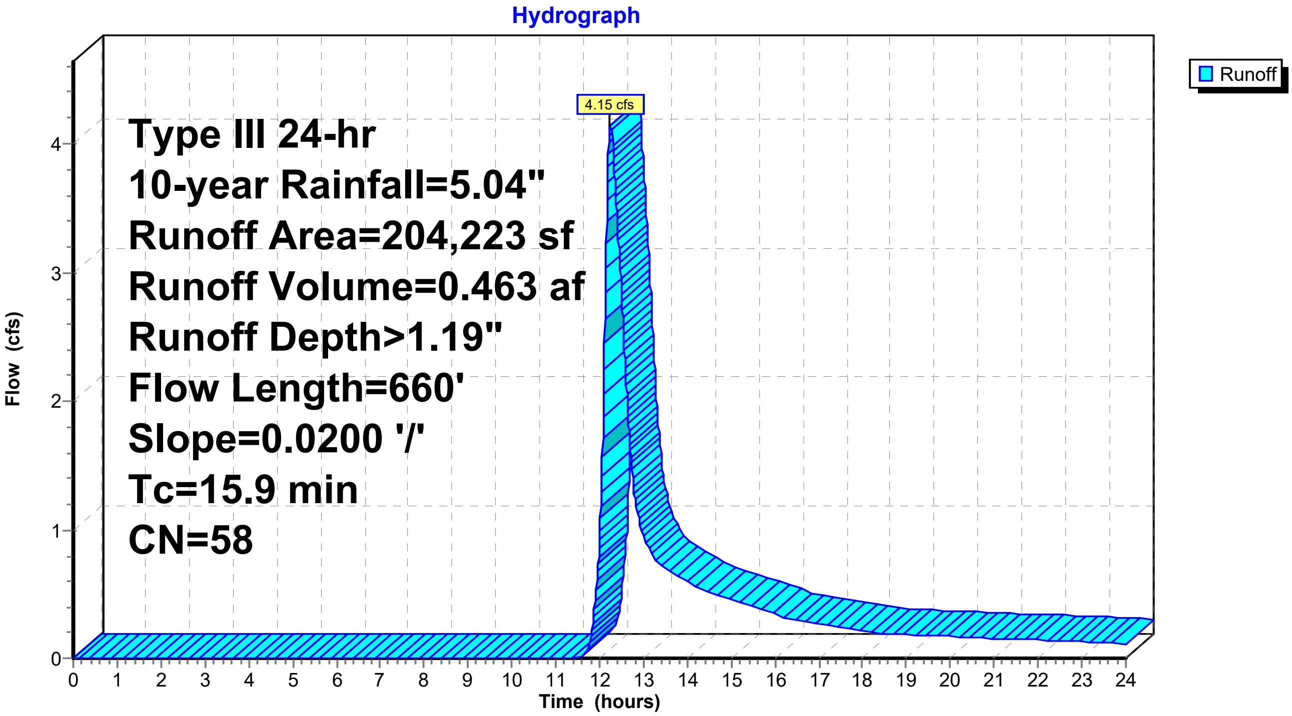
Subcatchment 3S: Area 3



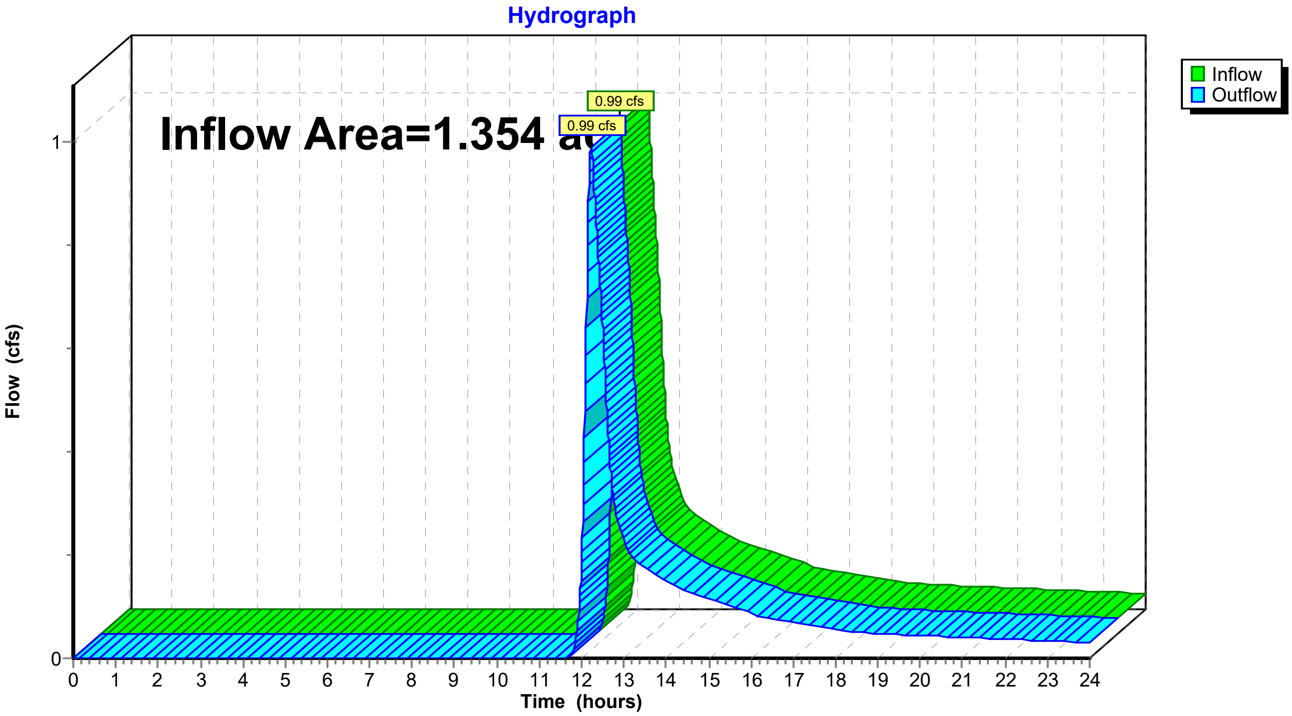
Subcatchment 4S: Area 4



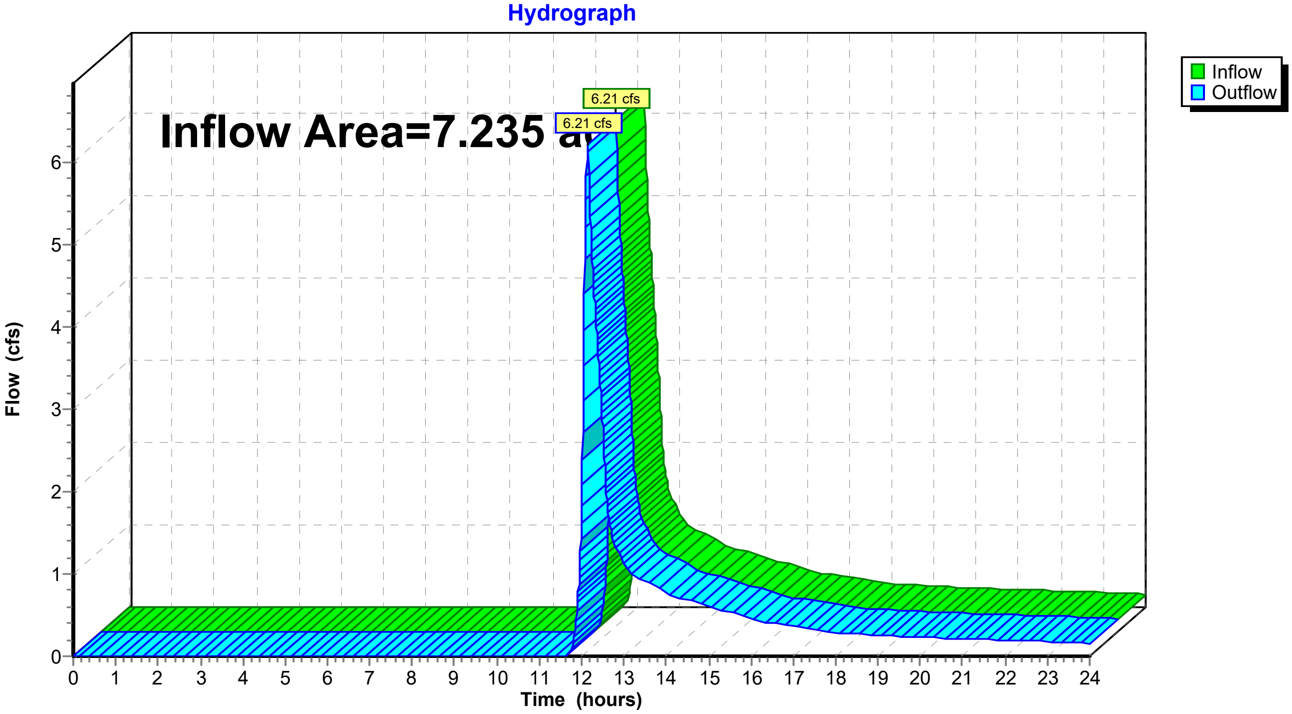
Subcatchment 5S: Area 5



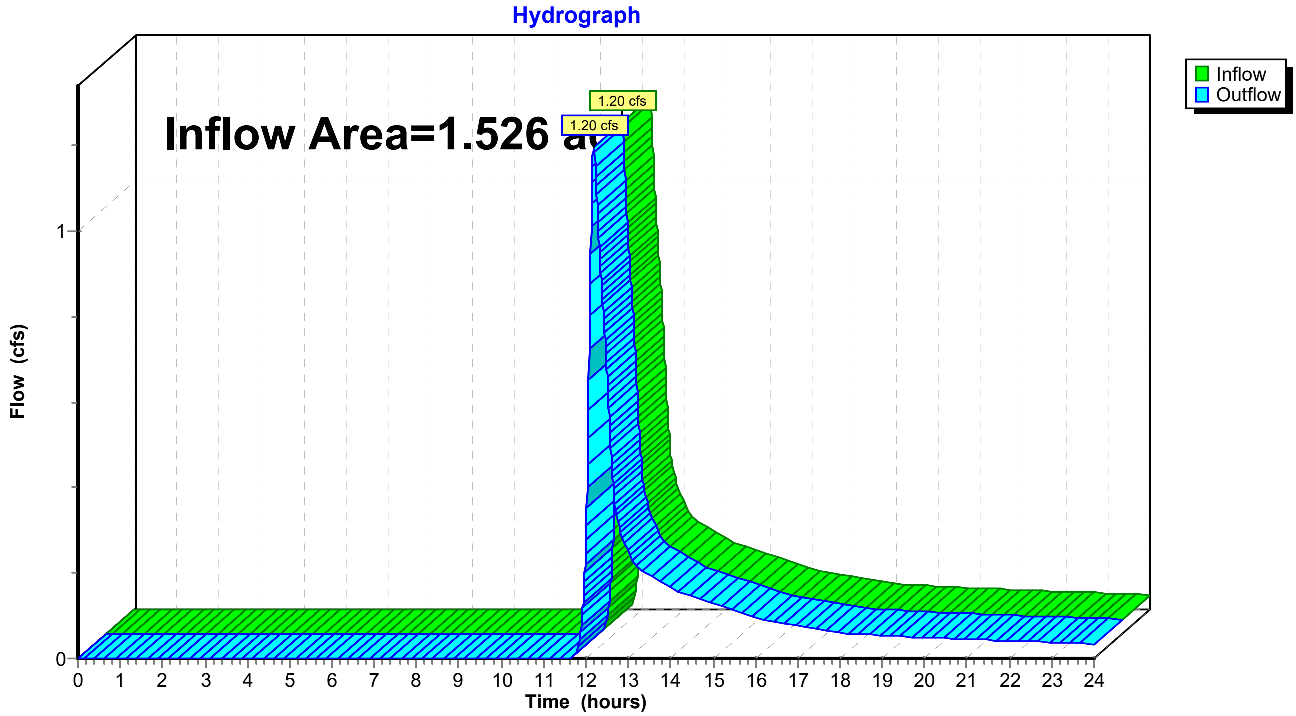
Reach 1R: Off-site Flow (Wetland - Northwest)



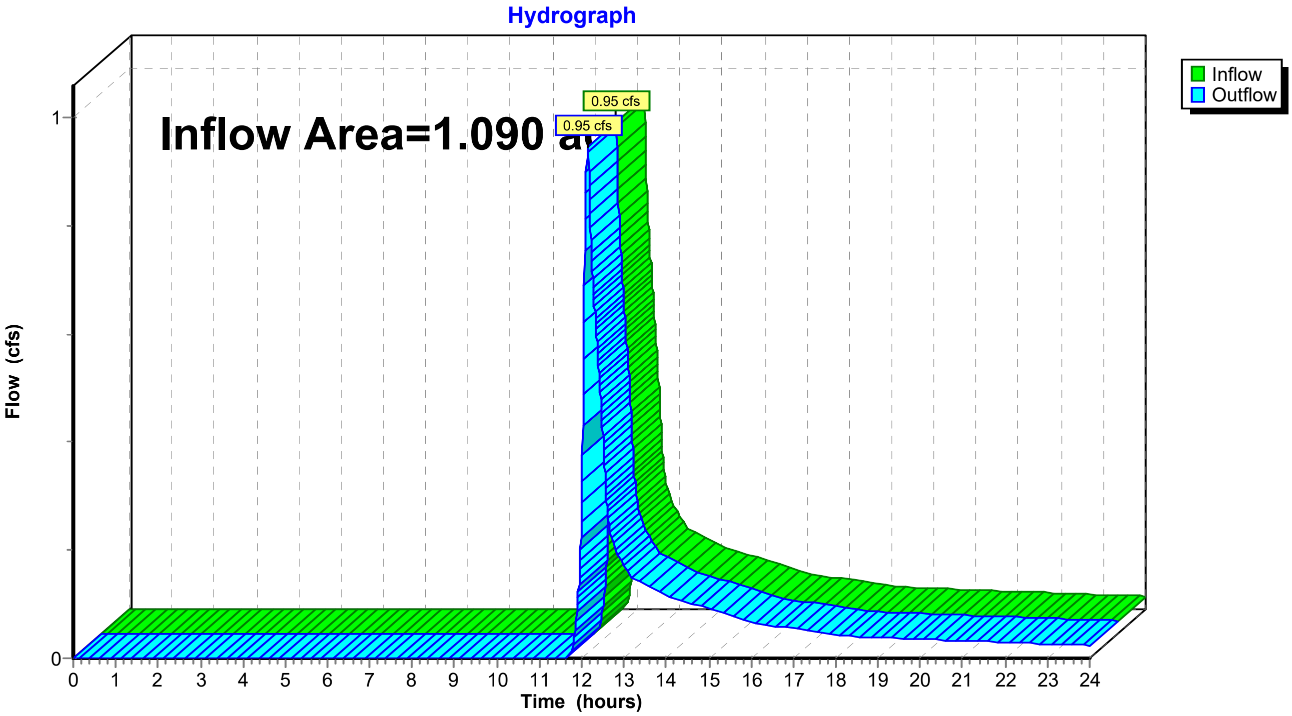
Reach 2R: Off-site Flow (East)



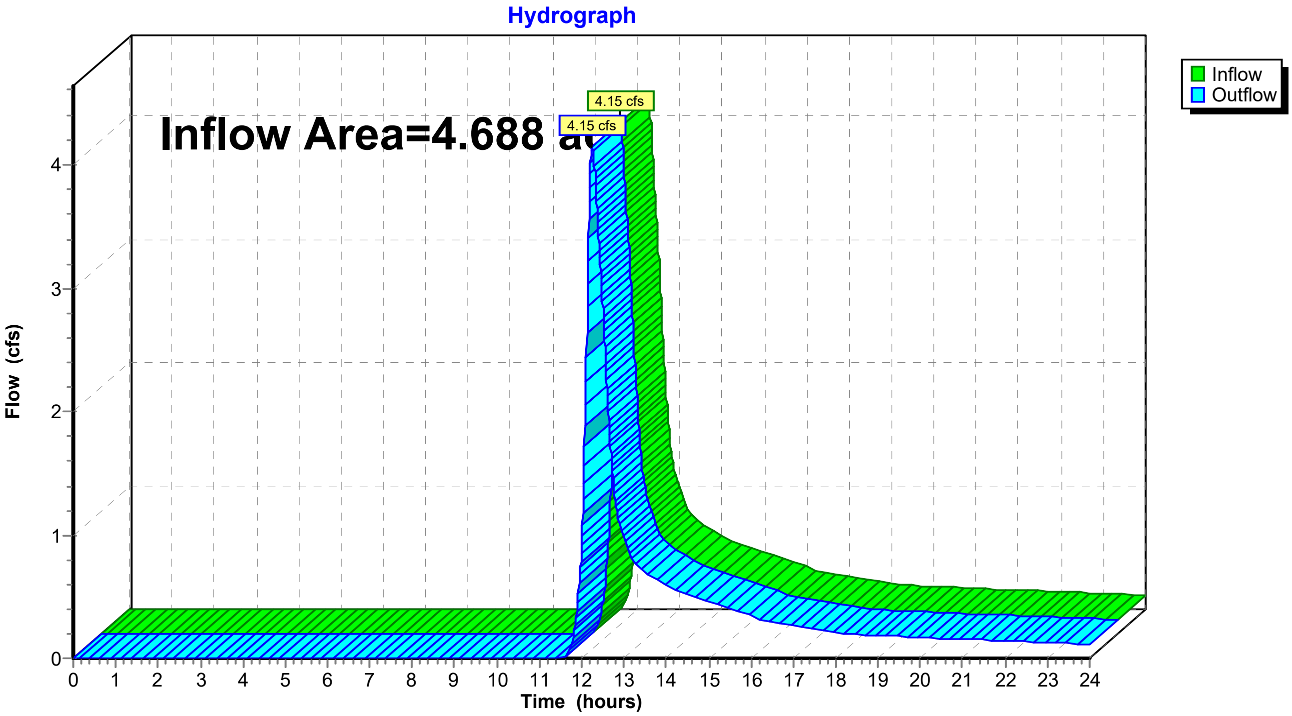
Reach 3R: Off-site flow (Route 15)



Reach 4R: Off-site Flow (South)



Reach 5R: Flow to Drianage Ditch



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Area 1 Runoff Area=58,975 sf 0.00% Impervious Runoff Depth>1.61"
Flow Length=407' Tc=13.5 min CN=55 Runoff=1.79 cfs 0.182 af

Subcatchment2S: Area 2 Runoff Area=315,168 sf 0.00% Impervious Runoff Depth>1.61"
Flow Length=318' Tc=8.5 min CN=55 Runoff=11.24 cfs 0.972 af

Subcatchment3S: Area 3 Runoff Area=66,458 sf 0.00% Impervious Runoff Depth>1.61"
Flow Length=212' Tc=11.1 min CN=55 Runoff=2.17 cfs 0.205 af

Subcatchment4S: Area 4 Runoff Area=47,465 sf 0.00% Impervious Runoff Depth>1.61"
Flow Length=226' Tc=8.2 min CN=55 Runoff=1.71 cfs 0.146 af

Subcatchment5S: Area 5 Runoff Area=204,223 sf 5.90% Impervious Runoff Depth>1.86"
Flow Length=660' Slope=0.0200 '/' Tc=15.9 min CN=58 Runoff=7.01 cfs 0.725 af

Reach 1R: Off-site Flow (Wetland - Northwest) Inflow=1.79 cfs 0.182 af
Outflow=1.79 cfs 0.182 af

Reach 2R: Off-site Flow (East) Inflow=11.24 cfs 0.972 af
Outflow=11.24 cfs 0.972 af

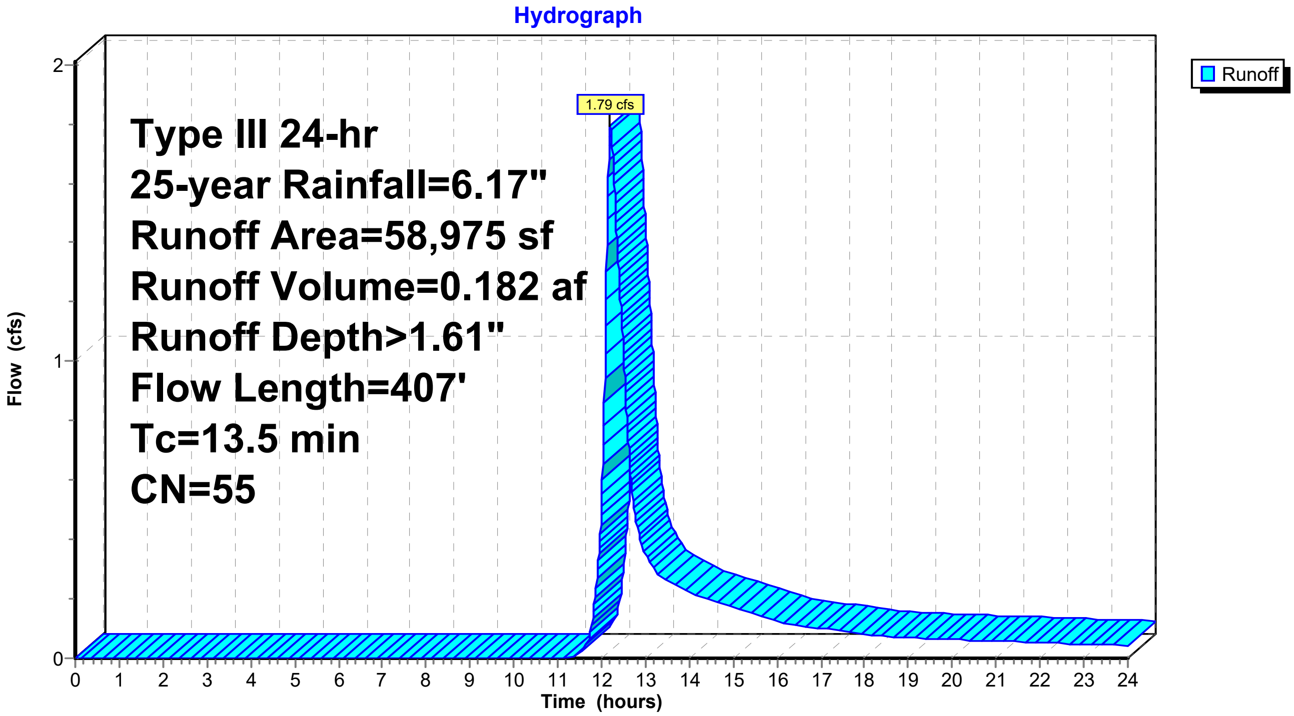
Reach 3R: Off-site flow (Route 15) Inflow=2.17 cfs 0.205 af
Outflow=2.17 cfs 0.205 af

Reach 4R: Off-site Flow (South) Inflow=1.71 cfs 0.146 af
Outflow=1.71 cfs 0.146 af

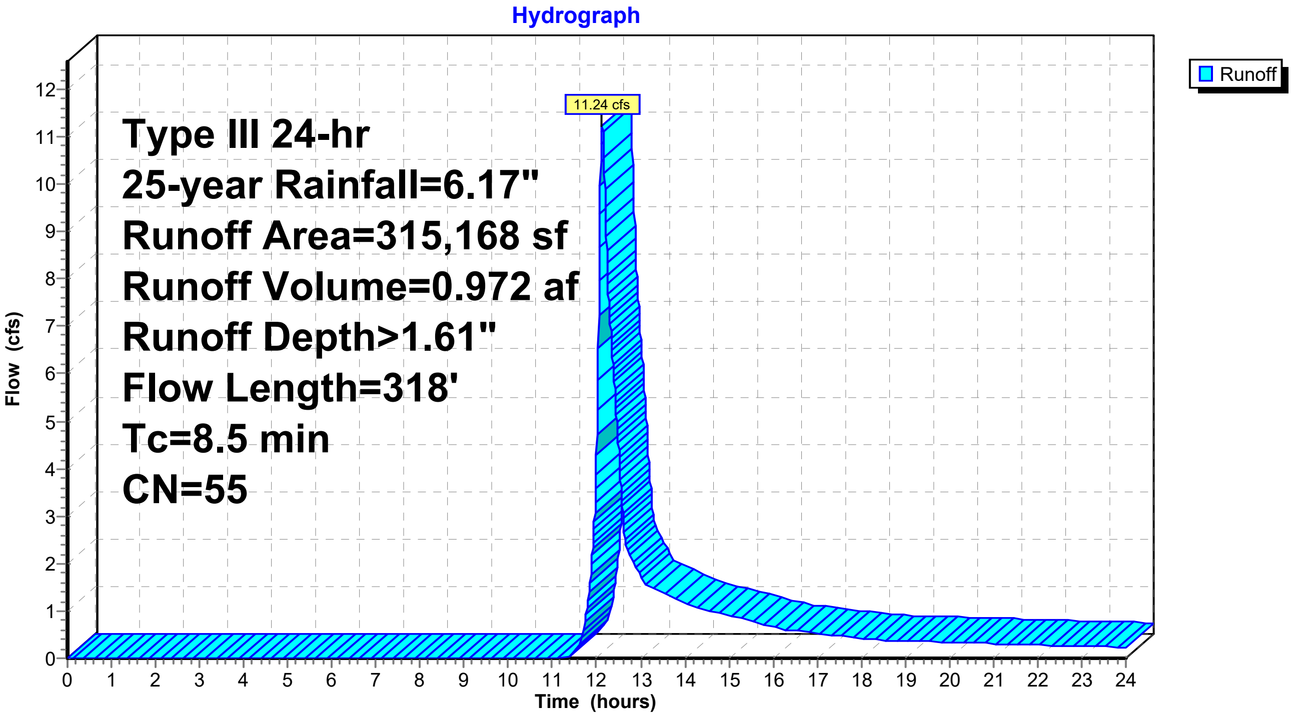
Reach 5R: Flow to Drianage Ditch Inflow=7.01 cfs 0.725 af
Outflow=7.01 cfs 0.725 af

Total Runoff Area = 15.893 ac Runoff Volume = 2.230 af Average Runoff Depth = 1.68"
98.26% Pervious = 15.616 ac 1.74% Impervious = 0.277 ac

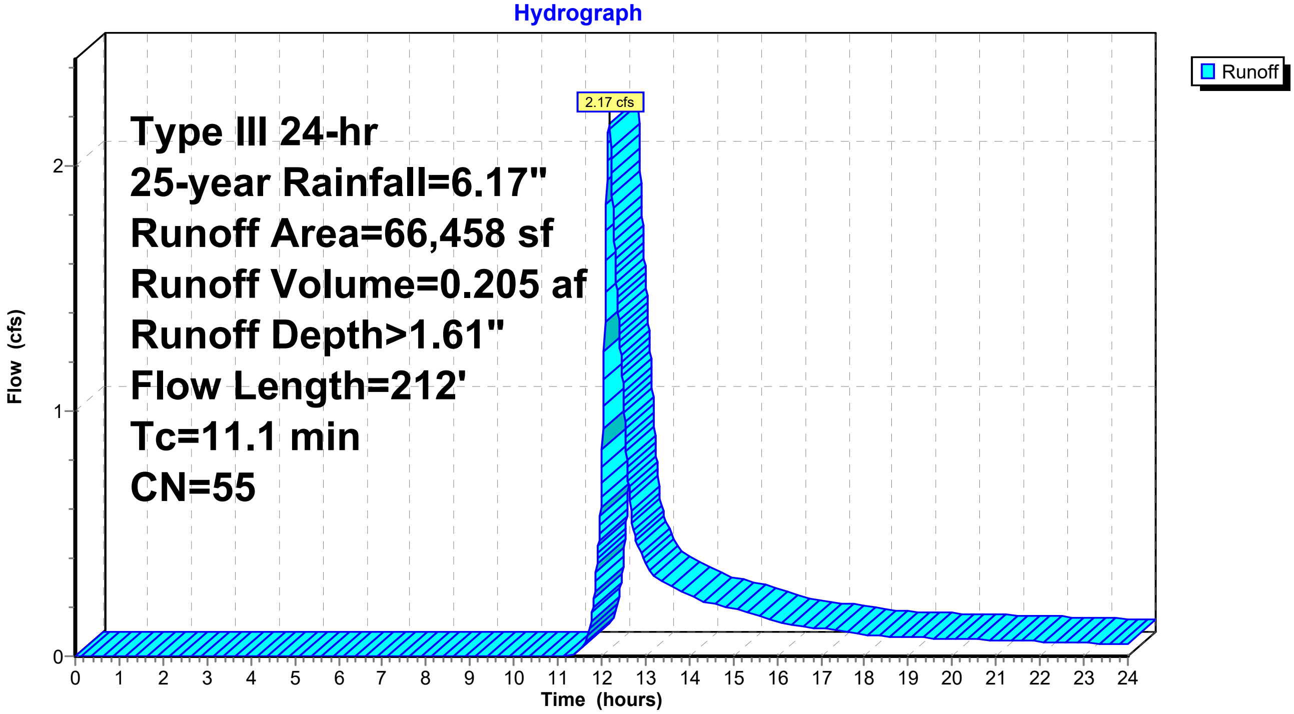
Subcatchment 1S: Area 1



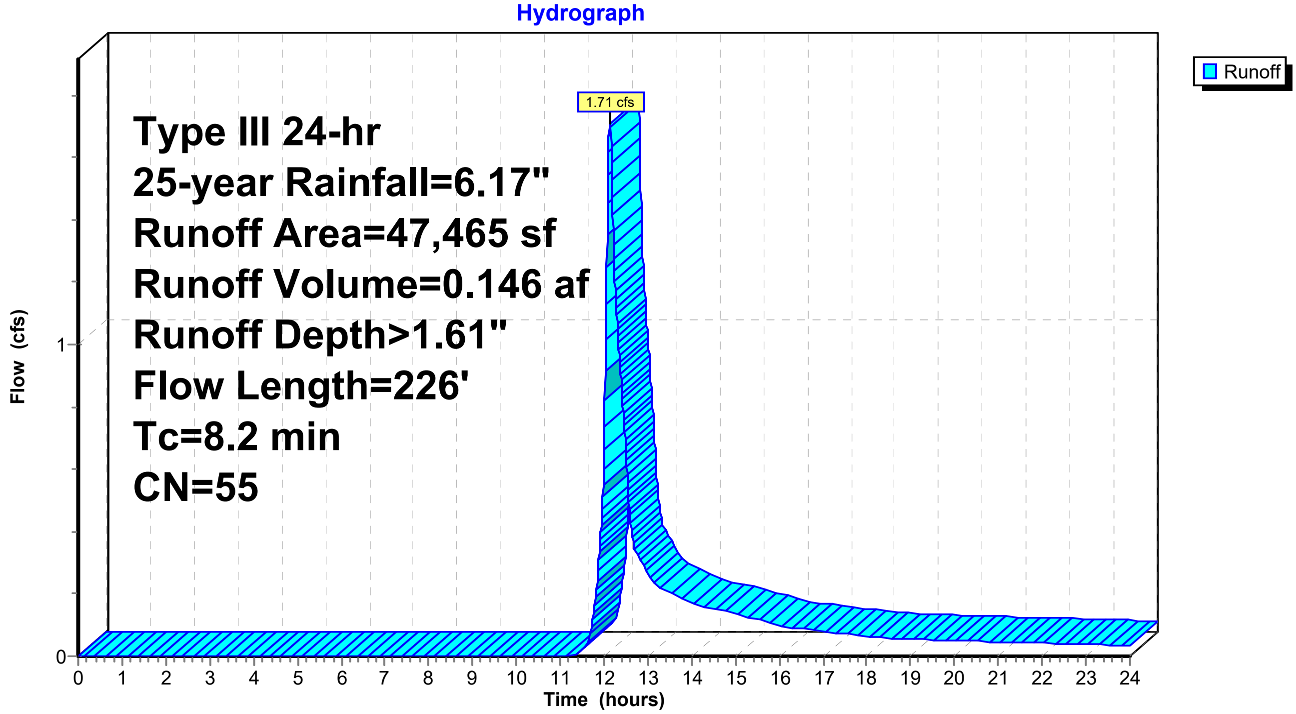
Subcatchment 2S: Area 2



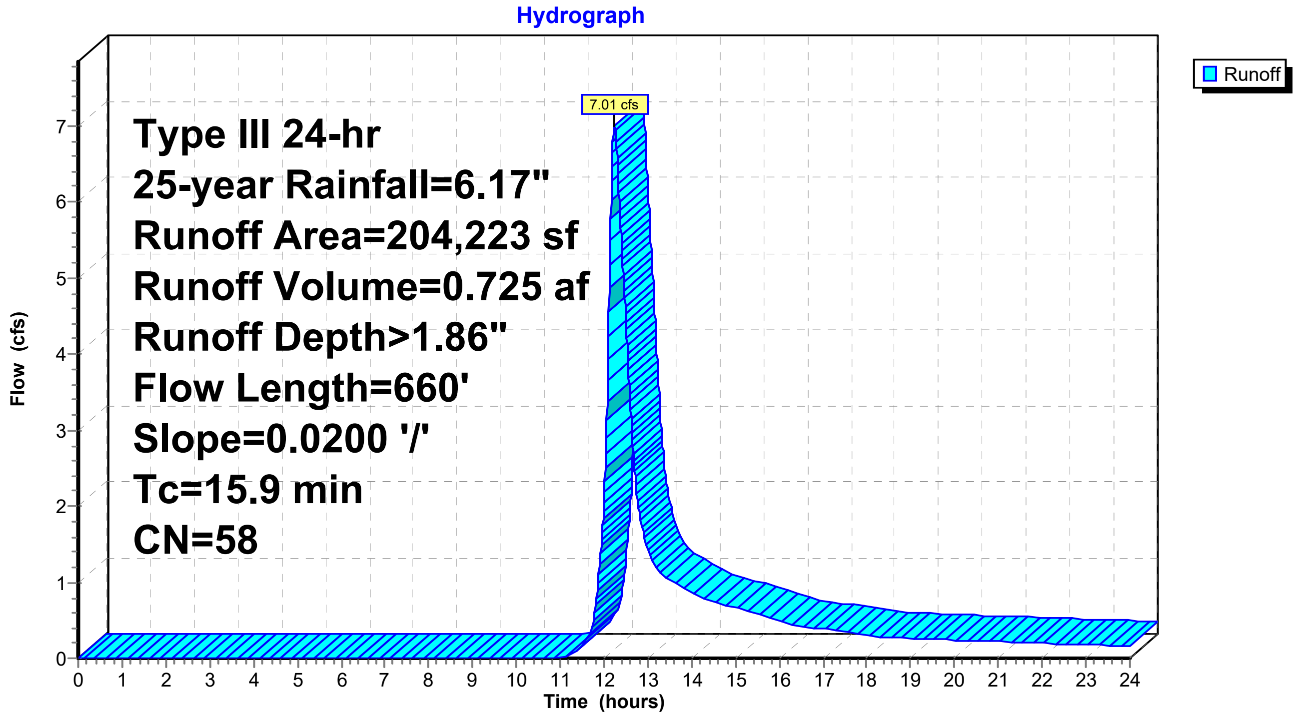
Subcatchment 3S: Area 3



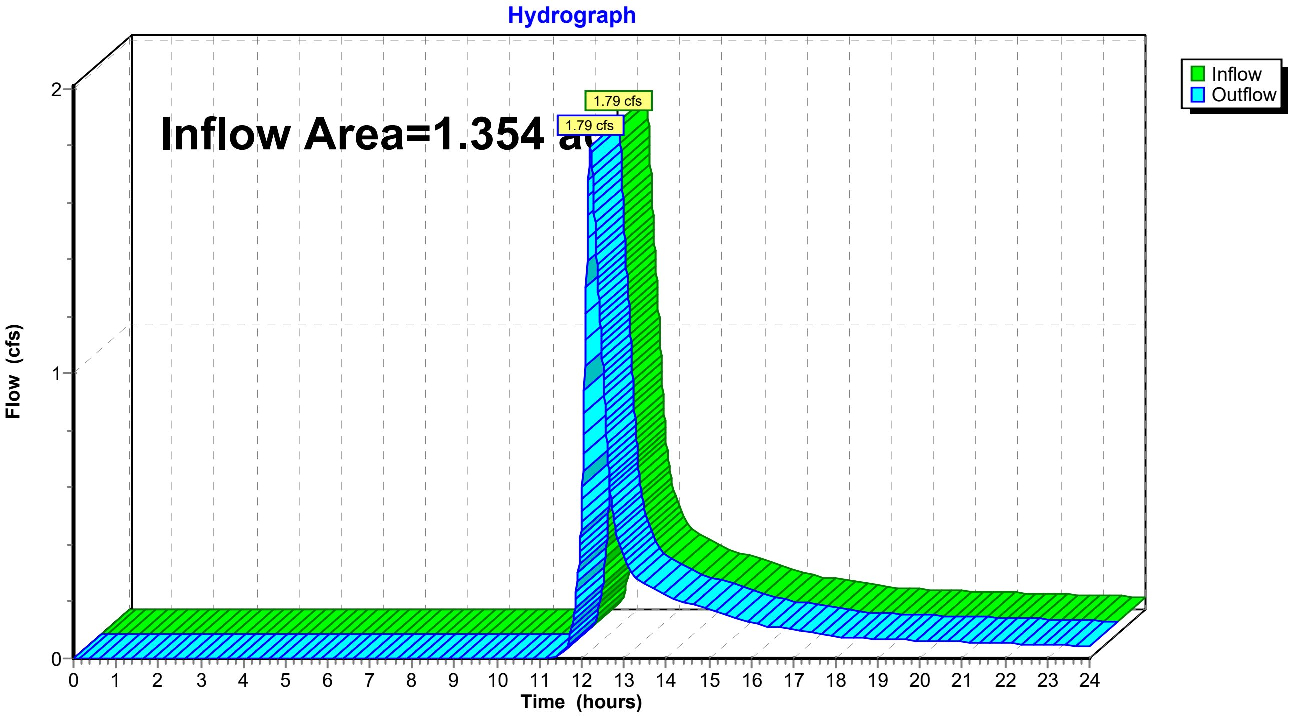
Subcatchment 4S: Area 4



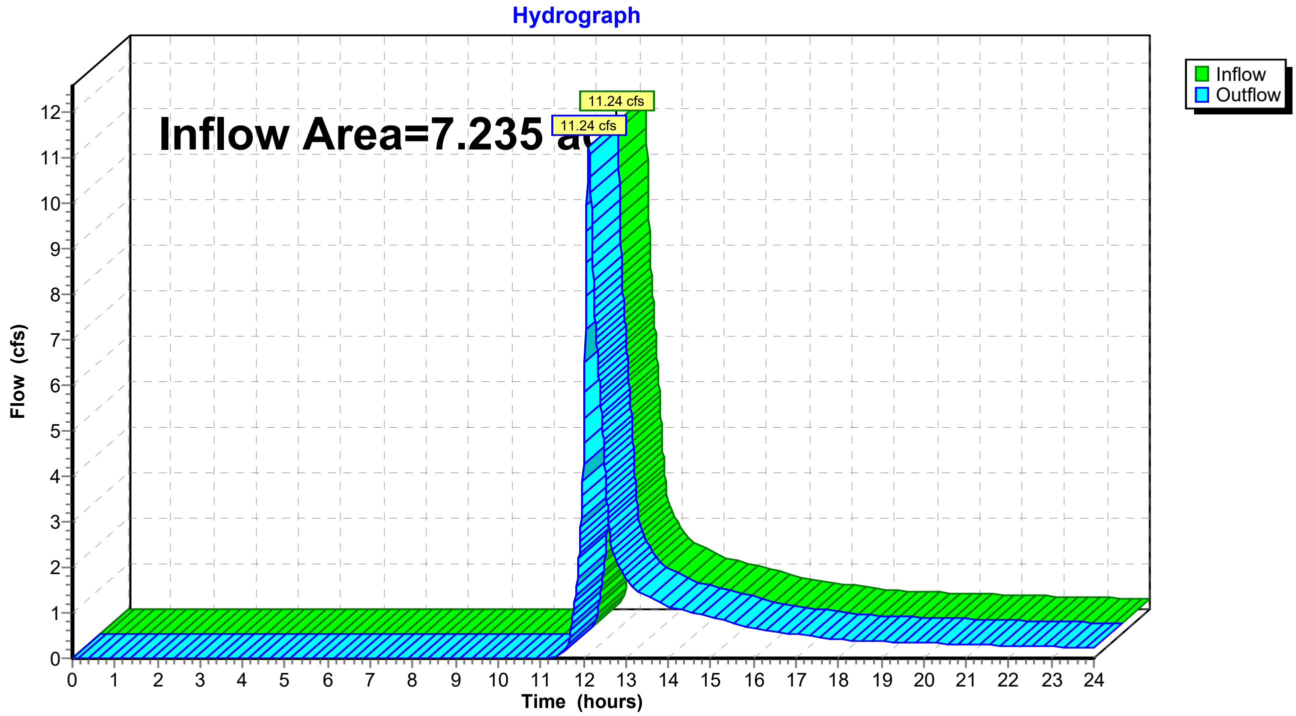
Subcatchment 5S: Area 5



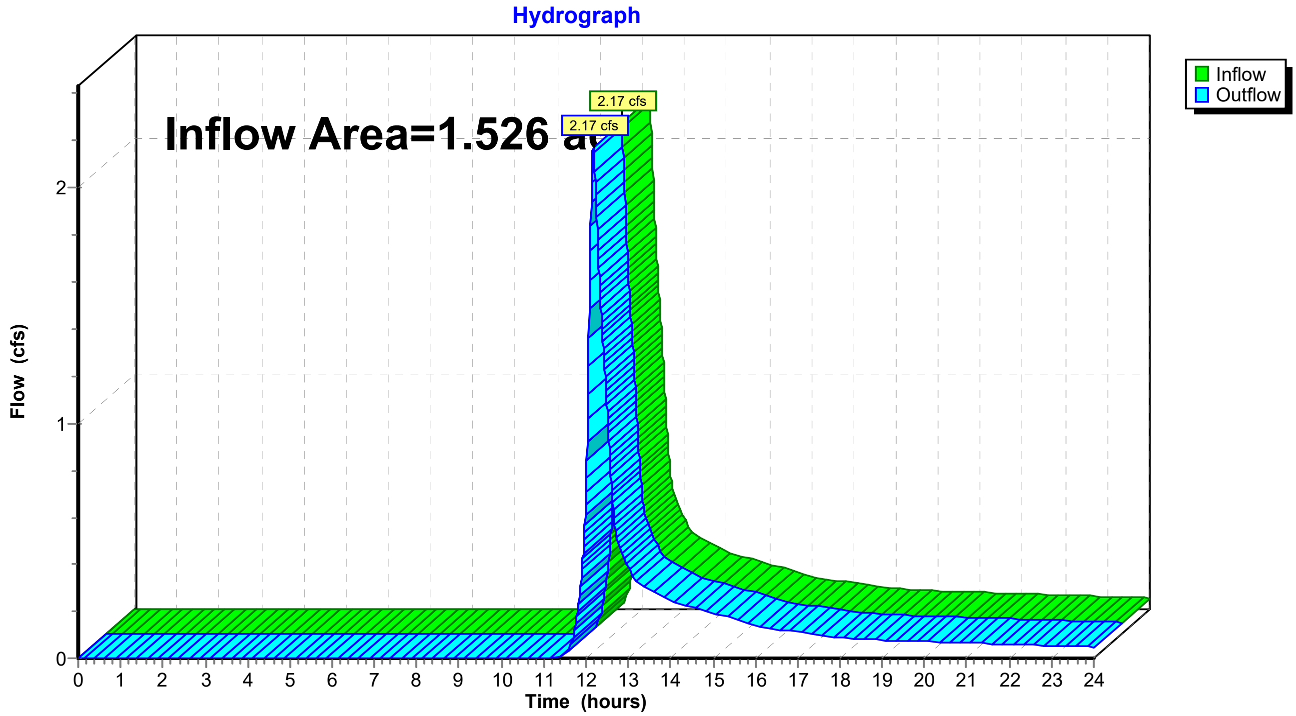
Reach 1R: Off-site Flow (Wetland - Northwest)



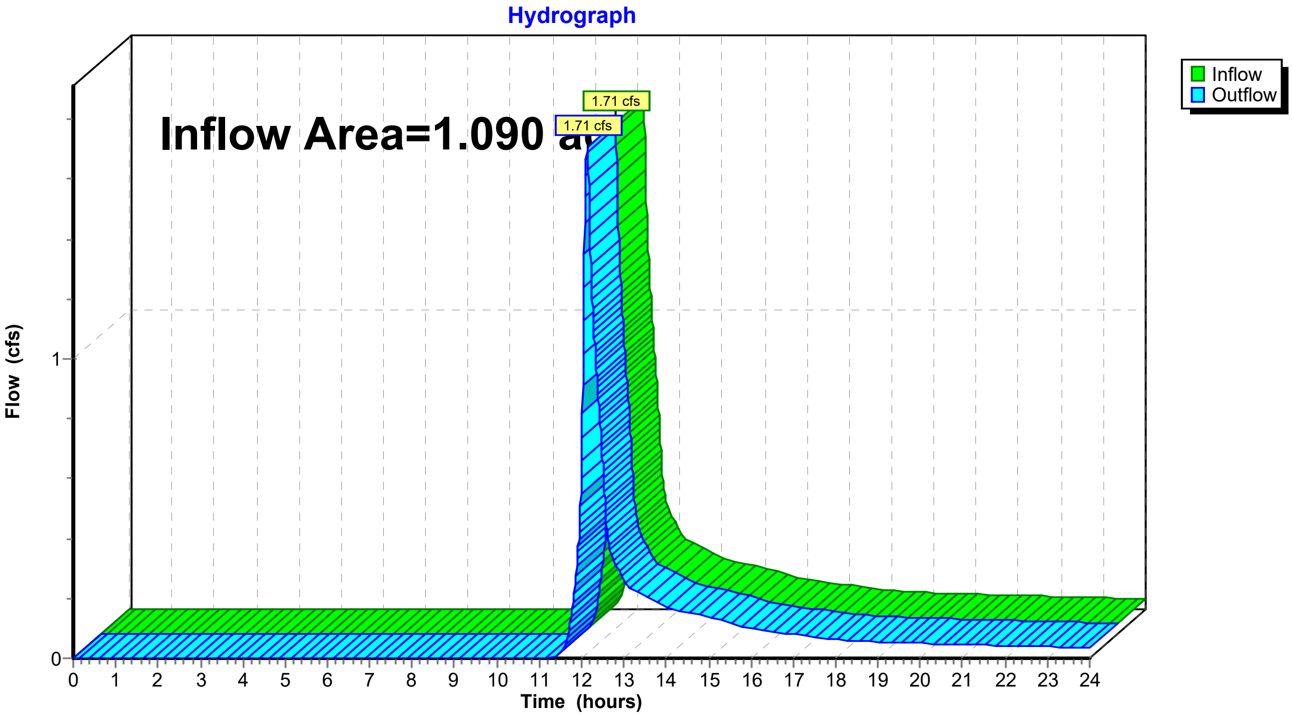
Reach 2R: Off-site Flow (East)



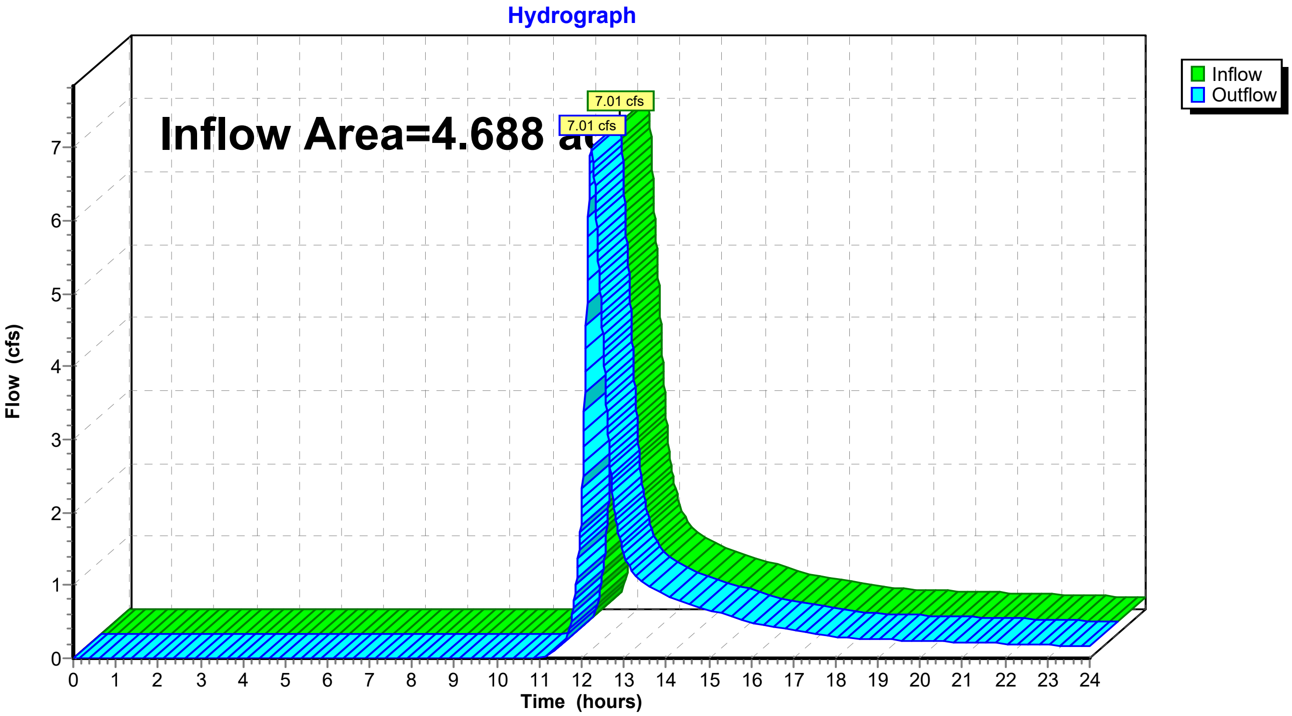
Reach 3R: Off-site flow (Route 15)



Reach 4R: Off-site Flow (South)



Reach 5R: Flow to Drianage Ditch



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Area 1 Runoff Area=58,975 sf 0.00% Impervious Runoff Depth>2.12"
Flow Length=407' Tc=13.5 min CN=55 Runoff=2.46 cfs 0.239 af

Subcatchment2S: Area 2 Runoff Area=315,168 sf 0.00% Impervious Runoff Depth>2.12"
Flow Length=318' Tc=8.5 min CN=55 Runoff=15.38 cfs 1.278 af

Subcatchment3S: Area 3 Runoff Area=66,458 sf 0.00% Impervious Runoff Depth>2.12"
Flow Length=212' Tc=11.1 min CN=55 Runoff=2.97 cfs 0.269 af

Subcatchment4S: Area 4 Runoff Area=47,465 sf 0.00% Impervious Runoff Depth>2.12"
Flow Length=226' Tc=8.2 min CN=55 Runoff=2.34 cfs 0.192 af

Subcatchment5S: Area 5 Runoff Area=204,223 sf 5.90% Impervious Runoff Depth>2.40"
Flow Length=660' Slope=0.0200 '/' Tc=15.9 min CN=58 Runoff=9.32 cfs 0.937 af

Reach 1R: Off-site Flow (Wetland - Northwest) Inflow=2.46 cfs 0.239 af
Outflow=2.46 cfs 0.239 af

Reach 2R: Off-site Flow (East) Inflow=15.38 cfs 1.278 af
Outflow=15.38 cfs 1.278 af

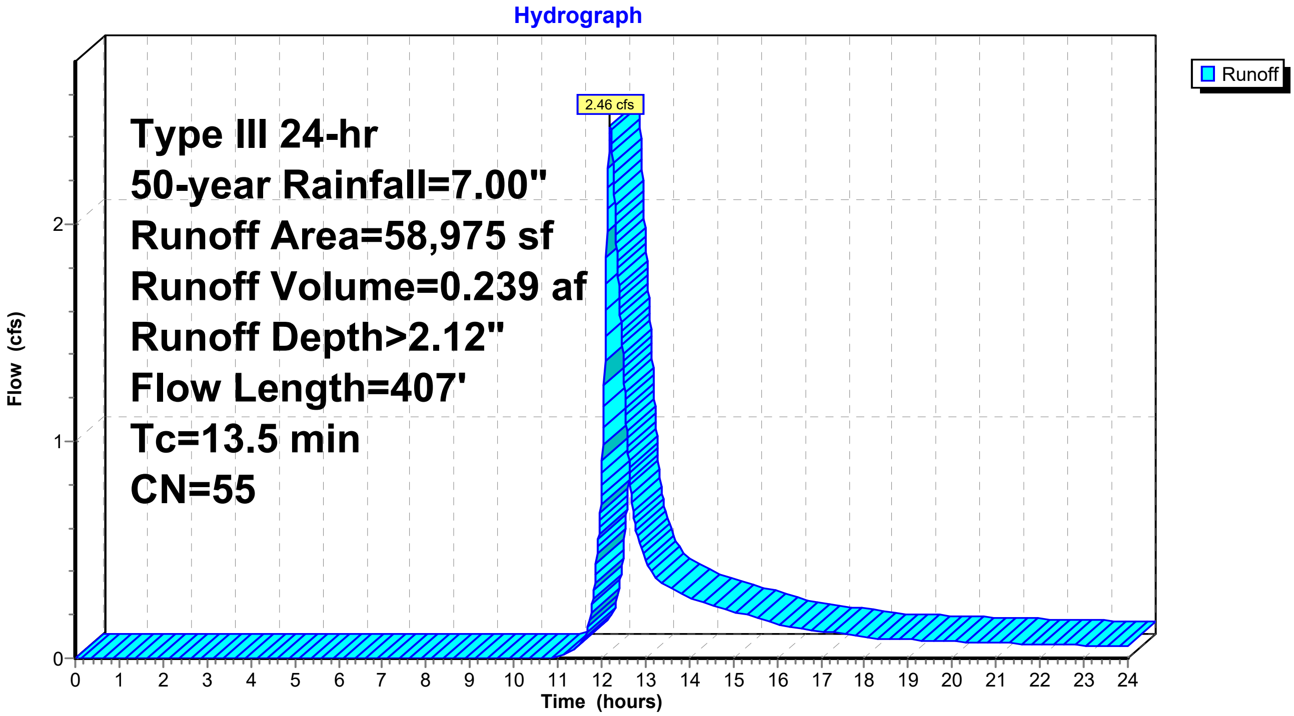
Reach 3R: Off-site flow (Route 15) Inflow=2.97 cfs 0.269 af
Outflow=2.97 cfs 0.269 af

Reach 4R: Off-site Flow (South) Inflow=2.34 cfs 0.192 af
Outflow=2.34 cfs 0.192 af

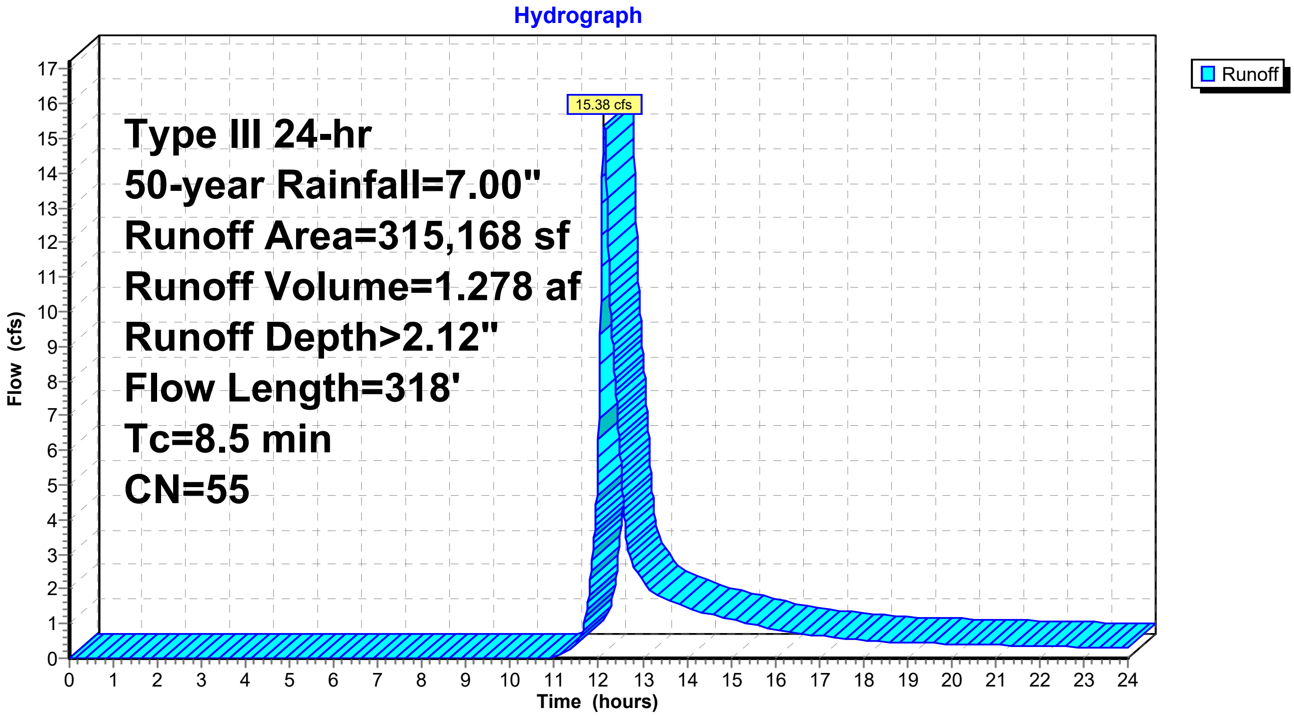
Reach 5R: Flow to Drianage Ditch Inflow=9.32 cfs 0.937 af
Outflow=9.32 cfs 0.937 af

Total Runoff Area = 15.893 ac Runoff Volume = 2.915 af Average Runoff Depth = 2.20"
98.26% Pervious = 15.616 ac 1.74% Impervious = 0.277 ac

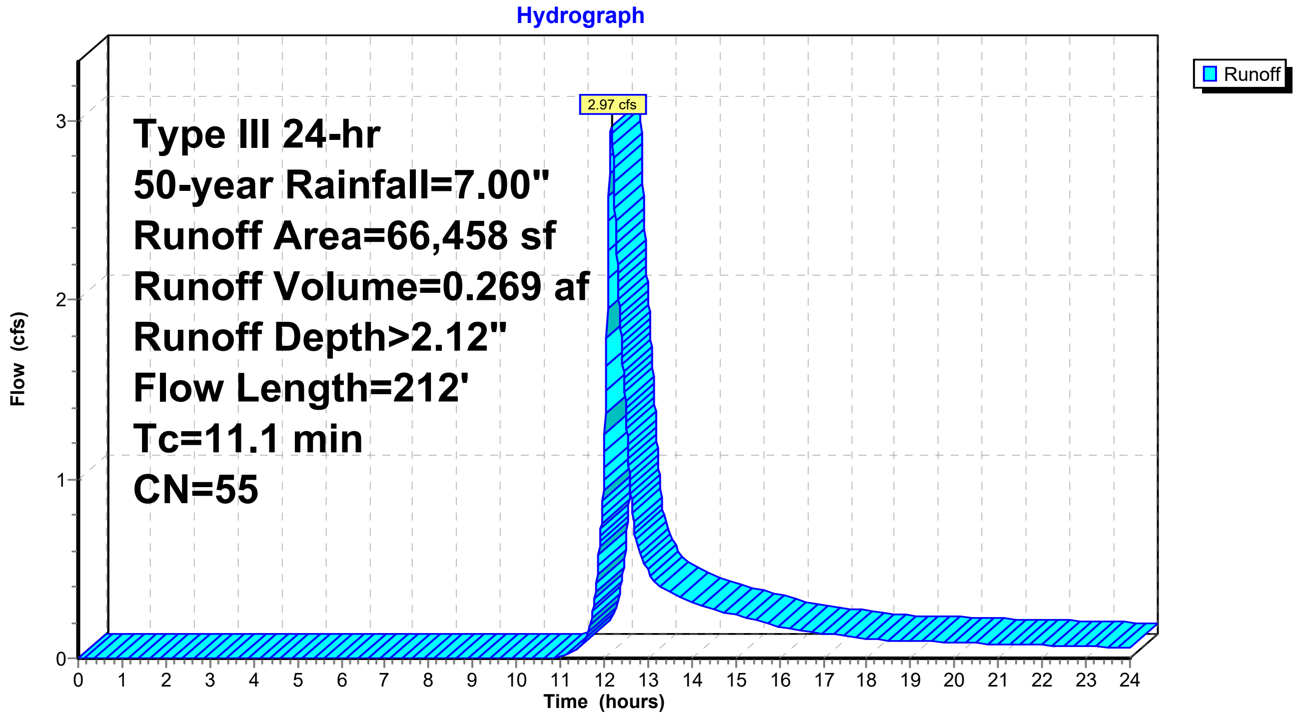
Subcatchment 1S: Area 1



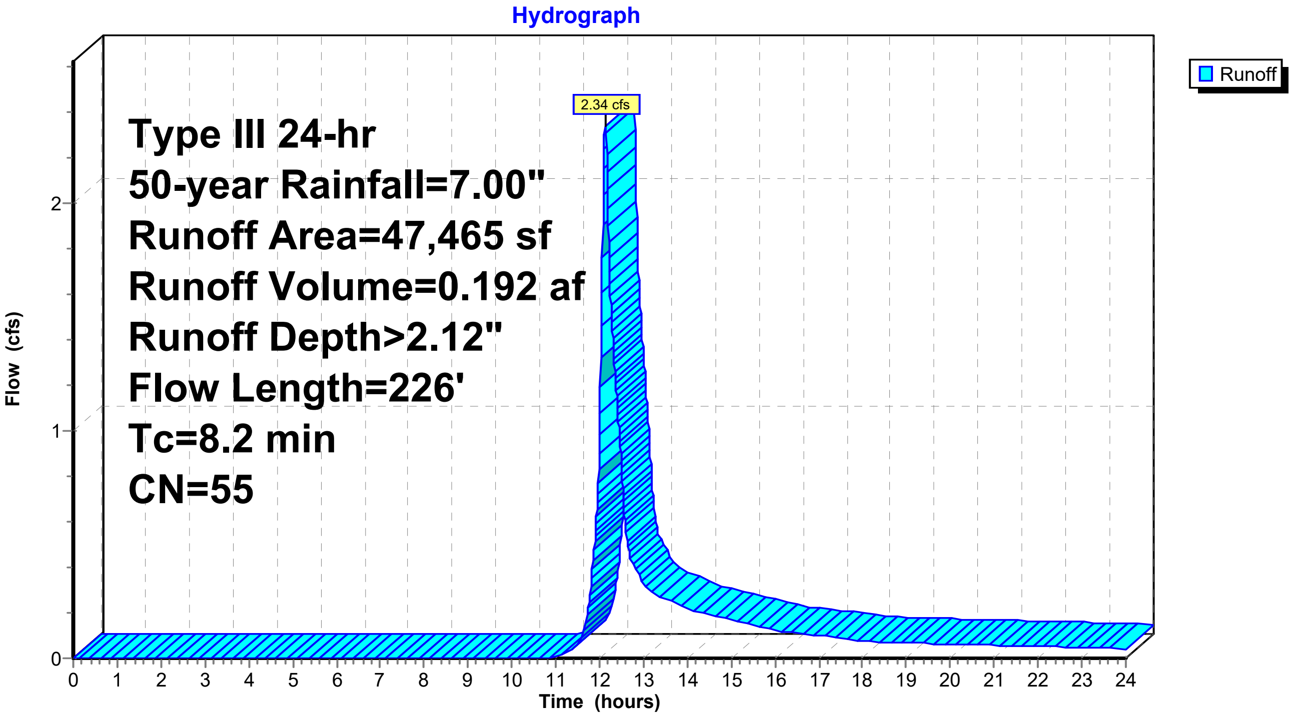
Subcatchment 2S: Area 2



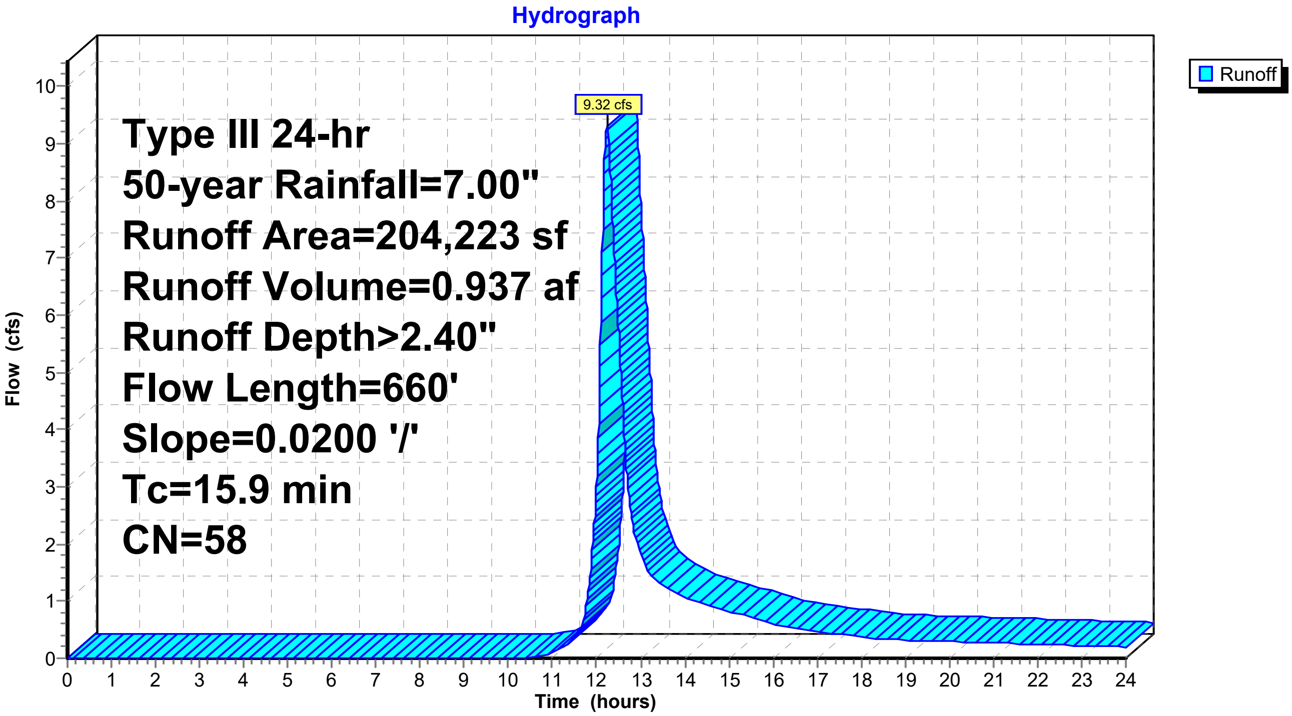
Subcatchment 3S: Area 3



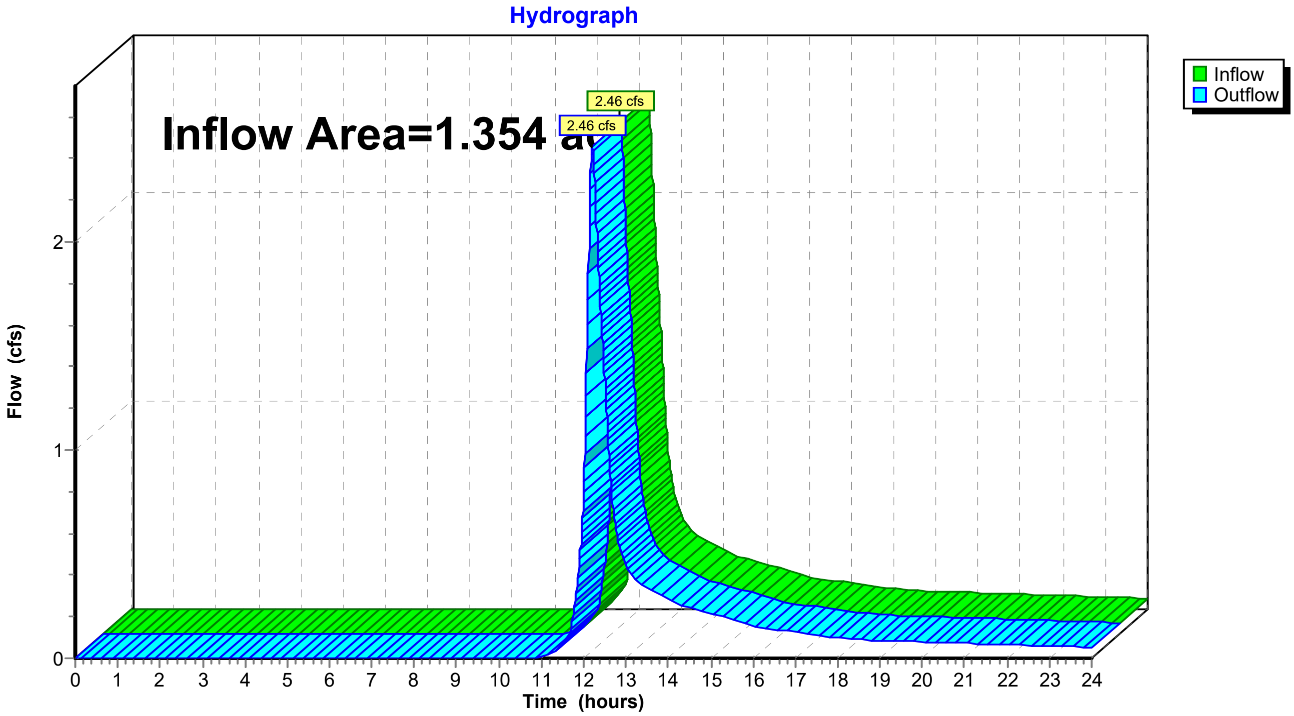
Subcatchment 4S: Area 4



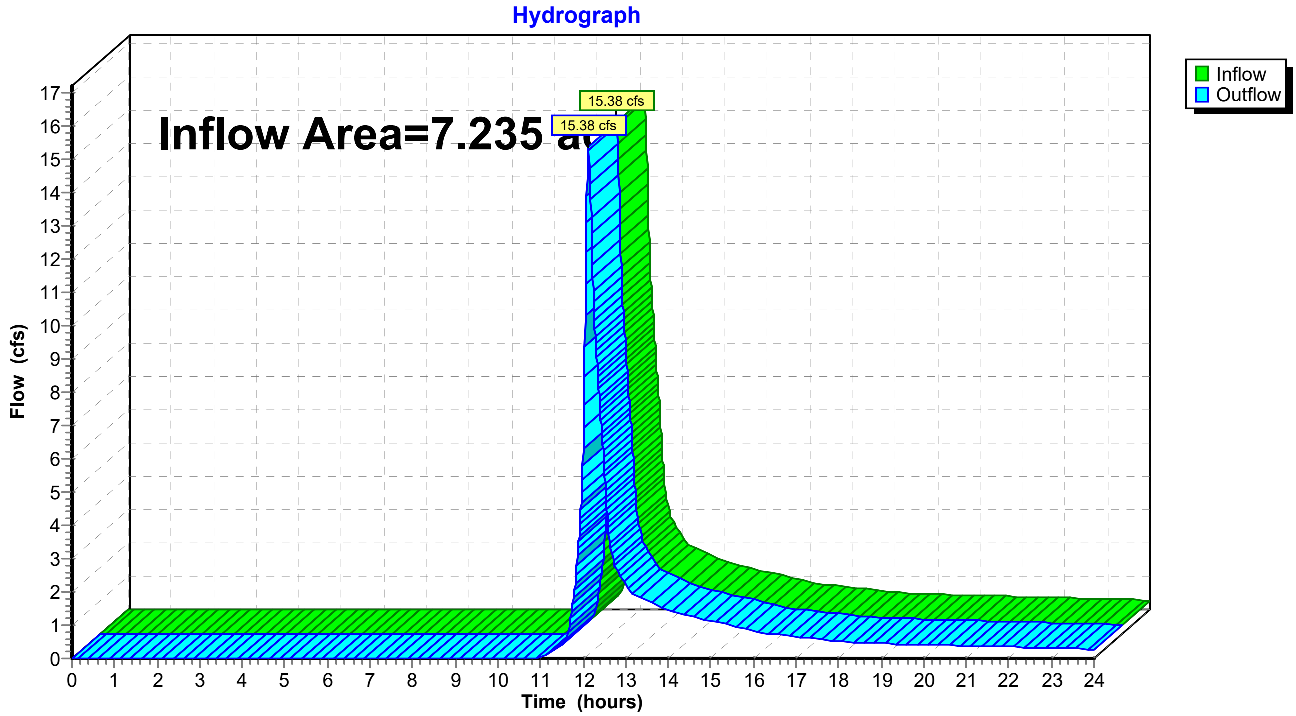
Subcatchment 5S: Area 5



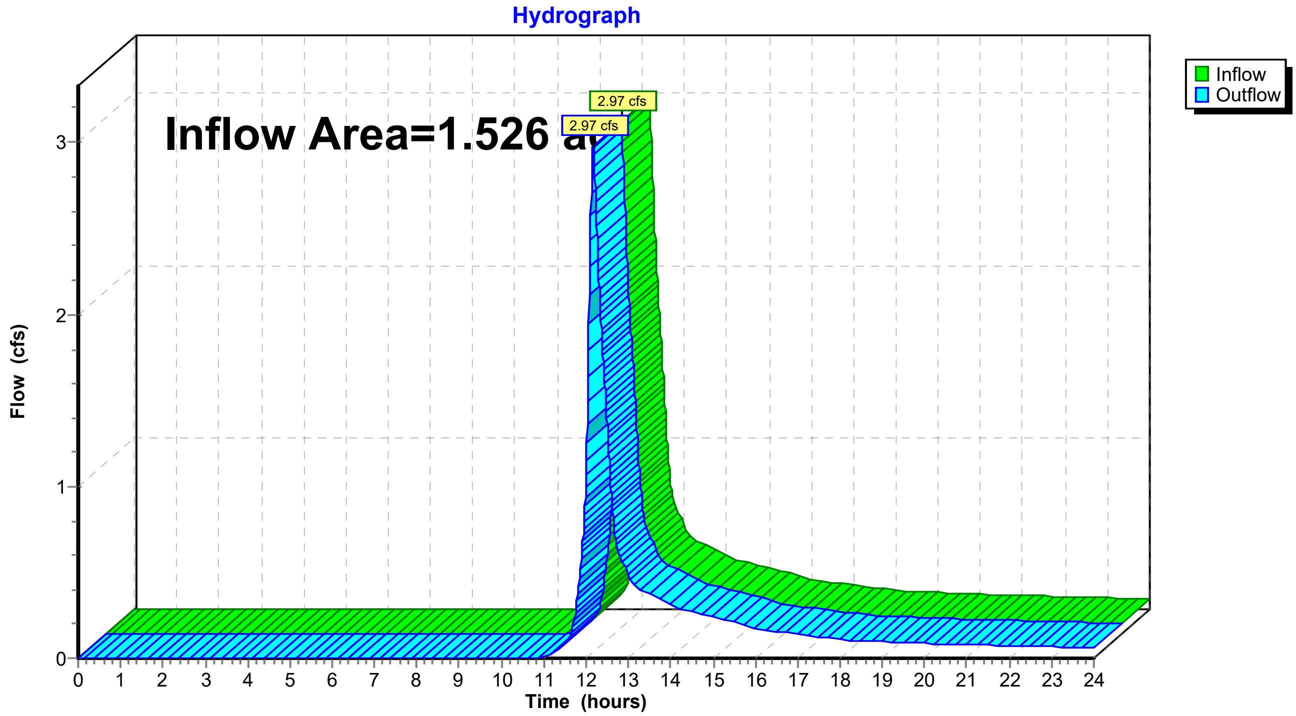
Reach 1R: Off-site Flow (Wetland - Northwest)



