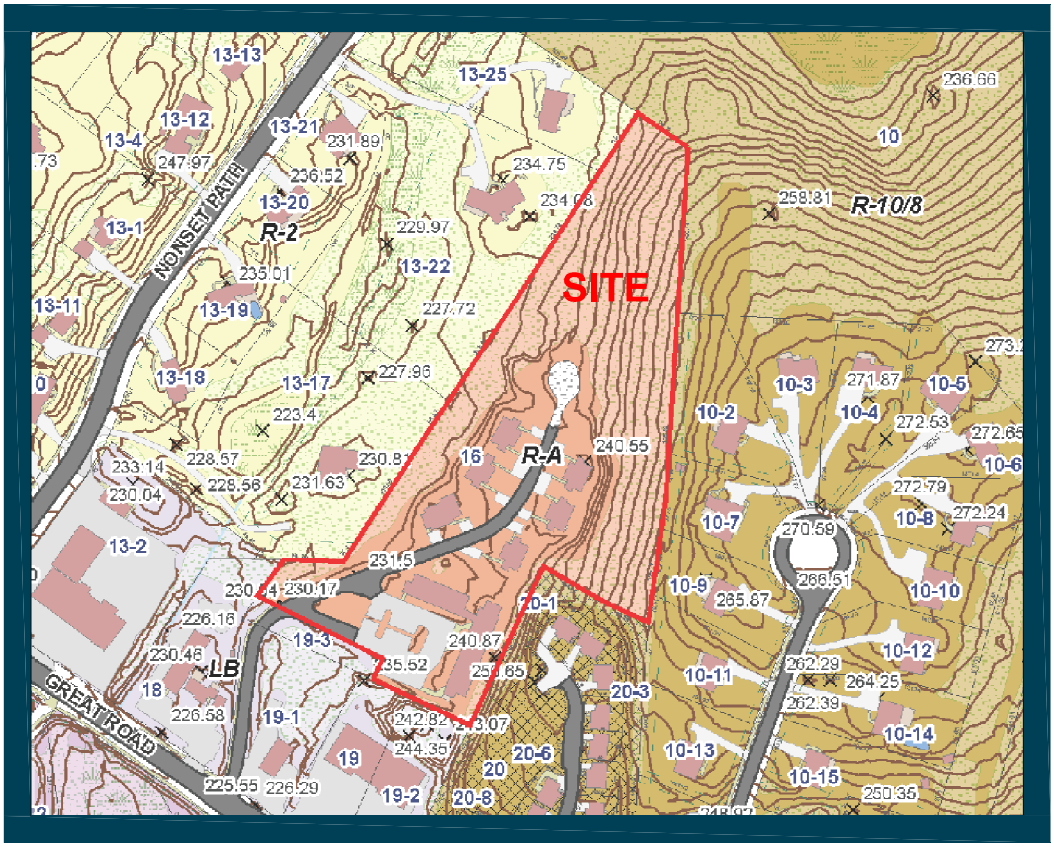
ALLEN & MAJOR ASSOCIATES, INC.

SITE LOCUS: N.T.S.



MCCARTHY VILLAGE II
SITE DEVELOPMENT
ACTON, MASSACHUSETTS
DRAINAGE REPORT

DATE PREPARED: JUNE 1, 2010

CLIENT:
ACTON HOUSING AUTHORITY
68 WINDSOR AVE
ACTON, MA 01720

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
100 COMMERCE WAY
WOBURN, MASSACHUSETTS 01888

A&M PROJECT NO. : 1298-08

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Section 1.0 Drainage Report

• INTRODUCTION

The purpose of this drainage report is to provide an overview of the proposed stormwater management system for the site development of McCarthy Village II, Acton, MA. The report will show by means of narrative, calculations and exhibits that there is no increase in peak rate of runoff from the site at each of the study points for all design storm events.

The proposed site improvements include six new duplex residential structures for a total of twelve dwelling units. There are two parking spaces per dwelling unit for a total of twenty-four spaces. The proposed new units will be accessed by an extension of the existing McCarthy Village access drive.

The stormwater management system incorporates structural and non-structural BMP's to provide stormwater quality treatment and conveyance. Pervious pavers are used within parking areas to reduce stormwater runoff. Drywells capture runoff from rooftop areas, and a subsurface infiltration system using chambers mitigates for the remainder of the site and offsite contributing area.

• SITE CATEGORIZATION FOR STORMWATER REGULATIONS

The proposed site development of McCarthy Village II is considered a "new" development under the MA DEP Stormwater Management Standards due to the net increase in impervious area. A new development project is required to meet the all of Stormwater Management Standards.

• DRAINAGE ANALYSIS METHODOLOGY

The peak rate of runoff was determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.

2. HydroCAD© Stormwater Modeling System by HydroCAD Software Solutions LLC, version 8.50, 2008. The HydroCAD program was used to generate the runoff hydrographs for the watershed areas, to determine discharge/stage/storage characteristics for the detention basins, to perform drainage routing and to combine the results of the runoff hydrographs. HydroCAD uses the TR-20 methodology of the SCS Unit Hydrograph procedure (SCS-UH).

3. Soil Survey of Middlesex County Massachusetts by United States Department of Agriculture, NRCS. Soil types and boundaries were obtained from this reference.

• PEAK RATE OF RUNOFF

The storm water runoff analysis of the existing and proposed conditions includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR-55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD 8.50 computer program. Further, the analysis has been prepared in accordance with the Town of Acton requirements and standard engineering practices. The peak rate of runoff has been estimated for each watershed during the 2, 10, 25, 50 and 100-year storm events. The rainfall intensities are based on the NRCC publication RR93-5 (The Cornell Study).

The stormwater runoff model shows that the proposed site development reduces the rate of runoff during all storm events at the identified point of analysis. The following tables provide a summary of the estimated

peak rate at the Study Point during each of the design storm events. The HydroCAD worksheets are included in Section 3 and 4 of this report.

STUDY POINT #1

	2-Year	10-Year	25-Year	50-Year	100-Year
Existing Runoff (CFS)	1.05	3.58	5.36	6.81	9.64
Redeveloped Runoff (CFS)	0.69	3.45	5.33	6.73	9.28
DECREASE	0.36	0.13	0.03	0.08	0.36

• MA DEP STORMWATER PERFORMANCE STANDARDS

The MA DEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for storm water management. The following section outlines how the proposed Stormwater Management System meets the standards set forth by the Policy.

BMP's implemented in the design include:

Deep sump catch basin with hood
Rooftop Drywells
Subsurface Infiltration System
Pervious Pavers
Specific maintenance schedule

Stormwater Best Management Practices have been incorporated into the design of the project to mitigate the anticipated pollutant loading. An Operations and Maintenance Plan has been developed for the project, which addresses the long term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include hay bale and/or silt fence barriers, inlet sediment traps, diversion channels, slope stabilization, and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are as follows:

1. *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:*

a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

5. For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

6. Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

7. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

8. A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

9. A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

10. All illicit discharges to the stormwater management system are prohibited.

The following calculations demonstrate that the proposed stormwater management system is in compliance with the standards as outlined in the MA DEP Stormwater Management Handbook.

- STANDARD #1: The proposed redevelopment will not introduce any new outfalls with direct discharge to a wetland area or waters of the Commonwealth of Massachusetts.

- STANDARD #2: The proposed development has been designed so that the post-development peak discharge rates do not exceed the predevelopment peak discharge rates. A summary of the existing and proposed discharge rates are included within this document (See page 1-3).

- STANDARD #3: The pre-development annual recharge for the site has been approximated in the post-developed condition. The stormwater infiltration system has been designed to collect and infiltrate stormwater runoff from the majority of the site. Five rooftop drywells provide recharge as well.

  The on-site soils were identified using the Middlesex County Interim Soil Survey Report, Fourth Edition, 1995. The project area is primarily soil type 420B – Canton, HSG B.

  On-site Impervious Area = 23,094 square feet

  Recharge Volume (*Rv*) = *(F) x (Impervious Area)*

  Where:

  Rv = *Required Recharge Volume, expressed in cubic feet*
  F = *Target Depth Factor associated with each Hydrologic Soil Group*
  Impervious Area = *proposed pavement, sidewalk, rooftop in square feet*

  Recharge Volume (*Rv*) = *(F) x (Impervious Area)*
  = (0.35 inches)*(1/12 inches/ft)* (23,094 square feet)
  = 674 ft^3

Recharge Provided	Infiltration System #1 below outlet	= 1,130 ft^3
	DW1 through 5	= 415 ft^3
	Total Storage/Recharge	= 1,545 ft^3

  1,545 ft^3 > 674 ft^3 Required

- STANDARD #4: Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long Term Pollution Prevention Plan.

  Water Quality Volume (V_{WQ}) = (D_{WQ}/12 inches/foot)*(A_{IMP} * 43,560 s.f./acre)

  V_{WQ} = *Required Water Quality Volume in cubic feet*

  D_{WQ} = *Water Quality Depth*
  - *one inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from a land use with higher potential pollutant loading (LUHPPL), or exfiltration to soils with infiltration rate greater than 2.4 inches/hour.*
  - *½-inch for discharges to other areas.*

  A_{IMP} = *Impervious Area (in acres)*

The proposed project will use the ½-inch water quality depth. The proposed site parking and access drive are not considered a land use with higher potential pollutant loads. The stormwater runoff from the impervious areas is routed through catch basin with deep sump prior to discharge to the infiltration system. Further the infiltration system routes the "first flush" volume through the isolator row to protect the remaining stone and chambers from sedimentation. The TSS removal rate is summarized below.

BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Infiltration System #1 (with pretreatment)	0.80	1.00	0.80	0.20

TOTAL TSS REMOVAL	0.80 or 80%

- STANDARD #5: The site is not considered a land use with higher potential pollutant loads.

- STANDARD #6: The project site does not discharge within a Zone II or Interim Wellhead Protection Area or near a critical area. Critical Areas are Outstanding Resource Waters as designated in 314 CMR 4.00, Special Resource Waters as designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02, bathing beaches as defined in 105 CMR 445.000, cold-water fisheries as defined in 314 CMR 9.02 and 310 CMR 10.04, and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04.

- STANDARD #7: The proposed project is not considered a re-development project under the Stormwater Management Handbook guidelines as there is an increase in the amount of total impervious area.

- STANDARD #8: A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities has been developed. A detailed Erosion and Sedimentation Control Plan is included in the Construction Drawings. A Pollution Prevention Plan is included within this document. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.

- STANDARD #9: A Long-Term Operation and Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. See Section 2.0 of this report.

- STANDARD #10: There are no expected illicit discharges to the stormwater management system. The applicant will submit the Illicit Discharge Compliance Statement prior to the discharge of stormwater runoff to the post-construction stormwater best management practices and prior to the issuance of a Certificate of Compliance.

WPA – STORMWATER MANAGEMENT FORM CHECKLIST

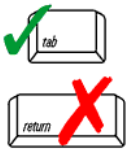
See following pages

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): Pervious Pavers

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

Section 2.0 Operation & Maintenance Plan

INTRODUCTION

In accordance with the standards set forth by the Stormwater Management Policy issued by the Department of Environmental Protection (DEP), Allen & Major Associates, Inc. has prepared the following Operation and Maintenance Plan for the development of McCarthy Village II, Acton, MA.

The plan is broken down into three major sections. The first section describes construction-related erosion and sedimentation controls (Construction Period). The second section describes the long term pollution prevention measures (Long Term Pollution Prevention Plan). The third section is a post-construction operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long Term Maintenance Plan).

• NOTIFICATION PROCEDURES FOR CHANGE OF RESPONSIBILITY FOR O&M

The Stormwater Management System (SMS) for this project is owned by the Acton Housing Authority (owner). The owner shall be legally responsible for the long-term operation and maintenance of this SMS as outlined in this Operation and Maintenance (O&M) Plan. Should ownership of the SMS change, the owner will continue to be responsible until the succeeding owner shall notify the Town of Acton that the succeeding owner has assumed such responsibility. Upon subsequent transfers, the responsibility shall continue to be that of transferring owner until the transferee owner notifies the Town of Acton of its assumption of responsibility.

In the event the SMS will serve multiple lots/owners, such as the subdivision of the existing parcel or creation of lease areas, the owner(s) shall establish an association on other legally enforceable arrangements under which the association or a single party shall have legal responsibility for the operation and maintenance of the entire SMS. The legal instrument creating such responsibility shall be recorded with the Registry of Deeds and promptly following its recording, a copy thereof shall be furnished to the Commission.

• CONTACT INFORMATION

Stormwater Management System Owner:

Acton Housing Authority
68 Windsor Ave
Acton, MA 01720
Phone: (978) 263-5339

Emergency Contact Information:

- o Allen & Major Associates, Inc. (Site Civil Engineer) Phone (781) 935-6889
- o Acton Public Works Phone (978) 264-9628
- o Acton Conservation Commission Phone (978) 264-9631
- o Acton Fire Department (non-emergency line) Phone (978) 264-9645

- **CONSTRUCTION PERIOD**

1. Contact the Acton Conservation Commission Administrator and the Acton Engineering Department at least fourteen (14) days prior to start of construction to schedule a pre-construction meeting.

2. Install the haybales, silt fence and construction fencing as shown on the Erosion and Sediment Control Plans.

3. Install the construction entrances at the locations shown on the Erosion and Sedimentation Control Plan.

4. Site access shall be achieved only from the designated construction entrances.

5. Stockpiles shall be stabilized with erosion control matting or temporary seeding whenever practicable.

6. Install silt sacks and hay bales around each drain inlet as soon as practicable.

7. Install stone check dams at locations shown on the Erosion and Sediment Control plans as soon as practicable.

8. Install Erosion control fabric on all vegetated slopes as shown on the Erosion and Sediment Control plans as soon as practicable.

9. All erosion control measures shall be inspected weekly and after every rainfall event.

10. All erosion control measures shall be maintained, repaired or replaced as required or at the direction of the owner's engineer, the Town Engineer, or the Town Conservation Agent.

11. Sediment accumulation up-gradient of the haybales and silt fence greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.

12. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.

13. The contractor shall comply with the General and Erosion Notes as shown on the Site Development Plans and Specifications.

14. The stabilized construction entrances shall be inspected weekly. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.

15. Dust pollution shall be controlled using on-site water trucks and or an approved soil stabilization product.

- **LONG TERM POLLUTION PREVENTION PLAN**

Standard #4 from the MA DEP Stormwater Management Handbook requires that a Long Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures for the LTPPP.

- **HOUSEKEEPING**

  The proposed site development has been designed to maintain a high level of water quality treatment for all stormwater discharges. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan is a strict and complete manner.

- **STORING OF MATERIALS AND WASTE PRODUCTS**

  There are no proposed exterior (un-covered) storage areas. The trash and waste program for the site includes interior trash storage. There will be a trash contractor used to pick up the waste material on a regular basis. The stormwater drainage system has catch basins with hooded outlets and deep sumps designed to capture trash and debris.

- **VEHICLE WASHING**

  Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system. The proposed project does not include any designated vehicle washing areas.

- **SPILL PREVENTION AND RESPONSE**

  Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the building and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

  1. Spill Hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
  2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
  3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
  4. All spills shall be cleaned up immediately after discovery
  5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at 888-304-1133.
  6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

- **MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPED AREAS**

It should be recognized that this is a general guideline towards achieving high quality and well groomed landscaped areas. The grounds staff / landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis. Questions regarding landscape work in the Riverfront Area and Floodplain should be directed to the civil engineer of record and/or the Acton Conservation Commission Agent.

- **Fertilizer**

Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) should be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

Only slow-release organic fertilizers should be used in the landscaped areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of developed areas on site will be performed within manufacturers labeling instructions and shall not exceed an NPK ration of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Additionally, the fertilizer will include a slow release element.

- **Suggested Aeration Program**

In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The soil cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

- **Landscape Maintenance Program Practices:**
  - **Lawn**
    1. Mow a minimum of once a week in spring, to a height of 2" to 2 1/2" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cut, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
    2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
    3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
    4. Do not remove grass clippings after mowing.
    5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.
  - **Shrubs**
    1. Mulch not more than 3" depth with shredded pine or fir bark.
    2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
    3. Fertilize with ½ lb. slow-release fertilizer (see above section on Fertilizer) every second year.
    4. Hand prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.
  - **Trees**
    1. Provide aftercare for new tree plantings for the first three years.
    2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
    3. Water once a week for the first year; twice a month the second, once a month the third year.
    4. Prune trees on a four-year cycle.

○ **STORAGE AND USE OF HERBICIDES AND PESTICIDES**

Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP) will be retained who is licensed with the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Agricultural Resources

The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor or structural pests. 333 CMR 13.08.

Before beginning each application, the applicator must post a Department approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company
2. Date and time of the application;
3. Name and license number of the applicator
4. Target pests
5. Name and EPA Registration Number of pesticide products applied

The notification must be made in writing. The intent is so that individuals, who wish to avoid exposure or want to avoid encountering the applicator, can make necessary arrangements. Applicators are required by law to follow all directions on the pesticide label and must take all steps necessary to avoid applications with people present in a room or area to be treated. Individuals occupying a room or area to be treated at the time of application shall be informed of the procedure. Whenever possible, the applicator should not apply pesticides with anyone present. That may mean treating other areas and returning when occupants have left, asking people to leave the area while the work is being done, or treating before or after people occupy the room. If people do not leave, the applicator must make it clear that he is there to apply pesticides. The applicator will be prepared to provide whatever information possible about the pesticides and techniques used.

- **PET WASTE MANAGEMENT**

There is a likelihood that pet waste will be present along the bikeway, which runs along the northern side of the site. The Town of Acton has regulations regarding the care of pets within public areas. The Town has a leash law and a pet waste law that requires pet owners to remove pet waste from public areas. The owner's landscape crew (or designee) shall remove any obvious pet waste that has been left behind by pet owners within the project area. The pet waste shall be disposed of in accordance with local and state regulations.

- **OPERATIONS AND MANAGEMENT OF SEPTIC SYSTEMS**
  There are no proposed septic systems within the limits of the project. The sanitary sewer is proposed to connect to the existing MWRA line, which runs through the site. The proposed connection requires a Direct Connection Permit from the MWRA.

- **MANAGEMENT OF DEICING CHEMICALS AND SNOW**
  Snow will be stockpiled on site within open space areas until the stockpile areas become a hazard to the daily operations of the site. At that point, snow will be disposed of off-site. It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to Massachusetts DEP, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-01, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations.

  The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. The de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. De-icing agents will not be stored outside.

- **LONG TERM MAINTENANCE PLAN – FACILITIES DESCRIPTION**

The following is a description of the stormwater management system for the project site.

- **STORMWATER COLLECTION SYSTEM – ON SITE**
  The stormwater collection system is a catch basin located at a low point within the limits of the paved area. The stormwater runoff from the building rooftops is collected using roof drains. The stormwater is conveyed to the drywells using exterior roof leaders.

STANDARD OPERATION AND MAINTENANCE PROTOCOL

This section will present the inspection and maintenance procedures associated with the stormwater collection system.

EQUIPMENT	MAINTENANCE ITEM	FREQUENCY
Catch Basins	Inspect grates and hoods	Quarterly
	Remove sediment from catch basin using a vacuum truck.	Quarterly or when sediment depth is 24"
Drain Manholes	Inspect cover for damage. Inspect pipe inlets and bottom for sign of infiltration/inflow. Perform inspection during dry weather.	Quarterly
Pavement Surface	Perform roadway sweeping following the spring thaw to remove any traction sand applied during the winter months.	Semi-annually (Early spring & late fall)
Outfall locations	Inspect for sign of erosion or displaced stone. Replace outlet protection stone if needed. Inspect flap valves or Tideflex valves at outfall locations for proper operation.	Annually

SUPPLEMENTAL INFORMATION (See following pages)

OPERATION & MAINTENANCE SCHEDULE & CHECKLIST
STORMTECH ISOLATOR ROW OPERATION & MAINTENANCE

OPERATION & MAINTENANCE PLAN SCHEDULE

Project: McCarthy Village II
Address: Acton, MA

Party Responsible for O & M Plan: Acton Housing Authority
Address: 68 Windsor Ave
Acton, MA
Phone:

Date: 6/1/2010

Structure or Task	Maintenance Activity	Schedule/Notes	Annual Maintenance Cost (% of construction cost)	Inspection Performed	
				Date:	By:
Street Sweeping	Sweep, power broom or vacuum paved areas and Permeable Interlocking Concrete Pavement (PICP) Areas.	Sweep paved areas and PICP as needed, but not less than four times annually.	$1,000		
		Submit information that confirms that all street sweepings have been disposed in accordance with state and local requirements			
Storm Water Management System					
Subsurface Infiltration Systems	Cleaning and removal of debris after major storm events	Perform as necessary, but not less than four times annually as well as after every storm exceeding 1" of rainfall. Remove sediment when basin is thoroughly dry.	$500		
	Sediment cleanout.				
	Mowing and maintenance of upland vegetated areas.	At least monthly during the growing season.			
Outlet Control Structure(s)	Vacuum.	Periodic cleaning of Outlet Control Structures as needed.	$500		
Mosquito Control	CB management targeted larviciding treatment to CB's and all storm drains to control mosquitoes in their aquatic stages.	Surveillance is a non chemical inspection method that involves classification of mosquito breeding sites, larval presents, and survey.	Varies		
Snow Storage	Debris shall be cleared from the site and properly disposed of at the end of the snow season, but shall be cleared no later than May 15.	Avoid dumping snow removal over catch basins, in detention ponds, sediment forebays, rivers, wetlands, and flood plain. (See Site Plan for appropriate locations)	Varies		

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Isolator™ Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator™ Row

1.1 INTRODUCTION

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

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

1.2 THE ISOLATOR™ ROW

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

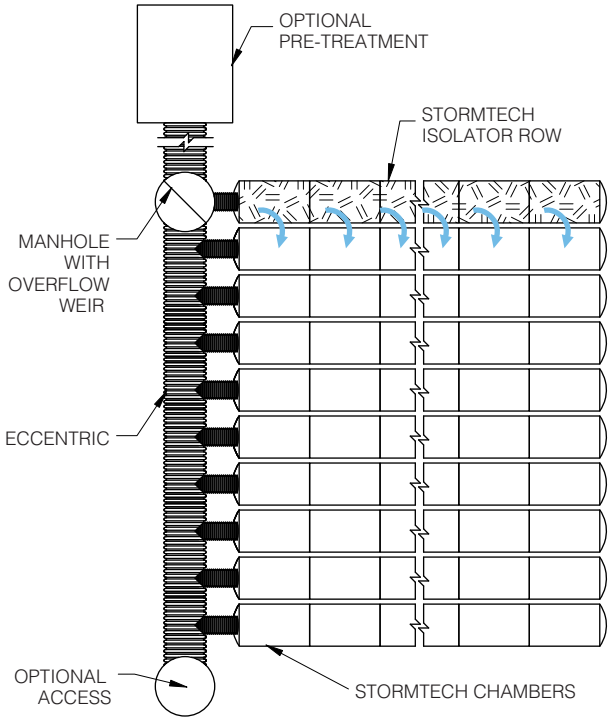
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber.

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

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

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

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

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

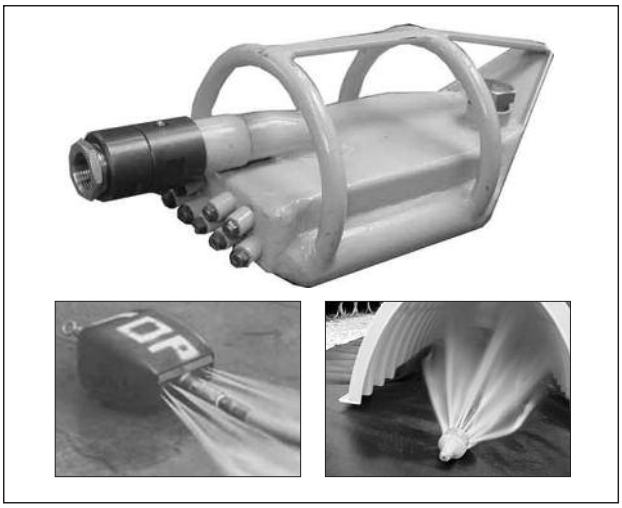
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

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

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

2.2 MAINTENANCE

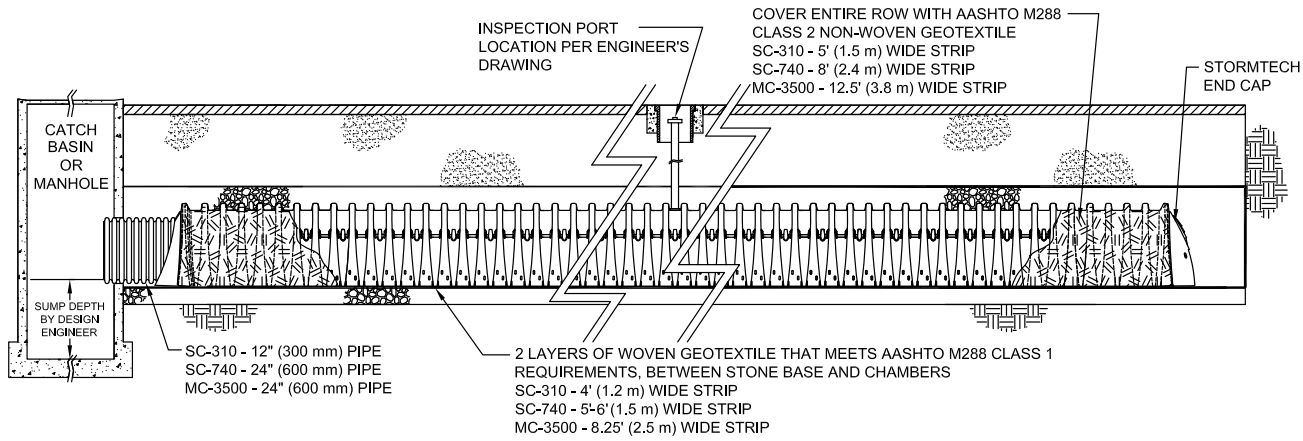
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via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



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

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

StormTech Isolator Row (not to scale)



3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

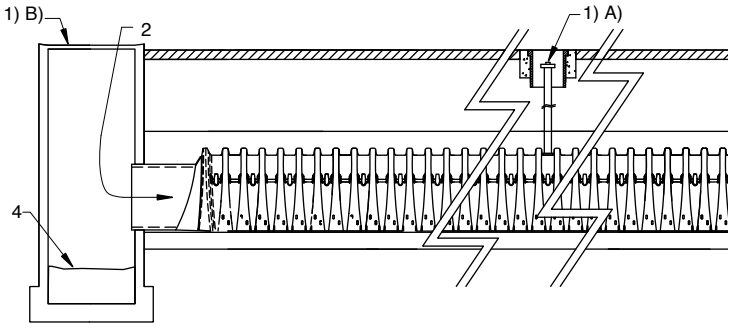
i. Remove cover from manhole at upstream end of Isolator Row

ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry
2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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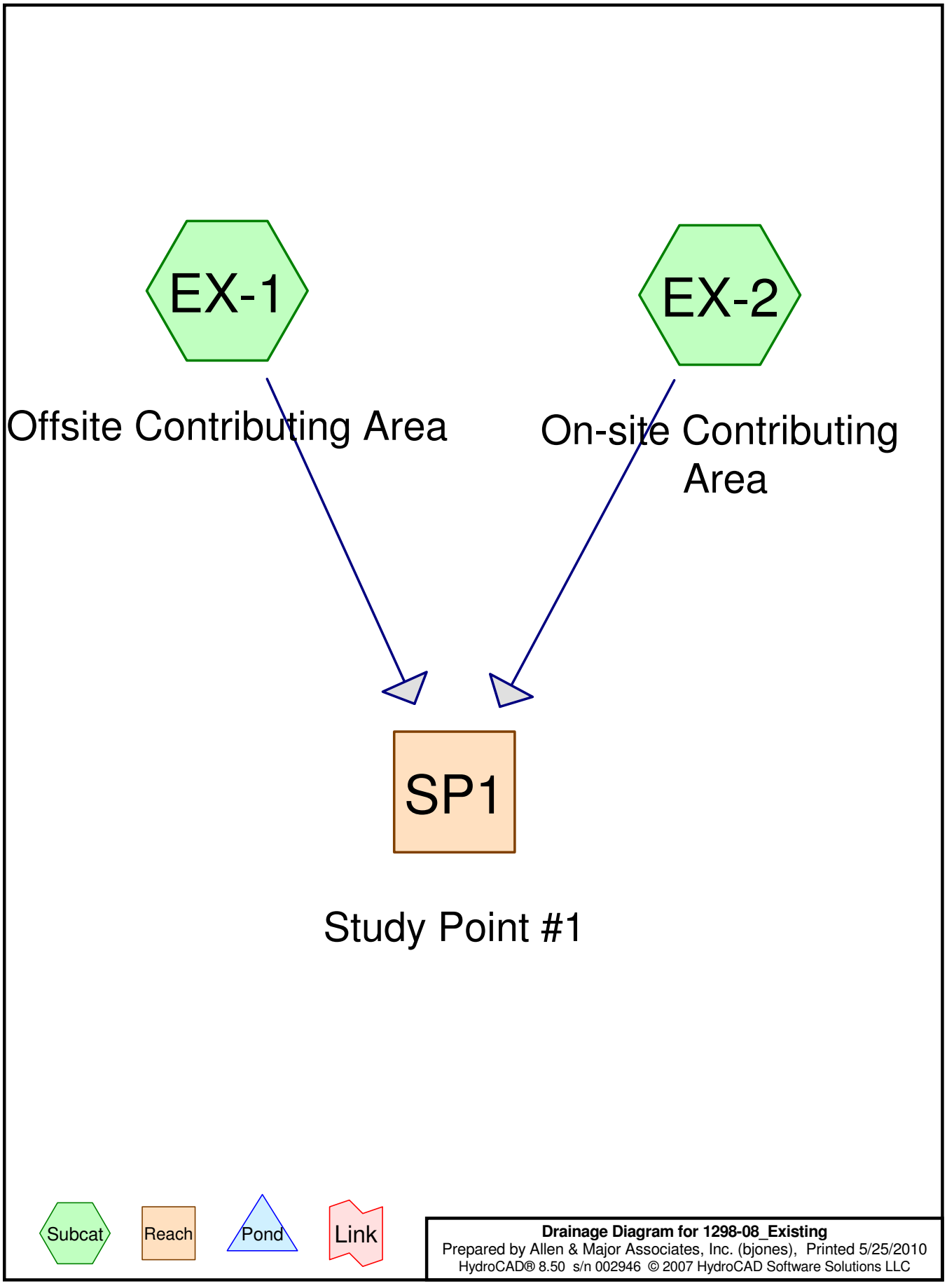
Section 3.0 HydroCAD Worksheets – Existing Conditions


EX-1
EX-2
Offsite Contributing Area
On-site Contributing Area
SP1
Study Point #1
Subcat
Reach
Pond
Link
Drainage Diagram for 1298-08_Existing
Prepared by Allen & Major Associates, Inc. (bjones), Printed 5/25/2010
HydroCAD® 8.50 s/n 002946 © 2007 HydroCAD Software Solutions LLC

Summary for Subcatchment EX-1: Offsite Contributing Area

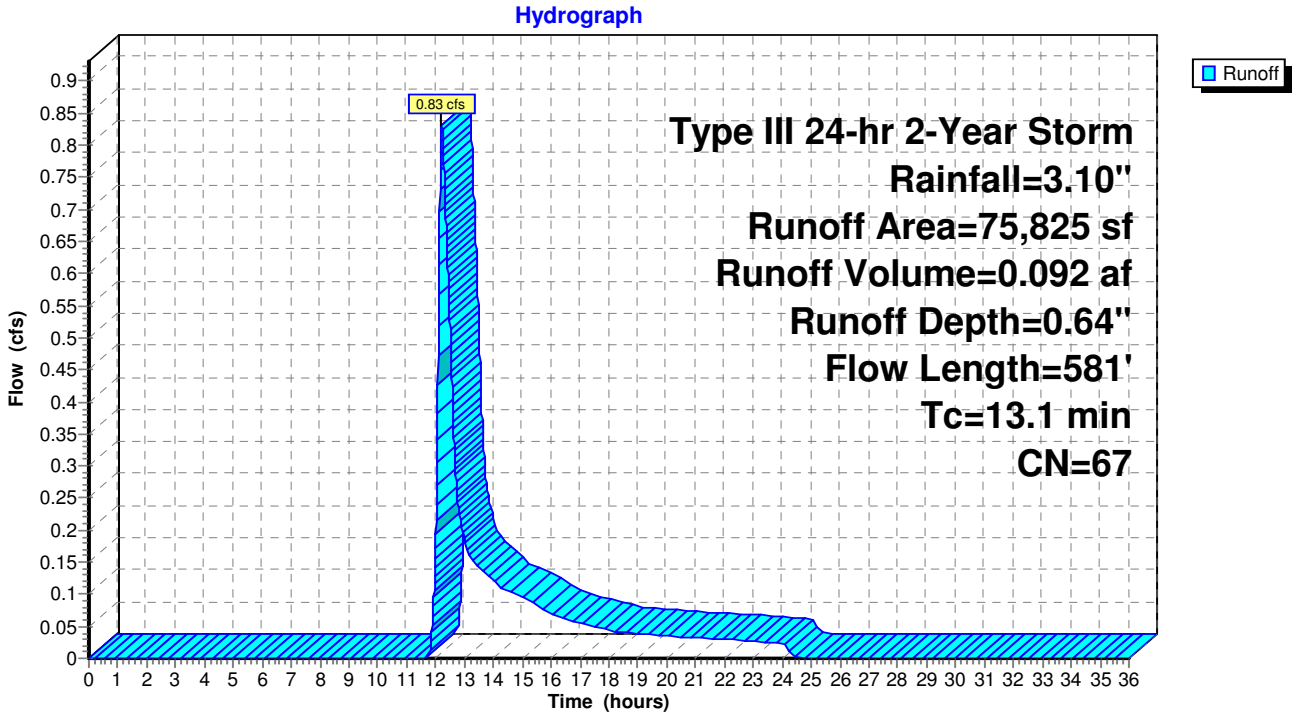
Runoff = 0.83 cfs @ 12.21 hrs, Volume= 0.092 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area



Summary for Subcatchment EX-2: On-site Contributing Area

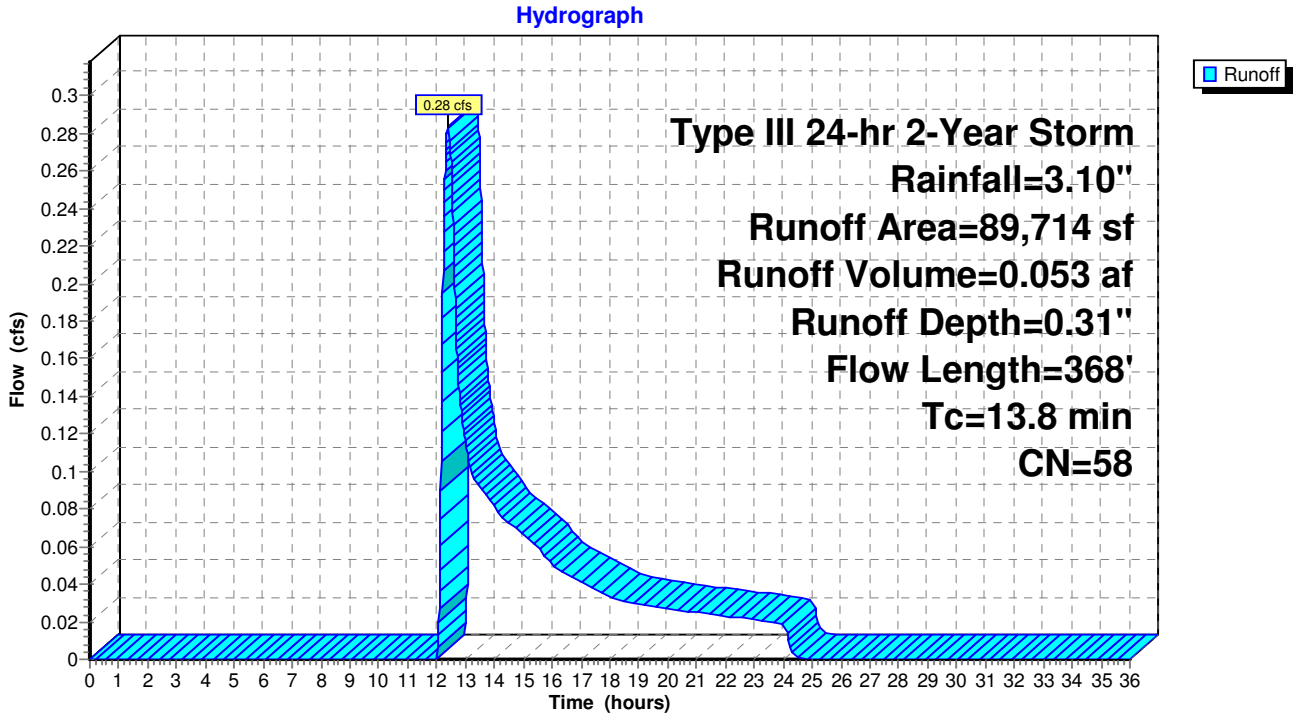
Runoff = 0.28 cfs @ 12.40 hrs, Volume= 0.053 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	4,980	98	Roadway & Gravel Drive
	12,112	61	>75% Grass cover, Good, HSG B
	72,622	55	Woods, Good, HSG B
	89,714	58	Weighted Average
	84,734		Pervious Area
	4,980		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.1200	0.08		**Sheet Flow, A to B** Woods: Dense underbrush n= 0.800 P2= 3.08"
1.0	100	0.1100	1.66		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
0.5	114	0.0500	3.60		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
1.6	104	0.0500	1.12		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.8	368	Total			

Subcatchment EX-2: On-site Contributing Area

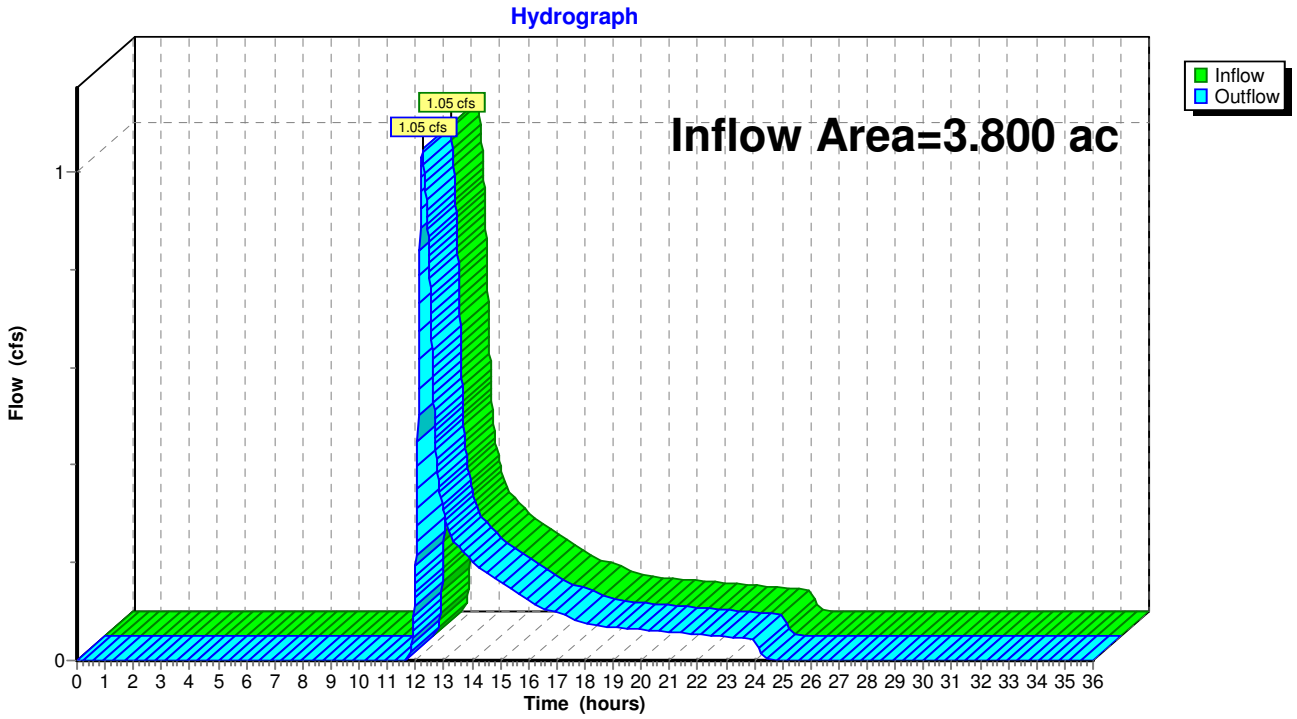


Summary for Reach SP1: Study Point #1

Inflow Area = 3.800 ac, 10.89% Impervious, Inflow Depth = 0.46" for 2-Year Storm event
Inflow = 1.05 cfs @ 12.24 hrs, Volume= 0.145 af
Outflow = 1.05 cfs @ 12.24 hrs, Volume= 0.145 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Summary for Subcatchment EX-1: Offsite Contributing Area

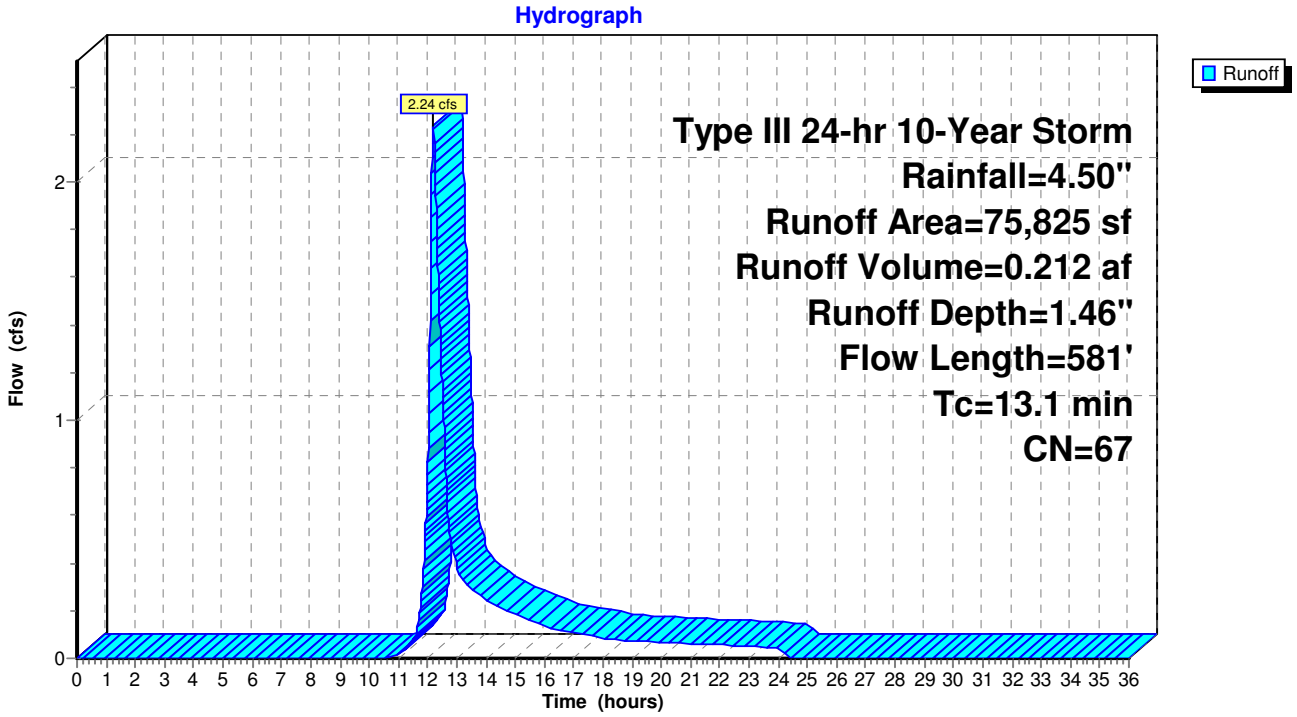
Runoff = 2.24 cfs @ 12.19 hrs, Volume= 0.212 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area



Summary for Subcatchment EX-2: On-site Contributing Area

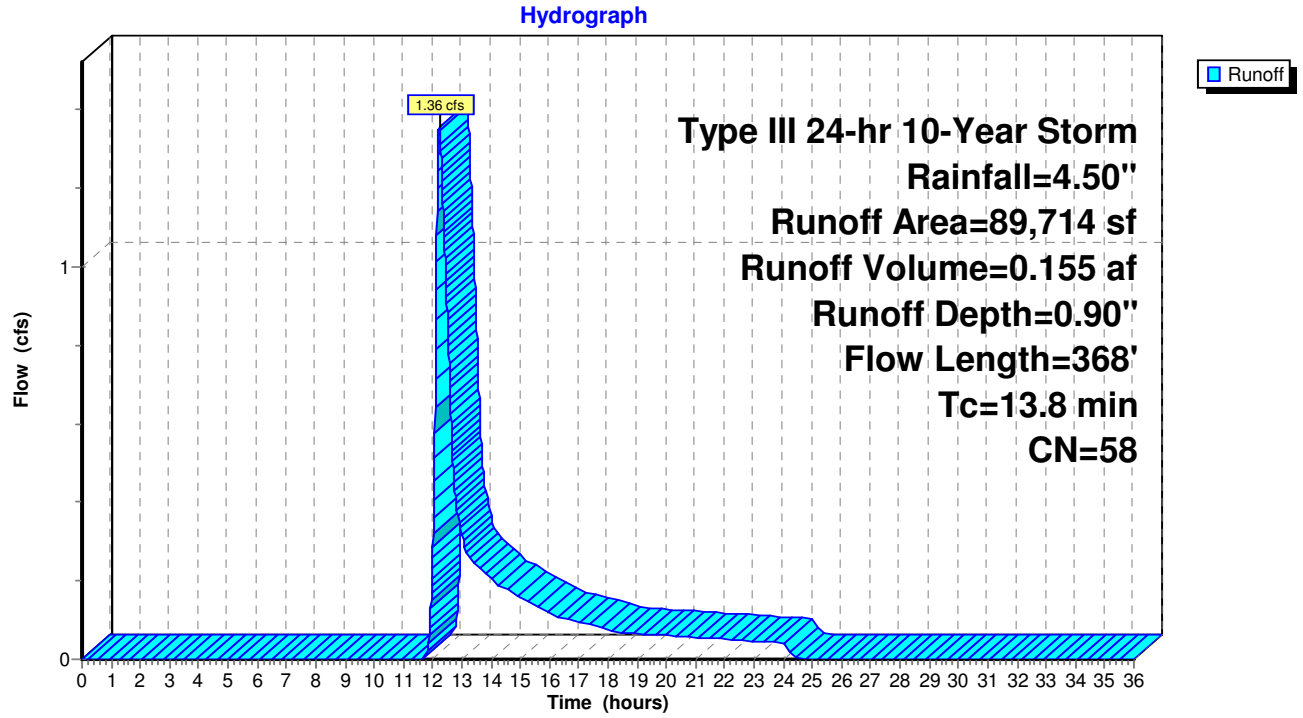
Runoff = 1.36 cfs @ 12.22 hrs, Volume= 0.155 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	4,980	98	Roadway & Gravel Drive
	12,112	61	>75% Grass cover, Good, HSG B
	72,622	55	Woods, Good, HSG B
	89,714	58	Weighted Average
	84,734		Pervious Area
	4,980		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.1200	0.08		**Sheet Flow, A to B** Woods: Dense underbrush n= 0.800 P2= 3.08"
1.0	100	0.1100	1.66		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
0.5	114	0.0500	3.60		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
1.6	104	0.0500	1.12		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.8	368	Total			

Subcatchment EX-2: On-site Contributing Area

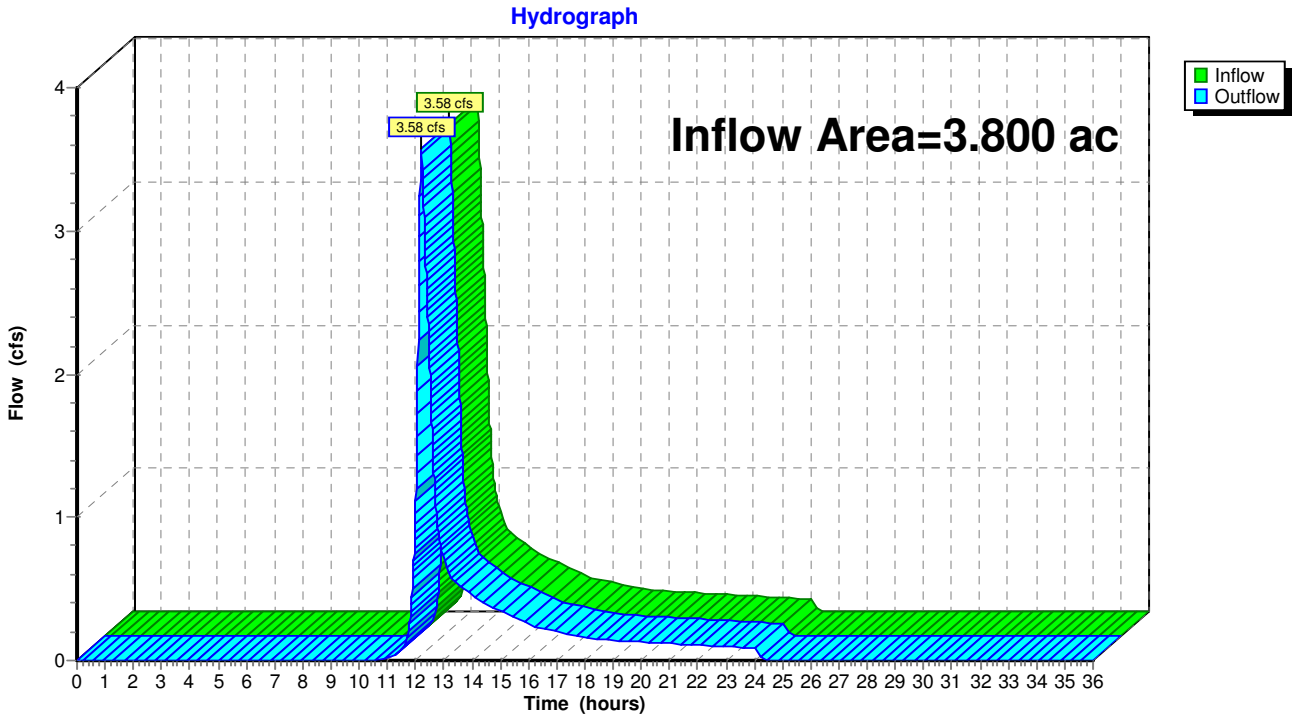


Summary for Reach SP1: Study Point #1

Inflow Area = 3.800 ac, 10.89% Impervious, Inflow Depth = 1.16" for 10-Year Storm event
Inflow = 3.58 cfs @ 12.21 hrs, Volume= 0.368 af
Outflow = 3.58 cfs @ 12.21 hrs, Volume= 0.368 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Summary for Subcatchment EX-1: Offsite Contributing Area

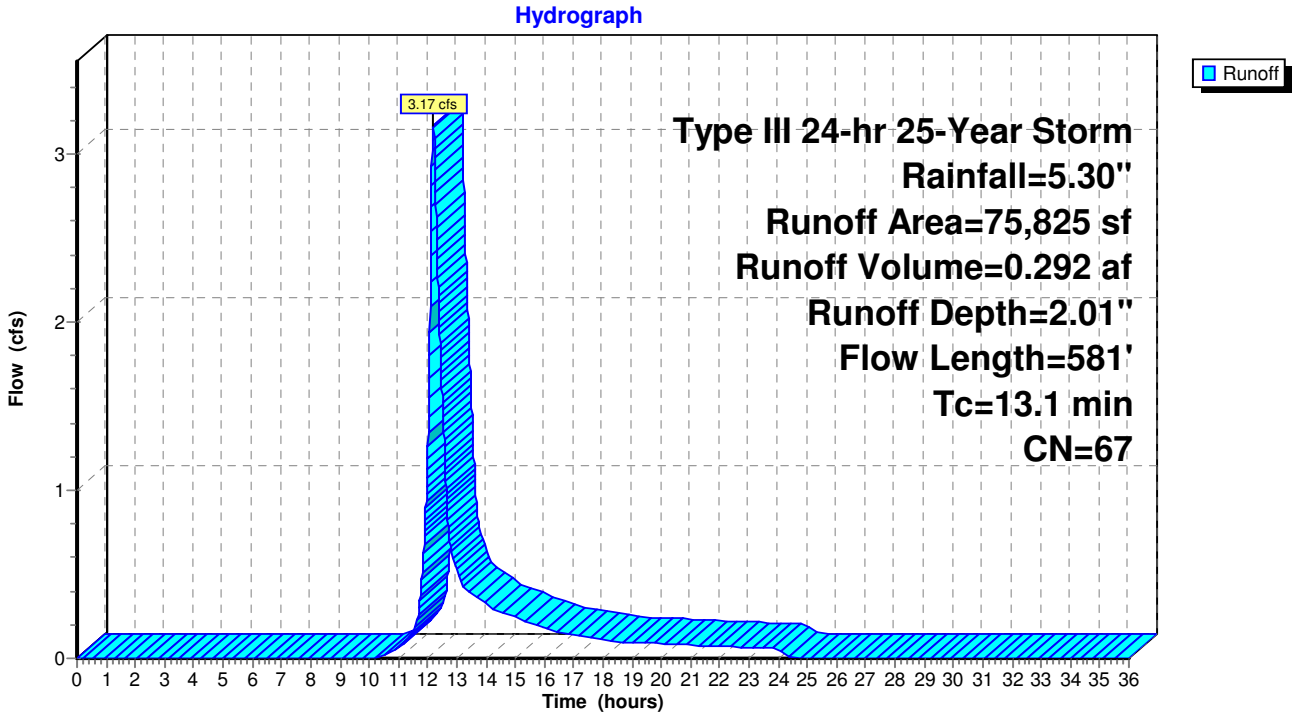
Runoff = 3.17 cfs @ 12.19 hrs, Volume= 0.292 af, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area



Summary for Subcatchment EX-2: On-site Contributing Area

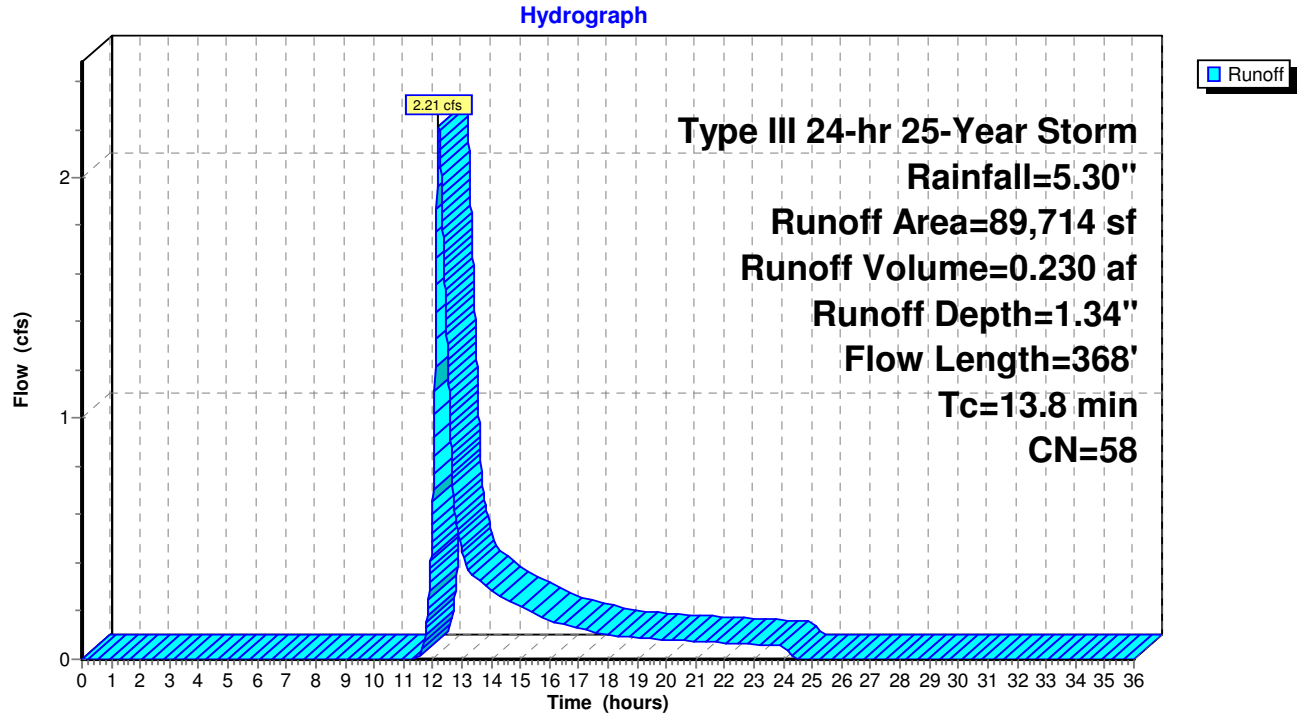
Runoff = 2.21 cfs @ 12.22 hrs, Volume= 0.230 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	4,980	98	Roadway & Gravel Drive
	12,112	61	>75% Grass cover, Good, HSG B
	72,622	55	Woods, Good, HSG B
	89,714	58	Weighted Average
	84,734		Pervious Area
	4,980		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.1200	0.08		**Sheet Flow, A to B** Woods: Dense underbrush n= 0.800 P2= 3.08"
1.0	100	0.1100	1.66		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
0.5	114	0.0500	3.60		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
1.6	104	0.0500	1.12		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.8	368	Total			

Subcatchment EX-2: On-site Contributing Area

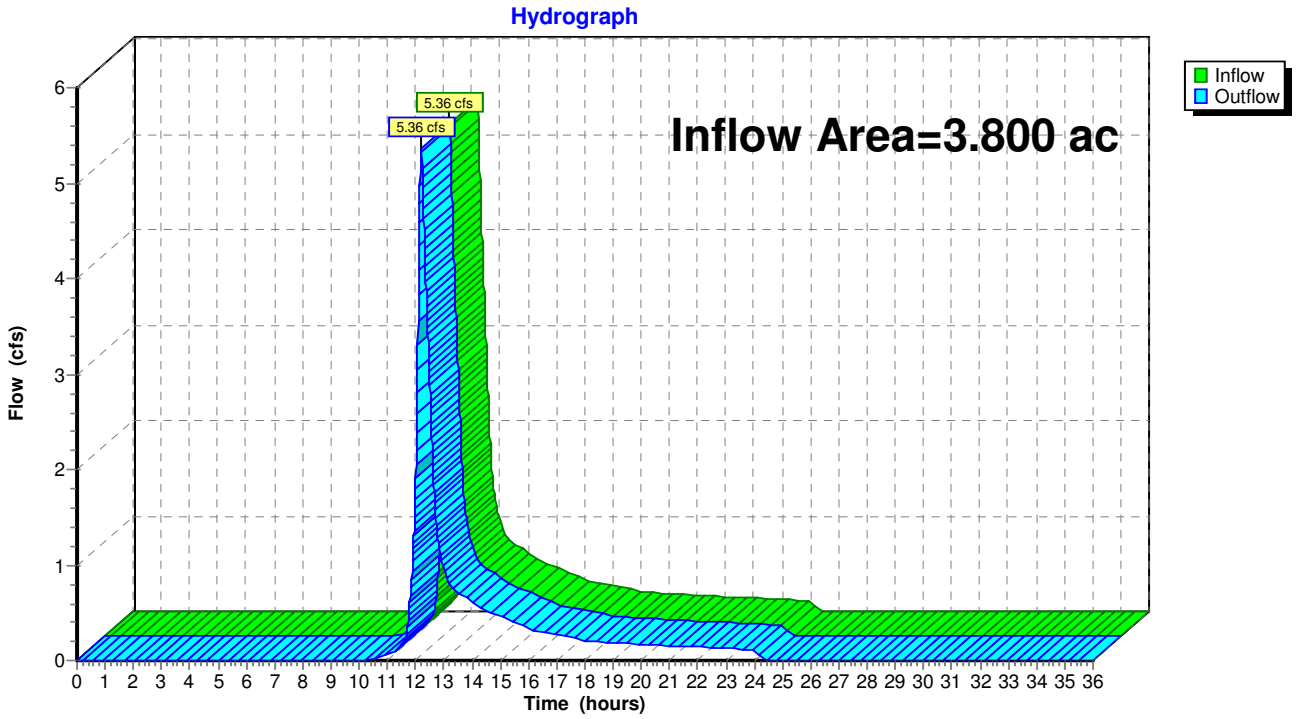


Summary for Reach SP1: Study Point #1

Inflow Area = 3.800 ac, 10.89% Impervious, Inflow Depth = 1.65" for 25-Year Storm event
Inflow = 5.36 cfs @ 12.20 hrs, Volume= 0.522 af
Outflow = 5.36 cfs @ 12.20 hrs, Volume= 0.522 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Summary for Subcatchment EX-1: Offsite Contributing Area

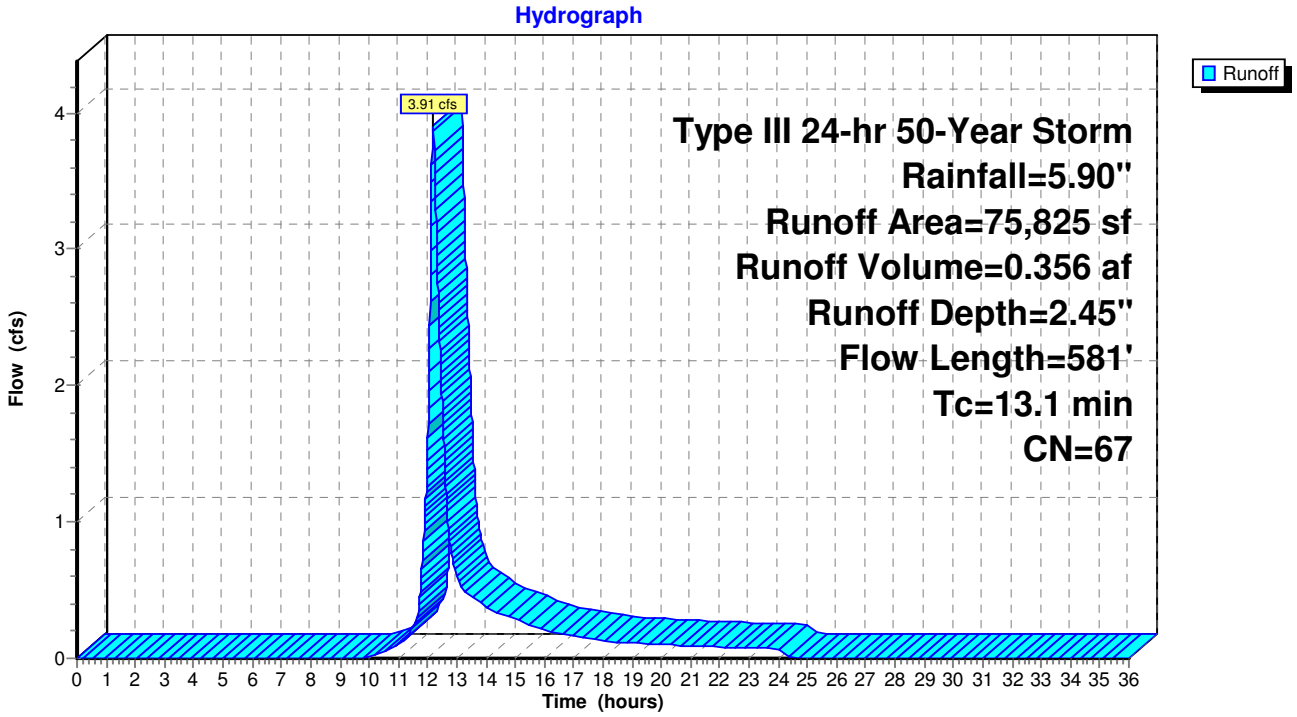
Runoff = 3.91 cfs @ 12.19 hrs, Volume= 0.356 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area



Summary for Subcatchment EX-2: On-site Contributing Area

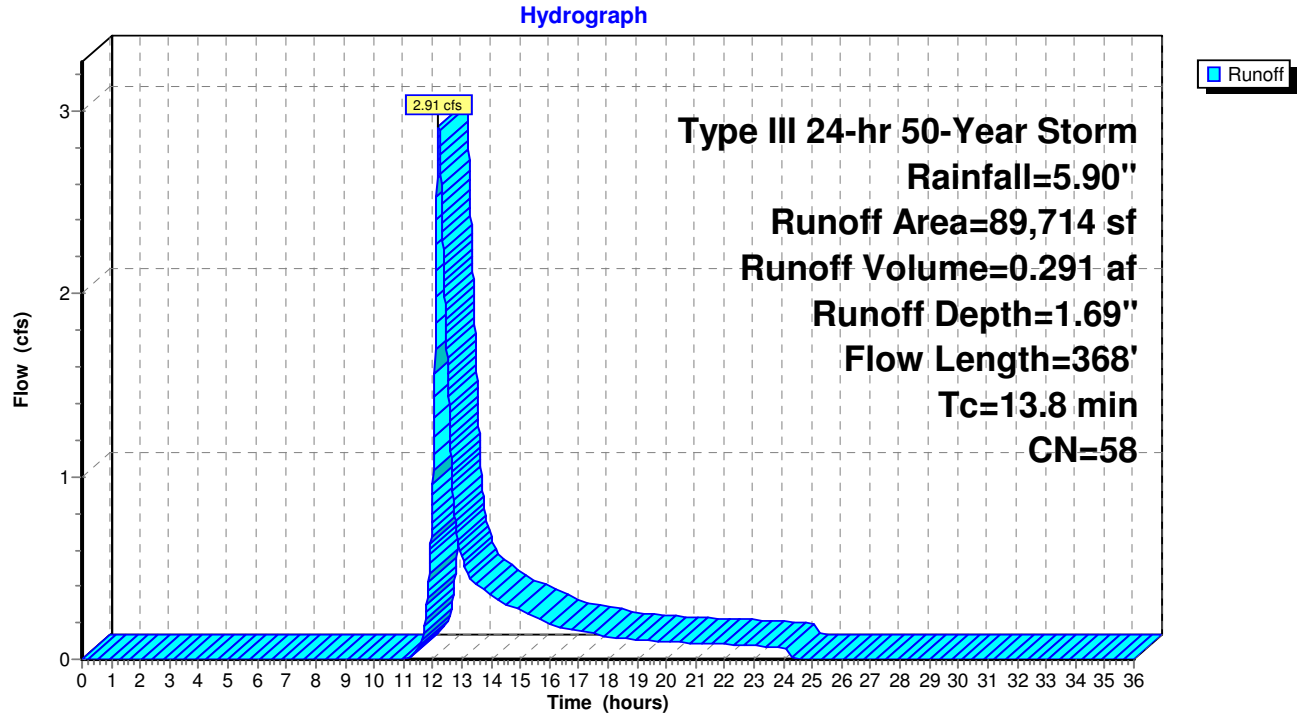
Runoff = 2.91 cfs @ 12.21 hrs, Volume= 0.291 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	4,980	98	Roadway & Gravel Drive
	12,112	61	>75% Grass cover, Good, HSG B
	72,622	55	Woods, Good, HSG B
	89,714	58	Weighted Average
	84,734		Pervious Area
	4,980		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.1200	0.08		**Sheet Flow, A to B** Woods: Dense underbrush n= 0.800 P2= 3.08"
1.0	100	0.1100	1.66		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
0.5	114	0.0500	3.60		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
1.6	104	0.0500	1.12		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.8	368	Total			

Subcatchment EX-2: On-site Contributing Area

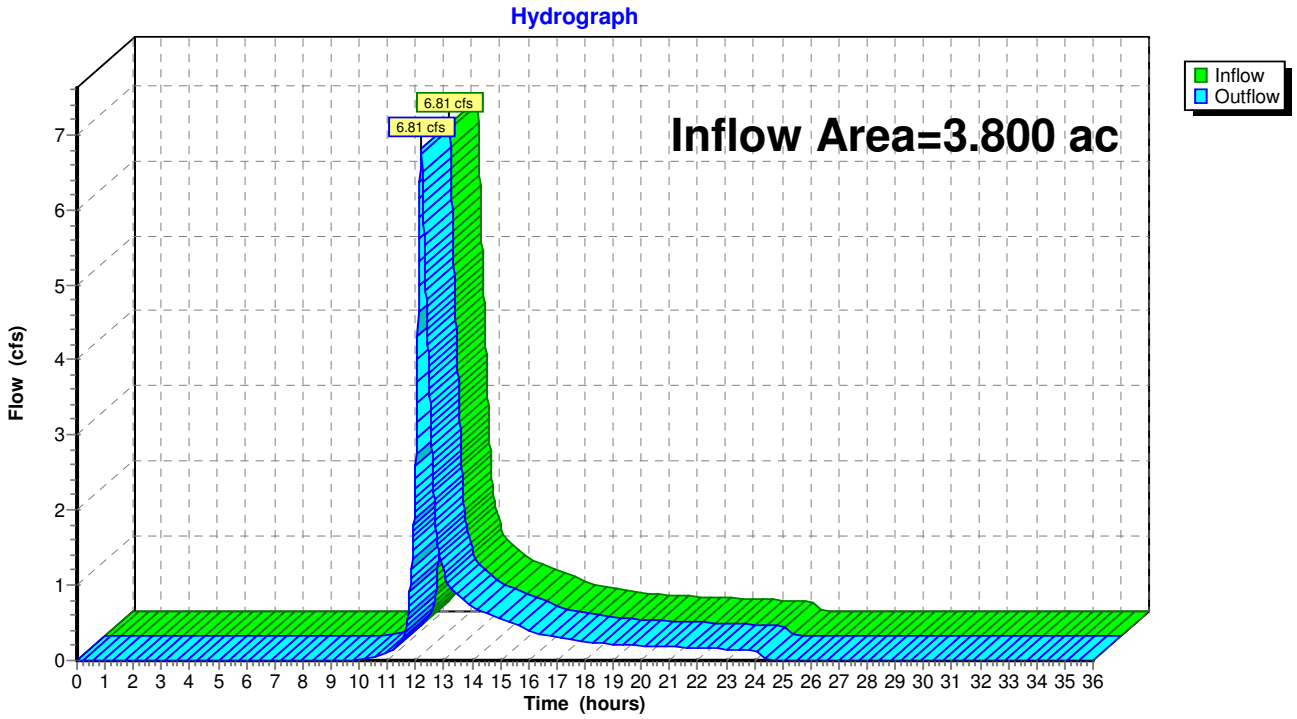


Summary for Reach SP1: Study Point #1

Inflow Area = 3.800 ac, 10.89% Impervious, Inflow Depth = 2.04" for 50-Year Storm event
Inflow = 6.81 cfs @ 12.19 hrs, Volume= 0.647 af
Outflow = 6.81 cfs @ 12.19 hrs, Volume= 0.647 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Summary for Subcatchment EX-1: Offsite Contributing Area

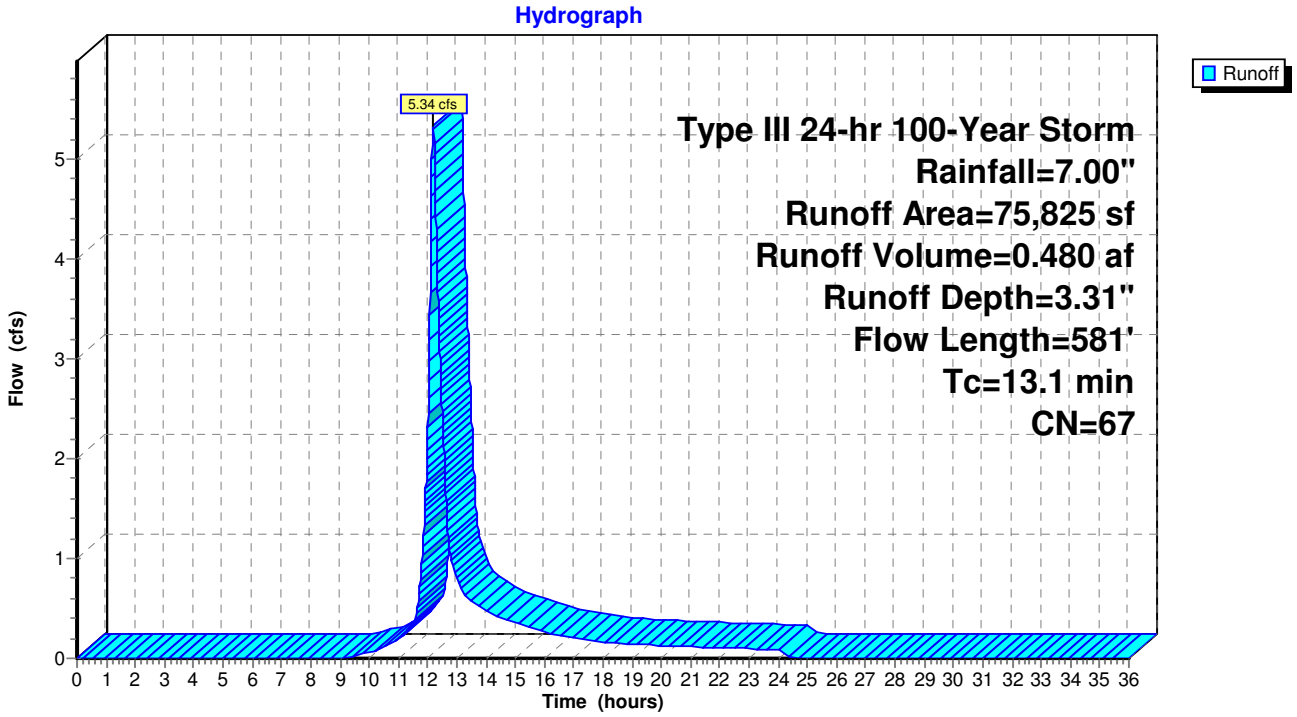
Runoff = 5.34 cfs @ 12.18 hrs, Volume= 0.480 af, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area



Summary for Subcatchment EX-2: On-site Contributing Area

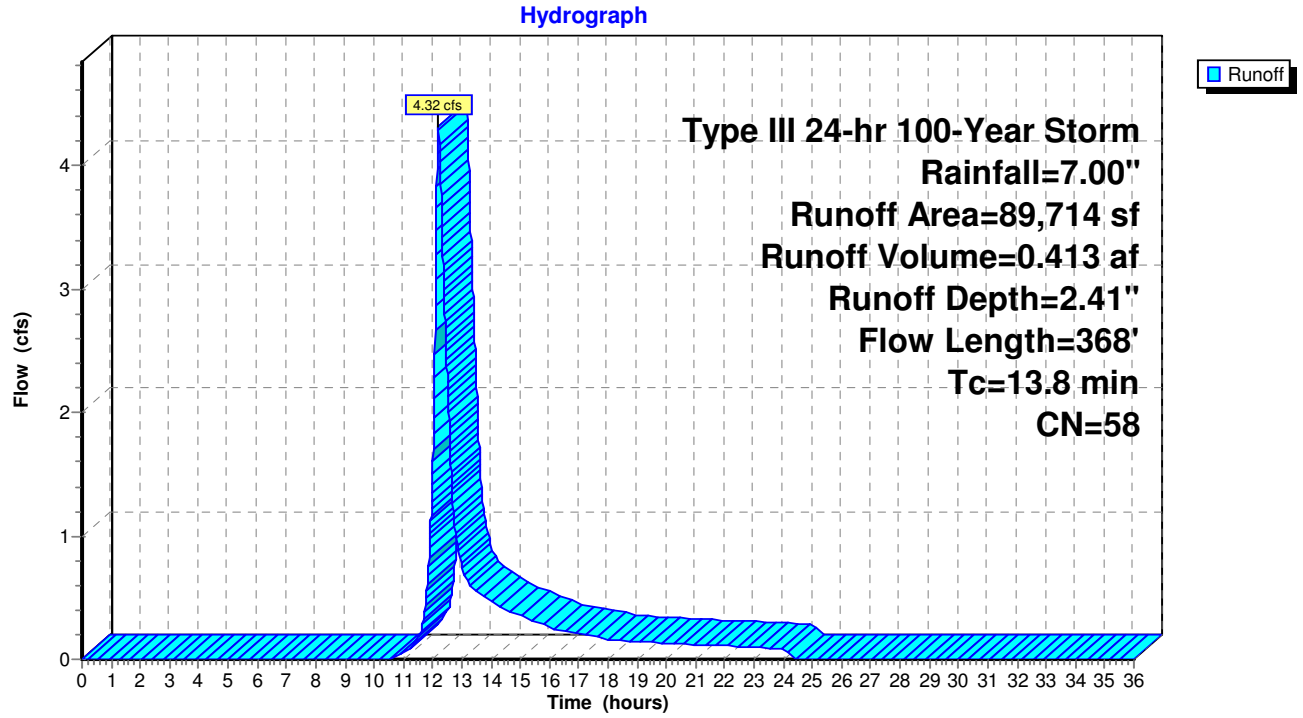
Runoff = 4.32 cfs @ 12.20 hrs, Volume= 0.413 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	4,980	98	Roadway & Gravel Drive
	12,112	61	>75% Grass cover, Good, HSG B
	72,622	55	Woods, Good, HSG B
	89,714	58	Weighted Average
	84,734		Pervious Area
	4,980		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.1200	0.08		**Sheet Flow, A to B** Woods: Dense underbrush n= 0.800 P2= 3.08"
1.0	100	0.1100	1.66		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
0.5	114	0.0500	3.60		**Shallow Concentrated Flow, C to D** Unpaved Kv= 16.1 fps
1.6	104	0.0500	1.12		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.8	368	Total			

Subcatchment EX-2: On-site Contributing Area

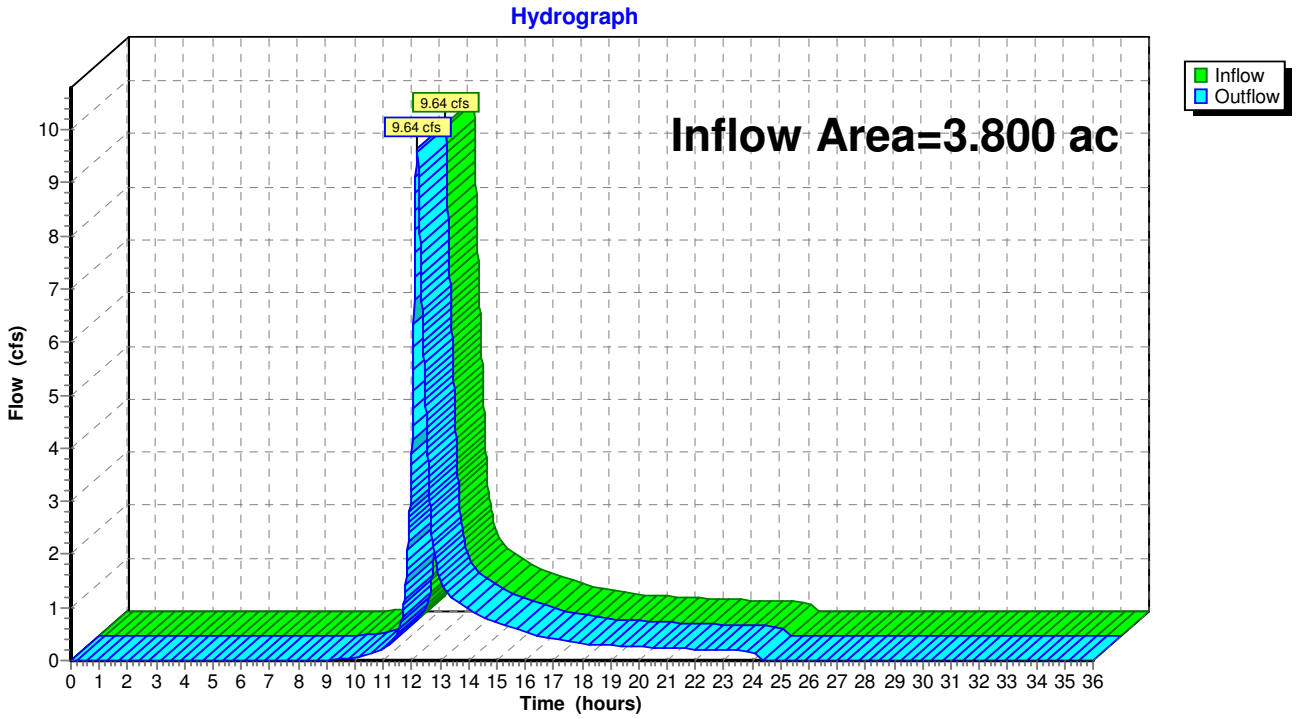


Summary for Reach SP1: Study Point #1

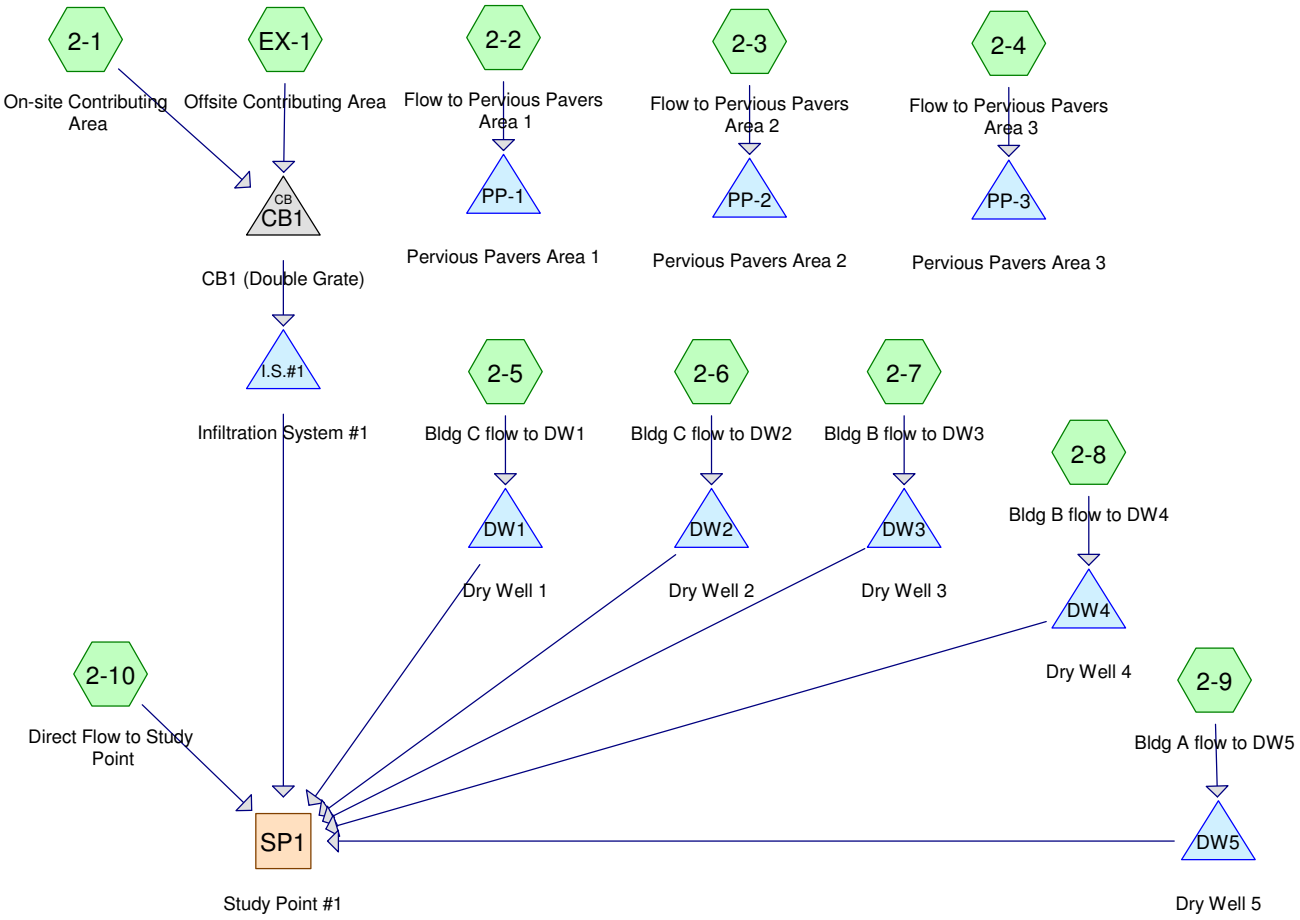
Inflow Area = 3.800 ac, 10.89% Impervious, Inflow Depth = 2.82" for 100-Year Storm event
Inflow = 9.64 cfs @ 12.19 hrs, Volume= 0.893 af
Outflow = 9.64 cfs @ 12.19 hrs, Volume= 0.893 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Section 4.0 HydroCAD Worksheets – Proposed Conditions



Drainage Diagram for 1298-08_Proposed

Prepared by Allen & Major Associates, Inc. (bjones), Printed 5/26/2010

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.547	55	Woods, Good, HSG B (2-1,2-10,EX-1)
0.275	58	Woods/grass comb., Good, HSG B (2-1,2-10)
2.149	61	>75% Grass cover, Good, HSG B (2-1,2-10,2-2,2-3,2-4,EX-1)
0.116	98	Building Rooftop Area (2-1)
0.225	98	Driveway (EX-1)
0.233	98	Pavement Area (2-1)
0.115	98	Rooftop Area (2-10,EX-1)
0.120	98	Sidewalk & Pervious Pavers (2-2,2-3,2-4,2-5,2-6,2-7,2-8,2-9)
0.020	98	Sidewalk Area (2-1)
3.800		**TOTAL AREA**

Summary for Subcatchment 2-1: On-site Contributing Area

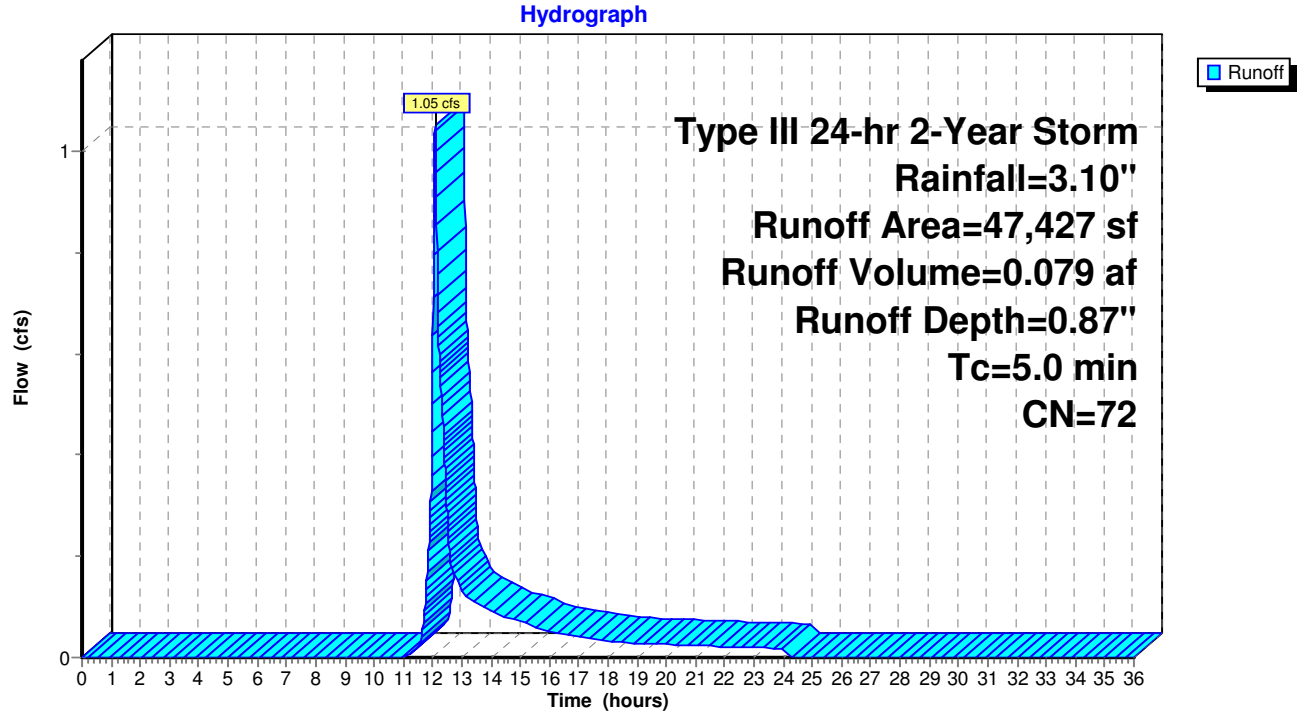
Runoff = 1.05 cfs @ 12.08 hrs, Volume= 0.079 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	5,048	98	Building Rooftop Area
*	889	98	Sidewalk Area
*	10,165	98	Pavement Area
	18,133	61	>75% Grass cover, Good, HSG B
	6,044	58	Woods/grass comb., Good, HSG B
	7,148	55	Woods, Good, HSG B
	47,427	72	Weighted Average
	31,325		Pervious Area
	16,102		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-1: On-site Contributing Area



Summary for Subcatchment 2-10: Direct Flow to Study Point

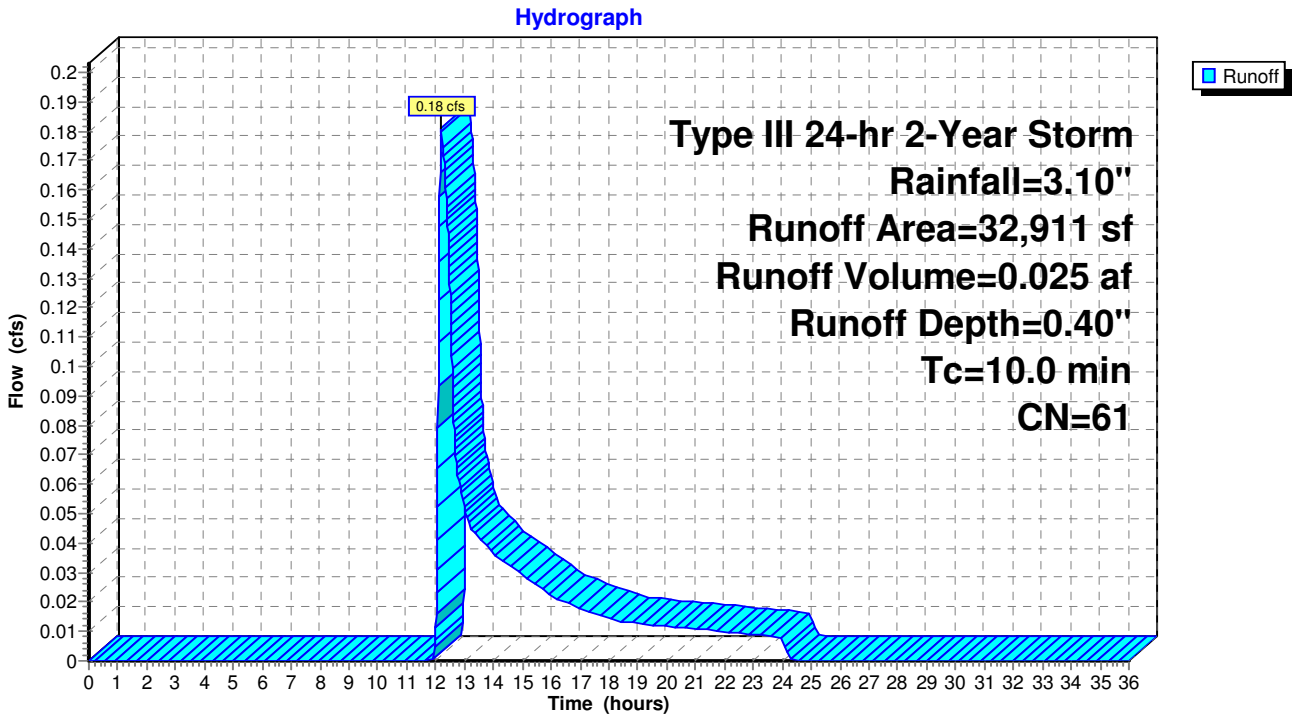
Runoff = 0.18 cfs @ 12.20 hrs, Volume= 0.025 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	1,793	98	Rooftop Area
	17,774	61	>75% Grass cover, Good, HSG B
	5,924	58	Woods/grass comb., Good, HSG B
	7,420	55	Woods, Good, HSG B
	32,911	61	Weighted Average
	31,118		Pervious Area
	1,793		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2-10: Direct Flow to Study Point



Summary for Subcatchment 2-2: Flow to Pervious Pavers Area 1

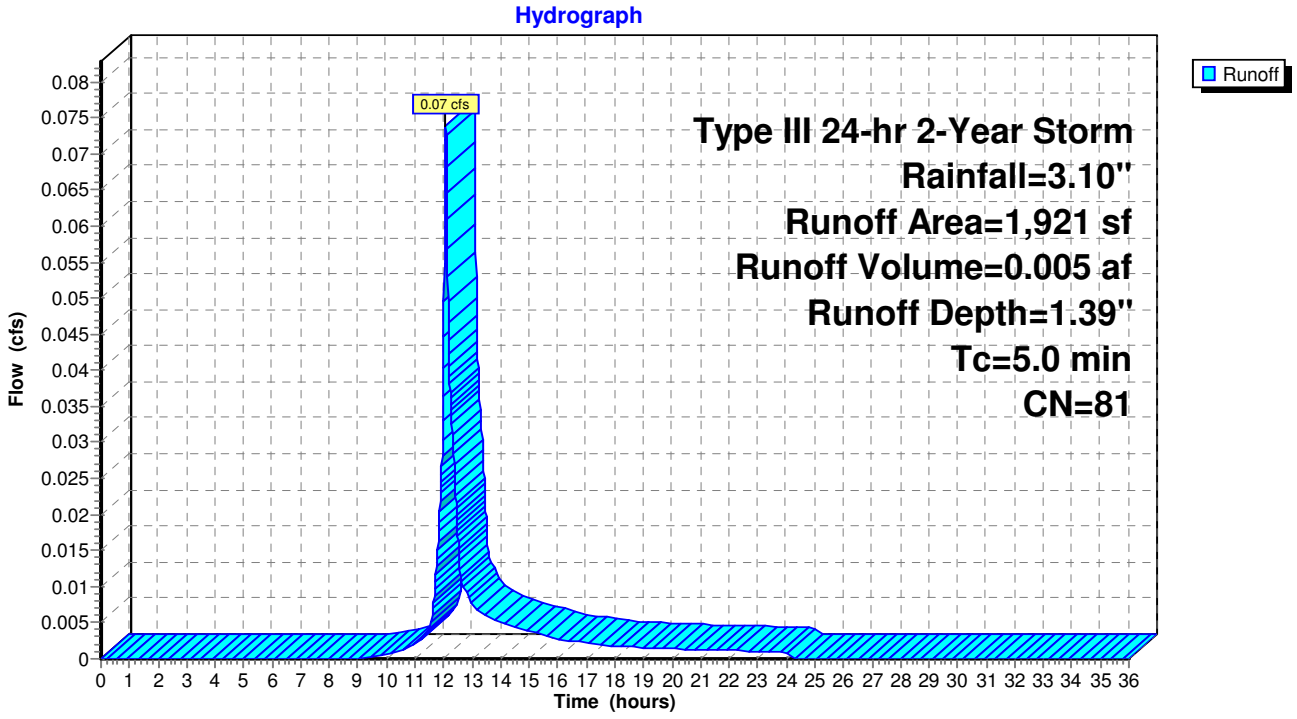
Runoff = 0.07 cfs @ 12.08 hrs, Volume= 0.005 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	1,031	98	Sidewalk & Pervious Pavers
	890	61	>75% Grass cover, Good, HSG B
	1,921	81	Weighted Average
	890		Pervious Area
	1,031		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-2: Flow to Pervious Pavers Area 1



Summary for Subcatchment 2-3: Flow to Pervious Pavers Area 2

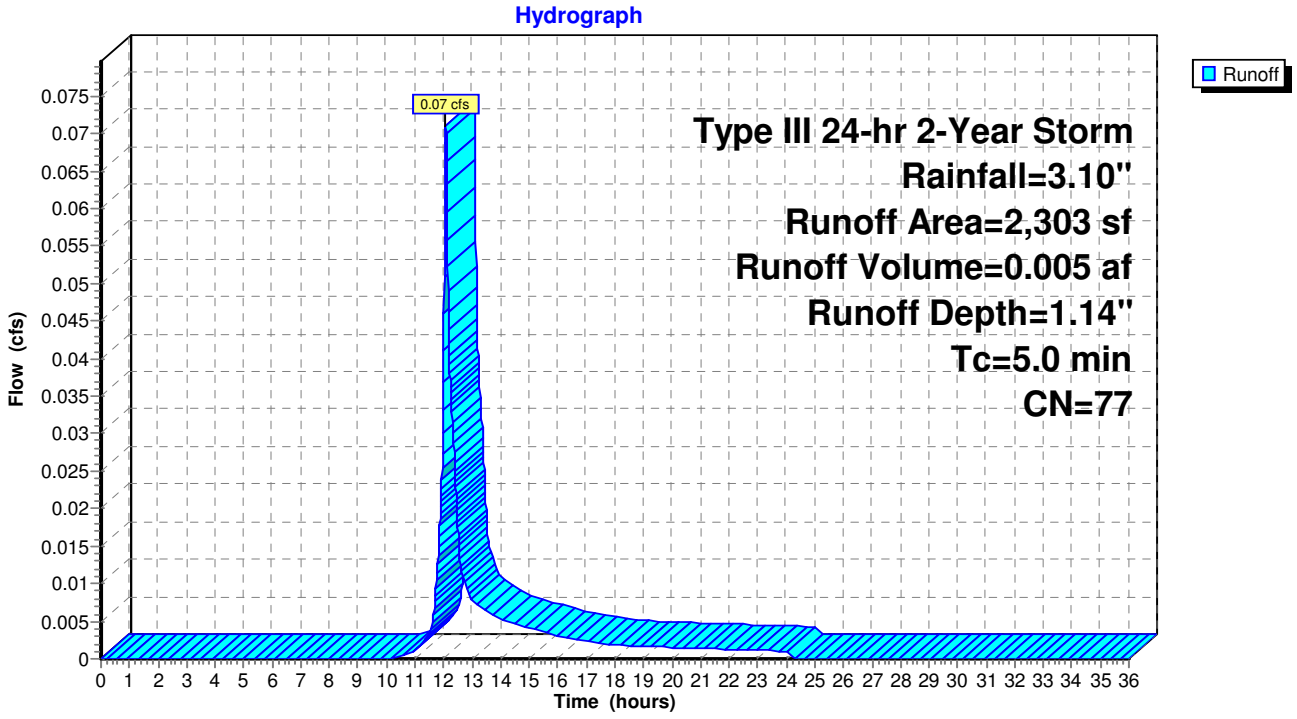
Runoff = 0.07 cfs @ 12.08 hrs, Volume= 0.005 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	1,007	98	Sidewalk & Pervious Pavers
	1,296	61	>75% Grass cover, Good, HSG B
	2,303	77	Weighted Average
	1,296		Pervious Area
	1,007		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-3: Flow to Pervious Pavers Area 2



Summary for Subcatchment 2-4: Flow to Pervious Pavers Area 3

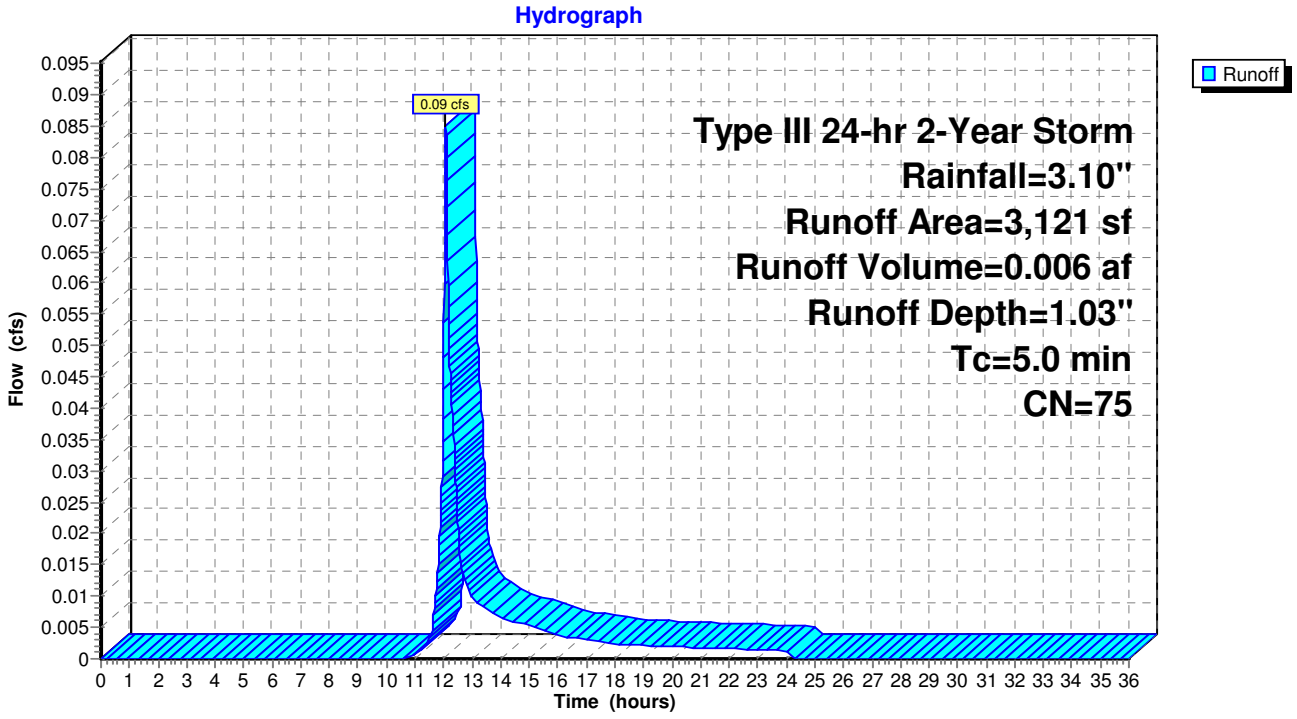
Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.006 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	1,145	98	Sidewalk & Pervious Pavers
	1,976	61	>75% Grass cover, Good, HSG B
	3,121	75	Weighted Average
	1,976		Pervious Area
	1,145		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-4: Flow to Pervious Pavers Area 3



Summary for Subcatchment 2-5: Bldg C flow to DW1

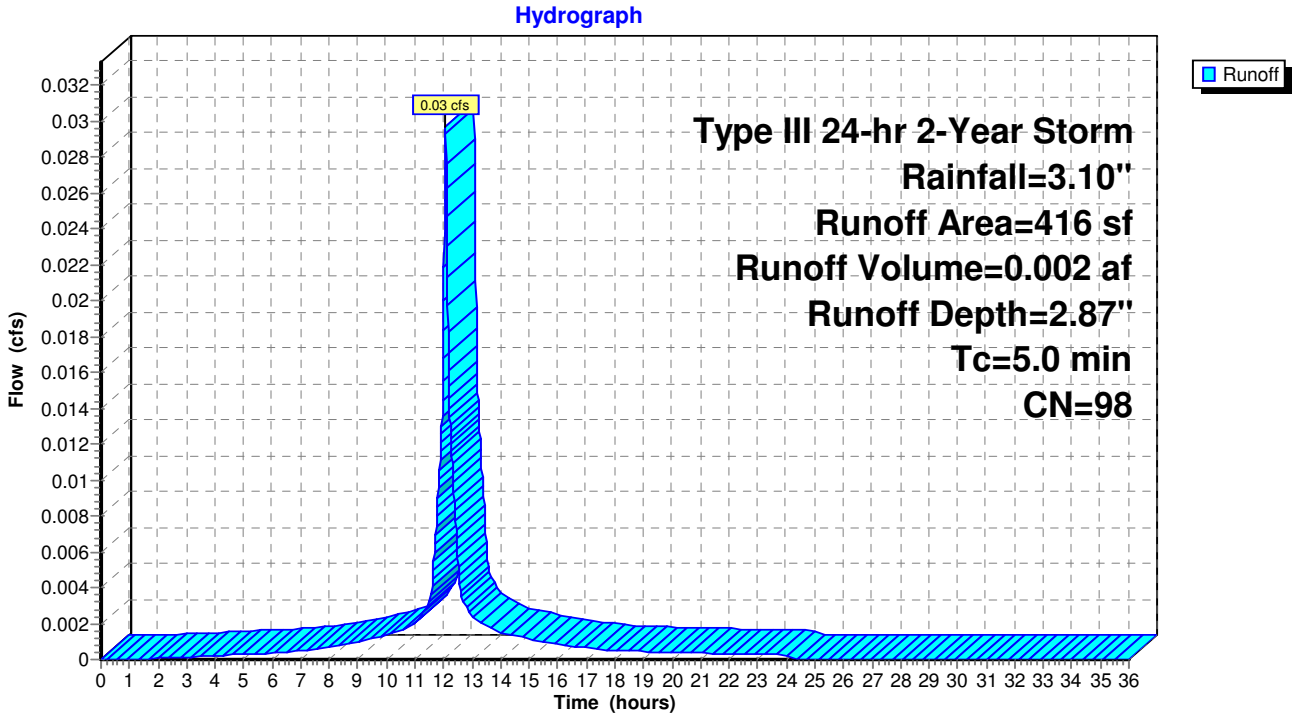
Runoff = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-5: Bldg C flow to DW1



Summary for Subcatchment 2-6: Bldg C flow to DW2

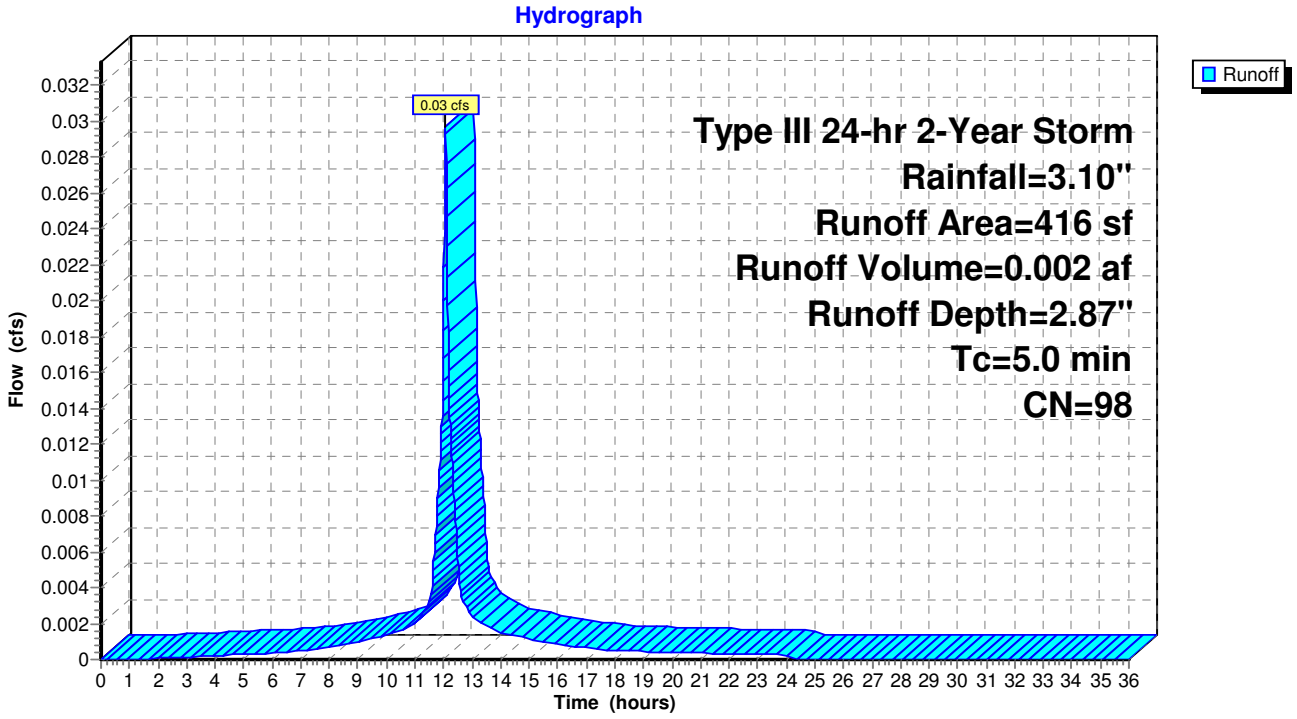
Runoff = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-6: Bldg C flow to DW2



Summary for Subcatchment 2-7: Bldg B flow to DW3

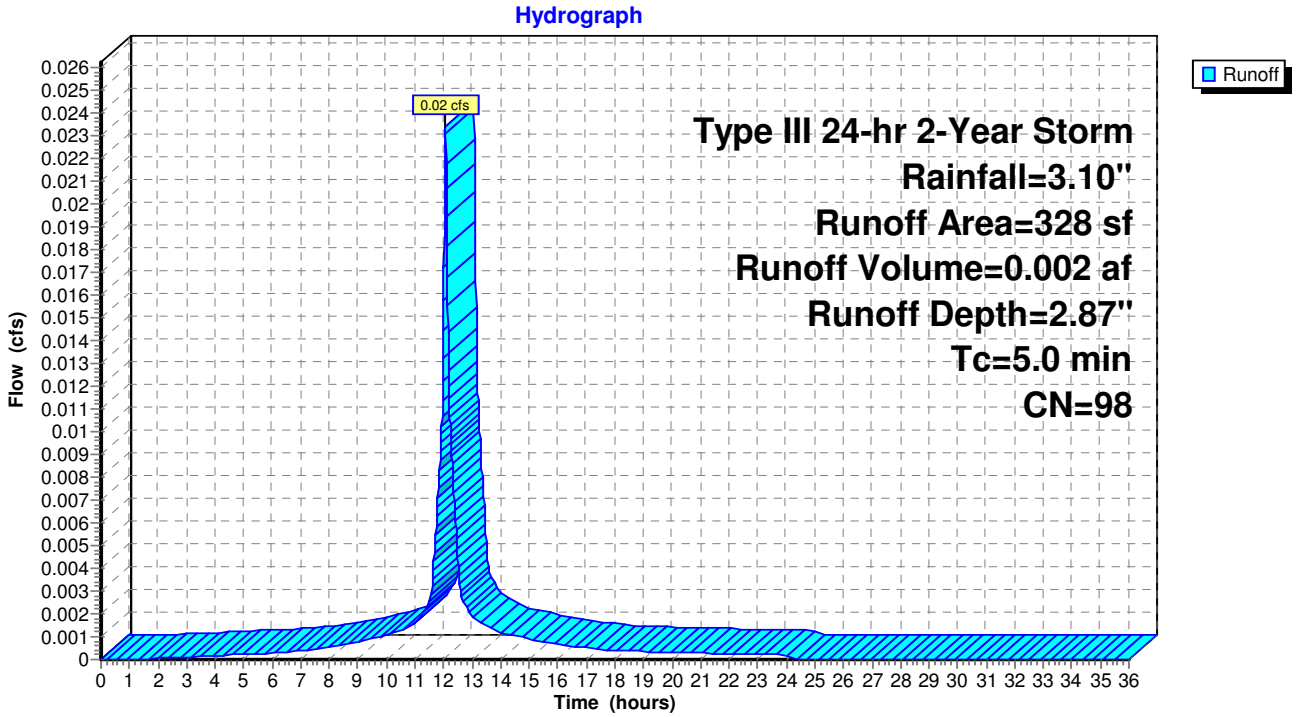
Runoff = 0.02 cfs @ 12.07 hrs, Volume= 0.002 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	328	98	Sidewalk & Pervious Pavers
	328		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-7: Bldg B flow to DW3



Summary for Subcatchment 2-8: Bldg B flow to DW4

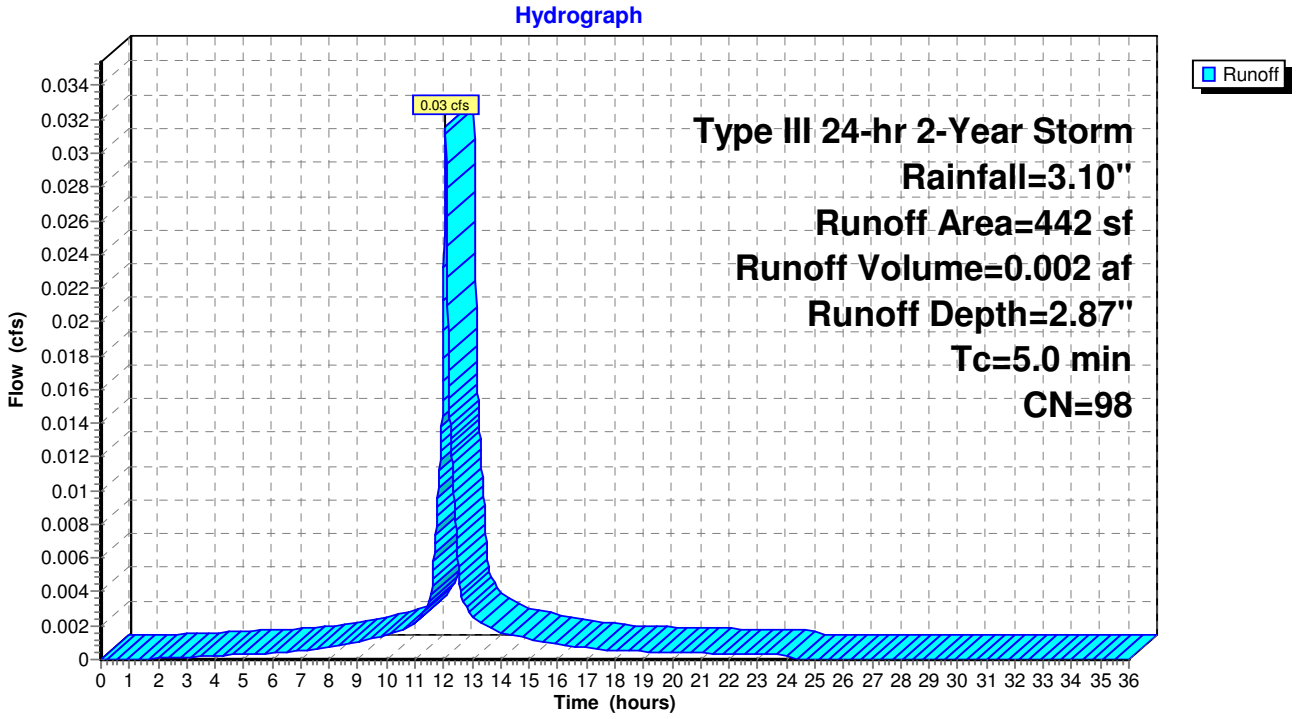
Runoff = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	442	98	Sidewalk & Pervious Pavers
	442		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-8: Bldg B flow to DW4



Summary for Subcatchment 2-9: Bldg A flow to DW5

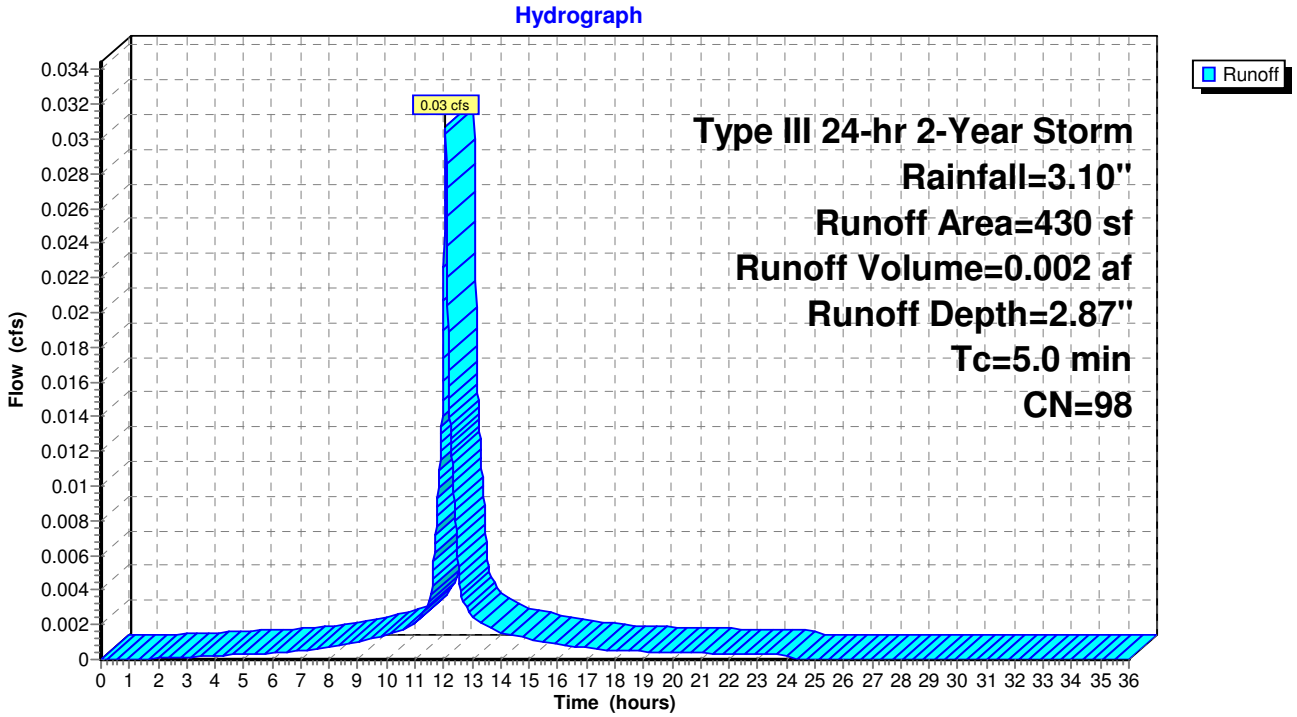
Runoff = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	430	98	Sidewalk & Pervious Pavers
	430		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-9: Bldg A flow to DW5



Summary for Subcatchment EX-1: Offsite Contributing Area

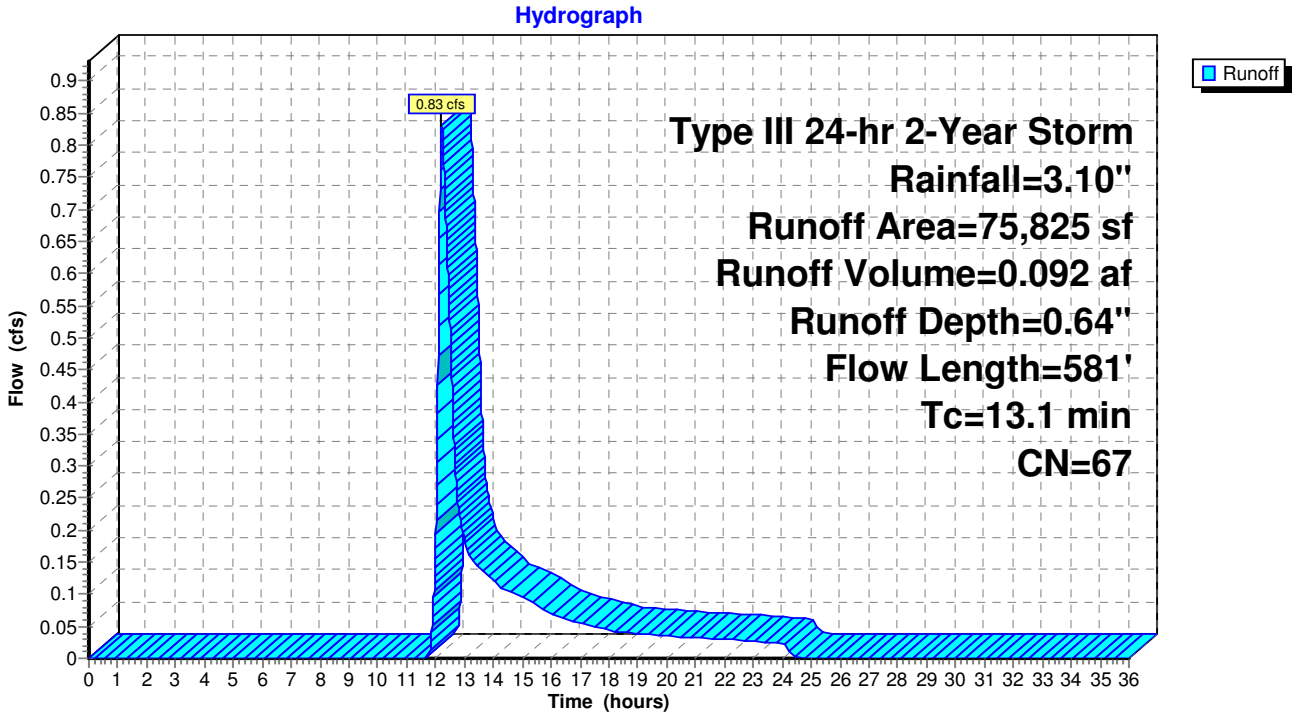
Runoff = 0.83 cfs @ 12.21 hrs, Volume= 0.092 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Storm Rainfall=3.10"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area

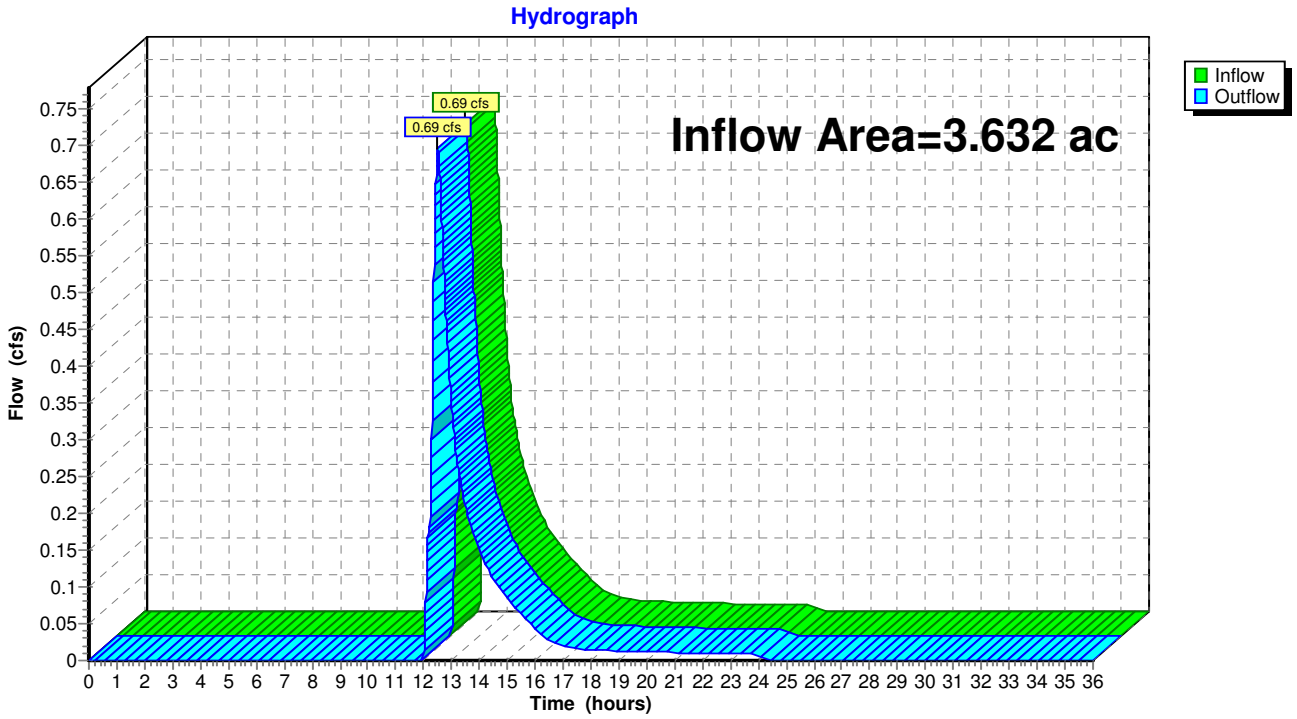


Summary for Reach SP1: Study Point #1

Inflow Area = 3.632 ac, 20.84% Impervious, Inflow Depth = 0.25" for 2-Year Storm event
Inflow = 0.69 cfs @ 12.51 hrs, Volume= 0.076 af
Outflow = 0.69 cfs @ 12.51 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Summary for Pond CB1: CB1 (Double Grate)

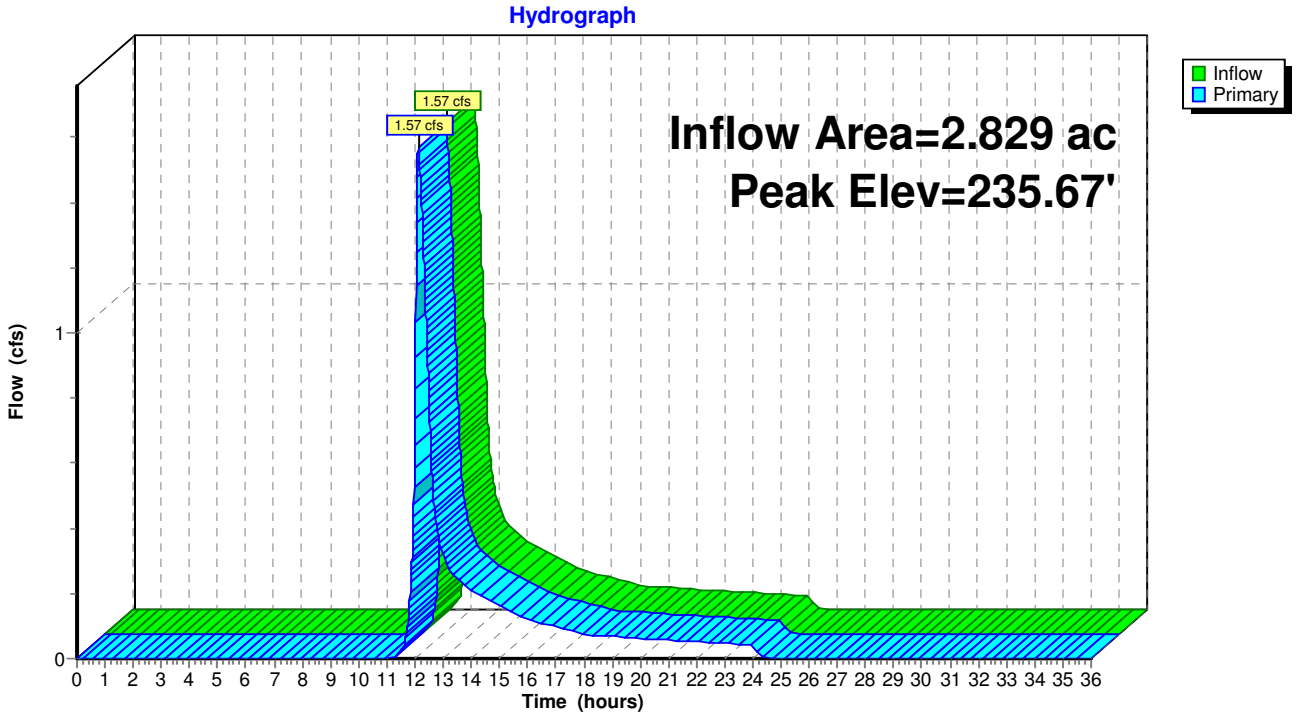
Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 0.72" for 2-Year Storm event
Inflow = 1.57 cfs @ 12.12 hrs, Volume= 0.171 af
Outflow = 1.57 cfs @ 12.12 hrs, Volume= 0.171 af, Atten= 0%, Lag= 0.0 min
Primary = 1.57 cfs @ 12.12 hrs, Volume= 0.171 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 235.67' @ 12.12 hrs
Flood Elev= 238.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.57 cfs @ 12.12 hrs HW=235.67' (Free Discharge)
1=Orifice/Grate (Orifice Controls 1.57 cfs @ 2.79 fps)

Pond CB1: CB1 (Double Grate)



Summary for Pond DW1: Dry Well 1

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 2.87" for 2-Year Storm event
Inflow = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 11.26 hrs, Volume= 0.002 af, Atten= 92%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.26 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.33' @ 13.02 hrs Surf.Area= 50 sf Storage= 37 cf

Plug-Flow detention time= 116.5 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 116.5 min (872.7 - 756.1)

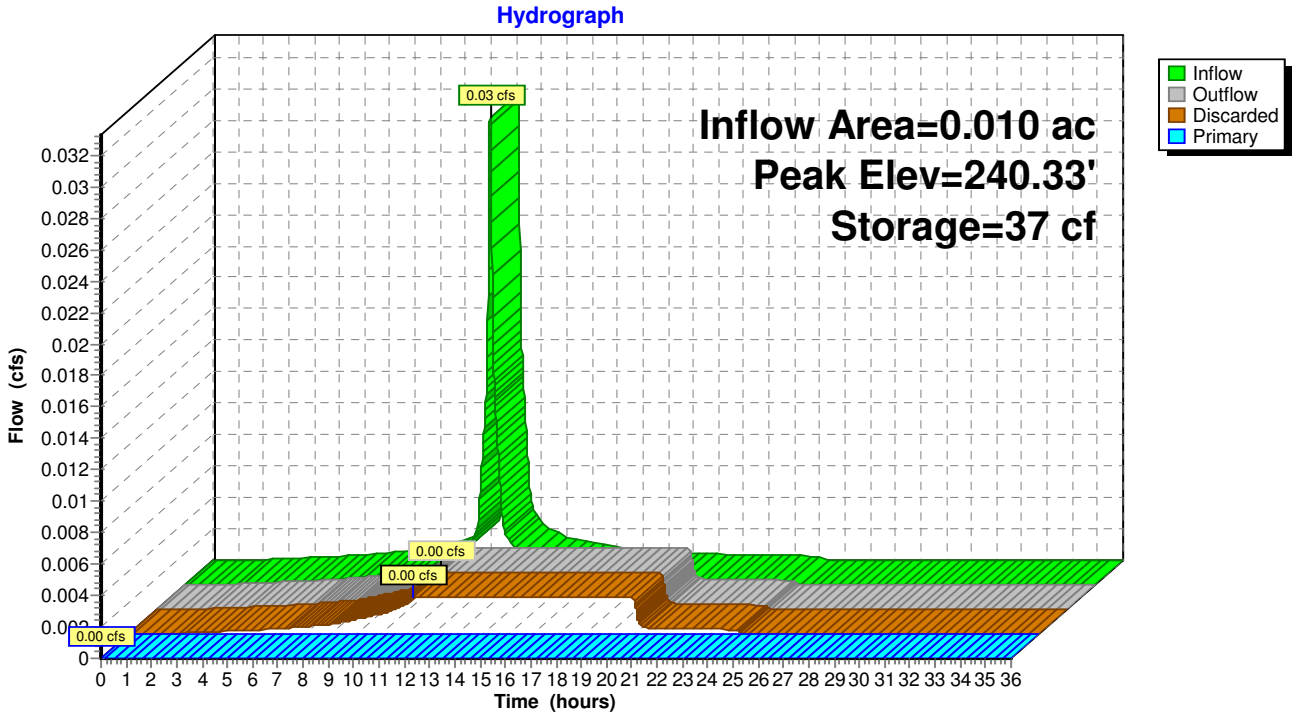
Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	239.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 11.26 hrs HW=239.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=239.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW1: Dry Well 1