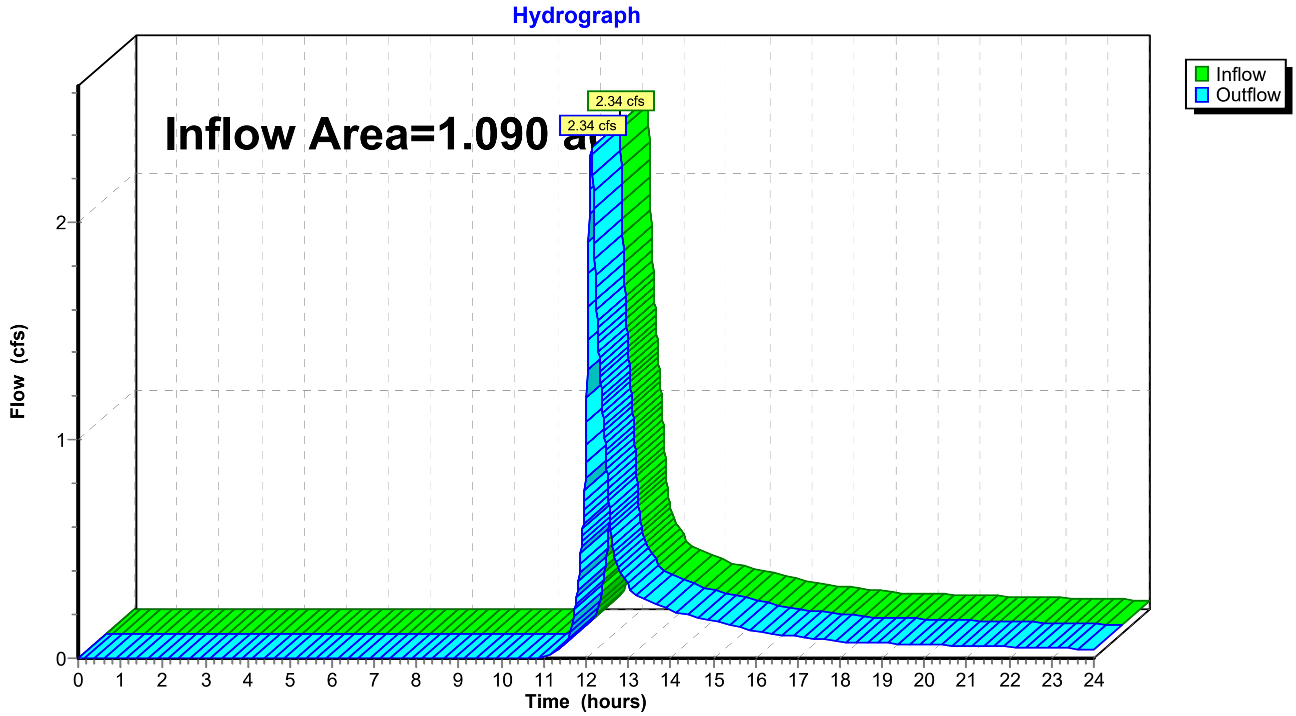
Reach 2R: Off-site Flow (East)



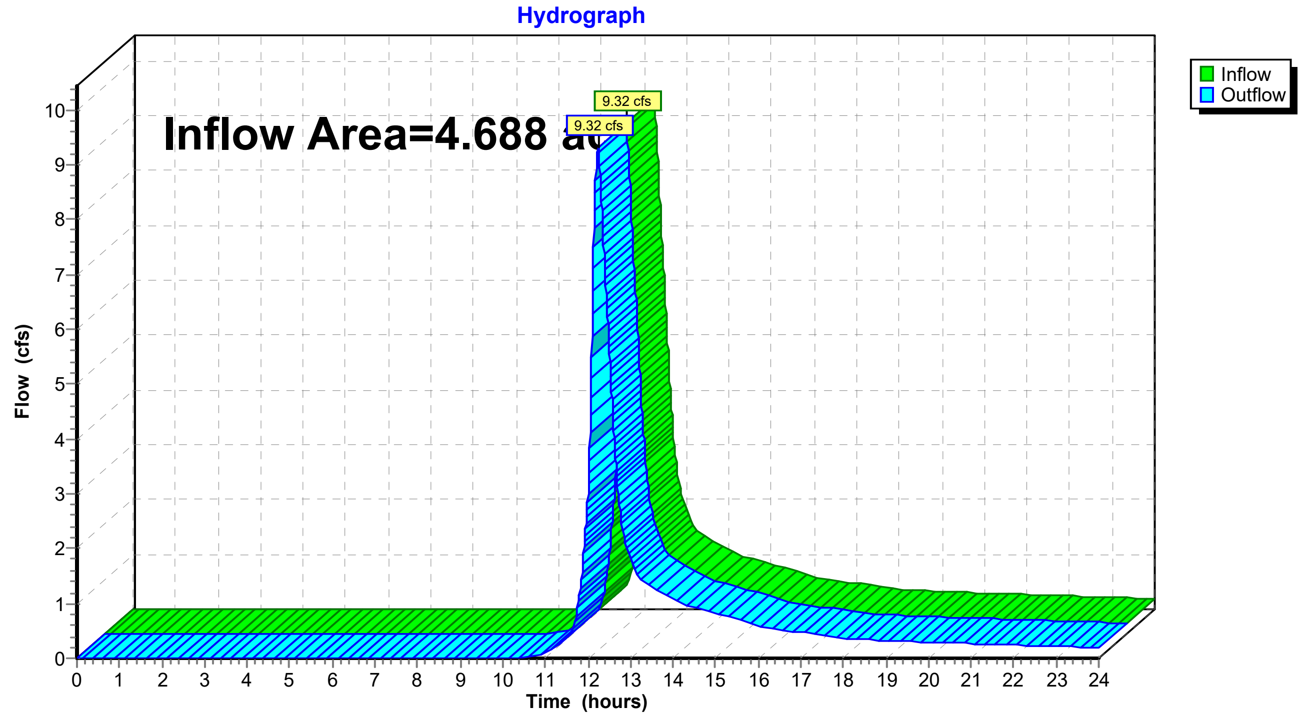
Reach 3R: Off-site flow (Route 15)



Reach 4R: Off-site Flow (South)



Reach 5R: Flow to Drianage Ditch



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Area 1 Runoff Area=58,975 sf 0.00% Impervious Runoff Depth>2.72"
Flow Length=407' Tc=13.5 min CN=55 Runoff=3.25 cfs 0.307 af

Subcatchment2S: Area 2 Runoff Area=315,168 sf 0.00% Impervious Runoff Depth>2.72"
Flow Length=318' Tc=8.5 min CN=55 Runoff=20.30 cfs 1.642 af

Subcatchment3S: Area 3 Runoff Area=66,458 sf 0.00% Impervious Runoff Depth>2.72"
Flow Length=212' Tc=11.1 min CN=55 Runoff=3.93 cfs 0.346 af

Subcatchment4S: Area 4 Runoff Area=47,465 sf 0.00% Impervious Runoff Depth>2.72"
Flow Length=226' Tc=8.2 min CN=55 Runoff=3.09 cfs 0.247 af

Subcatchment5S: Area 5 Runoff Area=204,223 sf 5.90% Impervious Runoff Depth>3.04"
Flow Length=660' Slope=0.0200 '/' Tc=15.9 min CN=58 Runoff=12.03 cfs 1.189 af

Reach 1R: Off-site Flow (Wetland - Northwest) Inflow=3.25 cfs 0.307 af
Outflow=3.25 cfs 0.307 af

Reach 2R: Off-site Flow (East) Inflow=20.30 cfs 1.642 af
Outflow=20.30 cfs 1.642 af

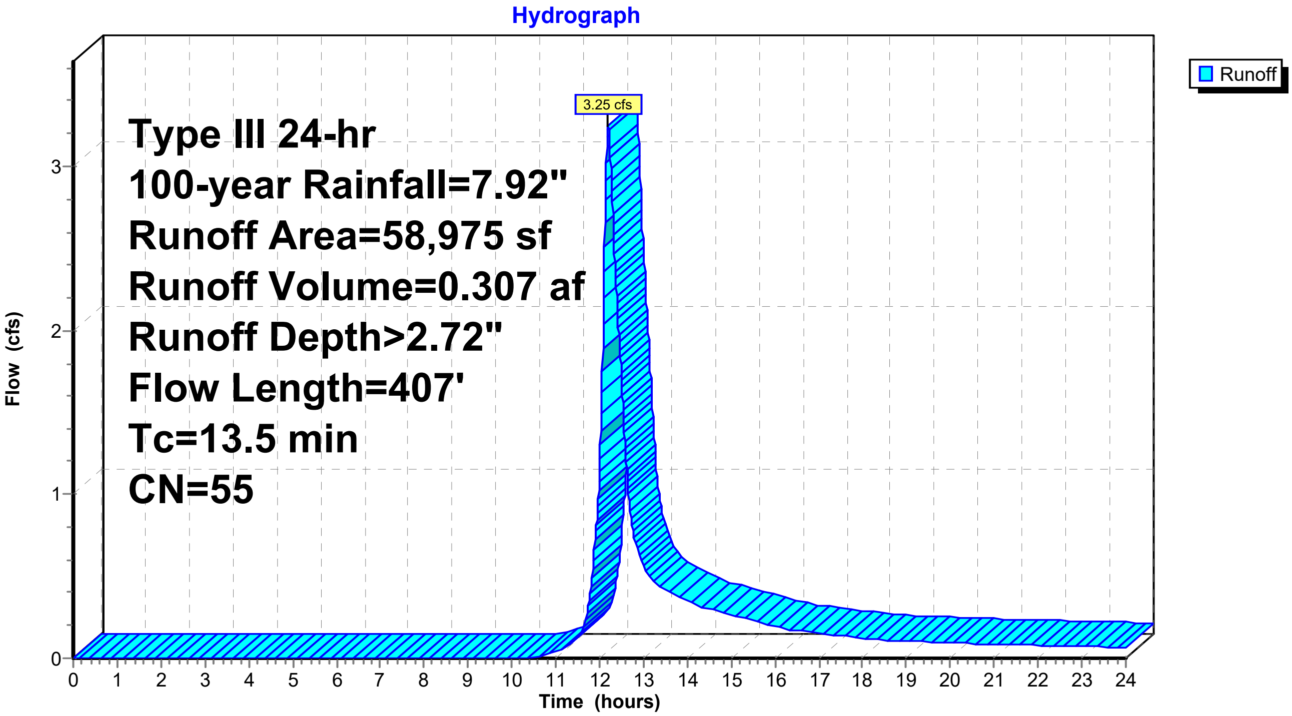
Reach 3R: Off-site flow (Route 15) Inflow=3.93 cfs 0.346 af
Outflow=3.93 cfs 0.346 af

Reach 4R: Off-site Flow (South) Inflow=3.09 cfs 0.247 af
Outflow=3.09 cfs 0.247 af

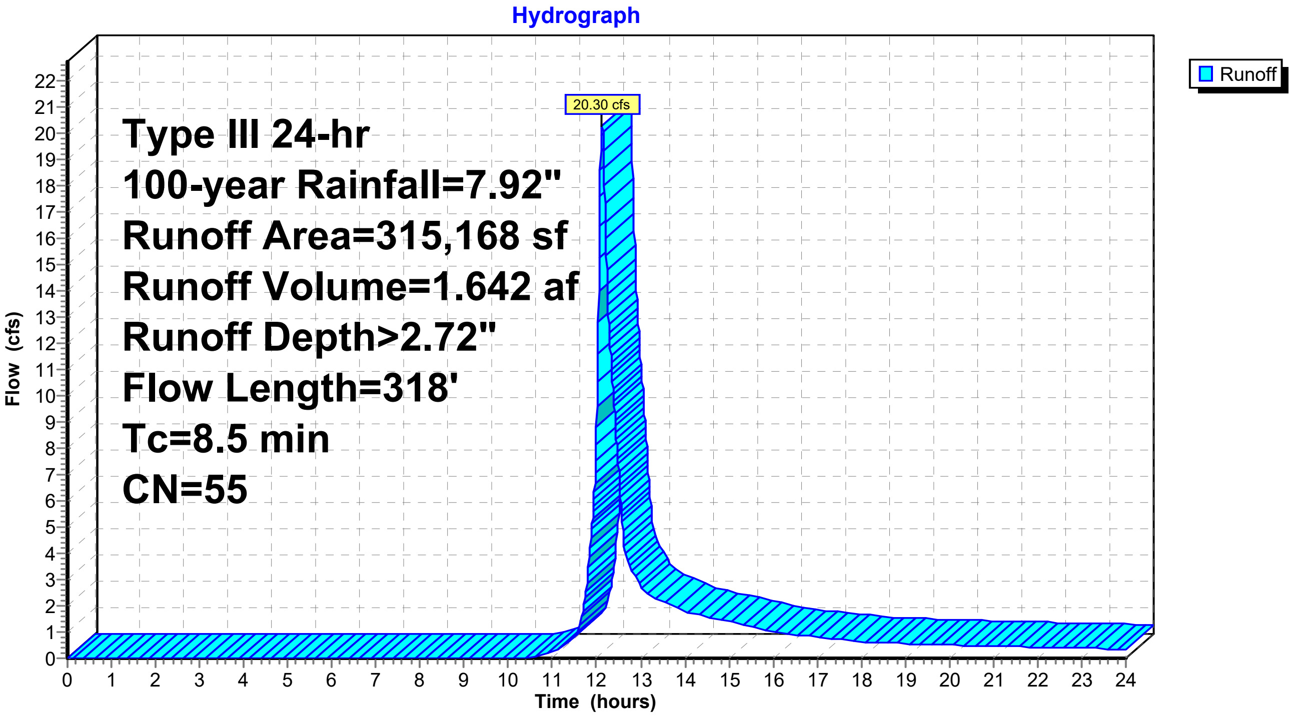
Reach 5R: Flow to Drianage Ditch Inflow=12.03 cfs 1.189 af
Outflow=12.03 cfs 1.189 af

Total Runoff Area = 15.893 ac Runoff Volume = 3.731 af Average Runoff Depth = 2.82"
98.26% Pervious = 15.616 ac 1.74% Impervious = 0.277 ac

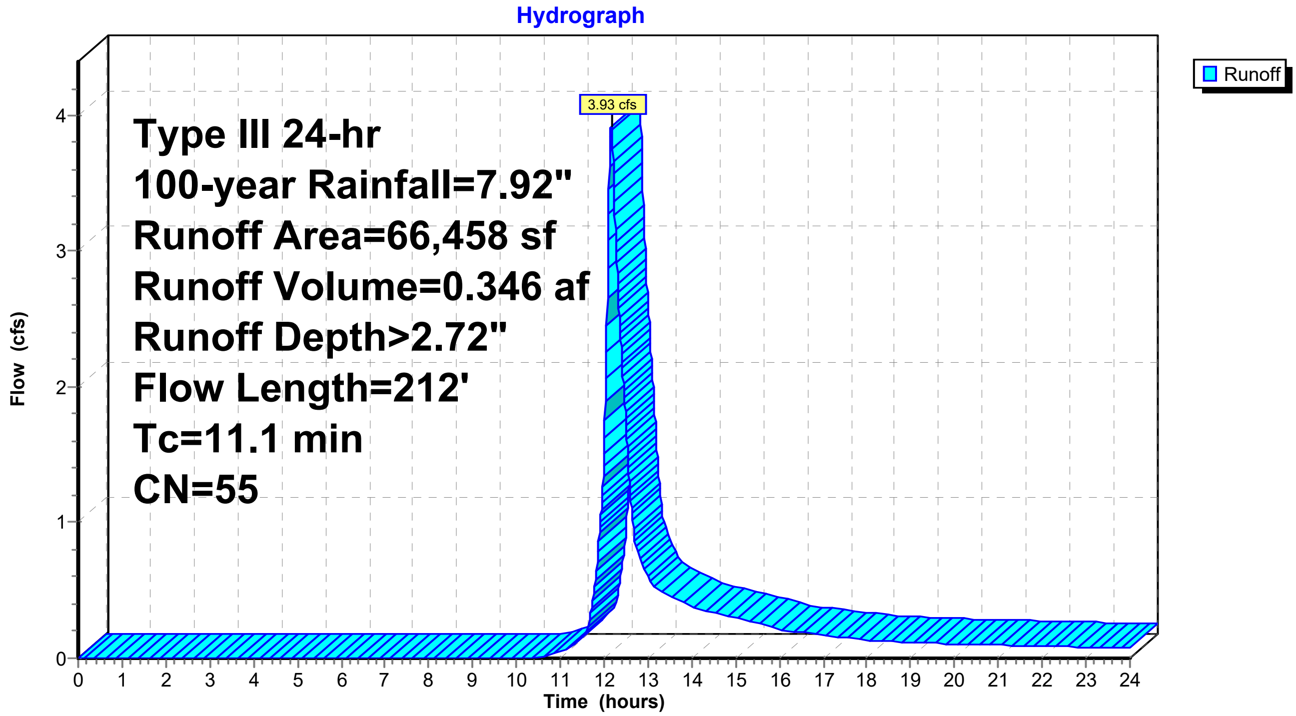
Subcatchment 1S: Area 1



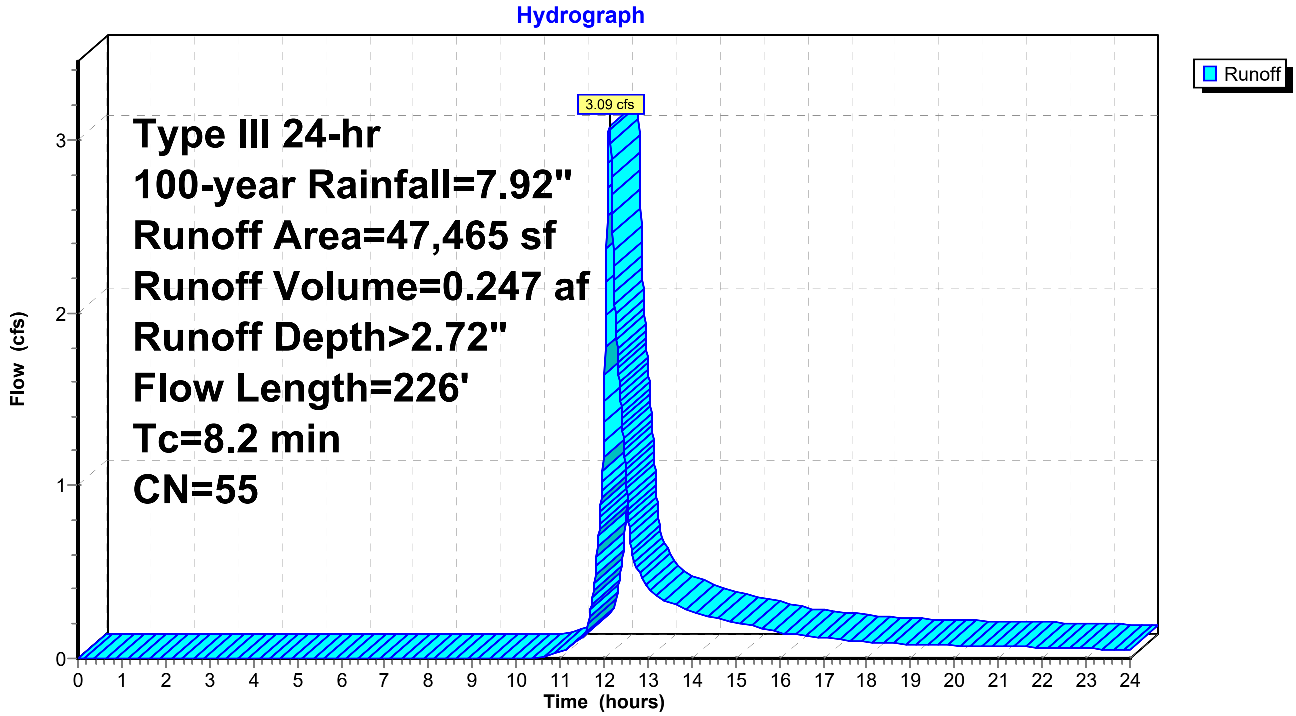
Subcatchment 2S: Area 2



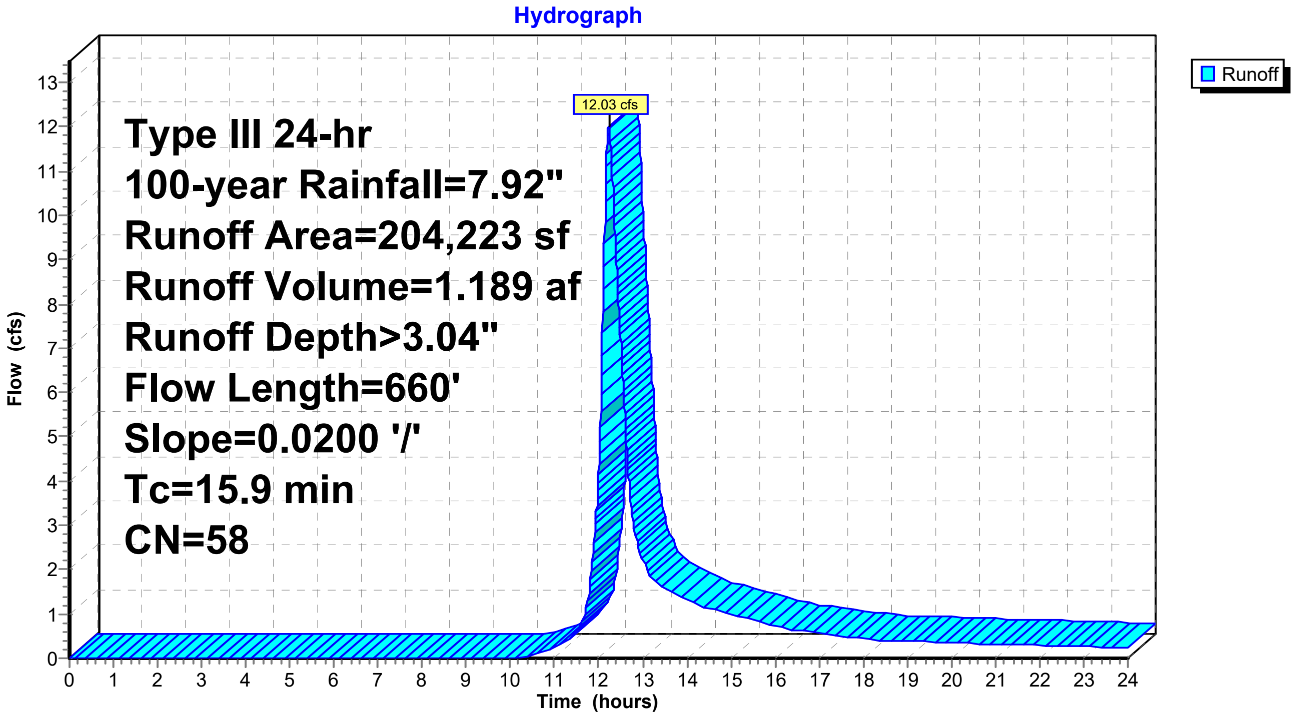
Subcatchment 3S: Area 3



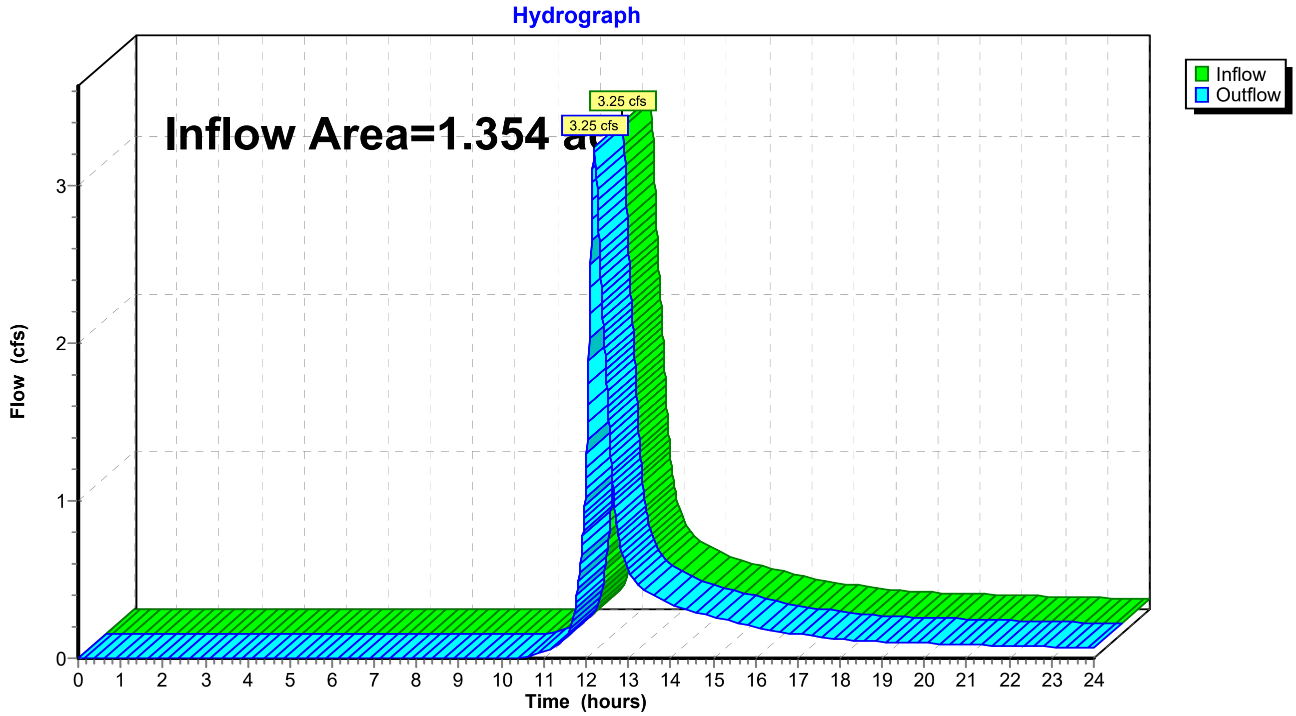
Subcatchment 4S: Area 4



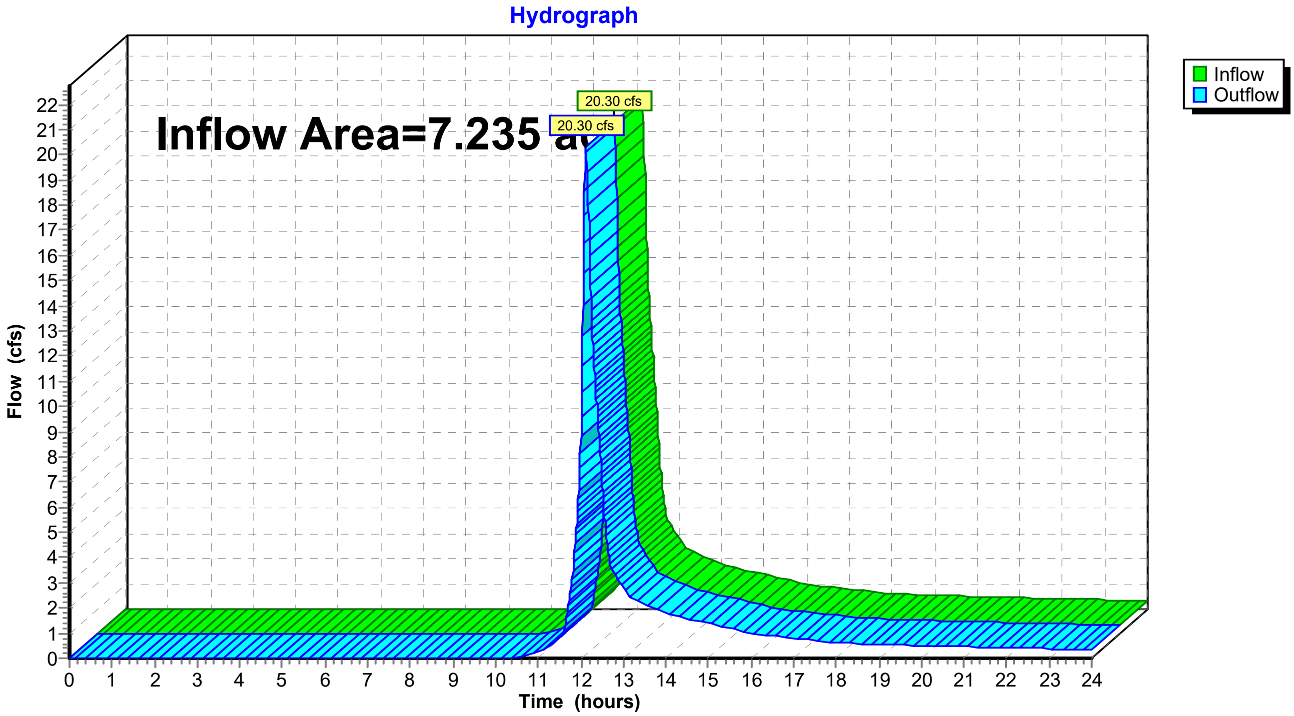
Subcatchment 5S: Area 5



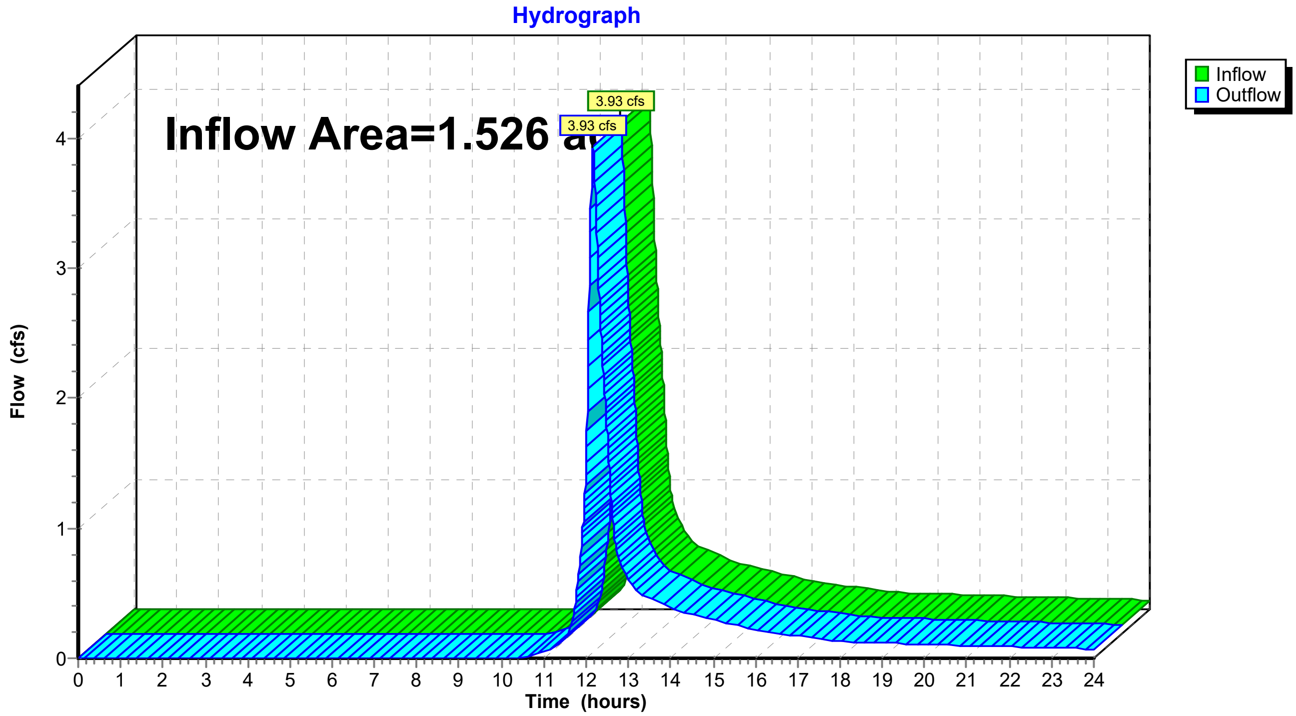
Reach 1R: Off-site Flow (Wetland - Northwest)



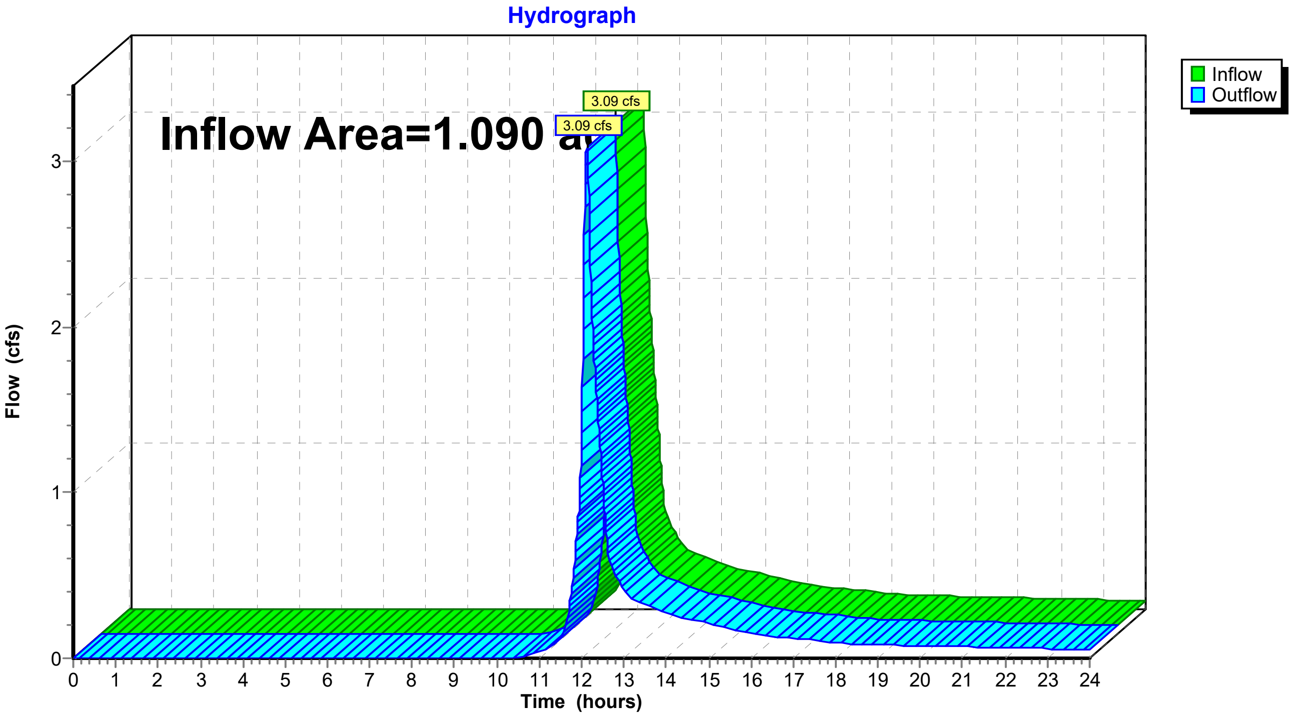
Reach 2R: Off-site Flow (East)



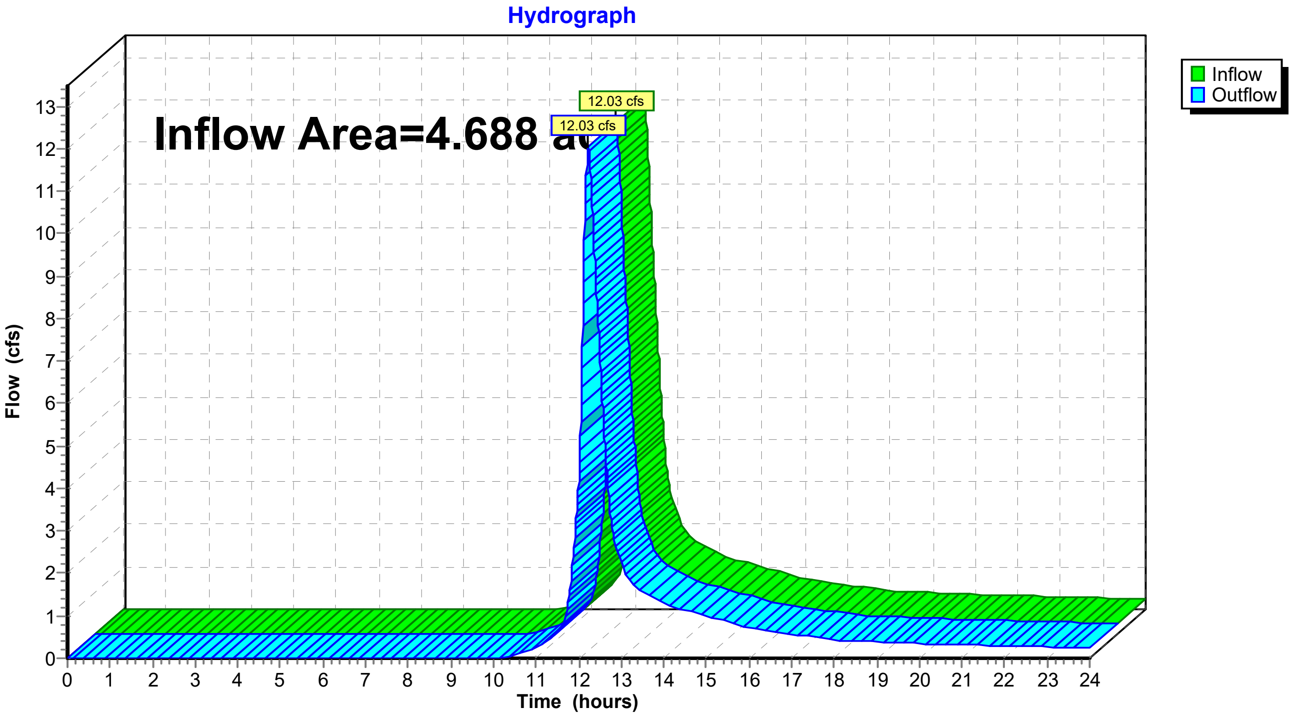
Reach 3R: Off-site flow (Route 15)



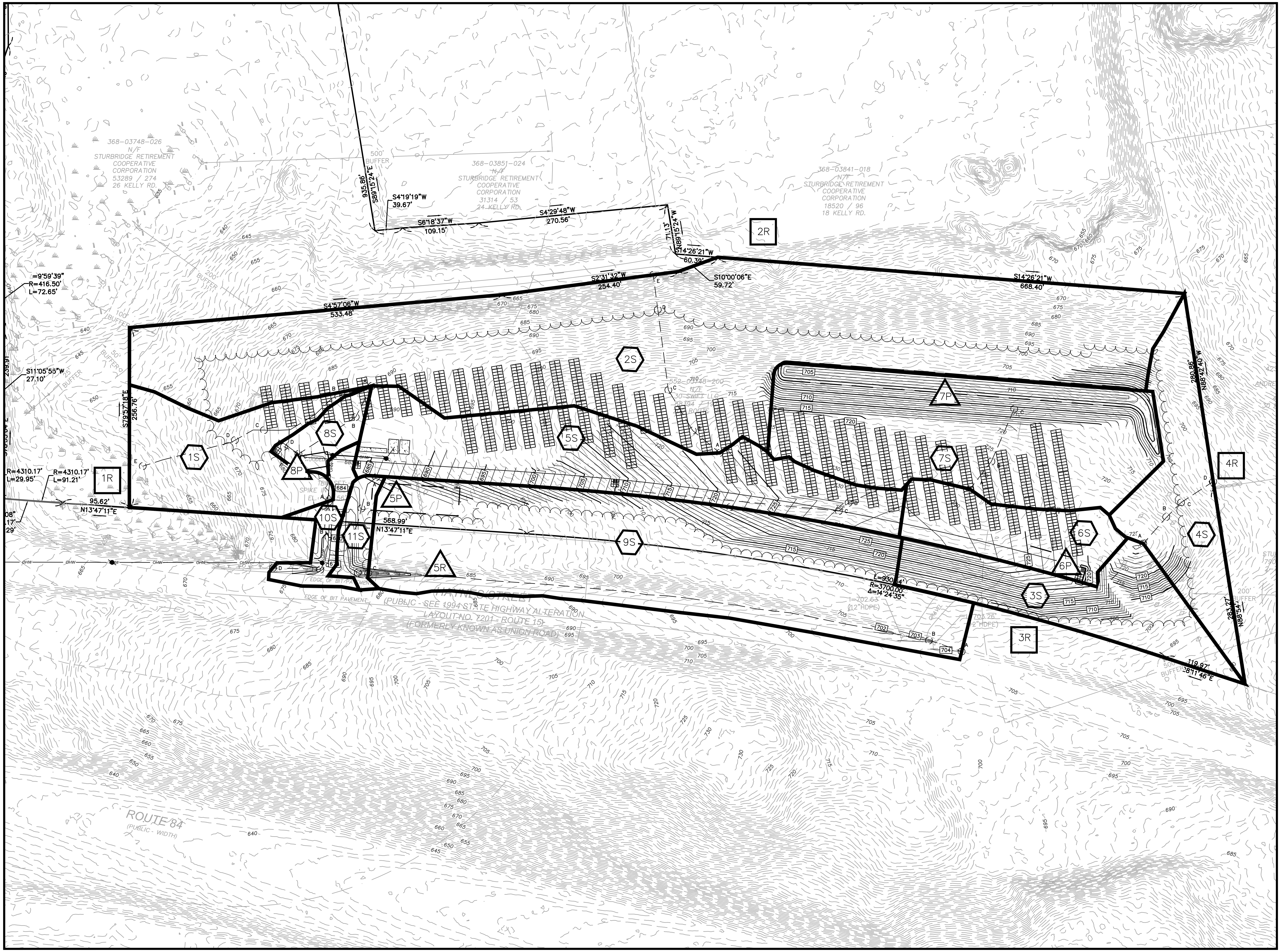
Reach 4R: Off-site Flow (South)



Reach 5R: Flow to Drianage Ditch



6.03 PROPOSED WATERSHED PLAN



BRIAN G. YERGATIAN
PROFESSIONAL ENGINEER
DATE

GROUND-MOUNTED PHOTOVOLTAIC SYSTEM

200 ROUTE 15

IN

STURBRIDGE MASSACHUSETTS

(WORCESTER COUNTY)

POST-DEVELOPMENT WATERSHED PLAN

APRIL 7, 2023

REVISIONS:

NO.	DATE	DESC.

PREPARED FOR:

STURBRIDGE PV, LLC
2420 17TH STREET
DENVER, CO 80202

BSC GROUP
349 Main Street - Route 28
West Yarmouth, Massachusetts
02673
508 778 8919

SCALE: 1" = 60'

0 30 60 120 FEET

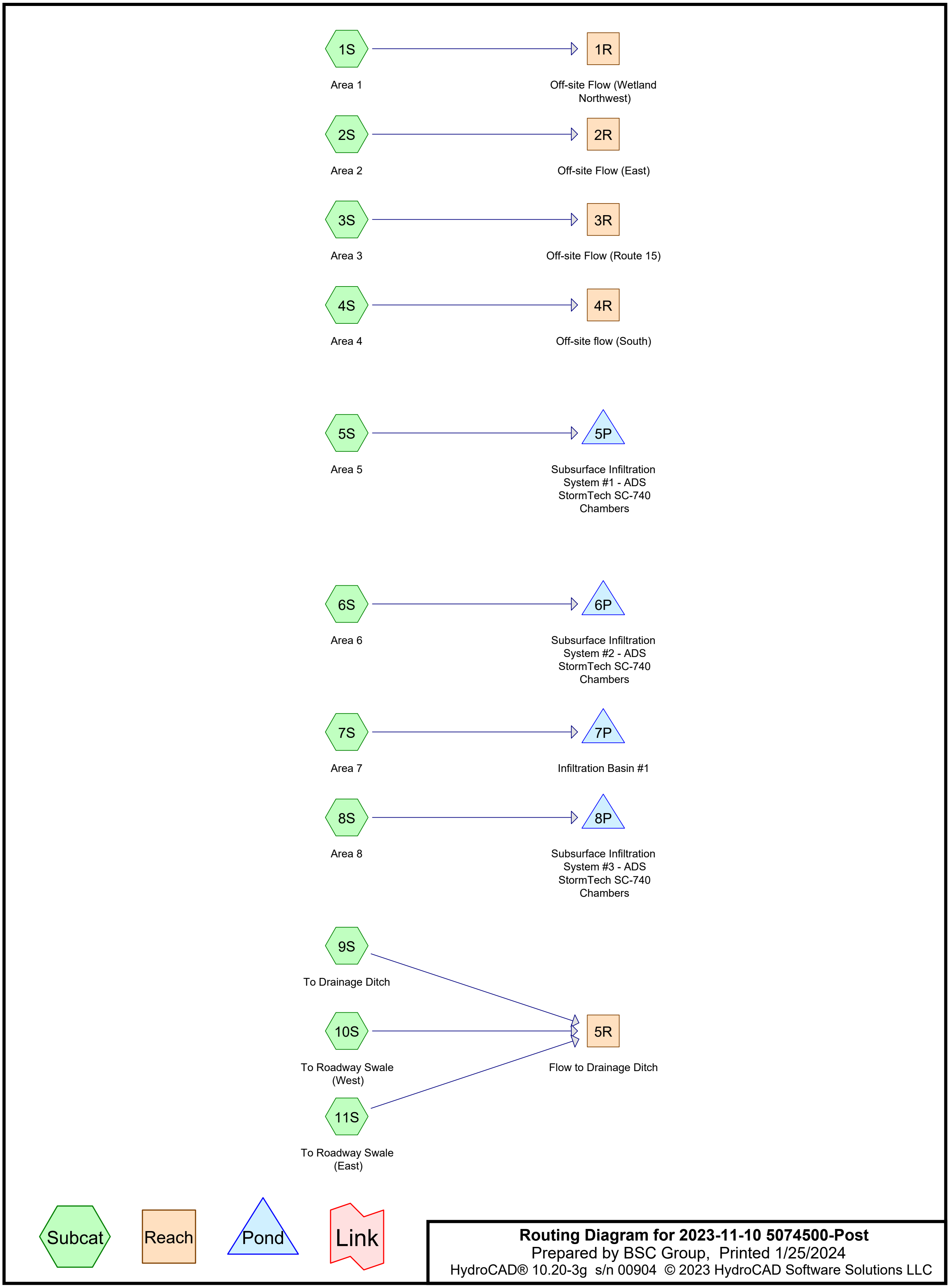
FILE: PROJECTS-YAR\5074500\C\D\5074500-SP.dwg

DWG.: DWG

JOB. NO: 5-0745.00

SHEET 1 OF 1

6.04 PROPOSED HYDROLOGY CALCULATIONS (HYDROCAD™ PRINTOUTS)



Routing Diagram for 2023-11-10 5074500-Post
Prepared by BSC Group, Printed 1/25/2024
HydroCAD® 10.20-3g s/n 00904 © 2023 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.23	2
2	10-year	Type III 24-hr		Default	24.00	1	5.04	2
3	25-year	Type III 24-hr		Default	24.00	1	6.17	2
4	50-year	Type III 24-hr		Default	24.00	1	7.00	2
5	100-year	Type III 24-hr		Default	24.00	1	7.92	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.121	61	>75% Grass cover, Good, HSG B (11S)
0.018	98	Equiptment pads, HSG B (5S)
0.485	96	Gravel surface, HSG B (5S, 6S)
8.861	58	Meadow, non-grazed, HSG B (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S)
0.405	98	Paved parking, HSG B (8S, 9S, 10S, 11S)
6.002	55	Woods, Good, HSG B (1S, 2S, 3S, 4S, 9S, 10S, 11S)
15.893	**59**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
15.893	HSG B	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
15.893		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.121	0.000	0.000	0.000	0.121	>75% Grass cover, Good	11S
0.000	0.018	0.000	0.000	0.000	0.018	Equiptment pads	5S
0.000	0.485	0.000	0.000	0.000	0.485	Gravel surface	5S, 6S
0.000	8.861	0.000	0.000	0.000	8.861	Meadow, non-grazed	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S
0.000	0.405	0.000	0.000	0.000	0.405	Paved parking	8S, 9S, 10S, 11S
0.000	6.002	0.000	0.000	0.000	6.002	Woods, Good	1S, 2S, 3S, 4S, 9S, 10S, 11S
0.000	**15.893**	**0.000**	**0.000**	**0.000**	**15.893**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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: Area 1 Runoff Area=40,217 sf 0.00% Impervious Runoff Depth>0.29"
Flow Length=350' Tc=6.0 min CN=56 Runoff=0.12 cfs 0.022 af

Subcatchment 2S: Area 2 Runoff Area=232,592 sf 0.00% Impervious Runoff Depth>0.29"
Flow Length=283' Tc=6.0 min CN=56 Runoff=0.70 cfs 0.128 af

Subcatchment 3S: Area 3 Runoff Area=39,823 sf 0.00% Impervious Runoff Depth>0.32"
Tc=6.0 min CN=57 Runoff=0.14 cfs 0.024 af

Subcatchment 4S: Area 4 Runoff Area=38,577 sf 0.00% Impervious Runoff Depth>0.29"
Flow Length=132' Tc=6.0 min CN=56 Runoff=0.12 cfs 0.021 af

Subcatchment 5S: Area 5 Runoff Area=72,459 sf 1.10% Impervious Runoff Depth>0.70"
Tc=6.0 min CN=67 Runoff=1.15 cfs 0.097 af

Subcatchment 6S: Area 6 Runoff Area=26,951 sf 0.00% Impervious Runoff Depth>0.66"
Tc=6.0 min CN=66 Runoff=0.39 cfs 0.034 af

Subcatchment 7S: Area 7 Runoff Area=89,330 sf 0.00% Impervious Runoff Depth>0.35"
Flow Length=133' Tc=6.0 min CN=58 Runoff=0.40 cfs 0.060 af

Subcatchment 8S: Area 8 Runoff Area=8,279 sf 20.69% Impervious Runoff Depth>0.66"
Flow Length=170' Tc=6.0 min CN=66 Runoff=0.12 cfs 0.010 af

Subcatchment 9S: To Drainage Ditch Runoff Area=127,753 sf 7.29% Impervious Runoff Depth>0.38"
Flow Length=857' Slope=0.0200 '/' Tc=19.2 min CN=59 Runoff=0.54 cfs 0.093 af

Subcatchment 10S: To Roadway Swale Runoff Area=9,297 sf 55.10% Impervious Runoff Depth>1.42"
Flow Length=167' Tc=6.0 min CN=80 Runoff=0.35 cfs 0.025 af

Subcatchment 11S: To Roadway Swale Runoff Area=7,003 sf 21.56% Impervious Runoff Depth>0.80"
Flow Length=153' Tc=6.2 min CN=69 Runoff=0.13 cfs 0.011 af

Reach 1R: Off-site Flow (Wetland Northwest) Inflow=0.12 cfs 0.022 af
Outflow=0.12 cfs 0.022 af

Reach 2R: Off-site Flow (East) Inflow=0.70 cfs 0.128 af
Outflow=0.70 cfs 0.128 af

Reach 3R: Off-site Flow (Route 15) Inflow=0.14 cfs 0.024 af
Outflow=0.14 cfs 0.024 af

Reach 4R: Off-site flow (South) Inflow=0.12 cfs 0.021 af
Outflow=0.12 cfs 0.021 af

Reach 5R: Flow to Drainage Ditch Inflow=0.73 cfs 0.129 af
Outflow=0.73 cfs 0.129 af

Pond 5P: Subsurface Infiltration System #1 - Peak Elev=680.92' Storage=830 cf Inflow=1.15 cfs 0.097 af
Outflow=0.33 cfs 0.097 af

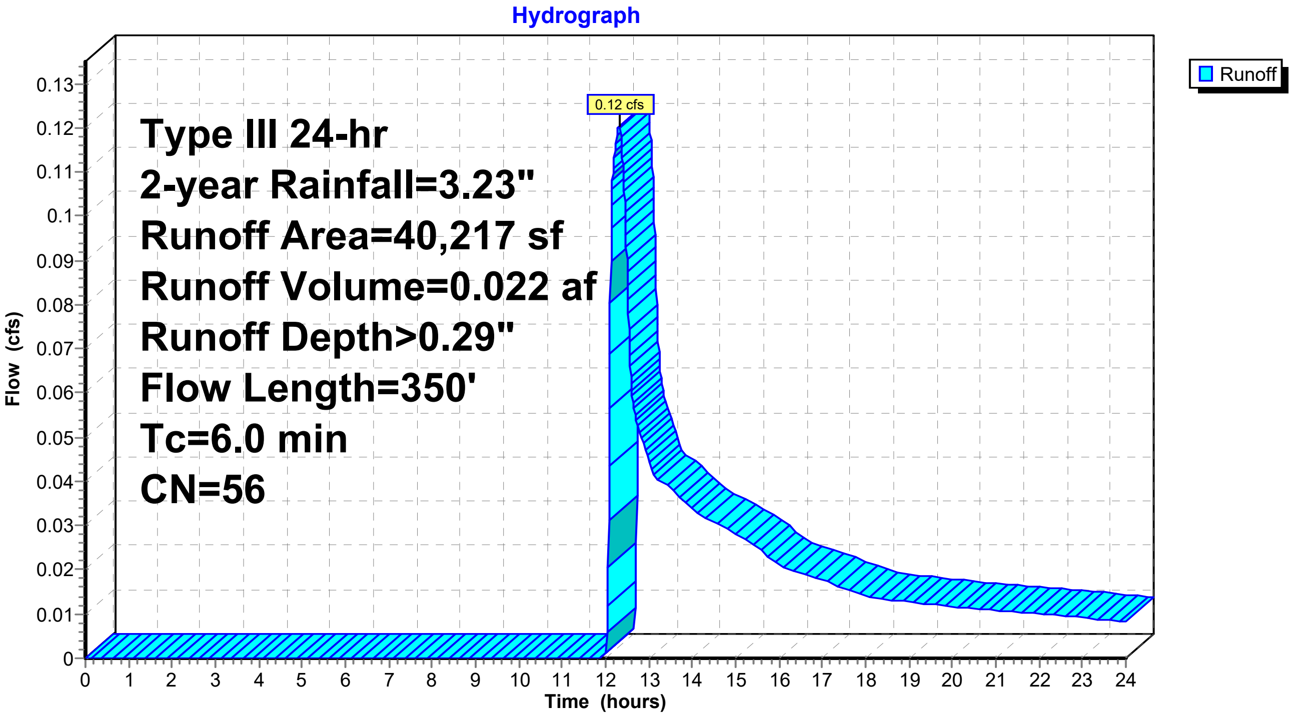
Pond 6P: Subsurface Infiltration System #2 - Peak Elev=711.37' Storage=272 cf Inflow=0.39 cfs 0.034 af
Outflow=0.12 cfs 0.034 af

Pond 7P: Infiltration Basin #1 Peak Elev=703.17' Storage=379 cf Inflow=0.40 cfs 0.060 af
Outflow=0.14 cfs 0.060 af

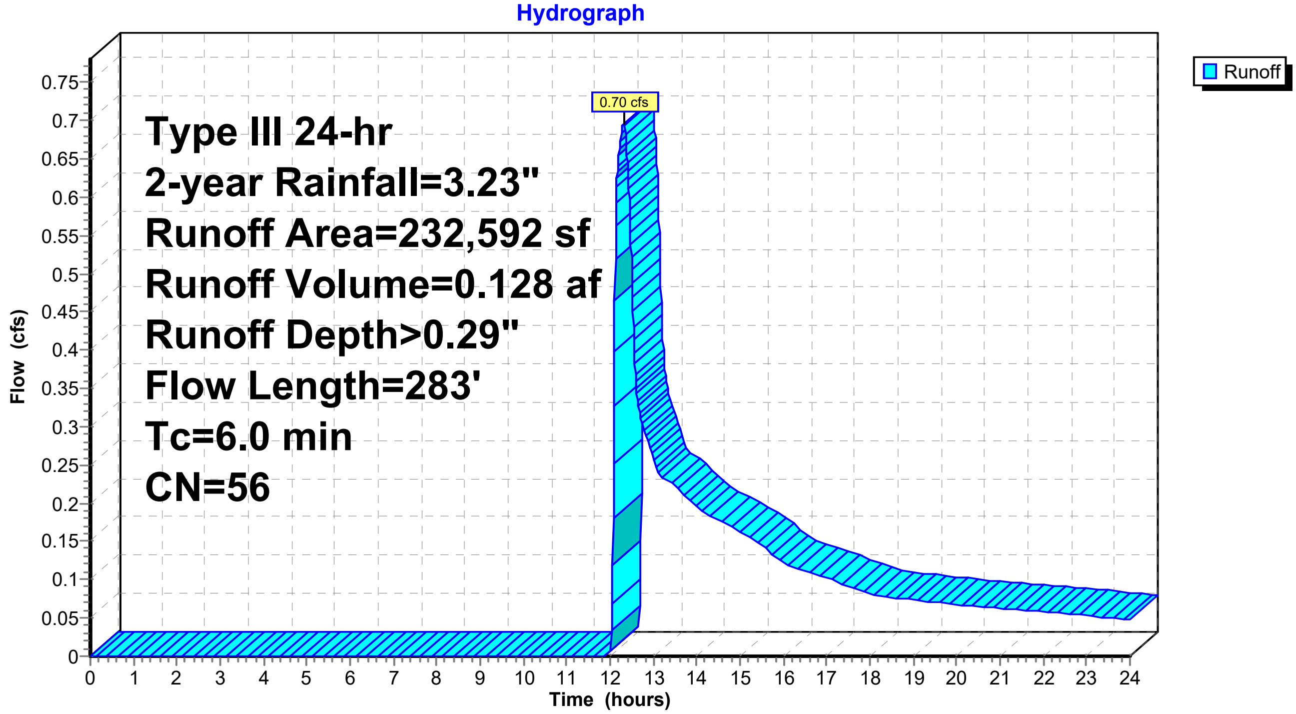
Pond 8P: Subsurface Infiltration System #3 - Peak Elev=677.44' Storage=61 cf Inflow=0.12 cfs 0.010 af
Outflow=0.05 cfs 0.010 af

Total Runoff Area = 15.893 ac Runoff Volume = 0.527 af Average Runoff Depth = 0.40"
97.34% Pervious = 15.469 ac 2.66% Impervious = 0.423 ac