Summary for Pond DW2: Dry Well 2

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 2.87" for 2-Year Storm event
Inflow = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 11.26 hrs, Volume= 0.002 af, Atten= 92%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.26 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.33' @ 13.02 hrs Surf.Area= 50 sf Storage= 37 cf

Plug-Flow detention time= 116.5 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 116.5 min (872.7 - 756.1)

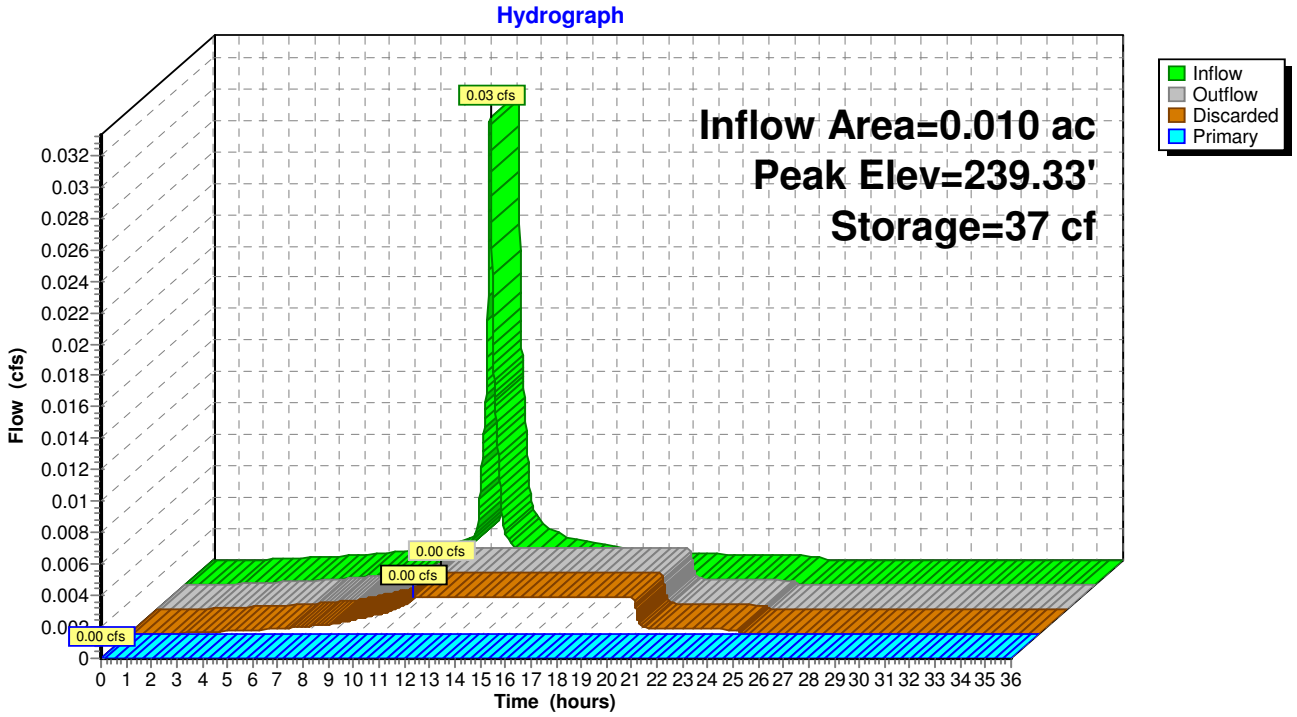
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 11.26 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=238.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW2: Dry Well 2



Summary for Pond DW3: Dry Well 3

Assumed percolation rate of 30MPI

Inflow Area = 0.008 ac,100.00% Impervious, Inflow Depth = 2.87" for 2-Year Storm event
Inflow = 0.02 cfs @ 12.07 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 11.51 hrs, Volume= 0.002 af, Atten= 90%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.51 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 238.95' @ 12.79 hrs Surf.Area= 50 sf Storage= 26 cf

Plug-Flow detention time= 77.7 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 77.6 min (833.8 - 756.1)

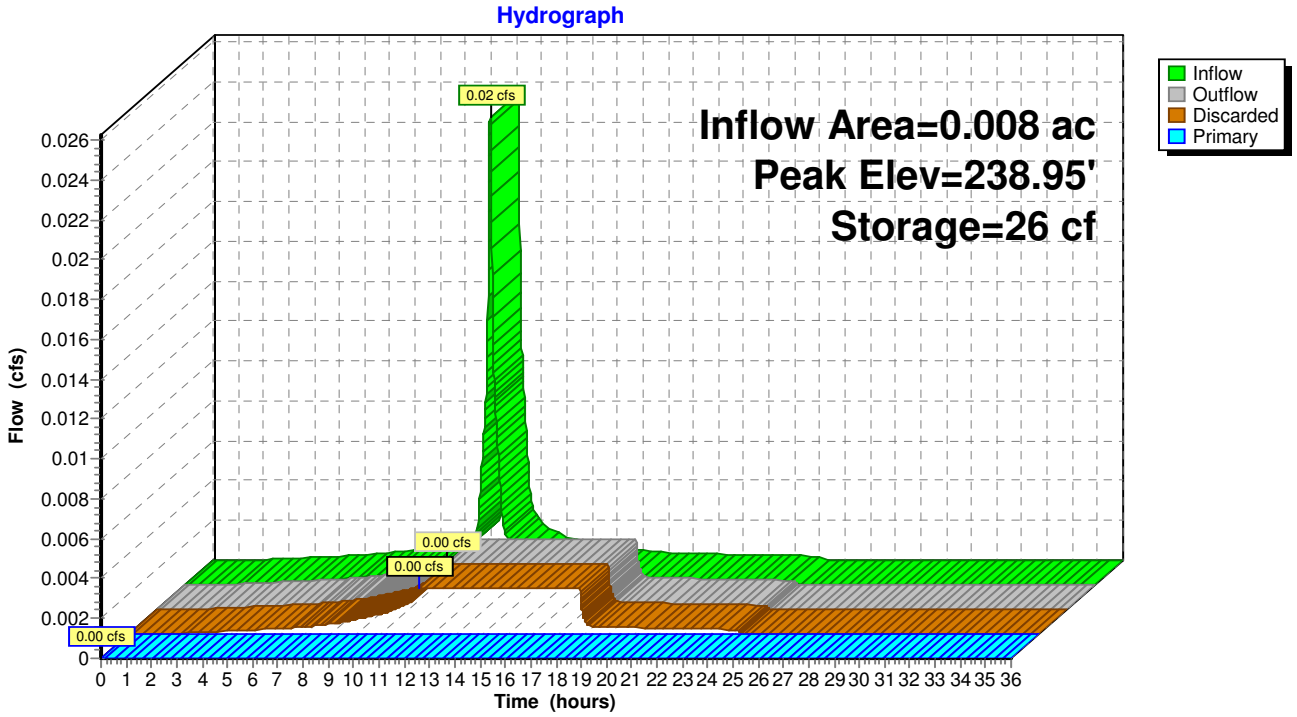
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 11.51 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=238.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW3: Dry Well 3



Summary for Pond DW4: Dry Well 4

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 2.87" for 2-Year Storm event
Inflow = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 11.20 hrs, Volume= 0.002 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.20 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 238.45' @ 13.08 hrs Surf.Area= 50 sf Storage= 40 cf

Plug-Flow detention time= 129.2 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 129.1 min (885.3 - 756.1)

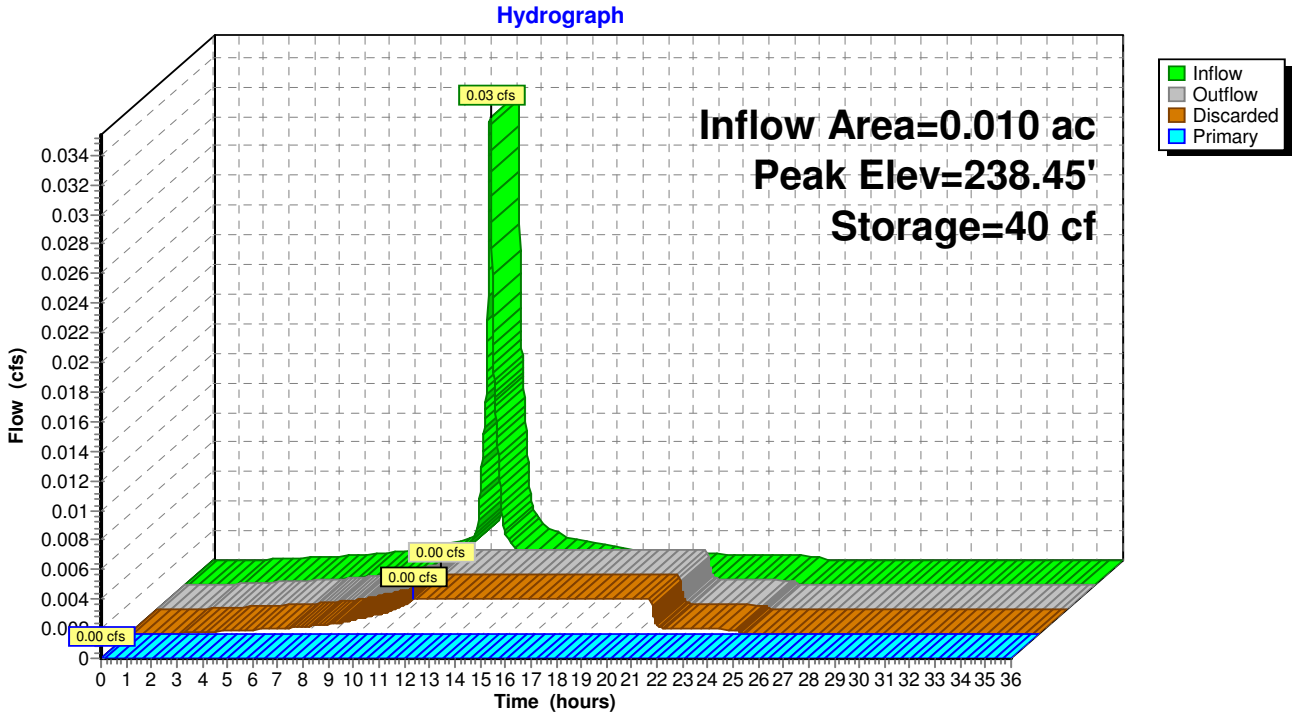
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 11.20 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=237.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW4: Dry Well 4



Summary for Pond DW5: Dry Well 5

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 2.87" for 2-Year Storm event
Inflow = 0.03 cfs @ 12.07 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 11.23 hrs, Volume= 0.002 af, Atten= 92%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.23 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 238.40' @ 13.05 hrs Surf.Area= 50 sf Storage= 39 cf

Plug-Flow detention time= 123.3 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 123.2 min (879.4 - 756.1)

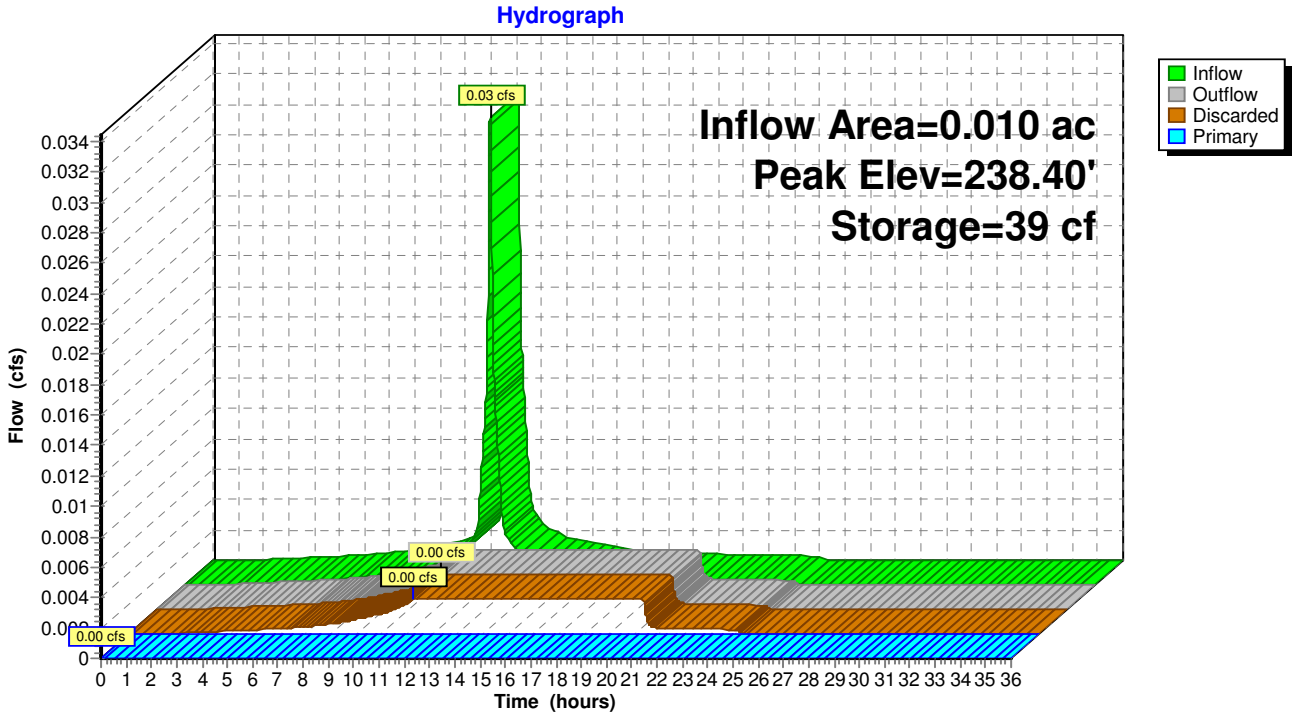
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 11.23 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=237.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW5: Dry Well 5



Summary for Pond I.S.#1: Infiltration System #1

Assumed percolation rate of 30 MPI

Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 0.72" for 2-Year Storm event
Inflow = 1.57 cfs @ 12.12 hrs, Volume= 0.171 af
Outflow = 0.71 cfs @ 12.54 hrs, Volume= 0.171 af, Atten= 55%, Lag= 25.0 min
Discarded = 0.13 cfs @ 12.21 hrs, Volume= 0.120 af
Primary = 0.58 cfs @ 12.54 hrs, Volume= 0.051 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 234.36' @ 12.54 hrs Surf.Area= 2,849 sf Storage= 1,877 cf

Plug-Flow detention time= 81.9 min calculated for 0.171 af (100% of inflow)
Center-of-Mass det. time= 81.9 min (966.2 - 884.3)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	3,258 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 9,545 cf Overall - 1,400 cf Embedded = 8,145 cf x 40.0% Voids
#2	234.00'	1,400 cf	**28.9"W x 16.0"H x 7.12'L StormTech SC-310** x 95 Inside #1
#3	234.50'	49 cf	**12.0"D x 62.00'L Horizontal Cylinder S= 0.0080 '/'**
#4	234.00'	44 cf	**4.00'D x 3.50'H DMH1**
#5	234.00'	44 cf	**4.00'D x 3.50'H OCS1**
		4,795 cf	Total Available Storage

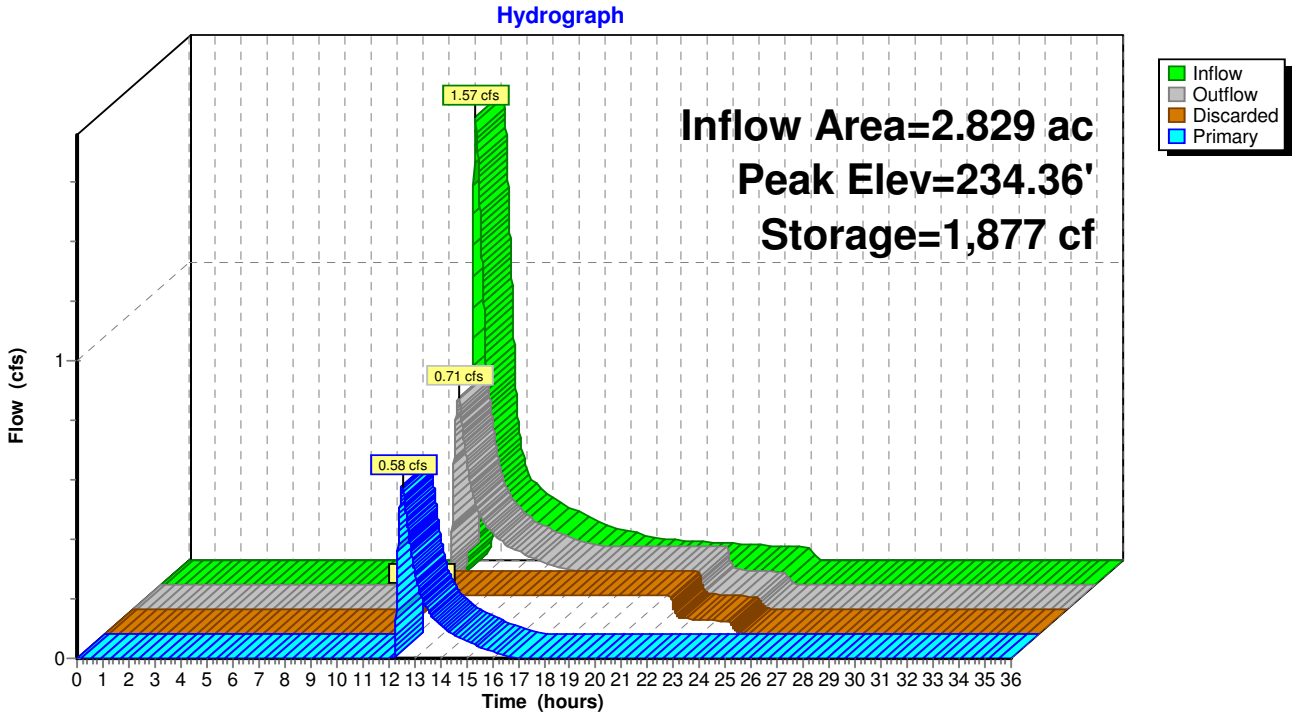
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
233.00	2,824	218.0	0	0	2,824
236.38	2,824	218.0	9,545	9,545	3,561

Device	Routing	Invert	Outlet Devices
#1	Discarded	233.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	234.00'	**14.5" Vert. Orifice/Grate** C= 0.600
#3	Primary	236.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.13 cfs @ 12.21 hrs HW=234.00' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.58 cfs @ 12.54 hrs HW=234.36' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.58 cfs @ 2.03 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond I.S.#1: Infiltration System #1



Summary for Pond PP-1: Pervious Pavers Area 1

Assumed percolation rate of 30MPI

Inflow Area = 0.044 ac, 53.67% Impervious, Inflow Depth = 1.39" for 2-Year Storm event
Inflow = 0.07 cfs @ 12.08 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 11.99 hrs, Volume= 0.005 af, Atten= 59%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.99 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.61' @ 12.32 hrs Surf.Area= 648 sf Storage= 28 cf

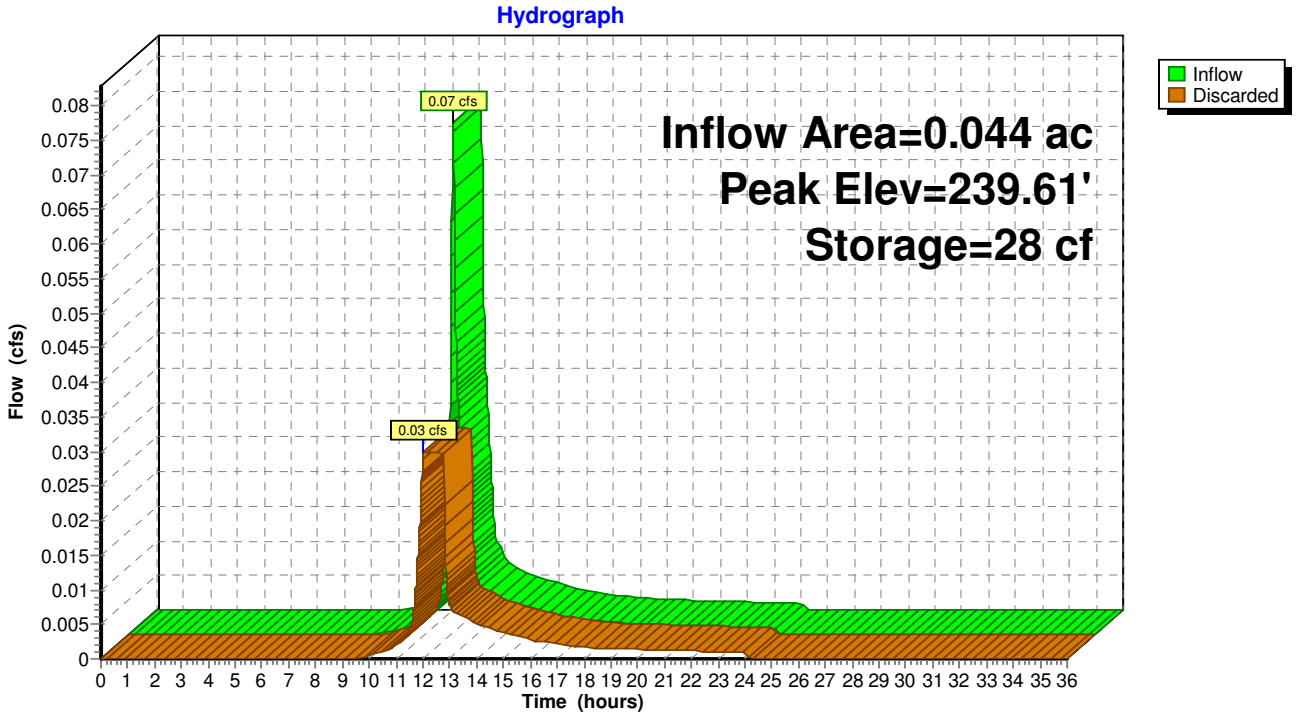
Plug-Flow detention time= 5.5 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 5.5 min (845.7 - 840.2)

Volume	Invert	Avail.Storage	Storage Description
#1	239.50'	389 cf	**18.00'W x 36.00'L x 1.50'H Prismatoid** 972 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.50'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 11.99 hrs HW=239.52' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-1: Pervious Pavers Area 1



Summary for Pond PP-2: Pervious Pavers Area 2

Assumed percolation rate of 30MPI

Inflow Area = 0.053 ac, 43.73% Impervious, Inflow Depth = 1.14" for 2-Year Storm event
Inflow = 0.07 cfs @ 12.08 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.01 hrs, Volume= 0.005 af, Atten= 58%, Lag= 0.0 min
Discarded = 0.03 cfs @ 12.01 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 238.85' @ 12.33 hrs Surf.Area= 648 sf Storage= 26 cf

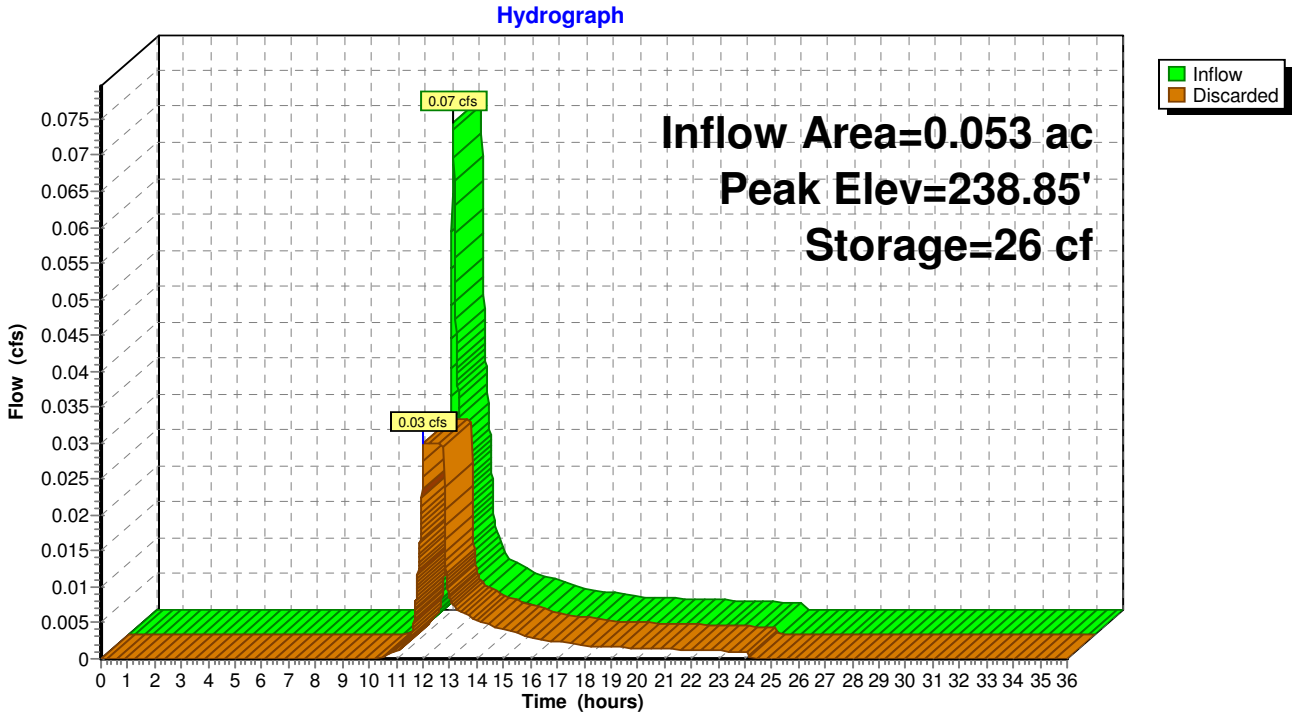
Plug-Flow detention time= 5.5 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 5.5 min (858.8 - 853.3)

Volume	Invert	Avail.Storage	Storage Description
#1	238.75'	454 cf	**18.00'W x 36.00'L x 1.75'H Prismatoid** 1,134 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 12.01 hrs HW=238.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-2: Pervious Pavers Area 2



Summary for Pond PP-3: Pervious Pavers Area 3

Assumed percolation rate of 30MPI

Inflow Area = 0.072 ac, 36.69% Impervious, Inflow Depth = 1.03" for 2-Year Storm event
Inflow = 0.09 cfs @ 12.08 hrs, Volume= 0.006 af
Outflow = 0.04 cfs @ 12.01 hrs, Volume= 0.006 af, Atten= 56%, Lag= 0.0 min
Discarded = 0.04 cfs @ 12.01 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 237.84' @ 12.32 hrs Surf.Area= 810 sf Storage= 30 cf

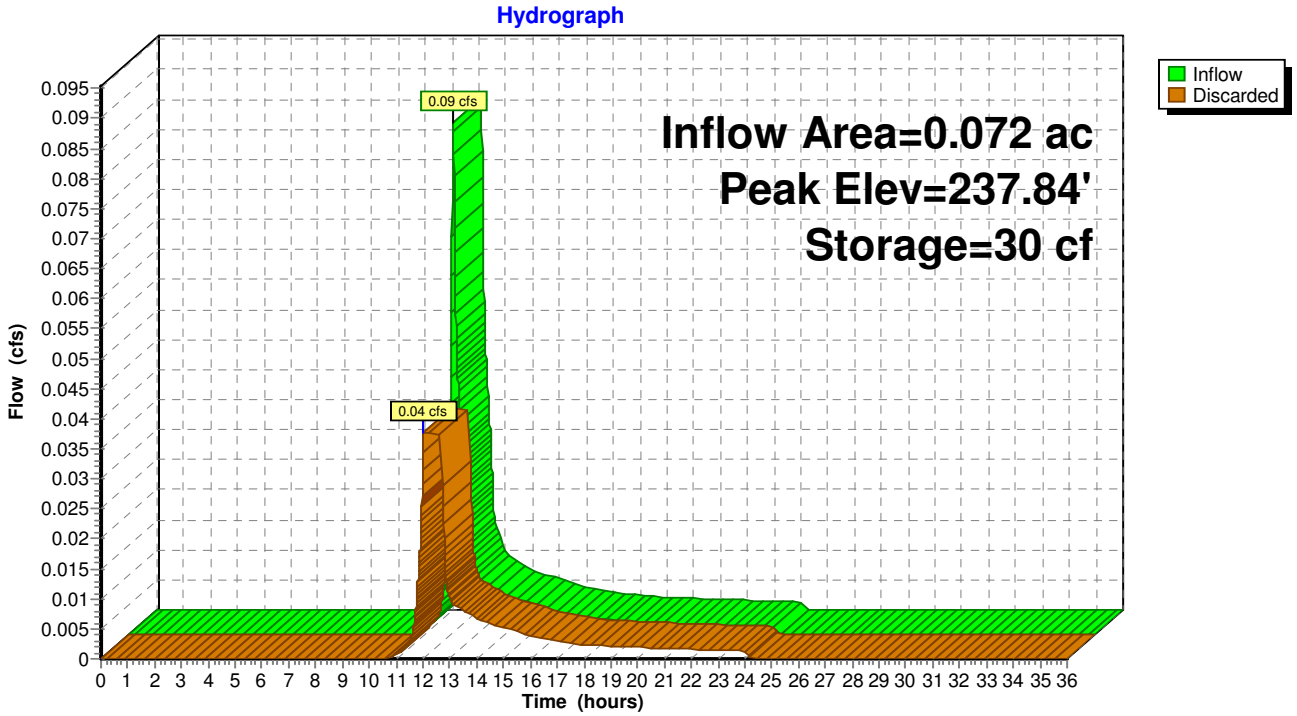
Plug-Flow detention time= 5.2 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 5.2 min (865.0 - 859.8)

Volume	Invert	Avail.Storage	Storage Description
#1	237.75'	567 cf	**18.00'W x 45.00'L x 1.75'H Prismatoid** 1,418 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 12.01 hrs HW=237.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond PP-3: Pervious Pavers Area 3



Summary for Subcatchment 2-1: On-site Contributing Area

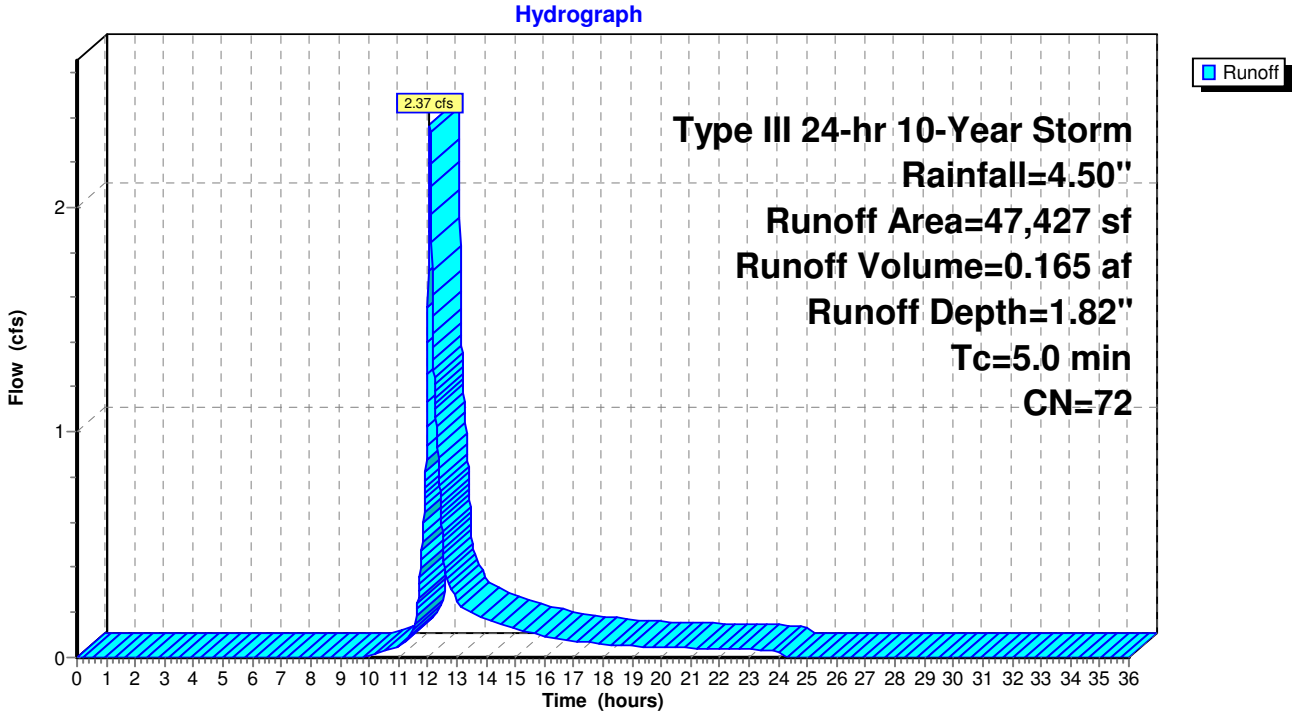
Runoff = 2.37 cfs @ 12.08 hrs, Volume= 0.165 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	5,048	98	Building Rooftop Area
*	889	98	Sidewalk Area
*	10,165	98	Pavement Area
	18,133	61	>75% Grass cover, Good, HSG B
	6,044	58	Woods/grass comb., Good, HSG B
	7,148	55	Woods, Good, HSG B
	47,427	72	Weighted Average
	31,325		Pervious Area
	16,102		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-1: On-site Contributing Area



Summary for Subcatchment 2-10: Direct Flow to Study Point

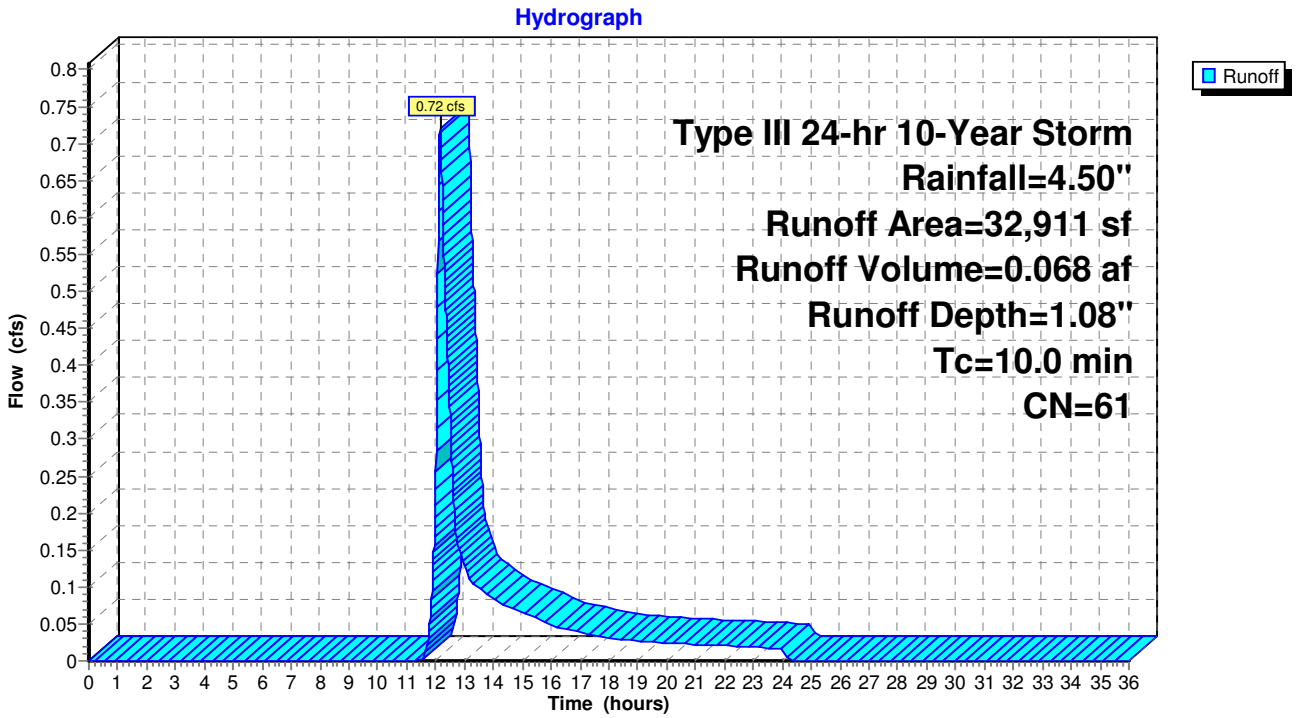
Runoff = 0.72 cfs @ 12.16 hrs, Volume= 0.068 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	1,793	98	Rooftop Area
	17,774	61	>75% Grass cover, Good, HSG B
	5,924	58	Woods/grass comb., Good, HSG B
	7,420	55	Woods, Good, HSG B
	32,911	61	Weighted Average
	31,118		Pervious Area
	1,793		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2-10: Direct Flow to Study Point



Summary for Subcatchment 2-2: Flow to Pervious Pavers Area 1

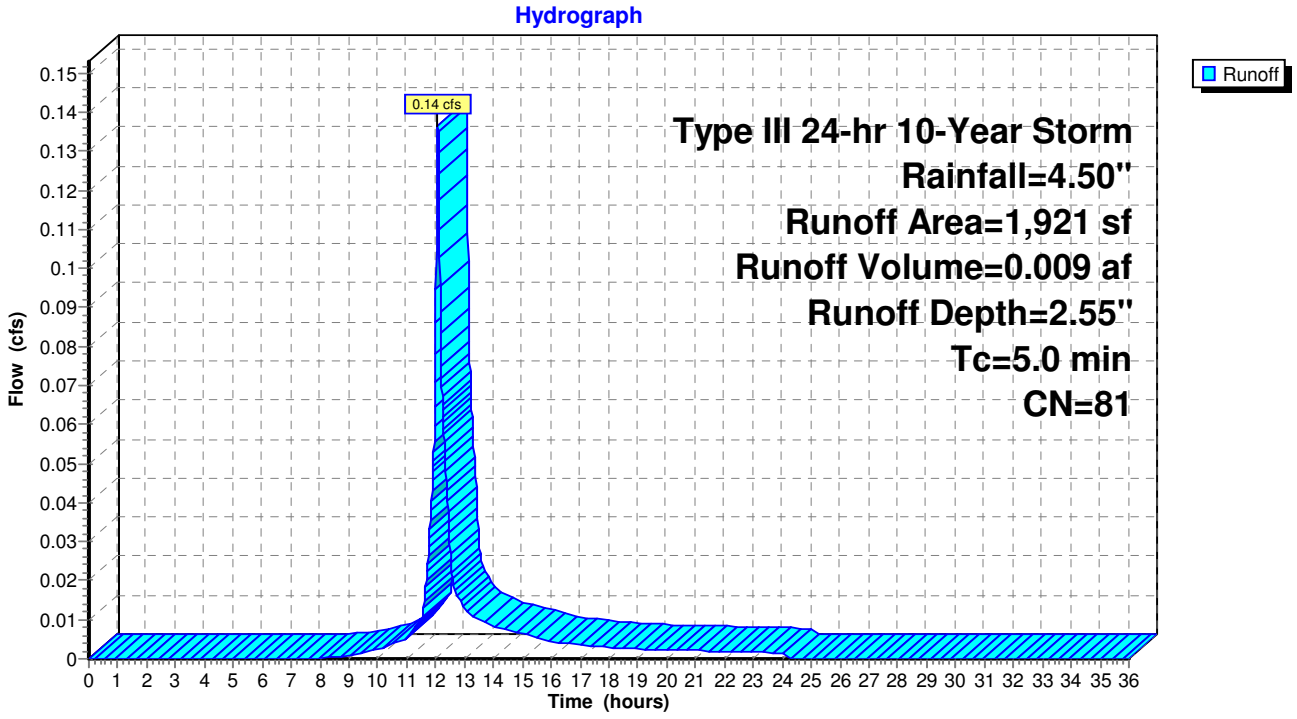
Runoff = 0.14 cfs @ 12.07 hrs, Volume= 0.009 af, Depth= 2.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	1,031	98	Sidewalk & Pervious Pavers
	890	61	>75% Grass cover, Good, HSG B
	1,921	81	Weighted Average
	890		Pervious Area
	1,031		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-2: Flow to Pervious Pavers Area 1



Summary for Subcatchment 2-3: Flow to Pervious Pavers Area 2

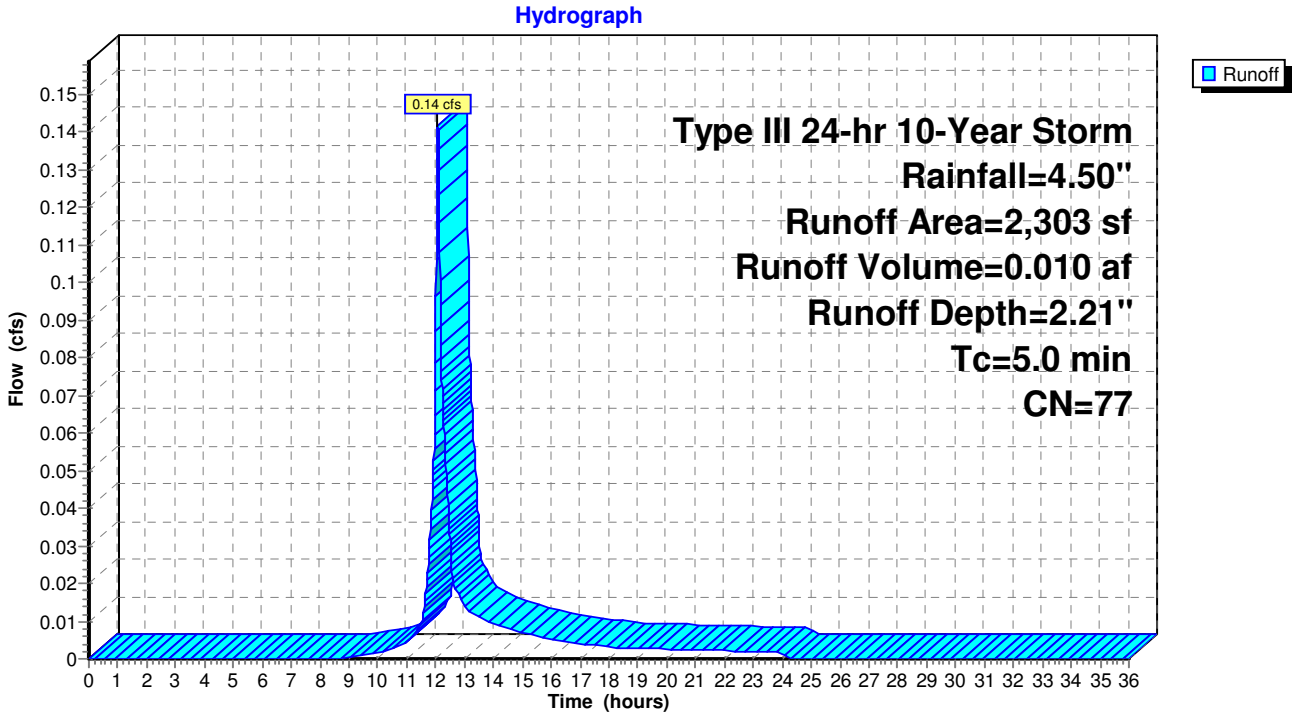
Runoff = 0.14 cfs @ 12.08 hrs, Volume= 0.010 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	1,007	98	Sidewalk & Pervious Pavers
	1,296	61	>75% Grass cover, Good, HSG B
	2,303	77	Weighted Average
	1,296		Pervious Area
	1,007		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-3: Flow to Pervious Pavers Area 2



Summary for Subcatchment 2-4: Flow to Pervious Pavers Area 3

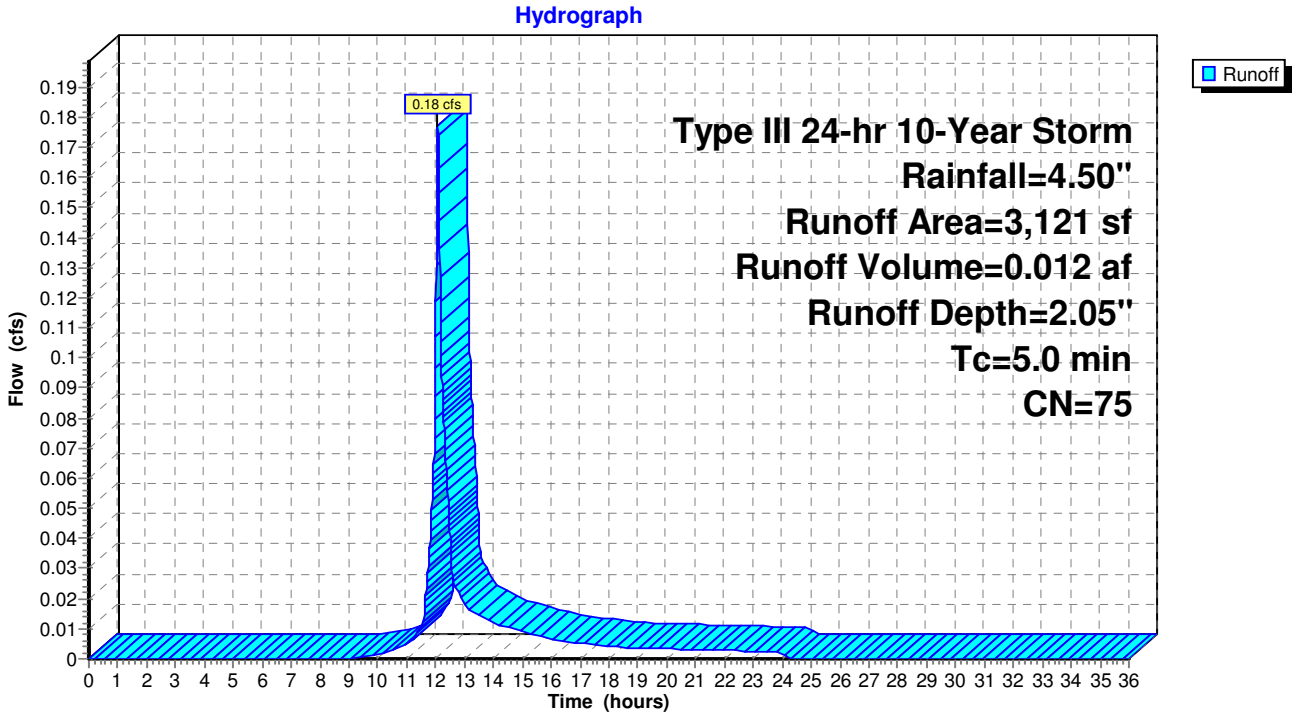
Runoff = 0.18 cfs @ 12.08 hrs, Volume= 0.012 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	1,145	98	Sidewalk & Pervious Pavers
	1,976	61	>75% Grass cover, Good, HSG B
	3,121	75	Weighted Average
	1,976		Pervious Area
	1,145		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-4: Flow to Pervious Pavers Area 3



Summary for Subcatchment 2-5: Bldg C flow to DW1

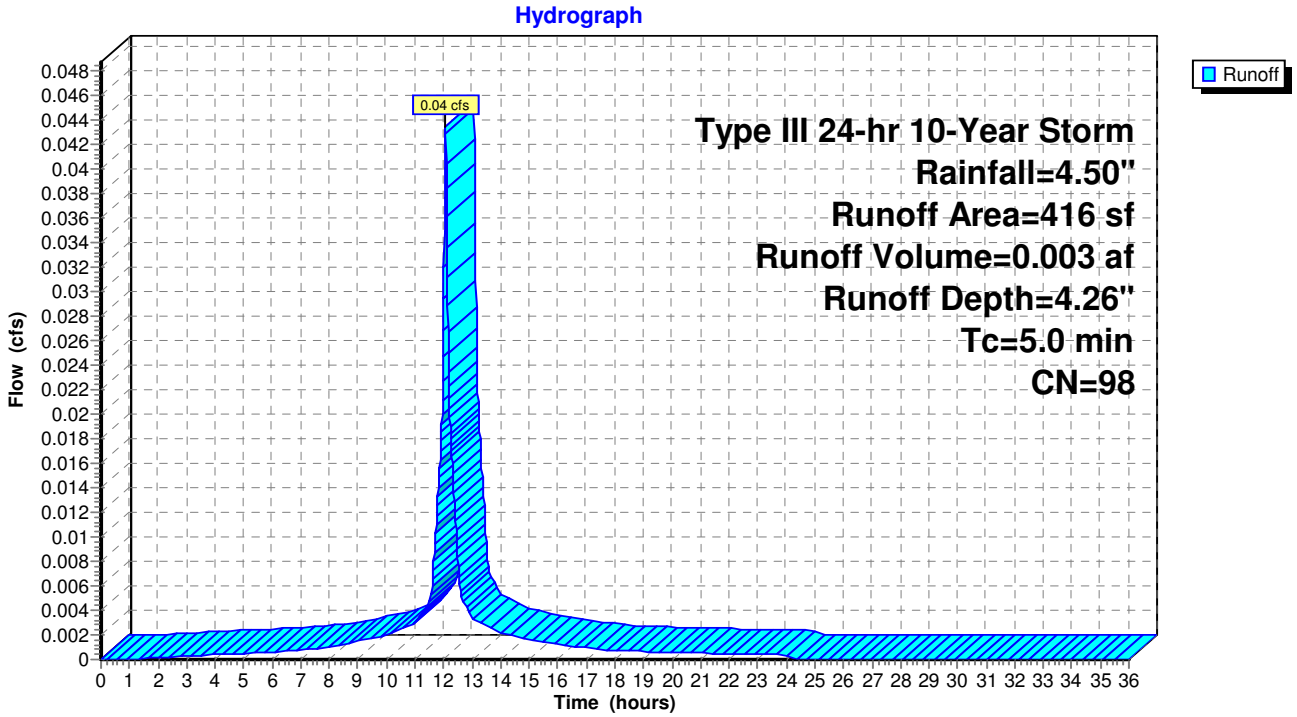
Runoff = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-5: Bldg C flow to DW1



Summary for Subcatchment 2-6: Bldg C flow to DW2

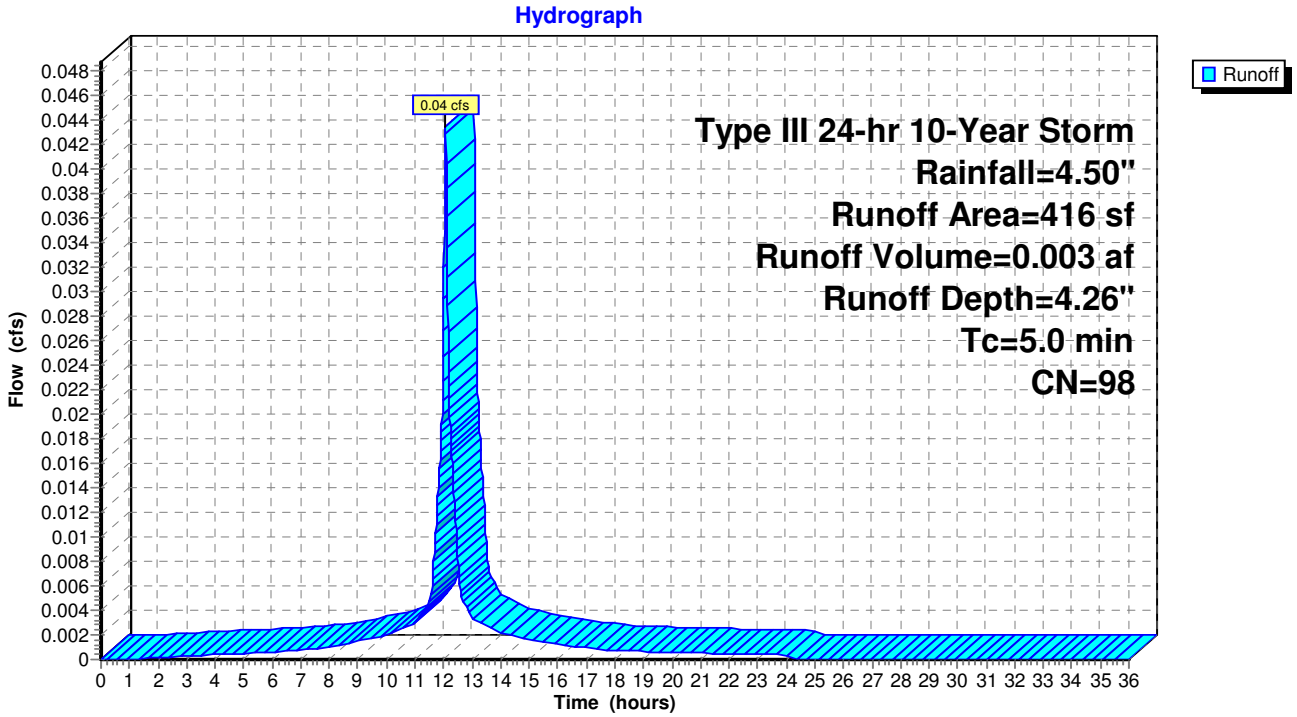
Runoff = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-6: Bldg C flow to DW2



Summary for Subcatchment 2-7: Bldg B flow to DW3

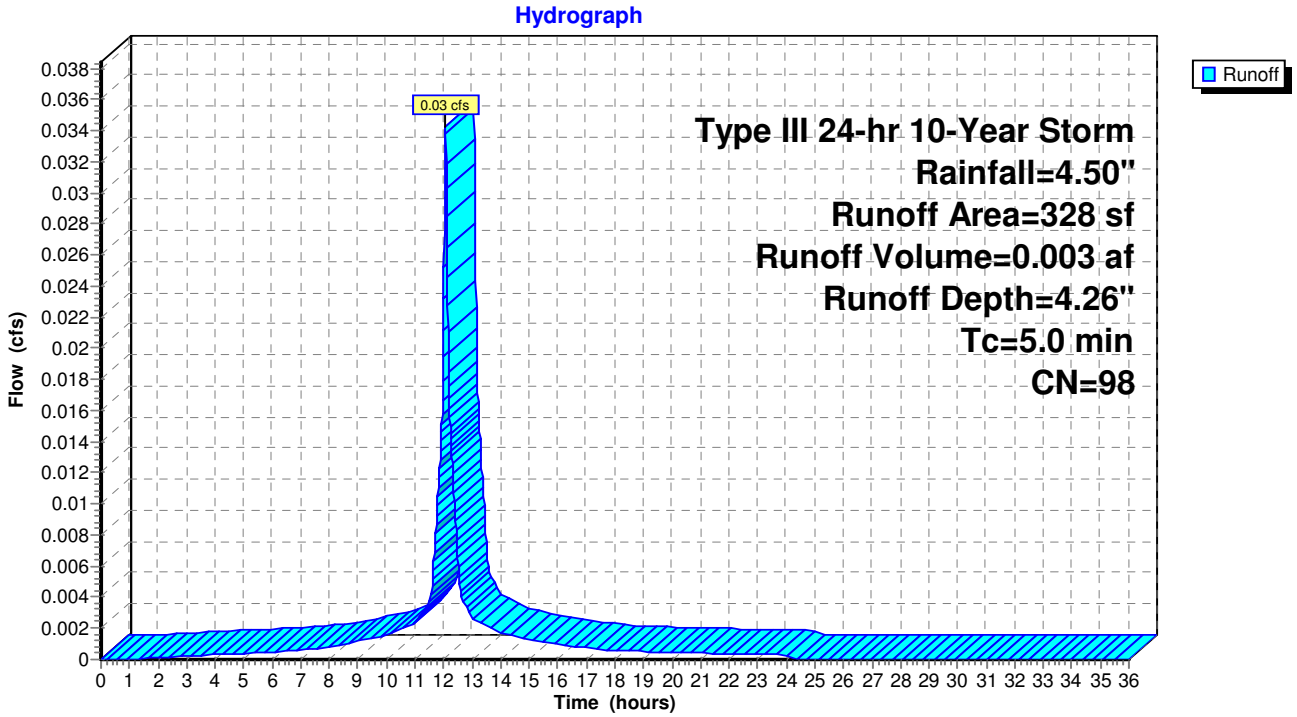
Runoff = 0.03 cfs @ 12.07 hrs, Volume= 0.003 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	328	98	Sidewalk & Pervious Pavers
	328		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-7: Bldg B flow to DW3



Summary for Subcatchment 2-8: Bldg B flow to DW4

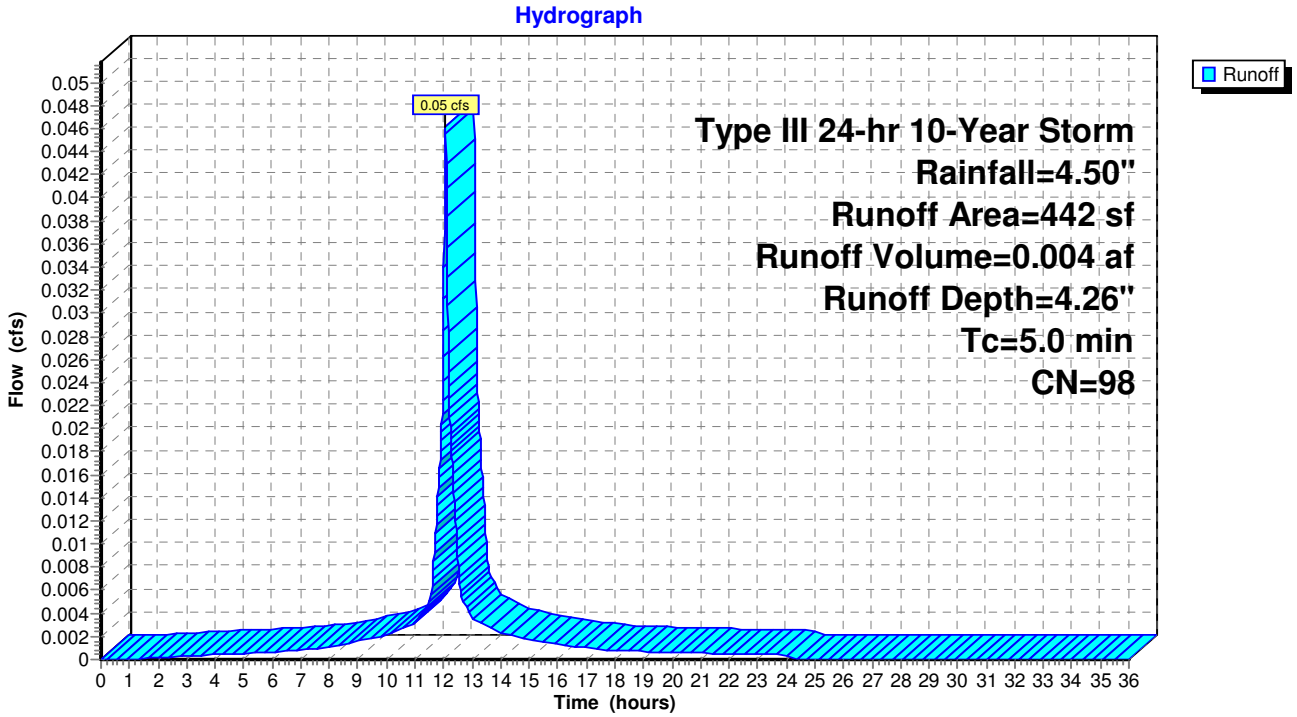
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	442	98	Sidewalk & Pervious Pavers
	442		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-8: Bldg B flow to DW4



Summary for Subcatchment 2-9: Bldg A flow to DW5

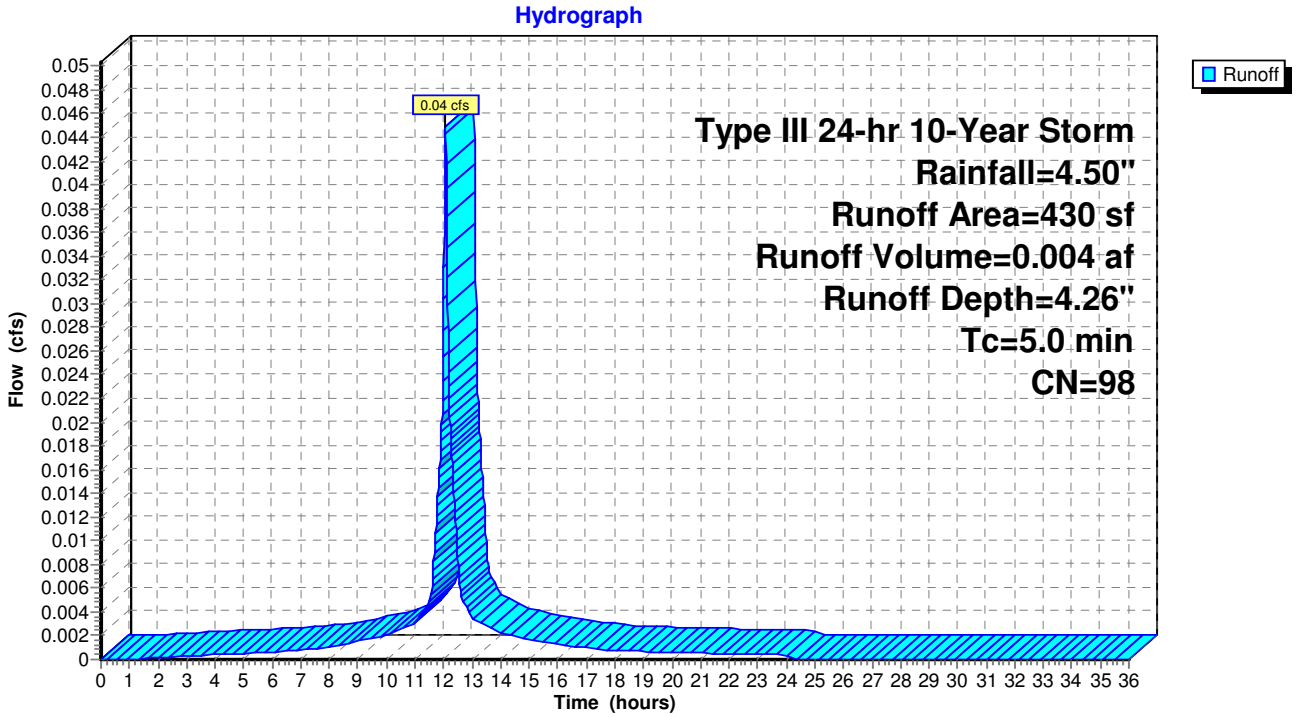
Runoff = 0.04 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	430	98	Sidewalk & Pervious Pavers
	430		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-9: Bldg A flow to DW5



Summary for Subcatchment EX-1: Offsite Contributing Area

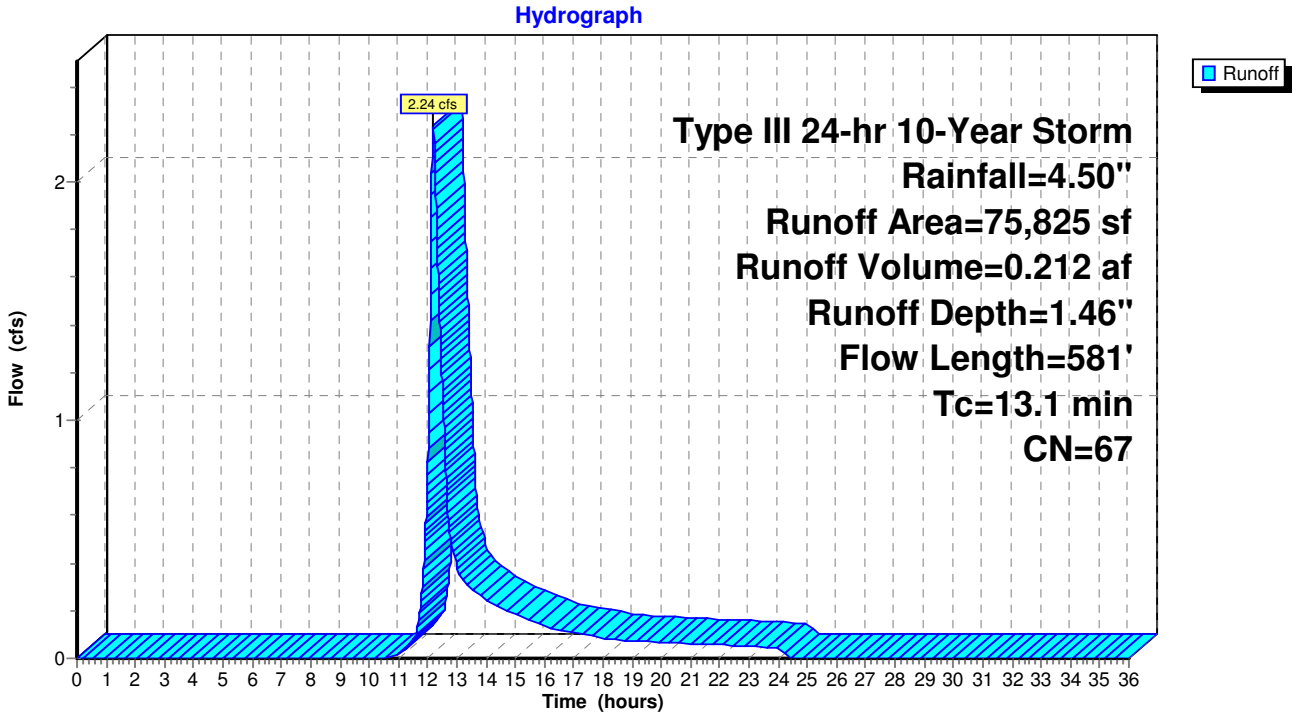
Runoff = 2.24 cfs @ 12.19 hrs, Volume= 0.212 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Storm Rainfall=4.50"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area

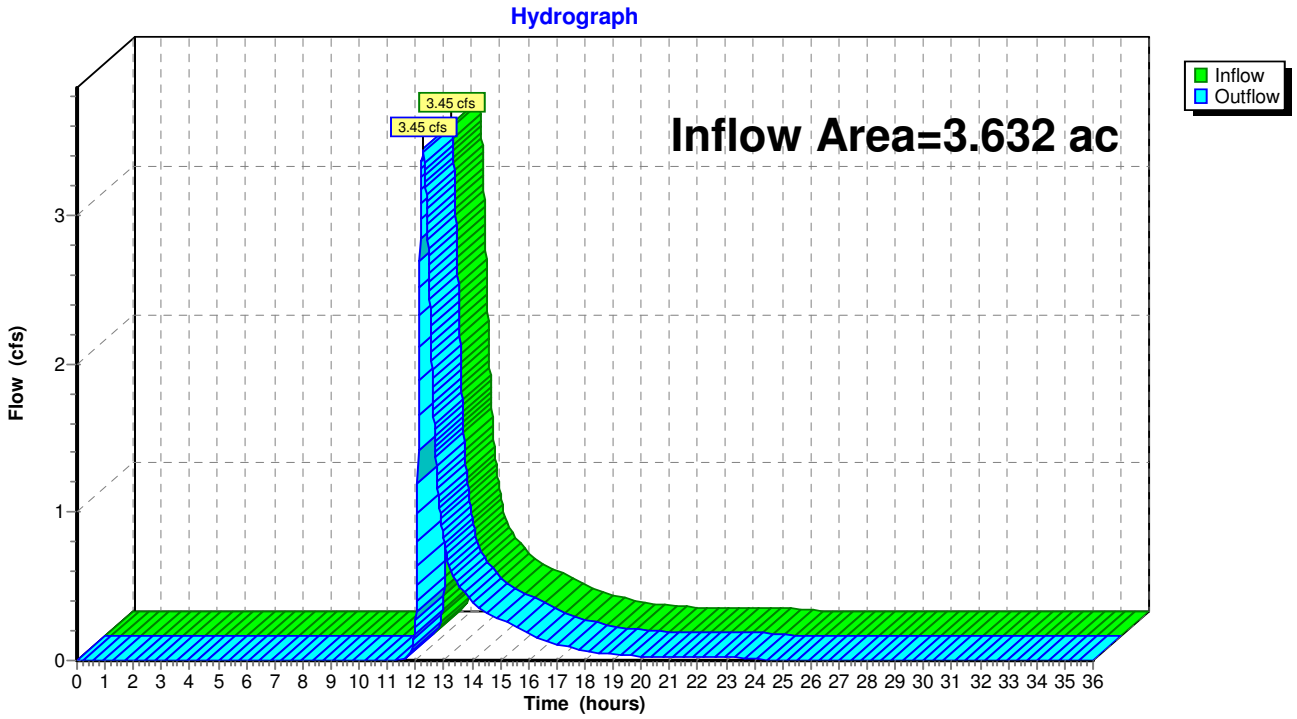


Summary for Reach SP1: Study Point #1

Inflow Area = 3.632 ac, 20.84% Impervious, Inflow Depth = 0.95" for 10-Year Storm event
Inflow = 3.45 cfs @ 12.26 hrs, Volume= 0.288 af
Outflow = 3.45 cfs @ 12.26 hrs, Volume= 0.288 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Summary for Pond CB1: CB1 (Double Grate)

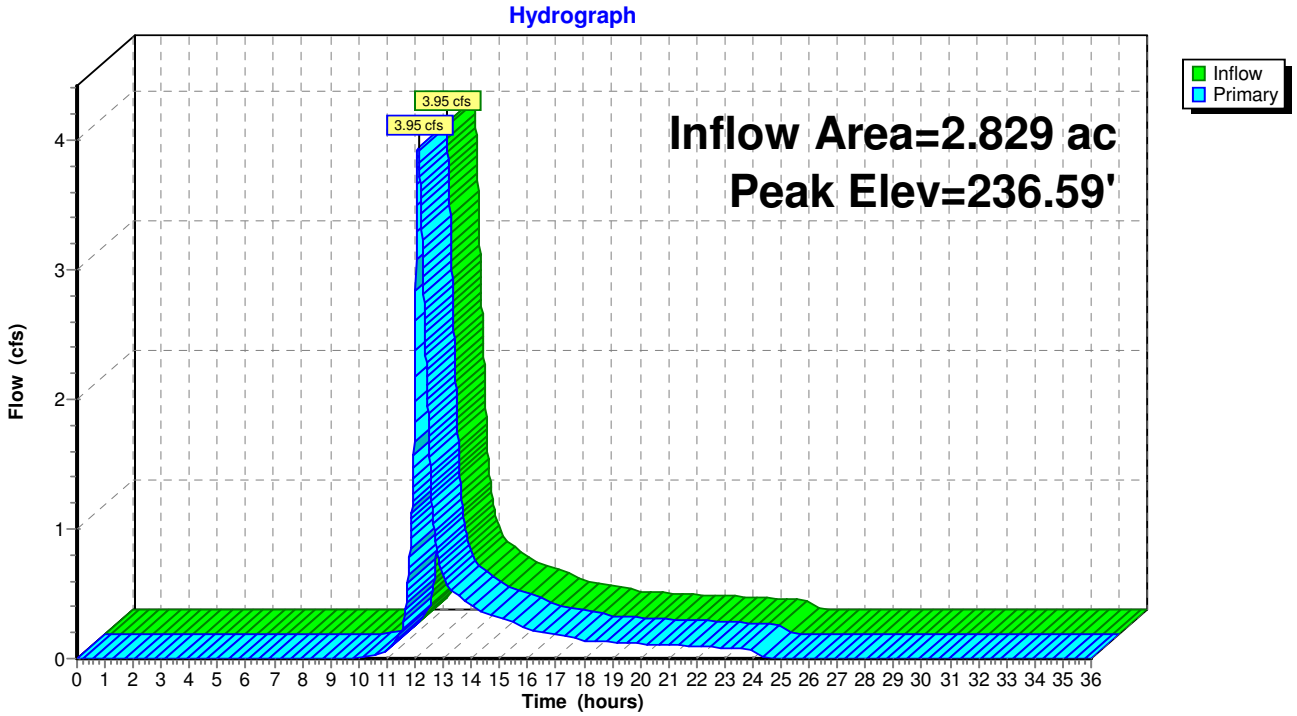
Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 1.60" for 10-Year Storm event
Inflow = 3.95 cfs @ 12.11 hrs, Volume= 0.377 af
Outflow = 3.95 cfs @ 12.11 hrs, Volume= 0.377 af, Atten= 0%, Lag= 0.0 min
Primary = 3.95 cfs @ 12.11 hrs, Volume= 0.377 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 236.59' @ 12.11 hrs
Flood Elev= 238.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=3.94 cfs @ 12.11 hrs HW=236.59' (Free Discharge)
1=Orifice/Grate (Orifice Controls 3.94 cfs @ 5.02 fps)

Pond CB1: CB1 (Double Grate)



Summary for Pond DW1: Dry Well 1

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 4.26" for 10-Year Storm event
Inflow = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 10.46 hrs, Volume= 0.003 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.00 cfs @ 10.46 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 241.30' @ 13.87 hrs Surf.Area= 50 sf Storage= 64 cf

Plug-Flow detention time= 219.3 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 219.3 min (968.2 - 748.9)

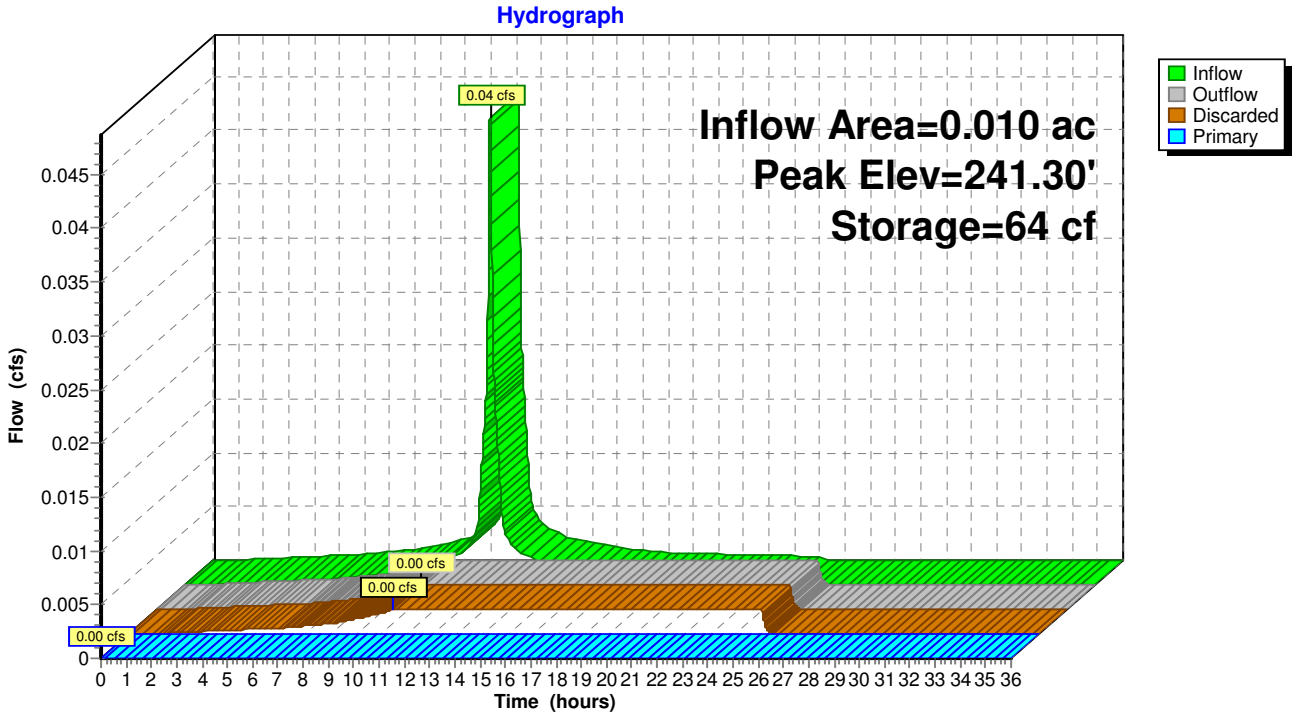
Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	239.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 10.46 hrs HW=239.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=239.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW1: Dry Well 1



Summary for Pond DW2: Dry Well 2

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 4.26" for 10-Year Storm event
Inflow = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 10.46 hrs, Volume= 0.003 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.00 cfs @ 10.46 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.30' @ 13.87 hrs Surf.Area= 50 sf Storage= 64 cf

Plug-Flow detention time= 219.3 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 219.3 min (968.2 - 748.9)

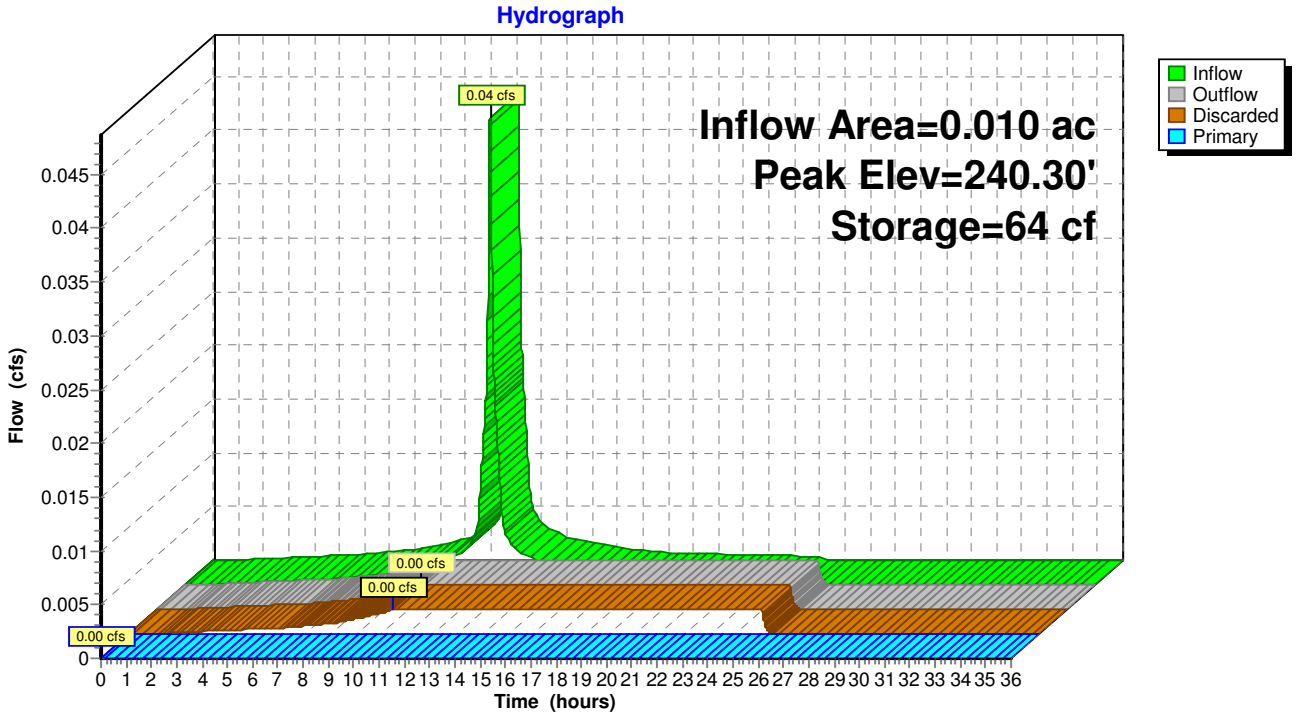
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 10.46 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=238.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW2: Dry Well 2



Summary for Pond DW3: Dry Well 3

Assumed percolation rate of 30MPI

Inflow Area = 0.008 ac,100.00% Impervious, Inflow Depth = 4.26" for 10-Year Storm event
Inflow = 0.03 cfs @ 12.07 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 11.05 hrs, Volume= 0.003 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.05 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.63' @ 13.27 hrs Surf.Area= 50 sf Storage= 45 cf

Plug-Flow detention time= 146.1 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 146.1 min (895.0 - 748.9)

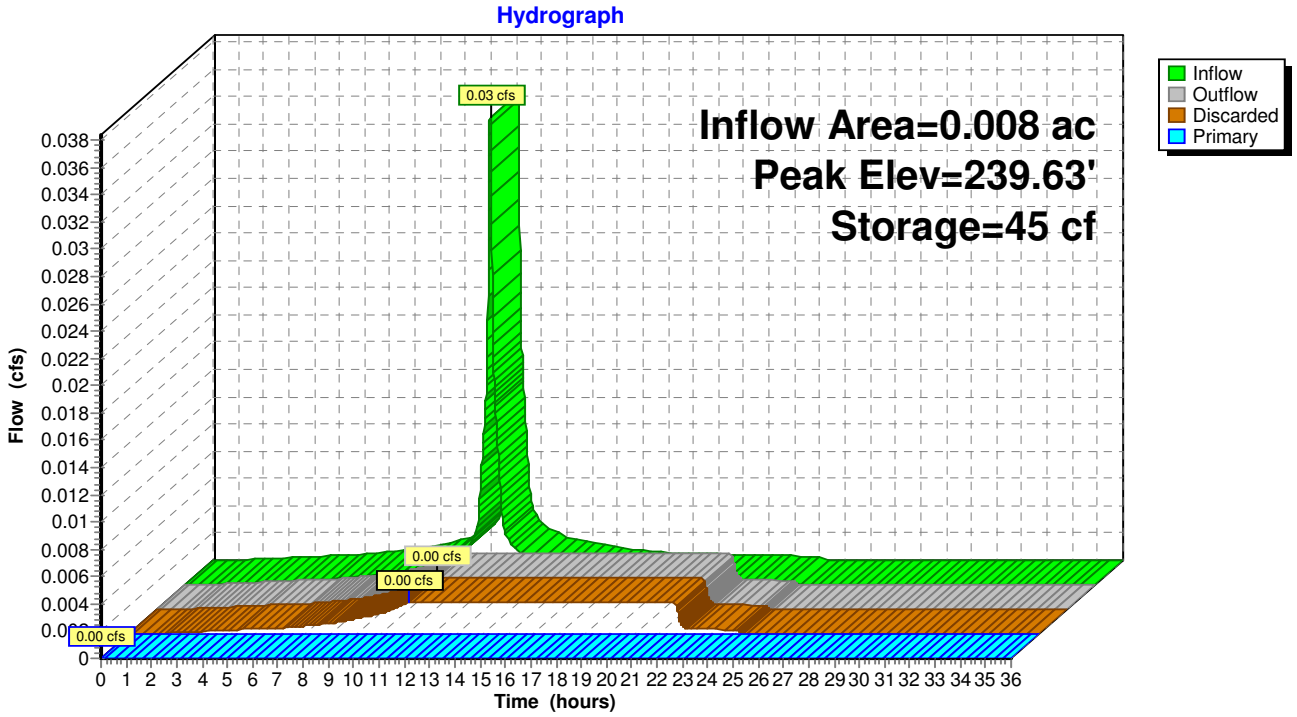
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 11.05 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=238.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW3: Dry Well 3



Summary for Pond DW4: Dry Well 4

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 4.26" for 10-Year Storm event
Inflow = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af
Outflow = 0.00 cfs @ 13.72 hrs, Volume= 0.004 af, Atten= 94%, Lag= 98.8 min
Discarded = 0.00 cfs @ 10.32 hrs, Volume= 0.004 af
Primary = 0.00 cfs @ 13.72 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.50' @ 13.72 hrs Surf.Area= 50 sf Storage= 69 cf

Plug-Flow detention time= 241.5 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 241.4 min (990.3 - 748.9)

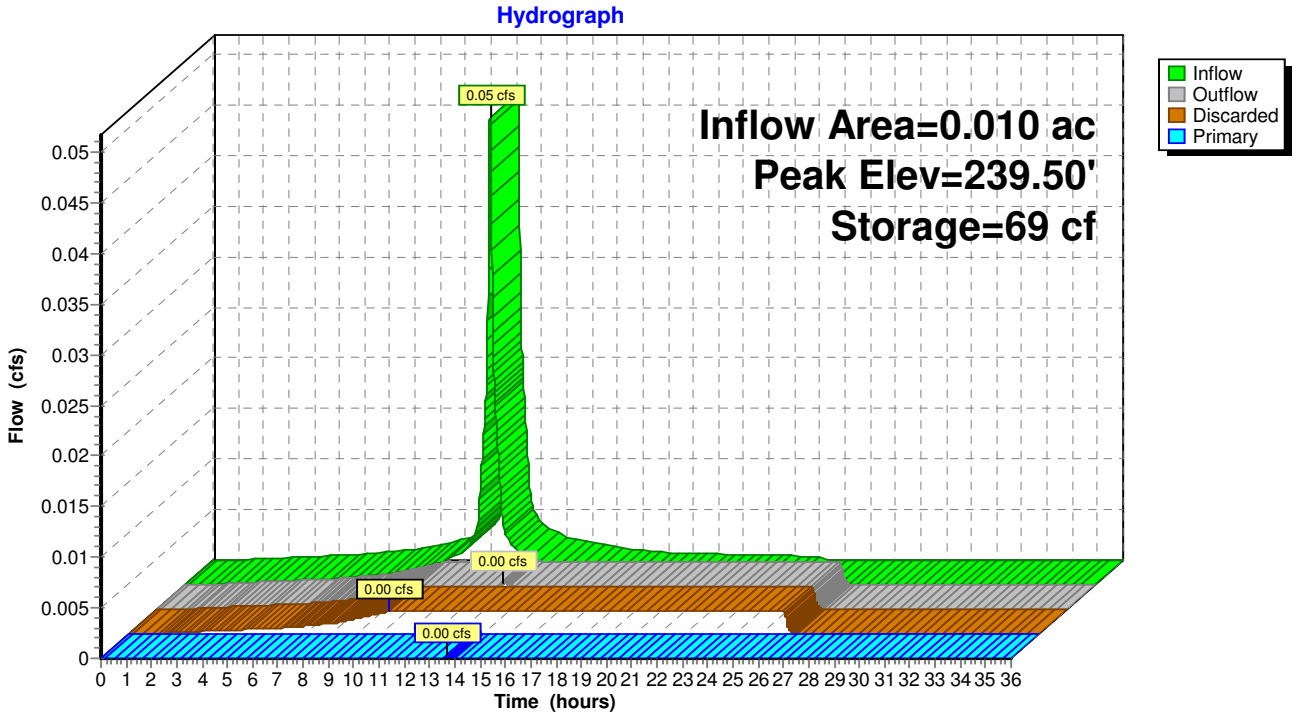
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 10.32 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 13.72 hrs HW=239.50' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.00 cfs @ 0.08 fps)

Pond DW4: Dry Well 4



Summary for Pond DW5: Dry Well 5

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 4.26" for 10-Year Storm event
Inflow = 0.04 cfs @ 12.07 hrs, Volume= 0.004 af
Outflow = 0.00 cfs @ 10.38 hrs, Volume= 0.004 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.00 cfs @ 10.38 hrs, Volume= 0.004 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.41' @ 13.95 hrs Surf.Area= 50 sf Storage= 67 cf

Plug-Flow detention time= 231.8 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 231.7 min (980.6 - 748.9)

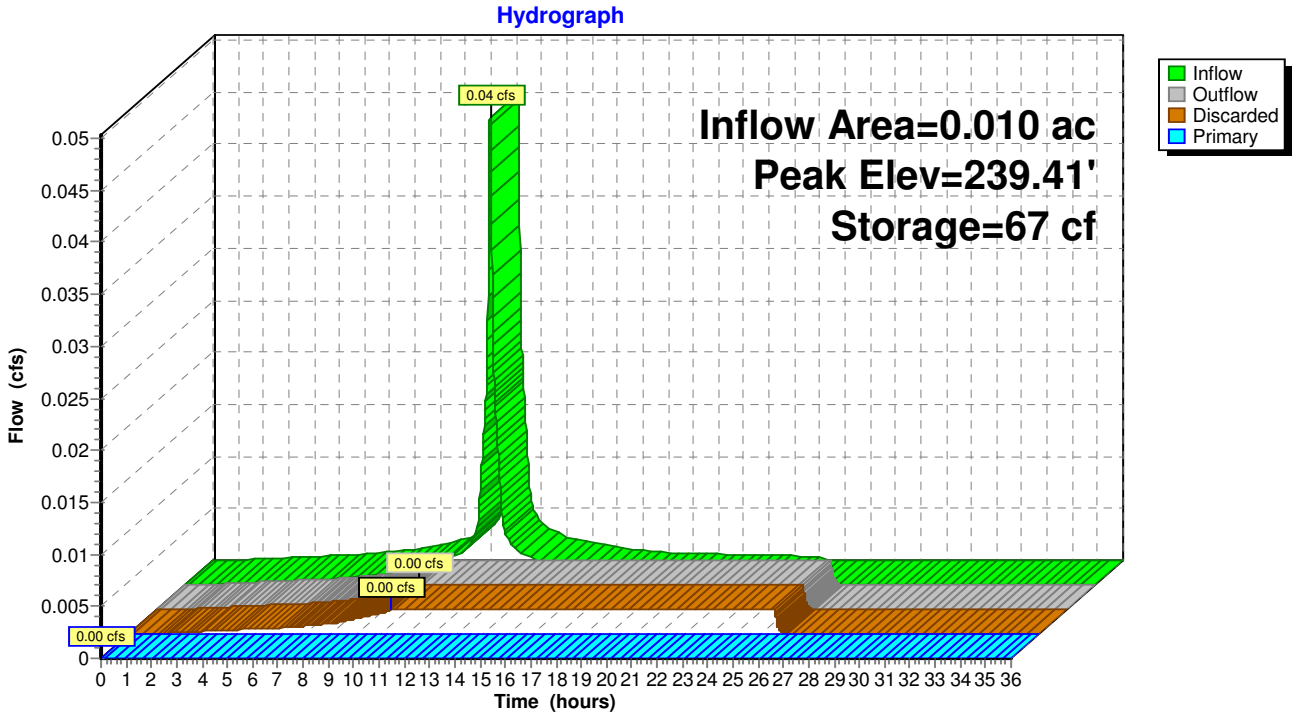
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 10.38 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=237.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW5: Dry Well 5



Summary for Pond I.S.#1: Infiltration System #1

Assumed percolation rate of 30 MPI

Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 1.60" for 10-Year Storm event
Inflow = 3.95 cfs @ 12.11 hrs, Volume= 0.377 af
Outflow = 3.02 cfs @ 12.28 hrs, Volume= 0.377 af, Atten= 23%, Lag= 9.9 min
Discarded = 0.13 cfs @ 12.28 hrs, Volume= 0.158 af
Primary = 2.89 cfs @ 12.28 hrs, Volume= 0.220 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 234.89' @ 12.28 hrs Surf.Area= 2,884 sf Storage= 2,883 cf

Plug-Flow detention time= 62.2 min calculated for 0.377 af (100% of inflow)
Center-of-Mass det. time= 62.2 min (921.4 - 859.1)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	3,258 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 9,545 cf Overall - 1,400 cf Embedded = 8,145 cf x 40.0% Voids
#2	234.00'	1,400 cf	**28.9"W x 16.0"H x 7.12'L StormTech SC-310** x 95 Inside #1
#3	234.50'	49 cf	**12.0"D x 62.00'L Horizontal Cylinder S= 0.0080 '/'**
#4	234.00'	44 cf	**4.00'D x 3.50'H DMH1**
#5	234.00'	44 cf	**4.00'D x 3.50'H OCS1**
		4,795 cf	Total Available Storage

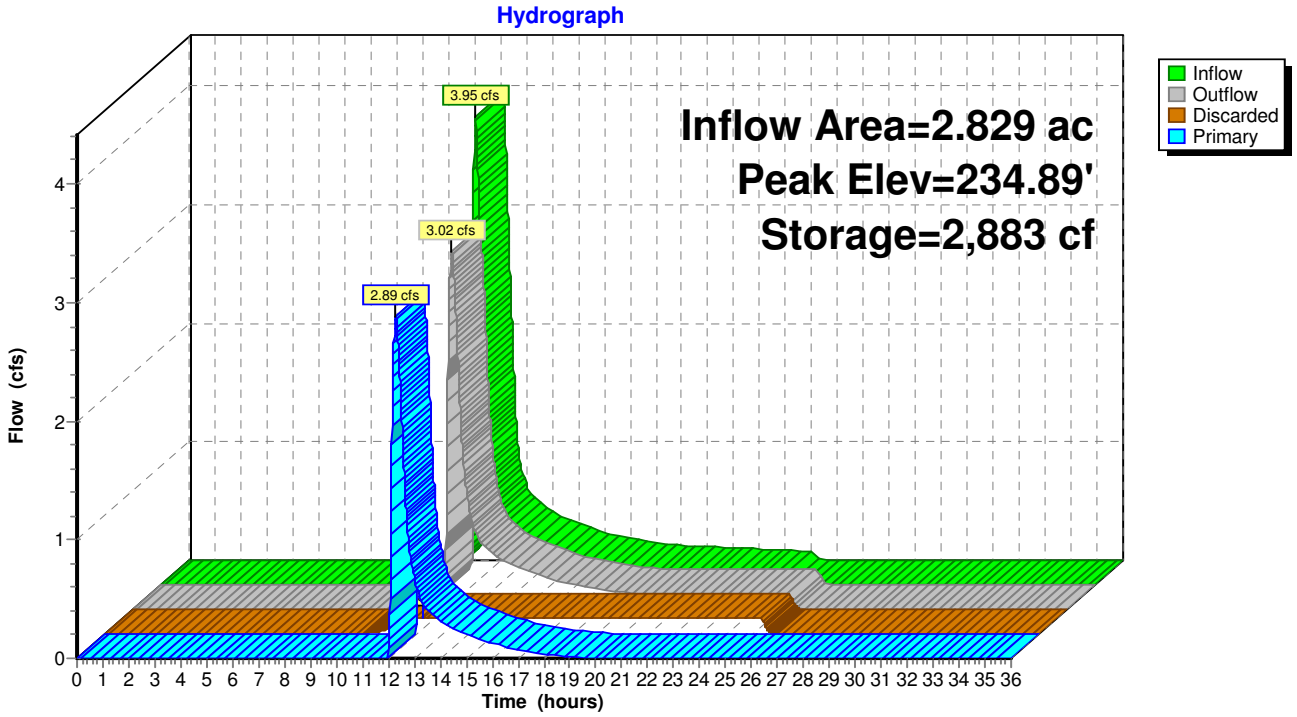
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
233.00	2,824	218.0	0	0	2,824
236.38	2,824	218.0	9,545	9,545	3,561

Device	Routing	Invert	Outlet Devices
#1	Discarded	233.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	234.00'	**14.5" Vert. Orifice/Grate** C= 0.600
#3	Primary	236.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.13 cfs @ 12.28 hrs HW=234.89' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=2.89 cfs @ 12.28 hrs HW=234.89' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 2.89 cfs @ 3.20 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond I.S.#1: Infiltration System #1



Summary for Pond PP-1: Pervious Pavers Area 1

Assumed percolation rate of 30MPI

Inflow Area = 0.044 ac, 53.67% Impervious, Inflow Depth = 2.55" for 10-Year Storm event
Inflow = 0.14 cfs @ 12.07 hrs, Volume= 0.009 af
Outflow = 0.03 cfs @ 11.81 hrs, Volume= 0.009 af, Atten= 78%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.81 hrs, Volume= 0.009 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.87' @ 12.49 hrs Surf.Area= 648 sf Storage= 96 cf

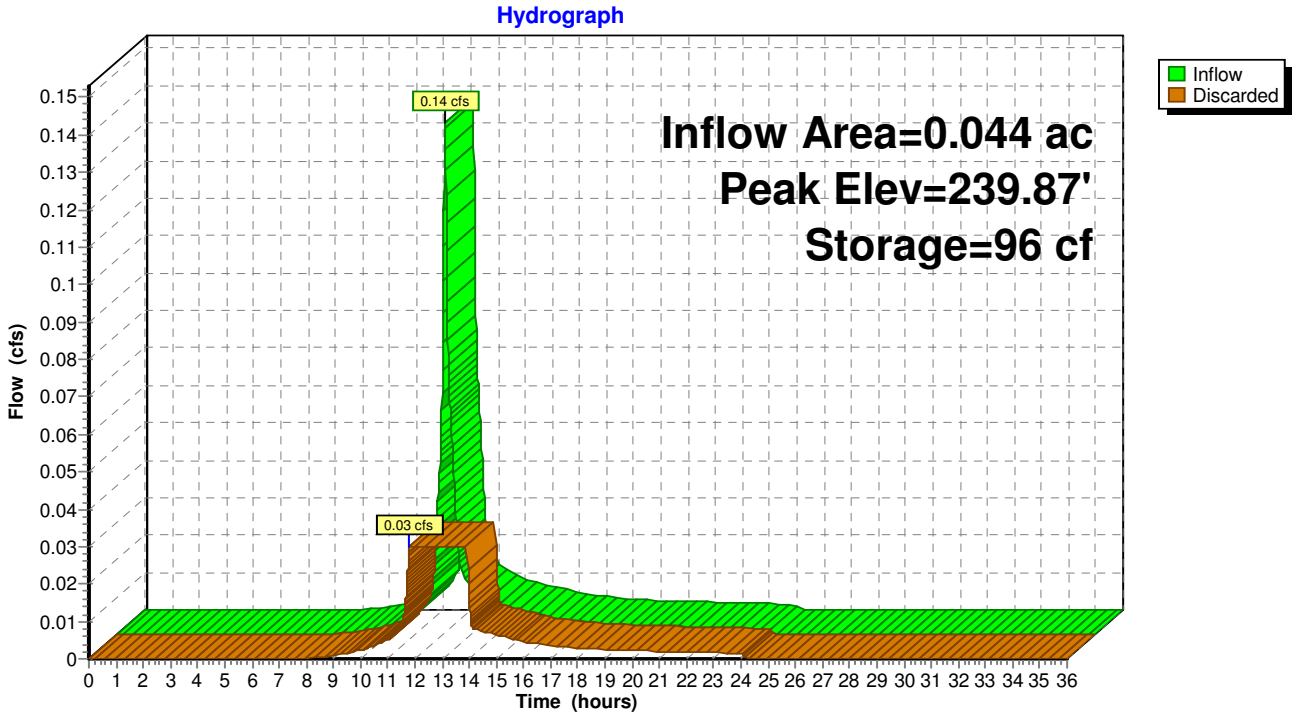
Plug-Flow detention time= 18.5 min calculated for 0.009 af (100% of inflow)
Center-of-Mass det. time= 18.5 min (841.1 - 822.7)

Volume	Invert	Avail.Storage	Storage Description
#1	239.50'	389 cf	**18.00'W x 36.00'L x 1.50'H Prismatoid** 972 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.50'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 11.81 hrs HW=239.52' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-1: Pervious Pavers Area 1



Summary for Pond PP-2: Pervious Pavers Area 2

Assumed percolation rate of 30MPI

Inflow Area = 0.053 ac, 43.73% Impervious, Inflow Depth = 2.21" for 10-Year Storm event
Inflow = 0.14 cfs @ 12.08 hrs, Volume= 0.010 af
Outflow = 0.03 cfs @ 11.82 hrs, Volume= 0.010 af, Atten= 79%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.82 hrs, Volume= 0.010 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.15' @ 12.51 hrs Surf.Area= 648 sf Storage= 103 cf

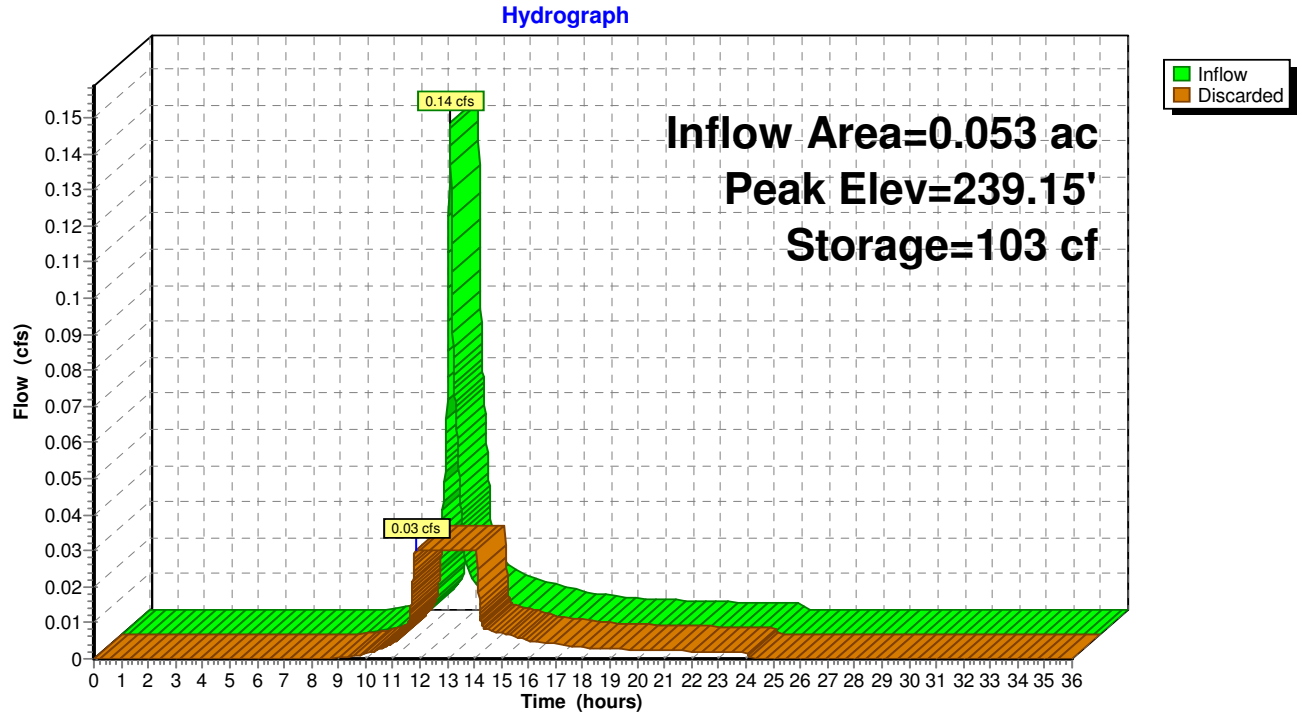
Plug-Flow detention time= 20.7 min calculated for 0.010 af (100% of inflow)
Center-of-Mass det. time= 20.6 min (854.4 - 833.7)

Volume	Invert	Avail.Storage	Storage Description
#1	238.75'	454 cf	**18.00'W x 36.00'L x 1.75'H Prismatoid** 1,134 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 11.82 hrs HW=238.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-2: Pervious Pavers Area 2



Summary for Pond PP-3: Pervious Pavers Area 3

Assumed percolation rate of 30MPI

Inflow Area = 0.072 ac, 36.69% Impervious, Inflow Depth = 2.05" for 10-Year Storm event
Inflow = 0.18 cfs @ 12.08 hrs, Volume= 0.012 af
Outflow = 0.04 cfs @ 11.84 hrs, Volume= 0.012 af, Atten= 79%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.84 hrs, Volume= 0.012 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 238.15' @ 12.52 hrs Surf.Area= 810 sf Storage= 129 cf

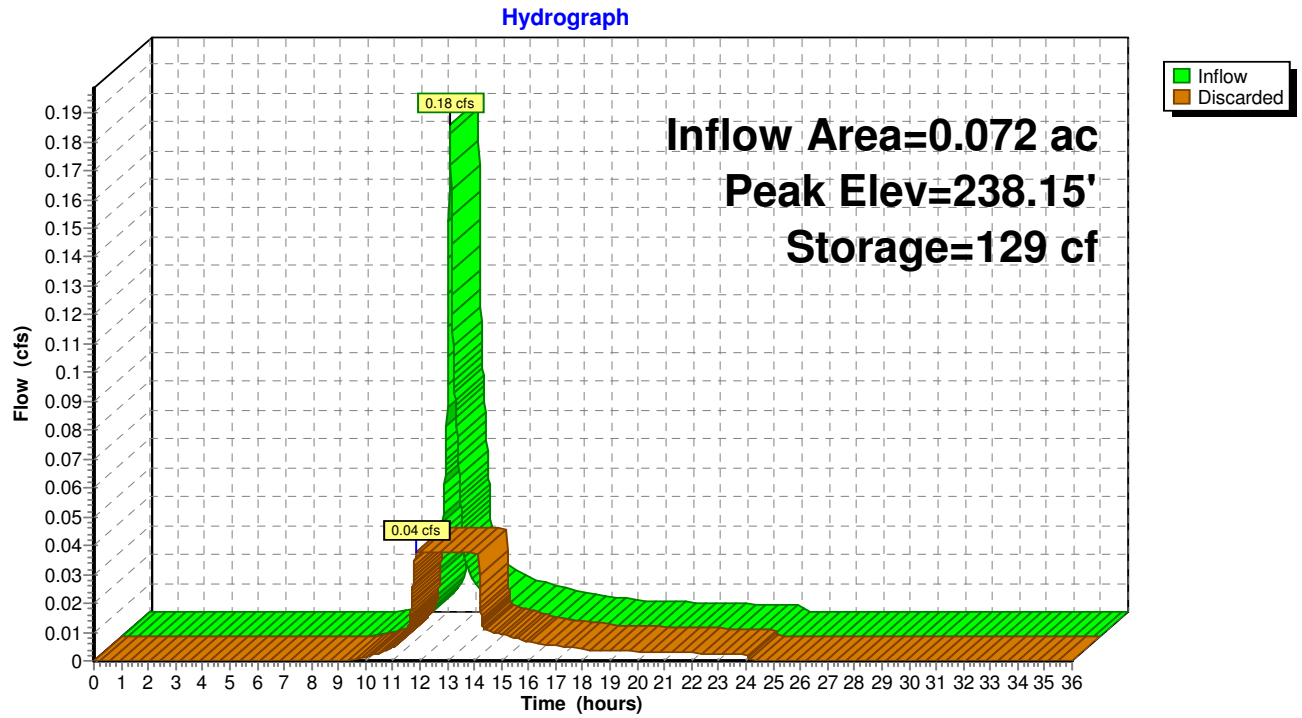
Plug-Flow detention time= 20.9 min calculated for 0.012 af (100% of inflow)
Center-of-Mass det. time= 20.9 min (860.0 - 839.1)

Volume	Invert	Avail.Storage	Storage Description
#1	237.75'	567 cf	**18.00'W x 45.00'L x 1.75'H Prismatoid** 1,418 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 11.84 hrs HW=237.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond PP-3: Pervious Pavers Area 3



Summary for Subcatchment 2-1: On-site Contributing Area

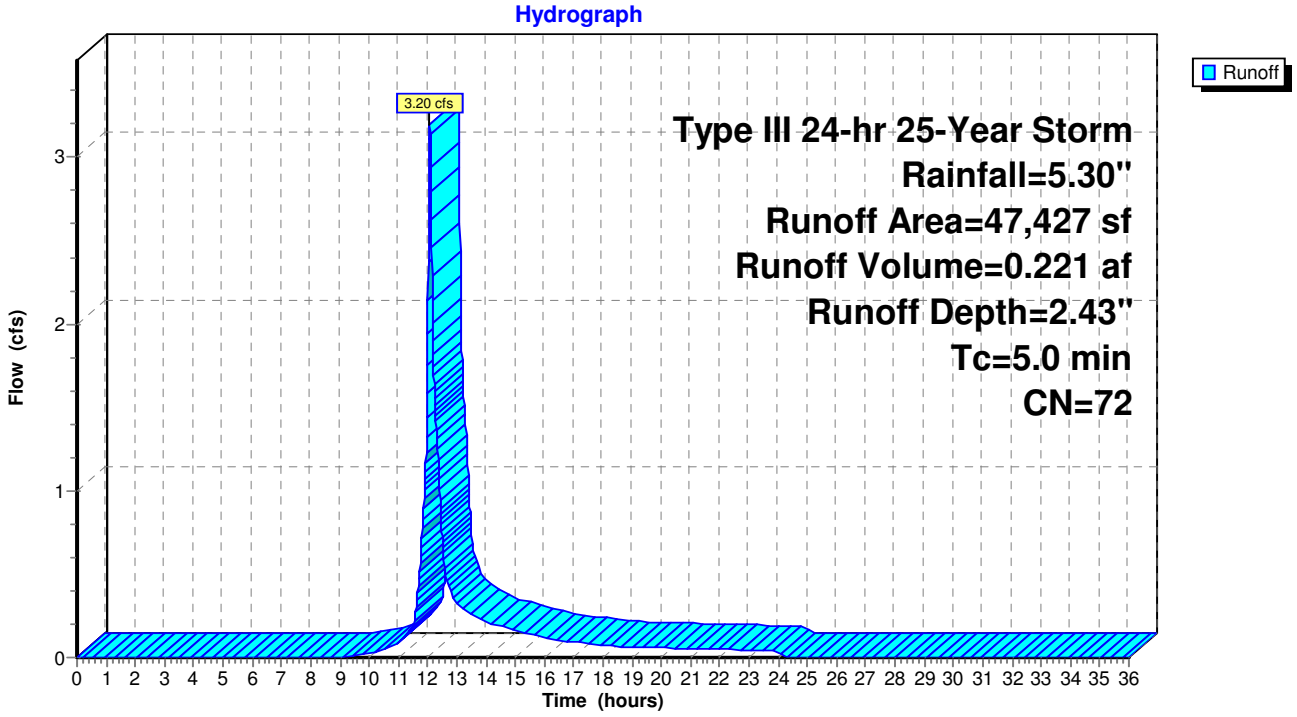
Runoff = 3.20 cfs @ 12.08 hrs, Volume= 0.221 af, Depth= 2.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	5,048	98	Building Rooftop Area
*	889	98	Sidewalk Area
*	10,165	98	Pavement Area
	18,133	61	>75% Grass cover, Good, HSG B
	6,044	58	Woods/grass comb., Good, HSG B
	7,148	55	Woods, Good, HSG B
	47,427	72	Weighted Average
	31,325		Pervious Area
	16,102		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-1: On-site Contributing Area



Summary for Subcatchment 2-10: Direct Flow to Study Point

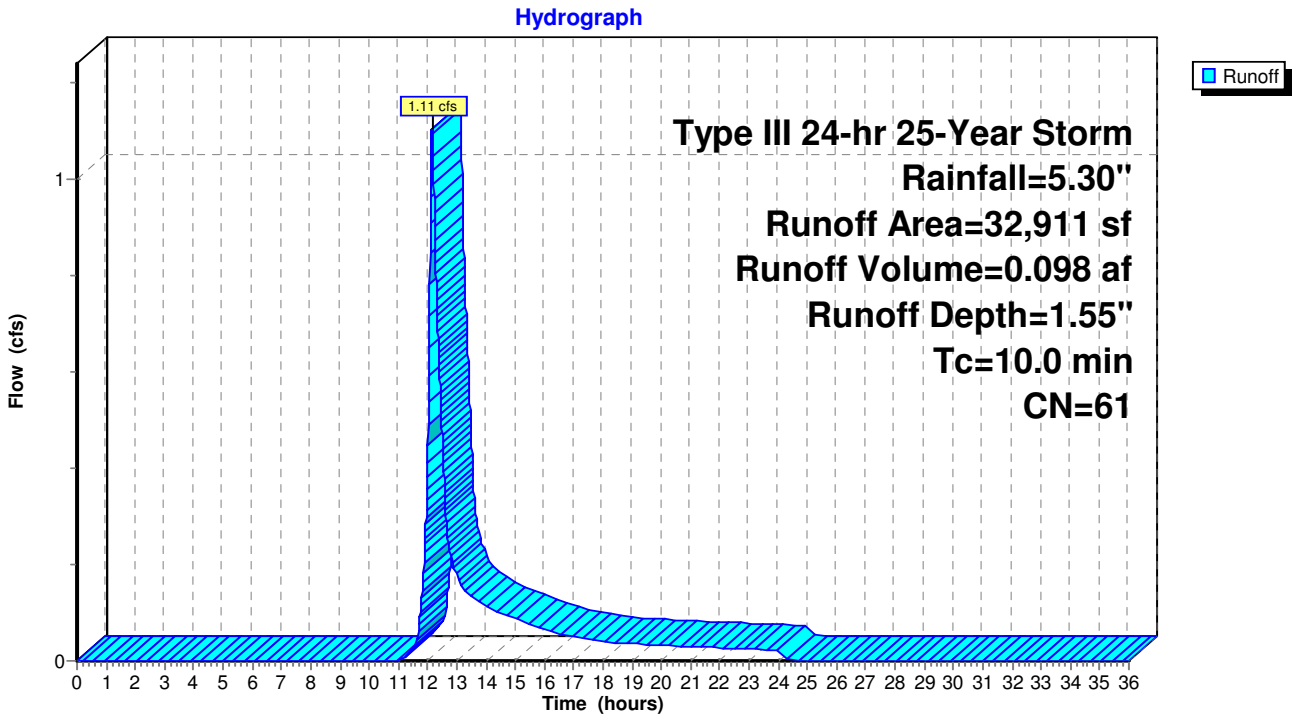
Runoff = 1.11 cfs @ 12.15 hrs, Volume= 0.098 af, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	1,793	98	Rooftop Area
	17,774	61	>75% Grass cover, Good, HSG B
	5,924	58	Woods/grass comb., Good, HSG B
	7,420	55	Woods, Good, HSG B
	32,911	61	Weighted Average
	31,118		Pervious Area
	1,793		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2-10: Direct Flow to Study Point



Summary for Subcatchment 2-2: Flow to Pervious Pavers Area 1

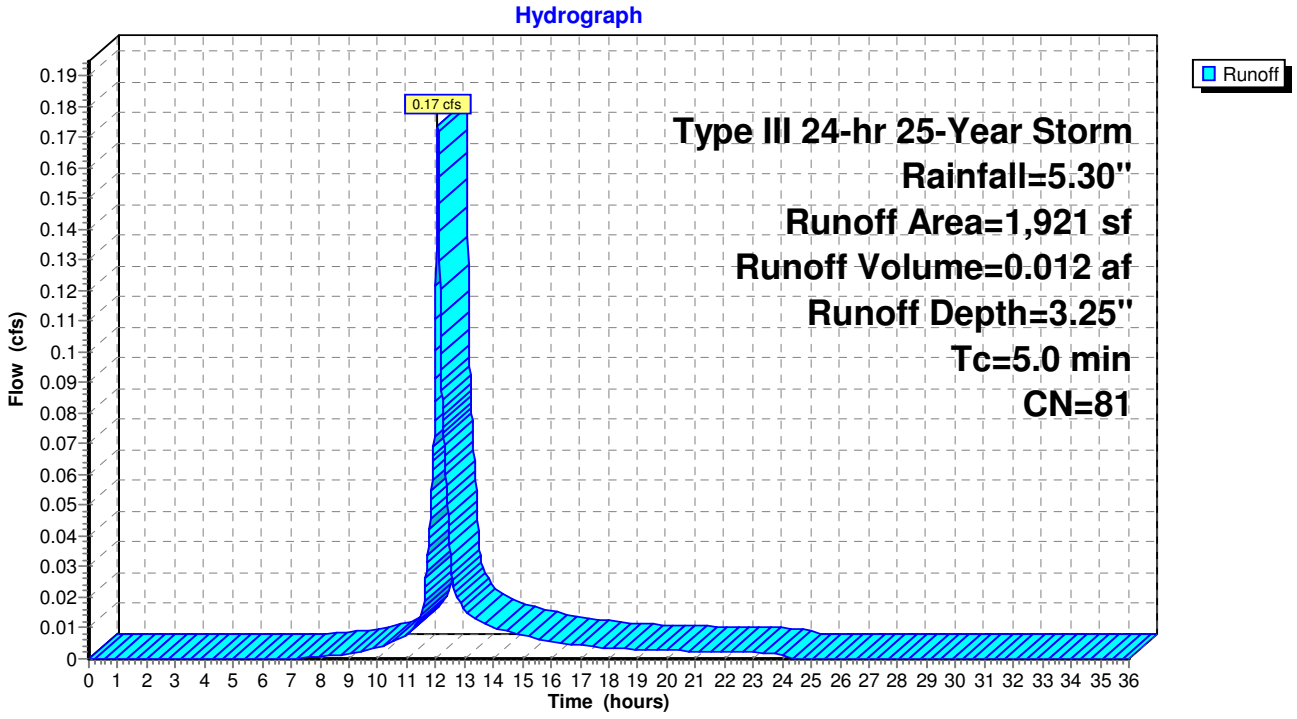
Runoff = 0.17 cfs @ 12.07 hrs, Volume= 0.012 af, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	1,031	98	Sidewalk & Pervious Pavers
	890	61	>75% Grass cover, Good, HSG B
	1,921	81	Weighted Average
	890		Pervious Area
	1,031		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-2: Flow to Pervious Pavers Area 1



Summary for Subcatchment 2-3: Flow to Pervious Pavers Area 2

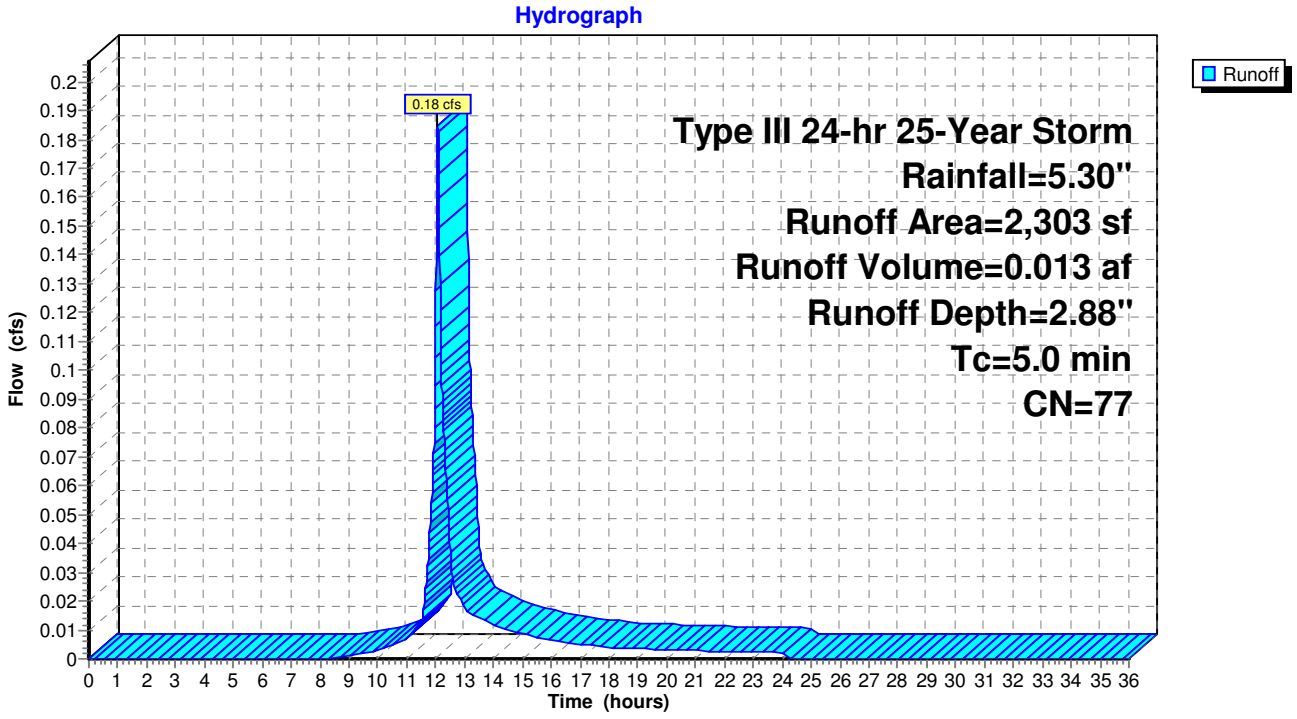
Runoff = 0.18 cfs @ 12.08 hrs, Volume= 0.013 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	1,007	98	Sidewalk & Pervious Pavers
	1,296	61	>75% Grass cover, Good, HSG B
	2,303	77	Weighted Average
	1,296		Pervious Area
	1,007		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-3: Flow to Pervious Pavers Area 2



Summary for Subcatchment 2-4: Flow to Pervious Pavers Area 3

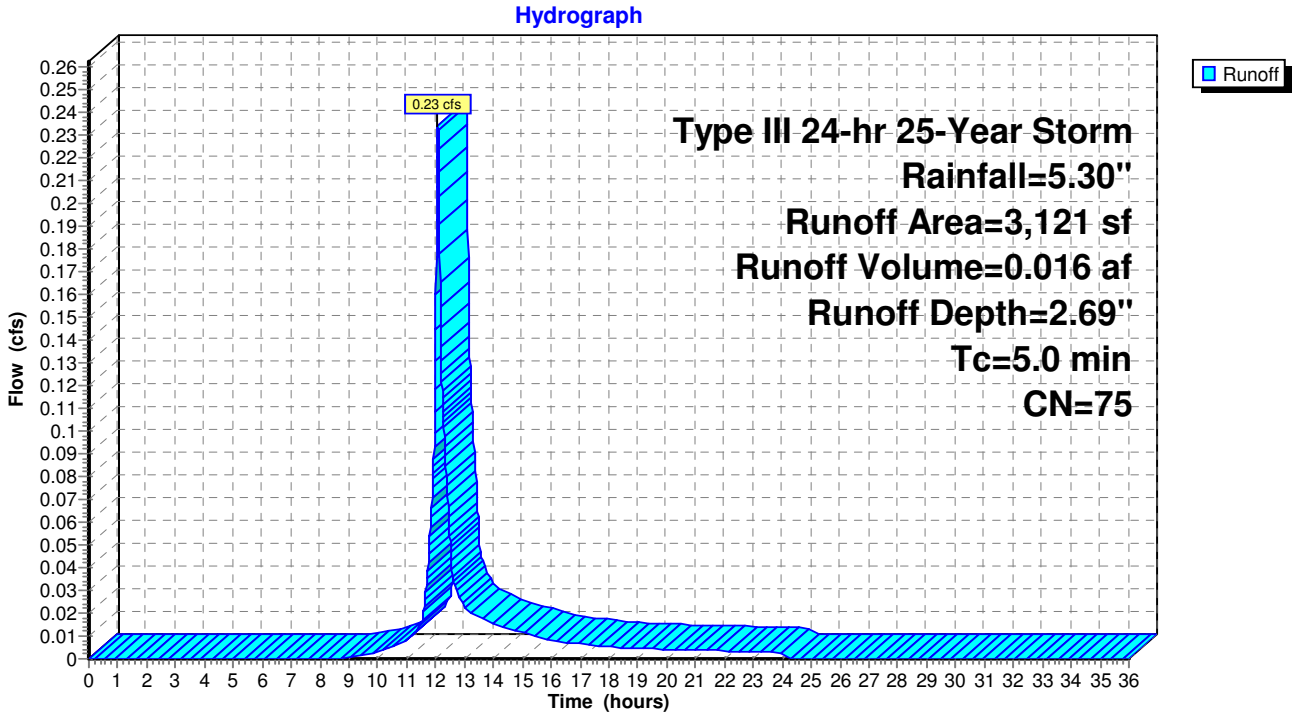
Runoff = 0.23 cfs @ 12.08 hrs, Volume= 0.016 af, Depth= 2.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	1,145	98	Sidewalk & Pervious Pavers
	1,976	61	>75% Grass cover, Good, HSG B
	3,121	75	Weighted Average
	1,976		Pervious Area
	1,145		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-4: Flow to Pervious Pavers Area 3



Summary for Subcatchment 2-5: Bldg C flow to DW1

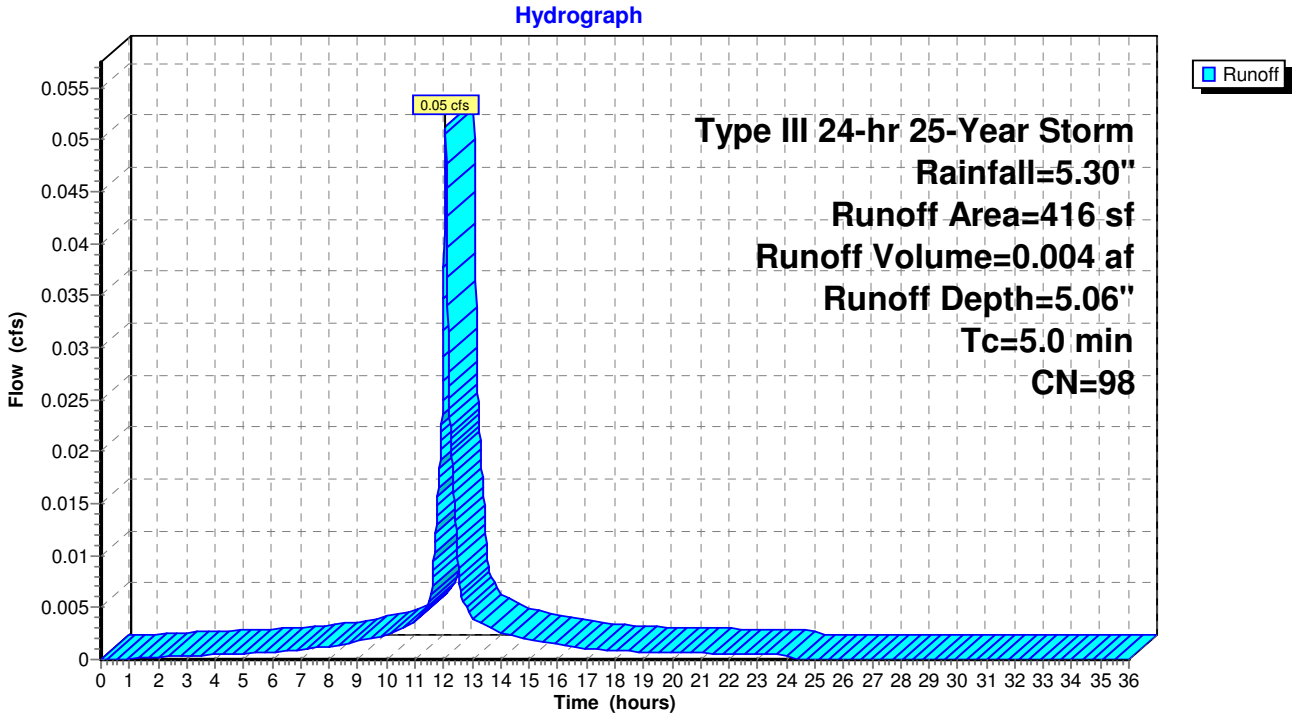
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-5: Bldg C flow to DW1



Summary for Subcatchment 2-6: Bldg C flow to DW2

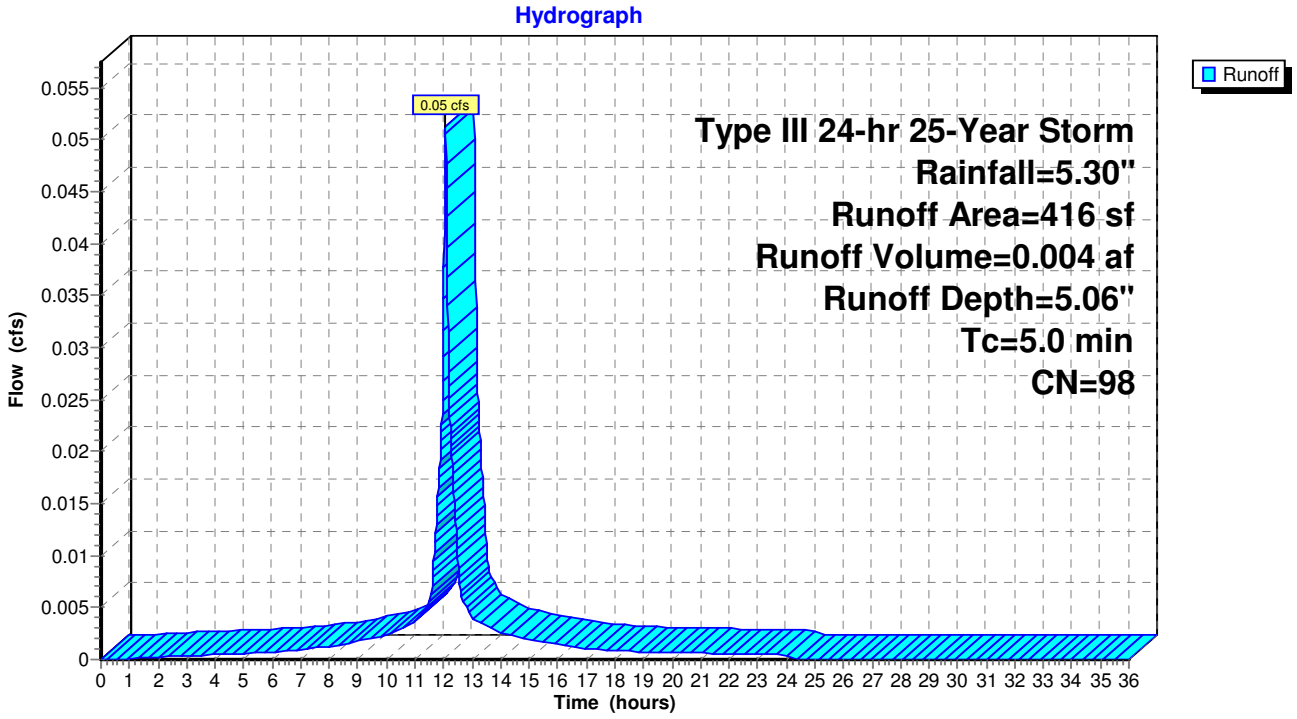
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-6: Bldg C flow to DW2