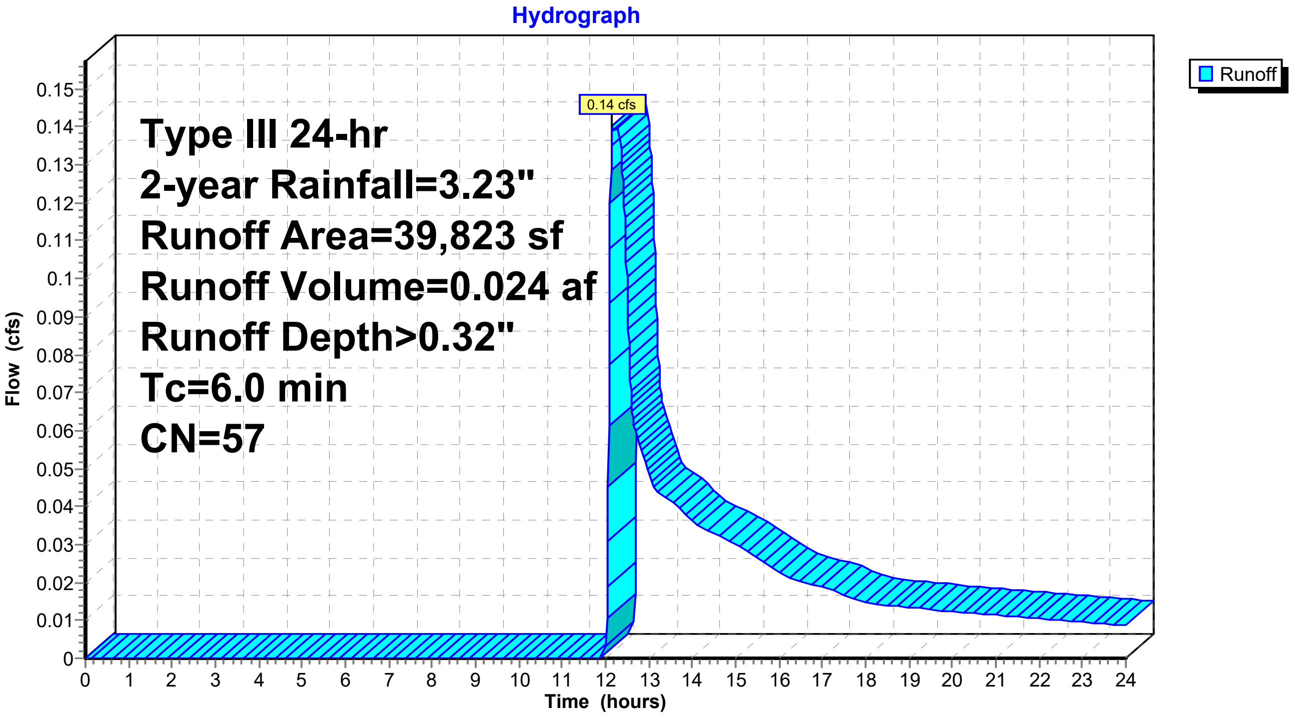
Subcatchment 1S: Area 1



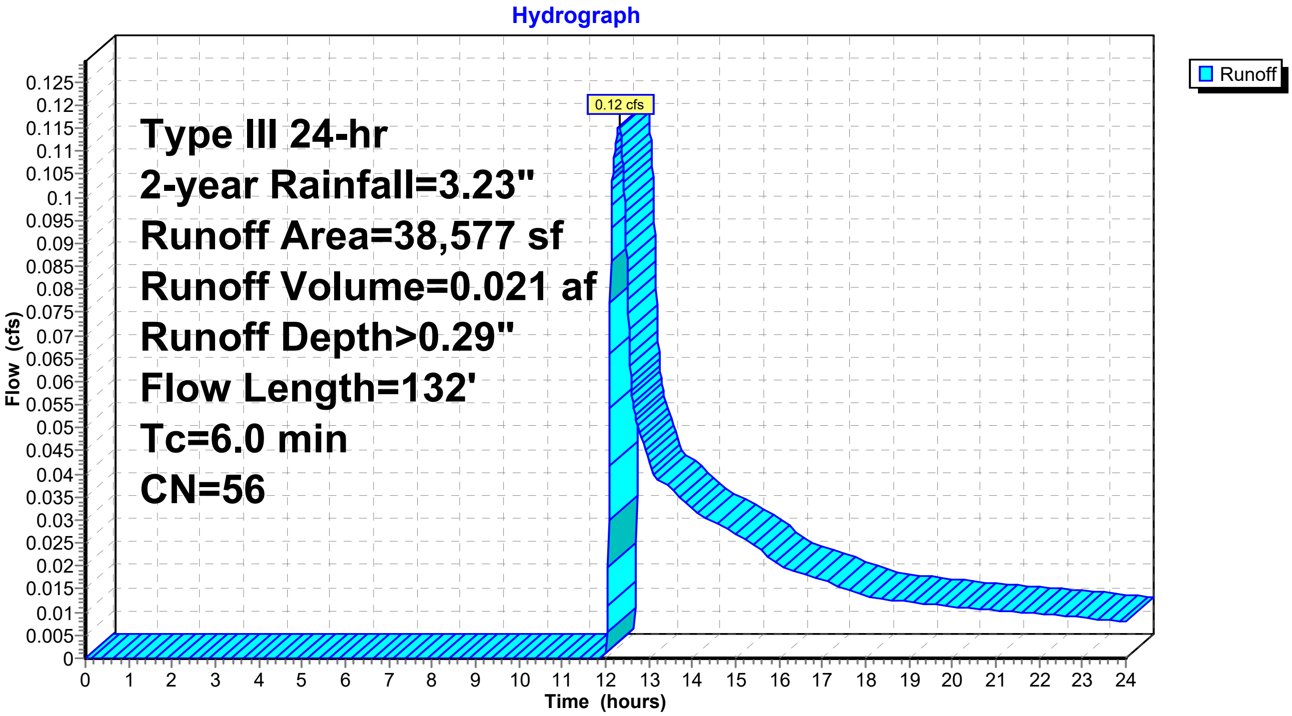
Subcatchment 2S: Area 2



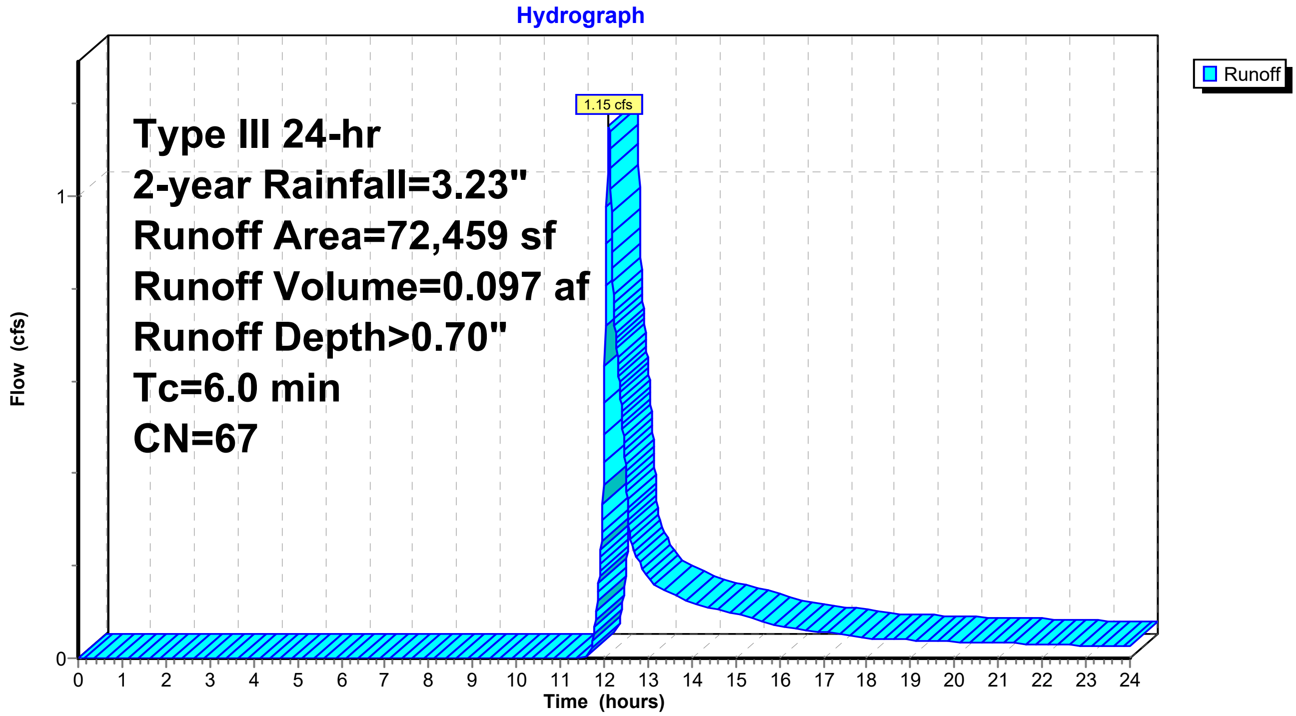
Subcatchment 3S: Area 3



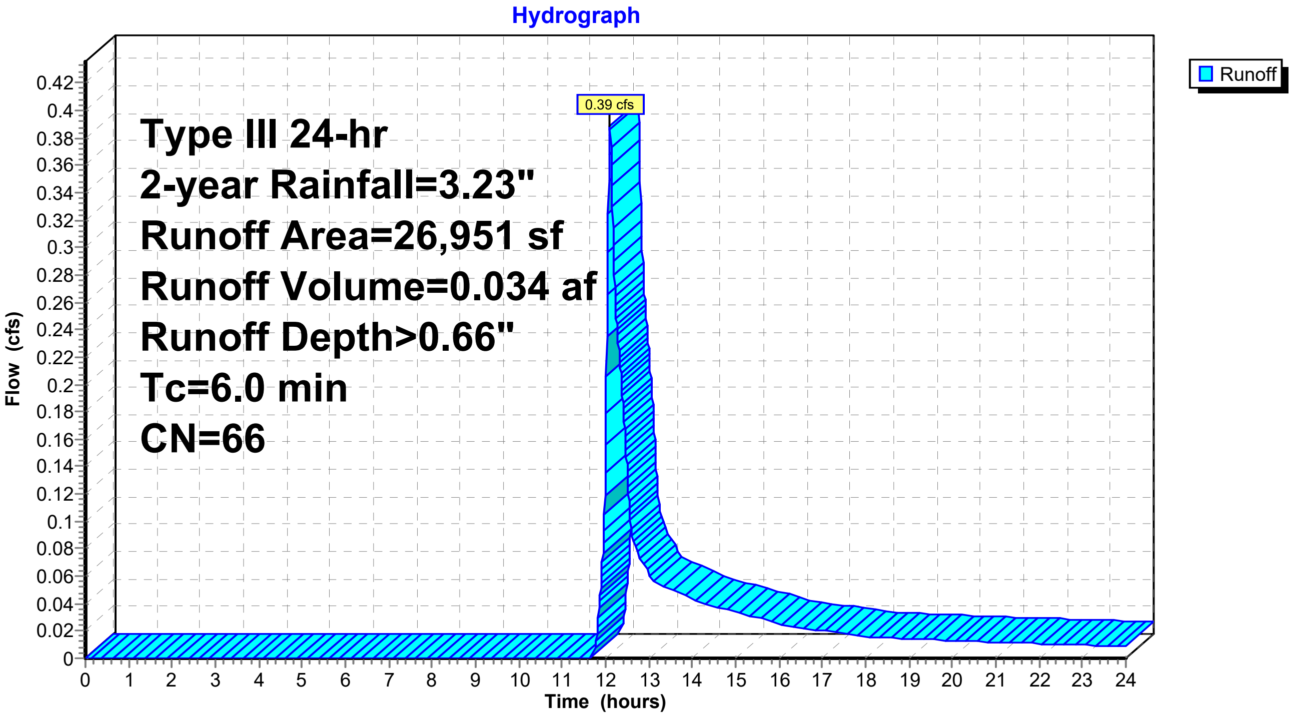
Subcatchment 4S: Area 4



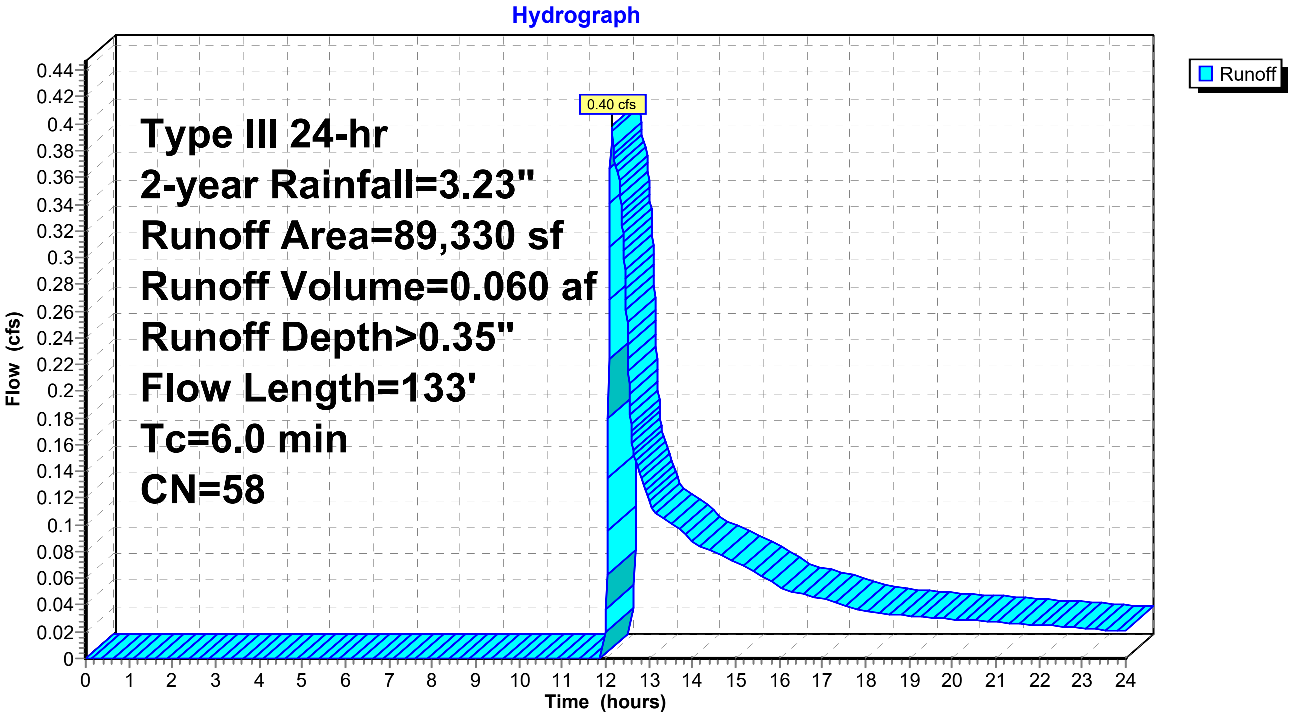
Subcatchment 5S: Area 5



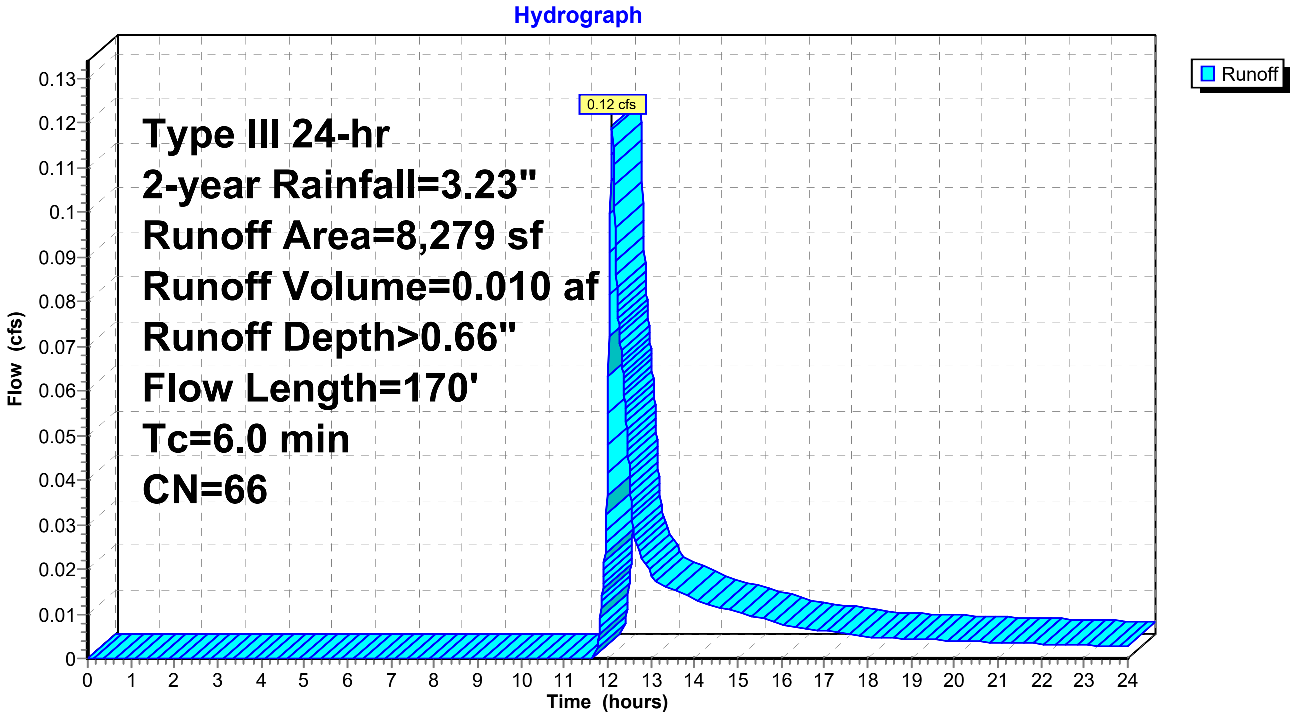
Subcatchment 6S: Area 6



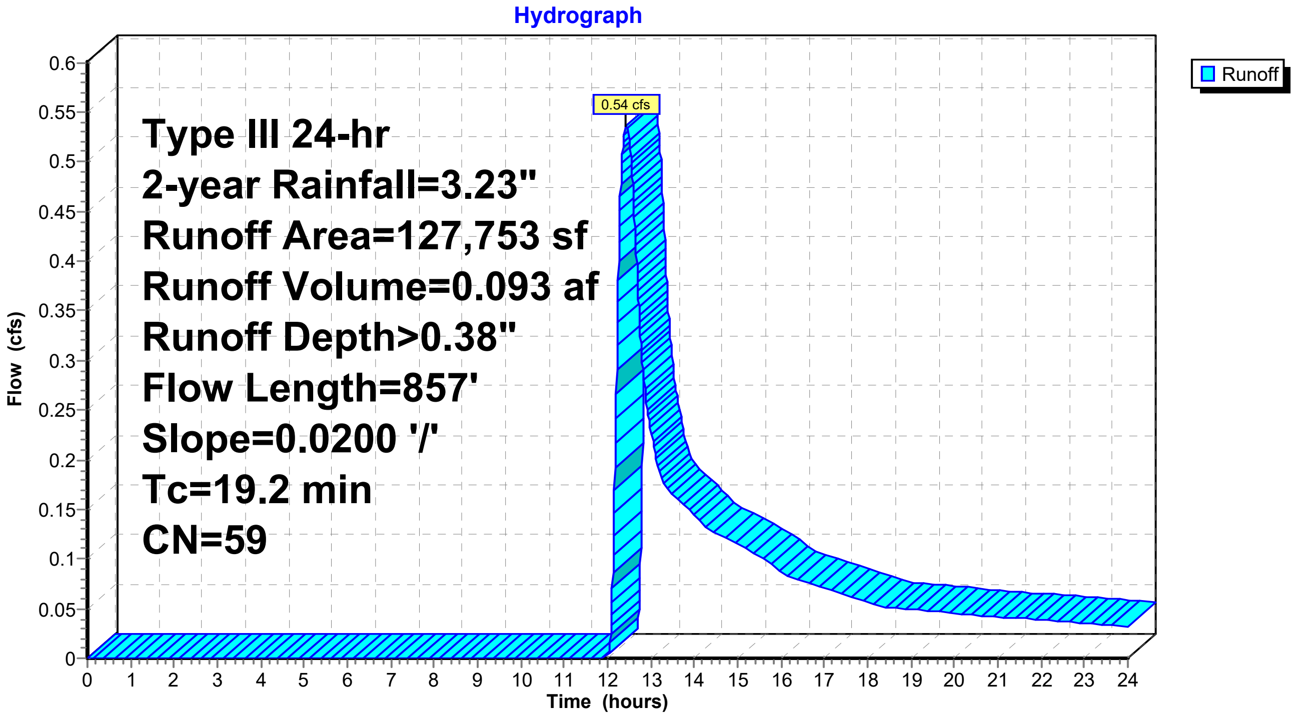
Subcatchment 7S: Area 7



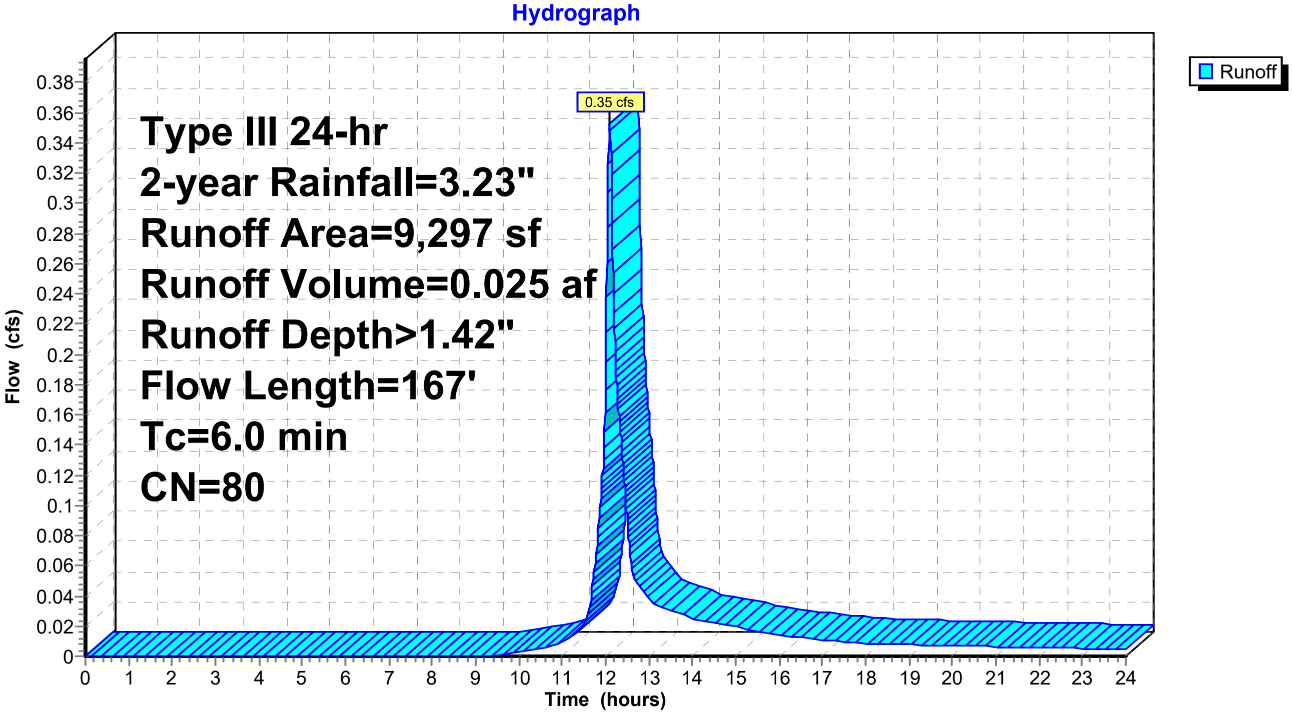
Subcatchment 8S: Area 8



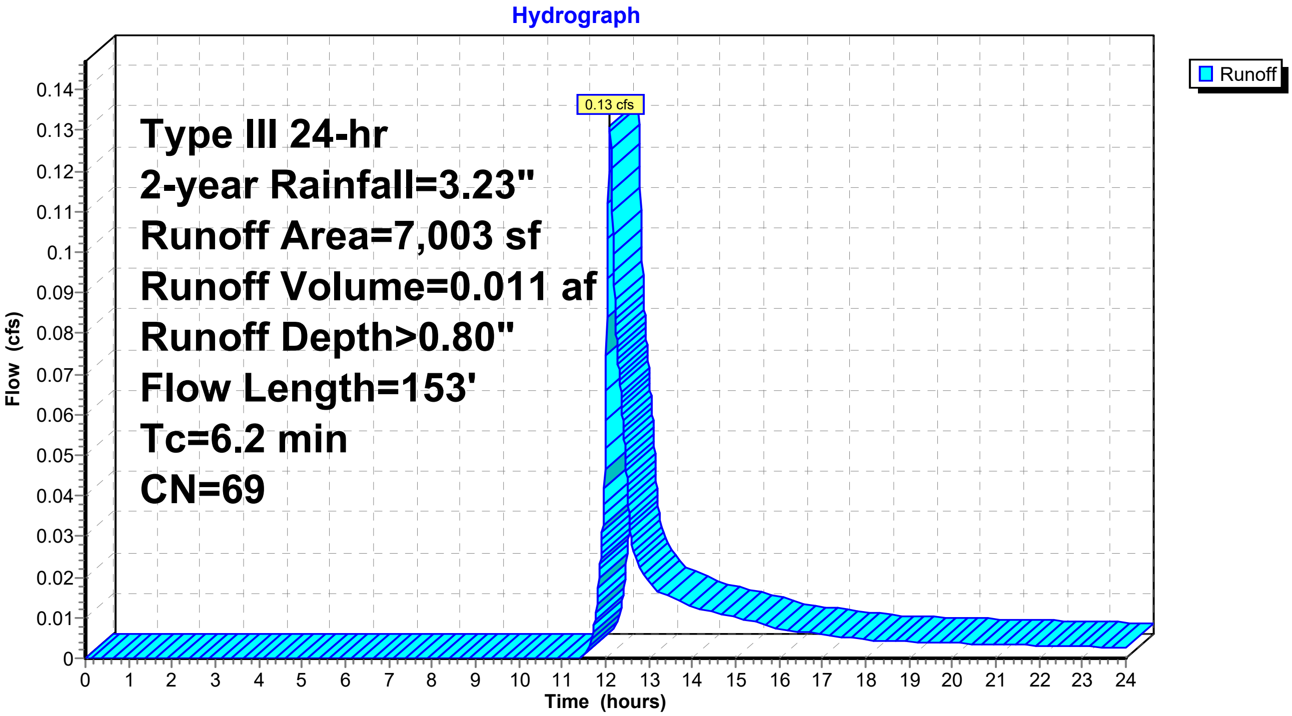
Subcatchment 9S: To Drainage Ditch



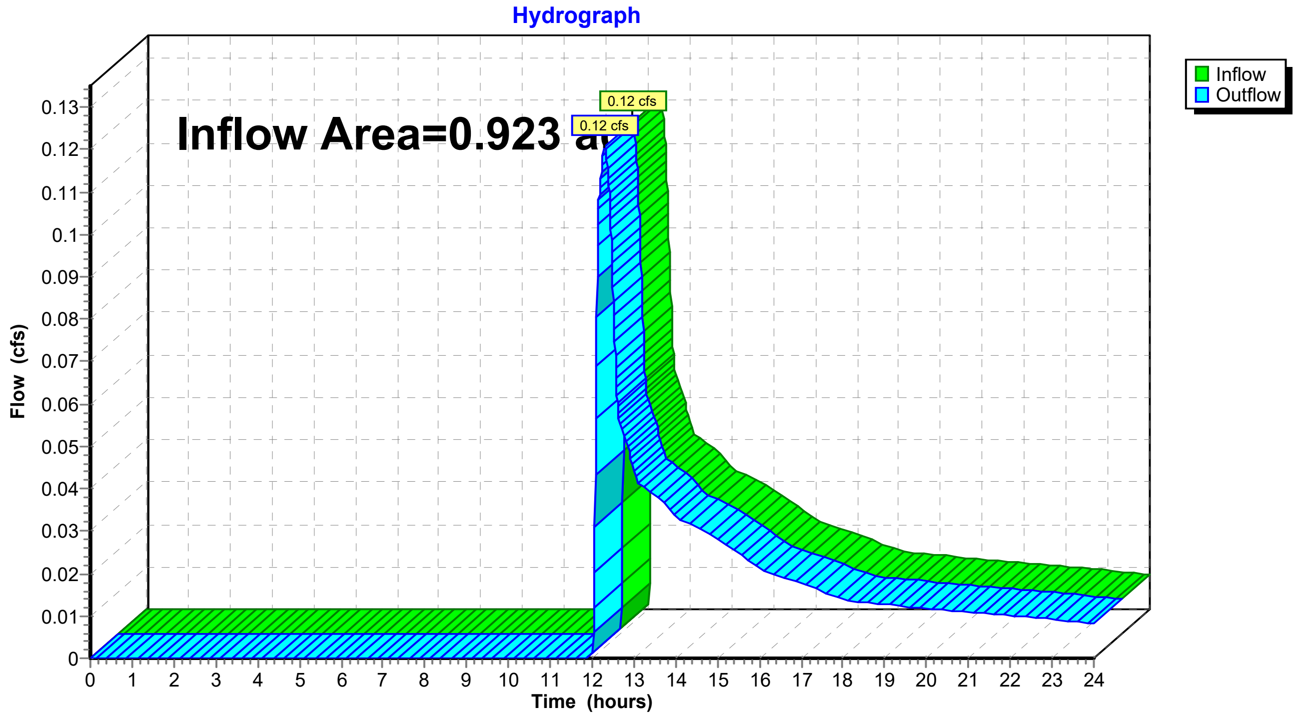
Subcatchment 10S: To Roadway Swale (West)



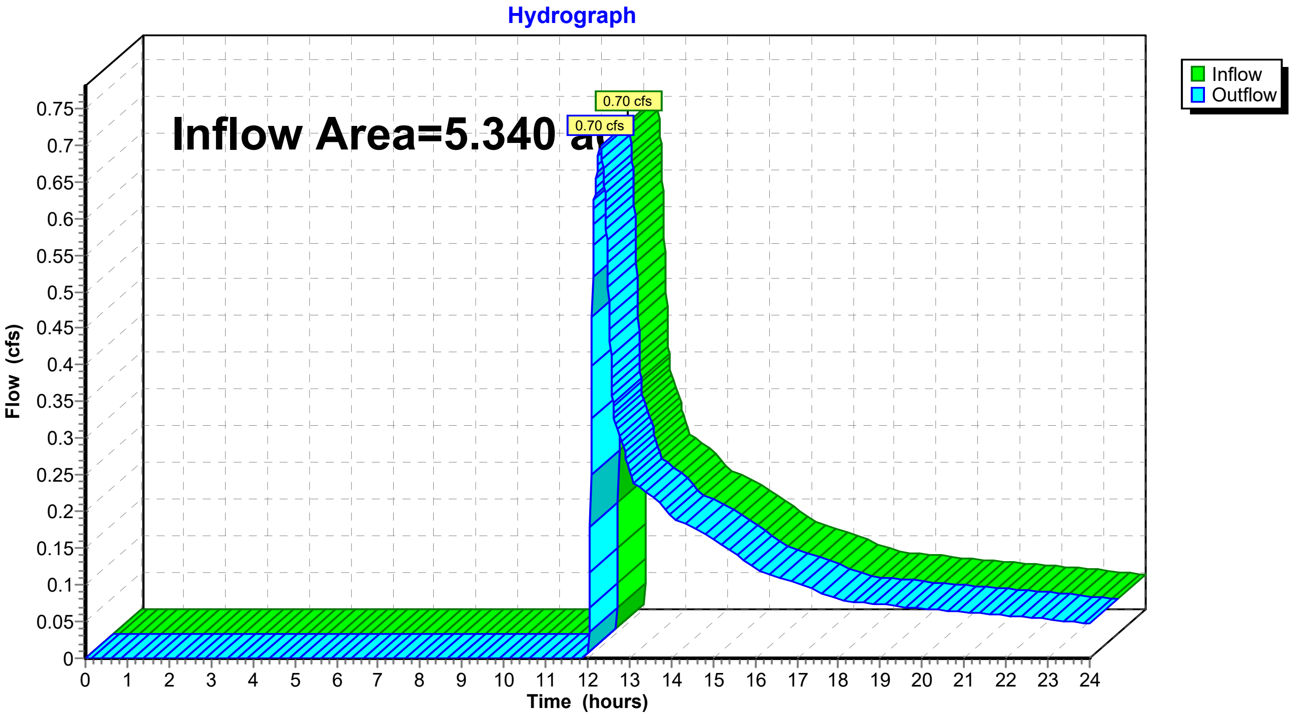
Subcatchment 11S: To Roadway Swale (East)



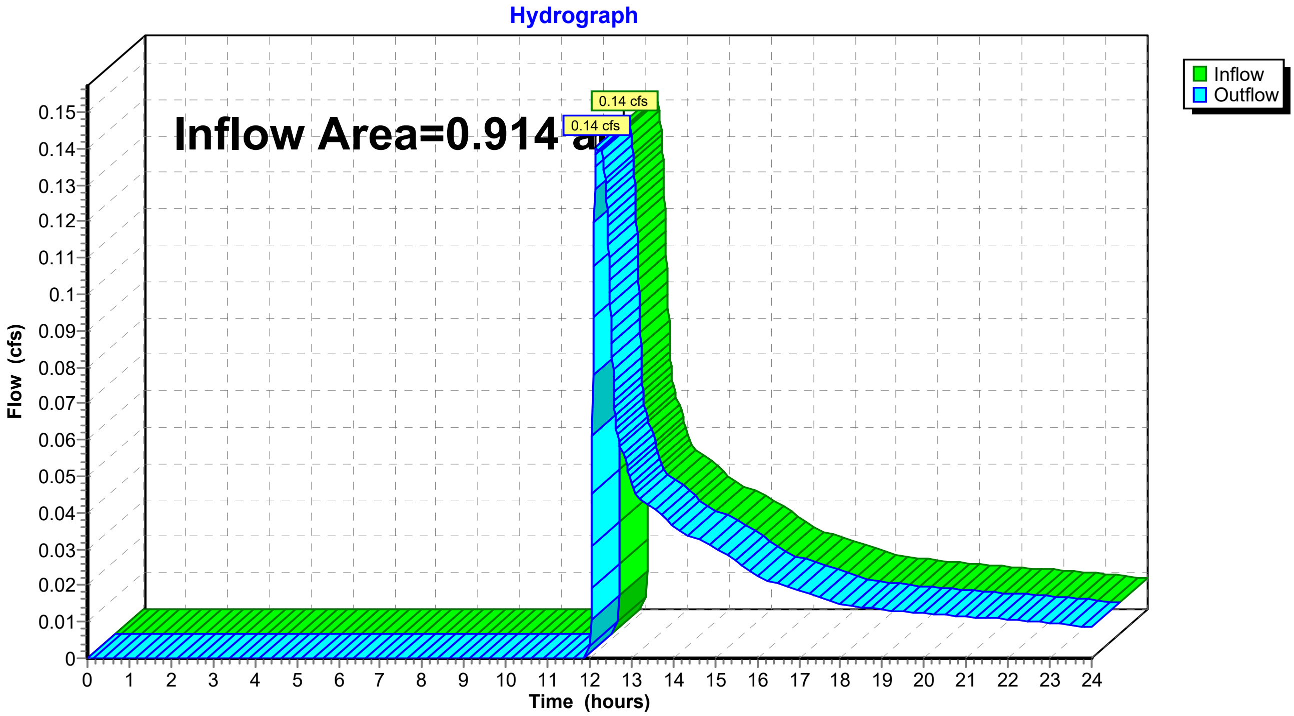
Reach 1R: Off-site Flow (Wetland Northwest)



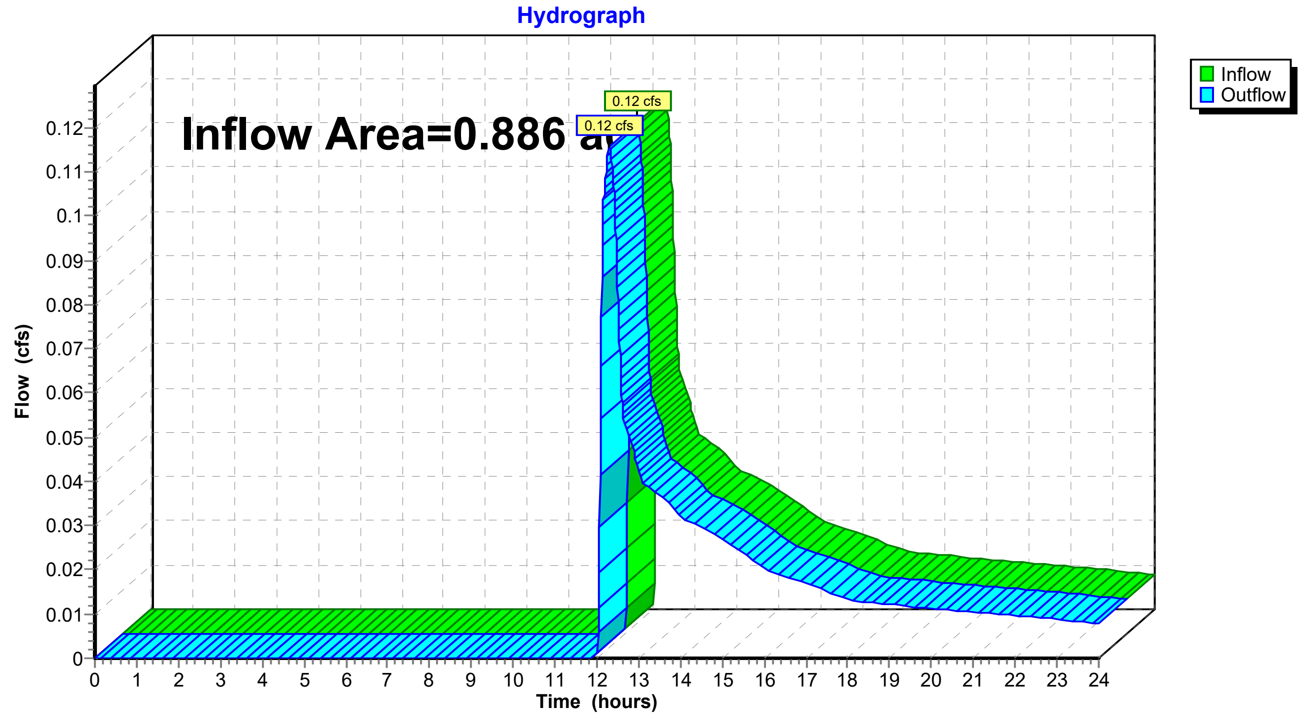
Reach 2R: Off-site Flow (East)



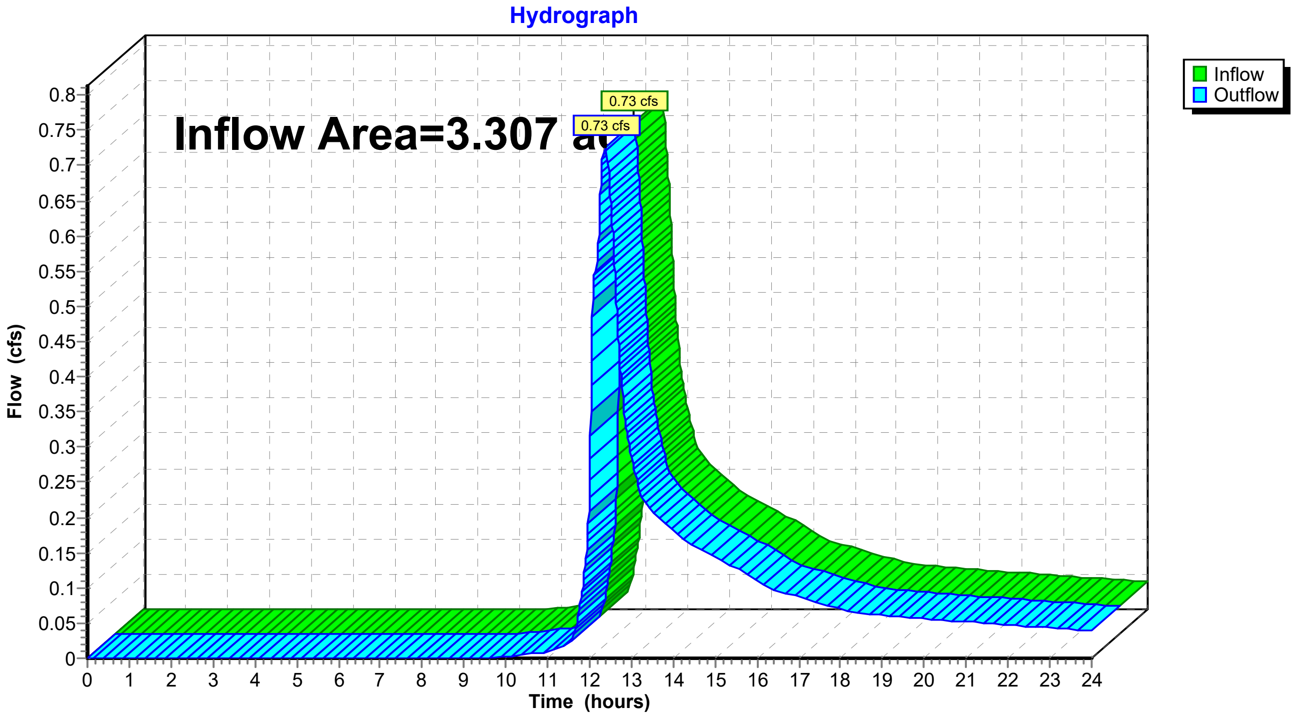
Reach 3R: Off-site Flow (Route 15)



Reach 4R: Off-site flow (South)



Reach 5R: Flow to Drainage Ditch



Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

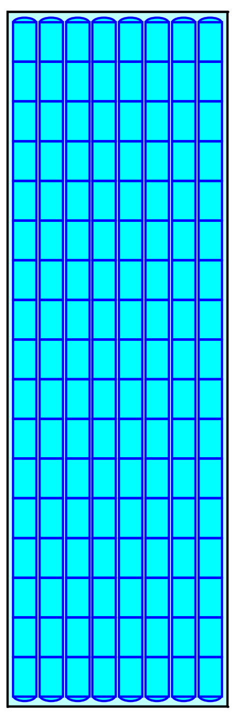
17 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 122.66' Row Length +12.0" End Stone x 2 = 124.66' Base Length
8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

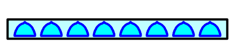
136 Chambers x 45.9 cf = 6,247.8 cf Chamber Storage

17,233.8 cf Field - 6,247.8 cf Chambers = 10,985.9 cf Stone x 40.0% Voids = 4,394.4 cf Stone Storage

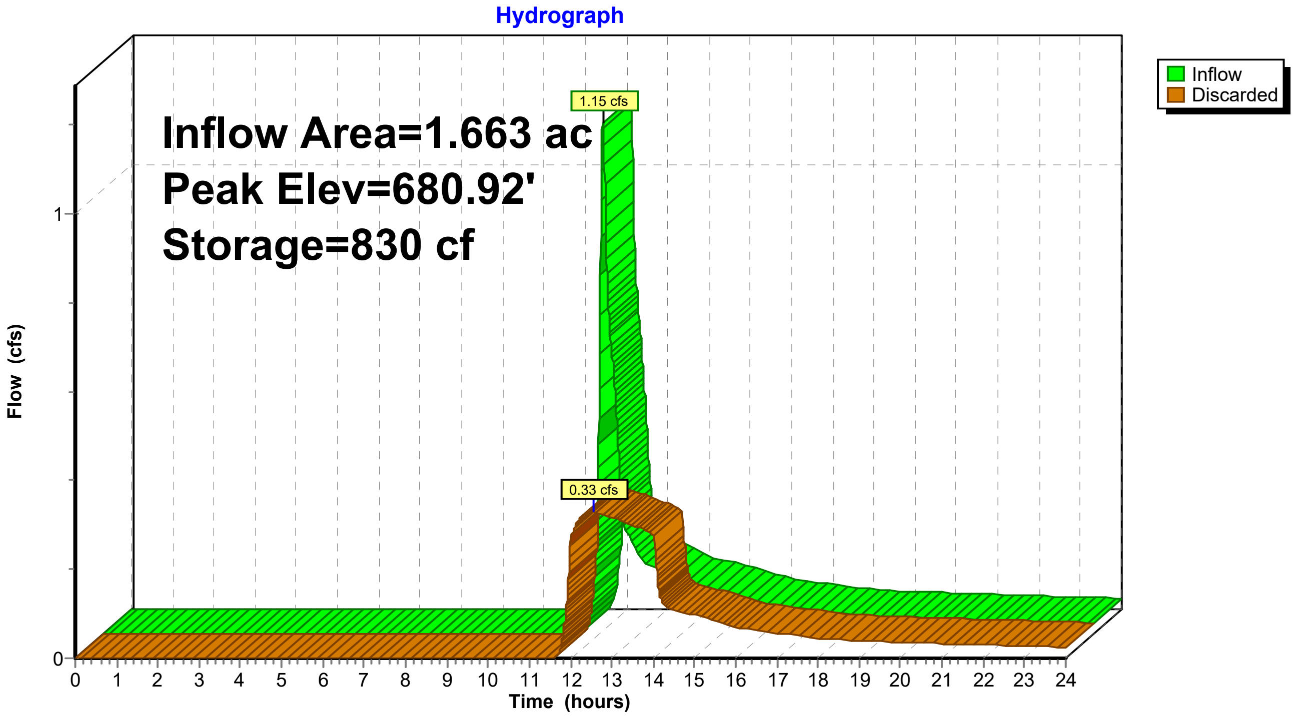
Chamber Storage + Stone Storage = 10,642.2 cf = 0.244 af
Overall Storage Efficiency = 61.8%
Overall System Size = 124.66' x 39.50' x 3.50'

136 Chambers
638.3 cy Field
406.9 cy Stone





Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers



Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

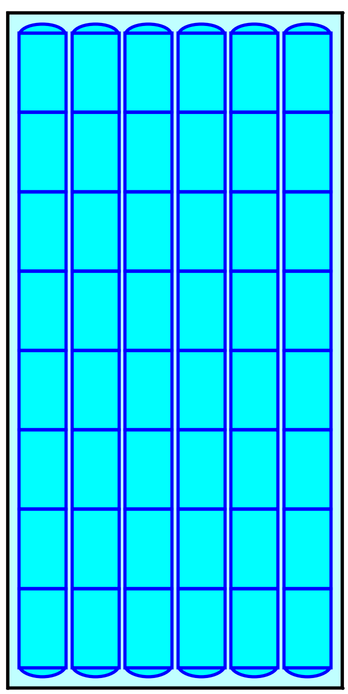
8 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 58.58' Row Length +12.0" End Stone x 2 = 60.58' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

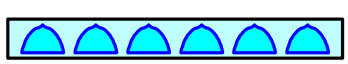
48 Chambers x 45.9 cf = 2,205.1 cf Chamber Storage

6,360.6 cf Field - 2,205.1 cf Chambers = 4,155.4 cf Stone x 40.0% Voids = 1,662.2 cf Stone Storage

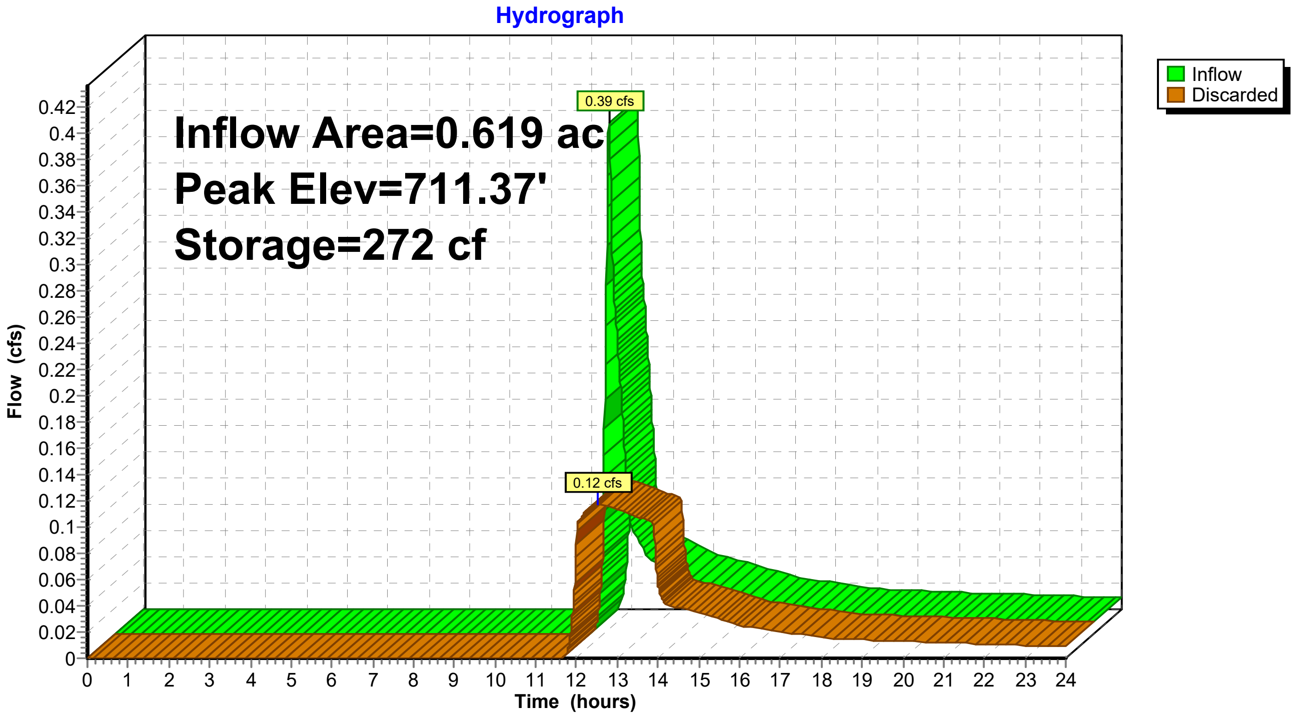
Chamber Storage + Stone Storage = 3,867.3 cf = 0.089 af
Overall Storage Efficiency = 60.8%
Overall System Size = 60.58' x 30.00' x 3.50'

48 Chambers
235.6 cy Field
153.9 cy Stone

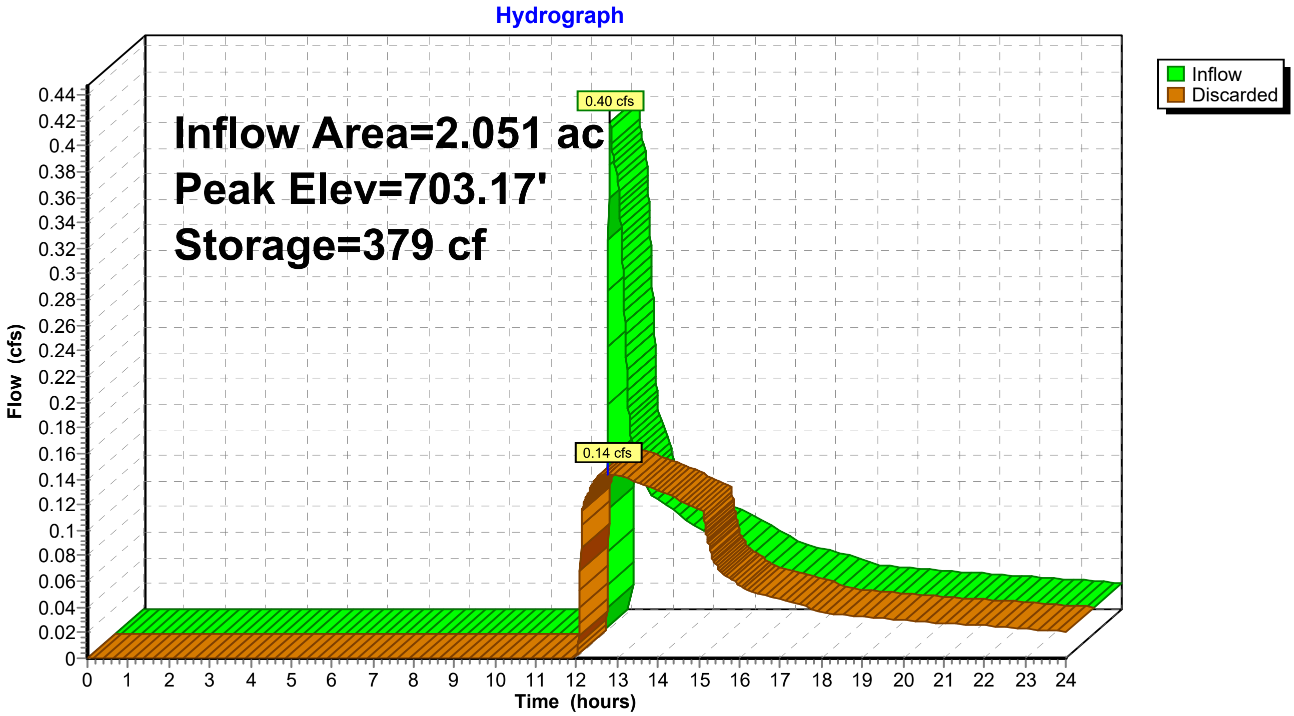




Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers



Pond 7P: Infiltration Basin #1



Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

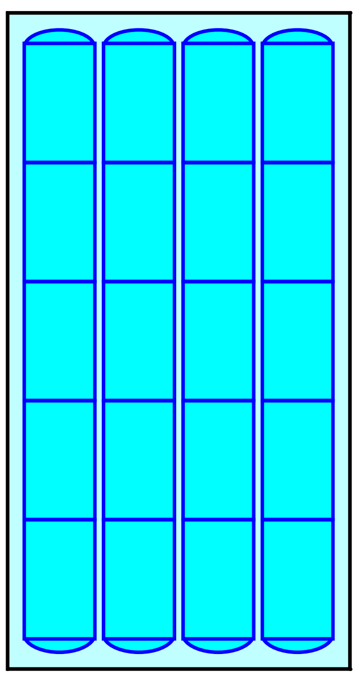
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

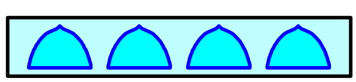
20 Chambers x 45.9 cf = 918.8 cf Chamber Storage

2,813.8 cf Field - 918.8 cf Chambers = 1,895.0 cf Stone x 40.0% Voids = 758.0 cf Stone Storage

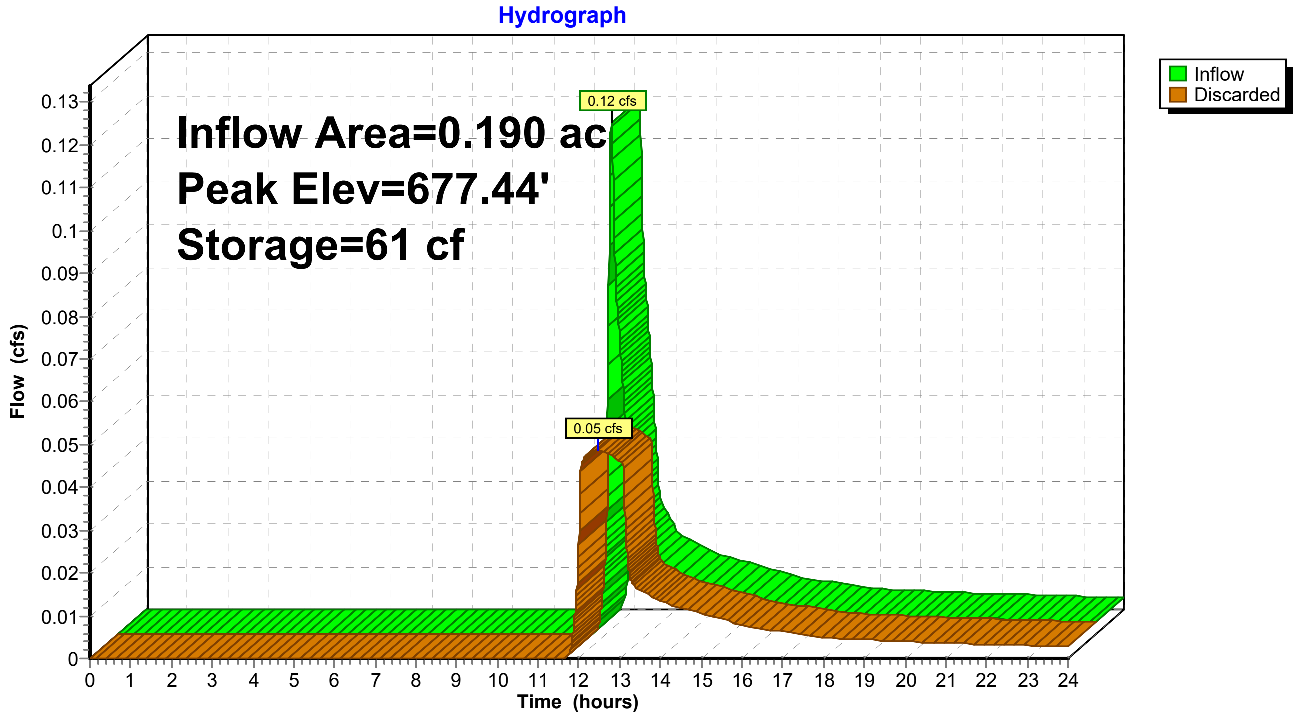
Chamber Storage + Stone Storage = 1,676.8 cf = 0.038 af
Overall Storage Efficiency = 59.6%
Overall System Size = 39.22' x 20.50' x 3.50'

20 Chambers
104.2 cy Field
70.2 cy Stone





Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Area 1 Runoff Area=40,217 sf 0.00% Impervious Runoff Depth>1.06"
Flow Length=350' Tc=6.0 min CN=56 Runoff=0.95 cfs 0.082 af

Subcatchment2S: Area 2 Runoff Area=232,592 sf 0.00% Impervious Runoff Depth>1.06"
Flow Length=283' Tc=6.0 min CN=56 Runoff=5.51 cfs 0.472 af

Subcatchment3S: Area 3 Runoff Area=39,823 sf 0.00% Impervious Runoff Depth>1.12"
Tc=6.0 min CN=57 Runoff=1.02 cfs 0.086 af

Subcatchment4S: Area 4 Runoff Area=38,577 sf 0.00% Impervious Runoff Depth>1.06"
Flow Length=132' Tc=6.0 min CN=56 Runoff=0.91 cfs 0.078 af

Subcatchment5S: Area 5 Runoff Area=72,459 sf 1.10% Impervious Runoff Depth>1.83"
Tc=6.0 min CN=67 Runoff=3.45 cfs 0.253 af

Subcatchment6S: Area 6 Runoff Area=26,951 sf 0.00% Impervious Runoff Depth>1.75"
Tc=6.0 min CN=66 Runoff=1.22 cfs 0.090 af

Subcatchment7S: Area 7 Runoff Area=89,330 sf 0.00% Impervious Runoff Depth>1.19"
Flow Length=133' Tc=6.0 min CN=58 Runoff=2.48 cfs 0.203 af

Subcatchment8S: Area 8 Runoff Area=8,279 sf 20.69% Impervious Runoff Depth>1.75"
Flow Length=170' Tc=6.0 min CN=66 Runoff=0.38 cfs 0.028 af

Subcatchment9S: To Drainage Ditch Runoff Area=127,753 sf 7.29% Impervious Runoff Depth>1.25"
Flow Length=857' Slope=0.0200 '/' Tc=19.2 min CN=59 Runoff=2.60 cfs 0.305 af

Subcatchment10S: To Roadway Swale Runoff Area=9,297 sf 55.10% Impervious Runoff Depth>2.92"
Flow Length=167' Tc=6.0 min CN=80 Runoff=0.73 cfs 0.052 af

Subcatchment11S: To Roadway Swale Runoff Area=7,003 sf 21.56% Impervious Runoff Depth>1.98"
Flow Length=153' Tc=6.2 min CN=69 Runoff=0.36 cfs 0.027 af

Reach 1R: Off-site Flow (Wetland Northwest) Inflow=0.95 cfs 0.082 af
Outflow=0.95 cfs 0.082 af

Reach 2R: Off-site Flow (East) Inflow=5.51 cfs 0.472 af
Outflow=5.51 cfs 0.472 af

Reach 3R: Off-site Flow (Route 15) Inflow=1.02 cfs 0.086 af
Outflow=1.02 cfs 0.086 af

Reach 4R: Off-site flow (South) Inflow=0.91 cfs 0.078 af
Outflow=0.91 cfs 0.078 af

Reach 5R: Flow to Drainage Ditch Inflow=3.10 cfs 0.384 af
Outflow=3.10 cfs 0.384 af

Pond 5P: Subsurface Infiltration System #1 - Peak Elev=681.71' Storage=3,851 cf Inflow=3.45 cfs 0.253 af
Outflow=0.43 cfs 0.253 af

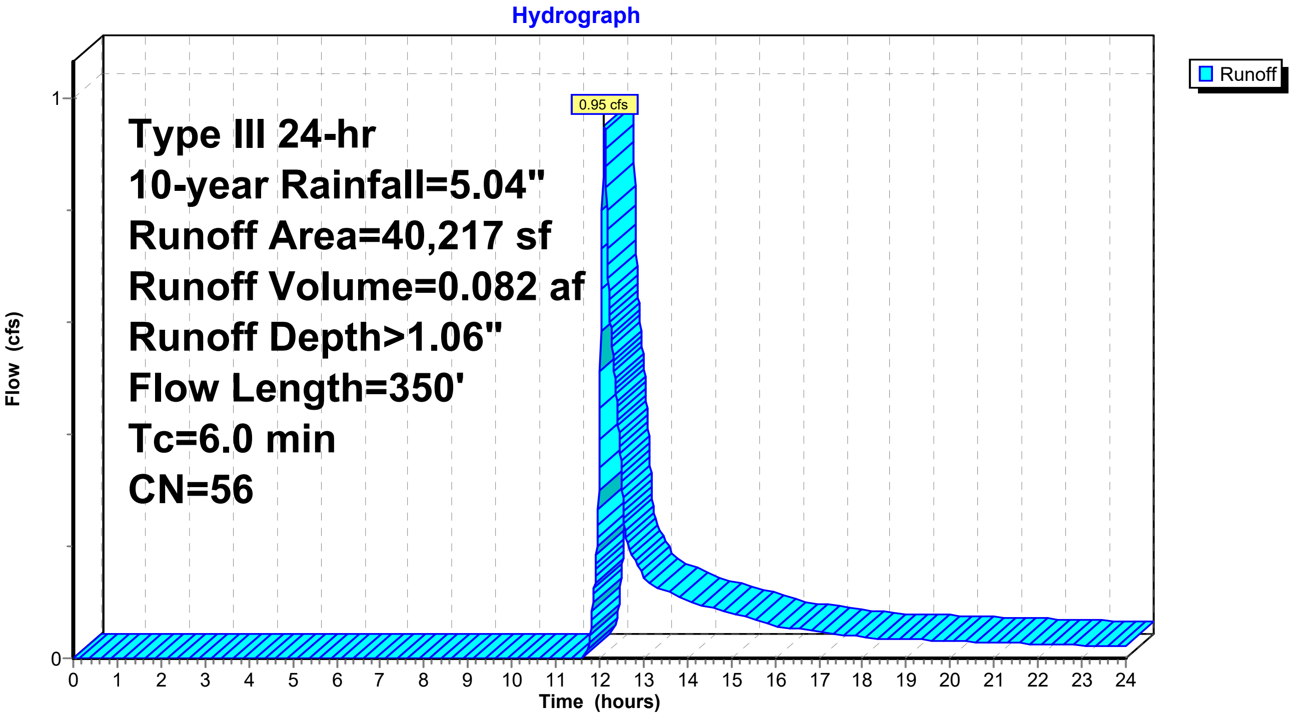
Pond 6P: Subsurface Infiltration System #2 - Peak Elev=712.18' Storage=1,366 cf Inflow=1.22 cfs 0.090 af
Outflow=0.15 cfs 0.090 af

Pond 7P: Infiltration Basin #1 Peak Elev=703.85' Storage=2,980 cf Inflow=2.48 cfs 0.203 af
Outflow=0.33 cfs 0.203 af

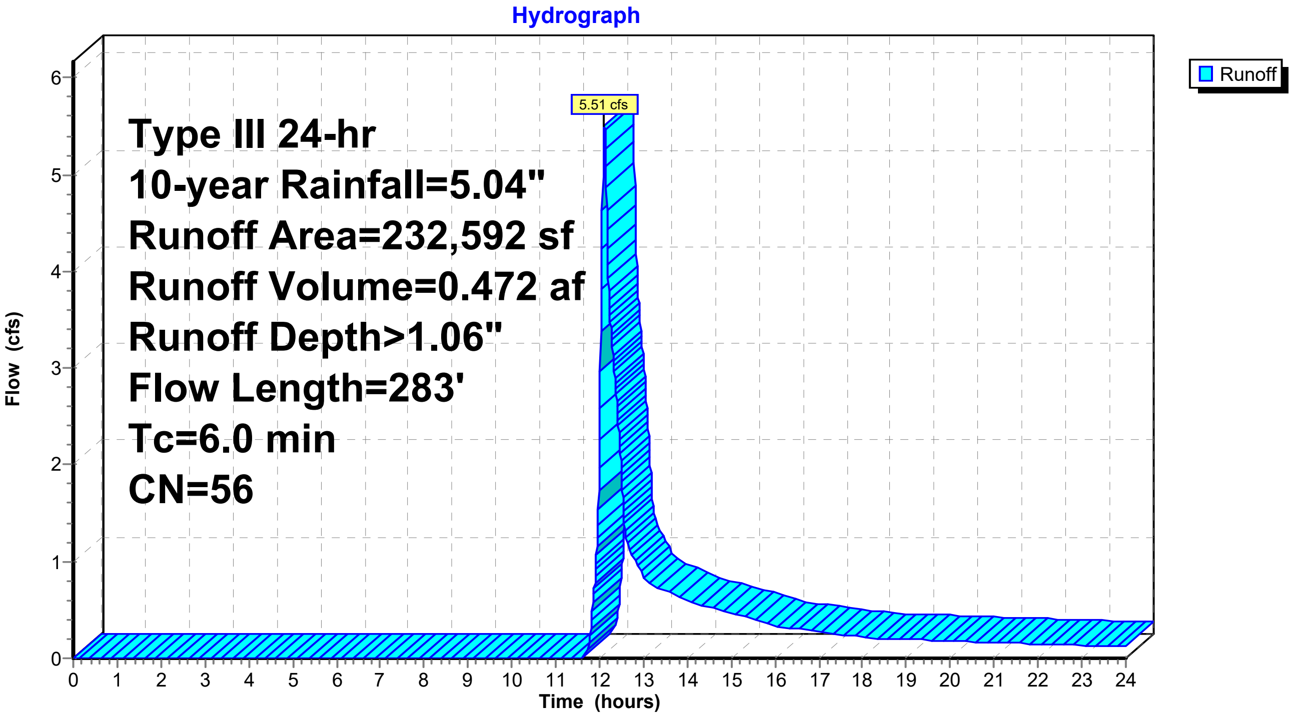
Pond 8P: Subsurface Infiltration System #3 - Peak Elev=678.07' Storage=363 cf Inflow=0.38 cfs 0.028 af
Outflow=0.06 cfs 0.028 af

Total Runoff Area = 15.893 ac Runoff Volume = 1.676 af Average Runoff Depth = 1.27"
97.34% Pervious = 15.469 ac 2.66% Impervious = 0.423 ac