Summary for Subcatchment 2-7: Bldg B flow to DW3

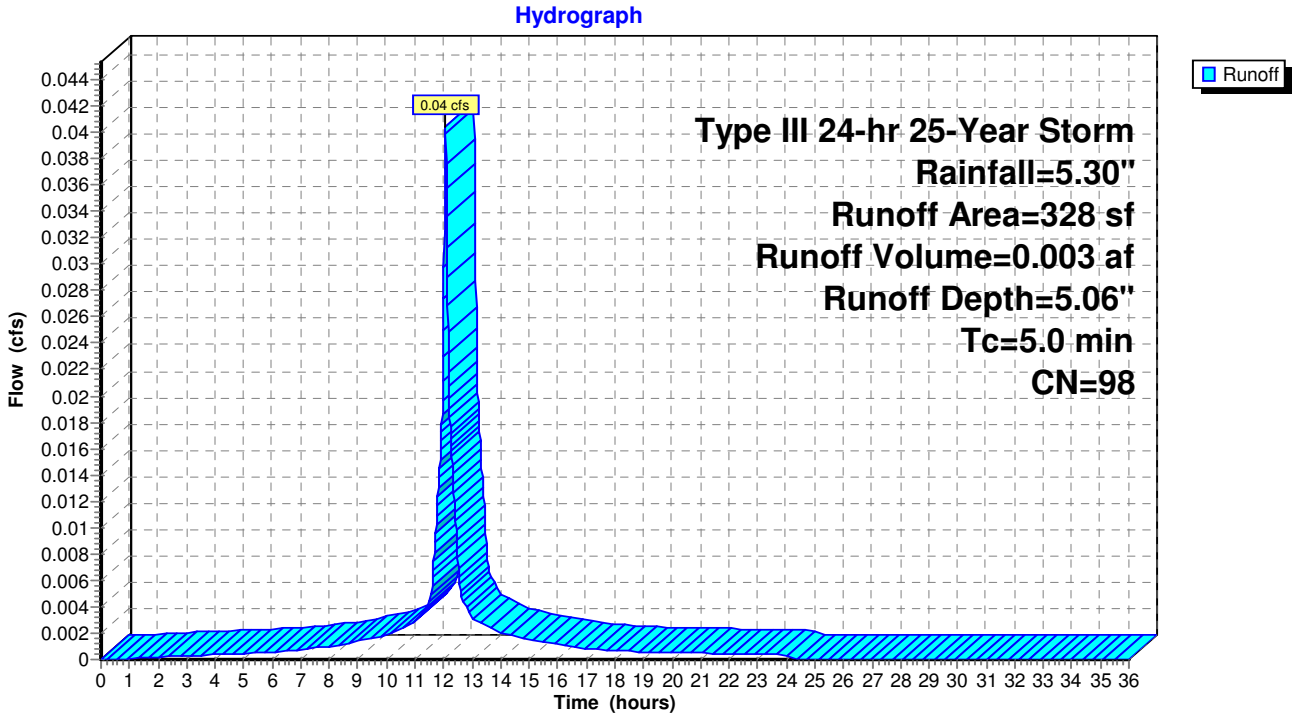
Runoff = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	328	98	Sidewalk & Pervious Pavers
	328		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-7: Bldg B flow to DW3



Summary for Subcatchment 2-8: Bldg B flow to DW4

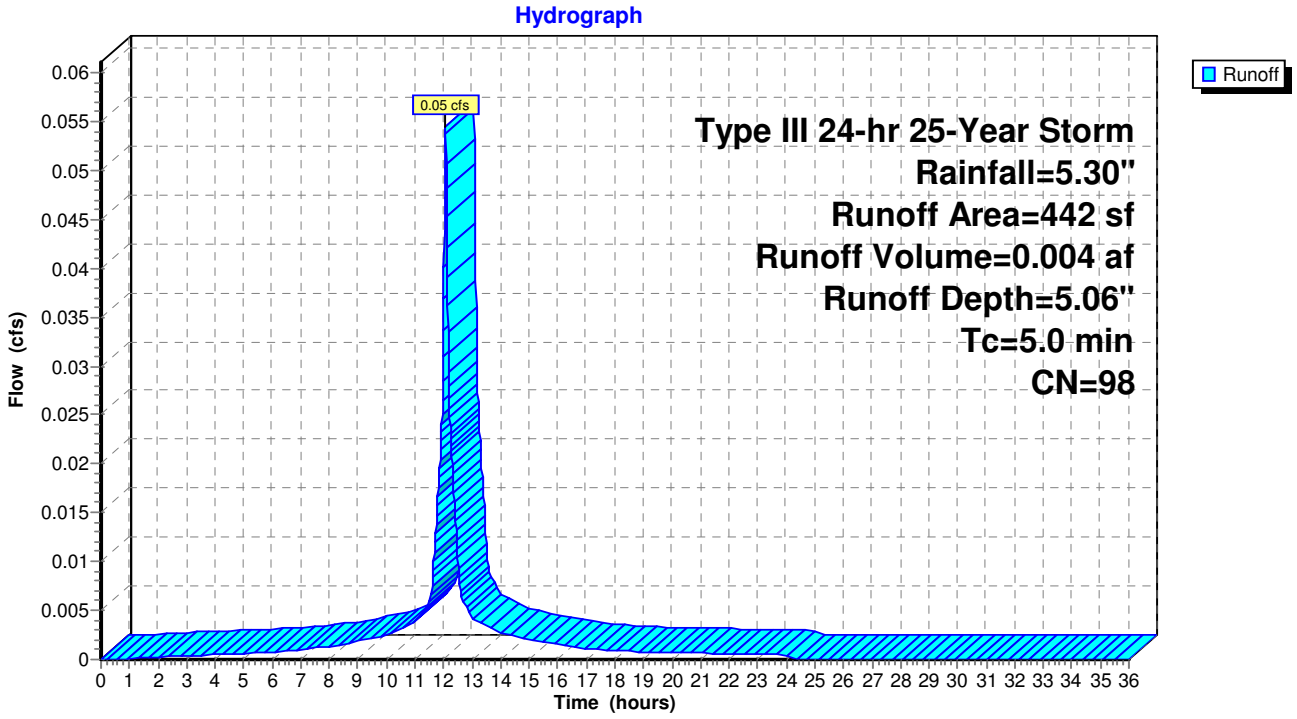
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	442	98	Sidewalk & Pervious Pavers
	442		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-8: Bldg B flow to DW4



Summary for Subcatchment 2-9: Bldg A flow to DW5

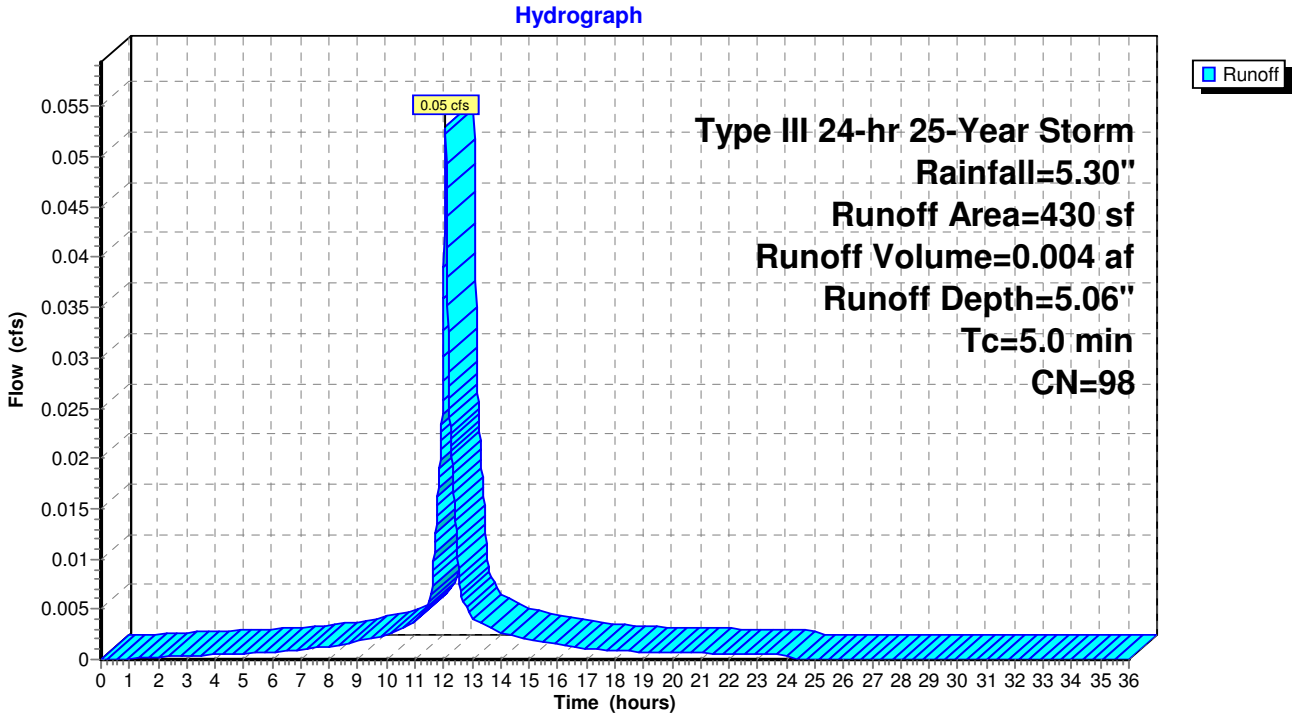
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	430	98	Sidewalk & Pervious Pavers
	430		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-9: Bldg A flow to DW5



Summary for Subcatchment EX-1: Offsite Contributing Area

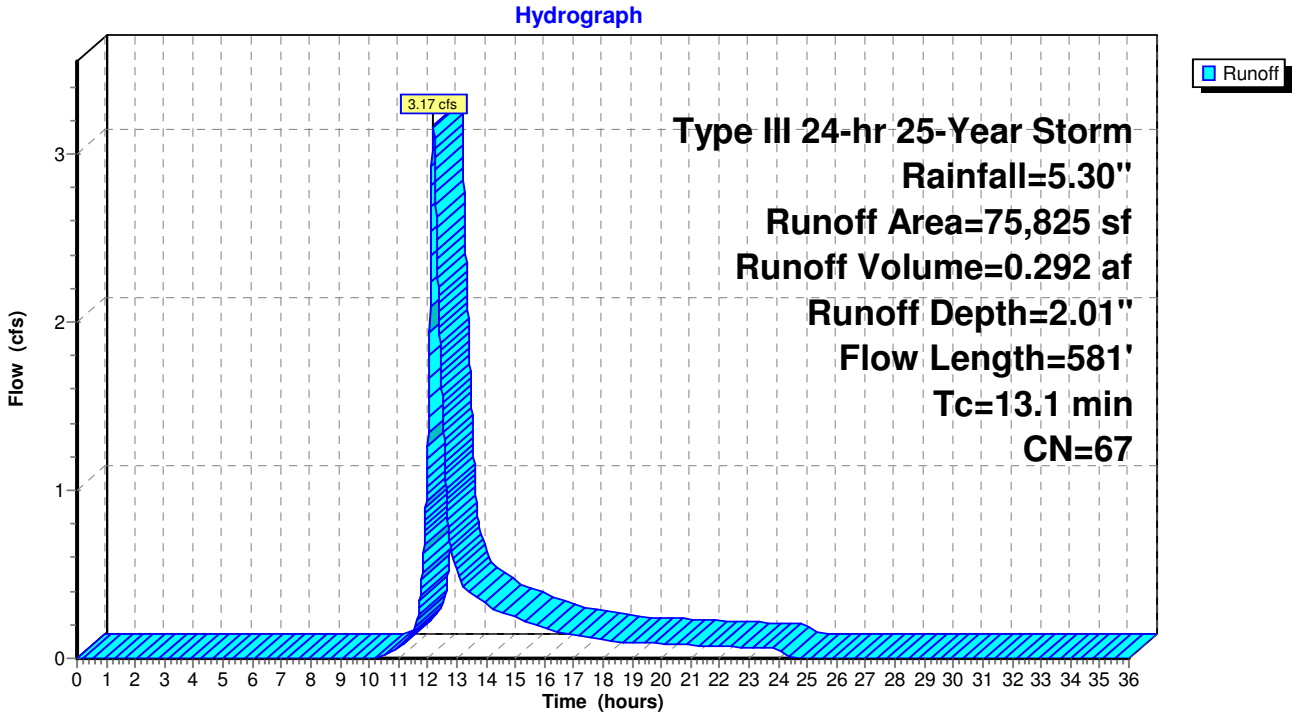
Runoff = 3.17 cfs @ 12.19 hrs, Volume= 0.292 af, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Storm Rainfall=5.30"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area

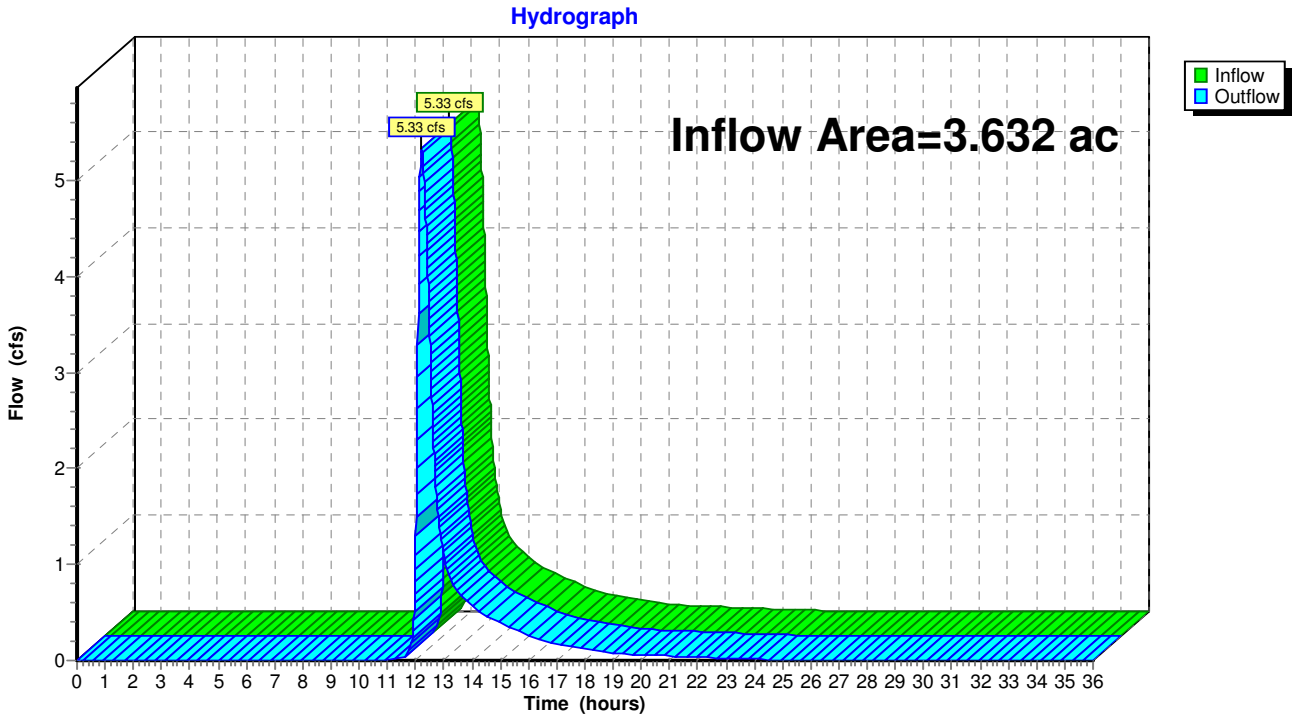


Summary for Reach SP1: Study Point #1

Inflow Area = 3.632 ac, 20.84% Impervious, Inflow Depth = 1.45" for 25-Year Storm event
Inflow = 5.33 cfs @ 12.21 hrs, Volume= 0.439 af
Outflow = 5.33 cfs @ 12.21 hrs, Volume= 0.439 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Summary for Pond CB1: CB1 (Double Grate)

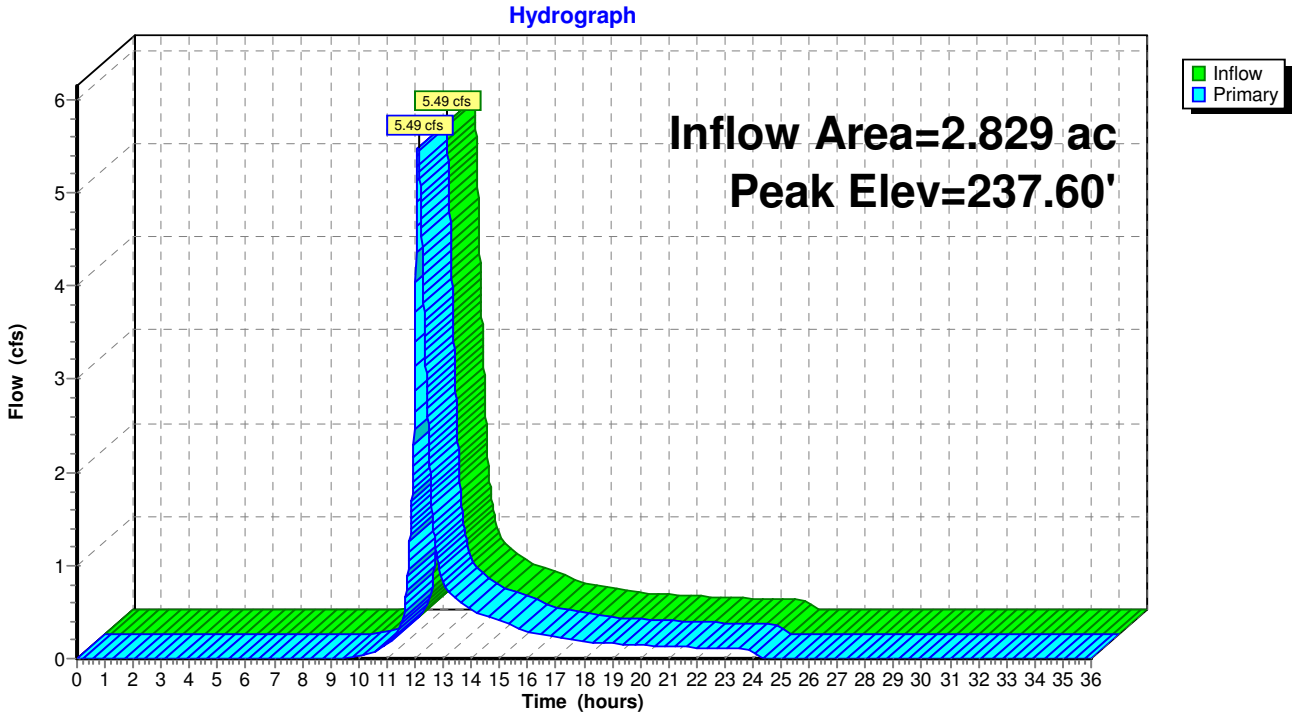
Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 2.18" for 25-Year Storm event
Inflow = 5.49 cfs @ 12.11 hrs, Volume= 0.513 af
Outflow = 5.49 cfs @ 12.11 hrs, Volume= 0.513 af, Atten= 0%, Lag= 0.0 min
Primary = 5.49 cfs @ 12.11 hrs, Volume= 0.513 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 237.60' @ 12.11 hrs
Flood Elev= 238.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=5.48 cfs @ 12.11 hrs HW=237.60' (Free Discharge)
1=Orifice/Grate (Orifice Controls 5.48 cfs @ 6.98 fps)

Pond CB1: CB1 (Double Grate)



Summary for Pond DW1: Dry Well 1

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 5.06" for 25-Year Storm event
Inflow = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af
Outflow = 0.01 cfs @ 12.46 hrs, Volume= 0.004 af, Atten= 78%, Lag= 23.4 min
Discarded = 0.00 cfs @ 10.02 hrs, Volume= 0.004 af
Primary = 0.01 cfs @ 12.46 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 241.52' @ 12.46 hrs Surf.Area= 50 sf Storage= 70 cf

Plug-Flow detention time= 228.9 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 228.9 min (975.0 - 746.1)

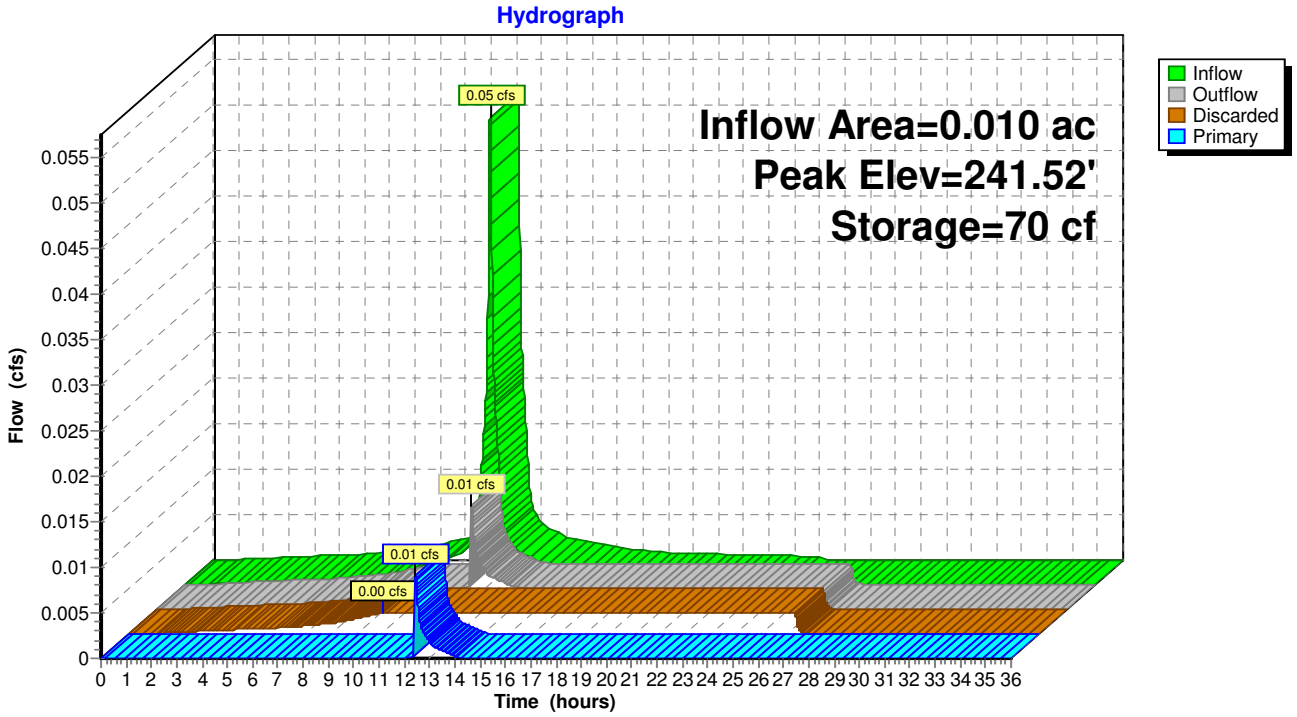
Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	239.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 10.02 hrs HW=239.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.01 cfs @ 12.46 hrs HW=241.51' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.40 fps)

Pond DW1: Dry Well 1



Summary for Pond DW2: Dry Well 2

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 5.06" for 25-Year Storm event
Inflow = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af
Outflow = 0.01 cfs @ 12.46 hrs, Volume= 0.004 af, Atten= 78%, Lag= 23.4 min
Discarded = 0.00 cfs @ 10.02 hrs, Volume= 0.004 af
Primary = 0.01 cfs @ 12.46 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.52' @ 12.46 hrs Surf.Area= 50 sf Storage= 70 cf

Plug-Flow detention time= 228.9 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 228.9 min (975.0 - 746.1)

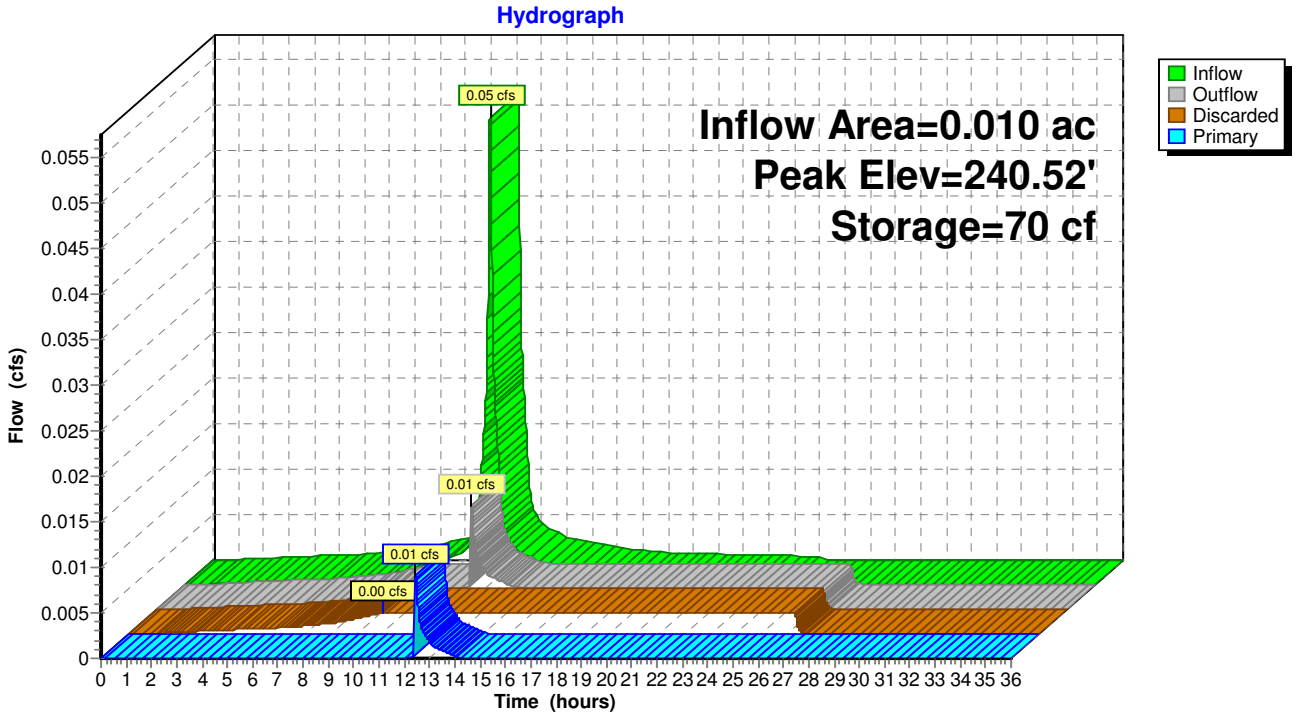
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 10.02 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.01 cfs @ 12.46 hrs HW=240.51' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.40 fps)

Pond DW2: Dry Well 2



Summary for Pond DW3: Dry Well 3

Assumed percolation rate of 30MPI

Inflow Area = 0.008 ac,100.00% Impervious, Inflow Depth = 5.06" for 25-Year Storm event
Inflow = 0.04 cfs @ 12.07 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 10.61 hrs, Volume= 0.003 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.00 cfs @ 10.61 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.07' @ 13.70 hrs Surf.Area= 50 sf Storage= 57 cf

Plug-Flow detention time= 193.1 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 193.1 min (939.2 - 746.1)

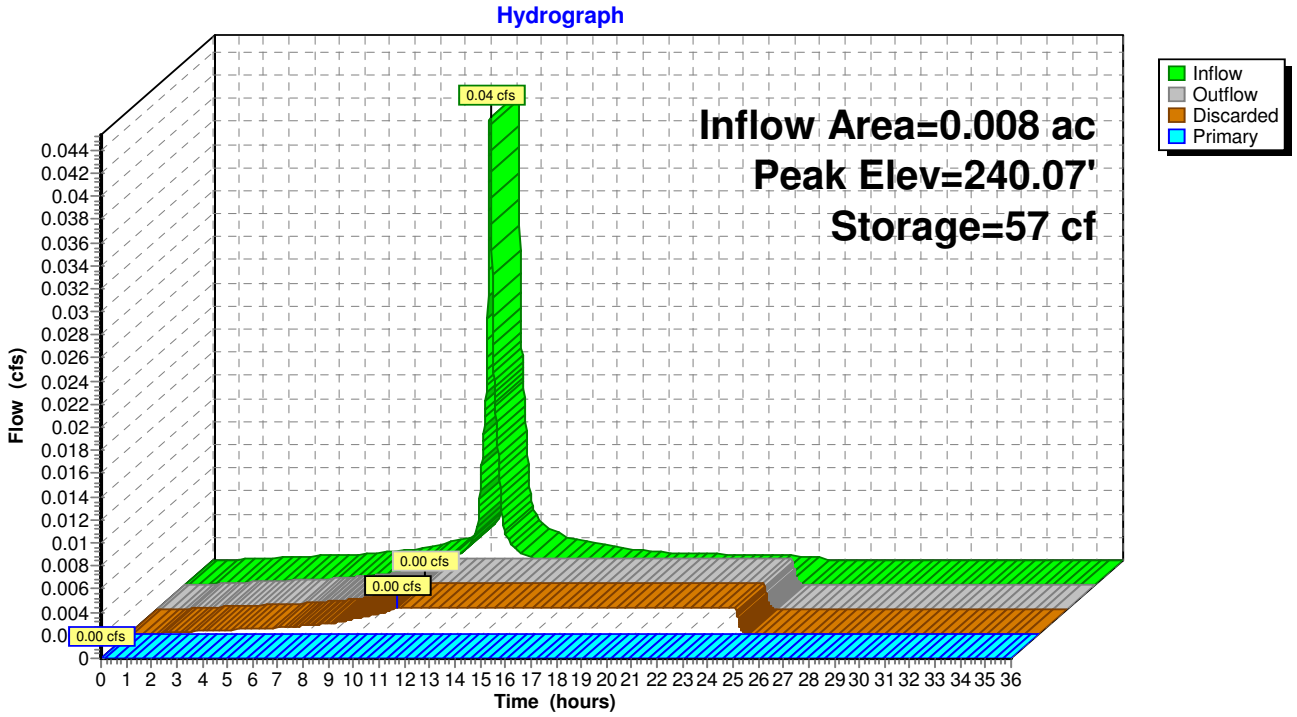
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 10.61 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=238.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW3: Dry Well 3



Summary for Pond DW4: Dry Well 4

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 5.06" for 25-Year Storm event
Inflow = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af
Outflow = 0.02 cfs @ 12.34 hrs, Volume= 0.004 af, Atten= 67%, Lag= 16.5 min
Discarded = 0.00 cfs @ 9.79 hrs, Volume= 0.004 af
Primary = 0.02 cfs @ 12.34 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.52' @ 12.34 hrs Surf.Area= 50 sf Storage= 70 cf

Plug-Flow detention time= 222.0 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 222.0 min (968.1 - 746.1)

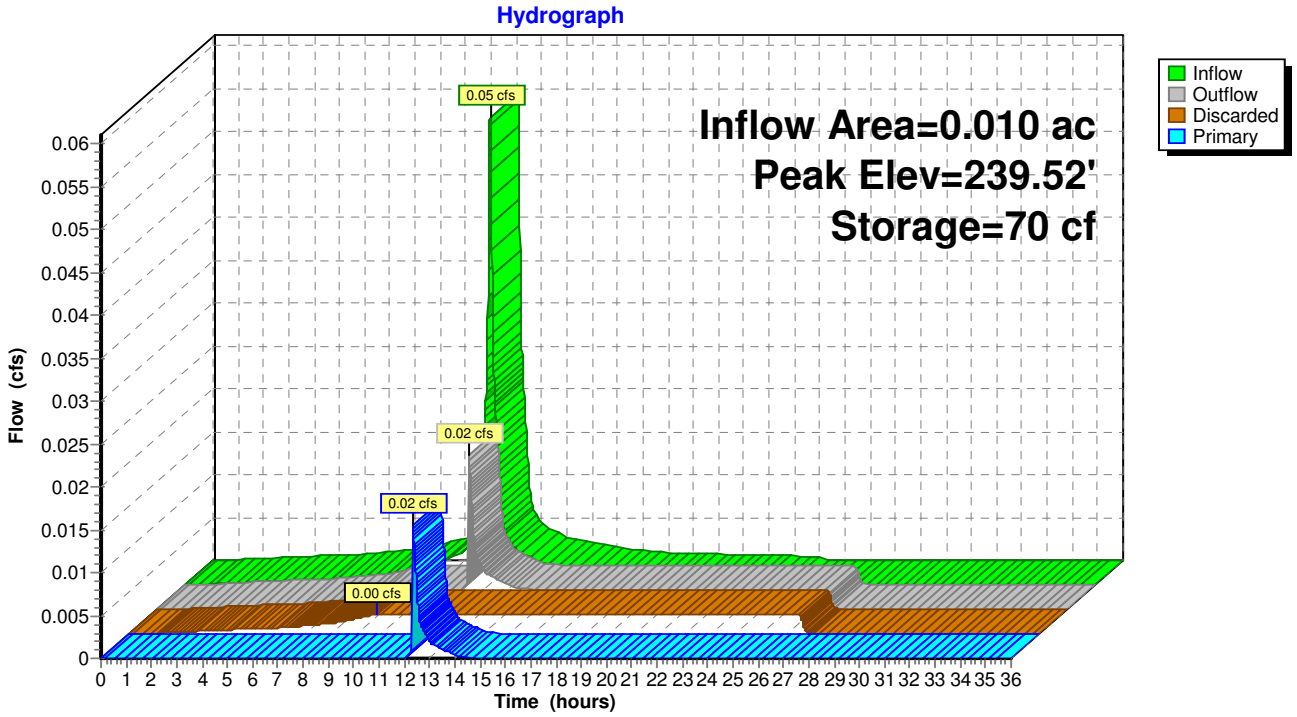
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 9.79 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.01 cfs @ 12.34 hrs HW=239.52' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.49 fps)

Pond DW4: Dry Well 4



Summary for Pond DW5: Dry Well 5

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 5.06" for 25-Year Storm event
Inflow = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af
Outflow = 0.01 cfs @ 12.39 hrs, Volume= 0.004 af, Atten= 72%, Lag= 19.5 min
Discarded = 0.00 cfs @ 9.89 hrs, Volume= 0.004 af
Primary = 0.01 cfs @ 12.39 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.52' @ 12.39 hrs Surf.Area= 50 sf Storage= 70 cf

Plug-Flow detention time= 225.2 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 225.1 min (971.3 - 746.1)

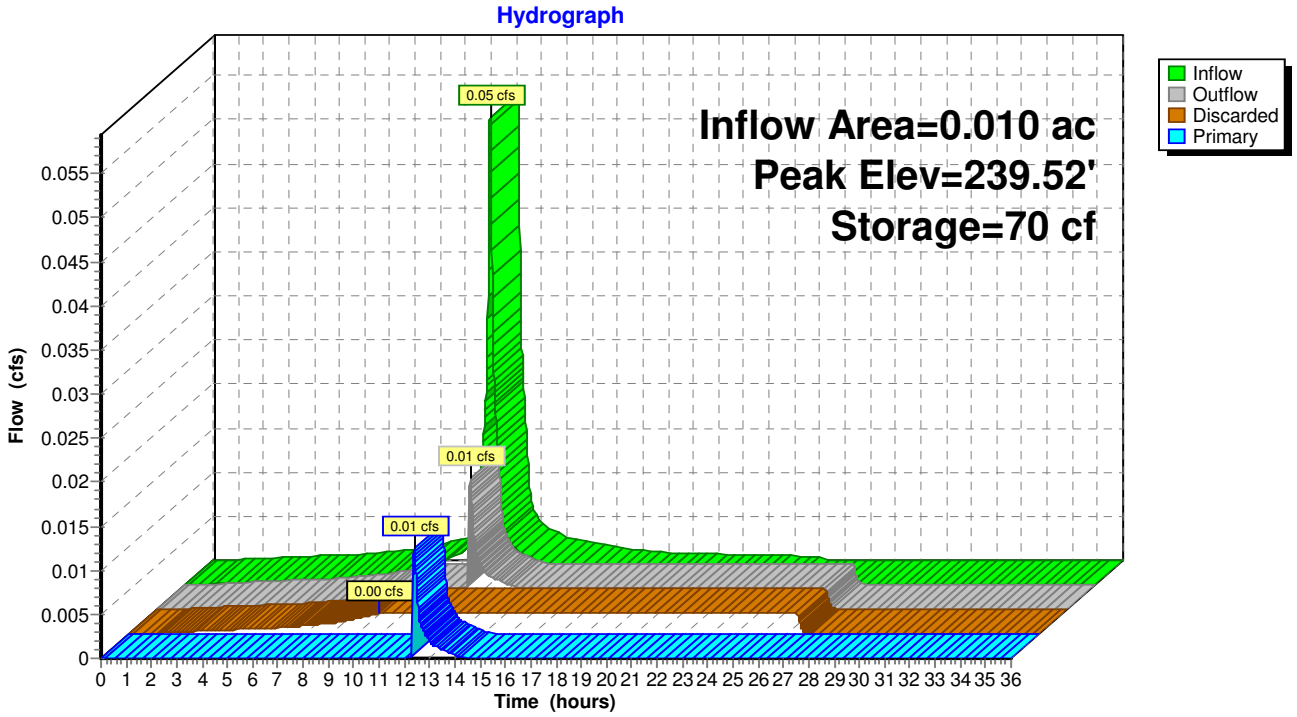
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 9.89 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.01 cfs @ 12.39 hrs HW=239.52' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.47 fps)

Pond DW5: Dry Well 5



Summary for Pond I.S.#1: Infiltration System #1

Assumed percolation rate of 30 MPI

Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 2.18" for 25-Year Storm event
Inflow = 5.49 cfs @ 12.11 hrs, Volume= 0.513 af
Outflow = 4.52 cfs @ 12.24 hrs, Volume= 0.513 af, Atten= 18%, Lag= 7.7 min
Discarded = 0.13 cfs @ 12.24 hrs, Volume= 0.173 af
Primary = 4.39 cfs @ 12.24 hrs, Volume= 0.340 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 235.24' @ 12.24 hrs Surf.Area= 2,908 sf Storage= 3,415 cf

Plug-Flow detention time= 53.6 min calculated for 0.513 af (100% of inflow)
Center-of-Mass det. time= 53.6 min (903.7 - 850.1)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	3,258 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 9,545 cf Overall - 1,400 cf Embedded = 8,145 cf x 40.0% Voids
#2	234.00'	1,400 cf	**28.9"W x 16.0"H x 7.12'L StormTech SC-310** x 95 Inside #1
#3	234.50'	49 cf	**12.0"D x 62.00'L Horizontal Cylinder S= 0.0080 '/'**
#4	234.00'	44 cf	**4.00'D x 3.50'H DMH1**
#5	234.00'	44 cf	**4.00'D x 3.50'H OCS1**
		4,795 cf	Total Available Storage

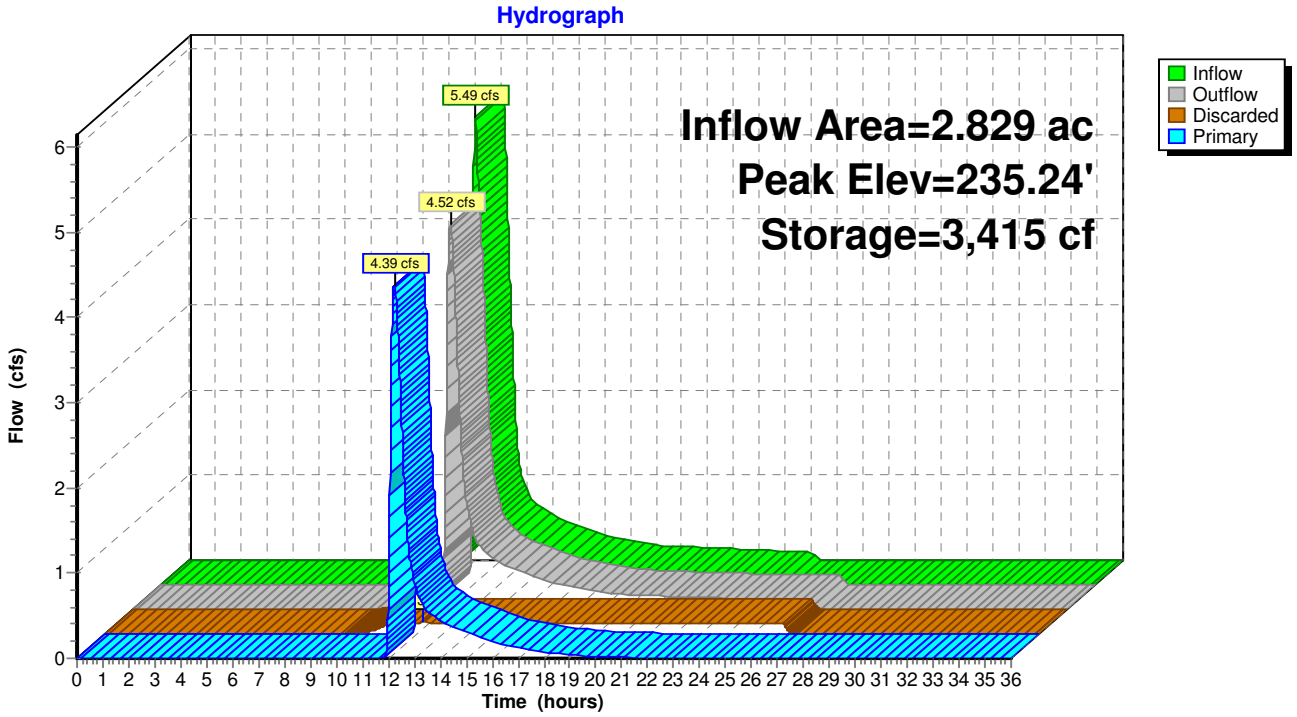
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
233.00	2,824	218.0	0	0	2,824
236.38	2,824	218.0	9,545	9,545	3,561

Device	Routing	Invert	Outlet Devices
#1	Discarded	233.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	234.00'	**14.5" Vert. Orifice/Grate** C= 0.600
#3	Primary	236.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.13 cfs @ 12.24 hrs HW=235.23' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=4.39 cfs @ 12.24 hrs HW=235.23' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 4.39 cfs @ 3.82 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond I.S.#1: Infiltration System #1



Summary for Pond PP-1: Pervious Pavers Area 1

Assumed percolation rate of 30MPI

Inflow Area = 0.044 ac, 53.67% Impervious, Inflow Depth = 3.25" for 25-Year Storm event
Inflow = 0.17 cfs @ 12.07 hrs, Volume= 0.012 af
Outflow = 0.03 cfs @ 11.74 hrs, Volume= 0.012 af, Atten= 83%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.74 hrs, Volume= 0.012 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.06' @ 12.54 hrs Surf.Area= 648 sf Storage= 144 cf

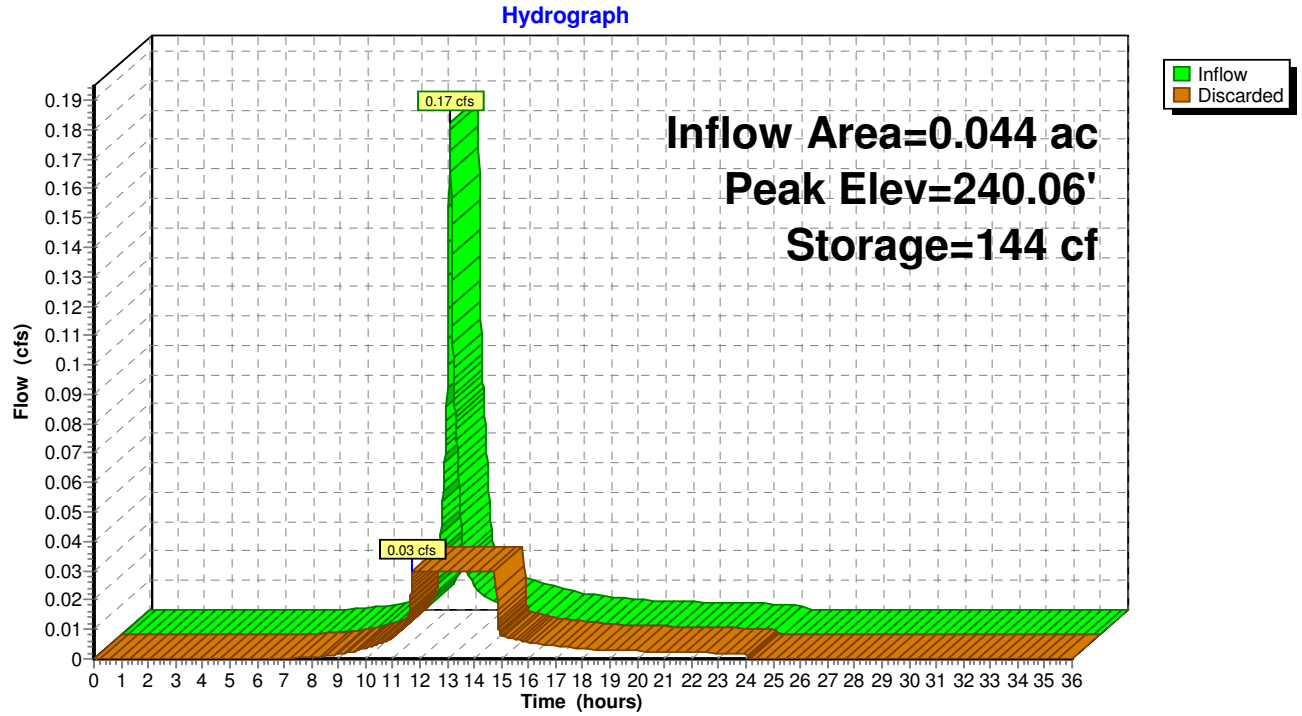
Plug-Flow detention time= 29.9 min calculated for 0.012 af (100% of inflow)
Center-of-Mass det. time= 29.9 min (845.6 - 815.7)

Volume	Invert	Avail.Storage	Storage Description
#1	239.50'	389 cf	**18.00'W x 36.00'L x 1.50'H Prismatoid** 972 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.50'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 11.74 hrs HW=239.52' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-1: Pervious Pavers Area 1



Summary for Pond PP-2: Pervious Pavers Area 2

Assumed percolation rate of 30MPI

Inflow Area = 0.053 ac, 43.73% Impervious, Inflow Depth = 2.88" for 25-Year Storm event
Inflow = 0.18 cfs @ 12.08 hrs, Volume= 0.013 af
Outflow = 0.03 cfs @ 11.75 hrs, Volume= 0.013 af, Atten= 84%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.75 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.36' @ 12.56 hrs Surf.Area= 648 sf Storage= 159 cf

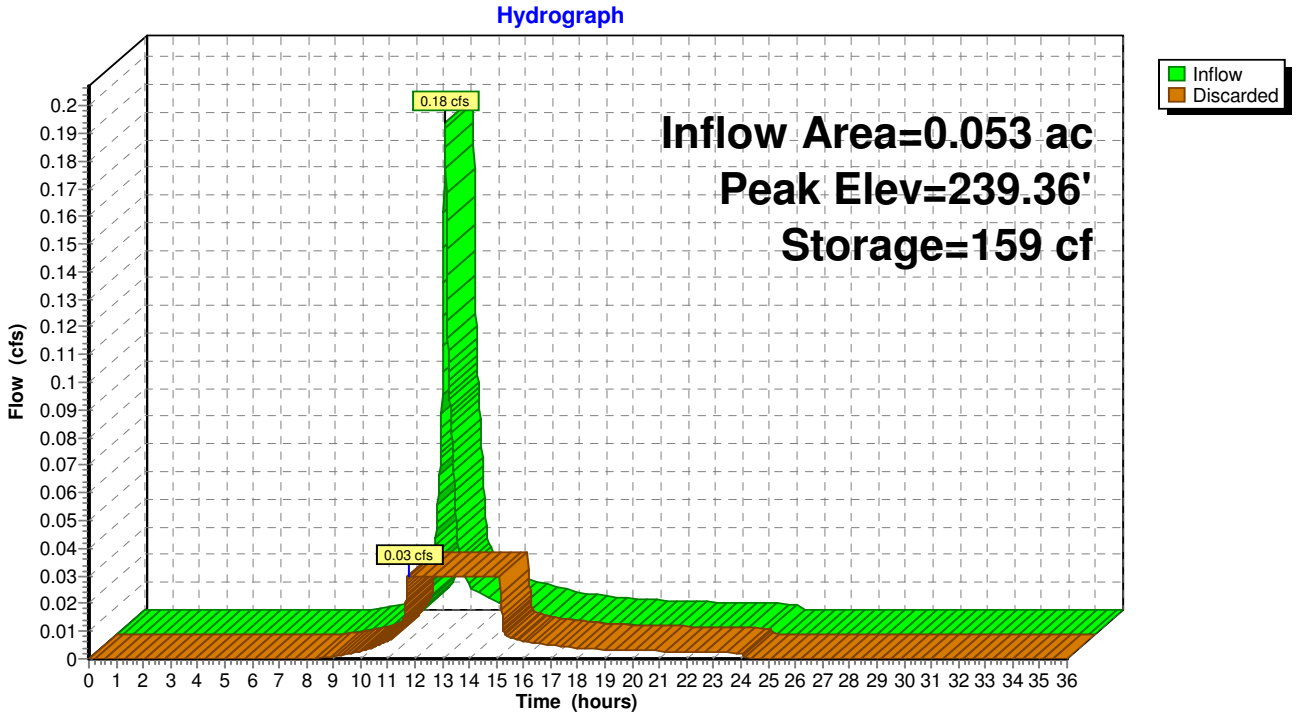
Plug-Flow detention time= 35.0 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 35.0 min (861.1 - 826.1)

Volume	Invert	Avail.Storage	Storage Description
#1	238.75'	454 cf	**18.00'W x 36.00'L x 1.75'H Prismatoid** 1,134 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 11.75 hrs HW=238.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-2: Pervious Pavers Area 2



Summary for Pond PP-3: Pervious Pavers Area 3

Assumed percolation rate of 30MPI

Inflow Area = 0.072 ac, 36.69% Impervious, Inflow Depth = 2.69" for 25-Year Storm event
Inflow = 0.23 cfs @ 12.08 hrs, Volume= 0.016 af
Outflow = 0.04 cfs @ 11.75 hrs, Volume= 0.016 af, Atten= 84%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.75 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 238.38' @ 12.57 hrs Surf.Area= 810 sf Storage= 203 cf

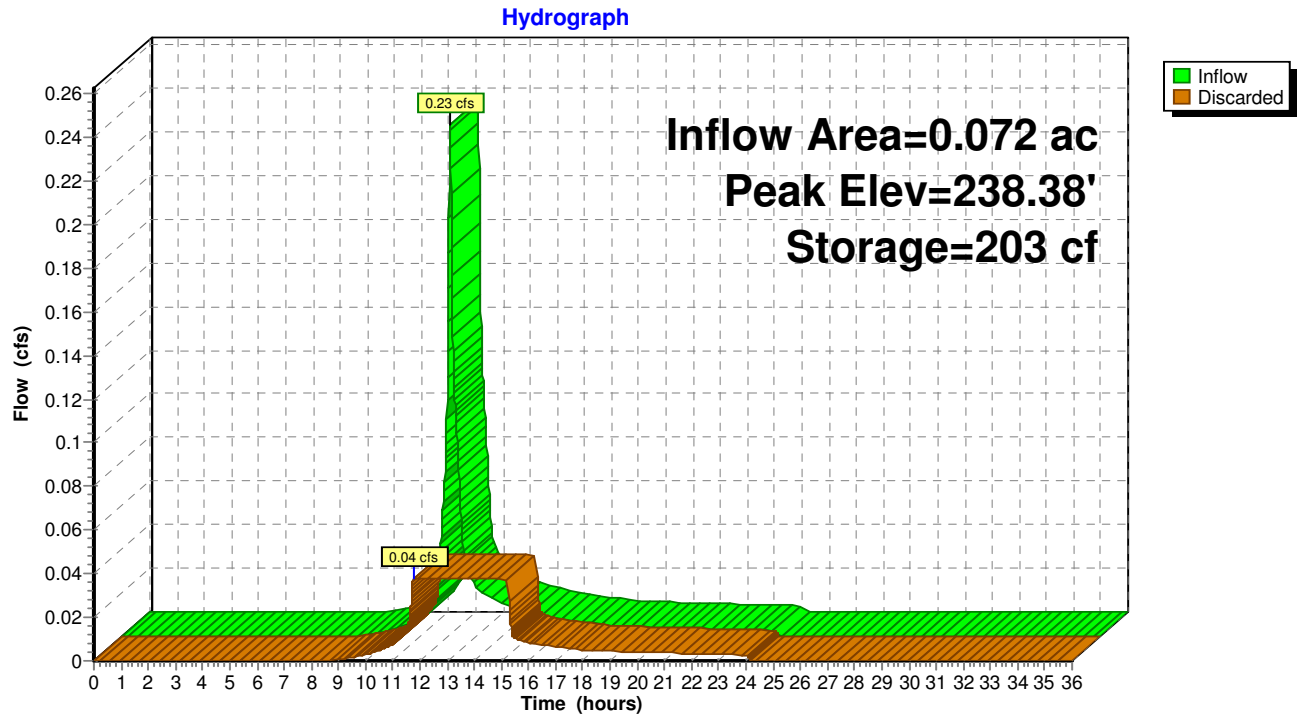
Plug-Flow detention time= 36.5 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 36.5 min (867.6 - 831.2)

Volume	Invert	Avail.Storage	Storage Description
#1	237.75'	567 cf	**18.00'W x 45.00'L x 1.75'H Prismatoid** 1,418 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 11.75 hrs HW=237.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond PP-3: Pervious Pavers Area 3



Summary for Subcatchment 2-1: On-site Contributing Area

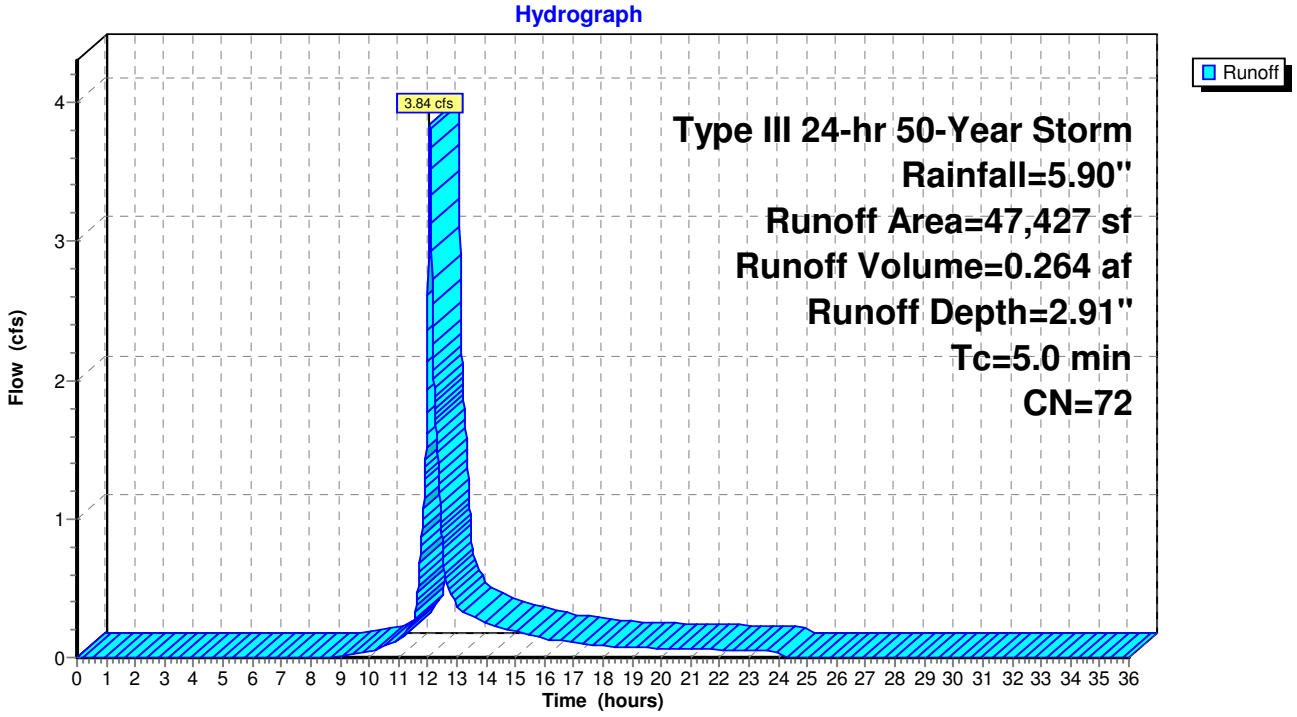
Runoff = 3.84 cfs @ 12.08 hrs, Volume= 0.264 af, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	5,048	98	Building Rooftop Area
*	889	98	Sidewalk Area
*	10,165	98	Pavement Area
	18,133	61	>75% Grass cover, Good, HSG B
	6,044	58	Woods/grass comb., Good, HSG B
	7,148	55	Woods, Good, HSG B
	47,427	72	Weighted Average
	31,325		Pervious Area
	16,102		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-1: On-site Contributing Area



Summary for Subcatchment 2-10: Direct Flow to Study Point

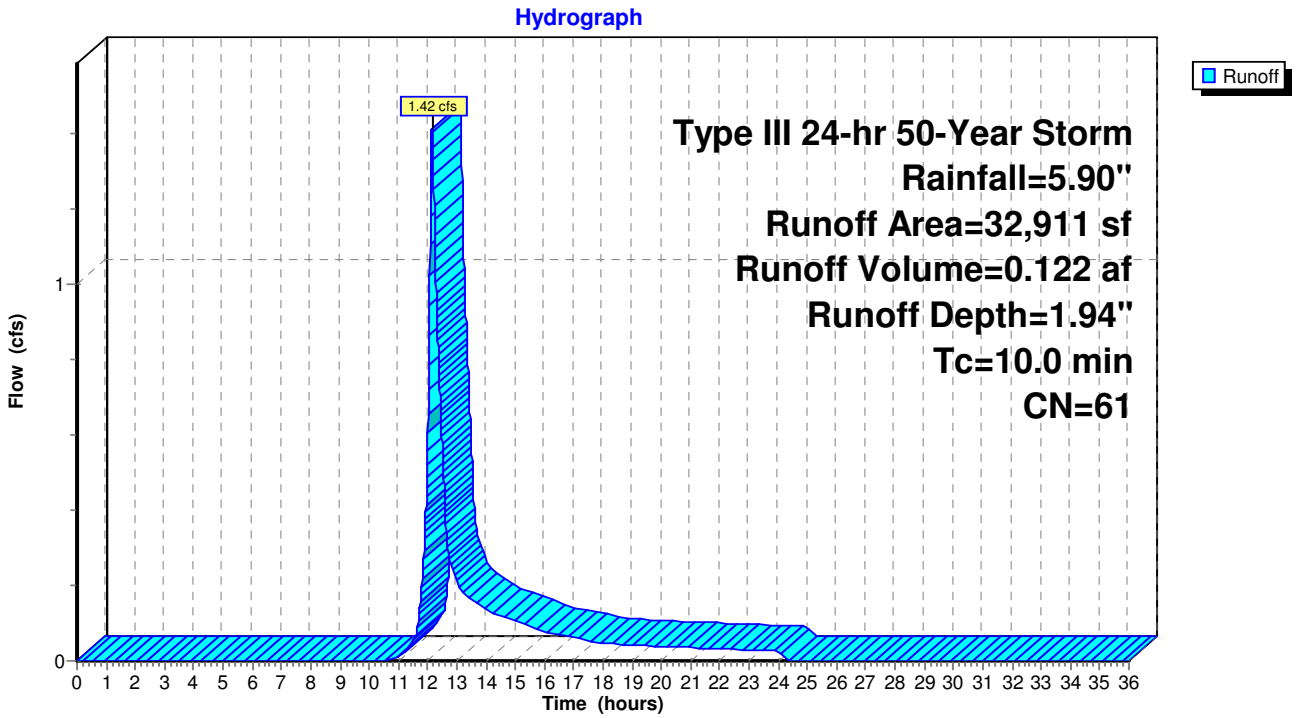
Runoff = 1.42 cfs @ 12.15 hrs, Volume= 0.122 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	1,793	98	Rooftop Area
	17,774	61	>75% Grass cover, Good, HSG B
	5,924	58	Woods/grass comb., Good, HSG B
	7,420	55	Woods, Good, HSG B
	32,911	61	Weighted Average
	31,118		Pervious Area
	1,793		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2-10: Direct Flow to Study Point



Summary for Subcatchment 2-2: Flow to Pervious Pavers Area 1

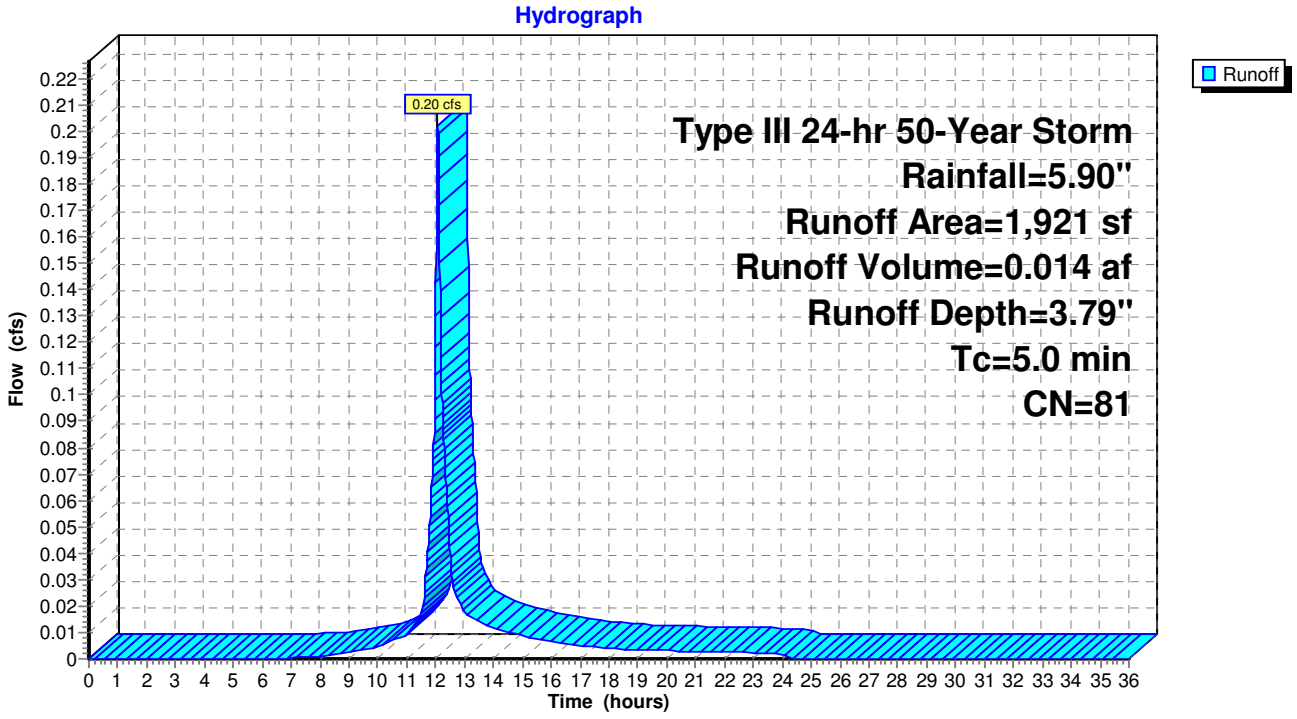
Runoff = 0.20 cfs @ 12.07 hrs, Volume= 0.014 af, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	1,031	98	Sidewalk & Pervious Pavers
	890	61	>75% Grass cover, Good, HSG B
	1,921	81	Weighted Average
	890		Pervious Area
	1,031		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-2: Flow to Pervious Pavers Area 1



Summary for Subcatchment 2-3: Flow to Pervious Pavers Area 2

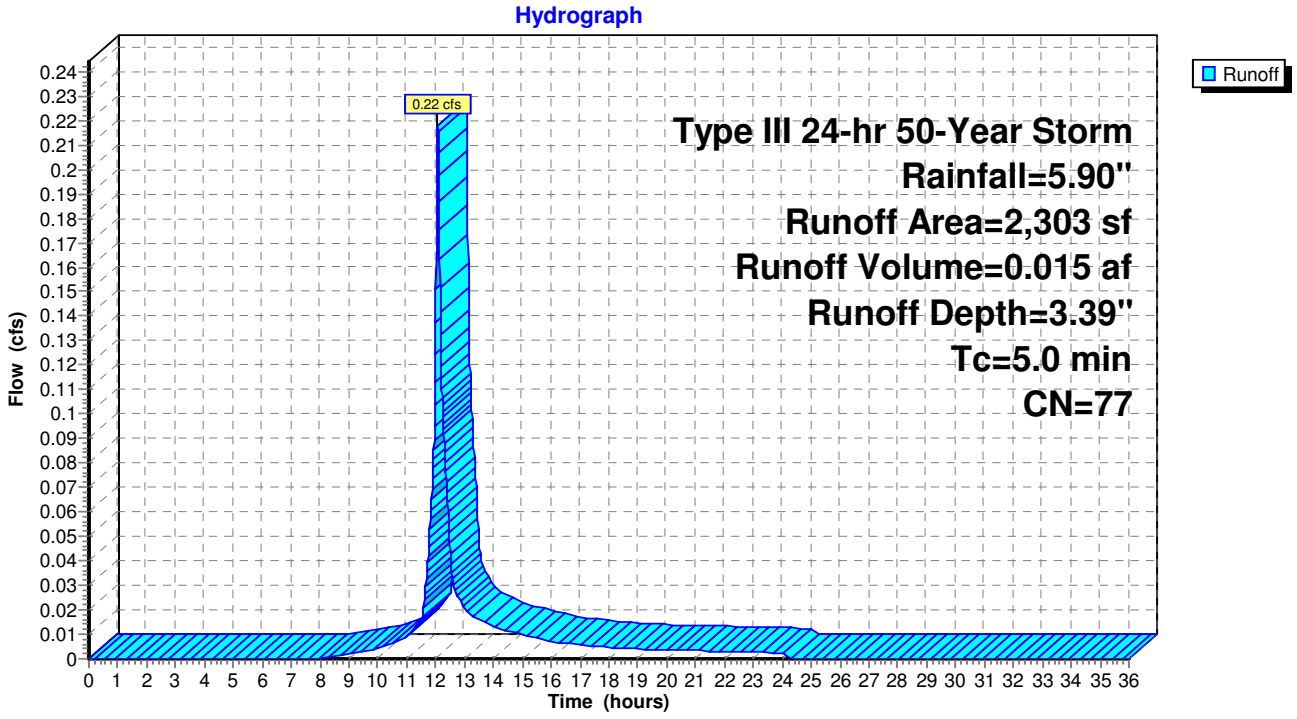
Runoff = 0.22 cfs @ 12.07 hrs, Volume= 0.015 af, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	1,007	98	Sidewalk & Pervious Pavers
	1,296	61	>75% Grass cover, Good, HSG B
	2,303	77	Weighted Average
	1,296		Pervious Area
	1,007		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-3: Flow to Pervious Pavers Area 2