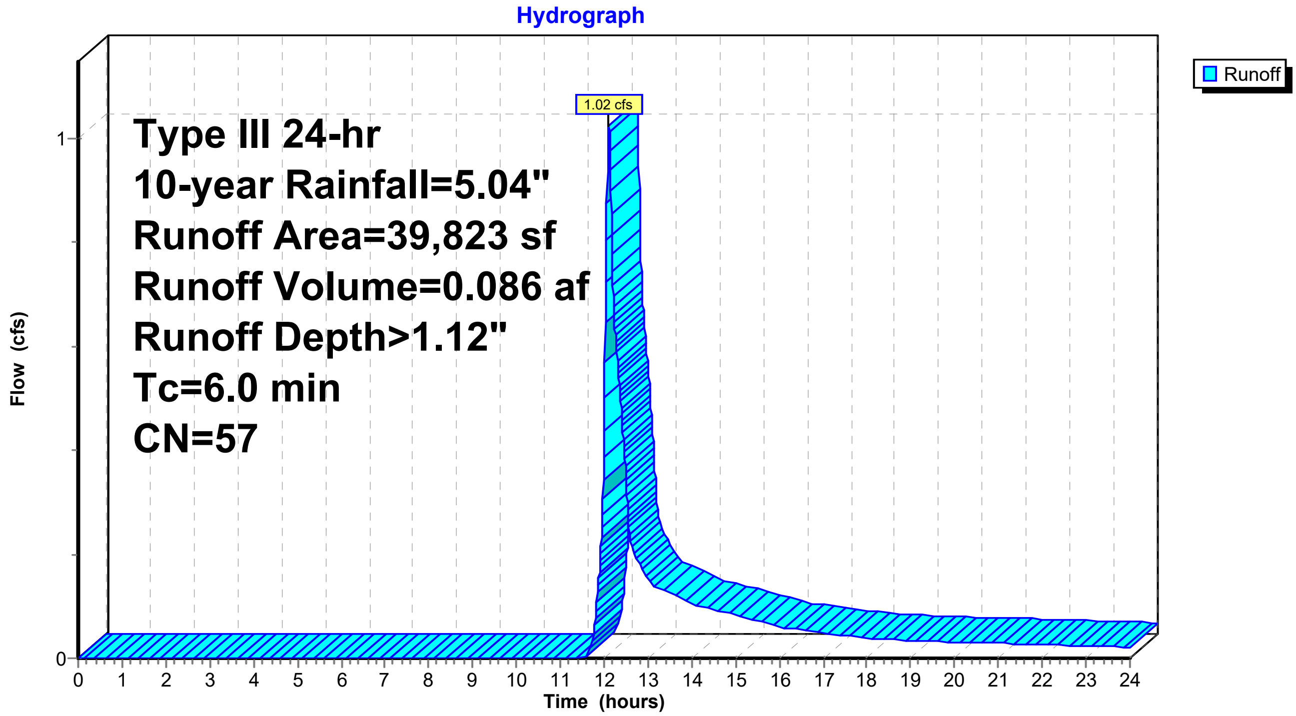
Subcatchment 1S: Area 1



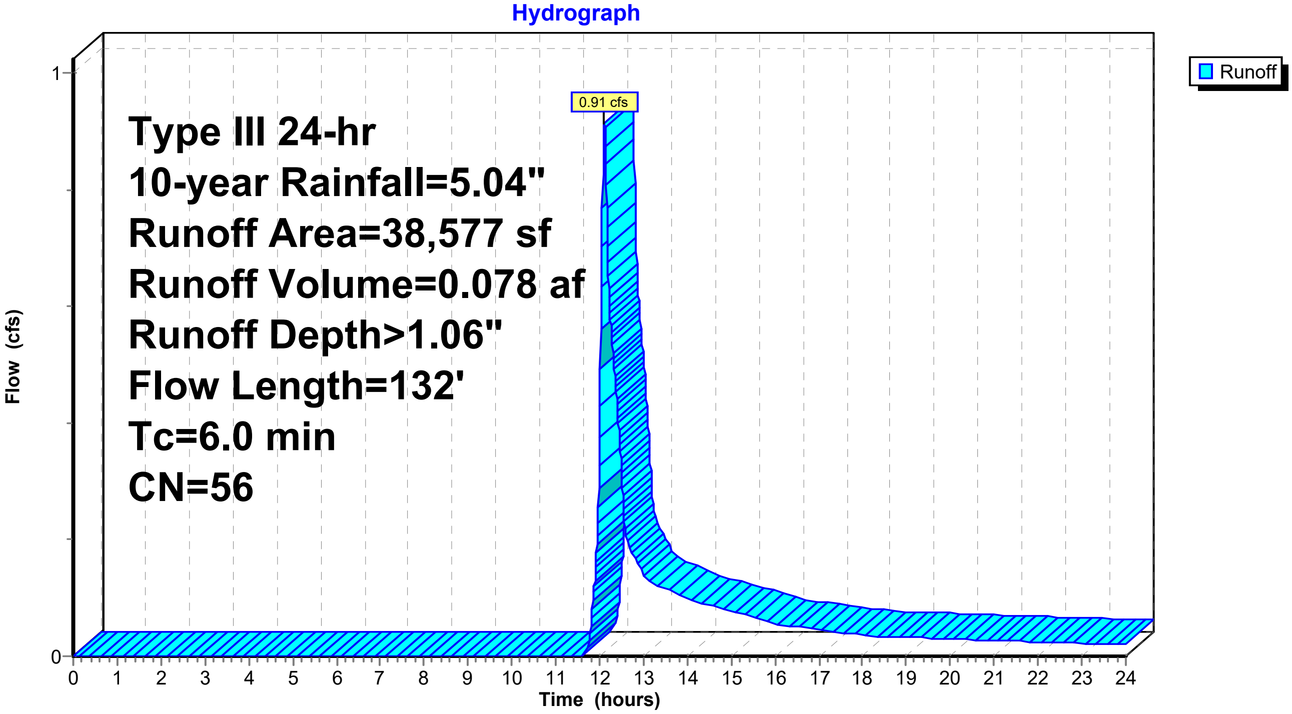
Subcatchment 2S: Area 2



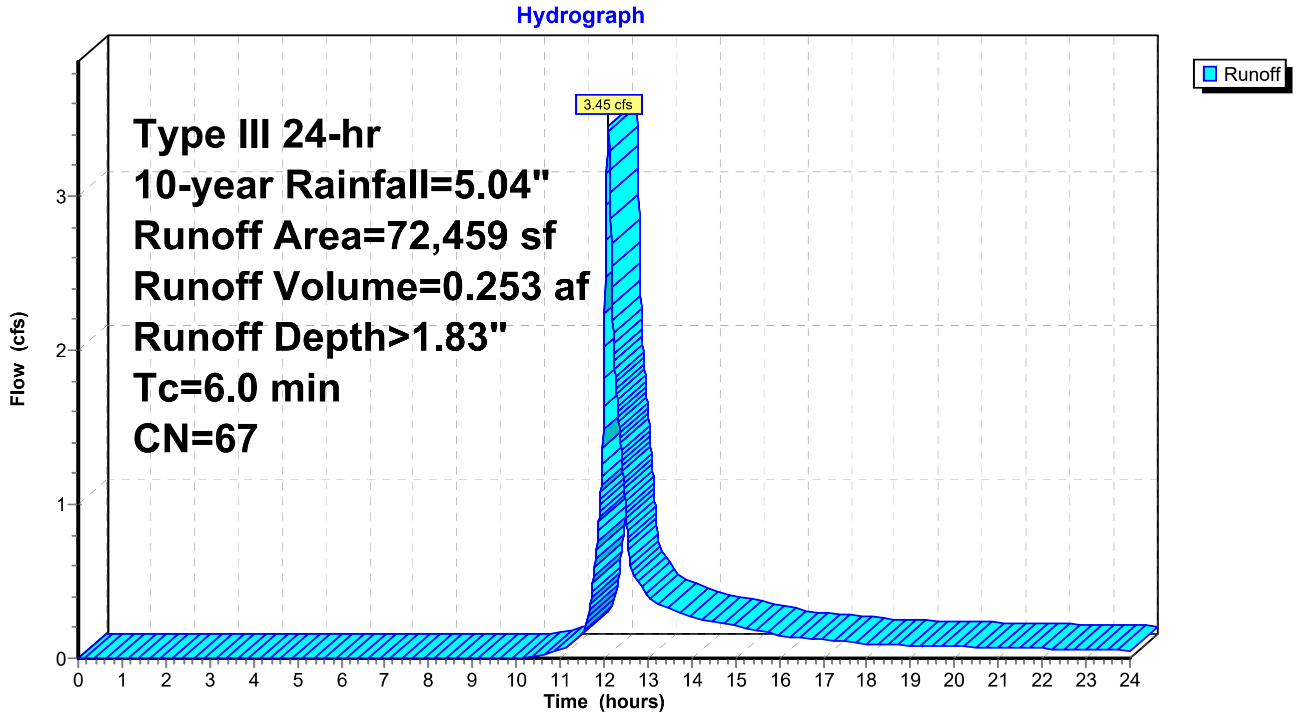
Subcatchment 3S: Area 3



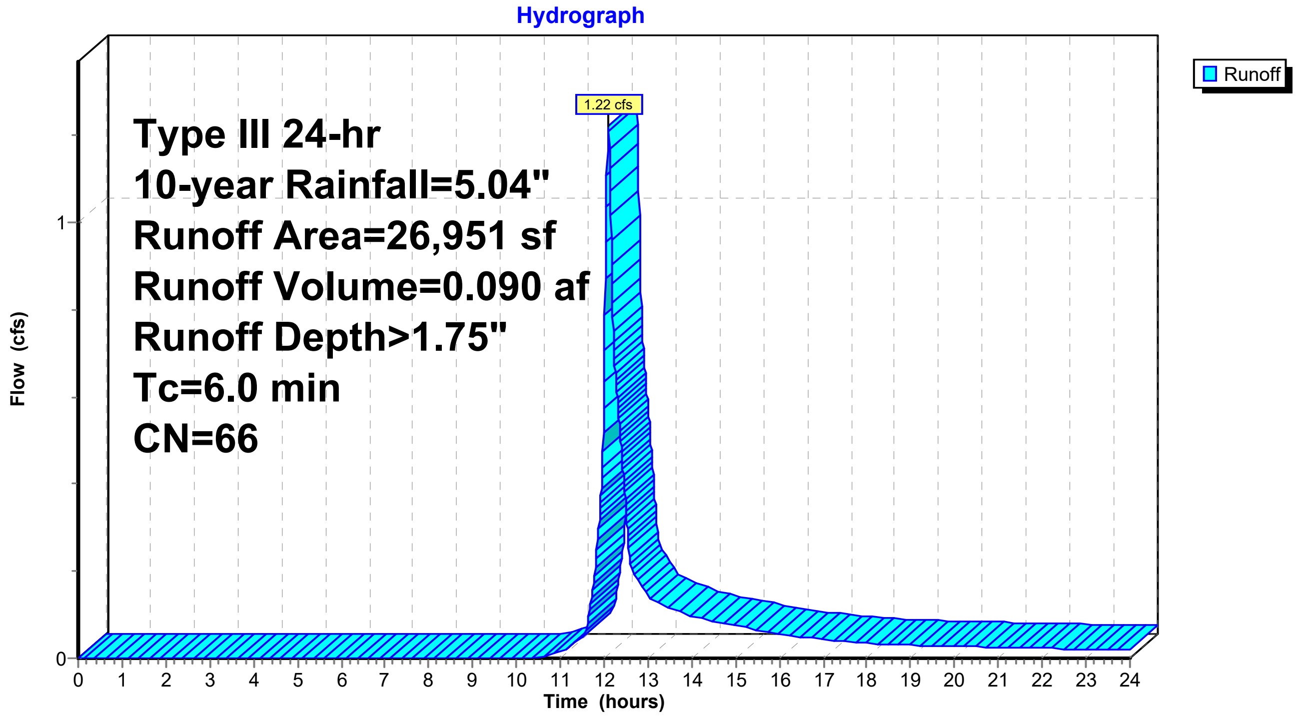
Subcatchment 4S: Area 4



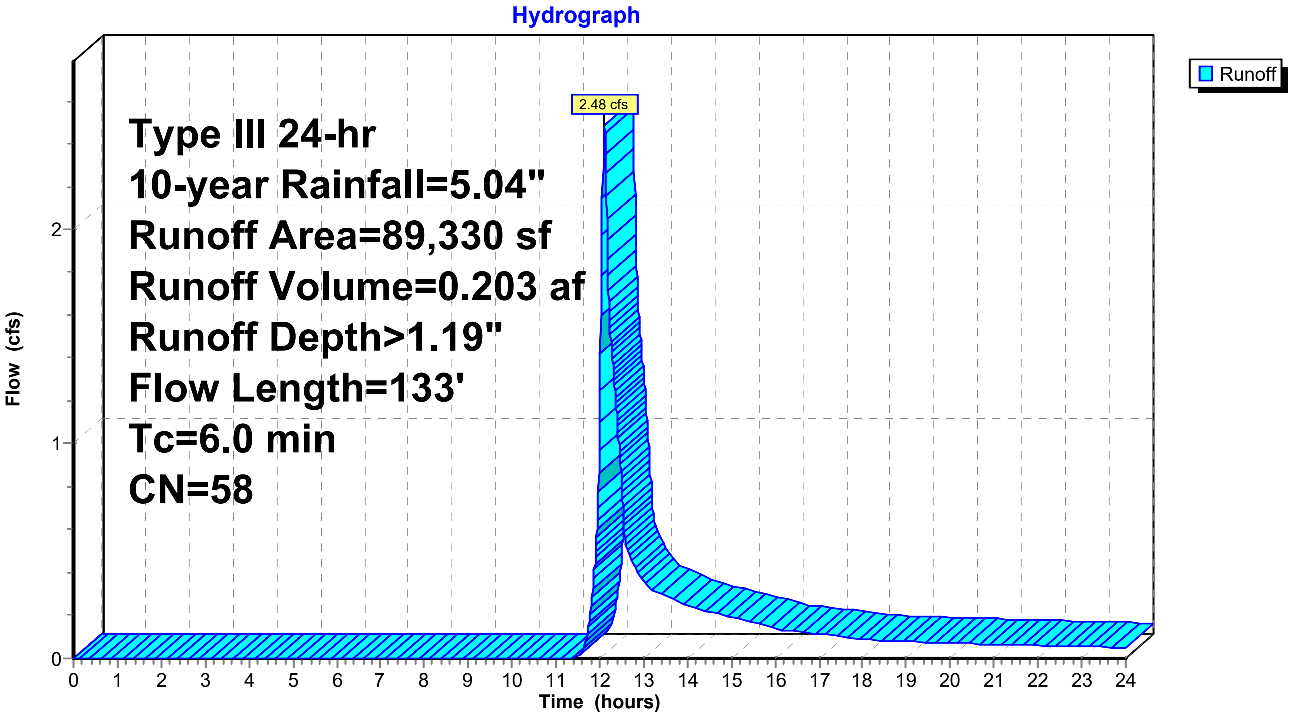
Subcatchment 5S: Area 5



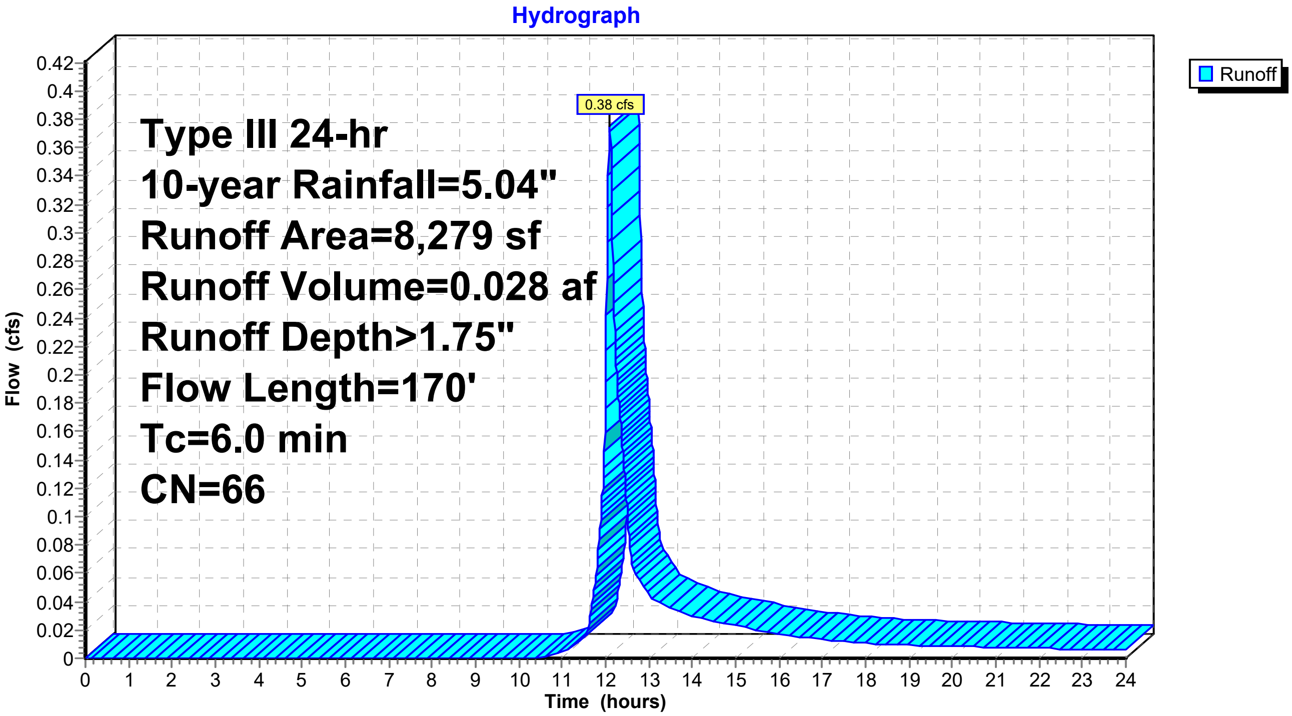
Subcatchment 6S: Area 6



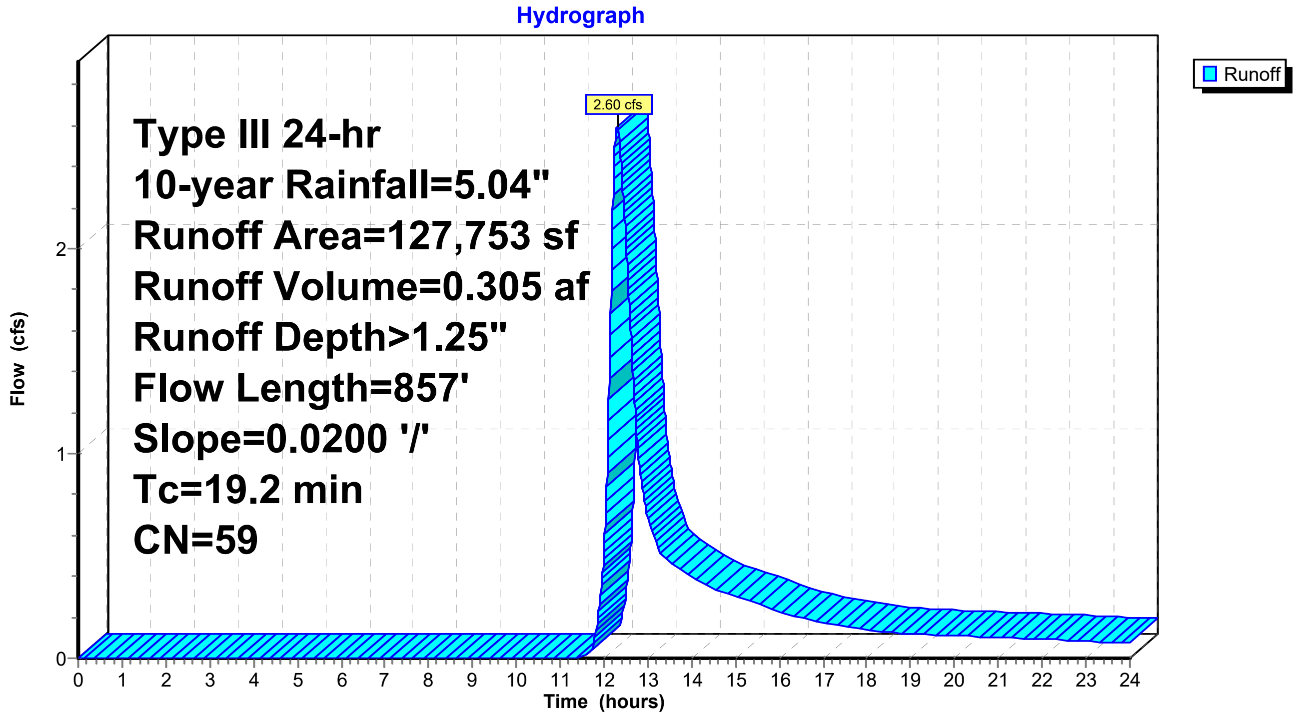
Subcatchment 7S: Area 7



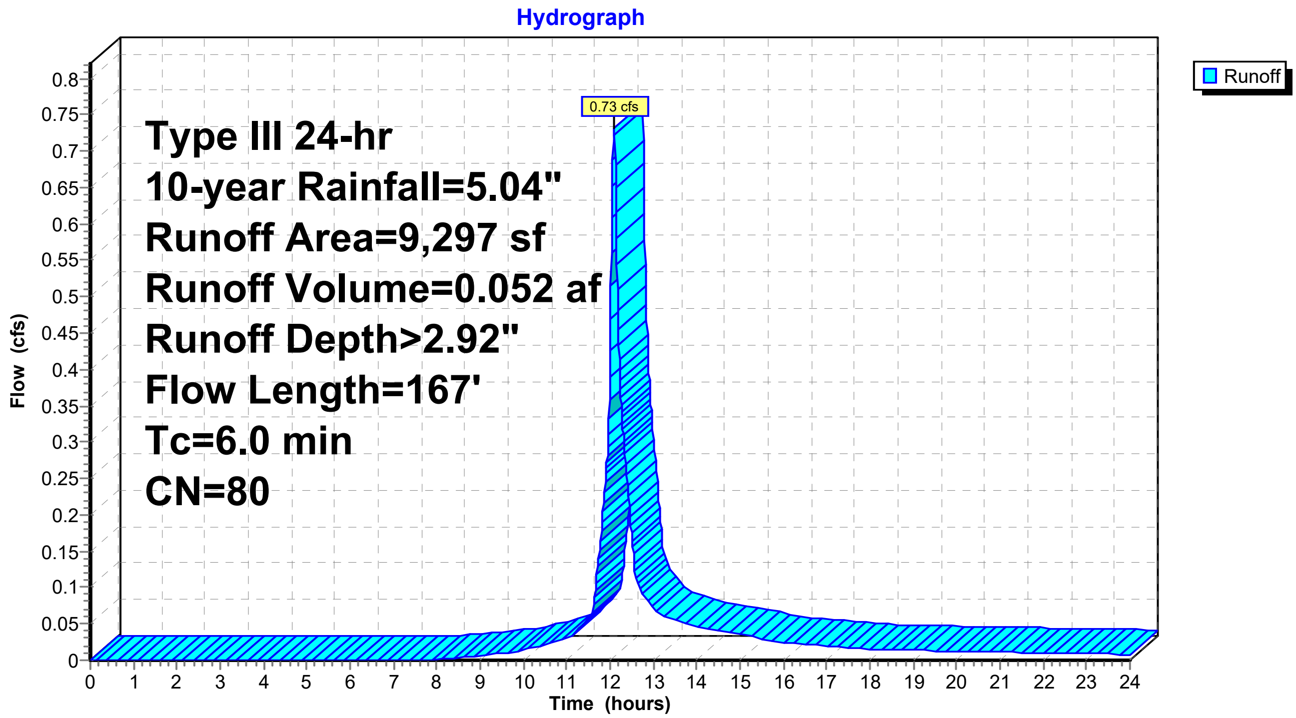
Subcatchment 8S: Area 8



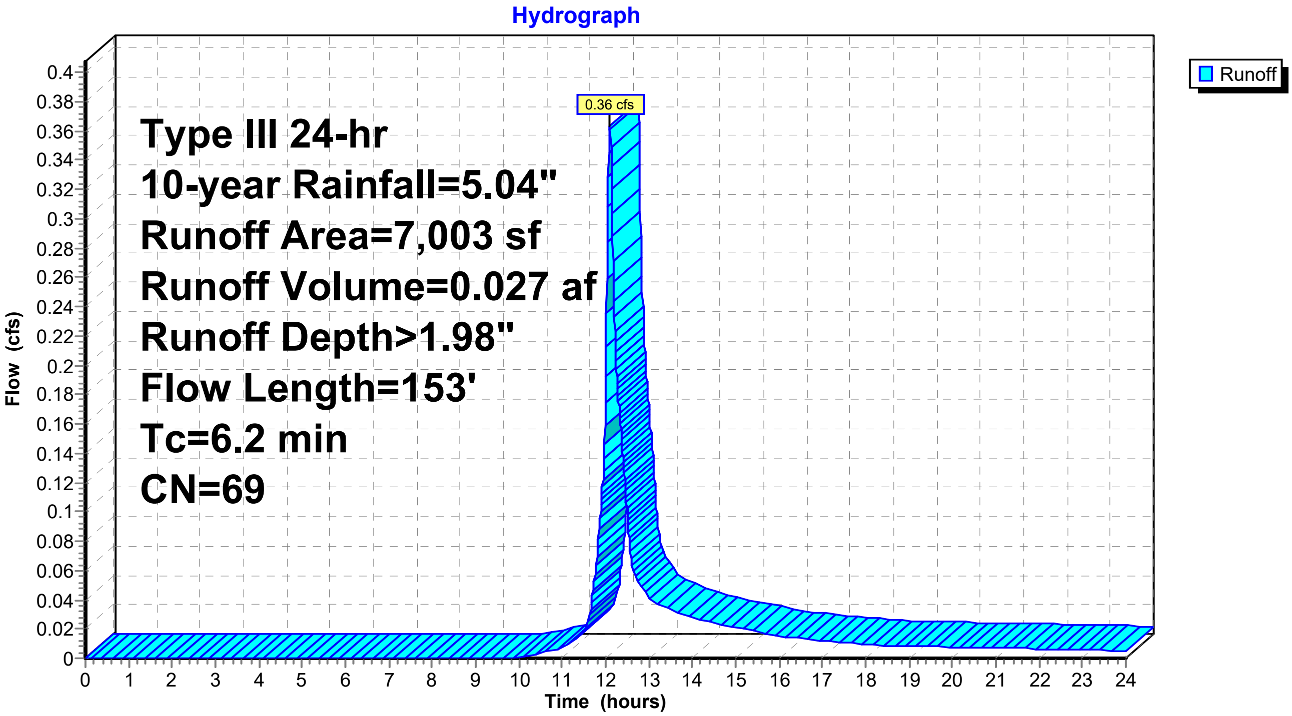
Subcatchment 9S: To Drainage Ditch



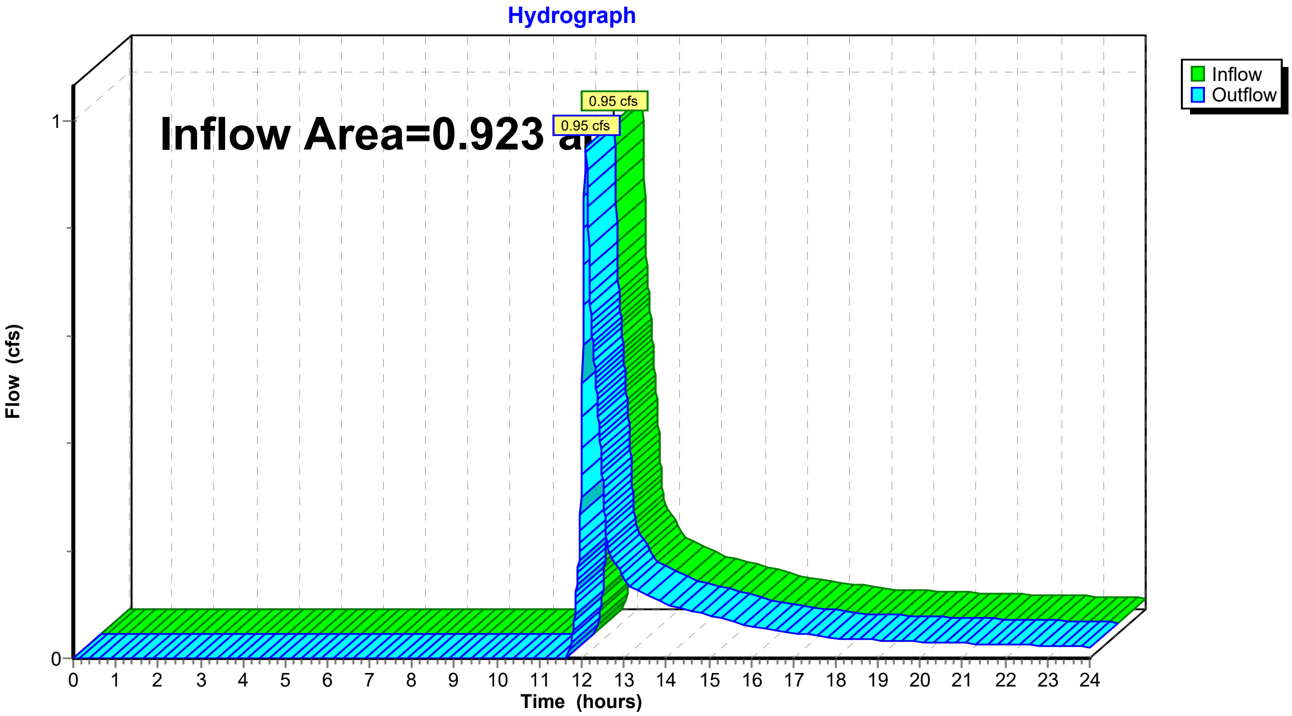
Subcatchment 10S: To Roadway Swale (West)



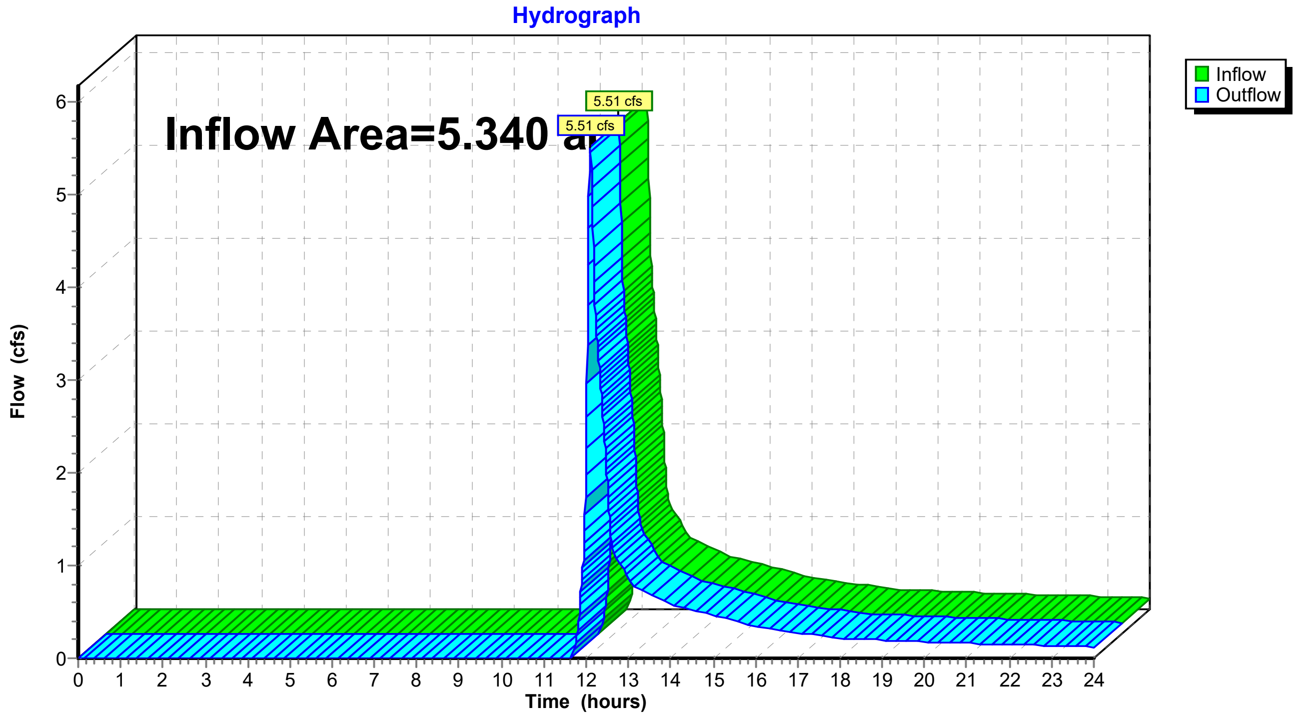
Subcatchment 11S: To Roadway Swale (East)



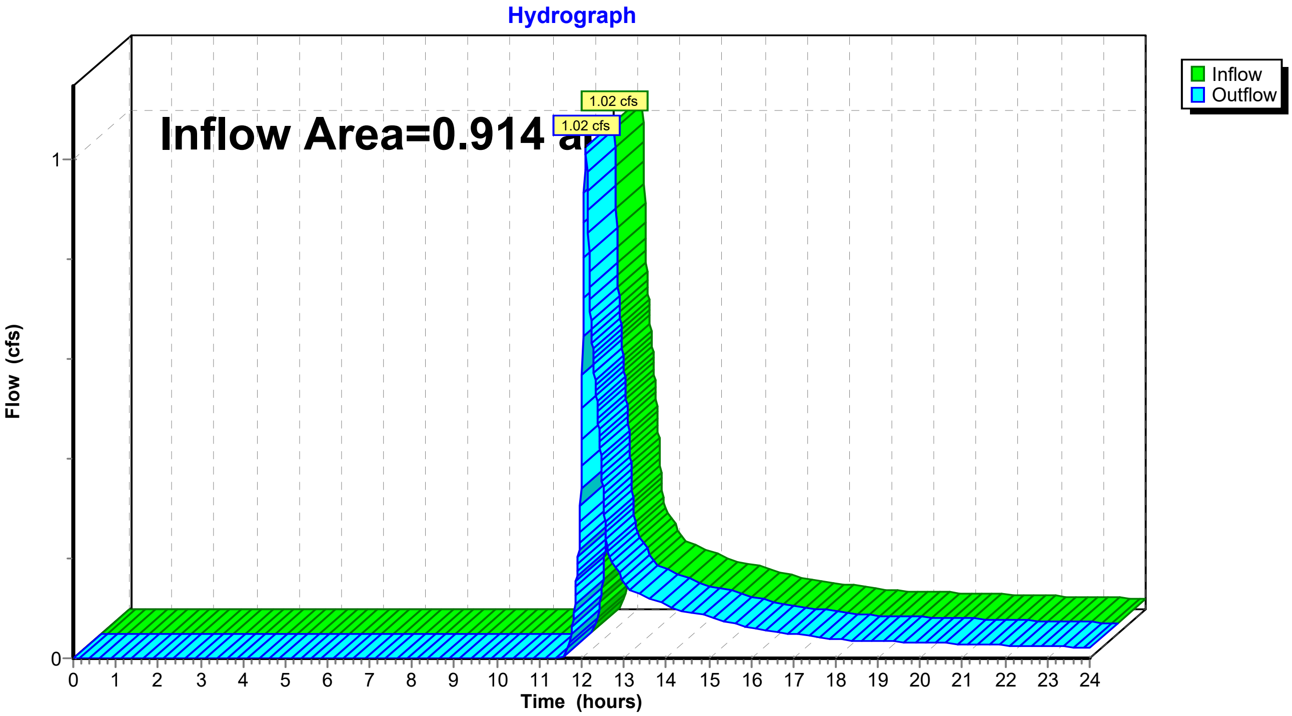
Reach 1R: Off-site Flow (Wetland Northwest)



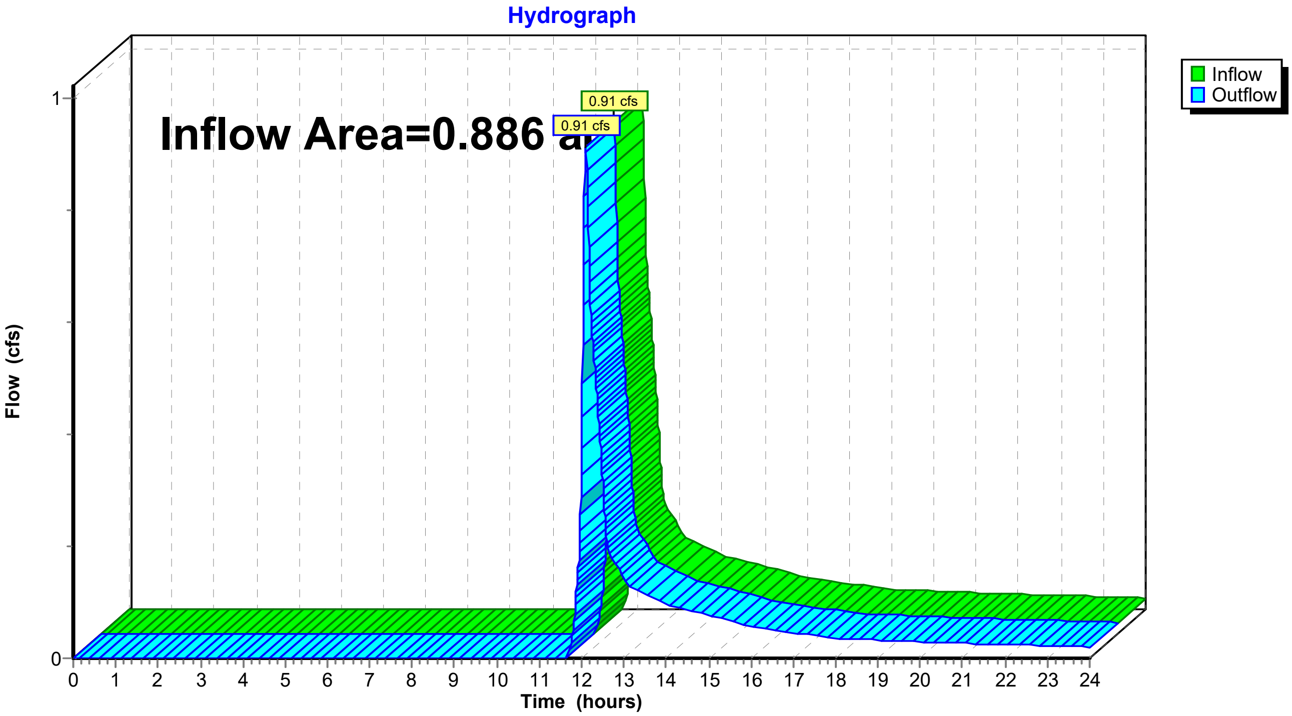
Reach 2R: Off-site Flow (East)



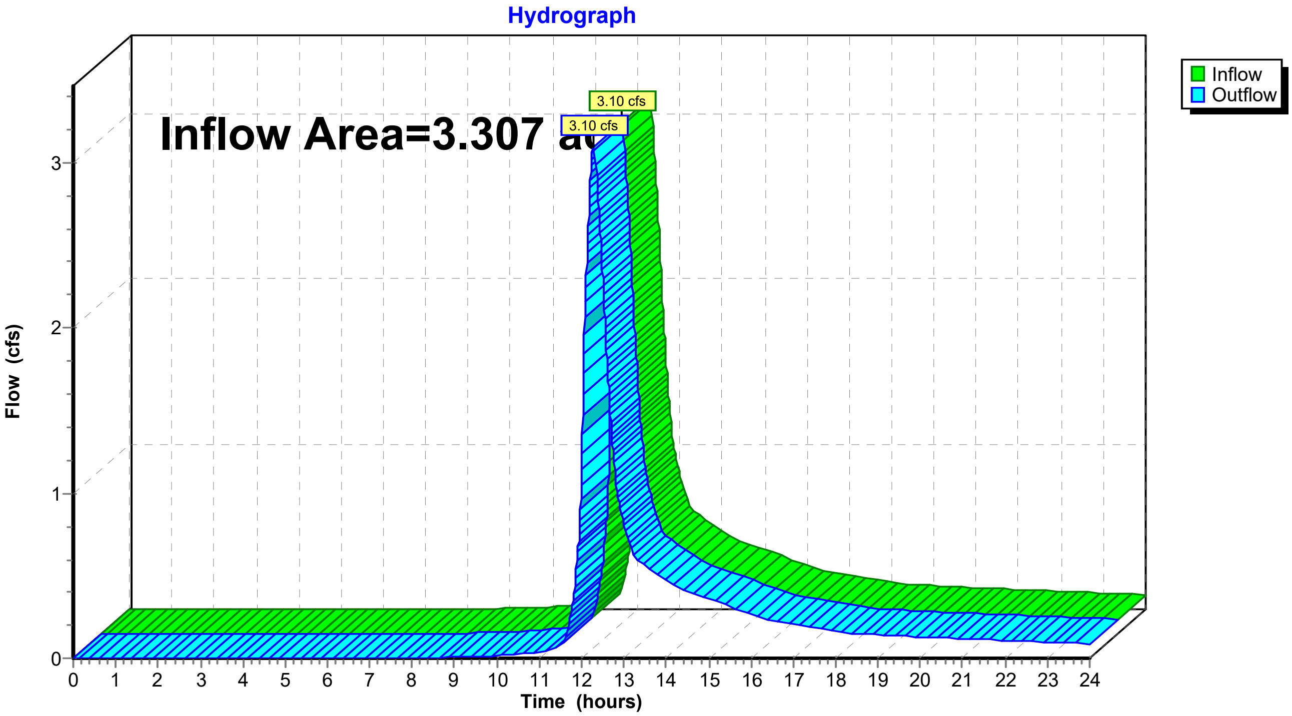
Reach 3R: Off-site Flow (Route 15)



Reach 4R: Off-site flow (South)



Reach 5R: Flow to Drainage Ditch



Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

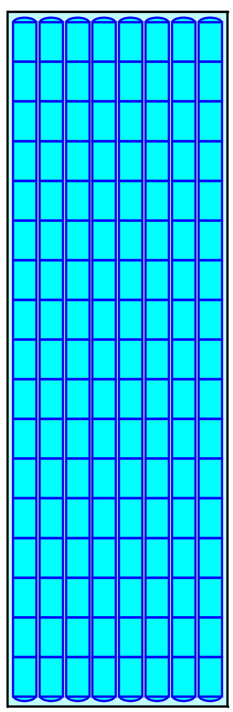
17 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 122.66' Row Length +12.0" End Stone x 2 = 124.66' Base Length
8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

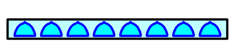
136 Chambers x 45.9 cf = 6,247.8 cf Chamber Storage

17,233.8 cf Field - 6,247.8 cf Chambers = 10,985.9 cf Stone x 40.0% Voids = 4,394.4 cf Stone Storage

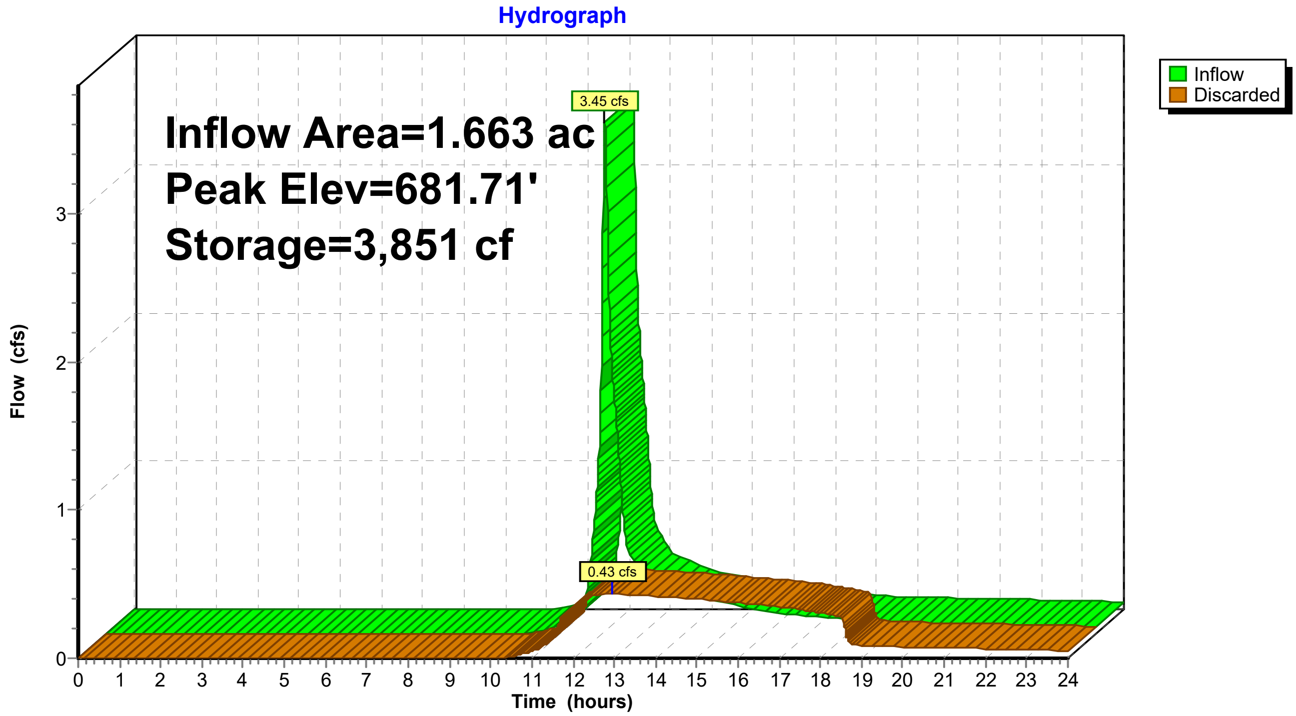
Chamber Storage + Stone Storage = 10,642.2 cf = 0.244 af
Overall Storage Efficiency = 61.8%
Overall System Size = 124.66' x 39.50' x 3.50'

136 Chambers
638.3 cy Field
406.9 cy Stone





Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers



Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

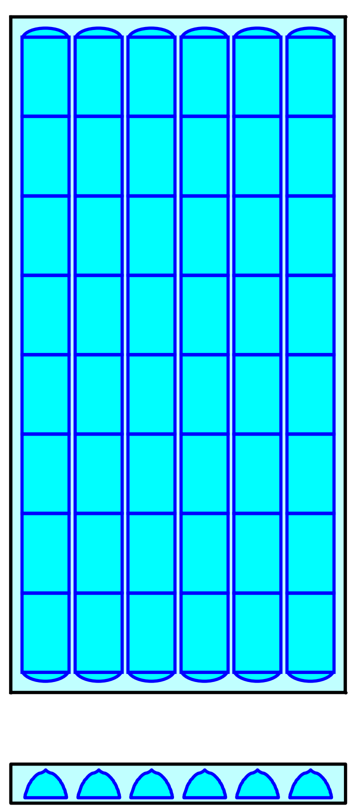
8 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 58.58' Row Length +12.0" End Stone x 2 = 60.58' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

48 Chambers x 45.9 cf = 2,205.1 cf Chamber Storage

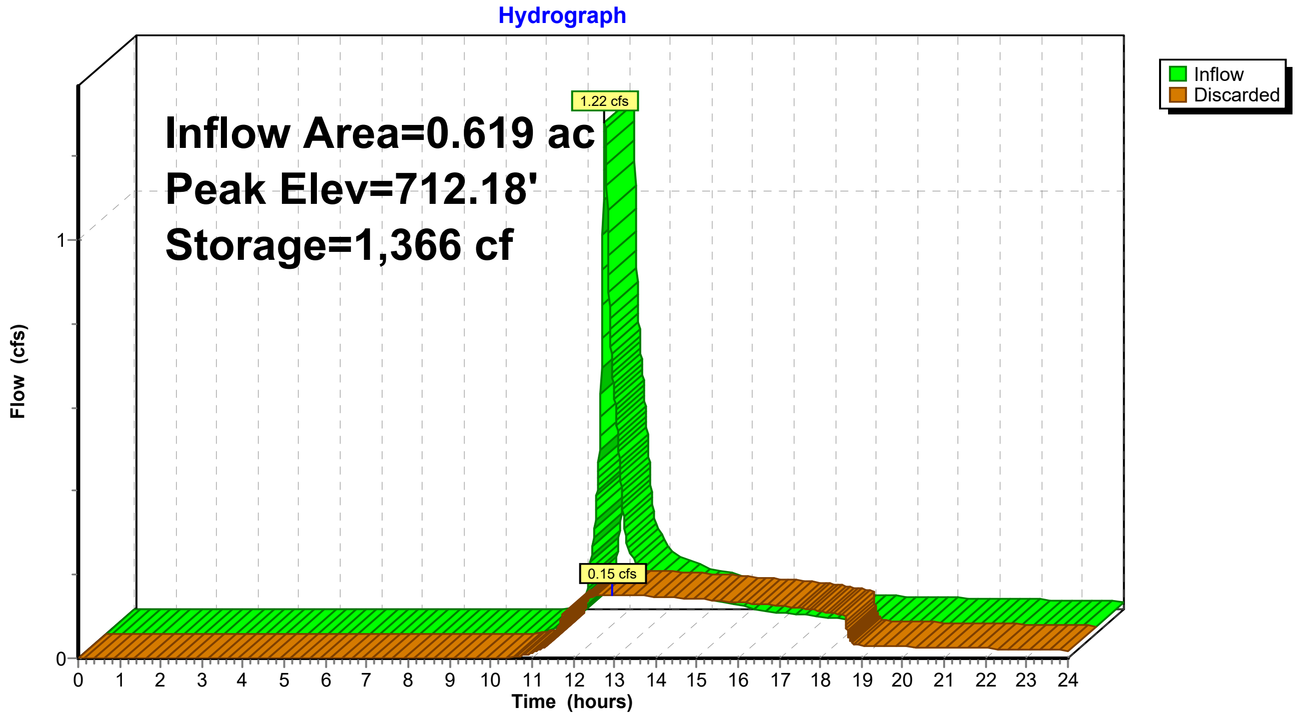
6,360.6 cf Field - 2,205.1 cf Chambers = 4,155.4 cf Stone x 40.0% Voids = 1,662.2 cf Stone Storage

Chamber Storage + Stone Storage = 3,867.3 cf = 0.089 af
Overall Storage Efficiency = 60.8%
Overall System Size = 60.58' x 30.00' x 3.50'

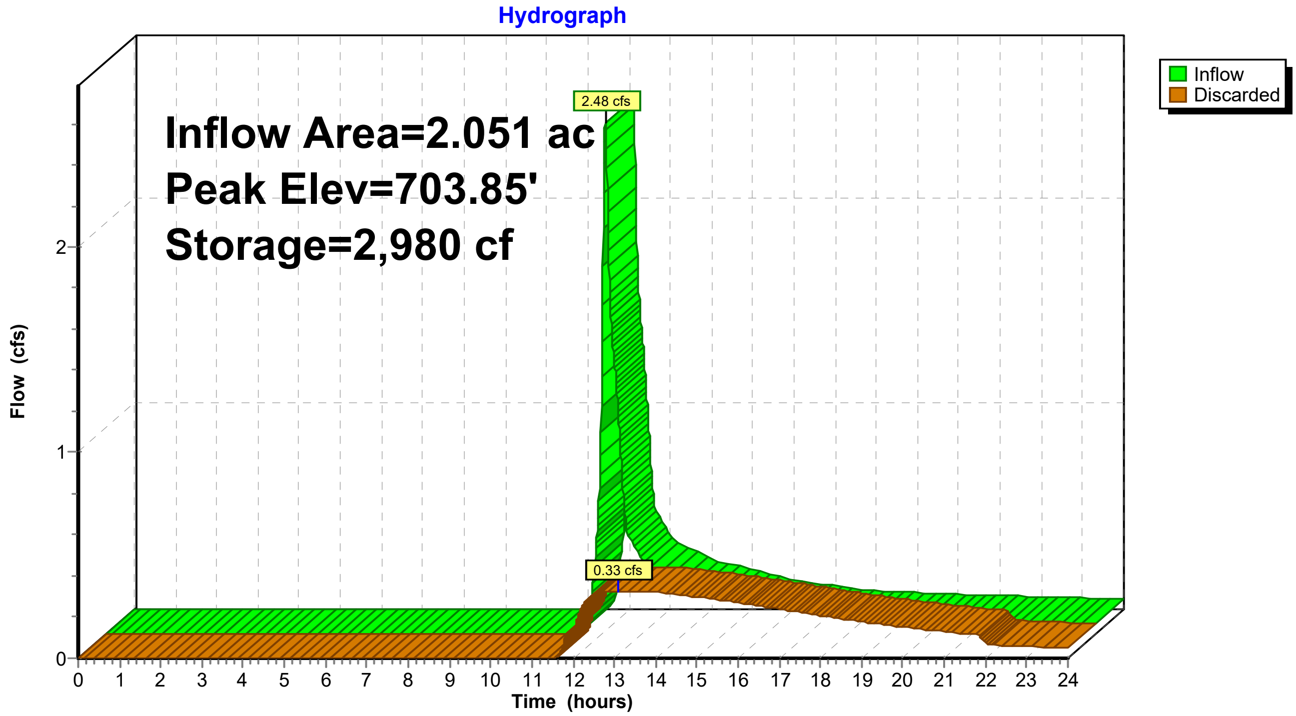
48 Chambers
235.6 cy Field
153.9 cy Stone



Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers



Pond 7P: Infiltration Basin #1



Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

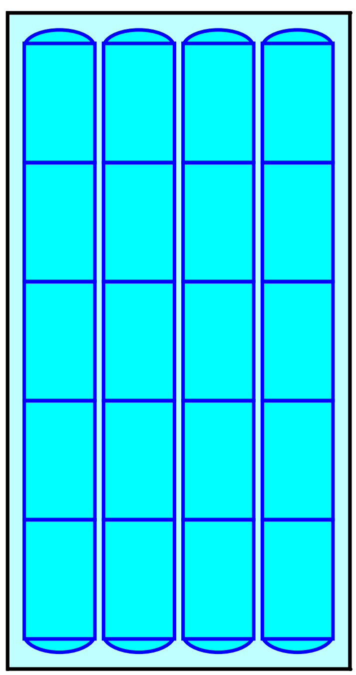
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

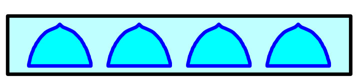
20 Chambers x 45.9 cf = 918.8 cf Chamber Storage

2,813.8 cf Field - 918.8 cf Chambers = 1,895.0 cf Stone x 40.0% Voids = 758.0 cf Stone Storage

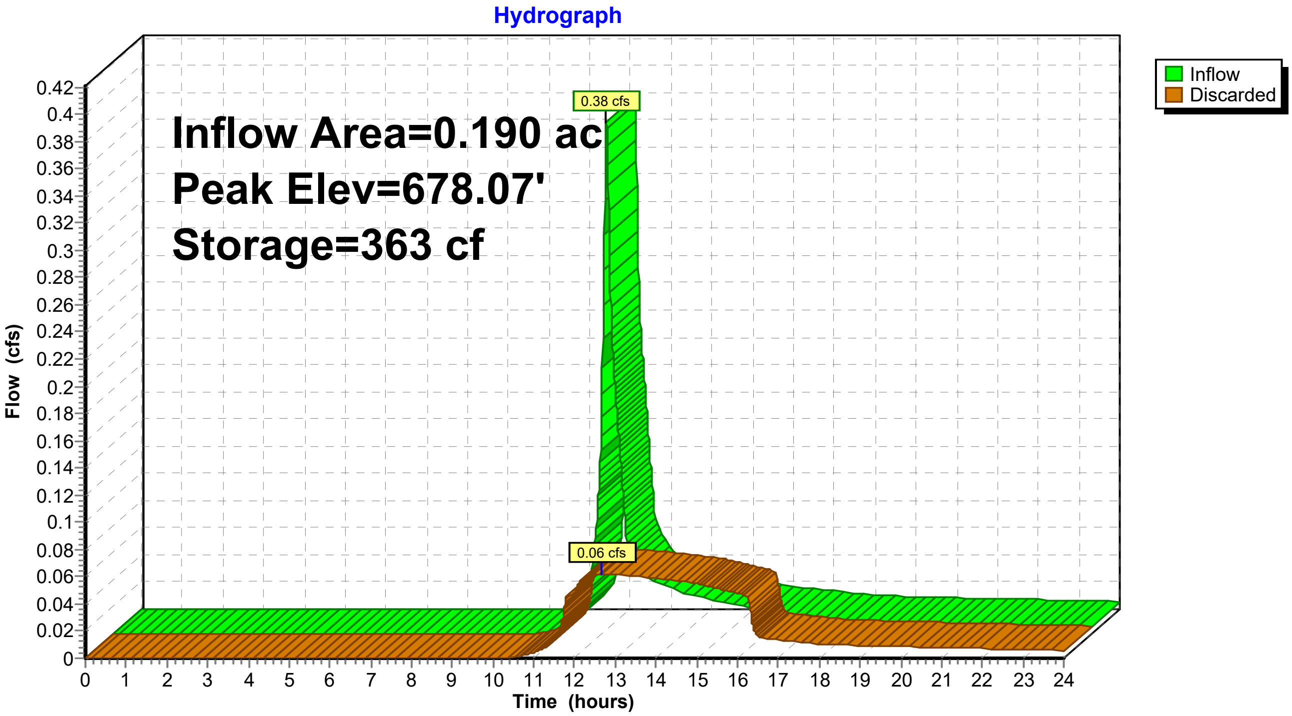
Chamber Storage + Stone Storage = 1,676.8 cf = 0.038 af
Overall Storage Efficiency = 59.6%
Overall System Size = 39.22' x 20.50' x 3.50'

20 Chambers
104.2 cy Field
70.2 cy Stone





Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Area 1 Runoff Area=40,217 sf 0.00% Impervious Runoff Depth>1.69"
Flow Length=350' Tc=6.0 min CN=56 Runoff=1.67 cfs 0.130 af

Subcatchment2S: Area 2 Runoff Area=232,592 sf 0.00% Impervious Runoff Depth>1.69"
Flow Length=283' Tc=6.0 min CN=56 Runoff=9.69 cfs 0.754 af

Subcatchment3S: Area 3 Runoff Area=39,823 sf 0.00% Impervious Runoff Depth>1.78"
Tc=6.0 min CN=57 Runoff=1.76 cfs 0.135 af

Subcatchment4S: Area 4 Runoff Area=38,577 sf 0.00% Impervious Runoff Depth>1.69"
Flow Length=132' Tc=6.0 min CN=56 Runoff=1.61 cfs 0.125 af

Subcatchment5S: Area 5 Runoff Area=72,459 sf 1.10% Impervious Runoff Depth>2.66"
Tc=6.0 min CN=67 Runoff=5.13 cfs 0.368 af

Subcatchment6S: Area 6 Runoff Area=26,951 sf 0.00% Impervious Runoff Depth>2.56"
Tc=6.0 min CN=66 Runoff=1.83 cfs 0.132 af

Subcatchment7S: Area 7 Runoff Area=89,330 sf 0.00% Impervious Runoff Depth>1.86"
Flow Length=133' Tc=6.0 min CN=58 Runoff=4.18 cfs 0.318 af

Subcatchment8S: Area 8 Runoff Area=8,279 sf 20.69% Impervious Runoff Depth>2.56"
Flow Length=170' Tc=6.0 min CN=66 Runoff=0.56 cfs 0.041 af

Subcatchment9S: To Drainage Ditch Runoff Area=127,753 sf 7.29% Impervious Runoff Depth>1.94"
Flow Length=857' Slope=0.0200 '/' Tc=19.2 min CN=59 Runoff=4.29 cfs 0.474 af

Subcatchment10S: To Roadway Swale Runoff Area=9,297 sf 55.10% Impervious Runoff Depth>3.93"
Flow Length=167' Tc=6.0 min CN=80 Runoff=0.98 cfs 0.070 af

Subcatchment11S: To Roadway Swale Runoff Area=7,003 sf 21.56% Impervious Runoff Depth>2.84"
Flow Length=153' Tc=6.2 min CN=69 Runoff=0.53 cfs 0.038 af

Reach 1R: Off-site Flow (Wetland Northwest) Inflow=1.67 cfs 0.130 af
Outflow=1.67 cfs 0.130 af

Reach 2R: Off-site Flow (East) Inflow=9.69 cfs 0.754 af
Outflow=9.69 cfs 0.754 af

Reach 3R: Off-site Flow (Route 15) Inflow=1.76 cfs 0.135 af
Outflow=1.76 cfs 0.135 af

Reach 4R: Off-site flow (South) Inflow=1.61 cfs 0.125 af
Outflow=1.61 cfs 0.125 af

Reach 5R: Flow to Drainage Ditch Inflow=4.99 cfs 0.582 af
Outflow=4.99 cfs 0.582 af

Pond 5P: Subsurface Infiltration System #1 - Peak Elev=682.36' Storage=6,322 cf Inflow=5.13 cfs 0.368 af
Outflow=0.52 cfs 0.368 af

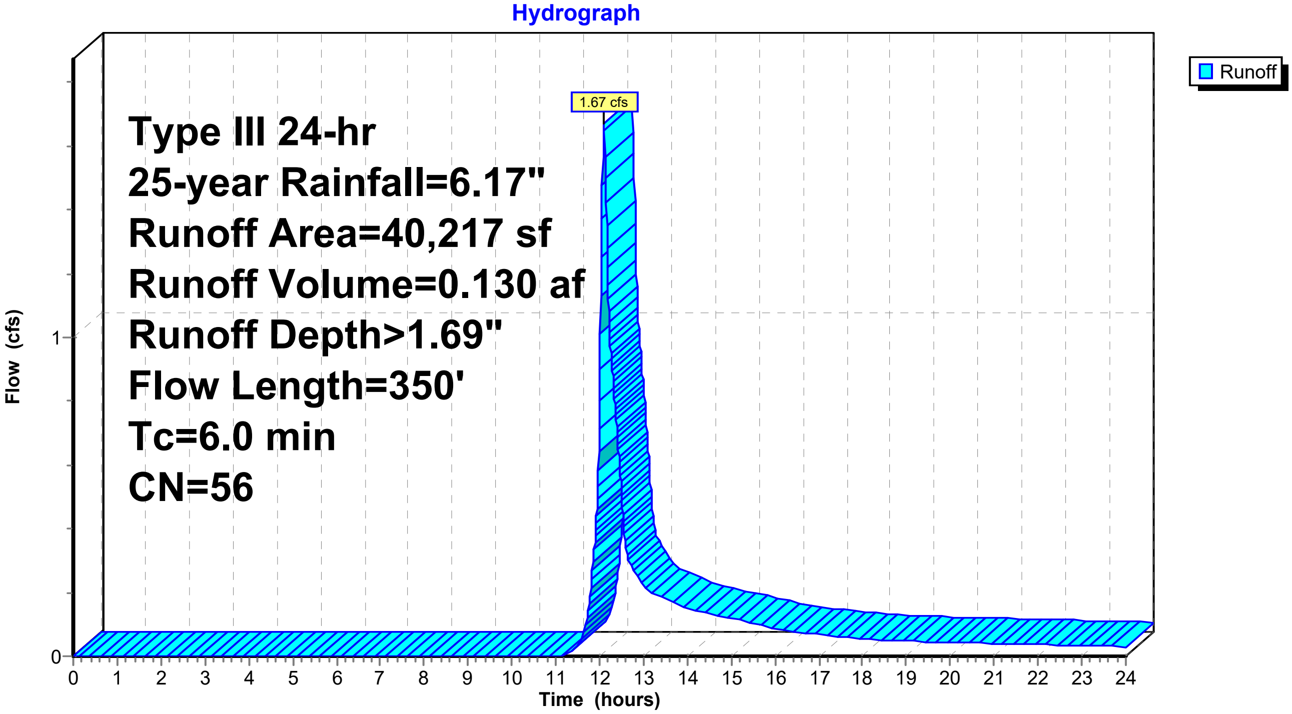
Pond 6P: Subsurface Infiltration System #2 - Peak Elev=712.85' Storage=2,281 cf Inflow=1.83 cfs 0.132 af
Outflow=0.18 cfs 0.132 af

Pond 7P: Infiltration Basin #1 Peak Elev=704.24' Storage=5,381 cf Inflow=4.18 cfs 0.318 af
Outflow=0.45 cfs 0.312 af

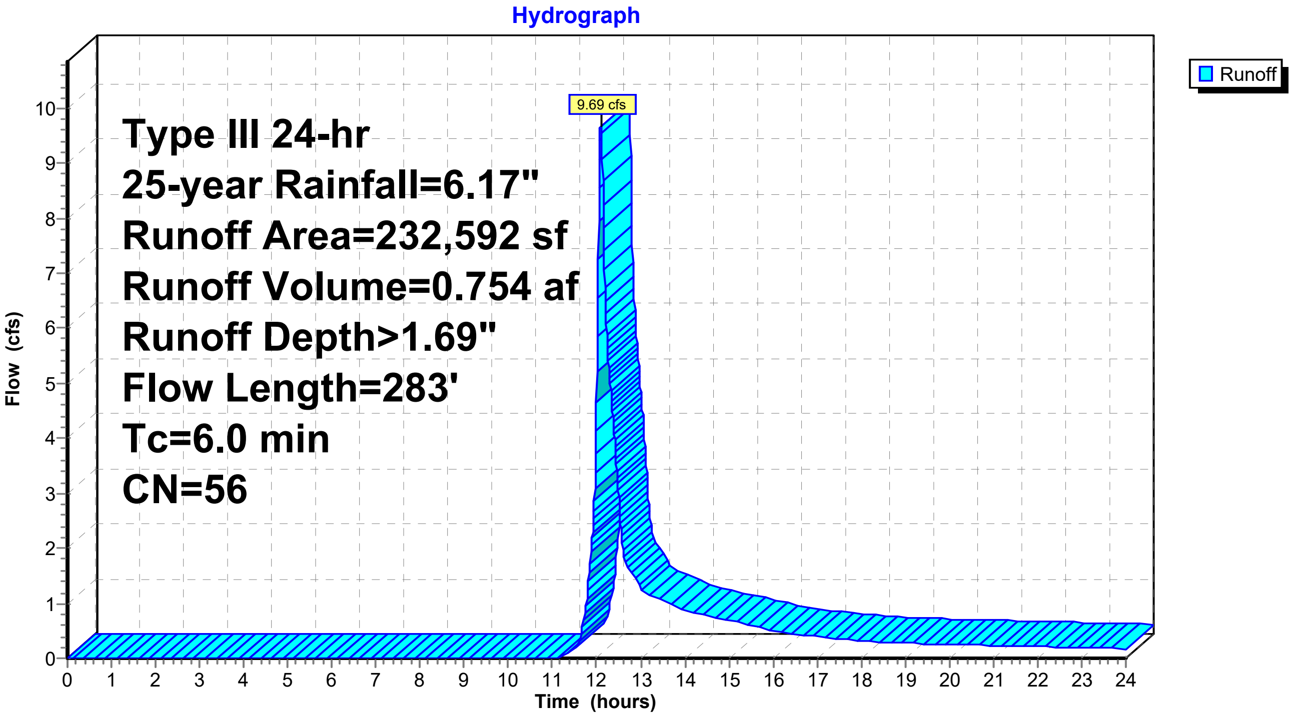
Pond 8P: Subsurface Infiltration System #3 - Peak Elev=678.49' Storage=625 cf Inflow=0.56 cfs 0.041 af
Outflow=0.07 cfs 0.041 af

Total Runoff Area = 15.893 ac Runoff Volume = 2.586 af Average Runoff Depth = 1.95"
97.34% Pervious = 15.469 ac 2.66% Impervious = 0.423 ac

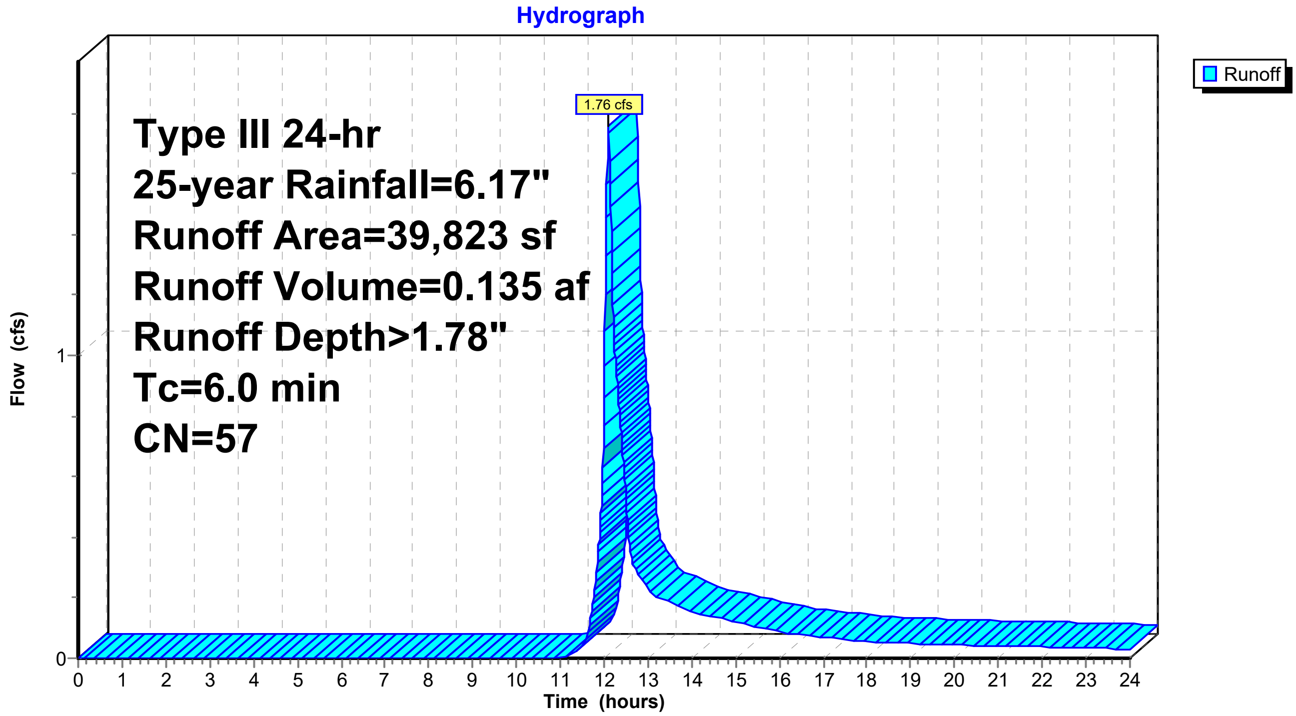
Subcatchment 1S: Area 1



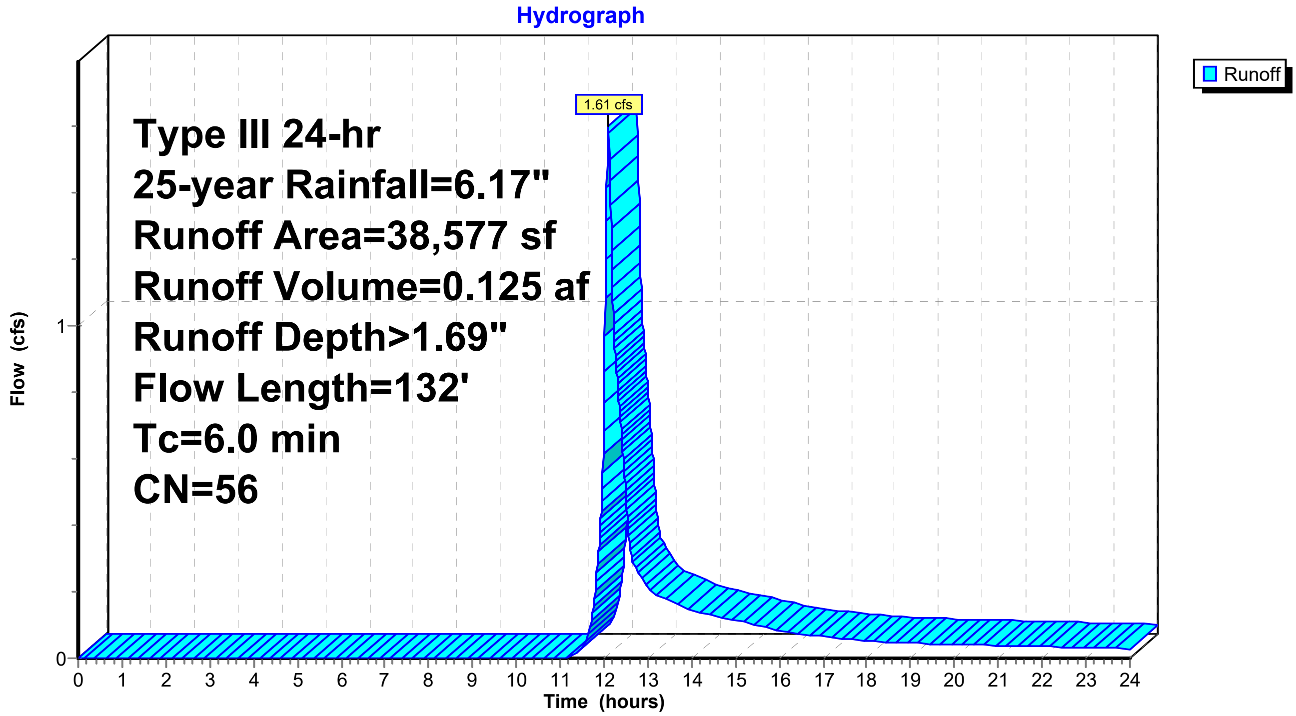
Subcatchment 2S: Area 2



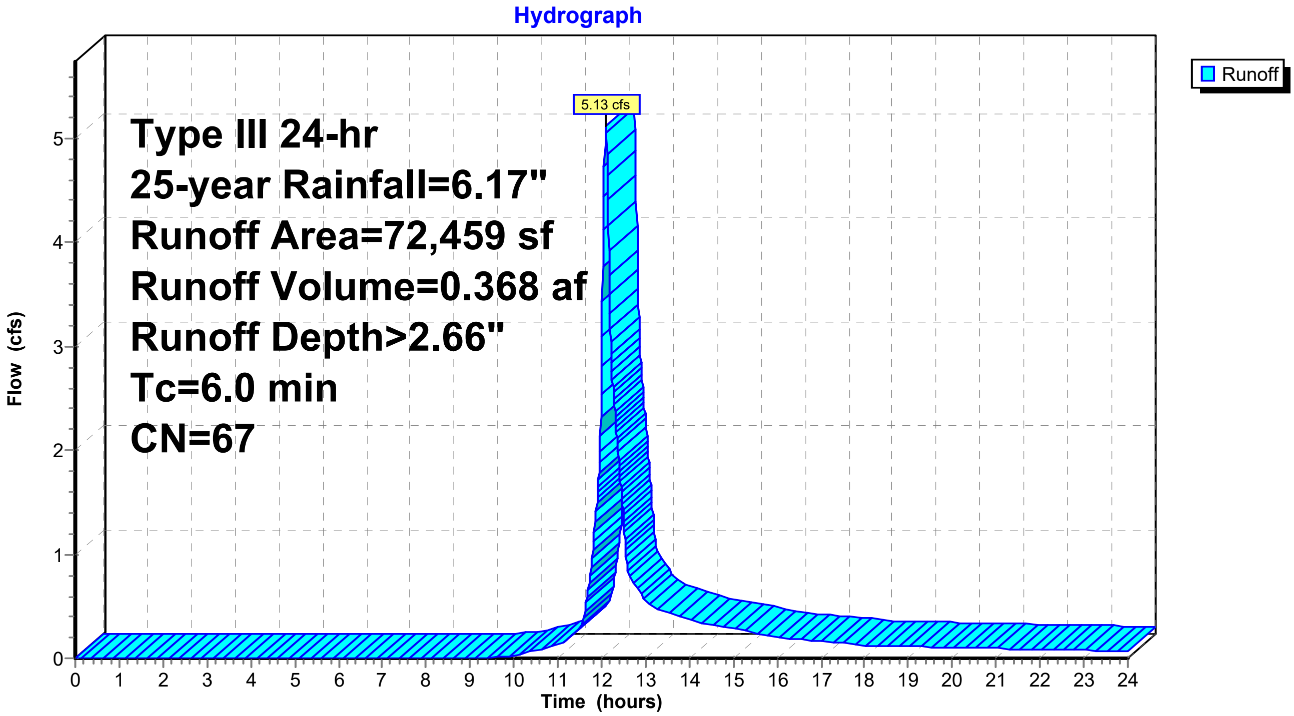
Subcatchment 3S: Area 3



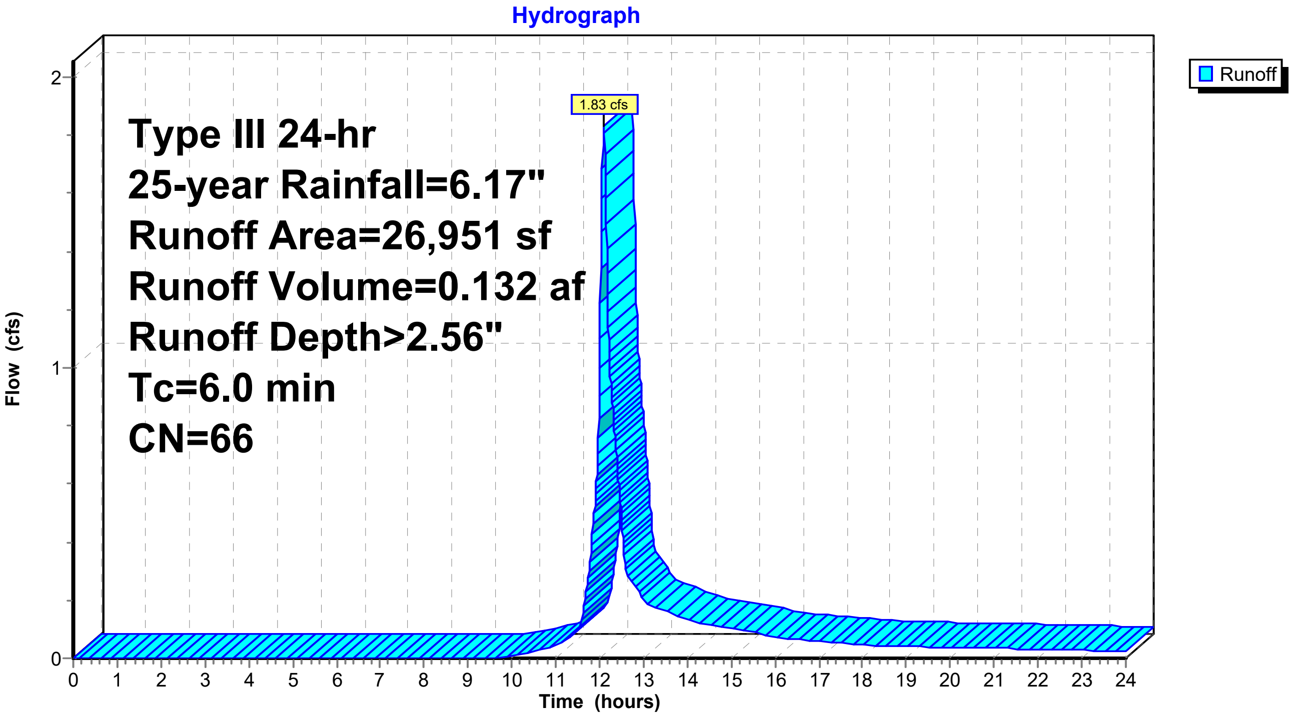
Subcatchment 4S: Area 4



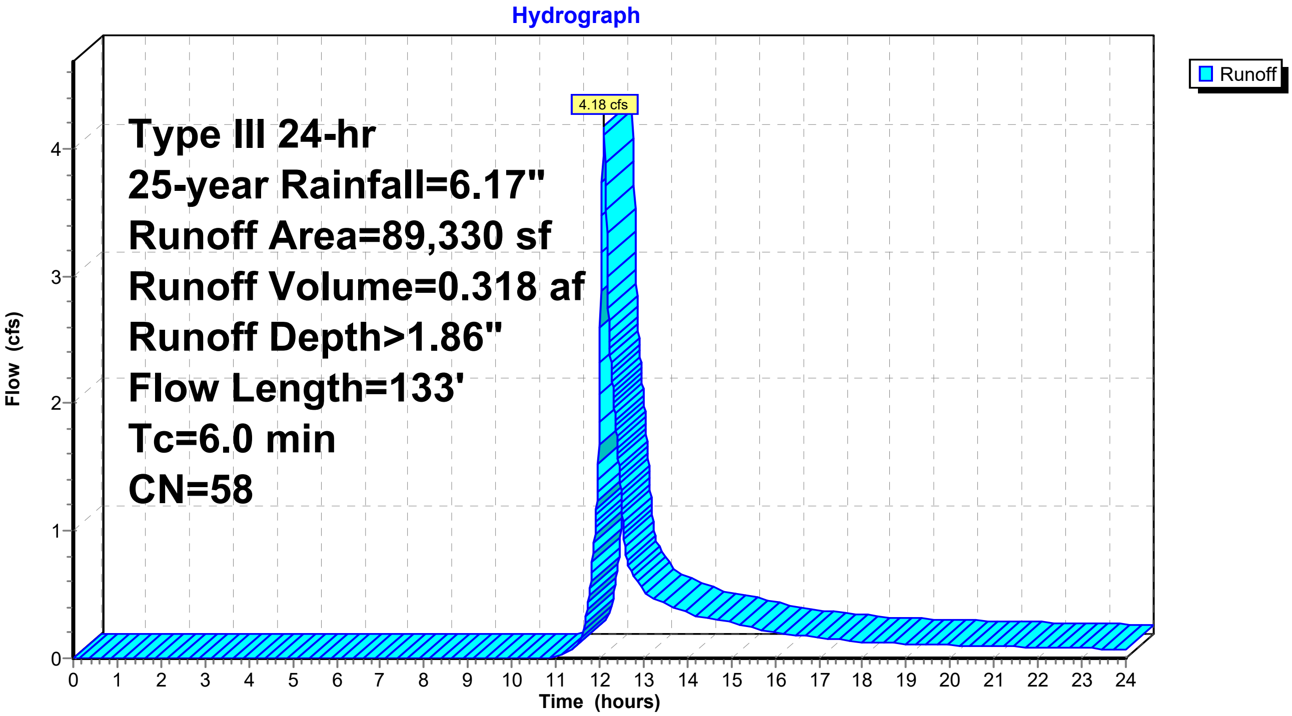
Subcatchment 5S: Area 5



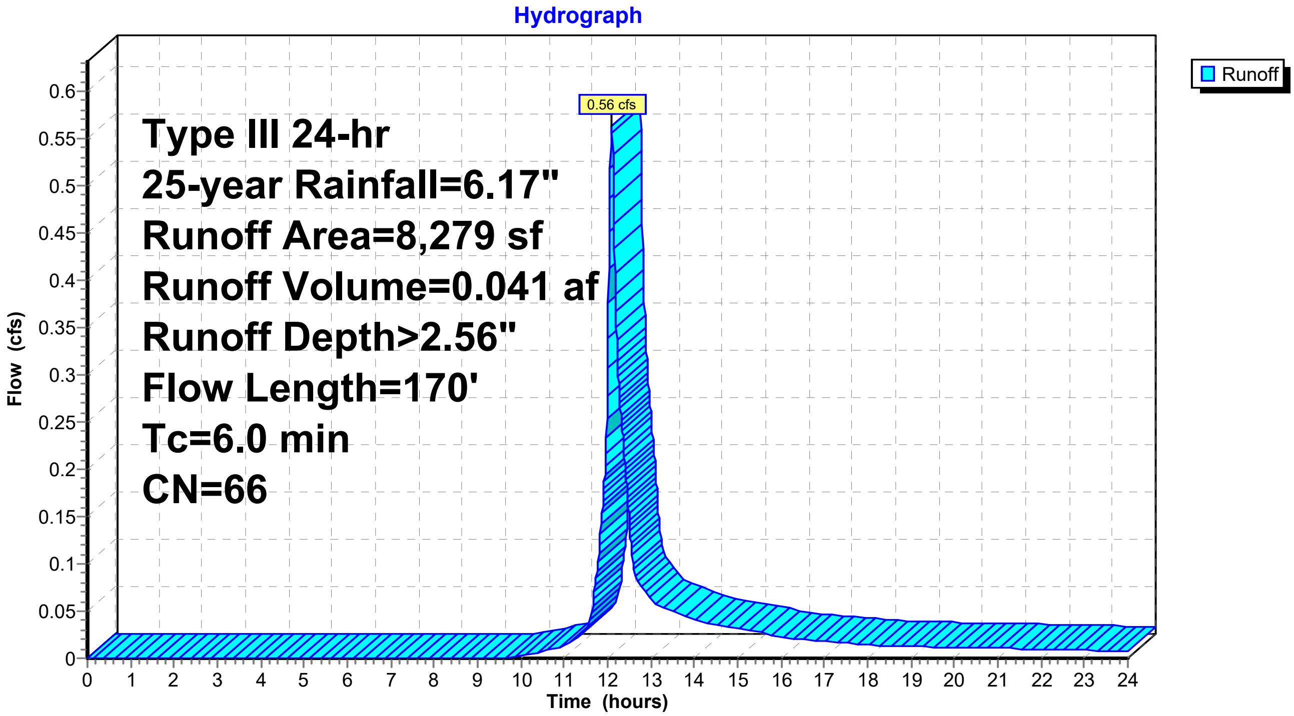
Subcatchment 6S: Area 6



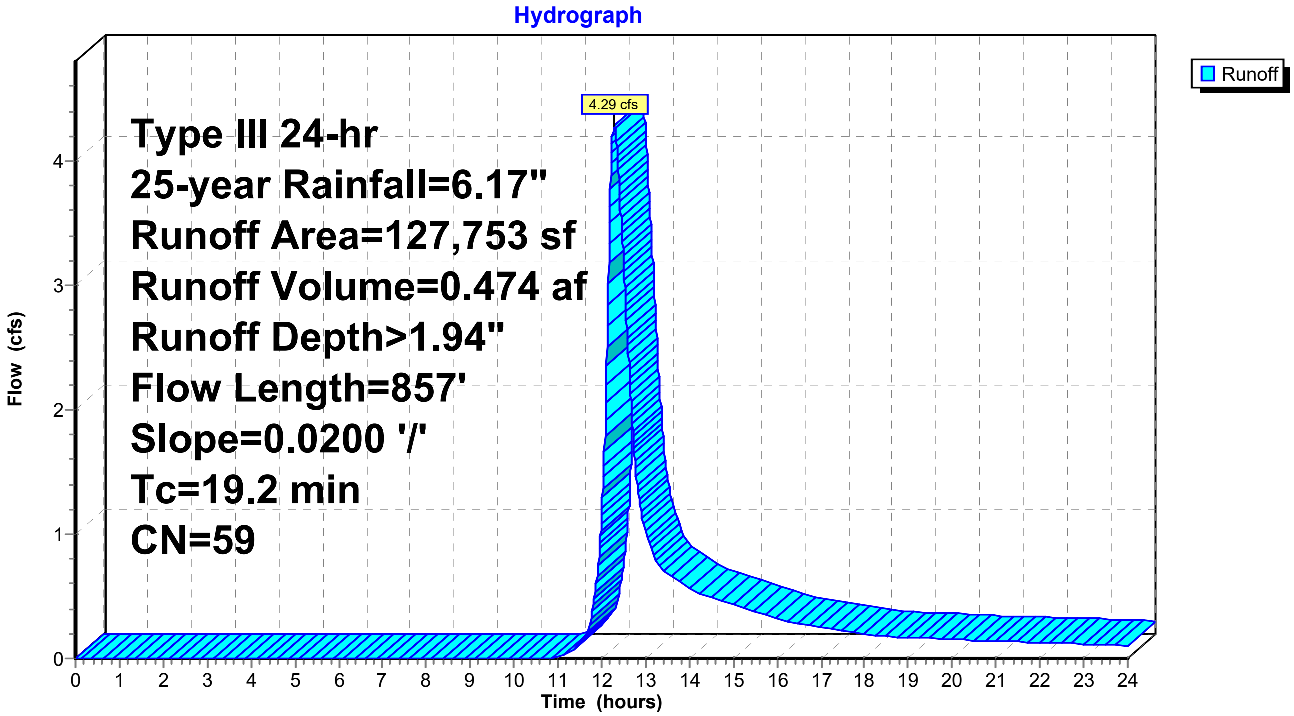
Subcatchment 7S: Area 7



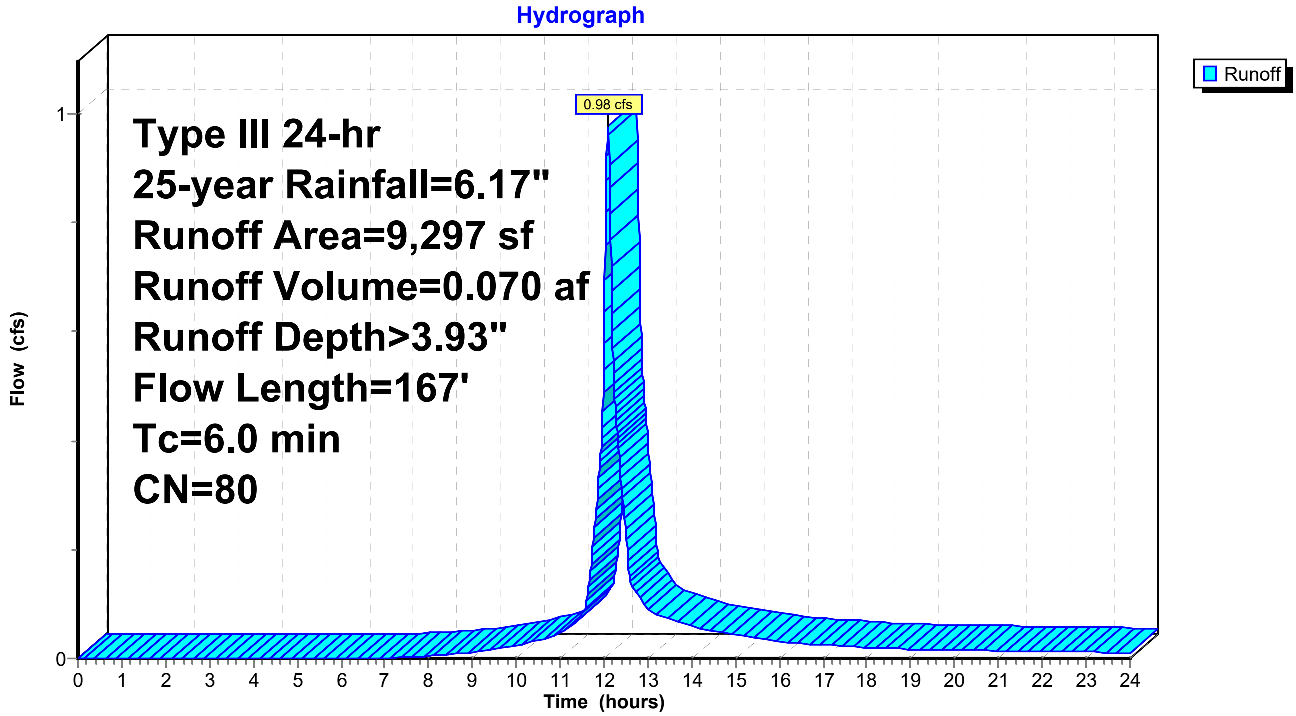
Subcatchment 8S: Area 8



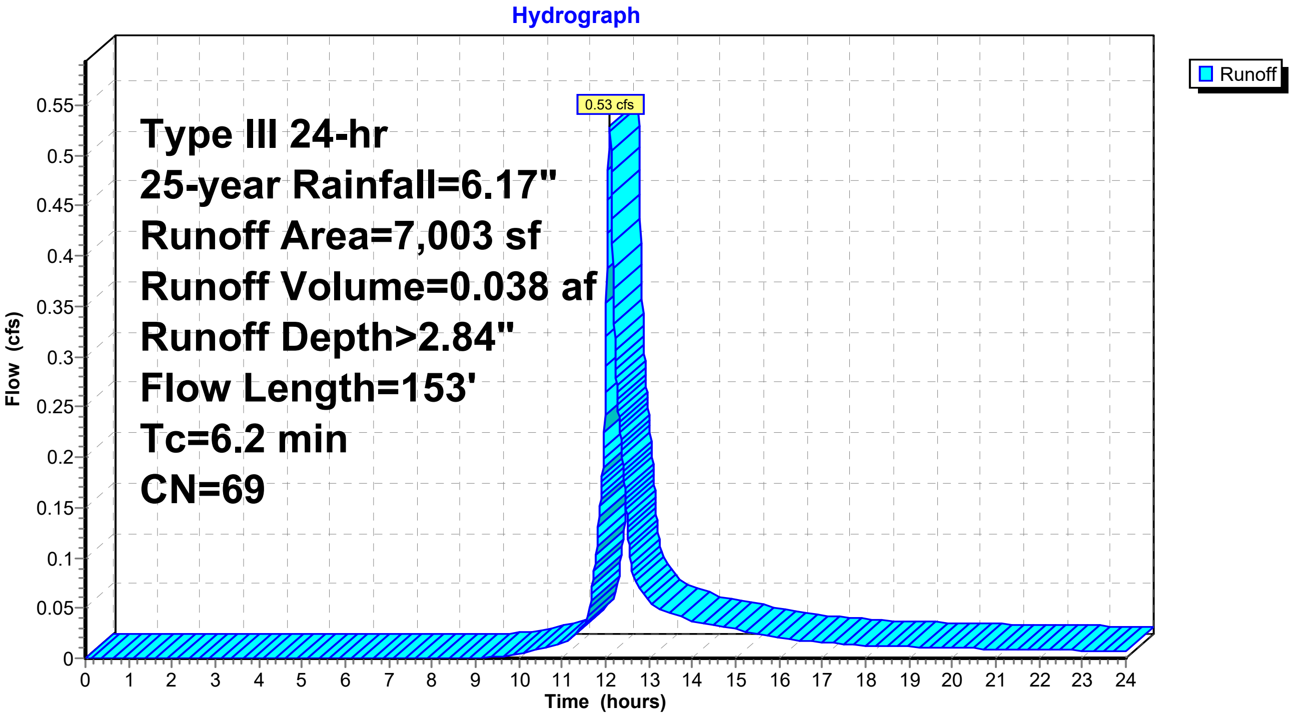
Subcatchment 9S: To Drainage Ditch



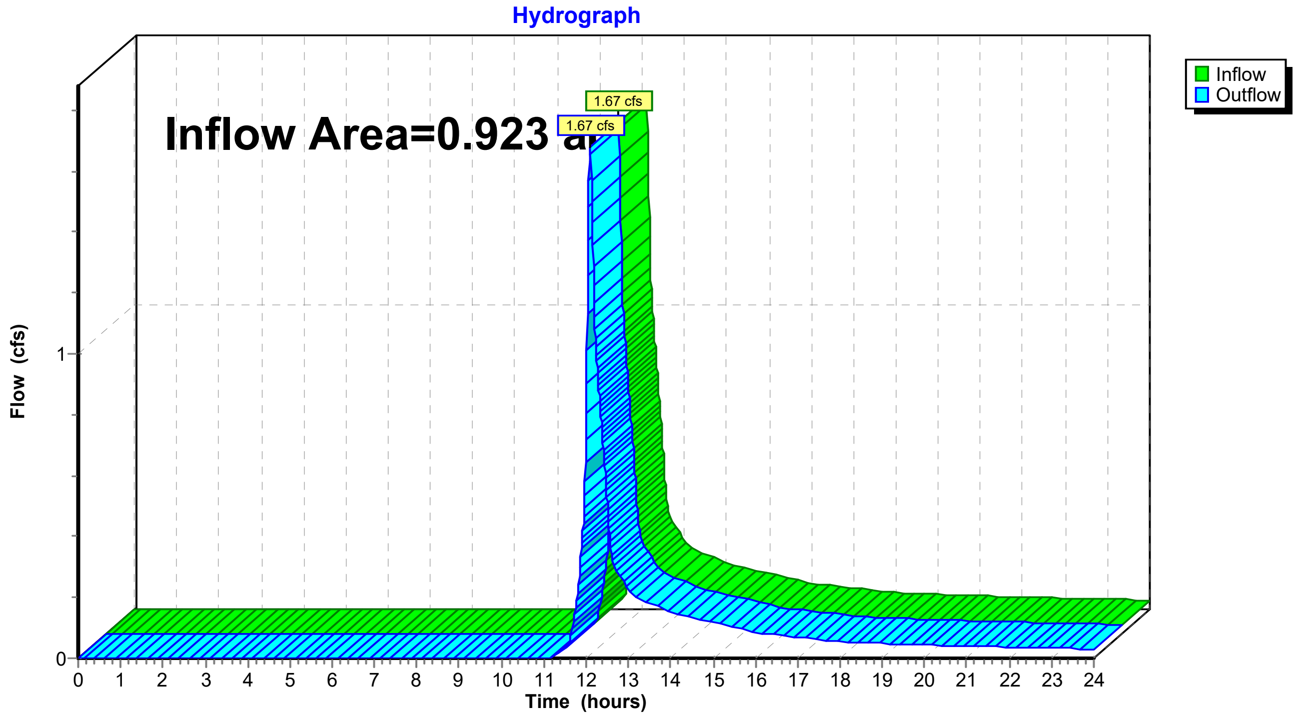
Subcatchment 10S: To Roadway Swale (West)



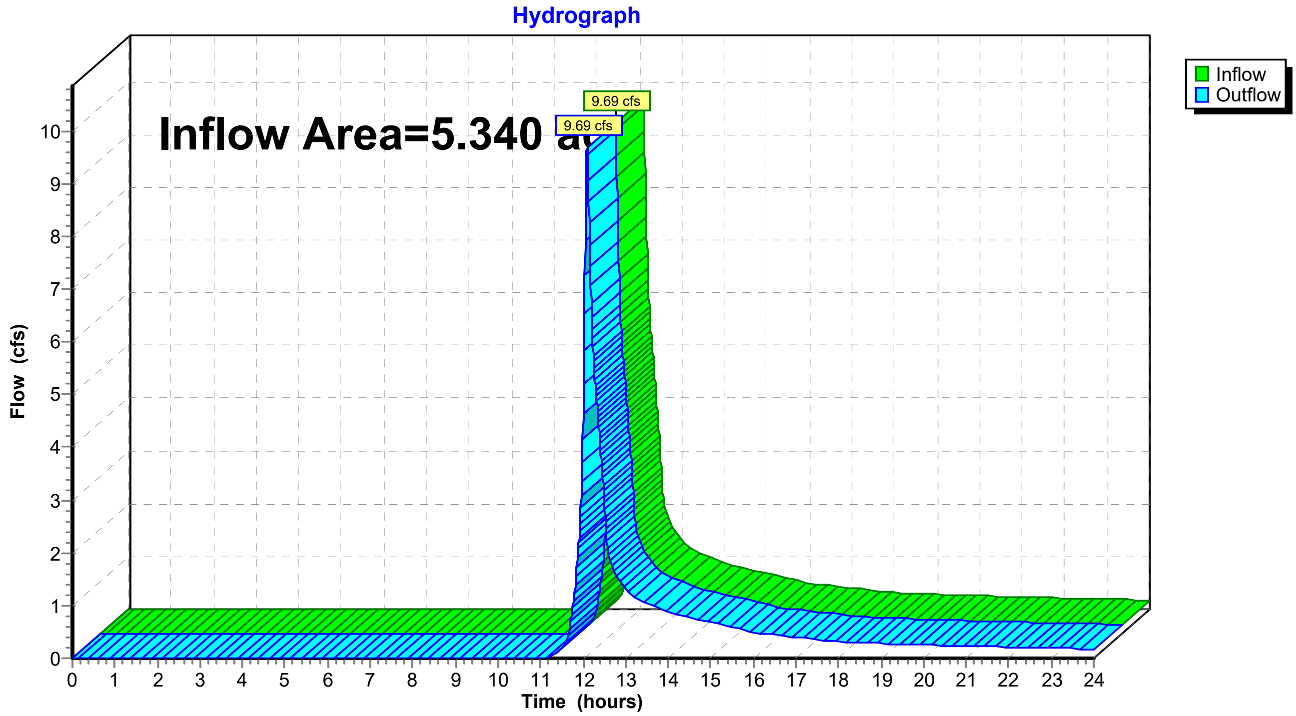
Subcatchment 11S: To Roadway Swale (East)



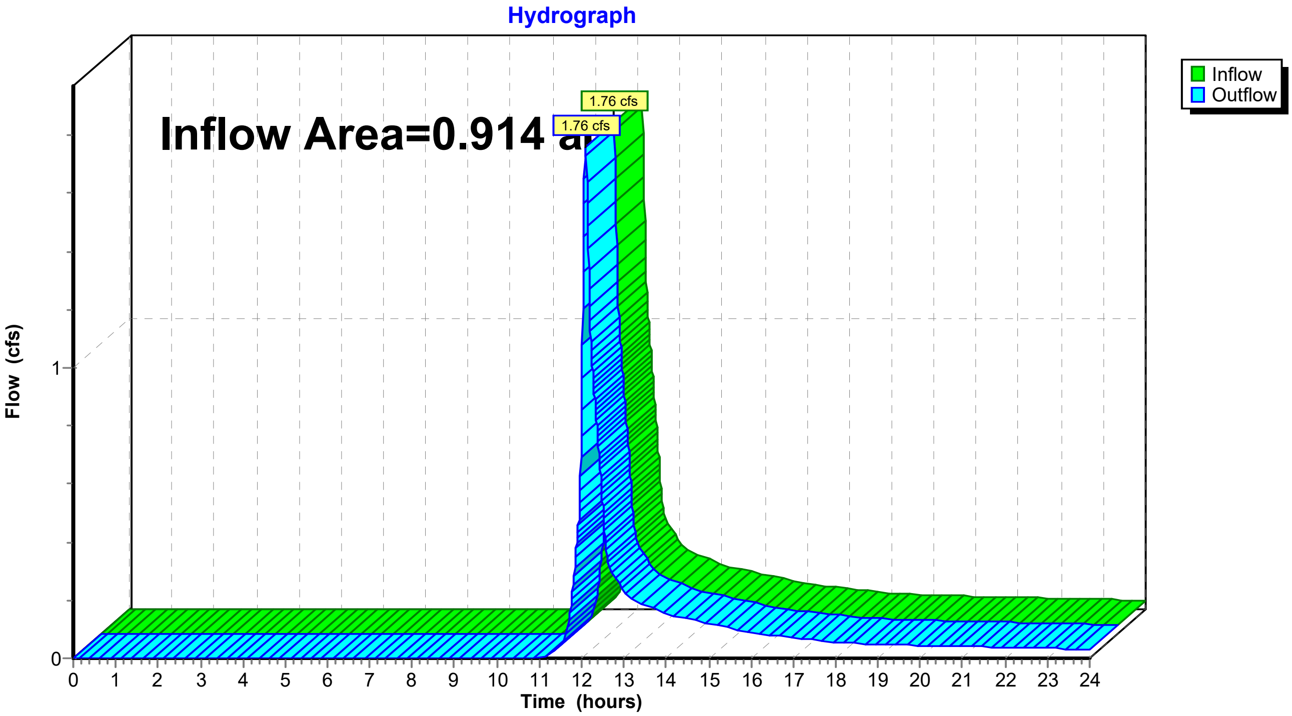
Reach 1R: Off-site Flow (Wetland Northwest)



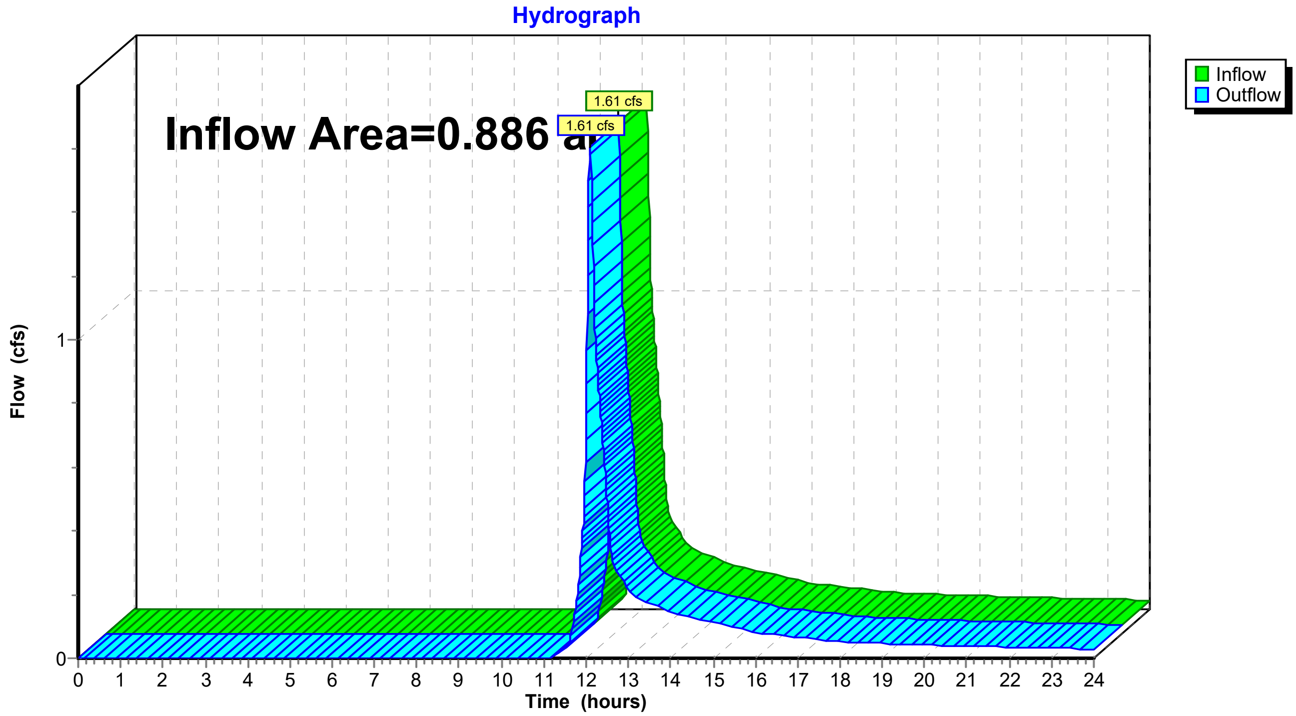
Reach 2R: Off-site Flow (East)



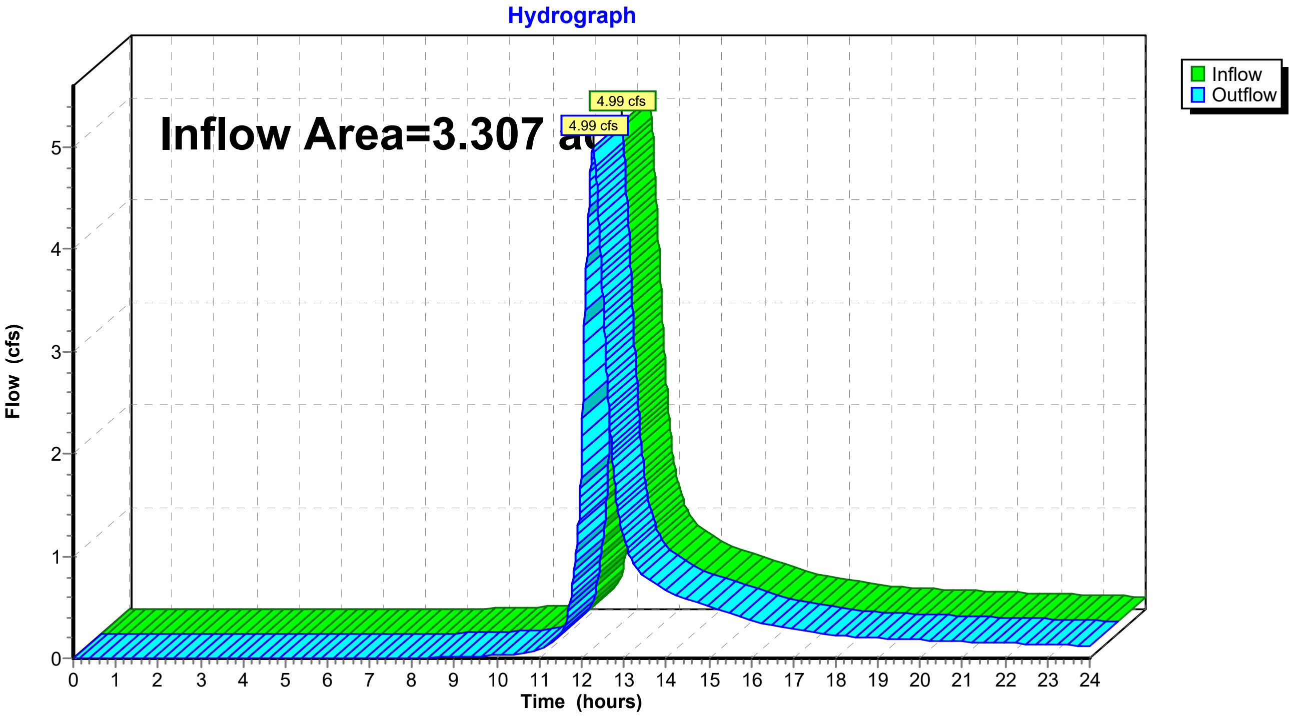
Reach 3R: Off-site Flow (Route 15)



Reach 4R: Off-site flow (South)



Reach 5R: Flow to Drainage Ditch



Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

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136 Chambers x 45.9 cf = 6,247.8 cf Chamber Storage

17,233.8 cf Field - 6,247.8 cf Chambers = 10,985.9 cf Stone x 40.0% Voids = 4,394.4 cf Stone Storage

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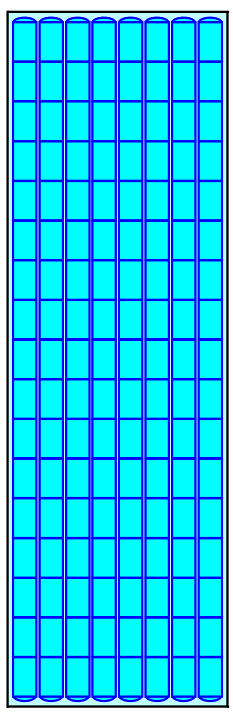
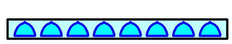
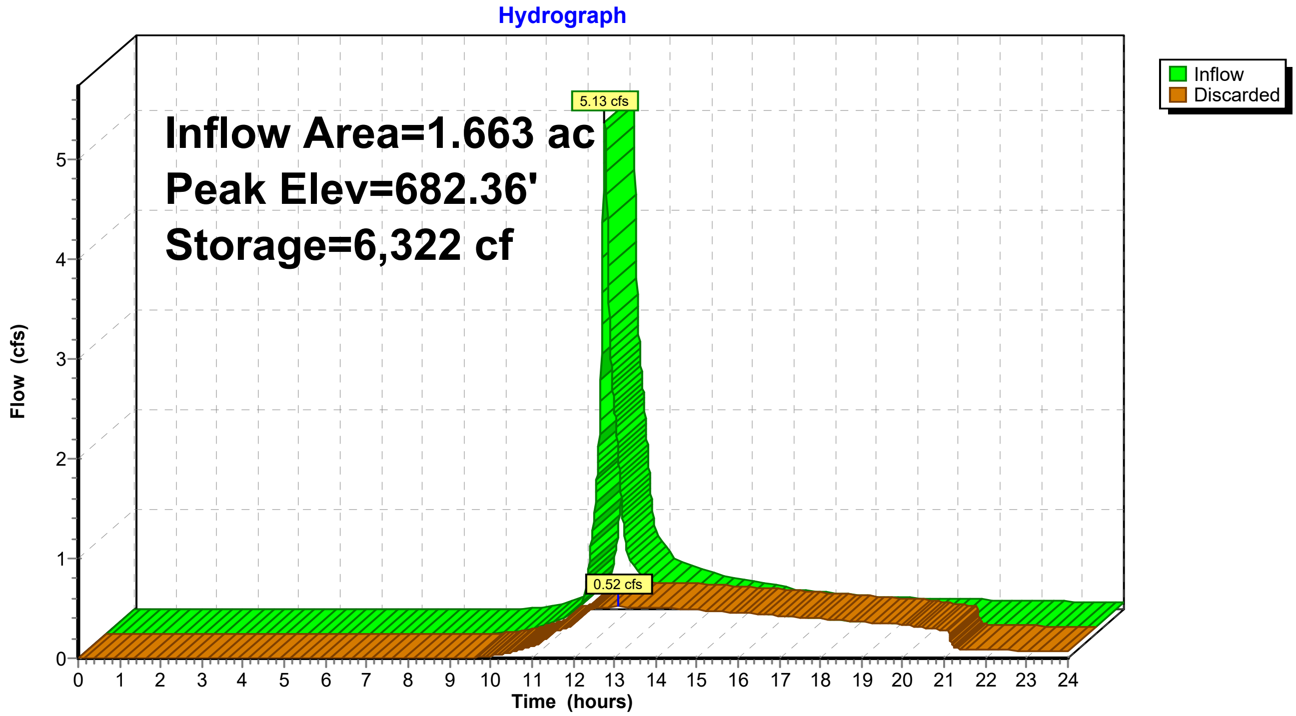
638.3 cy Field
406.9 cy Stone





Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers



Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

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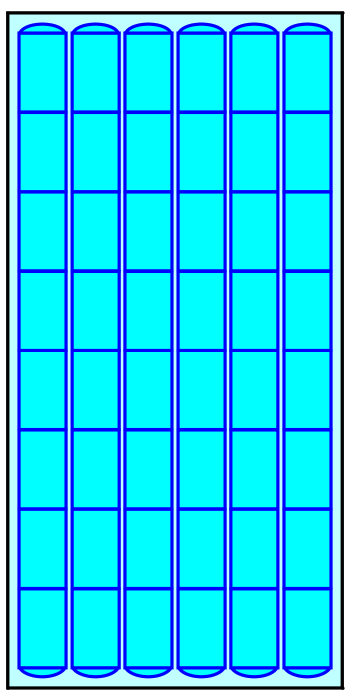
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

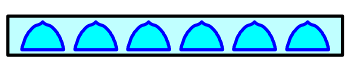
48 Chambers x 45.9 cf = 2,205.1 cf Chamber Storage

6,360.6 cf Field - 2,205.1 cf Chambers = 4,155.4 cf Stone x 40.0% Voids = 1,662.2 cf Stone Storage

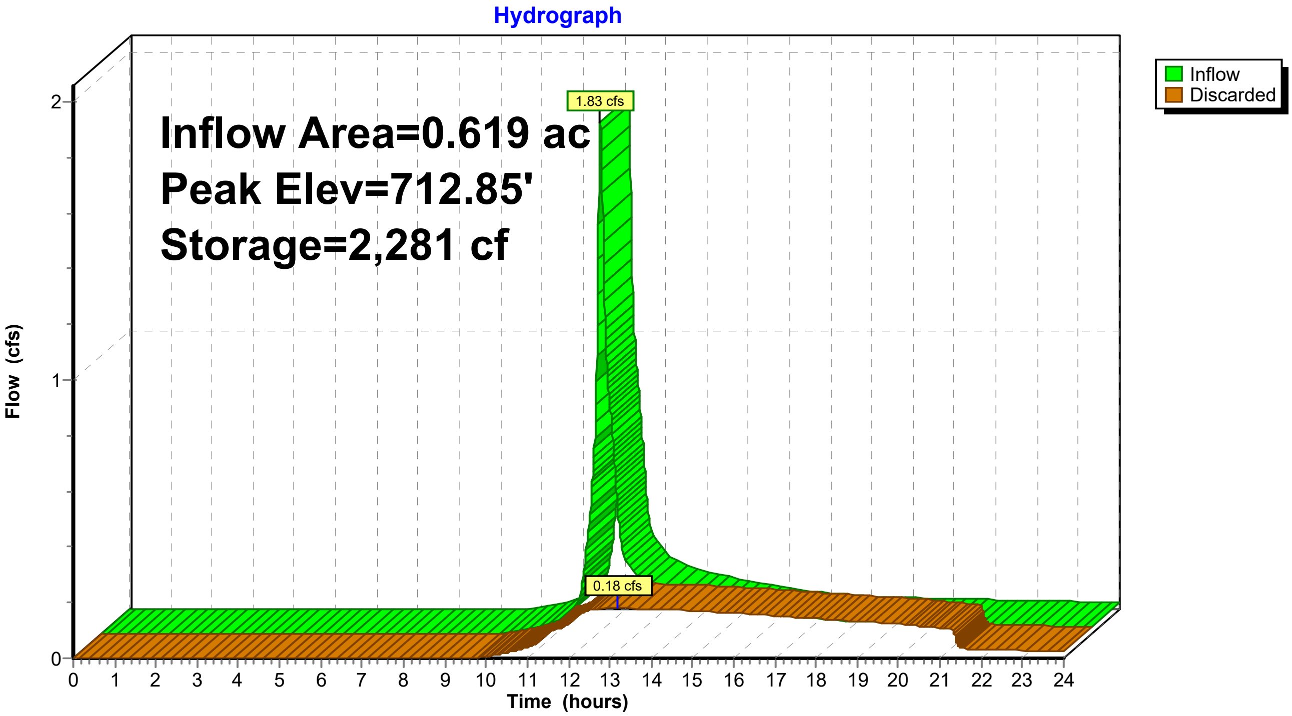
Chamber Storage + Stone Storage = 3,867.3 cf = 0.089 af
Overall Storage Efficiency = 60.8%
Overall System Size = 60.58' x 30.00' x 3.50'

48 Chambers
235.6 cy Field
153.9 cy Stone

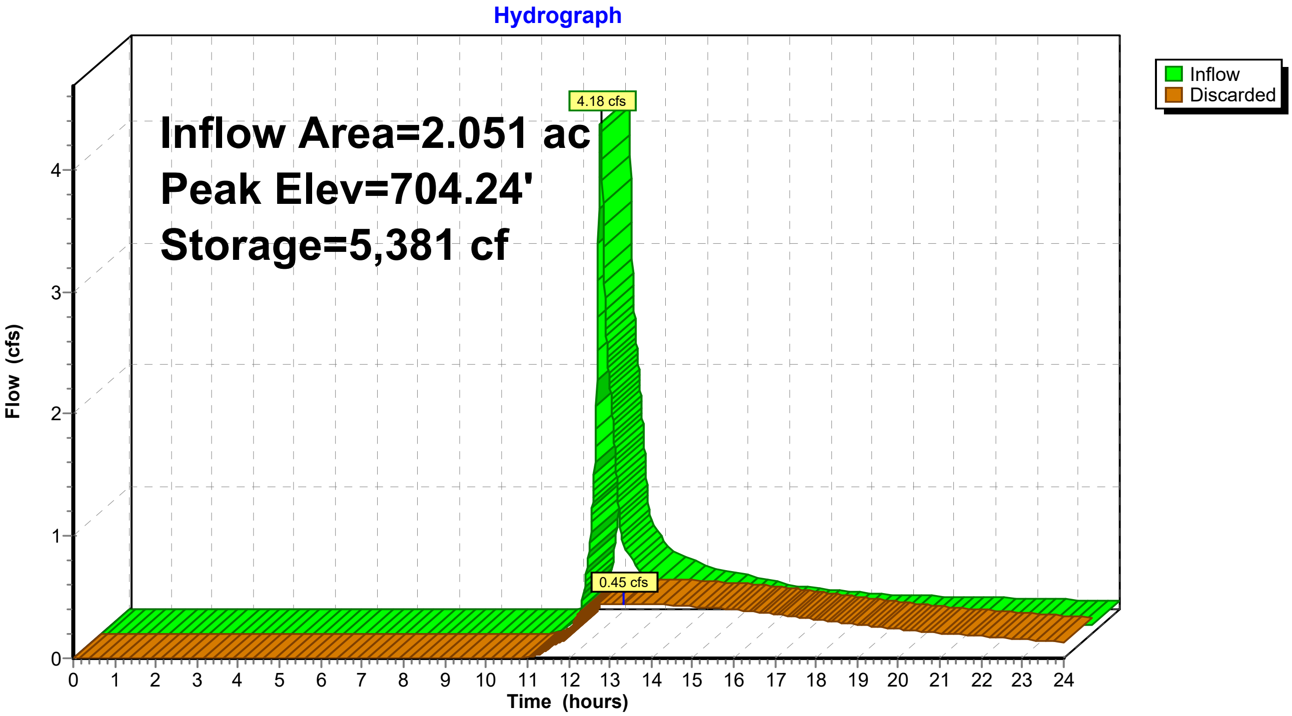




Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers



Pond 7P: Infiltration Basin #1



Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

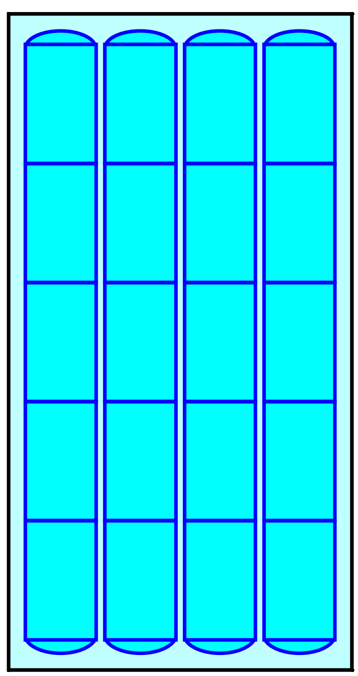
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

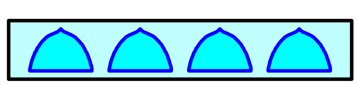
20 Chambers x 45.9 cf = 918.8 cf Chamber Storage

2,813.8 cf Field - 918.8 cf Chambers = 1,895.0 cf Stone x 40.0% Voids = 758.0 cf Stone Storage

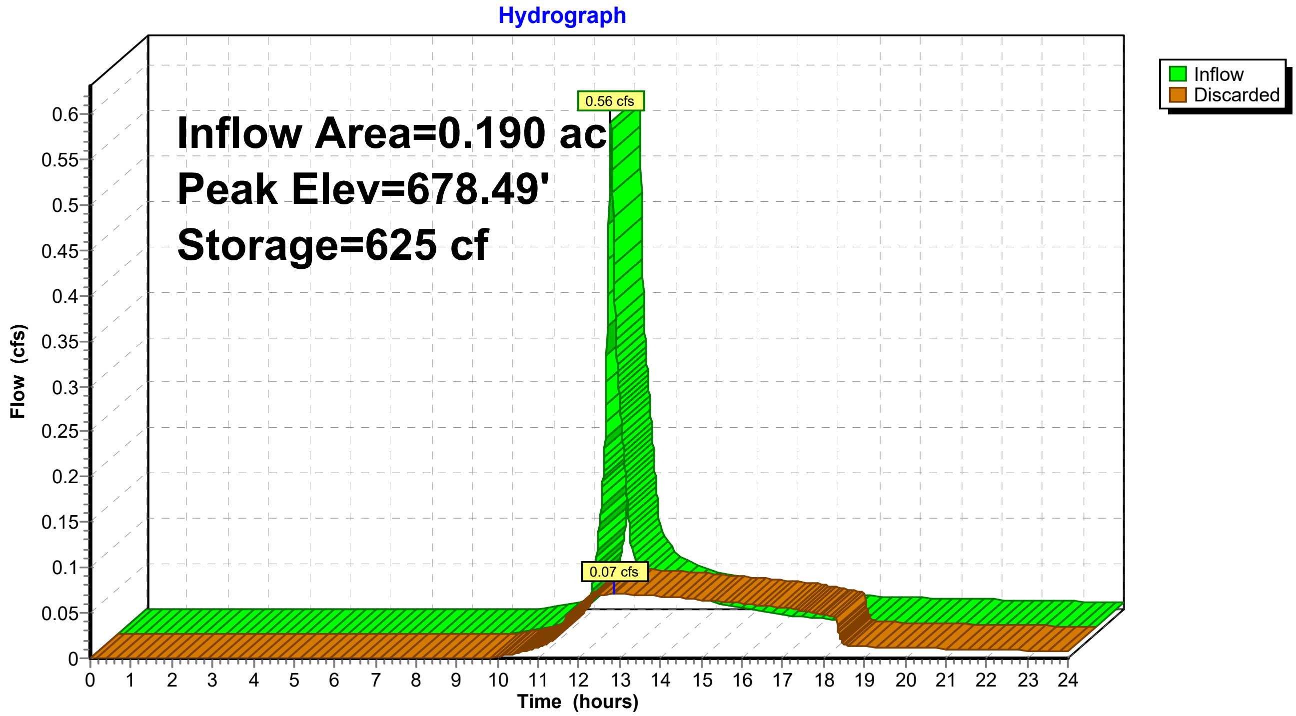
Chamber Storage + Stone Storage = 1,676.8 cf = 0.038 af
Overall Storage Efficiency = 59.6%
Overall System Size = 39.22' x 20.50' x 3.50'

20 Chambers
104.2 cy Field
70.2 cy Stone





Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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: Area 1 Runoff Area=40,217 sf 0.00% Impervious Runoff Depth>2.21"
Flow Length=350' Tc=6.0 min CN=56 Runoff=2.26 cfs 0.170 af

Subcatchment 2S: Area 2 Runoff Area=232,592 sf 0.00% Impervious Runoff Depth>2.21"
Flow Length=283' Tc=6.0 min CN=56 Runoff=13.10 cfs 0.985 af

Subcatchment 3S: Area 3 Runoff Area=39,823 sf 0.00% Impervious Runoff Depth>2.31"
Tc=6.0 min CN=57 Runoff=2.36 cfs 0.176 af

Subcatchment 4S: Area 4 Runoff Area=38,577 sf 0.00% Impervious Runoff Depth>2.21"
Flow Length=132' Tc=6.0 min CN=56 Runoff=2.17 cfs 0.163 af

Subcatchment 5S: Area 5 Runoff Area=72,459 sf 1.10% Impervious Runoff Depth>3.30"
Tc=6.0 min CN=67 Runoff=6.42 cfs 0.458 af

Subcatchment 6S: Area 6 Runoff Area=26,951 sf 0.00% Impervious Runoff Depth>3.20"
Tc=6.0 min CN=66 Runoff=2.31 cfs 0.165 af

Subcatchment 7S: Area 7 Runoff Area=89,330 sf 0.00% Impervious Runoff Depth>2.41"
Flow Length=133' Tc=6.0 min CN=58 Runoff=5.55 cfs 0.411 af

Subcatchment 8S: Area 8 Runoff Area=8,279 sf 20.69% Impervious Runoff Depth>3.20"
Flow Length=170' Tc=6.0 min CN=66 Runoff=0.71 cfs 0.051 af

Subcatchment 9S: To Drainage Ditch Runoff Area=127,753 sf 7.29% Impervious Runoff Depth>2.49"
Flow Length=857' Slope=0.0200 '/' Tc=19.2 min CN=59 Runoff=5.66 cfs 0.609 af

Subcatchment 10S: To Roadway Swale Runoff Area=9,297 sf 55.10% Impervious Runoff Depth>4.69"
Flow Length=167' Tc=6.0 min CN=80 Runoff=1.16 cfs 0.083 af

Subcatchment 11S: To Roadway Swale Runoff Area=7,003 sf 21.56% Impervious Runoff Depth>3.51"
Flow Length=153' Tc=6.2 min CN=69 Runoff=0.66 cfs 0.047 af

Reach 1R: Off-site Flow (Wetland Northwest) Inflow=2.26 cfs 0.170 af
Outflow=2.26 cfs 0.170 af

Reach 2R: Off-site Flow (East) Inflow=13.10 cfs 0.985 af
Outflow=13.10 cfs 0.985 af

Reach 3R: Off-site Flow (Route 15) Inflow=2.36 cfs 0.176 af
Outflow=2.36 cfs 0.176 af

Reach 4R: Off-site flow (South) Inflow=2.17 cfs 0.163 af
Outflow=2.17 cfs 0.163 af

Reach 5R: Flow to Drainage Ditch Inflow=6.51 cfs 0.740 af
Outflow=6.51 cfs 0.740 af

Pond 5P: Subsurface Infiltration System #1 - Peak Elev=682.95' Storage=8,300 cf Inflow=6.42 cfs 0.458 af
Outflow=0.60 cfs 0.457 af

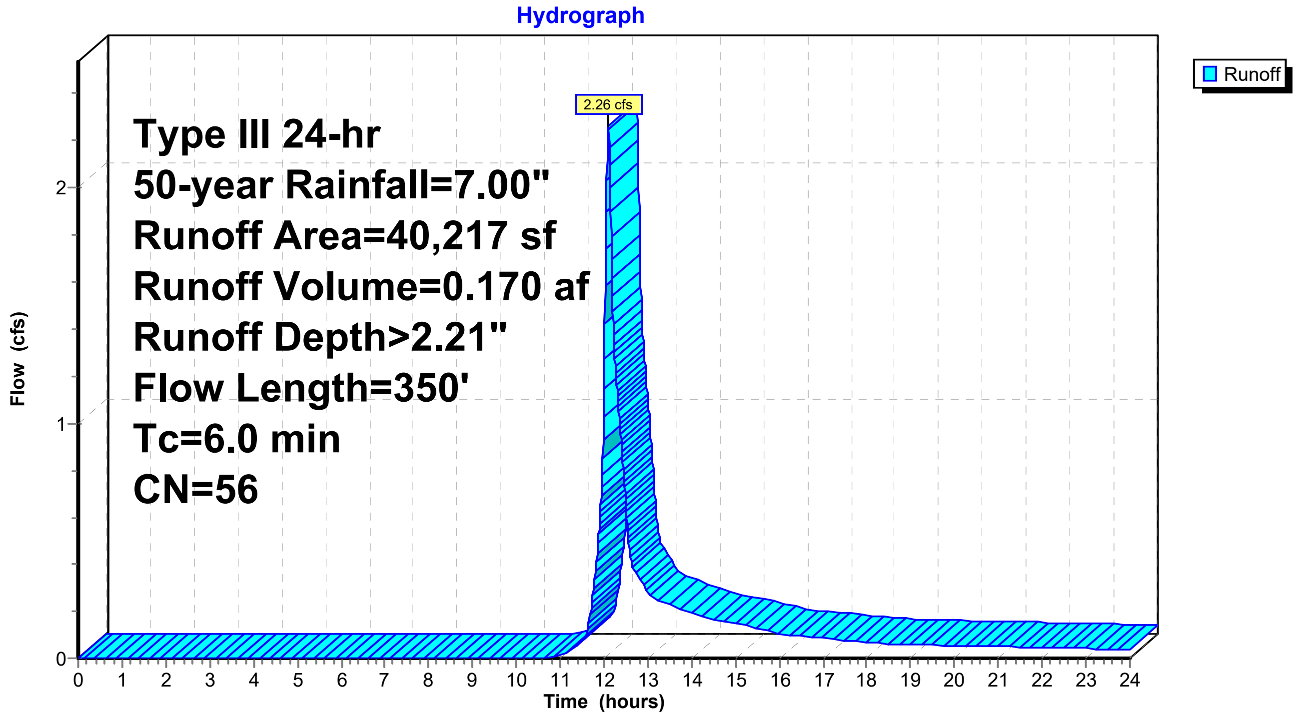
Pond 6P: Subsurface Infiltration System #2 - Peak Elev=713.46' Storage=3,019 cf Inflow=2.31 cfs 0.165 af
Outflow=0.21 cfs 0.165 af

Pond 7P: Infiltration Basin #1 Peak Elev=704.51' Storage=7,444 cf Inflow=5.55 cfs 0.411 af
Outflow=0.54 cfs 0.392 af

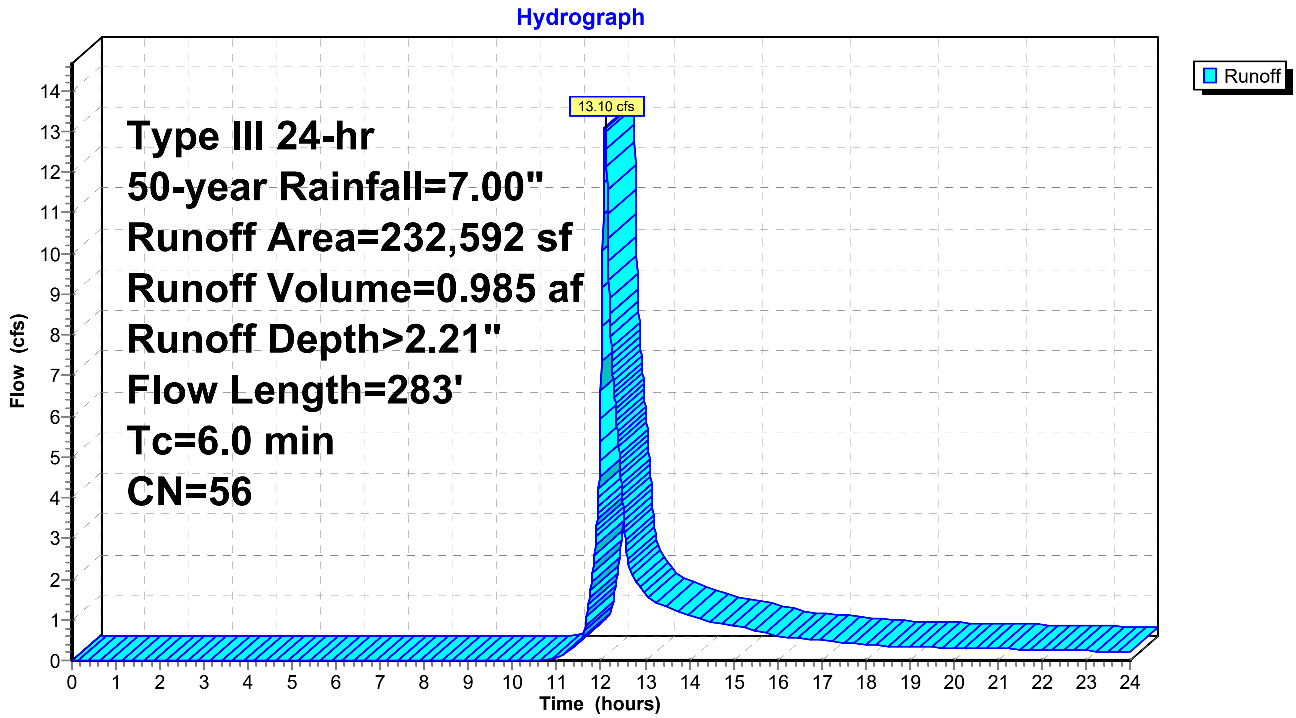
Pond 8P: Subsurface Infiltration System #3 - Peak Elev=678.85' Storage=838 cf Inflow=0.71 cfs 0.051 af
Outflow=0.08 cfs 0.051 af

Total Runoff Area = 15.893 ac Runoff Volume = 3.320 af Average Runoff Depth = 2.51"
97.34% Pervious = 15.469 ac 2.66% Impervious = 0.423 ac