Summary for Subcatchment 2-4: Flow to Pervious Pavers Area 3

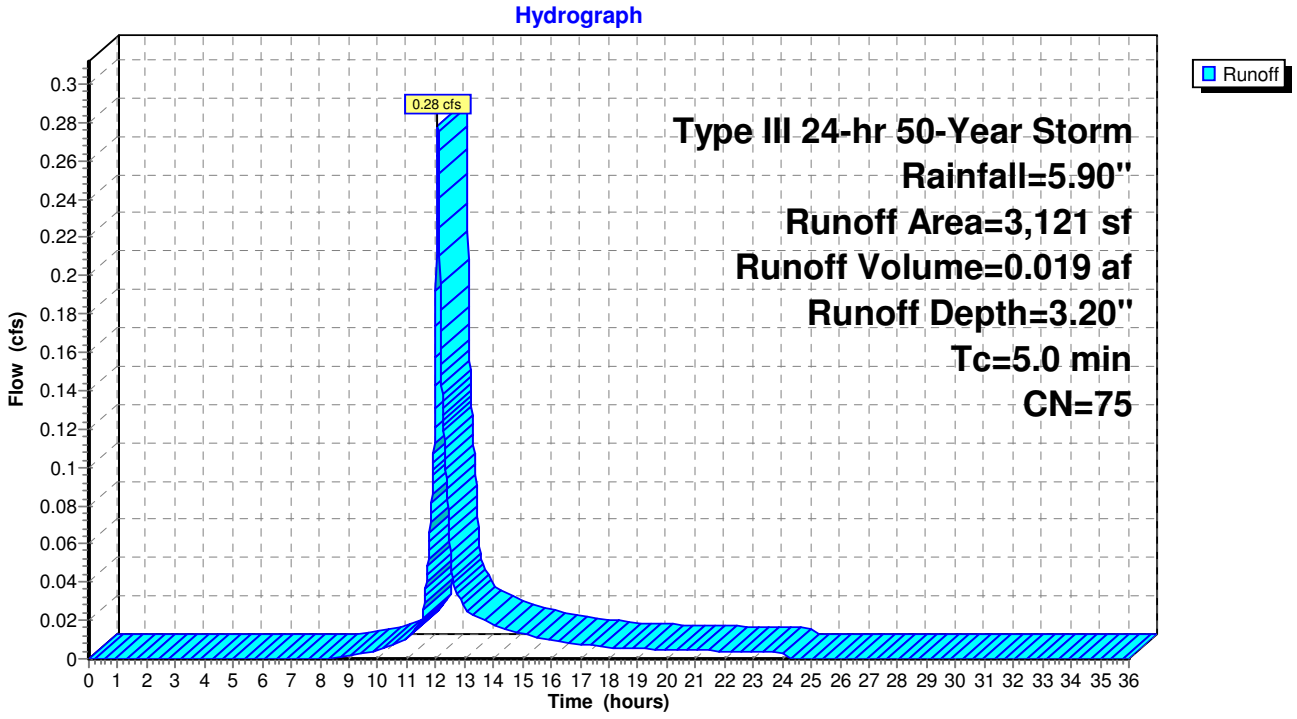
Runoff = 0.28 cfs @ 12.08 hrs, Volume= 0.019 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	1,145	98	Sidewalk & Pervious Pavers
	1,976	61	>75% Grass cover, Good, HSG B
	3,121	75	Weighted Average
	1,976		Pervious Area
	1,145		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-4: Flow to Pervious Pavers Area 3



Summary for Subcatchment 2-5: Bldg C flow to DW1

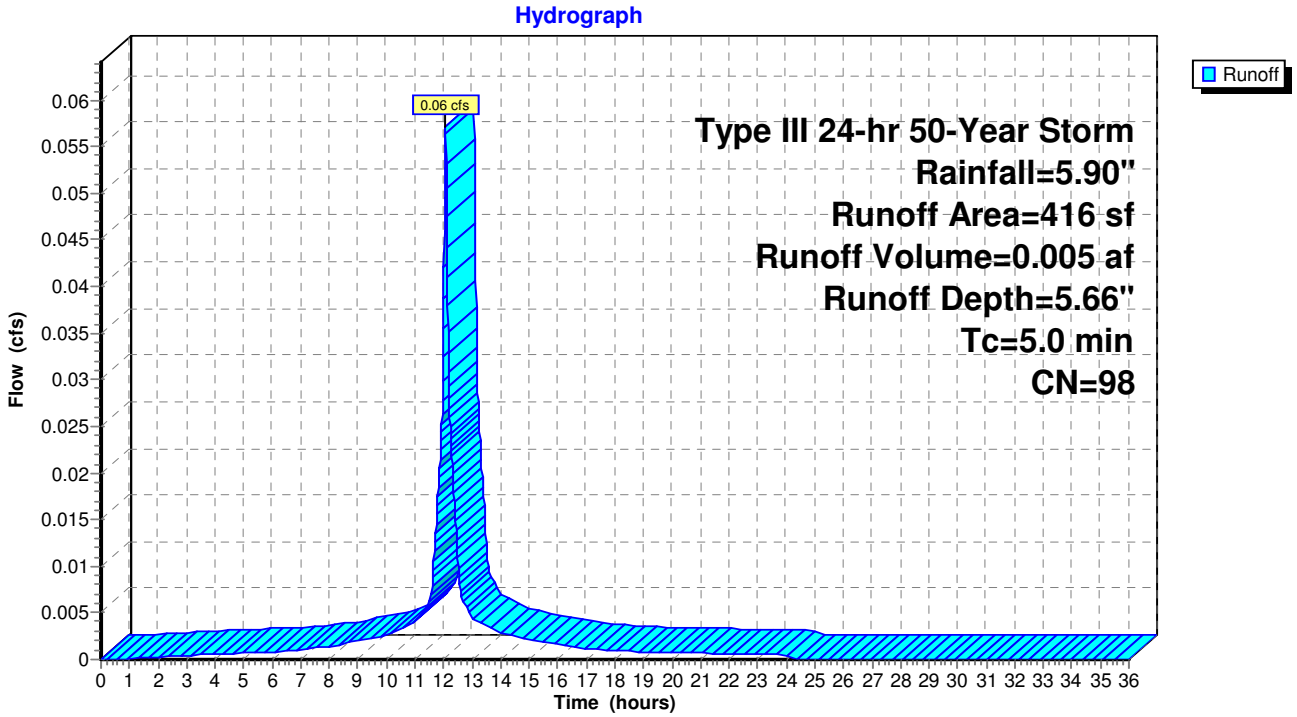
Runoff = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 5.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-5: Bldg C flow to DW1



Summary for Subcatchment 2-6: Bldg C flow to DW2

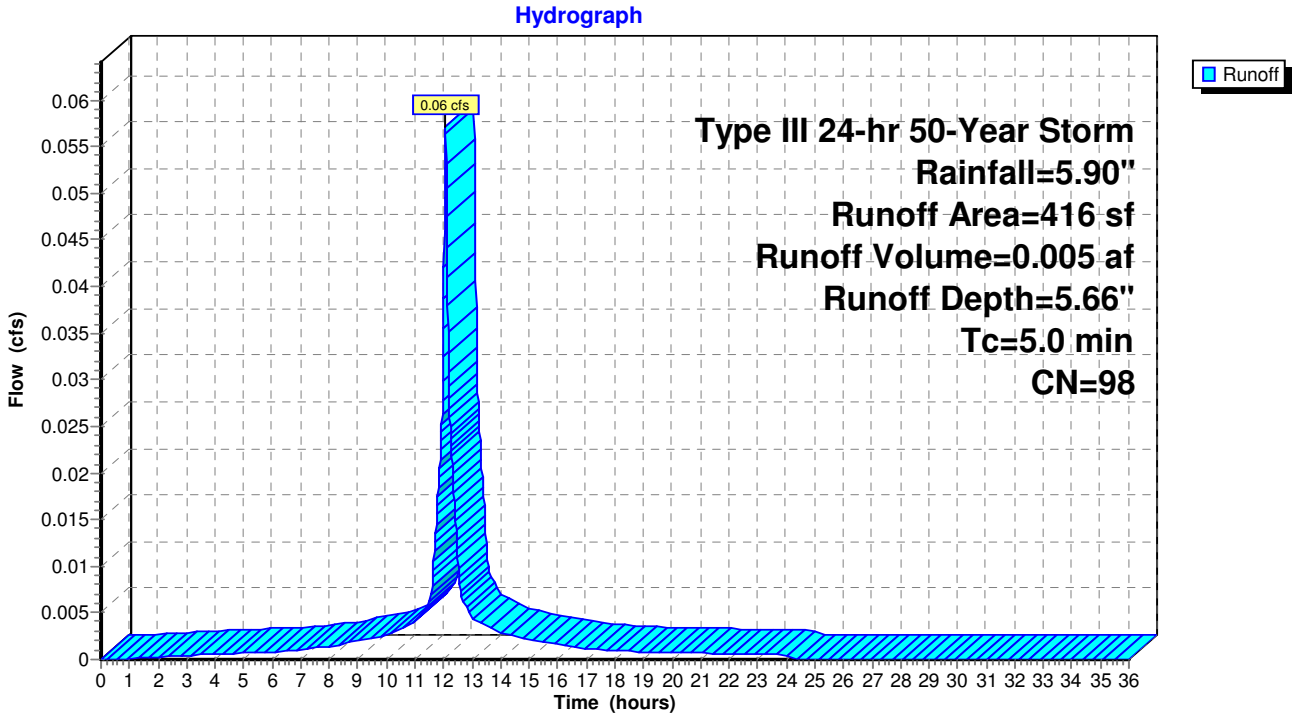
Runoff = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 5.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-6: Bldg C flow to DW2



Summary for Subcatchment 2-7: Bldg B flow to DW3

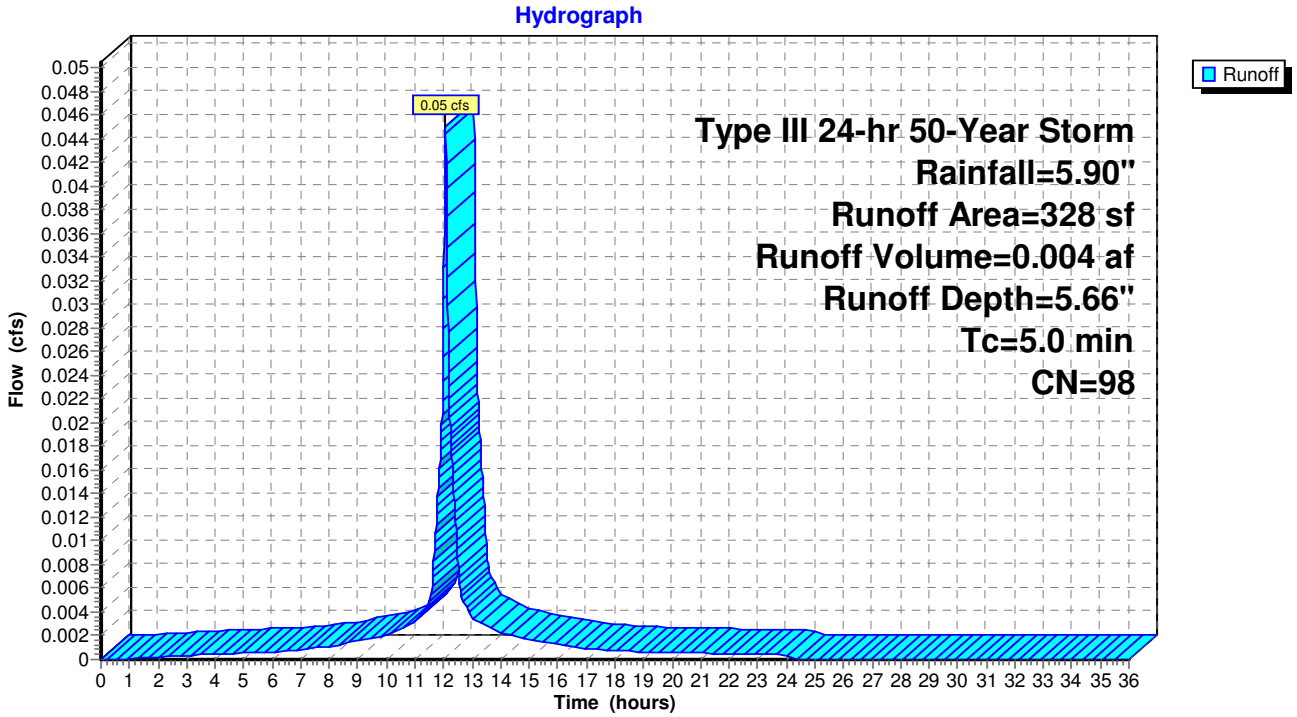
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 5.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	328	98	Sidewalk & Pervious Pavers
	328		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-7: Bldg B flow to DW3



Summary for Subcatchment 2-8: Bldg B flow to DW4

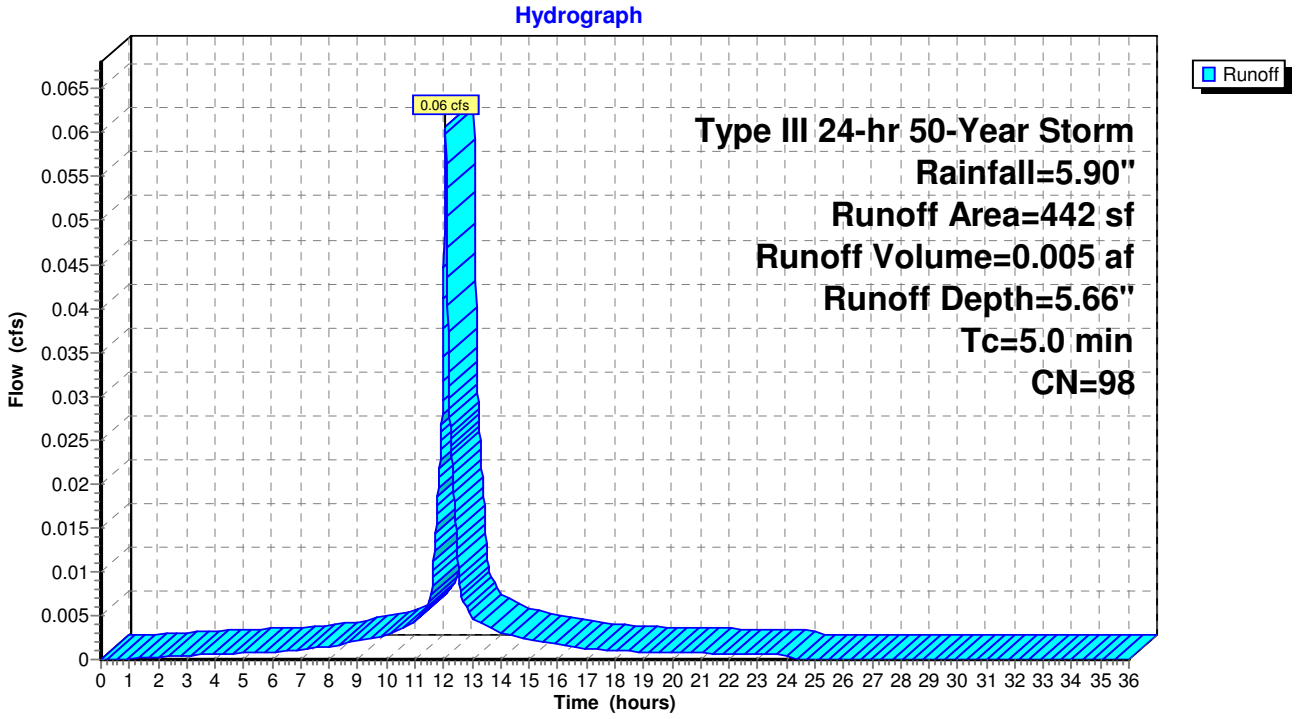
Runoff = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 5.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	442	98	Sidewalk & Pervious Pavers
	442		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-8: Bldg B flow to DW4



Summary for Subcatchment 2-9: Bldg A flow to DW5

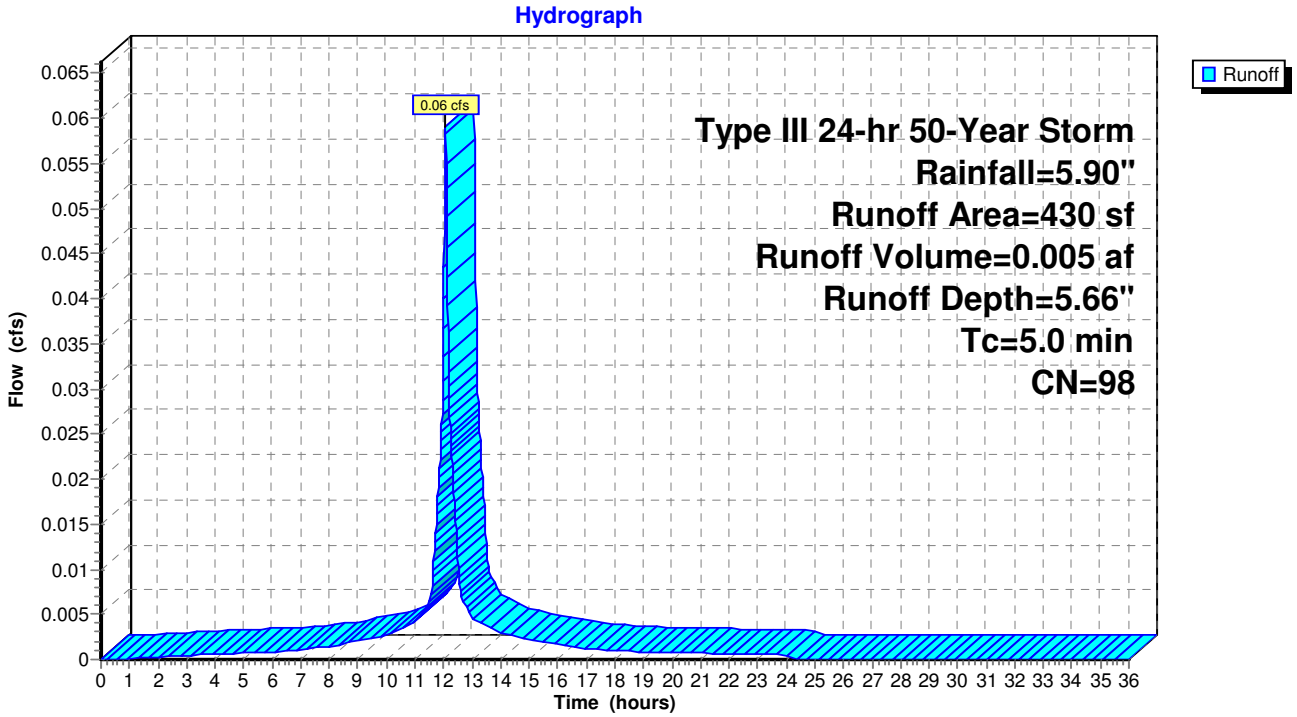
Runoff = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 5.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	430	98	Sidewalk & Pervious Pavers
	430		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-9: Bldg A flow to DW5



Summary for Subcatchment EX-1: Offsite Contributing Area

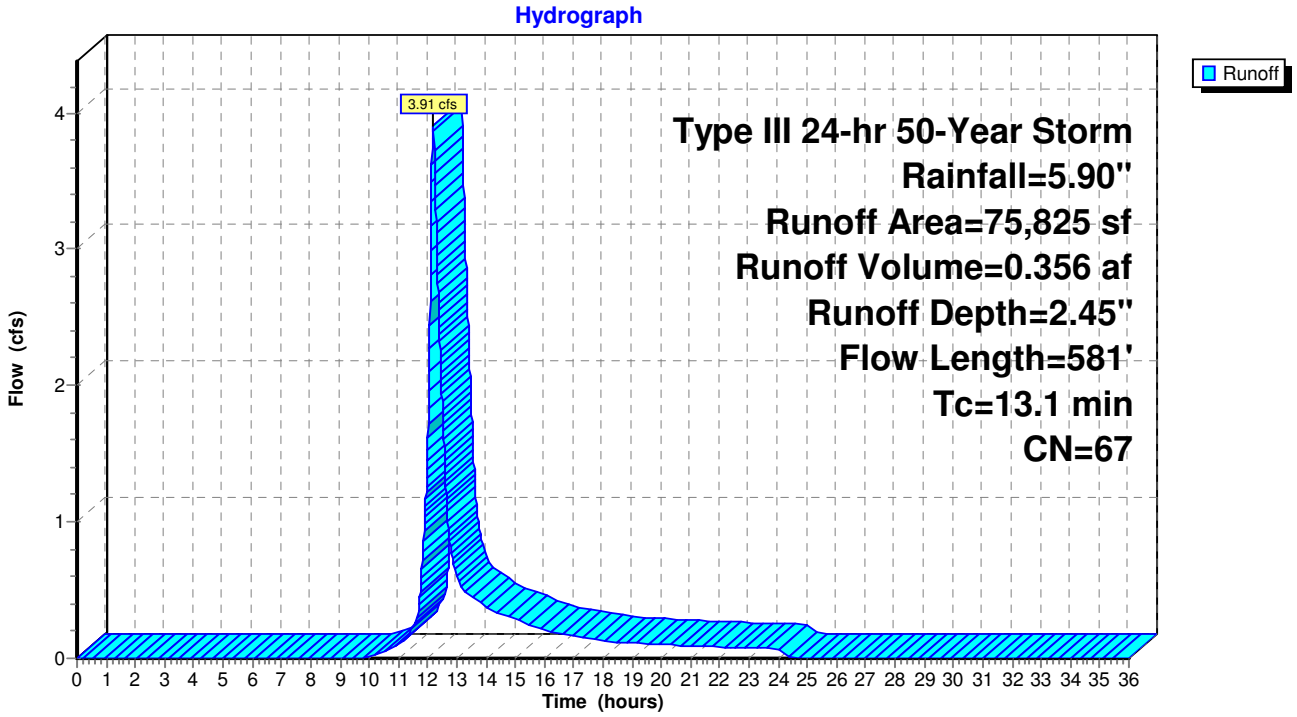
Runoff = 3.91 cfs @ 12.19 hrs, Volume= 0.356 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Storm Rainfall=5.90"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area

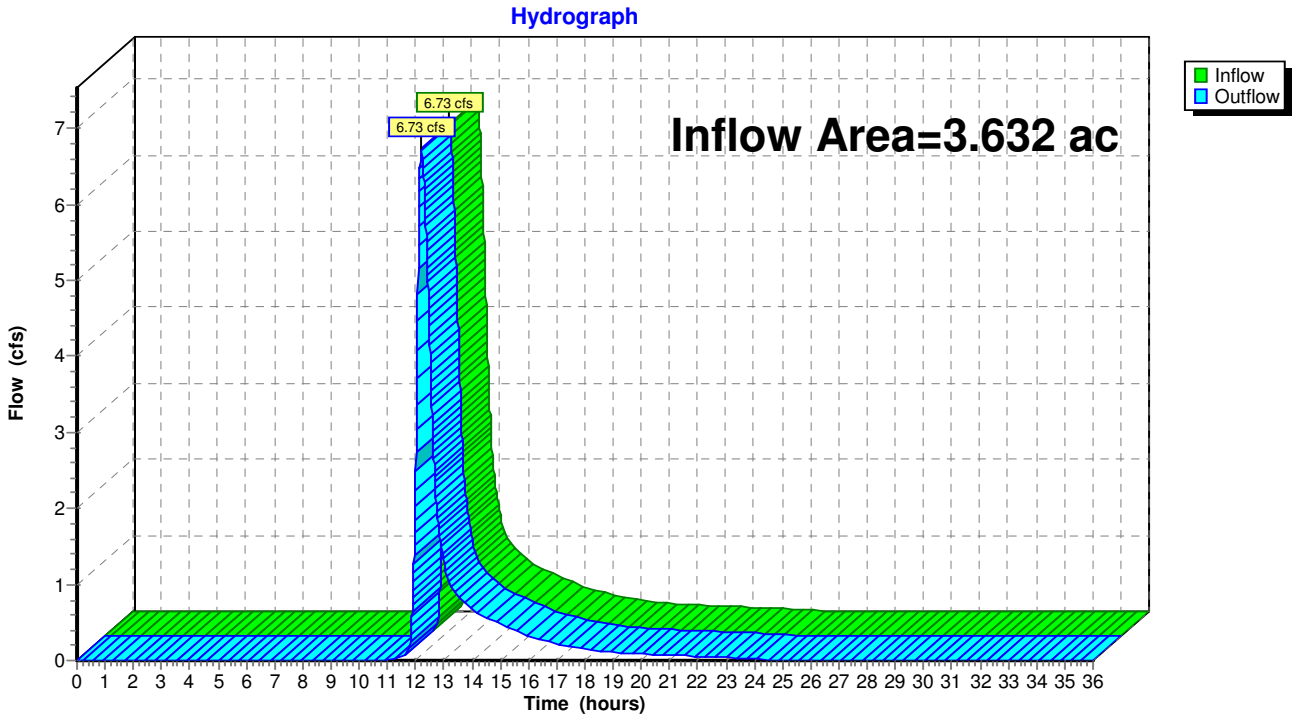


Summary for Reach SP1: Study Point #1

Inflow Area = 3.632 ac, 20.84% Impervious, Inflow Depth = 1.87" for 50-Year Storm event
Inflow = 6.73 cfs @ 12.20 hrs, Volume= 0.565 af
Outflow = 6.73 cfs @ 12.20 hrs, Volume= 0.565 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Summary for Pond CB1: CB1 (Double Grate)

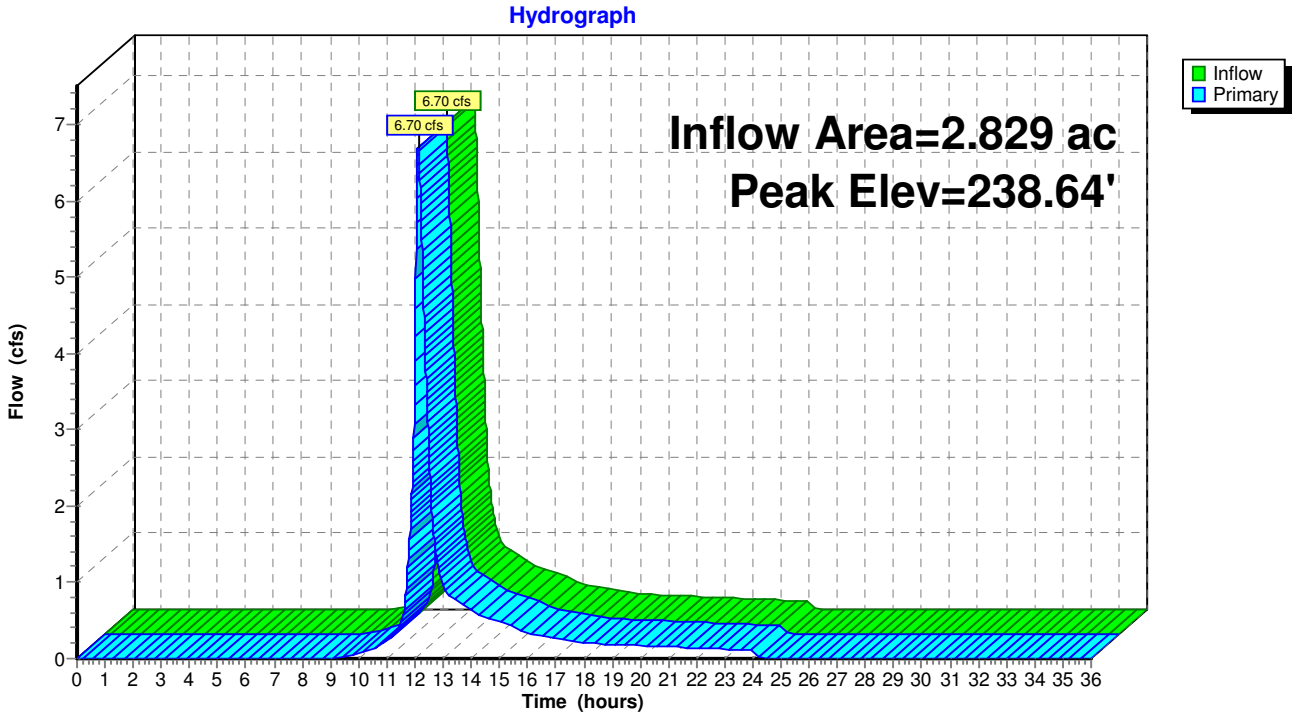
Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 2.63" for 50-Year Storm event
Inflow = 6.70 cfs @ 12.11 hrs, Volume= 0.620 af
Outflow = 6.70 cfs @ 12.11 hrs, Volume= 0.620 af, Atten= 0%, Lag= 0.0 min
Primary = 6.70 cfs @ 12.11 hrs, Volume= 0.620 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 238.64' @ 12.11 hrs
Flood Elev= 238.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=6.70 cfs @ 12.11 hrs HW=238.64' (Free Discharge)
1=Orifice/Grate (Orifice Controls 6.70 cfs @ 8.53 fps)

Pond CB1: CB1 (Double Grate)



Summary for Pond DW1: Dry Well 1

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 5.66" for 50-Year Storm event
Inflow = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af
Outflow = 0.02 cfs @ 12.28 hrs, Volume= 0.005 af, Atten= 61%, Lag= 12.4 min
Discarded = 0.00 cfs @ 9.60 hrs, Volume= 0.004 af
Primary = 0.02 cfs @ 12.28 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 241.53' @ 12.28 hrs Surf.Area= 50 sf Storage= 70 cf

Plug-Flow detention time= 215.8 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 215.8 min (960.3 - 744.5)

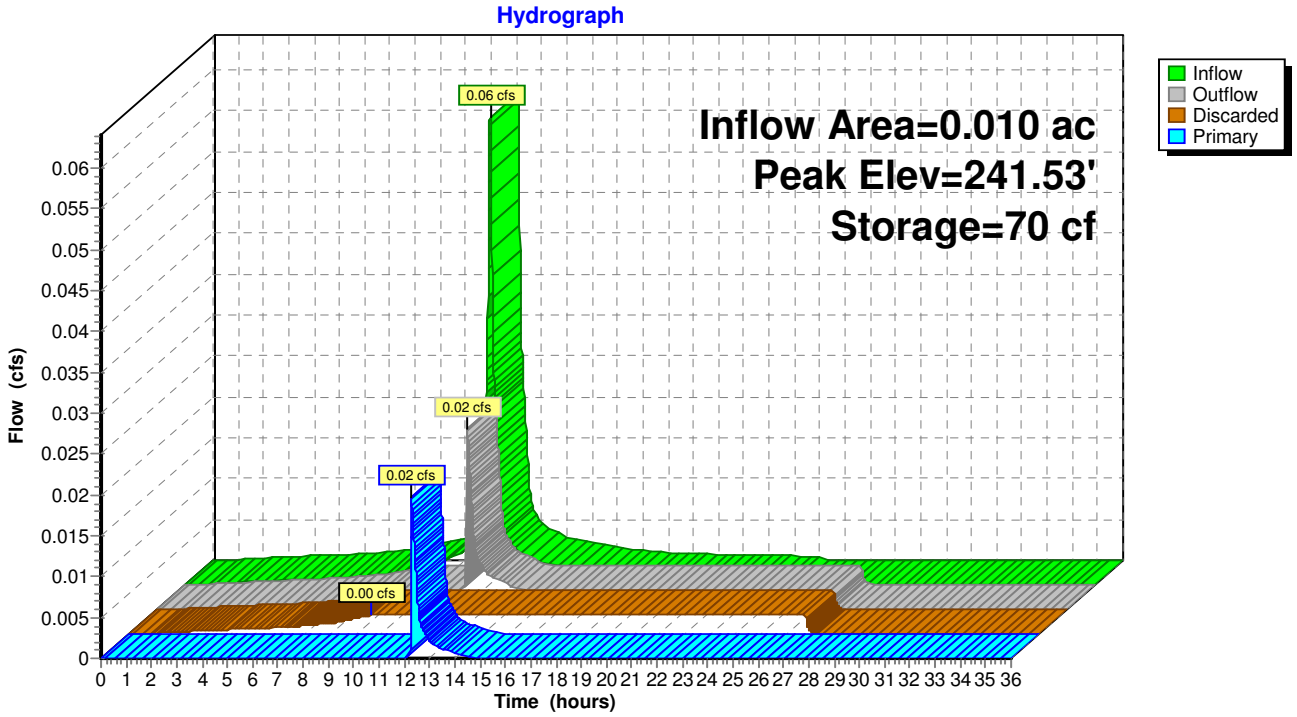
Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	239.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 9.60 hrs HW=239.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.02 cfs @ 12.28 hrs HW=241.53' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.02 cfs @ 0.53 fps)

Pond DW1: Dry Well 1



Summary for Pond DW2: Dry Well 2

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 5.66" for 50-Year Storm event
Inflow = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af
Outflow = 0.02 cfs @ 12.28 hrs, Volume= 0.005 af, Atten= 61%, Lag= 12.4 min
Discarded = 0.00 cfs @ 9.60 hrs, Volume= 0.004 af
Primary = 0.02 cfs @ 12.28 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.53' @ 12.28 hrs Surf.Area= 50 sf Storage= 70 cf

Plug-Flow detention time= 215.8 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 215.8 min (960.3 - 744.5)

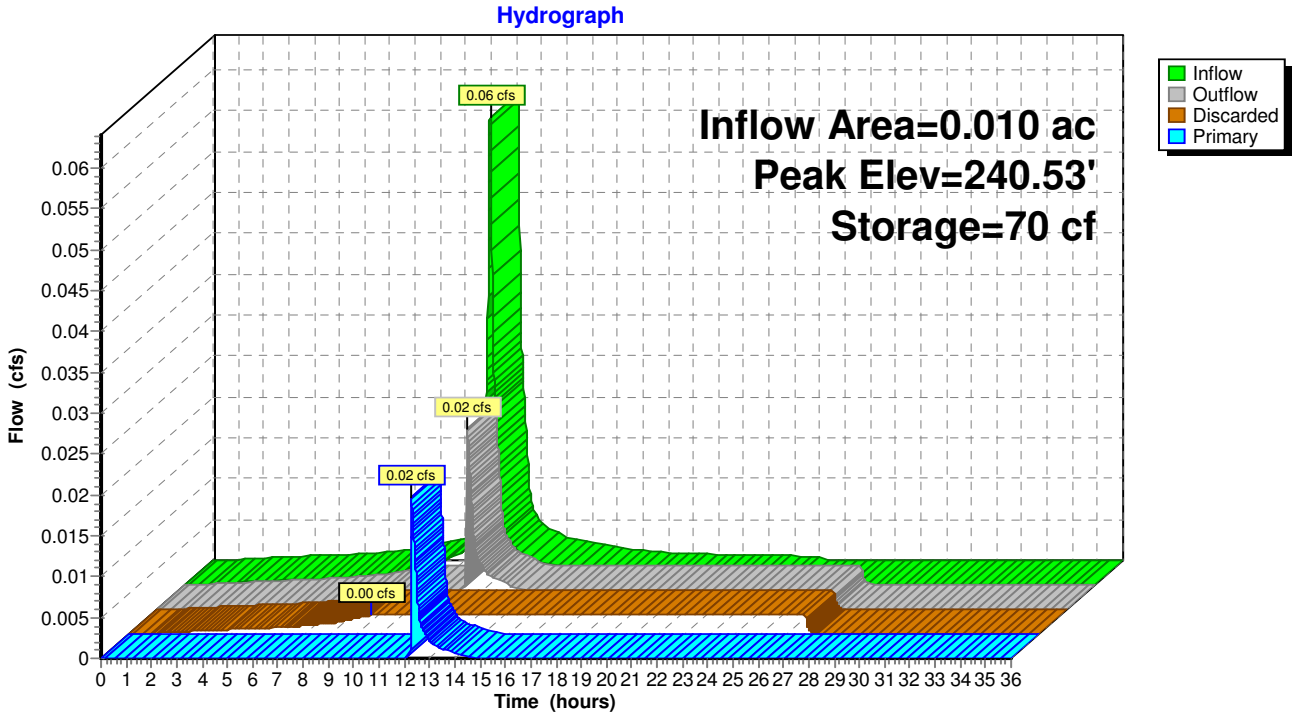
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 9.60 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.02 cfs @ 12.28 hrs HW=240.53' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.02 cfs @ 0.53 fps)

Pond DW2: Dry Well 2



Summary for Pond DW3: Dry Well 3

Assumed percolation rate of 30MPI

Inflow Area = 0.008 ac,100.00% Impervious, Inflow Depth = 5.66" for 50-Year Storm event
Inflow = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af
Outflow = 0.00 cfs @ 10.35 hrs, Volume= 0.004 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.00 cfs @ 10.35 hrs, Volume= 0.004 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.42' @ 13.95 hrs Surf.Area= 50 sf Storage= 67 cf

Plug-Flow detention time= 231.2 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 231.2 min (975.6 - 744.5)

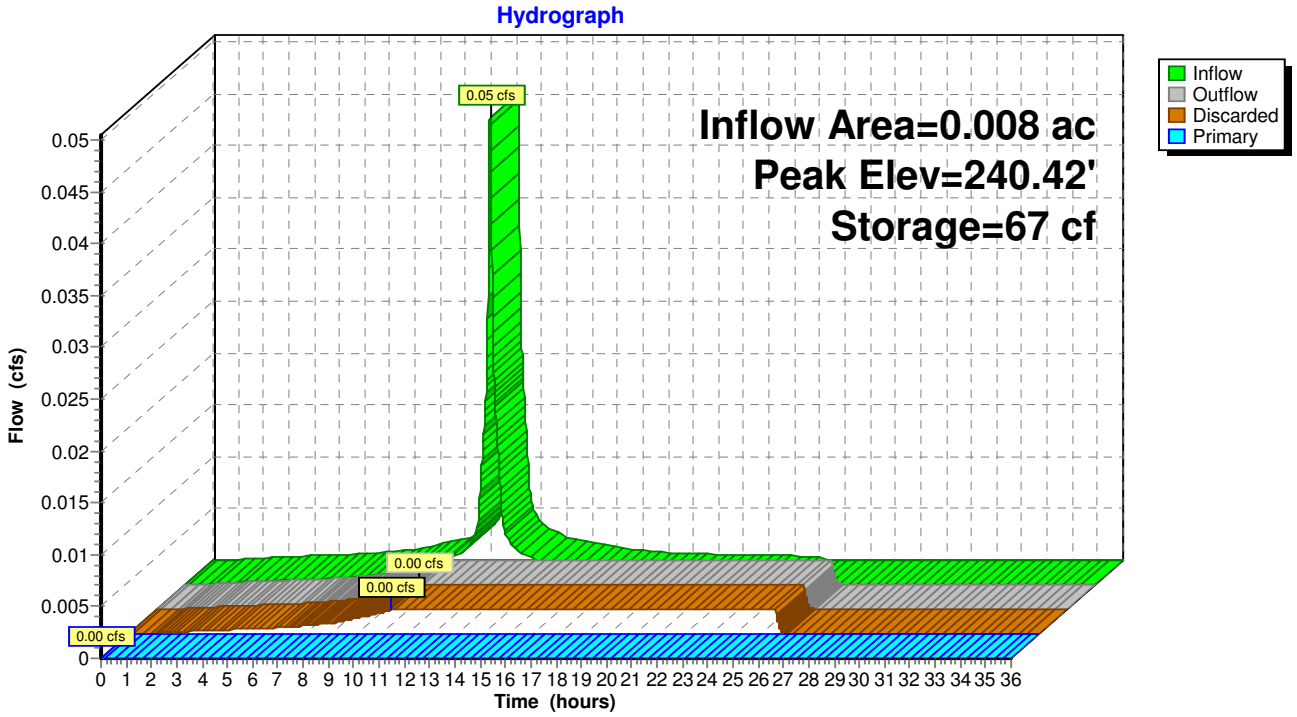
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 10.35 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=238.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond DW3: Dry Well 3



Summary for Pond DW4: Dry Well 4

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 5.66" for 50-Year Storm event
Inflow = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.21 hrs, Volume= 0.005 af, Atten= 52%, Lag= 8.6 min
Discarded = 0.00 cfs @ 9.40 hrs, Volume= 0.004 af
Primary = 0.03 cfs @ 12.21 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.53' @ 12.21 hrs Surf.Area= 50 sf Storage= 70 cf

Plug-Flow detention time= 209.1 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 209.1 min (953.6 - 744.5)

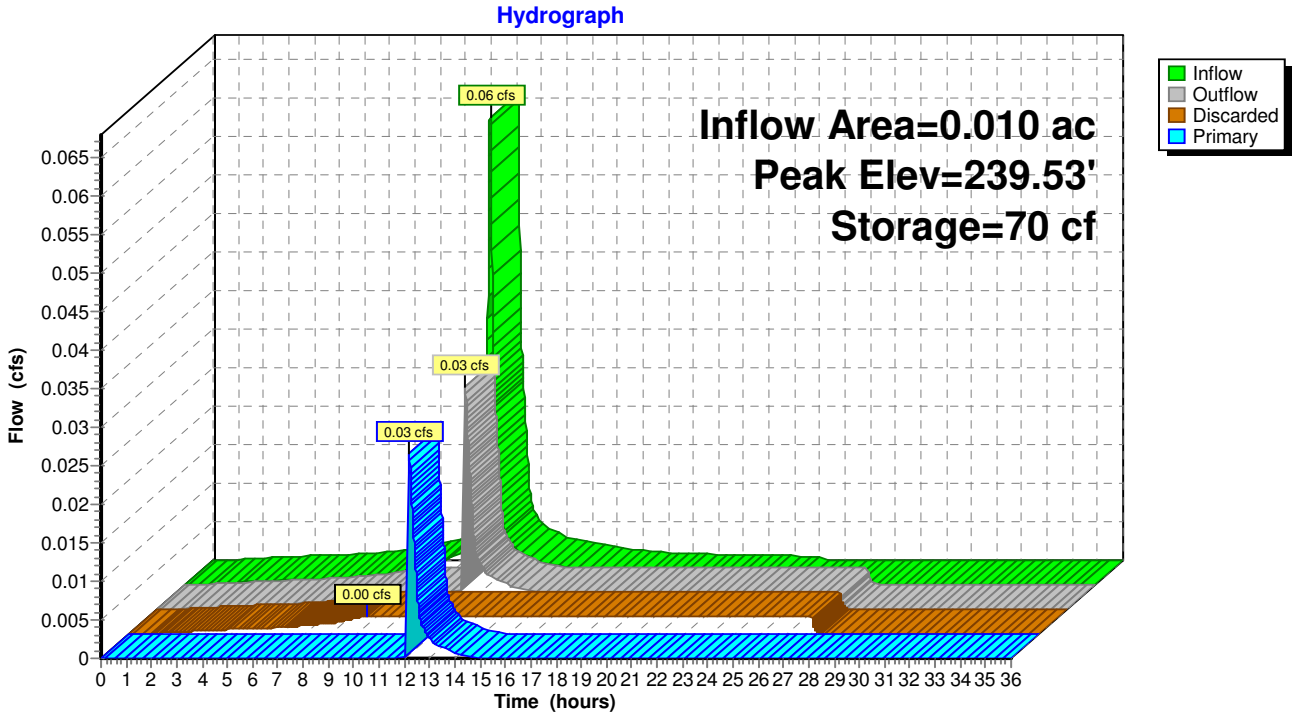
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 9.40 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.02 cfs @ 12.21 hrs HW=239.53' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.02 cfs @ 0.58 fps)

Pond DW4: Dry Well 4



Summary for Pond DW5: Dry Well 5

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 5.66" for 50-Year Storm event
Inflow = 0.06 cfs @ 12.07 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.24 hrs, Volume= 0.005 af, Atten= 57%, Lag= 10.1 min
Discarded = 0.00 cfs @ 9.49 hrs, Volume= 0.004 af
Primary = 0.02 cfs @ 12.24 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.53' @ 12.24 hrs Surf.Area= 50 sf Storage= 70 cf

Plug-Flow detention time= 212.1 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 212.1 min (956.6 - 744.5)

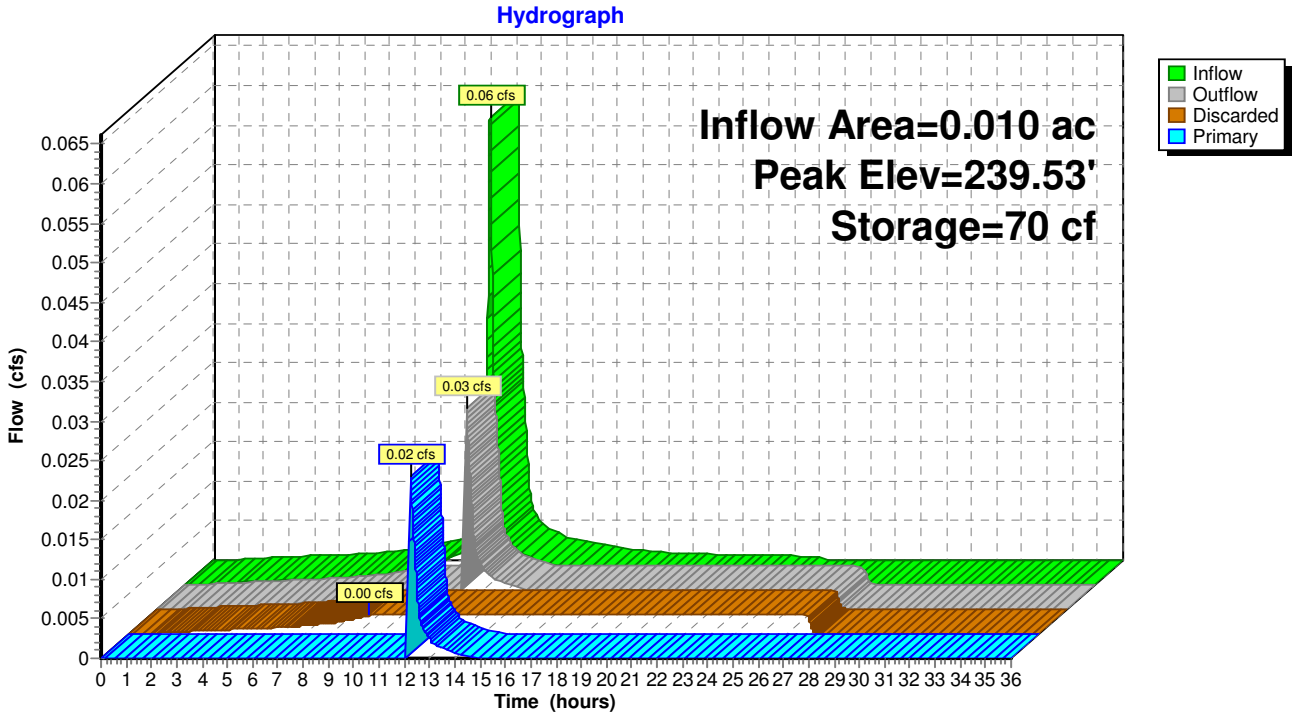
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 9.49 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.02 cfs @ 12.24 hrs HW=239.53' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.02 cfs @ 0.56 fps)

Pond DW5: Dry Well 5



Summary for Pond I.S.#1: Infiltration System #1

Assumed percolation rate of 30 MPI

Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 2.63" for 50-Year Storm event
Inflow = 6.70 cfs @ 12.11 hrs, Volume= 0.620 af
Outflow = 5.60 cfs @ 12.23 hrs, Volume= 0.620 af, Atten= 16%, Lag= 7.2 min
Discarded = 0.13 cfs @ 12.11 hrs, Volume= 0.180 af
Primary = 5.47 cfs @ 12.23 hrs, Volume= 0.440 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 235.58' @ 12.23 hrs Surf.Area= 2,887 sf Storage= 3,841 cf

Plug-Flow detention time= 47.9 min calculated for 0.620 af (100% of inflow)
Center-of-Mass det. time= 48.0 min (892.5 - 844.6)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	3,258 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 9,545 cf Overall - 1,400 cf Embedded = 8,145 cf x 40.0% Voids
#2	234.00'	1,400 cf	**28.9"W x 16.0"H x 7.12'L StormTech SC-310** x 95 Inside #1
#3	234.50'	49 cf	**12.0"D x 62.00'L Horizontal Cylinder S= 0.0080 '/'**
#4	234.00'	44 cf	**4.00'D x 3.50'H DMH1**
#5	234.00'	44 cf	**4.00'D x 3.50'H OCS1**
		4,795 cf	Total Available Storage

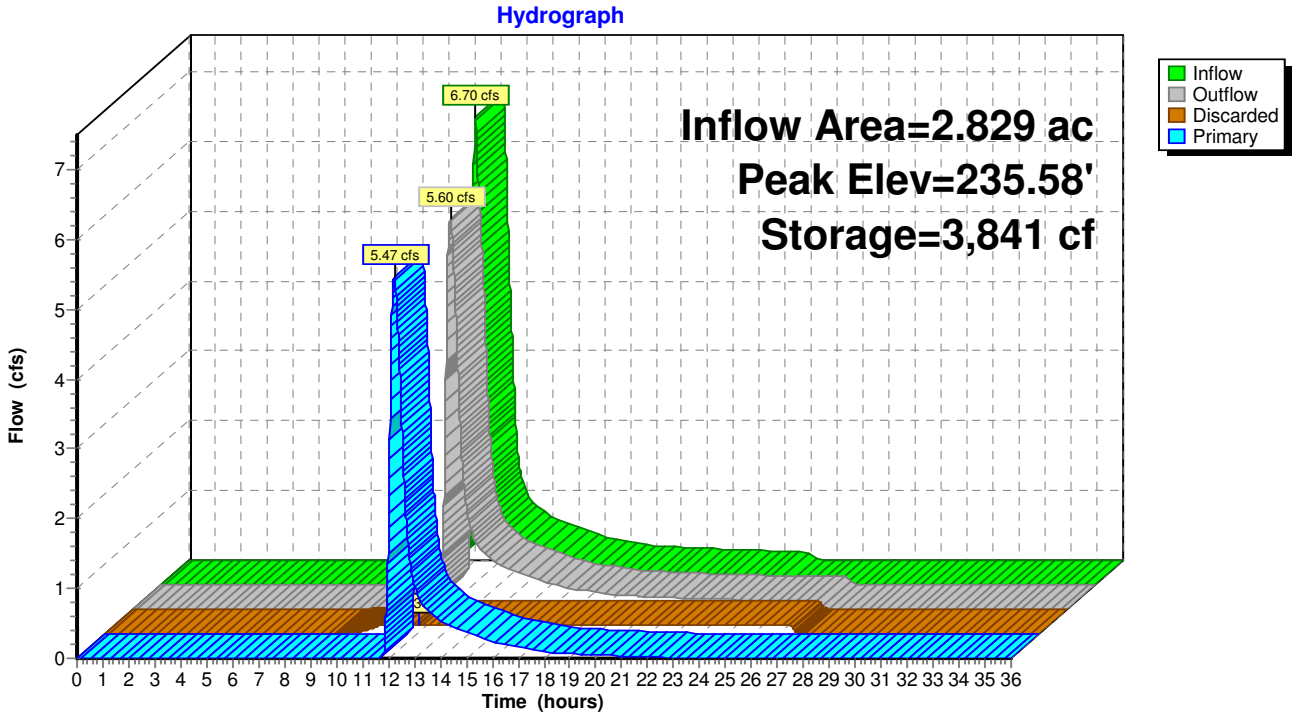
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
233.00	2,824	218.0	0	0	2,824
236.38	2,824	218.0	9,545	9,545	3,561

Device	Routing	Invert	Outlet Devices
#1	Discarded	233.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	234.00'	**14.5" Vert. Orifice/Grate** C= 0.600
#3	Primary	236.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.13 cfs @ 12.11 hrs HW=235.25' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=5.47 cfs @ 12.23 hrs HW=235.58' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 5.47 cfs @ 4.77 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond I.S.#1: Infiltration System #1



Summary for Pond PP-1: Pervious Pavers Area 1

Assumed percolation rate of 30MPI

Inflow Area = 0.044 ac, 53.67% Impervious, Inflow Depth = 3.79" for 50-Year Storm event
Inflow = 0.20 cfs @ 12.07 hrs, Volume= 0.014 af
Outflow = 0.03 cfs @ 11.70 hrs, Volume= 0.014 af, Atten= 85%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.70 hrs, Volume= 0.014 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.20' @ 12.57 hrs Surf.Area= 648 sf Storage= 182 cf

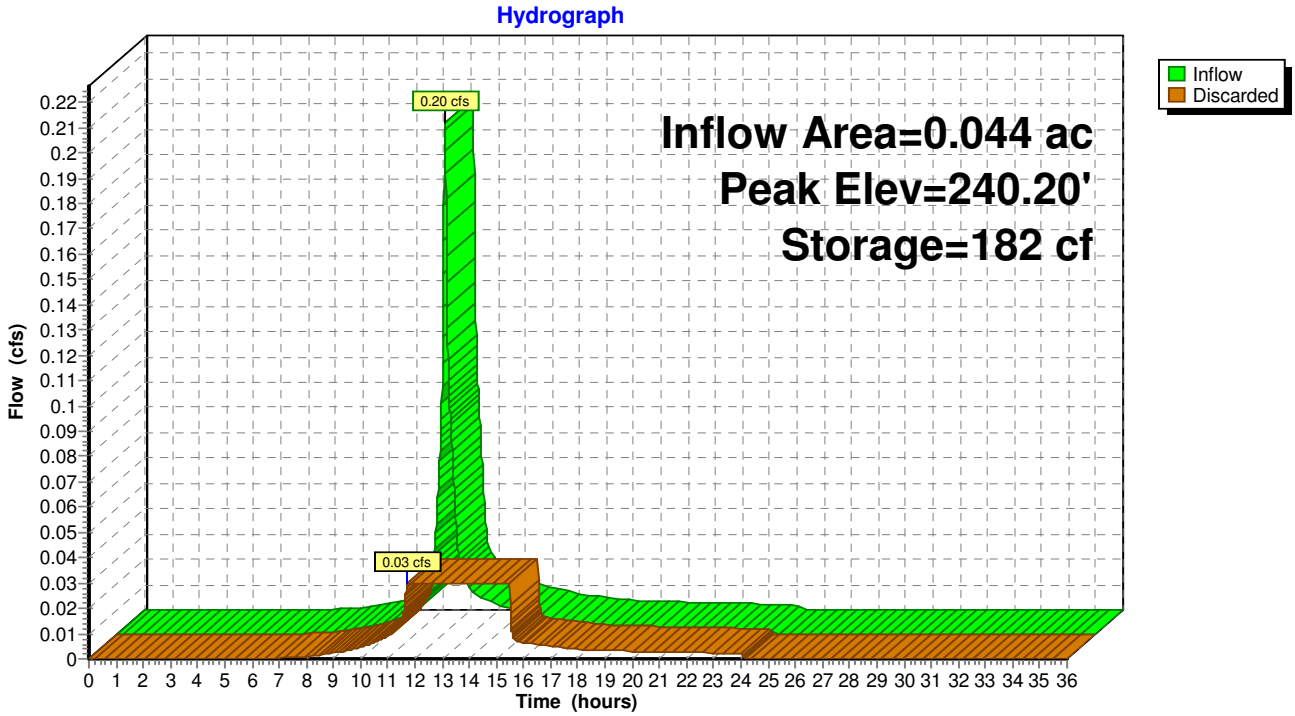
Plug-Flow detention time= 40.1 min calculated for 0.014 af (100% of inflow)
Center-of-Mass det. time= 40.1 min (851.4 - 811.3)

Volume	Invert	Avail.Storage	Storage Description
#1	239.50'	389 cf	**18.00'W x 36.00'L x 1.50'H Prismatoid** 972 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.50'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 11.70 hrs HW=239.52' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-1: Pervious Pavers Area 1



Summary for Pond PP-2: Pervious Pavers Area 2

Assumed percolation rate of 30MPI

Inflow Area = 0.053 ac, 43.73% Impervious, Inflow Depth = 3.39" for 50-Year Storm event
Inflow = 0.22 cfs @ 12.07 hrs, Volume= 0.015 af
Outflow = 0.03 cfs @ 11.70 hrs, Volume= 0.015 af, Atten= 86%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.70 hrs, Volume= 0.015 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.54' @ 12.61 hrs Surf.Area= 648 sf Storage= 204 cf

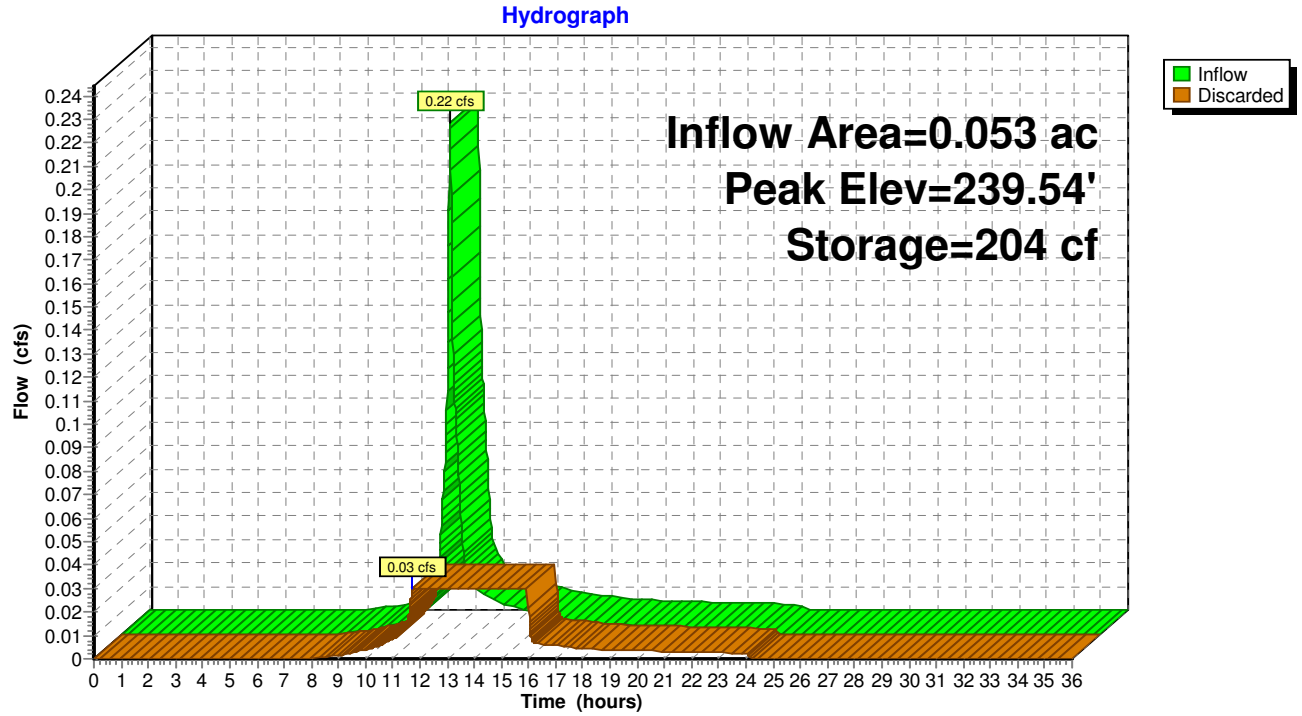
Plug-Flow detention time= 48.0 min calculated for 0.015 af (100% of inflow)
Center-of-Mass det. time= 48.0 min (869.4 - 821.4)

Volume	Invert	Avail.Storage	Storage Description
#1	238.75'	454 cf	**18.00'W x 36.00'L x 1.75'H Prismatoid** 1,134 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 11.70 hrs HW=238.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-2: Pervious Pavers Area 2



Summary for Pond PP-3: Pervious Pavers Area 3

Assumed percolation rate of 30MPI

Inflow Area = 0.072 ac, 36.69% Impervious, Inflow Depth = 3.20" for 50-Year Storm event
Inflow = 0.28 cfs @ 12.08 hrs, Volume= 0.019 af
Outflow = 0.04 cfs @ 11.71 hrs, Volume= 0.019 af, Atten= 87%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.71 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 238.56' @ 12.64 hrs Surf.Area= 810 sf Storage= 263 cf

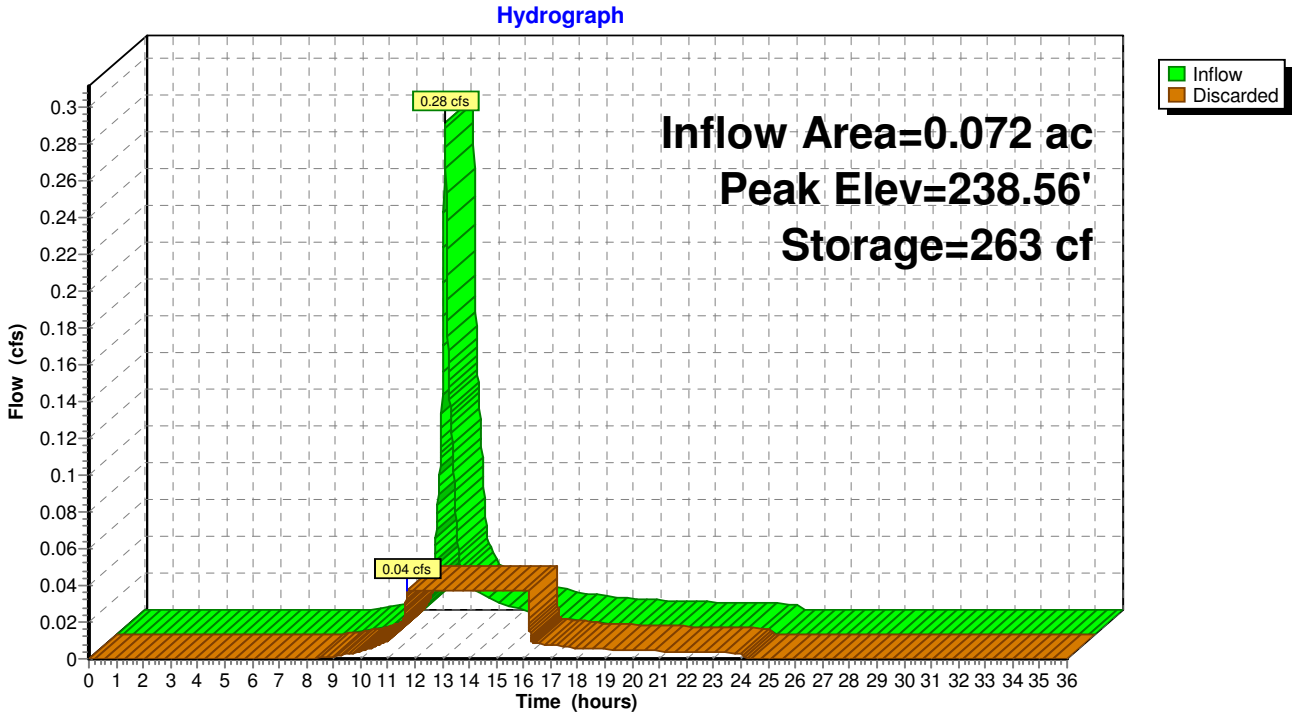
Plug-Flow detention time= 50.7 min calculated for 0.019 af (100% of inflow)
Center-of-Mass det. time= 50.7 min (877.0 - 826.3)

Volume	Invert	Avail.Storage	Storage Description
#1	237.75'	567 cf	**18.00'W x 45.00'L x 1.75'H Prismatoid** 1,418 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 11.71 hrs HW=237.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond PP-3: Pervious Pavers Area 3



Summary for Subcatchment 2-1: On-site Contributing Area

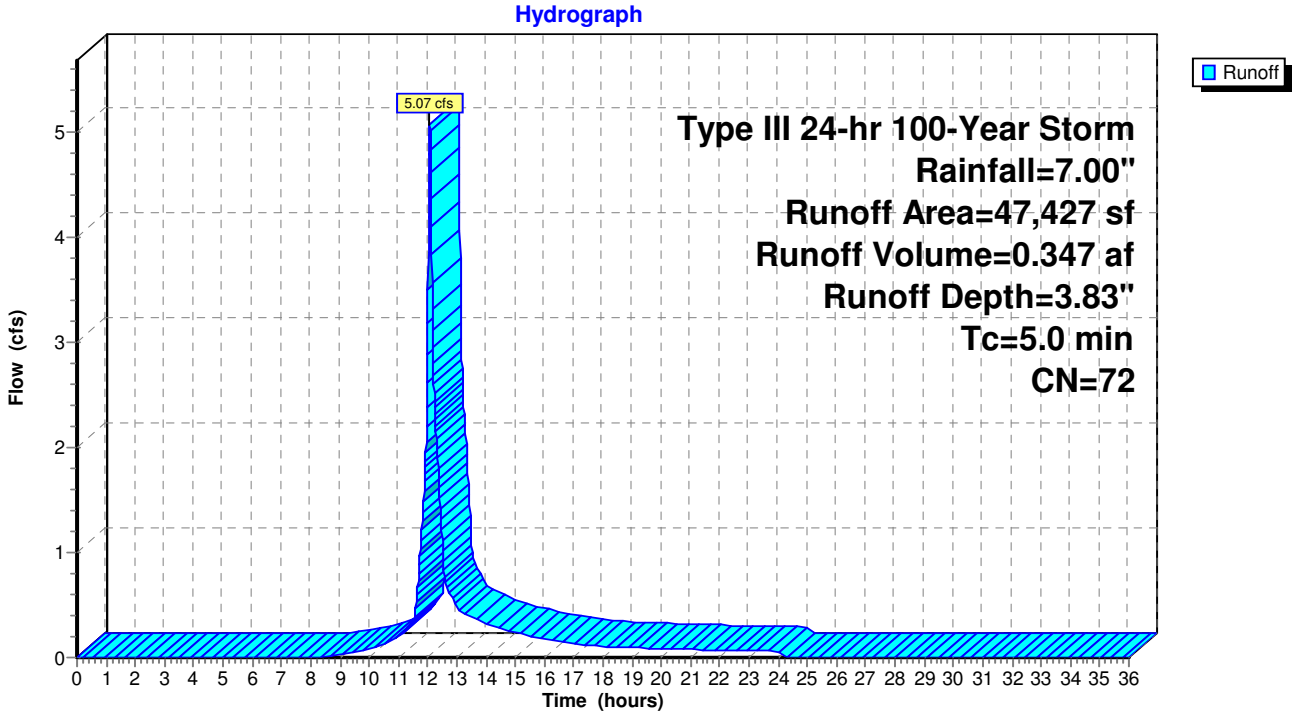
Runoff = 5.07 cfs @ 12.08 hrs, Volume= 0.347 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	5,048	98	Building Rooftop Area
*	889	98	Sidewalk Area
*	10,165	98	Pavement Area
	18,133	61	>75% Grass cover, Good, HSG B
	6,044	58	Woods/grass comb., Good, HSG B
	7,148	55	Woods, Good, HSG B
	47,427	72	Weighted Average
	31,325		Pervious Area
	16,102		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-1: On-site Contributing Area