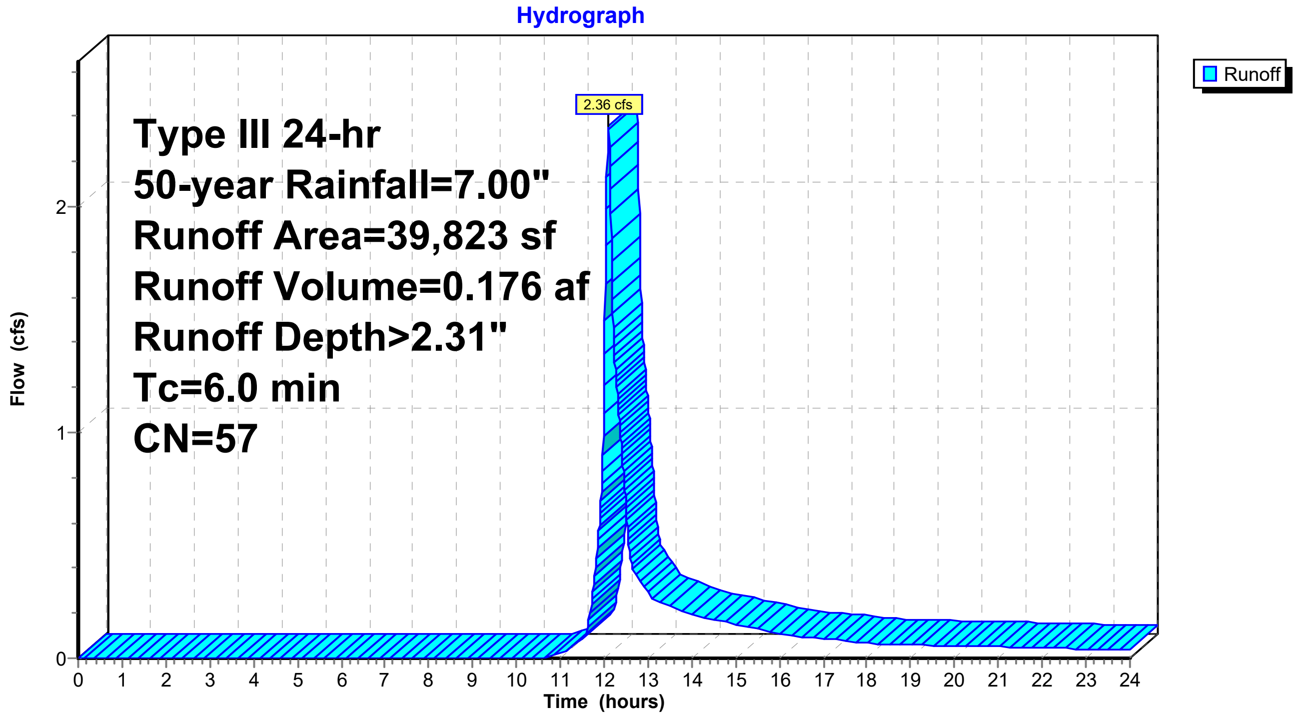
Subcatchment 1S: Area 1



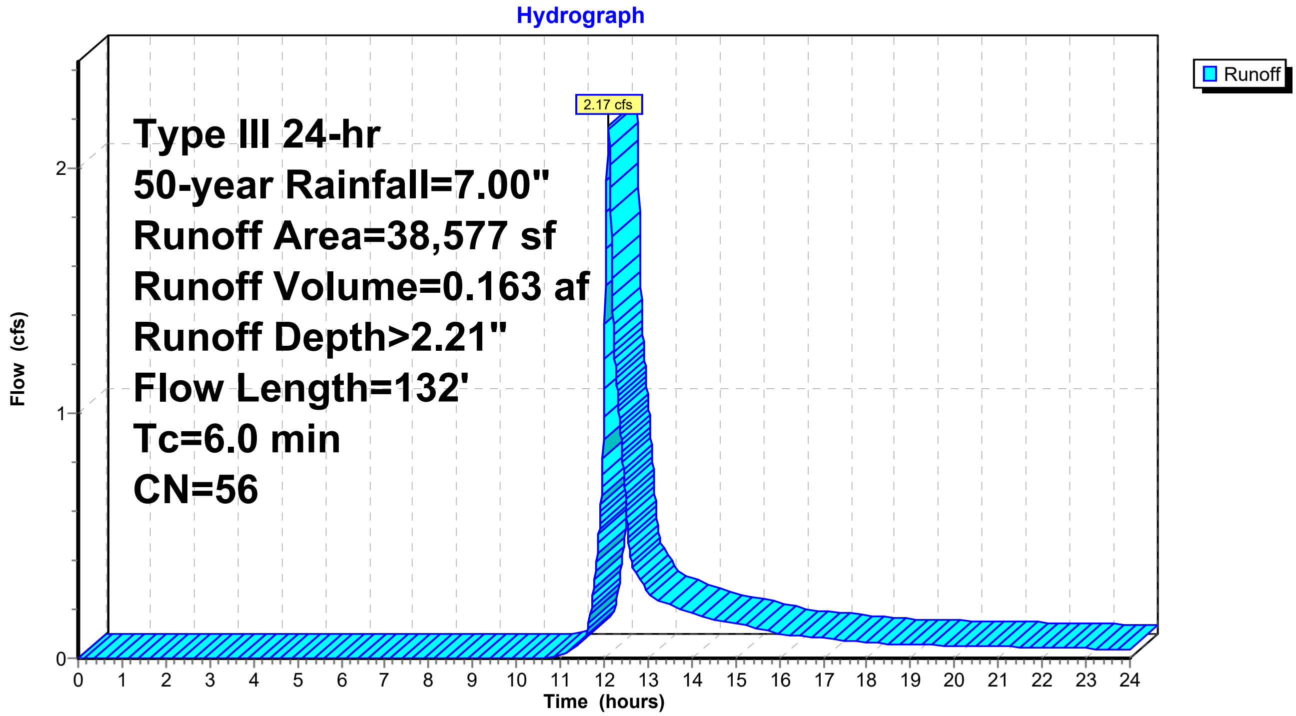
Subcatchment 2S: Area 2



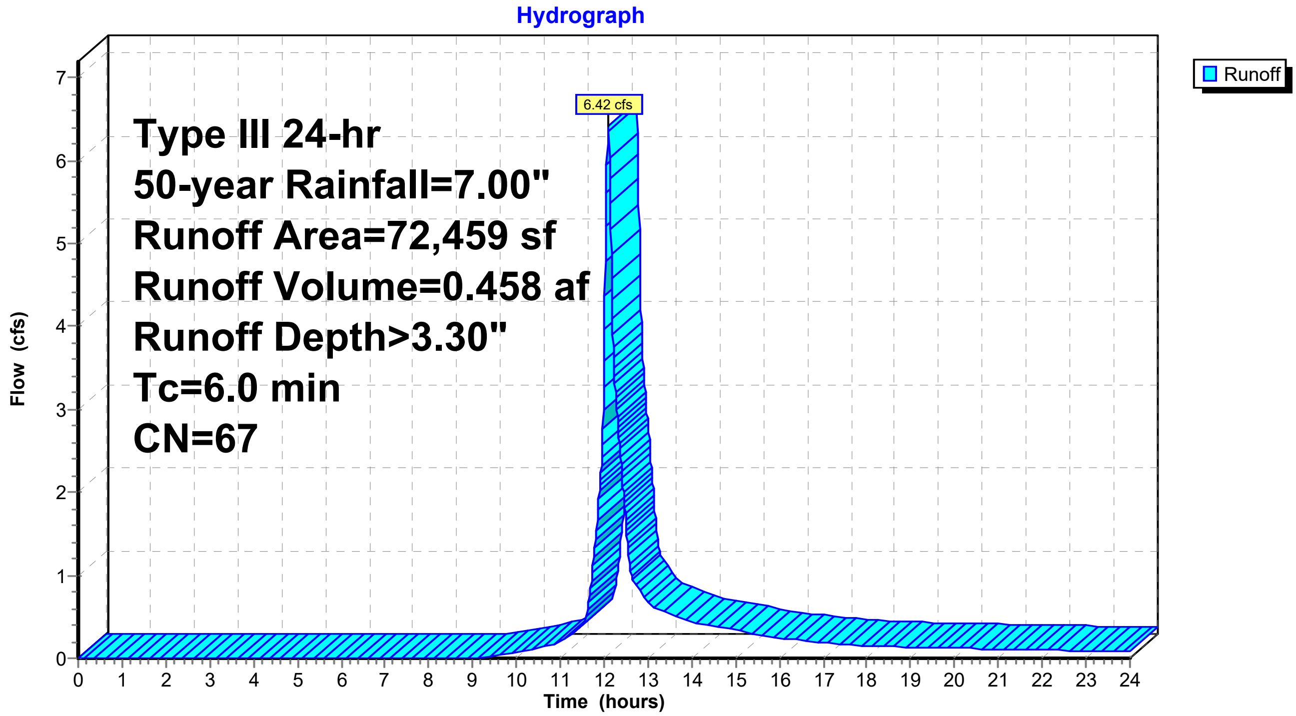
Subcatchment 3S: Area 3



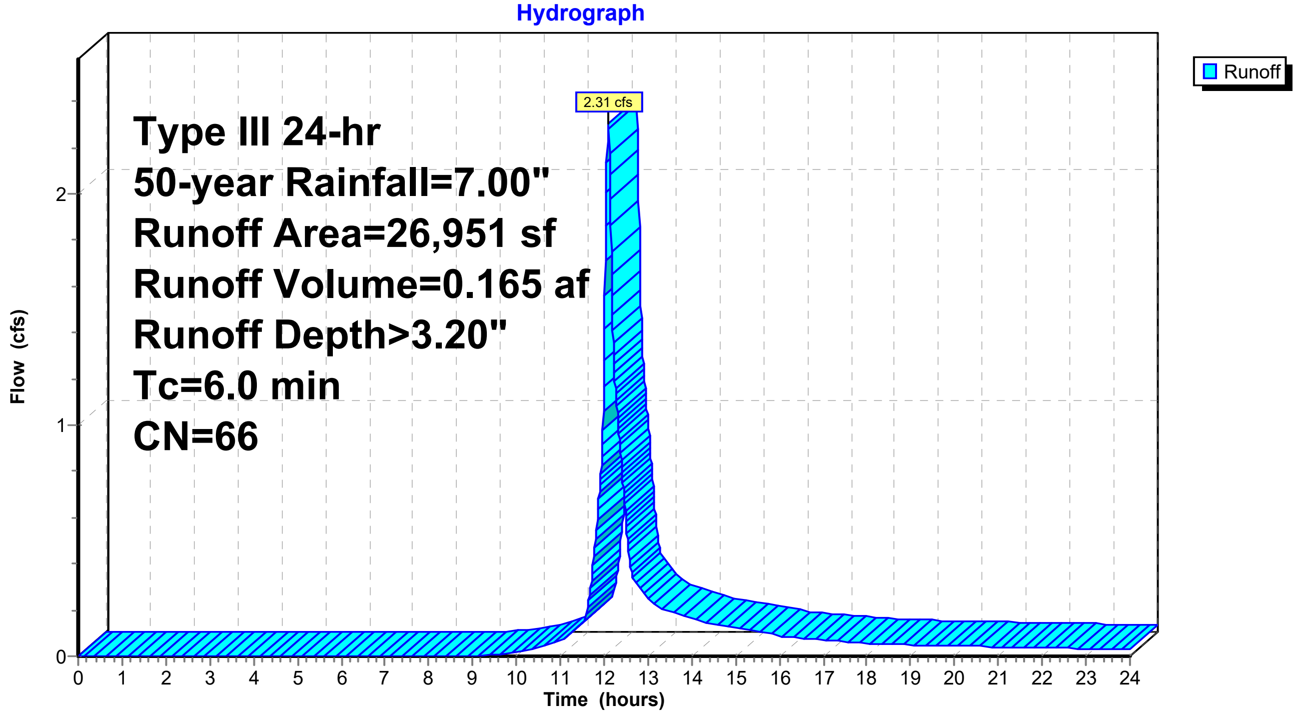
Subcatchment 4S: Area 4



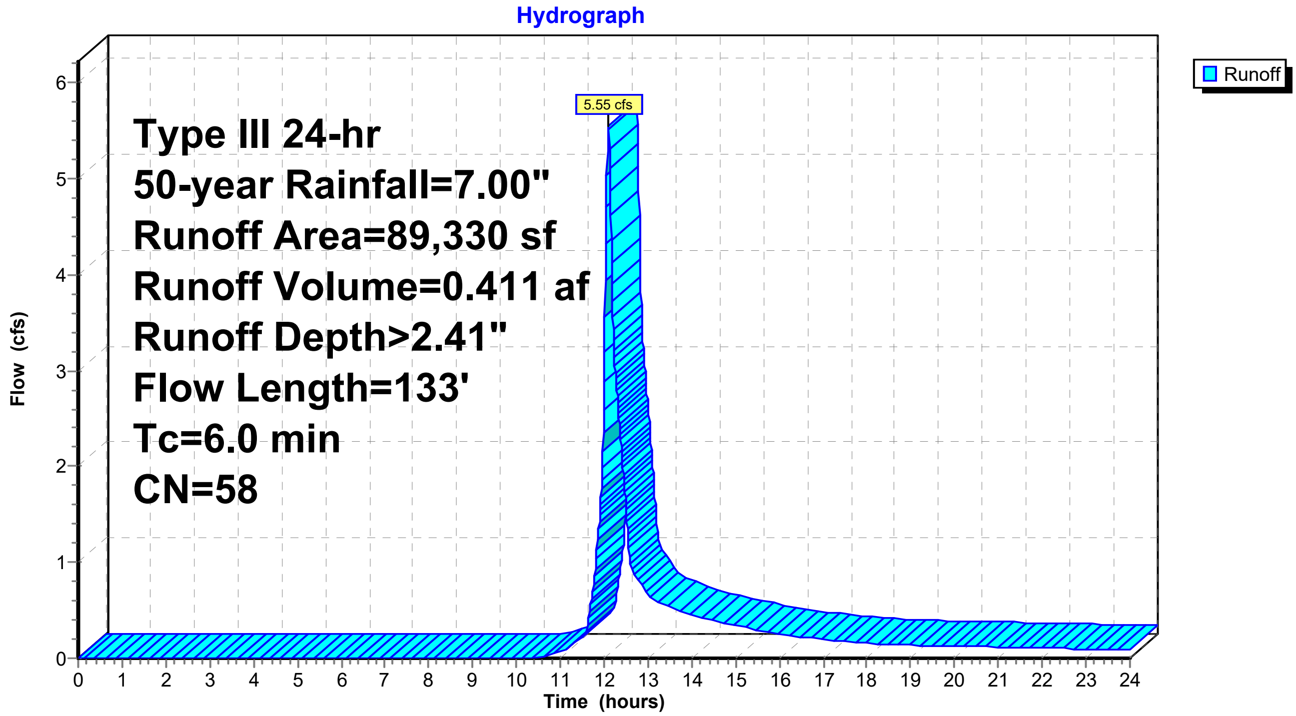
Subcatchment 5S: Area 5



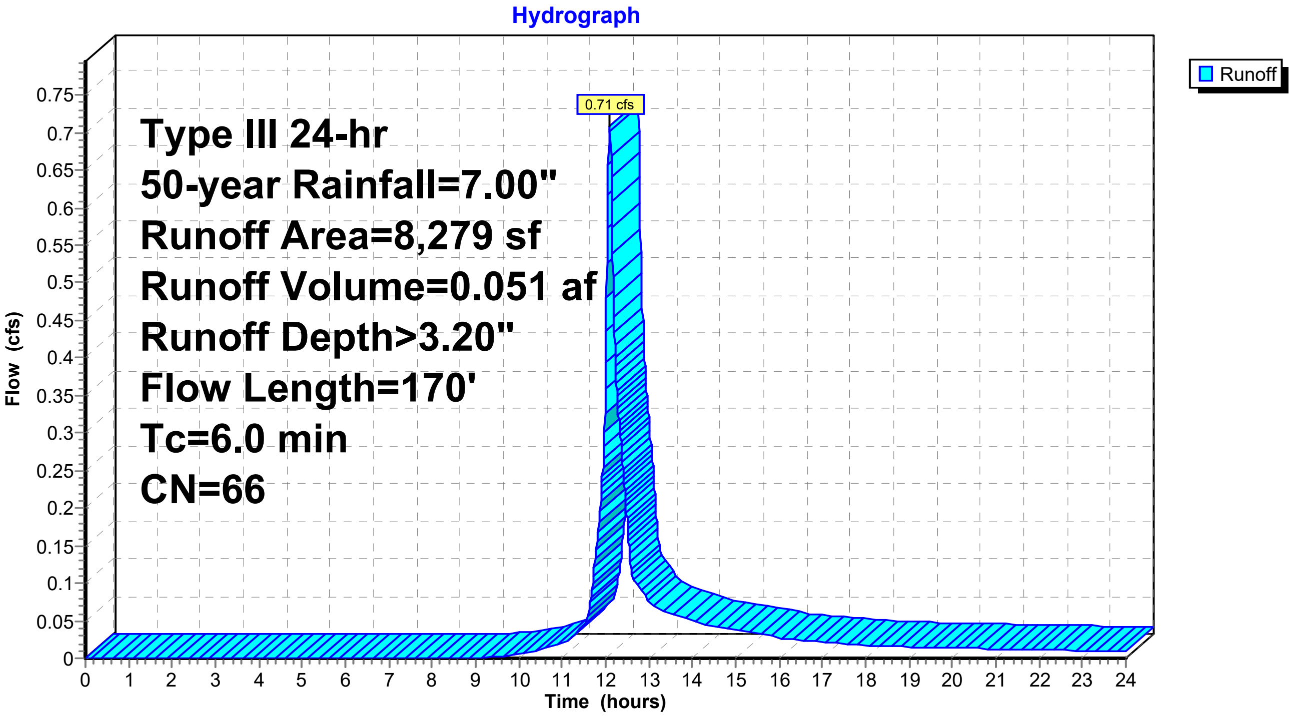
Subcatchment 6S: Area 6



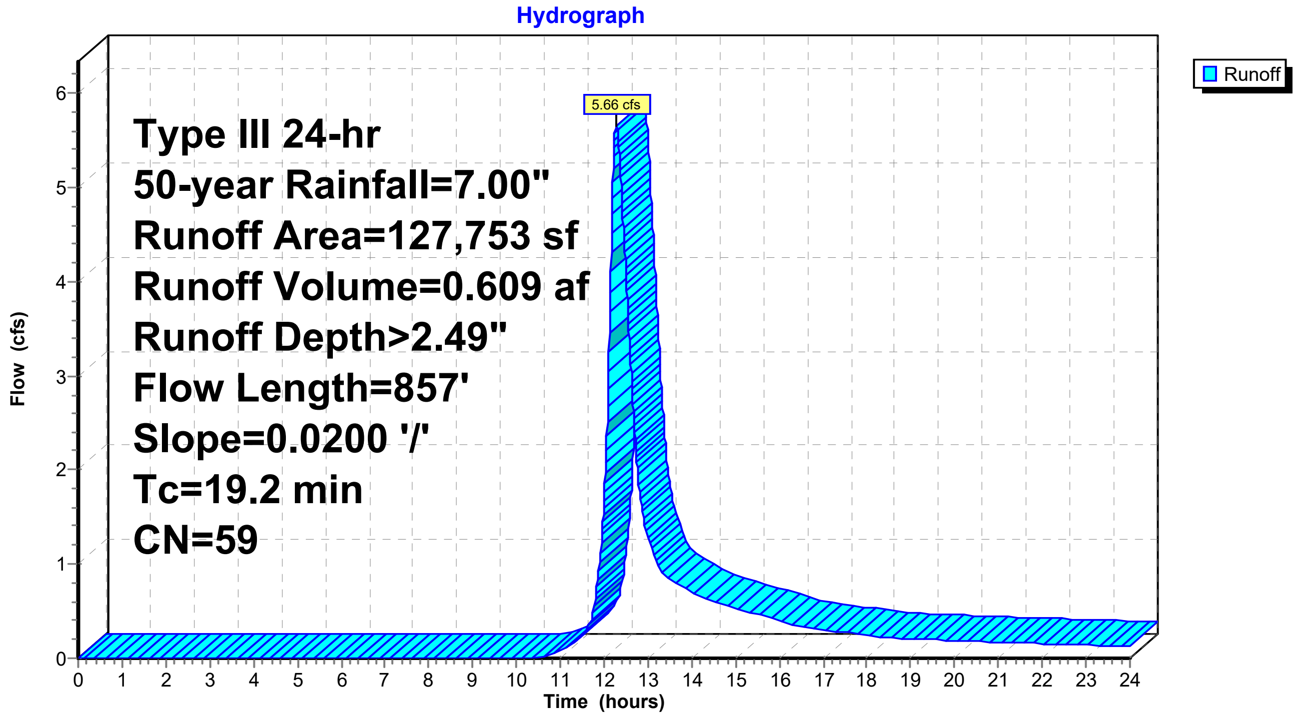
Subcatchment 7S: Area 7



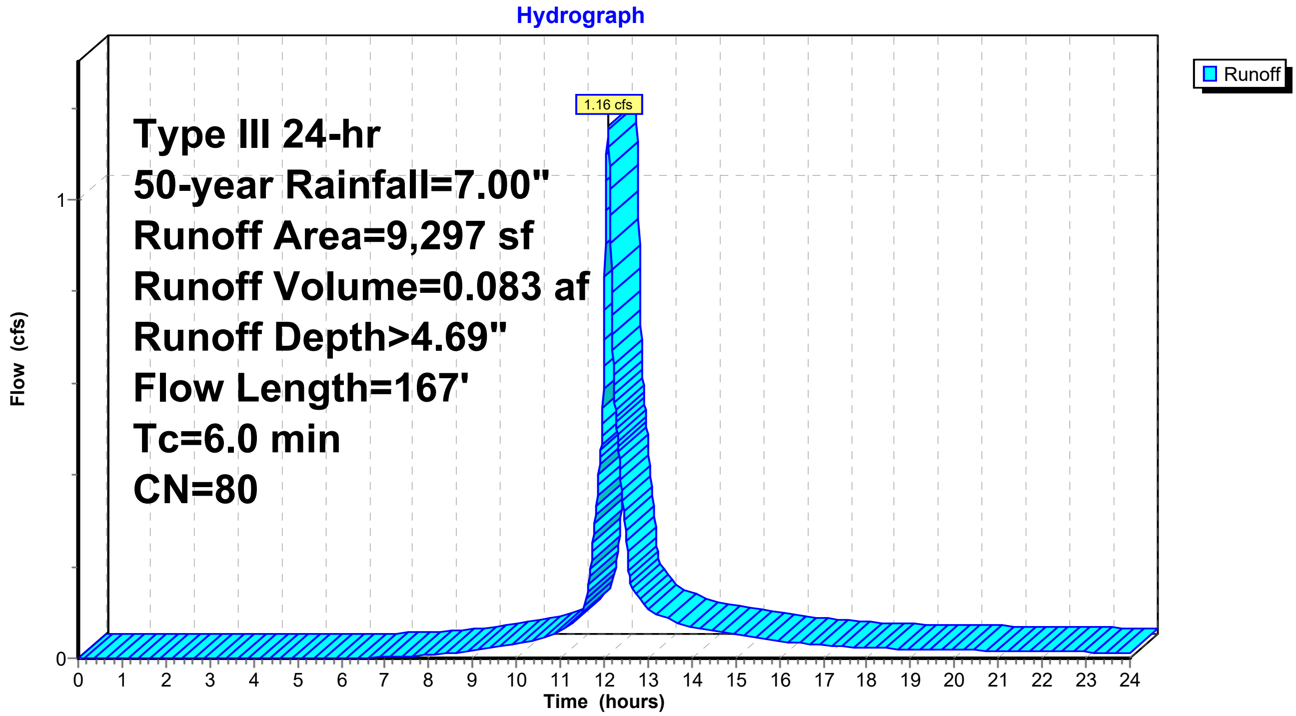
Subcatchment 8S: Area 8



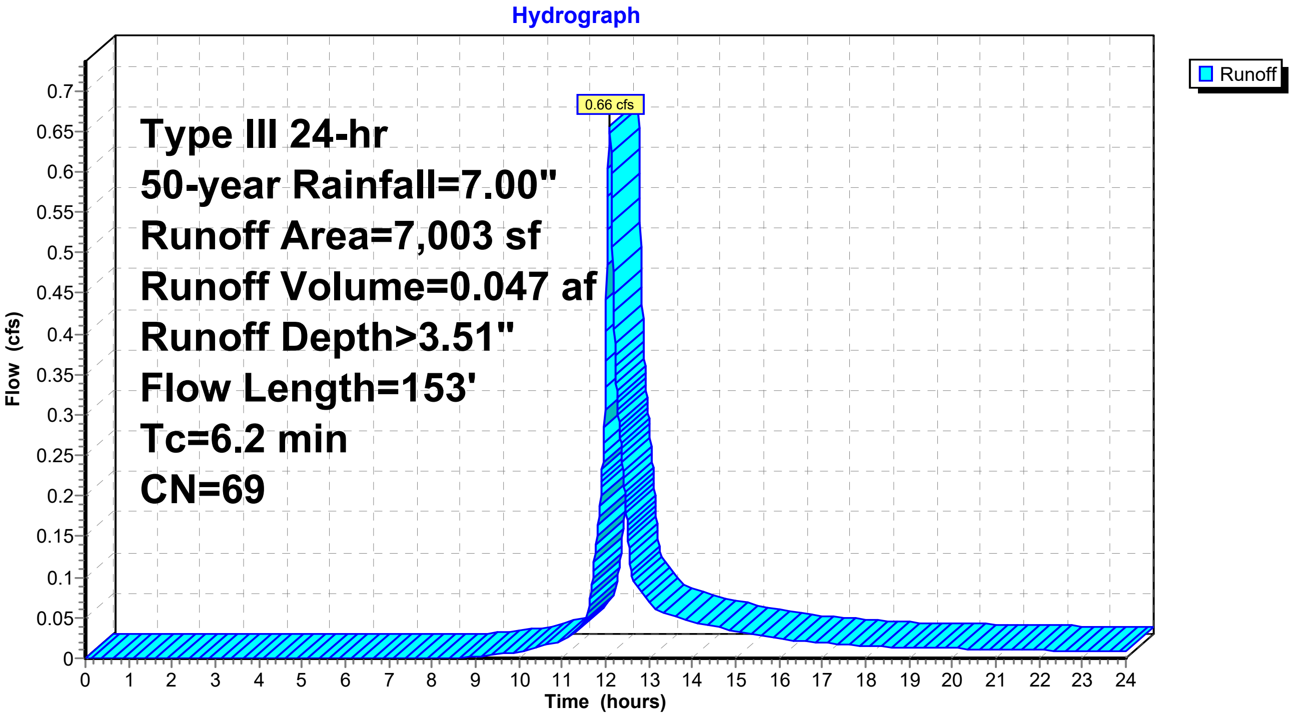
Subcatchment 9S: To Drainage Ditch



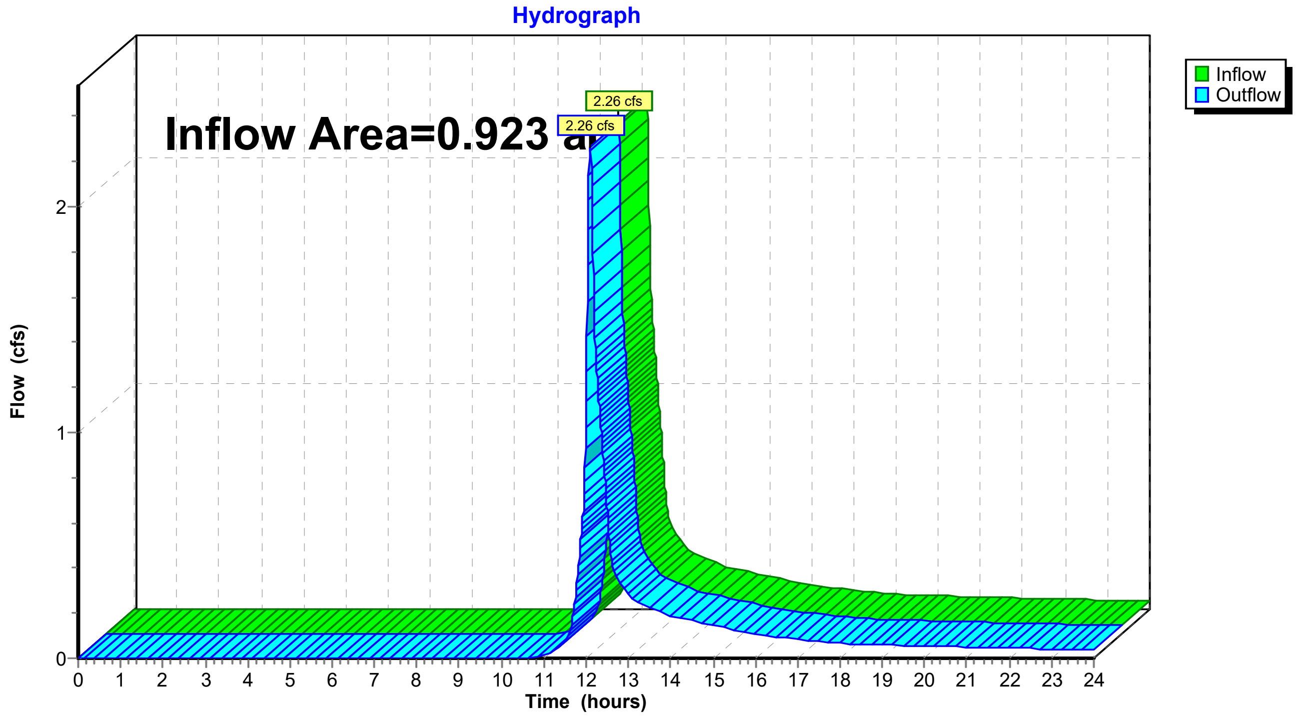
Subcatchment 10S: To Roadway Swale (West)



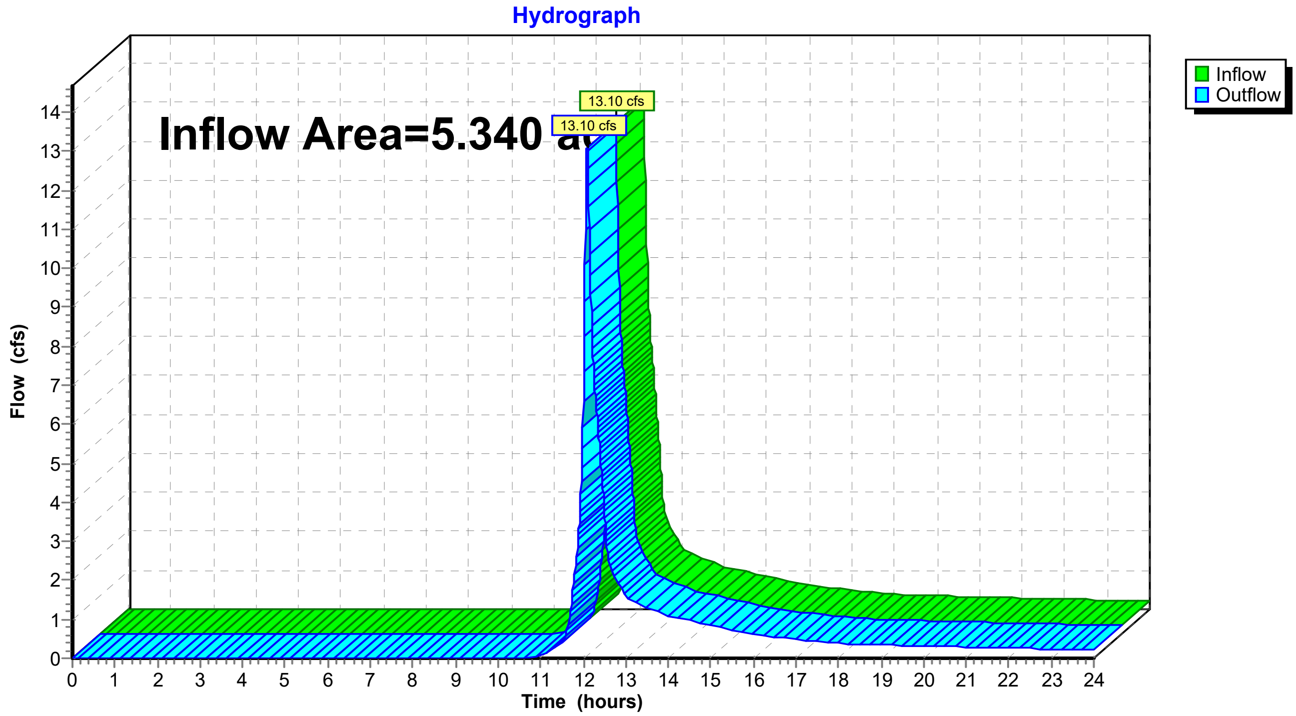
Subcatchment 11S: To Roadway Swale (East)



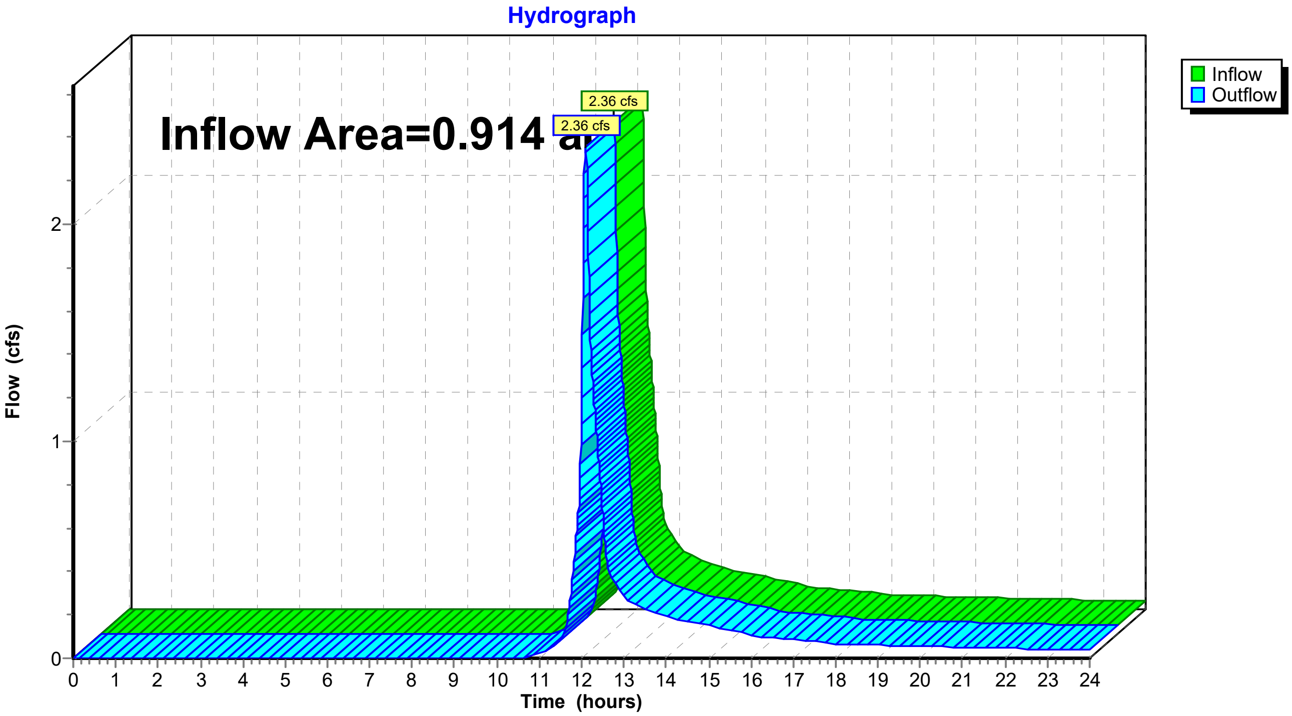
Reach 1R: Off-site Flow (Wetland Northwest)



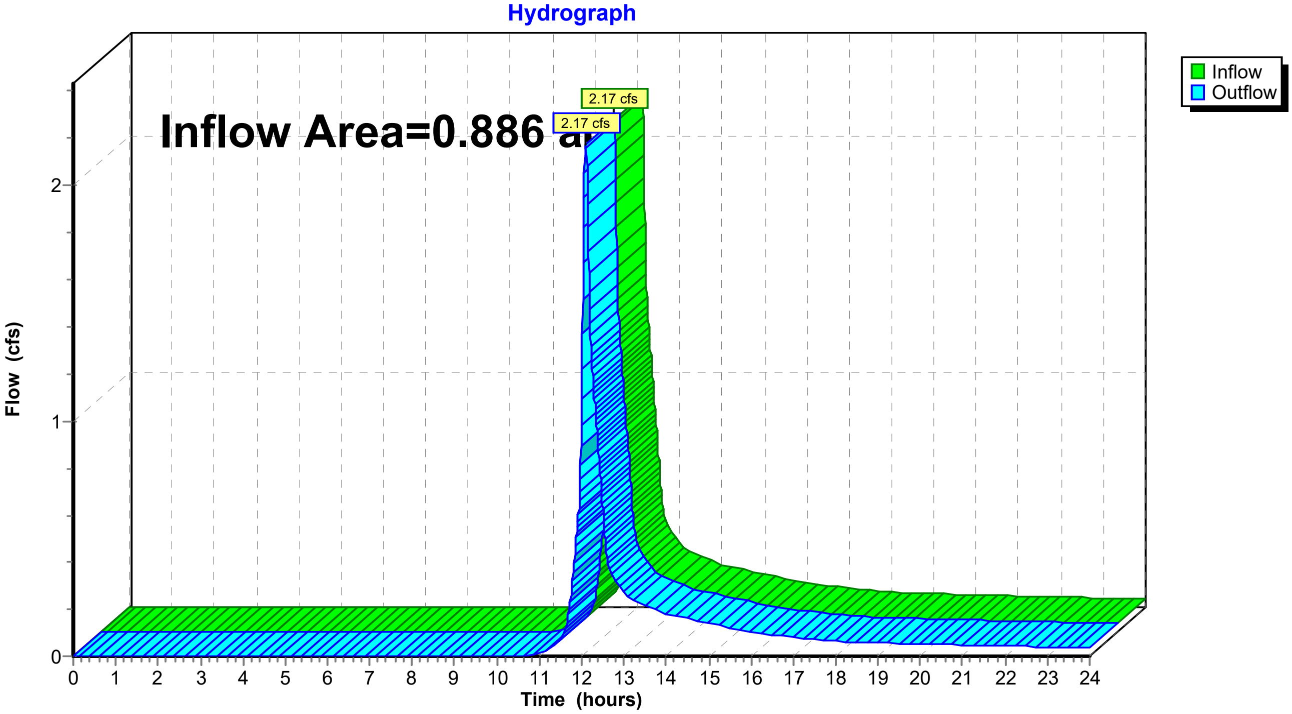
Reach 2R: Off-site Flow (East)



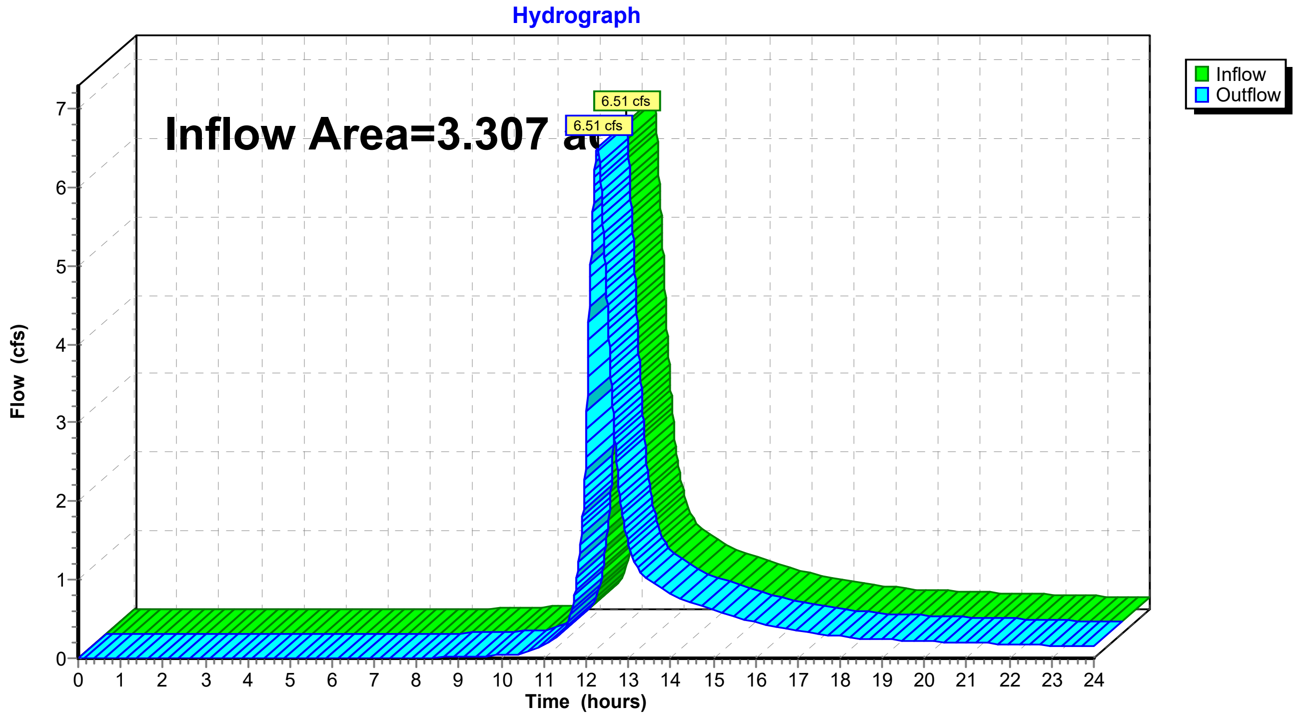
Reach 3R: Off-site Flow (Route 15)



Reach 4R: Off-site flow (South)



Reach 5R: Flow to Drainage Ditch



Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

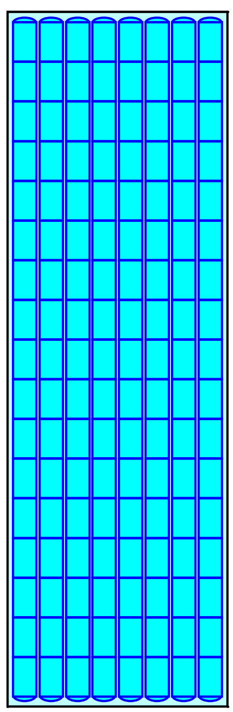
17 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 122.66' Row Length +12.0" End Stone x 2 = 124.66' Base Length
8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

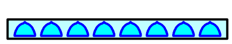
136 Chambers x 45.9 cf = 6,247.8 cf Chamber Storage

17,233.8 cf Field - 6,247.8 cf Chambers = 10,985.9 cf Stone x 40.0% Voids = 4,394.4 cf Stone Storage

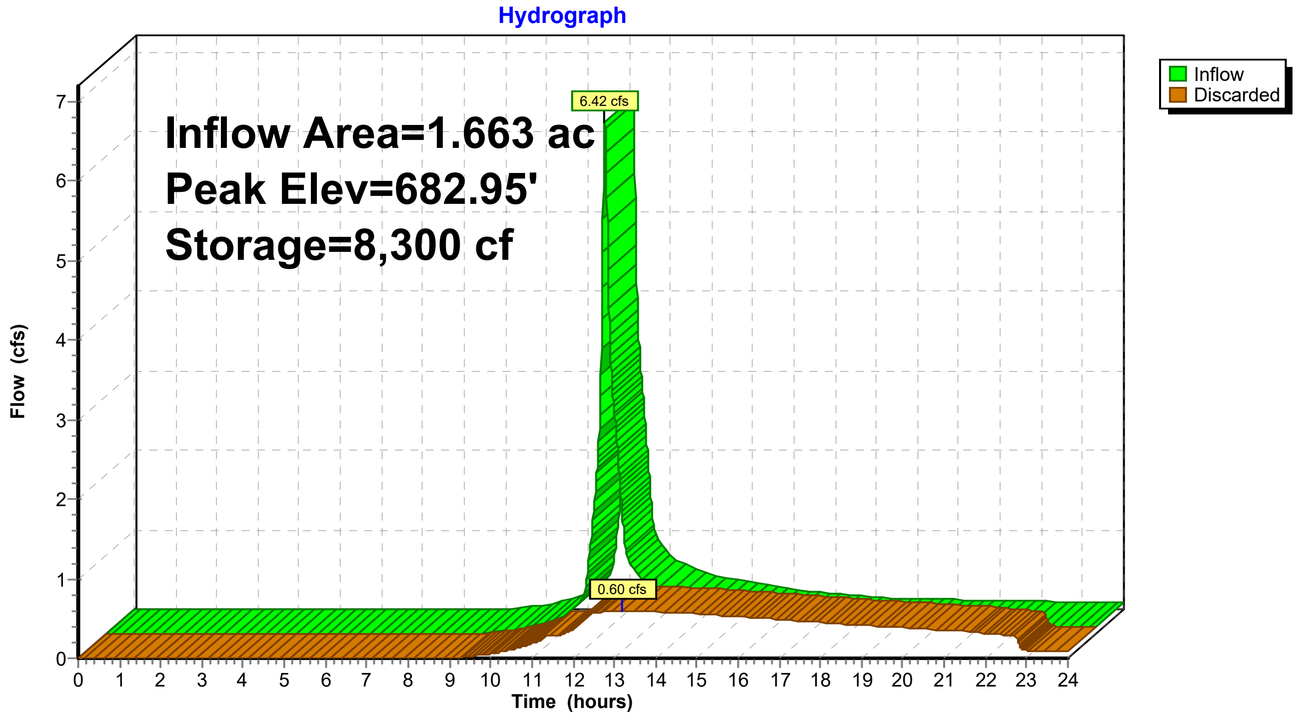
Chamber Storage + Stone Storage = 10,642.2 cf = 0.244 af
Overall Storage Efficiency = 61.8%
Overall System Size = 124.66' x 39.50' x 3.50'

136 Chambers
638.3 cy Field
406.9 cy Stone





Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers



Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

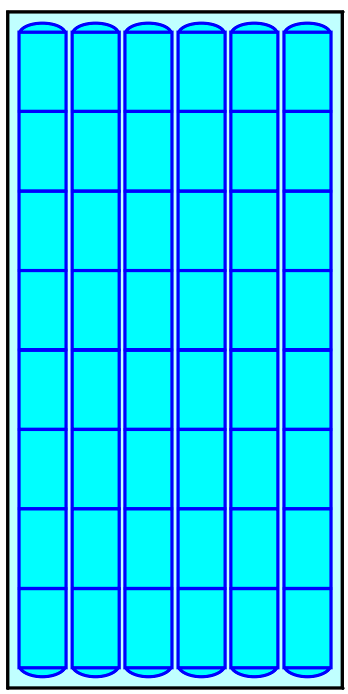
8 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 58.58' Row Length +12.0" End Stone x 2 = 60.58' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

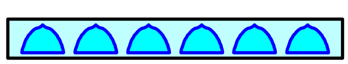
48 Chambers x 45.9 cf = 2,205.1 cf Chamber Storage

6,360.6 cf Field - 2,205.1 cf Chambers = 4,155.4 cf Stone x 40.0% Voids = 1,662.2 cf Stone Storage

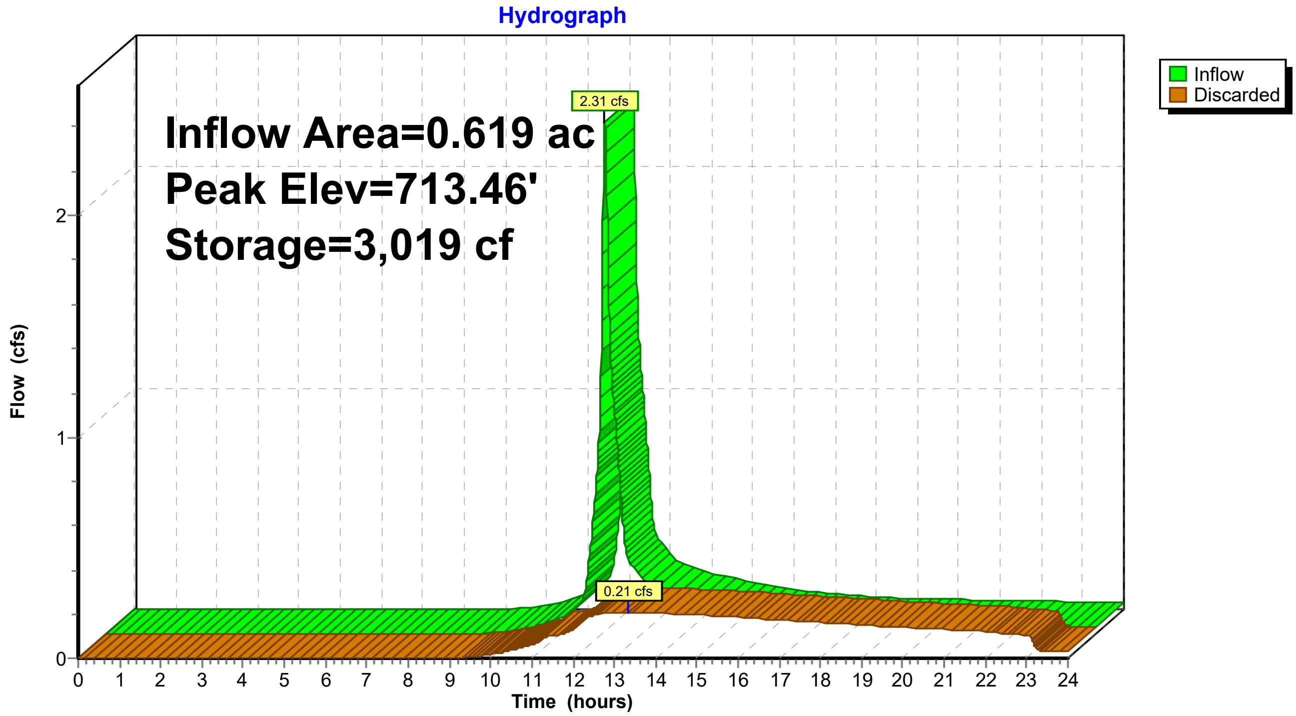
Chamber Storage + Stone Storage = 3,867.3 cf = 0.089 af
Overall Storage Efficiency = 60.8%
Overall System Size = 60.58' x 30.00' x 3.50'

48 Chambers
235.6 cy Field
153.9 cy Stone

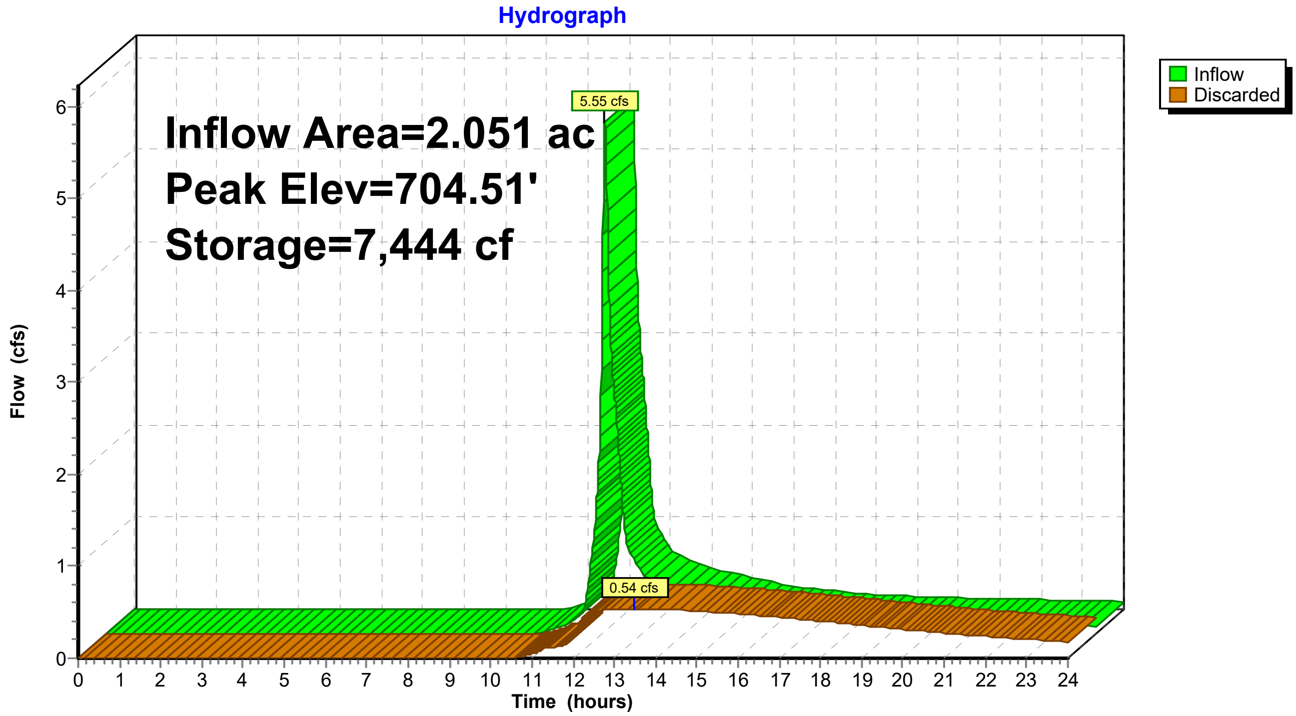




Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers



Pond 7P: Infiltration Basin #1



Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

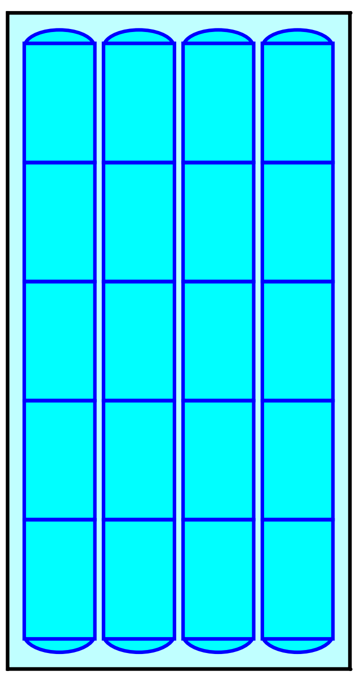
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

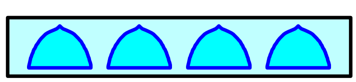
20 Chambers x 45.9 cf = 918.8 cf Chamber Storage

2,813.8 cf Field - 918.8 cf Chambers = 1,895.0 cf Stone x 40.0% Voids = 758.0 cf Stone Storage

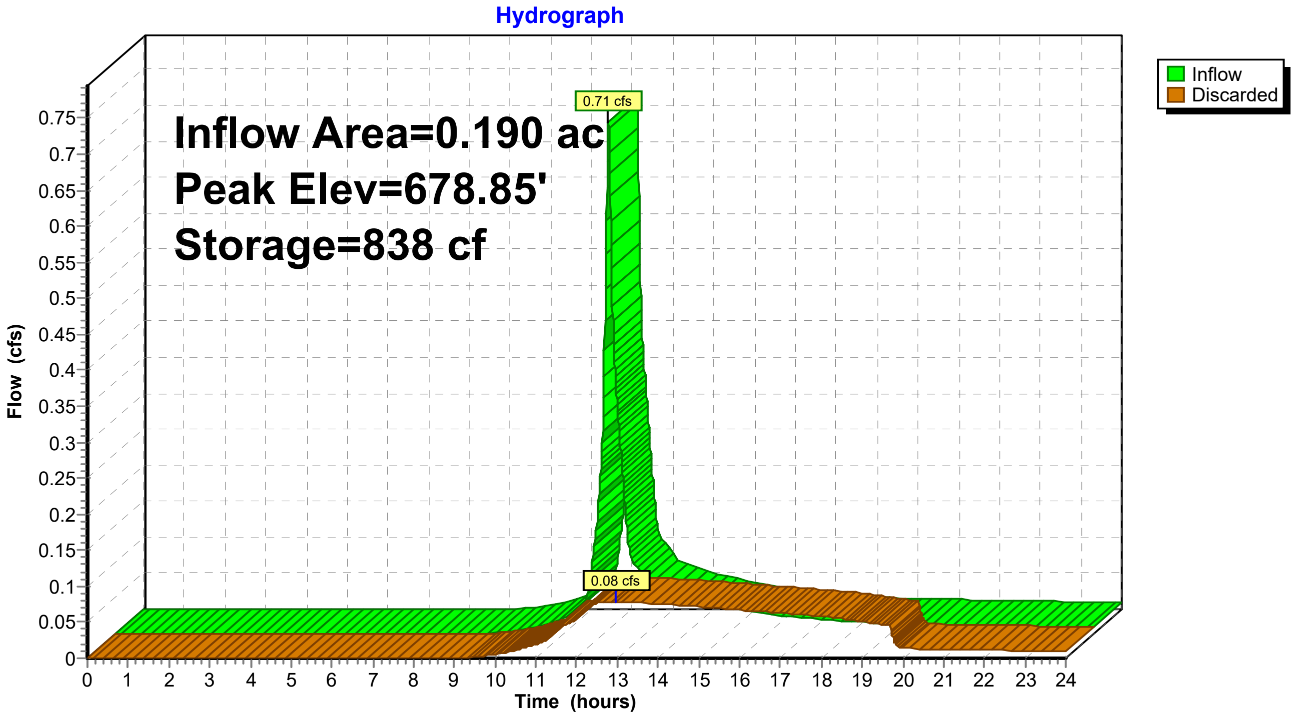
Chamber Storage + Stone Storage = 1,676.8 cf = 0.038 af
Overall Storage Efficiency = 59.6%
Overall System Size = 39.22' x 20.50' x 3.50'

20 Chambers
104.2 cy Field
70.2 cy Stone





Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Area 1 Runoff Area=40,217 sf 0.00% Impervious Runoff Depth>2.83"
Flow Length=350' Tc=6.0 min CN=56 Runoff=2.96 cfs 0.218 af

Subcatchment2S: Area 2 Runoff Area=232,592 sf 0.00% Impervious Runoff Depth>2.83"
Flow Length=283' Tc=6.0 min CN=56 Runoff=17.15 cfs 1.261 af

Subcatchment3S: Area 3 Runoff Area=39,823 sf 0.00% Impervious Runoff Depth>2.94"
Tc=6.0 min CN=57 Runoff=3.07 cfs 0.224 af

Subcatchment4S: Area 4 Runoff Area=38,577 sf 0.00% Impervious Runoff Depth>2.83"
Flow Length=132' Tc=6.0 min CN=56 Runoff=2.84 cfs 0.209 af

Subcatchment5S: Area 5 Runoff Area=72,459 sf 1.10% Impervious Runoff Depth>4.05"
Tc=6.0 min CN=67 Runoff=7.90 cfs 0.561 af

Subcatchment6S: Area 6 Runoff Area=26,951 sf 0.00% Impervious Runoff Depth>3.94"
Tc=6.0 min CN=66 Runoff=2.86 cfs 0.203 af

Subcatchment7S: Area 7 Runoff Area=89,330 sf 0.00% Impervious Runoff Depth>3.05"
Flow Length=133' Tc=6.0 min CN=58 Runoff=7.17 cfs 0.521 af

Subcatchment8S: Area 8 Runoff Area=8,279 sf 20.69% Impervious Runoff Depth>3.94"
Flow Length=170' Tc=6.0 min CN=66 Runoff=0.88 cfs 0.062 af

Subcatchment9S: To Drainage Ditch Runoff Area=127,753 sf 7.29% Impervious Runoff Depth>3.15"
Flow Length=857' Slope=0.0200 '/' Tc=19.2 min CN=59 Runoff=7.28 cfs 0.770 af

Subcatchment10S: To Roadway Swale Runoff Area=9,297 sf 55.10% Impervious Runoff Depth>5.54"
Flow Length=167' Tc=6.0 min CN=80 Runoff=1.37 cfs 0.099 af

Subcatchment11S: To Roadway Swale Runoff Area=7,003 sf 21.56% Impervious Runoff Depth>4.28"
Flow Length=153' Tc=6.2 min CN=69 Runoff=0.80 cfs 0.057 af

Reach 1R: Off-site Flow (Wetland Northwest) Inflow=2.96 cfs 0.218 af
Outflow=2.96 cfs 0.218 af

Reach 2R: Off-site Flow (East) Inflow=17.15 cfs 1.261 af
Outflow=17.15 cfs 1.261 af

Reach 3R: Off-site Flow (Route 15) Inflow=3.07 cfs 0.224 af
Outflow=3.07 cfs 0.224 af

Reach 4R: Off-site flow (South) Inflow=2.84 cfs 0.209 af
Outflow=2.84 cfs 0.209 af

Reach 5R: Flow to Drainage Ditch Inflow=8.28 cfs 0.925 af
Outflow=8.28 cfs 0.925 af

Pond 5P: Subsurface Infiltration System #1 Peak Elev=683.94' Storage=10,529 cf Inflow=7.90 cfs 0.561 af
Outflow=0.72 cfs 0.556 af

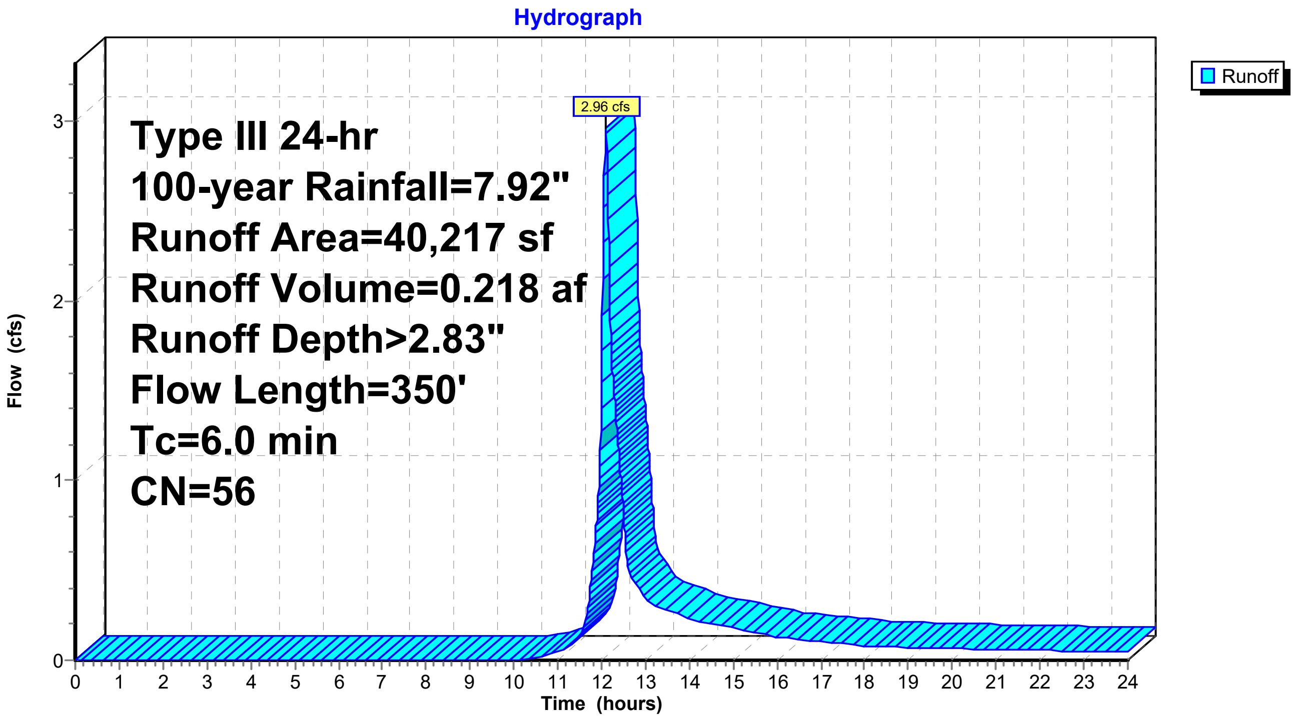
Pond 6P: Subsurface Infiltration System #2 - Peak Elev=714.48' Storage=3,852 cf Inflow=2.86 cfs 0.203 af
Outflow=0.25 cfs 0.198 af

Pond 7P: Infiltration Basin #1 Peak Elev=704.79' Storage=9,964 cf Inflow=7.17 cfs 0.521 af
Outflow=0.64 cfs 0.484 af

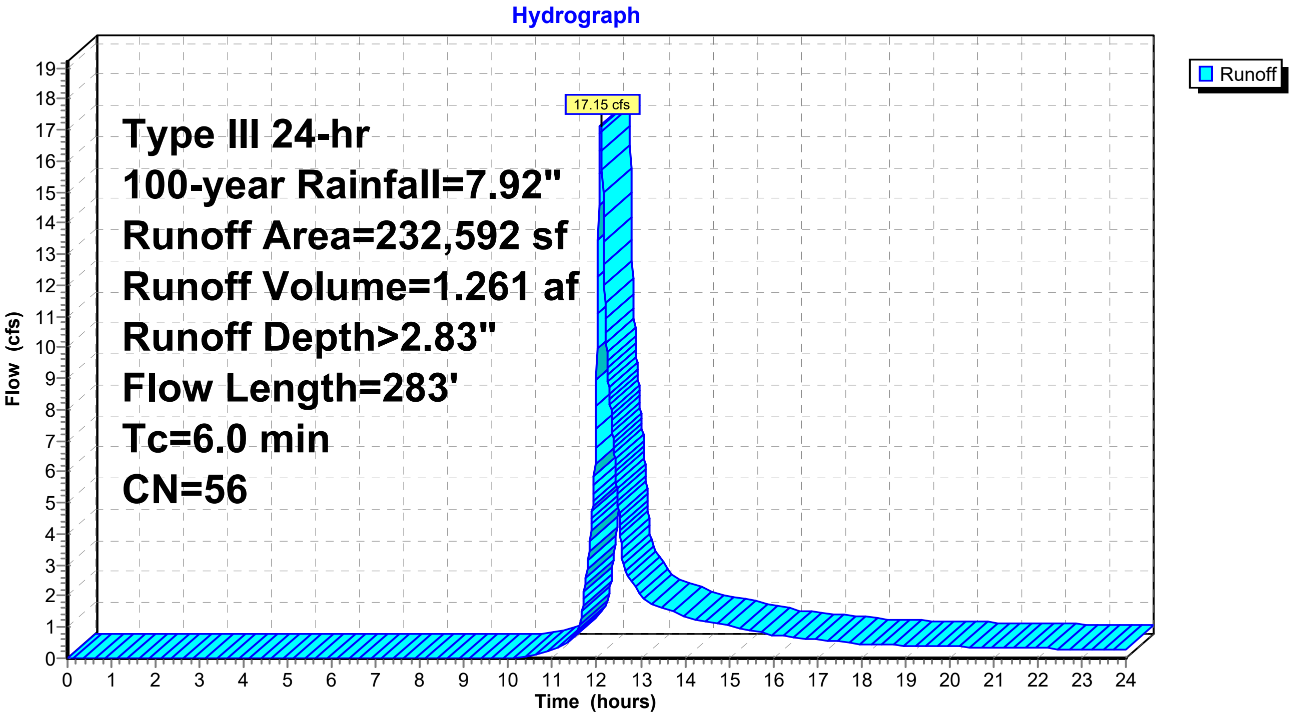
Pond 8P: Subsurface Infiltration System #3 - Peak Elev=679.29' Storage=1,090 cf Inflow=0.88 cfs 0.062 af
Outflow=0.09 cfs 0.062 af

Total Runoff Area = 15.893 ac Runoff Volume = 4.185 af Average Runoff Depth = 3.16"
97.34% Pervious = 15.469 ac 2.66% Impervious = 0.423 ac

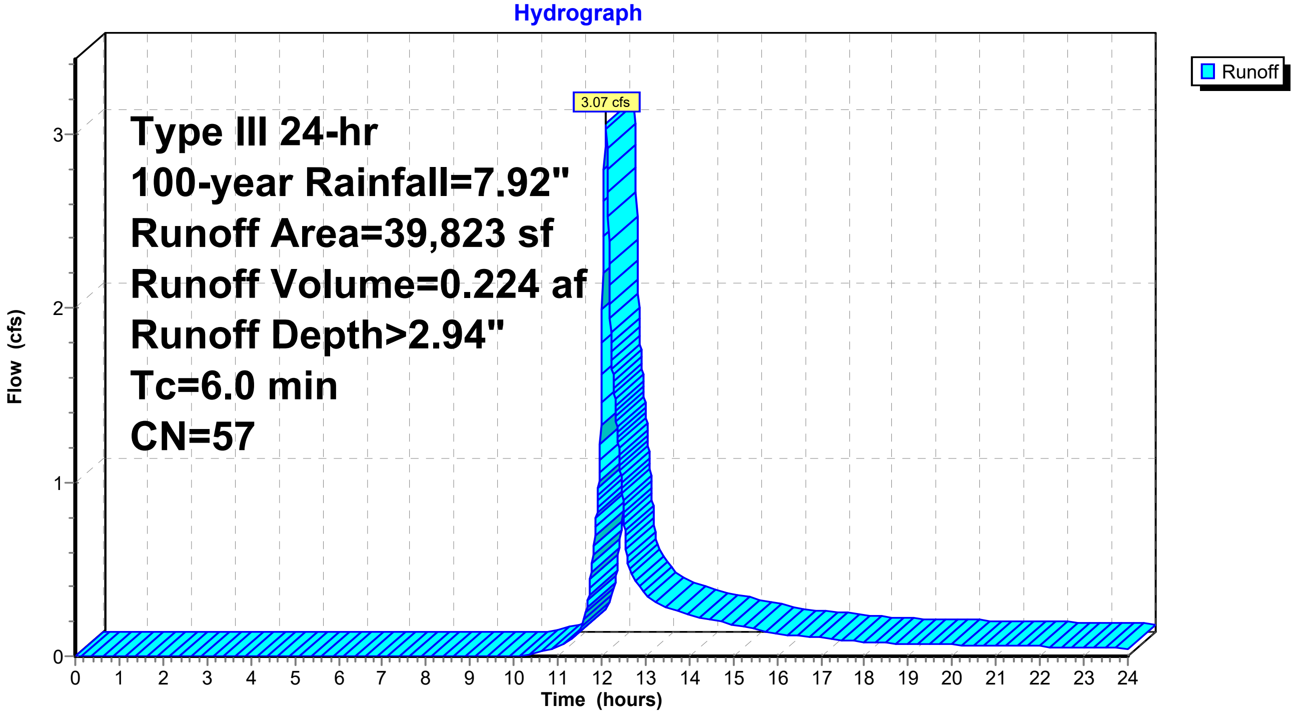
Subcatchment 1S: Area 1



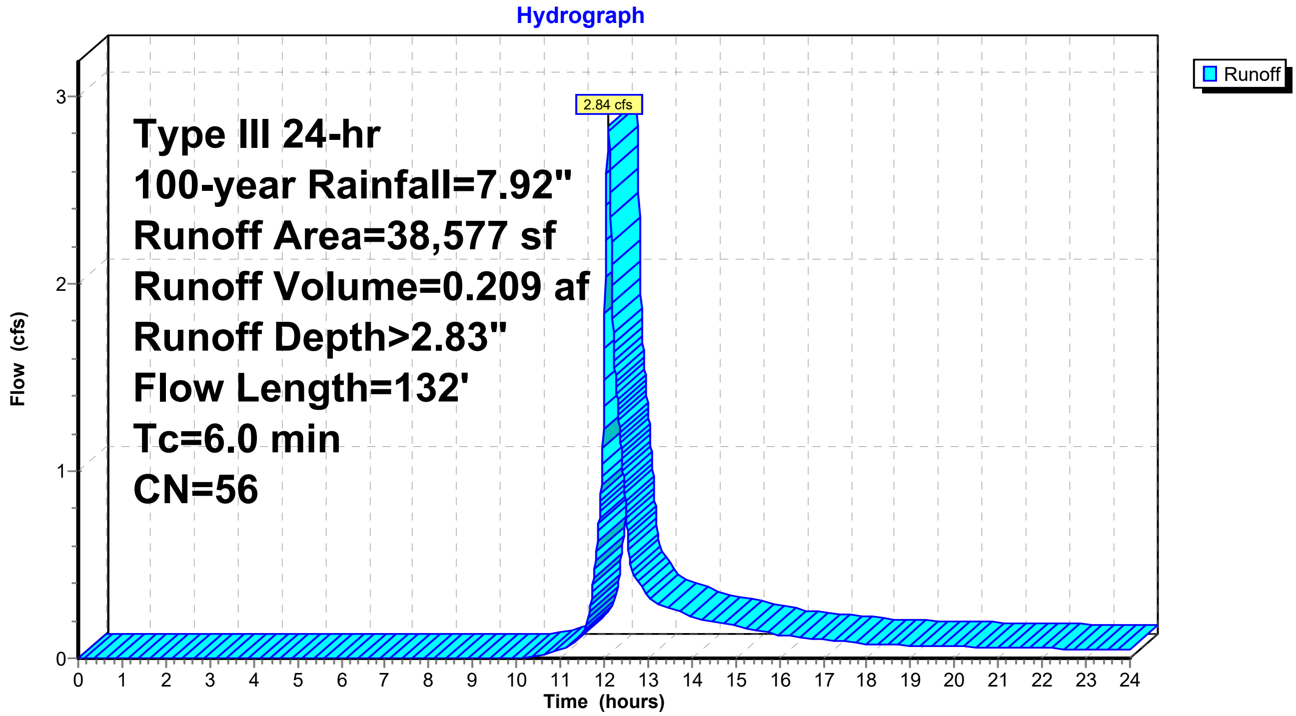
Subcatchment 2S: Area 2



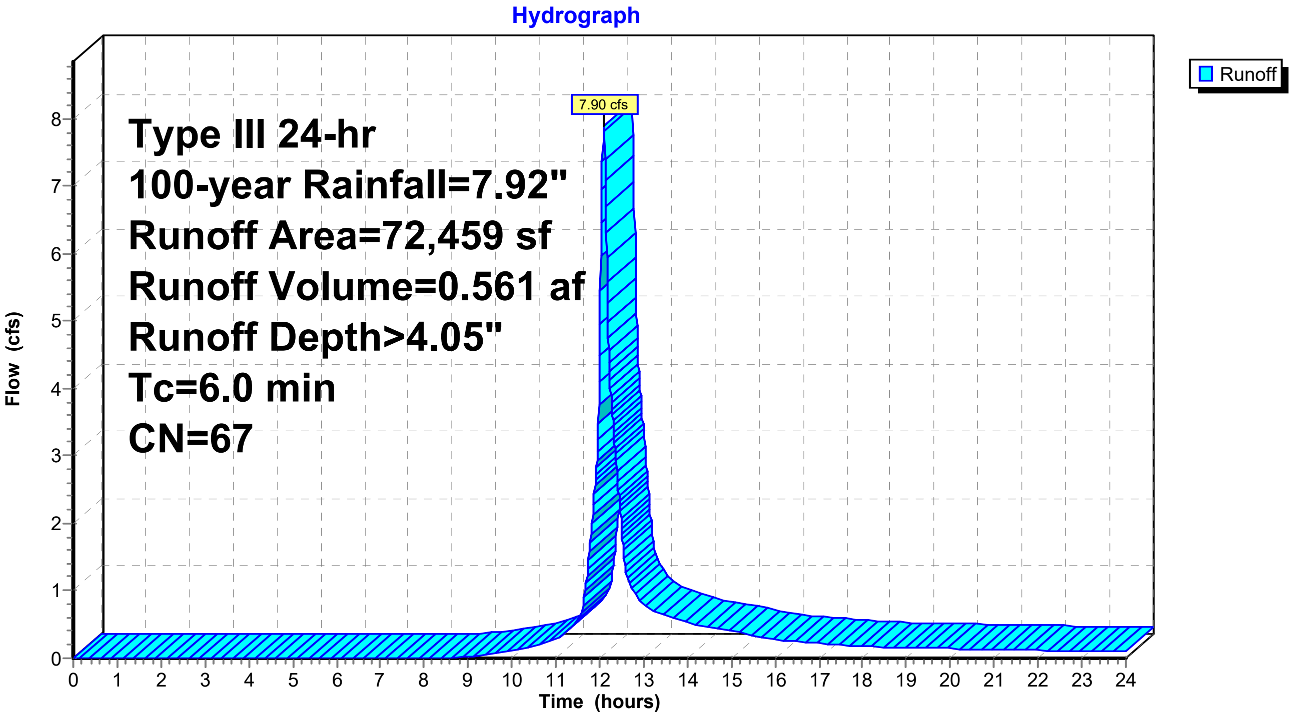
Subcatchment 3S: Area 3



Subcatchment 4S: Area 4



Subcatchment 5S: Area 5



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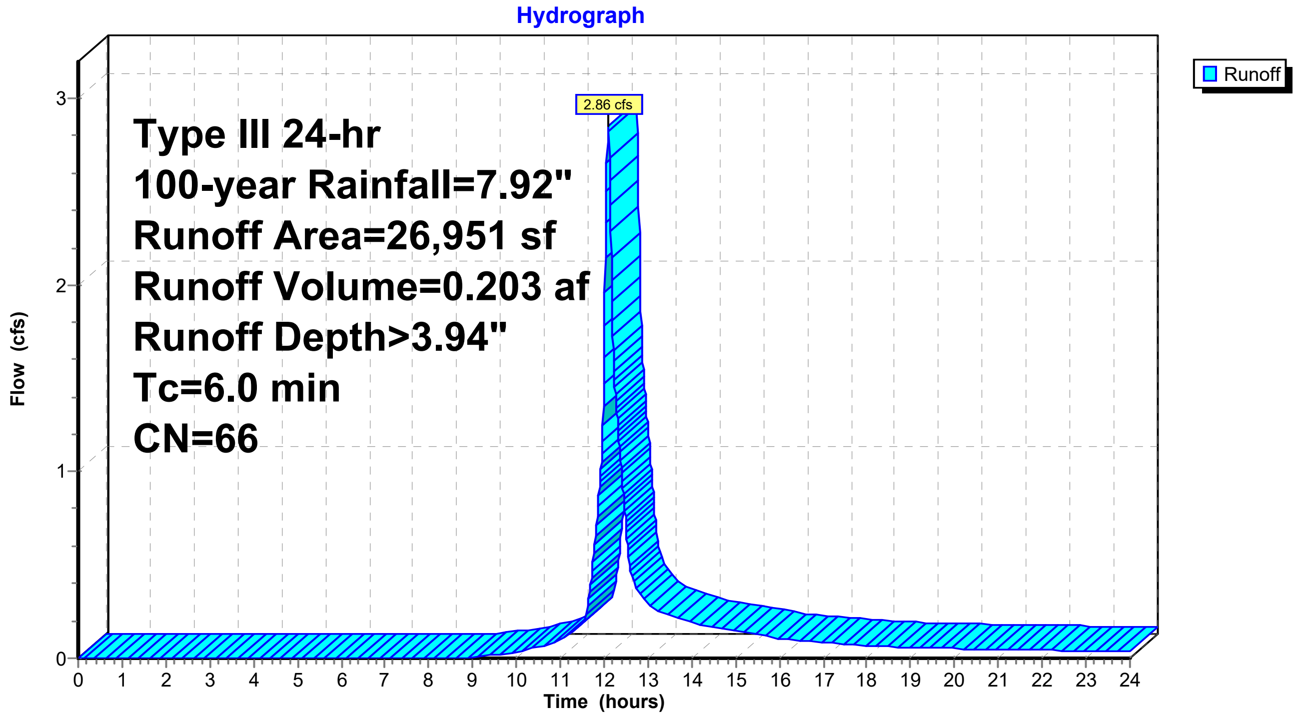
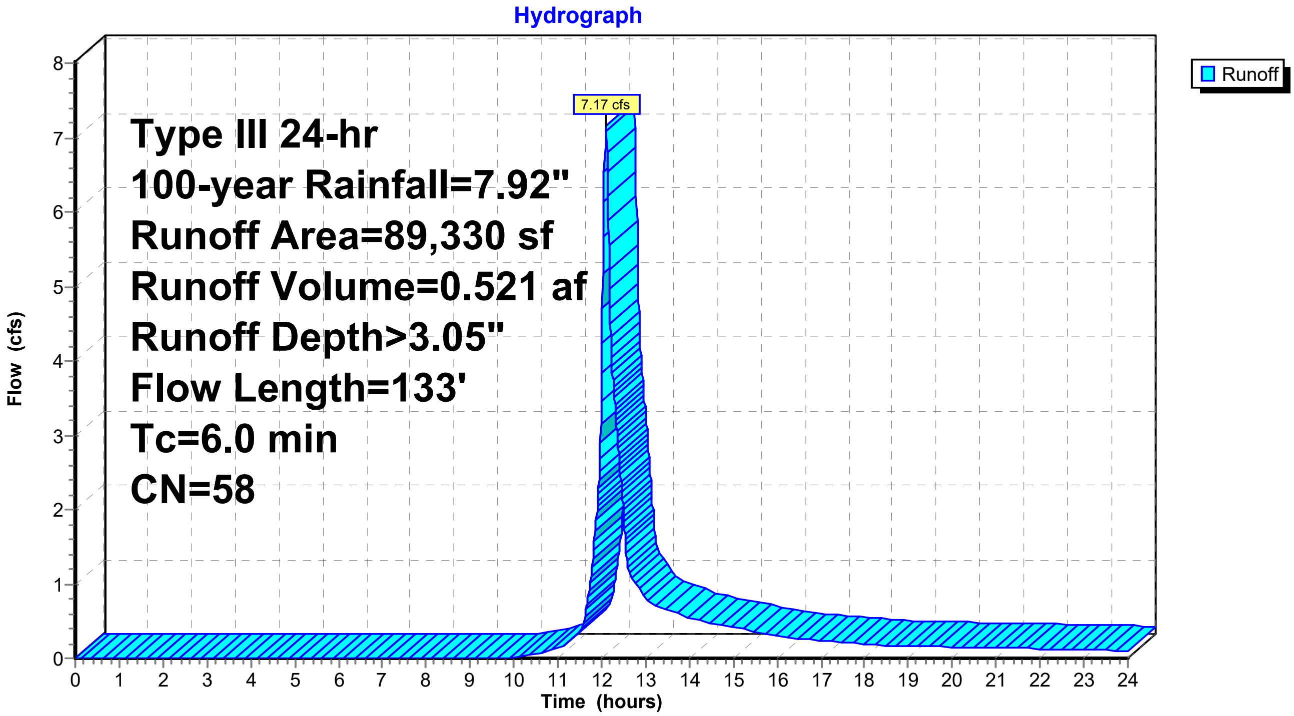
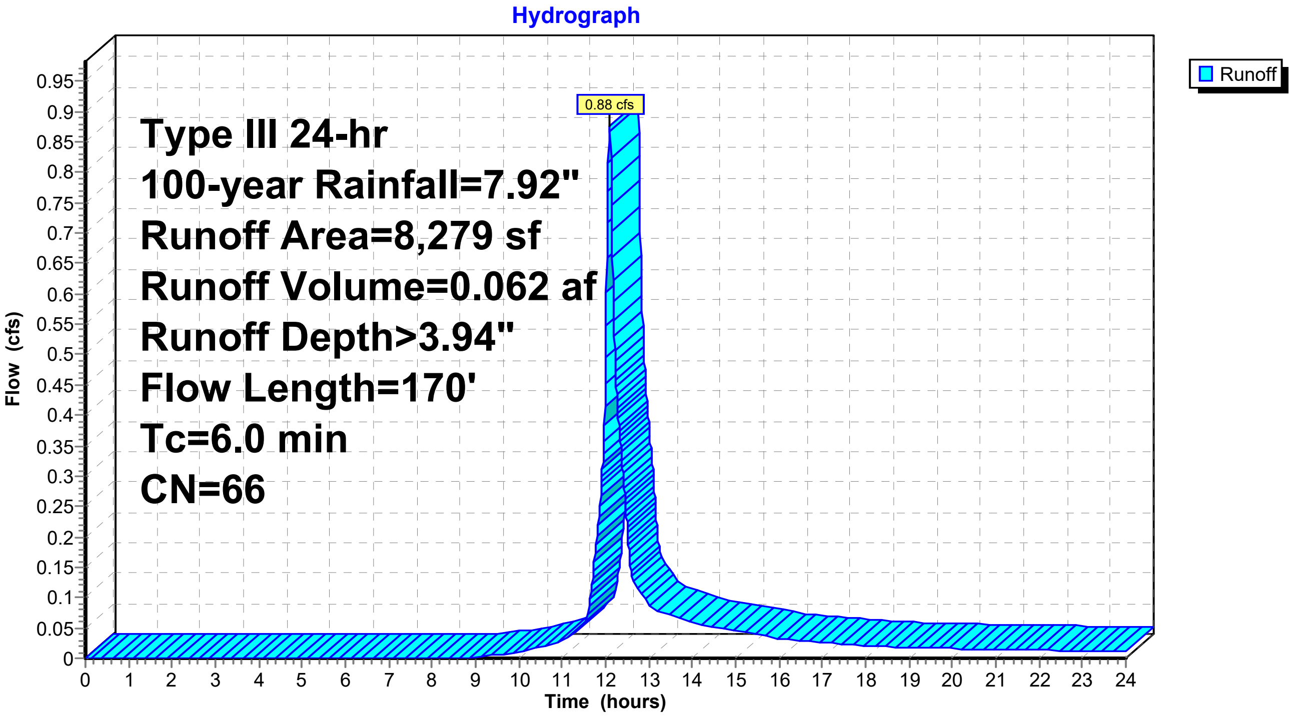


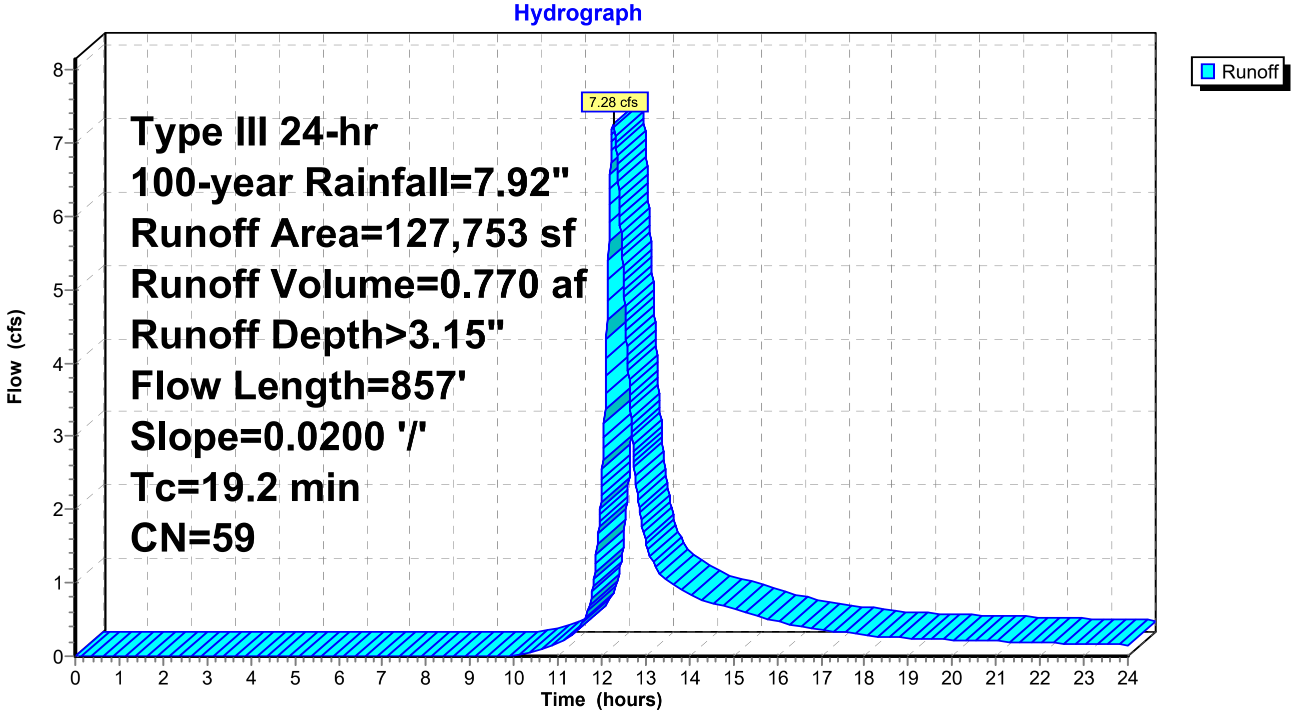
Subcatchment 7S: Area 7



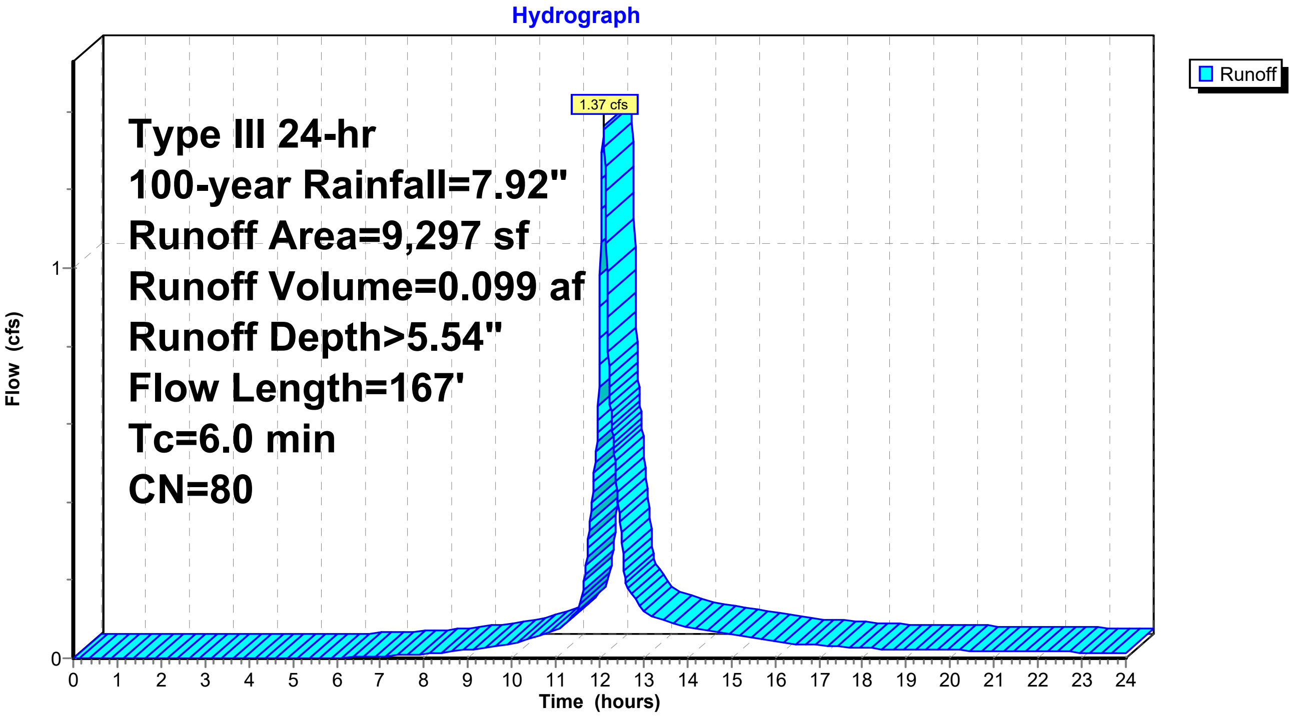
Subcatchment 8S: Area 8



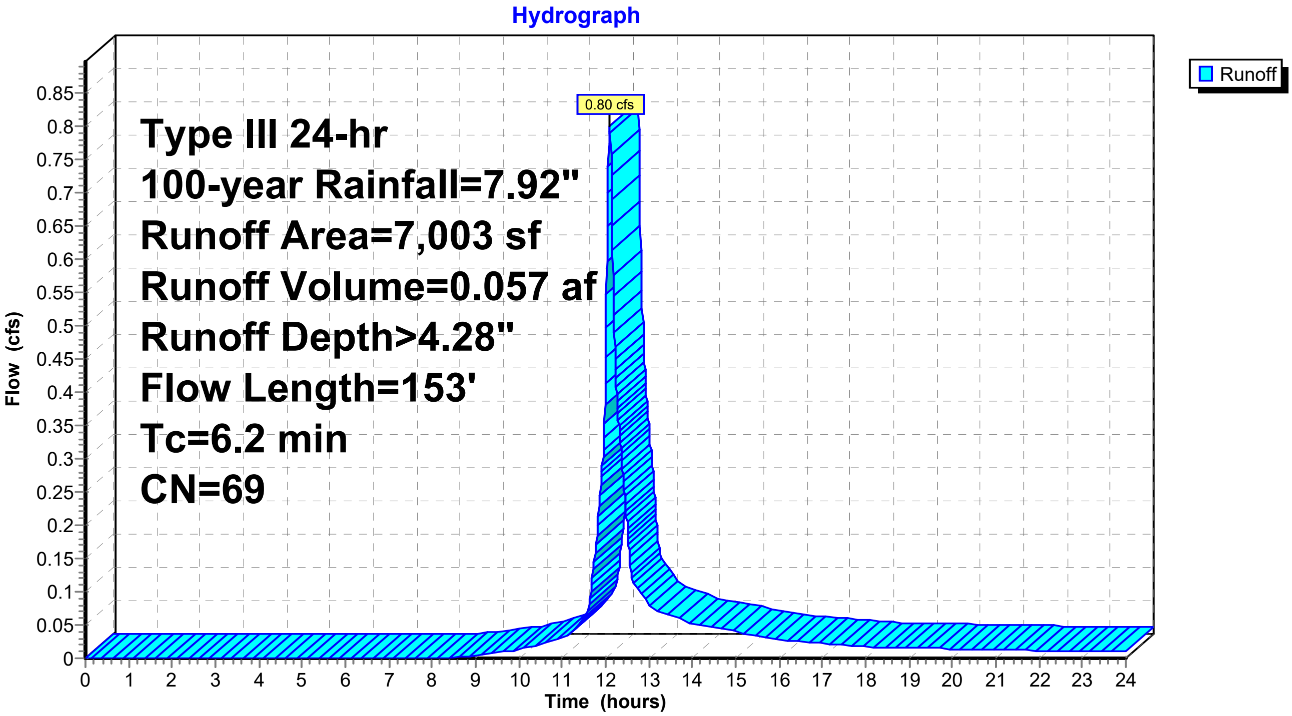
Subcatchment 9S: To Drainage Ditch



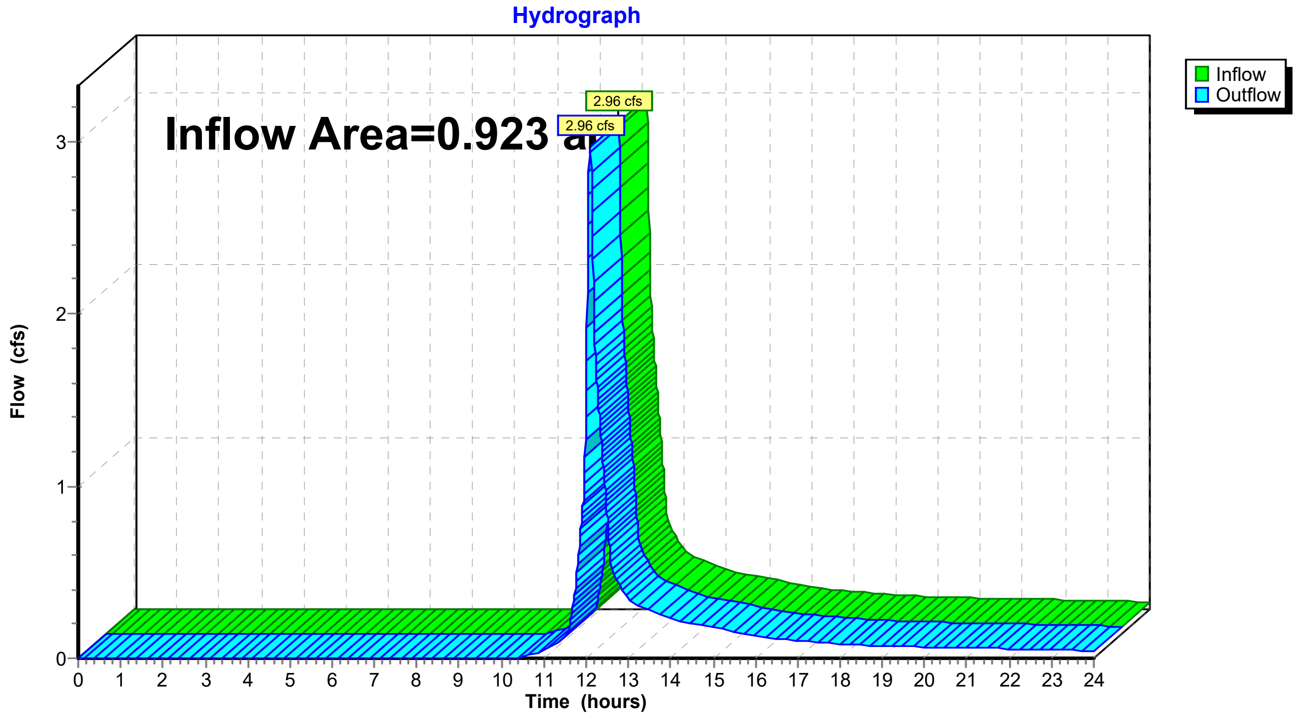
Subcatchment 10S: To Roadway Swale (West)



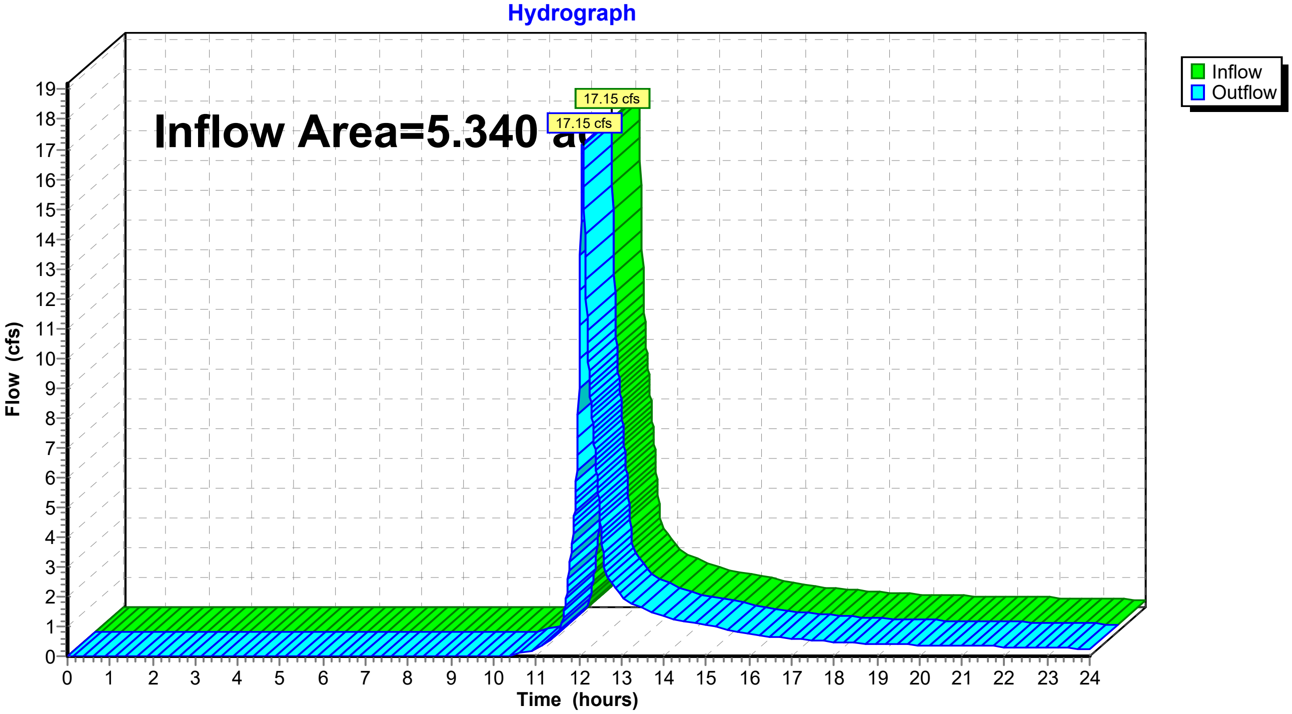
Subcatchment 11S: To Roadway Swale (East)



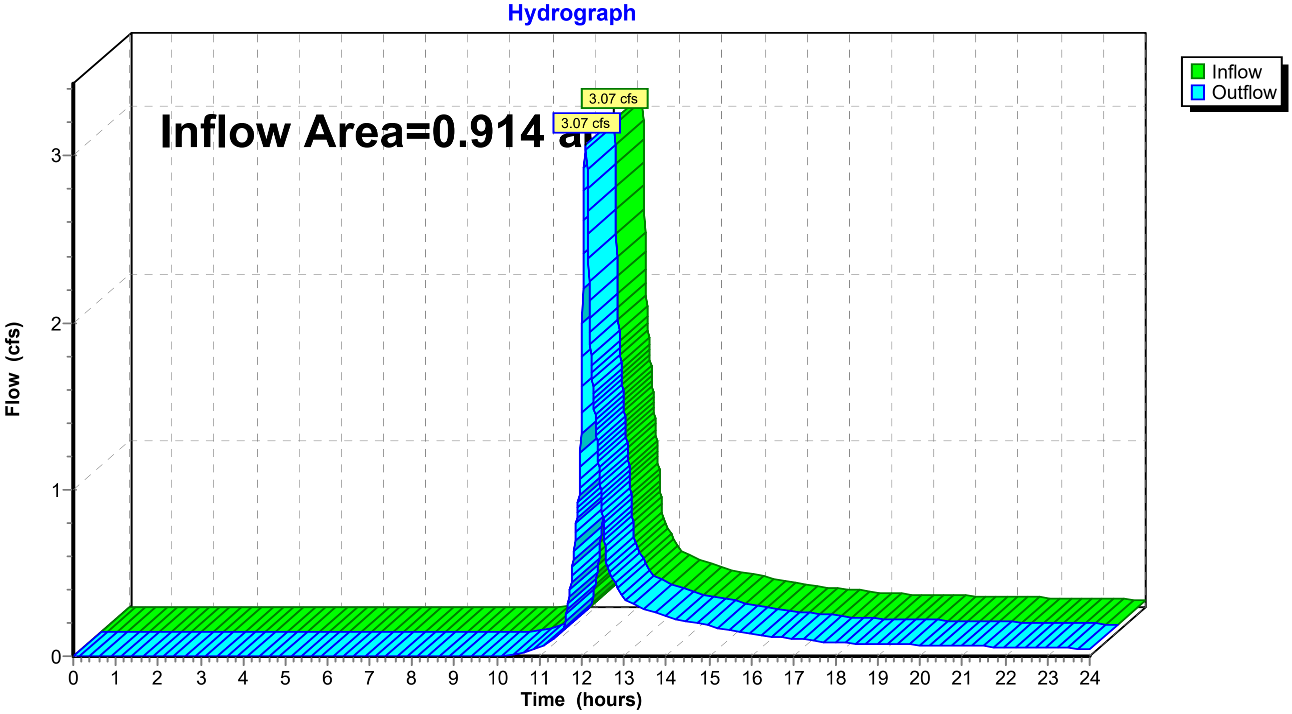
Reach 1R: Off-site Flow (Wetland Northwest)



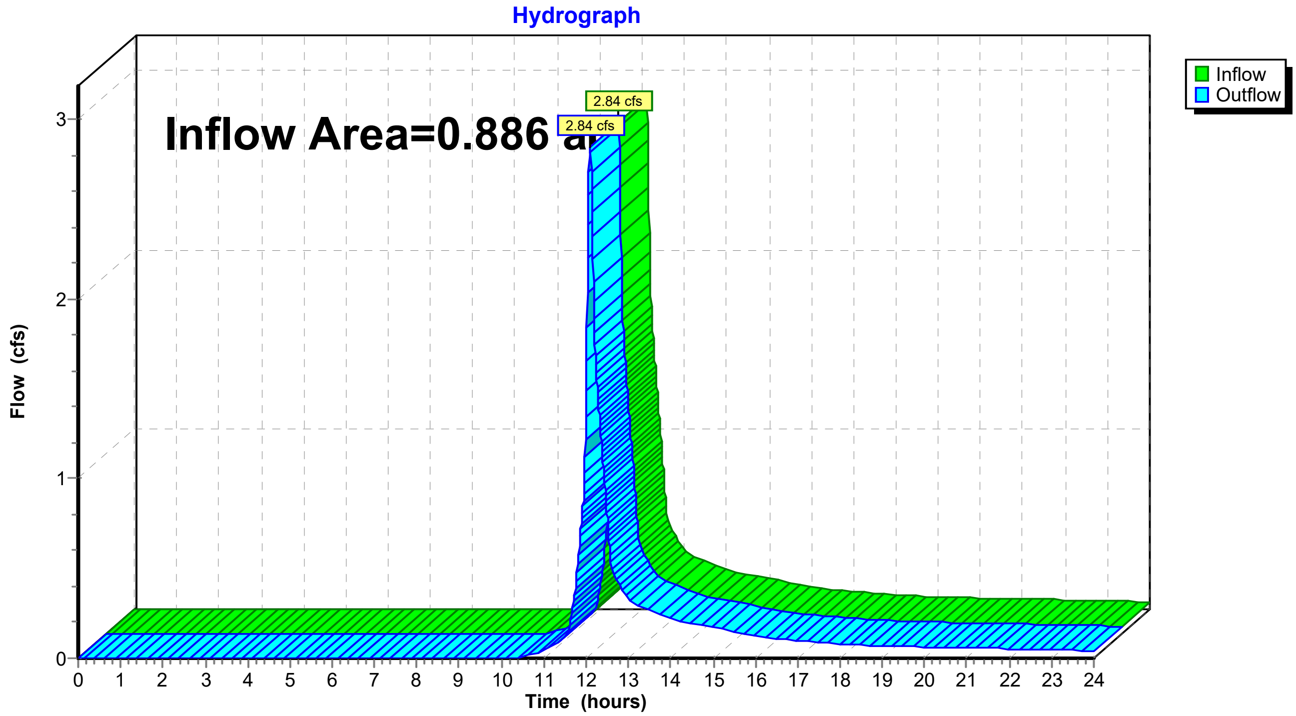
Reach 2R: Off-site Flow (East)



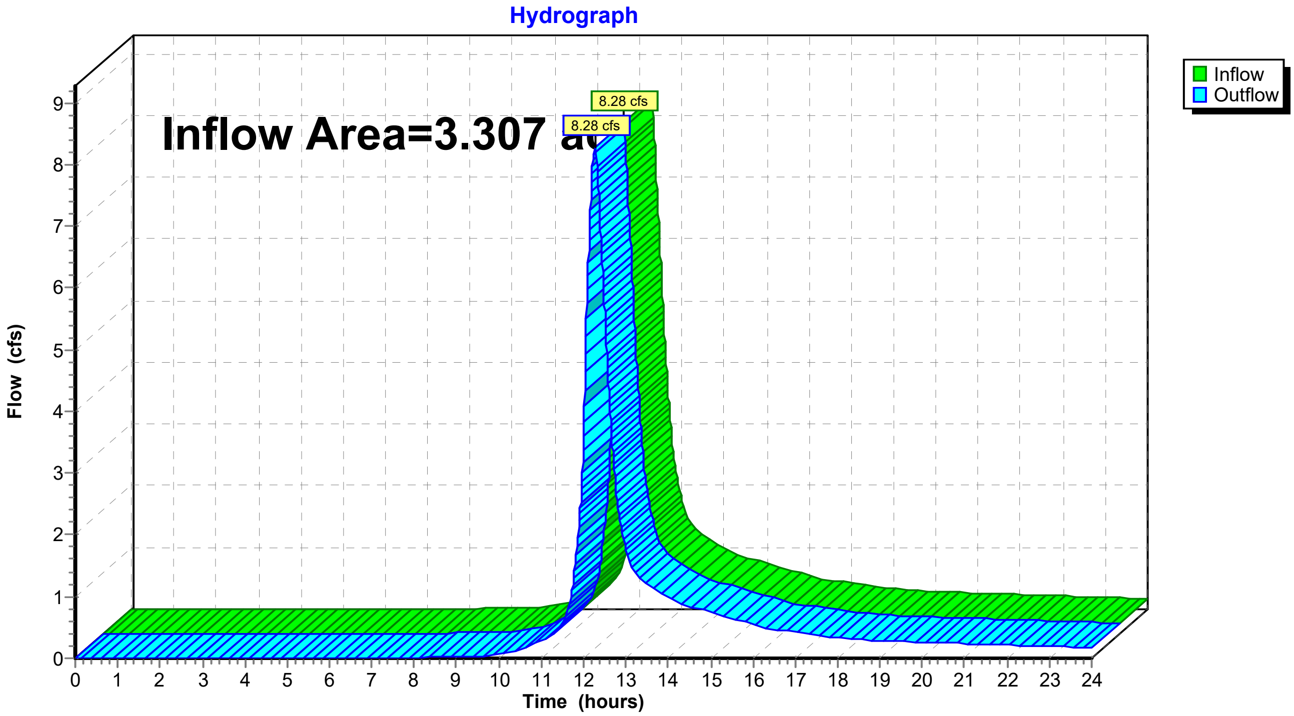
Reach 3R: Off-site Flow (Route 15)



Reach 4R: Off-site flow (South)



Reach 5R: Flow to Drainage Ditch



Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

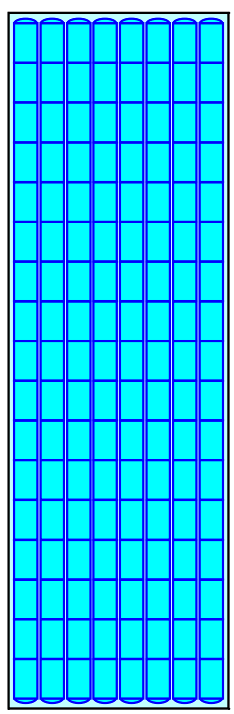
17 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 122.66' Row Length +12.0" End Stone x 2 = 124.66' Base Length
8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

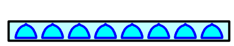
136 Chambers x 45.9 cf = 6,247.8 cf Chamber Storage

17,233.8 cf Field - 6,247.8 cf Chambers = 10,985.9 cf Stone x 40.0% Voids = 4,394.4 cf Stone Storage

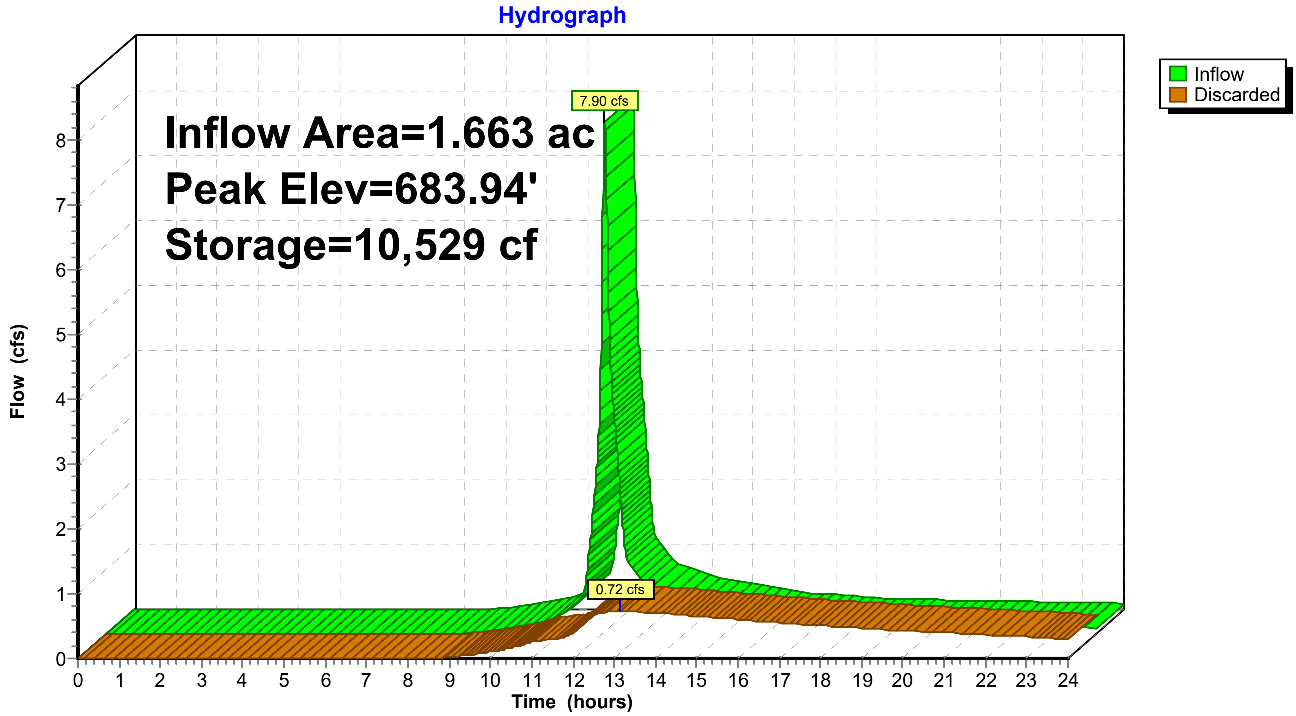
Chamber Storage + Stone Storage = 10,642.2 cf = 0.244 af
Overall Storage Efficiency = 61.8%
Overall System Size = 124.66' x 39.50' x 3.50'

136 Chambers
638.3 cy Field
406.9 cy Stone





Pond 5P: Subsurface Infiltration System #1 - ADS StormTech SC-740 Chambers



Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

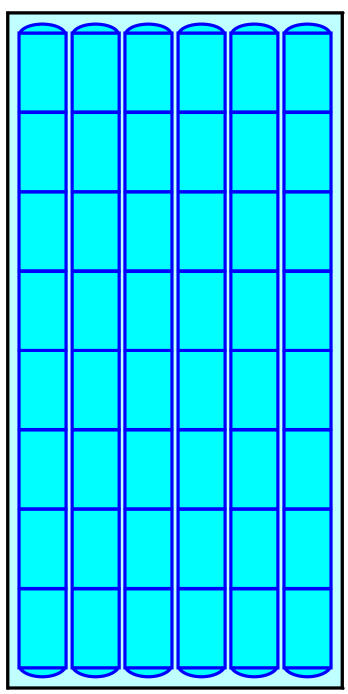
8 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 58.58' Row Length +12.0" End Stone x 2 = 60.58' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

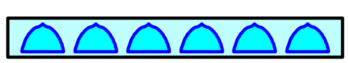
48 Chambers x 45.9 cf = 2,205.1 cf Chamber Storage

6,360.6 cf Field - 2,205.1 cf Chambers = 4,155.4 cf Stone x 40.0% Voids = 1,662.2 cf Stone Storage

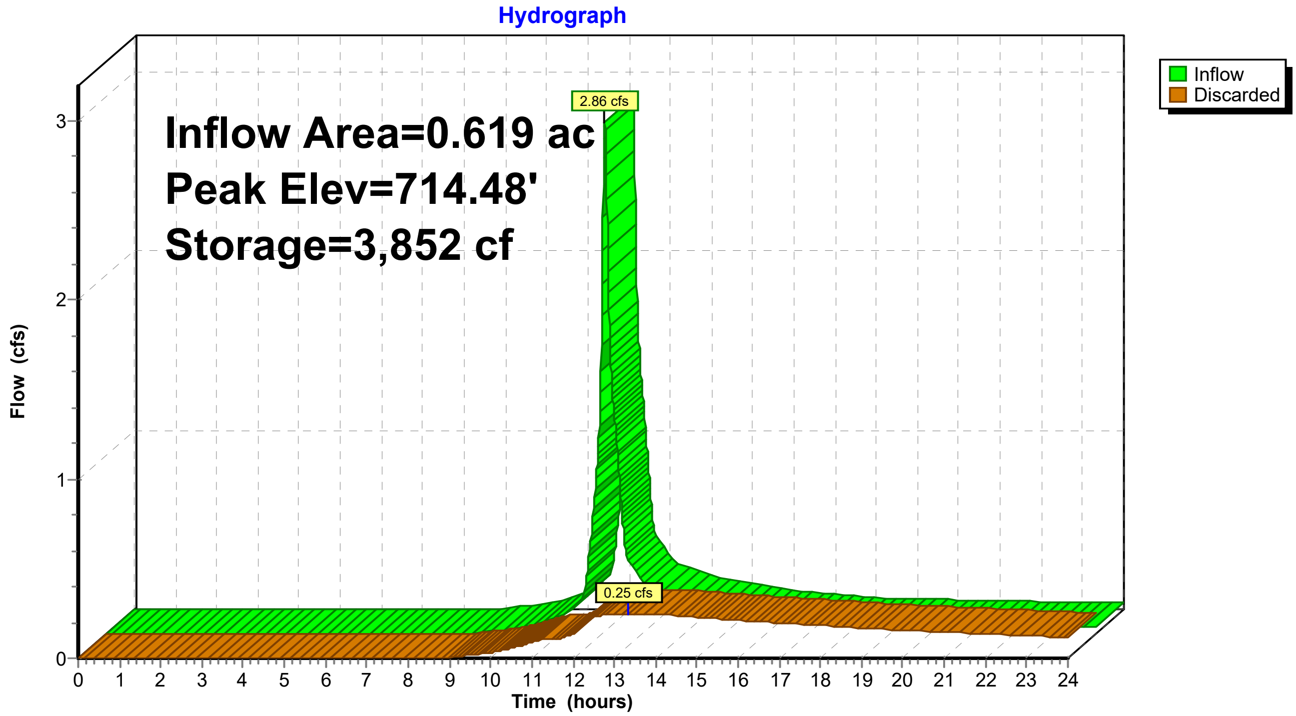
Chamber Storage + Stone Storage = 3,867.3 cf = 0.089 af
Overall Storage Efficiency = 60.8%
Overall System Size = 60.58' x 30.00' x 3.50'

48 Chambers
235.6 cy Field
153.9 cy Stone

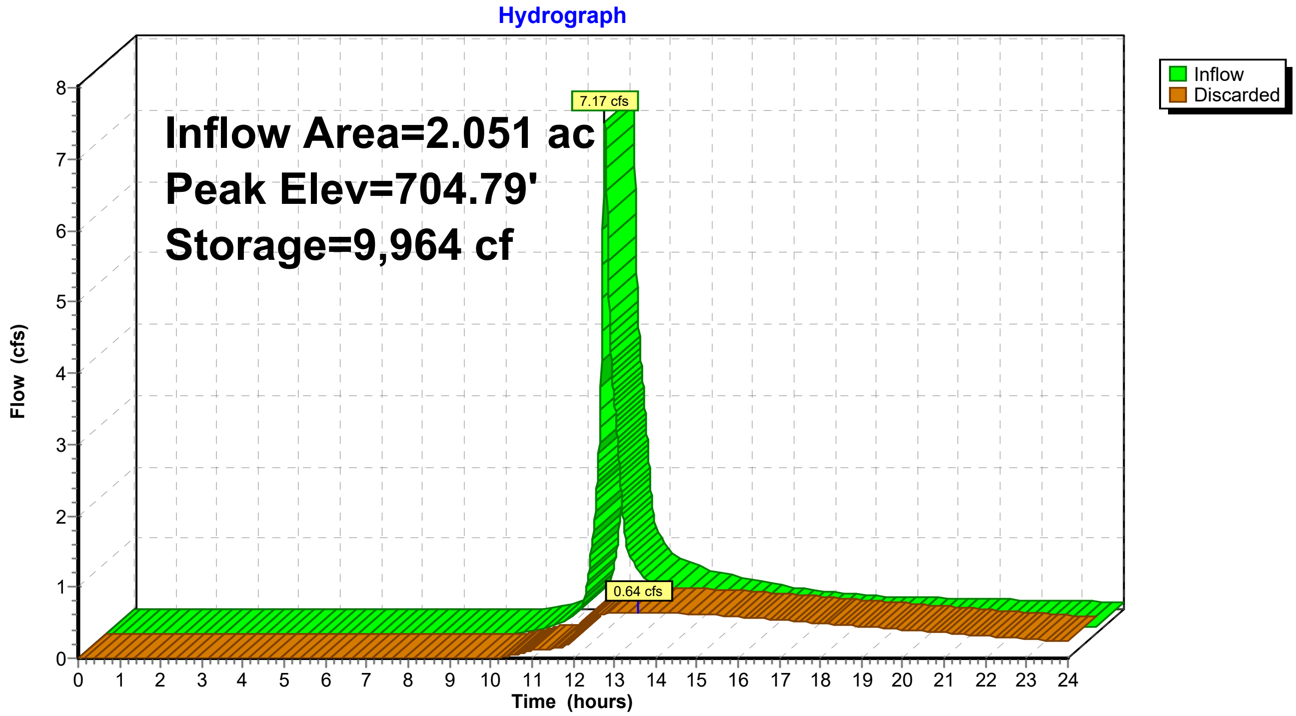




Pond 6P: Subsurface Infiltration System #2 - ADS StormTech SC-740 Chambers



Pond 7P: Infiltration Basin #1



Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers - Chamber Wizard Fiel

Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

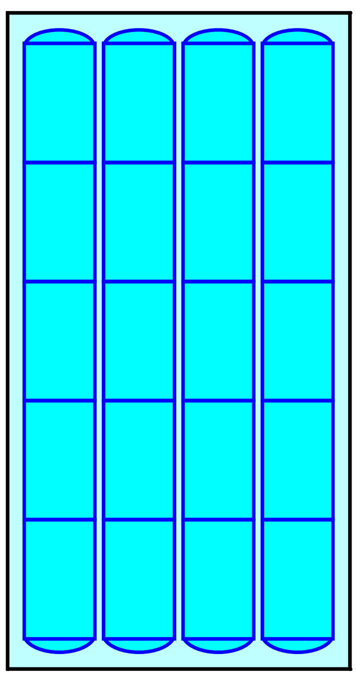
5 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 37.22' Row Length +12.0" End Stone x 2 = 39.22' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

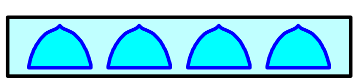
20 Chambers x 45.9 cf = 918.8 cf Chamber Storage

2,813.8 cf Field - 918.8 cf Chambers = 1,895.0 cf Stone x 40.0% Voids = 758.0 cf Stone Storage

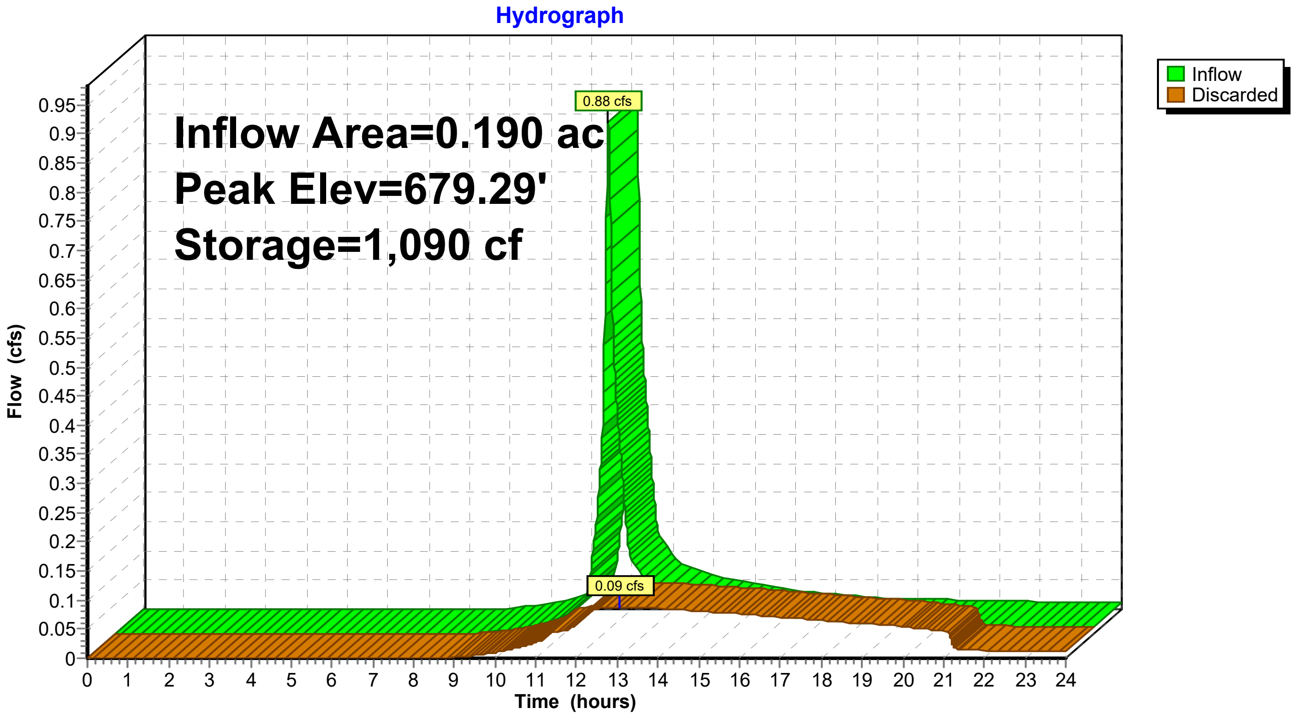
Chamber Storage + Stone Storage = 1,676.8 cf = 0.038 af
Overall Storage Efficiency = 59.6%
Overall System Size = 39.22' x 20.50' x 3.50'

20 Chambers
104.2 cy Field
70.2 cy Stone





Pond 8P: Subsurface Infiltration System #3 - ADS StormTech SC-740 Chambers



SECTION 7.0

ADDITIONAL DRAINAGE CALCULATIONS

7.01 TSS REMOVAL CALCULATIONS

TSS Removal Calculation Worksheet

Location: Sturbridge, Ma.

Project: Photovoltaic Panels

BSC GROUP

Prepared By: M. Morrison

Date: 11/19/2023

AREA 1

Subcatchments 3S &9S

Total Impervious Area, Acres= 0.016

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
No Treatment	0.00	1.00	0.00	1.00

TSS Removal = 0.00

AREA 2

Subcatchment 5S, 6S, & 8S

Total Impervious Area, Acres= 0.574

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Water Quality Unit	0.77	1.00	0.77	0.23
Infiltration Basin/Subsurface System	0.8	0.23	0.18	0.05

TSS Removal = 0.95

AREA 3

Subcatchment 10S & 11S

Total Impervious Area, Acres= 0.099

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Grassed Channel	0.5	1.00	0.50	0.50

TSS Removal = 0.50

WEIGHTED AVERAGE

Total Site TSS Removal = [(0.370*0.87)+(0.397*0.80)] / (0.370+0.397)

Total Site TSS Removal = 0.87

7.02 GROUNDWATER RECHARGE VOLUME CALCULATIONS

<u>Required Recharge Volume</u>

Rv = F x Impervious Area

Where:

Rv = Recharge Volume

F=Target Depth Factor associated with each Hydrologic Soil Group

(F=0.60-inch for Soil Type A)

Impervious Area = Proposed Pavement area on-site

$$Rv = \left(\frac{0.60\ in}{12\ in/ft}\right)(0.589\ ac)\left(43{,}560\frac{sf}{ac}\right) = 1{,}283\ cf$$

Rv = 1,283 cf (required recharge volume)

Storage Provided (Subsurface Infiltration Systems only):

- Infiltration System #1= 10,155 cubic feet provided
- Infiltration System #2= 3,833 cubic feet provided
- Infiltration System #3= 1,431 cubic feet provided
- Total = 15, 419 cubic feet provided
  Refer to the HydroCAD calculations for more information.

Drawdown Time

The following formula must be used to demonstrate that each proposed infiltration BMP will drain within 72 hours:

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

R_v = Storage Volume (Required Recharge Volume)
K = Saturated Hydraulic Conductivity For "Static" and "Simple Dynamic" Methods, use Rawls Rate
Bottom Area = Bottom Area of Recharge Structure

Subsurface Infiltration System #1 (Pond 5P)

$$Time_{drawdown} = \frac{829.1\ ft^3}{(2.410\ in/hr)(1\ ft/12\ in)(4{,}924\ ft^2)}$$

$$Time_{drawdown} = 0.07\ hours$$

Subsurface Infiltration System #2 (Pond 6P)

$$Time_{drawdown} = \frac{291\ ft^3}{(2.410\ in/hr)(1\ ft/12\ in)(1{,}817\ ft^2)}$$

$$Time_{drawdown} = 0.07\ hours$$

Subsurface Infiltration System #3 (Pond 8P)

$$Time_{drawdown} = \frac{166\ ft^3}{(2.410\ in/hr)(1\ ft/12\ in)(804\ ft^2)}$$

$$Time_{drawdown} = 0.09\ hours$$

7.03 WATER QUALITY VOLUME CALCULATIONS

V_{WQ} = (D_{WQ}/12 inches/foot) * (A_{IMP} square feet)

V_{WQ} = Required Water Quality Volume (in cubic feet)
D_{WQ} = Water Quality Depth: **1.0-inch** used (1-inch for rapid infiltration rates, greater than 2.4 inches per hour & 0.5-inch for other areas)
A_{IMP} = Total Impervious Area (in acres) used for driveways, parking, etc.