Summary for Subcatchment 2-10: Direct Flow to Study Point

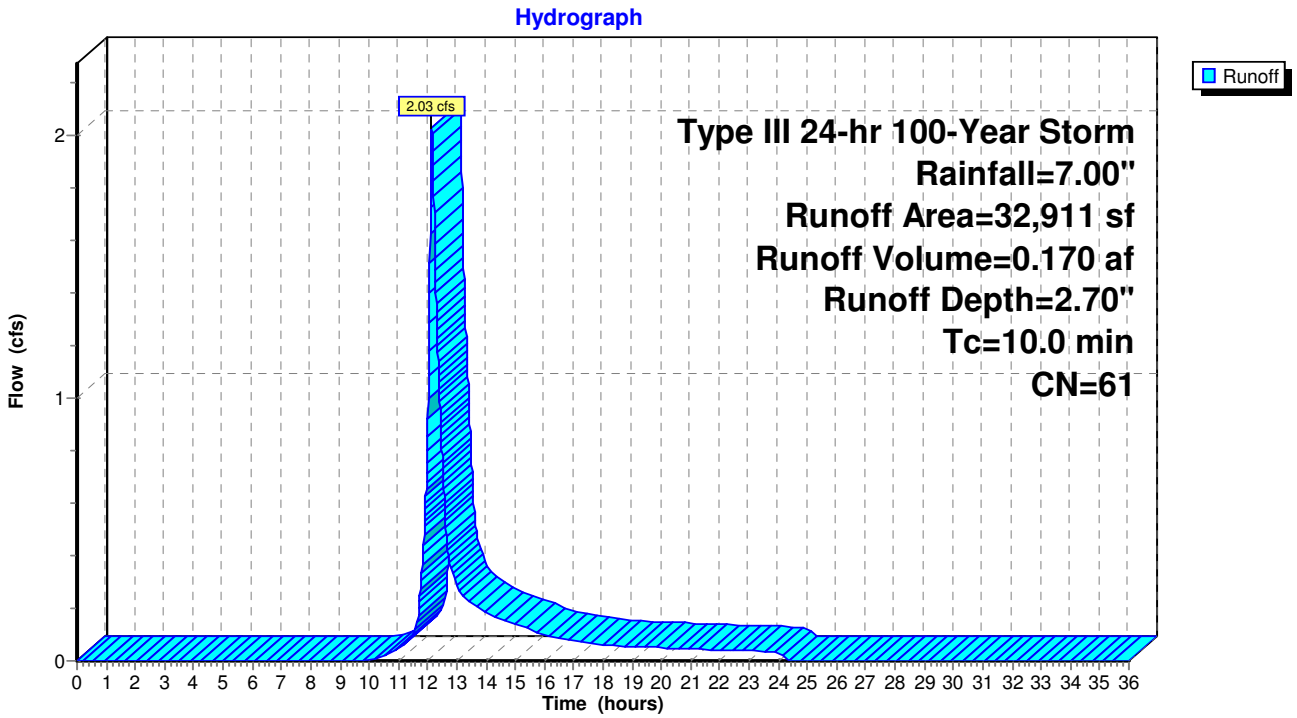
Runoff = 2.03 cfs @ 12.15 hrs, Volume= 0.170 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	1,793	98	Rooftop Area
	17,774	61	>75% Grass cover, Good, HSG B
	5,924	58	Woods/grass comb., Good, HSG B
	7,420	55	Woods, Good, HSG B
	32,911	61	Weighted Average
	31,118		Pervious Area
	1,793		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2-10: Direct Flow to Study Point



Summary for Subcatchment 2-2: Flow to Pervious Pavers Area 1

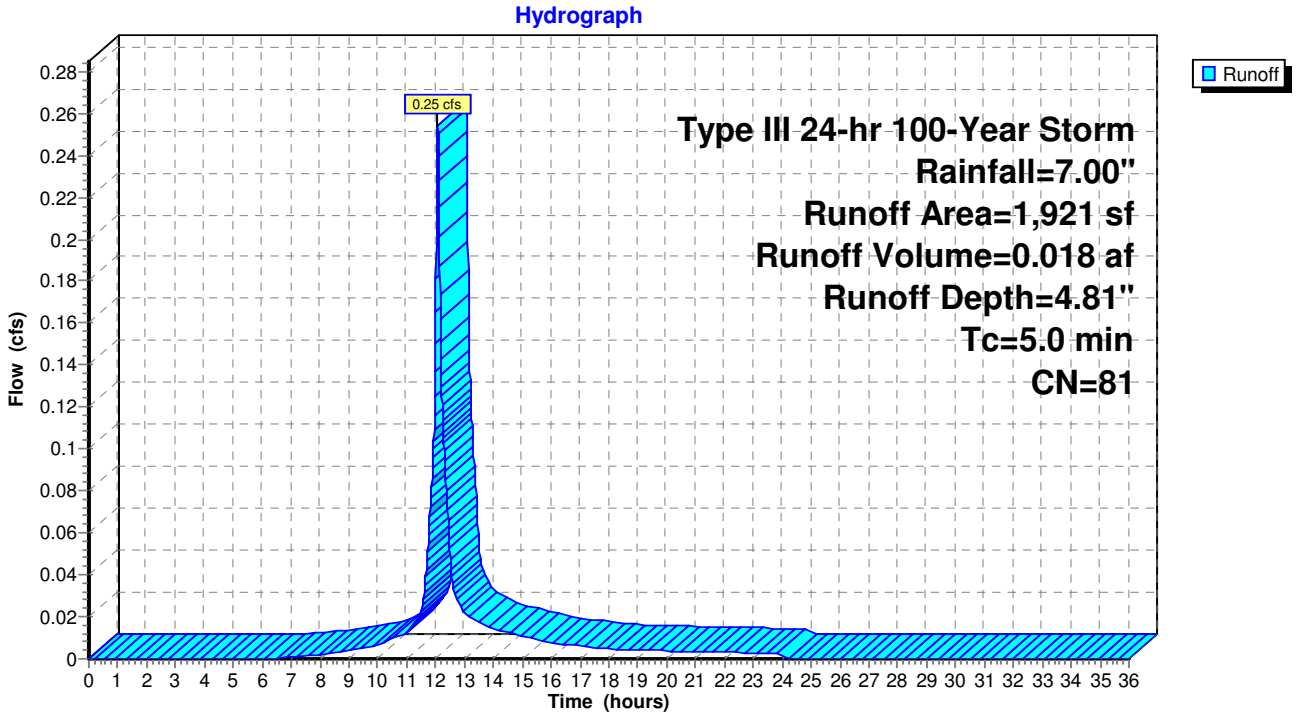
Runoff = 0.25 cfs @ 12.07 hrs, Volume= 0.018 af, Depth= 4.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	1,031	98	Sidewalk & Pervious Pavers
	890	61	>75% Grass cover, Good, HSG B
	1,921	81	Weighted Average
	890		Pervious Area
	1,031		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-2: Flow to Pervious Pavers Area 1



Summary for Subcatchment 2-3: Flow to Pervious Pavers Area 2

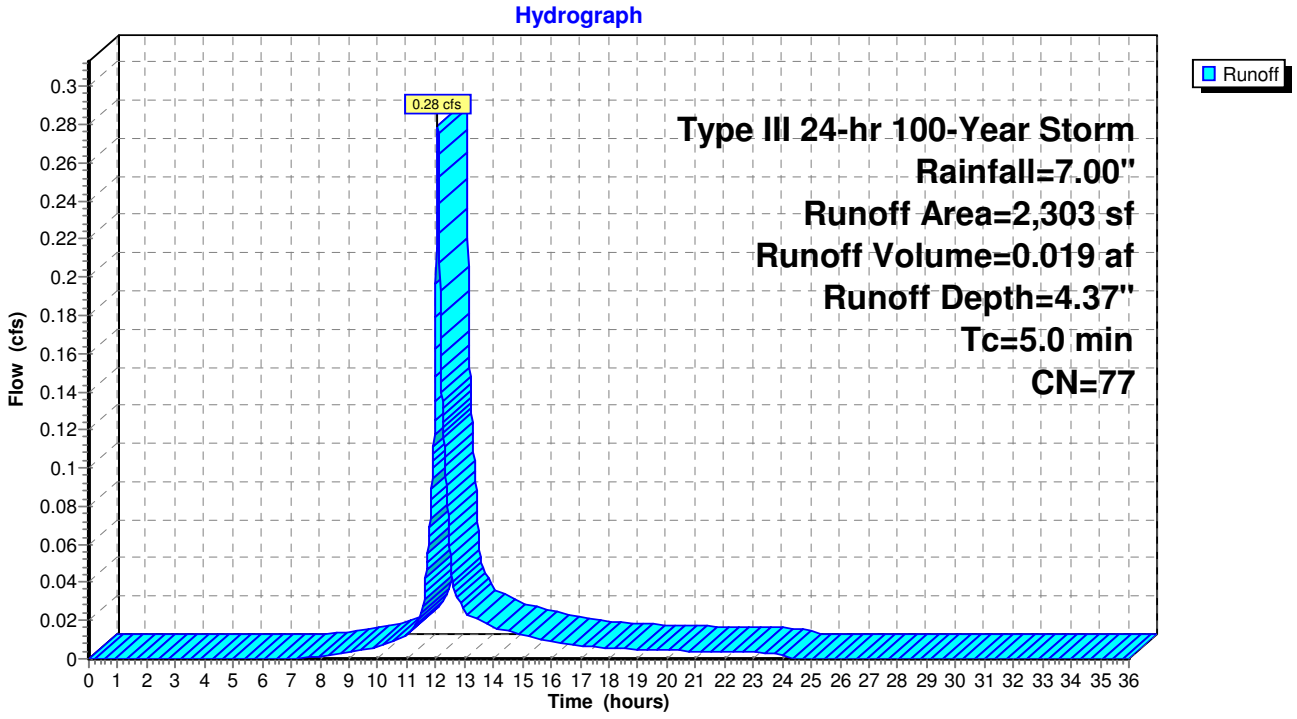
Runoff = 0.28 cfs @ 12.07 hrs, Volume= 0.019 af, Depth= 4.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	1,007	98	Sidewalk & Pervious Pavers
	1,296	61	>75% Grass cover, Good, HSG B
	2,303	77	Weighted Average
	1,296		Pervious Area
	1,007		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-3: Flow to Pervious Pavers Area 2



Summary for Subcatchment 2-4: Flow to Pervious Pavers Area 3

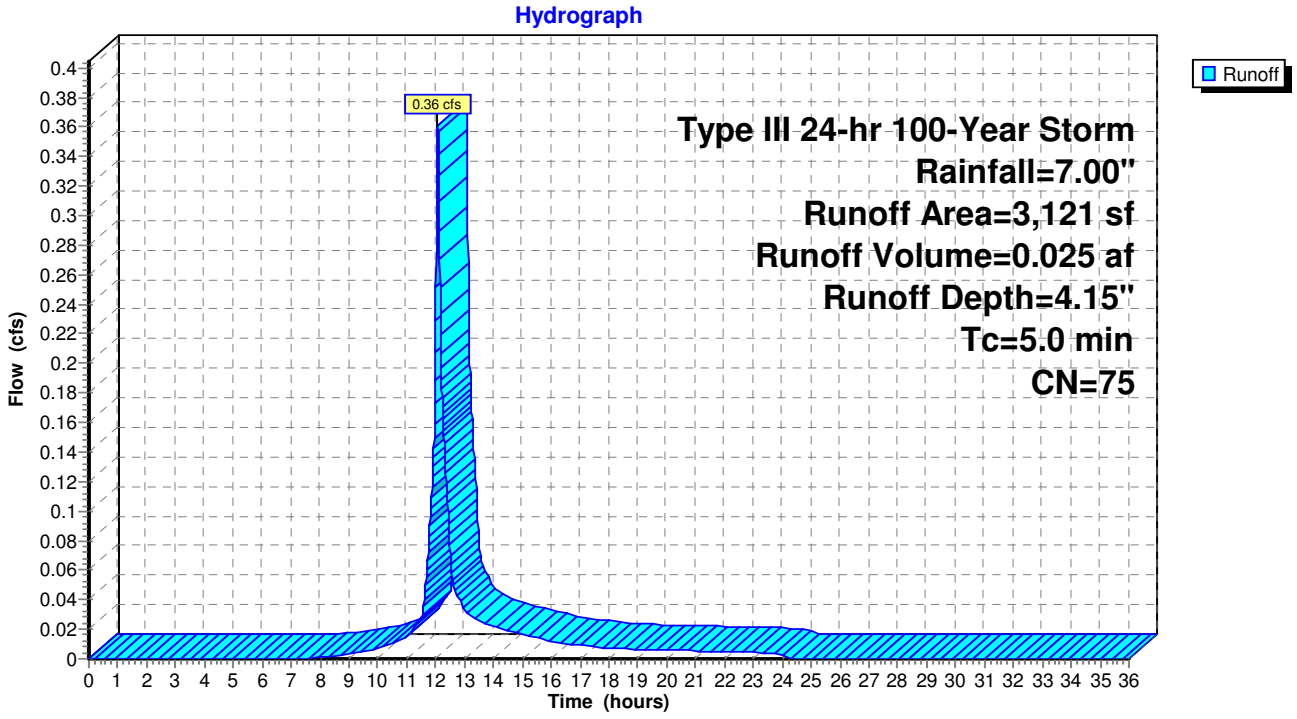
Runoff = 0.36 cfs @ 12.07 hrs, Volume= 0.025 af, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	1,145	98	Sidewalk & Pervious Pavers
	1,976	61	>75% Grass cover, Good, HSG B
	3,121	75	Weighted Average
	1,976		Pervious Area
	1,145		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-4: Flow to Pervious Pavers Area 3



Summary for Subcatchment 2-5: Bldg C flow to DW1

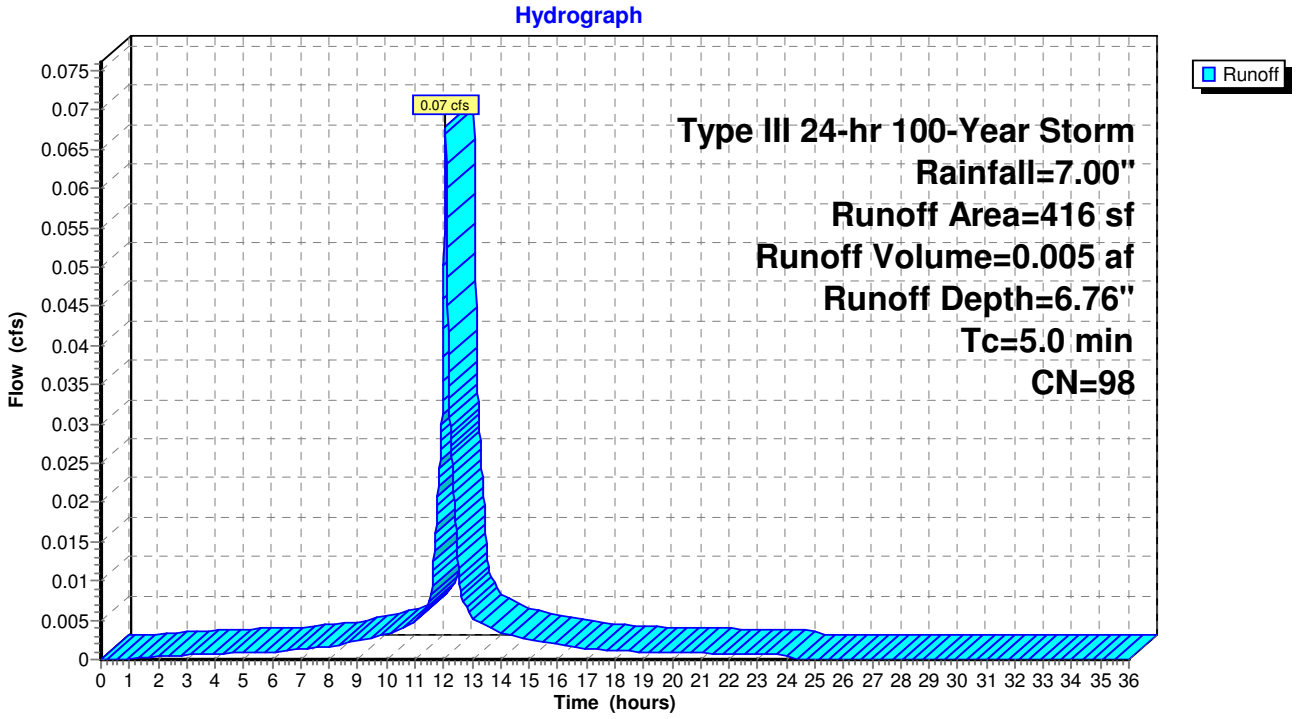
Runoff = 0.07 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-5: Bldg C flow to DW1



Summary for Subcatchment 2-6: Bldg C flow to DW2

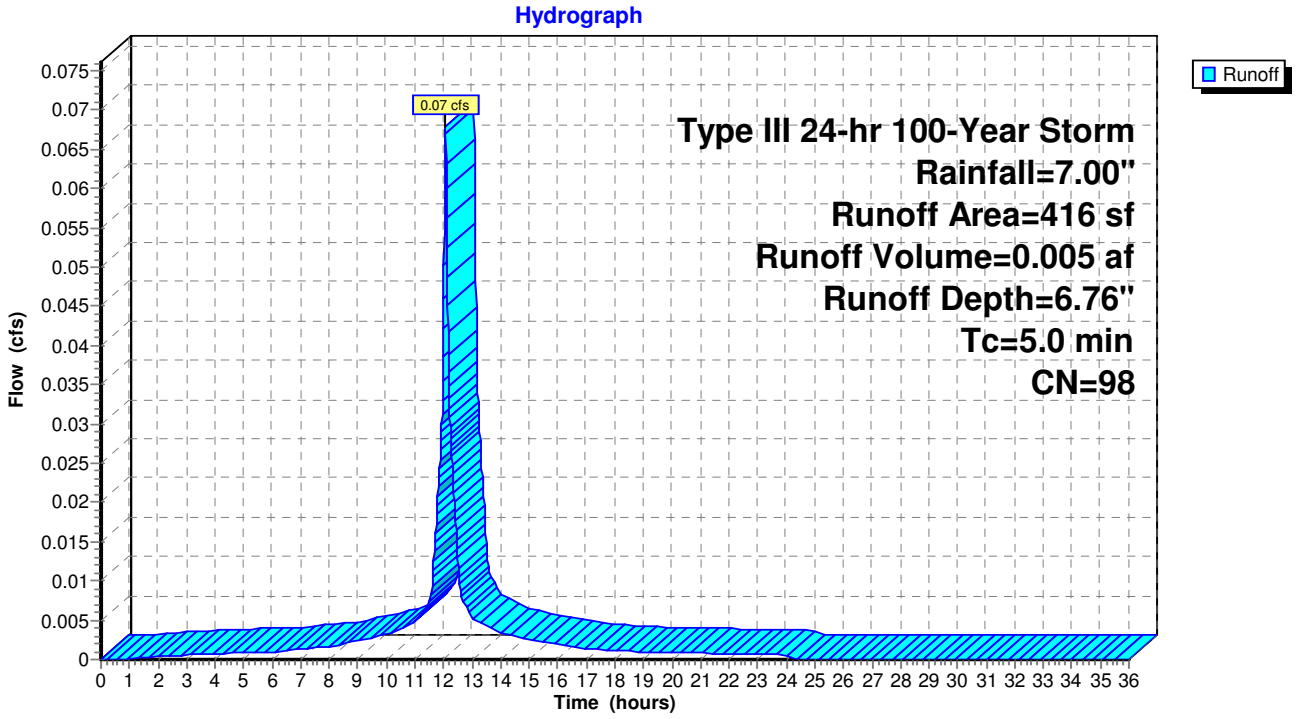
Runoff = 0.07 cfs @ 12.07 hrs, Volume= 0.005 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	416	98	Sidewalk & Pervious Pavers
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-6: Bldg C flow to DW2



Summary for Subcatchment 2-7: Bldg B flow to DW3

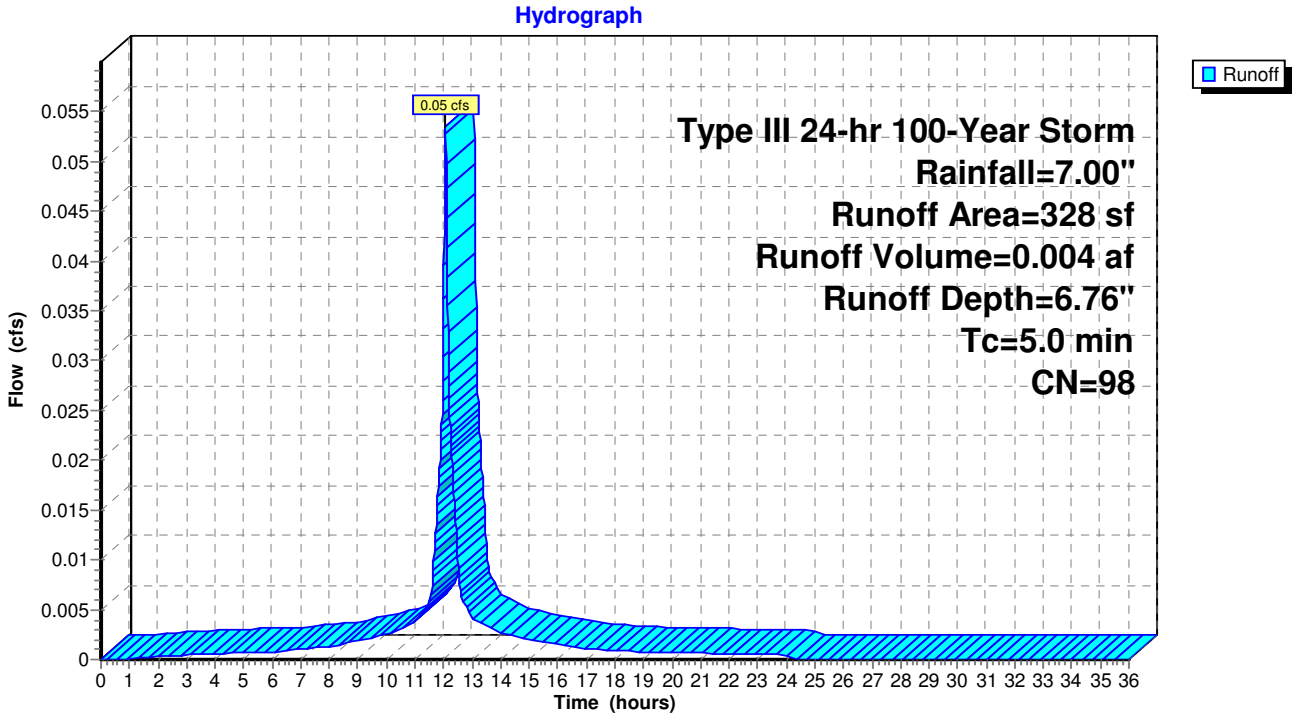
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	328	98	Sidewalk & Pervious Pavers
	328		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-7: Bldg B flow to DW3



Summary for Subcatchment 2-8: Bldg B flow to DW4

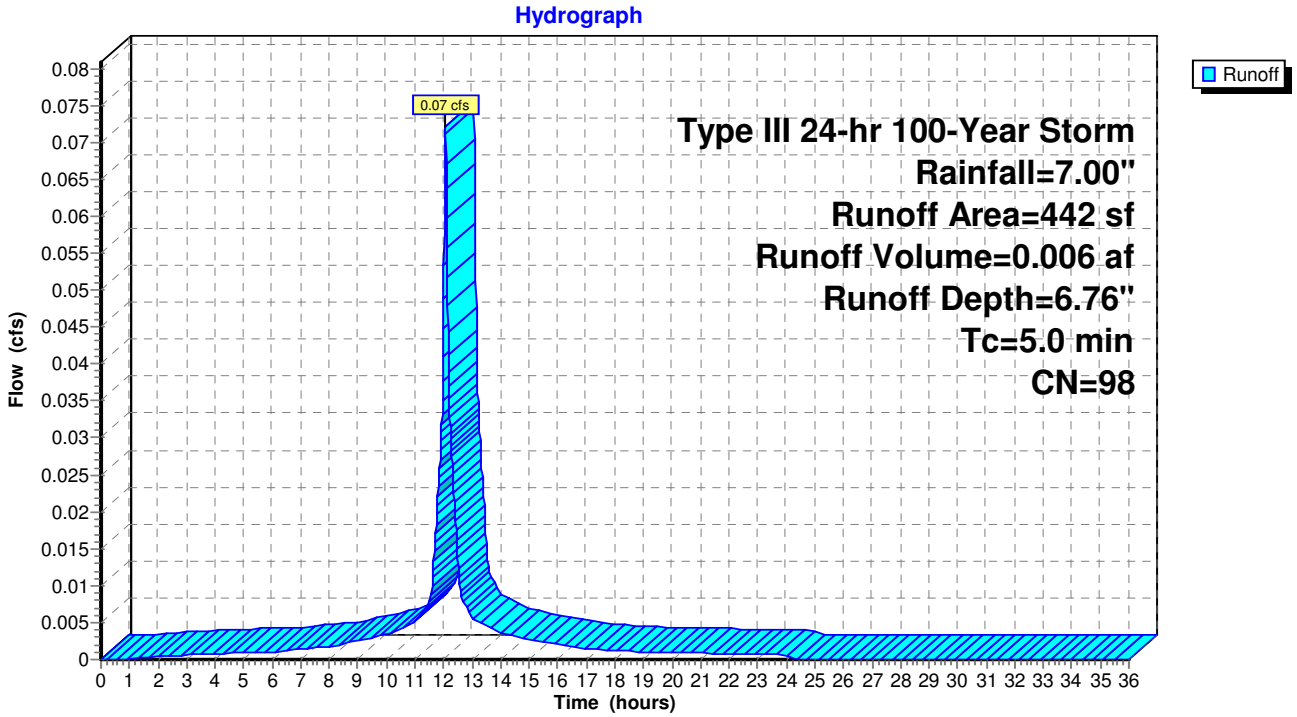
Runoff = 0.07 cfs @ 12.07 hrs, Volume= 0.006 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	442	98	Sidewalk & Pervious Pavers
	442		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-8: Bldg B flow to DW4



Summary for Subcatchment 2-9: Bldg A flow to DW5

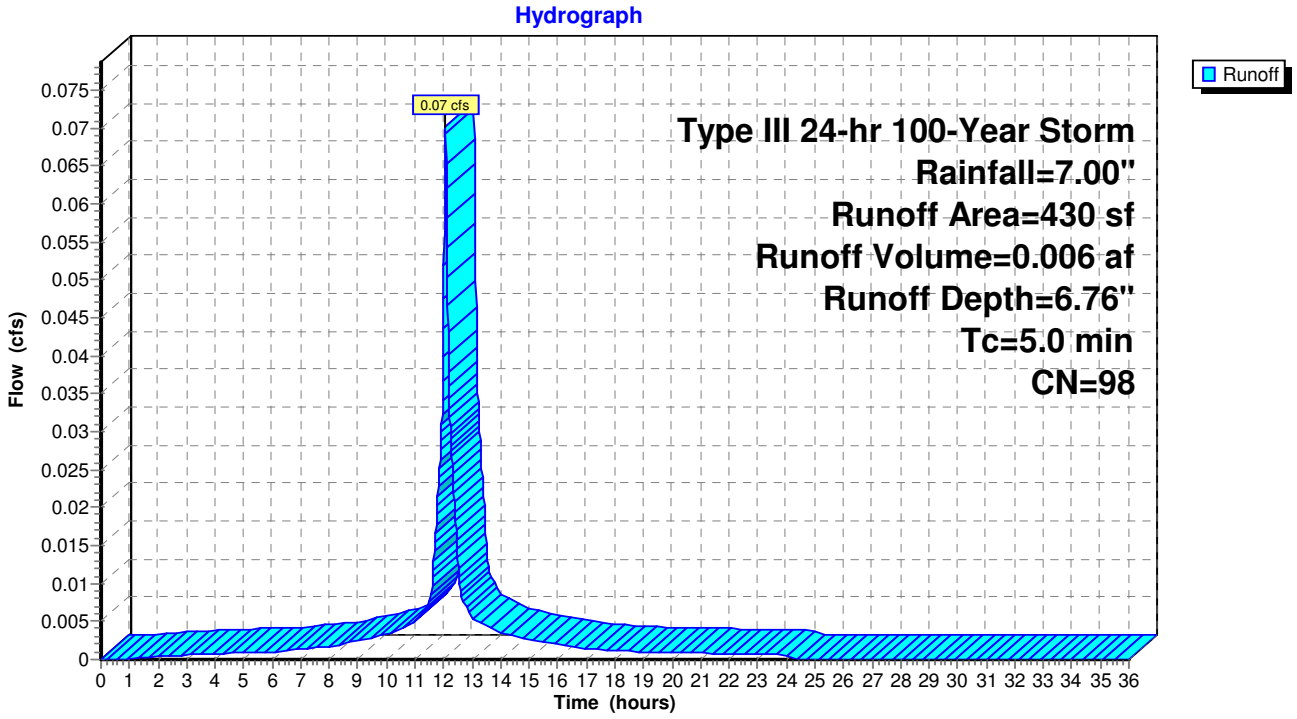
Runoff = 0.07 cfs @ 12.07 hrs, Volume= 0.006 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	430	98	Sidewalk & Pervious Pavers
	430		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 2-9: Bldg A flow to DW5



Summary for Subcatchment EX-1: Offsite Contributing Area

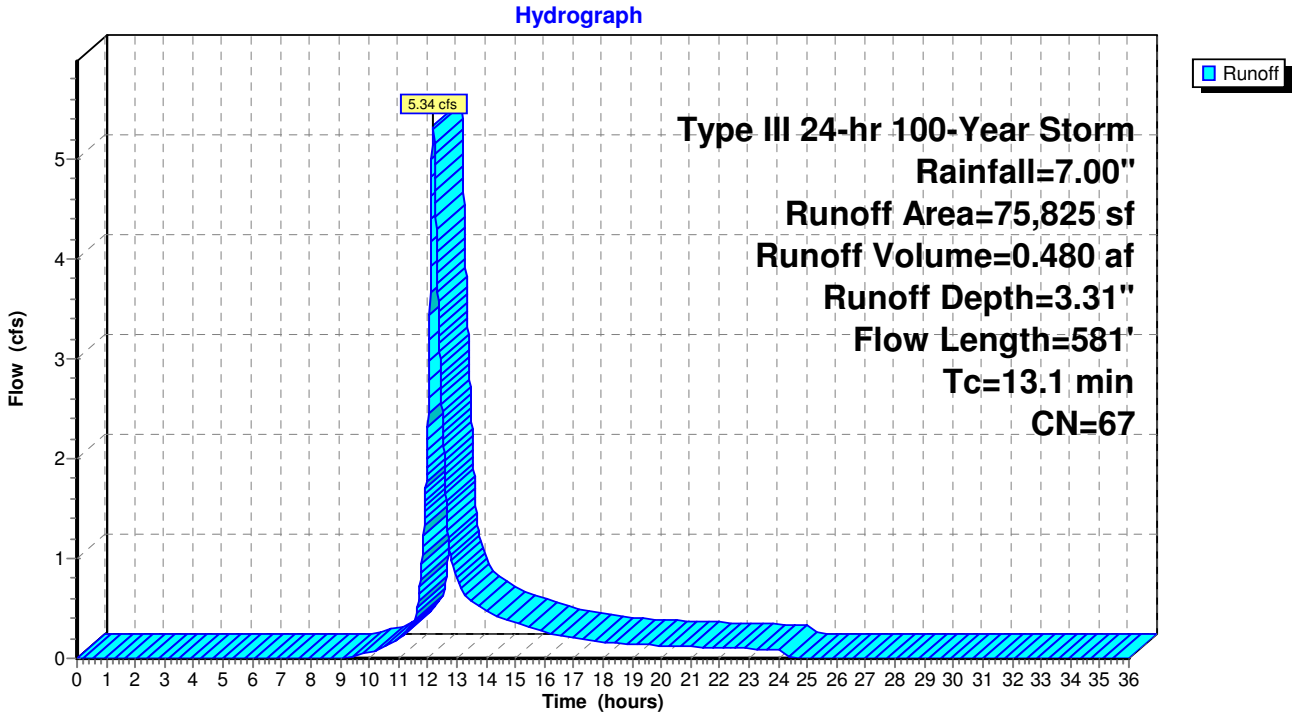
Runoff = 5.34 cfs @ 12.18 hrs, Volume= 0.480 af, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Storm Rainfall=7.00"

	Area (sf)	CN	Description
*	3,225	98	Rooftop Area
*	9,815	98	Driveway
	53,529	61	>75% Grass cover, Good, HSG B
	9,256	55	Woods, Good, HSG B
	75,825	67	Weighted Average
	62,785		Pervious Area
	13,040		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.15		**Sheet Flow, A to B** Grass: Dense n= 0.240 P2= 3.08"
1.2	128	0.0700	1.85		**Shallow Concentrated Flow, B to C** Short Grass Pasture Kv= 7.0 fps
2.4	227	0.1000	1.58		**Shallow Concentrated Flow, C to D** Woodland Kv= 5.0 fps
4.1	176	0.0200	0.71		**Shallow Concentrated Flow, D to E** Woodland Kv= 5.0 fps
13.1	581	Total			

Subcatchment EX-1: Offsite Contributing Area

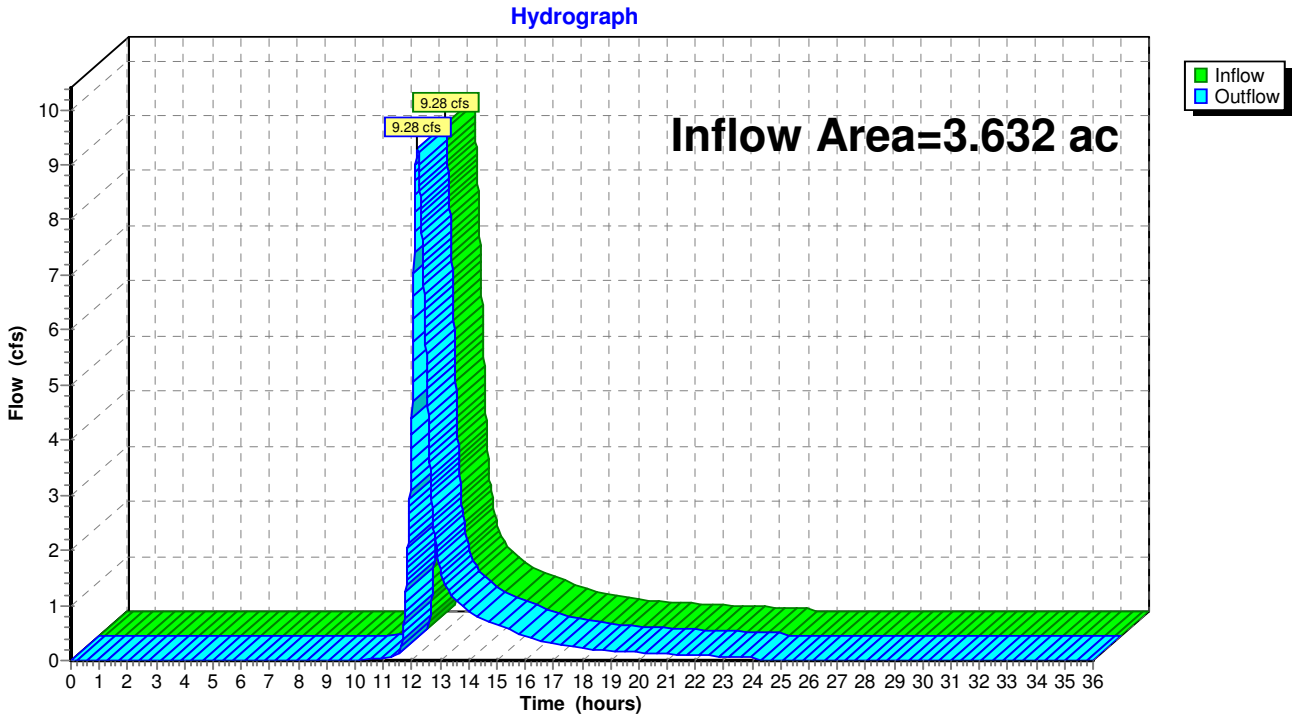


Summary for Reach SP1: Study Point #1

Inflow Area = 3.632 ac, 20.84% Impervious, Inflow Depth = 2.69" for 100-Year Storm event
Inflow = 9.28 cfs @ 12.21 hrs, Volume= 0.813 af
Outflow = 9.28 cfs @ 12.21 hrs, Volume= 0.813 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach SP1: Study Point #1



Summary for Pond CB1: CB1 (Double Grate)

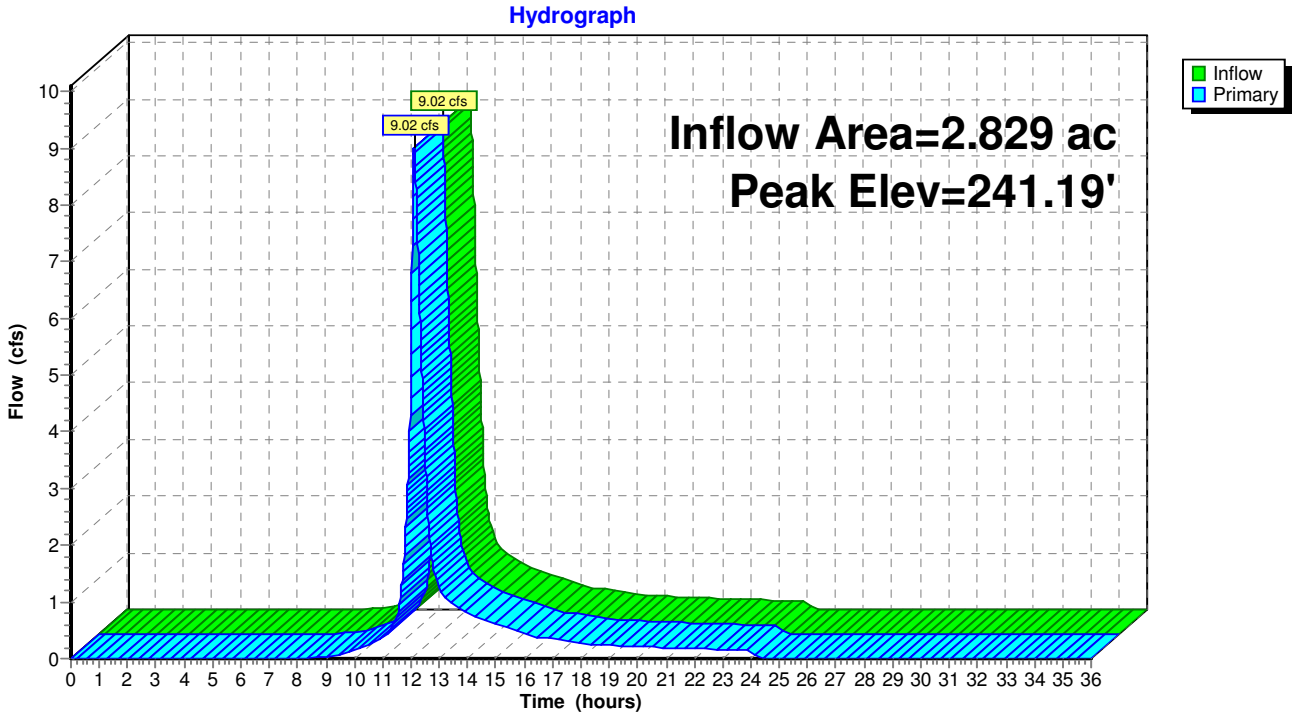
Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 3.51" for 100-Year Storm event
Inflow = 9.02 cfs @ 12.11 hrs, Volume= 0.827 af
Outflow = 9.02 cfs @ 12.11 hrs, Volume= 0.827 af, Atten= 0%, Lag= 0.0 min
Primary = 9.02 cfs @ 12.11 hrs, Volume= 0.827 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 241.19' @ 12.11 hrs
Flood Elev= 238.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=9.02 cfs @ 12.11 hrs HW=241.18' (Free Discharge)
1=Orifice/Grate (Orifice Controls 9.02 cfs @ 11.48 fps)

Pond CB1: CB1 (Double Grate)



Summary for Pond DW1: Dry Well 1

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 6.76" for 100-Year Storm event
Inflow = 0.07 cfs @ 12.07 hrs, Volume= 0.005 af
Outflow = 0.05 cfs @ 12.13 hrs, Volume= 0.005 af, Atten= 21%, Lag= 3.9 min
Discarded = 0.00 cfs @ 9.02 hrs, Volume= 0.004 af
Primary = 0.05 cfs @ 12.13 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 241.55' @ 12.13 hrs Surf.Area= 50 sf Storage= 71 cf

Plug-Flow detention time= 196.2 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 196.2 min (938.2 - 742.0)

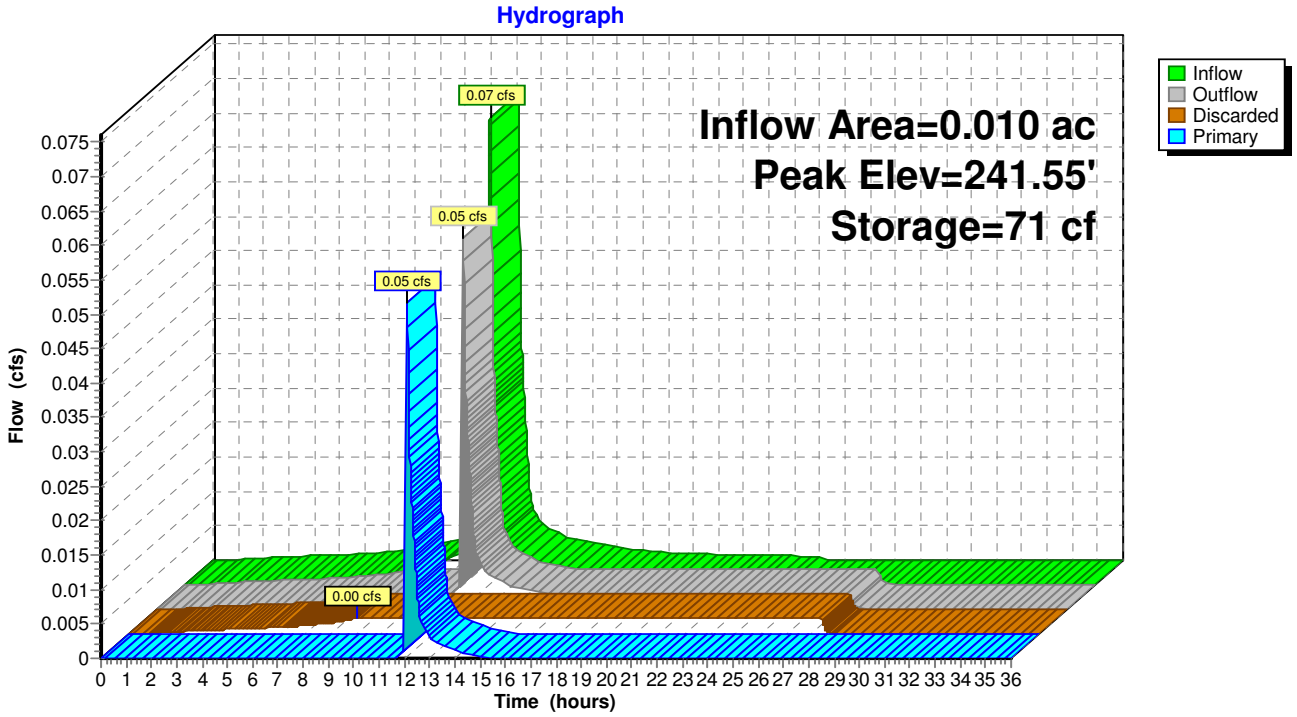
Volume	Invert	Avail.Storage	Storage Description
#1	239.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	239.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	241.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 9.02 hrs HW=239.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.05 cfs @ 12.13 hrs HW=241.55' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.05 cfs @ 0.74 fps)

Pond DW1: Dry Well 1



Summary for Pond DW2: Dry Well 2

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 6.76" for 100-Year Storm event
Inflow = 0.07 cfs @ 12.07 hrs, Volume= 0.005 af
Outflow = 0.05 cfs @ 12.13 hrs, Volume= 0.005 af, Atten= 21%, Lag= 3.9 min
Discarded = 0.00 cfs @ 9.02 hrs, Volume= 0.004 af
Primary = 0.05 cfs @ 12.13 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.55' @ 12.13 hrs Surf.Area= 50 sf Storage= 71 cf

Plug-Flow detention time= 196.2 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 196.2 min (938.2 - 742.0)

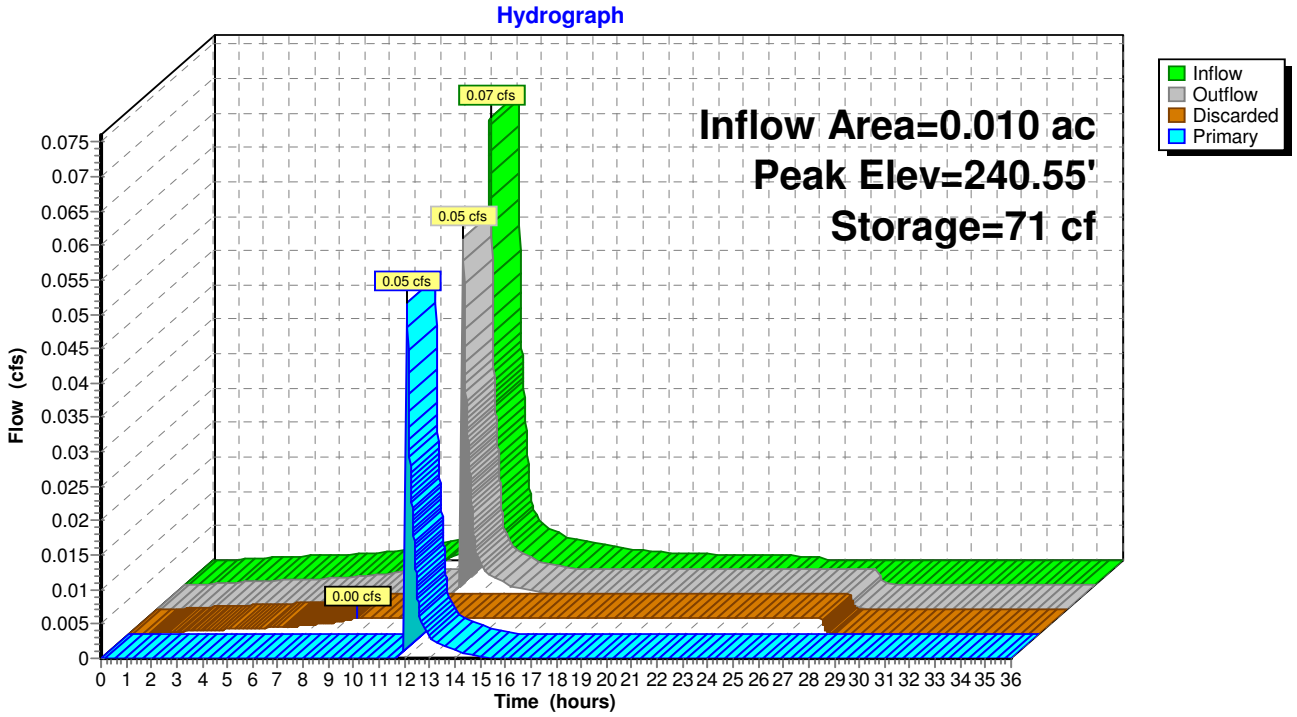
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 9.02 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.05 cfs @ 12.13 hrs HW=240.55' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.05 cfs @ 0.74 fps)

Pond DW2: Dry Well 2



Summary for Pond DW3: Dry Well 3

Assumed percolation rate of 30MPI

Inflow Area = 0.008 ac,100.00% Impervious, Inflow Depth = 6.76" for 100-Year Storm event
Inflow = 0.05 cfs @ 12.07 hrs, Volume= 0.004 af
Outflow = 0.02 cfs @ 12.37 hrs, Volume= 0.004 af, Atten= 70%, Lag= 18.2 min
Discarded = 0.00 cfs @ 9.81 hrs, Volume= 0.004 af
Primary = 0.01 cfs @ 12.37 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.52' @ 12.37 hrs Surf.Area= 50 sf Storage= 70 cf

Plug-Flow detention time= 222.1 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 222.1 min (964.1 - 742.0)

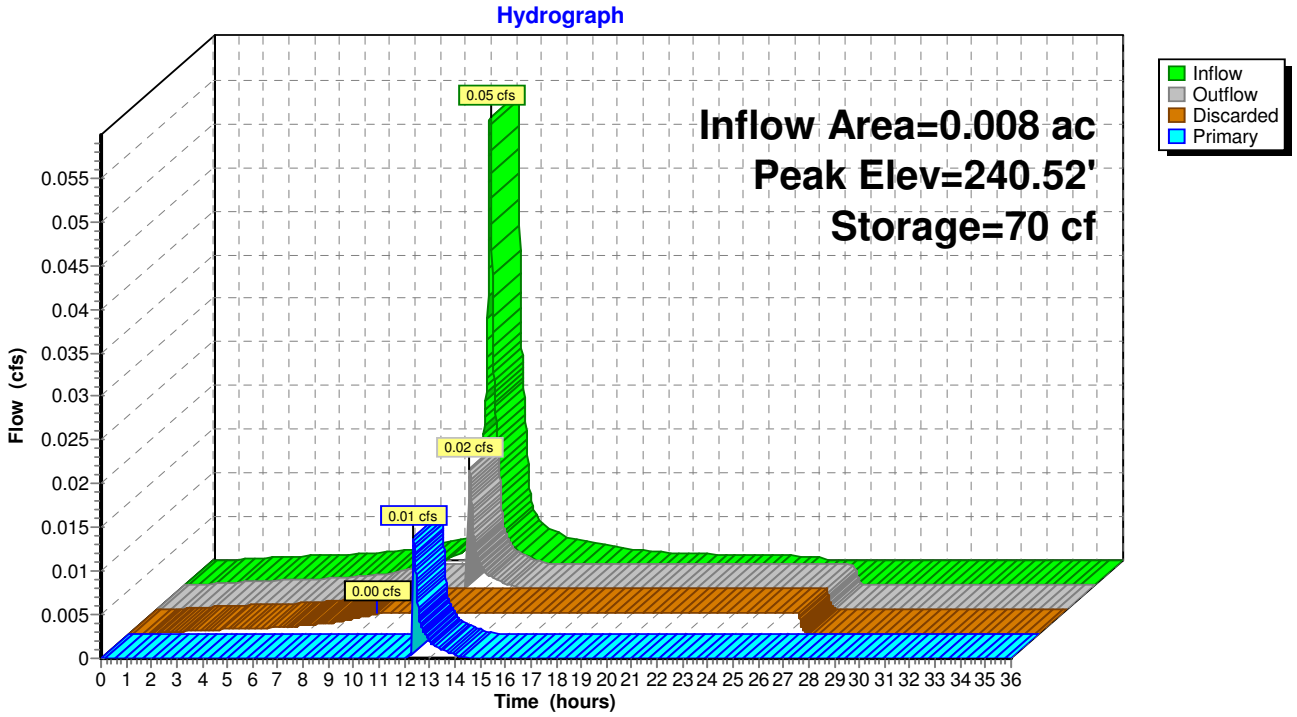
Volume	Invert	Avail.Storage	Storage Description
#1	238.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	238.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	240.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 9.81 hrs HW=238.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.01 cfs @ 12.37 hrs HW=240.52' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.48 fps)

Pond DW3: Dry Well 3



Summary for Pond DW4: Dry Well 4

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 6.76" for 100-Year Storm event
Inflow = 0.07 cfs @ 12.07 hrs, Volume= 0.006 af
Outflow = 0.07 cfs @ 12.11 hrs, Volume= 0.006 af, Atten= 9%, Lag= 2.3 min
Discarded = 0.00 cfs @ 8.85 hrs, Volume= 0.004 af
Primary = 0.06 cfs @ 12.11 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.56' @ 12.11 hrs Surf.Area= 50 sf Storage= 71 cf

Plug-Flow detention time= 190.1 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 190.1 min (932.1 - 742.0)

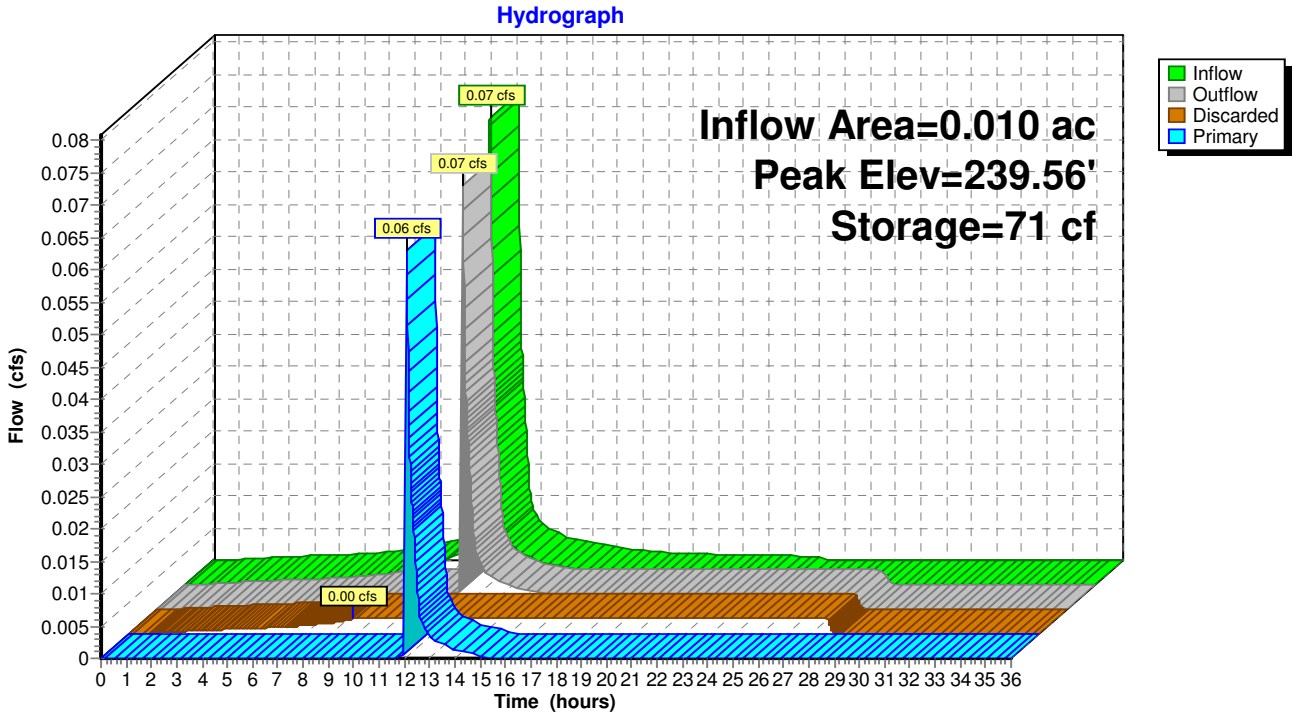
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 8.85 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.06 cfs @ 12.11 hrs HW=239.56' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.06 cfs @ 0.80 fps)

Pond DW4: Dry Well 4



Summary for Pond DW5: Dry Well 5

Assumed percolation rate of 30MPI

Inflow Area = 0.010 ac,100.00% Impervious, Inflow Depth = 6.76" for 100-Year Storm event
Inflow = 0.07 cfs @ 12.07 hrs, Volume= 0.006 af
Outflow = 0.06 cfs @ 12.12 hrs, Volume= 0.006 af, Atten= 14%, Lag= 3.1 min
Discarded = 0.00 cfs @ 8.92 hrs, Volume= 0.004 af
Primary = 0.06 cfs @ 12.12 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.56' @ 12.12 hrs Surf.Area= 50 sf Storage= 71 cf

Plug-Flow detention time= 192.8 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 192.8 min (934.9 - 742.0)

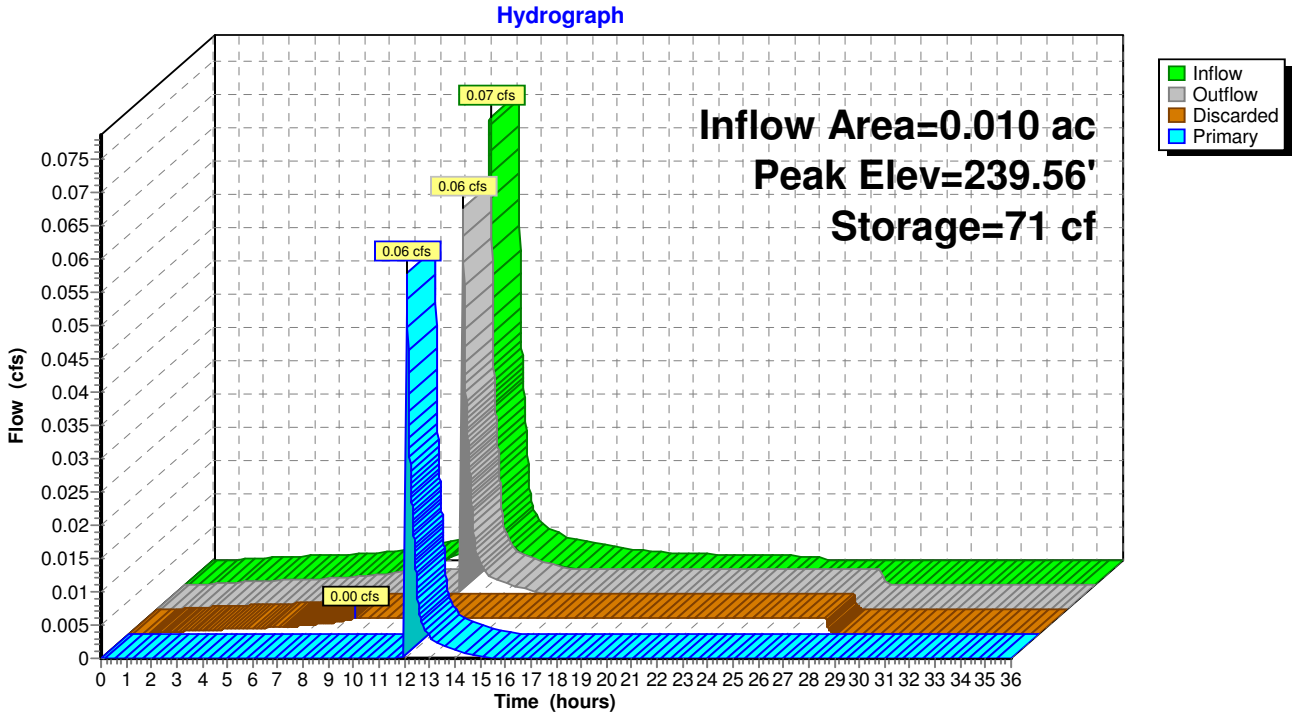
Volume	Invert	Avail.Storage	Storage Description
#1	237.00'	45 cf	**8.00'D x 3.00'H Stone** 151 cf Overall - 38 cf Embedded = 113 cf x 40.0% Voids
#2	237.00'	38 cf	**4.00'D x 3.00'H Pre-cast concrete drywell** Inside #1
		83 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	239.50'	**5.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600

Discarded OutFlow Max=0.00 cfs @ 8.92 hrs HW=237.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.06 cfs @ 12.12 hrs HW=239.56' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.06 cfs @ 0.77 fps)

Pond DW5: Dry Well 5



Summary for Pond I.S.#1: Infiltration System #1

Assumed percolation rate of 30 MPI

Inflow Area = 2.829 ac, 23.64% Impervious, Inflow Depth = 3.51" for 100-Year Storm event
Inflow = 9.02 cfs @ 12.11 hrs, Volume= 0.827 af
Outflow = 7.57 cfs @ 12.23 hrs, Volume= 0.827 af, Atten= 16%, Lag= 6.9 min
Discarded = 0.13 cfs @ 12.53 hrs, Volume= 0.190 af
Primary = 7.43 cfs @ 12.23 hrs, Volume= 0.637 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 236.32' @ 12.23 hrs Surf.Area= 2,849 sf Storage= 4,695 cf

Plug-Flow detention time= 40.2 min calculated for 0.827 af (100% of inflow)
Center-of-Mass det. time= 40.3 min (876.5 - 836.3)

Volume	Invert	Avail.Storage	Storage Description
#1	233.00'	3,258 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 9,545 cf Overall - 1,400 cf Embedded = 8,145 cf x 40.0% Voids
#2	234.00'	1,400 cf	**28.9"W x 16.0"H x 7.12'L StormTech SC-310** x 95 Inside #1
#3	234.50'	49 cf	**12.0"D x 62.00'L Horizontal Cylinder S= 0.0080 '/'**
#4	234.00'	44 cf	**4.00'D x 3.50'H DMH1**
#5	234.00'	44 cf	**4.00'D x 3.50'H OCS1**
		4,795 cf	Total Available Storage

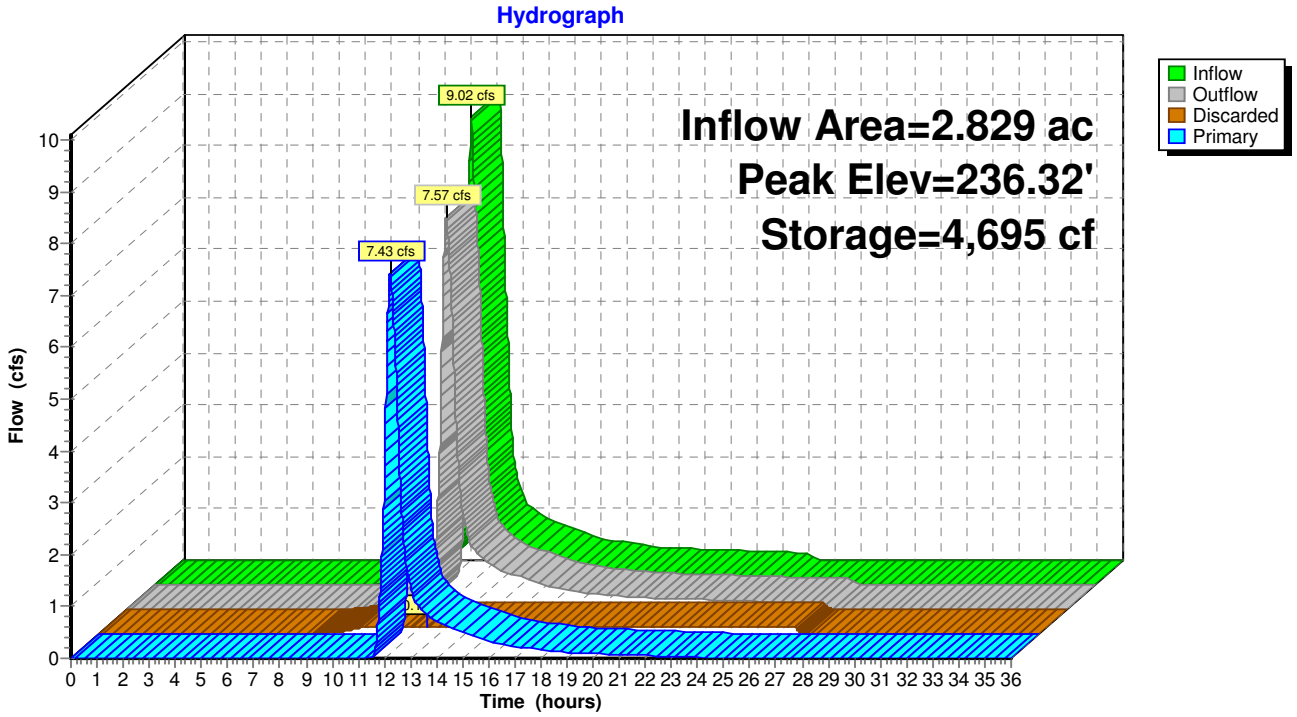
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
233.00	2,824	218.0	0	0	2,824
236.38	2,824	218.0	9,545	9,545	3,561