<u>Infiltration Systems</u>

A_{IMP} = 0.590 ac

V_{WQ} = (1.0 inch/12 inches/foot) * (0.590 ac x 43,560 square feet/ac)

V_{WQ} = 2,142 cubic feet (required volume), provided volume = 15, 419 cubic feet (refer to HydroCAD

7.04 WATER QUALITY UNIT SIZING CALCULATION

Stormceptor®

CONTECH ENGINEERED SOLUTIONS

Detailed Stormceptor Sizing Report – WQU-1

Project Information & Location			
Project Name	200 Route 15	**Project Number**	49924
City	Sturbridge	**State/ Province**	Massachusetts
Country	United States of America	**Date**	4/7/2023
Designer Information		**EOR Information (optional)**	
Name	Todd MacDonald	**Name**	
Company	BSC Group	**Company**	
Phone #	617-896-4409	**Phone #**	
Email	TMacDonald@BSCGroup.com	**Email**	

Stormwater Treatment Recommendation

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

Site Name	WQU-1
Recommended Stormceptor Model	STC 450i
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	92
PSD	Fine Distribution
Rainfall Station	EAST BRIMFIELD LAKE

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

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	92
STC 900	96
STC 1200	96
STC 1800	96
STC 2400	97
STC 3600	97
STC 4800	98
STC 6000	98
STC 7200	99
STC 11000	99
STC 13000	99
STC 16000	99

Stormceptor

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

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis

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

Rainfall Station

State/Province	Massachusetts	**Total Number of Rainfall Events**	5106
Rainfall Station Name	EAST BRIMFIELD LAKE	**Total Rainfall (in)**	1701.4
Station ID #	2107	**Average Annual Rainfall (in)**	37.8
Coordinates	42°7'0"N, 72°8'0"W	**Total Evaporation (in)**	110.5
Elevation (ft)	680	**Total Infiltration (in)**	437.1
Years of Rainfall Data	45	**Total Rainfall that is Runoff (in)**	1153.8

Notes

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

Drainage Area	
Total Area (acres)	0.19
Imperviousness %	74.0

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

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

Design Details	
Stormceptor Inlet Invert Elev (ft)	
Stormceptor Outlet Invert Elev (ft)	677.90
Stormceptor Rim Elev (ft)	681.90
Normal Water Level Elevation (ft)	
Pipe Diameter (in)	12
Pipe Material	HDPE - plastic
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	Yes

Particle Size Distribution (PSD)

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

Fine Distribution

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

Stormceptor®

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Site Name	WQU-1

Site Details

Drainage Area	
Total Area (acres)	0.19
Imperviousness %	74.0

Surface Characteristics	
Width (ft)	182.00
Slope %	2
Impervious Depression Storage (in)	0.02
Pervious Depression Storage (in)	0.2
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency	
Maintenance Frequency (months) >	12

Infiltration Parameters	
Horton's equation is used to estimate infiltration	
Max. Infiltration Rate (in/hr)	2.44
Min. Infiltration Rate (in/hr)	0.4
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation	
Daily Evaporation Rate (in/day)	0.1

Dry Weather Flow	
Dry Weather Flow (cfs)	0

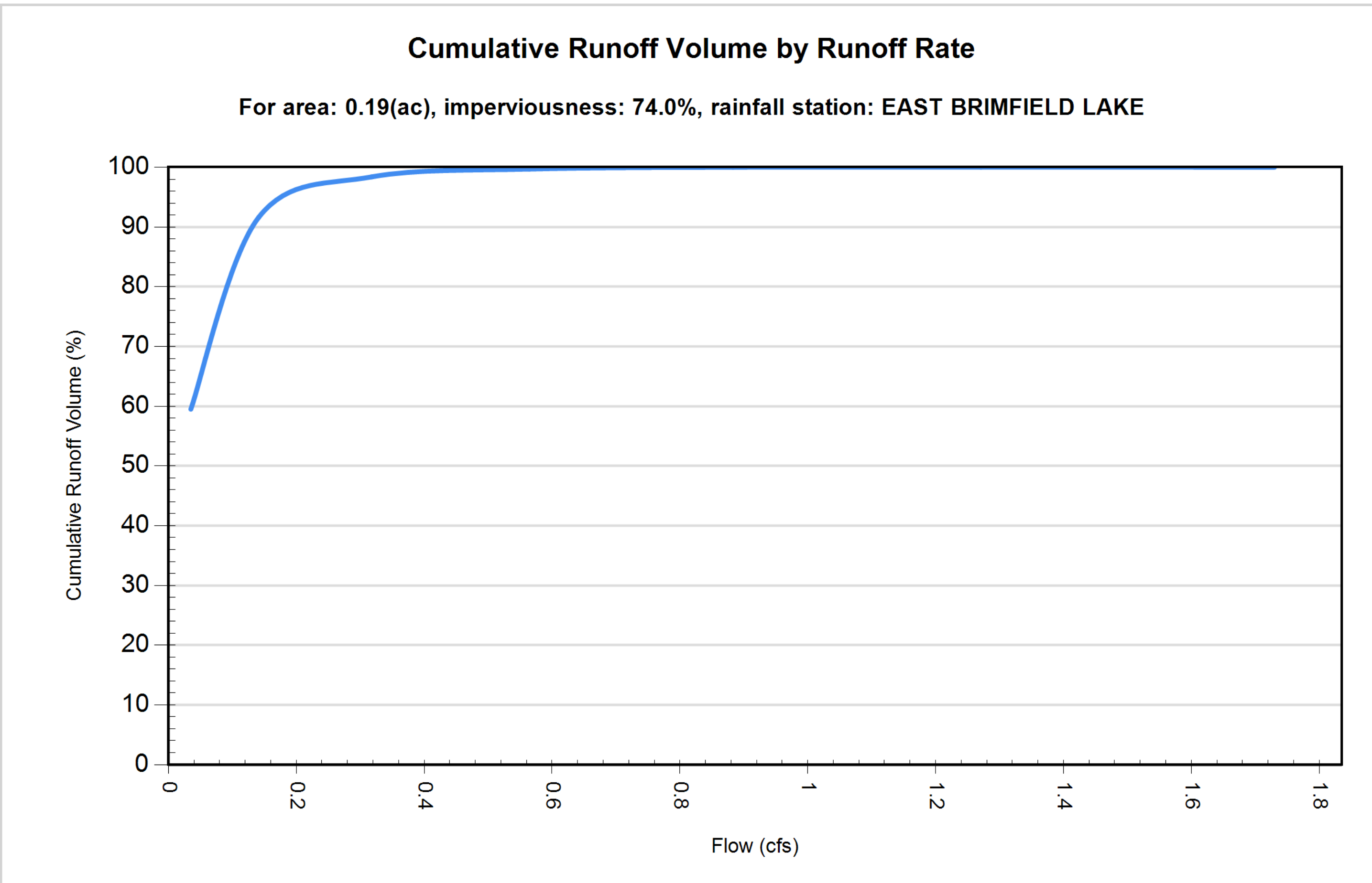
Winter Months	
Winter Infiltration	0

TSS Loading Parameters	
TSS Loading Function	

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

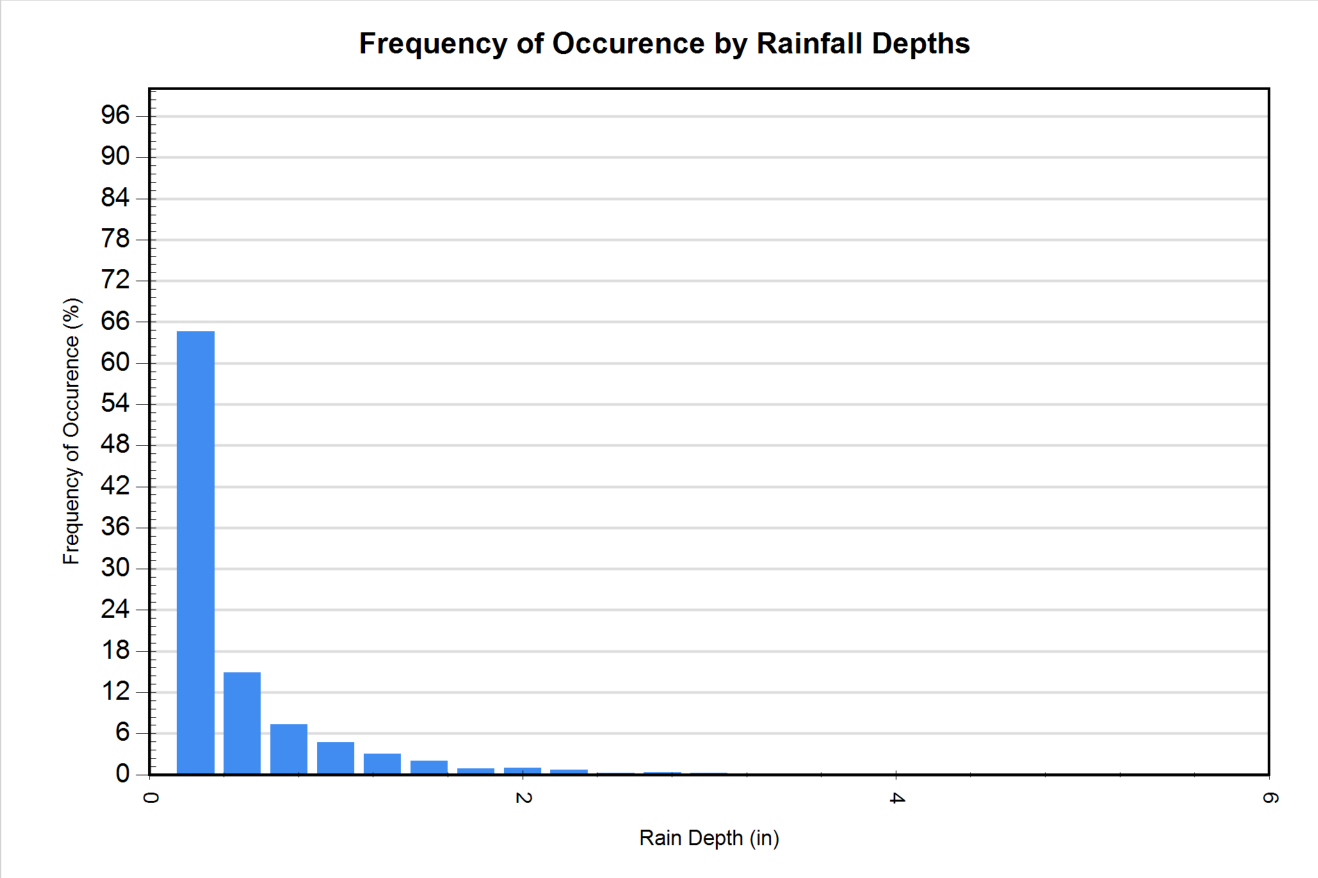
TSS Availability Parameters	
Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (cfs)	Runoff Volume (ft³)	Volume Over (ft³)	Cumulative Runoff Volume (%)
0.035	492371	334561	59.5
0.141	757683	69193	91.6
0.318	813259	13597	98.4
0.565	824417	2436	99.7
0.883	826653	200	100.0
1.271	826853	0	100.0
1.730	826853	0	100.0



Rainfall Event Analysis

Rainfall Depth (in)	No. of Events	Percentage of Total Events (%)	Total Volume (in)	Percentage of Annual Volume (%)
0.25	3297	64.6	282	16.6
0.50	761	14.9	281	16.5
0.75	371	7.3	229	13.5
1.00	241	4.7	211	12.4
1.25	154	3.0	172	10.1
1.50	102	2.0	139	8.2
1.75	45	0.9	73	4.3
2.00	50	1.0	93	5.5
2.25	34	0.7	72	4.2
2.50	12	0.2	29	1.7
2.75	14	0.3	36	2.1
3.00	12	0.2	35	2.0
3.25	5	0.1	16	0.9
3.50	1	0.0	3	0.2
3.75	1	0.0	4	0.2
4.00	2	0.0	8	0.5
4.25	1	0.0	4	0.2
4.50	0	0.0	0	0.0
4.75	1	0.0	5	0.3
5.00	1	0.0	5	0.3
5.25	1	0.0	5	0.3
5.50	0	0.0	0	0.0
5.75	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

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Detailed Stormceptor Sizing Report – WQU-2

Project Information & Location			
Project Name	200 Route 15	**Project Number**	49924
City	Sturbridge	**State/ Province**	Massachusetts
Country	United States of America	**Date**	4/7/2023
Designer Information		**EOR Information (optional)**	
Name	Todd MacDonald	**Name**	
Company	BSC Group	**Company**	
Phone #	617-896-4409	**Phone #**	
Email	TMacDonald@BSCGroup.com	**Email**	

Stormwater Treatment Recommendation

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

Site Name	WQU-2
Recommended Stormceptor Model	STC 900
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	80
PSD	Fine Distribution
Rainfall Station	EAST BRIMFIELD LAKE

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

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	71
STC 900	80
STC 1200	80
STC 1800	80
STC 2400	84
STC 3600	85
STC 4800	88
STC 6000	88
STC 7200	90
STC 11000	93
STC 13000	93
STC 16000	94

Stormceptor

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

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis

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

Rainfall Station

State/Province	Massachusetts	**Total Number of Rainfall Events**	5106
Rainfall Station Name	EAST BRIMFIELD LAKE	**Total Rainfall (in)**	1701.4
Station ID #	2107	**Average Annual Rainfall (in)**	37.8
Coordinates	42°7'0"N, 72°8'0"W	**Total Evaporation (in)**	108.6
Elevation (ft)	680	**Total Infiltration (in)**	573.9
Years of Rainfall Data	45	**Total Rainfall that is Runoff (in)**	1018.9

Notes

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

Stormceptor® CONTECH ENGINEERED SOLUTIONS A [illegible] COMPANY

Drainage Area	
Total Area (acres)	2.28
Imperviousness %	66.0

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

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

Design Details	
Stormceptor Inlet Invert Elev (ft)	680.90
Stormceptor Outlet Invert Elev (ft)	680.80
Stormceptor Rim Elev (ft)	685.00
Normal Water Level Elevation (ft)	
Pipe Diameter (in)	12
Pipe Material	HDPE - plastic
Multiple Inlets (Y/N)	Yes
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

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

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

Site Name	WQU-2

Site Details

Drainage Area	
Total Area (acres)	2.28
Imperviousness %	66.0

Surface Characteristics	
Width (ft)	630.00
Slope %	2
Impervious Depression Storage (in)	0.02
Pervious Depression Storage (in)	0.2
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency	
Maintenance Frequency (months) >	12

Infiltration Parameters	
Horton's equation is used to estimate infiltration	
Max. Infiltration Rate (in/hr)	2.44
Min. Infiltration Rate (in/hr)	0.4
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation	
Daily Evaporation Rate (in/day)	0.1

Dry Weather Flow	
Dry Weather Flow (cfs)	0

Winter Months	
Winter Infiltration	0

TSS Loading Parameters	
TSS Loading Function	

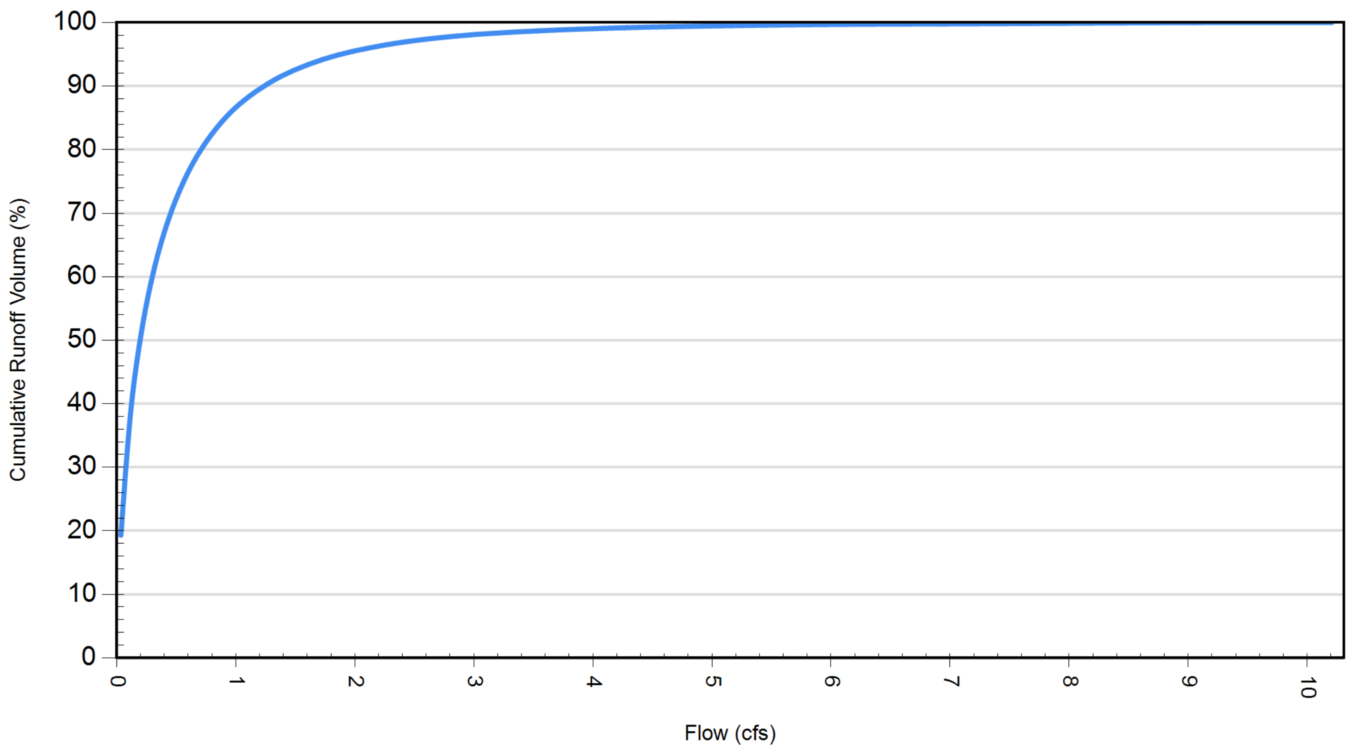
Buildup/Wash-off Parameters	
Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

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

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (cfs)	**Runoff Volume (ft³)**	**Volume Over (ft³)**	**Cumulative Runoff Volume (%)**
0.035	1682368	7038536	19.3
0.141	3719489	5001259	42.7
0.318	5359979	3361551	61.5
0.565	6546873	2173475	75.1
0.883	7360766	1360044	84.4
1.271	7885678	834543	90.4
1.730	8213450	506949	94.2
2.260	8413486	306729	96.5
2.860	8533191	187063	97.9
3.531	8607187	113025	98.7
4.273	8653712	66528	99.2
5.085	8680811	39412	99.5
5.968	8696678	23550	99.7
6.922	8706922	13303	99.8
7.946	8713577	6649	99.9
9.041	8717302	2921	100.0
10.206	8719419	805	100.0

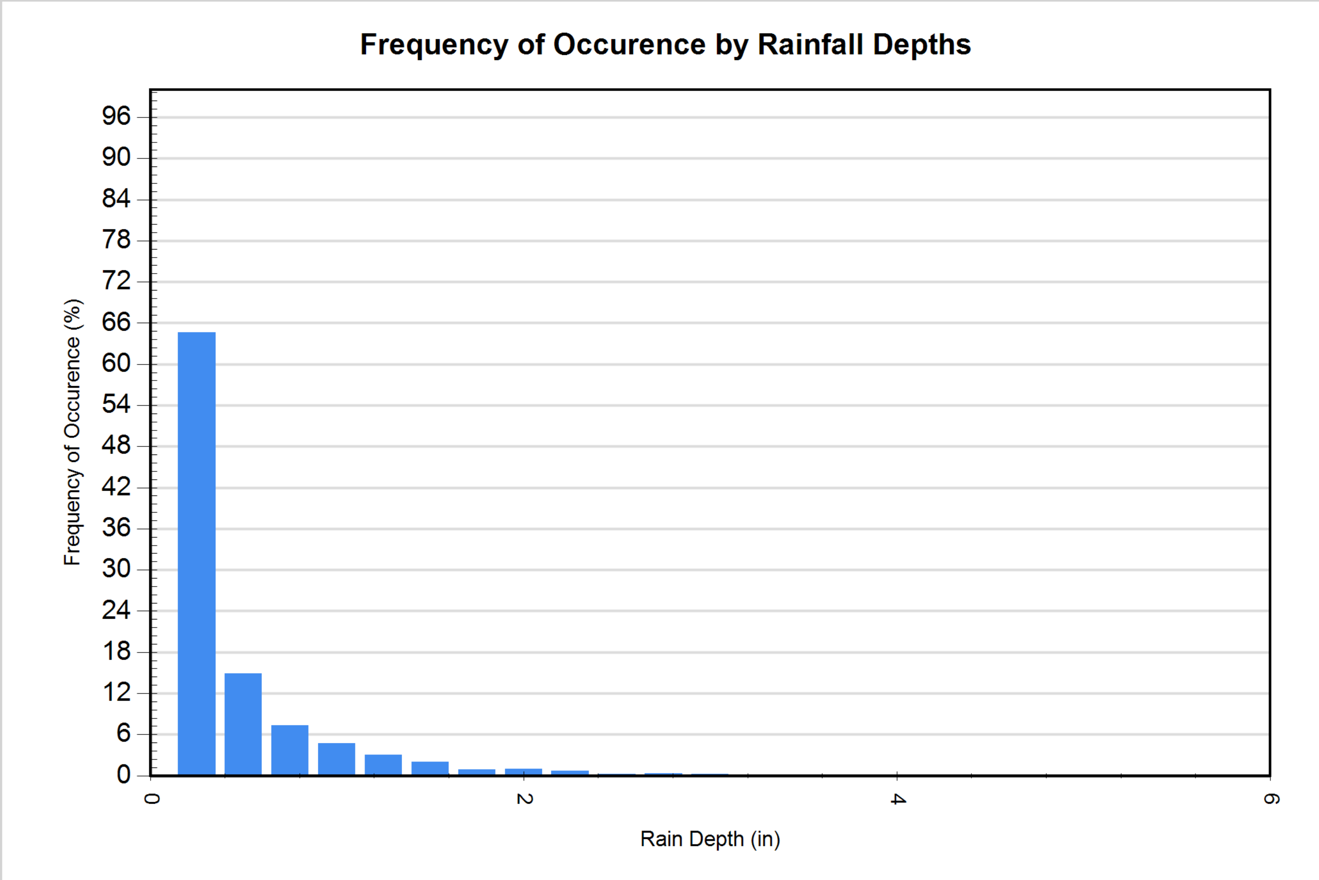
Cumulative Runoff Volume by Runoff Rate

For area: 2.28(ac), imperviousness: 66.0%, rainfall station: EAST BRIMFIELD LAKE



Rainfall Event Analysis

Rainfall Depth (in)	No. of Events	Percentage of Total Events (%)	Total Volume (in)	Percentage of Annual Volume (%)
0.25	3297	64.6	282	16.6
0.50	761	14.9	281	16.5
0.75	371	7.3	229	13.5
1.00	241	4.7	211	12.4
1.25	154	3.0	172	10.1
1.50	102	2.0	139	8.2
1.75	45	0.9	73	4.3
2.00	50	1.0	93	5.5
2.25	34	0.7	72	4.2
2.50	12	0.2	29	1.7
2.75	14	0.3	36	2.1
3.00	12	0.2	35	2.0
3.25	5	0.1	16	0.9
3.50	1	0.0	3	0.2
3.75	1	0.0	4	0.2
4.00	2	0.0	8	0.5
4.25	1	0.0	4	0.2
4.50	0	0.0	0	0.0
4.75	1	0.0	5	0.3
5.00	1	0.0	5	0.3
5.25	1	0.0	5	0.3
5.50	0	0.0	0	0.0
5.75	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

7.05 GROUNDWATER MOUNDING ANALYSIS

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

Input Values		use consistent units (e.g. feet & days **or** inches & hours)
4.8200	***R***	**Recharge (infiltration) rate (feet/day)**
0.200	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
43.38	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
20.000	**x**	**1/2 length of basin (x direction, in feet)**
255.000	**y**	**1/2 width of basin (y direction, in feet)**
0.080	**t**	**duration of infiltration period (days)**
2.000	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00

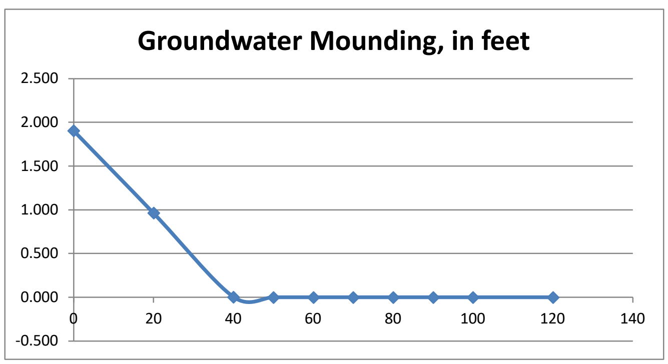
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

3.904	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.904	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.904	**0**
0.964	**20**
0.004	**40**
0.001	**50**
0.001	**60**
0.001	**70**
0.001	**80**
0.001	**90**
0.001	**100**
0.001	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin.
Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
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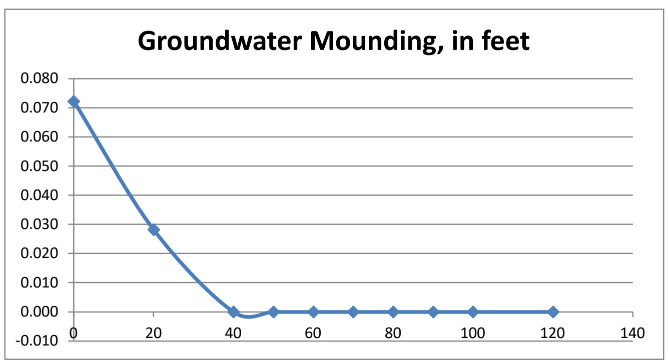
Input Values		use consistent units (e.g. feet & days **or** inches & hours)	**Conversion Table**	
			inch/hour	**feet/day**
4.8200	***R***	**Recharge (infiltration) rate (feet/day)**	0.67	1.33
0.200	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**		
43.38	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***	2.00	4.00
19.750	**x**	**1/2 length of basin (x direction, in feet)**		
62.330	**y**	**1/2 width of basin (y direction, in feet)**	**hours**	**days**
0.003	**t**	**duration of infiltration period (days)**	36	1.50
2.100	**hi(0)**	**initial thickness of saturated zone (feet)**		

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

2.172	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.072	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.072	**0**
0.028	**20**
0.000	**40**
0.000	**50**
0.000	**60**
0.000	**70**
0.000	**80**
0.000	**90**
0.000	**100**
0.000	**120**

Re-Calculate Now



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This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
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use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
4.8200	***R***	**Recharge (infiltration) rate (feet/day)**
0.200	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
43.38	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
15.000	**x**	**1/2 length of basin (x direction, in feet)**
30.290	**y**	**1/2 width of basin (y direction, in feet)**
0.003	**t**	**duration of infiltration period (days)**
2.400	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

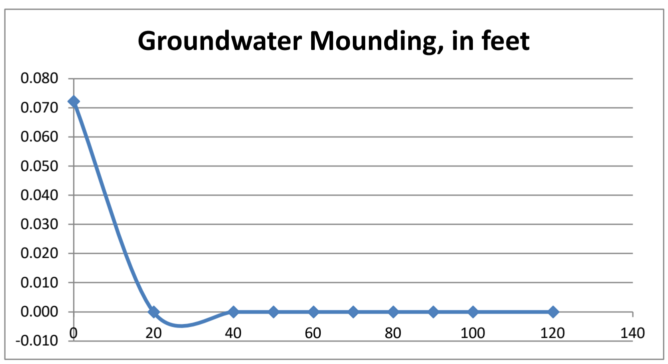
inch/hour	feet/day
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

2.472	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.072	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.072	**0**
0.000	**20**
0.000	**40**
0.000	**50**
0.000	**60**
0.000	**70**
0.000	**80**
0.000	**90**
0.000	**100**
0.000	**120**

Re-Calculate Now



Disclaimer

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This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
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Input Values		use consistent units (e.g. feet & days **or** inches & hours)
4.8200	*R*	**Recharge (infiltration) rate (feet/day)**
0.200	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
43.38	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
10.250	x	**1/2 length of basin (x direction, in feet)**
19.610	y	**1/2 width of basin (y direction, in feet)**
0.004	t	**duration of infiltration period (days)**
2.150	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

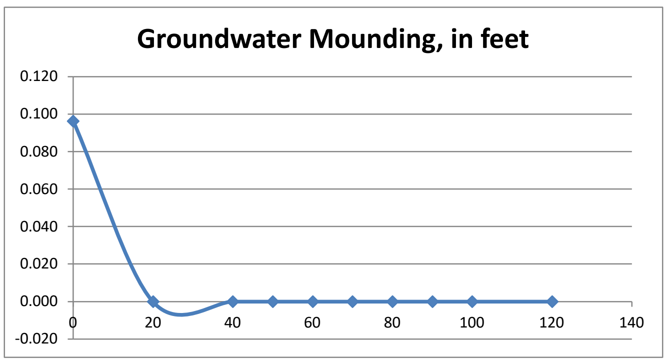
inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

2.246	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.096	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.096	0
0.000	20
0.000	40
0.000	50
0.000	60
0.000	70
0.000	80
0.000	90
0.000	100
0.000	120

Re-Calculate Now



Disclaimer

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7.06 PIPE SIZING CALCULATIONS

CATCH BASIN - 01

PROJECT NAME: Sturbridge, MA
DATE: 11/13/2023
CALCS BY: MM
CHECKED BY: BY

Rational Method Flow Rate

Total Area, A (ac) =	0.96
Area Impervious (ac) =	0.19
Area Grass (ac) =	0.77
Area Woods (ac) =	0.00
Time of Concentration, T_c (min) =	6.0
Return Frequency Period (years) =	25
Cover Characteristics, C =	0.42
Rainfall Intensity, i (in/hr) =	8.59

Areas Do Not Add Up

$Q = CiA$ [cfs]

Flow Rate, Q (cfs) =	3.42

Pipe Capacity Analysis

Design Flow Rate, Q (cfs) =	3.42
Pipe Material (HDPE, RCP, PVC) =	HDPE
Pipe Size (in) =	12
Pipe Slope, S (%) =	0.79%
Manning's Roughness Coefficient, n =	0.011
Wetted Area, A (sf) =	0.79
Wetted Perimeter, P (ft) =	3.14
Hydraulic Radius, R [A/P] (ft) =	0.25
$R^{2/3}$ =	0.397
Pipe Slope, S (ft/ft) =	0.008
$S^{1/2}$ =	0.09
Velocity, V (ft/s) =	4.77

Manning's Equation

$Q = VA = (1.49/n)AR^{2/3}S^{1/2}$ [cfs]

$(1.49/n)AR^{2/3}S^{1/2}$ = 3.75 cfs

Pipe Sufficiently Sized: Yes

CATCH BASIN - 02

PROJECT NAME: Sturbridge, MA
DATE: 11/13/2023
CALCS BY: MM
CHECKED BY: BY

Rational Method Flow Rate

Total Area, A (ac) =	0.66
Area Impervious (ac) =	0.18
Area Grass (ac) =	0.45
Area Woods (ac) =	0.00
Time of Concentration, T_c (min) =	6.0
Return Frequency Period (years) =	25
Cover Characteristics, C =	0.45
Rainfall Intensity, i (in/hr) =	8.59

Areas Do Not Add Up

Q = CiA [cfs]

Flow Rate, Q (cfs) =	2.54

Pipe Capacity Analysis

Design Flow Rate, Q (cfs) =	2.54
Pipe Material (HDPE, RCP, PVC) =	HDPE
Pipe Size (in) =	12
Pipe Slope, S (%) =	0.79%
Manning's Roughness Coefficient, n =	0.011
Wetted Area, A (sf) =	0.79
Wetted Perimeter, P (ft) =	3.14
Hydraulic Radius, R [A/P] (ft) =	0.25
$R^{2/3}$ =	0.397
Pipe Slope, S (ft/ft) =	0.008
$S^{1/2}$ =	0.09
Velocity, V (ft/s) =	4.77

Manning's Equation

$Q = VA = (1.49/n)AR^{2/3}S^{1/2}$ [cfs]

$(1.49/n)AR^{2/3}S^{1/2}$ = 3.75 cfs

Pipe Sufficiently Sized: Yes

CATCH BASIN - 03

PROJECT NAME: Sturbridge, MA
DATE: 11/13/2023
CALCS BY: MM
CHECKED BY: BY

Rational Method Flow Rate

Total Area, A (ac) =	0.37
Area Impervious (ac) =	0.11
Area Grass (ac) =	0.26
Area Woods (ac) =	0.00
Time of Concentration, T_c (min) =	6.0
Return Frequency Period (years) =	25
Cover Characteristics, C =	0.49
Rainfall Intensity, i (in/hr) =	8.59

Areas Do Not Add Up

Q = CiA [cfs]

Flow Rate, Q (cfs) =	1.54

Pipe Capacity Analysis

Design Flow Rate, Q (cfs) =	1.54
Pipe Material (HDPE, RCP, PVC) =	HDPE
Pipe Size (in) =	12
Pipe Slope, S (%) =	10.00%
Manning's Roughness Coefficient, n =	0.011
Wetted Area, A (sf) =	0.79
Wetted Perimeter, P (ft) =	3.14
Hydraulic Radius, R [A/P] (ft) =	0.25
$R^{2/3}$ =	0.397
Pipe Slope, S (ft/ft) =	0.100
$S^{1/2}$ =	0.32
Velocity, V (ft/s) =	17.00

Manning's Equation

$Q = VA = (1.49/n)AR^{2/3}S^{1/2}$ [cfs]

$(1.49/n)AR^{2/3}S^{1/2}$ = 13.35 cfs

Pipe Sufficiently Sized: Yes

CATCH BASIN - 04

PROJECT NAME: Sturbridge, MA
DATE: 11/13/2023
CALCS BY: MM
CHECKED BY: BY

Rational Method Flow Rate

Total Area, A (ac) =	0.14
Area Impervious (ac) =	0.01
Area Grass (ac) =	0.13
Area Woods (ac) =	0.00
Time of Concentration, T_c (min) =	6.0
Return Frequency Period (years) =	25
Cover Characteristics, C =	0.35
Rainfall Intensity, i (in/hr) =	8.59

Areas Do Not Add Up

Q = CiA [cfs]

Flow Rate, Q (cfs) =	0.42

Pipe Capacity Analysis

Design Flow Rate, Q (cfs) =	0.42
Pipe Material (HDPE, RCP, PVC) =	HDPE
Pipe Size (in) =	12
Pipe Slope, S (%) =	4.50%
Manning's Roughness Coefficient, n =	0.011
Wetted Area, A (sf) =	0.79
Wetted Perimeter, P (ft) =	3.14
Hydraulic Radius, R [A/P] (ft) =	0.25
$R^{2/3}$ =	0.397
Pipe Slope, S (ft/ft) =	0.045
$S^{1/2}$ =	0.21
Velocity, V (ft/s) =	11.40

Manning's Equation

$Q = VA = (1.49/n)AR^{2/3}S^{1/2}$ [cfs]

$(1.49/n)AR^{2/3}S^{1/2}$ = 8.96 cfs

Pipe Sufficiently Sized: Yes

PROJECT NAME: Sturbridge, MA
DATE: 1/11/2024
CALCS BY: MM
CHECKED BY: BY

Rational Method Flow Rate

Total Area, A (ac) =	3.08
Area Impervious (ac) =	0.35
Area Grass (ac) =	1.29
Area Woods (ac) =	1.44
Time of Concentration, T_c (min) =	20.8
Return Frequency Period (years) =	25
Cover Characteristics, C =	0.32
Rainfall Intensity, i (in/hr) =	0.00

Q = CiA [cfs]

Flow Rate, Q (cfs) =	8.28

Pipe Capacity Analysis

Design Flow Rate, Q (cfs) =	8.28
Pipe Material (HDPE, RCP, PVC) =	RCP
Pipe Size (in) =	15
Pipe Slope, S (%) =	3.80%
Manning's Roughness Coefficient, n =	0.013
Wetted Area, A (sf) =	1.23
Wetted Perimeter, P (ft) =	3.93
Hydraulic Radius, R [A/P] (ft) =	0.31
$R^{2/3}$ =	0.461
Pipe Slope, S (ft/ft) =	0.038
$S^{1/2}$ =	0.19
Velocity, V (ft/s) =	10.29

Manning's Equation

$Q = VA = (1.49/n)AR^{2/3}S^{1/2}$ [cfs]

$(1.49/n)AR^{2/3}S^{1/2}$ = 12.63 cfs

Pipe Sufficiently Sized: Yes

7.07 OUTLET PROTECTION SIZING CALCULATION

OUTLET PROTECTION SIZING

BSC GROUP
BUILD | SUPPORT | CONNECT

Project No.	50745.00	**Calc By**	MM
Subject	Ground-Mounted Photovoltaic System	**Date**	11/14/2023
Location	Sturbridge, MA	**Checked by**	
		Date	

FES-1

Q=Design Discharge, (ft^3/s) = 6.4 cfs

D=Culvert Diameter, (ft) = 1.00 ft

TW=Tailwater Depth, (ft) = 0.4 ft, (0.4xD for unknow tailwater, or enter known tailwater)

(Tailwater depth is to be limited to between 0.4D and 1.0D)

Riprap Rock Sizing

$$D_{50}= 0.2D\left[\frac{Q}{\sqrt{g}D^{2.5}}\right]^{4/3}\left[\frac{D}{TW}\right]$$

g=32.2 fps

D_{50} = median rock size, ft

$$D_{50}= 0.2\left|\frac{6.40}{5.67}\right|^{(4/3)}\left|\frac{1.00}{0.40}\right| = 0.59 \text{ ft}$$

= **7 inches**

Table 1 : Riprap Classes and Apron Dimensions

Class	D_{50} (in)	Apron Length	Apron Depth
1	5	4D	$3.5D_{50}$
2	6	4D	$3.5D_{50}$
3	**10**	**5D**	**$3.3D_{50}$**
4	14	6D	$2.2D_{50}$
5	20	7D	$2.0D_{50}$
6	22	8D	$2.0D_{50}$

Use Class 3

Apron Dimensions

Length, L=7D = **7 ft**

Depth=$2.0D_{50}$ = **14.09 Inches**

Width=3D+(2/3)L = **7.67 ft** (at apron end)

Riprap Rock Sizing Gradation

% of Weight Smaller than Given Size	Size of Stone, inches		
100	**11**	to	**14**
85	**9**	to	**13**
50	**7**	to	**11**
15	**9**	to	**4**

Reference Note: Sizing based in accordance with HEC #14 as required by MassHighway Design Manual

7.08 ILLICIT DISCHARGE COMPLIANCE STATEMENT

Illicit Discharge Compliance Statement

This statement is to document that, to the best of my knowledge and belief, there are no and will be no illicit discharges to the stormwater management systems or protected wetland resource areas for the Ground-Mounted Photovoltaic System on 200 Haynes Street in Sturbridge, Massachusetts.

Chris Vorlicek Director of Development

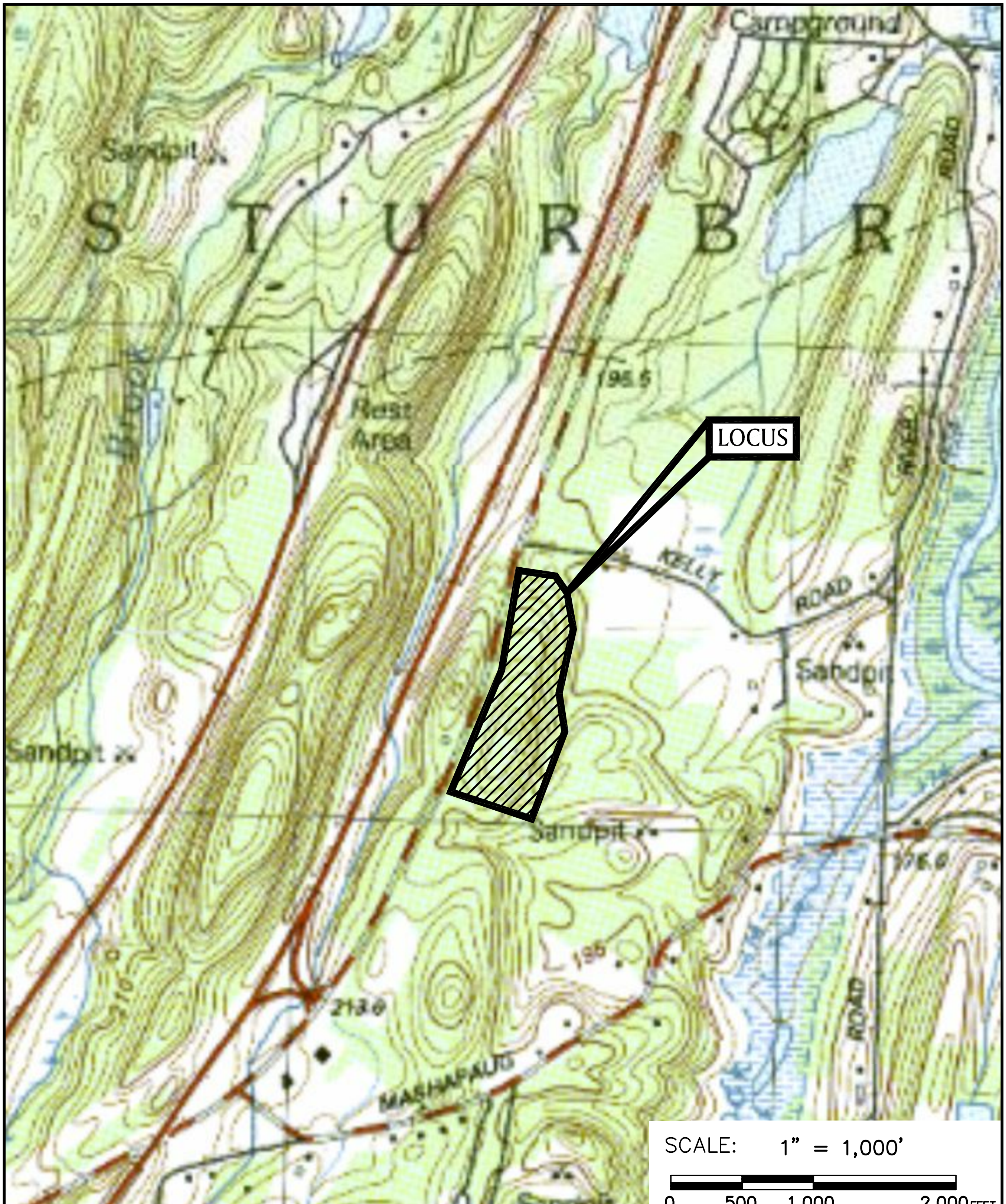
Authorized Signature/Title

01/29/2024

Date

APPENDIX A

USGS LOCUS MAP



PREPARED FOR:

BEAR PEAK POWER
2420 17TH STREET
DENVER, CO 80202

USGS LOCUS MAP

Source:

GROUND-MOUNTED
PHOTOVOLTAIC SYSTEM
200 ROUTE 15,
STURBRIDGE, MA 01566

BSC GROUP
349 Main Street - Route 28
West Yarmouth, Massachusetts
02673
508 778 8919

Job No.: 5-0745.00
Date: 4/7/2023
Scale: 1"=1,000'
Revised:
Dwg. No:
Figure:

APPENDIX B

FEMA MAP

National Flood Hazard Layer FIRMette

FEMA

72°5'52"W 42°4'54"N

72°5'14"W 42°4'27"N

Feet 0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/7/2023 at 4:04 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX C

WEB SOIL SURVEY

Map Scale: 1:2,560 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 35, 70, 140, 210

Feet: 0, 100, 200, 400, 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 15, Sep 9, 2022

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

Date(s) aerial images were photographed: Oct 15, 2020—Oct 31, 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
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	0.6	5.5%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	0.1	0.7%
255A	Windsor loamy sand, 0 to 3 percent slopes	0.0	0.2%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	6.3	62.7%
422E	Canton fine sandy loam, 15 to 35 percent slopes, extremely stony	3.1	30.9%
Totals for Area of Interest		**10.0**	**100.0%**

APPENDIX D

MASSACHUSETTS FORM 11 TEST PIT LOGS

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

30 SWIFT LLC
Owner Name

200 Route 15
Street Address

552-/0 3748/- 220
Map/Lot #

Sturbridge
City

MA
State

01566
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey
   Web Soil Survey
   Source
   422C, 422E
   Soil Map Unit
   Canton fine sandy loam, 8-15 percent slopes, extremely stony
   Canton fine sandy loam, 15-35 percent slopes, extremely stony
   Soil Series
   Hill - Summit
   Landform
   Extremely stony
   Soil Limitations
   coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist
   Soil Parent material

3. Surficial Geological Report
   2018 - Stone and DiGiacomo-Cohen
   Year Published/Source
   Thin till, some areas of shallow bedrock
   Map Unit
   Nonsorted, nostratified matrix of sand, some silt, and little clay containing scattered pebble, cobble, and boulder clasts
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer:
   Wetland Type

7. Current Water Resource Conditions (USGS): March 2023
   Month/Day/ Year
   Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:
   (Zone II, IWPA, Zone A, EEA Data Portal, etc.)

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-1 (Hole #) 3/21/23 (Date) 8AM (Time) Clear 45 F (Weather) ______ (Latitude) ______ (Longitude)

1. Land Use: Woodlands (e.g., woodland, agricultural field, vacant lot, etc.) Trees (wide range) (Vegetation) Surface stones & boulders present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-8% (Slope (%))

Description of Location: Wooded area

2. Soil Parent Material: coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist Hill (Landform) Summit (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >1,000 feet Drainage Way N/A feet Wetlands >800 feet

Property Line 20 feet Drinking Water Well N/A feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil/Fill Material ☒ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ______ Depth to Weeping in Hole ______ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	A / O	SL	10YR 2/1	-	Cnc : Dpl:	-	-	-	Granular	Friable	
4-18	B	LS	7.5YR 5/8	-	Cnc : Dpl:	-	3-5	0-3	Massive	Friable	
18-48	C	LS	10YR 5/4	-	Cnc : Dpl:	-	5-8	5-8	SG	Loose	Large stones present in C-layer
					Cnc : Dpl:						No GW Observed
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-2 (Hole #) | 3/21/23 (Date) | 8:30AM (Time) | Clear 45 F (Weather) | ____ (Latitude) | ____ (Longitude)

1. Land Use: Woodlands (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (wide range) (Vegetation) | Surface stones & boulders present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-8% (Slope (%))

   Description of Location: Wooded area

2. Soil Parent Material: coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist | Hill (Landform) | Summit (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >1,000 feet | Drainage Way N/A feet | Wetlands >800 feet
   Property Line 50 feet | Drinking Water Well N/A feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil/Fill Material ☒ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ____ Depth to Weeping in Hole ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	A / O	SL	10YR 2/1	-	Cnc : Dpl:	-	-	-	Granular	Friable	
4-20	B	LS	7.5YR 5/8	-	Cnc : Dpl:	-	3-5	0-3	Massive	Friable	
20-60	C	LS	10YR 5/4	-	Cnc : Dpl:	-	5-8	5-8	SG	Loose	Large stones present in C-layer
					Cnc : Dpl:						No GW Observed
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-3 (Hole #) | 3/21/23 (Date) | 9:30AM (Time) | Clear 45 F (Weather) | ____ (Latitude) | ____ (Longitude)

1. Land Use: Woodlands (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (wide range) (Vegetation) | Surface stones & boulders present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-8% (Slope (%))

Description of Location: Wooded area

2. Soil Parent Material: coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist | Hill (Landform) | Summit (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >1,000 feet | Drainage Way N/A feet | Wetlands >1,000 feet
Property Line 200 feet | Drinking Water Well N/A feet | Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ____ Depth to Weeping in Hole ____ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	A / O	SL	10YR 2/1	-	Cnc : Dpl:	-	-	-	Granular	Friable	
4-32	B	LS	7.5YR 4/6	-	Cnc : Dpl:	-	3-5	0-3	Massive	Friable	
32-84	C	LS	2.5Y 6/4	-	Cnc : Dpl:	-	10-15	5-8	SG	Loose	Very gravelly
					Cnc : Dpl:						Large stones present in C-layer
					Cnc : Dpl:						No GW Observed
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-4 (Hole #) 3/21/23 (Date) 10AM (Time) Clear 45 F (Weather) ______ (Latitude) ______ (Longitude)

1. Land Use: Woodlands (e.g., woodland, agricultural field, vacant lot, etc.) Trees (wide range) (Vegetation) Surface stones & boulders present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-8% (Slope (%))

   Description of Location: Wooded area

2. Soil Parent Material: coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist Hill (Landform) Summit (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >1,000 feet Drainage Way N/A feet Wetlands >1,000 feet

   Property Line 200 feet Drinking Water Well N/A feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil/Fill Material ☒ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ______ Depth to Weeping in Hole ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	A / O	SL	10YR 2/1	-	Cnc : Dpl:	-	-	-	Granular	Friable	
4-30	B	LS	7.5YR 4/6	-	Cnc : Dpl:	-	3-5	0-3	Massive	Friable	
30-84	C	LS	10YR 6/2	-	Cnc : Dpl:	-	5-8	5-8	SG	Loose	Large stones present in C-layer
					Cnc : Dpl:						No GW Observed
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-5 (Hole #) | 3/21/23 (Date) | 11AM (Time) | Clear 45 F (Weather) | ______ (Latitude) | ______ (Longitude)

1. Land Use: Woodlands (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (wide range) (Vegetation) | Surface stones & boulders present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-8% (Slope (%))

Description of Location: Wooded area

2. Soil Parent Material: coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist | Hill (Landform) | Summit (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >800 feet | Drainage Way N/A feet | Wetlands >600 feet

Property Line 50 feet | Drinking Water Well N/A feet | Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil/Fill Material ☒ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ______ Depth to Weeping in Hole ______ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	A / O	SL	10YR 2/1	-	Cnc : Dpl:	-	-	-	Granular	Friable	
4-26	B	LS	7.5YR 5/8	-	Cnc : Dpl:	-	3-5	0-3	Massive	Friable	
26-56	C	LS	10YR 5/3	-	Cnc : Dpl:	-	5-8	5-8	SG	Loose	Large stones present in C-layer
					Cnc : Dpl:						No GW Observed
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-6 (Hole #) | 3/21/23 (Date) | 11:30AM (Time) | Clear 45 F (Weather) | ____ (Latitude) | ____ (Longitude)

1. Land Use: Woodlands (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (wide range) (Vegetation) | Surface stones & boulders present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-8% (Slope (%))

   Description of Location: Wooded area

2. Soil Parent Material: coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist | Hill (Landform) | Summit (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >1,000 feet | Drainage Way N/A feet | Wetlands >500 feet

   Property Line 50 feet | Drinking Water Well N/A feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No   If Yes: ☐ Disturbed Soil/Fill Material ☒ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No   If yes: ____ Depth to Weeping in Hole ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	A / O	SL	10YR 2/1	-	Cnc : Dpl:	-	-	-	Gran ular	Friable	
4-39	B	LS	7.5YR 5/8	-	Cnc : Dpl:	-	3-5	0-3	Mass ive	Friable	
39-92	C	LS	10YR 4/6	-	Cnc : Dpl:	-	5-8	5-8	SG	Loose	Large stones present in C-layer
					Cnc : Dpl:						No GW Observed
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-7 (Hole #) 3/21/23 (Date) 1 PM (Time) Clear 45 F (Weather) ______ (Latitude) ______ (Longitude)

1. Land Use: Woodlands (e.g., woodland, agricultural field, vacant lot, etc.) Trees (wide range) (Vegetation) Surface stones & boulders present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-8% (Slope (%))

Description of Location: Wooded area

2. Soil Parent Material: coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist Hill (Landform) Summit (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >500 feet Drainage Way N/A feet Wetlands >200 feet

Property Line 50 feet Drinking Water Well N/A feet Other ______ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ______ Depth to Weeping in Hole ______ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features: Depth	Redoximorphic Features: Color	Redoximorphic Features: Percent	Coarse Fragments % by Volume: Gravel	Coarse Fragments % by Volume: Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
0-4	A / O	SL	10YR 2/1	-	Cnc : Dpl:	-	-	-	Granular	Friable	
4-38	B	LS	7.5YR 4/6	-	Cnc : Dpl:	-	3-5	0-3	Massive	Friable	
38-96	C	LS	10YR 4/4	-	Cnc : Dpl:	-	5-8	5-8	SG	Loose	Large stones present in C-layer
					Cnc : Dpl:						No GW Observed
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-8 (Hole #) 3/21/23 (Date) 1:30 PM (Time) Clear 45 F (Weather) ____ (Latitude) ____ (Longitude)

1. Land Use: Woodlands (e.g., woodland, agricultural field, vacant lot, etc.) — Trees (wide range) (Vegetation) — Surface stones & boulders present (Surface Stones (e.g., cobbles, stones, boulders, etc.)) — 0-8% (Slope (%))

   Description of Location: Wooded area

2. Soil Parent Material: coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist — Hill (Landform) — Summit (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >800 feet — Drainage Way N/A feet — Wetlands >800 feet

   Property Line 50 feet — Drinking Water Well N/A feet — Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No — If Yes: ☐ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No — If yes: ____ Depth to Weeping in Hole ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	A / O	SL	10YR 2/1	-	Cnc : Dpl:	-	-	-	Granular	Friable	
4-32	B	LS	7.5YR 4/6	-	Cnc : Dpl:	-	3-5	0-3	Massive	Friable	
32-72	C	LS	10YR 6/4	-	Cnc : Dpl:	-	5-8	5-8	SG	Loose	Large stones present in C-layer
					Cnc : Dpl:						No GW Observed
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

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City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one): Obs. Hole # _____ Obs. Hole # _____

	Obs. Hole # _____	Obs. Hole # _____	
☐ Depth to soil redoximorphic features	_____ inches	_____ inches	No GW Observed, bot. of test hole used
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches	
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches	

_______________ Index Well Number

_______________ Reading Date

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

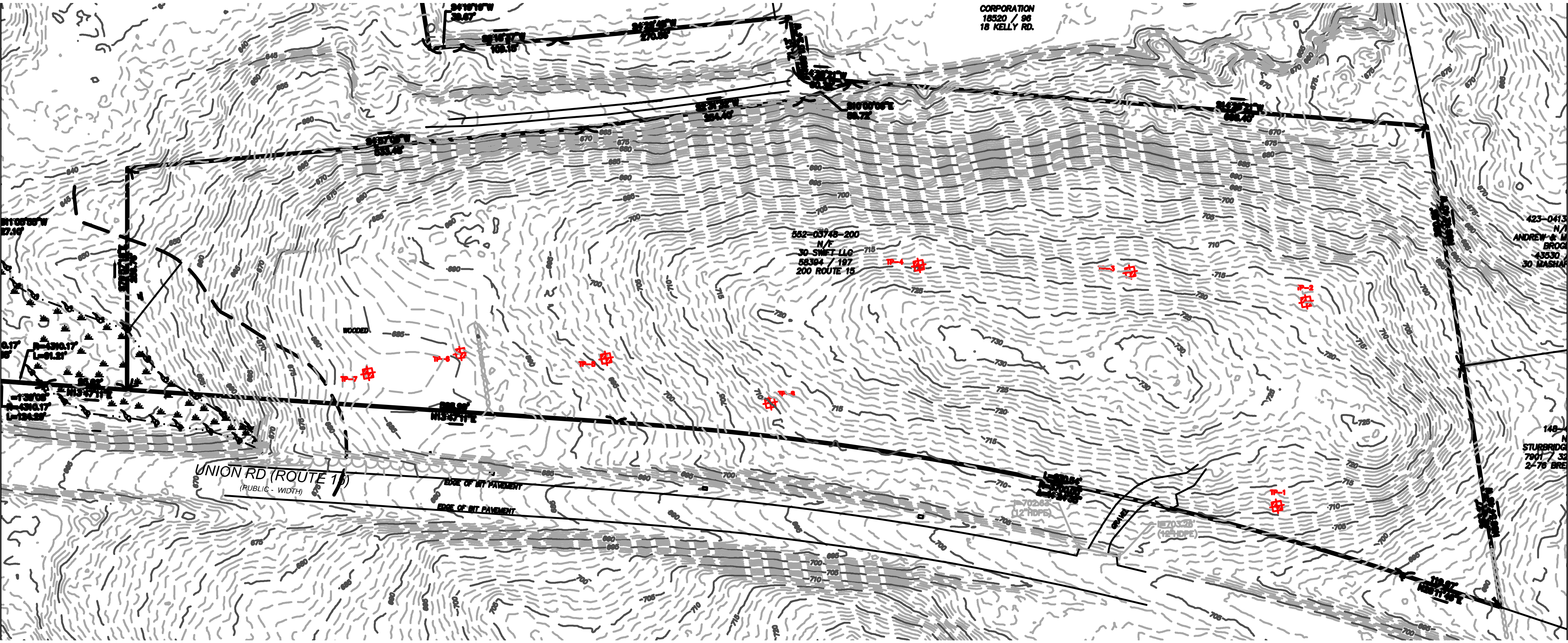
F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Todd MacDonald (signature)	4/10/2023
Signature of Soil Evaluator	Date 6/30/2023
Todd MacDonald, S.E. #14157	6/30/2023
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
N/A	N/A
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:


CORPORATION
18520 / 96
18 KELLY RD.
S10°00'06"E
58.72'
552-03748-200
N/F
30 SWIFT LLC
58394 / 197
200 ROUTE 15
TP-4
TP-3
TP-2
TP-1
TP-5
TP-6
TP-7
WOODED
UNION RD (ROUTE 15)
(PUBLIC - WIDTH)
EDGE OF BIT PAVEMENT
EDGE OF BIT PAVEMENT

APPENDIX E

NOAA ATLAS 14, PRECIPITATION FREQUENCY ESTIMATES

NOAA Atlas 14, Volume 10, Version 3
Location name: Sturbridge, Massachusetts, USA*
Latitude: 42.0775°, Longitude: -72.0925°
Elevation: 711.71 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.338 (0.262-0.430)	0.400 (0.309-0.509)	0.501 (0.385-0.640)	0.584 (0.448-0.751)	0.698 (0.518-0.936)	0.785 (0.570-1.08)	0.874 (0.616-1.24)	0.970 (0.653-1.42)	1.10 (0.715-1.67)	1.21 (0.764-1.87)
10-min	0.479 (0.371-0.610)	0.566 (0.438-0.721)	0.708 (0.546-0.905)	0.826 (0.633-1.06)	0.988 (0.733-1.33)	1.11 (0.808-1.52)	1.24 (0.873-1.76)	1.37 (0.924-2.01)	1.56 (1.01-2.37)	1.71 (1.08-2.65)
15-min	0.564 (0.437-0.717)	0.666 (0.515-0.848)	0.833 (0.642-1.07)	0.972 (0.745-1.25)	1.16 (0.863-1.56)	1.31 (0.951-1.79)	1.46 (1.03-2.07)	1.62 (1.09-2.37)	1.84 (1.19-2.79)	2.01 (1.27-3.12)
30-min	0.765 (0.592-0.973)	0.903 (0.699-1.15)	1.13 (0.870-1.44)	1.32 (1.01-1.69)	1.58 (1.17-2.11)	1.77 (1.29-2.43)	1.98 (1.39-2.80)	2.19 (1.48-3.21)	2.49 (1.61-3.78)	2.73 (1.73-4.23)
60-min	0.965 (0.747-1.23)	1.14 (0.882-1.45)	1.43 (1.10-1.82)	1.66 (1.27-2.14)	1.99 (1.48-2.67)	2.24 (1.63-3.07)	2.49 (1.76-3.54)	2.77 (1.86-4.05)	3.14 (2.04-4.77)	3.44 (2.18-5.34)
2-hr	1.24 (0.965-1.57)	1.45 (1.13-1.84)	1.81 (1.40-2.29)	2.10 (1.62-2.68)	2.50 (1.87-3.34)	2.80 (2.06-3.83)	3.12 (2.23-4.44)	3.49 (2.35-5.08)	4.03 (2.62-6.09)	4.48 (2.85-6.92)
3-hr	1.42 (1.11-1.79)	1.67 (1.31-2.11)	2.08 (1.62-2.63)	2.42 (1.87-3.08)	2.88 (2.17-3.85)	3.23 (2.38-4.42)	3.60 (2.59-5.14)	4.05 (2.74-5.88)	4.73 (3.08-7.12)	5.30 (3.37-8.16)
6-hr	1.78 (1.40-2.23)	2.12 (1.67-2.65)	2.67 (2.09-3.36)	3.13 (2.44-3.95)	3.76 (2.85-5.00)	4.22 (3.14-5.77)	4.73 (3.44-6.76)	5.36 (3.64-7.75)	6.34 (4.14-9.51)	7.20 (4.59-11.0)
12-hr	2.19 (1.74-2.72)	2.66 (2.11-3.31)	3.42 (2.70-4.27)	4.06 (3.18-5.09)	4.93 (3.76-6.53)	5.57 (4.17-7.58)	6.28 (4.59-8.94)	7.16 (4.87-10.3)	8.54 (5.59-12.7)	9.74 (6.23-14.8)
24-hr	2.62 (2.09-3.23)	3.23 (2.57-3.99)	4.22 (3.35-5.23)	5.04 (3.98-6.29)	6.17 (4.73-8.13)	7.00 (5.27-9.47)	7.92 (5.82-11.2)	9.06 (6.19-13.0)	10.8 (7.12-16.1)	12.4 (7.95-18.8)
2-day	3.05 (2.45-3.74)	3.77 (3.03-4.63)	4.95 (3.96-6.10)	5.93 (4.71-7.35)	7.28 (5.62-9.54)	8.27 (6.26-11.1)	9.36 (6.92-13.2)	10.7 (7.36-15.3)	12.9 (8.47-19.0)	14.7 (9.47-22.2)
3-day	3.33 (2.69-4.07)	4.12 (3.32-5.04)	5.41 (4.34-6.63)	6.48 (5.17-7.99)	7.95 (6.15-10.4)	9.03 (6.86-12.1)	10.2 (7.57-14.4)	11.7 (8.05-16.6)	14.1 (9.28-20.7)	16.1 (10.4-24.2)
4-day	3.57 (2.89-4.35)	4.41 (3.56-5.37)	5.78 (4.65-7.07)	6.92 (5.53-8.52)	8.49 (6.59-11.1)	9.64 (7.34-12.9)	10.9 (8.10-15.3)	12.5 (8.61-17.7)	15.0 (9.93-22.0)	17.2 (11.1-25.8)
7-day	4.24 (3.45-5.13)	5.18 (4.21-6.28)	6.73 (5.45-8.19)	8.01 (6.44-9.81)	9.78 (7.63-12.7)	11.1 (8.47-14.7)	12.5 (9.33-17.5)	14.3 (9.89-20.1)	17.2 (11.4-25.1)	19.6 (12.7-29.3)
10-day	4.92 (4.01-5.93)	5.92 (4.83-7.15)	7.56 (6.14-9.17)	8.92 (7.20-10.9)	10.8 (8.44-13.9)	12.2 (9.33-16.1)	13.7 (10.2-19.0)	15.6 (10.8-21.8)	18.5 (12.3-27.0)	21.1 (13.7-31.4)
20-day	7.10 (5.83-8.50)	8.16 (6.69-9.78)	9.90 (8.09-11.9)	11.3 (9.20-13.7)	13.3 (10.4-16.9)	14.8 (11.3-19.3)	16.4 (12.1-22.2)	18.2 (12.7-25.3)	20.9 (14.0-30.2)	23.1 (15.0-34.2)
30-day	8.93 (7.36-10.7)	10.0 (8.25-12.0)	11.8 (9.67-14.1)	13.3 (10.8-16.0)	15.3 (12.0-19.3)	16.8 (12.9-21.7)	18.4 (13.6-24.6)	20.1 (14.1-27.9)	22.5 (15.1-32.4)	24.3 (15.9-35.9)
45-day	11.2 (9.26-13.3)	12.3 (10.2-14.6)	14.1 (11.6-16.9)	15.7 (12.8-18.8)	17.7 (14.0-22.2)	19.4 (14.8-24.7)	21.0 (15.4-27.7)	22.5 (15.8-31.0)	24.5 (16.5-35.2)	26.0 (16.9-38.2)
60-day	13.1 (10.8-15.5)	14.2 (11.8-16.8)	16.1 (13.3-19.2)	17.7 (14.5-21.2)	19.8 (15.6-24.7)	21.6 (16.5-27.4)	23.2 (17.0-30.4)	24.6 (17.4-33.9)	26.4 (17.8-37.7)	27.5 (18.0-40.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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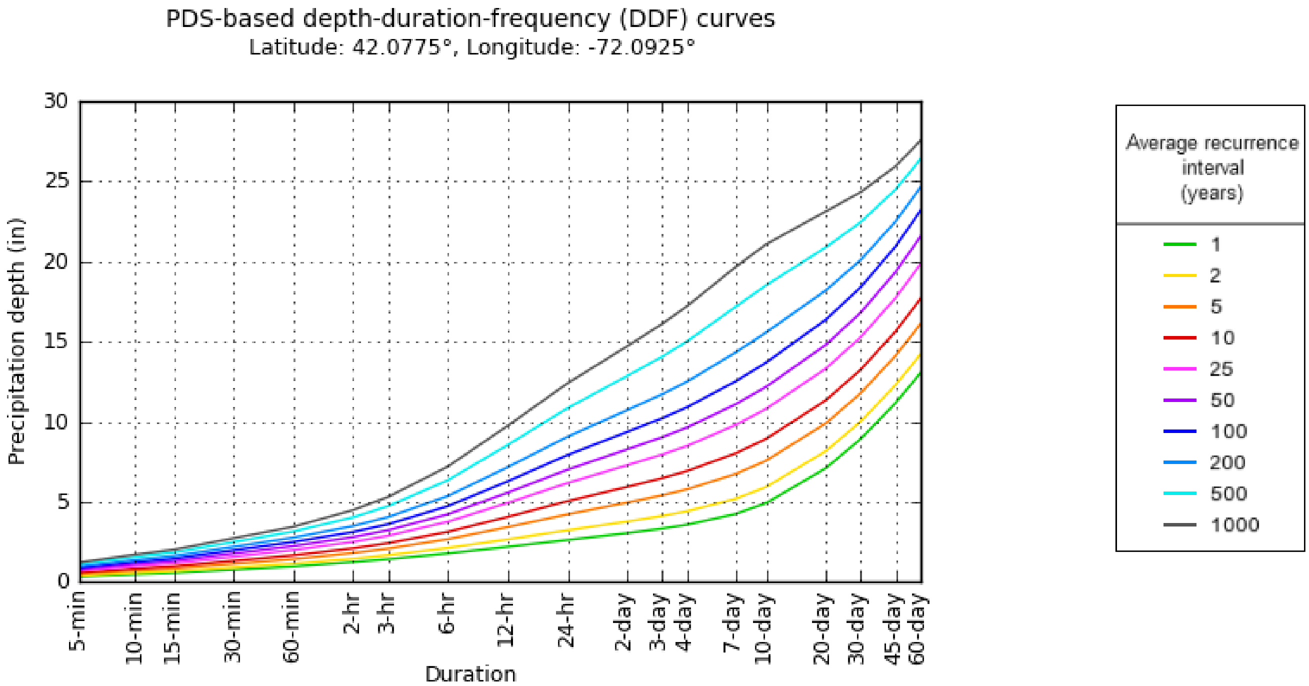
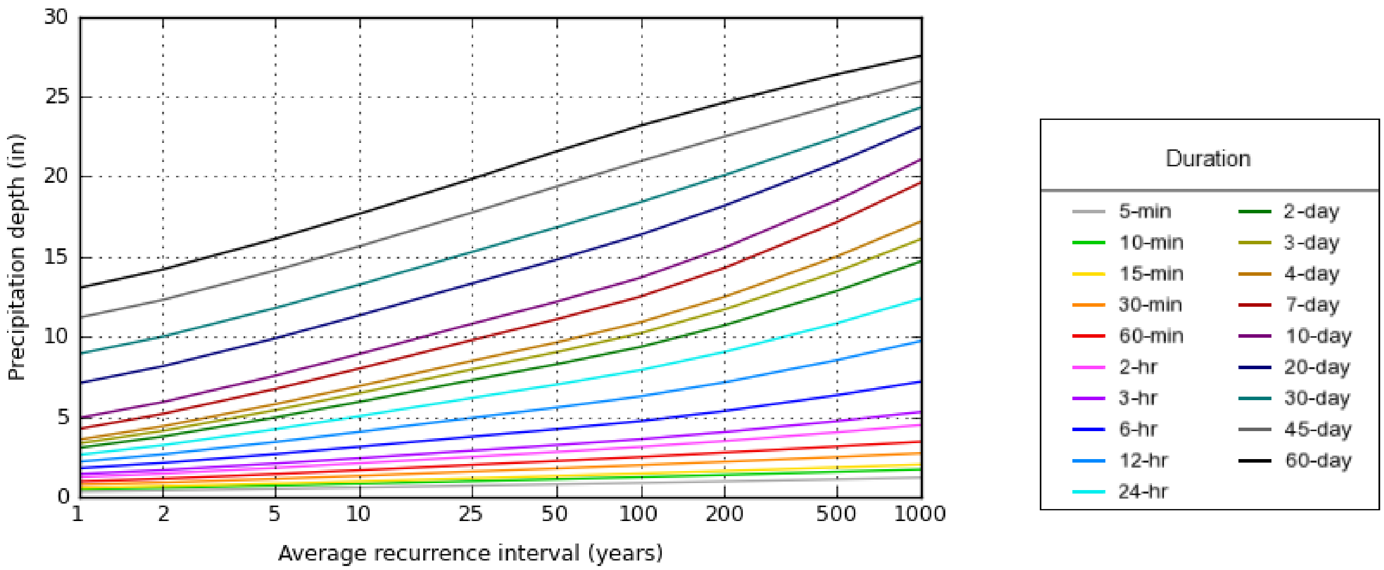
PF graphical





NOAA Atlas 14, Volume 10, Version 3 Created (GMT): Thu Dec 8 19:16:22 2022

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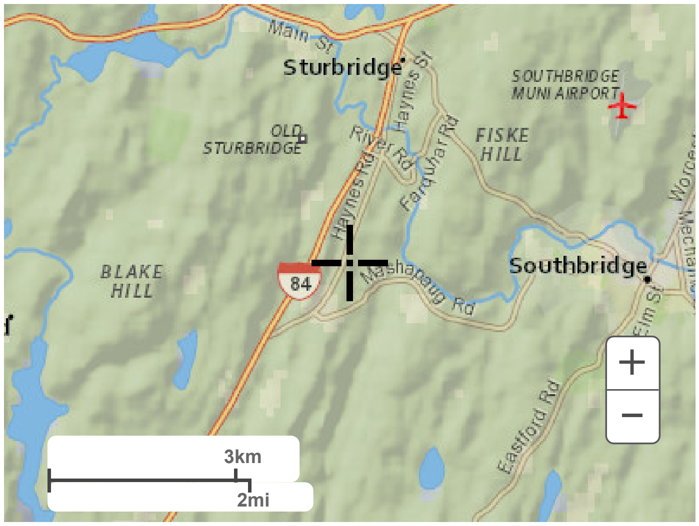
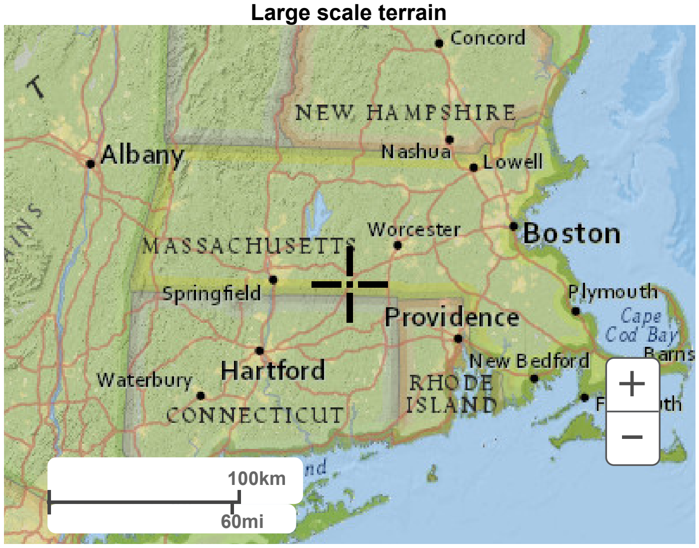
Maps & aerials

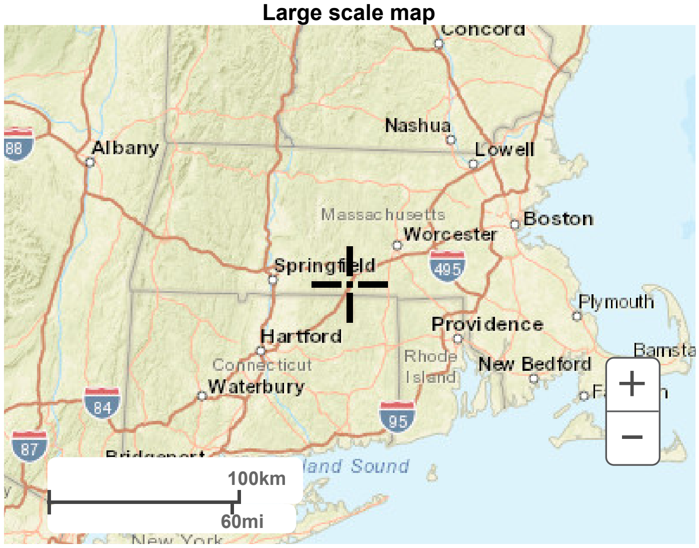
Small scale terrain



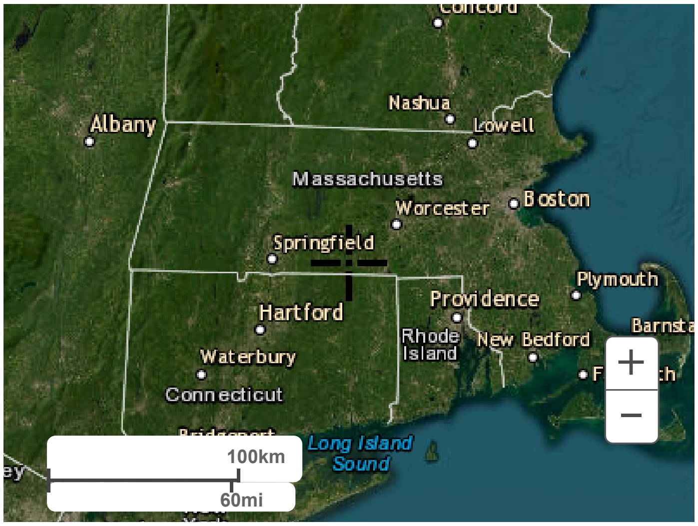
Large scale terrain



Large scale map



Large scale aerial



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