Device	Routing	Invert	Outlet Devices
#1	Discarded	233.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Primary	234.00'	**14.5" Vert. Orifice/Grate** C= 0.600
#3	Primary	236.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.13 cfs @ 12.53 hrs HW=235.25' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=7.42 cfs @ 12.23 hrs HW=236.32' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 7.23 cfs @ 6.30 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.20 cfs @ 0.73 fps)

Pond I.S.#1: Infiltration System #1



Summary for Pond PP-1: Pervious Pavers Area 1

Assumed percolation rate of 30MPI

Inflow Area = 0.044 ac, 53.67% Impervious, Inflow Depth = 4.81" for 100-Year Storm event
Inflow = 0.25 cfs @ 12.07 hrs, Volume= 0.018 af
Outflow = 0.03 cfs @ 11.64 hrs, Volume= 0.018 af, Atten= 88%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.64 hrs, Volume= 0.018 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 240.49' @ 12.69 hrs Surf.Area= 648 sf Storage= 256 cf

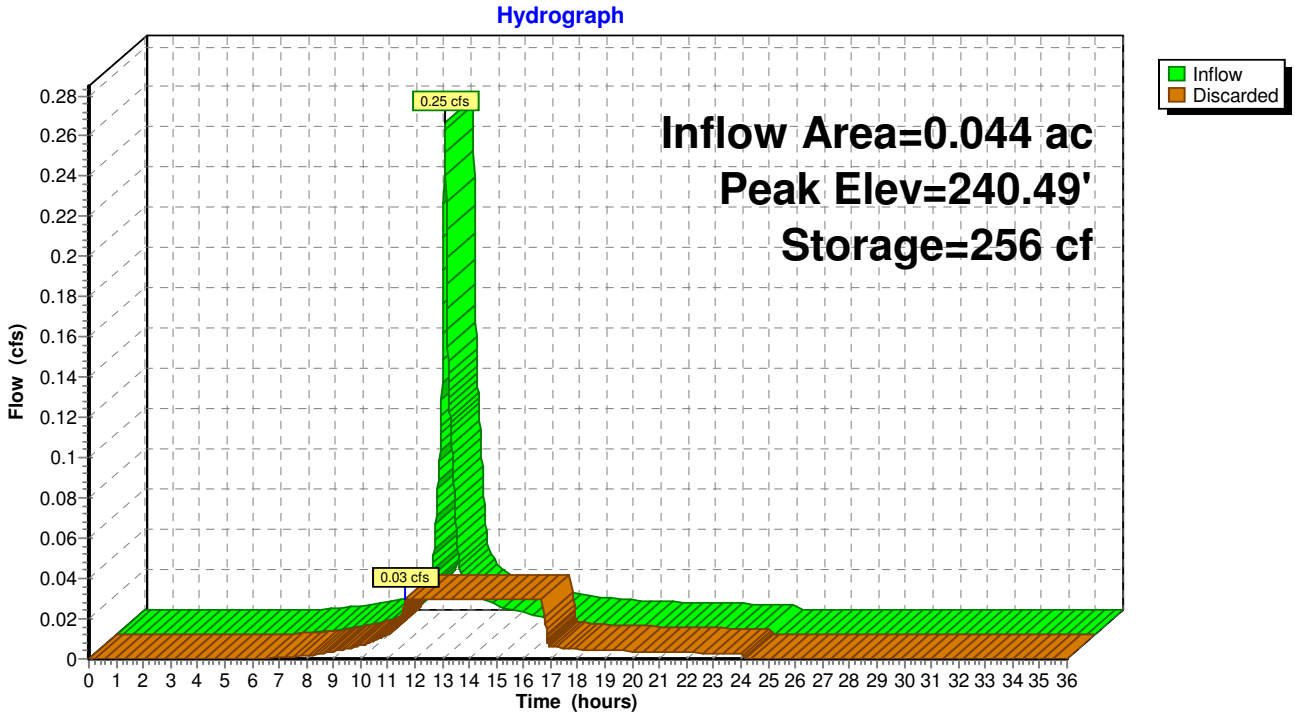
Plug-Flow detention time= 61.2 min calculated for 0.018 af (100% of inflow)
Center-of-Mass det. time= 61.2 min (865.8 - 804.6)

Volume	Invert	Avail.Storage	Storage Description
#1	239.50'	389 cf	**18.00'W x 36.00'L x 1.50'H Prismatoid** 972 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	239.50'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 11.64 hrs HW=239.52' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-1: Pervious Pavers Area 1



Summary for Pond PP-2: Pervious Pavers Area 2

Assumed percolation rate of 30MPI

Inflow Area = 0.053 ac, 43.73% Impervious, Inflow Depth = 4.37" for 100-Year Storm event
Inflow = 0.28 cfs @ 12.07 hrs, Volume= 0.019 af
Outflow = 0.03 cfs @ 11.64 hrs, Volume= 0.019 af, Atten= 89%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.64 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 239.88' @ 12.83 hrs Surf.Area= 648 sf Storage= 294 cf

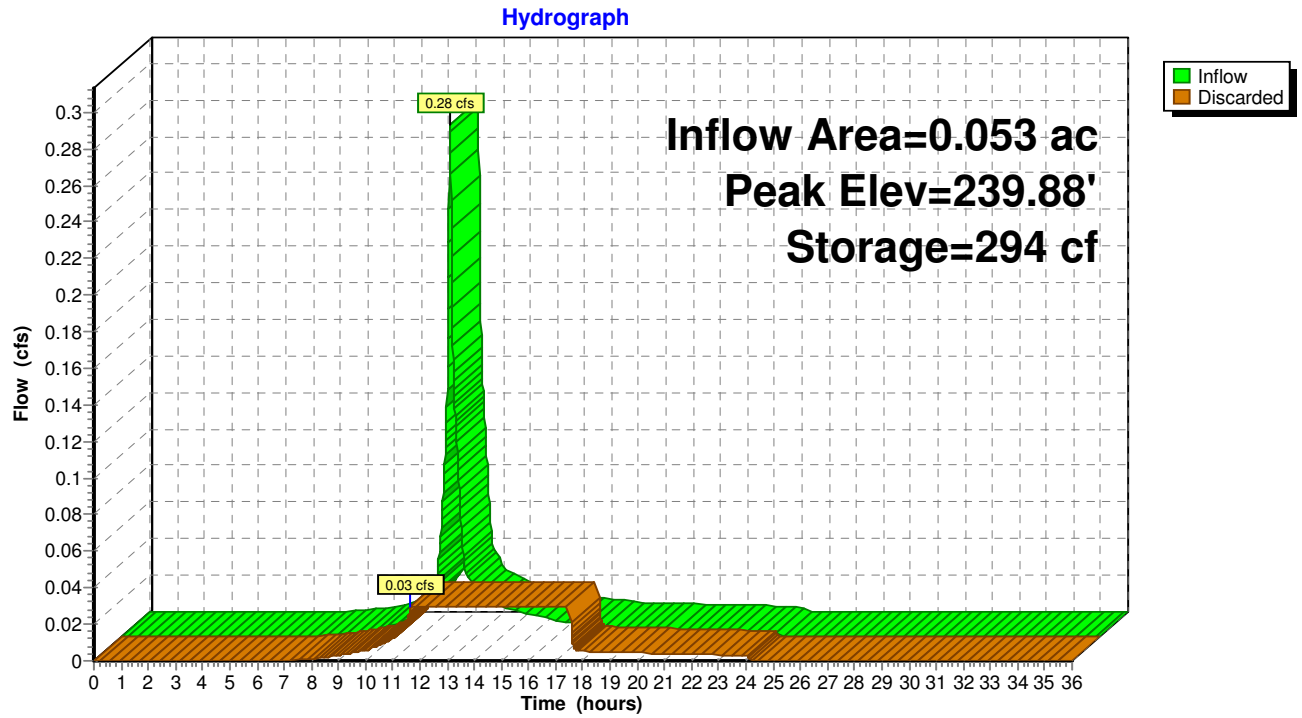
Plug-Flow detention time= 75.2 min calculated for 0.019 af (100% of inflow)
Center-of-Mass det. time= 75.2 min (889.4 - 814.2)

Volume	Invert	Avail.Storage	Storage Description
#1	238.75'	454 cf	**18.00'W x 36.00'L x 1.75'H Prismatoid** 1,134 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	238.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 11.64 hrs HW=238.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.03 cfs)

Pond PP-2: Pervious Pavers Area 2



Summary for Pond PP-3: Pervious Pavers Area 3

Assumed percolation rate of 30MPI

Inflow Area = 0.072 ac, 36.69% Impervious, Inflow Depth = 4.15" for 100-Year Storm event
Inflow = 0.36 cfs @ 12.07 hrs, Volume= 0.025 af
Outflow = 0.04 cfs @ 11.64 hrs, Volume= 0.025 af, Atten= 90%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.64 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 238.94' @ 12.88 hrs Surf.Area= 810 sf Storage= 385 cf

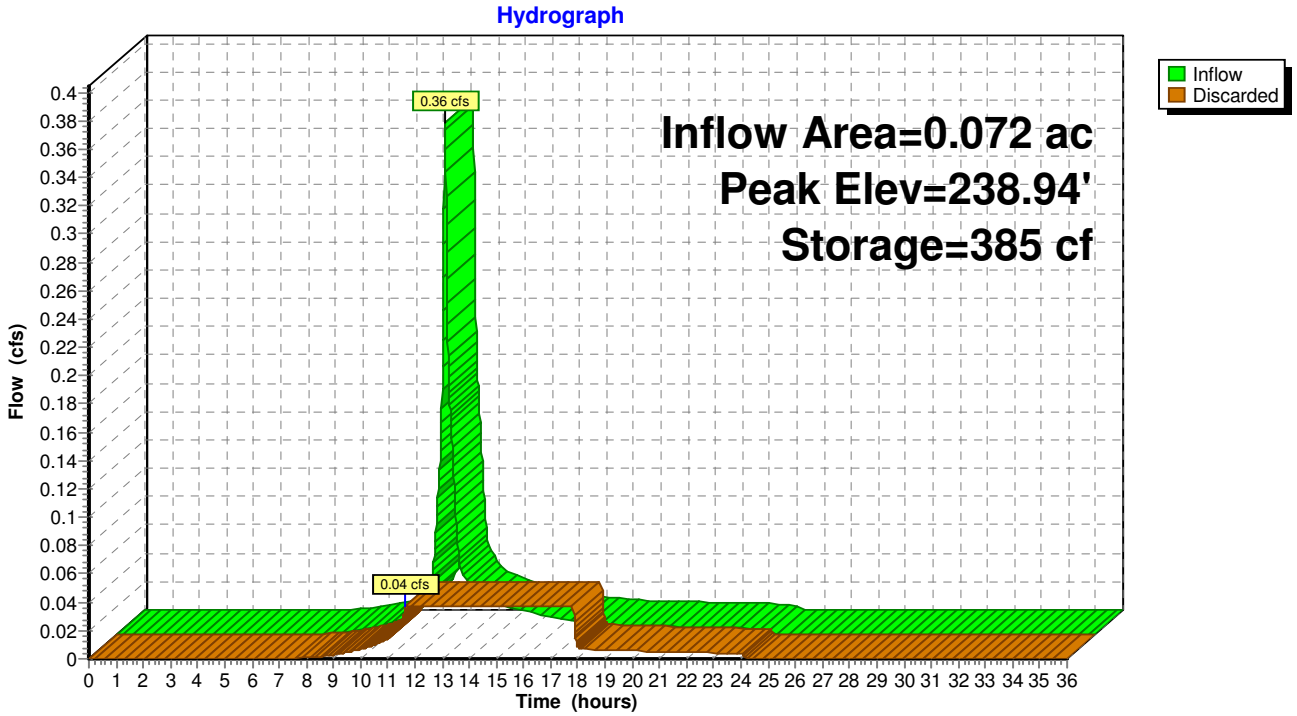
Plug-Flow detention time= 81.0 min calculated for 0.025 af (100% of inflow)
Center-of-Mass det. time= 81.0 min (899.7 - 818.8)

Volume	Invert	Avail.Storage	Storage Description
#1	237.75'	567 cf	**18.00'W x 45.00'L x 1.75'H Prismatoid** 1,418 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	237.75'	**2.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 11.64 hrs HW=237.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.04 cfs)

Pond PP-3: Pervious Pavers Area 3



Section 5.0 Appendix

RAINFALL DATA

USDA SOIL MAPPING

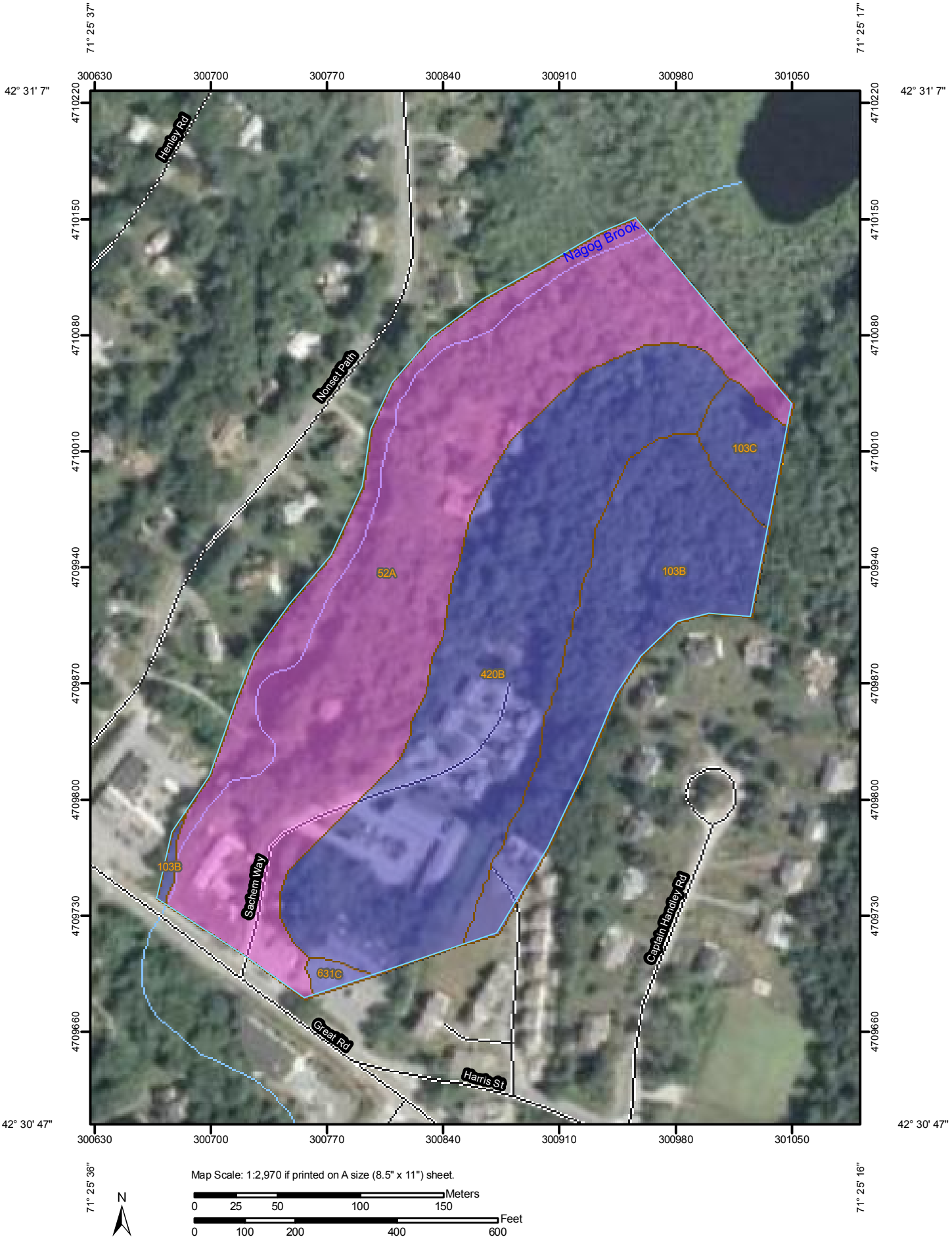
PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

F-1. Rainfall Data for Massachusetts from *Rainfall Frequency Atlas of the United States* (TP-40)

- Users of this Handbook should note that current MA DEP written guidance (see DEP Waterlines newsletter -- Fall 2000) requires the use of TP-40 Rainfall Data for calculations under the Wetlands Protection Regulations and the Stormwater Management Policy. More stringent design storms may be used under a local bylaw or ordinance. However, DEP will continue to require the use of TP-40 in any case it reviews under the Wetlands Protection Act and Stormwater Management Policy.

Adjusted Technical Paper 40 Design Storms for 24-hour Event by County

County Name	1-yr 24-hr	2-yr 24-hr	5-yr 24-hr	10-yr 24-hr	25-yr 24-hr	50-yr 24-hr	100-yr 24-hr
Barnstable	2.5	3.6	4.5	4.8	5.7	6.4	7.1
Berkshire	2.5	2.9	3.8	4.4	5.1	5.9	6.4
Bristol	2.5	3.4	4.3	4.8	5.6	6.3	7.0
Dukes	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Essex	2.5	3.1	3.9	4.5	5.4	5.9	6.5
Franklin	2.5	2.9	3.8	4.3	5.1	5.8	6.2
Hampden	2.5	3.0	4.0	4.6	5.3	6.0	6.5
Hampshire	2.5	3.0	3.9	4.5	5.2	5.9	6.4
Middlesex	2.5	3.1	4.0	4.5	5.3	5.9	6.5
Nantucket	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Norfolk	2.5	3.2	4.1	4.7	5.5	6.1	6.7
Plymouth	2.5	3.4	4.3	4.7	5.6	6.2	7.0
Suffolk	2.5	3.2	4.0	4.6	5.5	6.0	6.6
Worcester	2.5	3.0	4.0	4.5	5.3	5.9	6.5


71° 25' 37"
71° 25' 17"
42° 31' 7"
42° 30' 47"
71° 25' 36"
71° 25' 16"
300630
300700
300770
300840
300910
300980
301050
4710220
4710150
4710080
4710010
4709940
4709870
4709800
4709730
4709660
Henley Rd
Nonset Path
Nagog Brook
52A
103B
103C
420B
631C
Sachem Way
Captain Handley Rd
Great Rd
Harris St
Map Scale: 1:2,970 if printed on A size (8.5" x 11") sheet.
N
Meters
0 25 50 100 150
Feet
0 100 200 400 600

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:2,970 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N NAD83

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 9, Apr 15, 2009

Date(s) aerial images were photographed: 7/10/2003

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
52A	Freetown muck, 0 to 1 percent slopes	D	10.4	44.5%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	B	4.0	17.0%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	B	0.7	3.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	8.2	34.9%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	B	0.1	0.6%
Totals for Area of Interest			**23.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Of Massachusetts Inc.
"The Construction Testing People"

MEMORANDUM

TO: Ahmed Idris
Baker/ Wohl Architects
132 Lincoln Street
Boston, MA 02111

FROM: Kevin Martin, P.E.
Geotechnical Engineer

DATE: March 17, 2010

RE: **GEOTECHNICAL SUMMARY REPORT**
PROPOSED RESIDENTIAL DEVELOPMENT
McCARTHY VILLAGE II
SACHEM WAY
ACTON, MASSACHUSETTS Project No. 13328

This memorandum serves as a geotechnical summary report for the referenced project. The contents of this memorandum are subject to the attached ***Limitations***.

SITE & PROJECT DESCRIPTION

The project site is located at the end of Sachem Way in Acton, MA. The majority of the site consists of undeveloped, mature woodlands. The front of the site (south) includes a cleared gravel area that has been filled to shallow depth. Based on review of the *Site Survey Plan*, site grades possess a gradual downward slope to the east. Site grades are noted to vary from about elevation ≈256-233 ft possessing a general 4H:1V to 6H:1H slope. Surface boulders are scattered throughout the site.

The project includes an extension of McCarthy Village which includes clustered townhouse units. The development will include four (4) multi-unit residential buildings (Buildings "A" to "D"). The buildings are to consist of 2½-story, wood-framed town homes with 2-4 townhouse style units per building. It is intended to support the buildings on basement foundations using conventional spread footings with a concrete floor slab. Given the hillside contour, both cuts and fills will be required to achieve final grade. For the majority of the project, fill will be necessary given the shallow groundwater and proposed on-site septic system. Shallow cuts about ≈4-6 ft will be necessary along the eastern sections of the site with deeper fill about ≈5-10 ft in depth along the central and western portions of the site. It should be noted that most of the basement foundations will require cuts with some units that require shallow fill. Some deep cuts (≈10-18 ft) are necessary to accommodate the basement levels to the east.

The project will also require an on-site septic system to accommodate sewage and on-site infiltration systems to accommodate storm water. These systems are being designed by others. As part of this study, UTS completed field characterization and testing for these systems. These reports have been submitted under separate cover. The purpose of this study is to provide a geotechnical engineering evaluation with respect to foundation design and construction.

SUBSURFACE EXPLORATION PROGRAM & LABORATORY TESTING

Test Borings by UTS

The subsurface exploration program included the completion of nine (9) test borings at the prescribed locations. The test borings, identified as B1 to B9, were advanced to depths of ≈20-22 ft utilizing 4½ inch continuous flight hollow stem augers. Soil samples were typically retrieved at no greater than 5 ft intervals with a 2 inch diameter split-spoon sampler. Standard Penetration Tests (SPTs) were performed at the sampling intervals in general accordance with ASTM-D1586 (*Standard Method for Penetration Test and Split-Barrel Sampling of Soils*). Field descriptions and penetration resistance of the soils encountered, observed depth to groundwater, depth to apparent bedrock refusal and other pertinent data are contained on the attached *Test Boring Logs*. The explorations were located by taping from existing site features and are illustrated on the enclosed *Test Boring Location Plan*.

Test Pits by UTS

Eight (8) test pits (ie: *Deep Test Hole Logs*) were excavated around the project at the prescribed locations by others. Four (4) test pits were completed for Septic Evaluation and four (4) pits were completed in the respective infiltration beds. These pits were excavated to depths of 6-8 ft.

Test Pits by Others

We were provided with *Deep Test Hole Logs* by others (Foresite Engineering) dated February 2006 at the property. Two of these pits (TP-206-5 & TP-206-8) are located within the proposed project limits.

Laboratory Testing

Eight (8) bulk soil samples obtained from the respective test pits were submitted to our laboratory for sieve analyses per ASTM Standards. The purpose of the testing was to assess engineering characteristics for design and to assess the suitability of the site soils for re-use as structural fill on the project. The testing was also completed to evaluate infiltration and percolation rates. The test results are attached for review.

SUBSURFACE CONDITIONS

The subsurface conditions below the surface forest mat and subsoil horizon generally include a compact ablation till. There is also some shallow fill with the existing topsoil and subsoil beneath along the cleared gravel area towards the front of the project.

The site is blanketed with a ≈8-10 inch thick organic forest mat with topsoil, roots and humus. Below the forest mat is the subsoil horizon which extends about ≈2-4 ft below grade. The subsoil generally consists of a rust brown, loose, sandy Silt with trace to little gravel. Trace amounts of loam, roots and organic constituent are embedded in the subsoil as leached from the surface. The subsoil is loose and poor-draining.

The predominate overburden consists of an ablation till. With depth, there is a basal till which is not expected to be encountered during construction. The alation till consists of a brown to grey, well-graded, fine to medium Sand, some silt, little gravel. Occasional cobbles and boulders are embedded in the till. The glacial soils are generally stable and compact. The gradation tests are relatively similar consisting of a fine to medium Sand (55-65%), some silt (25-35%), little gravel (10-20%).

Groundwater was encountered in the test holes at shallow depths of ≈1-3 ft below grade. Several of the test holes were left open to allow for groundwater stabilization. It should be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time of the measurements. This study was completed at a time of seasonally high groundwater.

FOUNDATION SUBGRADE PREPARATION

The site subsurface conditions are favorable for supporting the proposed residential buildings on a spread footing foundation with a concrete floor slab. The surface organic soils (topsoil, forest mat, subsoil, stump holes, etc) are **not** considered suitable for foundation bearing support and should be fully stripped from the project limits to expose the parent Till. There is expected to be about ≈28-36 inches of loose, organic laden soils that should be stripped from the project site. These organic laden soils are also to be removed from the septic and infiltration beds. As such, these organic laden soils plus the undocumented fill to the front of the site should be fully stripped to expose the glacial till. If wet conditions are present at subgrade, then a clean Sand, sandy Gravel and/or crushed stone should be used for protection of the till.

The footings should bear upon the undisturbed glacial till and/or compacted Structural Fill. A minimum 8 inch thick base of ¾ inch minus crushed stone (protected with a geotextile filter fabric such as Mirafi 140N or equal) should be used below the footings in wet areas.

Parent earthen subgrades should be proof rolled with a vibratory compactor during construction. Recommended proof rolling should include 4-6 passes with vibratory equipment operating at peak rated energy. Areas exhibiting weaving or instability during the proof rolling process should be over-excavated and replaced with compacted structural fill. Proof rolling should not be performed near or below the groundwater table as this will likely disturb the sensitive glacial subgrade. Rather, the groundwater table should be controlled at least one foot below construction grade. A lift (minimum 8 inch thickness) of ¾ inch crushed stone should also be placed atop the wet subgrade to facilitate the dewatering, protect the competency of the glacial subgrade and provide a dry/stable base upon which to progress foundation construction. The groundwater should be continuously controlled with conventional sumps and pumps that extend at least 2 ft below foundation grade. The foundation subgrades should ultimately be stable, dewatered, protected from frost and compact throughout construction.

Given the proposed basement level foundations and shallow groundwater table, it is recommended that all the foundation pads be provided with a continuous base of ¾ inch crushed stone protected with a geotextile filter fabric such as Mirafi 140N or equal. The stone base should extend 8 inches below the BOF and be used for fill for support of the basement floor slab. The thickened stone base is to provide a working mat during construction then become part of the foundation drainage system post-construction. There is expected to be about ≈20 inches of stone below the slab and ≈8 inches below the footings. Temporary dewatering shall be required as necessary during construction to maintain a stable and dry subgrade. Permanent dewatering using sump pumps or gravity flow will be necessary post-construction as discussed further herein.

FOUNDATION DESIGN RECOMMENDATIONS

The footings are expected to gain bearing support atop the parent site soils and/or compacted structural fill. Footings may be designed using an allowable bearing capacity of 4 ksf (FS=3). This bearing capacity should be adequate for residential construction. The bearing capacity is contingent upon the perimeter strip footings and isolated column footings being no less than 20 inches and 30 inches in width respectively. For footings less than 3 ft in lateral dimension, the net allowable bearing capacity should be reduced to one-third and multiplied by the least lateral footing dimension in feet. The bearing capacity may be increased one third (⅓) for transient loads such as wind and seismic. Foundation settlement should be less than ¾-inch with differential settlement less than ½ inch. The settlement should be elastic and occur during construction. Exterior footings shall be provided with at least 4 ft of frost protection.

Recommendations for the lateral earth pressure against the unbalanced basement foundation walls and drainage control are outlined on Table 2. Proper drainage behind the unbalanced foundation walls will also be necessary as summarized on Table 2 and as addressed herein.

The subsurface conditions were reviewed with respect to seismic criteria set forth in the ***Massachusetts State Building Code (Seventh Edit)***. Based on the relative density of the soils and the depth to groundwater, the site is not susceptible to liquefaction in the event of an earthquake (*Section 1804.6*). Based on interpretation of the *Building Code*, the *Site Classification* (Section 9.4.1.2.1) is "D" (Stiff Soil).

FOUNDATION DRAINAGE

Due to the proposed basement floor levels, a foundation drainage system will be required to permanently control high groundwater. The purpose of the drainage system is to prevent uplift (buoyant) and lateral hydrostatic forces against the foundation walls and protect the basement level from groundwater intrusion. An underslab drainage system will also be necessary given the expected groundwater encroachment.

The perimeter drains that encompass the building should not encroach within the *Footing Zone of Influence* defined as that area extending laterally one foot from the edge of footing then outward and downward at a 1H:1V splay. Furthermore, the invert elevation of the drain should be at least 10 inches below the underside of the adjacent floor slab. The drains should consist of minimum 4 inch diameter, perforated PVC-SDR35 drain pipe encased within 12 inches of ¾-inch stone and wrapped with a filter fabric such as Mirafi 140N or equal. Where cuts deeper than 5 ft below existing grade are necessary to achieve BOF grade, the perimeter drain should be increased to 6 inch diameter. The 6 inch perimeter drains should be used for Building C & D along the eastern section of the site where deep cuts are necessary to achieve grade. To provide drainage along the basement wall, a 12 inch wide vertical lift of *Clean Granular Fill* (Table 1) should be placed directly behind the foundation wall to within 18 inches of finish grade. A prefabricated wall drain such as MiraDrain (Mirafi G100N drainage composite) may also be used for this purpose. The ground surface immediately adjacent to the foundation should be sloped away from the building to allow for positive drainage. It is also recommended that the surficial materials adjacent to the building be relatively impermeable to reduce the volume of precipitation infiltrating into the subsurface. Such impermeable materials include cement concrete, bituminous concrete or a vegetated silty topsoil. Roof gutters and other storm collection should not be discharged to the foundation drains.

The underslab drainage system should consist of a minimum 12 inch base of ¾-inch crushed stone placed atop a filter fabric such as Mirafi 140N or equal. The filter fabric should be over-lapped a minimum one foot at intersecting seams. Furthermore, minimum 4 inch perforated, PVC-SDR-35 pipe should be placed at minimum 25 ft intervals with an invert at least 9 inches below the underside of the slab. The perforated drainage pipe should be encased (trenched) in a minimum 6 inches of crushed stone and protected with a geotextile filter fabric similar to the exterior drains. The interior drains should not be located lower than the foundation footings. It is expected that the drains may flow by gravity to a storm drain system or day light if site grading permits. Gravity discharge of the drains should not be impacted by potential surcharges or flood conditions. The Site Engineer should

review the discharge of the foundation drains in this regard. Alternatively, the drains may discharge into a sump pit and be removed via a pump. It is recommended that a backflow preventer be installed at the outlet of the drains to reduce the impact of surcharges and to impede rodent activity that may clog the drain. The drains should be provided with permanent clean-outs at convenient locations to facilitate access to all sections of the system. Clean-outs should be located at bends and no greater than 125 ft on-center.

The basement foundation should be waterproofed or, at a minimum, damproofed to protect against moisture damage. The basement floor should be damproofed with minimum ten-mil polyethylene with joints lapped 8 inches below the floor slab or with application of bituminous or other approved material to the surface. Damproofing of below grade foundation walls should include the application of a bituminous or other approved material from the top of footing to above ground level. A water-proofing/insulation/drainage board system (ie: Warm-N-Dri or equal) is often used against the basement walls for increased protection against moisture damage especially where the basement level will be used for residential use. Such applications should be specified by others.

Based on review of the *Site Plans*, most of the infiltration systems have a bed elevation ≈1-4 ft higher than the adjacent basement floor level. The central septic leach field also has a bed elevation several feet higher than the proposed basement levels. It is expected that water from these systems will flow towards the basement level drains unless a cut-off barrier is provided. The cut-off may include a semi-impervious fill (silty glacial till) around these systems to mitigate lateral flow. Alternatively, the basement levels may be eliminated which would appear the most practical for site development. Removal of the basement levels would significantly reduce impact associated with the shallow groundwater table plus the septic and infiltration systems. This needs to be reviewed by others.

SITE DRAINAGE

Shallow groundwater was encountered throughout the site at depths of ≈1-3 ft. As such, shallow cuts are expected to encroach the groundwater table. Most of the site will be filled to accommodate the septic system and infiltrators. However, deep cuts are necessary along the eastern portions of the site about ≈4-6 ft. Deeper cuts about ≈10-18 ft will be necessary to construct the proposed basement levels in these areas. It is therefore recommended that interceptor drains be used in these deep cut areas to collect and remove groundwater seepage from the site.

The site drain should have an invert elevation at least 4 ft below final grade. The drain should consist of a 6 inch diameter perforated PVC drain pipe with positive flow towards a discharge outlet. The Site Engineer should review the discharge of this drain. The pipe shall be encased in at least 12 inches of one inch minus stone which is fully protected from the silty till with a geotextile filter fabric (Mirafi 180N or equal). The drain trench should be at least 2½ ft in width and 4½ ft deep. The entire trench should be filled with one inch crushed stone protected with a geotextile filter fabric to collect groundwater seepage from the sides. The final one foot shall include a 5 inch minus

graded rip-rap stone to collect surface flow. This drain should be installed along the eastern limits of the site and should be installed at the commencement of the project to intercept groundwater flow towards the site. The interceptor drain should help the parking areas, site construction and the cut slopes. Clean-outs shall be provided and the drain shall be cleaned and fully operation post-construction.

There should also be the deeper foundation drains in this area around Building C & D. These foundations drains should be located near BOF and be no less than 6 inch diameter. These drains may be constructed a few feet away from the foundation and below BOF grade to further collect and remove groundwater in these deep cuts areas. Such drains should further help with construction. Again, the Site Engineer should review the outlet of these drains.

CONSTRUCTION CONCERNS

The contractor should be required to maintain a stable-dewatered subgrade for the building foundation and other concerned areas during construction. Subgrade disturbance may be influenced by excavation methods, moisture, precipitation, groundwater control, and construction activities. The footings are expected to gain bearing support atop the parent site soils and/or compacted structural fill. It should be understood that the site soils (ie: silty glacial till) are considered moisture sensitive and will become weakened or softened if exposed to wet conditions and construction activities. The moisture sensitivity of the glacial till is associated with the high percentage of fine-grained soil (fine sand/silt) which acts to retain moisture. The presence of the shallow groundwater further impact subgrade stabilization. The contractor should understand these concerns and take precautions to reduce subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, limiting the extent of exposed subgrade especially if inclement weather is forecast, backfilling footings as soon as practicable and maintaining an effective dewatering program. Adequate protection of the bearing subgrade is necessary during construction. A protective base of ¾-inch minus crushed stone should be placed no less than 6 inches below and laterally beyond the footing limits. The stone base is to protect the moisture sensitive site soils, facilitate any necessary dewatering and provide a dry/stable base upon which to progress foundation construction. The crushed stone should also be used as Structural Fill in wet conditions. The protective base should be considered elective and dependent upon the site conditions. The stone base should strongly be considered if construction takes place during the winter/spring season or other periods of inclement weather and the till is present at BOF grade. The stone base should be considered necessary if groundwater is encountered within foundation limits. The protective stone base shall be tamped with a plate compactor and exhibit stable conditions. Soils which become softened or disturbed during construction will be rendered unsuitable for structural bearing support. An Engineer from UTS shall be scheduled to review the subgrade conditions and footing subgrade preparation during construction.

Groundwater Control

The groundwater table and/or storm water will need to be controlled during construction to complete work in dry conditions and protect the competency of the site soils. Groundwater is expected to be present at shallow depths depending upon the time of construction. The groundwater table, where encountered, should be continuously maintained at least one foot below construction grade until backfilling is complete. The groundwater or puddled storm water are expected to be controlled with conventional filtered sumps and submersible pumps. In areas where the groundwater table is encroached upon, it is recommended that a minimum 8 inch base of ¾-inch minus crushed stone (protected with geotextile filter fabric) be placed atop the subgrade to protect its competency and facilitate dewatering. The stone base shall be tamped with a plate compactor and exhibit stable conditions. The sumps should be located at least two feet below construction grade to protect the subgrade soils. Proper groundwater control and storm water management are necessary for maintaining the competency of the site soils.

CONSTRUCTION MONITORING

It is recommended that a qualified engineer or representative be retained to review earthwork activities such as the preparation of the foundation bearing subgrade and the placement/compaction of Structural Fill. It is recommended that UTS be retained to provide construction monitoring services. This is to observe compliance with the design concepts presented herein.

We trust the contents of this memorandum report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.

kmm48/uts10/acton.mem

LIMITATIONS

Explorations

1. The analyses, recommendations and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.

3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.

5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by UTS of Massachusetts, Inc.

Construction

6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of Baker/Wohl Architects & the Acton Housing Authority in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

8. This report has been prepared for this project by UTS of Massachusetts, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to geotechnical design considerations only.

TABLE 1

Proposed Residential Units
McCarthy Village II
Acton, Massachusetts

Recommended Soil Gradation & Compaction Specifications

Clean Granular Fill
(Select Gravel Fill)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
3 inch	100
3/4 inch	60-90
No. 4	20-70
No. 200	2-8

NOTE: For minimum 15-inch base for exterior concrete slabs exposed to frost
Minimum 12 inch base of ¾-inch crushed stone below basement slabs
Compact to at least 95% relative compaction per ASTM D1557

Structural Fill
(Gravelly SAND, little Silt)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
5 inch	100
3/4 inch	60-100
No. 4	20-85
No. 200	0-10

NOTE: For use as structural load support below the foundations
For use as backfill behind unbalanced foundation/retaining walls
A ¾-inch crushed stone may be used in wet conditions
Compact to at least 95% relative compaction per ASTM D1557

TABLE 1
(Page 2 of 2)

Proposed Residential Units
McCarthy Village II
Acton, Massachusetts

Recommended Soil Gradation & Compaction Specifications

Common Fill
(Silty SAND, little Gravel)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
6-8 inch	100
3/4 inch	60-100
No. 4	20-90
No. 200	0-25

NOTE: For use as roadway embankment fill is deep pavement areas.
Maximum stone size should be ⅔ the maximum lift thickness
Compact to at least 92% relative compaction per ASTM D1557

Clean Granular Fill & Structural Fill placed beneath the foundation should include the *Footing Zone of Influence* which is defined as that area extending laterally one foot from the edge of the footing then outward and downward at a 1H:1V splay. Structural Fill should be placed in loose lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors. All Structural Fill should be compacted to at least 95 percent of maximum dry density as determined by the Modified Proctor Test (ASTM-D1557). The Clean Granular Fill and Structural Fill should be compacted within ±3% of optimum moisture content. The adequacy of the compaction efforts should be verified by field density testing which is also a requirement of the *Massachusetts State Building Code*.

TABLE 2

McCarthy Village II
Acton, Massachusetts

Recommended Lateral Earth Pressures & Drainage for Unbalanced Walls

Lateral earth pressures for the structural design and stability analysis of unbalanced foundation walls (basement walls, retaining walls, elevator pit, etc) are provided herein. The following table outlines the recommended lateral earth pressure coefficients and equivalent fluid weights:

WALL CONDITION	LATERAL TRANSLATION (Δ/H)	EARTH PRESSURE COEFFICIENT (K)	EQUIVALENT FLUID WEIGHT (γ_{EFW})
restrained	0	K_o	60 pcf
no restraint	0.002	K_a	35 pcf
no restraint	0.02	K_p (FS=3)	100 pcf
seismic	n/a	K_{eq}	see note

where: Δ = movement at top of wall by tilting or lateral translation / H = height of wall

The above lateral earth pressures are based upon:

1. Rankine earth pressure theory;
2. Retaining wall backfilled with Structural Fill (Table 1);
3. Unit weight of backfill less than 135 pcf
4. No hydrostatic pressures (weeps/perimeter drains);
5. No surcharge loading;
6. A level backfill in front and behind of wall;
7. Seismic loads distributed as an inverse triangle over the height of wall (*MSBC*);
8. Dynamic/compaction stresses accounted for with seismic pressures;
9. Soil backfill densified with plate compactors within 3 ft lateral distance of wall;
10. Top 2 ft should not be considered for passive resistance.

The lateral load due to seismic pressure shall be in accordance with *Section 9.5.2.9* of the *MSBC* (7th Edition). *Equation 9.5.2.9* shall be used to estimate the seismic force (F_w). The unit weight of the backfill used in this equation is 125 pcf (Structural Fill). There are no soils subject to liquefaction below and/or behind the wall.

The lateral resistance of retaining walls should also accommodate surcharge and a sloping backfill, if necessary. Uniformly distributed loads should be superimposed along the face of the wall at a magnitude equal to the surcharge pressure multiplied by the appropriate earth pressure coefficient. Surcharge loads should be considered where they are located within a horizontal distance equivalent to 0.5 times the height of the wall. Anticipated point or line loads situated behind the wall should be evaluated in accordance with linear elastic theory.

For frost and drainage concerns, it is recommended that a 12-inch vertical lift of *Clean Granular Fill* (Table 1) be placed directly behind the retaining walls. The ground surface immediately adjacent to the unbalanced foundation should be sloped away from the building to allow for positive drainage. It is also recommended that the surficial materials adjacent to the building be relatively impermeable to reduce the volume of precipitation infiltrating into the subgrade. Such impermeable materials include Portland cement concrete, bituminous concrete, or a vegetated silty topsoil. Furthermore, retaining walls should be constructed with weeps installed no greater than 8 ft on-center or be provided with a perforated drain pipe for hydrostatic relief. The weeps should be minimum 2 inch diameter holes protected with a filter fabric such as Mirafi 180N or equal to reduce the migration of soil particles.

Unbalanced foundation walls around the building should be provided with adequate footing drains with positive drainage. The foundation drains should be located at least 4 inches above the bottom of footing elevation and six inches outward from the edge of footing. The drains should not encroach within the *Footing Zone of Influence* defined as that area extending laterally one foot from the edge of footing then outward and downward at a 1H:1V splay. Furthermore, the invert elevation of the drain should be at least 10 inches below the underside of the adjacent floor slab. The drains should consist of minimum 4 inch diameter, perforated PVC-SDR 35 drain pipe encased within at least six inches of ¾-inch stone and wrapped with a filter fabric such as Mirafi 140N or equal. Minimum 6-inch diameter perimeter drains should be used around Buildings C & D. An underslab drainage system is also necessary for the basement levels. The slab drainage shall include a minimum 12 inch base of ¾-inch stone protected with a geotextile fabric. Perforated pipe shall also be used below the basement floor slab with a spacing no greater than 25 ft. The drains should discharge via gravity to a storm drain line not subject to surcharge or possibly day-light if site grading permits. Alternatively, the drains may discharge into a sump pit and be removed via a pump. The discharge of the foundation drains should be reviewed by the Site Engineer. The drains should be provided with permanent clean-outs at convenient locations to facilitate access to all sections of the system.

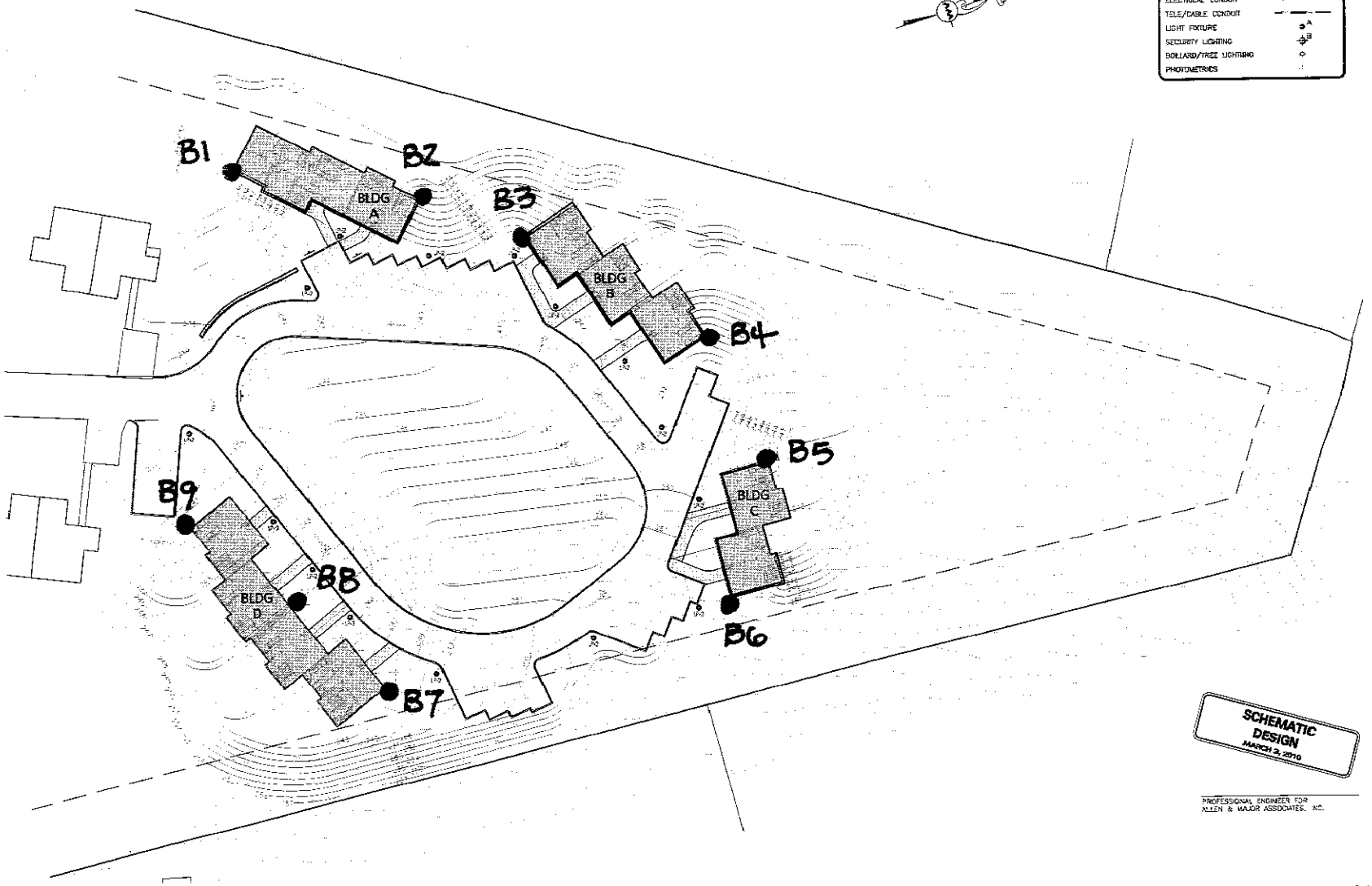
If the unbalanced foundation walls can not be drained to alleviate hydrostatic forces, then the lateral earth pressure equivalent fluid weight should be increased to 90 pcf. Such earth pressures should be used for elevator pits, if necessary.

The recommended friction factors to be used for retaining wall design are as follows:

<u>Recommended Friction Factor (f)</u>
$f = \tan(\delta)$, where δ is the interface friction angle

- Concrete against the following soils

Structural Fill (Table 1)	0.50
Parent Site Soils	0.50



Development of McCarthy Village II

ACTON HOUSING AUTHORITY

SCHEMATIC DESIGN

NOT FOR CONSTRUCTION

ALLEN & MAJOR ASSOCIATES, INC.

BAKER/WOHL ARCHITECTS

132 LINCOLN STREET, #4
BOSTON, MA 02111
TEL: 617.350.7420
FAX: 617.350.5383

Project No:	-
Drawn By:	BDJ
Checked By:	TJW
Issue Date:	3 MARCH 2010

Revisions

No	Date	Description	By

Drawing Title:

LIGHTING PLAN

Drawing Number:

C-5

TEST BORING LOG

SHEET 1

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

McCarthy Village II
Site: Sachem Way
Acton, MA

BORING B-1

PROJECT NO. 10-0309
DATE: March 12, 2010

Ground Elevation: 232 ft +/-
Date Started: March 11, 2010
Date Finished: March 11, 2010
Driller: GG
Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
3/11/10	2 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Sample Pen/Rec	Sample Depth	Sample Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
1		1	7"	0"-6"	1	6"	Organic Forest Mat
		1A		6"-2'0"	2-2-3		
		2	14"	2'0"-4'0"	5-5-6-7		Rust Brown, Fine Sand & Silt, trace loam, roots, organics, wet (SUBSOIL)
						2'6"	
5		3	18"	5'0"-7'0"	7-13-15-15		
10		4	15"	10'0"-12'0"	10-8-9-11		Brown, fine to medium Sand, some silt, little to trace gravel, cobbles, wet (TILL)
15		5	16"	15'0"-17'0"	11-14-19-18		
20		6	13"	20'0"-22'0"	17-27-41-42		
							End of boring at 22'
25							
30							
35							
39							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 2

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

McCarthy Village II
Site: Sachem Way
Acton, MA

BORING B-2

PROJECT NO. 10-0309
DATE: March 12, 2010

Ground Elevation: 233 ft +/-
Date Started: March 11, 2010
Date Finished: March 11, 2010
Driller: GG
Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
3/11/10	2 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Pen/Rec	Sample Depth	Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
1		1	4"	0"-6"	1	6"	Organic Forest Mat
		1A	3"	6"-2'0"	2-1-2		Rust Brown, loamy, sandy Silt, trace loam, roots, organics, wet (SUBSOIL)
		2	4"	2'0"-4'0"	5-6-9-7	2'6"	
5		3	16"	5'0"-7'0"	8-11-11-13		
10		4	17"	10'0"-12'0"	12-13-17-17		Brown, fine to medium Sand, some silt, trace to little gravel, cobbles, wet (TILL)
15		5	18"	15'0"-17'0"	9-17-21-23		
20		6	14"	20'0"-22'0"	17-29-31-33		
							End of boring at 22'
25							
30							
35							
39							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 3

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

McCarthy Village II
Site: Sachem Way
Acton, MA

BORING B-3

PROJECT NO. 10-0309
DATE: March 12, 2010

Ground Elevation: 234 ft+/-
Date Started: March 11, 2010
Date Finished: March 11, 2010
Driller: GG
Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
3/11/10	2 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Sample Pen/Rec	Sample Depth	Sample Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
		1	5"	0"-6"	1	8"	Topsoil
		1A	11"	6"-2'0"	2-1-1		Rust Brown, Fine Sand & Silt, trace load, roots, organics, wet (SUBSOIL)
1		2	9"	2'0"-3'0"	1-2	3'	
		2A	6"	3'0"-4'0"	7-10		
5		3	17"	5'0"-7'0"	9-12-12-14		
10		4	8"	10'0"-12'0"	13-17-17-24		Brown, fine to medium Sand, some silt, trace to little gravel, cobbles, boulders, wet (TILL)
15		5	3"	15'0"-17'0"	27-36-61-60		
20		6	4"	20'0"-21'3"	39-48-75/3"		End of boring at 21'3"
25							
30							
35							
39							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 4

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

McCarthy Village II
Site: Sachem Way
Acton, MA

BORING B-4

PROJECT NO. 10-0309
DATE: March 12, 2010

Ground Elevation: 238 ft +/-
Date Started: March 10, 2010
Date Finished: March 10, 2010
Driller: GG
Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
3/10/10	1 ft	n/a	4 hours

Depth Ft.	Casing bl/ft	Sample No.	Sample Pen/Rec	Sample Depth	Sample Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
		1	4"	0"-6"	1	6"	Black Organic Forest
1		1A	12"	6"-2'0"	1-1-2		Rust Brown, sandy Silt, little gravel, roots, loam, wet (SUBSOIL)
						3'6"	
5		2	16"	5'0"-6'7"	6-10-20-75/1"		Grey-Brown, fine to medium Sand, some silt, little gravel, cobbles, wet (ABLATION TILL)
10		3	14"	10'0"-12'0"	10-20-22-35		Same (TILL)
15		4	15"	15'0"-17'0"	11-17-21-34		Same (TILL)
20		5	2"	20'0"-20'8"	21-75/2"		Same, cobbles (TILL)
							End of boring at 21'
25							
30							
35							
39							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 5

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

McCarthy Village II
Site: Sachem Way
Acton, MA

BORING B-5

PROJECT NO. 10-0309
DATE: March 12, 2010

Ground Elevation: 244 ft +/-
Date Started: March 10, 2010
Date Finished: March 10, 2010
Driller: GG
Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
3/10/10	2 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Sample Pen/Rec	Sample Depth	Sample Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
		1	4"	0"-6"	1	6"	Black Organic Forest Mat
1		1A	6"	6"-2'4"	1-2-2		Rust Brown, sandy Silt with roots, loam, wet (SUBSOIL)
						36"	
5		2	20"	5'0"-7'0"	7-10-12-13		Brown, fine to medium Sand, little silt, little gravel, wet
10		3	15"	10'0"-12'0"	12-19-19-23		Brown, fine to medium Sand, some silt, little gravel, cobbles, wet (ABLATION TILL)
15		4	18"	15'0"-17'0"	13-20-22-24		Olive Brown, fine to medium Sand, little/some silt, little gravel, wet (TILL)
20		5	17"	20'0"-22'0"	13-17-26-25		Olive Brown, fine to medium Sand, some silt, little gravel, Cobbles, wet (TILL)
25							End of boring at 22'
30							
35							
39							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 6

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

McCarthy Village II
Site: Sachem Way
Acton, MA

BORING B-6

PROJECT NO. 10-0309
DATE: March 12, 2010

Ground Elevation: 251 ft +/-
Date Started: March 10, 2010
Date Finished: March 10, 2010
Driller: GG
Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
3/10/10	2 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Sample Pen/Rec	Sample Depth	Sample Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
		1	4	0"-6"	1	6"	Black Organic Forest Mat
		1A	10	6"-2'4"	1-2-1		Rust Brown, Sand & Silt, trace loam, roots, wet (SUBSOIL)
1						3'	
5		2		5'0"-7'0"	7-12-18-18		Brown, fine to medium Sand, little silt, little gravel, wet (ABLATION TILL)
10		3		10'0"-12'0"	11-16-21-21		Brown, fine to medium Sand, some silt, little gravel, cobbles, wet (TILL)
15		4		15'0"-16'2"	45-51-75/2"	14'	Olive Brown, fine to medium Sand & Silt, little gravel, wet (BASAL TILL)
20		5		20'0"-20'9"	31-75/3"		Same (TILL)
							End of boring at 21'
25							
30							
35							
39							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 7

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

McCarthy Village II
Site: Sachem Way
Acton, MA

BORING B-7

PROJECT NO. 10-0309

DATE: March 12, 2010

Ground Elevation: 253 ft+/-
Date Started: March 10, 2010
Date Finished: March 10, 2010
Driller: GG
Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
3/10/10	4 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Sample Pen/Rec	Sample Depth	Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
				0"-6"	1	6"	Organic Forest Mat
1		1	10"	6"-2'0"	1-1-2		Rust Brown, sandy Silt, trace gravel, roots, loam, organics, wet (SUBSOIL)
		2	4"	2'0"-4'0"	2-2-3-3	3'0"	
5		3	17"	5'0"-7'0"	14-14-19-19	5'0"	Brown, fine to medium Sand, little silt
10		4	14"	10'0"-12'0"	9-13-17-18		Brown, fine to medium Sand, some silt, trace to little gravel, cobbles, wet (TILL)
15		5	17"	15'0"-17'0"	21-40-45-46		
20		6	10"	20'0"-22'0"	18-29-34-41		End of boring at 22'
25							
30							
35							
39							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless; 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 8

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

McCarthy Village II
Site: Sachem Way
Acton, MA

BORING B-8

PROJECT NO. 10-0309
DATE: March 12, 2010

Ground Elevation: 247 ft +/-
Date Started: March 10, 2010
Date Finished: March 10, 2010
Driller: GG
Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
3/10/10	3 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Pen/Rec	Sample Depth	Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
		1		0"-6"	1	12"	Topsoil
		1A	9"	6"-2'0"	1-2-2		
1							Rust Brown, loamy, sandy Silt, trace loam, roots, organics, wet (SUBSOIL)
		2	8"	2'0"-3'0"	2-3		
		2A	3"	3'0"-4'0"	3-4	4'0"	
5		3	18"	5'0"-7'0"	12-15-15-16		
10		4	16"	10'0"-12'0"	7-17-23-27		Brown, fine to medium Sand, some silt, trace to little gravel, cobbles, wet (TILL)
15		5	13"	15'0"-17'0"	18-37-42-49		
20		6	6"	20'0"-20'10"	33-75/4"		End of boring at 20'10"
25							
30							
35							
39							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 9

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

McCarthy Village II
Site: Sachem Way
Acton, MA

BORING B-9

PROJECT NO. 10-0309
DATE: March 12, 2010

Ground Elevation: 239 ft +/-
Date Started: March 11, 2010
Date Finished: March 11, 2010
Driller: GG
Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION
3/11/10	2 ft	n/a	Upon Completion

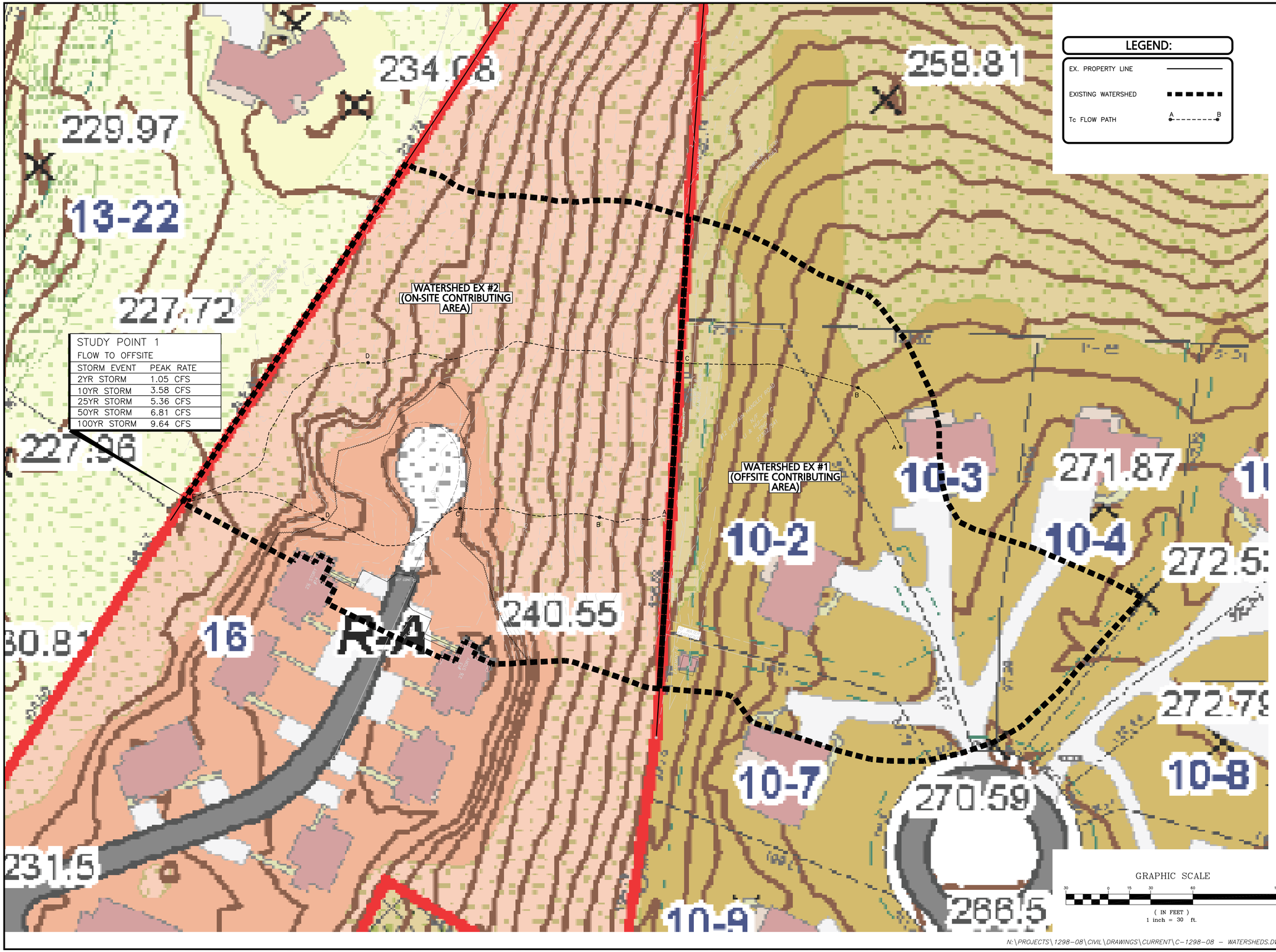
Depth Ft.	Casing bl/ft	Sample No.	Sample Pen/Rec	Sample Depth	Sample Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
		1		0"-6"	1	12"	Topsoil
		1A	8"	6"-2'0"	4-7-9		
1		2	9"	2'0"-4'0"	6-7-9-9		
5		3	16"	5'0"-7'0"	11-13-17-17		
10		4	17"	10'0"-12'0"	17-22-24-32		Brown, fine to medium Sand, some silt, little to trace gravel, cobbles, wet (TILL)
15		5	14"	15'0"-17'0"	20-24-36-39		
20		6	3"	20'0"-20'4"	75/4"		
25							End of boring at 20'4"
30							
35							
39							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35% to 50%

	CASING	SAMPLE	CORE TYPE
ID SIZE (IN)		SS	
HAMMER WGT (LB)		140 lb.	
HAMMER FALL (IN)		30"	



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Development of McCarthy Village II

ACTON HOUSING AUTHORITY

COMPREHENSIVE PERMIT

NOT FOR CONSTRUCTION

ALLEN & MAJOR ASSOCIATES, INC.

BAKER/WOHL ARCHITECTS

BWA

132 LINCOLN STREET, #4

BOSTON, MA 02111

TEL: 617.350.7420

FAX: 617.350.5383

Project No:	1298-08
Drawn By:	BDJ
Checked By:	TJW
Issue Date:	JUNE 1, 2010

Revisions

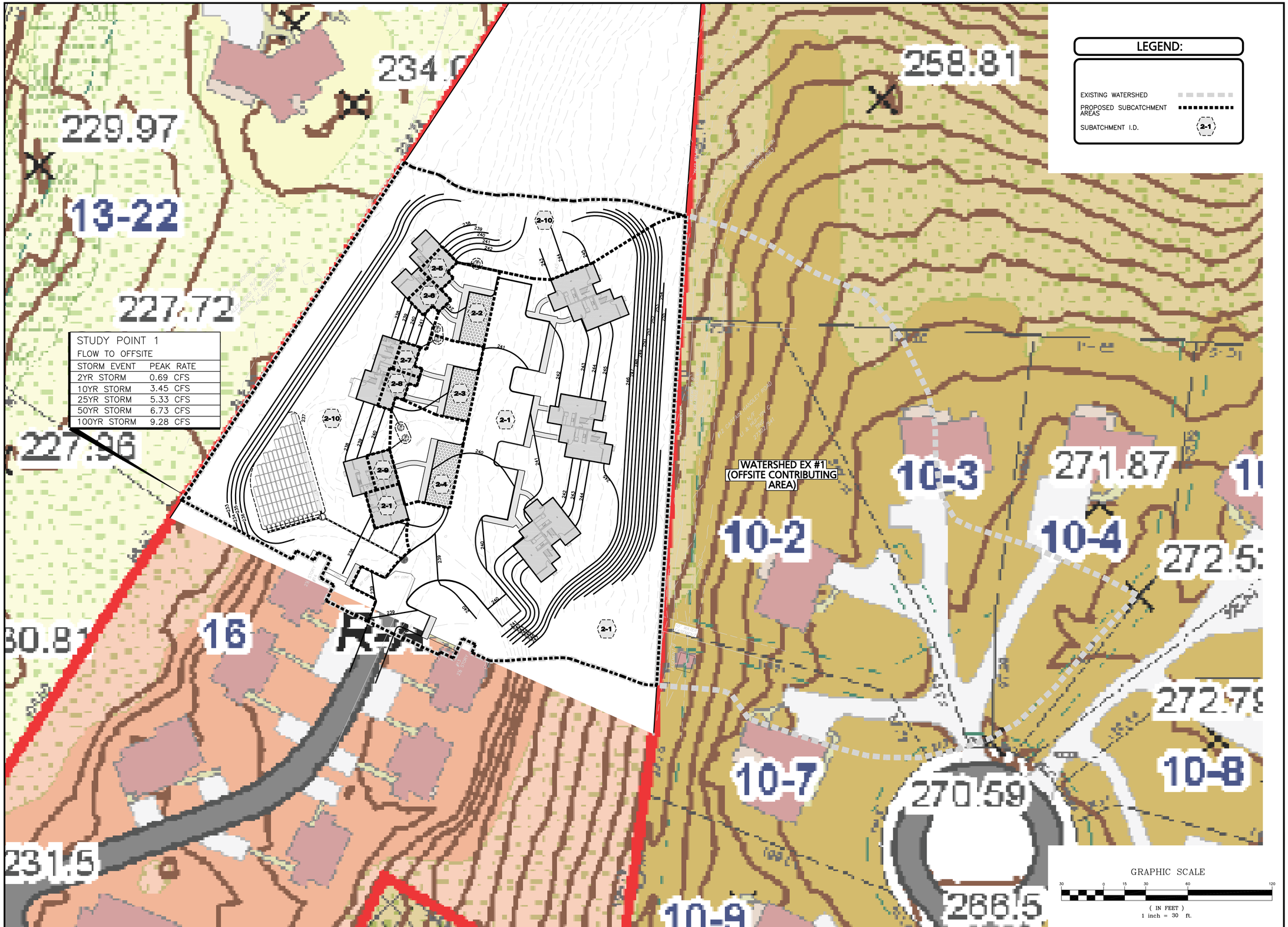
No	Date	Description	By

Drawing Title:

EXISTING CONDITIONS WATERSHED PLAN

Drawing Number:

WP-1



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Development of McCarthy Village II

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Project No:	1298-08
Drawn By:	BDJ
Checked By:	TJW
Issue Date:	JUNE 1, 2010

Revisions

No	Date	Description	By

Drawing Title:

POSTDEVELOPED WATERSHED PLAN

Drawing Number:

WP-2